Final
Environmental Impact Statement

ROCK CREEK PROJECT

September 2001

U. S. Forest Service
Kootenai National Forest

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Montana Department of
Environmental Quality

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Volume II

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APPENDIX A

DEFINITION OF SIGNIFICANCE IN NEPA/MEPA

APPENDIX A - Definitions of Significance in NEPA/MEPA

NEPA

40 CFR § 1508.27 Significantly

"Significantly" as used in NEPA requires considerations of both context and intensity:

(a) *Context.* This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.

(b) *Intensity.* This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions coming up about partial aspects of a major action. The following should be considered in evaluating intensity:

(1) Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.
(2) The degree to which the proposed action affects public health or safety.
(3) Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.
(4) The degree to which the effects on the quality of the human environment are likely to be highly controversial.
(5) The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
(6) The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
(7) Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.
(8) The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.
(9) The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

(10) Whether the action threatens a violation of Federal, State, or Local law or requirements imposed for the protection of the environment.

MEPA

ARM 26.2.644 Determining the Significance of Impacts

(1) In order to implement 75-1-201, MCA, the agency shall determine the significance of impacts associated with a proposed action. This determination is the basis of the agency's decision concerning the need to prepare an EIS and also refers to the agency's evaluation of individual and cumulative impacts in either EAs or EISs. The agency shall consider the following criteria in determining the significance of each impact on the quality of the human environment:

(a) the severity, duration, geographic extent, and frequency of occurrence of the impact;
(b) the probability that the impact will occur if the proposed action occurs; or conversely, reasonable assurance in keeping with the potential severity of an impact that the impact will not occur;
(c) growth-inducing or growth-inhibiting aspects of the impact, including the relationship or contribution of the impact to cumulative impacts;
(d) the quantity and quality of each environmental resource or value that would be affected, including the uniqueness and fragility of those resources or values;
(e) the importance to the state and to society of each environmental resource or value that would be affected;
(f) any precedent that would be set as a result of an impact of the proposed action that would commit the department to future actions with significant impacts or a decision in principle about such future actions; and
(g) potential conflict with local, state, or federal laws, requirements, or formal plans.

(2) An impact may be adverse, beneficial, or both. If none of the adverse effects of the impact are significant, an EIS is not required. An EIS is required if an impact has a significant adverse effect, even if the agency believes that the effect on balance will be beneficial. (History: Sec. 2-3-103, 2-4-201 MCA; IMP, Sec. 2-3-104, 75-1-201, MCA; NEW 1989 MAR p. 28, Eff. 1/13/89.)

APPENDIX B

FINAL BIOLOGICAL ASSESSMENT

- **Final Biological Assessment (7/31/98)**
- **Bull Trout Biological Assessment Revision (5/13/99)**
- **Lynx Amendment (4/4/00)**
- **Revised Terrestrial Threatened and Endangered Species Mitigation Plan (12/14/00)**

United States Department of Agriculture | Forest Service | Kootenai N. F. | 506 US Highway 2 West
Libby, MT 59923

File Code: 2670

Date: 7/31/98

Kemper McMaster
U.S. Fish and Wildlife Service
100 N. Park, Suite 320
Helena, MT 59601

Dear Kemper:

Attached is the Biological Assessment (BA) for the ASARCO Rock Creek Mine proposal on the Cabinet Ranger District. The conclusions of the BA, for terrestrial listed species, are that the proposed federal actions, in combination with proposed connected actions on the private lands, (1) may adversely affect the grizzly bear; (2) may affect but is not likely to adversely affect the bald eagle, peregrine falcon, and gray wolf; and (3) have no effect on water howellia. In addition, the proposed project is not likely to jeopardize the continued existence of lynx (proposed threatened) or result in the destruction or adverse modification of critical lynx habitat.

The conclusions for aquatic listed species are (1a) for bull trout that the proposed project is not likely to adversely affect bull trout habitat or bull trout individuals in Rock Creek; (1b) the project is likely to have no effect on both the bull trout stock and the bull trout meta-population; and (2) the project would have no effect on the white sturgeon as it does not occur in the Clark Fork river drainage.

In consideration of the identified potential effects on grizzly bear and in accordance with the Endangered Species Act Section 7, I request initiation of formal consultation on the ASARCO Rock Creek Mine project. A copy of the project Biological Assessment has been forwarded directly to Kevin Shelley in the Kalispell sub-office.

Additional project file data and maps are available at the Kootenai National Forest Supervisor's office. Questions on specific aspects of this BA can be addressed to Wayne Johnson (terrestrial species) or John Carlson (fish species), KNF Supervisor's Office (406-293-6211).

Sincerely,

Robert L. Schrenk

ROBERT L. SCHRENK
Forest Supervisor

cc w/enclosure: K. Shelley

United States Department of Agriculture
Forest Service
Kootenai N.F.
506 U.S. Highway 2 W.
Libby, MT 59923

File Code: 2670
Route To: All recipients

Date: 8-7-98

Subject: ASARCO Rock Creek Mine Biological Assessment: ERRATA

To: Reader

The Final Biological Assessment on the ASARCO Rock Creek Mine project was completed on July 31, 1998. There are minor corrections to the original document as follows:

- Appendix 5: Item A8 (page 57) - - delete the words "during active operations".
- Appendix 5: Item D (page 58) - third line - - insert "100 acres" before the word 'replacement'.

ROBERT L. SCHRENK
Forest Supervisor

FINAL BIOLOGICAL ASSESSMENT
of
Threatened, Endangered, and Proposed Species
for the proposed
ASARCO ROCK CREEK MINE

Supervisor's Office
Kootenai National Forest
1998

Wayne J. Johnson
Wayne J. Johnson
Wildlife Biologist

Date: 7-31-98

Dan Leavell
Ecologist/Botanist

Date: 7-31-98

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for the
ASARCO ROCK CREEK MINE

Cabinet Ranger District
Kootenai National Forest

SUMMARY OF FINDINGS

Implementation of the proposed federal action will have **NO EFFECT** on water howellia. The project **IS NOT LIKELY TO ADVERSELY AFFECT** gray wolf, bald eagle, and peregrine falcon. The project **IS LIKELY TO ADVERSELY AFFECT** the grizzly bear. The project is **NOT LIKELY TO JEOPARDIZE** the continued existence of the lynx or result in the destruction or adverse modification of critical lynx habitat.

CONSULTATION REQUIREMENTS

In accordance with the Endangered Species Act and its implementing regulations and FSM 2671.4, Kootenai National Forest is required to request written concurrence from FWS with respect to the determination of potential effects on Gray Wolf, Bald Eagle, and Peregrine Falcon.

Formal Consultation is required with respect to the determination of potential effects on the Grizzly Bear.

Informal consultation is summarized in Appendix 3.

NEED FOR RE-ASSESSMENT BASED ON CHANGED CONDITIONS

The biological assessment findings are based on the best current data and scientific information available. If new information reveals effects that may impact threatened, endangered, or proposed species or their habitats in a manner or to an extent not considered in this assessment; if the proposed action is subsequently modified in a manner that causes an effect that was not considered in this assessment; or if a new species is listed or habitat identified that may be affected by the action, a revised biological assessment should be prepared.

INTRODUCTION

This Biological Assessment addresses the potential effects of the proposed federal action on all threatened, endangered, and proposed species known or suspected to occur in the proposed action influence area. General life history information on these species is provided in Reel et al. (1989 pgs. 2-5, 7-8, 18-19) and is incorporated by reference into this Biological Assessment.

Threatened, endangered, and proposed species are managed under the authority of the federal Endangered Species Act (PL 93-205, as amended) and the National Forest Management Act (PL 94-588). The Endangered Species Act requires federal agencies to ensure that all actions which they "authorize, fund, or carry out" are not likely to jeopardize the continued existence of any threatened, endangered, or proposed species. Agencies are further required to develop and carry out conservation programs for these species. Conservation measures implemented to date for threatened, endangered, and proposed species by the Kootenai National Forest are listed in Appendix 1.

DESCRIPTION OF PROPOSED ACTION

The proposed federal action consists of permitting ASARCO to construct and operate the Rock Creek Mine. The project lies in Compartment 711 of the Cabinet Ranger District in Sanders County, MT. The project area starts approximately 1 air mile east of Noxon, MT. Figure 1 is a vicinity map of the project area. Figure 2 is a detailed map of the proposed activity.

The proposed federal action is alternative number 5 as described in detail in the ASARCO ROCK CREEK MINE Environmental Impact Statement. The detailed description of the action from the EIS is provided in Appendix 2. A summary of the proposed action is presented in Table 1.

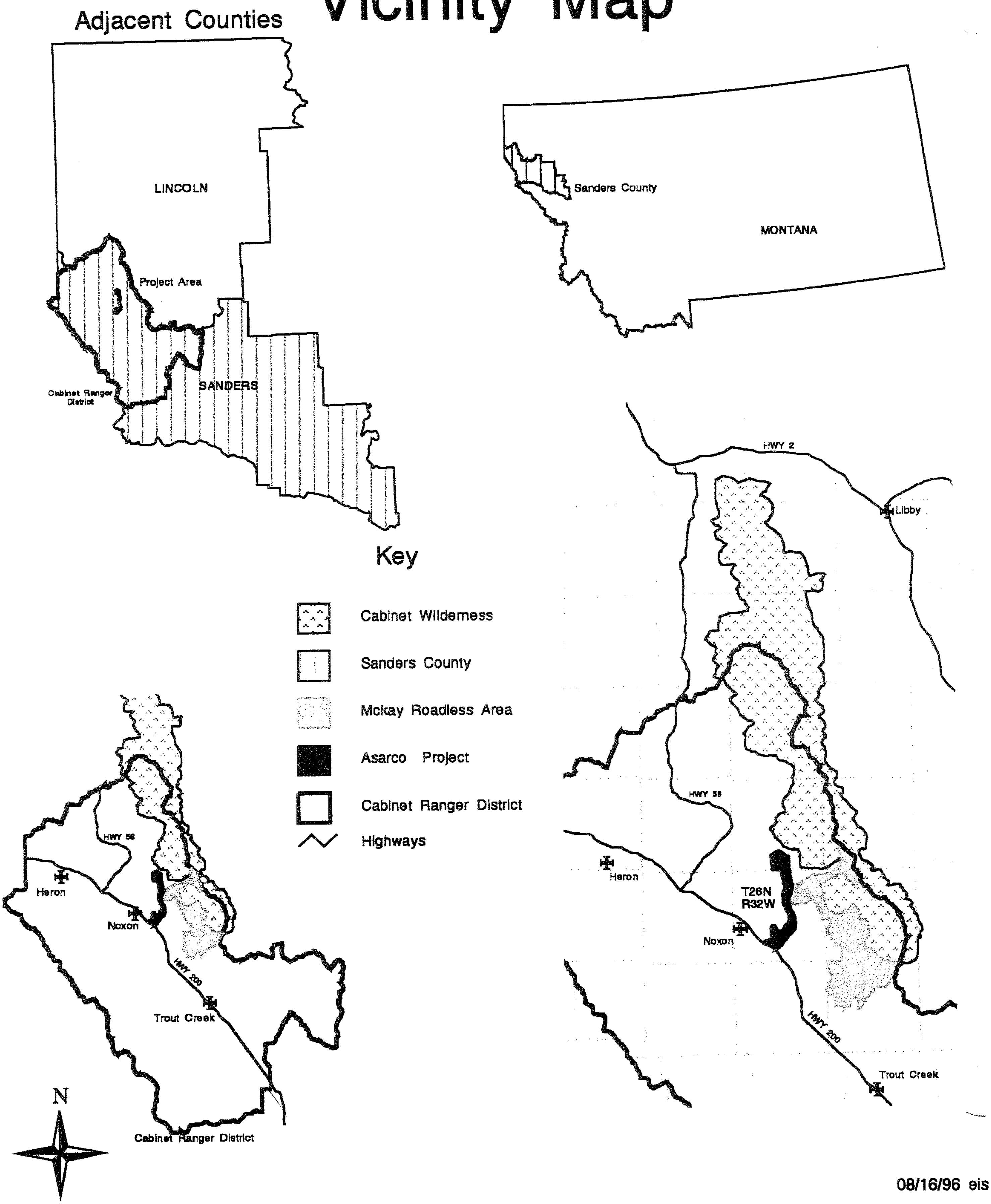
TABLE 1: Project Summary (Alternative 5)

Total acres in Analysis Area	198,394
Percent of Analysis Area Treated	0.8
Total acres in Permit Area	1,668
Physically Disturbed Areas (Acres)	
Tailings Impoundment & A.F.	368
Mill Site and A.F.	41
Exploration Adit & Support Facilities	10
Roads	64
TOTAL	483
Road Construction (miles)	3.54
Road Reconstruction (miles)	5.43
Project Duration (years: includes restoration)	35

AF = Associated Features

Asarco Rock Creek Vicinity Map

Figure BA1



08/16/96 eis

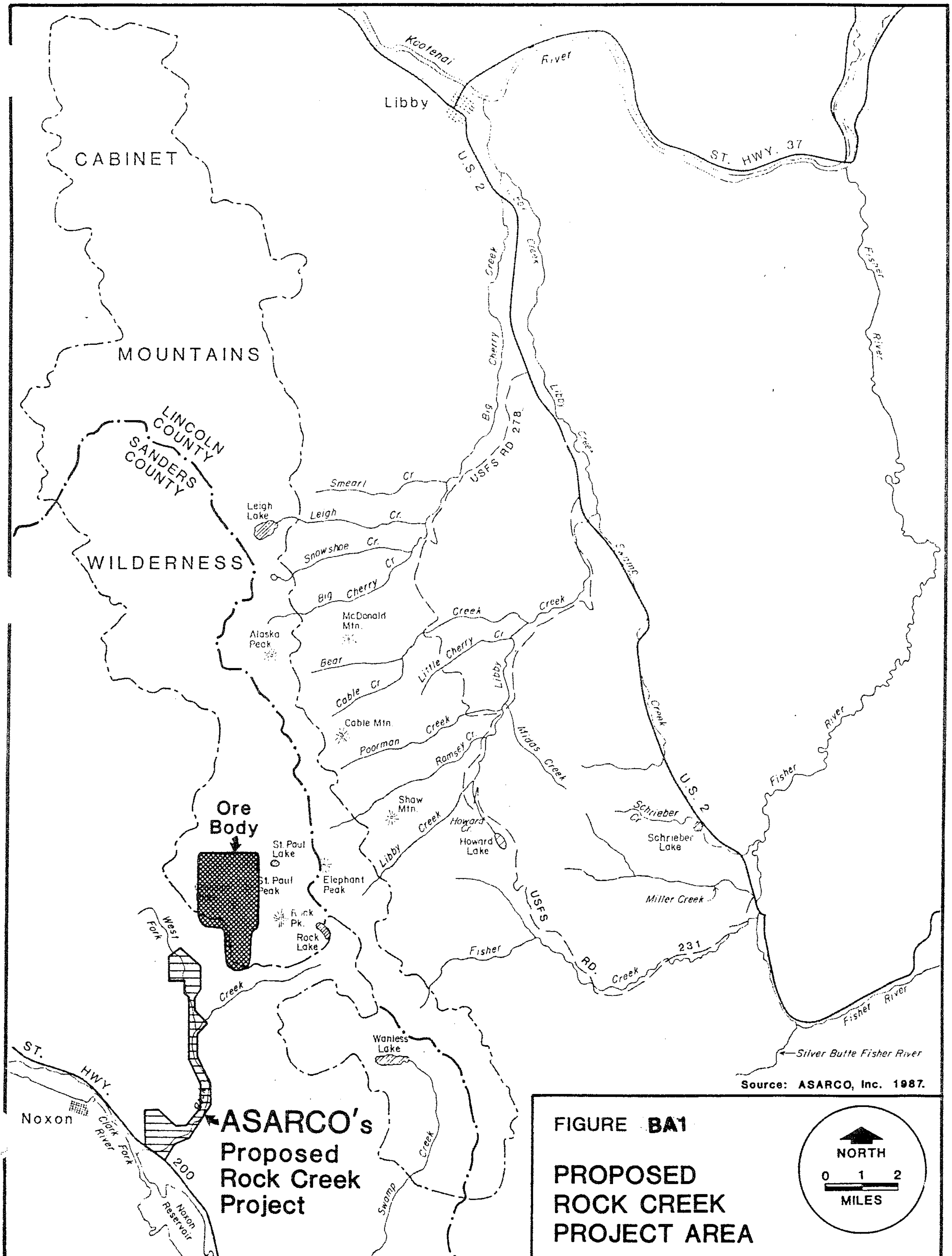


FIGURE BA1

PROPOSED ROCK CREEK PROJECT AREA

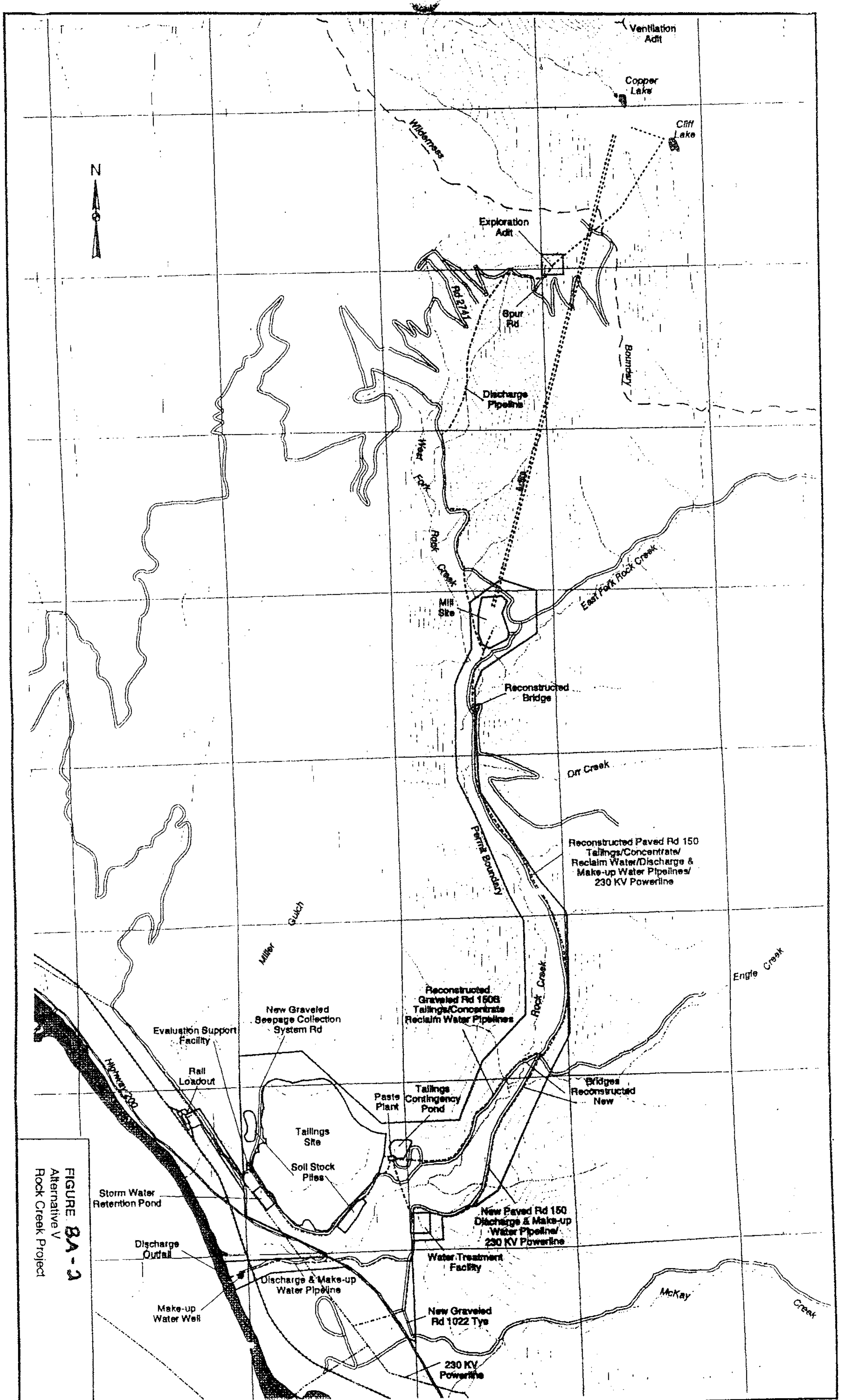


FIGURE BA-3
Alternative V
Rock Creek Project

Source: Kootenai National Forest GIS database 6-97 s.ague

SPECIES LIST

A current species list of proposed, threatened and endangered species known or suspected to occur in the project area was requested (3-30-98) and received (4-15-98) from the U.S. Fish and Wildlife Service (FWS). Table 2 lists the threatened, endangered, and proposed species which may be within the influence area of this proposed project.

TABLE 2: Threatened, endangered, and proposed species known or suspected to occur within the influence area of the proposed action

Status	Name	Occurrence
Threatened:	Grizzly bear (*Ursus arctos horribilis*)	Resident
	Bald Eagle (*Haliaetus leucocephalus*)	Resident
	Water howellia (*Howellia aquatilis*)	Potential Resident
	Bull trout (*Salvelinus confluentus*)	Resident/Migrant
Endangered:	Peregrine falcon (*Falco peregrinus*)	Transient
	Gray wolf (*Canis lupus*)	Transient
Proposed	Lynx (*Lynx canadensis*)	Resident

An analysis of bull trout is provided in a separate biological assessment (attached).

THREATENED and ENDANGERED SPECIES ASSESSMENT

BALD EAGLE (*Haliaeetus leucocephalus*)

Description of Population and Habitat Status
The Bald eagle population in the Clark Fork River valley is covered under the Pacific Bald Eagle Recovery Plan (USFWS 1986). The population recovery goals for the entire Pacific Bald Eagle population are: 1) 800 nesting pair; 2) 80% of recovery management zones meet zone breeding population recovery goals; 3) average reproductive rate of 1.0 fledged young per pair, with an average success rate per occupied site of not less than 65%; and 4) stable or increasing wintering populations (USFWS 1986: exec. summary). Currently (1997 data) there are 1,379 nesting pair in the population (Karen Steenhoff - Pacific Bald Eagle Recovery Coordinator - personal communication 6-24-98). Breeding population recovery goals are currently met in 70% of the management zones (ibid). Karen also stated that the reproductive rate is being achieved as is the stable or increasing wintering population numbers.

The project planning area lies in the Upper Columbia Basin Bald Eagle Recovery Zone (Zone 7 - NW Montana and the Idaho Panhandle) (USFWS 1986: pg 7 & 29 and MBEWG 1994: pgs 9-10). The recovery goals (USFWS 1986; pg 27-30) for this portion of the Pacific population are: 1) Habitat Management Goal of a minimum of 98 territories with secure habitat; 2) Population recovery goal of a minimum of 69 breeding pair; 3) Annual production of at least 1.0 fledged young per pair, with an average success rate of occupied sites not less than 65 percent on a 5 year average; and 4) stable or increasing wintering populations. Currently Zone 7 has 127 territories with 108 breeding pairs. The 1996 production averaged 1.2 fledged young per pair, with 74% of the occupied territories being successful (Rob Hazelwood, USFWS personal communication 6-9-98). The 5 year averages are 1.75 fledged young and 75% success rate (Dennis Flath - MFWP personal communication 6-15-98). Wintering populations have been increasing or are stable.

Bald eagles use the Clark Fork River corridor year long. Harms (1992) provided concurrence with a description and maps of the areas on the Kootenai National Forest that needed to be considered as potentially suitable bald eagle habitat in conducting consultations with the USFWS. Basically the area includes all lands within one mile of the major rivers and reservoirs. Over the past 10 years sightings within this zone along the Lower Clark Fork and the Bull rivers have varied from 6 to 38 eagles during a yearly one day January eagle count. The trend has been slightly increasing. The count is done from vehicles along the lower Clark Fork River from Thompson Falls to the Idaho state line and following the Bull river north to the Sanders/Lincoln county line. Farmer and Heath (1987: p.117) reported a total of 16 sightings in their study area, with five birds the most seen in a single day. Figure BA-3 shows the historic bald eagle sighting areas (not individual sightings as there are multiple year sightings at various locations), based on Farmer and Cabinet District records. Winter use level depends on ice conditions on the Noxon and Cabinet Gorge reservoirs. When the reservoirs freeze, the eagles move to areas with open water (i.e. Lake Pend Oreille in Idaho).

A total of 6 occupied nesting territories (one new site found in 1998) exist along the lower Clark Fork river (all or partially within the Cabinet Ranger District boundary). The 6 occupied nests represent a 60% occupancy of the 10 potential breeding areas on the lower Clark Fork. This is below the desired state-wide management objective of 68%, prescribed in the Montana Bald Eagle Management Plan (1994 pg. 14-15). Two of the breeding areas in the general vicinity of the proposed project contain active breeding pairs. One is about 3 air miles south of the proposed Rock creek tailings impoundment. This nest has been active since 1990 and has fledged young each year through 1997. The second nest was discovered in March of 1994. It is about 4 air miles west of the project area. The nest was occupied by a pair in 1994 and 1995, but failed to produce any young. It was not occupied in 1996, 1997, or 1998 and is thought to be abandoned due to damage to the nest tree. The pair has been seen in the area, but a new nest tree has not been found. The 5 sites have produced an average of 1.0 fledgling per site (5 year average for 1992-1996), with the success rate of occupied sites being 68.4% for the same 5 year period. These rates comply with the reproduction recovery goals for the Upper Columbia Basin Zone.

Nesting habitat is described as the largest living trees, in a multi-storied stand, that is near a body of water that supports an adequate food base (USFWS 1986: pg 13). The nest trees provide an unobstructed view of the foraging site(s). They have open crowns and sturdy limbs to support the massive eagle nests. There are no suitable nest trees (sites) in the ASARCO Rock creek mine project area.

Foraging for fish and waterfowl is done in the two reservoirs (Noxon and Cabinet Gorge) and the major tributary streams (Vermilion and Bull Rivers primarily). Scavenging is done along the railroad tracks and state highways 200 and 56, and along the first mile of Forest Development Road (FDR) 150.

Trees suitable as hunting perches generally have an unobstructed view of the hunting area, and are relatively close to the site. With the primary foraging area being the reservoirs, and most of the project area greater than one mile from the reservoir, the only area that hunting perch sites might occur is within a portion of the proposed tailings impoundment, immediately adjacent to FDR 150. Baseline surveys and district monitoring found no hunting perches in this area. A known hunting perch does exist within 1/2 mile of the proposed Rock creek tailings impoundment. It lies between Highway 200 and the Clark Fork river. Roosting sites (areas where eagles spend the night) were not found during baseline studies. District monitoring efforts have found no roost sites in the project area.

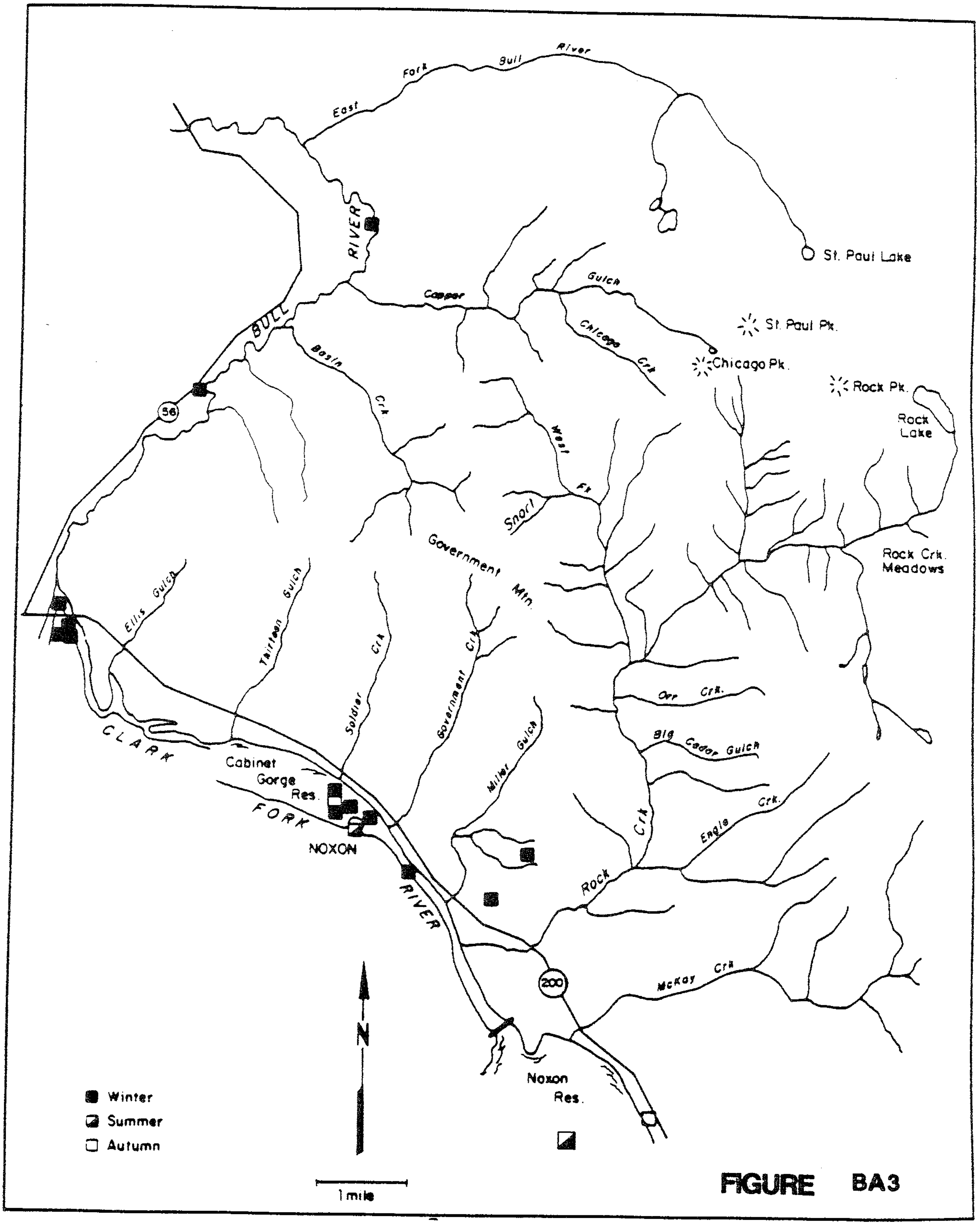


FIGURE BA3

HISTORIC BALD EAGLE SIGHTINGS

Analysis of Direct, Indirect, and Cumulative Effects

No activity is planned within 3.0 air miles of known bald eagle nest sites. Potential perching habitat (larger standing trees or snags) would be removed at the tailings impoundment site. Only a portion of this area is in the USFWS defined (Harms 1992) suitable bald eagle habitat area. Since the tailings impoundment perching habitat is outside the nearest known pair territory, and there is no evidence of eagle use in the proposed impoundment area, and there are many acres of this habitat component available in the area; the loss of perching habitat is not significant. The known hunting perch site is within the tailings impoundment disturbance influence zone (1/2 mile). The increased noise level may cause the eagles to abandon this hunting perch. The likelihood of this happening is low, as evidenced by the use of this site which is adjacent to Highway 200. Many other potential perch trees exist along the river.

Bald eagle foraging is done primarily in the Clark Fork river and associated reservoirs. The degree to which the project could affect the eagle is related to the predicted downstream effects on fish, the primary prey species. Eagles, as the top of the food chain, would be susceptible to accumulation of heavy metals (primarily arsenic and mercury). Based in part on data from the Troy mine, a minor increase in some toxic metals could occur, which can increase stress to aquatic life. The likelihood of this happening is low due to negligible potential to form acid (near neutral pH of adit water) and the low levels of dissolved metals. This suggests that metal mobility is not a concern (Schafer & Associates 1997). Water treatment is required that removes suspended solids, metals and nitrogen prior to discharge to the Clark Fork River. The resultant metal levels would remain below Montana cold-water aquatic life standards.

The main source of heavy metals would come from a tailings impoundment failure, but the likelihood of failure is very low (less than 1 in 1,000,000: Klohn-Crippen 1997). Based on the Troy mine toxicity data, it is likely that the Rock Creek impoundment tailings water would be toxic to aquatic life in the event of an impoundment failure, especially if the failure occurred a few years after the operation began. In the event of a failure, the lower one mile of Rock Creek would be impacted the most, due to low flows. The Clark Fork river contains harder water which is less sensitive to metals pollution. In addition the substantially larger flow of the Clark Fork River provides significant potential for dilution of metals. The downstream impacts to aquatic life, from metals loading into the Clark Fork river and lake Pend Oreille, would be negligible. Therefore, impacts (due to heavy metals) to the bald eagle would be negligible in both the short and long term.

Sediment and nitrogen loads would temporarily increase and this would impact aquatic invertebrates which could impact fish. Mitigation is planned to reduce sediment from existing sources so that the net result becomes a reduction in sediment (see Bull Trout BA). The down stream impact is negligible. While nitrogen loads will increase (actual level too small to measure), the state has established maximum discharge levels which will be met, with the result that nitrogen levels would remain below Montana cold-water aquatic life standards. The resultant indirect effect to bald eagles would also be negligible. The water resources and aquatics/fisheries monitoring plans are an integral part of the proposed action, and would be used to detect any adverse changes in the food chain used by bald eagles.

Since there is no suitable nesting or winter roost habitat in the project area, there would be no change in these habitat components. Foraging habitat along Highway 200, FDR 150, and the train tracks would potentially increase due to an expected increase in deer mortality (potential 86% increase) from vehicle (minimum 30% increase on Highway 200) and train traffic needed for the proposed project. The increased food source could result in an increase in mortality risk to bald eagles scavenging on road kill. Alternative V already has a reduced traffic level due to piping the ore slurry rather than hauling it down the 150 road. Mitigation is planned that would remove dead animals from the right-of-way clearings of Forest Road 150 (between Highway 200 junction and the mill site) on a daily basis. In addition, ASARCO would implement an Agency approved traffic management plan (including bussing employees between water treatment and mill sites) to reduce traffic levels on FDR 150. Mitigation should reduce the increased mortality risk, but it will still be greater than the present level due to the 300% increase in ADT (operation phase) on road 150.

Mortality risk from potential electrocution would be mitigated by the requirement to construct power lines using the standards in Olendorff et.al. (1981: pgs 19-43).

The increase in human population due to mine related jobs would require additional housing, which is likely to be along the Clark Fork and Bull rivers. An estimated 150 acres (EIS Ch. 4: Socioeconomics) could be developed, thus reducing bald eagle habitat on a portion of these acres. Because the actual level of hiring residents verses nonresidents in unknown and the site specific locations of construction activities are also unknown, the actual impacts from housing construction on bald eagle habitat are unquantified. No mitigation is planned for this indirect effect. This is because the recovery goals for Zone 7 are being met, and even exceeded by the present zone eagle population. Therefor, this potential minor habitat loss will not adversely effect the population.

Based on the low likelihood of adverse impacts and implementation of proposed mitigation to reduce mortality risk from the proposed project, bald eagle use along the Clark Fork river is expected to continue increasing, as evidenced by the increase in nesting pairs over the past 8 years (from none to 6), until all 10 of the potential breeding areas are occupied.

Statement of Findings

The proposed federal action is **not likely to adversely affect** the bald eagle or its habitat based on: 1) distance to nearest nest site is greater than 2.5 miles (nesting territory radius); 2) no winter roost or nesting habitat impacted by the project; and 3) implementation of effective mitigation and project designs to reduce increased mortality risk; 4) low risk of long term effects from heavy metals; 5) very low risk of catastrophic collapse of tailing impoundment; and 6) existing population is meeting recovery goals and is expected to show a continuing upward trend.

Potential Measures for Removing, Avoiding, or Compensating for Adverse Effects

The analysis performed in conjunction with this Biological Assessment determined that the proposed action is not like to adversely affect the bald eagle. No additional mitigation required than those already identified as part of project design.

PEREGRINE FALCON (*Falco peregrinus*)

Description of Population and Habitat Status

The proposed project area is part of the Rocky Mountain/Southwest population recovery zone (USFWS, 1984: pg. vi). The recovery goals for this population are: 1) a minimum of 183 breeding pairs and 2) sustaining a long term average production of 1.25 young per year (ibid pg 20). Presently there are 529 pair in the recovery zone (Rob Hazelwood, USFWS - personal communication 6-29-98) (24 of them in Montana - Dennis Flath: MFWP, personal communication 6-16-98), with an average production of 1.4 young per pair (Rob Hazelwood, USFWS - personal communication 6-29-98).

The peregrine falcon is considered a migrant and potential resident in the lower Clark Fork valley. There is one confirmed sighting (1993) approximately 4 air miles south of the proposed Rock Creek tailings impoundment. A second sighting was reported in May, 1994 by the Peregrine Fund. This sighting was a male (tagged and released from a Peregrine fund hack site in Idaho) in the same area as the 1993 report. Surveys to determine nesting status were conducted over a 5 day period, without confirmation.

An important habitat component for peregrine falcon habitat is the availability of suitable cliffs for nesting (generally greater than 200 feet tall : USFWS, 1984 pg 7) . The Peregrine Fund inventoried the Clark Fork drainage (including the Bull river) for such sites in 1989. They identified the cliffs west of Bull Lake and south of Noxon Reservoir (near Tuscor Hill) as potential nesting habitat (Bob Summerfield, KNF Wildlife Biologist, personal communication 10-12-93). The Bull lake cliffs are over 10 air miles northwest of the proposed project. The Tuscor Hill cliffs are 4 air miles south. Hamer (1976: pgs. 3-4) identified the cliffs on Ibex and Scotty peaks as possible nesting habitat. These sites are approximately 12 air miles north of the planning area boundary. Marginal cliffs (less than 200 feet tall) are on the south side of Government Mountain (1 mile west or north). There is no suitable nesting habitat in the ASARCO Rock creek mine project area.

A historic aerie is located just across the state line in Idaho. Attempts were being made to reintroduce peregrines at that site (Bob Summerfield, KNF wildlife biologist, personal communication 10-12-93) through a 'hacking' project. A pair nested and produced young at this site in 1997.

A peregrine prey base (waterfowl and small birds) exists on the Cabinet Gorge and Noxon reservoirs and the surrounding sloughs and wetlands.

<u>Analysis of Direct, Indirect, and Cumulative Effects</u>

Suitable nesting habitat will not be impacted. Peregrine falcon use along the Clark Fork river would remain a possibility. The suitable and marginal nesting habitat would still be available. Since bald eagles and peregrine falcons generally do not co-habit the same nesting territory, and since there is an existing bald eagle nest site within 1/3 mile of the suitable peregrine falcon nesting habitat, the likelihood of a nesting pair moving into the area is only fair. Bald eagles defend their nest territories against other raptors, which tends to discourage other raptor species from nesting in the vicinity of bald eagle nests. The use of the area by migrating peregrines could still occur.

Indirect impacts to the peregrine from heavy metals found in prey (fish-eating waterfowl) would be a low risk (see effects analysis section for bald eagle).

Since the planning area contains no suitable nesting habitat and activity is at least 3 miles from potential high quality nesting habitat, the proposed project would have no direct, indirect or cumulative impacts on peregrine falcon reproduction. Peregrines migrating in the fall could be displaced from any migration route that passes through the lower slopes of Rock Creek (an unknown situation).

Peregrine falcons have been known to collide with powerlines, resulting in death. The construction of new power lines for the project would slightly increase the mortality risk to any peregrine falcons moving through the area. The likelihood of this happening is extremely low, due to limited presence of peregrines and the location of the proposed power line (away from primary hunting area - along the reservoirs).

Statement of Findings

The proposed federal action is **not likely to adversely affect** the peregrine falcon or its habitat based on: 1) Absence of occupied nest sites; 2) No documented sightings in the project area; 3) No loss of suitable nesting habitat; and 4) extremely low mortality risks.

Potential Measures for Removing, Avoiding, or Compensating for Adverse Effects
IF a peregrine falcon nest site is found within 1 mile of proposed activities, restrict activities (in excess of those which have historically occurred at the site) between February 1 and August 31 (USFWS, 1984).

GRAY WOLF (*Canis lupus*)

Description of Population and Habitat Status

The former range of the Northern Rocky Mountain wolf (also called gray wolf) included the proposed project area (USDI 1987: pg 2). The gray wolf in this area is covered under the Northern Rocky Mountain Wolf Recovery Plan (USFWS 1987). The plan identified 3 recovery zones (USFWS, 1987: figure 2 pg. 23), with a recovery goal of a minimum of 10 breeding pairs for 3 successive years in each zone. Presently (Bangs 1998a & b) each of the three recovery areas have at least 8 breeding pairs.

The project area lies in "management zone III" between the Northwest Montana and Central Idaho recovery areas. Because wolves, themselves, have defined habitat as any lower elevation area that supports white-tailed deer (Bangs 1998a pg. 2) (mostly in management zone III) and because the habitat within the Northwest Montana Recovery area is fully occupied (Bangs 1998a pg. 6), wolf recovery in NW Montana is currently promoted in any area where there are not chronic conflicts with livestock (Bangs 1998a pg. 2). Currently there are about 75 adult wolves in 7-9 packs and up to 40 pups in NW Montana (Bangs 1998b pg. 1).

The wolf is a known transient and potential resident in the lower Clark Fork valley. There is a 1979 unconfirmed sighting 1 mile east of the proposed mill site. There are two unconfirmed sightings (1991) one mile west of the proposed ASARCO Rock Creek tailings impoundment and a second unconfirmed report of three wolves in the same area in 1995. There are three unconfirmed 1994 reports of a pack (minimum of 3 animals) using the Pillick Ridge/Blue creek area, which runs 7 to 15 air miles northwest of the project area. Information suggests a high probability of wolves west of the project area. The only confirmed wolf sighting (1996) comes from the Vermilion River which is 14 air miles southeast of the project area. Based on the historical range and the locations of the various sightings, the Rock Creek drainage probably serves as part of a movement area along the Clark Fork River valley between better habitats (i.e. Thompson River drainage to the southeast and Lightning Creek drainage to the northwest, in Idaho).

A prey base of elk and deer exists in the area to contribute to the support of a wolf pack, however the topography in the Rock Creek drainage does not provide easy hunting opportunities due to steep slopes. A wolf pack would need a much larger area (and generally an area with gentler slopes) than just the Rock creek drainage to establish a territory (i.e. a drainage the size of the Thompson River). The National Forest portion of the project area downstream from Engle creek is allocated to big game winter range.

The drainage configuration, relatively narrow v-shapped valley, does not provide many suitable denning or rendezvous sites. The presence of existing Forest road 150 (open to vehicle traffic) in the valley bottom, and the associated human activity, further reduces any opportunity for wolves to den or rendezvous in the Rock Creek drainage.

Den sites are generally greater than one mile from open roads or trails and one to two miles from camp sites (USFWS, 1987: p.73). These sites are normally on southerly aspects, on moderate slopes, within 400 yards of surface water, and at an elevation overlooking surrounding low-lying areas. There are no known den sites in the Rock creek drainage.

Rendezvous sites (resting and gathering areas) are usually complexes of meadows and adjacent timber, with surface water nearby (USFWS, 1987: p.73). They tend to be away from human activity and on drier sites that are slightly elevated above riparian areas (ibid). There are no known rendezvous sites in the Rock creek drainage.

A major component of wolf habitat is sufficient space with minimal exposure to humans (USFWS, 1987: p.7). Space is discussed in the section on grizzly bear.

Analysis of Direct, Indirect, and Cumulative Effects

The increase in human activity (operations 7 days a week for up to 30 years) would effectively eliminate the suitability of the stream bottom portion of Rock creek for use by wolves. The increased potential for human/wolf encounters would result in a greater mortality risk for wolves entering the Rock creek drainage. Mortality risk could also be increased due to the potential availability of a greater number of vehicle killed deer or elk (see discussion in Bald Eagle analysis). Mitigation (designed to protect the grizzly, but also benefiting the wolf) like the traffic management plan (includes busing employees from water treatment site to mill site), and not allowing firearms in ASARCO vehicles, should be effective in offsetting the increase in mortality risk. The closure of roads to meet ORD standards for grizzly bear would benefit wolves (see section on grizzly bear).

Prey base habitat and population potential would remain essentially the same. As there are no known den or rendezvous sites in the planning area and the likelihood of a pack establishing a site is low due to the presence of the 150 road, the proposed project would not affect this habitat component. Should wolves attempt to hunt in the area during operations, they would be displaced by mining activities (ie. mill site, hauling, tailings impoundment work). Displacement habitat would be available (see section on grizzly bear). Corridors connecting the project area to displacement habitat would be impacted by the increased traffic levels and perhaps by housing developments (see discussion in Bald Eagle and grizzly bear analyses). The reduced corridor effectiveness would primarily be in the corridor between bear analysis areas 7-6-1, 7-5-2 and 7-4-7. Mitigation from the agency approved ASARCO traffic management plan , and the proposed closure of a portion of the 150 road would reduce this effect.

Statement of Findings

The proposed federal action is **not likely to adversely affect** the gray wolf or its habitat based on: 1) Absence of confirmed wolf sightings in the area; 2) No known den or rendezvous sites in the area; 3) The low likelihood of wolves establishing a den or rendezvous site in Rock creek (due to 150 road location); and 4) Implementation of effective mitigation measures (designed for the grizzly , but also benefitting the wolf) as part of the project design (traffic management plan - with bussing, no firearms, road closures).

Potential Measures for Removing, Avoiding, or Compensating for Adverse Effects

The analysis performed in conjunction with this Biological Assessment determined that the proposed action is not like to adversely affect the gray wolf. No additional mitigation required as measures are part of project design.

GRIZZLY BEAR (*Ursus arctos horribilis*)

Description of Population and Habitat Status

The proposed project lies in the Cabinet/Yaak recovery zone (USFWS, 1993: figure 10 pg. 80). The grizzlies in the CYE are listed as threatened, but the USFWS determined that a reclassification to endangered is warranted but precluded (Fed.Reg. Vol. 58, No. 28, 1993 pgs 8250-8251).

Recovery plan goals for the CYE (USFWS 1993, pg 83) are:

- *Six females with cubs over a running 6 year average.* The 6 year average (1992-97) of females with cubs was 1.5 (Servheen 1998, pg 5).

- *18 of the 22 BMUs (Bear Management Units) to be occupied by females with young from a running 6 year sum.* Twelve of the 22 BMUs had credible sightings of females with young during 1992-1997 (ibid). It should be noted that the same female with young may occur in several BMUs (in the 1991-1996 reporting period 3 females occurred in 8 BMUs). During the same period, BMU 5 (1993) and BMU 6 (1993, 1996) were occupied. BMUs 4, 7 and 8 were not confirmed to be occupied by female(s) with young during that time frame.

- *Human caused mortality not to exceed 4% of the population estimate based on the most recent 3 year sum of females with cubs. An interim mortality goal of zero human caused mortalities has been established due to current low numbers.* Human caused mortality level is currently 0.6% (ibid). The human caused female mortality rate has been zero percent for the last three reporting 6 year periods.

- *A calculated minimum population (based on number of females with cubs) of 106 bear.* The calculated minimum population presently is 28 (based on - last 3 years ave. # of females = 5) (ibid).

The present total population estimate for this ecosystem is between 30 to 40 grizzly bears (Wayne Kasworm, et.al. 1997: pg. 6). The population was thought to be old-aged and on the decline (Kasworm and Manley, 1988), so four young female grizzlies were transplanted into the Cabinet Mountains from Canada (1990-1995). One of these transplants has since died from undetermined causes. Kasworms' research now indicates a very slow increase in the population, as the number of known grizzly bears has increased from 10 in 1990 to 16 in 1996. The increase is due to greater search efforts, augmentation, and a portion is due to reproduction (Kasworm has documented reproduction of offspring from offspring in the CYE).

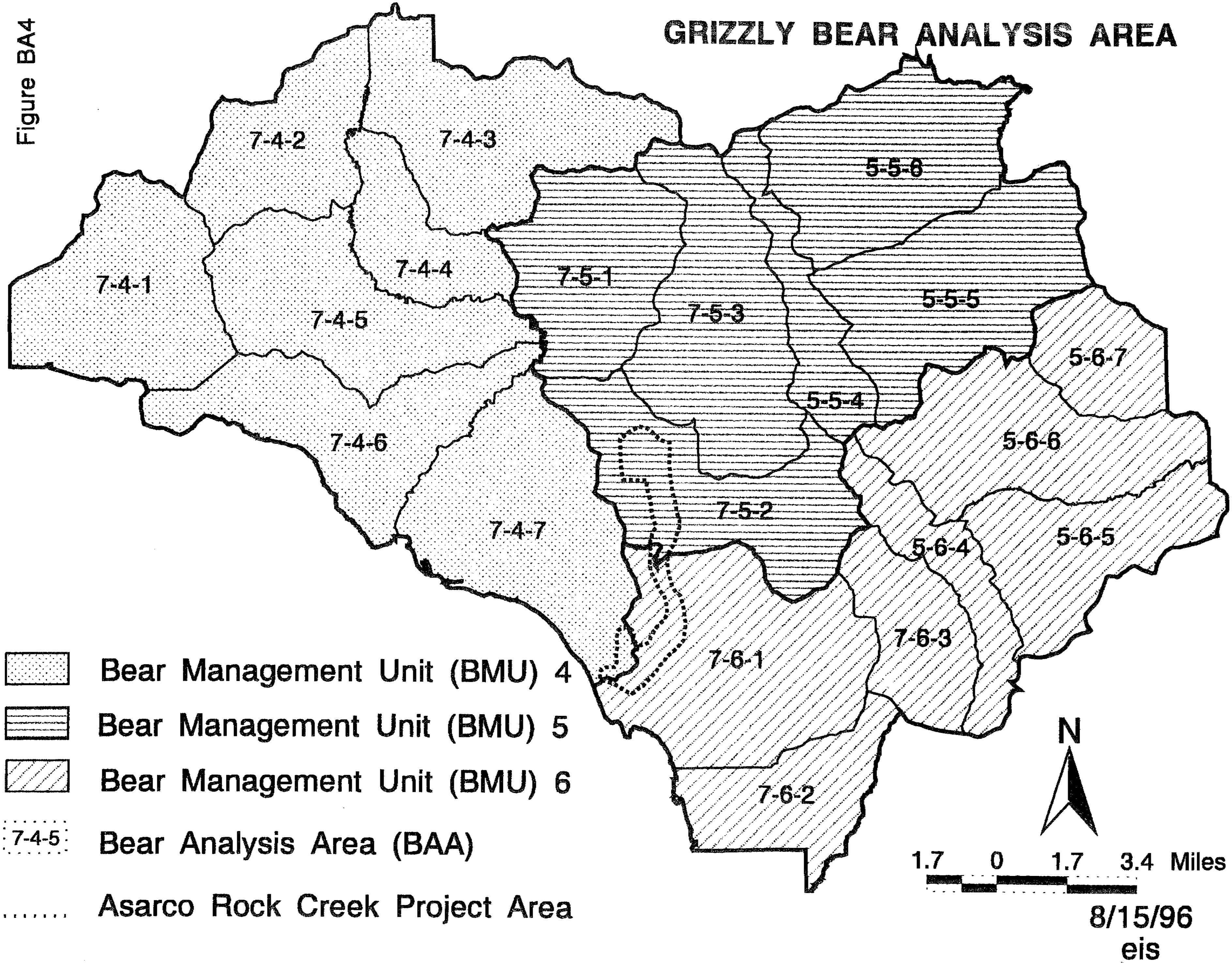
Research (Kasworm et.al. 1988 pgs 39-49; 1995 pgs 26-30) shows that seven bears have home ranges that include the portion of the Cabinet Mountains between Rock creek and Ramsey creek (Montanore project location). Two of these bears are known to have died since documentation of their home ranges. Native bear movements in this area are generally in a north/south pattern (personal communication: Wayne Kasworm, USFWS grizzly bear research biologist, 6-6-96). Southern movement generally takes place on the east side of the Cabinet Mountains and northern movements occur generally on the west side of the Cabinet range (based on movements of the 7 grizzly bear using the southern part of the Cabinet mountains.

Kasworm and Servheen (1995 pg 10) document 629 credible grizzly bear reports for the CYE between 1960 and 1994. Their data reveals two areas in the Cabinets that contain a dense cluster of sightings (Ibid Fig. 2 pg 11). One area is in the southern Cabinets between the Ramsey/Rock creeks and Swamp/Lake creeks area. This area is the primary analysis area for grizzly and covers Bear Management Units (BMUs) 4 (Bull), 5 (St.Paul), and 6 (Wanless) (Figure BA-4). The proposed project lies in Bear Analysis Areas (BAAs) 7-4-7, 7-5-2, 7-5-3 and 7-6-1 (Figure 3-20). Table 3 summarizes reports of grizzlies in these BAAs since 1960.

Table 3: Grizzly Reports Between 1960 and 1997.

BAA	Visual Sightings (1960-1997)	Radio Locations (1983-1995)	Den Sites (1977-97)	Mortality (1975-1997)
7-4-7	11	1	0	0
7-5-2	8	6	1	1
7-5-3	8	50	0	1
7-6-1	8	13	0	0

Figure BA4



GRIZZLY BEAR ANALYSIS AREA
7-4-1
7-4-2
7-4-3
7-4-4
7-4-5
7-4-6
7-4-7
7-5-1
7-5-2
7-5-3
5-5-4
5-5-5
5-5-6
5-6-4
5-6-5
5-6-6
5-6-7
7-6-1
7-6-2
7-6-3
Bear Management Unit (BMU) 4
Bear Management Unit (BMU) 5
Bear Management Unit (BMU) 6
7-4-5 Bear Analysis Area (BAA)
Asarco Rock Creek Project Area
N
1.7 0 1.7 3.4 Miles
8/15/96
eis

Habitat components important to grizzly bear have been mapped for the proposed project (Appendix 9). Table 4 summarizes the acres of each component whose polygon was all or partially in the project influence zone (analysis area), the actual influence zone habitat components, and the acres of habitat components physically changed by the project. Grizzlies select habitat types rich in herbaceous foods in spring and early summer. Late summer and fall habitat is dominated by sites with abundant huckleberry fields (Erickson et.al. 1987). There are no large huckleberry fields in the project direct impact area. Huckleberry production in the project area is probably declining due to closing forest canopies. The Rock creek drainage provides about the same proportion of key habitat components as other areas of the Cabinet mountains.

Table 4: Grizzly Bear Habitat Components (Map in Appendix 9)

Habitat Component	Analysis Area Acres *	IZ Impact Acres	Direct Impact Acres
Conifer Forest (seedling/sapling)	589	181	21
Conifer Forest (pole to medium sawtimber)	9254	3866	353
Conifer Forest (large sawtimber: >15" dbh)	5310	2122	88
Conifer Forest/Rock complex	207	76	
Huckleberry shrubfield	490	227	1
Rock	446	204	
Shrubfield	426	158	2
Wet Meadow	14	6	
Beargrass sidehill park	22	22	
Grassy sidehill park	39	25	5
Grassy disturbed area	20	20	1
Riparian stream bottom	66	66	
Forb field	155	12	2
Shrub/forb field	142	38	9
Dry meadow	3	1	
Aquatic	4	4	
Bare ground	17	16	1
TOTAL ANALYSIS AREA	17204	7044	483

* = These acres include area of habitat polygons that extend beyond project influence zone.
IZ = Influence zone (1/4 - 1/2 mile or ridge line from project activity) for Alternative 5.
Direct Impact acres = actual physical disturbance (Alt. 5).

Grizzly denning habitat is generally above 5200 feet in elevation and on north and west aspects in the Cabinet mountains (Kasworm and Thier, 1992: 40 and 1993: 44). The Rock creek drainage does contain suitable denning habitat, but none exists in the ASARCO Rock Creek Mine project permit area. There is one known den site in the Rock creek drainage. A transplanted bear denned in Rock Creek the winter prior to its death (cause unknown).

Habitat effectiveness or percent of the area free from human disturbance is one of the elements of bear habitat modeling. The existing habitat effectiveness of each impacted BMU is: BMU 4 - 62.5%, BMU 5 - 74.5%, and BMU 6 - 68.1% (see Appendix 7). BMU 5 meets the desired 70% minimum level of free space, as defined by model developers.

The Kootenai Forest Plan (USDA, 1987) establishes a maximum open road density (ORD) standard on areas managed for grizzly bear of 0.75 miles per square mile. This same objective applies to each BAA. Table 5 displays the existing situation for open road density in each Bear Analysis area where the project would be active, or used for a displacement area.

Table 5: Existing Road Density (Miles per square mile) Summary

ACTIVE BAA		DISPLACEMENT BAA	
BAA	ORD	BAA	ORD
7-4-7	0.62	7-4-5	0.00
		7-4-6	0.00
7-5-2	0.86	7-5-1	0.73
		7-5-3	0.00 1/
7-6-1	0.77	7-6-2	0.00
		7-6-3	0.00

1/ BAA 7-5-3 has minor surface activity during construction of ventilation adit, but then is available for displacement.
See Map in Appendix 13

The project area lies in Management Situation 1 (MS1) (necessary for the recovery of the species), and Management Situation 3 (MS3) lands (grizzly use may occur, but such use is not encouraged - to prevent conflicts with human use or occupancy). Private (non-corporate) land and lands within 1/4 mile of private lands along state highway 200 are in Management Situation 3.

Moving Windows Route Density Analysis and Core Existing Situations

An existing condition moving windows (Table 6) and core analysis (Table 7) was completed to comply with the USFWS incidental take statement (7-27-95) on the Kootenai National Forest Plan. Wakkinen and Kasworm (1997) reported that total route densities exceeding 2 mi/sq.mi. averaged 26 percent of the home range for 6 female grizzly bear in the CYE. The open route density greater than 1 mi./sq.mi. averaged 33 percent of the home range and core areas made up 55 percent of the home range.

Table 6: Existing Moving Windows route densities (% BMU by route density category)

	Open Routes (%)				Total Routes (%) *			
BMU	0 mi.	0-1 mi.	1-2 mi.	> 2 mi.	0 mi.	0-1 mi.	1-2 mi.	> 2 mi.
4 \a	46.9	14.1	15.0	24.0	43.9	13.7	14.3	28.1
5 \b	57.0	13.8	16.5	12.7	42.9	16.5	18.3	22.3
6 \a	51.4	14.3	13.4	20.9	37.0	13.2	15.7	34.1
7 \b	63.4	11.8	10.2	14.6	48.7	15.4	14.2	21.7
8 \c	40.4	17.1	21.8	20.7	36.4	19.5	21.9	22.2
22 \d	45.0	13.0	15.0	27.0	31.0	13.0	14.0	42.0

* does not include barriered roads (per IGBC Grizzly Bear Access Committee notes 2/97) (SEE MAPS - APPENDIX 6)
\a based on 7/98 analysis by Kootenai NF S.O.
\b based on 6/98 analysis by Kootenai NF S.O.
\c based on 2/97 analysis by Cabinet Ranger District, KNF
\d based on 5/97 analysis by Plains district (Lolo NF)

Table 7: Existing (8/97) Core habitat analysis summary (% BMU in Core by habitat block size)

BMU	≤ 4sq.mi. *	> 4 sq.mi. *	Total % Core
4 \a	5.1	55.1	60.2
5 \b	4.9	55.8	60.7
6 \c	10.1	41.0	51.1
7 \b	1.1	66.2	67.3
8 \d	3.3	52.7	56.0
22 \e	1.6	46.1	47.7

* core habitat block size (SEE MAPS - APPENDIX 6)
Existing does not include Montanore as planned start year was 1998, and "core" analysis was not available at the time of Montanore analysis.
\a based on 8/97 analysis by Kootenai NF S.O.
\b based on 6/98 analysis by Kootenai NF S.O.
\c based on 7/98 analysis by Libby Ranger District, KNF
\d based on 2/97 analysis by Cabinet Ranger District, KNF
\e based on 5/97 analysis by Plains district (Lolo NF)

Summary Analysis of Direct, Indirect, and Cumulative Effects

Construction and operation of the mine, mill and associated activities would have direct, indirect and cumulative effects on the grizzly bear and its habitat. Direct effects are those on-site activities which alter habitat, displace bears from habitat normally used, or affect the productivity, survival or mortality of the grizzly. Indirect effects are those activities that take place off-site (beyond the permit area) and are not directly tied to the operation of the mine. Indirect effects can also affect productivity, survival or mortality of grizzlies. Housing development and recreation activity are examples of indirect effects. Cumulative effects result from the combination of effects from past, present and other foreseeable future projects.

A cumulative effects analysis process was developed for the Cabinet/Yaak ecosystem (USDA et.al., 1988). This process is referred to as the Cumulative Effects Model, or CEM for short. This CEM looks at habitat conditions and all human activities that could displace or result in bear mortality. The details of this process are summarized in appendix 4 (habitat impacts) and appendix 11 (mortality risk). The results of the CEM analysis are included in the rest of the effects sections.

Table 8 displays the distribution of major activities (in the Bull, St. Paul and Wanless bear management units) that were included in the cumulative effects analysis.

The results of project implementation on moving windows route densities and core are displayed in Tables 9 and 10 and on the maps in Appendix 6.

Although the project effects on habitat effectiveness are relatively small (Table 11), the proposed project does not meet Forest direction for cumulative habitat effectiveness (70% in each BMU) in all 3 of the BMUs (Table 12).

Grizzly bear would be displaced from the project area (7044 acre influence zone) during all phases of the proposed project (exploration, construction, and operation). Displacement habitat would be provided in adjacent BAAs (see Table 15 and maps in Appendix 14). The greatest displacement factor would be the perpetual operations (7 days a week, 24 hours a day).

Grizzly habitat would be physically changed on 483 acres by the construction of the mill and water treatment sites, tailings impoundment, utility and road corridors and placement of excavated material at waste and storage sites. In addition, the presence of humans, during construction would influence grizzly use on an additional 6561 acres of habitat within 1/4 to 1/2 mile of physically disturbed sites and human travel routes. During operations the disturbance acres would only be 6420. A portion of the area influenced by the proposed project presently experiences some human disturbance. Disturbance would generally be much greater with the proposal because of intensity (7 days a week). Table 12 summarizes the cumulative reduced habitat effectiveness by BMU.

Denning habitat, as described by Kasworm and Thier (1992 pg.40 and 1993 pg.44), would not be directly disturbed by the proposed project. Indirectly, there is a potential to disturb bears in denning habitat from the expected increase in recreational activity (see Appendix 12).

Mitigation is required that would provide replacement habitat (2,350 acres - on or off-site as available) for those acres directly modified or having reduced habitat effectiveness from the direct impacts of the project. In addition, the indirect effects of increased recreation (displacement along a fracture zone) are mitigated by additional replacement habitat (100 acres of on-site mitigation - within north to south movement corridor in Cabinet Mountains).

Table 8. Temporal/spatial distribution of major activities in Bull, St.Paul, and Wanless BMUs. 1/

Bear Analysis Area	Present Activity 1997	Projected Major Activity				
		1998	1999	2000	2001-05	2006-35
7-6-1	AB	AB	A	CX	Y	Z
7-6-2						
7-6-3						
5-6-4						
5-6-5	I	I	IN	IN	IN	?
5-6-6	G	L	L	L	L	?
5-6-7			K			
7-5-1	D E F	E				
7-5-2				X	Y	Z
7-5-3				X	Y	Z
5-5-4						
5-5-5			M	M	M	M
5-5-6			M	M	M	M
7-4-1						
7-4-2						
7-4-3	H	H	H	H		
7-4-4	H	H	H	H		
7-4-5						
7-4-6						
7-4-7	J			X	Y	Z

1/ Each letter represents a separate major activity as shown below. Activities are included in cumulative effects analysis.

A = Cedar Gulch Timber Sale
B = ASARCO logging of private land
C = Cedar Gulch Timber Sale site prep and reforestation
(counted as major activity due to helicopter use)
D = Lost Girl Timber Sale
E = Lost Girl Timber Sale site prep and reforestation
F = North Sorrel Heli Timber Sale
G = Corral Salvage Timber Sale
H = Berray Mountain Timber Sale
I = Skranak Mine
J = MFP Private Logging
K = Noranda Montanore Powerline
L = Harpole Mine
M = Noranda MONTANORE mine project
N = Bear Lakes private property access and activity
X = ASARCO Rock Creek Mine Exploration
Y = ASARCO Rock Creek Mine Construction
Z = ASARCO Rock Creek Mine Operation and Rehabilitation

Moving Windows and Core Analysis

Table 9: Project Moving Windows route densities (% BMU by route density category)

	Open Routes				Total Routes *			
BMU	0 mi.	0-1 mi.	1-2 mi.	> 2 mi.	0 mi.	0-1 mi.	1-2 mi.	> 2 mi.
4	47.9	14.9	15.7	21.5	44.3	14.2	15.8	25.7
5	55.0	14.9	14.1	16.0	43.5	15.8	16.6	24.1
6	49.7	16.6	14.9	18.8	34.4	14.7	16.3	34.6
7	49.2	15.6	14.5	20.8	45.1	21.7	17.2	16.0
8	40.4	17.1	21.8	20.7	36.4	19.5	21.9	22.2
22	45.0	13.0	15.0	27.0	31.0	13.0	14.0	42.0

* does not include barriered roads (per IGBC Grizzly Bear Access Committee notes 2/97) (SEE MAPS - APPENDIX 6)
Changes are cumulative (includes all forseeable future projects).

Table 10: Project Core habitat analysis summary (% BMU in Core by habitat block size)

BMU	≤ 4 sq.mi. *	> 4 sq.mi. *	Total % Core	Core Change due to ASARCO 1999-2000 **	Cumulative Core Change 1998-2000 ***
4 \a	5.3	55.6	60.9	+ 1.2	+ 1.2
5 \b	4.1	56.1	60.2	0.0	- 0.8
6 \f	9.8	40.1	49.9	0.0	- 2.2
7 \c	1.1	64.9	66.0	0.0	- 1.9
8 \d	3.3	52.7	56.0	0.0	0.0
22 \e	1.6	0.0	47.7	0.0	0.0

* core habitat block size (SEE MAPS - APPENDIX 6)
** Change between 1999 (Noranda) and 2000 (due to ASARCO only)
***.Change from existing (1998) and Asarco (2000) due to all activities: (-) changes due to activity on private land.
\a based on 7/98 analysis by Kootenai NF S.O.
\b based on 6/98 analysis by Kootenai NF S.O.
\c based on 8/97 analysis by Kootenai NF S.O.
\d based on 2/97 analysis by Cabinet Ranger District, KNF
\e based on 5/97 analysis by Plains district (Lolo NF)
\f based on 7/98 analysis by Libby Ranger District

Recovery Objectives Analysis

The goal for grizzly bear management on the Kootenai National Forest is to provide sufficient quantity and quality of habitat to facilitate grizzly bear recovery. An integral part of the goal is to implement measures within the authority of the Forest Service to minimize human-caused grizzly bear mortalities.

This goal is accomplished by achieving certain objectives relative to grizzly bear recovery (Harms 1990). A number of measures are used to gauge whether the objectives are being met. These measures include Forest Plan standards and guidelines and other measures developed through consultation with U.S. Fish and Wildlife Service. The following analysis describes the potential effects, including cumulative effects of the proposed action by examining how these measures are implemented and, thus, how the objectives relating to grizzly bear recovery are met.

Objective 1: Provide adequate space to meet the spatial requirements of a recovered grizzly bear population.

Spatial requirements are achieved by implementing three Forest Plan standards. The first standard, application of the cumulative effects analysis process (Christensen and Madel 1982), demonstrates that the amount of available bear habitat is below the minimum threshold of 70 percent in two of the three affected Bear Management Units (BMU). This figure is referred to as habitat effectiveness or available space (see Tables 11 and 12).

TABLE 11: Percent change in grizzly bear habitat effectiveness (H.E) in the Bull, St.Paul, and Wanless BMUs due to ASARCO Rock creek mine *

Alt.	BMU 4	BMU 5	BMU 6
5	+1.0	-1.1	-0.3

* figures do not translate directly to % shown in table 12 because 12 includes all other projects effects (cumulative)

TABLE 12: Cumulative Grizzly bear H.E. in the Bull, St.Paul and Wanless BMUs before, during, and after the proposed action

	Existing Situation % H.E.		**During Proposed Action % H.E.**			**After Proposed Action % H.E.**
BMU	'98	'99	'00	'01	2002 - 2034	2035
4	62.5	62.5	62.3	62.3	65.4	65.5
5	75.4	64.8	64.1	64.1	64.1	64.6
6	68.1	68.0	66.0	66.0	66.0	68.0

(See Appendix 7 for projects included in cumulative change to H.E.)

Mitigation is required that will provide habitat enhancements to compensate for the reduction in HE caused by the proposed project (see Appendix 5 - Mitigation Plan item B2).

The second standard sets a maximum open road density of 0.75 linear miles of open road per square mile of habitat within each affected Bear Analysis Area. Table 13 displays ORD by Bear Analysis Area and maps in Appendix 13 show the spatial arrangement of BAAs meeting and not meeting the ORD standard.

Table 13: Open-road density (linear miles road/square mile) for BMUs 4, 5, and 6 by Bear Analysis Area (MS-1 lands only) (see map in Appendix 13)

Bear Analysis Area	Existing Situation		During Proposed Action					After Proposed Action
	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004-34**	**2035**
7-4-1	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
7-4-2	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
7-4-3	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.63
7-4-4 1/	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7-4-5 1/	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7-4-6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7-4-7 * 5/	0.62	0.62	0.59	0.59	0.59	0.59	0.59	0.62
7-5-1	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61
7-5-2 * 4/	0.86	0.86	0.79	0.79	0.79	0.79	0.79	0.79
7-5-3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5-5-4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5-5-5	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17
5-5-6	0.84	0.72	0.72	0.72	0.72	0.72	0.72	0.72
7-6-1 * 3/	0.77	0.77	0.62	0.62	0.62	0.62	0.62	0.62
7-6-2 1/	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7-6-3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5-6-4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5-6-5	0.62	0.43	0.51	0.51	0.51	0.51	0.51	0.51
5-6-6 2/	1.51	1.18	1.18	1.18	1.18	1.18	1.18	1.18
5-6-7	0.85	0.85	1.45	1.45	1.45	1.45	1.45	1.45

* BAA where ASARCO Rock Creek Mine active
1/ All road activity in Management Situation 3
2/ ORD reduced to 0.95 with Corral Salvage Timber Sale (~ 1995-96)
3/ ORD reduced to 0.62 with Cedar Gulch TS completion (~ 1999) and ASARCO Rock Creek Mine (2000- road 2285)
4/ ORD reduced to 0.79 with ASARCO Rock Creek Mine (roads 2741A - .5 mi., 2741x - .2 mi. and 150 - .9 mi.)
5/ ORD reduced to 0.59 with ASARCO Rock Creek Mine (road 150 - 2 miles)

The road densities displayed in Table 13 do not reflect the impacts of administrative use. The 1993 Grizzly Recovery Plan (pg. 148) recommends that administrative use not exceed 14 days during the time bears are out of the den (about April 1 to November 14). A bear does not differentiate between public or administrative use and may thus avoid administratively used roads. An analysis of open road density was done for the BAAs where ASARCO activities would take place. Data from the 1992, 1993 and 1994 administrative gate permits were analyzed. The results are displayed in Table 14. With administrative use, none of the BAAs meet 0.75 ORD. Consultation on the Skyline Timber Sale resulted in a change in the unit of measure for adminstrative use from "14 days" to "121 round trips". The number of trips have not been monitored prior to this time, therefore no data is available to analyze impacts of administrative use in this area using the round trip measurement.

TABLE 14: Open Road Densities by BAA including Administrative use \1

Bear Analysis Area	Without Admin. Use			With Administrative Use		
	1992	1993	1994	1992	1993	1994
7-4-7	0.89	0.89	0.89	1.07	0.98	0.98
7-5-1	0.52	0.52	0.57	1.05	1.05	1.05
7-5-2	0.78	0.78	0.79	0.78	0.78	0.79
7-6-1	0.76	0.76	0.76	1.03	1.03	1.03

\1 Admin. use counted as open road when days used exceeded 14 per bear year.

The third standard provides that a 5,000 - 15,000 acre displacement area (an area meeting all standards and containing no major activities) be provided adjacent to each Bear Analysis Area containing a major activity. Table 15 shows the displacement schedule and maps in Appendix 14 show spatial arrangement of active, displacement, and inactive BAAs.

The primary purpose of displacement analysis is to look at two broad scale bear habitat components, spring verses fall and denning habitat. While each of these general habitats are comprised of many individual elements (ie. avalanche chutes, huckleberry fields, coniferous forest etc.), the broader scale components have been defined using elevation and aspect (Kasworm's CYE annual grizzly and black bear research reports). Since grizzly bear habitat compontents are generally spread evenly across the ecosystem, as determined by physiographic features (ie. aspect, elevation), the use of these features (as a proxy) to determine acres of available replacement habitat is appropriate.

To assure in-kind habitat in the displacement areas an analysis was conducted on each BAA to determine the available acres by aspect (N,S,E,W) in two elevation zones (above and below 5,000 feet) (Table 16). This analysis method has been determined to be adequate for a displacement analysis (Kevin Shelly, USFWS, personal communication 11-19-93). In addition, the same analysis was done on the core habitat (Table 17).

The displacement analysis shows that it will take more than one BAA to provide displacement habitat for habitat lost due to activities in BAA 7-6-1 and 7-4-7. Two BAAs (7-6-2 and 7-6-3) will be required to provide displacement habitat for 7-6-1. Likewise, 7-4-7 will require two displacement areas (7-4-5 and 7-4-6). Displacement for 7-5-2 will be provided in 7-5-3. The displacement areas will not have any major activity in them for the life of ASARCO's Rock Creek Mine (see Tables 15 and 16 and maps in Appendix 14). The end result would be undisturbed displacement areas that provide 177 acres (below 5000 feet) and 7,452 acres (above 5000 feet) more than is available in BAAs where proposed project is planned.

TABLE 15: Displacement area scheduling in BULL, ST.PAUL and WANLESS BMUs

Year	Active BAA	Displacement BAA	Purpose
1997	7-4-3	7-2-3	Berray Mtn. TS
	7-4-4	7-4-2	Berray Mtn. TS
	7-6-1	7-6-2	Cedar Gulch TS
1998-1999	7-4-3	7-2-3	Berray Mtn. TS
	7-4-4	7-4-2	Berray Mtn. TS
	7-6-1	7-6-2	Cedar Gulch TS
	5-5-5	5-5-6 and 5-5-4	Noranda Montanore Mine
	5-5-6	5-5-4 and 5-5-6	Noranda Montanore Mine
	5-6-7	5-6-6	Noranda Powerline
2000-2002	7-4-3	7-2-3	Berray Mtn. TS
	7-4-4	7-4-2	Berray Mtn. TS
	5-5-5	5-5-6 and 5-5-4	Noranda Montanore Mine
	5-5-6	5-5-4 and 5-5-6	Noranda Montanore Mine
	7-6-1	7-6-2 and 7-6-3	ASARCO Rock Cr Mine
	7-5-2	7-5-3	"
	7-4-7	7-4-5 and 7-4-6	"
2003-2020	7-6-1	7-6-2 and 7-6-3	ASARCO Rock Cr Mine
	7-5-2	7-5-3	"
	7-4-7	7-4-5 and 7-4-6	"
	5-5-5	5-5-6 and 5-5-4	Noranda Montanore Mine
	5-5-6	5-5-4 and 5-5-6	Noranda Montanore Mine
2021-2034	7-6-1	7-6-2 and 7-6-3	ASARCO Rock Cr Mine
	7-5-2	7-5-3	"
	7-4-7	7-4-5 and 7-4-6	"

Table 16: Displacement Habitat Acres by Elevation Zone and Aspect

Aspect	Elevation	Active Area	Displacement Area	Difference
North	< 5000'	7225	6928	- 297
	> 5000'	1812	3274	+1462
				(+1165)
West	< 5000'	12884	7888	- 4996
	>5000'	5300	5971	+671
				(- 4325)
East	< 5000'	4649	9228	+ 4570
	>5000'	1488	4624	+ 3136
				(+7715)
South	<5000'	9289	10180	+ 891
	>5000'	2695	4878	(+ 2183)
				+ 3074

Active Area = BAAs with active ASARCO project (7-4-7, 7-5-2, and 7-6-1)

Displacement Area = BAAs 7-6-2, 7-6-3, 7-5-3, 7-4-5, 7-4-6

Table 17: BMU Core Displacement Habitat Acres by Elevation and Aspect Zones

BMU	Aspect	Elevation Zone	Available Acres
4	North	< 5000'	8114
		> 5000'	2607
	East	< 5000'	8624
		> 5000'	3124
	South	< 5000'	9284
		> 5000'	4088
	West	< 5000'	9725
		> 5000'	3437

BMU	Aspect	Elevation Zone	Available Acres
5	North	< 5000'	4274
		> 5000'	2734
	East	< 5000'	3694
		> 5000'	6322
	South	< 5000'	3438
		> 5000'	6046
	West	< 5000'	4197
		> 5000'	8043

BMU	Aspect	Elevation Zone	Available Acres
6	North	< 5000'	2734
		> 5000'	2712
	East	< 5000'	5660
		> 5000'	7131
	South	< 5000'	4414
		> 5000'	4167
	West	< 5000'	4707
		> 5000'	3753

Objective 2. **Manage for an adequate distribution of bears across the ecosystem.**

Grizzly bear habitat on the Kootenai National Forest is managed according to the Bear Management Unit (BMU) concept (Christensen and Madel 1982) for purposes of managing cumulative effects of human activities. This management concept potentially provides for an adequate distribution of bears by delineating BMUs (averaging about 100 square miles) and applying specific land management guidance to ensure compatibility with grizzly bears. BMUs are further broken down into Bear Analysis Areas (BAAs) (5,000 to 15,000 acres in size) for evaluation and application of measures to ensure adequate distribution of bears. Each BAA in the Bull, St.Paul, and Wanless BMUs was analyzed for five standards to determine if the distribution objective is being met.

1. Opening size -- Proposed harvest units, either individually or in combination with existing unrecovered units should normally be designed to be ≤40 acres. Where the 40 acre limitation is exceeded for justifiable reasons, no point in the resultant opening should be more than 600 feet from cover (i.e. maximum 1200 foot opening width.)

The largest proposed opening would be 324 acres (most in MS-3 lands), from the tailing impoundment (mostly private land). The mill site would require an opening of 41 acres. The opening size objective is not met. Mitigation is designed to replace habitat lost due to large openings (see Appendix 4 and mitigation plan item B1 in Appendix 5).

2. Movement corridors -- Unharvested corridors ≥600 feet in width should be maintained between proposed harvest units and between proposed and unrecovered existing harvest units.

Timbered corridors equal to or greater than 600 feet would be maintained between all created openings.

The increased traffic level on FDR 150 (1120% during construction and 300% during operations) would greatly reduce the effectiveness of the movement corridor between BAAs 7-6-1, 7-5-2 and 7-4-7. This reduction in corridor effectiveness would be partially offset by the required mitigation to develop a transportation plan that minimizes mine related traffic (including bussing of employees to mill site).

In addition the indirect effect of additional housing needs (see Bald Eagle effects) could further reduce the area available for bear movement to connect to habitat south of the Clark Fork River and west of the Bull River. This is because past history shows employees tend to concentrate within 30 miles of the work site. This concentration would occur in a short time frame, thus not allow time for bears to adjust to the new residences. Mortality risk would increase. Mitigation to provide replacement habitat may result in providing some secure areas for bear movement through these locations, however actual replacement habitat lands are not known at this time so there is still some risk of reducing connecting habitat. The corridor is currently significantly compromised from existing human developments and the incremental decrease in effectiveness of the corridor attributable to the project's effects are probably negligible.

The USFWS has stated that providing for adequate big game habitat in linkage zones between recovery areas is sufficent to maintain corridor habitat for the grizzly bear (USFWS 1993 pg 26). Maintaining 30% or more in security habitat (defined by Hillis et al. 1991) provides adequate protection for the grizzly bear in movement corridors outside the recovery zones. The portion of the Kootenai National Forest south of the Clark Fork contributes to the connecting corridor between the Cabinet/Yaak and the Bitterroot ecosystems. Analysis of the Clark Planning Unit, that covers this area, shows that during the spring and summer 34.6% of the area provides security habitat for big game, and thus grizzly bears. During the fall 42% of the area provides security habitat.

The draft BA indicated that a north to south movement corridor in the Cabinet Mountain portion of the CYE would be fragmented by having two large mining operations active at the same time. Additional analysis of the indirect recreational impacts and corridor assessment (see Appendices 10 & 12) shows that complete fragmentation is not likely to occur.

However, any grizzly bear with an established home range in the south half of the Cabinet Mountains would be impacted and may respond with changes in movement patterns and behaviors. At a minimum, this fracture zone (linear area of human activity that bisects grizzly habitat) would affect 31% (5 of 16) of the known grizzly bears in the CYE. The north to south movement patterns of bears would be further impacted (cumulative effect) by fracture zones created with the proposed access to three private parcels (Way-UP, Fourth of July, and Bear Lakes properties).

3. Seasonal components -- Schedule proposed mine activities to avoid known spring habitats during the spring-use period (April 1 to June 15) and known denning habitats during the denning period (November 15 to April 1.)

Since operations are planned 7 days a week, year round, the project would not avoid activity on spring habitat during the spring use period. Although there would be indirect effects on denning habitat from projected increases in recreational activity (see Appendix 12), denning habitat would not be adversely impacted, as the high use levels would occur during the summer and early fall months before the bears move to den sites.

Habitat unit (HU) analysis was done using the CEM for grizzly (USDA FS 1988) (see Table 4 for habitat components). Early (4/1 to 7/31) and late (8/1 to 11/30) habitat unit values were calculated and the effects (physically altered or disturbed by human activity) were determined (see appendix 4 for process details). The proposed project would affect 6133.5 early HUs (2.61 HUs per acre) and 3783.5 late HUs (1.61 HUs/ac.). This equates to an over all habitat value (OHV) of 2.11 (4958.5 HUs). "In kind" replacement habitat (2,350 acres) would be required as specified in the mitigation plan (Appendix 5).

4. Open-road densities -- Refer to discussion under objective 1.

5. Displacement areas -- Refer to discussion under objective 1.

Objective 3. **Manage for an acceptable level of mortality risk.**

There has been one documented grizzly bear mortality in the St. Paul BMU. The 1992 transplanted female was found dead of undetermined cause. This bear was known to have a cub of the year, which is assumed to be dead.

Mortality risk would increase due to the projected increase in vehicular killed deer and elk (up to 86%) that would draw bears to forest road 150. Vehicle traffic is projected to increase 1120% during construction (300% during operations), which increases the mortality risk to the bear. A cumulative mortality risk index (MRI) was developed (see Appendix 11). The analysis shows a relative increase of 0.2% in the MRI as a result of the proposed project.

Most human-caused grizzly bear mortalities on the Kootenai National Forest have resulted from interactions between bears and big game hunters (Kasworm and Manley 1988, pg 102). Grizzly bear vulnerability to human-caused mortality is partially a function of habitat security. Therefore, mortality can be partially managed by the application of standards which are designed to maintain or enhance habitat security. These standards have previously been discussed for objectives 1 and 2: 70 percent habitat effectiveness threshold, opening size, movement corridors, cover requirements, seasonal components, and open-road density.

Peak mine employee immigration levels are estimeated to be 180 families (375 people). An estimated 50-100 additional families (160-180 people) are expected to move into the area that will not be employed by the mine. A portion of all these people are expected to hunt. This increases the potential mortality risk to bears. This impact is partially mitigated with the provision of and I&E position that would educate these new hunters on grizzly bear identification and the laws concerning them, with the intent to reduce illegal and mistaken identity killings.

It is important to note that human-caused grizzly bear mortality is also a function of other factors, such as the regulation of big game hunting, which are beyond the authority of the Forest Service to control. Regulation of hunting is the responsibility of the State of Montana.

Actions specifically taken in the design of this proposed project to minimize the risk of grizzly bear mortality include: 1) closure of new roads to the public during operations, followed by yearlong closure to all persons after project completion. 2) No firearms in ASARCO employee's vehicles when traveling to and from work. 3) Transportation plan (including bussing) minimizes mine related traffic. 4) Removal of dead animals from the road corridor along FDR 150 and state highway 200. and 5) Using seed mixtures that do not contain clover.

Objective 4. **<u>Maintain/improve habitat suitability with respect to bear food production.</u>**

There are no actions specifically taken in the design of this proposed action to maintain or improve the production of bear foods. However, mitigation does require habitat enhancement on 484 acres (see mitigation plan item B2), a portion of which may result in improvement of bear food production. Maintenance would come through "in kind" replacement for habitat lost due to physical disturbance (see mitigation plan in appendix 5, item B1, and acre determinations in appendix 4).

Objective 5. **<u>Meet the management direction outlined in the Interagency Grizzly Bear Guidelines (51 Federal Register 42863) for management situations 1, 2, and 3.</u>**

The previously described Forest Plan standards and guidelines have been determined to meet the intent of the Interagency Grizzly Bear Guidelines (Buterbaugh 1991). Since the proposed project does not meet all Forest Plan standards and guidelines (specifically %HE and ORD), the intent of the Interagency Grizzly Bear Guidelines is not met, without additional measures (see measures below).

Objective 6. **<u>Meet the terms and conditions of the amended Biological Opinion (7-27-95) on the Kootenai Forest Plan</u>**

To meet this objective the USFWS set reasonable and prudent measures (USFWS 1995: pg 11) for: 1) open road and motorized trail density: meet Forest Plan Standards plus keep density at or below 0.75 over entire BMU. 2) Motorized trail access density: no increase. 3) Total motorized access route density: no net increase. 4) Percent of analysis area in core: no net decrease.

1) Open Road density by BAA has been displayed under objective 1 (Table 13). The ORD standard is met in all displacement BAAs that are scheduled to cover for active BMUs. In addition, the open motorized access route density for each of the entire BMUs is less than 0.75 mi./sq. mile (BMU 4 = 0.27; BMU 5 = 0.58; BMU 6 = 0.62).

2) There would be no increase in motorized trail access density. All road closures would be to ALL motorized vehicles. Closure devices would be barriers.

3) The total motorized access route density (TMARD) would remain unchanged in all BMUs. This is due to the mitigation to close an equal amount of road miles planned for construction in MS-1 lands (see mitigation plan in appendix 5).

4) Since the research is not complete, the amount of core habitat (by BMU) needed has not been established for the Cabinet Yaak ecosystem. In the interim, the USFWS set a measure requiring no net loss of core, until a standard is established. While core decreases in BMUs 5 & 6 from existing (see Table 10), core habitat levels would increase (Table 18) in BMU 4 and be maintained in BMUs 5 & 6 compared to 1999 core level (Noranda and other private land actions in operation). See Appendix 6 for maps of core habitat (by year) in each BMU. The core area impacted in BMU 5, by ASARCO Rock Creek mine, is the ventilation adit site. The location for the preferred alternative exits in a cliff. Since that site is not currently usable by the grizzly, and the noise level low (fans inside adit) there would be no loss of core habitat.

Table 18: Core Changes by BMU (*) due to ASARCO

BMU	Core %	Core Change *
4	60.9	+1.2
5	60.2	0.0
6	49.9	0.0

* Change is between 1999 (Noranda & Pvt. operations assumed active - added to existing) and 2000 (ASARCO start-up added to 1999)

Statement of Findings

The proposed federal action (with mitigation in place) still **may adversely affect** the grizzly bear and its habitat based on 1) Forest Plan standards and guides for grizzly are not met, including: percent habitat effectiveness (< 70% for all 3 impacted BMUs), and ORD (> 0.75 in 1 impacted BAA); 2) While direct Habitat loss is mitigated, there is a risk (level of uncertainty) that it may not be possible to achieve "in kind" replacement due to {a} unwilling sellers, {b} insufficient acres available in the disturbed BMUs (on site); 3) Project is active during seasonal use by bears for an extended time period thus reducing habitat suitability; 4) Connecting corridors to adjacent habitat areas (other BAAs) are impacted by increasing the width of the fracture zone along FDRs 150 and 2741; 5) Mortality Risk Index increase is small but, bear/human encounters could still result in additional bear mortality; 6) Interagency Grizzly Bear Guidelines intent is not met ; 7) The fracture zone (created by US Highway 200 and the residences along the highway corridor) human activity level increases, due to additional housing needs for ASARCO employees, which increases the mortality risk to bears attempting to move through the linkage zone to the Bitterroot ecosystem. The above factors contribute to the likelihood of incidental take occuring above the level currently permitted under the Kootenai National Forest Plan ammended

Biological Opinion and Incidental Take Statement (USFWS 7-27-95).

Potential Measures for Removing, Avoiding, or Compensating for Adverse Effects

The analysis performed in conjunction with this Biological Assessment identified unmitigated adverse effects on the grizzly. Additional mitigation or compensation for adverse effects are: 1) to meet the intent of the Interagency Grizzly Bear Guidelines, the Mitigation Plan items need to be in place **prior to the start** of the ASARCO Rock Creek Mine. Prior implementation of measures will be commensurate with planned work (progressive) as outlined in the Mitigation Plan.

WATER HOWELLIA (*Howellia aquatilis)*

Description of Population and Habitat Status
Surveys for this species were conducted concurrent with the sensitive plant surveys (see biological evaluation of sensitive species). No occurrences of this species were found.

Water howellia grows in firm consolidated clay and organic sediments that occur in wetlands associated with ephemeral glacial pothole ponds and former river oxbows (Shelly and Moseley 1988). These wetland habitats are filled by spring rains and snowmelt runoff; and depending on temperature and precipitation, exhibit some drying during the growing season. Microhabitats for this plant include shallow water, and the edges of deep ponds that are partially surrounded by deciduous trees (Shelly and Moseley 1988; Gamon 1992; USFWS 1994). No suitable habitat exists in the planning area.

Analysis of Direct, Indirect, and Cumulative Effects
No mining or road building activities occur in suitable water howellia habitat. There would be no direct, indirect or cumulative effects to this species or its habitat.

Statement of Findings

The proposed project would have **no effect** on water howellia or its habitat, based on 1) no activities in potentially suitable habitat, and 2) no plants present.

Potential Measures for Removing, Avoiding, or Compensating for Adverse Effects

The analysis performed in conjunction with this Biological Assessment determined that the proposed action would have no affect on water howellia or its habitat. Additional mitigation is not required .

PROPOSED SPECIES ASSESSMENT

LYNX (*Lynx canadensis)*

Description of Population and Habitat Status

Currently the lynx is listed as a 'sensitive' species in Region One of the Forest Service (Jolly 1994). In compliance with a court decision the USFWS proposed to list the Lynx under the Endangered Species Act on June 30, 1998 (Federal Regester Vol. 63 No. 130 pgs 36693-37013: July 8, 1998). The population of the lynx in the western United States and specifically Montana is unknown. While northwestern Montana is considered a stronghold for lynx in the lower 48 states, populations are very low and depressed (Lori Nordstrum, United States Fish and Wildlife Service, pers. comm. with Lisa Fairman, June 5, 1995). Lynx are known to occur on the Kootenai National Forest, however there are no recent sighting reports in the Rock Creek drainage. The status of the lynx in the project area and in the Cabinet Mountains is unknown. While lynx are considered to occur, populations are probably low. Trapping records suggest this, as only three lynx were trapped in Sanders County from 1977 to 1993 and all three were taken in 1984.

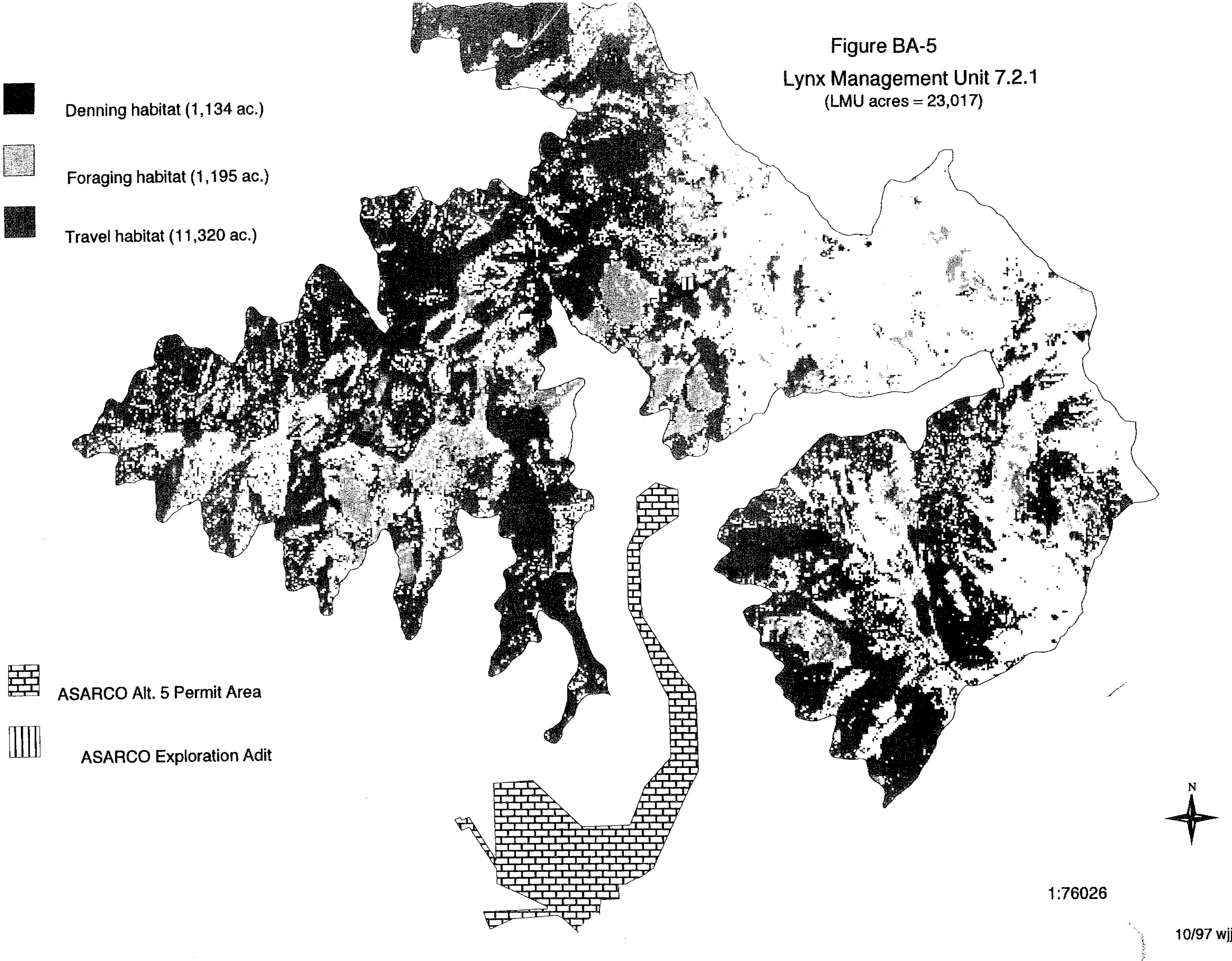
Lynx are solitary animals often associated with remote areas. They often use early seral stages at high elevations for foraging and mature to old growth forests with downed trees for denning and possible foraging (Weaver 1993). The distribution and abundance of the lynx appears to be tied to the snowshoe hare, their main prey (Ruggiero et al. 1994). Open areas discourage use by lynx and disrupt movement (Koehler 1990; Koehler and Brittell 1990 *In* Ruggiero et al. 1994). They are easily trapped. Humans are considered to be the single most important mortality factor for lynx (Ward and Krebs 1985 *In* Ruggiero et al. 1994).

Range of the lynx in the western contiguous United States has diminished over the last century. Habitat is more fragmented and restricted, which may cause the lynx to be less tolerant of human activities than in Canada and Alaska where refuge habitats occur (Ruggiero et al. 1994).

Lynx information has been summarized in the Kootenai National Forest's Lynx Conservation Strategy (Johnson et al. 1997). The strategy has summarized pertinent scientific literature, developed and mapped three habitat suitability models for the Kootenai National Forest, recommended an effects analysis process, provided updates on lynx research currently being conducted on the forest, and collected available sighting information.

The Lynx Conservation Strategy provides a base for determining the status of the population in the planning unit (the KNF) and in context, the project area. The three habitat suitability models mapped estimates of suitable habitat using three data sources to adjust for strengths and weaknesses of each source. The three models agree that lynx habitat is widespread and fairly common on the northern portion of the KNF (confirmed by the more common sightings found there), and less widespread and less common on the southern portion. The limiting factor for lynx habitat appears to be foraging habitat. The project area is limited in both denning and foraging habitat because most of it is lower elevation than lynx prefer. Habitat in the Rock Creek drainage falls within KNF Lynx management unit (LMU) 7.2.1 (see Figure BA-5). Of the 23,017 acres in LMU 7.2.1, only 4.9% (1,134 acres) is considered denning habitat and 5.2% (1,195 acres) is considered foraging habitat. The KNF Lynx Conservation Strategy suggests a minimum of 6% denning, a minimum of 30% foraging and between 40-60% travel habitat.

Figure BA-5
Lynx Management Unit 7.2.1
(LMU acres = 23,017)



Foraging habitat is less common than denning habitat for the CMW portion nearest the project boundary. Because only a small amount of denning habitat is needed for denning, foraging habitat is likely the limiting factor for lynx in the adjacent CMW as well as for other areas on the forest. Linkages to adjacent national forests and drainages do not appear to be limiting because travel habitat is well represented. Roads have an effect on the ability of animals to use otherwise suitable habitat for travel. In the Rock Creek drainage, suitable habitat is well-connected with a very large tract of habitat along the CMW. The portion of the LMU nearest the Noxon connectivity corridor is primarily travel habitat rather than denning or foraging habitat.

Analysis of Direct, Indirect and Cumulative Effects

The Kootenai Cumulative Effects Model (CEM) for lynx is considered to be the most accurate model for predicting lynx habitat suitability within the project area. While the TSMRS is more accurate where a high proportion of an area has stand examinations, the CEM is considered most accurate where these exams are lacking, as in the Rock Creek project area. Using the CEM, the project area has only 3 acres of denning habitat, and 17 acres of travel habitat at the evaluation adit. Travel habitat is much less specific than either foraging or denning habitat. The low amount of habitat within the project area suggests that the reason for few lynx observations (including trapping records) within the project area and vicinity is probably lack of suitable habitat.

Busing employees and incorporation of animal-friendly crossings along FDR No.150 would reduce the mortality risk to any dispersing lynx. Mitigation proposed for grizzly bear would also function as mitigation for the minor direct loss of habitat at the evaluation adit. Alternative V is not likely to adversely impact lynx or its habitat.

Statement of Findings

As a species proposed for listing the determination is **not likely to jeopardize the continued existence of lynx** or result in the destruction or adverse modification of critical lynx habitat. This determination is based on: 1) major activity is in low elevation dispersal habitat and there is sufficient dispersal habitat to allow movement of lynx through the Rock creek drainage, 2) direct impacts to denning and travel habitat are very minimal (3 and 17 acres respectively) and no loss of high quality forage habitat occurs, and 3) there are no recent sightings of lynx in the Rock Creek drainage.

Potential Measures for Removing, Avoiding, or Compensating, for Adverse, Effects

There are no measures required specifically for lynx. Measures designed to mitigate for effects to grizzly bear will provide benefits for the lynx (i.e. road closures, replacement habitat, bussing employees).

LITERATURE REVIEW

Bangs, Ed. 1998a. 1998. Reassessment of Montana Wolf Control Plan. Memorandum February 27, 1998. Ecological Services. Helena, MT. 17 pp.

Bangs, Ed. 1998b. Gray Wolf Recovery in the Rocky Mountains. Unpublished letter May 7, 1998 summarizing recovery status.

Buterbaugh, G. 1991. Biological Opinion on proposed timber sale (Grouse-Keeler) Compartment 40

Christensen, A. and M. Madel. 1982. Cumulative effects analysis process. Kootenai National Forest, Libby, MT. 23 pp.

Gamon, J. 1992. Report on the status in Washington of Howellia aquatilis Gray. Unpublished report, Washington Natural Heritage Program. Olympia, WA. 46pp. IN: USFWS. 1994. Endangered and Threatened Wildlife and Plants: The Plant, Water Howellia (Howellia aquatilis), Determined to be a threatened species. Federal Register Vol.59, No. 134 pages 35860 - 35864. July 14, 1994.

Hamer, T. 1976. First annual eagle-Osprey survey. Cabinet Ranger District ,Kootenai NF. Trout Creek, MT. 7pp.

Harms, D. 1990. Summary of the interagency biologist meeting of February 22,1990; grizzly bear standards and guidelines. Unpub. meeting notes. U.S.Fish and Wildlife Service, Helena, MT. 20 pp.

Harms, D. 1992. Interagency memo concerning distribution of listed species on the Kootenai National Forest. U.S. Fish and Wildlife Service, Helena, MT. 1 p. plus distribution maps.

Harms, D. 1993. Interagency memo announcing the proposal to list water howellia. U.S. Fish and Wildlife Service, Helena, MT. 2 pp.

Hillis, M. M. Thompson, J. Canfield, J. Lyon, C. Marcum, P. Dolan and D. McCleerey. 1991. Defining Elk Security: The Hillis Paradigm. P. 38-43 IN: Proc. Elk Vul. Symp. MT. St. Univ. Bozeman, Mt.

Interagency Grizzly Bear Committee . 1994 Taskforce Report 1994: Grizzly bear/motorized access management. 8 pp.

Johnson, Wayne J. et. al. 1997. Lynx Conservation Strategy: Kootenai National Forest. Kootenai National Forest. Libby, Mt. 105 pp.

Kasworm, W.F. and T.L. Manley. 1988. Grizzly bear and black bear ecology in the Cabinet Mountains of northwest Montana. Montana Dept. Fish, Wildlife, and Parks, Helena. 122pp.

Kasworm, W.F. and T.J.Thier. 1992. Cabinet-Yaak Ecosystem Grizzly Bear and Black Bear Research 1991 Progress Report. USFWS GB Recovery Coordinator's Office. U. of M. Missoula, MT. 67pp.

Kasworm, W.F. and C. Servheen. 1995. Cabinet-Yaak Ecosystem Grizzly Bear and Black Bear Research 1994 Progress Report. USFWS GB Recovery Coordinator's Office. U. of M. Missoula, MT. 42 pp.

Klohn-Crippen. 1997. Review of Tailing and Acid Rock Drainage, ASARCO Rock Creek Project. Draft September 22, 1997.

Mace, R.D. and T. Manley. 1992. South Fork lLathead River Grizzly Bear Project Progress Report. pps 24, 25. Montana Department of Fish, WIldlife and Parks.

McMaster, K.M. 1991. Interagency memo containing species list of threatened, endangered, and proposed species for Kootenai National Forest. U.S. Fish and Wildlife Service, Helena, MT. 2 pp.

Montana Bald Eagle Working Group (MBEWG). 1991. Habitat Management Guide for Bald Eagles in Northwestern Montana. C. Paige: editor. Billings, MT. 29pp.

Montana Bald Eagle Working Group (MBEWG). 1986. Montana Bald Eagle Management Plan. MBEWG. BLM. Billings, MT. 61pp.

Reel, S., L. Schassberger, and W. Ruediger. 1989. Caring for our natural community: Region 1 threatened, endangered, and sensitive species program. USDA Forest Service, Northern Region, Missoula, MT. 333 pp.

Schafer & Associates. 1997. Final Report on Rock Creek Humidity Cell Testing.

Servheen, Chris. 1998. Grizzly Update: News on grizzly bear recovery activities in the states of Wyoming, Montana, Idaho, and Washington from the Interagency Grizzly Bear Committee March 9, 1998. USFWS, IGBC Helena, MT. 12 pp.

Shelly, J.S. and R. Moseley. 1988. Report on the conservation status of Howellia aquatilis, a candidate threatened species. Unpublished report, Montana Natural Heritage Program. Helena, MT. 166pp. IN: USFWS. 1994. Endangered and Threatened Wildlife and Plants: The Plant, Water Howellia (Howellia aquatilis), Determined to be a threatened species. Federal Register Vol.59, No. 134 pages 35860 - 35864. July 14, 1994.

Solem, Stephen J. 1995. Implementation of Terms and Conditions USFWS Amended Biological Opinion. 2670 Memo Sept. 12, 1995. attachment: McMaster, K. 1995. Level 2 meeting summary: analysis need. Inter-agency memo USFWS - USFS Sept. 5, 1995.

Stark N. and S. Baker 1992. Ecology and culture of Montana huckleberries. Montana Forest and Conservation Exp. Sta. U. of M. Missoula, MT. 87pp.

USDA. 1987. Kootenai National Forest Land and Resource Management Plan, Final EIS. USDA Forest Service, Northern Region, Missoula, MT.

USDA Forest Service. 1988. Cumulative Effects Analysis Process for the Cabinet/Yaak Grizzly Bear Ecosystems 1988. USDA FS, IDF&G, WDW, MDFWP, USDI F&WS. 32 pp.

U.S. Fish and Wildlife Service. 1982. Grizzly Bear Recovery Plan. USDI USFWS. Denver, CO. 195 pp.

U.S. Fish and Wildlife Service. 1984. American Peregrine Falcon Recovery Plan (Rocky Mountain/Southwest Populations). Prepared in cooperation with the American Peregrine Falcon Recovery Team. USFWS. Denver, CO. 105pp.

U.S. Fish and Wildlife Service. 1986. Pacific Bald Eagle Recovery Plan. USFWS. 163pp.

U.S. Fish and Wildlife Service. 1987. Northern Rocky Mountain Wolf Recovery Plan. USDI, USFWS. Denver, CO. 119pp.

U.S. Fish and Wildlife Service. 1993. Grizzly Bear Recovery Plan. Missoula, MT. 181 pp.

U.S. Fish and Wildlife Service. 1994. Endangered and Threatened Wildlife and Plants: The Plant, Water Howellia (Howellia aquatilis), Determined to be a threatened species. Federal Register Vol.59, No. 134 pages 35860 - 35864. July 14, 1994.

U.S. Fish and Wildlife Service. 1995. Amendment (July 27, 1995) to Biological Opinion (June 26, 1985) on Kootenai Forest Plan: Incidental Take Analysis. Kemper McMaster letter to Robert Schrenk. 15 pp.

_____. 1986. Interagency Grizzly Bear Guidelines. USFS, USFWS, MDFWP, IF&G, WG&F, BLM, WDW, NPS. 100pp.

Wakkinen, W. and W.F. Kasworm. 1997. Grizzly Bear and Road Density Relationships in the Selkirk and Cabinet-Yaak Recovery Zones. USFWS. 28 pp.

PERSONAL COMMUNICATIONS

FLATH, DENNIS. 6-15-98. MFWP. Helena, MT. Topic: Bald Eagle recovery status and existing situation for Upper Columbia Basin recovery zone.

FLATH, DENNIS. 6-16-98. MFWP. Helena, MT. Topic: Peregrine Falcon recovery status and existing situation for Montana portion of Rocky Mountain/Southwest recovery zone.

HAZELWOOD, ROB. 6-9-98. USFWS . Helena, MT. Topic: Bald Eagle recovery status and existing situation for Upper Columbia Basin recovery zone.

HAZELWOOD, ROB. 6-29-98. USFWS . Helena, MT. Topic: Peregrine Falcon recovery status and existing situation for Rocky Mountain/Southwest recovery zone.

KASWORM, WAYNE. 7-19-94. USFWS Grizzly Research Biologist. Libby, MT. Topic: Population estimate for the Cabinet/Yaak ecosystem.

SHELLEY, KEVIN. 11-19-93. USFWS Consultation Biologist. Kalispell, MT. Topic: Displacement Analysis process to determine "in kind" displacement.

SUMMERFIELD, BOB. 10-12-93. Kootenai NF Forest Wildlife Biologist. Libby, MT. Topic: Peregrine Falcon Surveys - Bull river drainage, 1989 Peregrine Fund survey results.

OTHERS CONSULTED

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SUMMERFIELD, BOB. Forest Wildlife Biologist. Supervisor's Office, Kootenai NF

Appendix 1: TES Conservation Measures Implemented to Date on Kootenai National Forest (June 1992)

<u>Bald Eagle</u>

- Osprey/eagle nesting surveys done annually, 1980-present.
- Monitoring of reported eagle sightings.
- Participation in national mid-winter bald eagle surveys.
- Funding of aerial survey for bald eagle nests in 1989.
- Public education/school programs on TES species.

<u>Peregrine Falcon</u>

- Monitoring of reported sightings.
- Funding of 1989 aerial survey to identify potential peregrine habitat.
- Monitoring of historical nest site in the Yaak since 1979.
- Public education/school programs on TES species.

<u>Wolf</u>

- Monitoring and evaluation of reported sightings and sign.
- Funding Wolf Ecology Project to aerially monitor radio collared wolf.
- Coordination with Idaho Department of Fish and Game, Montana Department of Fish, Wildlife, and Parks, and USFWS on wolf management and planning.
- Management of habitats for ungulate prey base through road closures, prescribed habitat burning, forage seeding, timber sale coordination.
- Public contacts and educational presentations to the local schools in Troy, Libby, Eureka, and Yaak areas.

<u>Grizzly Bear</u>

<u>Habitat Improvement</u> (since 1975)

- Approximately 900 acres of prescribed burning of grizzly bear habitat.

- Approximately 2000 acres of big game habitat burning with secondary benefits to grizzly bears and wolves.

- Approximately 225 acres of forage seeding for grizzly bears.

- Approximately 1350 acres of forage seeding for big game with secondary benefits to grizzly bears and wolves.

- Approximately 450 miles of roads closed year round or seasonally.

- Approximately 2,826 acres replacement habitat proposed for Montanore

Habitat Inventory and Cumulative Effects Analysis (CEA)

- Participated with Border Grizzly Project (BGP) in reconnaissance surveys of the Yaak to assess habitat and populations.

- Conducted habitat component mapping.

- Developed and implemented grizzly bear Cumulative Effects Analysis process, and calculate CEA annually since 1984 on all BMU's.

Studies

- 1986-87, Yaak black bear study with secondary information collected on grizzlies. Provided administrative support, facilities, and equipment.

- 1989-present, Yaak grizzly study. Provided funding, vehicles, housing, equipment, and administrative support.

- 1985-present, funded aerial bear occurrence/shrubfield survey.

Grizzly Relocations

- 1976-83, provided relocation sites for a total of 7 bears from other ecosystems. Participated in monitoring these bears, also provided housing and administrative support to BGP trackers.

- 1991-1994, 4 female grizzly brought from Canada and placed in Cabinet Mountain wilderness as part of population augmentation plan

Monitoring

- Annually collect, record, and evaluate all grizzly reports since 1975.

- Aerial surveys during late summer to document grizzly occurrence.

Resource coordination

- Active participant in all interdisciplinary planning of activities within grizzly habitat; provide biological input at all levels and phases; develop Biological Evaluations for activities; initiate consultation with USFWS and MDFWP as needed.

- In the process of adopting a MOU with MDFWP and USFWS to oversee Montanore project grizzly bear mitigation plan.

Information/Education, Law Enforcement

- Annual road patrols concentrated mostly during rifle hunting seasons.

- Signing grizzly habitat with bear identification materials.

- Participate with MDFWP and USFWS in investigating mortality instances, coordinating additional closures, and informing the public.

- Established "Grizzly Bear Mortality Working Group" in conjunction with Interagency Grizzly Bear Committee in 1989.

- Public education/school programs on TES species. In the process of establishing I&E and Law enforcement positions as mitigation for Montanore project.

Lynx

⇒ Active participation in all interdisciplinary planning of actvities in lynx habitat. Provide biological input at all levels and phases. Develop Biological Evaluations for activities. Annual collection, recording and evaluation of all lynx reports. (on going)

⇒ Established a lynx taskforce that researched and summarized research information on lynx. Developed lynx habitat component defintions. Designed lynx habitat model. Produced Lynx Conservation Strategy for the Kootenai National Forest. (1994-1997)

⇒ Provided funding, administrative suppor,t and field participation in Lynx track surveys in partnership with the Montana Fish, Widlife and Parks. (1995)

⇒ Provided funding, administrative support, and field participation in "DNA Identification of lynx hair for assessing population status" study by John Weaver. (1996-1998)

⇒ Provided funding, administrative support, and field participation in "Lynx prey species habitat evaluation" study in partnership with the Northern Rockies Conservation Cooperative. (1997-present)

⇒ Provided field participation in lynx surveys (forest wide lynx hair snagging sampling program) (1997-98).

Appendix 2: **Detailed Proposed Project Description**
(taken from the Supplemental Draft EIS, January 1998)

~~*Wetlands Mitigation Plan.* Alternative IV would impact 6.0 acres of wetlands and 0.4 acres of Waters of the U.S. (see **Table 2-6**). Only 10.5 acres of wetlands mitigation sites proposed by ASARCO would still be available for use. Other locations within the riparian areas along Rock Creek and within the proposed permit area might have the necessary wetland hydrologic characteristics to replace the access road mitigation site acres. ASARCO might be required to identify additional mitigation sites to comply with its 404(b)(1) permit. Other components of the wetlands mitigation plan would be the same as for Alternative III.~~

Alternative V — Rock Creek Project with Tailings Paste Deposition and Alternate Water Treatment (Preferred Alternative)

The major modifications distinguishing this alternative from Alternative IV as described in the draft EIS are the deposition of tailings as a paste, an alternate water treatment system, an enclosed rail loadout facility, and relocation of the evaluation adit support facilities (see **Figure 2-26**). **Table 2-11** lists the significant issues pertinent to this project and indicates which of the following sections addresses mitigating measures for those issues. Chapter 4 contains a more detailed discussion of how the mitigating measures would reduce or eliminate environmental impacts.

In addition, to the major modification mentioned above, Alternative V includes the following applicable modifications, mitigations, and monitoring plans from Alternatives III and/or IV, described in the draft EIS:

Modifications:

- Alternate mill and mine portal location at confluence of east and west forks of Rock Creek (Alternative IV) and subsequently shorter access road and utility corridor
- Alternate rail loadout location near Miller Gulch (Alternative III)

TABLE 2-11
Alternative V Modifications and Mitigations

Significant Issues	Categories							
	Mine Plan & Ore Processing	Tailings Disposal	Water Use & Management	Transportation	Utilities	Employment	Reclamation	Monitoring & Mitigation Plans
Surface & Ground Water Quality		x	x	x	x		x	x
Fish, Wildlife, and T&E Species	x	x	x	x	x	x	x	x
Impoundment/Paste Facility Stability		x						
Socioeconomics	x							
Old Growth Ecosystem	x							
Waters of the U.S. and Wetlands	x	x						x
Public Access/Traffic Safety	x			x				
Aesthetic Qualities	x	x			x		x	

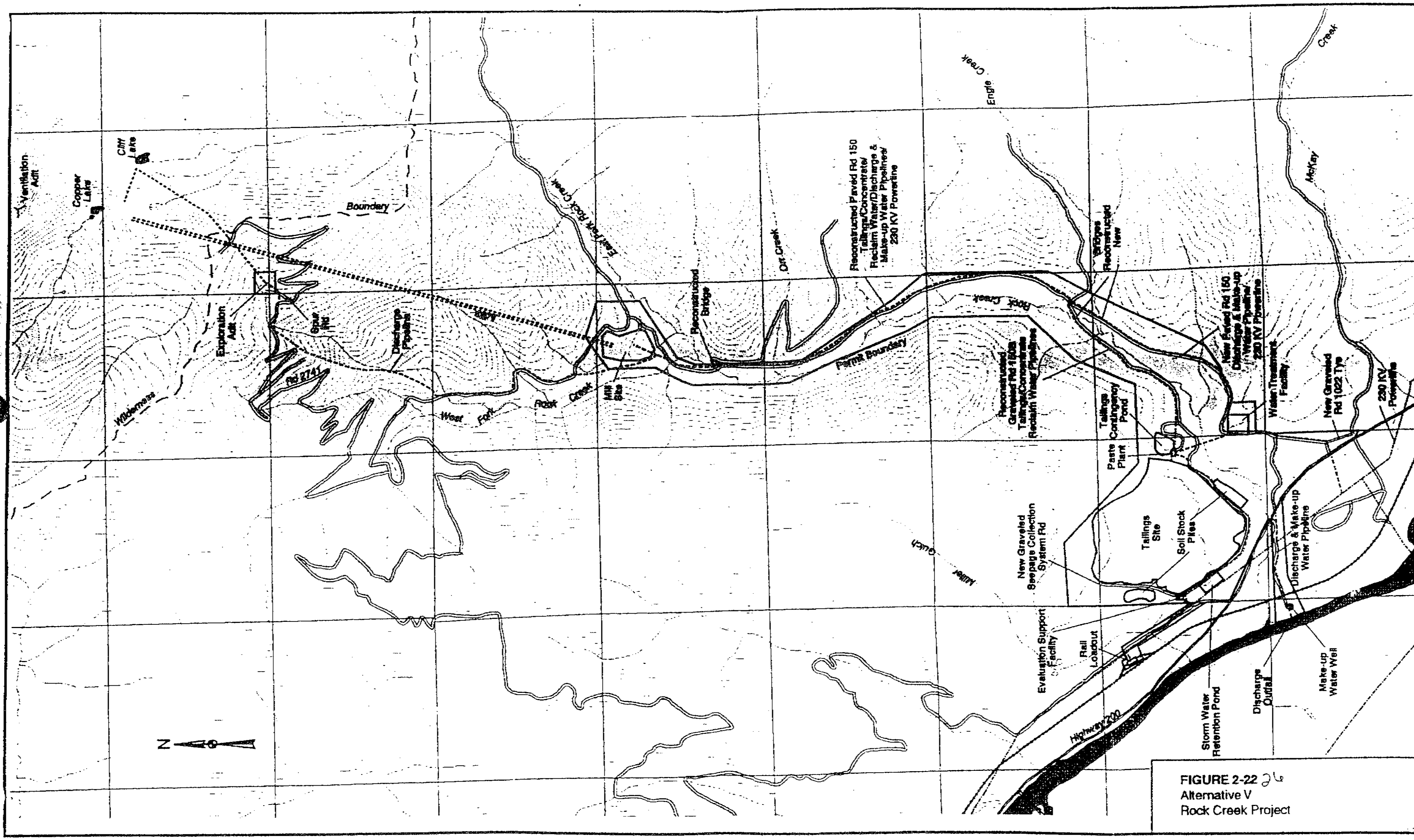


FIGURE 2-22 26
Alternative V
Rock Creek Project

- Alternate location for wilderness ventilation adit (Alternative III)
- Combined utility and road corridor (Alternative III)
- Relocation and reconstruction of FDR No. 150 (Alternative III)

Mitigations:

- Subsidence control and monitoring plan (Alternative III)
- Rock mechanics and hydrogeologic sampling, testing and monitoring program to include an acid-base testing program (Alternative (III)
- Visual and sound mitigations for the mill site (alternatives III and IV), and ventilation and evaluation adits (Alternative III)
- Technical panel review of final tailings impoundment design (paste facility under Alternative V) (Alternatives III and IV)
- Development of a transportation management plan (Alternative III)
- Visual mitigations for the utility corridor and tailings impoundment site (paste facility site under Alternative V) (Alternative III)
- Revised grading and revegetation plans for the mill site to mitigate visual impacts (Alternative IV)
- Deeper soil salvage (24 to 36 inches) and replacement depths (average of 24 inches) to facilitate revegetation (Alternative III)
- More detailed long-term reclamation monitoring plan than Alternative II (Alternative III)
- More detailed aquatics/fisheries, wildlife, threatened and endangered species monitoring and mitigation plans than under Alternative II, including a sediment source reduction plan (Alternative III)
- A comprehensive, long-term water monitoring plan which includes monitoring lake levels at Cliff and Copper lakes to be coordinated with subsidence control and monitoring plan and fisheries/aquatics monitoring plans (Alternative III)
- An alert level and contingency/corrective action plan for each monitoring plan (Alternative III)
- Maintenance and possible long-term post-closure waste water treatment (Alternative III)

Evaluation Adit

Evaluation activities would remain essentially the same as described for Alternative II in the draft EIS and summarized above in this chapter. However, the support facilities site has been relocated to a site within the paste facility footprint (see **Figure 2-26**). The power source for the adit has been changed to propane generators and is discussed under ***Utilities***. Changes to waste water treatment are discussed under ***Water Use and Management***.

Mine Plan

The mine plan would remain the same as described for Alternatives II through IV in the draft EIS. The mill site would be located at the confluence of the East and West forks of Rock Creek, as described for Alternative IV in the draft EIS. However, the mine portal would be moved to the west side of FDR No. 150 just north of the coarse ore storage. This lines the adits up with the mill facilities and eliminates two transfer points on the ore conveyor belt system. There would be no mine facilities on the east side of FDR No. 150 at the confluence mill site other than storm water control features. Some of the waste rock from driving the mine adits would be used for mill pad construction, road graveling, and paste facility construction. Hauling of waste rock from the adits to the tailings paste facility site would be restricted to mid-August through May as a mitigation to impacts on harlequin ducks.

There would be a minimum 100-foot vegetative buffer between FDR No. 150 and mine/mill facilities including the relocated mine portal for visual screening. There also would be a 300-foot buffer between the mill and either fork of Rock Creek.

Reduced-emission diesel engines would be used in place of standard diesel engines underground. Electric underground ore trucks would also be used. These modifications would reduce concentrations of NO_2, SO_2, and CO released to the atmosphere and underground workings.

Surface Disturbance

A total of about 481 acres would be disturbed within the permit area under Alternative V (see **Table 2-2**). The Forest Plan would be amended so that management allocations on 147 acres would be consistent with the intended use.

Ore Production Schedule

The development schedule has been lengthened because of the additional time needed to develop the longer adit.

The ore production schedule has been adjusted based on a more conservative recovery estimate of 65 percent and a revised amount of ore to 136,000,000 tons (see **Table 2-12**).

After limited ore production during early mine start-up there would be approximately 28 years of remaining production. The schedule is summarized below. This schedule could be affected by unforeseen delays related to permitting, design approvals, development or construction delays or accelerations, financial considerations, actual mining conditions and ore recoveries, and metal market conditions. An earliest estimated start date based on the EIS development schedule and possible timing of agency decisions would be no sooner than June 1999, however, actual project construction would be determined by ASARCO based on market conditions and other business considerations.

TABLE 2-12
Estimated Project Development Schedule

Project[1] Year 1	Evaluation Adit
Project Years 2 and 3	Mine Development[2]
Project Years 4 through 5.5	Mine Development[2]/Surface Facilities Construction[3]
Project Years 5.5 through 6	Start-up/Limited Production
Project Years 7 through 33	Production
Project Years 34 through 35	Reclamation

Notes:
1 Project year goes from beginning to end of that year. That is, project year 1 goes from 0 to end of year 1.
2 Waste rock would be hauled seasonally during mine development (years 2 through 6).
3 Includes construction of mill site, waste water treatment plant, paste plant and utilities corridor.

Ore Processing and Shipment

The ore-processing facility or mill would remain generally the same as is described for the proposed action, Alternative II, but located at the confluence of the east and west forks of Rock Creek as described for Alternative IV (described in the draft EIS). The primary difference from the other action alternatives is that there would be no tailings thickener facility at the mill site due to the change in tailings disposal (see Paste Deposition of Tailings below). The thickener would not be necessary as the tailings would be dewatered at the paste production plant adjacent to the tailings paste facility. However, the emergency dump pond and the storm water pond would be enlarged to provide additional water storage (see **Figure 2-27**).

ASARCO modified the milling operation to reduce particulate emissions under Alternative V. The surface dry milling operation or secondary crushing would be replaced with a semi-autogeneous (SAG) mill, a fully wet milling operation. Concentrate would be sent from the mill to the rail loadout facility as a slurry in a 3-inch HDPE-lined steel pipe with leak detection sensors and buried in the same corridor as the tailings and water pipelines. The rail-loadout process including concentrate de-watering, drying, filtering, and storage and railcar loading would take place within an enclosed building. Covered railcars would eliminate the use of a tackifier that would have been needed to minimize dust generation during transport to the smelter. Approximately 13 railcars of concentrate per week would be removed from the site. Reclaimed concentrate water would be piped to the paste plant and then to the mill for reuse.

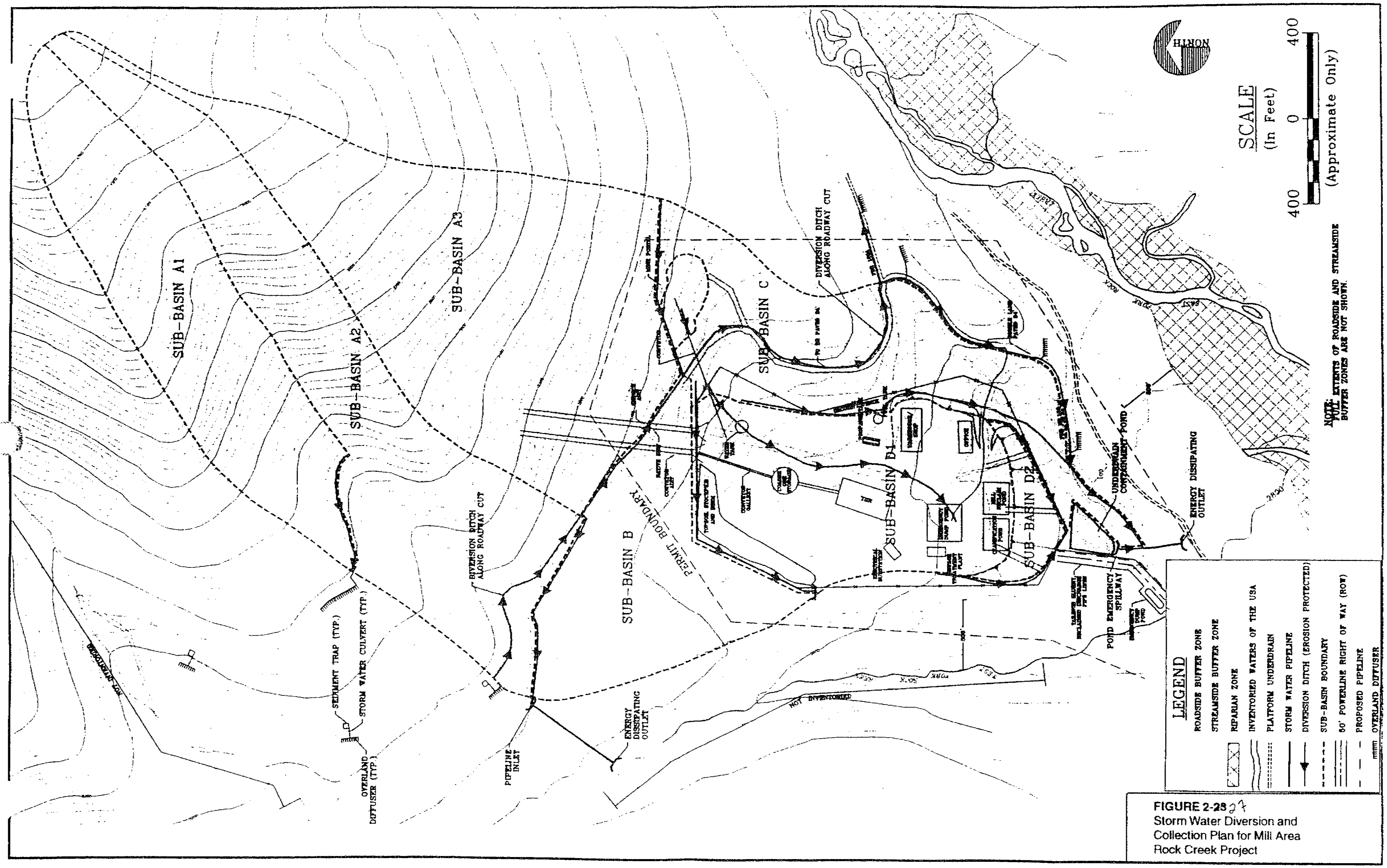


FIGURE 2-28 27
Storm Water Diversion and Collection Plan for Mill Area
Rock Creek Project

Paste Deposition of Tailings

Tailings Transport. Tailings would be transported 4.1 miles from the mill to the paste plant as a slurry (30 percent tailings, 70 percent water) in a 16- to 24-inch, urethane-lined, steel pipeline (a double-walled pipeline) with leakage detection devices. This pipeline along with the 15- to 18-inch return process water line, which would also be used as the make-up water line, and the concentrate pipeline would be buried 24 inches deep (see **Figure 2-28**). Burying the pipelines will provide better protection from vandalism, eliminate the visible presence of the pipelines, and facilitate concurrent reclamation in the pipeline corridor along most of the route between the mill and the paste plant. The pipelines would be visible at the three above ground crossings of Rock Creek, West Fork Rock Creek, and Engle Creek. All lines would be encased in a larger steel pipe at creek crossings adjacent to or near bridge crossings to guard against the unlikely event of a leak or rupture.

Paste Production. In general, the tailings would be delivered to the paste plant and dewatered to make a paste with a known proportion of water (approximately 20 percent by weight). This paste would be applied to the ground surface after sediment and erosion control features are in place and soil has been salvaged.

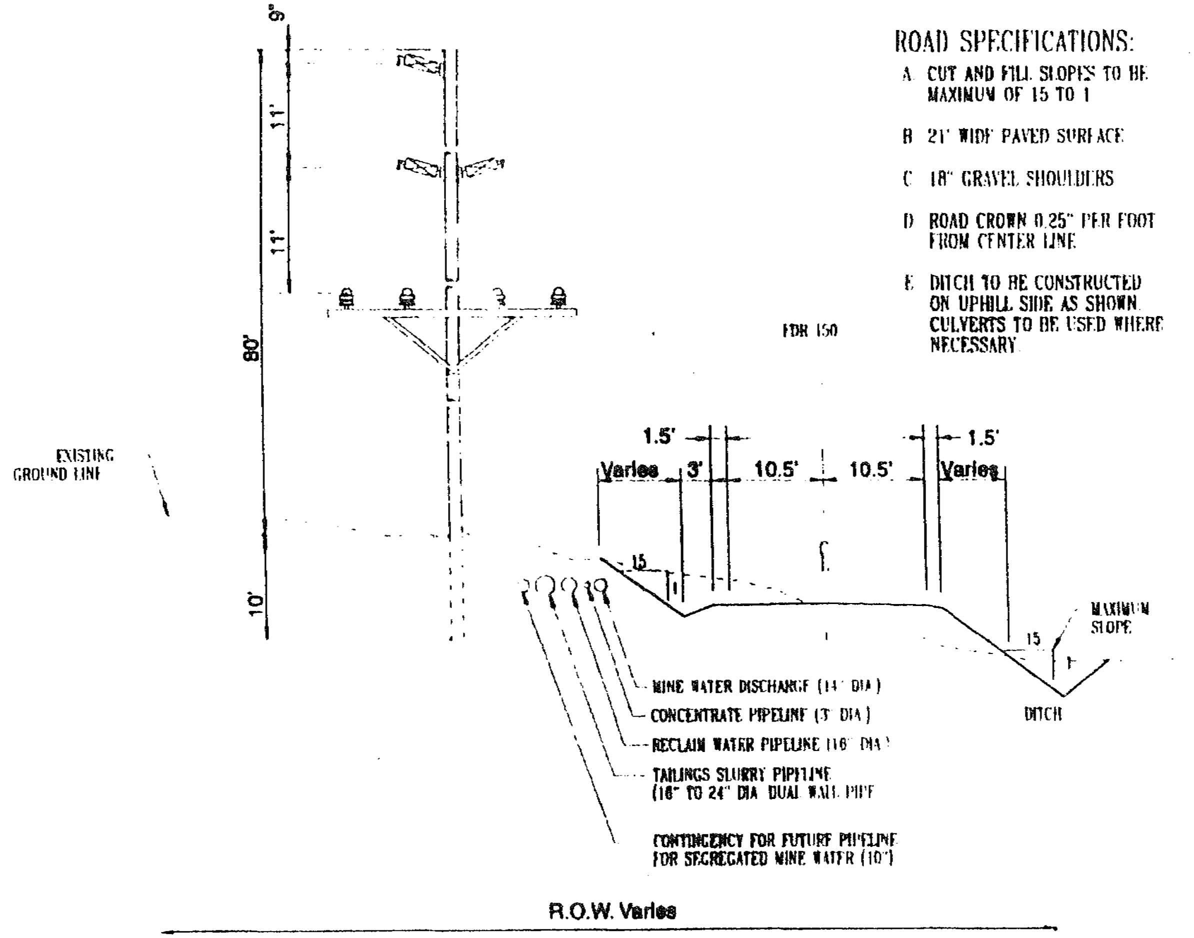
The paste plant building, approximately 80-feet by 80-feet by 110-feet high, would be located on the hillside adjacent to the tailings paste facility site. The building would be built into the hillside and painted to help reduce its visual impact. Trees and vegetation surrounding the paste plant would be retained or planted to help visually blend the plant site with adjacent hillsides. ASARCO would conduct a site study verified by a visit with the Agencies prior to final siting of the plant and access road to select a location that would reduce plant visibility and avoid harlequin duck habitat to the extent possible.

The paste plant would be designed to receive, dewater, mix, and pump 10,000 tons of tailings per day, 365 days per year. The paste process schematic is shown in **figures 2-29 and 2-30**. The tailings slurry would be deposited into a tailings surge tank and then fed into two cyclone/separators. The cyclone underflow, composed of the coarser tailings, would be discharged into an agitated storage tank (25-foot-diameter by 50-foot-high) and could be discharged at a rate of 50 tons per hour (tph). The overflow, composed of primarily finer tailings, would be fed through a distributor box into one or more of the four 32-foot-diameter by 60-foot-high dewatering tanks. The tailings would be discharged from each tank at a rate of 67 tph. Maximum discharge rate could reach 90 tph to allow for maintenance of one tank while continuing paste production in the other three tanks.

Process water for paste production would come from the water discharged from the dewatering tanks. Process water would be stored in a 30,000-gallon tank; excess water would be pumped back to the mill for reuse or discharged from the mill to the waste water treatment facility for disposal.

The full plant tailings paste would be produced by combining the fine tailings paste from the dewatering tanks, the coarser tailings in the agitated storage tank, and additional process water as needed. Supplemental material such as a binder (Portland cement, fly ash, or slag cement) or seed and/or fertilizer to facilitate reclamation may be added as needed. Each dewatering tank would have a separate mixer capable of handling the maximum discharge from the dewatering tank plus the coarse material from the storage tank. The paste production would be monitored and regulated so that the resultant paste

2-54 a5



NOTE:
1. ALL PIPELINES WOULD BE INSTALLED WITH LEAK DETECTION SYSTEMS.

FIGURE 2-24 -28
Pipeline Corridor Drawing
Rock Creek Project

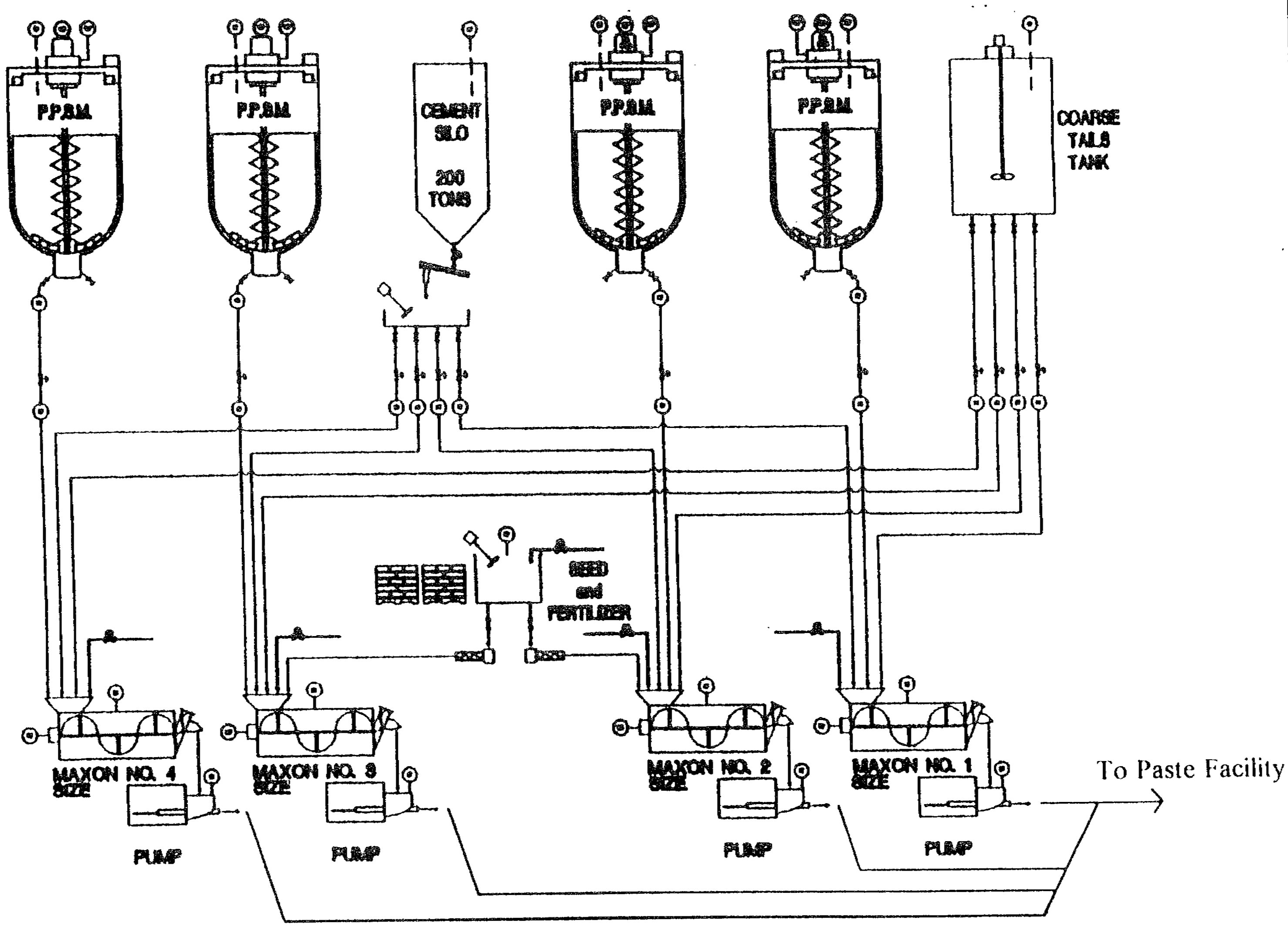


FIGURE 2-25 29
Paste Plant Process Schematic - Paste Production and Mixxing
Rock Creek Project

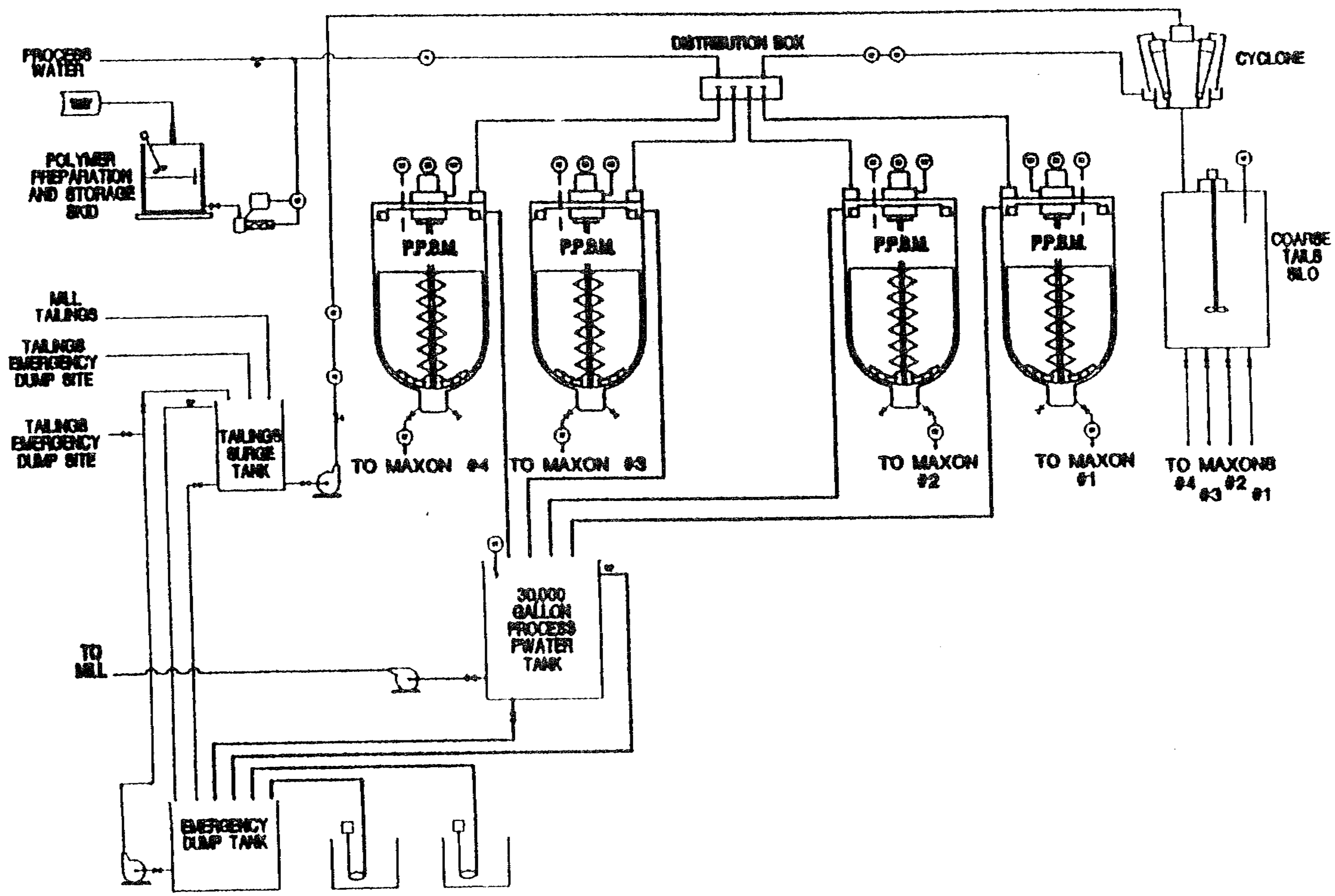


FIGURE 2-26 30
Paste Plant Process Schematic - Dewatering of Tailings Slurry
Rock Creek Project

2-57a

would have the consistency of a 7-inch slump. Positive displacement pumps would transport the paste via a high-pressure pipeline to the disposal location at the tailings paste facility.

The dewatering tanks would be designed to allow for continuous feed of tailings and production of paste even when one tank was off line for maintenance or repairs. The surge capacity of the dewatering tanks and the coarse tailings agitated storage tank would allow the paste production system to be shut down for 7 hours without stopping the tailings slurry feed from the mill or before using a tailings slurry feed containment site adjacent to the plant. In addition, each mixer has a surge capacity of 15 tons or approximately 10 minutes of down time for one mixer/pump pair without shutting down the paste production process.

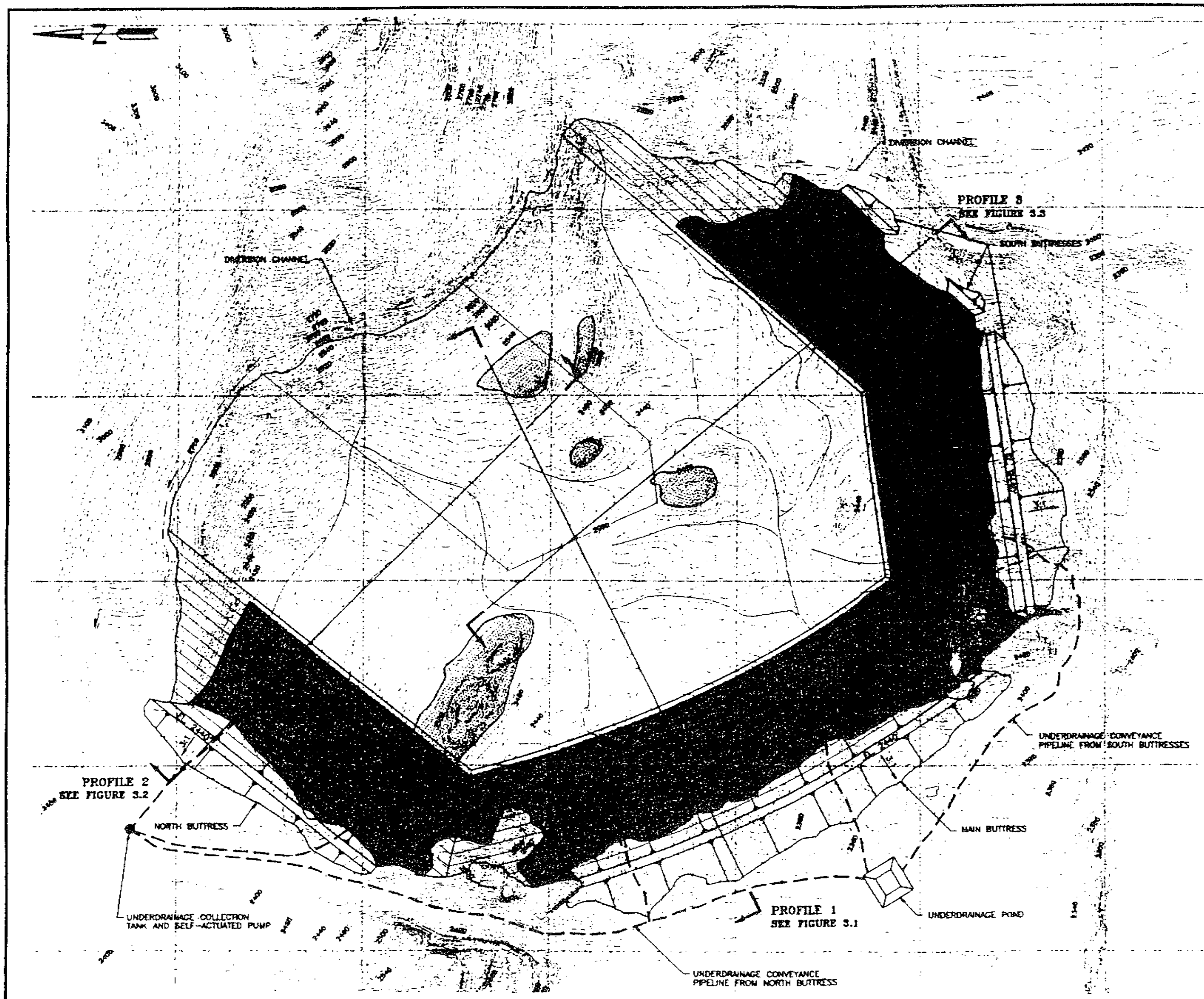
A 7-acre contingency tailings slurry feed containment site would be near the paste production plant to contain approximately 6 days of tailings production should the paste production plant be totally disabled or in the event of a major failure beyond the control of the plant design (see **Figure 2-26**). This facility would be designed using traditional slurry impoundment design methods with a dam or embankment and would be lined with low permeability native materials (clay-type soils) to control seepage. The tailings stored in the containment pond would be dredged from the pond and reintroduced into the plant for disposal as a paste after the plant resumed operation. A paste plant shutdown of more than 6 days would result in the suspension of milling.

Tailings Paste Deposition. The location of the paste plant was selected to utilize a hillside location adjacent to the paste facility for convenient tailings materials handling and disposal. The paste plant design provides operational flexibility and avoids duplication in pump transport. Positive displacement pumps with a combined design capacity of approximately 680 dry tph would be used in an arrangement that would allow one pump to be shut down for either preventative or unscheduled maintenance. The paste would be pumped to the paste delivery system.

There are two primary paste deposition options for Alternative V and one combined paste deposition option. These options are named according to the direction in which the paste is deposited and the landform is built (see **Figure 2-31**, **2-32**, and **2-33**). These options are termed Bottom-Up option (Alternative V-a), Top-Down option (Alternative V-b), and Combined option (Alternative V-c).

The Bottom-Up option would initially involve spigotting paste from the lower elevations and moving the spigot point upslope. The Top-Down option would result in deposition of the paste by spigotting the paste from the upper-most slopes and moving the spigot point towards the highway; the deposit would gradually progress to the southern most portion of the deposit site. Under the Combined option the direction of paste deposit and spigot location would depend on the method being used at the time as described for the Bottom-Up and Top-Down options. The combined option would be used on a seasonal basis each year or alternate between a number of years with each of the first two options. The tailings paste facility would encompass approximately 305 acres for the paste facility and another 20 acres for associated features, such as soil stockpiles, under all options but acreage would vary slightly based on the final approved design.

A series of toe buttresses would be required for all options to assist in containing the paste on the downslope sides, improving slope stability, and retaining sediment eroding off the slopes. Under these conceptual designs, the buttresses would reach an ultimate height of approximately 80 feet (elevation of



LEGEND:

- DESIGN CONTOUR AND EL. FEET
- INTERMEDIATE DESIGN CONTOUR
- DIVERSION CHANNEL AND DIRECTION OF FLOW
- EXISTING GROUND SURFACE CONTOUR AND EL. FEET
- FINGER DRAINS
- LIMITS OF BLANKET DRAIN SYSTEM
- POTENTIAL BORROW AREAS (ROCK OUTCROP)
- UNDERDRAIN CONVEYANCE PIPELINE

NOTE:

1. THIS PLAN DEPICTS THE GEOMETRIC SHAPE OF THE FACILITY AND DOES NOT SHOW TOPOGRAPHY RESHAPING FOR RECLAMATION.

NOTE:

1. THIS PLAN DEPICTS THE GEOMETRIC SHAPE OF THE FACILITY AND DOES NOT SHOW TOPOGRAPHIC RESHAPING FOR RECLAMATION.

2. THE OUTER SLOPES OF THE BOTTOM-UP OPTION COULD BE REDUCED OR FLATTENED TO REDUCE VISUAL IMPACTS (KLOHN-CRIPPEN 1997).

FIGURE 2-27 31
Tailings Paste Disposal Site - Bottom-Up Option
Rock Creek Project

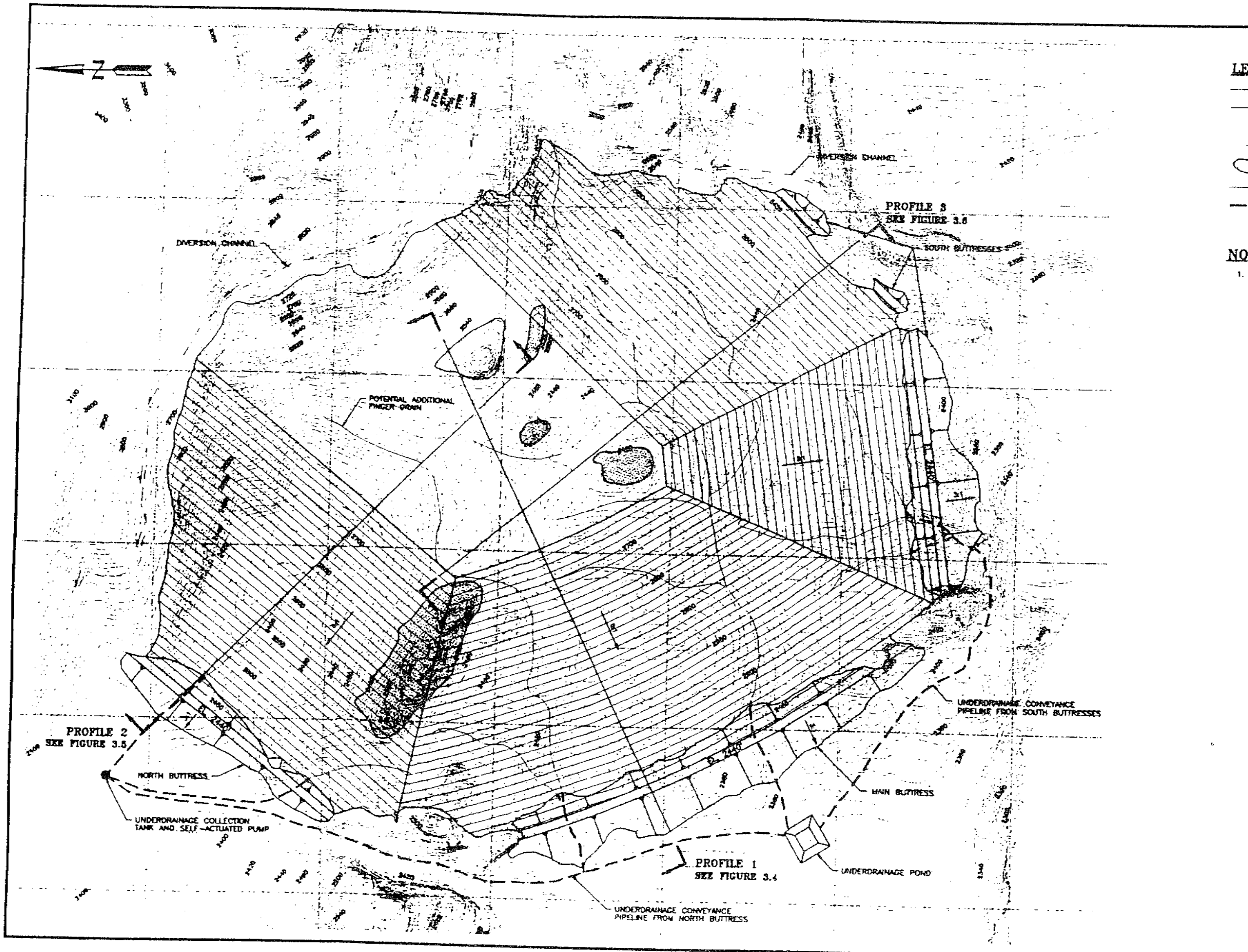


FIGURE 2-28 32
Tailings Paste Disposal Site - Top-Down Option
Rock Creek Project

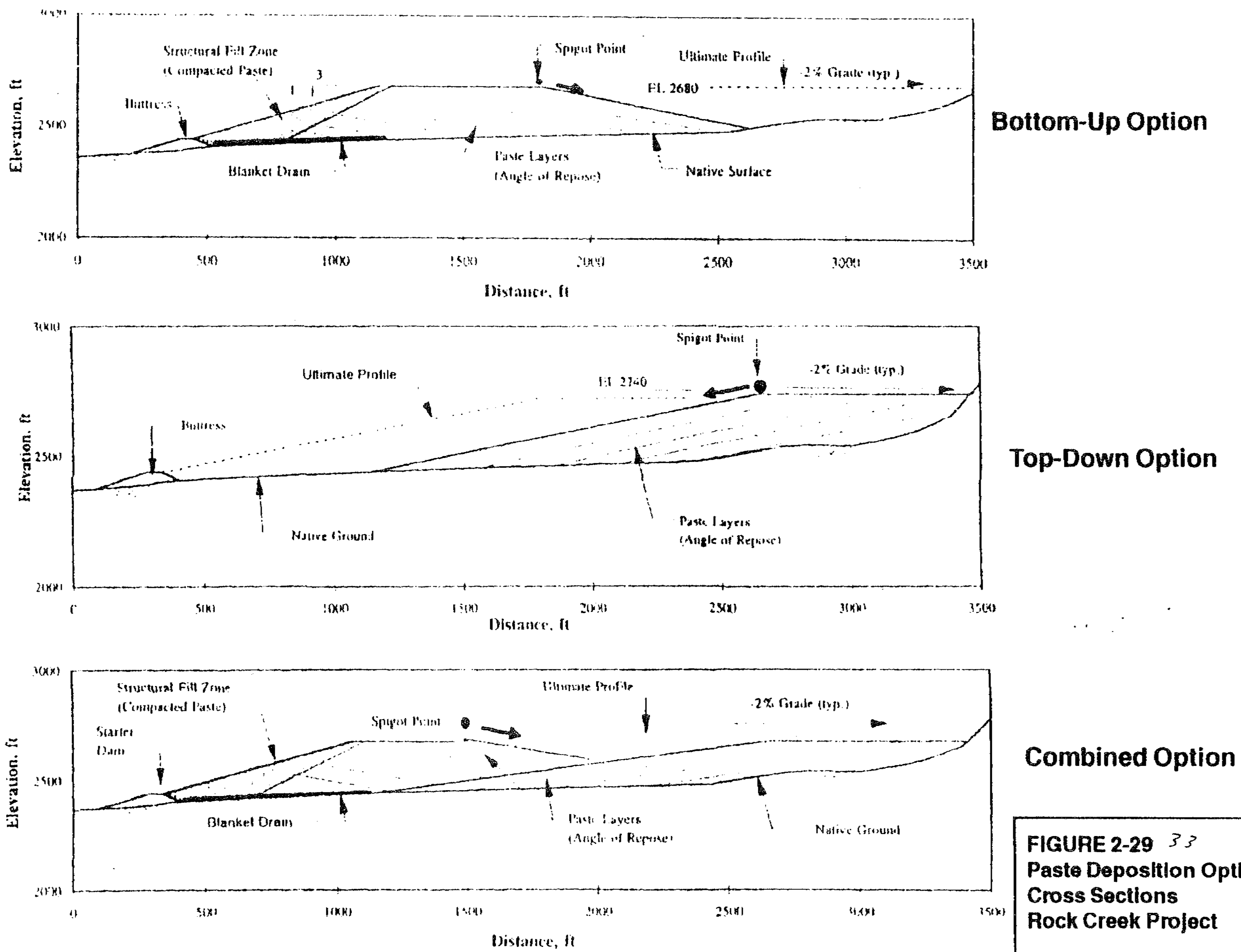


FIGURE 2-29
Paste Deposition Options
Cross Sections
Rock Creek Project

2440 feet), but the actual height would depend upon engineering behavior of foundation soils to be analyzed in more detail in the final design. The toe buttresses would be located in approximately the same location as the starter-dams for the tailings impoundment designs in alternatives II through IV. The buttresses would be built during initial stages of mine development as rock was salvaged from within the deposit footprint or became available during adit construction. The buttresses would consist predominantly of rockfill totaling approximately 1,360,000 cubic yards. The rockfill could be obtained from rock outcrops within the deposit site, borrow areas within the deposit site, and waste rock produced from mine adit development (see **Table 2-13** for preliminary estimates of materials obtained from these sources). Waste rock from the adits would be hauled to the tailings paste facility site and used immediately for buttress construction to avoid rehandling this material or the need for a waste rock dump at the mill site. The waste rock could only be hauled between August 1st and March 31 to minimize impacts to harlequin ducks.

TABLE 2-13
Preliminary Volumes of Paste Facility Toe-Buttress Waste Rock Requirements

Source	Quantity (Cubic Yards)
Rock Outcrops	480,000
Borrow Areas	130,000
Mine Waste	750,000
Total	**1,360,000**

The paste pipeline would be located either on the crest of the toe buttress for the Bottom-Up option or along the upper end of the deposition site for the Top-Down option. The location of the spigot or spigots for the Combined option would depend upon the method(s) being used at the time. A low load-bearing crawler crane would be used to position the pipe and spigotting would commence. Once a layer or a lift of paste had been completed, the crane, pipes, and spigot would be relocated further down the row onto the oldest portion of the previous paste layer, or to a new row if the previous one had been completed. A new layer of paste would then be spigotted onto the previous layer(s). There may be some delay in relocating the crane when using the Top-Down option as the paste would need to solidify or compact enough to support the equipment. Although earliest reports (Golder 1996) proposed paste deposit lifts of 3 to 4 feet, a later report recommends that the lifts be reduced to 1 foot until actual field construction experience indicates that a thicker lift can be deposited to ensure paste facility stability (Knight Piesold 1997).

In the Bottom-Up option and the Bottom-Up portion of the Combined option, a structural zone of compacted paste would be constructed upslope of the toe buttresses to permit the construction of a 3:1 slope. The paste would be spigotted behind the structural zone at its angle of repose. The outer slope of the structural zone would crest at an elevation of approximately 2680 feet (320 feet high) (see **Figure 2-31**). The Top-Down option would be constructed at the angle of repose (approximately 5:1), resulting in longer overall side slopes than the Bottom-Up option. Compaction of slopes would only occur if found to be necessary under the Top-Down option. This would depend on actual field experience. The Top-

Down option would have a crest of approximately 2740 feet (380 feet high); although the crest is slightly higher it would be positioned farther away from the highway (see **Figure 2-32**). The Combined option would have some flatter slopes on the upper portions of the deposit and steeper slopes closest to the highway. The Combined option would have an ultimate elevation somewhere between the first two options, the actual elevation would depend upon when the Bottom-Up component was begun relative to the Top-Down component. It may be possible in final design for either the Bottom-Up or combined option to flatten the outer slopes and deposit the remaining mass of the tailings facility closer to Government Mountain and away from Montana Highway 200 such that the resultant landform would more resemble the Top-Down option. Topographic relief of the upper surface of the paste facility constructed by any of the options could be created by preferential spigotting of the paste and the paste could also be reshaped by dozer to achieve the final grading prior to reclamation. Manipulation of the paste to vary the side slopes could be done more easily during construction under the Top-Down option than under the Bottom-Up option. The paste material would be reclaimed on the surface and outer edges when final grade was achieved and timing of reclamation varies somewhat depending upon the option used (see **Reclamation**).

A system of basin drains would be incorporated into any of the options to maximize recovery of seepage of residual process water in the paste and storm water infiltration through the paste. A blanket drain adjacent to the outer slopes and beneath the compacted structural zone would be constructed to maintain a drainage of the structural zone under the Bottom-Up option and the Bottom-Up portion of the Combined option. For all options an extensive system of finger drains would be constructed beneath the paste facility. Conceptually these drains would consist of 4-inch diameter, slotted pipe surrounded by a zone of crushed rock 10 feet wide and 2 feet thick. The actual location of these finger drains would be determined during the final design. The water collected by the finger drains would be routed to a single collection pond located outside the main buttresses (see **figures 2-31** and **2-32**), pumped back to the paste plant and, if not needed for paste production, returned to the mill for reuse.

Land would be cleared and topsoil salvaged in advance of paste deposition (see **Reclamation** for more detail). While a tailings impoundment would require the entire footprint of the impoundment to be cleared or disturbed prior to construction of the impoundment, the paste deposit alternative restricts disturbance to the active areas. There would be more land disturbed initially under the Bottom-Up option due to construction of the toe buttresses and blanket drain than under the Top-Down option (see **Table 2-14**).

Storm Water Control

All storm water detention and retention ponds would be lined with 30-mil HDPE liners for primary seepage containment. The mill pad underdrains would provide secondary collection for the mill site. Underdrains or blanket drains according to final design specifications would provide secondary collection of storm water seepage through the tailings paste facility.

TABLE 2-14
Summary of Estimated Active Versus Reclaimed Areas Over Time for Alternative Paste Facility Construction Scenarios

Year	Area of Active Disturbance	Area at Final Grade (reclaimable area)	Total Area	Comments
BOTTOM-UP CONSTRUCTION SEQUENCE				
YR 0	0 acres	0 acres	0 acres	
YR 7	78 acres	0 acres	78 acres	Southern face under construction
YR 19	190 acres	0 acres	190 acres	Southern face completed
YR 21	97 acres	115 acres	212 acres	25% of top completed to final elevation
YR 31	74 acres	190 acres	264 acres	50% of top completed to final elevation
YR 33	41 acres	250 acres	291 acres	75% of top completed to final elevation
YR 34	0 acres	305 acres	305 acres	100% of top completed to final elevation
TOP-DOWN CONSTRUCTION SEQUENCE				
YR 0	0 acres	0 acres	0 acres	
YR 7	57 acres	2 acres	59 acres	5:1 depositional surface started across 1/2 of northern boundary
YR 10	110 acres	4 acres	114 acres	5:1 depositional surface completed across northern boundary
YR 14	105 acres	48 acres	153 acres	25% of top completed to final elevation
YR 20	119 acres	80 acres	199 acres	50% of top completed to final elevation
YR 26	121 acres	135 acres	255 acres	75% of top completed to final elevation
YR 33	93 acres	211 acres	304 acres	
YR 34	0 acres	305 acres	305 acres	100% of top completed to final elevation

Note: Disturbed acreages do not include soil stripping in advance of paste deposition. If soil is removed for a distance of 500 feet in advance of paste deposition, an additional 30 acres of disturbance can be assumed.

Source: Hydrometrics 1997

The lined storm water pond at the mill would be enlarged along with all diversions to handle a 100-year/24-hour storm event. Storm water collected at the adit portal and mill sites would be collected and recycled to the mill for reuse. Water collected from the outer slopes of the mill pad and the mill site underdrains would only be allowed to discharge under conditions specified in the revised MPDES permit (see **Appendix M**). Otherwise water from the underdrain containment pond would be pumped back to the mill for reuse. Storm water diverted from undisturbed lands above and adjacent to the mill would be discharged through overland flow diffusers or energy dissipating outlets outside the 300 foot streamside-buffer zone (see **Figure 2-27**).

Since the tailings paste facility and the undisturbed portion of the disposal site would not retain storm water like an impoundment, one or two lined storm water ponds would be constructed at the lower elevations in the tailings disposal site (see **Figure 2-26**). These ponds would be removed and reclaimed after the tailings facility was completed and reclaimed. These ponds also would be sized to handle the runoff from the active portion of the tailings paste facility site during an 100-year/24-hour storm event. Water collected in the storm water pond could be pumped to the paste plant and then to the mill as process water or used for irrigating reclaimed portions of the tailings paste facility if water quality was acceptable.

Sediment and runoff control of the tailings facility would be handled in two methods. First, limiting unreclaimed areas to the active disposal areas could minimize sediment and runoff. Second, localized sediment retention structures and BMP's would be used in the downslope perimeter of the active panels for control, sampling and recovery of drainage from the tailings paste facility, sediment, and storm water runoff. These structures and collection ditches would act as storm water diversions to channel the water and sediment from the active portion of the tailings paste facility into the tailings facility site storm water ponds. The ditches would also be sized to accommodate a 100-year/24-hour storm event.

Storm water from undisturbed lands above the tailings paste facility would be diverted around the active portions into the north fork of Miller Gulch and to Rock Creek during mine operations. Runoff from reclaimed and fully revegetated, stabilized portions of the tailings paste facility would be diverted to settling basins before mixing with runoff from undisturbed areas. Settling ponds for runoff from newly reclaimed areas along the perimeter of the tailings paste facility would be unlined and would discharge through a constructed drainage network to existing drainages. However, settling ponds on the upper portion of the paste facility would require lining to prevent excess infiltration of water. Storm water from reclaimed areas that were not fully stabilized would be captured along with runoff from the active areas of the tailings paste facility. Undisturbed portions of the paste facility would either drain into existing drainages or be diverted away from active areas, soil stockpiles, and the storm water pond. All these diversions would be sized to handle a 100-year/24-hour storm event. These diversions would be reclaimed and permanent drainage ways established when mine operations ended and the site was fully reclaimed.

The final design for the storm water and sediment control structures at the paste facility must be approved by the Agencies prior to being constructed.

Water Use & Management

Water Use and Supply. Water use and supply for evaluation and underground mining operations would remain the same as described for Alternatives II through IV in the draft EIS. **Figure 2-34** provides a schematic diagram of project water handling for mine operation during the end of mine life. Additional water balance detail can be found ASARCO's Alternative V Water Management Plan (Hydrometrics, Inc. 1997b). Process water for the mill would come from five sources: reclaimed tailings slurry water, mine discharge water, reclaimed concentrate slurry water, mill site and tailings paste facility site storm water, and if needed, make-up-well water. Process water would remain in an essentially closed loop. Approximately 5 to 10 percent of the flow in the process loop will be diverted to the waste water treatment system and fresh water added to the circuit on an ongoing basis to prevent buildup of excess constituents in the process water.

General Waste Water Treatment. Two waste water treatment systems designed primarily for nitrate removal would be installed: an anoxic (low oxygen content) semi-passive biotreatment system and a reverse osmosis treatment system. Neither system would be designated as the primary or back-up system. A portable version of the reverse osmosis system would be built to handle mine discharge water from the evaluation adit and placed at the support facilities site. This unit would be moved to the water treatment facility site if a decision was made to continue with the mining operation and expanded to accommodate greater flows that would occur during mine construction and operation. It may take some

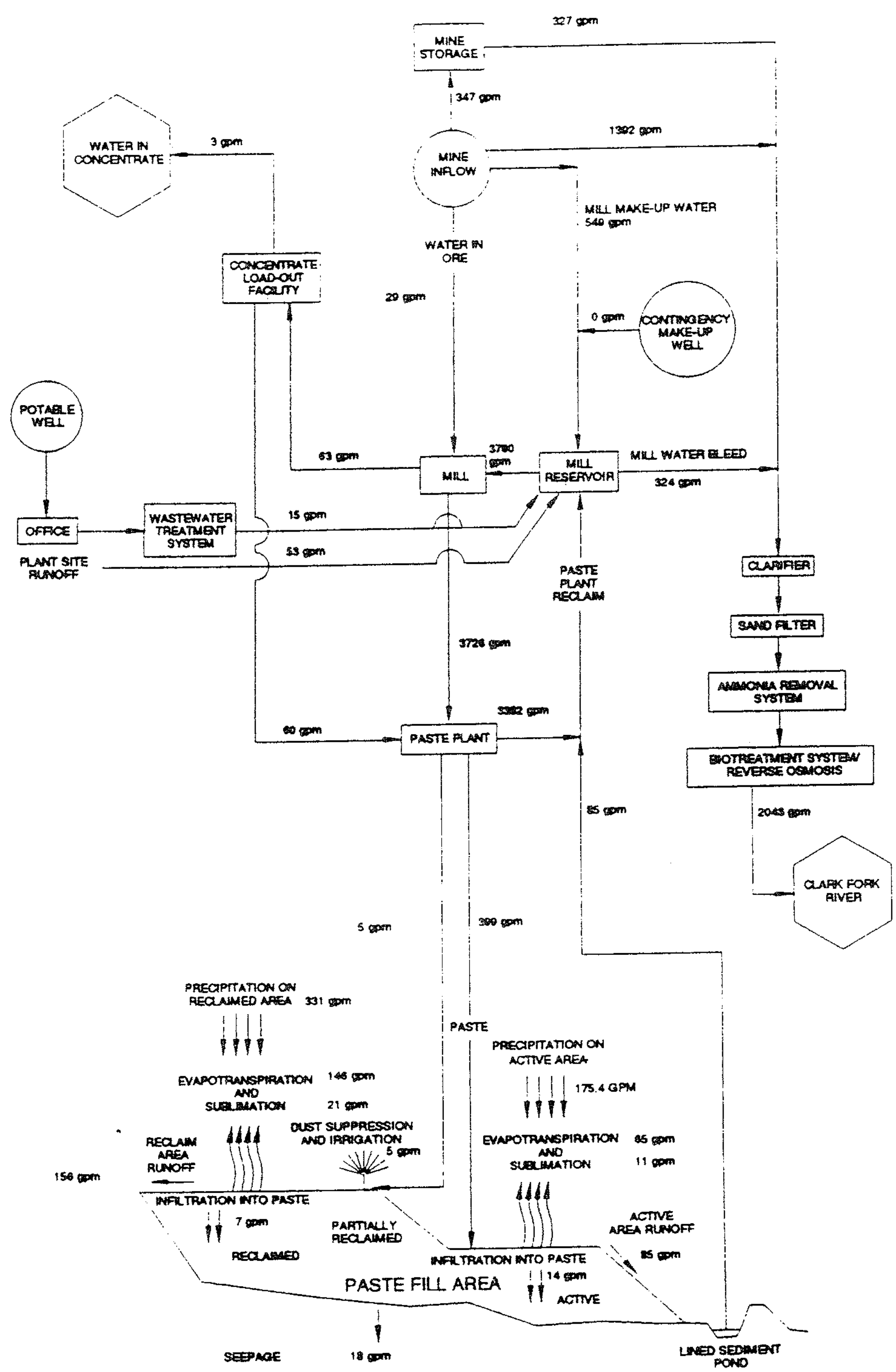


FIGURE 2-~~30~~34
Alternative V Schematic Diagram of Project Water Handling Production - Final Year
Rock Creek Project

time for the biological treatment system to become fully operational during mine start-up when variable flows and conditions could be expected: the reverse osmosis system would have the primary water treatment role during evaluation and mine start-up compared to the passive biotreatment system under Alternative II. ASARCO expects that the biotreatment system would become the main treatment system: however, the reverse osmosis system would still be available to operate during bioreactor upsets or if higher treatment efficiencies were required. A schematic diagram of the biotreatment waste water process is found in **Figure 2-35. Figure 2-36** displays the proposed layout of the water treatment facilities. At the final design stage, modifications to the treatment system may be made depending on a number of factors, including the actual discharge water characteristics, the final MPDES permit limits, and the technology available at the time.

Mine water would flow through a pipeline to the water treatment facility. Sedimentation tanks (clarifiers) would remove a high percentage of suspended solids in the discharge water (at least 95 percent). The sludge from the clarifiers would be taken to the paste plant and incorporated into the tailings paste for deposition. Water leaving the clarifiers would also flow through sand filters for final suspended solids removal (80 percent of the remaining fraction). The partially treated water would then be directed to one or both of the water treatment systems depending on system capacity, amount of flow, and other variable conditions.

Anoxic Biotreatment System. The semi-passive biological system for treating mine water would consist of one or more anoxic biotreatment cells, which would consist of gravel-packed, attached-growth denitrification reactors. An in-ground concrete biotreatment cell designed to treat 100 gpm would be 6 feet deep and 28.5 x 28.5 feet in area (810 ft^2), or about 136 x 136 feet (18,500 ft^2) for 2,300 gpm (maximum design flow). These cell dimensions are based on preliminary design data for 80 percent nitrate-nitrogen removal at 6°C. A maximum of 2 acres would be required to contain either a single large cell or several smaller cells and required support buildings.

The pretreated (clarified and filtered) water would flow through a trickling filter to convert the ammonia to nitrate (nitrification). The trickling filter may need to be enclosed or insulated to allow for proper functioning during colder seasons.

The biotreatment process would rely on methanol as the carbon source for the denitrification process instead of the manure and straw included in the passive biotreatment system proposed and discussed for alternatives II through IV in the draft EIS. Methanol at a concentration of approximately 60 mg/L would be continually added to the influent water. Methanol concentrations would be monitored and adjusted as necessary to achieve optimal nitrogen removal. A 300 gallon tank (approximate volume) would be located adjacent to the biotreatment system building for initial use of the biotreatment process. A larger tank would be installed if biotreatment proves to be successful. Daily methanol consumption, if the biotreatment system was the primary waste water treatment system, would range from several gallons during initial startup to approximately 250 gallons during maximum discharge of 2,300 gpm. Phosphorus may also need to be added for microbial growth. It is estimated that approximately 1 milligram of phosphate (as phosphorus) would have to be added for every 30 milligrams of nitrate (as nitrogen) removed.

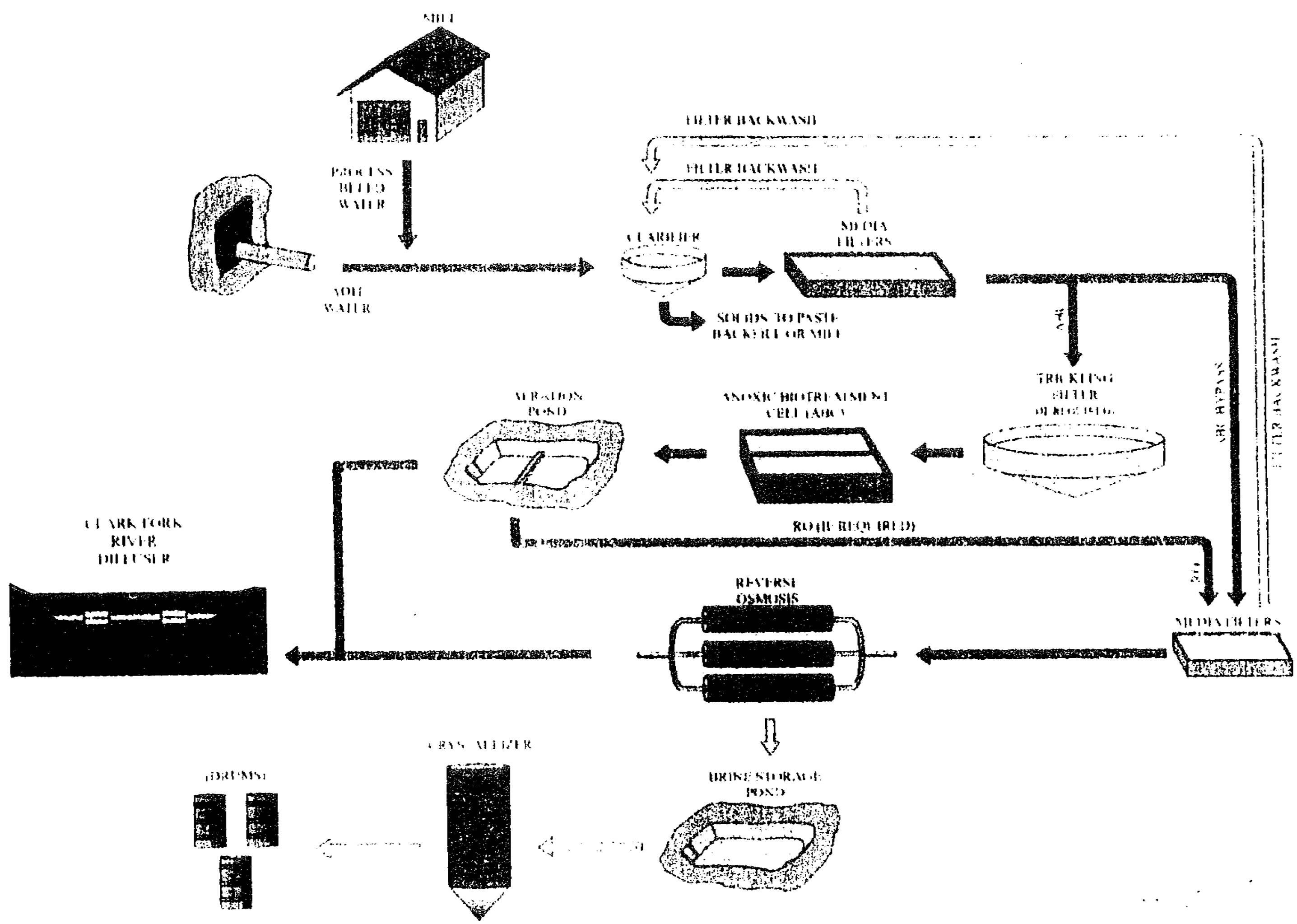


FIGURE 2-31 35
Biotreatment Waste Water
Rock Creek Project

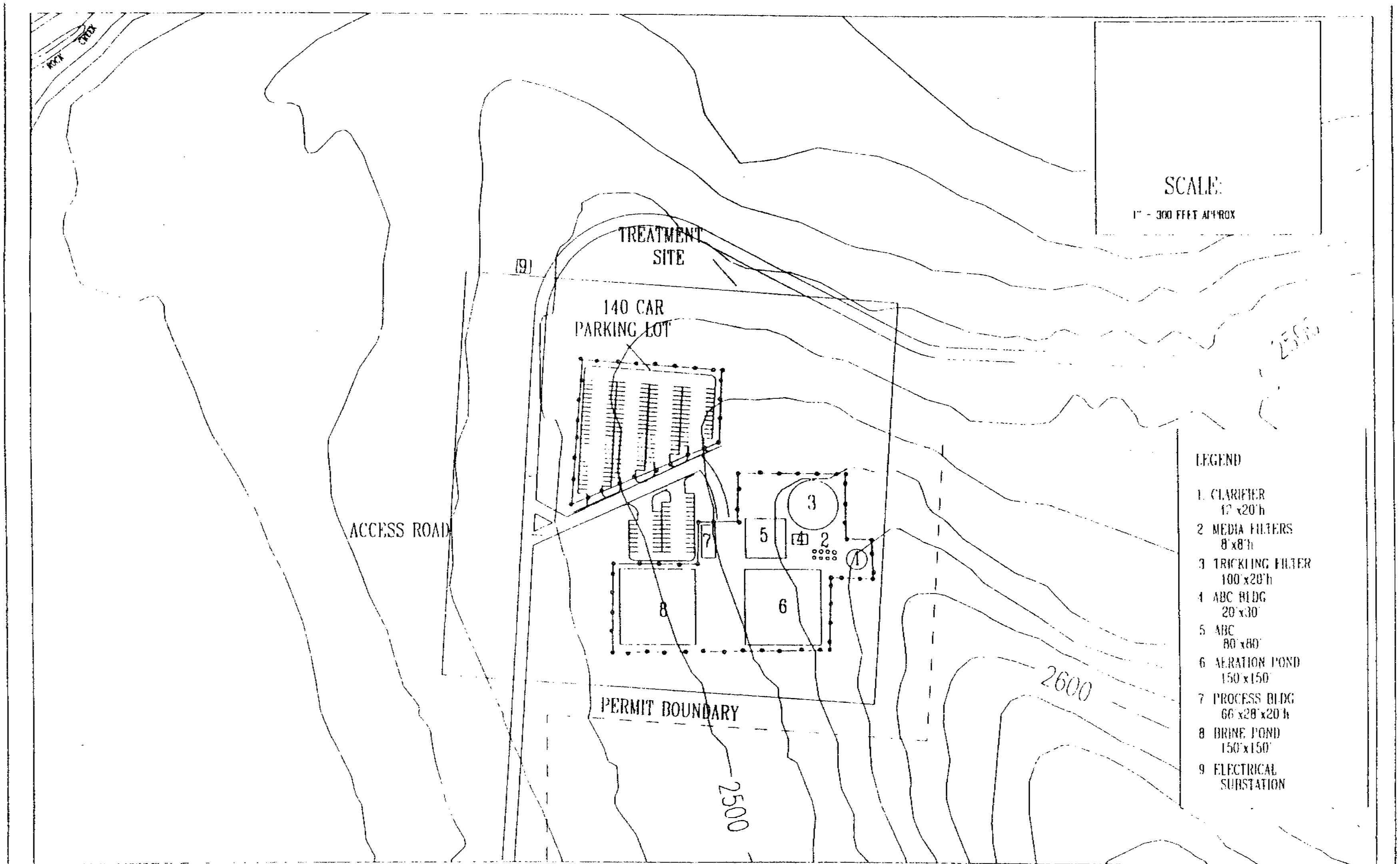


FIGURE 2-32- 34
Water Treatment Facility Plan
Rock Creek Project

2-68, 69

Mine water and methanol would enter the bottom of the biotreatment cell(s), and upwards flow through the cells would be controlled by a pump. The cell(s) would be filled with gravel and inoculated with several hundred gallons of sludge taken from the nitrogen-removal recycle loop at the Kalispell wastewater treatment plant. The cell(s) should not require reinoculation. The biotreatment cell(s) would not generate sludge or reject material requiring disposal. Nitrate would have been converted to nitrogen gas (denitrification) and methanol to carbon dioxide; these nontoxic gaseous by-products would be vented to the atmosphere. Relatively small amounts of biomass may be generated which would discharge to the aeration pond where it would be broken down.

After biological treatment for nitrate removal, the effluent would flow to an aeration pond with a 12-hour minimum residence time prior to reaching the final monitoring point before discharging to the Clark Fork River. The aeration pond would be lined with 30 mil HDPE. The aeration pond would include a calm pre-discharge zone and a multi-level discharge structure to minimize suspended solids in the effluent. Excess methanol and biomass from the biological nitrate removal system would be reduced through aerobic biological action. Dissolved hydrogen sulfide, if present, would also be reduced through aeration. At the full flow rate of 2,300 gpm near the end of mine life, the required ten-foot-deep pond would encompass approximately one-half acre. If the effluent did not meet discharge limits, it would be returned to the treatment facility for further treatment.

Reverse Osmosis Water Treatment. Reverse osmosis was selected for several reasons as the second water treatment system instead of ion exchange, which was proposed in the draft EIS. The reverse osmosis system is less complex, requires less operator attention, generates a smaller waste stream, and has no added chemicals. In addition, reverse osmosis technology has been proven to be capable of removing dissolved pollutants, such as nitrate, from water in many large capacity waste water treatment facilities throughout the world. Because the reject water or waste stream cannot be easily disposed of at the project site, the reverse osmosis system would operate at a high recovery rate to minimize the waste volume.

The reverse osmosis would most likely be the primary waste water treatment system used during evaluation and early stages of mine operation. When the biotreatment system became fully operational, the reverse osmosis systems would primarily be used during biotreatment system upsets or maintenance. It may also be used as a polishing step when the effluent did not meet standards. During such an event a portion of the biotreatment system effluent would be treated with reverse osmosis such that the recombined effluent from both systems met the limits of the MPDES permit.

The reverse osmosis system would be housed in a building approximately 66 feet long, 28 feet wide, and 12 feet high. It would contain reverse osmosis units sufficient to treat flows up to 650 gpm, the maximum flow expected in year 5 of production and year 10 of project life. The modular nature of reverse osmosis would allow simple installation of additional reverse osmosis units if reverse osmosis were still required for the treatment of 100 percent of the mine discharge in later years of mine operation. These units are complete with high-pressure pumps, cartridge filters, membrane modules and all other necessary equipment. This operation would probably require one operator around-the clock initially and after operations had been finalized, only a day-shift operator. The clarifier and media filters would probably be located outside the reverse osmosis building.

Once the influent water had undergone pretreatment for removal of suspended solids, the reverse osmosis could run continuously and reduce dissolved ion concentrations, including nitrate, nitrite, ammonia, and metals, by more than 90 percent. As flows increased during the life of the project, additional modules could be incorporated easily into the existing facility. Routine maintenance would include instrument calibration, chemical cleaning, and periodic membrane replacement. Membranes would require replacement every three to five years.

Only minimal quantities of brine (liquid waste from the reverse osmosis process containing elevated levels of nitrate, nitrite, ammonia, metals, and other ions) would be generated if the biotreatment becomes the primary treatment system with occasional use of the reverse osmosis. The waste brine that is generated, approximately 10 percent of system inflow when reverse osmosis treatment is required, would either be stored and gradually blended back into the biotreatment treatment system or crystallized/evaporated. The waste would not be classified as a hazardous waste as defined in 40 CFR 261.21-261.25. The brine or crystallized solid would not be ignitable, corrosive, or reactive and it would be non-toxic based on EPA's Toxicity Characteristic Leaching Procedure (TCLP) criteria (Hydrometrics, 1997a). Estimated concentrations of waste brine presume no nitrogen removal by biotreatment. Waste brine concentrations would decrease in direct proportion to nitrogen removal efficiencies in biotreatment.

The brine would be stored in 500,000 gallon, epoxy-coated, covered, vertical, bolted steel tanks (60 feet in diameter and 25 feet high). A single tank would provide 5 days of brine storage for the initial 650 gpm RO facility. Three tanks would be required to hold approximately 5 days of brine storage for estimated maximum mine operation waste water flow of 2,300 gpm.

A crystallizer/evaporator would be installed on site to treat any RO brine generated. The brine would be reduced to one 55-gallon drum of waste per day for every 250 gpm of water treated. This waste would either be stored in drums or in a tanker trailer based on the actual waste volume being produced. The end product would be a solid which could be used by fertilizer companies in western Montana, Idaho, eastern Washington, and Canada or disposed as a regulated waste in an approved landfill such as those in Missoula, Kalispell, and Spokane.

Transportation

Access to the evaluation adit and the minor improvements to FDR No. 2741 would remain the same as for alternatives III and IV as described in the draft EIS. Evaluation adit construction workers would be bused from the relocated support facilities site along FDR No. 150 and 2741. Road maintenance and snow plowing of FDR No. 150 would also remain the same. FDR No. 150 would be realigned with Montana Highway 200 as described for Alternatives III and IV in the draft EIS. However, FDR No. 150 would connect to an old existing road in the vicinity of the waste water treatment plant if final siting proved the old road to be suitable. This modified alignment would take advantage of an existing road farther away from Rock Creek and reduces the amount of new construction. This existing road would be upgraded and paved and a new segment constructed to connect to existing FDR No. 150 approximately 1200 feet above the confluence with Engle Creek as described for Alternative III in the draft EIS. However, mine construction workers would be bused from the support facilities site until FDR No. 150 had been relocated and the parking lot at the waste water treatment plant had been constructed. The relocated portions of FDR No. 150 and the parking lot at the proposed waste-water treatment facility site would be constructed during the first part of the development phase (year 2) to keep construction related-traffic away from Rock Creek, to provide a road capable of handling the expected mine construction-related and public levels of traffic, and to allow for busing of mine adit construction workers to the mill site and mine portal. Access to the paste plant and the tailings paste facility site from the mill would require mine vehicles travel down FDR No. 150 to Montana Highway 200 and then northwest on the highway to Government Mountain Road and then southeast on FDR No. 150B.

All roads used during mine operation between the mill, the mine, the paste plant, the water treatment facility, the highway, and the rail loadout facility would be paved or gravel (see **Table 2-15** and **Figure 2-26**). FDR No. 150 above the mine and the Chicago Peak Road, FDR No. 2741, would not be paved. The service road, FDR No. 150B, around the outer edge of the tailings disposal site from the paste plant to Government Mountain Road would be paved; a short stretch of maintenance road along the west side of the disposal site would be gravel. FDR No. 150B from the paste plant to the junction with FDR No. 150 would be reconstructed as a gravel road and used only for pipeline maintenance after mine production begins. FDR No.150B would be gated at both ends and access would be restricted to mine-related traffic. The existing bridge over Rock Creek near the junction of FDR nos. 150B and 150 would not be reconstructed because there would be no concentrate hauled from the mill to the rail loadout facility; however some repairs may be necessary to provide safe crossings for trucks hauling waste rock to the paste facility site during mine development. If during mine operation this bridge deteriorated and the Forest Service determined it was unsafe, it would be removed by ASARCO. A 10-foot wide gravel maintenance road would be constructed along the cross-country portion of the discharge water pipeline between the Clark Fork River and FDR No. 150. A small parking lot for 6-8 vehicles would be required at the paste plant for operators' and mine management vehicles and supply deliveries.

Truck hauling of concentrate from the mill to the rail loadout facility would be replaced by pipeline transport of the concentrate. This would eliminate eight trucks per day making the round trip between the mill and the loadout facility. ASARCO must submit a traffic management plan to mitigate impacts on harlequin duck as well as grizzly bears. This plan would address evaluation, construction, and operation mine-related traffic (excluding public recreation, Forest Service, logging traffic and other private and public traffic). The plan must include provisions for busing employees during mine construction and operation between the waste water treatment facility area and the mill and mine. A parking lot capable of handling the parking needs of the largest shift plus visitors to the mine, estimated at 150 to 175 vehicles, would be necessary. The most logical place for this parking lot would be adjacent to the waste water treatment facility (see **Figure 2-36**). Busing employees from this location would reduce the mine construction- and operation-related traffic to primarily supply vehicles, mine management vehicles, and two or three buses twice per shift including the administrative workers shift.

A portion of FDR No. 150B may be removed and reclaimed after the tailings paste facility has been reclaimed and the paste treatment plant decommissioned, removed, and reclaimed. The need for closure, reclamation, or modification of Forest System roads used by ASARCO during mine operation to gravel or dirt roads would be determined by the KNF at mine closure. The post-mining treatment of roads would depend on forest land uses, needed road densities, and KNF's ability to maintain paved roads versus gravel or dirt roads.

TABLE 2-15
Summary of Roads To Be Used
Under Alternative V

Road	Section	Type	Length	Width	Access
FDR 150	Hwy 200 to mill site	Paved	5.5 mi	24 ft	Open
FDR 150	Mill site to FDR 2741	Gravel	0.19 mi	20 ft	Open
FDR 2741	FDR 150 to evaluation adit portal	Gravel	1.25 mi	20 ft	Open only when there is no snow, plowed during year 1, but no public parking/turnarounds available during winter
FDR 150B	FDR 150 to paste plant	Gravel	1.07 mi	14 ft	Locked gates/ASARCO pipeline maintenance access only
FDR 150B	Paste plant to Government Mtn. Rd.	Paved	1.52 mi	14 ft	ASARCO and supply traffic only
FDR 150	Government Mtn. Rd. From FDR 150B to rail loadout facility	Gravel	0.19 mi	24 ft	Open
Access Rd.	FDR 150 to parking area/waste water treatment plant	Paved	0.15 mi	24 ft	ASARCO visitor, and supply traffic only
Access Rd.	North from 150B along west side if disposal site	Gravel	0.52 mi	14 ft	ASARCO maintenance only
Access Rd.	From Hwy 200 to Clark Fork River	Gravel	0.57 mi	10 ft	ASARCO pipeline maintenance only
Access Rd.	FDR 150B to paste plant	Paved	0.37 mi	14 ft	ASARCO and supply traffic only

Utilities

Evaluation activities at the adit would be powered with propane generators instead of diesel generators. The support facilities would be supplied with power from a local distribution line as described for Alternatives II through IV in the draft EIS.

The original proposal called for two 500 kW diesel-fired generators; Alternative V replaces the diesel generators with two propane-fired generators (545 kW and 735 kW).

A single utility corridor would be developed along FDR No. 150 and would include the transmission powerline, a tailings slurry pipeline, ore concentrate pipeline, mine discharge pipeline, and return water pipeline (see **Figure 2-28**). The pipelines would split into two corridors at the junction of FDR nos. 150 and 150B. The tailings slurry pipeline and concentrate pipeline and a return water line would follow or parallel the FDR No.150B road alignment to the paste plant. The concentrate pipeline and return water line would continue along FDR No. 150B and a short stretch of the Government Mountain Road to the rail loadout facility. The mine water discharge line and a return water line would follow the new FDR No. 150 alignment to the waste water treatment plant and the discharge line would continue to the discharge outfall in the Clark Fork River and connect with the make-up water well located adjacent to the river. See **Table 2-16** for information on the size and types of pipe proposed for use.

TABLE 2-16
Summary of Pipeline Information for Alternative V

Pipeline	Location	Size	Type
Tailings Slurry Line	Mill to paste plant	16 to 24 inches(1)	Steel/polyethylene dual-wall pipe w/leak detection
Tailings water return line	Paste plant to mill	16 inches	Dual-wall pipe w/leak detection(2)
Mine discharge pipeline/make-up water pipeline(3)	Mine to waste water treatment plant to Clark Fork river diffuser	12 to 14 inches	Single-walled pipe w/leak detection
Mine segregation water pipeline (option for later development)	Mine to waste water treatment plant	10 inches	Type undetermined at this time
Concentrate pipeline	Mill to rail loadout facility	3 inches	Dual-wall pipe w/leak detection(2)
Concentrate return water line	Rail siding to paste plant	2 inches	Dual-wall pipe w/leak detection(2)
Storm water return pipeline	Paste facility site storm water retention pond to paste plant	6 inches	Single-walled pipe w/leak detection

Source: Hydrometrics 1997

Notes: (1) The final pipeline diameter will need to be determined based on tailings viscosity and topographic analysis of final pipeline corridor.
(2) The type of dual wall pipe has not been determined at this time.
(3) Mine water is estimated to meet mill make-up water requirements; however, a contingency make-up water well site has been identified near the Clark Fork River in the event that insufficient mine water is available. In this event, make-up water would utilize the discharge pipeline.

The transmission line would follow the same route along the new FDR No. 150 and existing FDR No 150 from a new switchyard on an existing 230 kV line near Montana Highway 200 to the mill as described for alternatives III and IV in the draft EIS. The substations at the mill and in the impoundment area would remain the same as for alternatives II through IV. The rail loadout facility and the relocated evaluation adit support facilities site would be supplied power from a local distribution line along Government Mountain Road. Although the draft EIS identified a power provider, no power provider has been selected for supplying the mine's estimated annual consumption of 95,000,000 kW-hours.

Erosion and Sediment Control

ASARCO would be required to implement all BMPs detailed in its permit application and which are described in the draft EIS. These include measures for fugitive dust control, site grading, soil handling, surface water protection, and revegetation. In addition, a vegetation management plan would be developed by ASARCO and approved by the Agencies to minimize disturbance during clearing and construction and to maximize revegetation success on all cut-and-fill slopes and reclaimed road segments. A field review would be required by agency hydrologists/soil scientists after facilities and roads have been staked in the field but before construction begins to identify any additional BMPs needed on a site-specific basis. There will be 114 acres of sediment reduction work done as mitigation for BMP's being less effective than planned.

Employment

Estimated employment would remain as described for Alternative IV in the draft EIS; a peak employment of 350 workers during mine construction and 340 during mine operation. Evaluation adit employment would peak at 55 employees in the fourth quarter of the year of evaluation construction. The paste production plant and waste water treatment facility would require specialized operators to ensure proper facilities operation.

Adit Closure

The adit closure plan would need to be finalized and submitted to the Agencies for review and approval prior to mine closure.

The evaluation adit would be plugged with reinforced concrete at mine closure. Since this adit would be a decline and the portal is above the water table, the purpose of the plug would be primarily to close off access and eliminate any potential for surface water inflow.

The service and conveyor adits would be plugged with reinforced concrete near the elevation of the orebody within the mine. This would prevent 1,500 feet of water pressure that would develop if adit seals or plugs were placed at lower elevations in the adits. The adits would be closed at the portal with non-mineralized waste rock to prevent access. Drainage from the portal (inflow to the adits below the elevation of the plugs) would be treated until it meets water quality standards without treatment at which time it would be allowed to infiltrate into the reclaimed mill pad and underlying alluvium. Monitoring data would be used to establish discharge requirements prior to the time of adit closure.

Reclamation

Reclamation of the evaluation disturbances, adits, mill site and utility corridors would remain the same as described for Alternative IV in the draft EIS. The revegetation plan and seed mixes are described in Appendix G of the draft EIS. A detailed reclamation plan that covered revegetation of all mine facilities would need to be submitted for Agency review and approval before implementation. The plan would provide the means to ensure adequate reclamation and minimize visual impacts of the project. Plans for reclaiming any Forest System roads, if required, would be submitted to the Forest Service for review and approval.

Pipeline Corridor Reclamation. The pipeline would be built and installed and covered with at least 24 inches of soil that had been salvaged prior to construction. No trees or shrubs would be seeded along the pipeline corridor, but any trees or shrubs that volunteered would be left. Trees that encroached on powerline conductors or were in the way of maintenance vehicles would be removed. Maintenance or replacement of a pipeline liner would require some redisturbance of a small area that would be immediately reclaimed after the work was done. When the pipelines were no longer needed they would be removed for a distance of 15 to 20 feet from stream crossings and where the pipes surfaced at the mill, the paste plant, the waste water treatment facility, and the Clark Fork River. The pipes would be completely drained, capped, sealed, the ends reburied, and the redisturbed section regraded, stabilized if necessary, and revegetated. The remaining buried segments of the pipeline would remain in place.

Reclamation of Tailings Paste Facility. Reclamation of the tailings paste facility would be somewhat different from that of a traditional tailings impoundment. Concurrent topsoiling and reclamation would allow the portion of the top and outer slopes of the paste facility that had achieved final grade to be reclaimed while the next segment was constructed. However, the timing of final reclamation would vary somewhat depending upon which option is selected. Final reclamation of the Bottom-Up option would occur on an annual basis unless specified otherwise by the Agencies. Reclamation of a small portion of the Top-Down option could begin in year 7 of mine operation (see **Table 2-14**) and could only be done when the row had reached its maximum height as each succeeding paste layer would cover the preceding layer. The sides and top of the Top-Down option could still be reclaimed concurrently with the stripping of soil from the next area proposed for disturbance rather than waiting until the facility was completely constructed. Reclamation of the Combined option would depend upon which method was being used at the time.

Interim reclamation would occur on an on-going basis for all paste options. An interim seed mix would be added to the paste before its deposition to limit erosion off paste slopes during operations and to reduce aesthetic impacts. A color tackifier or hydroseeding could also be applied to deposit lifts as needed for interim reclamation and stabilization prior to initiation of final reclamation activities. Both toe buttresses and paste deposit slopes for any of the deposition options would be seeded annually with final revegetation mix on any portion that reaches final grade.

Because the paste would be deposited in rows, layer upon layer, soil would be stripped just ahead of the extent of the proposed disturbance for each layer. The soil stripped from the first two or three rows would need to be stockpiled for reclaiming the final segment and outer slope. At times soil being salvaged may not be suitable for the portions of the facility that need to be reclaimed; this soil would also need to be stockpiled until needed. The soils would be segregated according to rocky or non-rocky soils and first lift versus second lift and, if necessary, stockpiled adjacent to the deposit site (see **Figure 2-26**). Sufficient volumes of the colluvial and alluvial soils, including their rocky subsoils, within the tailings paste facility footprint would need to be salvaged and stored for use in reclaiming slopes 8 percent or greater and along reconstructed drainage ways to minimize erosion. Based on experience and preliminary research to control erosion at Golden Sunlight Mines, the lacustrine soils could be mixed with the rocky subsoils or crushed bedrock to produce a soil with 20% rocks greater than 1 inch in diameter. The mixed soil must also have less than 20% very fine sand in the fine soil matrix (Golden Sunlight Mines 1995). The lacustrine soils could be placed on all slopes less than 8 percent (approximately 12.5:1) without the addition of rock materials as long as the slope length is limited by armored drainageways or other erosion control features. Soil would be salvaged in a two-lift process with the first lift being the more suitable topsoil and the second lift being subsoils excavated up to 36 inches; average total salvage depth equaling 24 inches. Replaced soil depths would average 24 inches over the tailings paste facility. The final design of the paste facility would need to include a volume determination of soil types needed based on the slope breakdown of the paste facility.

ASARCO would need to conduct a detailed soil survey to more accurately determine the amounts and types of soils available for reclamation prior to construction of the paste facility and associated facilities. Since rocky materials are also needed for constructing the toe buttresses, the survey is especially important to ensure there is enough material available for both requirements or to identify the need to obtain more rocky material from other sources than has been estimated in **Table 2-13.**

The tailings paste could, if needed, have organic amendments or fertilizer added to the uppermost lift. This material, which would have no cement added, may need to be ripped prior to topsoil replacement to minimize the development of a root-barrier zone. Both regrading this material and selective placement of the paste during deposition would be used to create diverse topographic pockets, swales, ridges and surface water drainages constructed to a predetermined surveyed gradient in the final design. Overall outer slopes would range between 2H:1V and 5H:1V. These slopes would be protected against erosion using best management practices described in detail for Alternative II in the draft EIS. The compacted slopes of the Bottom-Up or Combined option would have less potential for slope variability due to the method of construction and would have a general appearance similar to that of a conventional tailings impoundment. The flatter slopes of the Top-Down option appear to offer greater flexibility to develop a more natural appearing landform.

Trees would be planted on each segment as it was reclaimed and seeded with approved planting mixes of grasses, forbs, and shrubs. ASARCO has planted trees for screening between the main power line and Montana Highway 200; however, the planting would be inspected during evaluation activities and any dead, dying or missing trees would be replaced to achieve the required density.

ASARCO would be required to submit detailed design, regrading, and revegetation plans for all mine facilities for Agencies' approval in conjunction with the final design of the paste facility. Landform design for the tailings paste facility would incorporate topographic templates from the surrounding area to help meet reclamation goals and Forest Service visual standards. These plans would result in reclaimed sites that decrease landform and vegetation differences between mine facilities and surrounding natural landscapes. Final reclamation of portions of mine facilities, such as outer slopes of the mill site pad and completed portions of the tailings paste facility would be done as early as possible to assist in decreasing the visual impact of the project. Toe buttresses and paste layers creating the deposit surfaces for all options, and the compacted paste zone of the Bottom-Up option, would be designed to minimize straight horizontal crests, long linear contours and uniformly sloping surfaces; however, stability requirements would have precedence. Contours of reclaimed surfaces, including those on the top surface of the deposit, would mimic those of surrounding topography. Both regrading and selective placement of the paste during deposition would be used to create topographic pockets, swales, ridges and surface water drainages. Rocky soils and possibly cement additive would be used in steepened drainageways to create naturalized swales and help break up the massiveness of the deposit.

Monitoring and Mitigation Plans

ASARCO would be required to submit for Agency review and approval the monitoring and mitigations plans described for Alternatives III and IV in the draft EIS (also see **Appendix H** for summaries of these plans). These plans include: rock mechanics monitoring, water resources monitoring, wildlife monitoring, aquatics and fisheries monitoring, and reclamation monitoring. Additional or modified plans are briefly described below.

Acid Rock Drainage and Metals Leaching Plan. Alternative V incorporates recommendations from a third party technical analysis and risk assessment (Failure Modes Effects Analysis) that evaluated geochemistry data that relates to the Rock Creek Project (Klohn-Crippen 1997). This plan would include additional testing (of the Rock Creek Project and Troy Mine) before and during operations to confirm the mineralogy and geochemistry of ore, waste rock, and tailings, monitoring of water quality in surface and groundwater, and a response plan for collection and treatment of contaminated water. In addition, selection of waste rock to be used in the paste facility buttress would be based on mineralogy and acid base accounting and kinetic leaching tests.

Influent and Effluent Monitoring. The influent to the water treatment systems would be monitored for nitrogen and other parameters identified in the revised draft MPDES permit and the monitoring plan attached in **Appendix H**. Characterizing the influent is critical for maintaining a consistent effluent. The influent would be monitored continuously so that system adjustments could be made whenever required.

Monitoring the effluent frequently is also critical in determining whether the treatment systems are operating properly and allowing adjustments to be made to the system to maintain a quality discharge. Effluent measurements would be made more frequently than required in the draft MPDES permit; the revised draft permit would require weekly or monthly monitoring depending on the parameter. Nitrates would be measured continuously with an on-line analyzer. These water quality results would be verified through weekly or monthly samples, depending on the parameter, and would be analyzed by a certified lab for permit compliance purposes.

Monitoring of Biological Oxygen Demand (BOD). Methanol would be added to the ABCs in an amount sufficient to sustain biological activity, but in small enough amounts to avoid excess BOD in the effluent. Excess BOD, similar to excess nitrogen, could cause unwanted aquatic growth. BOD in the effluent would be measured on at least a weekly basis.

Wildlife Mitigation Plan. All mitigations proposed under Alternatives III and IV in the draft EIS would remain, with the following additions. Design features to prevent disturbance to harlequin ducks during breeding season include limited operating seasons during construction, busing of mine employees, change in location of evaluation adit support facility to lower elevation, eventual closure and obliteration of FDR No. 150B, screening of disturbance zones, area closures of Rock Creek during critical breeding season periods, and water quality monitoring and hazardous material spill plan relative to harlequin ducks. Additional harlequin duck mitigations are planned and identified in the Wildlife

Mitigation Plan pending agency and ASARCO negotiations. Design features to prevent road impacts to fisher include wildlife diversion structures along FDR No. 150. Design features would be incorporated at the millsite to avoid attraction and mortality to songbird night migrants.

Mitigation for several species would be accomplished concurrently with grizzly bear mitigation. These would include road closures for wolverine, and securing of private land habitat for fisher and lynx. Although the securing of private land would not create any additional habitat (although road closures increase habitat effectiveness), this mitigation would secure the sites from almost inevitable habitat alteration as a result of regional increases in human development unrelated to the project. Other concurrent mitigation would be funding for personnel to protect mountain goats and other wildlife species through law enforcement, removal of carcasses killed by vehicles from roadsides to reduce mortality risk to carrion eaters, and inform and educate the public about Threatened and Endangered and other wildlife species.

Monitoring leading to an increased understanding of wolverine and mountain goat population trends as a result of mine-related effects and other regional effects, is included in the mitigation plan to help ensure prompt detection of declining population trends, should they occur. Current monitoring levels would not enable wildlife biologists to detect trends in a timely fashion.

Threatened and Endangered Species Mitigation Plan. Nearly all aspects of the Threatened and Endangered Species Mitigation Plan proposed for Alternatives III and IV would be the same. ASARCO would have to provide 2,350 replacement or conservation easement acres as part of the mitigation for grizzly bear. The reduction of mine-related traffic proposed for inclusion in the Wildlife Mitigation Plan, the transportation management plan, and additional road closures would also benefit threatened and endangered species such as the grizzly bear.

Aquatics and Fisheries Monitoring and Mitigation Plan. This plan, prepared and implemented in cooperation with DFWP and the Agencies, would remain essentially the same as described for alternatives III and IV in the draft EIS. However, the sediment source reduction plan would need to incorporate two additional items. ASARCO would be encouraged to negotiate to the extent possible with private landowners in the Rock Creek drainage to repair severe sediment sources such as the eroding bank on Engle Creek, which is believed to be on private lands. The plan would also include measures to improve in-stream sediment transport such that streambed scouring and sediment storage would be enhanced. This strategy will also result in the development of pools and stable riffles; therefore increasing habitats for fish and macroinvertebrates.

Mitigation would include funding for personnel (in conjunction with the personnel mentioned under Wildlife Mitigation) to protect bull and westslope cutthroat trout through law enforcement and informing and educating the public. Angling pressure in Rock Creek and it tributaries would likely increase due to improved access and increased use. Bull trout harvest is not allowed, but the fish is often misidentified by the public. Westslope cutthroat trout are highly susceptible to angling, therefore harvest rate information and protection are needed.

Hard Rock Impact Plan. Under the approved Hard Rock Impact Plan (ASARCO Incorporated 1997), ASARCO expects to hire 80 percent of workers employed directly by ASARCO during construction and operations from the local study area (Sanders County, Lincoln County, and northern

Idaho). The expected local hire of mine construction contract labor would be 40 percent. During the first three years of project development, the workforce would total about 70 workers (all directly employed by ASARCO). During mine start up and operations, ASARCO expects that about 68 of the 340 total mine workers would be hired from outside the study area. Sixty-five percent (44 workers) of the 68 in-migrating operational mine workers are expected to settle in Sanders County; 30 percent (20 workers) are projected to in-migrate to Lincoln County; and five percent (4 workers) are expected to reside in Idaho.

Local governmental units within the defined study area that may be affected by development of the Rock Creek Project include:

1. Sanders County Government (including Rural Fire Districts of Thompson Falls, Trout Creek, Noxon, and Heron)
2. City of Thompson Falls
3. Town of Plains
4. Elementary School District #10 (Noxon)
5. High School District #10 (Noxon)
6. Elementary School District #6 (Trout Creek)
7. Elementary School District #2 (Thompson Falls)
8. High School District #2 (Thompson Falls)
9. Elementary School District #1 (Plains)
10. High School District #1 (Plains)
11. Lincoln County Government
12. City of Libby
13. City of Troy
14. Elementary School District #4 (Libby)
15. High School District #4 (Libby)
16. Elementary School District #1 (Troy)
17. High School District #1 (Troy)
18. Noxon County Water District (Sanders County)
19. Bull River Rural Fire District

ASARCO would pay $883,500 in grants and prepaid taxes during the project impact period. Impact payments are expected to occur in year 1, year 2, and year 4 of the project. In addition to the base mitigation, ASARCO would also be responsible to make conditional payments should actual in-migration exceed projections.

Due to local government fiscal disparities, ASARCO has recommended that tax base sharing should occur between local governments in Sanders County. Tax base sharing would equal five percent for the municipality of Thompson Falls. The elementary school districts in Sanders County would share the taxable value of the mineral development in the following proportions: 75 percent for Noxon Elementary; 10 percent for Trout Creek Elementary; and 15 percent for Thompson Falls Elementary. For the high schools in Sanders County, the tax base sharing would be in the following distribution: 80 percent for Noxon High School and 20 percent for Thompson Falls High School. All tax base sharing would be in effect at those proportions until tax crediting is completed.

Tax crediting is scheduled to begin in year 7 for each local government that receives prepaid taxes. The amount of tax credits available for each year would be equal to 20 percent of total tax credits available, although the amount would be subject to restrictions and limitations as outlined in 90-6-309, MCA, and inherent in 90-6-307, MCA, and as described in Appendix 12 of the Guide to Implementation of the Hard-Rock Mining Impact Act.

Wetlands Mitigation Plan. The use of tailings paste landfill technology for tailings disposal eliminates the need for borrow materials outside of the paste facility site to construct starter dams although some rocky material would be required for constructing the toe buttresses. The primary mitigation site proposed in the draft EIS relied on the excavation of borrow material from "Borrow Site #3" adjacent to Rock Creek near the tailings impoundment. The elimination of this 7.5 acre mitigation site has required a modification in ASARCO's 404(b)(1) application to the Corps of Engineers (ASARCO March 26, 1997). Pertinent details and aspects of ASARCO's wetland mitigation plan for Alternative V are provided in **Appendix N**. Changes in the Agencies' 404(b)(1) preliminary showing as a result of these modifications are contained in **Appendix C**. The primary functions and values of the created wetlands would be to reestablish diversity and abundance of habitat for aquatic and terrestrial species, reduce sediment transport to Rock Creek and Miller Gulch, and attenuate peak flows.

ASARCO has identified 7.0 acres of higher terraces, benches, and abandoned channels that are typically above the water table and located adjacent to Rock Creek that would be suitable for the development of linear wetlands (see **Figure 2-37**). The Miller Gulch Tributary sites identified in Alternative II would still be used for wetland mitigation (see **Figure 2-37**). Additional mitigation sites have also been identified for use should the proposed sites prove unfeasible or if the projected created wetlands fail to meet the proposed goals of any of the sites. The mitigation sites would be developed for wetland establishment by excavating the sites, topsoiling, and planting appropriate wetland vegetation species. Whenever possible, soils taken from impacted wetlands would be used. These sites would be constructed during evaluation and project construction to allow the maximum amount of time for stabilization and any required modifications to achieve that prior to mine closure and reclamation (see **Table 2-17**).

The upper Rock Creek wetland mitigation site is located on the East side of Rock Creek near mile post 3, north of the confluence of Rock Creek with Engle Creek. The wetlands would be constructed in the streamside terrace. Trees and shrubs would be removed from the site and topsoil stockpiled in non-wetland areas adjacent to the site. Linear channels would be excavated down to groundwater depths, estimated at 6 to 8 feet below the surface. The width of the bottom of the linear channels would vary from 10 to 25 feet. Benches, 6 to 12 inches tall, would be constructed on one or both sides of the bottom to create zones with variable periods of saturation or inundation. Side slopes would vary reflecting excavation depth and adjacent natural topography. In general, one side of the excavation would be relatively steep (40 to 50 percent) with the opposite side constructed at a gentle to moderate slope (10 to 40 percent). Since the wetland hydrology will be provided by groundwater, no amendments would be placed on the channel bottom to decrease the permeability.

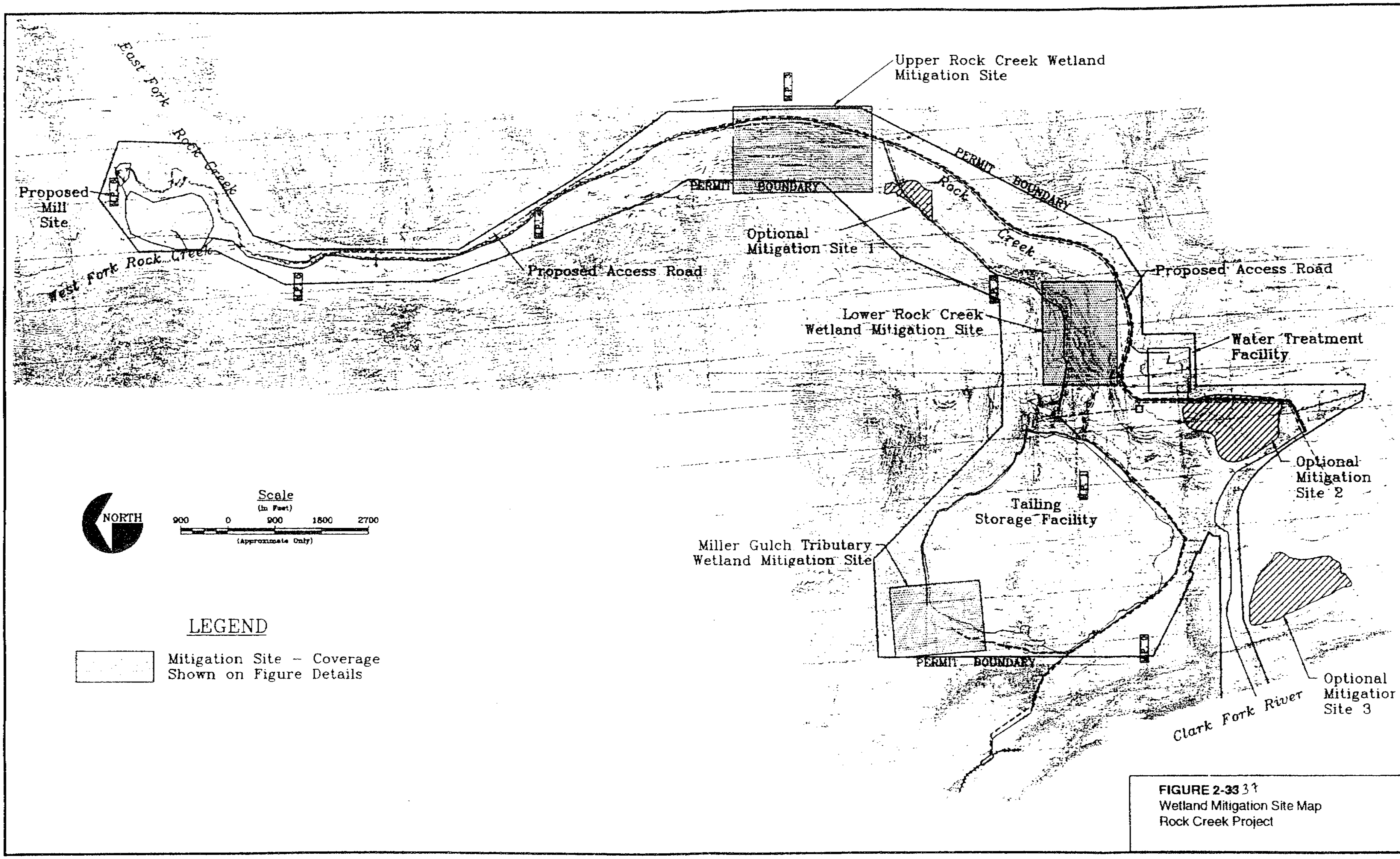


FIGURE 2-33 37
Wetland Mitigation Site Map
Rock Creek Project

TABLE 2-17
Proposed Acreage and Schedule[1] for Created Wetlands for Alternative V

Wetland Mitigation Sites	Created Acreage	Site Construction	Projected Resumption of Comparable Functions
Miller Gulch Tributary	1.2	Preproduction Year 3	Production Year 22
Lower Rock Creek	1.4	Preproduction Year 5	Production Year 3
Upper Rock Creek			
Stage 1	1.1	Preproduction Year 1	Preproduction Year 4
Stage 2	3.3	Preproduction Year 3	Production Year 1
Total Wetland Mitigation	**7.0**		

Note:
1 Schedule based on 5 years preproduction activity, 30 years production, and 5 years post-production closure and reclamation.

The lower Rock Creek site is located on a gently sloping toe-slope and bench primarily between FDR No. 150 and Rock Creek just opposite the road leading to the paste plant and northwest from the water treatment plant. A small segment would be located west of the road. The site entails a portion of the area designated as Borrow Area 3. Alternative V does not incorporate the use of borrow from this site at the tailings disposal site; however, if the final tailings paste disposal design changes that requirement, the wetland mitigation design would be modified to account for any topographic changes. After tree and shrub removal and soil salvage and storage had taken place, linear channels would be excavated to a depth of 2 to 3 feet with variable widths between 10 and 25 feet. Side slopes would vary between 50 and 20 percent. Small depressions would be constructed along the longitudinal profile of each channel to increase water retention. If necessary, small flow barrier (detention dikes) similar to those proposed for the Miller Gulch Tributary mitigation site would be constructed across the channel to create additional diversity in wetland hydrology by creating longer periods of inundation or saturation upstream of the dike. If scouring occurred at the outlet of the channels, rock energy dissipators would be constructed.

The Rock Creek mitigation sites would be topsoiled with 12 to 13 inches of salvaged soil. The sites would be revegetated with a herbaceous revegetation mix. Channel side slopes and any berms created with excavated materials would be seeded with the project's standard upland herbaceous mix as described in the draft EIS. Since the narrow configuration of the mitigation sites would preclude effective drill seeding, the sites would be broadcast seeded. The sites would then be mulched with noxious weed-free straw (2,000 pounds/acre) or cellulose fiber hydromulch (1,500 pounds/acre).

Appendix 3: Record of Informal Consultation with U.S. Fish and Wildlife Service

Feb. 16, 1988	U.S. Fish and Wildlife Service response to ASARCO scoping document.
Mar. 31, 1988	Kootenai National Forest requests species list from U.S. Fish and Wildlife Service.
Apr. 21, 1988	U.S. Fish and Wildlife Service provides Species list for ASARCO project area.
Dec. 15, 1988	Meeting with Larry Lockard (USFWS) and Forest Service biologists to discuss mitigation and compensation for ASARCO Rock creek mine proposal.
Dec. 20, 1988	USFWS letter to verify species list provided in April 21, 1988 letter.
Mar. 27, 1989	Documentation of Phone conversation between Larry Lockard (USFWS) and Brian Kahn and Bob Kiesling (Nature Conservancy) on the Nature Conservancy being a third party participant in grizzly bear recovery.
Mar. 27, 1989	Documentation of Phone conversation between Larry Lockard (USFWS) and Chris Servheen (Grizzly Bear Coordinator - USFWS) on grizzly bear mortality as related to public education and the augmentation program.
Jun. 29, 1989	USFWS letter to verify species list provided in April 21, 1988 letter and reconfirmed on Dec. 20, 1988.
Jan. 30, 1990	USFWS letter to verify species list provided in April 21, 1988 letter and reconfirmed on Dec. 20, 1988 and June 29, 1989.
May 4, 1990	USFWS response as an informal review of a draft biological assessment on the Montanore and Rock Creek mine projects.
Nov. 19, 1993	Meeting with Kevin Shelly (USFWS), Lisa Fairman (OEA contract biologist), Paul Kaiser (KNF IDT Leader), Wayne Johnson (Cabinet District Biologist). Parties agree to a number of items regarding analysis of effects on grizzly bear. Also clarified USFWS position concerning ASARCO and Montanore project overlap.
Dec. 1, 1993	District Ranger requests updated list of endangered, threatened, and proposed species in or near the planning area from the U.S. Fish and Wildlife Service.

Jan. 25, 1994	U.S. Fish and Wildlife Service provides updated list of threatened, endangered, and proposed species that may be present in project area.
April 29, 1994	Meeting between USFWS, MDFWP, KNF biologists to discuss 4-27-94 Draft Mitigation Plan of ASARCO. Team reviewed draft and accepted, modified or deleted items as appropriate. Draft Mitigation plan to be included in Draft BA.
July 22, 1994	District Ranger requests updated list of endangered, threatened, and proposed species in or near the planning area from the U.S. Fish and Wildlife Service.
Aug. 24, 1994	U.S. Fish and Wildlife Service provides updated list of threatened, endangered, and proposed species that may be present in project area.
Dec. 21, 1994	Meeting with MDFWP and USFWS to review agency's draft ASARCO mitigation plan. Changes made to draft plan based on input from Harvey Nyberg (MDFWP), Kevin Shelly and Wayne Kasworm (USFWS).
May 18, 1995	District Ranger requests updated list of endangered, threatened, and proposed species in or near the planning area from the U.S. Fish and Wildlife Service.
June 6, 1995	U.S. Fish and Wildlife Service provides updated list of threatened, endangered, and proposed species that may be present in project area.
May 2, 1996	Meeting with Kevin Shelley (USFWS), Paul Kaiser (KNF), Joe Elliot (ASARCO contract biologist), Wayne Johnson (Cabinet RD). ASARCO concerns about Draft BA shared. Discussion of mitigation plan.
June 4, 1996	Conference call between Kevin Shelley (USFWS), Bob Summerfield (KNF) and Wayne Johnson (Cabinet RD). Discussed USFWS informal response to Draft BA. Identified desired additional analysis for final BA.
Jan. 7, 1997	KNF submitted assessment of potential mitigation lands to USFWS for review in advance of mitigation planning meeting.
Mar. 10, 1997	Meeting with Kevin Shelley (USFWS), Bob Summerfield, Paul Kaiser, Rich Stearns and Wayne Johnson (USFS). USFWS requests use of Moving Windows analysis. Kevin states "mitigation lands assessment looks good".

July 2, 1997	Conference call with Kevin Shelley (USFWS), Wayne Johnson, Paul Kaiser, Sandy Jacobsen (USFS), Joe Elliot and Doug Parker (ASARCO) and Kathy Johnson (MDEQ). USFWS request seasonal habitat analysis of Core habitat as it is the "replacement area". ASARCO has concern on timing of mitigation - can mitigation be phased? Yes, but separate from NORANDA. Monthly meetings set to complete final mitigation package.
July 9, 1997	Meeting with Kevin Shelley (USFWS), Wayne Johnson, Sandy Jacobson, Bob Summerfield and Paul Kaiser (USFS). How to approach to mitigation - is it more than just replacement of habitat units?
Aug. 4, 1997	Kootenai Forest requests updated list of endangered, threatened, and proposed species in or near the planning area from the U.S. Fish and Wildlife Service.
Aug. 15, 1997	U.S. Fish and Wildlife Service provides updated list of endangered, threatened, and proposed species that my be present in the project area.
Aug. 26, 1997	Kootenai Forest submits draft Biological Assessment to USFWS with request for a draft Biological Opinion.
Sept. 26, 1997	USFWS responds to KNF Aug. 26, 1997 request by identifying it as "early consultation" and therefore did not provide a draft B.O..
Dec. 18, 1997	Phone conference notes between KNF & USFWS biologists discussing predicisional information on USFWS position and finding on draft B.A. Jeopardy and take elements covered and ideas for potential reasonable and prudent alternatives considered.
Mar. 30, 1998	Kootenai Forest requests updated list of endangered, threatened, and proposed species in or near the planning area from the U.S. Fish and Wildlife Service.
April 15, 1998	U.S. Fish and Wildlife Service provides updated list of endangered, threatened, and proposed species that my be present in the project area.

APPENDIX 4

"Cumulative Effects Model" (CEM) Process

T&E ANALYSIS PROCESSES AND ANALYSIS AREAS

FOR

ASARCO ROCK CREEK MINE

INTRODUCTION

This paper documents the project specific replacement habitat needs due to project impacts. It also identifies the analysis areas used for each species and the elements used in cumulative effects analysis. Projects included in the cumulative effects analysis are listed in the project file. Data from aerial, vehicle, and foot surveys and sightings, radio telemetry, historical sightings, scat analysis, and vegetative mapping were used in the analysis. This provides information on populations and habitat. Literature reviews pertinent to the species and the proposed project supplemented detailed studies.

BALD EAGLE AND PEREGRINE FALCON

The primary study area centers around the proposed permit area for peregrine falcon and bald eagles. Cumulative effects analysis area expands to cover the Clark Fork and Bull river corridors (1 mile either side of the river).

GRAY WOLF

The primary study area centers around the proposed permit area. Cumulative effects analysis area expands to cover that portion of the Cabinet Ranger District that lies north and east of the Clark Fork River. This is based on the territory size, and the assumption that a pack territory could exist on each side of the Clark Fork River.

GRIZZLY BEAR

A larger area was used for analysis of cumulative impacts to the grizzly bear. This area includes all of bear management units (BMU) 4, 5, and 6, which are areas which have been delineated for direct cumulative effects analysis. The bear units have been in use for analyzing cumulative impacts to grizzlies since 1982. BMUs were used to determine percent habitat effectiveness, based on minimum level of 70 percent.

Sub-units of BMUs called bear analysis areas (BAA) were used to determine open road densities, based on a maximum level of 0.75 miles per square mile (640 acres).

An even larger area was used to determine the indirect cumulative effects of two mines (Rock Creek and Montanore) operating at the same time. The entire Cabinet-Yaak Recovery Zone (2580 square miles) was the starting point and then the Cabinet Mountain portion of the CYE (35% of CYE) and finally the south half of the Cabinet Mountain portion (22% of CYE) was evaluated for this effect.

The vegetative habitat analysis follows the cumulative effects model (CEM) as outlined in "Cumulative Effects Analysis Process for the Selkirk/Cabinet-Yaak Grizzly Bear Ecosystems" (USFWS 1988). Early and Late habitat units were mapped within the Rock creek drainage and values and acres displayed for all habitat units that were impacted (physically changed or within project influence zone of 1/4 to 1/2 mile or ridge line).

Based on the CEM process, specifically Table 4 pg 12,(USFWS 1988) replacement habitat needs were identified as follows:

Tailings site:

368 acres physically changed

A disturbance coefficient (DC) of 0.0 is assigned. This means that total displacement occurs and none of the area would be available for bear use at any time during the project. A 100% compensation level assigned.

368 x 1 = 368 acres needed

Tailings site influence zone:

Motorized point with 24 hour activity - 1/2 mile influence zone

486 acres (includes only those acres not already disturbed by existing facilities (Road 150, railroad)

A DC of 0.1 is assigned. This means that the ability of the area to support bears is 10% of potential. A 90% compensation level assigned.

486 x .9 = 437.4 acres needed

Mill site and Facilities (mill, water treatment and mine sites):

41 acres physically changed

A DC of 0.0 is assigned. This means that total displacement occurs and none of the area would be available for bear use at any time during the project. A 100% compensation level assigned.

41 x 1 = 41 acres needed

SUMMARY

FEATURE	*ACRES*
Tailings Site	368.0
Tailings Site Influence Zone	437.4
Mill Site Acres	41.0
Mill Site Influence Zone	207.0
Transportation Facilities	64.0
Transportation Facilities Influence Zone	37.8
Exploration Adit	10.0
Exploration Adit Influence Zone	43.4
Existing Transportation Facilities Influence Zone	1131.2
Ventilation Adit	0.0
Ventilation Adit Influence Zone	10.0
Total Project Replacement Acres	2349.8

REPLACEMENT ACRES (rounded to nearest whole acre) = 2350

Habitat replacement acres must be "IN KIND"

"IN KIND" acres must provide a total of 6133.5 early habitat units; and 3783.5 late habitat units. Overall habitat value of 2.11 habitat units per acre (2.61 early HUs ; 1.61 late HUs) is desired.

Acceptable "in kind" replacement acres include:

1. Fee title or:
2. Conservation easement.

   Either method must be, at a minimum, for the life of the mine (35 years) plus a reasonable recovery period following mine reclamation. Bear generations are about 7 years, so a "reasonable" period would be 2 bear generations in order to give bears time to start re-using lands from which they had been displaced.

3. Lands must provide equivalent early and late habitat units as described in the BA seasonal component section.

USFWS et.al. 1988. Cumulative Effects Analysis Process for the Selkirk/Cabinet-Yaak Grizzly Bear Ecosystems 1988. USFWS Boise Field Office. Boise ID. 32 pp.

APPENDIX 5

THREATENED and ENDANGERED SPECIES MITIGATION PLAN
for
PROPOSED ASARCO ROCK CREEK MINE

This mitigation plan displays the specific items identified that are required to reduce, eliminate, or provide substitution for environmental consequences to species federally listed as threatened or endangered. It covers implementing Alternative Five as displayed in the Environmental Impact Statement for the ASARCO Rock Creek Mine project. This Final Mitigation Plan will be implemented by ASARCO and appropriate state and federal agencies.

A. To reduce mortality risk (avoid incidental take) to Threatened and Endangered species ASARCO will:

1. Develop a transportation plan designed to minimize mine related vehicular traffic, traveling between state highway 200 and the mill site, and minimize parking availability at the plant site. Agencies approval required.

2. Not use salt when sanding during winter plowing operations, on Forest Development Road 150 (FDR-150), to reduce big game mortality that could draw bald eagles, wolves and grizzly (in spring) to the road corridor and increase mortality.

3. Daily remove vehicular killed deer and elk from road rights-of-way within the permit area and along roadways used for access or hauling ore (FDR 150, 150A and new roads built for the project). Road kills would be moved at least 50 feet beyond the right-of-way clearing and further if necessary to be out of sight from the road. During construction and the first three years of full operation, ASARCO would monitor the number of vehicular killed deer and elk on these roads and report findings annually. They would also monitor and report (within 24 hours) all grizzly bear, bald eagle and wolf mortalities within the permit area. If a T&E species mortality occurs, and it is determined that the carrion was a contributing factor, then ASARCO would start hauling the dead deer and elk to a dumping location approved by Montana Fish, Wildlife and Parks (MFWP). After five years of full operation the Forest Service, in consultation with the U.S. Fish and Wildlife Service, will do a reevaluation of mortality risk to bald eagles, wolf, and grizzly bear to determine the need to continue this mitigation measure.

4. Construct power lines following criteria outlined by Olendorff, Miller and Lehman (1981) to reduce potential for electrocution of bald eagles.

5. Work with other mines operating in the area (ie. Noranda) to fund a MFWP public information and education program to aid in grizzly bear conservation. This would be the same program as required in the Record of Decision for the Montanore Project (9/93), not an additional one. The program would be funded for 5 years and then evaluated for need to continue as is or modify to better benefit the grizzly. If ASARCO is unable to find a partner for this measure, they will be responsible to fully fund the program. The purposes are to reduce mortality risk through (1)education of the public on the law and penalty for violation (illegal killing of T&E species); (2) education of hunters on bear

identification to reduce accidental killing of grizzly and (3) educate the public on biological needs of the grizzly so that an understanding exists that reduces "social jeopardy".

6. Work with other mines operating in the area (ie. Noranda) to fund a local MFWP law enforcement position for the life of the mine. This would be the same position as required in the Record of Decision for the Montanore Project (9/93), not an additional one. If for some reason the Montanore project does not proceed, ASARCO will be responsible to fully fund the position.

7. Use bear-proof containers to hold attractants and remove them in a timely manner (weekly unless a problem develops, then daily).

8. Not use clover in the seed mix used on any disturbed area during active operations, to reduce grizzly/human encounters caused by bears being drawn to clover sites.

9. Prohibit employees from carrying firearms within the permit area, except for security officers and other designated personnel.

10. Prohibit employees from feeding wildlife, especially bears, as food becomes attractants to bears.

B. To maintain habitat effectiveness for Threatened and Endangered species, ASARCO will:

1. Secure or protect (through conservation easement, including road closures, or acquisition) from development (including but not limited to housing, motorized access) and use (timber harvest, adverse grazing, mining) replacement habitat to compensate for acres lost by physical alterations, or acres with reduced habitat availability due to disturbance. Replacement acres for Alternative Five are: 2350. The "in kind" replacement acres must provide 2.61 early (6133.5 total), 1.61 late (3783.5 total) or an overall 2.11 habitat unit value (4958.5 total overall HUs). Replacement habitat will be provided using the following schedule:

Activity Area	Replacement Acres	Timing
Exploration Adit	53	Prior to Construction
Tailings & AF	806	Prior to Construction
Mill & AF	248	Prior to Construction
Ventilation Adit	10	Prior to Construction
New Roads	102	Prior to Construction
Existing Roads (Reconstruction)	565	Prior to Reconstruction
Existing Roads (Increased Influence)	566	Prior to Operations
Total Alternative 5	2350	Prior to Operations

AF = Associated Features

This schedule will have all replacement habitat (except ventilation adit) in place prior to starting full operations (end of year 5).

Either fee title or conservation easements are acceptable. Either method must be, at a minimum, for the life of the mine (35 years) plus a reasonable recovery period following mine reclamation. Bear generations are between 7 and 10 years (per Wayne Kasworm personal communicaiton 7-15-98) and a 'reasonable' period would be 2 bear generations. This means a minmum of about 50 years is reasonable. Fee title lands would be turned over to the Forest Service. First choice for replacement habitat is within the disturbed BMUs. If adequate replacement acres are not available in those BMUs then acres may be found in other BMUs within the southern portion of the Cabinet Mountains. See the attached Replacement Habitat Assessment for acceptable lands to consider **(Not available to public until replacement habitat mitigation completed).**

2. Fund habitat enhancement, commensurate with loss of habitat effectiveness. Enhancements include, but are not limited to, prescribed fire to restore whitebark pine, road closures and obliterations. Enhancements are preferred in the affected BMU, however if opportunities are not available, then work may be done in adjacent BMUs.

BMU	% H.E. Change	Acres H.E. Mitigation
4	+1.0	0
5	- 1.1	348
6	- 0.3	136

C. To reduce mortality risk and maintain habitat effectiveness for Threatened and Endangered species, ASARCO will fully fund the following road closures:

1. Close the following roads prior to the start of ASARCO construction activities (see maps):

Road Number	Road Name	Closure Miles	Closure Period	Closure Method
2285	Orr Creek	1.61	Yearlong	Barrier
2741X	unnamed	0.18	Yearlong	Barrier
150	Rock Creek	2.92	Yearlong	Gate *
2741A	unnamed	0.47	Yearlong	Barrier

* North 0.42 miles will be obliterated, South 2.5 miles will be gated (see map)

D. To mitigate for habitat constriction which reduces the potential to achieve CYE grizzly bear recovery goals (by impacting individuals in the Cabinet Mountains), ASARCO will:

1. Secure or protect (through conservation easement, including road closures or acquisition) from development (including but not limited to housing, motorized access) and use (mining, timber harvest, adverse grazing) replacement habitat that will enhance the north to south habitat corridor in the Cabinet Mountains. These lands are in addition to those identfied under mitigation item B-1. See the attached Corridor Replacement Habitat Assessment for acceptable lands to consider **(Not available to public until corridor replacement habitat mitigation completed)** Either fee title or

conservation easements are acceptable. Either method must be, at a minimum, for the life of the mine (35 years) plus a reasonable recovery period following mine reclamation. Bear generations are between 7 and 10 years (per Wayne Kasworm personal communicaiton 7-15-98) and a 'reasonable' period would be 2 bear generations. This means a minmum of about 50 years is reasonable. Fee title lands would be turned over to the Forest Service.

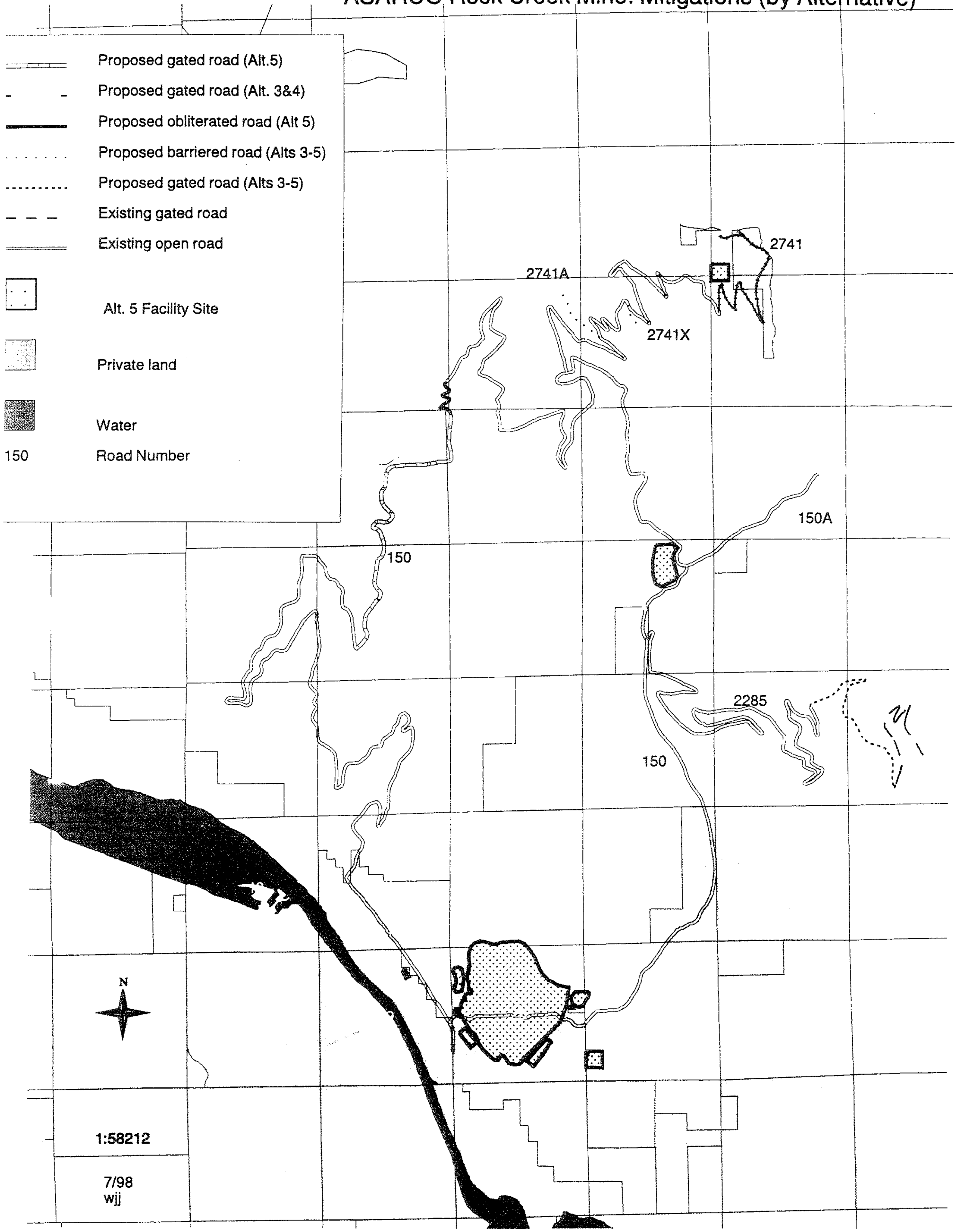
E. To assure compliance with the T&E species mitigation plan ASARCO will:

1. Establish a trust fund and/or post a bond, prior to initiating any activities, to cover the mitigation plan implementation costs. The amount in the fund or posted in a bond will be comensurate with projected work and associated required mitigation items (see table below) (initial cost estimates, 1997 dollars, are about $9.7 million over the life of the mine, actual amount will be adjusted for inflation).

Estimated Deposit Summary:

Year	Deposit
1	$ 3,756,850
3	$ 2,533,400
5	$ 1,177,000
15	$ 2,300,000

ASARCO Rock Creek Mine: Mitigations (by Alternative)



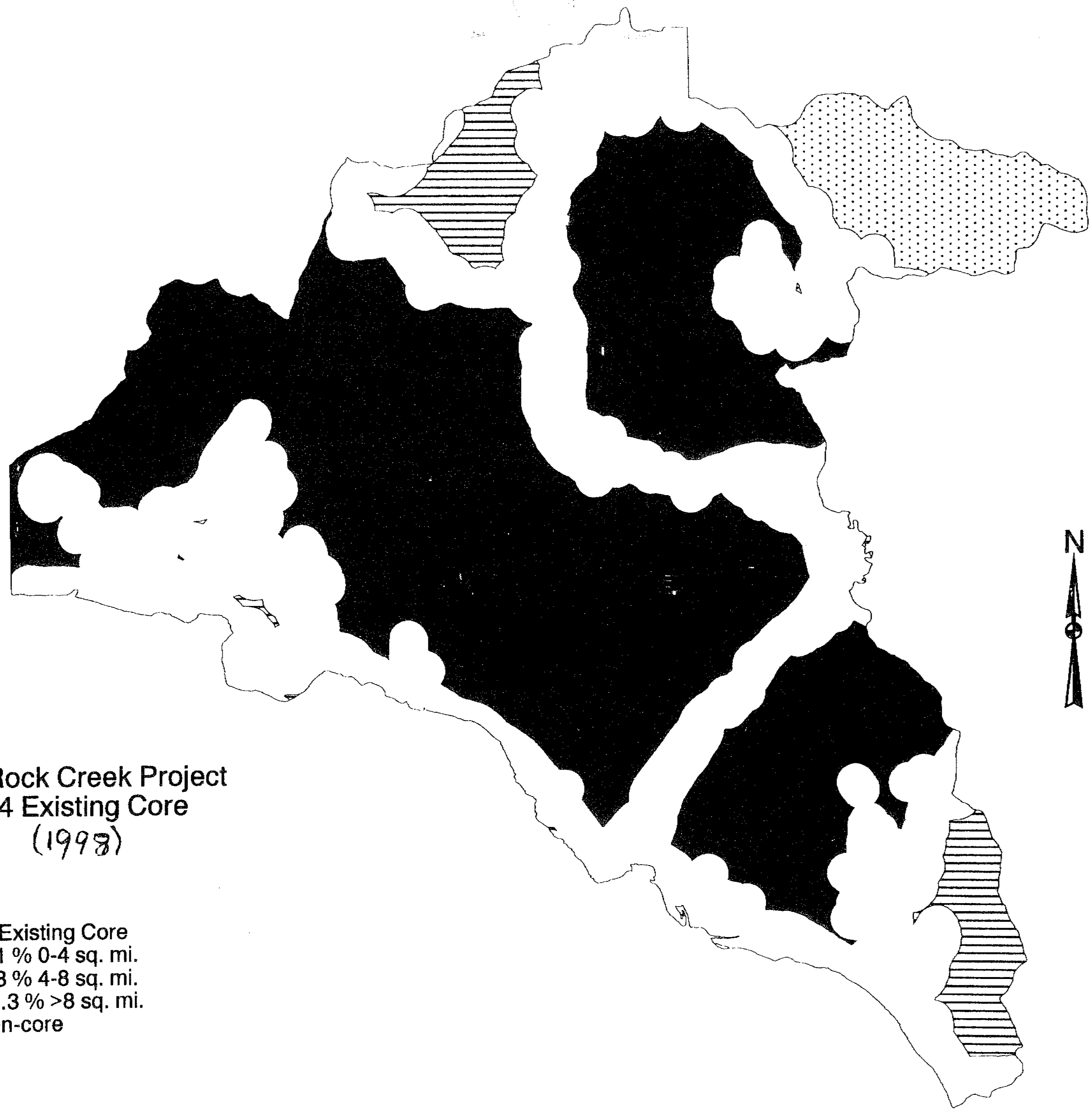
APPENDIX 6

CORE HABITAT ANALYSIS MAPS (1998, 1999, 2000)

BMU 4
BMU 5
BMU 6

MOVING WINDOWS ANALYSIS MAPS (OPEN AND TOTAL ROUTES - 1998, 2000)

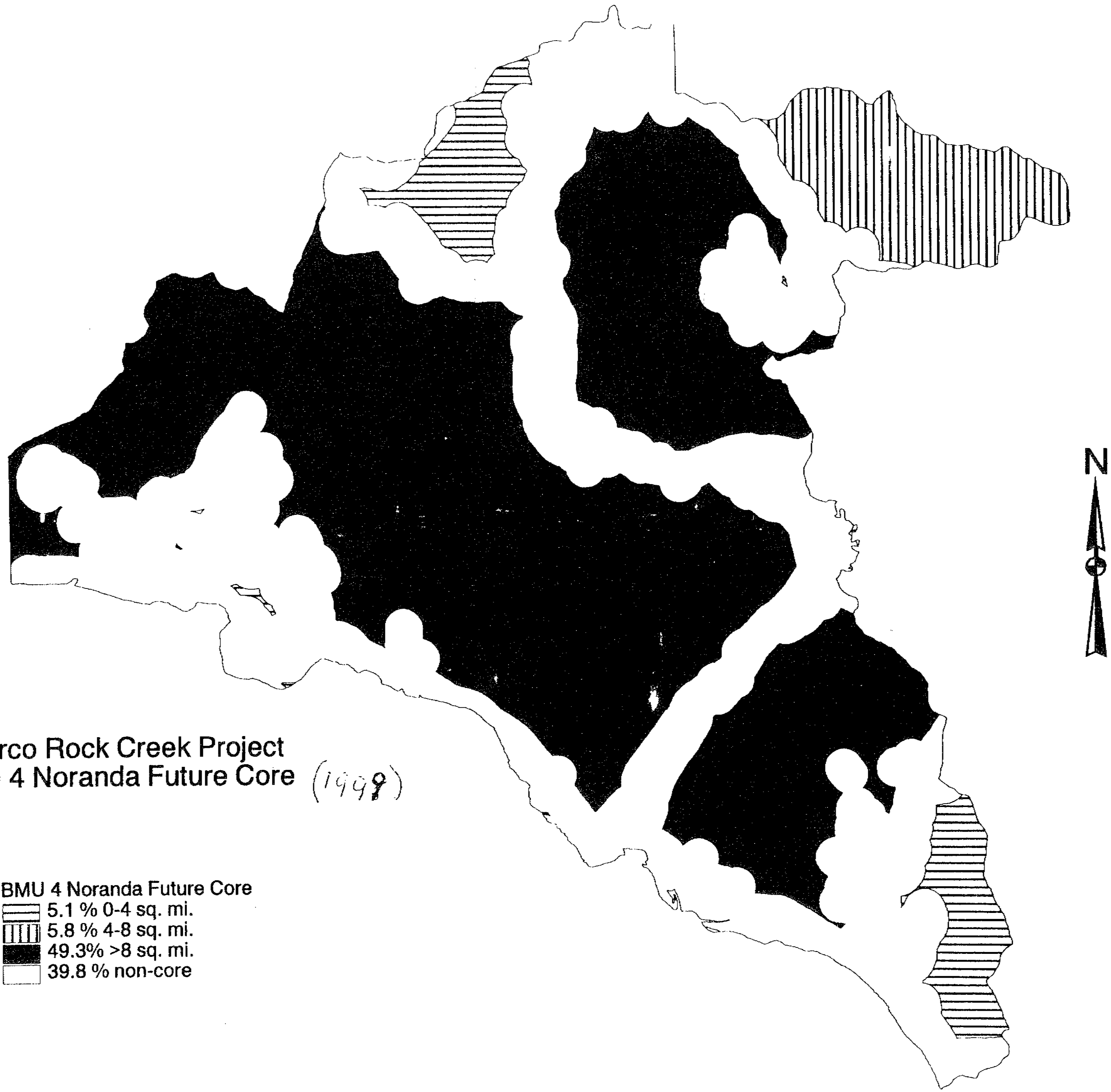
BMU 4
BMU 5
BMU 6



Asarco Rock Creek Project
BMU 4 Existing Core
(1998)

BMU 4 Existing Core
- 5.1 % 0-4 sq. mi.
- 5.8 % 4-8 sq. mi.
- 49.3 % >8 sq. mi.
- non-core

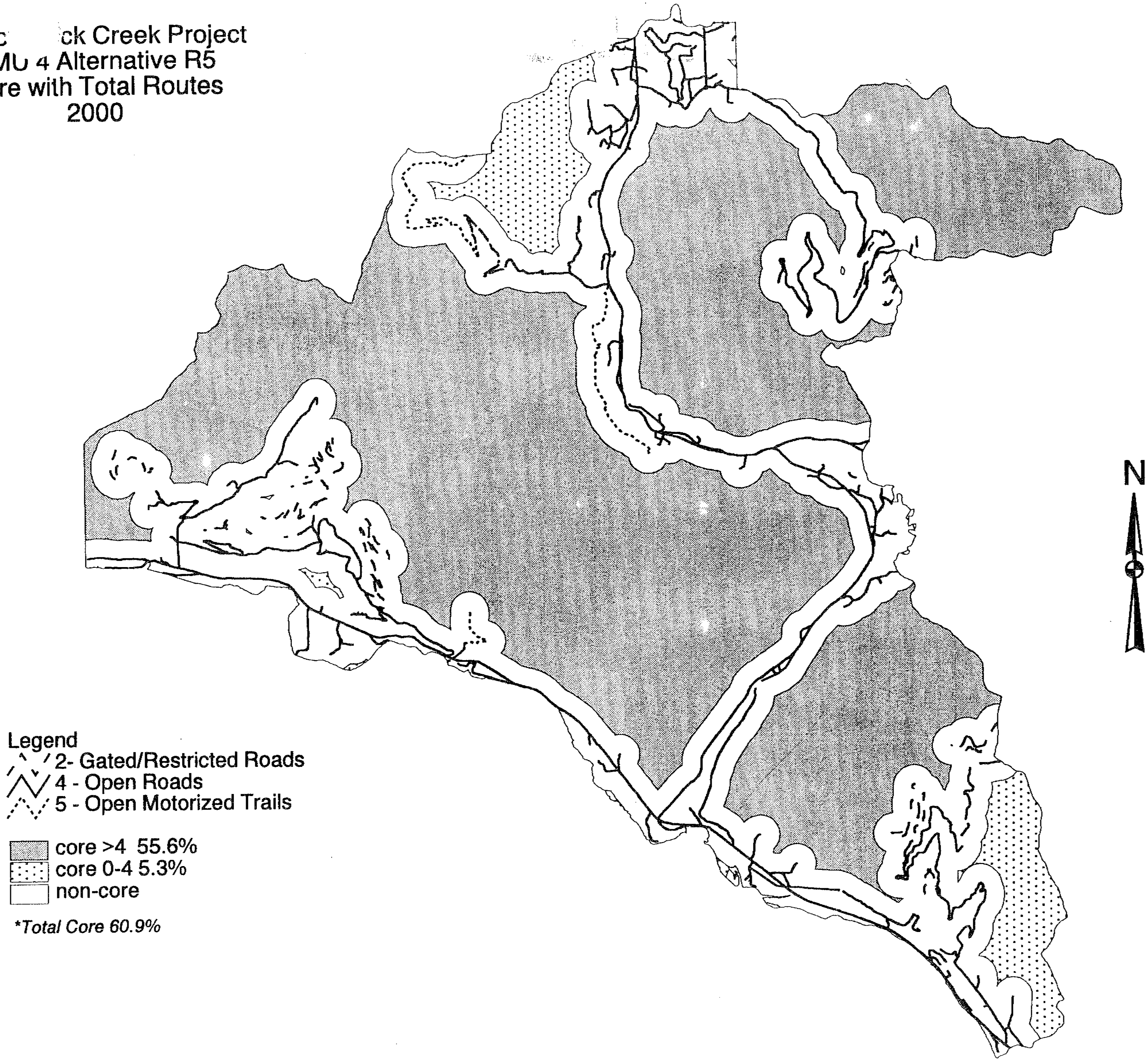
s.ague 8-97



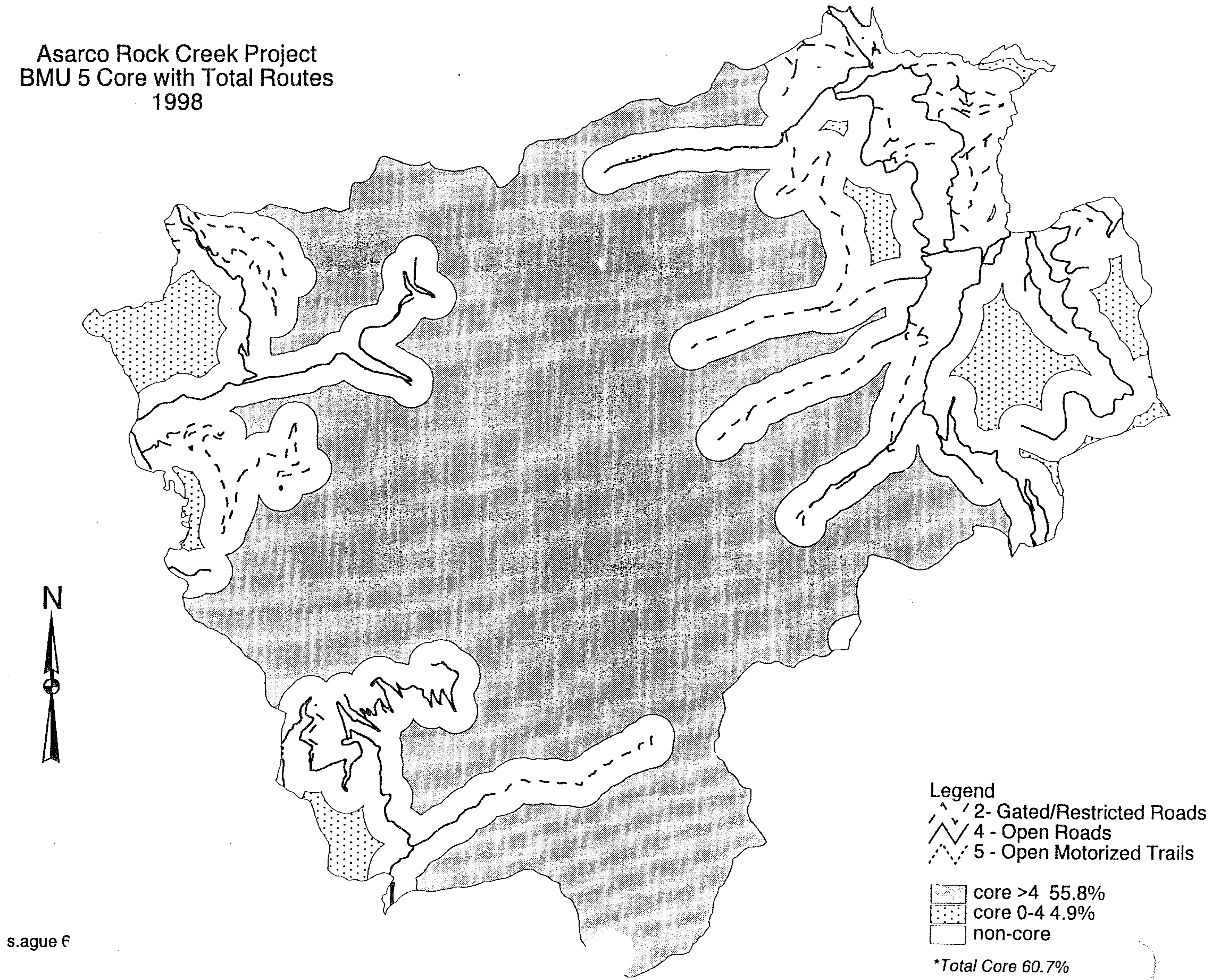
Asarco Rock Creek Project
BMU 4 Noranda Future Core (1998)

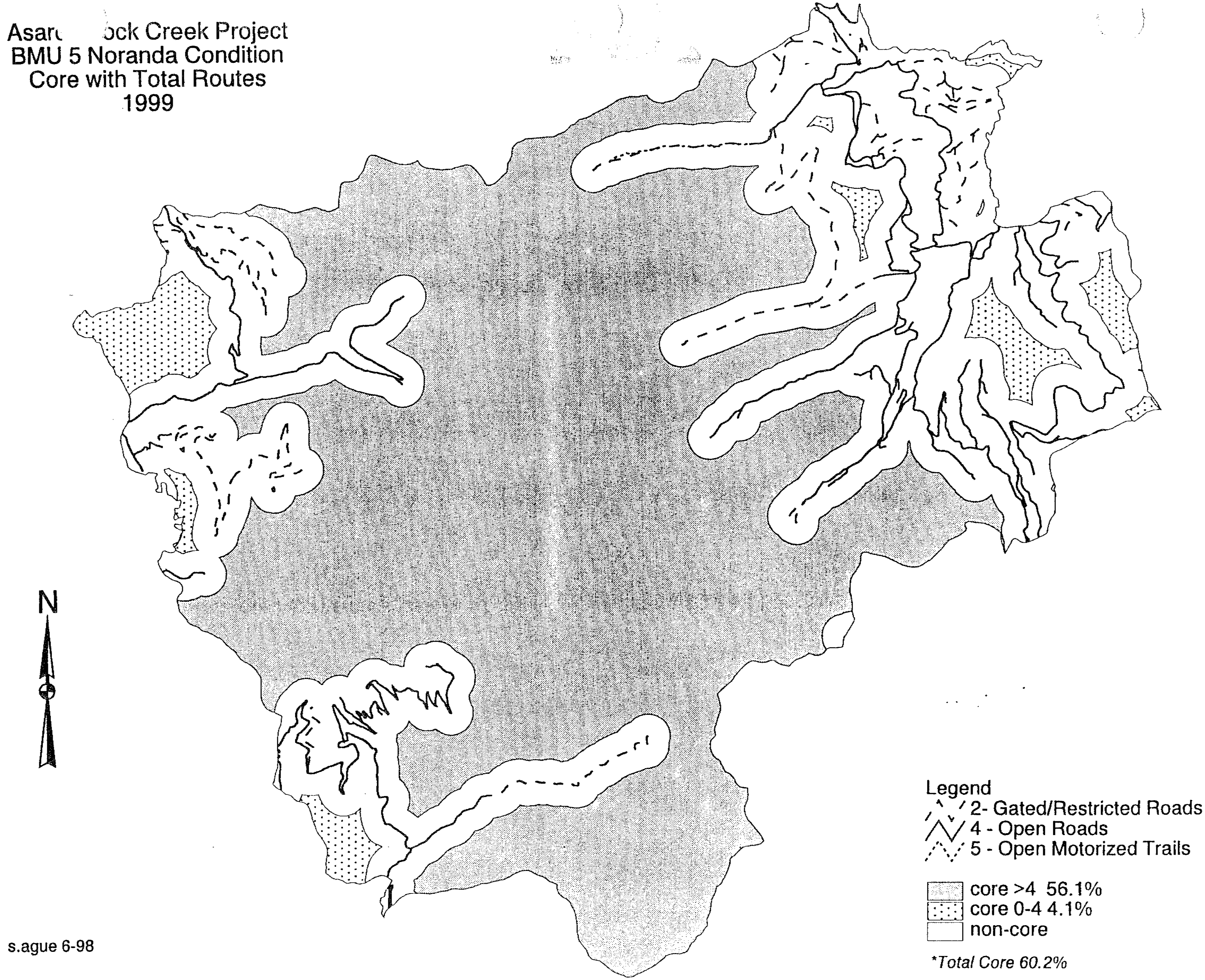
BMU 4 Noranda Future Core
- 5.1 % 0-4 sq. mi.
- 5.8 % 4-8 sq. mi.
- 49.3% >8 sq. mi.
- 39.8 % non-core

Asarc ck Creek Project
BMU 4 Alternative R5
Core with Total Routes
2000

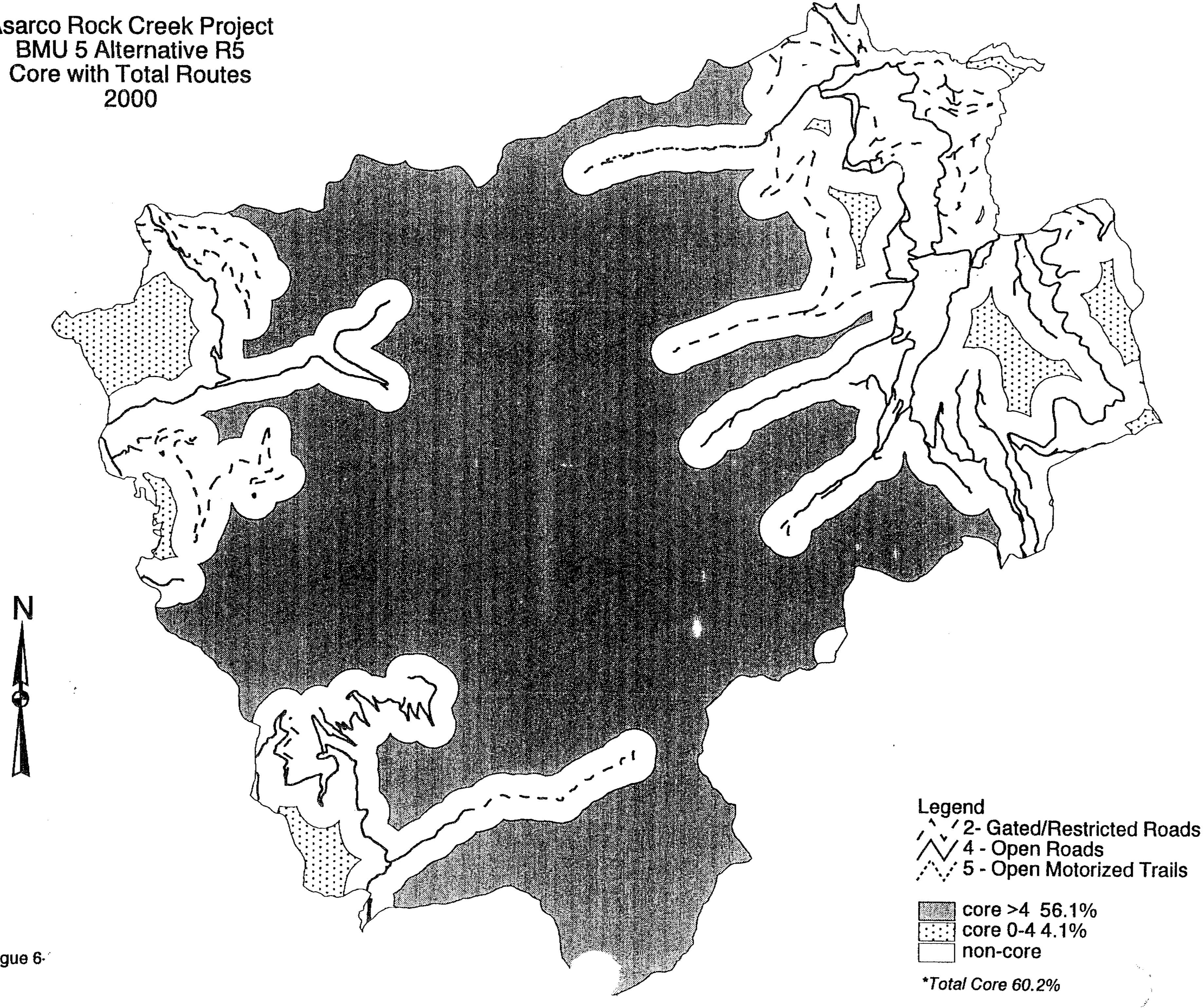


s.ague 6-98


Asarco Rock Creek Project
BMU 5 Core with Total Routes
1998
N
Legend
2- Gated/Restricted Roads
4 - Open Roads
5 - Open Motorized Trails
core >4 55.8%
core 0-4 4.9%
non-core
*Total Core 60.7%
s.ague 6

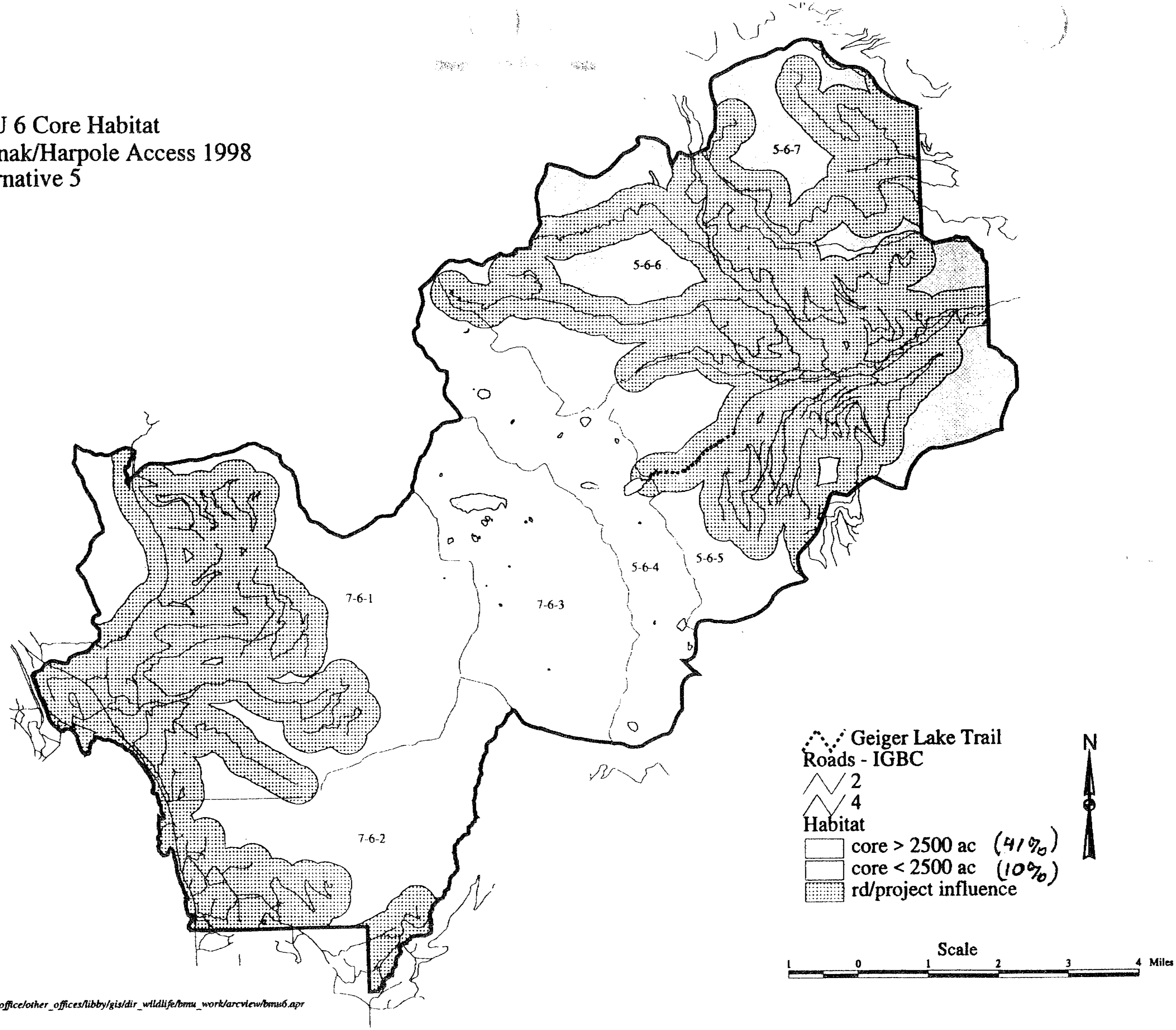

Asarc ock Creek Project
BMU 5 Noranda Condition
Core with Total Routes
1999
N
Legend
2- Gated/Restricted Roads
4 - Open Roads
5 - Open Motorized Trails
core >4 56.1%
core 0-4 4.1%
non-core
*Total Core 60.2%
s.ague 6-98

Asarco Rock Creek Project
BMU 5 Alternative R5
Core with Total Routes
2000



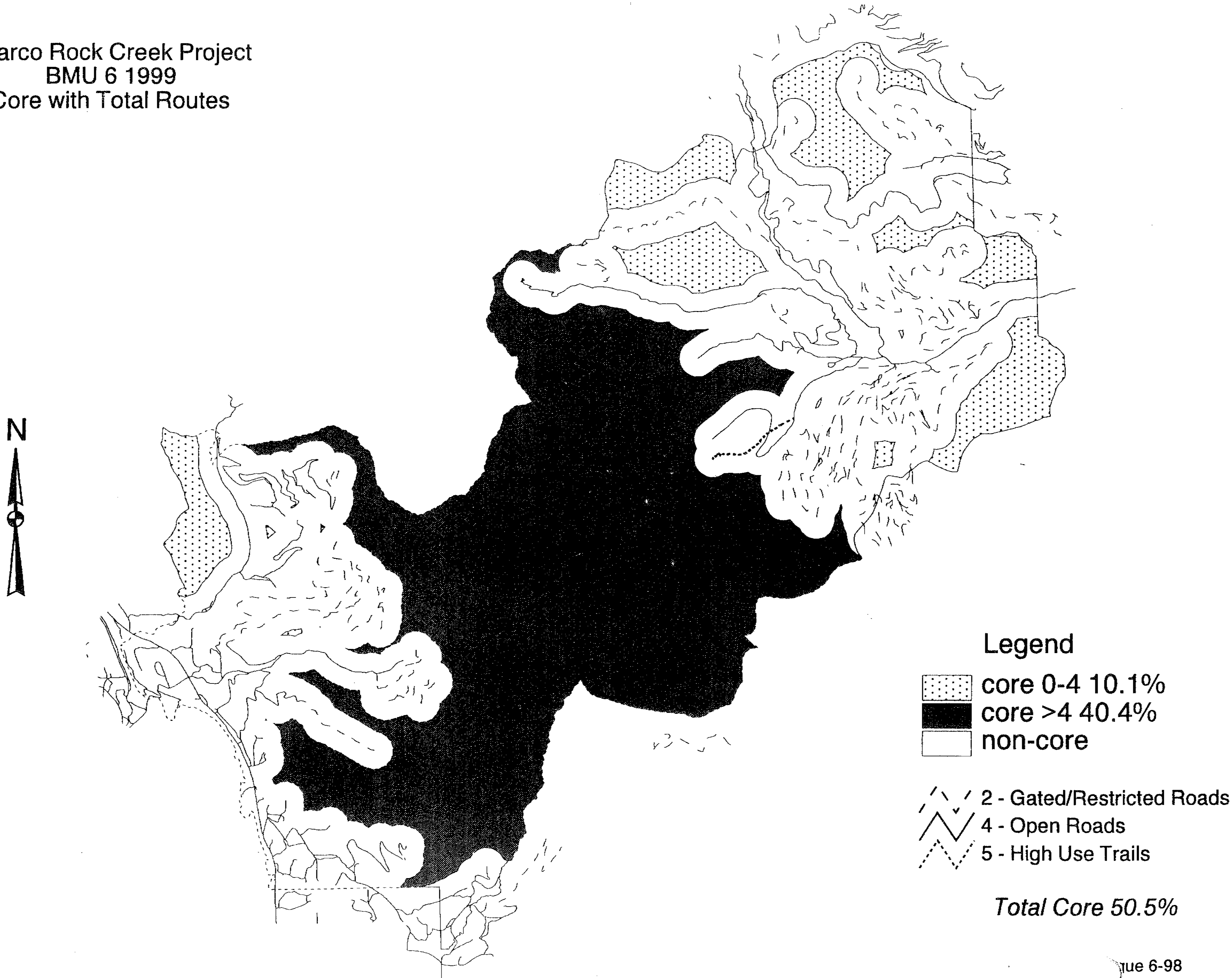
s.ague 6-

BMU 6 Core Habitat
Skranak/Harpole Access 1998
Alternative 5



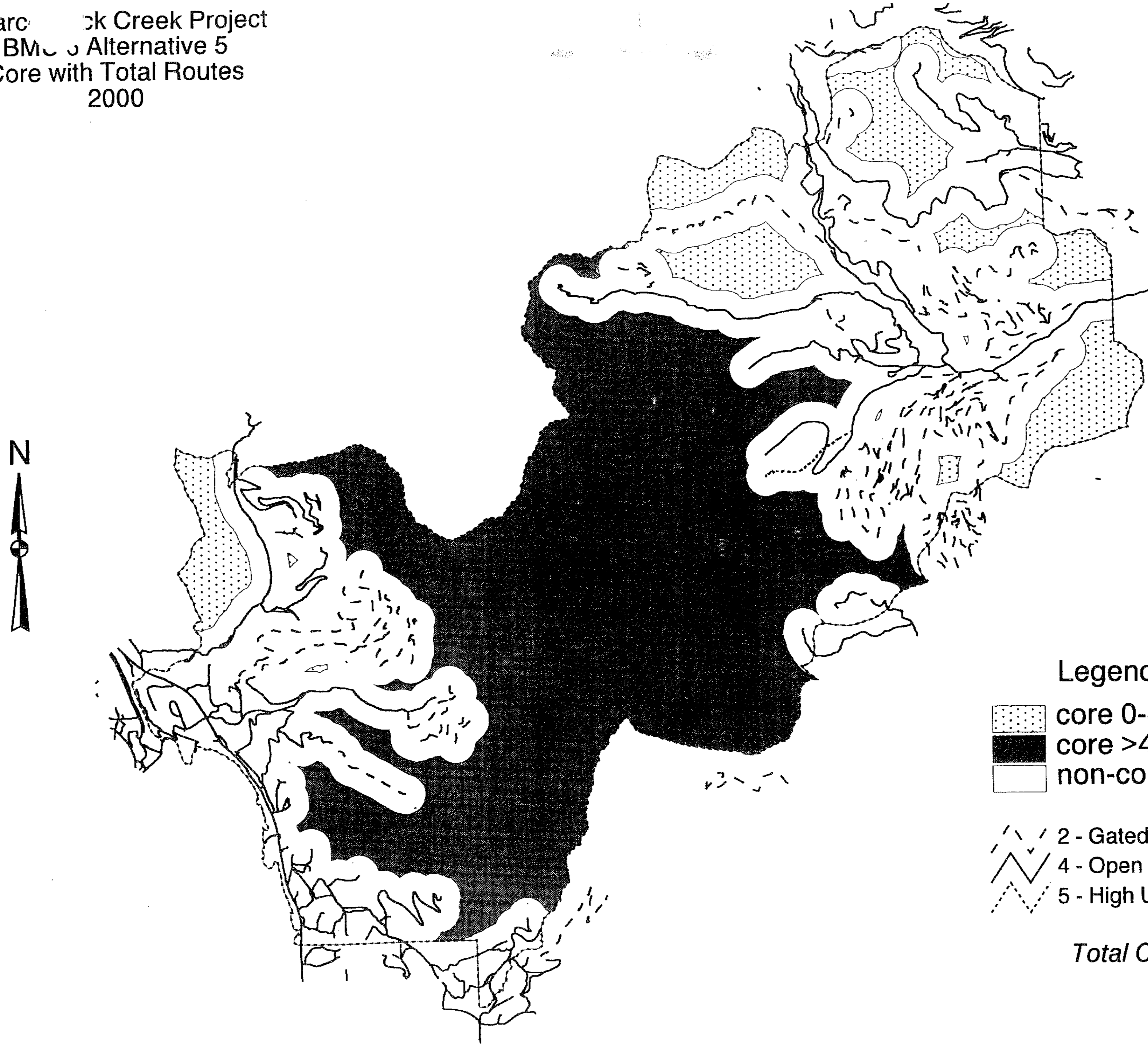
spf 7/21/98 /fsfiles/office/other_offices/libby/gis/dir_wildlife/bmu_work/arcview/bmu6.apr

Asarco Rock Creek Project
BMU 6 1999
Core with Total Routes



ue 6-98

Asarc⸱ ⸱ck Creek Project
BM⸱ ⸱ Alternative 5
Core with Total Routes
2000



Legend

core 0-4 9.8%
core >4 40.1%
non-core

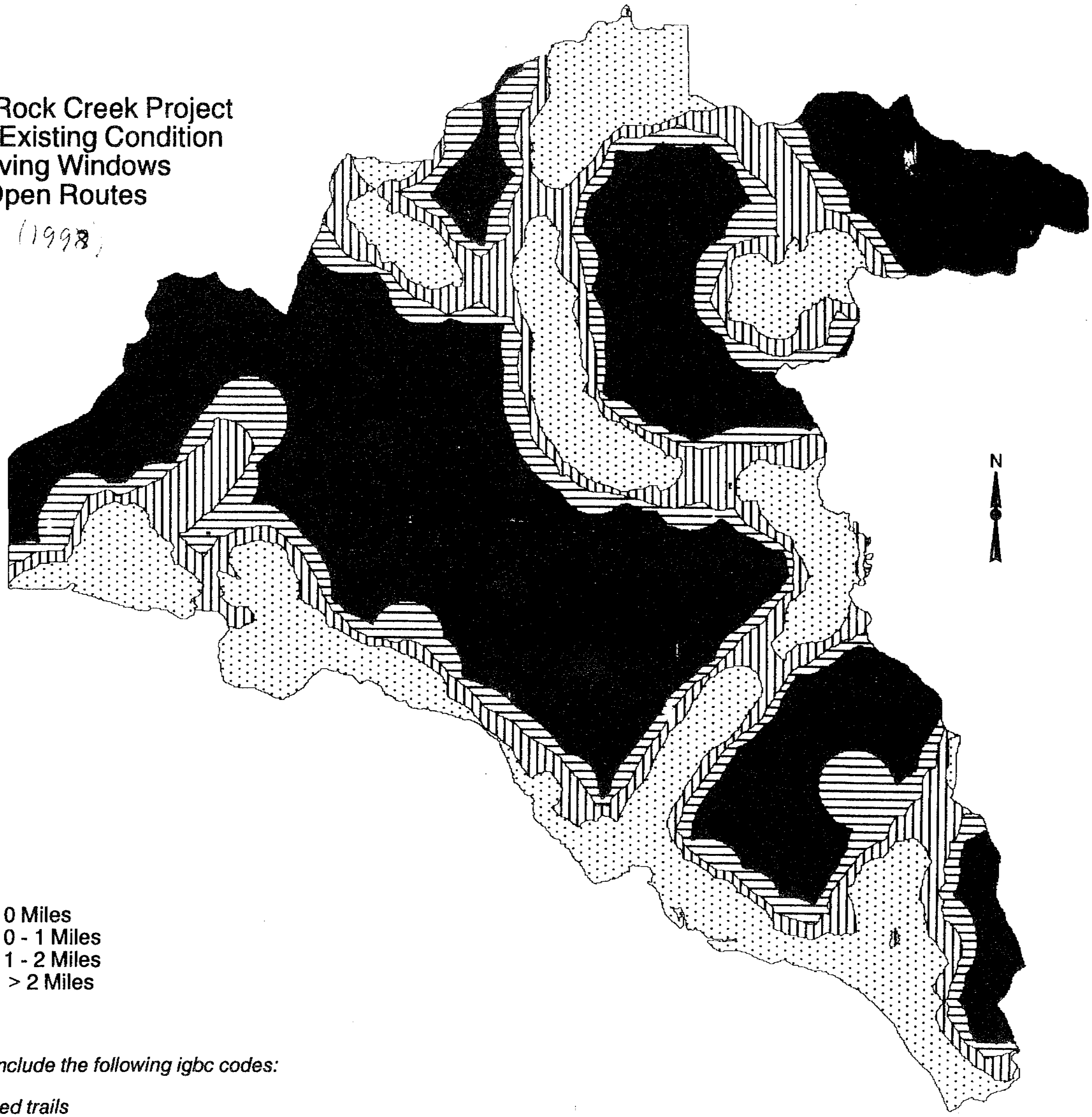
2 - Gated/Restricted Roads
4 - Open Roads
5 - High Use Trails

Total Core 49.9%

s.ague 6-98

Asarco Rock Creek Project
BMU 4 Existing Condition
Moving Windows
Open Routes

(1998)



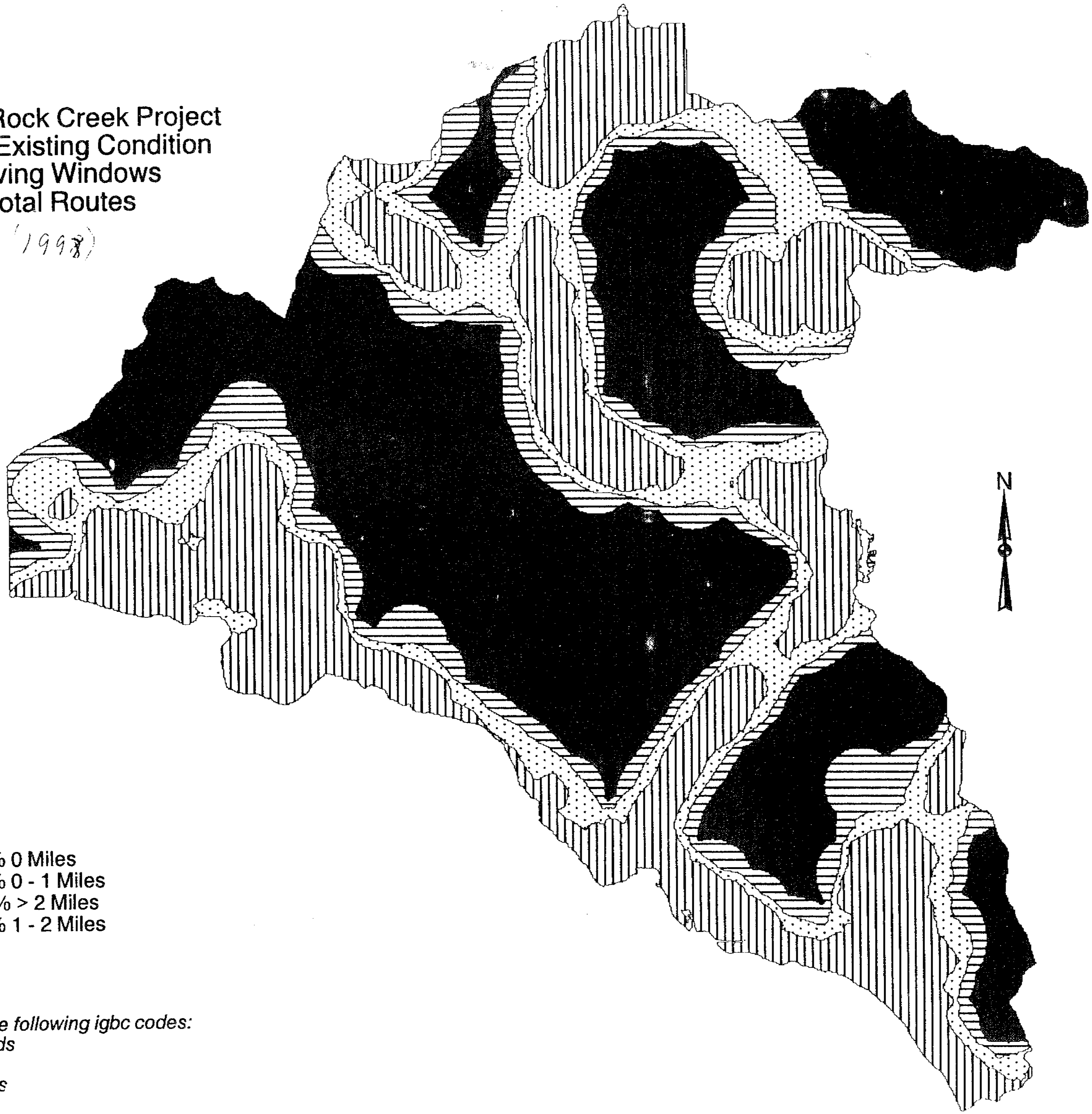
Legend
- 46.9 % 0 Miles
- 14.1 % 0 - 1 Miles
- 15.0 % 1 - 2 Miles
- 24.0 % > 2 Miles

** Open Routes include the following igbc codes:*
4 - ope ads
5 - o torized trails

s.ar 8-97

Asarco Rock Creek Project
BMU 4 Existing Condition
Moving Windows
Total Routes

(1998)

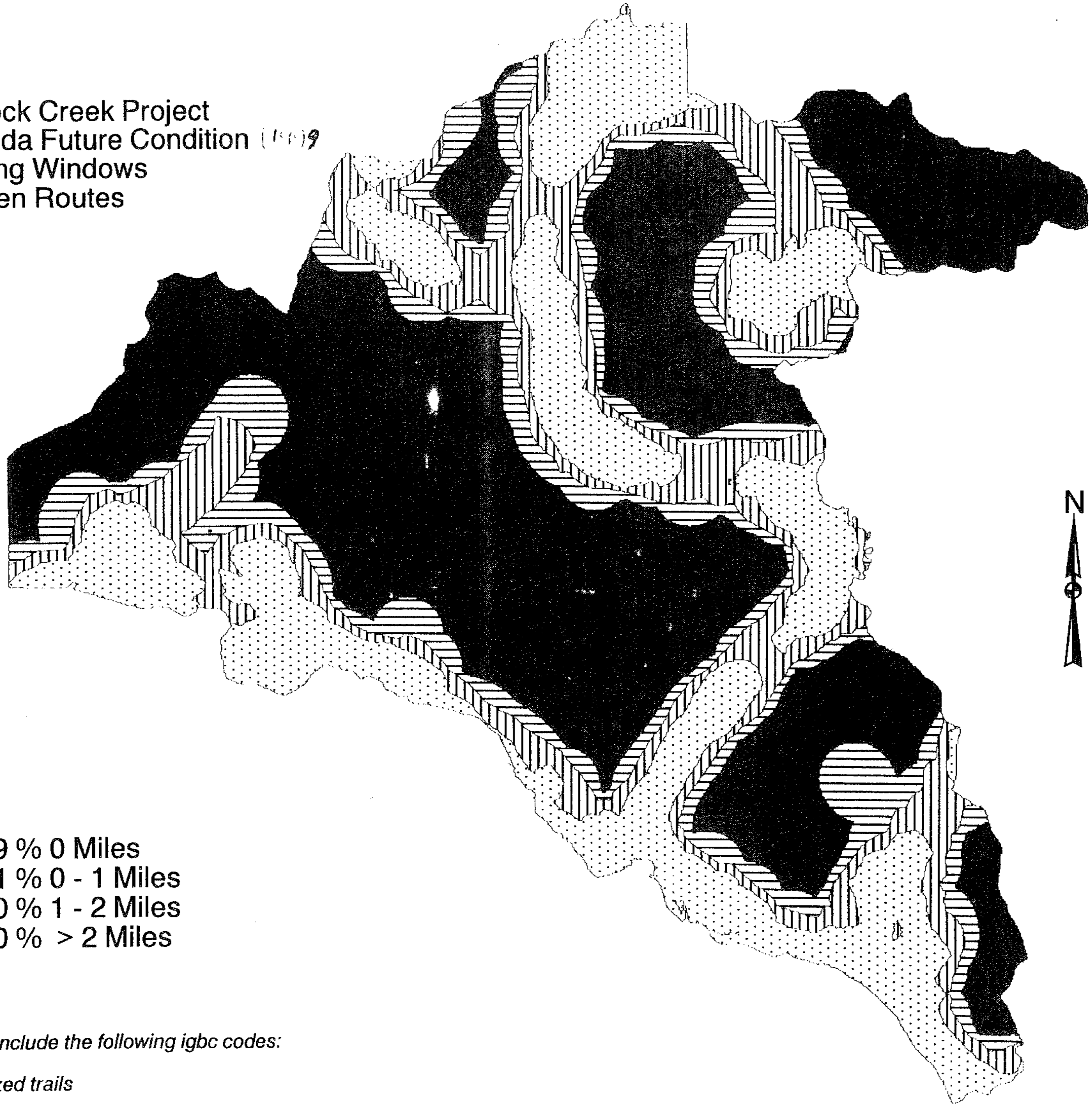


Legend
- 43.9 % 0 Miles
- 13.7 % 0 - 1 Miles
- 14.3 % > 2 Miles
- 28.1 % 1 - 2 Miles

Total Routes include the following igbc codes:
2 - gated/restricted roads
4 - open roads
5 - open motorized trails

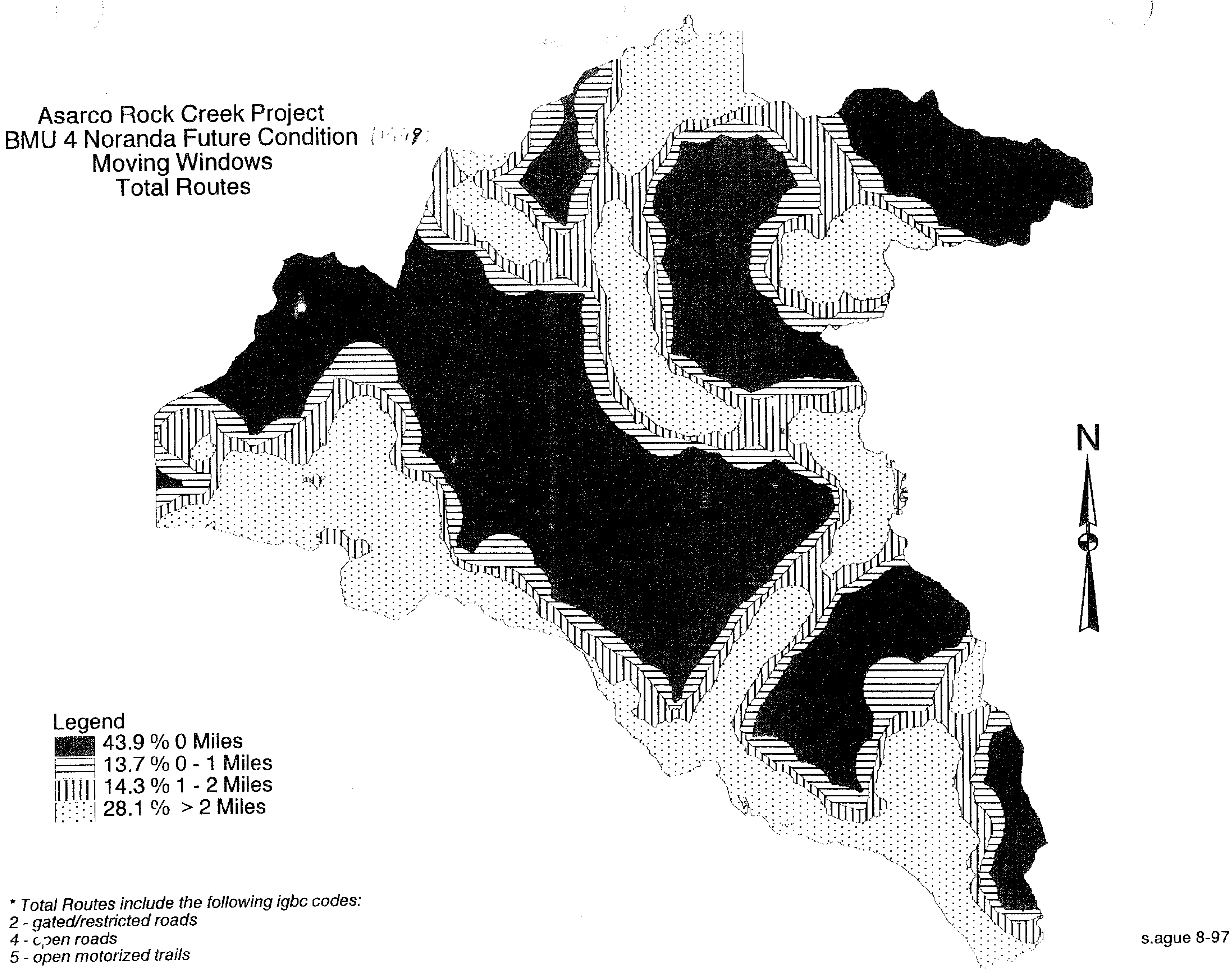
s.ague 8-97

Asarco Rock Creek Project
BMU 4 Noranda Future Condition
Moving Windows
Open Routes



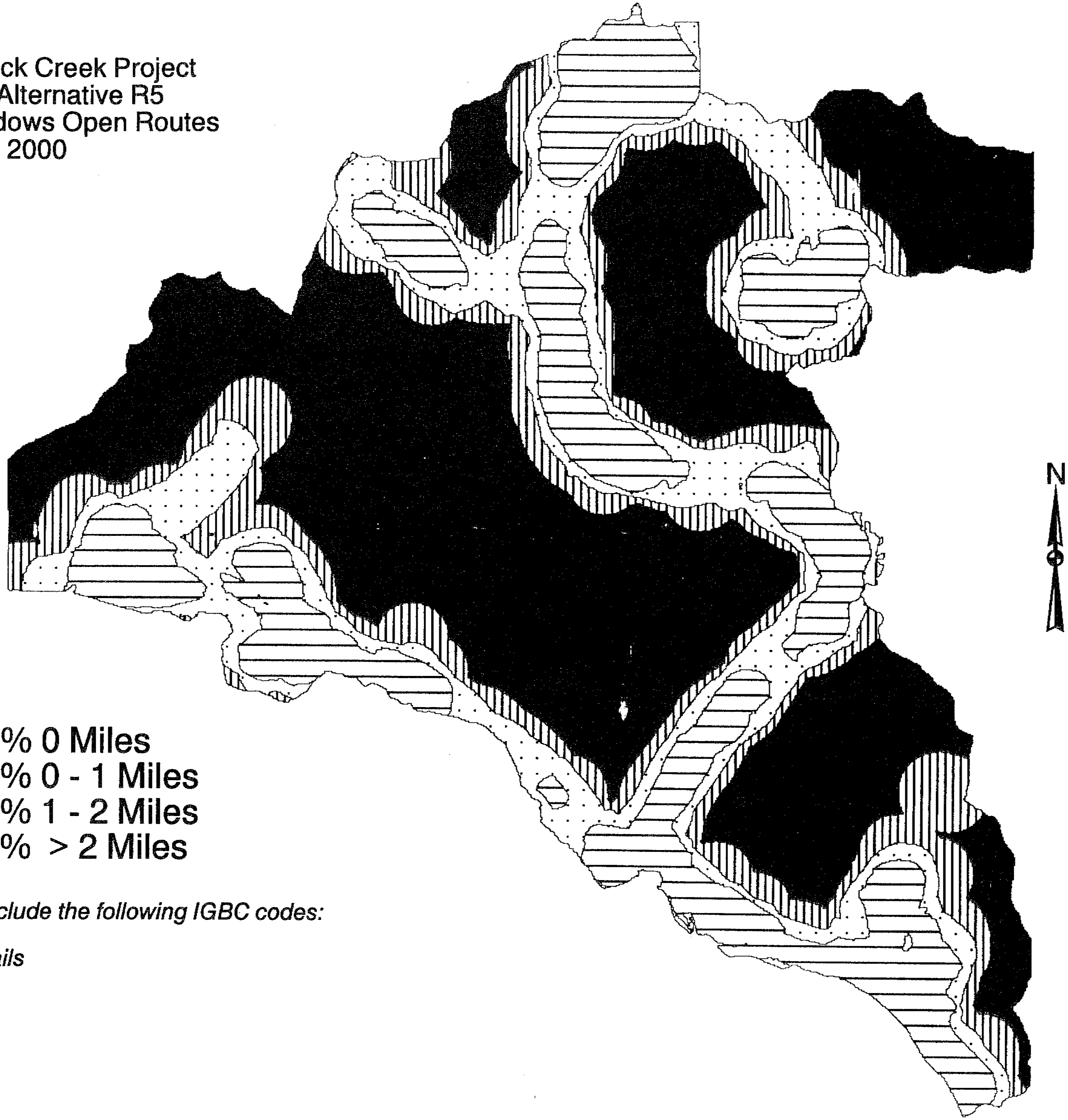
Legend
46.9 % 0 Miles
14.1 % 0 - 1 Miles
15.0 % 1 - 2 Miles
24.0 % > 2 Miles

** Open Routes include the following igbc codes:*
4 - open roads
5 - op[illegible] motorized trails



Asarco Rock Creek Project
BMU 4 Noranda Future Condition
Moving Windows
Total Routes
N
Legend
43.9 % 0 Miles
13.7 % 0 - 1 Miles
14.3 % 1 - 2 Miles
28.1 % > 2 Miles
* Total Routes include the following igbc codes:
2 - gated/restricted roads
4 - open roads
5 - open motorized trails
s.ague 8-97

Asarco Rock Creek Project
BMU 4 Alternative R5
Moving Windows Open Routes
2000

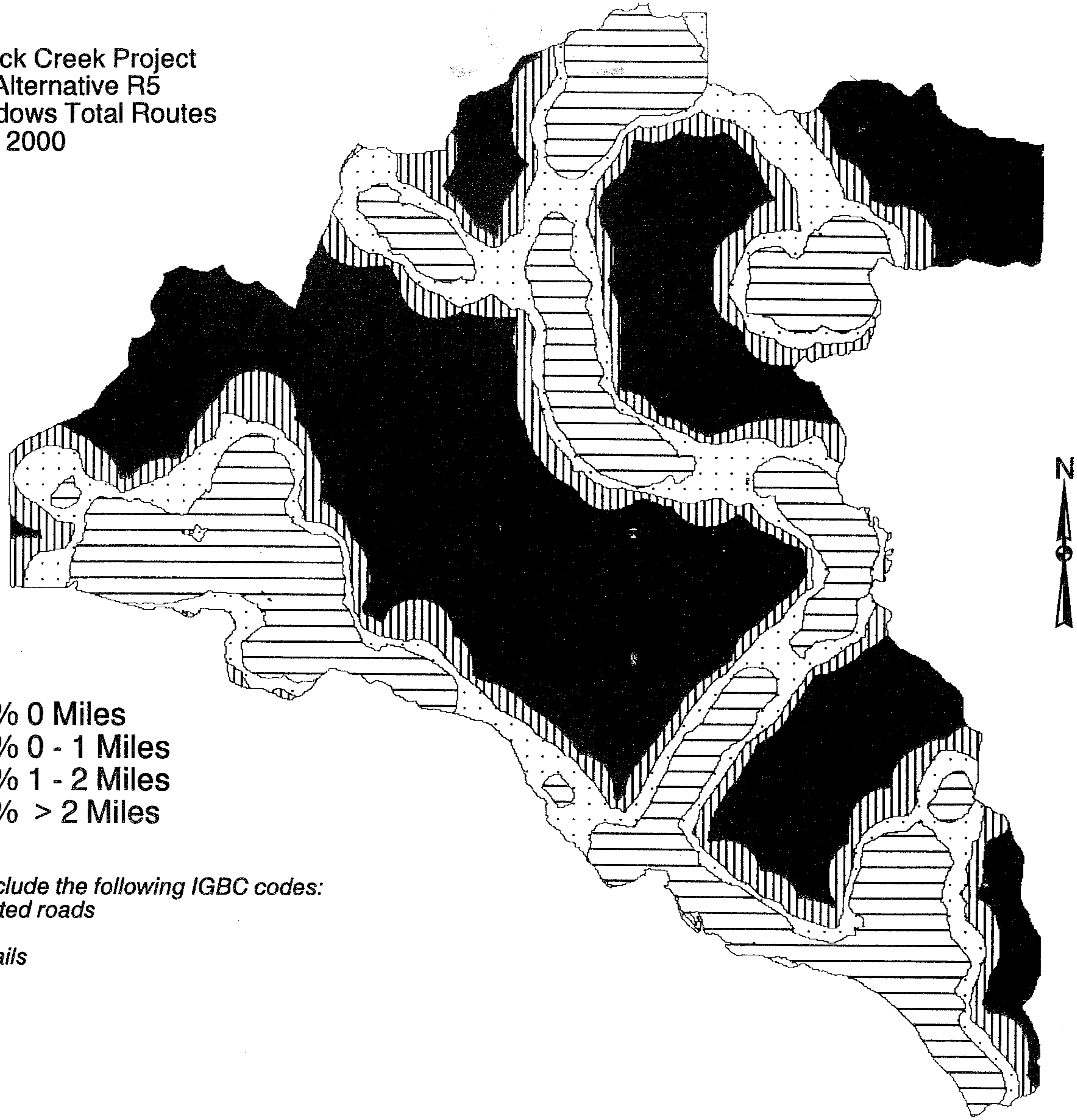


Legend
- 47.9% 0 Miles
- 14.9% 0 - 1 Miles
- 15.7% 1 - 2 Miles
- 21.5% > 2 Miles

Open Routes include the following IGBC codes:
4 - open roads
5 - motorized trails

Figure 7-98

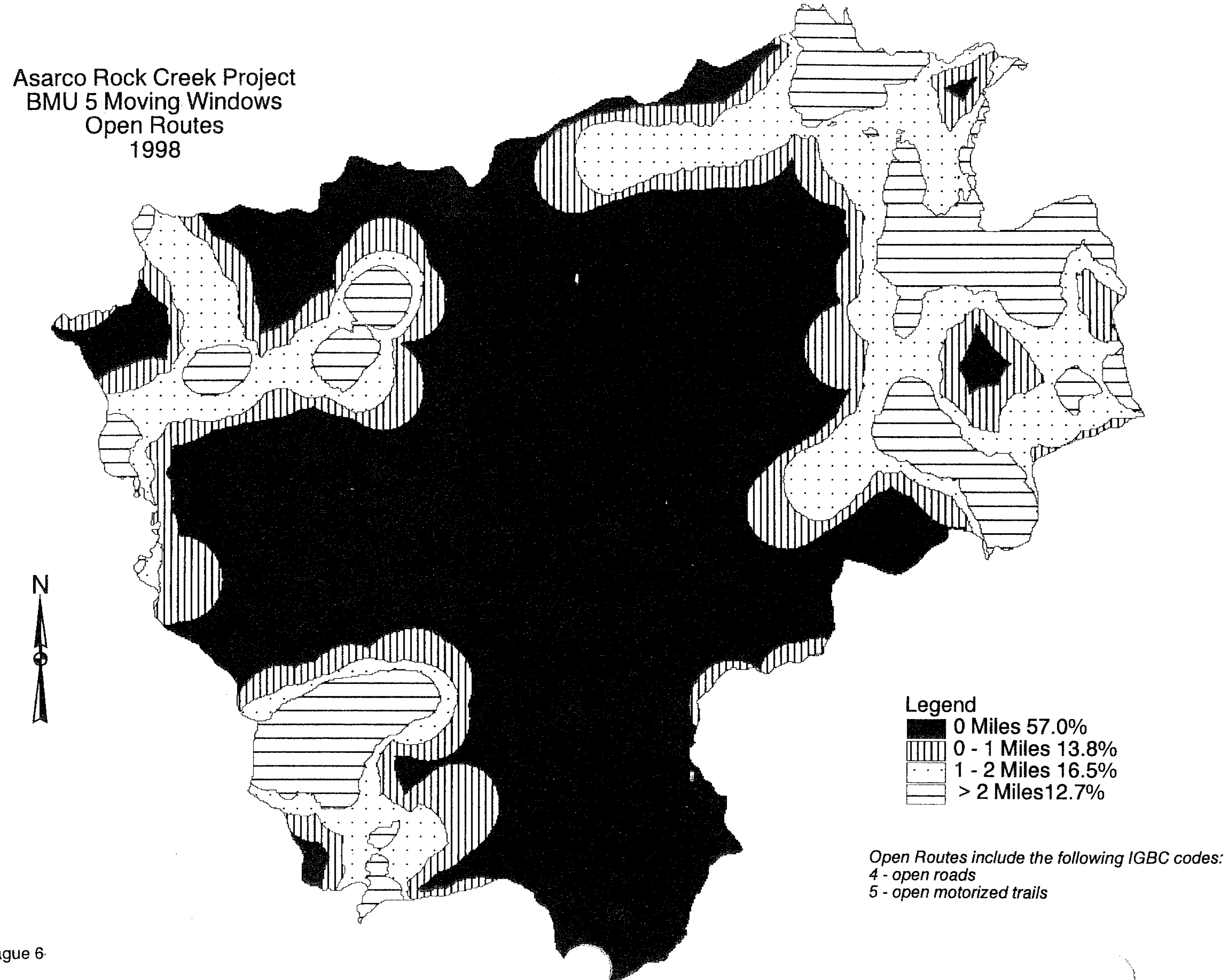
Asarco Rock Creek Project
BMU 4Alternative R5
Moving Windows Total Routes
2000



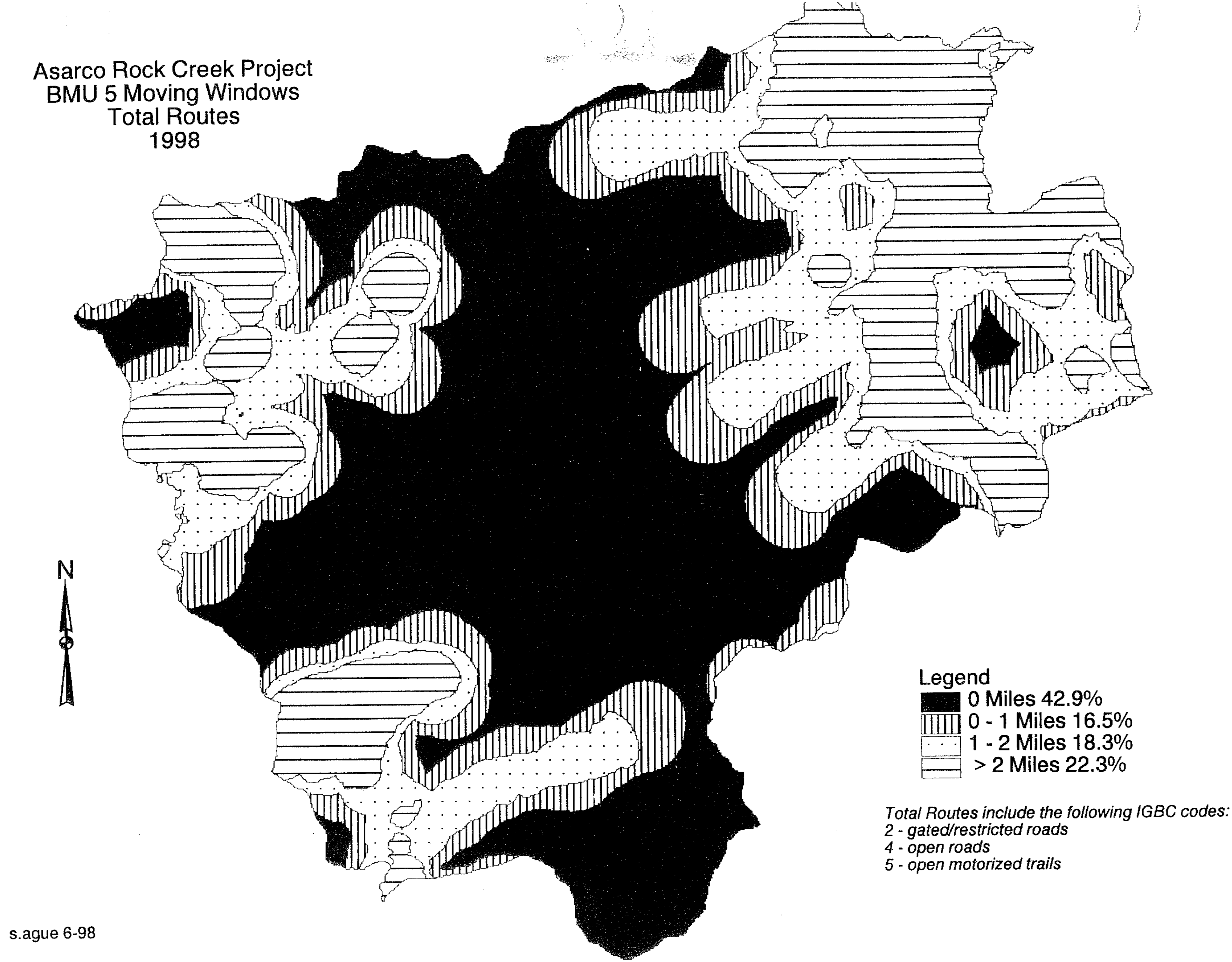
Legend
44.3% 0 Miles
14.2% 0 - 1 Miles
15.8% 1 - 2 Miles
25.7% > 2 Miles

Total Routes include the following IGBC codes:
2 - gated/restricted roads
4 - open roads
5 - motorized trails

s.ague 7-98

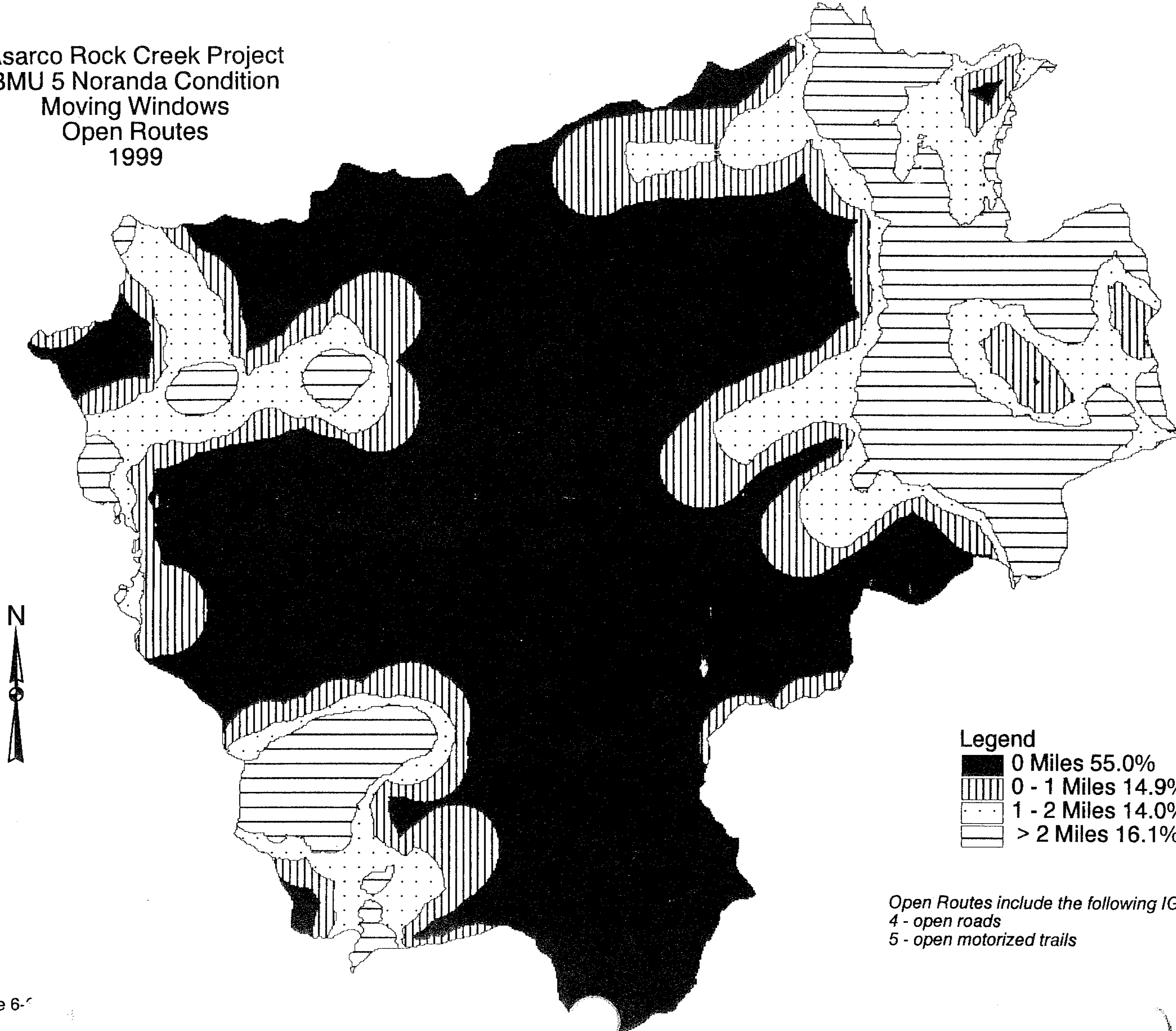

Asarco Rock Creek Project
BMU 5 Moving Windows
Open Routes
1998
N
Legend
0 Miles 57.0%
0 - 1 Miles 13.8%
1 - 2 Miles 16.5%
> 2 Miles12.7%
Open Routes include the following IGBC codes:
4 - open roads
5 - open motorized trails

s.ague 6



Asarco Rock Creek Project
BMU 5 Moving Windows
Total Routes
1998
N
Legend
0 Miles 42.9%
0 - 1 Miles 16.5%
1 - 2 Miles 18.3%
> 2 Miles 22.3%
Total Routes include the following IGBC codes:
2 - gated/restricted roads
4 - open roads
5 - open motorized trails
s.ague 6-98

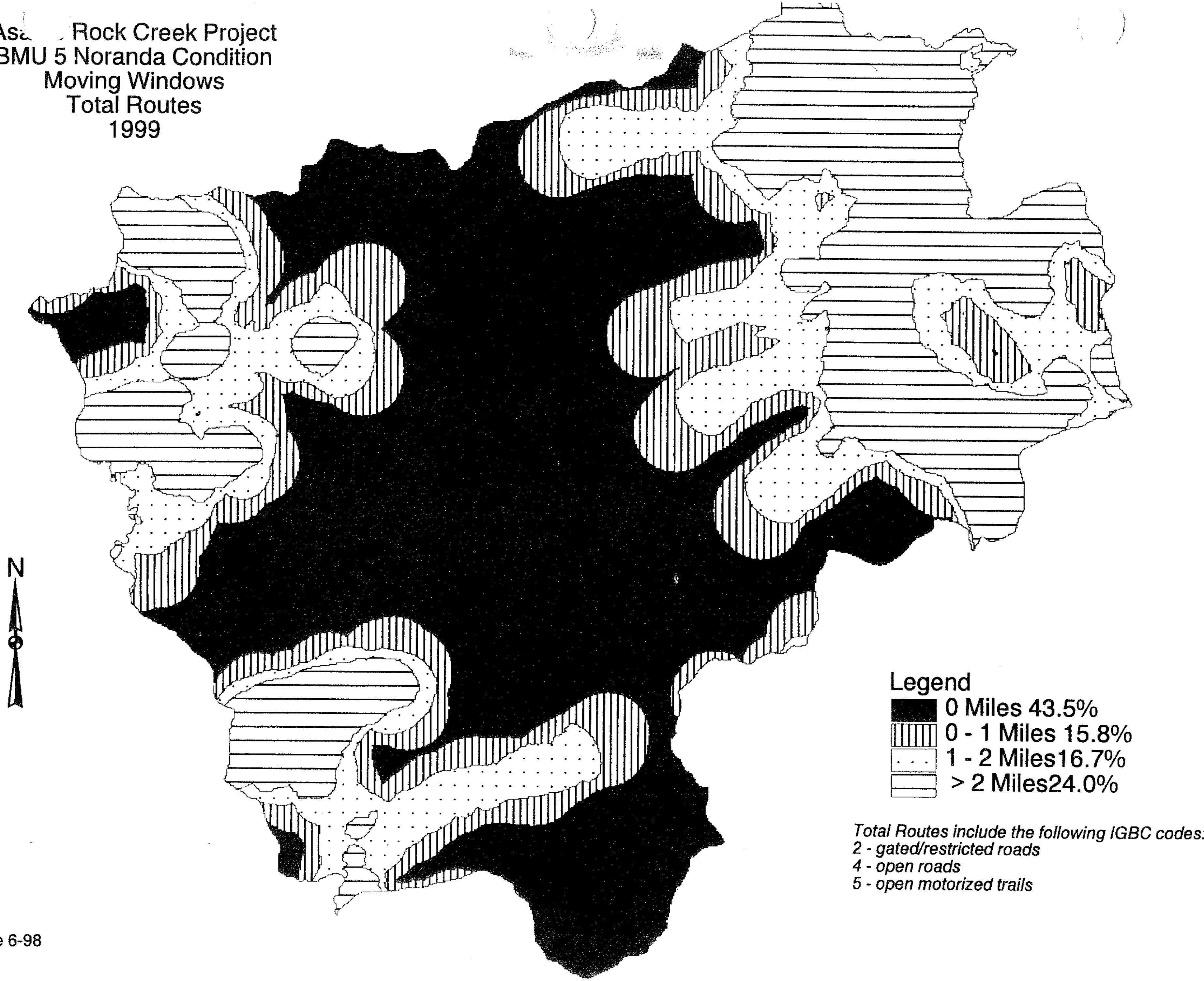
Asarco Rock Creek Project
BMU 5 Noranda Condition
Moving Windows
Open Routes
1999



Open Routes include the following IGBC codes:
4 - open roads
5 - open motorized trails

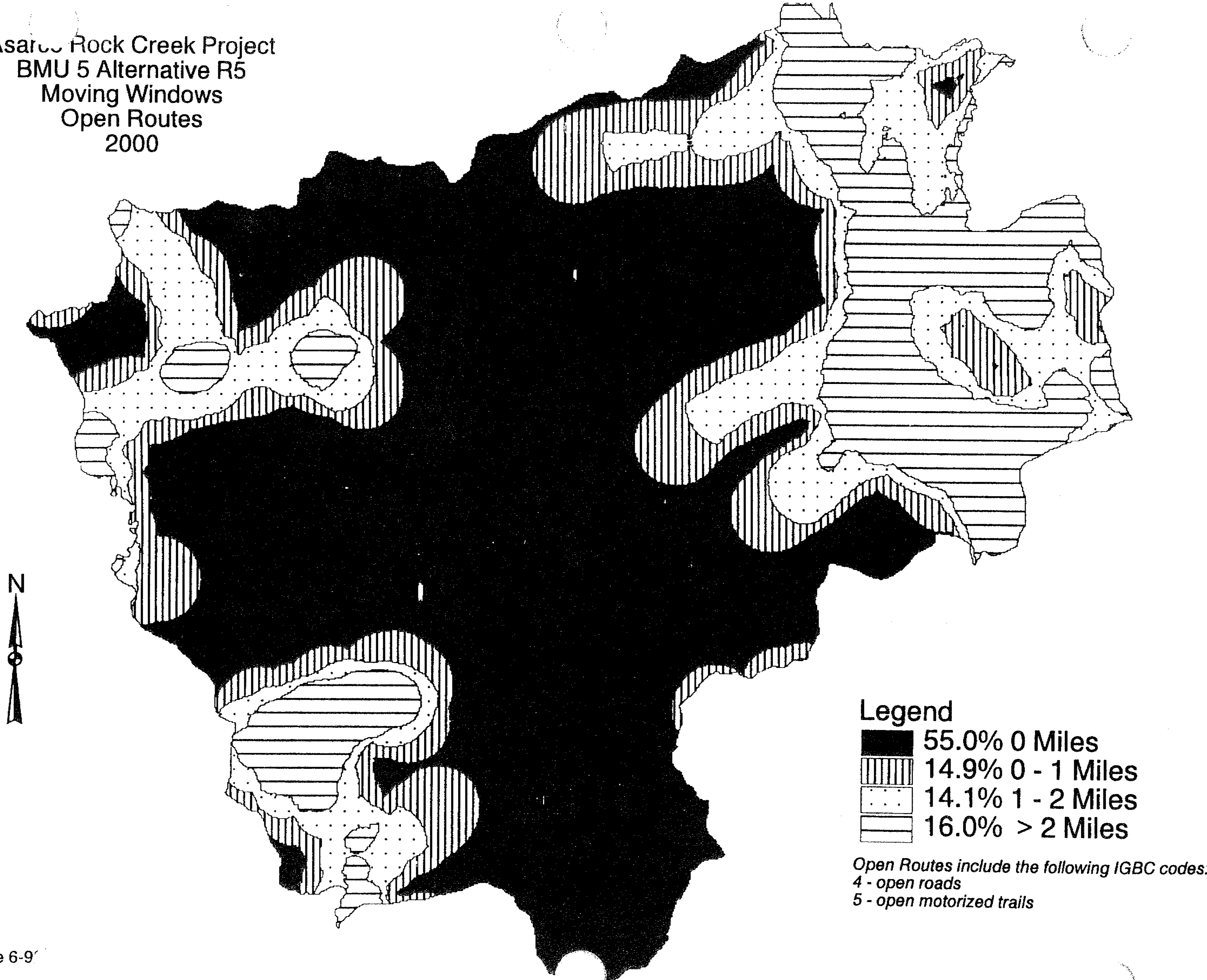
s.ague 6-

Asa[illegible] Rock Creek Project
BMU 5 Noranda Condition
Moving Windows
Total Routes
1999



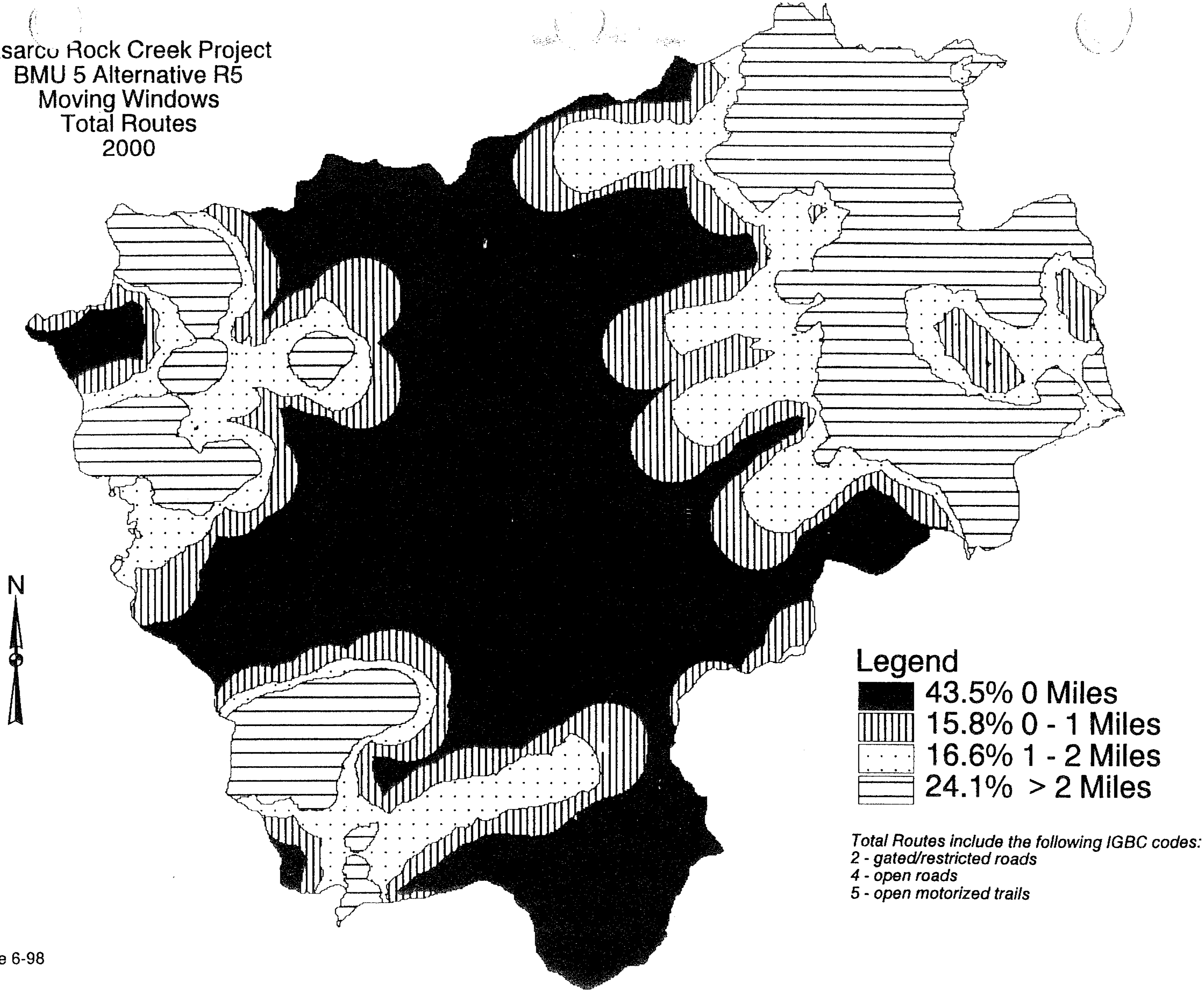
s.ague 6-98

Asarco Rock Creek Project
BMU 5 Alternative R5
Moving Windows
Open Routes
2000



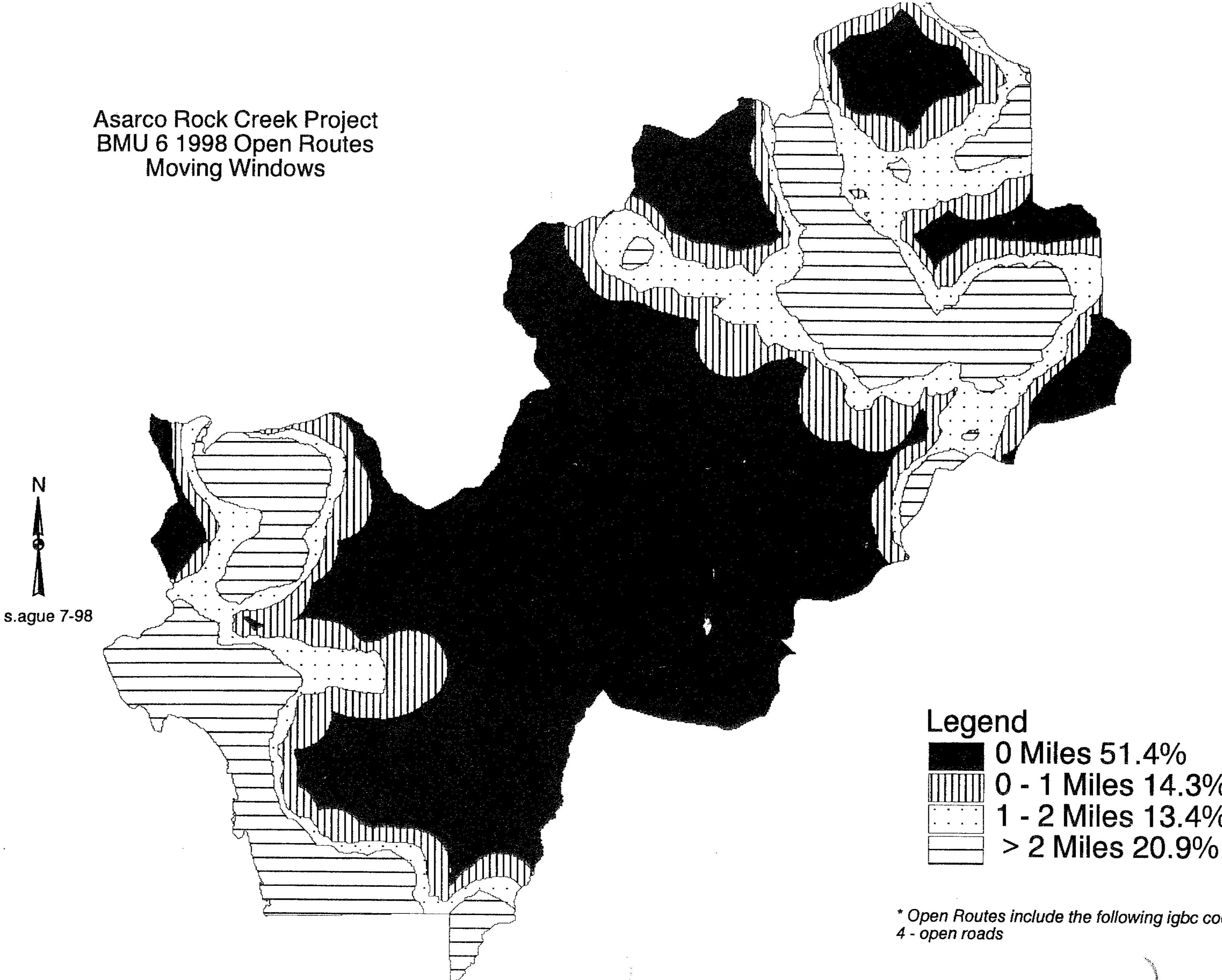
s.ague 6-9

Asarco Rock Creek Project
BMU 5 Alternative R5
Moving Windows
Total Routes
2000

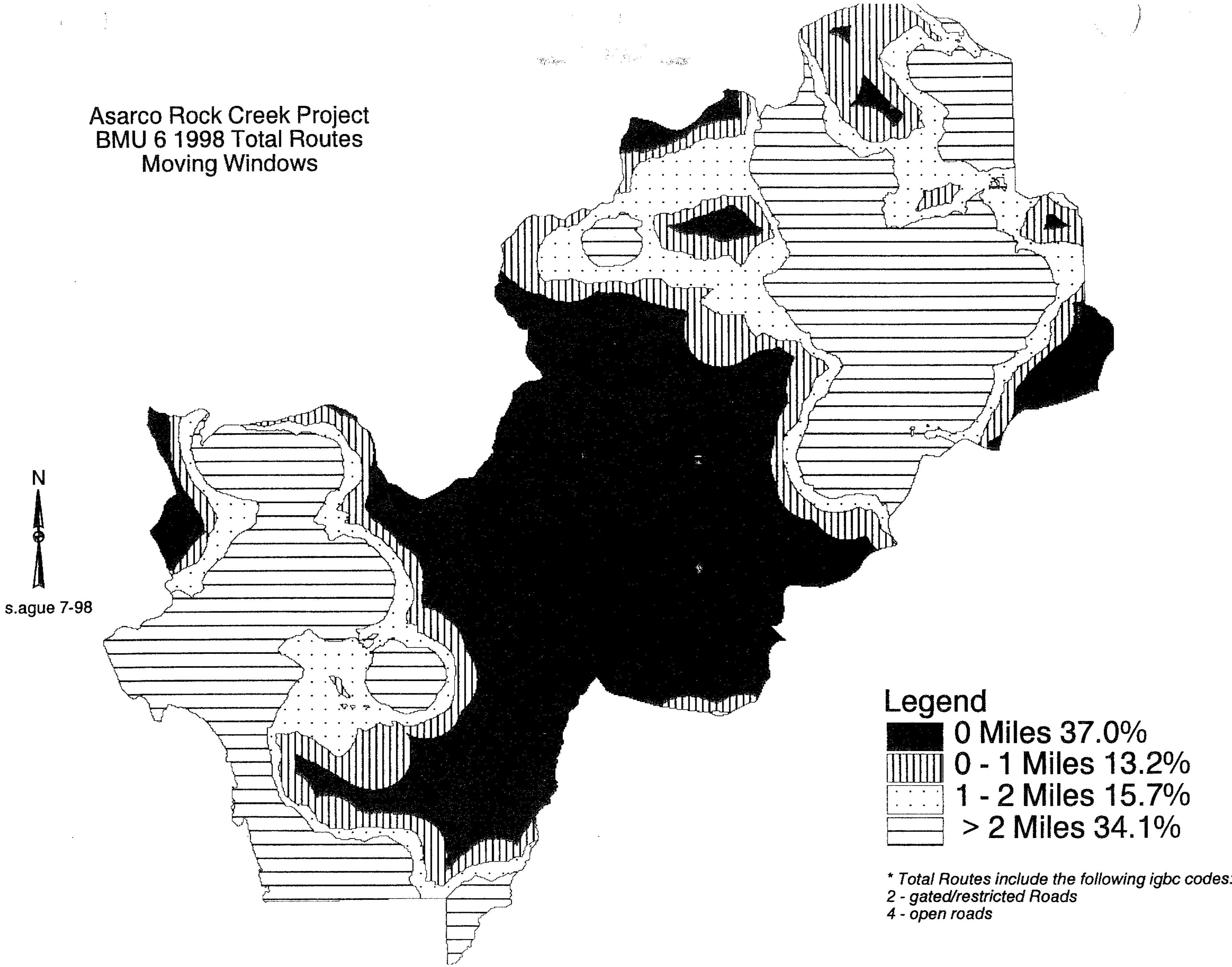


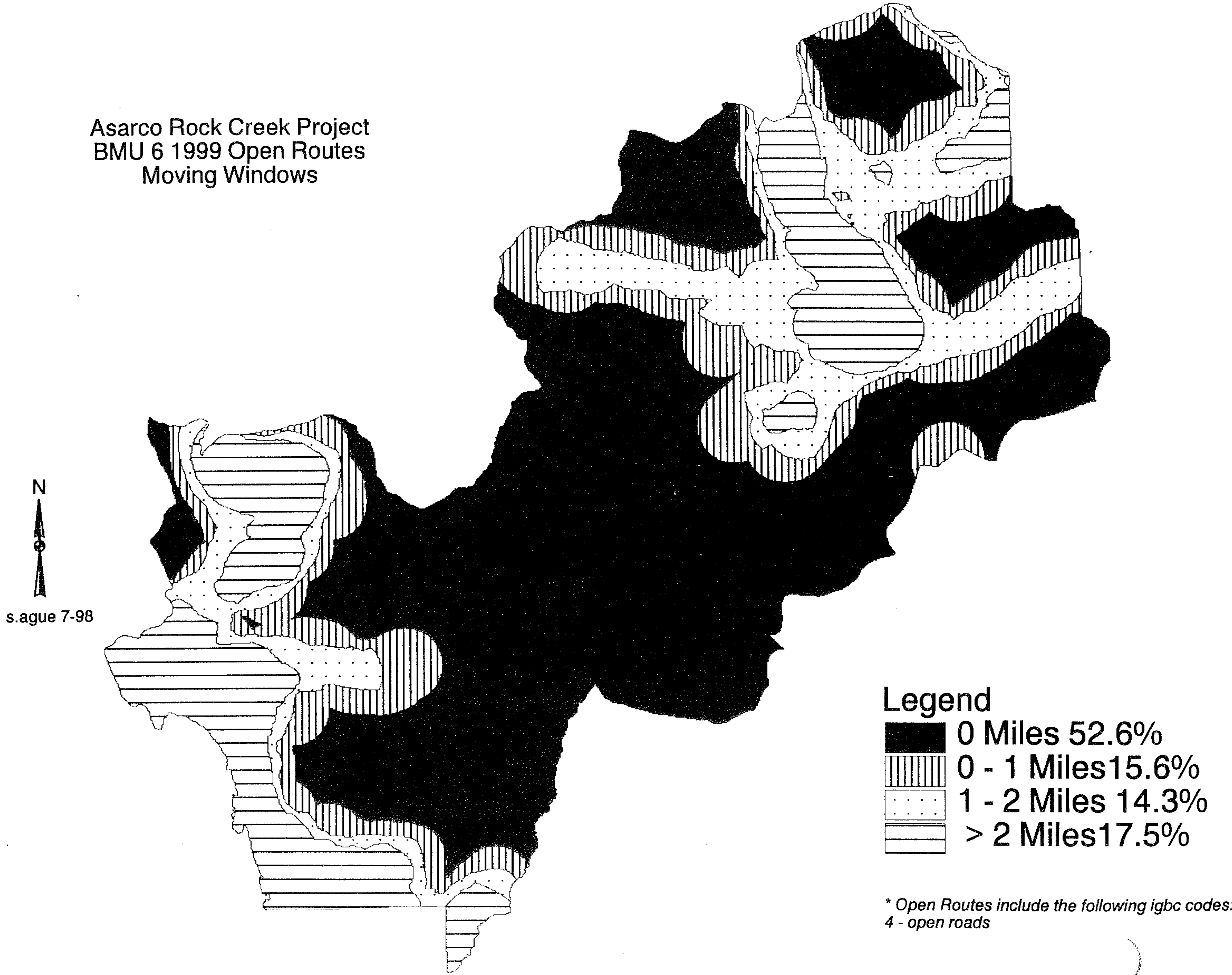
s.ague 6-98

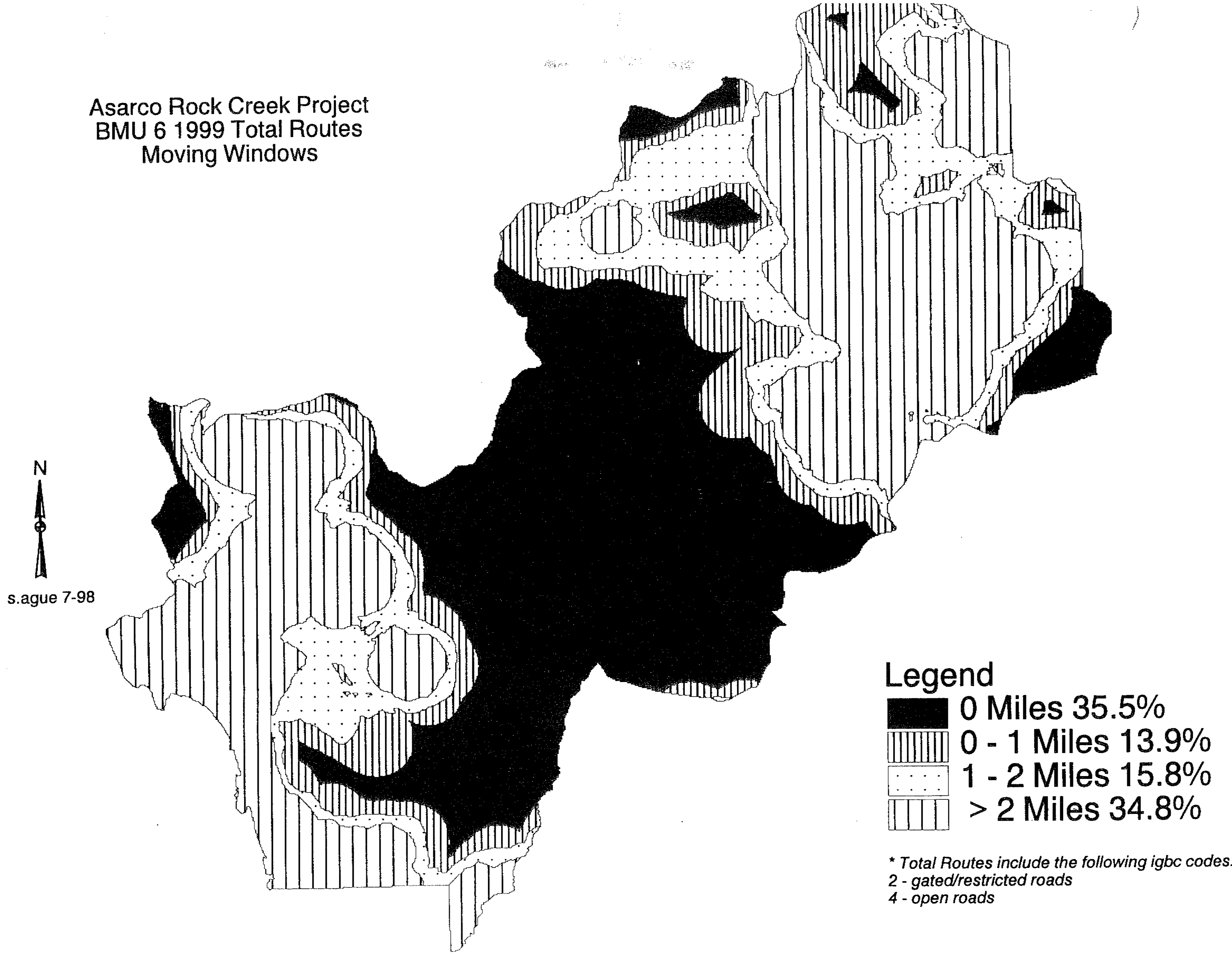
Asarco Rock Creek Project
BMU 6 1998 Open Routes
Moving Windows



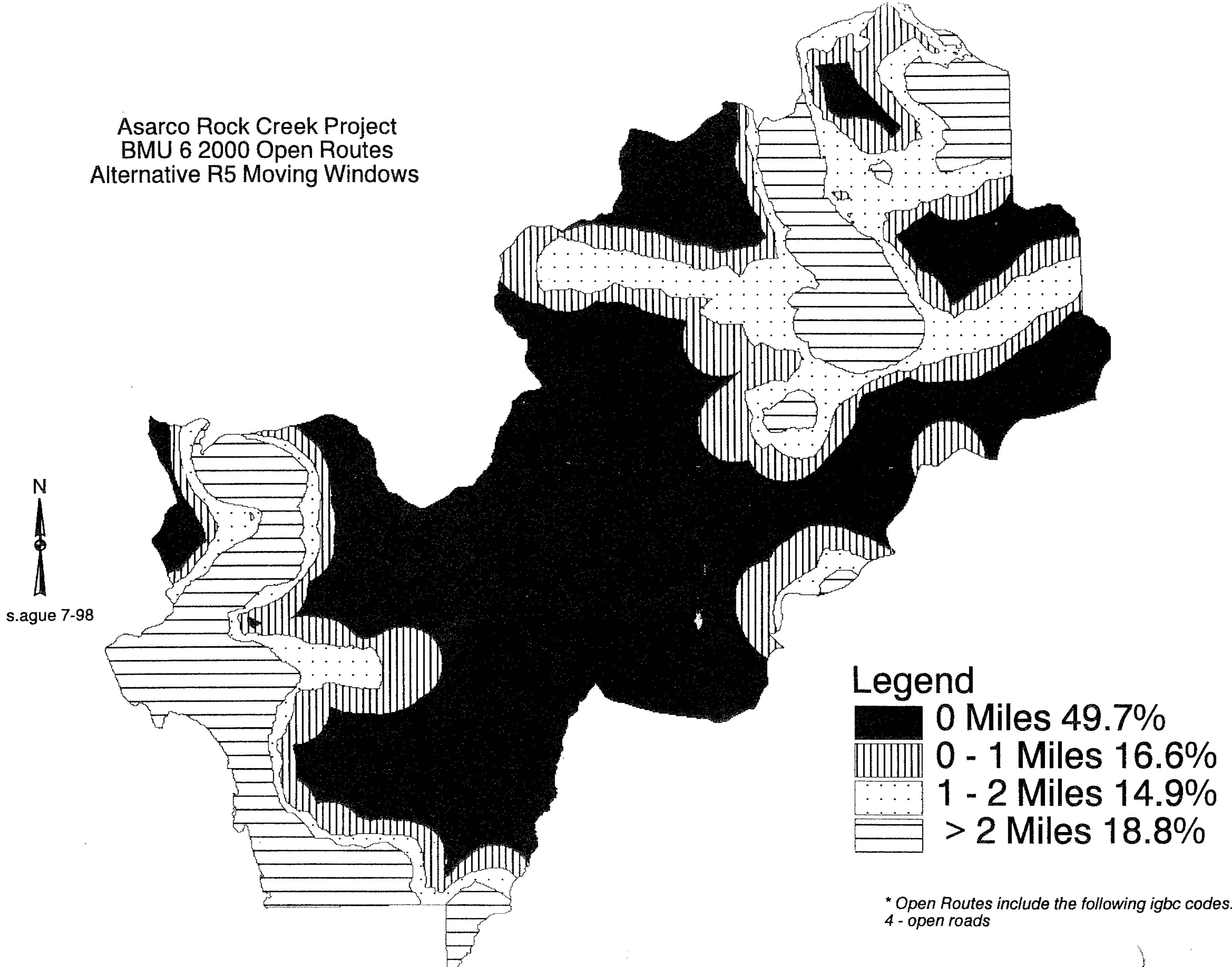
** Open Routes include the following igbc codes:*
4 - open roads

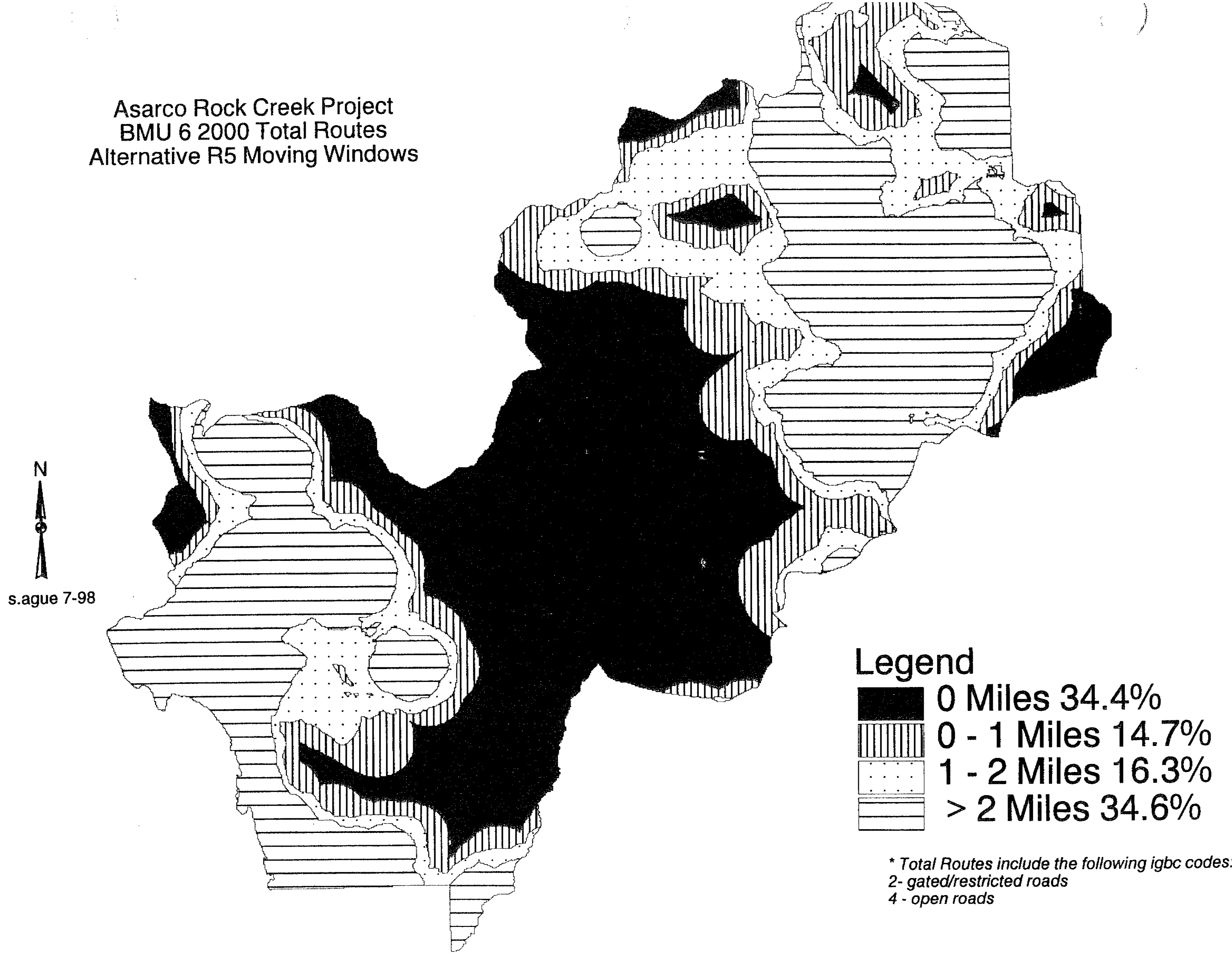

Asarco Rock Creek Project
BMU 6 1998 Total Routes
Moving Windows
N
s.ague 7-98
Legend
0 Miles 37.0%
0 - 1 Miles 13.2%
1 - 2 Miles 15.7%
> 2 Miles 34.1%
* Total Routes include the following igbc codes:
2 - gated/restricted Roads
4 - open roads


Asarco Rock Creek Project
BMU 6 1999 Open Routes
Moving Windows
N
s.ague 7-98
Legend
0 Miles 52.6%
0 - 1 Miles15.6%
1 - 2 Miles 14.3%
> 2 Miles17.5%
* Open Routes include the following igbc codes:
4 - open roads



Asarco Rock Creek Project
BMU 6 1999 Total Routes
Moving Windows
N
s.ague 7-98
Legend
0 Miles 35.5%
0 - 1 Miles 13.9%
1 - 2 Miles 15.8%
> 2 Miles 34.8%
* Total Routes include the following igbc codes:
2 - gated/restricted roads
4 - open roads


Asarco Rock Creek Project
BMU 6 2000 Open Routes
Alternative R5 Moving Windows
N
s.ague 7-98
Legend
0 Miles 49.7%
0 - 1 Miles 16.6%
1 - 2 Miles 14.9%
> 2 Miles 18.8%
* Open Routes include the following igbc codes:
4 - open roads


Asarco Rock Creek Project
BMU 6 2000 Total Routes
Alternative R5 Moving Windows
N
s.ague 7-98
Legend
0 Miles 34.4%
0 - 1 Miles 14.7%
1 - 2 Miles 16.3%
> 2 Miles 34.6%
* Total Routes include the following igbc codes:
2- gated/restricted roads
4 - open roads

APPENDIX 7

BMU STATUS SUMMARIES

BMU 4

BMU 5

BMU6

STATUS SUMMARY

BMU 4 - BULL

ACREAGES

BAA	Management Situation	Acres	Square Miles
7-4-01	1	8596	13.4
	3	4174	6.5
	Total	12770	19.9
7-4-02	1	6460	10.1
	3	2328	3.6
	Total	8788	13.7
7-4-03	1	12136	19.0
	3	1882	2.9
	Total	14018	21.9
7-4-04	1	3976	6.2
	3	1940	3.0
	Total	5916	9.2
7-4-05	1	10474	16.4
	3	2037	3.2
	Total	12511	19.6
7-4-06	1	7126	11.1
	3	4825	7.5
	Total	11951	18.6
7-4-07	1	10220	16.0
	3	5103	8.0
	Total	15323	24.0

TOTAL AREA SITUATION 1	58988	92.2
TOTAL AREA SITUATION 3	22289	34.8
TOTAL AREA BMU 4	81277	127.0

Acre determination method:
MS1 lands = Total BMU GIS acres minus MS3 acres (GIS)

HABITAT EFFECTIVENESS

Year	ROAD INFLUENCE ACRES	SQUARE MILES	HE %
1993	6347	9.9	64.8
1997	6400	10.0	64.7

Methodology:

Habitat Effectiveness (HE) = Total BMU (sq.mi.) minus (Situation 3 sq.mi. + Road Influence sq.mi.)

127.0 - (34.8 + 9.9) = 82.3

82.3 sq.mi. divided by 127.0 sq. mi. = 64.8% HE

CHANGES IN EFFECTIVE HABITAT
(starting at 82.2 sq. mi. - 1997)

ACTIVITY	1998	1999	2000	2001	2002	2003	2035
Berray Mtn Sub Div. A	-1800		+1800				
Berray Mtn Sub Div B			-2500		+2500		
Gvmt. Road Salv	+40						
Asarco RC Mine *			-119				+119
Close 2.9 mi. Rd 150 **			+640				
TOTAL ACRES	-1760		-179		+2500		+119
SQUARE MILES	-2.8		-0.3		+3.9		+0.2
SITUATION 1	79.4	79.4	79.1	79.1	83.0	83.0	83.2
BMU HE %	62.5	62.5	62.3	62.3	65.4	65.4	65.5

* = ASARCO Rock Creek Mine Alternative 5 Additional acres lost beyond existing road influence zones
** = Closed for ASARCO Rock Creek Mine Alternative 5

Methodology:

Total Acres divided by 640 = square miles

Situation 1 = Previous year Situation 1 plus (or minus) current year situation 1 change in sq.miles.
ie.: 1998 = 82.2 - 2.8 = 79.4

BMU HE % = Current years Situation 1 divided by 127.0
ie. 1998 = 79.4 / 127.0 = 62.5%

ROAD DENSITIES
(Situation 1 habitat only)

BAA 7-4-01

Area = 13.4 sq.mi.

Road No.	OPEN ROAD MILES						
	1996	1997	1998	1999	2000	2001	2002
409	0.4	0.4	0.4	0.4	0.4	0.4	0.4
2292	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Seasonal 2294	0.5	0.5	0.5	0.5	0.5	0.5	0.5
TOTAL OPEN	1.1 (1.6)	1.1 (1.6)	1.1 (1.6)	1.1 (1.6)	1.1 (1.6)	1.1 (1.6)	1.1 (1.6)
ORD mi./mi2	0.08 (0.12)	0.08 (0.12)	0.08 (0.12)	0.08 (0.12)	0.08 (0.12)	0.08 (0.12)	0.08 (0.12)

Numbers in parentheses are when seasonal roads open

BAA 7-4-02

Area = 10.1 sq.mi.

Road No.	OPEN ROAD MILES						
	1996	1997	1998	1999	2000	2001	2002
1118	1.9	1.9	1.9	1.9	1.9	1.9	1.9
1118A	0.8	0.8	0.8	0.8	0.8	0.8	0.8
14611	0.5	0.5	0.5	0.5	0.5	0.5	0.5
TOTAL OPEN	3.2	3.2	3.2	3.2	3.2	3.2	3.2
ORD mi./mi2	0.32	0.32	0.32	0.32	0.32	0.32	0.32

BAA 7-4-03

Area = 19.0.mi.

Road No.	OPEN ROAD MILES						
	1996	1997	1998	1999	2000	2001	2002
410	5.8	5.8	5.8	5.8	5.8	5.8	5.8
2272	6.2	6.2	6.2	6.2	6.2	6.2	6.2
14607A *	0.0	0.0	0.5	0.5	0.5	0.5	0.5
TOTAL OPEN	12.0	12.0	12.5	12.5	12.5	12.5	12.5
ORD mi./mi2	0.63	0.63	0.66	0.66	0.66	0.66	0.66

* = Berray Mtn timber sale

BAA 7-4-04

Area = 6.2 sq.mi.

Road No.	OPEN ROAD MILES						
	1996	1997	1998	1999	2000	2001	2002
All road in MS3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL OPEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ORD mi./mi2	0.0	0.0	0.0	0.0	0.0	0.0	0.0

7-4-05

Area = 16.4 sq.mi.

Road No.	OPEN ROAD MILES						
	1996	1997	1998	1999	2000	2001	2002
All road in MS3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL OPEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ORD mi./mi2	0.0	0.0	0.0	0.0	0.0	0.0	0.0

7-4-06

Area = 11.1 sq.mi.

Road No.	OPEN ROAD MILES						
	1996	1997	1998	1999	2000	2001	2002
All road in MS3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL OPEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ORD mi./mi2	0.0	0.0	0.0	0.0	0.0	0.0	0.0

BAA 7-4-07

Area = 16.0 sq.mi.

Road No.	OPEN ROAD MILES						
	1998	1999	2000	2001	2002	2003	2035
150 *	9.4	9.4	7.4	7.4	7.4	7.4	7.4
NS3	0.5	0.5	0.5	0.5	0.5	0.5	0.5
TOTAL OPEN	9.9	9.9	7.4	7.4	7.4	7.4	7.4
ORD mi./mi2	0.62	0.62	0.59	0.59	0.59	0.59	0.59

* Close 2.0 miles of 150 road for ASARCO Rock Creek Mine

ACTIVITIES COVERED IN TABLES

Berray Mountain timber sale
ASARCO Rock Creek Mine: Reduction in HE% starts in 2000
Government Road Salvage: Reduction in HE% in 1996, uses FDRs 150H and 14640
ASARCO Rock Creek Mine (all new roads in MS-3 lands in BMU 4: BAA 7-4-07)

BMU 4

Area = 92.2 sq.mi.

Road No.	OPEN ROAD MILES						
	1998	1999	2000	2001	2002	2003	2035
7-4-1	1.6	1.6	1.6	1.6	1.6	1.6	1.6
7-4-2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
7-4-3	12.5	12.5	12.5	12.5	12.5	12.5	12.5
7-4-4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7-4-5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7-4-6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7-4-7	9.9	9.9	7.4	7.4	7.4	7.4	9.9
TOTAL OPEN	27.2	27.2	24.7	24.7	24.7	24.7	27.2
ORD mi./mi2	0.30	0.30	0.27	0.27	0.27	0.27	0.30

DISPLACEMENT AREA SCHEDULING 1997

BAA	STATUS	DISPLACEMENT AREA	PURPOSE
7-4-1	Inactive		
7-4-2	Displacement		
7-4-3	Active	7-2-3	Berray Mtn TS
7-4-4	Active	7-4-2	Berray Mtn TS
7-4-5	Inactive		
7-4-6	Displacement		
7-4-7	Active	7-4-6	Government Rd Salv

DISPLACEMENT AREA SCHEDULING 1998

BAA	STATUS	DISPLACEMENT AREA	PURPOSE
7-4-1	Inactive		
7-4-2	Displacement		
7-4-3	Active	7-2-3	Berray Mtn TS
7-4-4	Active	7-4-2	Berray Mtn TS
7-4-5	Inactive		
7-4-6	Displacement		
7-4-7	Inactive		

DISPLACEMENT AREA SCHEDULING 1999

BAA	STATUS	DISPLACEMENT AREA	PURPOSE
7-4-1	Inactive		
7-4-2	Displacement		
7-4-3	Active	7-2-3	Berray Mtn TS
7-4-4	Active	7-4-2	Berray Mtn TS
7-4-5	Inactive		
7-4-6	Displacement		
7-4-7	Inactive		

DISPLACEMENT AREA SCHEDULING 2000

BAA	STATUS	DISPLACEMENT AREA	PURPOSE
7-4-1	Inactive		
7-4-2	Displacement		
7-4-3	Active	7-2-3	Berray Mtn TS
7-4-4	Active	7-4-2	Berray Mtn TS
7-4-5	Inactive		
7-4-6	Displacement		
7-4-7	Active	7-4-5 & 7-4-6	ASARCO Rock Cr. Mine

DISPLACEMENT AREA SCHEDULING 2001

BAA	STATUS	DISPLACEMENT AREA	PURPOSE
7-4-1	Inactive		
7-4-2	Displacement		
7-4-3	Active	7-2-3	Berray Mtn TS
7-4-4	Active	7-4-2	Berray Mtn TS
7-4-5	Inactive		
7-4-6	Displacement		
7-4-7	Active	7-4-5 & 7-4-6	ASARCO Rock Cr. Mine

DISPLACEMENT AREA SCHEDULING 2002

BAA	STATUS	DISPLACEMENT AREA	PURPOSE
7-4-1	Inactive		
7-4-2	Displacement		
7-4-3	Active	7-2-3	Berray Mtn TS
7-4-4	Active	7-4-2	Berray Mtn TS
7-4-5	Displacement		
7-4-6	Displacement		
7-4-7	Active	7-4-5 & 7-4-6	ASARCO Rock Cr. Mine

DISPLACEMENT AREA SCHEDULING 2003-2035

BAA	STATUS	DISPLACEMENT AREA	PURPOSE
7-4-1	Inactive		
7-4-2	Displacement		
7-4-3	Inactive		
7-4-4	Inactive		
7-4-5	Inactive		
7-4-6	Displacement		
7-4-7	Active	7-4-5 & 7-4-6	ASARCO Rock Cr. Mine

STATUS SUMMARY

BMU 5 - St.Paul

ACREAGES

BAA	Management Situation	Acres	Square Miles
7-5-01	1	10132	14.58
	3	636	2.24
	Total	10768	16.83
7-5-02	1	12012	18.77
	3	528	.83
	Total	12540	19.59
7-5-03	1	14359	22.4
	3	0	0.0
	Total	14359	22.44
5-5-04	1	5436	8.5
	3	0	0.0
	Total	5437	8.5
5-5-05	1	13639	21.31
	3	444	.69
	Total	14083	22.0
5-5-06	1	13025	20.35
	3	0	0.0
	Total	13025	20.35

TOTAL AREA SITUATION 1	67801	105.9
TOTAL AREA SITUATION 3	2409	3.8
TOTAL AREA BMU 5	70210	109.7

Acre determination methods:
MS1 lands = Total BMU GIS acres minus MS3 GIS acres

HABITAT EFFECTIVENESS

SITUATION 1 ROAD INFLUENCE *

YEAR	ROAD INFLUENCE ACRES	SQUARE MILES
1997	15138	23.7
1998	15459	24.2
1999	16907	26.4
2000	17163	26.6

* Results from GRIZTOOLS

HABITAT EFFECTIVENESS

BMU	HE %
BMU 5	74.9

Methodology:

Baseline effectiveness with no loss of habitat effectiveness other than from roads and MS-3 lands.

Habitat Effectiveness (HE) = Total BMU (sq.mi.) minus (Situation 3 sq.mi. + Road Influence sq.mi.)

109.7 - (3.8+23.7) = 82.2

82.2 sq.mi. divided by 109.7 sq. mi. = 74.9% HE in 1997

CAUSE OF CHANGE IN EFFECTIVE HABITAT

ACTIVITY	1998	1999	2000	2001	2002	2003	2035
LOST GIRL TS (D7)	X						
ASARCO RC MINE *1 (D7)			-348				
Noranda *2 (D5)		-5397					
Close FDR 4784 *3 (D5)		X					
TOTAL ACRES		-5397	-348				+348
SQUARE MILES		-8.4	-0.5				+0.5

*1 = ASARCO Rock Creek Mine (Alt. 5)
*2: Construction phase start up Noranda Montanore Mine
*3: Upper Bear Cr. road closure (Noranda start up mitigation: 809 ac., 2.5 mi.)
D5 = Libby Ranger District
D7 = Cabinet Ranger District
x = The change in acres of effective habitat from road closures or openings are included in GRIZTOOLS model results (which are included in the Table below). If acres shown for a project, they are in addition to any acres gained or lost as a result of opening or closing a road.

CHANGES IN EFFECTIVE HABITAT
(starting at 82.2 square miles - 1997)

ACTIVITY	1998	1999	2000	2001	2002	2003	2035
SQUARE MILES	-0.5	-10.6	-0.7	0	0	0	+0.5
SITUATION 1 sq.miles	81.7	71.1	70.4	70.4	70.4	70.4	70.9
BMU HE %	74.5	64.8	64.1	64.1	64.1	64.1	64.6

Methodology:
Total Acres divided by 640 = square miles
Situation 1 = Previous year Situation 1 [(plus or minus square miles of projects) plus (road iz change)]
ie.: 1999 = 81.7 - [(8.4) + (2.2)] = 71.1
BMU HE % = Current years Situation 1 divided by 109.7
ie. 1999 = 71.1/ 109.7 = 64.8%

ROAD DENSITIES
(Situation 1 habitat only)

BAA 7-5-01

Area = 14.58 sq.mi. (GIS based) (Open Road Miles are GIS based)

Road No.	OPEN ROAD MILES						
	1998	1999	2000	2001	2002	2003	2004
407	4.57	4.57	4.57	4.57	4.57	4.57	4.57
410	3.73	3.73	3.73	3.73	3.73	3.73	3.73
2278	0.3	0.3	0.3	0.3	0.3	0.3	0.3
407A	.14	.14	.14	.14	.14	.14	.14
2278A	.12	.12	.12	.12	.12	.12	.12
TOTAL OPEN	8.86	8.86	8.86	8.86	8.86	8.86	8.86
ORD mi./mi2	0.61	0.61	0.61	0.61	0.61	0.61	0.61

BAA 7-5-02

Area = 18.77 sq.mi.

Road No.	OPEN ROAD MILES						
	1998	1999	2000	2001	2002	2003	2004
150	7.86	7.86	6.96 *3	6.96	6.96	6.96	6.96
2741	6.68	6.68	6.68	6.68	6.68	6.68	6.68
2285	0.37	0.37	0.37	0.37	0.37	0.37	0.37
2741X	.18	.18	0 *1	0	0	0	0
2741A	.51	.51	0 *1	0	0		
150A	.5	.5	.5	.5	.5	.5	.5
Asarco	0	0	0.3 *2	0.3	0.3	0.3	0.3
TOTAL OPEN	16.1	16.1	14.81	14.81	14.81	14.81	14.81
ORD mi./mi2	0.86	0.86	0.79	0.79	0.79	0.79	0.79

*1 = ASARCO Rock Creek Mine closure of 0.51 mi. for 2741A, and 0.18 mi. FDR 2741X for start-up in 2000 (Alt. 5)
*2 = New roads constructed (0.1 mi.), and closed roads opened (0.2 mi.) for ASARCO (Alt. 5)
*3 = ASARCO Alt. 5 closes 0.9 miles of FDR 150

BAA 7-5-03

Area = 22.4.mi.

Road No.	OPEN ROAD MILES						
	1998	1999	2000	2001	2002	2003	2004
CMW							
TOTAL OPEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ORD mi./mi2	0.0	0. 0	0. 0	0. 0	0.0	0.0	0. 0

CMW = Cabinet Mountain Wilderness (No roads)

BAA 5-5-04

Area = 8.5 sq.mi.

Road No.	OPEN ROAD MILES						
	1998	1999	2000	2001	2002	2003	2004
CMW							0.0
TOTAL OPEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ORD mi./mi2	0.0	0.0	0.0	0.0	0.0	0.0	0.0

CMW = Cabinet Mountain Wilderness (No roads)

5-5-05

Area = 21.31 sq.mi.

Road No.	OPEN ROAD MILES						
	1996	1997	1998	1999	2000	2001	2002
231	6.69	6.69	6.69	6.69	6.69	6.69	6.69
278	0.22	0.22	0.22	0.22	0.22	0.22	0.22
2316	1.12	1.12	1.12	1.12	1.12	1.12	1.12
4776	1.03	1.03	1.03	1.03	1.03	1.03	1.03
4776A	1.55	1.55	1.55	1.55	1.55	1.55	1.55
4778	5.79	5.79	5.79	5.79	5.79	5.79	5.79
4778B *1	.7	**0**	0	0	0	0	0
4778C *1	3.19	**1.79**	1.79	1.79	1.79	1.79	1.79
4779	0.98	0.98	0.98	0.98	0.98	0.98	0.98
5314	.07	.07	.07	.07	.07	.07	.07
4780	0.97	0.97	0.97	0.97	0.97	0.97	0.97
4781 *2	1.4	1.4	**3.4**	3.4	3.4	3.4	3.4
4720	.06	.06	.06	.06	.06	.06	.06
4773	.57	.57	.57	.57	.57	.57	.57
5327	.09	.09	.09	.09	.09	.09	.09
14458	.30	.30	.30	.30	.30	.30	.30
UV8693	.36	.36	.36	.36	.36	.36	.36
TOTAL OPEN	25.1	23.0	25.0	25.0	25.0	25.0	25.0
ORD mi./mi2	1.18	1.08	1.17	1.17	1.17	1.17	1.17

*1: Midas roads to be closed in 1997 - .7miles of 4778B and 1.4 miles of 4778C (Little Cherry Pit Project)

*2: Ramsey creek road 4781 - 2.0 miles of road to be opened (Noranda start up in 1998)

5-5-06

Area = 20.35 sq.mi.

Road No.	OPEN ROAD MILES						
	1996	1997	1998	1999	2000	2001	2002
278	6.49	6.49	6.49	6.49	6.49	6.49	6.49
6199	.78	.78	.78	.78	.78	.78	.78
6212	4.94	4.94	4.94	4.94	4.94	4.94	4.94
4784 *1	3.61	3.61	3.61	1.11	1.11	1.11	1.11
4785	.1	.1	.1	.1	.1	.1	.1
UV8693	.13	.13	.13	.13	.13	.13	.13
2317	.81	.81	.81	.81	.81	.81	.81
4781	.11	.11	.11	.11	.11	.11	.11
5187	.2	.2	.2	.2	.2	.2	.2
TOTAL OPEN	17.15	17.15	17.15	14.65	14.65	14.65	14.65
ORD mi./mi2	0.84	0.84	0.84	0.72	0.72	0.72	0.72

*1: Upper Bear Creek road (2.5 mi. to be closed in 1999 at Noranda start up)

ACTIVITIES COVERED IN TABLES for D-5

Precommercial thinning
Noranda Mine (assumes 1999 start-up date)
Little Cherry Pit Project

BMU 5 Open Road Density (ORD)

Area = 105.95 sq. miles (Situation 1 habitat only)

BAA.	OPEN ROAD MILES						
	1996	1997	1998	1999	2000	2001	2002
7-5-01	13.06	13.06	8.86	8.86	8.86	8.86	8.86
7-5-02	15.59	15.59	16.1	16.1	14.81	14.81	14.81
7-5-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-5-04	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-5-05	25.1	23.0	25.0	25.0	25.0	25.0	25.0
5-5-06	17.15	17.15	17.15	14.65	14.65	14.65	14.65
TOTAL OPEN	70.9	68.8	67.11	64.6	63.3	63.3	63.6
ORD mi./mi2	0.67	0.65	0.63	0.59	0.58	0.58	0.58

DISPLACEMENT AREA SCHEDULING 1997

BAA	STATUS	DISPLACEMENT AREA	PURPOSE
7-5-1	Active	7-5-3, 5-5-4	Lost Girl
7-5-2	Inactive		
7-5-3	Displacement		
5-5-4	Displacement		
5-5-5	Inactive		
5-5-6	Active	5-2-7	Little Cherry Pit

DISPLACEMENT AREA SCHEDULING 1998

BAA	STATUS	DISPLACEMENT AREA	PURPOSE
7-5-1	Inactive		
7-5-2	Active	7-5-3	Cedar Gulch TS
7-5-3	Displacement		
5-5-4	Inactive		
5-5-5	Inactive		
5-5-6	Inactive		

DISPLACEMENT AREA SCHEDULING 1999

BAA	STATUS	DISPLACEMENT AREA	PURPOSE
7-5-1	Inactive		
7-5-2	Inactive		
7-5-3	Inactive		
5-5-4	Inactive		
5-5-5	Active	5-5-6 (Cable Mtn.)	Noranda Montanore Mine
5-5-6	Displacement		

DISPLACEMENT AREA SCHEDULING 2000

BAA	STATUS	DISPLACEMENT AREA	PURPOSE
7-5-1	Inactive		
7-5-2	Active	7-5-3 *	Asarco Rock Cr. Mine
7-5-3	Displacement		
5-5-4	Displacement		
5-5-5	Active	5-5-4, 5-5-6 (Cable Mtn.)	Noranda Montanore Mine
5-5-6	Displacement		

* Ventilation adit present but activity underground with low noise levels suface activity on in 1 year (about year 5?)

DISPLACEMENT AREA SCHEDULING 2001

BAA	STATUS	DISPLACEMENT AREA	PURPOSE
7-5-1	Inactive		
7-5-2	Active	7-5-3 *	Asarco Rock Cr. Mine
7-5-3	Displacement		
5-5-4	Displacement		
5-5-5	Active	5-5-4, 5-5-6 (Cable Mtn.)	Noranda Montanore Mine
5-5-6	Displacement		

* Ventilation adit present but activity underground with low noise levels

DISPLACEMENT AREA SCHEDULING 2002-2035

BAA	STATUS	DISPLACEMENT AREA	PURPOSE
7-5-1	Inactive		
7-5-2	Active	7-5-3 *	Asarco Rock Cr. Mine
7-5-3	Displacement		
5-5-4	Displacement		
5-5-5	Active	5-5-4, 5-5-6 (Cable Mtn.)	Noranda Montanore Mine
5-5-6	Displacement		

* Ventilation adit present but activity underground with low noise levels

STATUS SUMMARY

BMU 6 - Wanless

ACREAGES

BAA	Management Situation	Acres	Square Miles
7-6-01	1	14174	22.1
	3	2959	4.6
	Total	17133	26.8
7-6-02	1	4065	6.4
	3	3497	5.5
	Total	7562	11.8
7-6-03	1	6581	10.3
	3	0	0.0
	Total	6581	10.3
5-6-04	1	5668	8.9
	3	0	0.0
	Total	5668	8.9
5-6-05	1	9446	14.8
	3	108	0.2
	Total	9554	14.9
5-6-06	1	12308	19.2
	3	121	0.2
	Total	12429	19.4
5-6-07	1	5222	8.2
	3	0	0.0
	Total	5222	8.2

TOTAL AREA SITUATION 1	57464	89.8
TOTAL AREA SITUATION 3	6685	10.4
TOTAL AREA BMU 6	64149	100.2

Acre determination methods:
MS1 lands = Total BMU GIS acres (5/4/98) minus MS3 GIS acres (5/4/98)

HABITAT EFFECTIVENESS (1997)

ROAD INFLUENCE

BAA	ROAD INFLUENCE ACRES	SQUARE MILES
7-6-1	3457	5.4
7-6-2	2	0.0
7-6-3	0	0.0
5-6-4	51	0.1
5-6-5	3152	4.9
5-6-6	5412	8.5
5-6-7	1907	3.0
Total	13981	21.8

Methodology:

Habitat Effectiveness = Total BMU (sq.mi.) minus (Situation 3 sq.mi. + Road Influence sq.mi.)

100.2 - (10.4 + 21.8) = 68.0

68.0 sq.mi. divided by 100.2 sq. mi. = 67.9% HE

CHANGES IN EFFECTIVE HABITAT D-7

ACTIVITY	1998	1999	2000				
Cedar Gulch TS	-265		+265				
ASARCO RC MINE *1			-135				
Close FDR 2285 *2			+376				
TOTAL ACRES	-91		+506				
SQUARE MILES	-0.1		0.79				

*1 = ASARCO Rock Creek Mine (Alt. 5)
*2: = Tied to ASARCO Rock Creek Mine mitigation (close 1.61 miles FDR 2285 after Cedar Gulch TS completed)

CHANGES IN EFFECTIVE HABITAT D-5

ACTIVITY	1998	1999	2000				
Corral Salv. TS	+1500						
Skranak Access		-1084					
Harpole Access		-1141					
Bear Lakes Access			-733				
PCTC Sec. 3 TS *1		+634					
PCTC Sec 21 TS *4	-1229	+1229					
Noranda PL *2			-1153				
Close FDR 6746		+103					
PCTC Sec.5 TS *3							
Close FDR 5323 & 5323A *5		+224					
TOTAL ACRES	271	-35	-1886				
SQUARE MILES	0.4	-.06	-2.95				

*1: PCTC (Plum Creek timber company) roading and harvest - W Fisher 3 TS
*2: Powerline construction tied to Noranda Mine start-up date
*3: PCTC roading and harvest W Fisher 5 TS
*4: PCTC roading and harvest West Fisher 21 TS
*5: Mitigation for Harpole access

CHANGES IN EFFECTIVE HABITAT: BMU TOTAL
(starting at 67.9 square miles - 1997)

ACTIVITY	1998	1999	2000				
SQUARE MILES	+0.3	-.06	-2.16				
SITUATION 1	68.2	68.1	65.9				
BMU HE %	68.1	68.0	66.0				

Methodology:
Total Acres divided by 640 = square miles
Situation 1 = Previous year Situation 1 plus or minus current year situation 1
ie.: 1998 = 67.9 + 0.3 = 68.2
BMU HE % = Current years Situation 1 divided by 100.2
ie. 1998= 68.2/ 100.2 = 68.1%

ROAD DENSITIES
(Situation 1 habitat only)

BAA 7-6-01
Area = 22.1 sq.mi.

Road No.	OPEN ROAD MILES						
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
150	2.96	2.96	2.96				
150M	0.25	0.25	0.25				
2285	6.80	6.80	5.23				
2285L*1	0.29	0.29	0.00				
1022	2.38	2.38	2.38				
2287	0.11	0.11	0.11				
2277 *1	0.36	0.36	0.00				
2723 *1	0.20	0.20	0.00				
2282	0.92	0.92	0.92				
WI_07	1.90	1.90	1.90				
New rd *1	0.74	0.74	0.00				
TOTAL OPEN	16.91	16.91	13.75				
ORD mi./mi2	0.77	0.77	0.62				

*1 - Cedar Gulch TS

BAA 7-6-02
Area = 6.4 sq.mi.

Road No.	OPEN ROAD MILES						
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
All road in MS-3							
TOTAL OPEN	0.0	0.0	0.0				
ORD mi./mi2	0.0	0. 0	0. 0				

BAA 7-6-03

Area = 10.3 sq.mi.

Road No.	OPEN ROAD MILES					
	[illegible]	[illegible]	[illegible]			
All road in MS-3						
TOTAL OPEN	0.0	0.0	0.0			
ORD mi./mi2	0.0	0.0	0.0			

BAA 5-6-04

Area = 8.9 sq.mi.

Road No.	OPEN ROAD MILES					
	[illegible]	1998	2000			
Peterson Access	0.0	0.0	0.44			
TOTAL OPEN	0.0	0.0	0.44			
ORD mi./mi2	0.0	0.0	0.05			

5-6-05

Area = 14.8 sq.mi.

Road No.	OPEN ROAD MILES					
	[illegible]	[illegible]	[illegible]			
231	2.32	2.32	2.32			
6748	1.18	4.04	4.04			
2314 *1	5.39	0.00				
2315	0.02	0.02	0.02			
99808 *1	0.28	0.00	0.00			
99810 *1	0.05	0.00	0.00			
Peterson	0.00	0.00	1.20			
TOTAL OPEN	9.24	6.38	7.58			
ORD mi./mi2	0.62	0.43	0.51			

*1 - open for PCTC sec 21 TS

5-6-06

Area = 19.2 sq.mi.

Road No.	OPEN ROAD MILES						
231	5.91	5.91	5.91				
2332	3.10	3.10	3.10				
4724	0.05	0.05	0.05				
4780	0.18	0.18	0.18				
5200 *1	1.02	0.00	0.00				
6745	1.51	1.51	1.51				
5320 *3	0.22	0.00	0.00				
5323 *3	1.18	0.00	0.00				
5323A *3	0.22	0.00	0.00				
5324	1.27	1.27	1.27				
6746C *2	2.56	2.56	2.56				
6746 *4	4.17	4.94	4.94				
6748	0.17	0.17	0.17				
1054	0.06	0.06	0.06				
5327	0.74	0.74	0.74				
99758 *2	1.53	1.53	1.53				
99758A *2	0.43	0.43	0.43				
99825	0.13	0.13	0.13				
99845 *1	0.97	0.00	0.00				
99844 *1	3.05	0.00	0.00				
99844A *1	0.32	0.00	0.00				
99844B *1	0.27	0.00	0.00				
TOTAL OPEN	29.06	22.58	22.58				
ORD mi./mi2	1.51	1.18	1.18				

*1 - open for PCTC sec 3 TS
*2 - open for PCTC sec 5 TS
*3 - Rds 5320, 5323, 5323A closed for Skranak/Harpole access mitigation
*4 - .96 mile of rd 6746 closed for Skranak access mitigation; 1.73 miles opened for Harpole access; net .77 mile opened

5-6-07

Area = 8.2 sq.mi.

Road No.	OPEN ROAD MILES						
[illegible]							
385	1.21	1.21	1.21				
4724	5.43	5.43	5.43				
4725	0.00	0.00	4.18				
4780	0.00	0.00	0.00				
5195	0.16	0.16	0.16				
8751	0.10	0.10	0.10				
8752	0.05	0.05	0.05				
• Nor pwrl	0.00	0.00	0.73				
TOTAL OPEN	6.95	6.95	11.86				
ORD mi./mi2	0.85	0.85	1.45				

ACTIVITIES COVERED IN TABLES for D-5

Corral Salvage timber sale (USFS) - 1997-98
BAA 5-6-6 road closures
Plum Creek timber company road construction & timber harvest : 1997-2000
Noranda powerline construction : 2000
Skranak mining operations - 1999- ?
Harpole mining operations - 1999 - ?
Peterson Access - 2000 -?

Percent grizzly bear core habitat in BMU 6

	Core > 4 mi^2	Core < 4 mi^2
1998	41%	10%
1999	~~40%~~ 40.4	~~12%~~ 10.1
2000	~~39%~~ 40.8	~~11%~~ 9.8

WJ 7-30-98

APPENDIX 8

GLOSSARY

BAA: Bear Analysis Area: a sub-unit of a BMU used to analyze ORD. Also used to determine adequate "in kind" displacement habitat.

BMU: Bear Management Unit: land area containing sufficient quantity and quality of all seasonal habitat components to support a female grizzly. Used to analyze %HE.

ORD: Open road density: miles of open road per 640 acres in Management Situation 1 lands.

%HE: Percent Habitat Effectiveness: Percent of the BMU area free from human disturbance (greater than 1/4 mile from open roads, or greater than 1 mile from helicopter flight path). Formula:

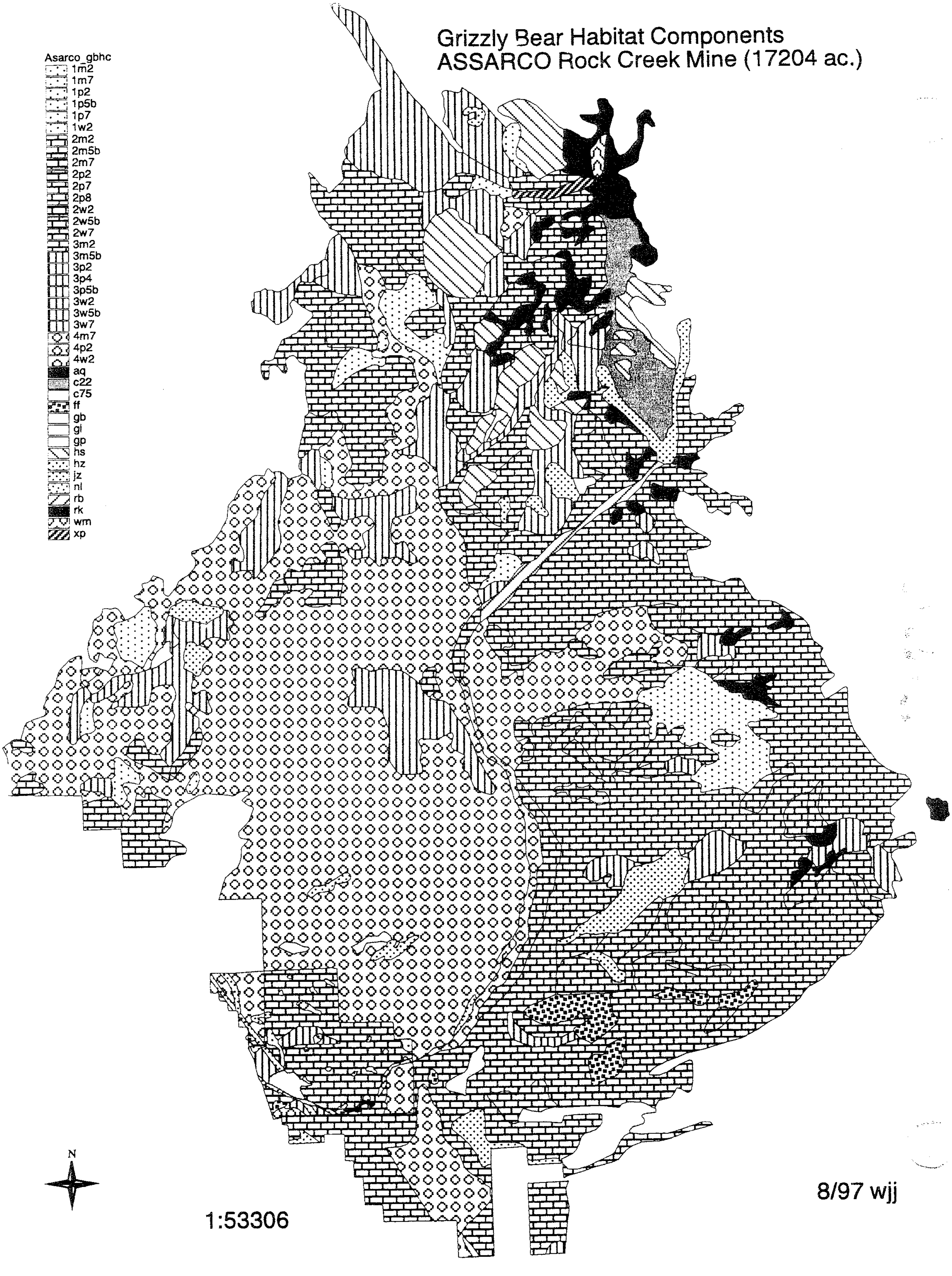
$$\frac{\text{Total BMU Ac. - (MS3 Ac. + MS1 Influence Zone Ac)}}{\text{Total BMU Acres}} = \%\text{HE}$$

MS1 Management Situation One: lands where grizzly habitat maintenance and improvement, and grizzly-human conflict minimization will receive the highest management priority (pg. 3 Interagency Grizzly Bear Guidelines, 1986).

MS3 Management Situation Three: lands where grizzly bear presence and factors contributing to their presence will be actively discouraged (pg. 4 Interagency Grizzly Bear Guidelines, 1986).

CORE: Grizzly bear habitat that contains: no motorized use of roads and trails during the non-denning period; no non-motorized high intensity use roads or trails; and habitat is a minimum of 0.3 miles from any open road or motorized trail (pg. 4 Interagency Grizzly Bear Guidelines, 1986).

SECURITY HABITAT (Hillis 1991): timbered stands greater than 250 acres in size, that provide at least hiding cover, and that are greater than 0.5 miles from an open road.


Grizzly Bear Habitat Components
ASSARCO Rock Creek Mine (17204 ac.)
Asarco_gbhc
1m2
1m7
1p2
1p5b
1p7
1w2
2m2
2m5b
2m7
2p2
2p7
2p8
2w2
2w5b
2w7
3m2
3m5b
3p2
3p4
3p5b
3w2
3w5b
3w7
4m7
4p2
4w2
aq
c22
c75
ff
gb
gl
gp
hs
hz
jz
nl
rb
rk
wm
xp
N
1:53306
8/97 wjj

APPENDIX 10
ASARCO ROCK CREEK MINE:
GRIZZLY BEAR MOVEMENT CORRIDOR CONSTRICTION ANALYSIS

There is a concern that the operations of two large scale mines (ASARCO Rock creek and Noranda's Montanore mines) at the same time may narrow the north to south grizzly bear movement corridor in the Cabinet Mountains. The concern is not that all movement through the area would stop, but that movements would be inhibited by encountering humans. A second part of the concern then becomes the potential for increased mortality risk due to more frequent bear/human encounters (see report titled "ASARCO Rock Creek Project: Grizzly Bear Mortality Risk Assessment"). Figure A shows the big picture of the corridor and displays the distances (air miles) between several points of concern. This analysis looks at the landscape scale for movement corridors, not the site specific level (ie. minimum 600 feet of cover between openings). In an undisturbed environment, lower levels of cover are not a problem, however, the assumption is that human disturbance is present and will increase substantially (from low to high level as defined in USDI 1988), especially along the trail between Rock Creek meadows and Rock Lake (see report titled "ASARCO Rock Creek Project: Grizzly Bear Analysis - Corridor Constriction: Recreation Use Levels"). This results in the need for secure cover to allow bear movement north and south along the Cabinet Mountains.

As proposed the greatest distance between activity points is seven miles (between Asarco's Rock creek mill site and Noranda's plant site: point B to G). Activity would influence habitat within one-half mile of each site, thus reducing the distance to six miles.

Indirect effects from the proposed project include an increase in the number of people using the Rock creek trail (see attached analysis of increased recreational activity). To access the trail, forest visitors would drive Forest roads 150 and 150A. The trailhead (Point C) is at the end of road 150A. The distance from point C to G is six miles. The use on the trail is expected to reach a high level (as defined in USDI 1988 pg 28). This high use level is projected to extend to the Rock Lake area (point H), based on huckleberry picking opportunity, fishing opportunity, and difficulty of trail beyond that point. The distance between points H and G is 3.7 miles. Between points H and F the distance is only 3.6 miles.

Cumulative effects from "foreseeable future actions" are possible due to the proposed Harpole private property access and potential associated activity (point E). The distance between points E and G is 3.5 miles and 2.8 miles between E and F (Noranda's Libby creek adit). Should the Harpole project proceed, then the high activity points are H and E, with a distance of 1.4 miles (not reflecting any influence zone from activities at those points). A minimum influence zone (ibid, pg. 12) would extend to the crest of the Cabinet Mountains from point E and 0.25 miles from point H, resulting in about 1.0 mile of undisturbed corridor on the Rock Creek side of the Cabinet mountains. About 3/4 (0.75 miles) of this west side undisturbed corridor provides open forest cover. The east side corridor would be between points E and F (2.8 miles without influence zones). A minimum 1/4 mile influence zone would extend from point E and a 1/2 mile zone from point F, leaving 2 miles of undisturbed habitat on the east side of the Cabinet for the bears to move through in the north/south directions. Approximately 2/3 (1.3 miles) of the undisturbed east side corridor provides dense forest cover. The east side area would have a road open to access the Harpole property at point E which would further reduce bear security in this movement area.

To be an effective corridor the area must provide adequate cover for the bear to move undetected. Open areas (timber harvest, rock, meadows, water, low shrubs) do not provide secure movement habitat unless the opening is within 600 feet of cover. Areas of over steepened ground (ie. cliffs) serve as barriers to movement as well. Figure B shows the portion of the north to south movement corridor that is encircled by the proposed projects. This area contains 12,238 acres. Travel habitat conditions within this area are shown in Figures C and D, and summarized in Table I. Almost 1/2 (44.8%) of the area contains habitat components that do not provide movement cover. An additional 5.4% of the area provides limited cover (alder). The distribution pattern of the remaining habitat shows the best movement cover is in the vicinity of proposed activities and associated indirect activities (trail use). The increased activity level may displace grizzly bears, resulting in use of less desirable movement habitat, exposing them to humans. Bears that do not displace may encounter a greater mortality risk due to higher probability of human encounters. The overall result is a narrowing of the effective movement corridor.

Table I: Travel habitat conditions within impacted portion of North/South Corridor.

Habitat Component	Acres	% of Area
Water	80	0.7
Scree	4887	39.9
Alder	664	5.4
Sedge/grass	87	0.7
Low shrubs	433	3.5
Forest	6087	49.8

% = Acres/12,238

In addition, there are two other known access proposals, and associated human activities, south of the Harpole property but still within the corridor of concern. They are the Skranak and Bear Lakes private property access proposals. The Skranak and Harpole properties access proposals have gone through formal consultation with the USFWS (Biological Opinion issued 4/13/98), while the Bear Lakes access project is scheduled for analysis in late 1998 or early 1999. The spatial arrangement of these two projects, along with the Noranda, ASARCO, and Harpole sites, is a concern because they could contribute toward further fragmentation of the Cabinet Mountain grizzly bear habitat. However, as indicated in the report on recreation use, fracture zones (linear area of human activity that bisects grizzly bear habitat), similiar to the ones that would be created by the Skranak, Harpole and Bear Lakes access routes, are being crossed by grizzly bears. This does not mean that bears are not impacted, as they are likely to modify movement patterns in order to move around the high use sites at the ends of the fracture zones. This is based on grizzly bear research that has demonstrated human activity results in changes in bear behavior and movement patterns (see report titled "ASARCO Rock Creek Project: Grizzly Bear Analysis - Corridor Constriction: Recreation Use Levels" for references).

Based on the above information, bear movement, north and south in the Cabinet Mountains, is not likely to stop but bear/human encounters are likely to increase. Most grizzly bear mortality research shows that increased encounters with humans results in greater bear mortality. The mortality risk index (MRI) increases only 0.2% due to the ASARCO Rock Creek project. Cumulatively the MRI would increase 2.1 percent over the present (1998) situation. The cumulative increase is primarily due to the Noranda, Skranak, and Harpole projects.

There are three alternatives that would eliminate this impact: 1) drop the ASARCO Rock Creek project; 2) Use a combined set of mine facilities (including adit) with Noranda; and 3) Time the ASARCO project to start only after the Noranda project is fully competed (including rehabilitation). Since there is no mitigation proposed that would minimize the spatial location impacts, this becomes a contributing factor for the "may adversely affect" determination displayed in the biological assessment.

References

USDI et.al. 1988. Cumulative Effects Analysis Process for the Selkirk/Cabinet-Yaak Grizzly Bear Eco-systems. FWS Boise, ID. 32 pp.

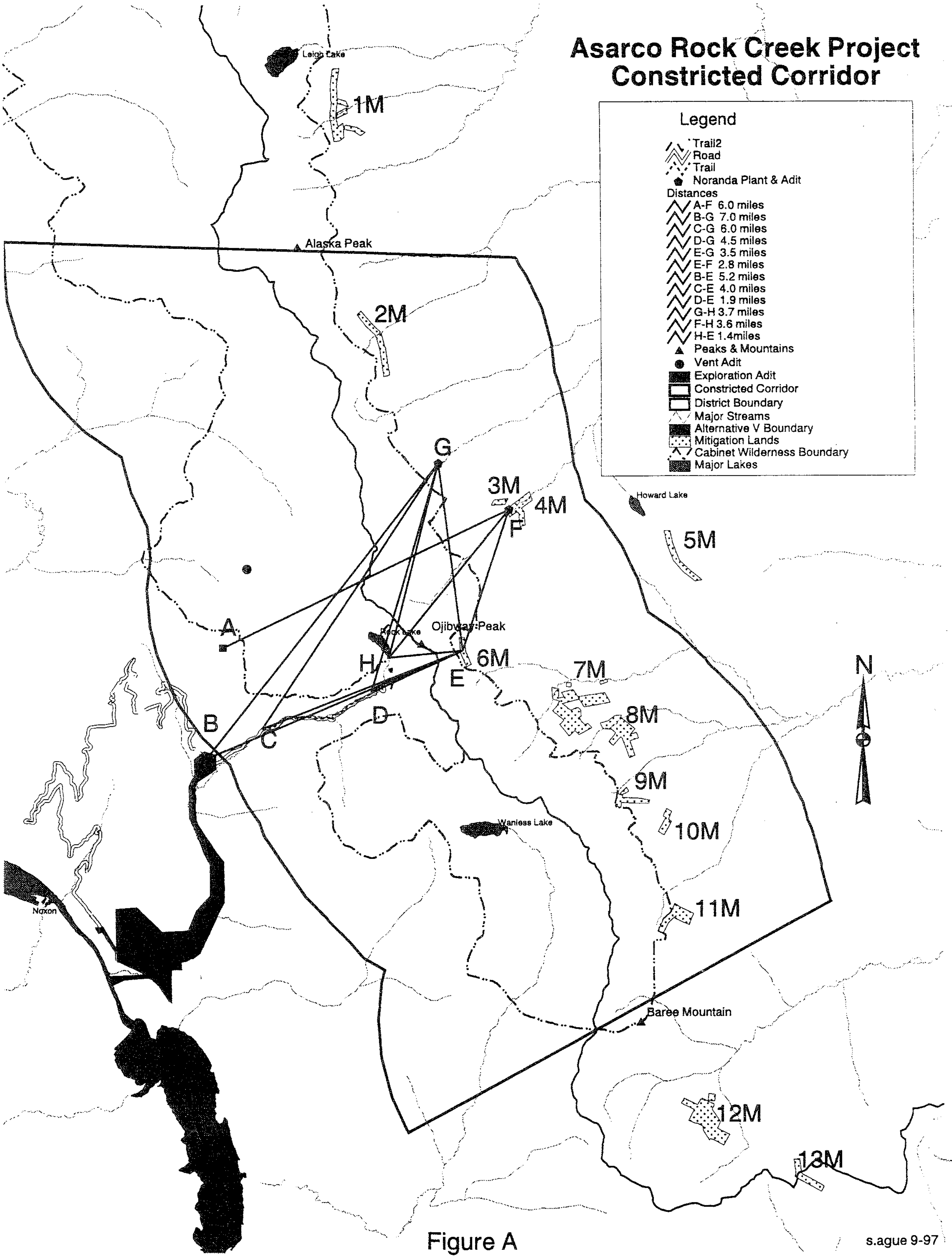


Figure A

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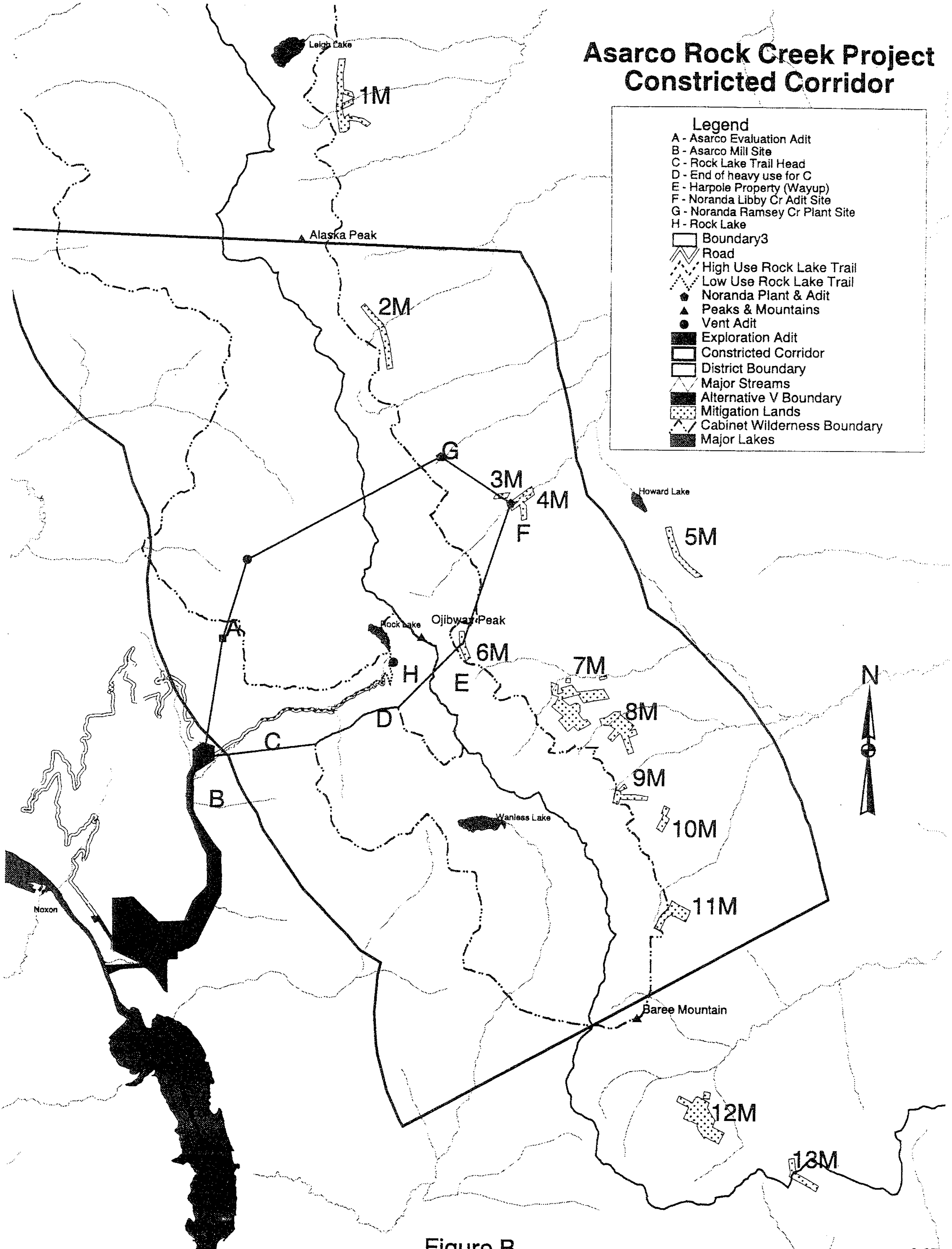

Figure B

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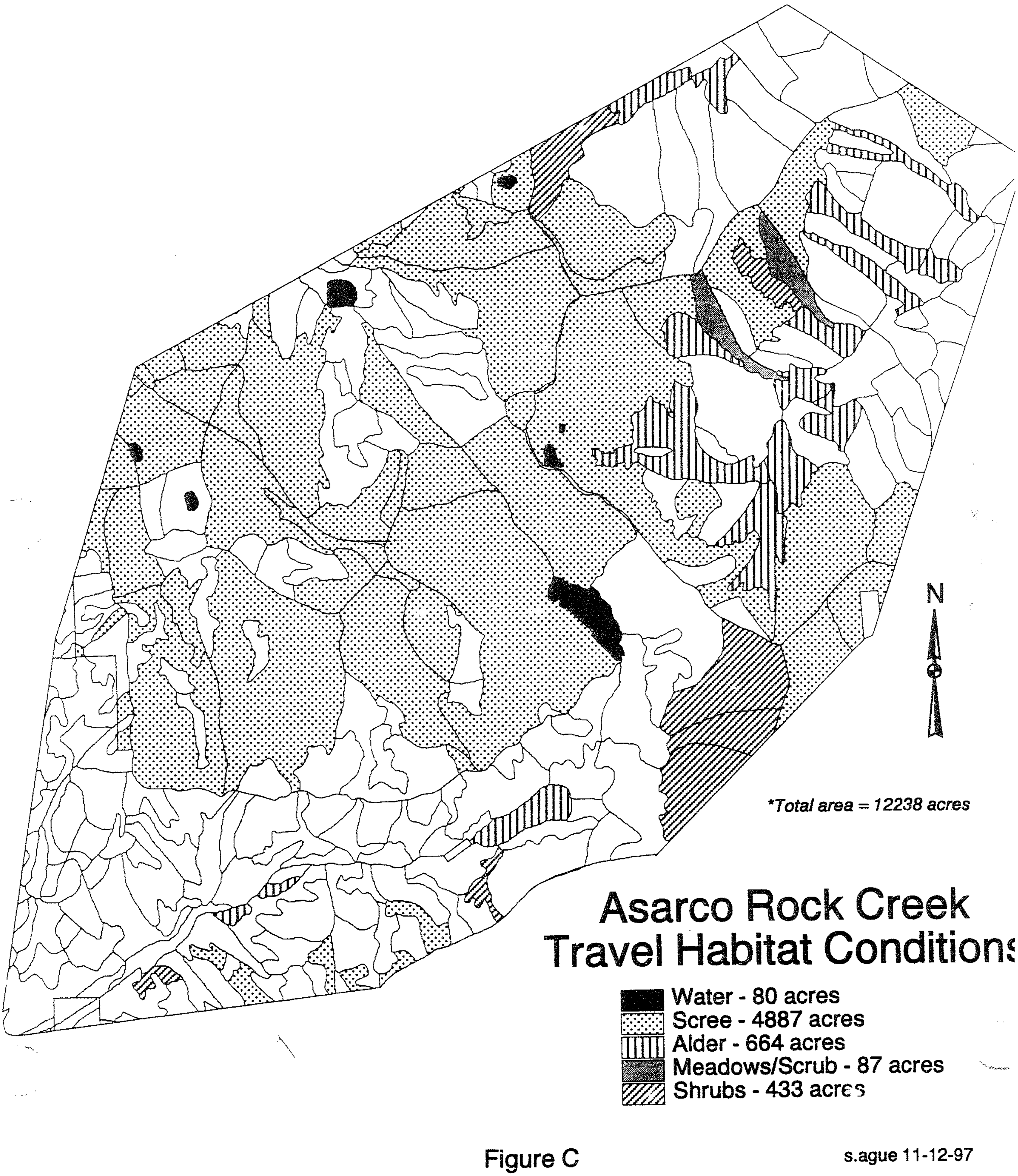

Figure C

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APPENDIX 11: ASARCO Rock Creek Project: Grizzly Bear Mortality Risk Assessment

This assessment is based on the coefficients of mortality risk developed in the interagency cumulative effects analysis process (USFWS et.al. 1988: Table 5 - pg. 17). The interagency grizzly bear group determined that human activites are additive (cumulative) when applied to the risk of bear mortality (USFWS et.al. 1990: pg. 12). Using this assumption the following simple risk assessment was developed.

Mortality risk is the result of potential bear/human encounters. The places these encounters can occur are on roads, trails, at use points (i.e. campgrounds), and dispersed across the forest (i.e. ATV use). With the exception of vehicle caused mortality, the other risks are associated with firearms. Hunting activity results in a higher risk, therefor the mortality coefficients are higher when hunting is present. Food sources that attract bears are also a major factor in causing bear/human encounters that most often end in a bear mortality, therefor coefficients are higher when attractants are present.

Taking the above factors into account the assessment includes the following steps:

1. Within the analysis area (BMUs impacted by ASARCO - BMUs 4, 5 & 6) - determine the existing activities and their intensity (high or low), if hunting is present or not at activity site, and presence or absence of attractants at each site .

2. Assign the appropriate mortality coefficients (high or low).

3. Multiply mortality coefficients by the number of activities.

4. Add resulting index coefficients for all features to determine cumulative risk index (Tables 1A & B).

5. Repeat process for changed conditions under each project alternative as appropriate (Tables 2-5).

6. Determine percent change (due to ASARCO) from pre-existing condition (Table 1B). Formula is: (Alt.X Index minus Alt. 1 index) divided by Alt. 1 Index.

This is not an absolute measure of risk but a method of comparison between alternatives, and a relative index of change in risk from a designated starting point.

Mortality Risk Summary

Alternative	Mortality Risk Index	% Change from Alt. 1
1	163.0	0
2	164.9	+ 1.2
3	164.9	+ 1.2
4	164.5	+ 0.9
5	163.4	+ 0.2

± inidcates direction of change in mortality risk index
% change = (Alt X MRI - Alt 1 MRI) / Alt 1 MRI (MRI = Mortality Risk Index)

References

U.S. Fish and Wildlife Service et. al. 1988. Cumulative Effects Analysis Process for the Selkirk/Cabinet-Yaak Grizzly Bear Ecosystems 1988. USDI USFWS Boise, ID. 32 pp.

U.S. Fish and Wildlife Service et. al. 1990. CEM - A Model for Assessing Effects on Grizzly Bears. 24 pp.

Table 1A : Exisiting Condition (1998)

Feature	Activity (Attractant) **	Mortality Coefficients High	Low	Number of Activities High	Low	Mortality Risk Index ****
Linear - Open Roads *	Hunting (NP)	0.4	0.2	0	27	5.4
Linear - Open Roads *	Non-hunting (NP)	0.2	0.1	0	0	0.0
Linear - Trails	Hunting (NP)	0.2	0.1	0	11	1.1
	Non-hunting (NP)	0.1	0.1	0	0	0.0
Point ***	Hunting (P)	1.0	0.8	146	2	147.6
	Hunting (NP)	0.4	0.2	0	6	1.2
	Non-hunting (NP)	0.2	0.1	3	3	0.9
	Non-hunting (P)	0.8	0.6	1	0	0.8
Dispersed	Hunting (NP)	0.5	0.3	0	3	0.9
Linear - Closed Roads *	Hunting (NP)	0.2	0.1	0	22	2.2
	Non-hunting (NP)	0.1	0.1	0	17	1.7
MRI =						161.0

* linear features in 10 mile segments (USFWS 1988 pg 17). Each segment = 1 activity

** Attractant: P = present NP = not present

*** points are associated with human made or related features

**** Mortality Risk Index = sum of (Mortality coefficients times Number of activities by high and low use levels).

MRI = Mortality Risk Index

Activities included in existing condition are are shown in Appendix A.

Table 1B : Pre-ASARCO Rock Creek Condition (1999) = Alt. 1

Feature	Activity (Attractant) **	Mortality Coefficients High	Low	Number of Activities High	Low	Mortality Risk Index ****
Linear - Open Roads *	Hunting (NP)	0.4	0.2	4	27	7.0
Linear - Open Roads *	Non-hunting (NP)	0.2	0.1	0	0	0.0
Linear - Trails	Hunting (NP)	0.2	0.1	0	11	1.1
	Non-hunting (NP)	0.1	0.1	0	0	0.0
Point ***	Hunting (P)	1.0	0.8	146	2	147.6
	Hunting (NP)	0.4	0.2	0	6	1.2
	Non-hunting (NP)	0.2	0.1	6	3	1.5
	Non-hunting (P)	0.8	0.6	1	0	0.8
Dispersed	Hunting (NP)	0.5	0.3	0	3	0.9
Linear - Closed Roads *	Hunting (NP)	0.2	0.1	0	20	2.0
	Non-hunting (NP)	0.1	0.1	0	17	1.7
MRI =						163.0

* linear features in 10 mile segments (USFWS 1988 pg 17). Each segment = 1 activity

** Attractant: P = present NP = not present

*** points are associated with human made or related features

**** Mortality Risk Index = sum of (Mortality coefficients times Number of activities by high and low use levels).

MRI = Mortality Risk Index

Assumes Noranda active

- Linear roads: # miles divided by 10 = # activities (any distance above multiples of 10 = 1 more activity)
  - Open High use roads = 34.03 mi (Hunting) and 0 miles (non-hunting)
  - Open Low use roads = 265.6 miles (hunting) and 0 miles (non-hunting)
  - Closed High use roads = 0 miles. (hunting) and 0 miles (non-hunting)
  - Closed Low use roads = 196.36 miles (hunting) and 164.5 miles (non-hunting)
- Linear trails: Same as existing condition.
- Points: Existing conditions plus:
  - Mill site, tailing impoundment complex, Libby creek vent adit (non-hunting : attractant not present - high use)
  - Dispersed: Same as exisitng conditions

Table 2 : Alternative # 2 Condition

Feature	Activity (Attractant) **	Mortality Coefficients High	Low	Number of Activities High	Low	Mortality Risk Index ****
Linear - Open Roads *	Hunting (NP)	0.4	0.2	5	27	7.4
Linear - Open Roads *	Non-hunting (NP)	0.2	0.1	1	0	0.2
Linear - Trails	Hunting (NP)	0.2	0.1	1	10	1.2
	Non-hunting (NP)	0.1	0.1	0	0	0.0
Point ***	Hunting (P)	1.0	0.8	146	2	147.6
	Hunting (NP)	0.4	0.2	0	6	1.2
	Non-hunting (NP)	0.2	0.1	8	0	1.9
	Non-hunting (P)	0.8	0.6	1	0	0.8
Dispersed	Hunting (NP)	0.5	0.3	0	3	0.9
Linear - Closed Roads *	Hunting (NP)	0.2	0.1	0	20	2.0
	Non-hunting (NP)	0.1	0.1	0	17	1.7
MRI =						164.9

* linear features in 10 mile segments (USFWS 1988 pg 17). Each segment = 1 activity
** Attractant: P = present NP = not present
*** points are associated with human made or related features
**** Mortality Risk Index = sum of (Mortality coefficients times Number of activities by high and low use levels).

Activities included in Alternative # 2 condition are:

- Linear roads: # miles divided by 10 = # activities (any distance above multiples of 10 = 1 more activity)
  Open High use roads = 49.47 mi (Hunting) and 5.25 miles (non-hunting)
  Open Low use roads = 265.6 miles (hunting) and 0 miles (non-hunting)
  Closed High use roads = 0 miles. (hunting) and 0 miles (non-hunting)
  Closed Low use roads = 196.7 miles (hunting) and 164.7 miles (non-hunting)

- Linear trails: Same as existing condition except: EF Rock Creek Trail becomes high use.

- Points: Existing conditions plus:
  Mill site, tailing impoundment, exploration adit, evaluation support facility, water treatment facility (non-hunting : attractant not present - high use)

- Dispersed: Same as exisitng conditions with:
  No Proposed mitigation to put legal closure on the 3 potential use areas identified in existing condition.

Table 3 : Alternative # 3 Condition

Feature	Activity (Attractant) **	Mortality Coefficients High	Low	Number of Activities High	Low	Mortality Risk Index ****
Linear - Open Roads *	Hunting (NP)	0.4	0.2	5	27	7.4
Linear - Open Roads *	Non-hunting (NP)	0.2	0.1	1	0	0.2
Linear - Trails	Hunting (NP)	0.2	0.1	1	10	1.2
	Non-hunting (NP)	0.1	0.1	0	0	0.0
Point ***	Hunting (P)	1.0	0.8	146	2	147.6
	Hunting (NP)	0.4	0.2	0	6	1.2
	Non-hunting (NP)	0.2	0.1	8	3	1.9
	Non-hunting (P)	0.8	0.6	1	0	0.8
Dispersed	Hunting (NP)	0.5	0.3	0	3	0.9
Linear - Closed Roads *	Hunting (NP)	0.2	0.1	0	20	2.0
	Non-hunting (NP)	0.1	0.1	0	17	1.7
MRI =						164.9

* linear features in 10 mile segments (USFWS 1988 pg 17). Each segment = 1 activity

** Attractant: P = present NP = not present

*** points are associated with human made or related features

**** Mortality Risk Index = sum of (Mortality coefficients times Number of activities by high and low use levels).

Activities included in Alternative # 3 condition are:

- Linear roads: # miles divided by 10 = # activities (any distance above multiples of 10 = 1 more activity)
  Open High use roads = 48.1 mi (Hunting) and 4.33 miles (non-hunting)
  Open Low use roads = 265.6 miles (hunting) and 0 miles (non-hunting)
  Closed High use roads = 0 miles. (hunting) and 0 miles (non-hunting)
  Closed Low use roads = 199.63 miles (hunting) and 166.6 miles (non-hunting)

- Linear trails: # miles divided by 10 = # activities (any distance above multiples of 10 = 1 more activity)
  Same as existing conditions except:EF Rock Creek Trail becomes high use.

- Points: Private residences in sections 11 and 26 (hunting: attractant present)
  Existing conditions plus:
  Mill site, tailing impoundment, exploration adit, evaluation support facility, water treatment facility (non-hunting : attractant not present - high use)

- Dispersed: Same as existing condition as there are NO proposed mitigation to put legal closure on the 3 potential use areas identified in existing condition.

Table 4 : Alternative # 4 Condition

Feature	Activity (Attractant) **	Mortality Coefficients High	Low	Number of Activities High	Low	Mortality Risk Index ****
Linear - Open Roads *	Hunting (NP)	0.4	0.2	4	27	7.0
Linear - Open Roads *	Non-hunting (NP)	0.2	0.1	1	0	0.2
Linear - Trails	Hunting (NP)	0.2	0.1	1	10	1.2
	Non-hunting (NP)	0.1	0.1	0	0	0.0
Point ***	Hunting (P)	1.0	0.8	146	2	147.6
	Hunting (NP)	0.4	0.2	0	6	1.2
	Non-hunting (NP)	0.2	0.1	8	3	1.9
	Non-hunting (P)	0.8	0.6	1	0	0.8
Dispersed	Hunting (NP)	0.5	0.3	0	3	0.9
Linear - Closed Roads *	Hunting (NP)	0.2	0.1	0	20	2.0
	Non-hunting (NP)	0.1	0.1	0	17	1.7
MRI =						164.5

* linear features in 10 mile segments (USFWS 1988 pg 17). Each segment = 1 activity
** Attractant: P = present NP = not present
*** points are associated with human made or related features
**** Mortality Risk Index = sum of (Mortality coefficients times Number of activities by high and low use levels).

Activities included in Alternative # 4 condition are:

- Linear roads: # miles divided by 10 = # activities (any distance above multiples of 10 = 1 more activity)
  Open High use roads = 31.73 mi (Hunting) and 4.34 miles (non-hunting)
  Open Low use roads = 265.6 miles (hunting) and 0 miles (non-hunting)
  Closed High use roads = 0 miles. (hunting) and 0 miles (non-hunting)
  Closed Low use roads = 199.8 miles (hunting) and 164.42 miles (non-hunting)

- Linear trails: # miles divided by 10 = # activities (any distance above multiples of 10 = 1 more activity)
  Same as existing conditions except:
  EF Rock Creek Trail becomes high use.

- Points: Private residences in sections 11 and 26 (hunting: attractant present)
  Existing conditions plus:
  Mill site, tailing impoundment, exploration adit, evaluation support facility, water treatment facility (non-hunting : attractant not present - high use)

- Dispersed: Same as existing condition as there are NO proposed mitigation to put legal closure on the 3 potential use areas identified in existing condition.

Table 5 : Alternative # 5 Condition

Feature	Activity (Attractant) **	Mortality Coefficients High	Low	Number of Activities High	Low	Mortality Risk Index ****
Linear - Open Roads *	Hunting (NP)	0.4	0.2	4	27	7.0
Linear - Open Roads *	Non-hunting (NP)	0.2	0.1	1	0	0.2
Linear - Trails	Hunting (NP)	0.2	0.1	1	10	1.2
	Non-hunting (NP)	0.1	0.1	0	0	0.0
Point ***	Hunting (P)	1.0	0.8	146	2	147.6
	Hunting (NP)	0.4	0.2	0	6	1.2
	Non-hunting (NP)	0.2	0.1	7	3	1.7
	Non-hunting (P)	0.8	0.6	1	0	0.8
Dispersed	Hunting (NP)	0.5	0.3	0	0	0.0
Linear - Closed Roads *	Hunting (NP)	0.2	0.1	0	20	2.0
	Non-hunting (NP)	0.1	0.1	0	17	1.7
MRI =						163.4

* linear features in 10 mile segments (USFWS 1988 pg 17). Each segment = 1 activity

** Attractant: P = present NP = not present

*** points are associated with human made or related features

**** Mortality Risk Index = sum of (Mortality coefficients times Number of activities by high and low use levels).

Activities included in Alternative # 5 condition are:

- Linear roads: # miles divided by 10 = # activities (any distance above multiples of 10 = 1 more activity)
  Open High use roads = 38.69 mi (Hunting) and 3.82 miles (non-hunting)
  Open Low use roads = 256.6 miles (hunting) and 0 miles (non-hunting)
  Closed High use roads = 0 miles. (hunting) and 0 miles (non-hunting)
  Closed Low use roads = 199.82 miles (hunting) and 164.42 miles (non-hunting)

- Linear trails: # miles divided by 10 = # activities (any distance above multiples of 10 = 1 more activity)
  Same as existing conditions except:
  EF Rock Creek Trail becomes high use.

- Points: Existing conditions plus:
  Mill site & evaluation support facility combined, tailing impoundment, exploration adit, , water treatment facility (non-hunting : attractant not present - high use)

- Dispersed: No dispersed sites as there is proposed mitigation to put legal closure on the 3 potential use areas identified in existing condition.

Appendix A

Existing Conditions: Mortality Risk Raw Data by BMU

Feature	BMU 4	BMU 5	BMU 6	Cumulative
Linear: Open road miles with hunting and no attractant	High use - 0 Low Use - 133.02	High use - 0 Low use - 89.08	High use - 0 Low use - 43.5	High Use - 0 Low Use - 265.6/10 = 27
Linear: Open road miles non-hunting and no attractant	High use - 0 Low Use - 0	High use - 0 Low Use - 0	High use - 0 Low Use - 0	High use - 0 Low Use - 0
Linear: Trail miles with hunting and no attractant	High use - 0 Low Use - 49.7	High use - 0 Low Use - 32.1	High use - 0 Low use - 28.1	High use - 0 Low use - 109.9/10 = 11
Linear: Trail miles non-hunting and no attractant	High use - 0 Low Use - 0	High use - 0 Low Use - 0	High use - 0 Low use - 0	High use - 0 Low use - 0
Point: with hunting and attractant	High use - 133 Residences: (Bull R. = 56) Hwy 200 = 77) Low Use - 0	High use - 1 Residence: (T26R32S11) Low Use - 1 Summer cabin: (T27R31S11)	High use - 12 Residence: (T26R32S26) (Hwy 200 = 11) Low use - 1 Summer Cabin: (T27R30S22)	High use - 146 Low use - 2
Point: with hunting and no attractant	High use - 0 Low Use - 1 (Rock Lake site)	High use - 0 Low Use - 1 (Engle lake site)	High use - 0 Low use - 4 (Geiger Lake site -2) (Bramlet lake site) (Wanless lake site)	High use - 0 Low use - 6
Point: non-hunting and no attractant	High use - 2 (Bull R. CG) (MSHD shop) Low Use - 2 (Big Eddy CG) (Noxon Senior C.)	High use - 1 (Howard Lake CG) Low Use - 0	High use - 0 Low use - 1 (Lake Cr. CG)	High use - 3 Low use - 3
Point: non-hunting with attractant	High use - 1 (Noxon dump) Low Use - 0	High use - 0 Low use - 0	High use - 0 Low Use - 0	High use - 1 Low use - 0
Dispersed: hunting and no attractant	High use - 0 Low Use - 1 (rd # 2280, 2281 area)	High use - 0 Low Use - 0	High use - 0 Low use - 2 (rd # 14641 area) (rd # 2210, 2287, 2288 area)	High use - 0 Low use - 3
Linear: closed road miles hunting and no attractant	High use - 0 Low Use - 52.1	High use - 0 Low Use - 91.42	High use - 0 Low use - 74.7	High use - 0 Low use - 218.22/10 = 22
Linear: closed road miles non-hunting and no attractant	High use - 0 Low Use - 94.14	High use - 0 Low Use - 57.12	High use - 0 Low use - 15.32	High use - 0 Low use - 166.58/10 =17

CG = campground
MSHD = Montana State Highway Department

- High = use level defined in appendix 4 of USFWS 1988.
- Low = use level defined in appendix 4 of USFWS 1988.

- Hunting: IGBC codes (2, 3, 4) (5, 6, 7, 8) (Roads: restricted, barriered, open) (Trails: open motorized, open non-motorized, restricted, high use non-motorized)
- Non-hunting: IGBC code 1 (impassable); ASARCO properties with facilities present

APPENDIX 12

ASARCO Rock Creek Project: Grizzly Bear Analysis - Corridor Constriction: Recreation Use Levels

INTRODUCTION

The possible constriction of the north to south movement corridor for grizzly bears on the Rock creek side of the east Cabinet mountains is a result of two potential activities. The first is the direct effect of construction and operation of the proposed Rock creek mine. This part of the impacts is discussed in the report titled "Asarco Rock Creek Mine: Grizzly Bear Movement Corridor Constriction Analysis".

The second is the indirect effect of potential increased recreational use of the Rock Lake trail that goes up the east fork of Rock creek. The consequences of superimposing high recreational activity on productive grizzly bear habitat include both direct mortality and reduced habitat effectiveness. Mattson et al. (in press) presents results that show mortality risk to females is 5 times higher than males due to developments and roads. This is believed to be a consequence of habituation to predictable high density human presence.

Reduced habitat effectiveness, due to human activity is well documented. Schleyer et al. (1984) demonstrated that disturbances from nonmotorized recreational activity caused immediate and rapid displacement. Disturbances also resulted in bears using less suitable habitat. Haroldson and Mattson (1985) reported that the spatial-temporal level of human use was a significant factor in determining the level of a bear response to accumulated backcountry use. Bear responses were greater in open or more productive habitats. They also show that the greater the recreational use the longer the displacement effects last. McLelan and Shackleton (1989) observed greater responses to off-trail hikers than any other disturbance (bears fleeing greater than 1 Km in both open and forested habitat). Mace and Waller (1996) demonstrated that grizzly bears minimize their interaction with recreationists by spatially avoiding high use areas. Kasworm (1990) also shows that grizzly bears are displaced from habitat near trails. He does, however indicate that grizzly bear avoidance of habitat near trails is at least partially related to habitat availability (primarily shrubfields, snowchutes and graminoid park habitats). These components make up less than 10% of the habitat in the corridor and very little is available near the Rock Lake trail.

EXISTING SITUATION

To determine the indirect effects of recreational use, a baseline level of use was first established. An analysis of existing recreational use on the East Fork Rock Creek trail was conducted with the data collected on trail registration cards by the Cabinet Ranger District. Data was available for two time periods: 1990-92 and 1995-1997. Data from known special use permittees (guides) was also included for 1991, 1995-1997).

The data was summarized by grizzly bear seasons of use (Table 1). The seasons used were: spring (Den emergence, about 4/1, to 6/15); summer (6/16 to 9/15) and fall (9/16 to den entrance, about 11/15). This provides a bear year of 229 days. Analysis also looked at levels of use to three destination points (Rock Creek Meadows, Rock Lake, and Areas beyond Rock Lake in the Cabinet Mountain Wilderness) (Table 2).

Table 1: Existing Recreational Use Levels (registration cards)(6 year average 1990-92 & 1995-97)

Year	Season	Days Used in Bear Year	Total People	No. Parties	Ave. Party Size	Total Trip Days	Ave. Days per Trip
Ave.	Spring	10	34	11	3.1	15	1.4
	Summer	54	179	55	3.3	103	1.9
	Fall	6	20	8	2.5	11	1.4
	Bear Yr.	70	233	74	3.1	129	1.7

* Based on actual days trail used, not entire bear year.

Table 2: Existing Use Pattern - Party Destinations

Season	Meadows	Rock Lake	Beyond Rock Lake
Spring	9 (14%)	53 (84%)	1 (2%)
Summer	59 (16%)	281 (76%)	28 (8%)
Fall	13 (27%)	33 (67%)	3 (6%)
Bear Year	81 (17%)	367 (76%)	32 (7%)

Evidence from electronic trail counters (Table 3- 1992 data) indicates that actual use level is likely higher than indicated by the registered use level. A wilderness guard note from 1990 tends to support this possibility. The guard reported 30 unregistered trail users (number of parties unknown) over a 10 day period in August. The trail registration card data for the same period indicated only 18 trail users (6 parties).

Table 3: Existing Recreational Use Levels - Number of People per day (electronic counters & registration cards)

Year	Monitored Period	Electronic Counts per day 1/	Registration Card Counts (actual days) 2/	Registration Card Counts (bear year) 3/
1990		-	1.5	0.7
1991		-	2.6	0.6
1992	7/16-11/2	4.0	2.8	1.0
1993	6/10-10/14	6.3	-	-
1994	5/31-9/26	6.3	-	-
1995		-	3.2	1.2
1996		-	4.6	1.8
1997		-	3.6	1.4

1/ Three years of automatic trail counter information are available in the Cabinet Ranger District's recreation files. The counter was located approximately one-half mile up the trail from the gated trailhead. **The data is the count of people numbers, not parties. The use levels show the average daily total passing through the counter. The number does include return trips, which means the actual number of people per day could be half the average shown.** The number of parties per day can not be determined from this data.

2/ The number of people per day is based on actual number of bear year days that had recreational parties in the area. Column 3 of Table 1 is the seasonal averages.

3/ The number of peopl_ per day is based on the bear season (229 days).

The cumulative effects models use the number of "parties" per day (USDA FS et.al. 1988) or week (USDI USFWS et.al. 1990) as the measure of human activity and associated disturbance levels (see use level definitions at end of this report). The current average use level over the entire bear year is considered low (Table 4).

Table 4: Use Levels - Parties per day or week (based on registration card data)

Period	Number Parties per day 1/	Number Parties per week 2/
1990-92	0.8 3/	5.7
1995-97	1.2	8.2
Average	1.0	7.1

1/ Number of parties per day based on actual use days.
2/ Number of parties per week based on actual use days divided by 7.
3/ Actual use would be 1.0 per day. Average is less because of length of trip. Parties staying more than a day are still counted as only one party.

While data summarized in Table 4 would indicate a low level of use, this information is incomplete. As noted above actual use is very likely to be higher than indicated by the registration card data. Use levels could be between 50% and 400% higher than determined by registrations. This means the number of parties could be between 1.5 and 4 parties per day.

EFFECTS ANALYSIS

The Supplemental Draft Environmental Impact Statement for the ASARCO Rock Creek Mine Project documents the assumptions and resulting changes in population numbers in the impacted counties (Sanders & Lincoln in Montana, and Bonner in Idaho) (SDEIS chapter 4: Socioeconomic section). Table 5 summarizes the projected changes for the Montana counties.

Table 5: Expected Settlement of Immigrating Construction, Operation and Secondary Workers

	Workers		Population *	
County	Construction	Operation	Construction	Operation
Sanders	125	59	261	155
Lincoln	19	7	39	20
MT Total	144	66	300	175

* Assumes the average family size is 2.6 persons (75% of workers are married with 1.2 children). (based on SDEIS socioeconomic analysis - chapter 4)

The Social Assessment for the Kootenai National Forest (1995) demonstrates that residents of both Sanders and Lincoln county use the Rock Creek area for huckleberry picking, fishing, hunting, hiking, scenic driving, and wilderness access. The Social Assessment also shows the percentage of Kootenai National forest users that participate in various recreation activities (pg 14-15). Applying these percentages against the projected increases shown in Table 5 provides an estimate of the increased use on the Kootenai National Forest, a portion of which will occur in the East Fork Rock Creek area. Table 6 depicts the potential changes in use, based on immigrant employees and their families. These figures do not include the estimated 50 to 100 families (160 people -SDEIS: based on Troy mine pattern documented by Wenner, 1992) that would move to the area seeking employment but be unsuccessful.

A portion of them would remain in the area and further increase the numbers shown in Table 6. In addition the improved access (paved two lane road to the mill site) is likely to encourage additional use of the area. This source of increase is not projected in this analysis.

Table 6: Projected Increases in Recreation Activities due to ASARCO Rock Creek Project

Recreation Activity	Worker Increase *	Population Increase *
Fishing 1.	17	46
Hunting 2.	25	67
Wilderness Use 3.	32	86
Hiking 4.	35	93
Scenic Driving 5.	65	172
Berry Picking 6.	1	3

* Used Operation numbers from Table 2 (above) as this is the long term effect.
1. 26% of KNF users fish
2. 38% of KNF users hunt
3. 49% of KNF users visit wilderness
4. 53% of KNF users hike
5. 98% of KNF users drive to enjoy scenery
6. 1.8% of KNF users pick berries
Source of % users: Social Assessment for the Kootenai National Forest (1995)

Assuming that a portion of each activity group uses the EF Rock Creek area, and because actual percentages of KNF users that use Rock creek are not known, and because people generally participate in more than one activity, the average percentage of the six users groups was calculated (44.3%) and applied to the population increase from Table 5 (175 people) to project the worst case situation for increased people activity in the area. The resulting average recreational population increase is an estimated 78 people. Only 59 of these people would be expected to use the trail, all 78 of them would use Forest road 150A to the trail head. These people could use the Rock Lake trail as individuals or as groups. If they used the trail as individuals there would be 59 "parties". However past use has tended to be family oriented so the group scenario is more likely. Assuming the average party size equals the average family size (2.6 persons per ASARCO DEIS), then the number of additional parties using the area would be 23 (59 / 2.6= 22.7). This would be a 31% increase over the 6 year average of 74 parties per year (Table 1). Based on past use patterns (Table 2), about 17% (4 parties) would stop at the meadows, 76% (17 parties) would continue to Rock Lake, and 7% (2 parties) would go beyond Rock Lake.

To answer the question of "Is there a potential for human bear conflict?" Wayne Kasworm (USFWS) provided a summary analysis of bear location data for the corridor and the East Fork of Rock Creek (see attached letter). Kasworm's summary clearly shows grizzly bears using the area during all seasons. He also indicates use of both timber and non-timber habitat components, with higher use levels in the latter.

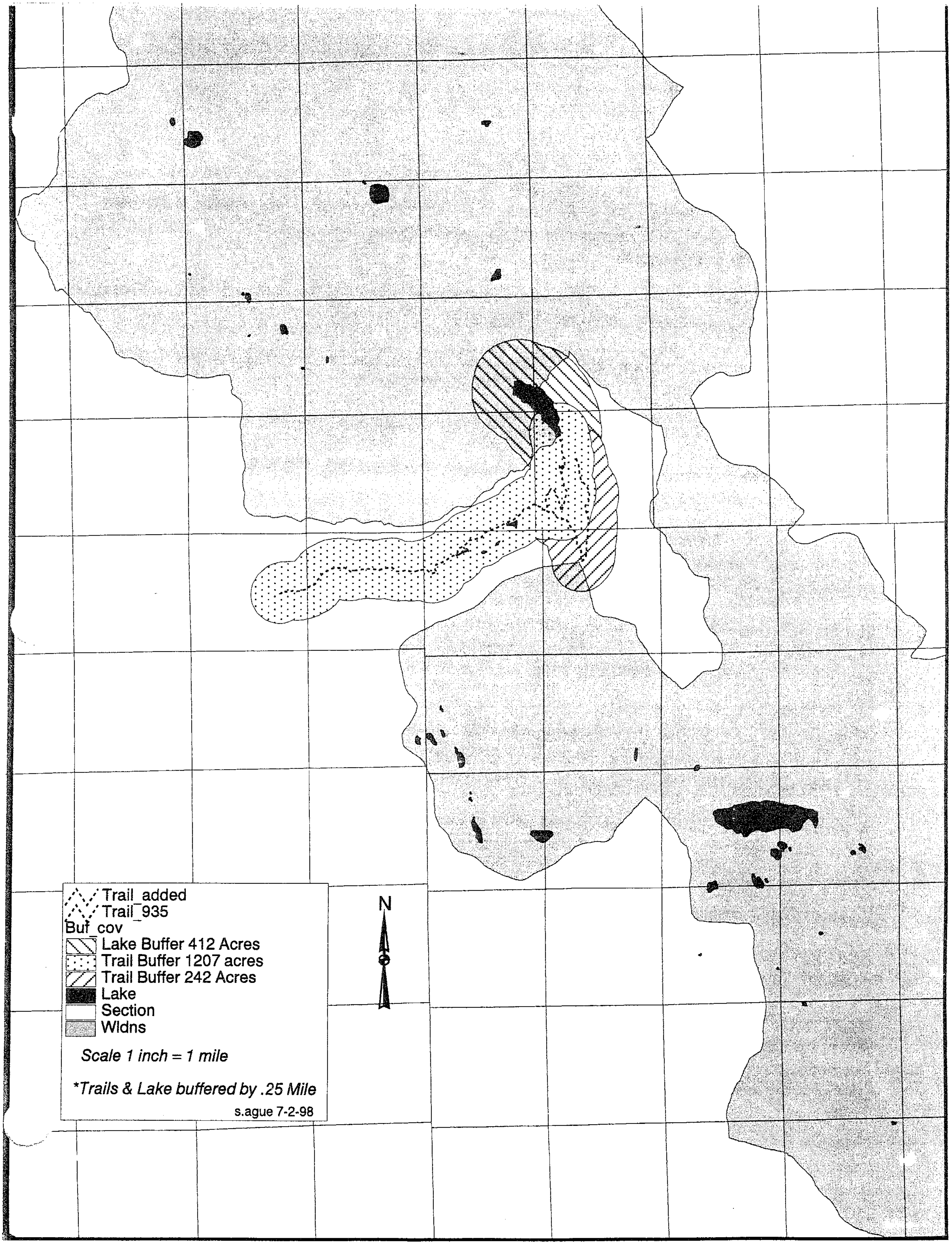
While the human population (and thus the corresponding recreation level) in Sanders and Lincoln counties are projected to increase, even without the ASARCO Rock Creek mine project; with the project the increase occurs sooner and then lasts over a longer period (life of mine). This extended period of increased recreational use results in a longer bear displacement time (Haroldson and Mattson 1985).

Whether or not the indirect effects of the mine results in a need to provide mitigation depends on what assumption is made concerning the actual existing use levels (range of 1.5-4 parties per day). At the lower level a 31% increase results in an estimated 2 parties per day which is still in the low level as defined in the cumulative effects model, where no mitigation would be needed. At the higher level the projected increase would give an estimated 5 parties per day, but the use level would already be above the "threshold" of 3, resulting in no additional impacts on grizzly bears and their habitat use. Since the use level is unknown, but believed to be near the "threshold", the concept of proportional mitigation is being applied. Mace (1996) and Haroldson et al. (1985) both suggest that bear response is proportional to human use levels (e.g. as people numbers increase, displacement effects on bears increase accordingly).

The assumption is that the increase in recreational use resulting from the mine employees would cause the loss of a proportional amount of habitat. The Cumulative Effects Analysis Process (USDA et al. 1988, Zone of Influence and Disturbance Coefficients table) indicates a negative change in disturbance coefficient (from 1.0 down to 0.8) and an increase in the zone of influence. Applying the cumulative effects model zone of influence (0.25 mile)(USDI et al. 1990, Zone of Influence and Disturbance Coefficients table) to the trail system results in 1,619 acres affected by recreational use (see attached map). The projected new disturbance coefficient results in a 20% reduction in habitat usability. Minimum compensation would be needed for 100 acres (.2 x 1619 acres x .31 (proportional increase in recreational use levels) - influence area of trail to Rock Lake and area around rock lake that receive highest use levels. Old road/trail to ridge line receives low use levels so influence area of 149 acres not included).

To further answer the question of whether or not these potential impacts from increased recreational activity may contribute cumulatively to a narrowing of the north to south movement corridor for grizzly bear, bear movements across existing fracture zones (linear area of human activity that bisects grizzly bear habitat) was examined. Fracture zones can have a high, moderate or low level of human activity. In general, the higher level of human activity the less likely a bear is to cross the zone. In addition to the potential new fracture zone at the EF Rock Creek trail, fracture zones exist in two locations within the southern part of the Cabinets. They are the Vermilion river road (FDR 154) and the Swamp creek power line road (FDR 2220). Kasworm's telemetry data shows that 2 of 3 native bears crossed FDR 154 and 3 of 3 crossed FDR 2220 and the EF Rock Creek trail (with existing recreation use levels) (Wayne Kasworm, USFWS, personal communication 7-13-98). In years of low food availability bears tend to travel further and take greater risks of exposure and it is not known if the crossings took place during a low food availability year. On a relative scale the identified zones would classify as high for FDR 154 (due to yearlong motorized use) moderate for FDR 2220 (due to restricted motorized use), and low for EF Rock Creek trail (due to non-motorized use). Based on the limited telemetry data of bears crossing the "high" and "moderate" fracture zones, it is likely that they would also cross the "low" fracture zone at the EF Rock Creek Trail. However, this does not say that bears will not be impacted. While fragmentation (loss of genetic interchange) may not occur, individual bear behavior and movement patterns are likely to be changed, although perhaps in a minor way. Complete avoidance of the EF Rock creek drainage is not likely.

In addition, the potential changes may increase mortality risk associated with bear/human encounters. The simple fact that there would be more people in the area increases the chance of a bear/human encounter. As the number of encounters increases, the potential for a bear fatality would increase, especially for female bears (Mattson et al.). The level of increased risk is unknown as information on the number of recreationists carrying firearms (primary mortality risk factor) is not available, However a relative risk index has been determined and is shown in the report titled; "ASARCO Rock Creek Project: Grizzly Bear Mortality Risk Assessment".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Trail_935
Buf_cov
Lake Buffer 412 Acres
Trail Buffer 1207 acres
Trail Buffer 242 Acres
Lake
Section
Wldns
Scale 1 inch = 1 mile
*Trails & Lake buffered by .25 Mile
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References

Haroldson, M. and D. Mattson. 1985. Response of grizzly bears to backcountry human use in yellowstone national park. USDI interagency grizzly bear study team. Bozeman, MT. 37 pp. IN: IGBC 1987. Grizzly Bear Compendium.

Impact Assessment Inc. 1995. Social Assessment for the Kootenai National Forest. USDA Forest Service, Kootenai National Forest, Libby, MT. 318 pp.

Kasworm, Wayne and T.L. Manley. 1990. Road and Trail Influences on Grizzly Bears and Black Bears in Northwest Montana. Int. Conf. Bear Res. and Manage 8:79-84.

Mace, R.D. and J. S. Waller 1996. Grizzly bear distribution and human conflicts within jewel basin hiking area, swan mountains, Montana. pages 74-80 IN: Mace, R.D. and J. S. Waller 1997. Final Report: Grizzly Bear Ecology in the Swan Mountains Montana. Montana Fish, Wildlife, and Parks, 1920 6th Ave. E. Helena, MT. 189 p.

Mattson, D.J., R.R. Knight, and B.M. Blanchard. (in press). The effects of developments and primary roads on grizzly bears in yellowstone national park, Wyoming. Int. Conf. Bear Res. and Manage. 7. (paper presented) IN: IGBC 1987. Grizzly Bear Compendium.

McLellan, B.N and D.M. Shackleton. 1989. Immediate reactions of grizzly bears to human activities. Wildl. Soc. Bull. 17:269-274. IN: Mace, R.D. and J. S. Waller 1997. Final Report: Grizzly Bear Ecology in the Swan Mountains Montana. Montana Fish, Wildlife, and Parks, 1920 6th Ave. E. Helena, MT. 189 p.

Schleyer, B.O. ; J.J. Jonkel; K.G. Rhoades, and D.M. Dunbar. 1984. The effects of nonmotorized recreation on grizzly bear behavior and habitat use. USDI interagency grizzly bear study team. Bozeman, MT. 83 pp. IN: IGBC 1987. Grizzly Bear Compendium.

Wenner, L.N. 1992. Minerals, people and dollars: Social economic and technological aspects of mineral resource development. USDA Forest Service, Northern Region, RI-92-133, Missoula, MT.

USDA Forest Service, Idaho Department of Fish and Game, Washington Department of Wildlife, USDI Fish and Wildlife Service, and Montana Department of Fish Wildlife and Parks. 1988. Cumulative Effects Analysis Process for the Selkirk/Cabinet-Yaak Grizzly Bear Ecosystems 1988. USDA FS Idaho, Idaho F & G, Washington Dept. of Wildlife, USDI F & WS, Montana Dept. Fish, Wildlife & Parks. Boise, ID. 32 pp.

USDI U.S. Fish and Wildlife Service, Bureau of Land Management, U.S. Forest Service, Idaho Department of Fish and Game, Washington Department of Wildlife, Montana Department of Fish Wildlife, Wyoming Game and Fish Department, and Parks, National Park Service. 1990. CEM - A Model for Assessing Effects on Grizzly Bears. 24 pp.

Use Level Definitions:

The "Cumulative Effects Analysis Process for the Selkirk/Cabinet-Yaak Grizzly Bear Ecosystems" (1988) defines non-motorized linear high and low use (pg 28) as follows:

> High-use: trails having > 3 parties/day. Party = group of 1-15 people.
> Low-use: trails having < 3 persons or parties per day

The "CEM - A Model for Assessing Effects on Grizzly Bears" (1990) defines non-motorized linear high and low use (pg 9) as follows:

> High intensity - receiving an average of 20 or more parties per week
> Low intensity - receiving and average of less than 20 parties per week

United States Department of the Interior

TAKE PRIDE IN AMERICA

FISH AND WILDLIFE SERVICE
Grizzly Bear Recovery Coordinator
NS 312, University of Montana
Missoula, Montana 59812

IN REPLY REFER TO:

TO: Wayne Johnson, KNF

FROM: Wayne Kasworm, U.S. Fish and Wildlife Service, 475 Fish Hatchery Road, Libby, MT 59923 (406) 293-4161 FAX (406) 293-6338

SUBJECT: Grizzly Bear Information for ASARCO Mitigation

DATE: 19 March 1998

In response to your request for information regarding grizzly bear habitat use within the Asarco Corridor boundary you provided and the East Fork of Rock Creek, I have developed the following summaries. First you requested information regarding elevation of grizzly bear radio locations by season (Tables 1 and 3) and habitat use in timber and nontimber components by season (Tables 2 and 4). Also attached is a map of locations within the boundary provided. Seasons were defined as: Spring = Den emergence to 6/15, Summer = 6/16 - 9/15, Autumn = 9/16 - Den entry.

Table 1. Seasonal use of elevation (meters) by radio collared grizzly bears in the Asarco corridor, 1983-95.

Elevation (m)	Spring	Summer	Autumn	Den	Annual
Mean	1521	1697	1779	1915	1690
N	27	154	35	1	217
95% CI	1422-1620	1666-1729	1714-1844	N/A	1661-1718
Range	1030-1954	1230-2205	1285-2123	N/A	1030-2205

Table 2. Seasonal use frequency of timbered and nontimbered habitat by radio collared grizzly bears in the Asarco corridor, 1983-95. Seasonal percents in parentheses.

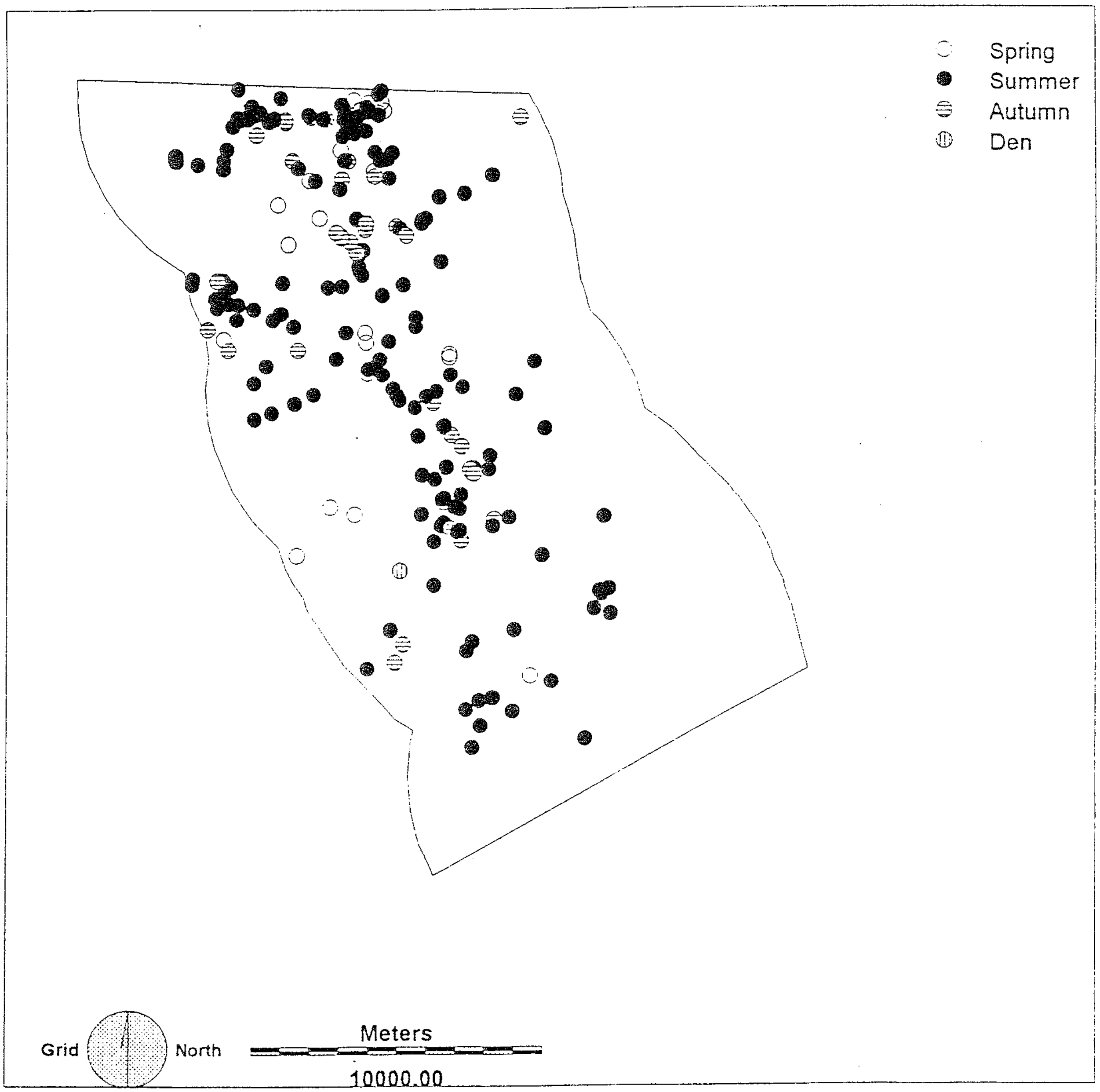
Habitat	Spring	Summer	Autumn	Den	Annual
Timber	8 (30)	57 (37)	17 (49)	0	82 (38)
Nontimber	19 (70)	97 (63)	18 (51)	1 (100)	135 (62)

Table 3. Seasonal use of elevation (meters) by radio collared grizzly bears in the East Fork of Rock Creek, 1983-95.

Elevation (m)	Spring	Summer	Autumn	Den	Annual
Mean	1342	1756	1844	1915	1701
N	4	17	2	1	24
95% CI	912-1772	1647-1864	986-2701	N\A	1589-1811
Range	1030-1676	1400-2205	1776-1911	N/A	1030-2205

Table 4. Seasonal use frequency of timbered and nontimbered habitat by radio collared grizzly bears in the East Fork of Rock Creek, 1983-95. Seasonal percents in parentheses.

Habitat	Spring	Summer	Autumn	Den	Annual
Timber	2 (50)	2 (11)	2 (100)	0	6 (25)
Nontimber	2 (50)	15 (89)	0	1 (100)	18 (75)



Spring
Summer
Autumn
Den
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North
Meters
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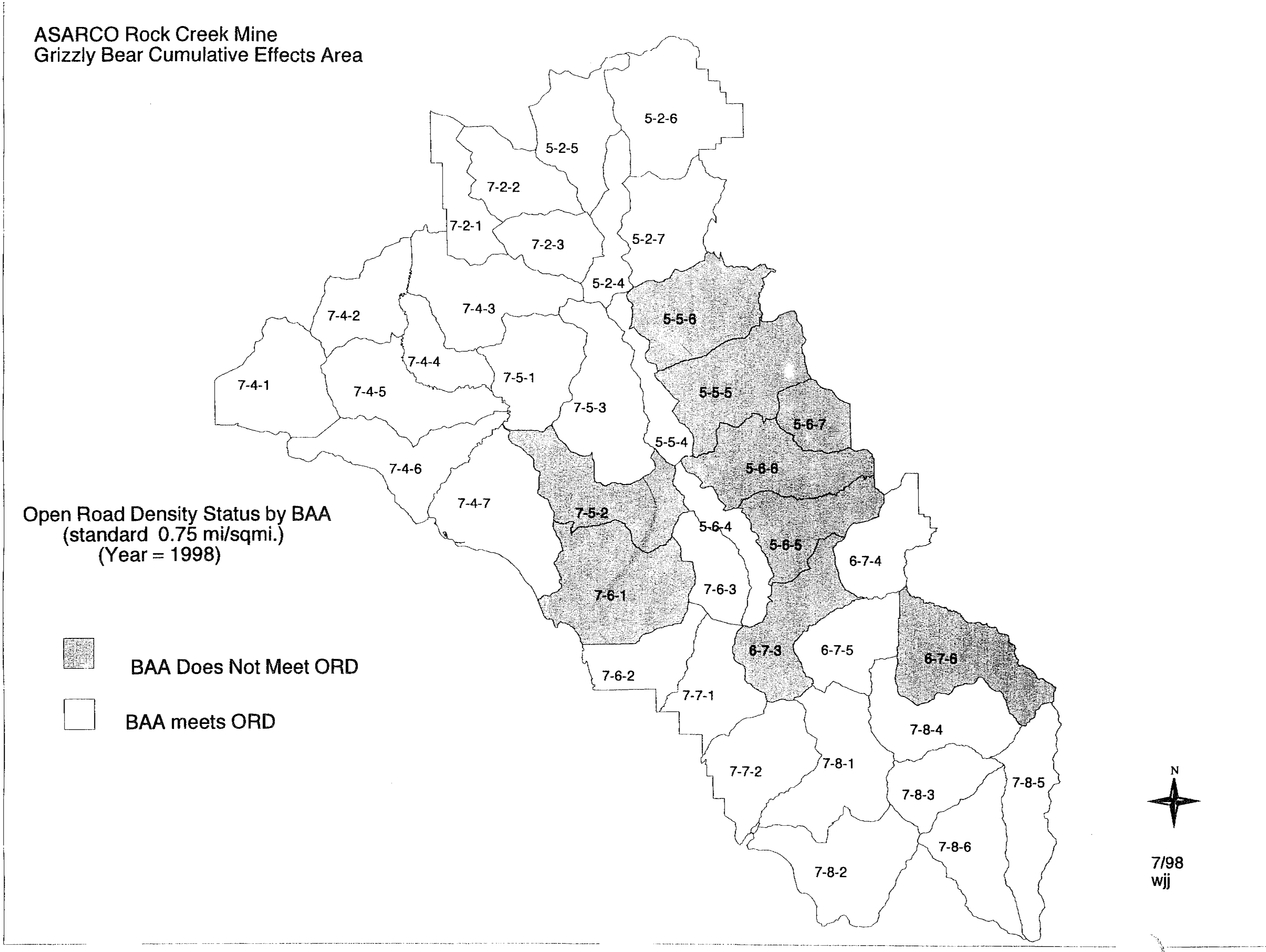
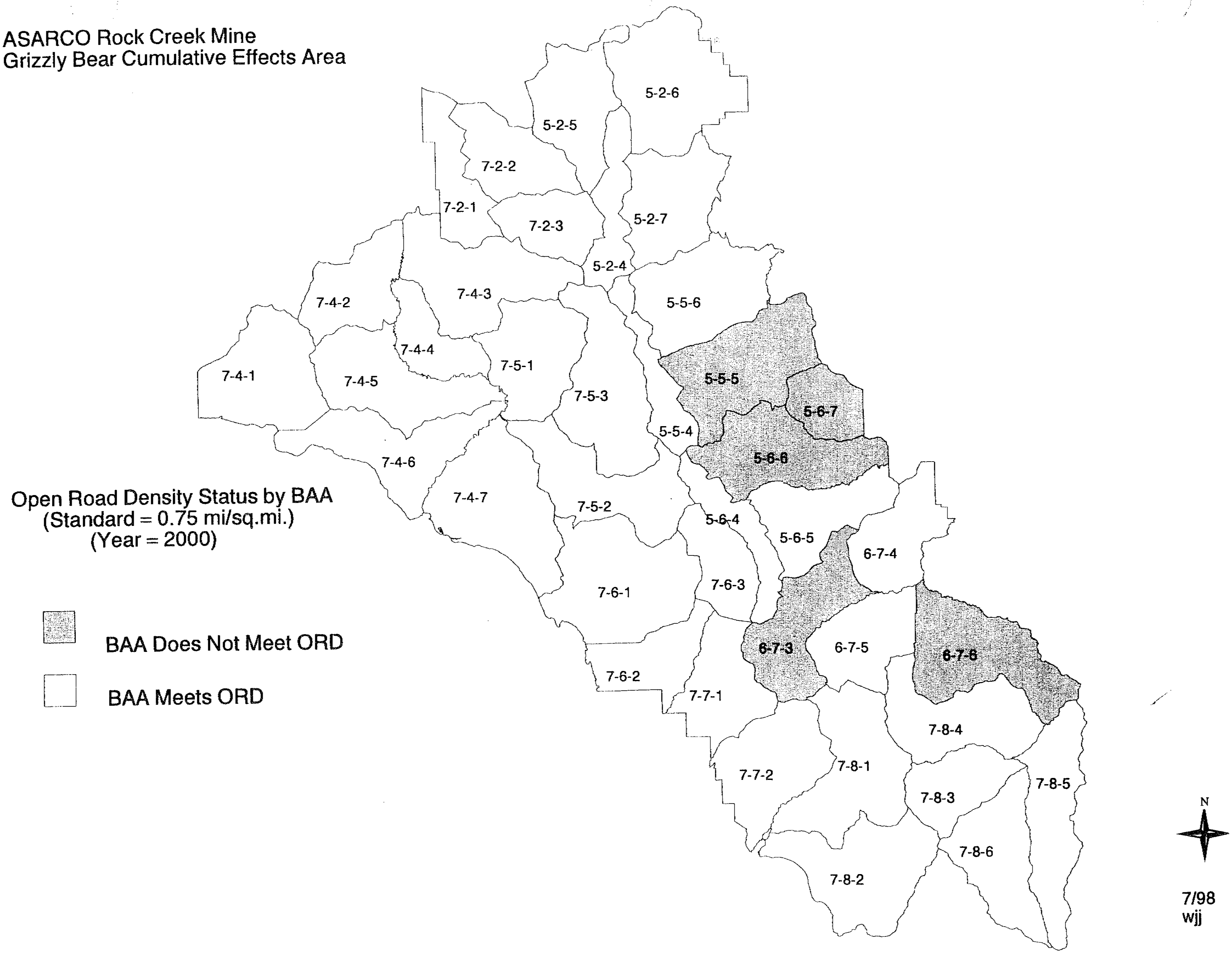
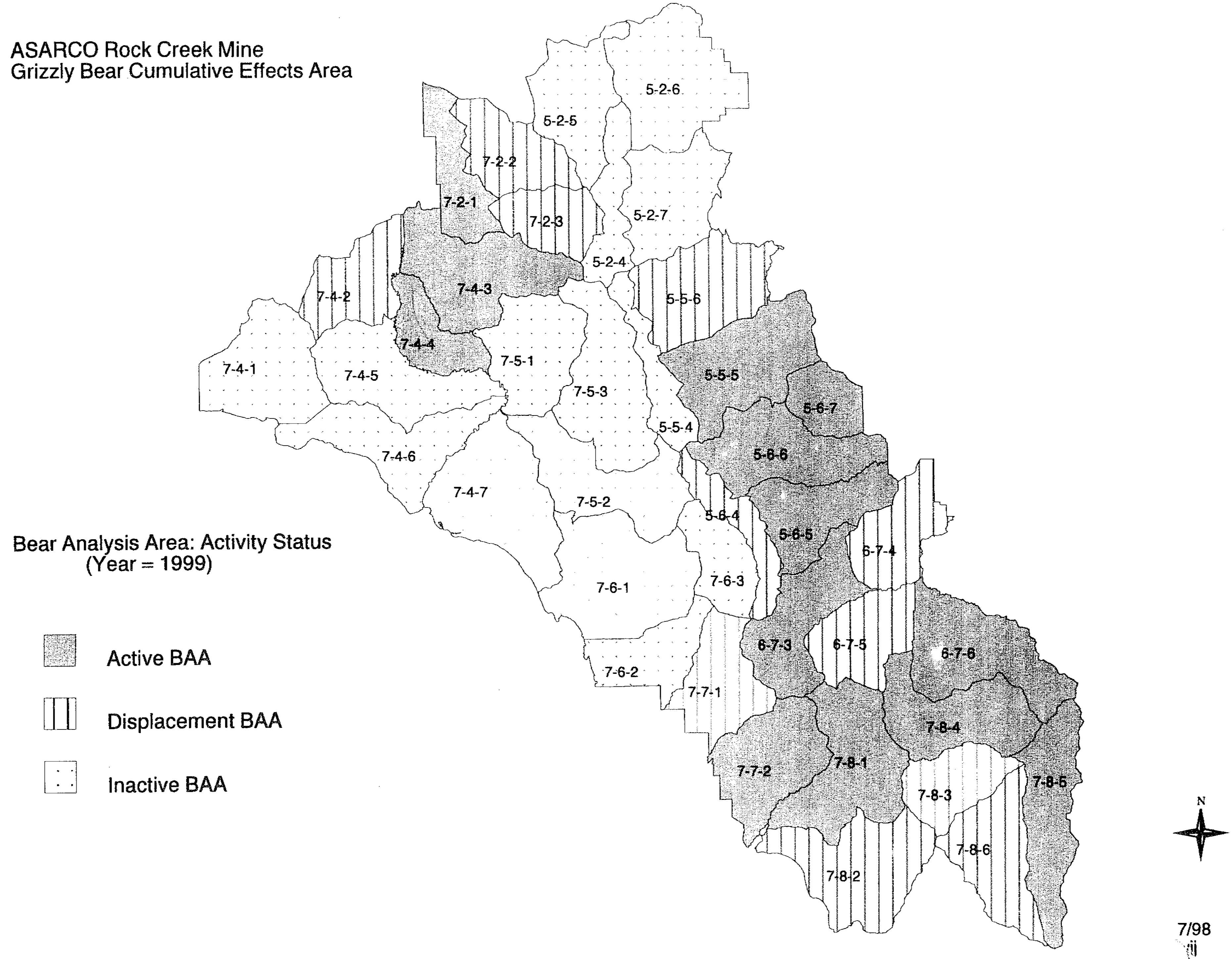


ASARCO Rock Creek Mine
Grizzly Bear Cumulative Effects Area
5-2-6
5-2-5
7-2-2
7-2-1
7-2-3
5-2-7
5-2-4
7-4-2
7-4-3
5-5-6
7-4-4
7-5-1
7-4-1
7-4-5
5-5-5
7-5-3
5-6-7
5-5-4
7-4-6
5-6-6
7-4-7
7-5-2
5-6-4
5-6-5
6-7-4
7-6-1
7-6-3
6-7-3
6-7-5
6-7-6
7-6-2
7-7-1
7-8-4
7-7-2
7-8-1
7-8-3
7-8-5
7-8-6
7-8-2
Open Road Density Status by BAA
(standard 0.75 mi/sqmi.)
(Year = 1998)
BAA Does Not Meet ORD
BAA meets ORD
N
7/98
wjj

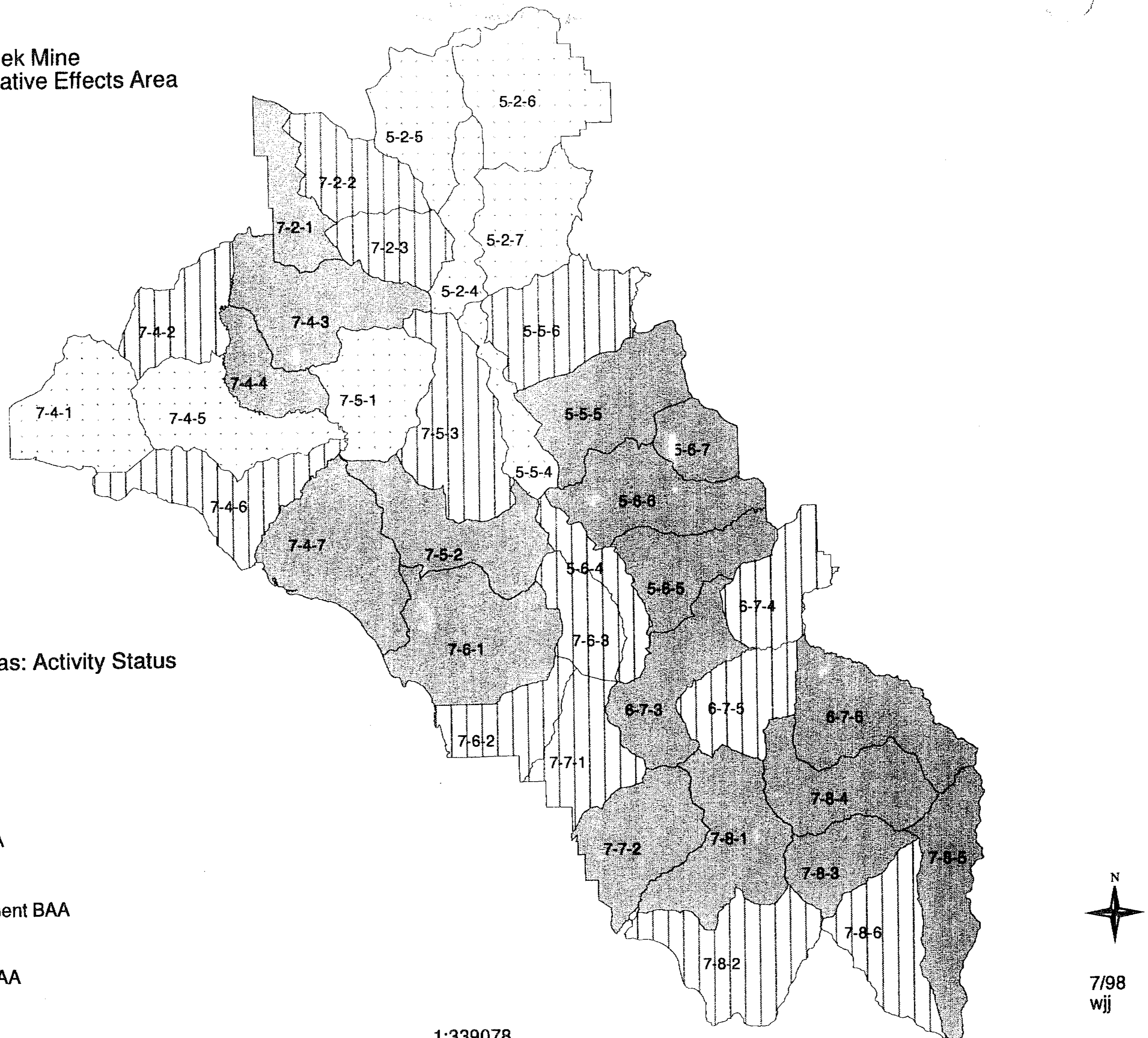
ASARCO Rock Creek Mine
Grizzly Bear Cumulative Effects Area





ASARCO Rock Creek Mine
Grizzly Bear Cumulative Effects Area
5-2-6
5-2-5
7-2-2
7-2-1
7-2-3
5-2-7
5-2-4
7-4-3
7-4-2
5-5-6
7-4-4
7-5-1
7-4-1
7-4-5
5-5-5
7-5-3
5-6-7
5-5-4
5-6-6
7-4-6
7-4-7
7-5-2
5-6-4
Bear Analysis Area: Activity Status
(Year = 1999)
5-6-5
6-7-4
7-6-3
7-6-1
Active BAA
6-7-3
6-7-5
6-7-6
7-6-2
Displacement BAA
7-7-1
7-8-4
7-7-2
7-8-1
Inactive BAA
7-8-5
7-8-3
N
7-8-6
7-8-2
7/98

ASARCO Rock Creek Mine
Grizzly Bear Cumulative Effects Area



Bear Analysis Areas: Activity Status

(Year = 1998)

Active BAA

Displacement BAA

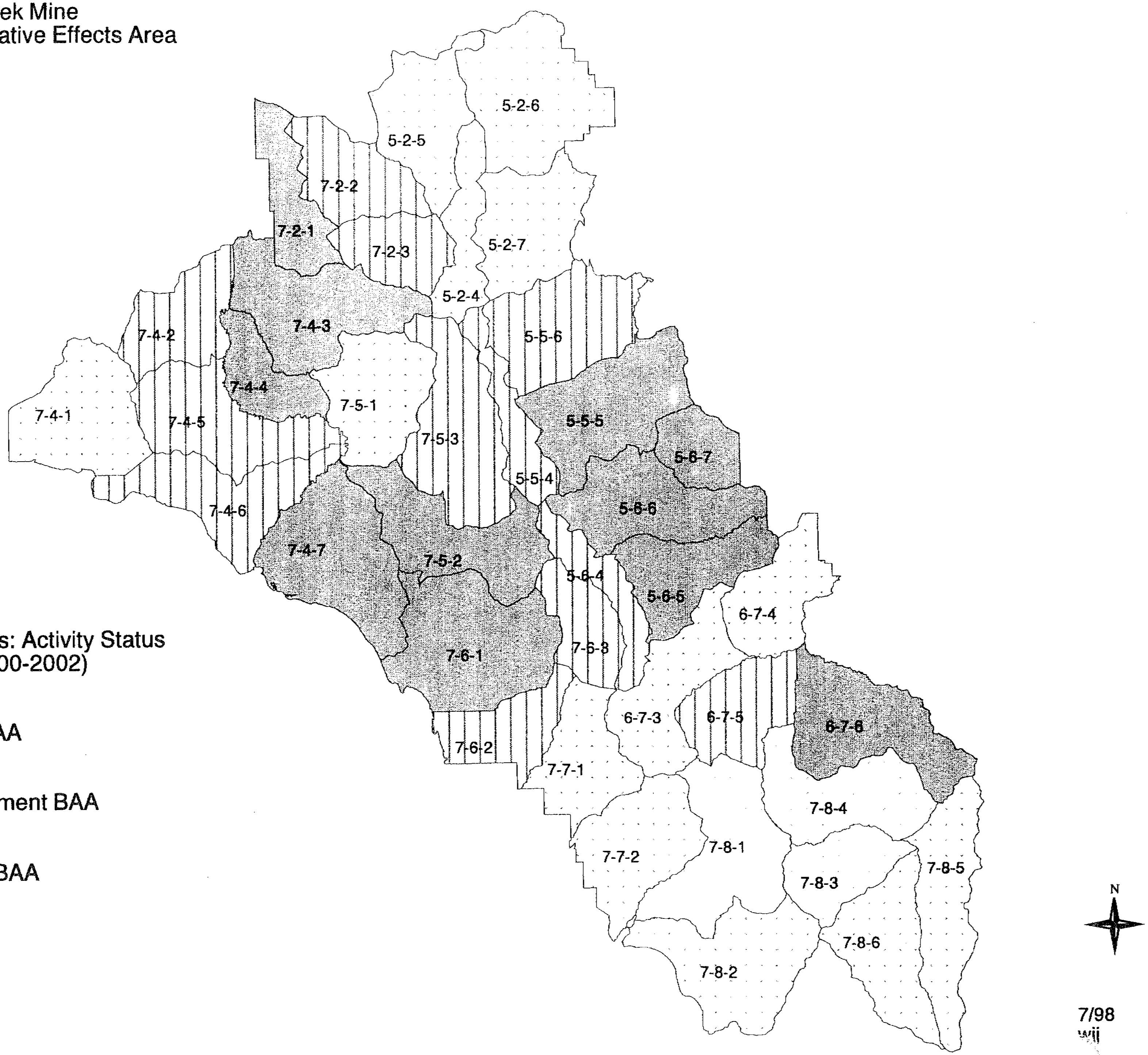
Inactive BAA

7-6-1 BAA Number

1:339078

7/98
wjj

ASARCO Rock Creek Mine
Grizzly Bear Cumulative Effects Area



Bear Analysis Areas: Activity Status
(Year = 2000-2002)

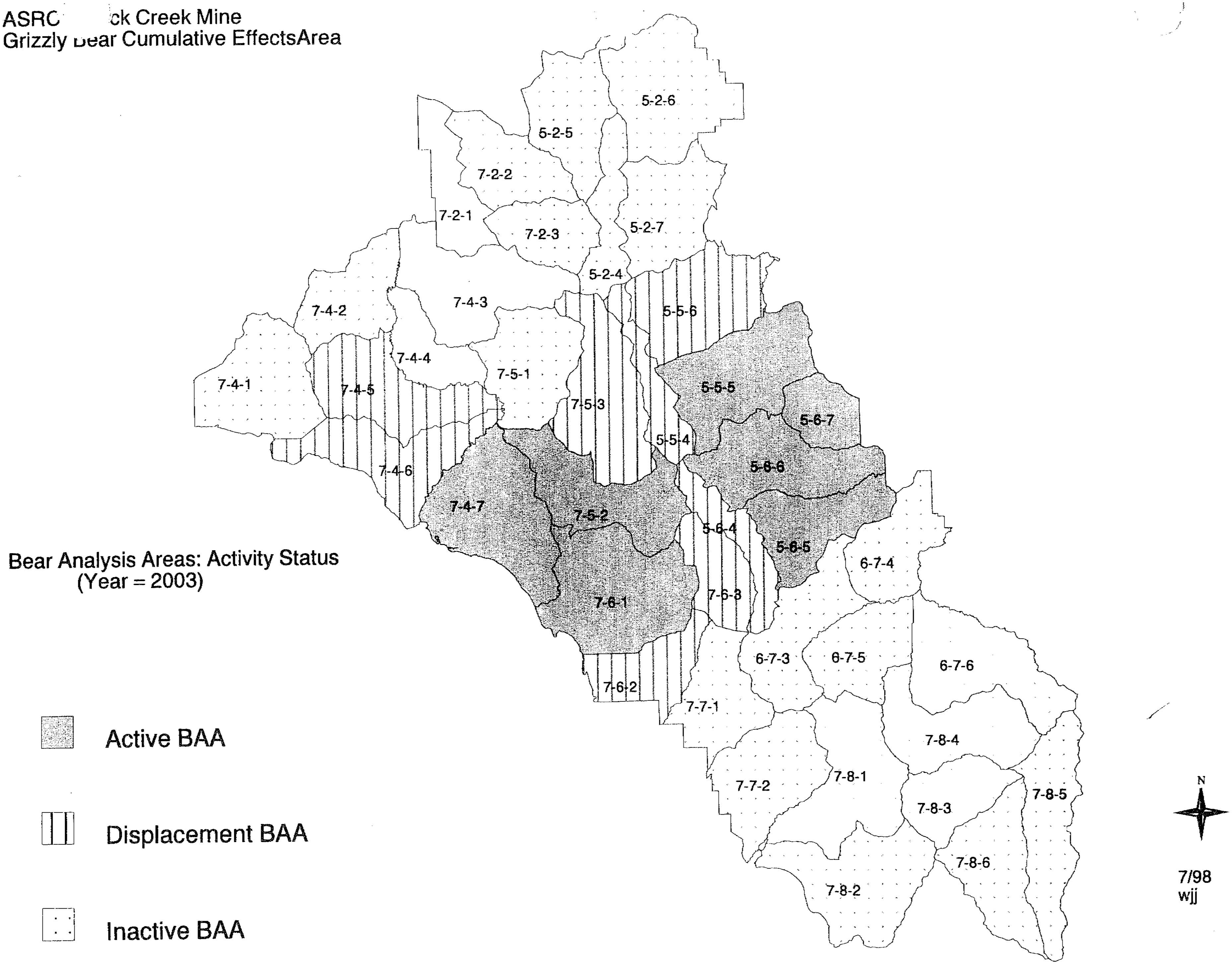
Active BAA

Displacement BAA

Inactive BAA

7/98
wjj

ASRC ck Creek Mine
Grizzly bear Cumulative EffectsArea



E-5-a-2-d

United States Department of Agriculture | Forest Service | Kootenai N. F. | 1101 US Highway 2 West
Libby, MT 59923

File Code: 2670

Date: May 13, 1999

Kemper McMaster
U.S. Fish and Wildlife Service
100 N. Park, Suite 320
Helena, MT 59601

Dear Kemper:

Attached is an updated Biological Assessment for the effects of the ASARCO Rock Creek Mine Project to the threatened bull trout. This revised BA was developed as a result of the peer review done by the Western Montana Regional Level 1 Team and their subsequent recommendations.

In consideration of the identified potential effects to bull trout and in accordance with the Endangered Species Act Section 7, I request initiation of formal consultation on the ASARCO Rock Creek Mine Project with regards to bull trout. A copy of the revised bull trout Biological Assessment is attached and is intended to replace the original bull trout BA recieved by your office on 8/3/98. The conclusion of the revised BA is that the proposed federal action may affect and is **likely to adversely affect the** bull trout.

Additional project file data and maps are available at the Kootenai National Forest Supervisor's Office. Questions on specific aspects of this revised BA can be addressed to John Carlson, KNF Supervisor's Office (406-293-6211).

Sincerely,

Bob Castaneda

BOB CASTANEDA
Forest Supervisor

BIOLOGICAL ASSESSMENT
for
BULL TROUT

Cabinet Ranger District
Kootenai National Forest

May 10, 1999

Prepared by:

Tad Deshler, Fisheries Biologist
EVS Environment Consultants, Inc.

5/10/99
Date

Reviewed by:

John Carlson, Forest Fisheries Biologist
Kootenai National Forest

5/13/99
Date

Description of Proposed Action

The proposed Federal action consists of permitting ASARCO to construct and operate the Rock Creek mine. The project lies within the Cabinet Ranger District in Sanders County, Montana, near Noxon, Montana. Alternative V, as described in the Final Environmental Impact Statement (FEIS) for the project, includes a number of protection and mitigation measures to reduce adverse impacts to bull trout (Table 1). The major modifications distinguishing this alternative from Alternative IV (the preferred alternative prior to development of Alternative V) are the deposition of tailings as a paste, an alternate water treatment system, an enclosed rail loadout facility, and relocation of the evaluation adit support facilities. Additional details on these project components are provided in the FEIS.

TABLE 1. Components of Proposed Action Which Should Reduce Impacts to Bull Trout

Project Component	Effect
Consolidation of linear disturbances (e.g., powerline, waterline, tailings line, roads)	Reduces disturbance area in riparian zone
Improve road drainage to current standards	Decreases sediment delivery to Rock Creek
Hard surfacing of FR150	Decreases sediment delivery to Rock Creek
Resurfacing and partial closure of FR150b	Decreases sediment delivery to Rock Creek
Relocation of part of FR150 away from RHCA	Reduces disturbance area in riparian zone
Stabilization of roadfill and cutbanks on FR150	Decreases sediment delivery to Rock Creek
Reduced mine traffic levels on Highway 200 and FR150 (relative to other alternatives)	Decreases sediment delivery to Rock Creek
Upgrade of bridges	Decreases sediment delivery to Rock Creek
Best management practices and revegetation of road corridor	Decreases sediment delivery to Rock Creek
Low permeability paste tailings deposit with no standing water	Reduction in risk and magnitude of effects from catastrophic failure of tailings impoundment
Reduced groundwater seepage from tailings	Reduction of potential adverse impacts from tailings leachate
Double-wall tailings pipeline	Reduction in risk and magnitude of effects of catastrophic failure of tailings pipeline
Emergency equipment (e.g., dump ponds, dikes, doublepipe stream crossings, emergency shutdown monitoring equipment)	Reduction in risk and magnitude of effects of catastrophic failure of tailings pipeline
Burial of all pipelines	Reduction in risk and magnitude of effects of catastrophic failure of tailings pipeline

TABLE 1 (cont.)

Project Component	Effect
Transport of metals concentrate via pipeline rather than by truck	Reduction in risk and magnitude of effects of concentrate spill
Three-stage treatment for discharge water	Reduction of adverse impacts from effluent discharge
Large waterbody available for dilution of discharge water	Reduction of adverse impacts from effluent discharge
Effluent outfall designed to leave a "cleanwater" migratory path to the base of Noxon Dam	Migration of bull trout should be not be obstructed
Relocation of mill to confluence of East and West Forks of Rock Creek (relative to other alternatives)	Reduction of adverse impacts in West Fork of Rock Creek
Sediment containment elements at millsite and tailings area	Decreases sediment delivery to Rock Creek
100-year flood design for all water management facilities	Risk from catastrophic flood minimized
300-foot buffer around mill site	Adverse effects from mill site to Rock Creek minimized

Description of Population and Habitat Status

I. *Population*

Historical

The historical range of bull trout was restricted to North America (Cavendar 1978, Haas and McPhail 1991). Bull trout have been recorded from the McCloud River in northern California, the Klamath River basin in Oregon and throughout much of interior Oregon, Washington, Idaho, western Montana, and British Columbia (Lee et al. 1997). Bull trout are known or predicted to occur in 45 percent of watersheds in the historical range and to be absent in 55 percent (Lee et al. 1997).

Bull trout are believed to be a glacial relict (McPhail and Lindsey 1986), and their broad distribution has probably contracted and expanded periodically with natural climate change (Williams et al. 1997). Genetic variation suggests an extended and evolutionarily important isolation between populations in the Klamath and Malheur basins and those in the Columbia River basin (Leary et al. 1993). Populations within the Columbia River basin are more closely allied and are thought to have expanded from common glacial refugia or to have maintained higher levels of gene flow among populations in recent geologic time (Williams et al. 1997).

It is unlikely that bull trout occupied all the accessible streams at any one time. Distribution of existing populations is often patchy even where numbers are still strong and habitat is in good condition (Rieman and McIntyre 1993, 1995). Habitat preferences or selection is likely important (Dambacher et al. 1997, Goetz 1994), but more stochastic extirpation and colonization processes may influence distribution even within suitable habitats (Rieman and McIntyre 1995).

Even though bull trout may move throughout whole river basins seasonally, spawning and juvenile rearing appear to be limited to the coldest streams or stream reaches. The lower limits of habitat used by bull trout are strongly associated with gradients in elevation, longitude, and latitude, that likely approximate a gradient in climate across the basin (Goetz 1994). The patterns indicate that spatial and temporal variation in climate may strongly influence habitat available to bull trout. While temperatures are probably suitable throughout much of the northern portion of the range, predicted spawning and rearing habitat are restricted to increasingly isolated high elevation or headwater "islands" toward the south (Goetz 1994, Rieman and McIntyre 1995).

Present

The Columbia River population segment of bull trout was designated by U.S. Fish and Wildlife Service for threatened listing under the Endangered Species Act on June 10, 1998 (63 FR 31647). Bull trout within this population segment are distributed in a more fragmented pattern throughout the Columbia River basin with fewer adult migratory fish and fewer or more compressed spawning reaches than existed historically.

Within the Lower Clark Fork River drainage, bull trout are believed to have been found in 86 percent of the tributary habitat, while they are presently found in 59 percent (Pratt and Huston 1993). Bull trout densities are highest in upper, high-order tributary reaches that have fairly stable channels, cobble and rubble substrates, high amounts of large woody debris (LWD), moderate to cold water temperature regimes, and low levels of fine sediment deposition and competition from other species (WWP 1996). They are most heavily concentrated within areas where either groundwater inflow is known to exist or where the potential for groundwater influences is very high. Bull trout populations in the tributaries include both resident and adfluvial life forms, often in conjunction with one another (WWP 1996).

Within the Rock Creek drainage, bull trout are distributed throughout mainstem Rock Creek, the West Fork of Rock Creek, and the East Fork of Rock Creek. Bull trout exist throughout the West Fork Rock Creek up to the water fall at river mile 1.9. This falls is a barrier to upstream migrants (Barnard and Vashro 1986). Beyond the falls there is an isolated bull trout population identified by WWP (Smith, pers. comm., March 3 1993). The upper limit of bull trout distribution in East Fork Rock Creek appears to be a waterfall located approximately 0.6 miles above the Rock Lake Trail bridge (R. Smith, Washington Water Power Co., Noxon, Montana, personal communication, July 6, 1995). Bull trout have been found in the East Fork at a sampling site downstream of this waterfall, but have not been found in Rock Creek Meadows (approximately 3.5 miles upstream from the confluence with the West Fork of Rock Creek) (Hightower 1988).

Limited fish sampling has occurred on several tributaries of Rock Creek. Engle Creek and Orr Creek have been sampled by Montana Fish, Wildlife, and Parks and no bull trout were found. Engle Creek contains primarily brook trout and a few cutthroat trout. Orr Creek contains pure strain westslope cutthroat trout (Huston 1994). Snort Creek was electrofished in 1985 and no fish were found (Barnard and Vashro 1986). Although the presence of bull trout has not been confirmed in Rock Creek tributaries,

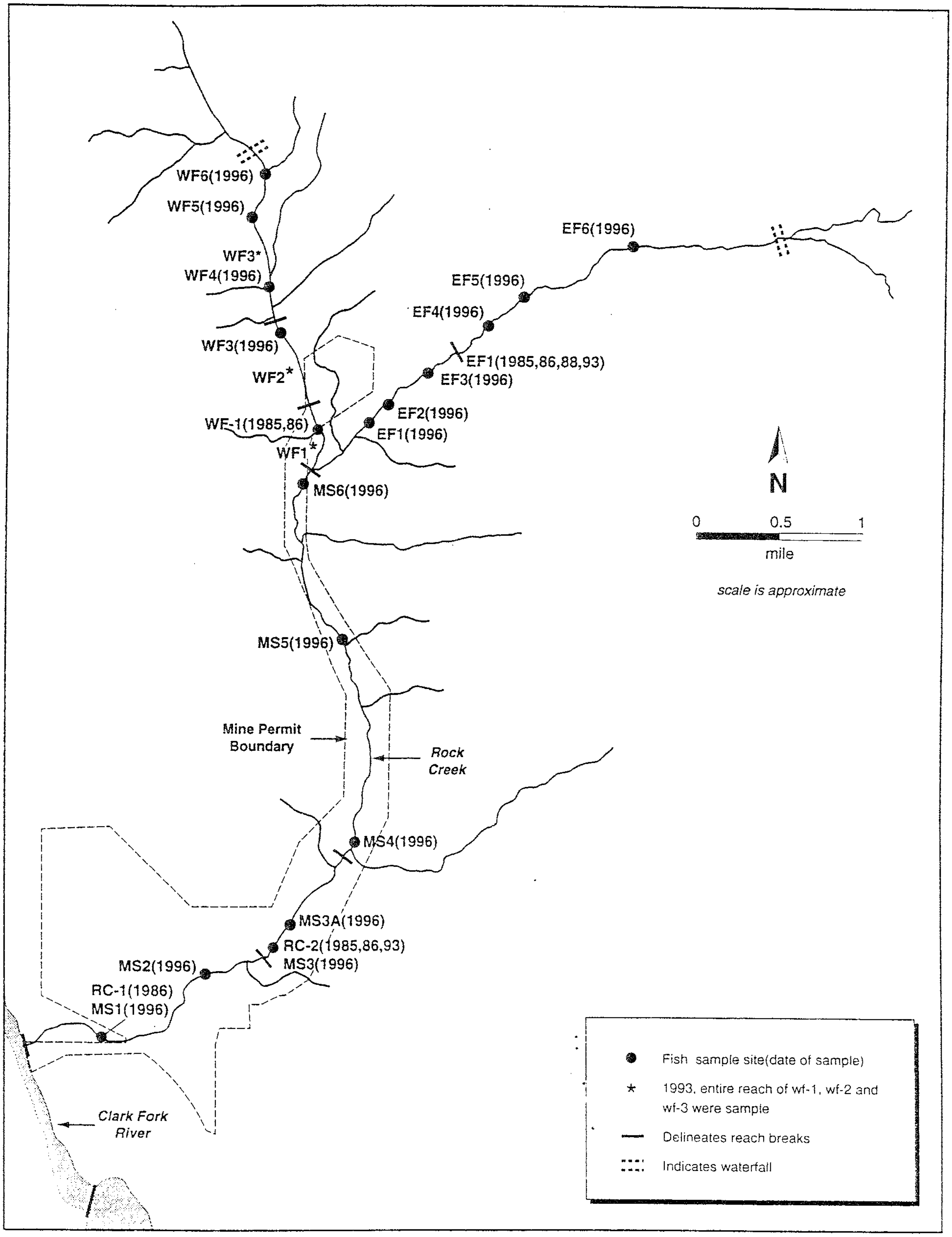


Figure 1. Stream segments and sample sites for fish
Rock Creek Project

single sampling events can not be used to confirm the absence of a particular species. Watson et al. (1997) suggest that some historical survey methods have been inadequate to detect the presence of bull trout present at low densities. None of the other tributaries to Rock Creek have been sampled for fish. Most of these streams flow intermittently with steep gradients that are unlikely to support bull trout.

Baseline fisheries data have been collected at various locations on Rock Creek through the use of electrofishing surveys (Figure 1). Results for these surveys are presented in Table 2.

Bull trout are more abundant in the West Fork and East Fork of Rock than in the mainstem. The majority of the bull trout observed in 1996 were found in the East Fork (79 percent of total bull trout). Young-of-year bull trout were sampled as far upstream as the EF4 sampling reach, suggesting that the previous year's spawning may have occurred upstream of the site (Watershed Consulting 1997). Given the relatively high stream gradient in this sampling reach, it is unlikely that young-of-year fish could have moved upstream to EF4. Spawning by bull trout within Rock Creek has not been confirmed, but data collected by Watershed Consulting (1997)(i.e., possible redds, bull trout in spawning condition, and young-of-year fish) indicate spawning has probably occurred.

There is anecdotal evidence of bull trout migration from Cabinet Gorge Reservoir into Rock Creek, presumably for spawning. Hightower and Vashro (1987) collected a 27-inch bull trout that appeared to be from Cabinet Gorge Reservoir at section RC-2. Other large bull trout have also been documented in Rock Creek (Joe Huston, Department of Fish, Wildlife and Parks, personal communication, March 9, 1995). Although a small number of large bull trout which presumably migrated from Cabinet Gorge Reservoir have been observed in Rock Creek, spawning by these individuals in Rock Creek has not been documented. Four bull trout were tagged in May 1994 and observed until September 1995 (Avista 1999). None of these fish were observed in Rock Creek, although they did show a strong preference for cold water (<9°C) located at the mouth of Pilgrim Creek and in the tailrace of Noxon Rapids Dam. Both these locations are located within 2 miles of Rock Creek.

A likely limiting factor for fish in this drainage is the three intermittent stream segments, RC-1, RC-4, and WF-1. In most years, these segments are dry for at least a portion of the summer or fall (Hydrometrics 1998). The cause of Rock Creek dewatering is the subject of much debate - climate change, riparian logging, geologic events, and the 1910 wildfire and subsequent floods are all considered possible reasons for the "stressed" condition. WWP (1996) indicated that the flows at the mouth of Rock Creek in recent years have been insufficient to allow upstream passage of fall-spawning bull trout from the reservoir. However, the precise timing of bull trout spawning in Cabinet Gorge tributaries (including Rock Creek) has not been determined. During December 1993, a bull trout redd was observed in the lower reach of Rock Creek even though the stream had been dry downstream of this point since early June (WWP 1996). The suggests that bull trout may move into Rock Creek in the spring or early summer, well before they spawn in the late summer.

TABLE 2. Bull Trout Density Estimates in Rock Creek, 1985-1996

Section (Date Sampled)	Source	# Fish/100 sq. ft.	Percent of all fish that were bull trout	Other species present
RC-1 (8/4/86)	2	0.08	9	Ct, Br
RC-2 (10/30/93)	4	0.04	2	Ct, Br
RC-2 (8/5/86)	2	0.09	5	Ct, Br
RC-2 (7/22/85)	1	0.03	1	Ct, Br
RC-4 (8/8/86)	2	0.08	23	Ct, Br
RC-4 (8/7/85)	1	0.07	18	Ct
WF-1[a] (11/19/93)	4	1.2	57	Ct
WF-2[a] (11/19/93)	4	1.1	60	Ct
WF-3[a] (11/19/93)	4	1.1	57	Ct
WF-1[b] (11/19/93)	4	0.22	76	Ct
WF-1 (7/31/86)	2	0.19	70	Ct
WF-1 (7/25/85)	1	0.34	82	Ct
EF-1 (10/30/93)	4	0.44	19	Ct
EF-1 1988	3	0.40	31	Ct
EF-1 (8/7/86)	2	0.99	30	Ct
EF-1 (8/22/85)	1	0.30	25	Ct
MS3 (8/29/96)	5[c]	0.11	8	Ct, Br
EF1 (9/9/96)	5[c]	0.22	18	Ct
EF2 (9/10/96)	5[c]	0.41	18	Ct
EF3 (9/10/96)	5[c]	0.39	24	Ct
EF4 (9/11/96)	5[c]	0.72	42	Ct
EF5 (9/11/96)	5[c]	0.41	26	Ct
EF6 (9/12/96)	5[c]	0.13	9	Ct

Sources: 1=Barnard and Vashro 1986; 2=Hightower and Vashro 1987; 3=Hightower 1988; 4=WWP 1996; 5=Watershed Consulting 1997.

Ct = Westslope cutthroat trout, Br = Brook trout

[a] WF-1 = mouth to RM 0.37, WF-2 = RM 0.37 to RM 0.50; WF-3 = RM 0.50 to RM 0.74

[b] WF-1 includes small sample site sampled in 1985 and 1986

[c] Sampling locations from Watershed Consulting (1997) different from all locations sampled previously; population estimates recalculated by excluding fish < 75 mm in length to be consistent with reporting conventions of other sampling events

Summary of Environmental Baseline—Species

The U.S. Fish and Wildlife Service (USFWS) has established four species-level "condition indicators" relevant to the evaluation of environmental baseline conditions for bull trout (USFWS 1998). These indicators are (1) subpopulation size, (2) growth and survival, (3) life history diversity and isolation, and (4) persistence and genetic integrity. For each of these indicators, the following summary indicates whether the baseline conditions are functioning appropriately, functioning at risk, or functioning at unacceptable risk. Given that the monitoring data for Rock Creek is somewhat limited, particularly for redd counts, the conclusions given below are associated with a rather high degree of uncertainty.

Subpopulation size. The bull trout subpopulation under consideration in this assessment is that which either resides in or migrates to and from the Rock Creek drainage. Population estimates for age 1+ fish in this stock range from 1,900 to 2,600 (WWP 1996). This represents the highest abundance for this species of any tributary in the Lower Clark For River drainage (WWP 1996). Although Rieman and McIntyre (1993) suggest that extinction risk is reduced considerably for populations greater than 2,000 individuals, low habitat complexity, limited availability of suitable spawning and rearing habitat, stream intermittency, and the absence or rarity of the adfluvial form indicate the Rock Creek population remains largely isolated and vulnerable to extinction due to random events. Consequently, the subpopulation is considered to be functioning at risk.

Growth and survival. Monitoring data indicate that the abundance of the resident component of this subpopulation may be stable (Table 2), but the adfluvial component is absent or rare (WWP 1996). Estimates of growth rates and survival have been made for bull trout from Rock Creek (WWP 1996). The average size of age 1+ and 3+ fish was 66 and 157 mm, respectively. The instantaneous survival of age 3+ fish was estimated at 23 percent. These growth and survival estimates are lower than estimates from other tributaries in the Lower Clark Fork River drainage (WWP 1996). Under current management, the subpopulation condition is not likely to improve within 2 generations (5 to 10 years). Therefore, this condition factor is considered to be functioning at unacceptable risk.

Life history and diversity. As indicated above, the adfluvial component is absent or rare. This indicates that this condition indicator is considered to be functioning at unacceptable risk.

Persistence and genetic integrity. Brook trout are relatively abundant in Rock Creek and may compete and hybridize with bull trout. This fact, coupled with the lack of connectivity with other subpopulations, indicates that this condition indicator is considered to be functioning at unacceptable risk.

II. *Habitat*

Habitat Relationships

Bull trout appear to have more specific habitat requirements than other salmonids (Rieman and McIntyre 1993). Habitat characteristics including water temperature, stream size, substrate composition, cover and hydraulic complexity have been associated with the distribution and abundance of this species (Dambacher et al. 1997, Jakober 1995, Rieman and McIntyre 1993).

Stream temperatures and substrate composition may be particularly important characteristics of suitable habitats. Bull trout have repeatedly been associated with the coldest stream reaches within basins. Goetz (1994) did not find juvenile bull trout in Oregon mountain streams with water temperatures above 12 °C. Temperature also appears to be a critical factor in the spawning and early life history of bull trout. Bull trout in several different basins spawned when temperature dropped below 9 to 10 °C (Fraley and Shepard 1989, McPhail and Murray 1979). Survival of bull trout eggs is inversely proportional with water temperature. Egg development and survival to hatching appear to require temperatures below 6 °C

(McPhail and Murray 1979, Weaver and White 1985).

Bull trout are more strongly tied to the stream bottom and substrate than other salmonids (Pratt 1992). Substrate composition has repeatedly been correlated with the occurrence and abundance of juvenile bull trout (Dambacher et al. 1997, Rieman and McIntyre 1993) and spawning site selection by adults (Graham et al. 1981, McPhail and Murray 1979). Fine sediments can influence incubation survival and emergence success (Weaver and White 1985), but might also limit access to substrate interstices that are important cover during rearing and overwintering (Goetz 1994, Jakober 1995). Weaver and Fraley (1991 and 1993) found that the higher the percent of the spawning substrate less than 0.25 inch in diameter, the lower the survival-to-emergence success of bull trout and westslope cutthroat trout. Experimental data indicated greater than 75 percent survival when there were no sediments below this diameter threshold, but less than 50 percent survival when incubation sediments have more than 18 percent fines less than 0.25 inch in diameter (Weaver and Fraley 1991, 1993).

Bull trout usually associate with complex forms of cover and with pools (Rieman and McIntyre 1993). Pools are especially important during winter, where they may provide overwintering habitat to both adults and juveniles in mountainous regions where river flow reaches an annual low (Boag and Hvenegaard 1997). Woody debris often correlates with bull trout abundance, but habitat complexity in any form can be just as important (Rieman and McIntyre 1993).

Habitat Conditions - Rock Creek

Rock Creek is characterized by soft water with low or nondetectable levels of oil and grease, nutrients, and metals. During baseline studies, the average hardness of water in Rock Creek was about 10 mg/L. Overall productivity of the stream is low. All water quality constituents are well within the range of concentrations established to protect uses such as drinking water, recreation, irrigation, and livestock watering. The concentrations of some metals have occasionally exceeded numeric water quality standards. This is due to extremely low hardness. (Water quality criteria for many metals are proportional to water hardness). No metal toxicity to aquatic life has been documented in Rock Creek.

Mainstem Rock Creek has an average gradient of 5.2 percent (WWP 1996). Several sections of the mainstem have intermittent streamflow. At RM 1.7 on the mainstem, flows are perennial and ranged from 3.5 cfs in February 1994 to 81 cfs in April 1994 (WWP 1996). Substrate in the lower reaches is comprised of high amounts of gravel (WWP 1996). Substrate is relatively unstable and there is considerable bedload movement. Spawning habitat is limited to isolated pockets of gravel behind stable debris or boulders above the confluence of Engle Creek. Below Engle Creek, spawning habitat was found behind stable debris and boulders as well as some side and main-channel depositional areas. A major source of these gravels and fine sediments is a large eroding bank located about 0.2 miles up Engle Creek (WWP 1996)

Sediment core samples (to 6 inches deep) were collected and analyzed from the perennial reach of Rock Creek just downstream from the confluence of Engle Creek (station RC-2) on several occasions since 1988 (Table 3). The mean percentage of sediment less than 0.25 inch in diameter was not significantly different ($p > 0.05$) from 1988-1991 at station RC-2. The overall mean and median percentage for the four years of data was 28.1 and 24.8 percent, respectively (Table 3). The overall mean percentage from station RC-2 was significantly less ($p < 0.05$) than the mean percentage (41.8 percent) determined from samples collected by WWP (1996) from a reach which includes river both above and below the confluence of Engle Creek. Based on data presented by Weaver and Fraley (1991 and 1993), survival to emergence in the portion of Rock Creek downstream of Engle Creek is predicted to range from 16 percent (for WWP data) to 40 percent (for station RC-2 data) for bull trout who could potentially be reared in this gravel. These survival-to-emergence estimates should not be extrapolated to other portions of Rock Creek because of the lack of sediment core data in other areas.

TABLE 3.
Percentage of Mainstem Rock Creek Sediments[1] Less than 0.25 Inch Diameter

Station	Date	Number of Replicates	Mean	Median	Standard Deviation
RC-2 [2]	Aug-88	8	37.5	43.1	16.9
RC-2	Aug-89	8	22.6	24.8	10.3
RC-2	Nov-90	8	26.5	25.3	7.9
RC-2	Aug-91	10	26.4	15.4	24.3
RC-2	All 4 years	34	28.1	24.8	16.9
RC-reach2 [3]	Oct-93	12	41.8	43.1	10.5

1 Sediment samples taken by McNeil core sampler
2 RC-2 located just downstream of confluence with Engle Creek; sampled by Hydrometrics (1989, 1990, 1992)
3 Reach 2 extends from canyon located at RM 1.9 to confluence of East and West Forks of Rock Creek; sampled by WWP (1996)

Surface fines in sediment (less than 0.25 inch diameter) were also measured in mainstream Rock Creek by WWP (1996) and Watershed Consulting (1997). The methods used to measure surface fines are visual as opposed to the gravimetric method (using sieves and a balance) used to analyzed core samples. The relationship between fine sediments and fry survival-to-emergence developed by Weaver and Fraley (1991, 1993) should not be used for surface fines data. The percentages of surface fines measured in 1993 were 22 percent in reach one and 9 percent in reach two (WWP 1996). The sampling station in reach 2 was relatively close to station RC-2 from which sediment core data were also analyzed. A comparison of the surface fines from mainstem reach 2 (WWP 1996) and station RC-2 (Table 3) indicates that fine sediment is more prevalent in the deeper sediments. This relationship may not hold at all sites. In 1996, the percentages ranged from 0 to 22.6 over eight stations, with a mean of 10 percent (Watershed Consulting 1997).

The mainstem of Rock Creek contains a relatively low amount of LWD relative to other watersheds in the Lower Clark Fork River drainage (WWP 1996). The total number of LWD pieces per 100 feet is only 15 percent of the average value for other pristine reaches in the Kootenai National Forest (Watershed Consulting 1997).

East Fork Rock Creek begins at Rock Lake. Below Rock Creek Meadows, it is a steep gradient (average 10.4 percent), perennial stream with a partially closed coniferous overstory and overhanging deciduous understory. There is a low gradient section in Rock Creek Meadows, below Rock Lake (Farmer et al. 1986). The East Fork contains considerable amounts of LWD. The substrate consists primarily of large cobble and boulders with relatively little bedload movement. The percentage of surface fines averages 1 percent (Watershed Consulting 1997). Stream banks are stable with some channel braiding. Spawning habitat is limited to pockets of gravel behind stable debris or boulders (WWP 1996).

West Fork Rock Creek's gradient is highly variable, but averages 7.3 percent. It has a generally closed coniferous overstory and shrub understory along its entire length (Farmer et al. 1986). Stream banks are stable with some channel braiding. The entire lower reach (0.4 miles) of the West Fork is intermittent, as is 21 percent of the middle reach (0.4 miles) (WWP 1996). Mean monthly flow during 1994 was as high as 25 cfs (WWP 1996).

The West Fork of Rock Creek contains very high amounts of stable LWD. A potential fish passage barrier consisting of LWD mixed with gravel exists 0.75 mile upstream from the mouth of the West Fork (Smith, pers. comm., March 3, 1994). Substrate primarily consists of small cobble and gravel with relatively little bedload movement. The percentage of surface fines average less than 7 percent (Watershed Consulting 1997). Spawning habitat is present in the form of pockets of gravel behind and above stable debris or boulders and in the main channel depositional areas. The median percent of substrate less than 0.25 inches ranged from 24.2 to 27.4 percent at the two sample sites (Table 4), which were statistically indistinguishable from each other ($p > 0.05$). Based on the median percent fines value for the two stations combined (26.5 percent), survival to emergence in West Fork of Rock Creek is predicted to be 38 percent for bull trout, should spawning occur there.

TABLE 4.
Percentage of West Fork Rock Creek Sediments[1] Less than 0.25 Inch Diameter

Station	Date	Number of Replicates	Mean	Median	Standard Deviation
WRC-reach 1 [2]	Oct-93	12	30.0	27.4	6.4
WRC-reach 2 [3]	Oct-93	12	28.2	24.2	10.9
both stations	Oct-93	24	29.1	26.5	8.8

[1] = Sediment samples taken by McNeil core sampler
[2] = reach 1 extends from confluence with mainstem to RM 0.4; sampled by WWP (1996)
[3] = reach 2 extends from RM 0.4 to RM 0.6; sampled by WWP (1996)

Summary of Environmental Baseline—Habitat
The USFWS (1998) has established 19 watershed-level "condition indicators" relevant to the evaluation of environmental baseline conditions for bull trout. These indicators are presented in Table 5.

TABLE 5.
Watershed Condition Indicators for Bull Trout (USFWS 1998)

Category	Indicator
Water Quality	Temperature
	Sediment in areas of spawning and incubation
	Nutrients and contaminants
Hydrologic	Peak and base flows
	Increase in drainage network
Geomorphic	Pool width/depth
	Streambank condition
	Floodplain connectivity
Habitat	Substrate embeddedness in rearing areas
	Large woody debris
	Pool frequency
	Pool quality
	Off-channel habitat
	Prime habitat
Accessibility	Physical barrier
Watershed	Road density and location
	Disturbance history
	Riparian Habitat Conservation Areas
	Disturbance regime

For each of these indicators, the following summary indicates whether the baseline conditions are functioning appropriately, functioning at risk, or functioning at unacceptable risk.

Temperature. Existing monitoring data indicate that the temperature regime within Rock Creek is as follows: 12°C or less during the summer, 9°C or less during the spring and fall, and 5°C or less during the winter (WWP 1996). Consequently, this condition indicator is considered to be functioning appropriately.

Sediment in areas of spawning and incubation. Sediment conditions for this factor can be evaluated using sediment fines data from subsurface core samples. The percentages of sediment fines in the lower end of the West Fork of Rock Creek and the mainstem near Engle Creek are relatively high (Tables 3 and 4), but have not been measured in any other area. Although spawning has not been documented in the areas where sediment cores were taken, the abundance of spawning gravels is highest in these reaches. Spawning gravels in Rock Creek are rare due to the high abundance of large cobble and boulders (Watershed Consulting 1997). Therefore, this condition indicator is considered to be functioning at risk.

Nutrients and contaminants. Nutrients and metals generally occur at low levels within Rock Creek, although EPA freshwater chronic aquatic life criteria for cadmium, copper, lead, and zinc were exceeded occasionally during baseline monitoring surveys. The exceedances are related to the extremely low hardness of Rock Creek, and the hardness dependence of the standards for these metals. Because of these natural exceedances, this condition indicator is considered to be functioning at risk.

Peak and base flows. Below the confluence of the East and West forks of Rock, the flow in Rock Creek often sinks into the coarse alluvial material during low-flow periods. The intermittency of flow in this part of the watershed indicates that this condition indicator is functioning at unacceptable risk.

Drainage network. According to road survey data collected by the Cabinet Ranger District, some of the roads along the West Fork of Rock Creek lack relief culverts and the appropriate application of best management practices (BMPs). Accordingly, this condition indicator is considered to be functioning at risk for the drainage as a whole.

Pool width/depth. Although data collected by Cabinet Ranger District indicate the pool width to depth ratio is greater than 10, suggesting less than optimal conditions, this criterion may be inappropriate for }C~ type channels (Rosgen 1994). Therefore, based on professional judgement this condition indicator is considered to be functioning appropriately.

Streambank condition. Recent monitoring data suggests that alluvial terraces in Rock Creek are being undermined (Watershed Consulting 1997). Consequently, this condition indicator is considered to be functioning at risk.

Floodplain connectivity. Existing data are inadequate to make definitive statements about this indicator. However, professional judgement suggests that the cedar/hemlock reaches within Rock Creek should have a higher water table than is evident. This suggests that this condition indicator is functioning at risk

Substrate embeddedness in rearing areas. With the exception of small areas in the West Fork of Rock Creek and at the mouth of Engle Creek, the percentage of fine-grained particles in surface substrate is generally very low in Rock Creek (WWP 1996, Watershed Consulting 1997). Although embeddedness has not been specifically estimated during Rock Creek field surveys, it is generally closely related to the percentage of surface fines. Overall, the embeddedness of the entire watershed is estimated to be less than 20 percent, indicating that this condition indicator is functioning appropriately.

Large woody debris. Although the East and West Forks of Rock Creek contain relatively large amounts of LWD, the mainstem reach of Rock Creek should have a higher loading rate of LWD than is evident. Consequently, this condition indicator is considered to be functioning at risk.

Pool frequency. Pool frequency in Rock Creek is similar to other tributaries of the Lower Clark Fork River (WWP 1996). Pool frequency within the mainstem reach of Rock Creek is similar to the frequency in the West and East forks, but there has been a moderate reduction in pool volume due to fine sediment loading. Therefore, this condition indicator is considered to be functioning at risk.

Pool quality. Professional judgement suggests that existing pools, particularly in mainstem Rock Creek, are too wide, shallow, and lacking in cover due to the low levels of LWD. Therefore, this condition indicator is considered to be functioning at risk.

Off-channel habitat. Professional judgement indicates that cedar/hemlock reaches should have more off- channel habitat than is evident in Rock Creek. Consequently, this condition indicator is considered to be functioning at risk.

Prime habitat. Important bull trout refugia are periodically disconnected due to intermittency at baseflow. The riparian habitat has still not completely recovered from historical timber harvesting in the watershed. Therefore, this condition indicator is considered to be functioning at unacceptable risk.

Physical barriers. The dewatering that occurs at the mouth of Rock Creek may inhibit the migration of bull trout from Cabinet Gorge Reservoir to Rock Creek at certain times of year, particularly the summer months. However, the specific timing of bull trout migration to Rock Creek, to the extent it even exists, has not been determined. Tagged bull trout from Cabinet Gorge Reservoir have not been observed entering Rock Creek (Avista 1999). Because of the importance of access in determining the success of this subpopulation, this condition indicator is considered to be functioning at risk.

Road network. Data collected by the Cabinet Ranger District indicate that the road density within the watershed is between 1.5 and 3.0 road miles/mi^2. Some of these roads parallel the stream. Consequently, this condition indicator is considered to be functioning at risk.

Disturbance history. Kootenai National Forest conducted sediment load modeling using the R1-WATSED model. Included in this model are data on the disturbance history (e.g., road construction and reconstruction, logging, fires) in the watershed. Based on this historical record, the equivalent clearcut area (ECA) of the affected areas is less than 15 percent and there have been some localized channel adjustments. Therefore, this condition indicator is considered to be functioning at risk.

Riparian Habitat Conservation Areas (RHCA). Portions of FR 150 (an existing road) are currently within the RHCA for Rock Creek (see Figure 4-3 in the FEIS). The project proposal is to reconstruct the lower portion of this road (to be called road 150B), around the south end of the tailings impoundment to a single-lane 14-foot paved road. Rd 150 is within the RHCA for an approximate distance of 0.3 mi. Road 150 will be reconstructed to a paved, two-lane road. Rd 150 is within the RHCA for a distance of approximately 0.2 mi. Paving both the road sections that are within the RHCA may reduce sediment production. However, there has been a moderate loss of connectivity and incomplete protection of prime habitat within the RHCA. Consequently, this condition indicator is considered to be functioning at risk.

Disturbance regime. Because of the intermittency of lower Rock Creek, the ability of the watershed to recover from disturbance is compromised. Therefore, this condition indicator is considered to be functioning at risk.

Analysis of Direct, Indirect, and Cumulative Effects

I. *Evaluation Framework*

In anticipation of the final threatened listing for the Columbia River bull trout population segment, the USFWS (1998) developed a framework for making Endangered Species Act (ESA) determinations for individual or grouped actions at the subpopulation watershed scale. The framework was patterned after a similar framework developed by the National Marine Fisheries Service (NMFS) to determine the effects of actions on listed anadromous fish species. The framework contains the following items: (1) definitions of ESA effects and examples of effects determinations, (2) a matrix of effects and indicators of those effects, (3) a checklist for documenting the environmental baseline and effects of the proposed action on the relevant indicators, and (4) a dichotomous key for making determinations of effect and documenting expected incidental take. The matrix reflects the information needed to evaluate effects of proposed and on-going land management actions of the U.S. Forest Service and U.S. Bureau of Land Management on the persistence and potential recovery of listed bull trout subpopulations. Determinations of effect will depend on whether a proposed action hinders the attainment of relevant environmental conditions and further impacts the status of a bull trout subpopulation, and/or results in }take~ of a proposed or listed species, as defined in the ESA.

The matrix developed by Fish and Wildlife Service was modified slightly by fisheries biologists in the Kootenai National Forest to reflect local conditions. The various forms that make up the matrix have been completed for this project and form the basis for the analysis presented below.

II. *Direct/Indirect Effects*

Habitat Effects

To evaluate the effects of the project on bull trout habitat, each of the 19 evaluation criteria listed in Table 5 were applied to the bull trout migration corridor (i.e., the mainstem intermittent reaches), the spawning and incubation habitat (i.e., the perennial reaches in the mainstem and East and West forks), and the rearing habitat (i.e., Cabinet Gorge Reservoir). For each of these criteria, the following summary indicates whether implementation of the project will restore, maintain, or degrade the baseline conditions for each watershed indicator. In a related evaluation, it was determined that for each watershed indicator, the proposed action was consistent with INFISH objectives.

Temperature. Implementation of the preferred alternative will lead to a minor increase in right-of-way clearing (i.e., logging) within the RHCA due to the construction of roads, powerlines, and pipelines. Much of the logging has already occurred on land owned by ASARCO. Although no temperature data have been collected since the logging occurred, this activity may have resulted in a minor increase in temperature around the junction between the East and West Forks of Rock Creek and the original FR 150 stream crossing. The temperature increase was likely unmeasureable because of the natural variability in this parameter. The temperature increase may have caused an unmeasurable degradation to the migration corridor and spawning/incubation habitat, but should not have affected rearing habitat.

There may be areas within Rock Creek where groundwater joins with surface water in the form of springs and seeps. The groundwater recharge tends to provide a cooling effect to surface water in the summer and a warming effect in the winter because the temperature profile of the groundwater is less variable compared to surface water. Areas of groundwater upwelling are often preferred spawning locations for bull trout. At peak production, more than 2,000 gpm of groundwater are predicted to seep into the mine workings. Since the amount of groundwater discharged to Rock Creek has not been estimated, the effect of this groundwater seepage on the discharge of groundwater to surface water is difficult to predict. Some of the groundwater entering the mine workings could ultimately be discharged through adit openings to Rock Creek via overland flow, but this volume should be insignificant compared to typical surface water flow rates in Rock Creek. Given the fact that the areal extent of mine operations would only be 2 percent of the entire watershed, groundwater seepage to mine workings should be insignificant relative to other sources of groundwater inflow to Rock Creek. Therefore, temperature should be unaffected by this removal of groundwater to the mine workings. Overall, clearing within the riparian zone and removal of groundwater to the mine workings are likely to maintain baseline conditions for this watershed indicator.

Sediment in areas of spawning and incubation. At the height of construction for the preferred alternative, fugitive sediment loading is predicted to increase (using the Forest Service model R1-WATSED) 46 percent in the West Fork of Rock Creek, 20 percent in East Fork of Rock Creek, and 38 percent overall for the entire Rock Creek watershed. These estimates do not include proposed mitigation activities which would occur before, during, and after construction. These short-term increases should be offset by long-term benefits from road surfacing, road upgrades to meet current standards, and a sediment abatement program that eliminates existing streambank and floodplain sediment sources. Over the long-term, there should be a measurable improvement in water quality due to reduced sediment loading. In spite of the predicted long-term improvement, pulses of sediment from reconstruction of some stream crossings, plus road reconstruction and sediment abatement efforts may degrade baseline conditions for this indicator over the short-term. Over the long-term, baseline conditions should be restored.

Nutrients and contaminants. Discharge of project-related water to waterbodies in the Rock Creek watershed will be strictly limited in the preferred alternative. Water will be discharged to Cabinet Gorge Reservoir following treatment by either a biotreatment or reverse osmosis system according to the MPDES permit obtained by ASARCO. Unmeasurable increase of nutrients and metals within the reservoir (e.g., rearing habitat) could result. Seepage of storm water or excess water from the dewatered tailings from the paste facility to groundwater should not exceed 30 gpm throughout the life of the mine. Stormwater from the reclaimed portion of the paste impoundment will be discharged to Miller Gulch and Rock Creek only after being mixed with stormwater from undisturbed areas upslope of the paste facility. Seepage water could adversely affect the groundwater (and indirectly the surface water) due to the presence of elevated nitrate and manganese, although the effect on the migration corridor is not likely to be measurable. Any increase in metals loading to Rock Creek from groundwater recharge will adversely affect bull trout because of the extremely low hardness of the surface water. The naturally low concentrations of calcium and magnesium in Rock Creek surface waters will cause fishes in the stream to be extremely susceptible to metals toxicity, particularly aluminum, copper, lead, cadmium and zinc. Acute toxicity will occur even at what might be considered trace concentrations under the existing soft water conditions. Seepage water may improve the quality of groundwater for other substances (e.g., phosphorus and zinc) because concentrations in seepage water are predicted to be lower than ambient concentrations. There is not likely to be any effect on spawning and incubation habitat because no water will be discharged to these regions. Overall, seepage from the paste facility and discharge of storm water to Rock Creek should maintain baseline conditions for this watershed indicator. It is possible that pipeline leakages or ruptures could occur during the life of the mine and could degrade the function of this indicator, but the frequency of these catastrophic events cannot be predicted.

Peak and base flows. Peak flows were modeled for the life of the project using the Forest Service model R1-WATSED. Modeled peak flows are not predicted to increase at all during the life of the project and are predicted to drop by 2 percent in the West Fork of Rock Creek and by 1 percent for the entire Rock Creek drainage by the year 2031 (end of project) due to vegetation recovery. Initial model validation efforts conducted by the Kootenai National Forest indicate that the water yield portion of the model displays good correlation between collected data and model predictions. Model predictions suggest an unmeasurable improvement for both the migration corridor and incubation/spawning habitat and no effect on rearing habitat. The very small to nonexistent changes to peak flows indicate that implementation of the preferred alternative will maintain baseline conditions for this watershed indicator.

Drainage network. Implementation of the preferred alternative is not expected to alter the existing drainage network (e.g., road ditches, clear cuts) in any way. Consequently, baseline conditions for this watershed indicator should be maintained.

Pool width/depth. The existing depth or width of pools may be slightly reduced by the increased sediment loading associated with construction. Over the long-term sediment loading is expected to be reduced from baseline conditions, but there is no guarantee that sediment added to pools during construction will be removed from the system. Consequently, construction effects are likely to degrade baseline conditions for this watershed indicator.

Streambank condition. The proposed sediment abatement program will treat existing streamside sediment sources through stabilization, armoring, and revegetation. While the reduction in sediment loading could be significant, the overall abundance of unstable streambanks is generally low within the drainage. Therefore, mitigation should result in an unmeasurable improvement in both the migration corridor and incubation/spawning habitat. There is likely to be no effect on rearing habitat. Overall, geomorphic impacts to streambank condition are likely to maintain baseline conditions for this watershed indicator.

Floodplain connectivity. Implementation of the preferred alternative is not expected to alter the extent to which off-channel habitat is connected to main-channel habitat in any way. Consequently, baseline conditions for this watershed indicator should be maintained.

Substrate embeddedness in rearing areas. According to the preferred alternative, sediment abatement will be implemented both before and during the project construction period. On a drainage-area wide basis, these mitigation measures are designed to offset increases in sediment loading that would otherwise be expected to occur and should also minimize any unavoidable short-term increase in fugitive sediment. All such short-term increases can not be prevented, however. On a very localized scale, fine sediment levels may increase during project construction. To the extent that fine sediment levels are increased over the short-term in bull trout rearing areas, the baseline condition for this watershed indicator would be degraded.

Large woody debris. Implementation of the preferred alternative is not expected to alter the amount or quality of instream LWD in any way. Consequently, baseline conditions for this watershed indicator should be maintained.

Pool frequency and quality. Implementation of the preferred alternative is not expected to alter pool frequency and quality in any way. Consequently, baseline conditions for this watershed indicator should be maintained.

Off-channel habitat. Implementation of the preferred alternative is not expected to effect off-channel habitat (e.g., shallow backwaters, low velocity overflow channels) in any way. Consequently, baseline conditions for this watershed indicator should be maintained.

Prime habitat. Implementation of the preferred alternative is not expected to effect prime habitat (e.g., deep pools, groundwater channels, off-channel habitats, winter habitats) in any way. Consequently, baseline conditions for this watershed indicator should be maintained.

Physical barriers. Implementation of the preferred alternative is not expected to alter physical barriers in any way. Consequently, baseline conditions for this watershed indicator should be maintained.

Road network. The hard surfacing of some roads, together with construction that will bring them up to present standards for drainage control and revegetation, should result in short-term unmeasurable degradation to both the migration corridor and incubation/spawning habitat. Over the long-term, there should be an unmeasurable improvement in both these habitat types. Also, restrictions on the lower end of FR150 and relocation of road 150 will reduce indirect and cumulative effects of FR150 in the RHCA. Project activities should have no effect on rearing habitat. Overall, road reconstruction should maintain baseline conditions for this watershed indicator.

Disturbance history. Implementation of the preferred alternative will not change the acreage of roads and amount of deforested riparian lands in any way. Consequently, baseline conditions for this watershed indicator should be maintained.

Riparian Habitat Conservation Areas (RHCA). In the short-term, road reconstruction will occur within the RHCA (see Figure 4-3 of the FEIS). INFISH Standard MM-2 specifies that adverse impacts to riparian zones and fish from the construction of roads and facilities should be avoided. Through relocation of some activities and additional sediment mitigation, implementation of the preferred alternative would meet this standard. Over the long-term, there should be an unmeasurable improvement in both the migration corridor and spawning/rearing habitat due to continued regeneration (e.g., tree growth) of RHCA vegetation community and overstory. Consequently, baseline conditions for this watershed indicator should be maintained.

Disturbance regime. Implementation of the preferred alternative will not alter ability of the watershed to recover from disturbances in any way. Consequently, baseline conditions for this watershed indicator should be maintained.

Biological Effects

To evaluate the effects of the project on the bull trout individual and subpopulation, each of the factors listed in Table 6 below were addressed separately.

TABLE 6.
Factors for Project Species Effect Rating (USFWS 1998)

Category	Indicator
Fish	Egg mortality Juvenile mortality Adult mortality Growth rate Other physiological Reproduction
Harassment	Access to prime habitat Species poaching Recreational fishing/harvest Redd disturbance Migration or smoltification Other behavioral

The evaluation of each factor in Table 6 will lead to one of the following conclusion related to the project: measurable improvement, unmeasurable improvement, no effect, unmeasurable degradation, or measurable degradation.

Egg mortality. Pulses of sediment from reconstruction of some stream crossings, plus road reconstruction and sediment abatement efforts could result in a small increase in incubation mortality in the short-term. This increase constitutes a }take~ of bull trout as defined in the Endangered Species Act. Over the long-term, however, sediment abatement should produce a net improvement in incubation success in the mainstem. Short-term effects at the individual level are not widespread or persistent enough to adversely affect the subpopulation. Over the long-term, the Rock Creek stock should show an unmeasurable improvement and the subpopulation should be unaffected.

Access to prime habitat and species poaching. Travel restrictions on FR150 near the proposed paste facility and relocation of the road out of the RHCA will benefit individual fish and the subpopulation, but benefits (e.g., increase in bull trout abundance) are unlikely to be attributable to this action.

Recreational fishing/harvest. There is likely to be a slight increase in fishing pressure during project construction, primarily due to the construction crew. Over the life of the project, the limited quality of the fishery together with increasing traffic levels in the drainage should result in a slight drop in fishing pressure. Changes in fishing pressure are likely to have no effect on the subpopulation.

Redd disturbance. Travel restrictions on FR150 near the proposed paste facility and relocation of the road out of the RHCA will benefit individual fish and the stock, but benefits (e.g., increase in bull trout abundance) are unlikely to be attributable to this action. Over the life of the project, the limited quality of the fishery together with increasing traffic levels in the drainage should result in a slight drop in redd disturbance. Changes in redd disturbance are likely to have an unmeasurable improvement on individuals and the subpopulation.

Juvenile and adult mortality, growth rate, reproduction, migration or smoltification, and other physiological and behavioral factors. The implementation of the preferred alternative should have no effect on these species factors at any of the levels of biological organization under consideration.

III. *Cumulative Effects*

The Rock Creek bull trout subpopulation evaluated in the preceding sections is a component of the Lower Clark Fork River bull trout meta-population. Within the area occupied by the meta-population, there are 16 separate watersheds. Activities which impact the meta-population could also potentially impact the subpopulation, although the connection between the Rock Creek subpopulation and the Lower Clark Fork River meta-population has yet to be demonstrated unequivocally. The cumulative effects section below focuses on the meta-population. Information on activities within Rock Creek is directly relevant to the subpopulation; information for the other watersheds is less relevant.

Eight of the watersheds occupied by the meta-population, including Rock Creek, are known to support bull trout. In addition to the ASARCO project described above, there are many other projects occurring in these watersheds. For each watershed, baseline and ongoing project findings similar to that made above were made for the bull trout meta-population (Table 7). The data presented in this table are preliminary. The Kootenai National Forest is in consultation with USFWS on many of these projects. Some of the effects conclusions will change as project details are cooperatively reviewed and mitigation measures are designed.

TABLE 7. Lower Clark Fork Bull Trout Meta-population Cumulative Effects [1]

Watershed	Baseline Findings [2]			Ongoing Project Findings					
	Phys.	Biolog.[3]	Integrated	Number [4]	Amount [5]	INFS [6]	MA [7]	LAA [8]	Cumulative [9]
Elk	FAR	n/a	FAR	31	1318/57	Y	0	0	Maintain
Blue	FAR	n/a	FAR	6	65/2	Y	0	0	Maintain
Pilgrim	FAR	n/a	FAR	23	167/37	Y	0	0	Maintain
Bull*	FA	FAUR	FAUR	60	1345/65	Y	8	1	Maintain
Clark*	FAR	FAUR	FAUR	61	1793/42	Y	4	4	Maintain
Trout	FAR	n/a	FAR	22	331/31	Y	0	0	Maintain
Rock*	FAR	FAUR	FAUR	9	175/17	Y	8	0	Degrade
Marten*	FAR	FAUR	FAUR	18	471/34	Y	6	2	Maintain
McKay	FAR	n/a	FAR	8	16/9	Y	0	0	Maintain
White	FAR	n/a	FAR	19	432/131	Y	0	0	Maintain
Swamp*	FAR	FAUR	FAUR	14	1220/8	Y	5	1	Maintain
Beaver	FAR	n/a	FAR	26	2096/227	Y	0	0	Maintain
Vermillion*	FAUR	FAUR	FAUR	28	94/65	Y	9	1	Maintain
Prospect*	FAUR	FAUR	FAUR	158	1101/84	N	13	10	Degrade
Graves*	FAR	FAUR	FAUR	14	2/9	N	0	1	Degrade
Squaw	FA	FAUR	FAUR	13	1/3	Y	1	0	Maintain

Notes

* occupied or used intermittently by bull trout

n/a not applicable

1 findings and activity levels are preliminary estimates subject to revision as ESA Section 7 consultation proceeds

2 existing conditions relative to bull trout optimums (Functioning Appropriately [FA], Functioning at Risk [FAR], Functioning at Unacceptable Risk [FAUR]) for physical and biological environment

3 watersheds with biological findings are occupied yearlong or intermittently by bull trout

4 number of discrete projects underway (each project typically involves multiple activities)

5 acres/miles of "disturbance" authorized, funded or conducted (acres or miles may be disturbed one or multiple times by sequential or concurrent activities)

6 all projects consistent with Forest Plan (INFISH) management standards?

7 number of projects that "May Affect" bull trout

8 number of projects "likely to adversely affect" bull trout

9 cumulative effect of all projects (restore, maintain, degrade)

In addition to the information presented in Table 7, there are a number of other characteristics of the forseeable projects that are important for evaluating the cumulative effects. These characteristics are presented in the following bullets:

- Approximately 2 percent of the 650,000 acres in the watersheds in Table 7 will be disturbed
- Approximately 80 percent of the 800-plus miles of linear disturbance is road reconstruction that will upgrade roads to present design standards or road decomissioning
- Approximately 50 percent of the ongoing activity is occurring in bull trout watersheds
- The level of disturbance is discountable in terms of downstream cumulative effects on the travel corridor (e.g., reservoirs and the Clark Fork River in Idaho), adult holding habitat due to entrapment in the still waters of the reservoirs, and modification of the environment by hydro-power management

The cumulative effects evaluation must also be evaluated in the context of the factors currently limiting the recovery of the bull trout meta-population. The six primary factors are:

- Reservoir temperatures preclude any significant habitat value except as a travel corridor
- Meta-population has been fragmented due to the presence of three dams and unsuitable reservoir conditions
- Dewatering at the lower end of many tributaries
- Historic stream cleaning (i.e., loss of woody debris and deep pools) and stream sedimentation (i.e,. road and channel erosion)
- Channel instability in some powerline, pipeline, and road corridors that parallel the stream network
- Exceptionally low numbers of adfluvial and fluvial migrants.

Ultimately, the prospect of recovery for the meta-population is good if connectivity to Lake Pend Oreille is restored. On a more local scale, recovery prospects are better for tributaries of Noxon Reservoir compared to tributaries of Cabinet Gorge Reservoir because of the larger foodbase and more stable water levels. In summary, although the meta-population is functioning at unacceptable risk in all the Lower Clark Fork watersheds which contain bull trout, the cumulative effect of all forseeable projects in these watersheds is to maintain function.

Statement of Findings

The analysis of the 19 watershed condition indicators (Table 5) suggests that the habitat baseline is functioning at risk. Analysis of the species condition indicators suggests that the baseline for the Rock Creek bull trout subpopulation is functioning at unacceptable risk. Implementation of the preferred alternative is expected to maintain the function of all watershed and species condition indicators, except those associated with short-term increases in fugitive sediment loading, which are expected to be degraded. Because of the predicted habitat degradation, impacts are **likely to adversely affect** bull trout habitat in the watershed and are **likely to adversely affect** bull trout individuals. The implementation of this project **will not result in jeopardy** for the Columbia River distinct population segment.

The primary habitat limitations for bull trout in the Rock Creek watershed are intermittency at baseflow conditions, loss of important refugia meso-habitats due to historic riparian harvest, and stream cleaning that resulted in significant loss of habitat diversity. The net effect determination for each habitat region (i.e., migration corridor, spawning/incubation, and rearing) indicates that some degradation (only in short-term for migration corridor and incubation/spawning habitat) is to be expected. Measurable improvement over the long-term is expected for sediments. Degradation may occur over the short-term with respect to individual egg and juvenile mortality, but an unmeasurable improvement is expected for all other species condition indicators provided there is no increase in surface water metals concentrations.

A project of this size and scope does have the potential for long term effects given the life-span and the complexity of the project. There is a high probability that during the life-span of the project there will be mechanical failures, operational mistakes, and accidents that will have adverse effects to the bull trout population in Rock Creek. The everyday operations and maintenance of the road system will have chronic adverse effects. The intensity and magnitude of these effects is impossible to predict, however it is certain they will occur.

As noted above, the environmental baseline for the species is functioning at unacceptable risk because of the loss of connectivity between the adfluvial and resident forms of the Rock Creek stock. The degree to which connectivity can be restored is based in part upon the potential for fish passage facilities to be constructed in conjunction with ongoing dam relicensing on the lower Clark Fork River. Implementation of any measures relating to fish passage through Cabinet Gorge Reservoir are outside the scope of the project and this biological assessment.

Potential Measures for Removing, Avoiding, or Compensating for Adverse Effects

I. *Mitigation*

Several sediment mitigation measures were added to the preferred alternative specifically to maintain or improve the functioning of bull trout habitat. These measures would consist of stabilization, armoring and revegetation of existing sediment sources in the Rock Creek floodplain, and maintenance of these measures for the life of the project. Concurrent with project start-up, ASARCO would mitigate an eroding cutbank where Engle Creek joins Rock Creek and inventory the Orr Creek and Snort Creek basins to identify potential sediment mitigation opportunities. ASARCO will submit a fine sediment mitigation plan to the Agencies for approval, and cumulatively reduce the annual fine sediment loading to Rock Creek by at least 400 tons by mitigating two or more sediment sources in the West Fork basin and in the mainstem floodplain of Rock Creek prior to the end of the project construction period.

If fisheries monitoring shows an increase in the abundance of non-native species in the Rock Creek drainage, several actions will be needed. First, impacts to the environment that could be causing the spread of the non-native-fishes should be identified and corrected if possible. If ASARCO is responsible for the declines in fish habitat or is responsible in any other way for the spread of non-native species then it will be ASARCO's responsibility to undertake mitigation. It may be necessary to remove the non-native fish through the use of electrofishing or toxicants.

INFISH recommends the development and implementation of a road management plan to avoid adverse effects to inland native fish. ASARCO would develop this plan, in cooperation with the agencies, to include the items specified in INFISH. This plan is needed to help avoid the adverse effects of transportation-related accidents and road maintenance impacts to bull trout in Rock Creek. Large, clean riprap should be added to armor the streambank in places where the road encroaches upon the stream.

In the event of a mine-related accident that adversely affected aquatic life in Rock Creek or the Clark Fork River, ASARCO would be required to undertake mitigation. The agencies, in consultation with ASARCO, would develop a plan aimed at restoring the waters to their pre-accident condition.

II. *Monitoring*

A monitoring plan describing sampling and reporting procedures is found in Appendix H of the Final Environmental Impact Statement. No additional monitoring is proposed in this biological assessment.

References

ASARCO, Incorporated. 1987-1994. *Environmental baseline reports/application for a hard rock operating permit for the Rock Creek project, Sanders County, Montana.* Submitted by ASARCO, Incorporated to the Montana Department of State Lands and U.S. Forest Service, Kootenai National Forest. Permit Application Vols. 1, 2, and 2A. Baseline Report Vols. 1, 2, and 2A.

Avista. 1999. Habitat use and movement of fish in Noxon and Cabinet Gorge reservoirs. Draft. Avista Corporation, Spokane, WA.

Barnard, D. and J. Vashro. 1986. *In* ASARCO, Incorporated. 1987-1994. (See ASARCO, Incorporated 1987-1994).

Boag, T.D. and P.J. Hvenegaard. 1997. Spawning movements and habitat selection of bull trout in a small Alberta foothills stream. pp. 317-323. *In:* W.C. Mackay, M.K. Brewin, and M. Monit (eds.), Proceedings - Alberta Friends of the Bull Trout, 1994 May. Calgary, Alberta, Canada: Trout Unlimited, Bull Trout Task Force.

Cavendar, T.M. 1978. Taxonomy and distribution of the bull trout (*Salvelinus confluentus*) from the American Northwest. California Fish and Game 64(3): 139-174.

Dambacher, J.M. and K.K. Jones. 1997. Stream habitat of juvenile bull trout populations in Oregon and benchmarks for habitat quality. pp. 353-360. *In:* W.C. Mackay, M.K. Brewin, and M. Monita (eds.), Proceedings - Alberta Friends of the Bull Trout, 1994 May. Calgary, Alberta, Canada: Trout Unlimited, Bulltrout Task Force.

Farmer, C., P. Farmer, and S. Heath. 1986. *Rock Creek Project. Aquatic Baseline Study 1985.* Prepared for ASARCO, Inc., Troy, MT. Western Technology and Engineering, Inc., Helena, MT.

Fraley, J.J. and B.B. Shepard. 1989. Life history, ecology, and population status of migratory bull trout (*Salvelinus confluentus*) in the Flathead Lake and River system, Montana. Northwest Science. 63:133-143.

Goetz, F.A. 1994. Distribution and juvenile ecology of bull trout (*Salvelinus confluentus*) in the Cascade Mountains. Corvallis, Oregon: Oregon State University. M.S. thesis.

Graham, P.J., B.B. Shepard, and J.J. Fraley. 1981. Use of stream habitat classifications to identify bull trout spawning areas in streams. pp. 186-190 *In:* Acquisition and Utilization of Habitat Inventory Information, Proceedings of the Symposium. 1981 October 28-30. Portland, Oregon: American Fisheries Society, Western Division.

Haas, G.R. and J.D. McPhail. 1991. Systematics and distribution of Dolly Varden (*Salvelinus malma*) and bull trout (*Salvelinus confluentus*) in North America. Canadian Journal of Fisheries and Aquatic Sciences 48: 2191-2211.

Hightower, T. and J. Vashro. 1987. *In* ASARCO, Incorporated. 1987-1994. (See ASARCO, Incorporated 1987-1994).

Hightower, T.P. 1988. *Baseline fisheries inventory of selected streams within the Libby Creek watershed and upper Rock Creek drainage.* Montana Department of Fish, Wildlife and Parks, Kalispell, MT. Prepared for Noranda Minerals Corp., Reno, NV.

Huston, J.E. 1994. Northwest Montana coldwater stream investigations, species of special concern segment. Job Progress Report F-46-R-7, Job II-a. Montana Fish, Wildlife, and Parks. Helena, MT.

Hydrometrics. 1999. 1998 Supplemental baseline water resources monitoring report for the ASARCO Rock Creek Project. Prepared for ASARCO, Inc., Troy, MT. Hydrometrics, Inc., Helena, MT.

Jakober, M.J. 1995. Influence of stream size and morphology on the seasonal distribution and habitat use of resident bull trout and westlope cutthroat trout in Montana. Bozeman, Montana: Montana State University. M.S. thesis.

Leary, R.F., F.W. Allendorf, and S.H. Forbes. 1993. Conservation genetics of bull trout in the Columbia and Klamath River drainages. Conservation Biology 7(4):856-865.

Lee, D.C., J.R. Sedell, B.E. Rieman, R.F. Thurow, J.E. Williams, et al. 1997. Chapter 4: Broadscale Assessment of Aquatic Species and Habitats. *In:* T.M. Quigley and S.J. Arbelbide (eds.), *An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins, Volume III~*. U.S. Department of Agriculture, Forest Service, and U.S. Department of Interior, Bureau of Land Management, Gen. Tech. Rep. PNW-GTR-405.

McPhail, J.D. and C.C. Lindsey. 1986. Zoogeography of the freshwater fishes of Cascadia (the Columbia system and rivers north to the Stikine). pp. 615-638 *In:* C.H. Hocutt and E.O. Wiley (eds.), *The Zoogeography of North American Freshwater Fishes.* New York: John Wiley and Sons.

McPhail, J.D. and C.B. Murray. 1979. The early life history and ecology of Dolly Varden (*Salvelinus malma*) in the Upper Arrow Lakes. Vancouver, B.C.: University of British Columbia, Department of Zoology and Institute of Animal Resources. 113 pp.

Pratt, K.L. 1992. A review of bull trout life history. pp. 10-17 *In:* P.J. Howell and D.V. Buchanan (eds.), Proceedings of the Gearhart Mountain bull trout workshop, 1992 August, Gearhart Mountain, Oregon. Corvallis, Oregon: Oregon Chapter of the American Fisheries Society.

Pratt, K.L. and J.E. Huston. 1993. *Status of bull trout (Salvelinus confluentus) in Lake Pend Oreille and the lower Clark Fork River.* Draft report prepared for Washington Water Power Company, Spokane, WA.

Rieman, B.E. and J.D. McIntyre. 1993. *Demographic and habitat requirements for conservation of bull trout.* USDA Int. Mtn. Res. Sta. GTR INT-302.

Rieman, B.E. and J.D. McIntyre. 1995. Occurrence of bull trout in naturally fragmented habitat patches of varied size. Transactions of the American Fisheries Society 124:285-296.

Rosgen, D. 1994. Classification of natural rivers. Catena 22:169-199.

USFWS. 1998. *A framework to assist in making Endangered Species Act determinations of effect for indiviudal or grouped actions at the bull trout subpopulation watershed scale.* U.S. Fish and Wildlife Service, adapted from the National Marine Fisheries Service. Typescript.

Watershed Consulting. 1997. 1996 Field data summary report for Rock Creek near Noxon, Montana. Final. Prepared for ASARCO Inc., Troy, MT. Watershed Consulting, Polson, MT.

Watson, G., S. Toth, T. Hillman, and W. Platts. 1997. Implementation of a method to detect the presence of bull trout. pp. 421-425 *In:* W.C. Mackay, M.K. Brewin, and M. Monita (eds.), Proceedings - Alberta Friends of the Bull Trout, 1994 May. Calgary, Alberta, Canada: Trout Unlimited, Bulltrout Task Force.

Weaver, T.M. and R.G. White. 1985. Coal Creek fisheries monitoring study no. III. Bozeman, Montana: Montana State Cooperative Fisheries Research Unit. 94 pp.

Weaver, T.M. and J.J. Fraley. 1991. *Flathead Basin forest practices water quality fisheries cooperative program: fisheries habitat and fish populations.* Flathead Basin Commission, Kalispell, MT.

Weaver, T.M. and J.J. Fraley. 1993. A method to measure emergence success of westslope cutthroat trout fry from varying substrate compositions in a natural stream channel. N. Am. J. Fish. Manage. 13:817-822.

Williams, R.N., R.P. Evans, and D.K. Shiozawa. 1997. Mitochondrial DNA diversity patterns of bull trout in the upper Columbia River basin. pp. 283-297 *In:* W.C. Mackay, M.K. Brewin, and M. Monita (eds.), Proceedings - Alberta Friends of the Bull Trout, 1994 May. Calgary, Alberta, Canada: Trout Unlimited, Bull Trout Task Force.

WWP. 1996. Lower Clark Fork River tributary survey. Final Report. Washington Water Power Company, Spokane, WA. Two volumes.

E-5-d-1-a

United States Department of Agriculture | Forest Service | Kootenai N.F. | 1101 U.S. Highway 2 W.
Libby, MT 59923

File Code: 2670

Date: April 4, 2000

Bill Olsen
U.S. Fish and Wildlife Service
100 N. Park Suite 320
Helena, MT. 59601

Dear Bill,

On March 24, 2000 the U.S. Fish and Wildlife Service published its determination on the status for the contiguous U.S. distinct population segment of the Canada lynx (*Lynx Canadensis*) (USFWS 2000). The determination was to list the lynx as Threatened. This constitutes a change in conditions for the ASARCO Rock Creek Mine project. In addtion ASARCO has sold its rights to the Rock Creek Project and the new company is titled GENSIS.

The final Biological Assessment of Threatened, Endangered, and Proposed species for the proposed GENSIS (formerly ASARCO) Rock Creek Mine was completed on July 31, 1998 and submitted to the U.S. Fish and Wildlife Service on the same date. At that time the lynx was a proposed species and the determination in the BA was that the project is "not likely to jeopardize the continued existence of lynx or result in the destruction or adverse modification of critical lynx habitat".

The conclusion of the BA Ammendment is that the proposed federal action may affect but is **not likely to adversely affect the lynx**. In accordance with Endangered Species Act Section 7, I request your concurrence with the proposed GENSIS Rock Creek Mine on the Cabinet Ranger District, Kootenai National Forest. A copy of the project Biological Assessment Ammendment for lynx is attached. Please provide your written concurrence if you agree with the BA's determinations.

A copy of the Ammendment has been forwarded directly to Carole Jorgensen in the Kalispell sub-office. Questions on specific aspects of this Ammendment can be addressed to Wayne Johnson, KNF Supervisor's Office (406-293-6211 or email wjjohnson@fs.fed.us).

Sincerely,
Bob Castaneda

BOB CASTANEDA
Forest Supervisor

Cc w/enclosure: C. Jorgensen

GENESIS ROCK CREEK MINE
(Formerly ASARCO)

BIOLOGICAL ASSESSMENT
LYNX AMMENDMENT

INTRODUCTION

On March 24, 2000 the U.S. Fish and Wildlife Service published its determination on the status for the contiguous U.S. distinct population segment of the Canada lynx (*Lynx Canadensis*) (USFWS 2000). The determination was to list the lynx as Threatened. This constitutes a change in conditions for the GENESIS Rock Creek Mine.

The final Biological Assessment of Threatened, Endangered, and Proposed species for the proposed GENESIS Rock Creek Mine was completed on July 31, 1998 and submitted to the U.S. Fish and Wildlife Service for formal consultation on the same date. At that time the lynx was a proposed species and the determination in the BA was that the project is "not likely to jeopardize the continued existence of lynx or result in the destruction or adverse modification of critical lynx habitat".

Now that the lynx is listed, in order to comply with the Endangered Species Act, a new determination of either "likely to adversely affect" or "may affect, but is not likely to adversely affect" the lynx is required. This BA amendment documents the new determination and the supporting information used in making it.

The U.S. Fish and Wildlife Service and the U.S. Forest Service signed a Canada Lynx Conservation Agreement (CA) (USFS Agreement # 00-MU-11015600-013: 2/7/2000) that establishes the use of the 1) Lynx Conservation Assessment and Strategy (LCAS) (USFS, USFWS, USPS, BLM 2000), 2) local conditions and activities, and 3) modifications (if any) made to proposed projects that reduce or eliminate potential adverse effects to lynx, in all determinations of effect for lynx.

ASSESSMENT

The description of the lynx population status is documented in the original BA (pg. 36) and in the final lynx listing rule (USFWS 2000). Both are incorporated in this amendment by reference.

The LCAS establishes conservation measures that are intended to conserve the lynx, and to reduce or eliminate adverse effects from management activities on federal lands. Under the CA, the Forest Service is to review and consider these recommended measures, which apply only to lynx habitat within lynx analysis units (LCAS pg 76 & 77). The conservation measures are displayed in three forms: objectives (measures of desired resource condition); guidelines (ways to meet objectives); and standards (required management actions). The following analysis includes those conservation measures that apply to activities proposed for this specific project, measures outlined in the LCAS for other types of activities not anticipated (i.e. Livestock grazing) are not analyzed.

I. Conservation Measures Applicable to - All Programs and Activities:

Delineation of Lynx Analysis Units (LAUs) (LCAS pg. 77)
The Kootenai National Forest has delineated LAUs. Most of the GENESIS Rock Creek project is nearest to, but falls out side of LAU 14702 (formerly 7.2.1, see pg 37 of original BA). A small portion (Evaluation adit) is in the LAU. This LAU covers approximately 23,000 acres which meets the size guideline for LAUs (LCAS pg. 77).

Mapping Lynx Habitat (LCAS pg. 77)
Lynx habitat has been mapped using the criteria for the Northern Rocky Mountains Geographic Area (Montana portion – LCAS pp 46-47). Based on satellite image data, a total of 20 acres of lynx habitat (3 acres of denning habitat) would be impacted by the project. Less the 30% of the potential lynx habitat within the LAU is currently classified as unsuitable (LCAS pg. 101). The proposed activity on 20 acres of lynx habitat will not result in more than 30% of potential habitat in the LAU to be classified as unsuitable, or result in a permanent loss of habitat. This meets the LCAS standard (pg. 77).

Maintain at least 10% of potential lynx habitat acres in denning habitat (LCAS pg.78)
Currently only 8.3% (4.9% of the LAU) of the potential lynx habitat provides denning habitat. The loss of 3 acres of denning habitat is less the one tenth of one percent of existing denning habitat. The proposed project will delay achievement of denning habitat structure on an estimated 17 acres. These acres are in the same condition as most forested habitat in the LAU. That is, that they are younger stands that currently do not have an adequate down log component to provide denning habitat. Since there are many acres moving toward denning habitat, the delay on 17 acres is not significant.

II. Conservation Measures to Address Risk Factors Affecting Lynx Productivity

Timber Management:

Management actions shall not change more than 15% of lynx habitat within a LAU to an unsuitable condition with a 10 year period. (LCAS pg. 79)

The majority of LAU 14702 is in wilderness and areas without roads, so far less than 15% of the LAU has been changed in the last 10 years by management activities. The 20 acre change proposed with this project meets the standard.

The project does not propose salvage harvest following a disturbance nor precommercial thinning.

Recreation Management:

The project is not proposing changes in recreation management during the winter season, therefore LCAS standards for recreation management (pg. 82 and 83) are met.

Other human developments (including mines) (LCAS pg. 85):

To access the mill site, Forest road 150 would be plowed for approximately the first 5 miles. This segment is not in lynx habitat, nor in any LAU. With the high traffic level to the mill site, it is unlikely that the road would become an access point for snowmobile use into lynx habitat at higher elevations. There would be no increase in groomed or designated over-the-snow routes or snowmobile play areas.

There are no new roads being constructed in lynx habitat. The existing access route to the exploration adit (road 2741) goes through lynx habitat. The project proposes to close the portion of this road that currently extends beyond the adit. This minimizes disturbance around some potential denning habitat, which is important from May to August. The standards and guidelines are met.

III. Conservation Measures to address mortality risk factors

The project proposes to provide funding for a position with the Montana Department of Fish, Wildlife and Parks as part of the mitigation for grizzly bear. Part of the duties of that position is information and education on grizzly bear, but lynx would be included as well (LCAS standard pg. 86). The proposed project includes busing employees to the mill site, which reduces the projected traffic increase and thus keeps mortality risk to any dispersing lynx at a minimum.

IV. Conservation Measures to address Movement and Dispersal (LCAS pp 87-89)

The project does propose paving an existing dirt road (# 150), however the segment planned for paving is not in lynx habitat. The potential to increase mortality risk, due to higher traffic levels and increased speeds, was mitigated by busing employees to the mill site (see measure III above).

The project does include the possibility of land ownership changes as part of the mitigation package for grizzly bear. Most lands identified as possible mitigation for grizzly bear would also provide habitat for lynx, thus acquiring ownership or conservation easements would maintain or in some cases improve habitat conditions for movement and dispersal.

the project complies with all standards and guidelines of the lynx conservation assessment and strategy.

Wayne J. Johnson
Wildlife Biologist

4/3/2000
Date

References

USFS and USFWS. 2000. Canada Lynx Conservation Agreement. Agreement # 00-MU-11015600-13. USFS Northern Region. Missoula, MT. 11 pp.

USFS, USFWS, USPS, BLM. 2000. Canada Lynx Conservation Assessment and Strategy. USDA Forest Service, USDI Fish and Wildlife Service, USDI National Park Service, USDA Bureau of Land Management. Northern Region USFS. Missoula, MT. 120 pp.

USFWS. 2000. Endangered and Threatened Wildlife and Plants: Determination of Threatened Status for the Contiguous U.S. Distinct Population Segment of the Canada Lynx and Related Rule; Final Rule. UDSI FWS. Federal Register March 24, 2000 Vol. 65 No. 58. pp 16051-16086.

REVISED TERRESTRIAL THREATENED and ENDANGERED SPECIES MITIGATION PLAN for the PROPOSED Sterling ROCK CREEK MINE December 14, 2000

This mitigation plan displays the specific items identified that are required to reduce, eliminate, or provide substitution for environmental consequences to species federally listed as threatened or endangered. It covers implementing alternative five as displayed in the final environmental impact statement for the Sterling Rock Creek Mine project and supports requirements from the U.S. Fish and Wildlife Service Biological Opinion. This mitigation plan will be implemented by Sterling and appropriate state and federal agencies. Timing of completion of this plan is tied to three phases of mine activity (evaluation adit – requires letter to proceed, construction – requires letter to proceed, operation – estimated to be 5 years after construction starts).

A. To reduce mortality risk (avoid incidental take) to Threatened and Endangered species Sterling will:

1. Develop a transportation plan designed to minimize mine related vehicular traffic, traveling between state highway 200 and the mill site, and minimize parking availability at the plant site. Busing employees to the mill site will be a part of the plan. Forest Service approval required. The plan will be in place prior to starting the evaluation adit.

2. Not use salt when sanding during winter plowing operations, on Forest Development Road 150 (FDR-150), to reduce big game mortality that could draw bald eagles, wolves and grizzly (in spring) to the road corridor and increase mortality.

3. Daily remove vehicular killed deer and elk from road rights-of-way within the permit area and along roadways used for access or hauling ore (FDR 150, 150A and new roads built for the project). Road kills would be moved at least 50 feet beyond the right-of-way clearing and further if necessary to be out of sight from the road. During construction and the first three years of full operation, Sterling would monitor the number of vehicular killed deer and elk on these roads and report findings annually. They would also monitor and report (within 24 hours) all grizzly bear, bald eagle, lynx and wolf mortalities within the permit area. If a T&E species mortality occurs, and it is determined that the carrion was a contributing factor, then Sterling would start hauling the dead deer and elk to a dumping location approved by Montana Fish, Wildlife and Parks (MFWP). After five years of full operation the Forest Service, in consultation with the U.S. Fish and Wildlife Service, will do a reevaluation of mortality risk to bald eagles, wolf, and grizzly bear to determine the need to continue this mitigation measure.

4. Construct power lines following criteria outlined by Olendorff, Miller and Lehman (1981) to reduce potential for electrocution of bald eagles.

5. Work with other mines permitted to operate in the area (ie. Montanore) to fund a MFWP grizzly bear management specialist (with focus on public information and education) position (estimated at State grade 14) to aid in grizzly bear conservation. This would be the same position as required in the Record of Decision for the Montanore Project (9/93), not an additional one. The position would be funded for 3 years and in place prior to starting the evaluation adit, and then evaluated for need to continue as is or modify to better benefit the grizzly. Funding would be provided prior to starting the evaluation adit to cover the first 3 years. The position would be stationed either in the lower Clark Fork valley or the Libby area. If for some reason the Montanore project does not proceed, Sterling will be responsible to fully fund the position. The purposes are to reduce mortality risk through (1) education of the public on the law and penalty for violation (illegal killing of T&E species); (2) education of hunters on bear identification to reduce accidental killing of grizzly and (3) educate the public on biological needs of the grizzly so that an understanding exists that reduces "social jeopardy" and 4) educates the public on storage of human and pet (animal) food in bear habitat to prevent and correct sanitation problems. The position description and an initial list of work items will be developed jointly by the agencies (including but not limited to Forest Service, U.S. Fish and Wildlife Service, Montana Fish, Wildlife and Parks) and Sterling representatives.

6. Work with other mines operating in the area (ie. Montanore) to fund a local MFWP law enforcement position (estimated at State grade 14) for the life of the mine. This would be the same position as required in the Record of Decision for the Montanore Project (9/93), not an additional one. The position would be stationed in the lower Clark Fork valley. If for some reason the Montanore project does not proceed, Sterling will be responsible to fully fund the position. The program would be funded for 3 years and in place prior to starting the evaluation adit, and then evaluated for need to continue as is or modify to better benefit the grizzly. The position description and an initial list of work items will be developed jointly by the agencies (including but not limited to Forest Service, U.S. Fish and Wildlife Service, Montana Fish, Wildlife and Parks) and Sterling representatives.

7. Use bear-proof containers to hold attractants and remove them in a timely manner (weekly unless a problem develops, then daily) at all Rock Creek facilities. Containers will be in place at each mine facility site prior to starting any work on each site.

8. Not use clover or other preferred bear food plants in the seed mix used on any disturbed area, to reduce grizzly/human encounters caused by bears being drawn to clover sites.

9. Prohibit employees from carrying firearms within the permit area, except for security officers and other designated personnel.

10. Prohibit employees from feeding wildlife, especially bears, as food becomes attractants to bears.

11. Fund the acquisition of bear proof garbage containers to be placed in all developed campgrounds within Bear Management Units 4, 5 and 6 (Bull River and Howard Lake campgrounds; Lake Creek campground is a pack in/pack out site and will not require garbage containers).

12. Require mine employees to attend training related to living and working in grizzly bear habitat prior to starting work and on an annual basis thereafter or as scheduled by the grizzly bear management specialist.

B. To maintain habitat effectiveness for Threatened and Endangered species, Sterling will:

1. Secure or protect (through conservation easement, including road closures, or acquisition in fee with restrictive covenants) from development (including but not limited to housing, motorized access) and use (timber harvest, adverse grazing, mining) replacement habitat to compensate for acres lost by physical alterations, or acres with reduced habitat availability due to disturbance. Replacement acres for Alternative Five are: 2350. The "in kind" replacement acres must provide 2.61 early (6133.5 total), 1.61 late (3783.5 total) for an overall 2.11 habitat unit value (4958.5 total overall HUs). Replacement habitat will be provided using the following schedule:

Activity Area	Replacement Acres	Timing
Exploration Adit	53	Prior to Eval. Adit
Tailings & AF	806	Prior to Construction
Mill & AF	248	Prior to Construction
Ventilation Adit	10	Prior to Construction
New Roads	102	Prior to Construction
Existing Roads (Reconstruction)	565	Prior to Construction
Existing Roads (Increased Influence)	566	Prior to Operations
Total Alternative 5	2350	Prior to Operations

AF = Associated Features

This schedule will have all replacement habitat (except ventilation adit) in place prior to starting full operations (end of year 5). Replacement habitat to the ventilation adit will be in place prior to construction, if the adit becomes necessary.

Either fee title or conservation easements are acceptable. Fee lands must be protected by a restrictive covenant that ensures protection in perpetuity while in private ownership. Conservation easements will be in perpetuity and transferred to the Forest Service. Fee title lands may be considered for donation or land exchange with the Forest Service. Costs of processing land exchanges, and preparing and accepting conservation easement by the Forest Service for these acres will be funded by Sterling. Land exchanges would be for equal valued lands as determined by a federal land appraisal. Any exchange must be beneficial to the Forest Service. All land interest conveyed to the Forest Service must be acceptable and approved by the Office of General Counsel. Fee title land must be conveyed by Warranty Deed in accordance with Department of Justice standards. Conservation easement s must be prepared and conveyed in accordance with Department of Justice standards. All property, or interest in property, shall be inspected for hazardous substances in accordance with law, regulation and policy. If hazardous substance are found an agreement needs to be reached on removal and remedial action. First choice for replacement habitat is within the disturbed BMUs (4,5,6). If adequate replacement acres are not available in those BMUs then acres may be found in other BMUs (7 & 8) within the southern portion of the Cabinet Mountains. See the Replacement Habitat Assessment for acceptable lands to consider **(Not available to public until replacement habitat mitigation completed).**

Forst Service and US Fish and Wildlife Service will have final approval of mitigation acres and associated covenants prior to recording.

2. Fund habitat enhancement, commensurate with loss of habitat effectiveness. Enhancements include, but are not limited to, prescribed fire to restore whitebark pine, road closures and obliterations. Enhancements are preferred in the affected BMUs, however if opportunities are not available, then work may be done in BMUs in the southern portion of the Cabinet Mountains. Generally enhancements would occur in relation to replacement habitat acres. Enhancements associated with replacement acres will occur in a timely manner as agreed to by the agencies.

BMU	% H.E. Change	Acres H.E. Mitigation
4	+ 1.0	0
5	- 1.1	348
6	- 0.3	136

C. To reduce mortality risk, maintain habitat effectiveness, reduce incidental take and avoid jeopardy for Threatened and Endangered species the Kootenai National Forest, with Sterling funds, will:

1. Close the following roads prior to the start of construction phase (see maps):

Road Number	Road Name	Closure Miles	Closure Period	Closure Method
2285	Orr Creek	1.61	Yearlong	Barrier
2741X	unnamed	0.18	Yearlong	Barrier
2741A	unnamed	0.51	Yearlong	Barrier
150	Rock Creek	2.92	Yearlong	Gate *

* 2.5 miles gated (south end), 0.42 miles obliterated (north end) - see map

2. Implement a food storage order for Bear Management Units 4, 5 and 6 prior to allowing Sterling to start the evaluation adit.

3. Monitor use on the Rock Lake and St Paul Lake trails to assure use levels do not exceed "high use" as defined by the IGBC. A recreational use management plan will be developed to assure high use does not occur. The plan will be implemented when monitoring indicates high use has occurred during one bear season. The plan will be prepared within 3 years of the signature date on the Record of Decision and must be signed by the involved agencies (Forest Service, US Fish & Wildlife Service).

D. To address habitat constriction which reduces the potential to achieve CYE grizzly bear recovery goals (by impacting individuals in the Cabinet Mountains) and to avoid Jeopardy, Sterling will:

1. Secure or protect (through conservation easement, including road closures or acquisition in fee with restrictive covenants) from development (including but not limited to housing, motorized access) and use (mining, timber harvest, adverse grazing) 100 acres of replacement habitat that will enhance the north to south habitat corridor in the Cabinet Mountains. These lands are in addition to those identified under mitigation item B-1. A total of 53 acres of replacement habitat will be secured prior to starting the evaluation adit, with the remainder prior to construction phase. These acres must be approved by the agencies. See the Corridor Replacement Habitat Assessment for acceptable lands to consider **<u>(Not available to public until corridor replacement habitat mitigation completed)</u>** Either fee title or conservation easements are acceptable. Conservation easements would be in perpetuity and transferred to the Forest Service. Fee title lands within the corridor would be placed in public ownership either through donation or land exchange. Costs of processing land exchanges, and preparing and accepting conservation easement by the Forest Service for these acres will be funded by Sterling. Land exchanges would be for equal valued lands as determined by a federal land appraisal. Any exchange must be beneficial to the Forest Service. All land interest conveyed to the Forest Service must be acceptable and approved by the Office of General Counsel. Fee title land must be conveyed by Warranty Deed in accordance with Department of Justice standards. Conservation easement s must be prepared and conveyed in accordance with Department of Justice standards. All property, or interest in property, shall be inspected for hazardous substances in accordance with law, regulation and policy. If hazardous substance are found an agreement needs to be reached on removal and remedial action.

E. To assure compliance with the T&E species mitigation plan, and effectiveness of the management plan Sterling will:

1. Establish a trust fund and/or post a bond, prior to initiating any activities, to cover the mitigation plan implementation costs. The amount in the fund or posted in a bond will be commensurate with projected work and associated required mitigation items (see table below). Initial cost estimates; in year 2000 dollars are about $7.66 million over the life of the mine. Actual amount will be adjusted for inflation.

Estimated Deposit Summary:

Year	Deposit/Bond
1	$ 1,282,300
5	$ 2,128,200
15	$ 4,250,000

2. Participate in the development of and be a signer on a Memorandum of Understanding that

   a) establishes the roles and responsibilities of all participants (agencies and company).
   b) outlines the commitments of the signing parties.
   c) sets timelines for development of access management plans related to mitigation acres.
   d) describes the process for approving mitigation lands.
   e) specifies wording for conservation easements and other restrictive covenants on fee lands.
   f) provides framework for any proposed land exchanges related to mitigation acres.
   g) outlines job descriptions and work tasks for the two Montana Fish, Wildlife and Parks positions.

3. Contribute funding to support radio telemetry monitoring of bear movements in the Southern Cabinet Mountains to confirm the effectiveness of mitigation measures implemented to provide a secure north to south movement corridor. Funding to support monitoring would start when the U.S. Forest Service issues the letter to proceed with the evaluation adit. Funding would continue through mine life, whether that be at the end of the evaluation adit reclamation or full mine development.

APPENDIX C

DEPARTMENT DECISION ON AIR QUALITY PERMIT

APPENDIX C - AIR QUALITY PERMIT

Air Quality Permit

Issued to: Sterling Mining Company
P.O. Box 868
Troy, MT 59935

Permit #2414-01
Original Application Received: 12/15/87
Supplemental Information Received: 12/4/95, 5/29/97, 7/24/98
Original Preliminary Determination Issued: 3/5/96
Revised Preliminary Determination Issued: 1/23/98
Department Decision Issued:
Final Permit Decision:

An air quality permit, with conditions, is granted to Sterling Mining Company (Sterling), pursuant to Section 75-2-204 and 211, Montana Codes Annotated (MCA), as amended, and Administrative Rules of Montana (ARM), 17.8.701 et seq. as amended, for the following:

SECTION I: Permitted Facilities

An underground silver/copper mine and processing facility known as the Rock Creek Project located primarily in Sections 3 and 28, Township 25 North, Range 32 West and Section 34, Township 27 North, Range 32 West, Sanders County.

SECTION II: Limitations and Conditions

A. Maximum ore production (measured as throughput at the primary crusher) shall be limited to 10,000 tons during any 24 hour rolling period and 3,540,000 tons during any 12 month rolling period. Maximum diesel fuel consumption by underground equipment shall be limited to 306,365 gallons during any 12 month rolling period. Maximum propane consumption by the propane fired heaters shall be limited to 610,000 gallons during any 12 month rolling period. Maximum Ammonium Nitrate/Fuel Oil (ANFO) use shall be limited to 2761 tons during any 12 month rolling period. By the 25th day of each month, Sterling shall total the process amounts for the previous twelve months to verify compliance with the monthly rolling averages. These records must be maintained on-site and be available for inspection for a period of 5 years (ARM 17.8.710).

B. Sterling shall install, operate, and maintain a catalyst to control nitrogen oxides (NOx) on each temporary propane generator. The stack height of each generator shall be a minimum of 5 meters above ground level (ARM 17.8.710).

C. Particulate stack emissions are limited to 0.05 grams per dry standard cubic meter. This applies to the baghouse controlling emissions from surface ore handling. Within 180 days after initial start up of the ore processing facilities, Sterling shall conduct performance tests on the baghouse to verify compliance with this limitation. The need for future testing will be determined by the Department of Environmental Quality (department). Detailed descriptions of the baghouse (make, model, flowrate, etc.) shall be submitted to the department prior to the commencement of construction. All performance tests shall be conducted in accordance with the Montana Source Test Protocol and Procedures Manual (ARM 17.8.340, 17.8.710, 17.8.105, 17.8.106, and 40 CFR Part 60, Subpart LL).

D. Sterling shall perform particulate and NOx emissions testing of the exhaust ventilation adit (evaluation adit) to verify and evaluate emission and deposition estimates contained in the application. Concentrations should be measured near the point of generation inside the mine and at the point of exhaust to the atmosphere. The specific emission limitations which are applicable at the point of exhaust to the atmosphere are 1.0 tons per year of particulate less than 10 microns (PM-10) and 29.9 tons per year of NOx. Testing methodology must be approved in advance by the department (ARM 17.8.105, 17.8.106, and 17.8.710).

E. Process fugitive emissions are subject to an opacity limitation of 10%. Other fugitive emissions are limited to 20% opacity. Baghouse stack emissions are limited to 7% opacity (40 CFR Part 60, Subpart LL, ARM 17.8.308 and ARM 17.8.340).

F. Sterling shall furnish the department the following notification(ARM 17.8.710):

1. Date adit advancement or construction is commenced postmarked no later than 30 days after such date.

2. Anticipated date of initial start up of milling operations postmarked not more than 60 days nor less than 30 days prior to such date.

3. Actual date of initial start up of milling operations postmarked within 15 days after such date (40 CFR Part 60, ARM 17.8.340).

4. Make, model, year of manufacture, and date of installation of each catalyst used to control NOx emissions on the temporary propane generator.

G. Compliance with emission and opacity standards and testing requirements shall be as specified in 40 CFR Part 60, where applicable.

H. Sterling shall operate an ambient air quality monitoring network as described in Attachment 1 of this permit. The monitoring plan will be periodically reviewed by the department and revised if necessary (ARM 17.8.710).

I. Sterling shall maintain an adequate level of dust control from wind erosion at the tailings disposal area. The potential emissions from the proposed paste tailings management system are much less than from a conventional slurry tailings system. The need for any additional dust control at the site will be evaluated by the department based on the air quality monitoring results and visual observations (ARM 17.8.710 and 17.8.715).

J. Sterling must take reasonable precautions to minimize fugitive dust with respect to all construction and operation activities related to the project. This would include watering and/or chemical stabilization of roads and work areas on an as-necessary basis and adequate control of any process or material handling operations (ARM 17.8.715 and 17.8.308).

K. Sterling shall comply with all applicable standards, limitations, and the reporting, record keeping, and notification requirements contained in 40 CFR Part 60 Subpart LL (ARM 17.8.340 and 40 CFR Part 60).

L. Sterling shall supply the department with annual production information for all emission points required by the department in the annual emissions inventory request. Production information shall be gathered on a calendar-year basis and submitted to the department by the date required in the emissions inventory request. Information shall be in units as required by the department.

In addition, Sterling shall submit the following information annually to the department by March 1 of each year. This information is required for the annual emission inventory, as well as to verify compliance with permit limitations (ARM 17.8.710).

1. Amount of ore and waste handled;
2. Amount of diesel used (surface and underground separately);
3. Amount of propane used;
4. Amount of explosives used;
5. An estimate of vehicle miles traveled on on-site access roads;
6. Amount of disturbed acreage (including tailings area); and
7. Other emission related information the department may request.

Sterling shall notify the department of any construction or improvement project conducted pursuant to ARM 17.8.705(1)(r), that would include a change in control equipment, stack height, stack diameter, stack flow, stack gas temperature, source location, or fuel specifications, or would result in an increase in source capacity above its permitted operation or the addition of a new emissions unit.

The notice must be submitted to the department, in writing, 10 days prior to start up or use of the proposed de minimis change, or as soon as reasonably practicable in the event of an unanticipated circumstance causing the de minimis change, and must include the information requested in ARM 17.8.705(1)(r)(iv) (ARM 17.8.705).

SECTION III: General Conditions

A. Inspection - The recipient shall allow the department's representatives access to the source at all reasonable times for the purpose of making inspections, surveys, collecting samples, obtaining data, auditing any monitoring equipment (CEMS, CERMS) or observing any monitoring or testing, and otherwise conducting all necessary functions related to this permit.

B. Waiver - The permit and all the terms, conditions, and matters stated herein shall be deemed accepted if the recipient fails to appeal as indicated below.

C. Compliance with Statutes and Regulations - Nothing in this permit shall be construed as relieving the permittee of the responsibility for complying with any applicable federal, or Montana statute, rule or standard, except as specifically provided in ARM 17.8.701, et seq. (ARM 17.8.717).

D. Enforcement - Violations of limitations, conditions and requirements contained herein may constitute grounds for permit revocation, penalties or other enforcement as specified in Section 75-2-401 et seq., MCA.

E. Appeals - Any person or persons jointly or severally adversely affected by the department's decision may request, within 15 days after the department renders its decision, upon affidavit setting forth the grounds therefor, a hearing before the Board of Environmental Review (Board). A hearing shall be held under the provisions of the Montana Administrative Procedures Act. The department's decision on the application is not final unless 15 days have elapsed and there is no request for a hearing under this section. The filing of a request for a hearing postpones the effective date of the department's decision until the conclusion of the hearing and issuance of a final decision by the Board.

F. Permit Inspection - As required by ARM 17.8.716, Inspection of Permit, a copy of the air quality permit shall be made available for inspection by department personnel at the location of the permitted source.

G. Construction Commencement - Construction must begin within 3 years of permit issuance and proceed with due diligence until the project is complete or the permit shall be revoked. If after 3 years Sterling desires to keep the permit active but has not commenced construction, an alteration application could be submitted. This process would essentially allow for permit renewal and would provide an updated review of Best Available Control Technologies and other applicable rules.

H. Permit Fees - Pursuant to Section 75-2-220, MCA, as amended by the 1991 Legislature, the continuing validity of this permit is conditional upon the payment by the permittee of an annual operating fee, as required by that Section and rules adopted thereunder by the Board.

Attachment 1

AMBIENT AIR MONITORING PLAN
STERLING MINING COMPANY
ROCK CREEK PROJECT
Permit #2414-01

1. This ambient air monitoring plan is required by air quality permit #2414-01 which applies to Sterling's silver/copper mining operation located at Rock Creek, approximately 3 miles east of Noxon, Montana. This monitoring plan may be modified by the department. All current requirements of this plan are considered conditions of the permit.

2. Sterling shall operate and maintain three air monitoring sites in the vicinity of their silver/copper mine and facilities. The exact locations of the monitoring sites must be approved by the department and meet all the siting requirements contained in the Montana Quality Assurance Project Plan, including revisions; the EPA Quality Assurance Manual, including revisions; and Parts 50, 53 and 58 of the Code of Federal Regulations, or any other requirements specified by the department.

3. Sterling shall start monitoring for particulate matter less than 10 microns (PM10) at the commencement of construction of the mill facilities or the tailings disposal area. Sterling shall analyze for metals as described below on the PM10 filters once the mill facilities and the tailings impoundment are operational. Sterling shall continue monitoring for at least 1 year after normal production is achieved. Sterling may request an annual review of the air monitoring data and, at that time, the data will be reviewed and the department will determine the extent of monitoring which is warranted. The department may require continued air monitoring to track long-term impacts of emissions from the facility or require additional ambient air monitoring or analyses if any changes take place in regard to quality and/or quantity of emissions or the area of impact from the emissions.

4. Sterling shall monitor the following parameters at the sites and frequencies described below:

AIRS# and Site Name	UTM Coordinates	Parameter	Frequency
30-089-XXXX "Plant Area"	UTM Zone 11 N 53XXXXX E 59XXXX Elev. 2XXX ft	PM_{10}[1] As, Cu, Cd, Pb, Zn[2]	Every Third Day "
30-089-XXXX "Tailings - Upwind"	UTM Zone 11 N 53XXXXX E 59XXXX Elev. 2XXX ft	PM_{10}[1] As, Cu, Cd, Pb, Zn[2]	Every Third Day "
30-089-XXXX "Tailings Downwind"	UTM Zone 11 N 53XXXXX E 59XXXX Elev. 2XXX ft	PM_{10}[1]/PM_{10} Collocated[3] As, Cu, Cd, Pb, Zn[2] Wind Speed and Direction Sigma Theta[4], Temperature	Every Third/Sixth Day " Continuous "
[1] PM_{10} = particulate matter less than 10 microns. [2] As = Arsenic, Cu = Copper, Cd = Cadmium, Pb = Lead, Zn = Zinc. [3] The requirement for a collocated PM10 sampler may be waived if the monitor operator operates a collocated PM_{10} sampler at another site. [4] Sigma Theta = Standard Deviation of Horizontal Wind Direction.			

5. Data recovery for all parameters shall be at least 80 percent computed on a quarterly and annual basis. The department may require continued monitoring if this condition is not met.

6. Any ambient air monitoring changes proposed by Sterling must be approved in writing by the department.

7. Sterling shall utilize air monitoring and quality assurance procedures which are equal to or exceed the requirements described in the Montana Quality Assurance Project Plan, including revisions; the EPA Quality Assurance Manual including revisions; 40 CFR Parts 50, 53 and 58 of the Code of Federal Regulations; and any other requirements specified by the department.

8. Sterling shall submit quarterly data reports within 45 days after the end of the calendar quarter and an annual data report within 90 days after the end of the calendar year. The annual report may be substituted for the fourth quarterly report if all information in 9 below is included in the report.

9. The quarterly report shall consist of a narrative data summary and a submittal of all data points in AIRS format. This data may be submitted in ASCII files or on 3½diskettes (IBM-compatible format). The narrative data summary shall include:

a. A topographic map of appropriate scale with UTM coordinates and a true north arrow showing the air monitoring site locations in relation to the mine and facilities, the Cabinet Mountains Wilderness Area, the town of Noxon, and the general area;

b. A hard copy of the individual data points;

c. The quarterly and monthly means for PM10, each of the metals, and wind speed;

d. The first and second highest 24-hour concentrations for PM10 and each of the metals;

e. The quarterly and monthly wind roses;

f. A summary of the data collection efficiency;

g. A summary of the reasons for missing data;

h. A precision and accuracy (audit) summary;

i. A summary of any ambient air standard exceedances; and

j. Calibration information.

10. The annual data report shall consist of a narrative data summary containing:

a. A topographic map of appropriate scale with UTM coordinates and a true north arrow showing the air monitoring site locations in relation to the mine and facilities, the Cabinet Mountains Wilderness Area, the town of Noxon, and the general area;

b. A pollution trend analysis;

c. The annual means for PM10, wind speed, and each of the metals;

d. The first and second highest 24-hour concentrations for PM10 and each of the metals;

e. The annual wind rose;

f. An annual summary of data collection efficiency;

g. An annual summary of precision and accuracy (audit) data;

h. An annual summary of any ambient standard exceedance; and

i. Recommendations for future monitoring.

11. The department may audit, or may require Sterling to contract with an independent firm to audit, the air monitoring network, the laboratory performing associated analyses, and any data handling procedures at unspecified times. On the basis of the audits and subsequent reports, the department may recommend or require changes in the air monitoring network and associated activities in order to improve precision, accuracy and data completeness.

Permit Analysis
Sterling Mining Company
Rock Creek Project
Permit #2414-01

I. Introduction

Sterling submitted the original air quality permit application (#2414-00) for the Rock Creek Project on December 15, 1987. Following the submittal of additional information that application was deemed complete on June 8, 1988. Subsequently, Sterling requested a temporary suspension of the review process. On August 22, 1995 and December 4, 1995, Sterling submitted updated modeling analyses in support of the application. The original Preliminary Determination on the application was issued March 5, 1996. Sterling submitted revisions to the application on March 28, 1997, and May 28, 1997. This revised Preliminary Determination reflects the updated proposal and the revised application was given number 2414-01 for clarification. Based on comments received from the public, the Department of Environmental Quality (department) requested additional clarification regarding the deposition factor for NOx and the emissions from the temporary generators. The additional information was submitted by Sterling on July 24, 1998.

Sterling has proposed to construct a 10,000 ton-per-day (3.54 million tons per year) mine and mill complex to extract copper and silver ore from a mineral deposit underlying a portion of the Cabinet Mountains Wilderness, about 13 miles northeast of Noxon, in Sanders County, Montana. The project is similar in scope and operation to Sterling's inactive Troy Mine in Lincoln County, Montana. Sterling anticipates a 1 to 1.5 year period for constructing an evaluation adit, in addition to a 3-year period for mine construction and development with limited ore production. Full production would begin after that and is estimated to last for 30 years. The full production life would depend upon metal prices, engineering, and other factors that determine financial viability. Post-mining reclamation is estimated to last a few years.

Ore would be initially processed in an underground crusher. The above-ground ore-processing complex would further grind the ore, using a semi-autogenous mill (wet process) to liberate metal-bearing sulfides. Sulfides would then be removed by flotation and the concentrate transported by slurry pipeline to the Miller Gulch rail siding and ultimately shipped to an off-site smelter.

The mill complex, including surface conveyor, office building, shop, sewage treatment plant and warehouse, would be located at the confluence of the East and West Fork of Rock Creek. Tailings would be transported as a slurry to a paste plant at the tailings disposal area located about five miles away. There it would be dewatered to make a paste (20 percent by weight). Approximately 3.5 million tons per year of tailings would be deposited in a series of panels allowing for concurrent reclamation.

The proposed evaluation (exploration) adit would be driven prior to other work on the project in an attempt to better understand the configuration of the ore body. During the mine production phase, this adit would serve as an additional ventilation (exhaust) opening and as a secondary escapeway. Conventional mining methods would be employed for the 1-year adit construction period. Two propane generators would be used for power needs. Access would be by existing roads.

Mine development would include driving two parallel adits directly northeast of the mill site. The north adit would be used as a conveyor adit and the south as a service adit for mine access. A level working area at the portal would be constructed by cutting into the hill to create a vertical face for adit construction. Adit size is dictated by ventilation requirements and dimensions of mining equipment. Each adit would be approximately 25 feet wide by 20 feet high.

Electric ventilation fans would initially use the conveyor adit for intake and the service adit for exhaust. The evaluation adit would be used for primary exhaust removal when the underground workings reach it.

The changes to the original proposal which reduce emissions and air quality impacts are summarized below.

A. Paste Technology Tailings Management - A tailings paste, with a much lower water content than a slurry, would be generated. This allows for alternative construction methods. Paste tailings would be deposited in panels with some concurrent reclamation and reduced exposed tailings area reducing the potential for wind erosion.

B. Electric Underground Mining Equipment - Most underground mobile equipment would be electric powered. The diesel fueled equipment which would be used are classified as clean burning. Air pollutant reductions of about 60 percent are estimated from these changes.

C. Propane Generators - Cleaner burning propane generators would be used during the evaluation adit development phase of the operation.

D. Concentrate Slurry - Processed concentrate would be transported from the plant site to the Miller Gulch rail siding by slurry pipeline rather than by haul trucks, eliminating the emissions associated with hauling.

E. Semi-Autogenous Grinding (SAG) Mill - The surface dry milling operation (secondary crushing) would be replaced by a fully wet milling operation (SAG mill), reducing particulate emissions.

II. Applicable Rules and Regulations

The following are partial quotations of some applicable rules and regulations which apply to the operation. The complete rules are stated in the Administrative Rules of Montana (ARM) and are available upon request from the department. Upon request, the department will provide references for locations of complete copies of all applicable rules and regulations or copies where appropriate.

A. ARM 17.8, Subchapter 1 - General Provisions, including, but not limited to:

1. ARM 17.8.101 Definitions. This rule includes a list of applicable definitions used in this chapter, unless indicated otherwise in a specific subchapter.

2. ARM 17.8.105 Testing Requirements. Any person or persons responsible for the emissions of any air contaminant into the outdoor atmosphere shall, upon written request of the department, provide the facilities and necessary equipment (including instruments and sensing devices) and shall conduct tests, emission or ambient, for such periods of time as may be necessary using methods approved by the department.

3. ARM 17.8.106 Source Testing Protocol. The requirements of this rule apply to any emission source testing conducted by the department, any source, or other entity as required by any rule in this chapter, or any permit or order issued pursuant to this chapter, or the provisions of the Clean Air Act of Montana, 75-2-101, et seq., Montana Code Annotated (MCA).

   Sterling shall comply with the requirements contained in the Montana Source Test Protocol and Procedures Manual, including, but not limited to, using the proper test methods and supplying the required reports. A copy of the Montana Source Test Protocol and Procedures Manual is available from the department upon request.

4. ARM 17.8.110 Malfunctions. (2) The department must be notified promptly by telephone whenever a malfunction occurs that can be expected to create emissions in excess of any applicable emission limitation, or to continue for a period greater than 4 hours.

5. ARM 17.8.111 Circumvention. (1) No person shall cause or permit the installation or use of any device or any means which, without resulting in reduction in the total amount of air contaminant emitted, conceals or dilutes an emission of air contaminant which would otherwise violate an air pollution control regulation. (2) No equipment that may produce emissions shall be operated or maintained in such a manner that a public nuisance is created.

B. ARM 17.8, Subchapter 2 - Ambient Air Quality, including, but not limited to the following:

1. ARM 17.8.204 Ambient Air Monitoring;
2. ARM 17.8.210 Ambient Air Quality Standards for Sulfur Dioxide;
3. ARM 17.8.211 Ambient Air Quality Standards for Nitrogen Dioxide;
4. ARM 17.8.212 Ambient Air Quality Standards for Carbon Monoxide;
5. ARM 17.8.213 Ambient Air Quality Standard for Ozone;
6. ARM 17.8.214 Ambient Air Quality Standard for Hydrogen Sulfide;
7. ARM 17.8.220 Ambient Air Quality Standard for Settled Particulate Matter;
8. ARM 17.8.221 Ambient Air Quality Standard for Visibility;
9. ARM 17.8.222 Ambient Air Quality Standard for Lead;
10. ARM 17.8.223 Ambient Air Quality Standard for PM10; and
11. ARM 17.8.230 Fluoride in Forage.

Sterling must maintain compliance with the applicable ambient air quality standards.

C. ARM 17.8, Subchapter 3 - Emission Standards, including, but not limited to:

1. ARM 17.8.304 Visible Air Contaminants. This rule requires that no person may cause or authorize emissions to be discharged into an outdoor atmosphere from any source installed after November 23, 1968, that exhibits an opacity of 20% or greater averaged over 6 consecutive minutes.

2. ARM 17.8.308 Particulate Matter, Airborne. (1) This rule requires an opacity limitation of 20% for all fugitive emission sources and that reasonable precautions be taken to control emissions of airborne particulate.

   (2) Under this rule, Sterling shall not cause or authorize the use of any street, road, or parking lot without taking reasonable precautions to control emissions of airborne particulate matter.

3. ARM 17.8.309 Particulate Matter, Fuel Burning Equipment. This section requires that no person shall cause, allow, or permit to be discharged into the atmosphere particulate matter caused by the combustion of fuel in excess of the amount determined by this section.

4. ARM 17.8.310 Particulate Matter, Industrial Process. This section requires that no person shall cause, allow, or permit to be discharged into the atmosphere particulate matter in excess of the amount set forth in this section.

5. ARM 17.8.322 Sulfur Oxide Emissions--Sulfur in Fuel. Commencing July 1, 1971, no person shall burn any gaseous fuel containing sulfur compounds in

excess of 50 grains per 100 cubic feet of gaseous fuel, calculated as hydrogen sulfide at standard conditions.

6. ARM 17.8.340 Standard of Performance for New Stationary Sources and Emission Guidelines for Existing Sources. This section incorporates, by reference, 40 CFR Part 60, Standards of Performance for New Stationary Sources (NSPS). This facility is considered an NSPS affected facility under 40 CFR Part 60 and is subject to the requirements of the following subparts.

   Subpart LL - Metallic Mineral Processing Plants – Requires opacity limitations of 10% on process fugitives emissions and 7% on baghouse stack emissions and a stack particulate limitation of 0.05 grams per dry standards cubic meter.

D. ARM 17.8, Subchapter 5 - Air Quality Permit Application, Operation and Open Burning Fees, including, but not limited to:

1. ARM 17.8.504 Air Quality Permit Application Fees. This section requires that an applicant submit an air quality permit application fee concurrent with the submittal of an air quality permit application. A permit application is incomplete until the proper application fee is paid to the department. The original application on this project was submitted prior to implementation of this rule. The rule would apply to future permitting actions.

2. ARM 17.8.505 Air Quality Operation Fees. An annual air quality operation fee must, as a condition of continued operation, be submitted to the department by each source of air contaminants holding an air quality permit, excluding an open burning permit, issued by the department; and the air quality operation fee is based on the actual or estimated actual amount of air pollutants emitted during the previous calendar year.

   An air quality operation fee is separate and distinct from an air quality permit application fee. The annual assessment and collection of the air quality operation fee, described above, shall take place on a calendar-year basis. The department may insert into any final permit issued after the effective date of these rules, such conditions as may be necessary to require the payment of an air quality operation fee on a calendar-year basis, including provisions which pro-rate the required fee amount.

E. ARM 17.8, Subchapter 7 - Permit, Construction and Operation of Air Contaminant Sources, including but not limited to:

1. ARM 17.8.701 Definitions. This rule is a list of applicable definitions used in this subchapter, unless indicated otherwise in a specific subchapter.

2. ARM 17.8.704 General Procedures for Air Quality Preconstruction Permitting. This air quality preconstruction permit contains requirements and conditions applicable to both construction and subsequent use of the permitted equipment.

3. ARM 17.8.705 When Permit Required--Exclusions. This rule requires a facility to obtain an air quality permit or permit alteration if they construct, alter, or use any air contaminant sources which have the potential to emit more than 25 tons per year of any pollutant.

4. ARM 17.8.706 New or Altered Sources and Stacks--Permit Application Requirements. This rule requires that a permit application be submitted prior to installation, alteration or use of a source. Sterling has submitted the required permit application.

5. ARM 17.8.707 Waivers. ARM 17.8.706 requires that a permit application be submitted 180 days before construction begins. This rule allows the department to waive this time limit. The department hereby waives this time limit.

6. ARM 17.8.710 Condition of Issuance of Permit. This rule requires that Sterling demonstrate compliance with applicable rules and standards before a permit can be issued. Also, a permit may be issued with such conditions as are necessary to assure compliance with all applicable rules and standards. Sterling has demonstrated compliance with all applicable rules and standards as required for permit issuance.

7. ARM 17.8.715 Emission Control Requirements. This rule requires a source to install the maximum air pollution control capability which is technically practicable and economically feasible, except that best available control technology (BACT) shall be utilized. The required BACT analysis is included in Section III of the permit analysis.

8. ARM 17.8.716 Inspection of Permit. This rule requires that air quality permits shall be made available for inspection by the department at the location of the source.

9. ARM 17.8.717 Compliance with Other Statutes and Rules. This rule states that nothing in the subchapter shall be construed as relieving Sterling of the responsibility for complying with any applicable federal or Montana statute, rule or standard, except as specifically provided in ARM 17.8.101, et seq.

10. ARM 17.8.720 Public Review of Permit Applications. This rule requires that the applicant notify the public by means of legal publication in a newspaper of general

circulation in the area affected by the application for a permit. The public notice for the original application was published in the Sanders County Ledger.

11. ARM 17.8.731 Duration of Permit. An air quality permit shall be valid until revoked or modified, as provided in this subchapter, except that a permit issued prior to construction of a new or altered source may contain a condition providing that the permit will expire unless construction is commenced within the time specified in the permit, which in no event may be less than 1 year after the permit is issued.

12. ARM 17.8.733 Modification of Permit. An air quality permit may be modified for changes in any applicable rules and standards adopted by the Board or changed conditions of operation at a source or stack which do not result in an increase in emissions because of those changed conditions. A source may not increase its emissions beyond those found in its permit unless the source applies for and receives another permit.

13. ARM 17.8.734 Transfer of Permit. This section states an air quality permit may be transferred from one person to another if written notice of intent to transfer, including the names of the transferor and the transferee, is sent to the department.

F. ARM 17.8, Subchapter 8 - Prevention of Significant Deterioration of Air Quality, including, but not limited to:

1. ARM 17.8.801 Definitions. This rule is a list of applicable definitions used in this subchapter.

2. ARM 17.8.818 Review of Major Stationary Sources and Major Modifications--Source Applicability and Exemptions. The requirements contained in ARM 17.8.819 through 17.8.827 shall apply to any major stationary source and any major modification, with respect to each pollutant subject to regulation under the Federal Clean Air Act (FCAA) that it would emit, except as this subchapter would otherwise allow.

   This facility is not a PSD source since this facility is not a listed source and the site's potential to emit is below 250 tons per year of any pollutant (excluding fugitive emissions).

G. ARM 17.8, Subchapter 12 - Operating Permit Program Applicability, including, but not limited to:

1. ARM 17.8.1201 Definitions. (23) Major Source under Section 7412 of the FCAA is defined as any stationary source having:

a. Potential to Emit (PTE) > 10 tons/year of any one hazardous air pollutant (HAP), PTE > 25 tons/year of a combination of all HAPs, or lesser quantity as the department may establish by rule,

b. PTE > 100 tons/year of any pollutant, or

c. Sources with the PTE > 70 tons/year of PM-10 in a serious PM-1 nonattainment area.

2. ARM 17.8.1204 Air Quality Operating Permit Program. (1) Title V of the FCAA Amendments of 1990 requires that all sources, as defined in ARM 17.8.1204 (1), obtain a Title V Operating Permit. In reviewing and issuing Air Quality Permit #2414-01 for Sterling, the following conclusions were made:

a. The facility's PTE is less than 100 tons/year for any pollutant.

b. The facility's PTE is less than 10 tons/year for any one HAP and less than 25 tons/year of all HAPs.

c. This source is not located in a serious PM-10 nonattainment area.

d. This facility is not subject to any current NSPS.

e. This facility is not subject to any current NESHAP standards.

f. This source is not a Title IV affected source nor a solid waste combustion unit.

g. This source is not an EPA designated Title V source.

Based on these facts, the department has determined that Sterling will be a minor source of emissions as defined under Title V.

III. Existing Air Quality

Sterling performed baseline air quality monitoring in the area during 1985 and parts of 1986. Given the lack of new air pollutant sources in the area, the monitored levels are assumed to still be representative of current conditions. Current air pollutant sources include logging activities, vehicle traffic, and home heating/wood burning. The following table summarizes the baseline monitoring results.

Baseline Air Monitoring Summary

Pollutant	Site	Time Interval	Concentration (ug/m^3)[1]	Ambient Standard
TSP[2]	Highway 200[3]	Annual Average Annual Average 24-hour Maximum	16.5 11.5 56.9	NA NA NA
TSP	Mill[4]	Annual Average[5] Annual Average[5] 24-hour Maximum	23.2 19.0 69.9	NA NA NA
PM10[6]	Highway 200	Annual Average Annual Average 24-hour Maximum	10.4 6.6 41.2	NA NA NA
Lead	Highway 200	90-day Average	0.08	1.5
Lead	Mill	90-day Average	0.13	1.5

Notes:

[1]µg/m3 - micrograms per cubic meter of air samples.
[2]TSP - total suspended particulate - measured with high volume sampler.
[3]proposed tailings impoundment.
[4]proposed mill site.
[5]annual averages for the mill site are based on partial year data.
[6]PM10 - Particulate matter with a diameter of 10 microns or less.

IV. Emission Inventory and Control Technology Review

The following table lists the primary emission sources for the project, along with the emission control equipment and practices to be used. These emission control practices have been determined to represent BACT for this project and are consistent with practices on similar operations.

Estimated Pollutant Emission Inventory and Emission Controls

Source/Activity	Pollutant	Uncontrolled Emission (tons/year)	Type of Control Equipment/Practice	Estimated Control Efficiency (%)	Controlled Emission (tons/year)
Blasting	PM10 NOx SO_2 CO	0.3 19.4 1.5 92.5	Stemming, Drill Hole Size Optimization, Rubble Watering Control Overshooting Control Overshooting, Low Sulfur Fuel Oil Control Overshooting	--- --- --- ---	0.3 19.4 1.5 92.5
Diesel Equipment	PM10 NOx SO_2 CO HC	-- – – – –	Particulate Matter Trap Removals: Low Ash Fuel DITA Engines[1] Low Sulfur Diesel Oil Frequent Tune-ups to Manufacturer's Specs Frequent Tune-ups to Manufacturer's Specs Evap. Control System Maintenance	--- --- --- --- --- ---	0.1 7.0 0.3 4.8 3.2
Space Heating Propane Combustion	PM10 NOx CO HC	0.1 3.5 0.8 0.2	Use Propane, Routine Maintenance Schedule Maintain Near Stoichiometric Atmosphere Maintain Near Stoichiometric Atmosphere Routine Fuel Delivery and Burner System Inspection/Renewal	--- --- --- ---	0.1 3.5 0.8 0.2
Primary Crushing	PM10	15.0	High Efficiency Wet Scrubber	98	0.3
Surface Milling	PM10	--	Wet Process	---	Neg.
Ore Transfer	PM10	106.2	Baghouse	99	1.1
Road Dust	PM10	--	Paving	---	Neg.
Tailings Impoundment	PM10	--	Paste Tailings, Concurrent Reclamation	---	3.7

Note: The service adit and later the exploration adit are the emission points for blasting, diesel equipment, space heating, and primary crushing. 1DITA - Direct Injection Turbo-Charged Aftercooling

The total estimated emissions, by pollutant, are as follows:

Pollutant	Tons/Year
Particulate Matter less than 10 microns (PM-10)	5.6
Nitrogen Oxides (NOx)	29.9
Sulfur Dioxide (SO2)	1.8
Carbon Monoxide (CO)	98.1
Hydrocarbons (HC)	3.4

There would also be short-term emissions associated with the development of the evaluation adit (approximately 1 year). These would occur prior to the operational phase emissions listed above. The pollutant of most concern would be NOx from two propane generators used to supply power at the site located approximately 2 kilometers northeast of the proposed plant site. Total NOx emissions from these generators are estimated at 8.06 tons per year. These emissions will be controlled with add-on NOx controls. The add-on control includes a stack height on each generator of 5 meters. CO and HC emissions are estimated at 83.4 and 4.5 tons per year, respectively. Particulate emissions from the adit development operations and material handling should be negligible. BACT for these generators has been determined to be proper operation according to manufacturer specifications and continuous use of the added stack height of 5 meters above ground level.

A specific air quality concern is the potential for wind erosion from the tailings disposal area. When tailings surfaces are allowed to dry, there is significant potential for wind erosion to occur, given the fine texture of tailings material. Under the proposed paste tailings system, the exposed tailings surface is drastically reduced, given concurrent reclamation. There would also be a lack of the open, flat tailings surfaces typical of conventional tailings impoundments, which are more conducive to wind erosion. The need for supplemental dust control, such as watering, would be evaluated by the department through ongoing air quality monitoring and visual observation.

Another specific concern is the potential air quality impact to the Cabinet Mountains Wilderness. This area is designated as Class I under the Prevention of Significant Deterioration (PSD) regulations. The review of PSD requirements is carried out primarily through the analysis of permit applications for "major stationary sources." The Rock Creek Project is not classified as a major stationary source because estimated emissions by individual pollutant type are less than 250 tons per year. Although the PSD regulations do not apply directly to the proposed project, many of the specific PSD requirements have been applied. These include:

1) preconstruction and post-construction ambient air monitoring,
2) computer simulation modeling of emission impacts, and
3) an analysis of visibility impacts.

The impact analyses in Section V summarize the predicted air quality impact at the wilderness boundary. Compliance with the Class I and II increments has been demonstrated. (Note: The state's position is that increment consumption is not applicable to this project because it is a minor source in an area where the baseline has not been triggered. The Environmental Protection Agency's position is that the baseline is triggered for the entire state and all sources consume increment).

Section II.D of the permit requires emissions testing of the evaluation adit for NOx and particulate. The purpose of this testing is to evaluate and verify the emission estimates used in the application. Of special concern are the estimates of deposition rates in the adit prior to release to the atmosphere. By measuring the concentrations just downstream of the generation point and at the outlet, deposition and/or absorption rates as well as actual emissions can be determined. It is assumed portable ambient monitors would be used; however, the final methodology will be developed at that time.

Concentrations of potentially toxic trace metals in the particulate emissions were also analyzed in the original application. Specific metals included were lead, arsenic, cadmium, antimony, chromium, zinc, copper, and iron. This type of analysis is required for most large mining operations to identify whether any of these metals are present in sufficient quantities in the ore and/or tailings to create a hazardous condition from airborne particulate levels. The modeled TSP concentrations were multiplied by the mass fraction (percentage) of each metal in the ore and tailings. (Metals contents were based on data from the Troy Project.) The resulting metals concentrations were then added to the measured background levels in the area. Predicted concentrations of lead are well below state and federal ambient air quality standards. There are no standards for the other metals. Concentrations for those metals are, therefore, compared against guideline values used by the department. All concentrations were predicted to be below the guideline values.

V. Impact Analyses

Computer dispersion modeling was used to predict PM-10, NOx, and SO2 concentrations resulting from this operating scenario. The results are included in Table V-1 and indicate compliance with state and federal ambient air quality standards. Table V-2 compares the modeling results to PSD increments. The modeling details, as well as the analysis of the short-term impacts related to the evaluation adit development, are included in the application.

TABLE V-1
COMPARISON OF MAXIMUM PREDICTED CONCENTRATIONS WITH NATIONAL AND MONTANA AMBIENT AIR
(Production Scenario)

Time Interval	Maximum Contribution ug/m^3	Background Concentration ug/m^3	Contribution Plus Background ug/m^3	MAAQS/NAAQS
PM10 24-hour[a]	5.16	41.20	46.4	150
PM10 Annual[b]	2.00	10.54	12.54	50
SO_2 1-hour	257.1	35.0	292.1	1316
SO_2 3-hour	67.09	26.0	93.1	1300
SO_2 24-hour	12.16	11	23.2	263
SO_2 Annual[b]	0.52	3	3.52	53
NO_2 1-hour	-	-	0.159 ppm	0.30 ppm
NO_2 Annual[b]	-	-	7.17	100

[a] 24-hour concentration expressed as high, second-high values.
[b] Annual modeled contributions expressed as arithmetic mean.

TABLE V-2
COMPARISON OF MAXIMUM MODELED CONCENTRATIONS WITH APPLICABLE PSD INCREMENTS

Pollutant	Time Interval	Class I Predicted Concentration ug/m^3	Class II Predicted Concentration ug/m^3	Class I Increment ug/m^3	Class II Increment ug/m^3
PM10	24-hour	1.3	5.16	8	30
PM10	annual	0.075	2.00	4	17
SO_2	3-hour	16.5	67.09	25	512
SO_2	24-hour	3.36	12.16	5	91
SO_2	annual	0.19	0.52	2	20
NO_2	annual	2.41	4.74	2.5	25

Computer dispersion modeling was used to predict NOx concentrations resulting from the temporary propane-fired electrical generators. The results are included in Table V-3 and indicate compliance with state and federal ambient air quality standards. Table V-4 compares the modeling results to PSD increments. The modeling details, as well as the analysis of the short-term impacts related to the evaluation adit development, are included in the application.

TABLE V-3
COMPARISON OF MAXIMUM PREDICTED CONCENTRATIONS WITH NATIONAL AND MONTANA AMBIENT AIR
(Development Scenario)

Time Interval	Contribution Plus Background ug/m^3	MAAQS/NAAQS
NO_2 1-hour	0.222 ppm	0.30 ppm
NO_2 Annual[b]	17.3	100

[b] Annual modeled contributions expressed as arithmetic mean.

TABLE V-4
COMPARISON OF MAXIMUM MODELED CONCENTRATIONS WITH APPLICABLE PSD INCREMENTS

Pollutant	Time Interval	Class I Predicted Concentration ug/m^3	Class I Increment ug/m^3
NO_2	annual	1.62	2.5

An updated visibility analysis was also done using the VISCREEN MODEL. The estimated reduction in visual range caused by plumes was well below the perceptible level. The screening criteria for visibility impairment related to contrast was also not exceeded.

A concern for acid deposition impacts to some wilderness lakes had been raised due to their low neutralizing capacity. The proposed project site facilities are located about 2.7 to 4.5 miles from upper and lower Libby lakes. The Libby lakes meet the criteria for key Air Quality Related Values (AQRV) in the Class I wilderness area. Both lakes are positioned on the crest of the Cabinet Mountains in small Revett Quartzite watersheds. The lake watersheds have very limited mineral weathering, poorly developed soils, and sparse vegetation. The low amount of alkalinity (which neutralizes acid deposition from rain, snow, and dry deposition) results in the high sensitivity of the Libby lakes to acid deposition induced chemical change.

Potential acid deposition effects on upper and lower Libby Lakes from the Sterling Rock Creek Project and cumulative effects for the Noranda Montanore project were evaluated using the Model of Acidification of Groundwater in Catchments/With Aggregated Nitrogen Dynamics (MAGIC/WAND). The estimated changes in acid anions and base cations are not sufficient for the MAGIC/WAND model to project any changes in pH or alkalinity in upper and lower Libby lakes for either the Sterling emissions only or Sterling and Montanore cumulative emissions. The modeling results are due to the relatively low levels of project mine emissions and associated low dispersion model projections of percent increases in nitrogen and sulfur deposition to the Libby lakes. The full report from the U. S. Forest Service is on file with the department.

VI. Taking or Damaging Implication Analysis

As required by 2-10-101 through 105, MCA, the department conducted a private property taking and damaging assessment and determined there are no taking or damaging implications.

VII. Montana Environmental Policy Act (MEPA) Compliance

A Draft, Supplemental Draft, and Final Environmental Impact Statement on this project have been prepared by the department and the U. S. Forest Service.

Permit Analysis prepared by: Pat Driscoll
Date: August 1, 1997
Updated by: Vickie Walsh
Date: February 26, 2001

APPENDIX D

**PROPOSED MPDES PERMIT,
FACT SHEET, AND
STATEMENT OF BASIS**

Major Industrial
Acute Bio-monitoring
Permit No.: MT0030287

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

AUTHORIZATION TO DISCHARGE UNDER THE
MONTANA POLLUTANT DISCHARGE ELIMINATION SYSTEM (MPDES)

In Compliance with Mont. Code Annot. Section 75-5-101 *et seq.* and ARM Title 17, Chapter 30, Subchapters 5, 6, 7, 10 and 13.

Sterling Mining Company
424 S. Sullivan Road, Suite 300
Veradale, WA 99034

is authorized to discharge from its **Rock Creek Mine and Mill,**

to receiving waters named**, Clark Fork River and associated alluvial ground water, Miller Gulch, and Rock Creek.**

in accordance with discharge point(s), effluent limitations, monitoring requirements and other conditions set forth herein. Authorization for discharge is limited to those outfalls specifically listed in the permit. Specified load allocations support and serve to define total maximum daily loads for the receiving waters affected.

This permit shall become effective **December 1, 2001**.

This permit and the authorization to discharge shall expire at midnight, **November 30, 2006.**

FOR THE MONTANA DEPARTMENT OF
ENVIRONMENTAL QUALITY

____
Jan P. Sensibaugh
Director

Dated this ____________ day of _________________

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I. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

A. Definitions.

1. The "**30-day (and monthly) average**," other than for fecal coliform bacteria is the arithmetic average of all samples collected during a consecutive 30-day period or calendar month, whichever is applicable. Geometric means shall be calculated for fecal coliform bacteria. The calendar month shall be used for purposes of reporting self-monitoring data on discharge monitoring report forms.

2. The "**7-day (and weekly) average**," other than for fecal coliform bacteria, is the arithmetic mean of all samples collected during a consecutive 7-day period or calendar week, whichever is applicable. Geometric means shall be calculated for fecal coliform bacteria. The 7-day and weekly averages are applicable only to those effluent characteristics for which there are 7-day average effluent limitations. The calendar week which begins on Sunday and ends on Saturday, shall be used for purposes of reporting self-monitoring data on discharge monitoring report forms. Weekly averages shall be calculated for all calendar weeks in the month that has at least four days. For example, if a calendar week overlaps two months, the weekly average is calculated only in the month that contains four or more days of that week.

3. The **"Act"** means the Federal Clean Water Act.

4. "**Acute Toxicity Unit (TU_a)**" is the reciprocal of the lethal concentration (LC_{50}) multiplied by 100.

5. The "**Arithmetic Mean**" or "**Arithmetic Average**" for any set of related values means the summation of the individual values divided by the number of individual values.

6. "**Best Management Practices (BMP)**" means a schedule of activities, prohibitions of practices, maintenance procedures, and other activities to prevent or reduce the pollution of state waters. BMPs also include treatment requirements, operating procedures and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw, intermediate or finished products.

7. "**BOD_5**" is the five-day measure of pollutant parameter biochemical oxygen demand.

8. "**Bypass**" means the intentional diversion of waste streams from any portion of a treatment facility.

9. "**$CBOD_5$**" is the five-day measure of pollutant parameter carbonaceous biochemical oxygen demand.

10. "**Composite samples**" shall be flow proportioned. The composite sample shall, as a minimum, contain at least four (4) samples collected over the compositing period. Unless otherwise specified, the time between the collection of the first sample and the

last sample shall not be less than four (4) hours nor more than 24 hours. Acceptable methods for preparation of composite samples are as follows:

a. Constant time interval between samples, sample volume proportional to flow rate at time of sampling;

b. Constant time interval between samples, sample volume proportional to total flow (volume) since last sample. For the first sample the flow rate at the time the sample was collected may be used;

c. Constant sample volume, time interval between samples proportional to flow (i.e., sample taken every "X" gallons of flow); and,

d. Continuous collection of sample, with sample collection rate proportional to flow rate.

10. A "**Daily Maximum Limit**" specifies the maximum allowable discharge of a pollutant during a calendar day. Expressed as units of mass, the daily discharge is cumulative mass discharged over the course of the day. Expressed as a concentration, it is the arithmetic average of all measurements taken that day.

11. "**Department**" means the Montana Department of Environmental Quality (MDEQ).

12. "**Director**" means the Director of the United States Environmental Protection Agency's Water Management Division.

13. "**EPA**" means the United States Environmental Protection Agency.

14. A "**grab**" sample, for monitoring requirements, is defined as a single "dip and take" sample collected at a representative point in the discharge stream.

15. An "**instantaneous**" measurement, for monitoring requirements, is defined as a single reading, observation, or measurement.

16. "**Load limits**" are mass-based discharge limits expressed in units such as lb/day.

17. A "**mixing zone**" is a limited area of a surface water body or aquifer where initial dilution of a discharge takes place and where water quality changes may occur. Also recognized as an area where certain water quality standards may be exceeded.

18. **"Mine Drainage"** means any water drained, pumped or siphoned from the active mine area, including underground workings, mill area, storage or waste piles, rock dumps or mill tailings.

19. "**Nondegradation**" means the prevention of a significant change in water quality that lowers the quality of high-quality water for one or more parameters. Also, the prohibition of any increase in discharge that exceeds the limits established under or determined from a permit or approval issued by the Department prior to April 29, 1993.

20. "**Process Water**" means water or wastewater used in and resulting from the beneficiation of ores, including solutions used in leach pads, process ponds, or mill facilities, as well as, any water which commingles with any process water.

21. The "**Regional Administrator**" is the administrator of the EPA Region with Jurisdiction over federal water pollution control activities in the State of Montana.

22. "**Severe property damage**" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

23. "**Sludge**" is any solid, semi-solid or liquid residue that contains materials removed during waste treatment. Sludge includes, but is not limited to, primary and secondary solids and sewage sludge products.

24. "**TIE**" is a toxicity identification evaluation.

25. "**TRE**" is a toxicity reduction evaluation.

26. The term "**TMDL**" means the total maximum daily load limitation of a parameter, representing the estimated assimilative capacity for a water body before other designated uses are adversely affected. Mathematically, it is the sum of wasteload allocations for point sources, load allocations for non-point and natural background sources, and a margin of safety.

27. "**TSS**" is the parameter total suspended solids.

28. "**Upset**" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

29. **"Work Plan"** means any schedule, document, plan or activity required as a condition of this permit.

B. Description of Discharge Points

The authorization to discharge provided under this permit is limited to those outfalls specially designated below as discharge locations. Discharges at any location not authorized under an MPDES permit is a violation of the Montana Water Quality Act and could subject the person(s) responsible for such discharge to penalties under the Act. Knowingly discharging from an unauthorized location or failing to report an unauthorized discharge within a reasonable time from first learning of an unauthorized discharge could subject such person to criminal penalties as provided under Section 75-5-632 of the Montana Water Quality Act.

Outfall Serial Number	Description of Discharge Point
001	At the end of the discharge pipe emptying to Clark Fork River, located approximately 47° 58’ 30” N latitude, 115° 44’ 0” W through an effluent diffuser located approximately 750 feet above the confluence with Rock Creek. The mixing zone would extend 300 feet downstream from the point of discharge.
002	Seepage from the tailing paste storage facility into the unconsolidated groundwater with hydrological connection to the Clark Fork River, centered at approximately 47° 58’ 55” N latitude, 115° 43’ 37” W. The mixing zone includes ground water below the impoundment and extends down gradient 700 feet.
003	At the outfall structure for the storm water detention pond(s) associated with the tailing paste storage pond emptying into Miller Gulch, located approximately 47° 58’ 56” N latitude, 115° 44’ 02” W. There is no mixing zone associated with this outfall.
004	At the end of the pipe emptying into Rock Creek located at approximately 48° 01’ 29” N latitude, 115° 42’ 15” W. Mixing is instantaneous.
005 (Internal)	At the end of the pipe from the domestic wastewater treatment system emptying into the mine drainage wastewater treatment unit located at approximately 48° 01’ 37” N latitude, 115° 42’ 21” W.

C. Specific Effluent Limitations

Outfall 001

1. Wastewater Effluent Requirements

Effective immediately and lasting through the term of the permit, the quality of effluent discharged by the facility shall, as a minimum, meet the limitations as set forth below:

Table 1. Final effluent wastewater limits for Outfall 001A.

Parameter	**Daily Maximum(1) (mg/L)**	**30-day Average(1) (mg/L)**	**30-day Average(2) (lbs/day)**
Total Inorganic Nitrogen, as N	15.0	8.4	232.0
Total Phosphorus, as P	1.5	0.84	23.2
pH, S.U.	(3)		
Total Suspended Solids	30	20	552.
Arsenic, Total Recoverable	0.0011	0.0004	0.011
Manganese, Total Recoverable	1.4	0.9	24
Mercury, Total Recoverable	0.000012	0.000006	0.0002
Whole Effluent Toxicity, TU_a	2	NA	NA

(1) See definitions in Part I.A of permit.
(2) Based on the 30-day average values of flow and concentration.
(3) Must be maintained with the range of 6.5 to 8.5 standard units (s.u.)

Table 2. Effluent limits for Outfall 001B.

Parameter	**Daily Maximum(1) (mg/L)**	**30-day Average(1) (mg/L)**	**30-day Average(1) (lbs/hr)**
Cadmium, Total Recoverable	0.0102	0.0066	0.0076
Copper, Total Recoverable	0.051	0.033	0.038
Lead, Total Recoverable	0.0114	0.0074	0.0085
Selenium, Total Recoverable	0.061	0.039	0.0449
Zinc, Total Recoverable	0.5	0.279	0.321

(1) See definitions in Part I.A of permit.
(2) Based on the 30-day average values of flow and concentration.

Outfall 001 – Conditional Effluent Limits

Subject to written approval, and lasting through the term of the permit, the quality of effluent discharged by the facility shall, as a minimum, meet the limitations as set forth below when the receiving water flow exceeds 3,600 cubic feet per second (cfs):

Table 3. Conditional effluent limits for Outfall 001C (High flow).

Parameter	**Daily Maximum(1) (mg/L)**	**30-day Average(1) (mg/L)**	**30-day Average(1) (lbs/hr)**
Cadmium, Total Recoverable	0.097	0.05	0.057
Copper, Total Recoverable	0.30	0.15	0.172
Lead, Total Recoverable	0.098	0.064	0.074
Selenium, Total Recoverable	0.582	0.377	0.43
Zinc, Total Recoverable	1.5	0.75	0.86

(1) See definitions in part I.A. of permit.
(2) Based on the 30-day average values of flow and concentration.

2. Other Limitations and Conditions – Outfall 001

a. There shall be no discharge of Process Water, except as follows:

The total volume of bleed-off from the mill circuit shall not be allowed to exceed 170.3 million gallons per year.

Outfall 002

1. Ground Water Compliance Limits

Effective immediately and lasting through the term of the permit, the quality of groundwater, after mixing with effluent from the paste storage facility shall, as a minimum, meet the limitations as set forth below:

Table 4. Ground water Compliance Levels.

Parameter	**Compliance Limit**(1)
pH, S.U.	6.5 – 8.5
Total Dissolved Solids, mg/L	500
Nitrite + Nitrate, as N, mg/L	7.5
Sulfate, mg/L	250
Arsenic, dissolved, mg/L	No Increase(2)
Cadmium, dissolved, mg/L	0.002
Copper, dissolved, mg/L	0.150
Lead, dissolved, mg/L	0.002
Manganese, dissolved, mg/L	No Increase(2)
Mercury, dissolved, mg/L	No Increase(2)
Zinc, dissolved, mg/L	0.75

(1) Compliance limits apply to all monitoring wells located down gradient of the paste storage facility, not to exceed 750 feet from the footprint of the facility, except if baseline monitoring determines a higher concentration exists prior to construction of facility.
(2) No increase means, that the analytical result for any single sample event including a check sample, if necessary, shall not exceed the upper bound of a 95 percent prediction interval calculated for the individual well from baseline monitoring.

2. Other Conditions – Outfall 002

Action Levels

If any action level is exceeded, the permittee shall notify the Department within five (5) working days. The Department will determine if additional corrective action is necessary. If the Department decides that additional corrective action is necessary, it shall provide written notification to the permittee requiring submittal of a Work Plan within 60 days. The Work Plan shall address the items in Part V.G. of this permit. Exceedance of an action limit is not considered a permit violation unless the permittee fails to submit the required work plan. Action levels are contained in Table 5.

Table 5. Action limits for ground water compliance wells.

Parameter	Action Level(1) mg/L
Nitrite + Nitrate, as N	5.0
Sulfate	20
Potassium	10
Dissolved Metals	(2)

(1) If background exceeded 50 percent of action level for any individual monitoring well, then action might be increased accordingly.
(2) Prior to permit renewal the permittee would be required to conduct a trend analysis of the data to determine if a statistically significant ($p < 0.05$) positive trend existed after accounting for seasonal and spatial variability.

Outfall 003

1. Wastewater Effluent Requirements

Effective immediately and lasting through the term of the permit, the quality of effluent discharged by the facility shall, as a minimum, meet the limitations as set forth below:

Table 6. Effluent limits for Outfall 003.

Parameter	Daily Maximum(1) (mg/L)
Oil and Grease	10
Acute, Whole Effluent Toxicity	1.0 TU_A
Arsenic, Total Recoverable	0.0011
Cadmium, Total Recoverable	0.0102
Copper, Total Recoverable	0.051
Lead, Total Recoverable	0.0114
Manganese, Total Recoverable	1.4
Mercury, Total Recoverable	0.000012
Selenium, Total Recoverable	0.061
Zinc, Total Recoverable	0.5

(1) See definition in Part I.A of permit.

2. Other Limitations and Conditions – Outfall 003

a) There shall be no discharge allowed from Outfall 003 unless the measured precipitation exceeded 2.8 inches, or equivalent amount of snowmelt runoff, in a 24-hour period as recorded at the paste storage facility.

b) The facility shall be designed, constructed, and maintained to contain the maximum volume of wastewater from the active surface (110 areas) that would result from a 100-year event during any 24-hour period, or the equivalent snowmelt, during a 24-hour period from all areas contributing runoff to the pond.

c) The permittee shall submit to the Department for review and approval, 180 days prior to construction, complete plans, specifications and schedule, for the paste storage facility storm water detention pond and structures collection and transporting wastewater to the detention pond.

d) The permittee is required to construct and maintain the outfall structure for the detention ponds to prevent overland flow and excess erosion and to maintain structural control of Miller Gulch during discharge events. Plans and specifications for erosion control structures and/or Best Management Practices (BMPs) would have to be submitted concurrently with plans and specifications for the pond design as required in item (b) above.

Outfall 004

1. Wastewater Effluent Requirements

Effective immediately and lasting through the term of the permit, the quality of effluent discharged by the facility shall, as a minimum, meet the limitations as set forth below:

Table 7. Final effluent limits for Outfall 004.

Parameter	**Daily Maximum[(1)] (mg/L)**	**30-day Average[(1)] (mg/L)**
Total Suspended Solids (TSS)[(2)]	30	20
pH[(2)]	Within the range 6.0 to 9.0	
Oil and Grease	10	NA
Ammonia, as N, Total	0.5	NA
Total Inorganic Nitrogen, as N	1.5	1.0
Arsenic, Total Recoverable[(3)]	0.009	0.001
Cadmium, Total Recoverable[(3)]	0.0016	0.0003
Copper, Total Recoverable[(3)]	0.008	0.003
Lead, Total Recoverable[(3)]	0.005	0.0004
Manganese, Total Recoverable[(3)]	0.05	0.025
Mercury, Total Recoverable[(3)]	0.0002	0.000012
Selenium, Total Recoverable	0.008	0.0005
Zinc, Total Recoverable[(3)]	0.020	NA

(1) See definitions in Part I.A. of permit.
(2) The limits would not apply when the discharge was a result of a 2.8-inch precipitation event or equivalent snowmelt.

2. Other Limitations and Conditions Outfall 004:

a) There shall be no discharge allowed from Outfall 004 except during the period April 1 to July 1 or when the measured precipitation at the mill site exceeded 2.8 inches in a 24 hour period or equivalent snow melt.

b) The facility shall have to be designed, constructed, and maintained to contain the maximum volume of wastewater that would be generated and stored in the detention pond during a 24-hour period and the maximum volume of additional wastewater generated by 2.8 inches of precipitation during a 24-hour period from all areas contributing runoff to the pond.

c) At least 180 days prior to construction, the permittee shall submit for Department review and approval complete plans, specifications, and schedule for the paste storage facility storm water detention pond and structures collection and transporting wastewater to the detention pond.

d) Infiltration to ground water must be minimized.

e) The permittee shall submit a Storm Water Management Plan for the mill facility for Department review and approval 90 days prior to construction of the mill detention pond.

f) The permittee shall install a continuous stream flow monitoring device Rock Creek in the vicinity of the discharge and to develop a stage-discharge relationship for the receiving water.

Outfall 005 – Internal Outfall

1. Wastewater Effluent Requirements

Effective immediately and lasting through the term of the permit, the quality of effluent discharged by the facility shall, as a minimum, meet the limitations as set forth below:

Table 8. Internal effluent limits for Outfall 005

Parameter	**7-Day Average (mg/L)**	**30-Day Average (mg/L)**
BOD_5	45	30
Total Suspended Solids	45	30

(1) See the definitions in Part I.A for the explanation of terms.

2. Other Limitations and Conditions – Outfall 005

a) Effluent pH shall remain between 6.0 and 9.0. For compliance purposes, any single analysis and/or measurement beyond this limitation would be considered a violation of the conditions of this permit.

b) The 30-day average percent removal of BOD_5 would not be less than 85 percent.

3. Sewage Sludge Requirements

a. The permittee would be required to handle and dispose of sewage sludge in a manner so as to protect public health and the environment.

b. The permittee would be required to submit a plan for disposal of sewage sludge generated from this facility.

D. <u>Self-Monitoring Requirements</u>

Outfall 001

1. Wastewater Monitoring

As a minimum, upon the effective date of this permit, the following constituents shall be monitored at the frequency and with the type of measurement indicated; samples or measurements shall be representative of the volume and nature of the monitored discharge. If no discharge occurs during the entire monitoring period, it shall be stated on the Discharge Monitoring Report Form (EPA No. 3320-1) that no discharge or overflow occurred.

Table 9. Monitoring requirements for Outfall 001.

Parameter *(in mg/L unless noted)*	**Frequency**	**Type(1)**	**RRV(4)**
Mill Bleed, gallons(3)	Continuous	Recorder	NA
Effluent Flow Rate, gallons per minute(3)	Continuous	Recorder	NA
Duration of Discharge, Outfall 001B, hrs per month	Continuous	Recorder	NA
Duration of Discharge, Outfall 001C, hrs per month	Continuous	Recorder	(8)
PH, s.u.	2/Day	Grab	0.1 SU
TSS	2/Day	Grab	5 mg/L
Hydrocarbon Sheen – Oil and Grease/Diesel Range Organics	2/Day	Visual(6)	NA
Ammonia, Total, as N	4/Week	Composite	0.05 mg/L
Nitrite + Nitrate, as N	4/Week	Composite	0.05 mg/L
Kjeldahl Nitrogen, as N	4/Week	Composite	0.1 mg/L
Total inorganic Nitrogen, as N	Per Sample Event	Calculated(5)	NA
Orthophosphate, as P	4/Week	Composite	0.005 mg/L
Total Phosphate, as P	4/Week	Composite	0.01 mg/L
Arsenic, Total Recoverable(2)	2/Week	Composite	0.003 mg/L
Cadmium, Total Recoverable(2)	4/Week	Composite	0.0001 mg/L
Copper, Total Recoverable(2)	4/Week	Composite	0.001 mg/L
Lead, Total Recoverable(2)	4/Week	Composite	0.003 mg/L
Manganese, Total Recoverable(2)	4/Week	Composite	0.01 mg/L
Mercury, Total Recoverable(2)	4/Week	Composite	0.0006 mg/L
Zinc, Total Recoverable(2)	4/Week	Composite	0.01 mg/L

Silver, Total Recoverable(2)	2/Week	Composite	0.003 mg/L
Selenium, Total Recoverable(2)	2/Week	Composite	0.001 mg/L
Acute Whole Effluent Toxicity	Quarterly	Grab	NA
Five-day biochemical oxygen demand	Weekly	Grab	NA
Group B and Group B Section 1 Priority Pollutants Scan(7)	Annual	Composite	NA
TSS, lbs/day	Monthly	Calculated	NA
Total inorganic Nitrogen, as N, lbs/day	Monthly	Calculated	NA
Total Phosphate, as P, lbs/day	Monthly	Calculated	NA
Arsenic, Total Recoverable, lbs/day	Monthly	Calculated	NA
Cadmium, Total Recoverable, lbs/hour	Monthly	Calculated	NA
Copper, Total Recoverable, lbs/hour	Monthly	Calculated	NA
Lead, Total Recoverable, lbs/hour	Monthly	Calculated	NA
Manganese, Total Recoverable, lbs/day	Monthly	Calculated	NA
Mercury, Total Recoverable, lbs/day	Monthly	Calculated	NA
Selenium, Total Recoverable, lbs/hour	Monthly	Calculated	NA
Zinc, Total Recoverable, lbs/hour	Monthly	Calculated	NA

(1) See the definitions in Part I.A. of the permit.
(2) Metals shall be analyzed according to "Methods for the Chemical Analysis of Water and Wastes, EPA-600/4-79-020, revised 1983", use Method 4.1.1 dissolved metal and Method 4.1.4 for total recoverable metals.
(3) If no discharge occurs during the reporting period, "no discharge" shall be recorded on the DMR report form.
(4) Required Reporting Value (RRV) based on Department Circular WQB-7 (DEQ 11/98).
(5) Total Inorganic Nitrogen is calculated as sum of [Ammonia] and [Nitrite plus Nitrate] concentrations.
(6) If a visual examination of the discharge indicated the presence of hydrocarbons by sheen, odor, or other sign, the permittee will be required to sample to Oil & Grease and for Diesel Range Organic by EPA Method 8015 (modified). For this method, three quantities are reported: DRO, DRO as Diesel, and Total Extractable Hydrocarbons.
(7) See NPDES Application Form 2D. If parameters in this list were already monitored as a condition of this permit, they might be excluded.
(8) See Part II.B of this permit.

2. Compliance with Effluent Limitations

For purposes of determining compliance with the effluent limits set forth in this permit, the permittee would have to use the Required Reported Values (RRV) listed Table I.D.1. For arsenic and mercury, the permittee would be required to use the following procedure for reporting compliance on the Discharge Monitoring Report (DMR).

Maximum Daily Limit (mg/L) – If all analytical results for the reporting period were less than the RRV, the reported value would be rounded to zero (“0”); otherwise, the maximum value is reported.

Average Monthly Limit (mg/L) – The permittee would be required to calculate the median (50th percentile) of all monthly values. If the analytical result given by the median were less than the RRV, the value reported would be reported as zero; otherwise the analytical result would be reported. For an even number of samples, both the N/2 and N/2 +1 values would have to be less that the RRV for the median to be reported as less than the RRV.

In addition to reporting the concentration values, load limits would have to be be calculated and reported according to the following method.

$$\textbf{LOAD} = \left(\sum \frac{C_i}{n}\right) x \left(\frac{V}{D}\right) x \quad CF \qquad eq.\ 4$$

Where:

1) For parameters with loads limits expressed as *pound per day* (lbs/day), use:

Load = 30-day calculated load, lbs/day,
C_i = measured concentration, mg/L,
N = number of samples,
V = total volume per reporting period, in millions of gallons,
D = number of days per reporting period,
CF = conversion factor, 8.345

2) For parameter with loads limits express as pound per hour (lbs/hr), use:

Load = 30-day calculated load, lbs/hr,
C_i = measured concentration at appropriate flow condition, mg/L,
N = number of samples,
V = total volume at high or low river flow, in millions of gallons,
D = duration of event, hours,
CF = conversion factor, 8.345

For load calculations involving arsenic and mercury, if the analytical result is less than the required reporting value, a zero (“0”) shall be used in the calculation of the mean; for the remaining parameters, the RRV would have to be used.

Outfall 002

1. Operational Monitoring

As a minimum, upon the effective date of this permit, the following constituents shall be monitored at the frequency and with the type of measurement indicated; samples or measurements shall be representative of the volume and nature of the hydrostratigraphic units. If no discharge occurs during the entire monitoring period, it shall be stated on the Discharge Monitoring Report Form (EPA No. 3320-1) that no discharge or overflow occurred.

Each monitoring cluster shall provide representative ground water quality data for hydrostratigraphic units present at that location. For most locations, three monitoring wells would be necessary. One well would monitor the upper portion of the lacustrine aquifer, and the second well would evaluate water quality in the basal gravel or shallow fractured bedrock aquifer. The third well would be installed to monitor the deep bedrock. Ground water monitoring at several locations would require an additional well to monitor water quality within shallow alluvial deposits.

These monitoring requirements would apply after the baseline-monitoring period and upon use of the tailing impoundment as a waste disposal facility. Operational monitor requirements are presented in Table II.B.3.1.

Table 10. Operational monitoring requirements for ground water compliance.

Parameter(2)	**Frequency**	**Type(1)**	**Minimum Level**
Static water level, elevation	Monthly	Instantaneous	0.01 feet
pH, s.u.	Monthly	Instantaneous	0.1
Temperature, °C	Monthly	Instantaneous	0.1 °C
Specific Conductance, mg/L	Monthly	Grab	10 mg/L
Total Dissolved Solids	Quarterly	Grab	10 mg/L
Ammonia, Total, as N	Monthly	Grab	0.1 mg/L
Nitrite + Nitrate, as N	Quarterly	Grab	0.05 mg/L
Total Phosphorus	Monthly	Grab	0.01 mg/L
Potassium	Quarterly	Grab	1 mg/L
Sulfate	Quarterly	Grab	1 mg/L
Arsenic, dissolved	Quarterly	Grab	0.003 mg/L
Cadmium, dissolved	Quarterly	Grab	0.001 mg/L
Copper, dissolved	Quarterly	Grab	0.01 mg/L
Lead, dissolved	Quarterly	Grab	0.003 mg/L
Manganese, dissolved	Quarterly	Grab	0.01 mg/L
Mercury, dissolved	Quarterly	Grab	0.001 mg/L
Silver, dissolved	Quarterly	Grab	0.005 mg/L
Selenium, dissolved	Quarterly	Grab	0.005 mg/L
Zinc, dissolved	Quarterly	Grab	0.01 mg/L

(1) See the definitions in Part I.A. of the permit.
(2) In mg/L, unless noted otherwise.
(3) If specific conductance measurements were to indicate a significant change (greater than 25 percent from previous month's measurement), a sample would have to be collected and analyzed for these parameters. These parameters would have to be collected at all quarterly sampling events.

Operational Compliance with Limits. For those parameters for which no increase in concentration would be allowed in this permit, no sample concentration would be allowed to exceed the upper bound of a 95 percent prediction interval calculated for the individual well from baseline monitoring (Part V.). For all parameters, the analytical result would be deemed in compliance with the terms of this permit if the sample concentration were less than the minimum level.

Check Sampling. If a compliance limit or action level were exceeded for Outfall 002, the permittee would be required to take an additional sample following approved procedures and methods within five working days of the receipt of the analytical result showing the exceedance. Both sample results shall be reported. The Department may use the lower value to determine compliance if the permittee submits evidence that the original sample was contaminated. The Department may require additional sampling.

Beginning the first calendar quarter after the effective date of this permit, the permittee shall submit a quarterly report describing the activities undertaken pursuant to this part (Part V.). The report would have to be submitted to the Department and postmarked not later than the 28th day of the month following the calendar quarter.

Outfall 003

1. Wastewater Monitoring

As a minimum, upon the effective date of this permit, the following constituents shall be monitored at the frequency and with the type of measurement indicated; samples or measurements shall be representative of the volume and nature of the monitored discharge. If no discharge occurs during the entire monitoring period, it shall be stated on the Discharge Monitoring Report Form (EPA No. 3320-1) that no discharge or overflow occurred.

Table 11. Monitoring requirements for Outfall 003.

Parameter *(in mg/L unless noted)*	**Frequency**	**Type** (1)
Precipitation, Total Daily(4)	Daily	Recorder
Effluent Flow Rate, gpm(3)	Continuous	Recorder
PH, s.u.	Daily	Instantaneous
TSS	Daily	Grab
Ammonia, Total, as N	Daily	Grab
Nitrite + Nitrate, as N	Daily	Grab
Kjeldahl Nitrogen, as N	Daily	Grab
Total Phosphorus, as P	Daily	Grab
Arsenic, Total Recoverable	Daily	Grab
Cadmium, Total Recoverable, mg/L	Daily	Grab
Copper, Total Recoverable	Daily	Grab
Lead, Total Recoverable	Daily	Grab
Manganese, Total Recoverable(2)	Daily	Grab
Mercury, Total Recoverable(2)	Daily	Grab
Selenium, Total Recoverable(2)	Daily	Grab
Zinc, Total Recoverable(2)	Daily	Grab
Silver, Total Recoverable	Daily	Grab
Acute Whole Effluent Toxicity Testing	Per Event	Grab

(1) See the definitions in Part I.A. of the permit.
(2) Metals would have to be analyzed according to "Methods for the Chemical Analysis of Water and Wastes, EPA-600/4-79-020, revised 1983.". Use Method 4.1.1 for dissolved metal and Method 4.1.4 for total recoverable metals.
(3) If no discharge occurs during the reporting period, "no discharge" shall be recorded on the DMR report form.

(4) If the event were snowmelt runoff, calculations would have to be submitted to justify equivalence in runoff to the 2.8 inches of precipitation.
(5) Load calculations would be calculated based on volume and concentration and reported for Outfall 001.
(6) The permittee shall use the Required Reporting Values (RRV) listed in WQB – 7 [DEQ 1998].

In addition to Table 11, the following monitoring conditions would apply:

(1) For Outfall 003 the permittee would be required to report all discharge events by separate letter submitted with the DMR, listing the time the discharge began, duration of the discharge, form of precipitation (rainfall or snow melt), and sampling history.

Outfall 004

1. Wastewater Monitoring

As a minimum, upon the effective date of this permit, the following constituents shall be monitored at the frequency and with the type of measurement indicated; samples or measurements shall be representative of the volume and nature of the monitored discharge. If no discharge occurs during the entire monitoring period, it shall be stated on the Discharge Monitoring Report Form (EPA No. 3320-1) that no discharge or overflow occurred.

Table 12. Monitoring requirements for Outfall 004.

Parameter ***(in mg/L unless noted)***	**Minimum Frequency**	**Type** (1)
Effluent Flow Rate, gpm (3)	Continuous	Recorder
PH, s.u.	Daily	Instantaneous
TSS	Daily	Grab
Ammonia, Total , as N	Daily	Grab
Nitrite + Nitrate, as N	Daily	Grab
Kjeldahl Nitrogen, as N	Daily	Grab
Total Phosphorus, as P	Daily	Grab
Arsenic, Total Recoverable	Daily	Grab
Cadmium, Total Recoverable	Daily	Grab
Copper, Total Recoverable	Daily	Grab
Lead, Total Recoverable	Daily	Grab
Manganese, Total Recoverable(2)	Daily	Grab
Mercury, Total Recoverable(2)	Daily	Grab
Selenium, Total Recoverable(2)	Daily	Grab
Zinc, Total Recoverable(2)	Daily	Grab
Silver, Total Recoverable(2)	Daily	Grab

(1) See the definitions in Part I.A. of the permit.
(2) Metals would be analyzed according to "Methods for the Chemical Analysis of Water and Wastes, EPA-600/4-79-020, revised 1983", use Method 4.1.1 for dissolved metal and Method 4.1.4 for total recoverable metals.
(3) If no discharge occured during the reporting period, "no discharge" would have to be recorded on the DMR report form.

The following conditions apply to Outfall 004:

(1) For each discharge event, a grab sample shall be taken within the first 30 minutes. If the collection of a grab sample within the first 3 minutes was not practicable, a grab sample could be taken during the first hour of the discharge. The permittee would be required to submit with the monitoring report a description of why the sample could not be taken in the first 30 minutes.

(2) For Outfall 004 the permittee would be required to report all discharge events by separate letter submitted with the DMR, listing the time the discharge began, duration of the discharge, form of precipitation (rainfall or snowmelt), and sampling history.

Outfall 005

1. Wastewater Monitoring

As a minimum, upon the effective date of this permit, the following constituents shall be monitored at the frequency and with the type of measurement indicated; samples or measurements shall be representative of the volume and nature of the monitored discharge. If no discharge occurs during the entire monitoring period, it shall be stated on the Discharge Monitoring Report Form (EPA No. 3320-1) that no discharge or overflow occurred.

Table 13. Monitoring requirements for Outfall 004.

Parameter *(in mg/L unless noted)*	Frequency	Type(1)
Inffluent Flow Rate, gpm	Continuous	Recorder
Effluent Flow Rate, gpm	Continuous	Recorder
BOD_5(2)	Weekly	Grab
Total Suspended Solids(2)	Weekly	Grab
PH	Weekly	Instantaneous
Percent Removal BOD_5(3)	Monthly	Calculated
Percent Removal TSS(3)	Monthly	Calculated

(1). See the definitions in Part I.A. of the permit.
(2) In addition to monitoring the final discharge, influent samples would have to be taken and analyzed for this constituent at a frequency of once per week.
(3) Percent removal would have to be calculated using the monthly average values.

E. Whole Effluent Toxicity Testing – Acute Toxicity

Starting in the first calendar quarter following the effective date of the permit, the permittee shall, at least once each calendar quarter conduct an acute static replacement toxicity test on an undiluted composite/grab sample of the effluent. Testing will employ one species per quarter and the permittee shall alternate between the two test species from one quarter to the next. Samples shall be collected on a two day progression; i.e., if the first yearly sample is on a Monday, the second yearly sample shall be on a Wednesday, etc. Saturdays, Sundays and Holidays will be skipped in the progression.

Any Starting in the first calendar quarter following the effective date of the permit, the permittee shall, at least once each calendar quarter conduct an acute static replacement toxicity test on an undiluted composite/grab sample of the effluent. Testing will employ one species per quarter and the permittee shall alternate between the two test species from one quarter to the next. Samples shall be collected on a two day progression; i.e., if the first yearly sample is on a Monday, the second yearly sample shall be on a Wednesday, etc. Saturdays, Sundays and Holidays will be skipped in the progression.

The replacement static toxicity tests shall be conducted in general accordance with the procedures set out in the latest revision of Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms, EPA-600/4-90-027 and the "Region VIII EPA NPDES Acute Test Conditions – Static Renewal Whole Effluent Toxicity". The permittee shall conduct an acute 48-hjour static renewal toxicity test using *Ceriodaphnia sp*. and fathead minnows (*Pimephales promelas*) as the alternating species.

Acute toxicity occurs when 50 percent or more mortality is observed for either species at any effluent concentration. If more than 10 percent control mortality occurs, the test is considered invalid and shall be repeated until satisfactory control survival is achieved, unless a specific individual exception is granted by the Department. This exception may be granted if less than 10 percent mortality was observed at the dilutions containing high effluent concentrations.

If acute toxicity occurs in a routine test, an additional test shall be conducted within 30 days of the date of the initial sample. Should acute toxicity occur in the second test, testing shall occur once a month until further notified by the Department.

The quarterly test results from the laboratory shall be reported along with the Discharge Monitoring Report (DMR) form submitted for the end of the reporting calendar quarter (e.g., whole effluent results for the reporting quarter ending March 31 shall be reported with the March DMR due April 28, with the remaining quarterly reports submitted with the June, September, and December DMRs). The format for the laboratory report shall be consistent with the latest revision of Region VIII Guidance for Acute Whole Effluent Reporting, and shall include all chemical and physical data as specified.

G. Toxicity Reduction Evaluation (TRE)/Toxicity Identification Evaluation (TIE)

Should acute toxicity be detected in the permittee's discharge, a TIE-TRE shall be undertaken by the permittee to establish the cause of the toxicity, locate the source(s) of the toxicity, and develop control of, or treatment for the toxicity. Failure to initiate, or conduct an adequate TIE-TRE, or delays in the conduct of such tests, shall not be considered a justification for noncompliance with the whole effluent toxicity limits contained in Part I.C.1 of this permit.

II. MONITORING RECORDING AND REPORTING REQUIREMENTS

A. Representative Sampling. Samples taken in compliance with the monitoring requirements established under Part I of the permit shall be collected from the effluent stream prior to discharge into the receiving waters. Samples and measurements shall be representative of the volume and nature of the monitored discharge.

B. Monitoring Procedures. Monitoring must be conducted according to test procedures approved under Part 136, Title 40 of the Code of Federal Regulations, unless other test procedures have been specified in this permit. All flow-measuring and flow-recording devices used in obtaining data submitted in self-monitoring reports must indicate values within 10 percent of the actual flow being measured.

C. Penalties for Tampering. The Montana Water Quality Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $25,000, or by imprisonment for not more than six months, or by both.

D. Reporting of Monitoring Results. Self-Monitoring results will be reported monthly. Monitoring results obtained during the previous reporting period shall be summarized and reported on a Discharge Monitoring Report Form (EPA No. 3320-1), postmarked no later than the 28th day of the month following the completed reporting period. Whole effluent toxicity (biomonitoring) results must be reported with copies of the laboratory analysis report on forms from the most recent version of EPA Region VIII's "Guidance for Whole Effluent Reporting". If no discharge occurs during the reporting period, "no discharge" shall be reported. Legible copies of these, and all other reports required herein, shall be signed and certified in accordance with the "Signatory Requirements" (see Part IV.G of this permit), and submitted to the Department and the Regional Administrator at the following address:

a) Montana Department of Environmental Quality
Water Protection Bureau
P.O. Box 200901
Helena, Montana 59620-0901
Phone: (406) 444-3080

b) U.S. Environmental Protection Agency
301 South Park Avenue
Drawer 10096
Helena, Montana 59626
Phone: (406) 441-1123

E. Compliance Schedules. Reports of compliance or noncompliance with, or any progress reports on interim and final requirements contained in any Compliance Schedule of this permit shall be submitted no later than 14 days following each schedule date.

F. Additional Monitoring by the Permittee. If the permittee monitors any pollutant more frequently than required by this permit, using approved analytical methods as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the Discharge Monitoring Report. Such increased frequency shall also be indicated.

G. Records Contents. Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements;

2. The initials or name(s) of the individual(s) who performed the sampling or measurements;

3. The date(s) analyses were performed;

4. The time analyses were initiated;

5. The initials or name(s) of individual(s) who performed the analyses;

6. References and written procedures, when available, for the analytical techniques or methods used; and

7. The results of such analyses, including the bench sheets, instrument readouts, computer disks or tapes, etc., used to determine these results.

H. Retention of Records. The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least three years from the date of the sample, measurement, report or application. This period may be extended by request of the Department at any time. Data collected on site, copies of Discharge Monitoring Reports, and a copy of this MPDES permit must be maintained on site during the duration of activity at the permitted location.

I. Twenty-four Hour Notice of Noncompliance Reporting.

1. The permittee shall report any serious incidents of noncompliance as soon as possible, but no later than twenty-four (24) hours from the time the permittee first became aware of the circumstances. The report shall be made to the Water Protection Bureau at (406) 444-3080 or the Office of Disaster and Emergency Services at (406) 841-3911. The following examples are considered serious incidents:

   a. Any noncompliance which may seriously endanger health or the environment;

   b. Any unanticipated bypass which exceeds any effluent limitation in the permit (See Part III.G of this permit, "Bypass of Treatment Facilities".); or

   c. Any upset which exceeds any effluent limitation in the permit (See Part III.H of this permit, "Upset Conditions”.).

2. A written submission shall also be provided within five days of the time that the permittee becomes aware of the circumstances. The written submission shall contain:

   a. A description of the noncompliance and its cause;

b. The period of noncompliance, including exact dates and times;

c. The estimated time noncompliance is expected to continue if it has not been corrected; and

d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

3. The Department may waive the written report on a case-by-case basis if the oral report has been received within 24 hours by the Water Protection Bureau, by phone, (406) 444-3080.

4. Reports shall be submitted to the addresses in Part II.D of this permit, "Reporting of Monitoring Results".

J. Other Noncompliance Reporting. Instances of noncompliance not required to be reported within 24 hours shall be reported at the time that monitoring reports for Part II.D of this permit are submitted. The reports shall contain the information listed in Part II.I.2 of this permit.

K. Inspection and Entry. The permittee shall allow the head of the Department or the Director, or an authorized representative thereof, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

4. Sample or monitor at reasonable times, for the purpose of assuring permit compliance, any substances or parameters at any location.

III. COMPLIANCE RESPONSIBILITIES

A. Duty to Comply. The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Montana Water Quality Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application. The permittee shall give the Department or the Regional Administrator advance notice of any planned changes at the permitted facility or of an activity which may result in permit noncompliance.

B. Penalties for Violations of Permit Conditions. The Montana Water Quality Act provides that any person who violates a permit condition of the Act is subject to civil or criminal penalties not to exceed $10,000 per day of such violation. Any person who willfully or negligently violates permit conditions of the Act is subject to a fine of not more than $50,000 per day of violation, or by imprisonment for not more than 2 years, or both, for subsequent convictions. MCA 75-5-611(a) also provides for administrative penalties not to exceed $10,000 for each day of violation and up to a maximum not to exceed $100,000 for any related series of violations. Except as provided in permit conditions on Part III.G of this permit, "Bypass of Treatment Facilities" and Part III.H of this permit, "Upset Conditions", nothing in this permit shall be construed to relieve the permittee of the civil or criminal penalties for noncompliance.

C. Need to Halt or Reduce Activity not a Defense. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D. Duty to Mitigate. The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

E. Proper Operation and Maintenance. The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit. However, the permittee shall operate, as a minimum, one complete set of each main line unit treatment process whether or not this process is needed to achieve permit effluent compliance.

F. Removed Substances. Collected screenings, grit, solids, sludges, or other pollutants removed in the course of treatment shall be disposed of in such a manner so as to prevent any pollutant from entering any waters of the state or creating a health hazard. Any sludges removed from the facility shall be disposed of in accordance with 40 CFR 503, 258 or other applicable rule. EPA and MDEQ shall be notified at least 180 days prior to such disposal taking place.

G. Bypass of Treatment Facilities:

1. Bypass not exceeding limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential

maintenance to assure efficient operation. These bypasses are not subject to the provisions of Parts III.G.2 and III.G.3 of this permit.

2. Notice:

a. Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least ten (10) days before the date of the bypass.

b. Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required under Part II.I of this permit, "Twenty-four Hour Reporting".

3. Prohibition of bypass.

a. Bypass is prohibited and the Department may take enforcement action against a permittee for a bypass, unless:

(1) The bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

(2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgement to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

(3) The permittee submitted notices as required under Part III.G.2 of this permit.

b. The Department may approve an anticipated bypass, after considering its adverse effects, if the Department determines that it will meet the three conditions listed above in Part III.G.3.a of this permit.

H. <u>Upset Conditions</u>.

1. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with technology based permit effluent limitations if the requirements of Part III.H.2 of this permit are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review (i.e., Permittees will have the opportunity for a judicial determination on any claim of upset only in an enforcement action brought for noncompliance with technology-based permit effluent limitations).

2. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

    a. An upset occurred and that the permittee can identify the cause(s) of the upset;

    b. The permitted facility was at the time being properly operated;

    c. The permittee submitted notice of the upset as required under Part II.I of this permit, "Twenty-four Hour Notice of Noncompliance Reporting"; and

    d. The permittee complied with any remedial measures required under Part III.D of this permit, "Duty to Mitigate".

3. Burden of proof. In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof.

I. Toxic Pollutants. The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

J. Changes in Discharge of Toxic Substances. Notification shall be provided to the Department as soon as the permittee knows of, or has reason to believe:

1. That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

    a. One hundred micrograms per liter (100 μg/l);

    b. Two hundred micrograms per liter (200 μg/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 μg/l) for 2,4-dinitrophenol and for 2-methyl-4, 6-dinitrophenol; and one milligram per liter (1 μg/l) for antimony;

    c. Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7); or

    d. The level established by the Department in accordance with 40 CFR 122.44(f).

2. That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

    a. Five hundred micrograms per liter (500 μg/l);

    b. One milligram per liter (1 mg/l) for antimony;

c. Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7); or

d. The level established by the Department in accordance with 40 CFR 122.44(f).

IV. GENERAL REQUIREMENTS

A. Planned Changes. The permittee shall give notice to the Department as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when the alteration or addition could significantly change the nature or increase the quantity of pollutant discharged. This notification applies to pollutants which are not subject to effluent limitations in the permit.

B. Anticipated Noncompliance. The permittee shall give advance notice to the Department of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

C. Permit Actions. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

D. Duty to Reapply. If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit. The application must be submitted at least 180 days before the expiration date of this permit.

E. Duty to Provide Information. The permittee shall furnish to the Department, within a reasonable time, any information which the Department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Department, upon request, copies of records required to be kept by this permit.

F. Other Information. When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or any report to the Department, it shall promptly submit such facts or information with a narrative explanation of the circumstances of the omission or incorrect submittal and why they weren't supplied earlier.

G. Signatory Requirements. All applications, reports or information submitted to the Department or the EPA shall be signed and certified.

1. All permit applications shall be signed as follows:

   a. For a corporation: by a responsible corporate officer:

   b. For a partnership or sole proprietorship: by a general partner or the proprietor, respectively;

   c. For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected official.

2. All reports required by the permit and other information requested by the Department shall be signed by a person described above or by a duly authorized representative of that person. A person is considered a duly authorized representative only if:

   a. The authorization is made in writing by a person described above and submitted to the Department; and

   b. The authorization specified either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or an individual occupying a named position.)

3. Changes to authorization. If an authorization under Part IV.G.2 of this permit is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of Part IV.G.2 of this permit must be submitted to the Department prior to or together with any reports, information, or applications to be signed by an authorized representative.

4. Certification. Any person signing a document under this section shall make the following certification:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

H. <u>Penalties for Falsification of Reports</u>. The Montana Water Quality Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction be punished by a fine of not more that $25,000 per violation, or by imprisonment for not more than six months per violation, or by both.

I. <u>Availability of Reports</u>. Except for data determined to be confidential under 40 CFR Part 2, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Department. As required by the Clean Water Act, permit applications, permits and effluent data shall not be considered confidential.

J. Oil and Hazardous Substance Liability. Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Clean Water Act.

K. Property or Water Rights. The issuance of this permit does not convey any property or water rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.

L. Severability. The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

M. Transfers. This permit may be automatically transferred to a new permittee if:

1. The current permittee notifies the Department at least 30 days in advance of the proposed transfer date;

2. The notice includes a written agreement between the existing and new permittees containing a specific date for transfer of permit responsibility, coverage, and liability between them;

3. The Department does not notify the existing permittee and the proposed new permittee of an intent to revoke or modify and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in Part IV.M.2 of this permit; and

4. Required annual and application fees have been paid.

N. Fees. The permittee is required to submit payment of an annual fee as set forth in ARM 17.30.201. If the permittee fails to pay the annual fee within 90 days after the due date for the payment, the Department may:

1. Impose an additional assessment consisting of 15% of the fee plus interest on the required fee computed at the rate established under 15-31-510(3), MCA, or

2. Suspend the processing of the application for a permit or authorization or, if the nonpayment involves an annual permit fee, suspend the permit, certificate or authorization for which the fee is required. The Department may lift suspension at any time up to one year after the suspension occurs if the holder has paid all outstanding fees, including all penalties, assessments and interest imposed under this sub-section. Suspensions are limited to one year, after which the permit will be terminated.

O. Reopener Provisions. This permit may be reopened and modified (following proper administrative procedures) to include the appropriate effluent limitations (and compliance schedule, if necessary), or other appropriate requirements if one or more of the following events occurs:

1. Water Quality Standards: The water quality standards of the receiving water(s) to which the permittee discharges are modified in such a manner as to require different effluent limits than contained in this permit.

2. Water Quality Standards are Exceeded: If it is found that water quality standards in the receiving stream are exceeded either for parameters included in the permit or others, the department may modify the effluent limits or water management plan.

3. TMDL or Wasteload Allocation: TMDL requirements or a wasteload allocation is developed and approved by the Department and/or EPA for incorporation in this permit.

4. Water Quality Management Plan: A revision to the current water quality management plan is approved and adopted which calls for different effluent limitations than contained in this permit.

5. Toxic Pollutants: A toxic standard or prohibition is established under Section 307(a) of the Clean Water Act for a toxic pollutant which is present in the discharge and such standard or prohibition is more stringent than any limitation for such pollutant in this permit.

6. Toxicity Limitation.. Change in the whole effluent protocol, or any other conditions related to the control of toxicants have taken place, or if one or more of the following events have occurred:

   a. Toxicity was detected late in the life of the permit near or past the deadline for compliance.

   b. The TRE/TIE results indicated that compliance with the toxic limits will require an implementation schedule past the date for compliance and the permit issuing authority agrees with the conclusion.

   c. The TRE/TIE results indicated that the toxicant(s) represent pollutant(s) that may be controlled with specific numerical limits, and the permit issuing authority agrees that numerical controls are the most appropriate course of action.

   d. Following the implementation of numerical controls on toxicants, the permit issuing authority agreed that a modified whole effluent protocol is needed to compensate for those toxicants that are controlled numerically.

   e. The TRE/TIE revealed other unique conditions or characteristics which, in the opinion of the permit issuing authority, justify the incorporation of unanticipated special conditions in the permit.

V. Special Conditions –Work Plans

A. Waterwater Treatment – Submittal of Plans

At least 180 days prior to construction, the permittee shall submit, for Department review and approval, plans and specifications, and schedule for construction of the wastewater treatment plant, including the results of any pilot test or other tests demonstrating the ability of the system to control pollutants regulated by this permit. The plan and specifications will have to show the exact location of all sample points and outfalls regulated in this permit. This plan would have to address the disposal of sludge, by-products, backwash, or other wastes that are generated by the facility and address the testing of these materials. The permittee shall not begin construction of the facility until the Department issued written approval of these plans and specifications. The Department may deny, approve, or approve with modifications. The work plan required under this paragraph would be deemed approved if the Department were to fail to act within 60 days of the complete submittal.

B. Flow-Based Effluent Limits

Prior to approval of Conditional Effluent Limits for Outfall 001(Part I.C), the permitee shall submit for Department review and approval a Work Plan for a system to monitoring receiving water (Clark Fork River) flow. As a part of this Work Plan, the permittee would be required to develop a method to test the monitoring system to determine its effectiveness at monitoring instream flow. The Department's final approval would be required to be based on the permittee having demonstrated that the flow monitoring system can achieve a 99 percent success rate incorrectly detecting when river flow is less than 3,600 cfs. Upon written approval from the Department, the permittee would be allowed to implement the flow monitoring system in conjunction with the modified effluent limits for metals. Final effluent limits would be based on low flow (365 cfs) and apply to Outfall 001 until the Work Plan has been approved and demonstrated to the satisfaction of the Department.

C. Instream Monitoring – Clark Fork River

The permittee shall submit a Work Plan for Department review and approval to accurately determine the instream concentration (mean and related parameters) for all parameters regulated by this permit or that might be found in the discharge at concentrations that exceed water quality standards and for supporting field parameters such as dissolved oxygen, pH, specific conductance, temperature and turbidity. The Work Plan shall address both high and low flow conditions and account for seasonal variation. Samples for analysis of metals must be conducted at a location above (upstream) of the proposed point of discharge. Monitoring for nutrients, including total nitrogen (ammonia, organic nitrogen, nitrite + nitrate) and total phosphorus (ortho-phosphorus organic), would have to be conducted at a location above (upstream) and below (downstream) of the proposed discharge. The location of the downstream sample location would have to be located below where the effluent had completely mixed (less than 10 percent bank-to-bank variation) and above any other significant source(s) of nutrients. In addition to the chemical analyses, the permittee would be required to monitor chlorophyll-a, total chlorophyll and ash-free dry weight above and below the point of discharge.

Field samples would have to be collected using an isokinetic depth-integrated sampler with sufficient number of adequately characterize the river. When river velocities were not sufficient to use isokinetic samplers, grab samples shall be taken at representative vertical locations and composited to obtain representative samples. Field sampling procedures would follow those outlined in USGS Techniques for Water-Resources Investigations of the U.S. Geological Survey (TWRI) series, specifically, Book 9. Handbook for Water-Resources Investigations. Deviations from these methods would have to be noted in the Work Plan.

For metals parameters with expected mean concentrations less than the RRV in WQB-7 (DEQ 1998), the permittee shall use EPA 1600 series methods and employ sampling procedure consistent with EPA method 1669 (EPA, 1996). All other analytical methods shall conform to ARM 17.30.641 [Sampling Methods]. The Work Plan shall have to address flow measurement and report flow, in cfs, for each sample event, or would have to demonstrate flow values from a reliable source.

The plan would also have to address the following specific components:

i. Objectives
ii. Sample locations;
iii. Sampling supplies and equipment;
iv. Sampling methods, including QA/QC samples;
v. Analytical parameters, and test methods, including QA/QC samples;
vi. Shipping and handling arrangements;
vii. Field verifications; and schedule.

D. Mixing Zone – Clark Fork River

The mixing zone is approved subject to the following conditions:

1. The permittee is required to submit complete plans and specifications, along with any site-specific information to support the diffuser design, for Department approval prior to construction.

2. The permittee is required to obtain all necessary permits and approvals prior to initiating any construction activities on the effluent diffuser.

3. Within one year after installation of the effluent diffuser, the permittee shall conduct a verification study of the diffuser characteristics, using a tracer to demonstrate that complete mixing might occur within the approved distance. The actual length of the mixing zone might be modified in subsequent permit renewals based on this information.

The permittee shall submit a Work Plan for Department review and approval to verify the nature and extent of effluent mixing at low flow through the use of a tracer. The purpose of this study would be to demonstrate that the effluent is completely mixed (less than 10 percent bank variation) within the downstream boundary of the mixing zone. The permittee shall use procedures consistent with those published by the USGS [Kilpatrick and Cobb], or equivalent. The study would have to address both critical low-flow and normal-flow conditions.

E. Ground Water Work Plan – Baseline Monitoring

The permittee shall submit a Work Plan to the Department for review and approval which addresses the perimeter of mixing zone to ensure that it is adequately delineated and a suitable baseline for the proposed compliance wells is developed in a timely manner. The Work Plan would have to include a schedule for submittal of all deliverables identified in this section and address the following components. The baseline monitoring would have to be completed 365 days prior to construction and use of the paste storage facility. The Work Plan must address the following items:

a. Monitor Well Location, Construction, and Development. The Work Plan must contain recommendations for the location, design and development of monitoring wells to delineate the spatial and temporal variability in water quality parameters down gradient of the proposed impoundment. Monitoring wells would be located on land owned or controlled by the permittee, or if not owned or controlled by the permittee, the permittee must demonstrate access to these wells for the reasonable life of the facility. This work must include design drawings of proposed well installations, and a description of the proposed well development method. The Work Plan must also address upgradient reference wells to be located in the same hydrostratigraphic units outside of the influence of the tailing impoundment. If, due to geological conditions, upgradient wells in individual hydrostratigraphic units cannot be completed, the permittee must identify an alternative upgradient, or other suitable reference site not influenced by the paste storage facility.

b. The Work Plan would have to contain a detailed Sampling Plan and a Quality Assurance/Quality Control (QA/QC) Plan, including but not limited to:
   i. Objectives;
   ii. Sample locations and sequencing, including QA/QC samples;
   iii. Sampling supplies and equipment;
   iv. Sampling methods;
   v. Analytical parameters and test methods;
   vi. Shipping and handling arrangements;
   vii. Field verification; and
   viii. Schedule.

   Sampling of monitoring wells would be conducted on a monthly basis, at minimum. In addition to the parameters regulated in this permit [Section II.B.1], the Sampling Plan would have to include a suite of parameters sufficient to provide a complete geochemical assessment of the aquifer, including major cations and anions, as well as a trace elements known or suspected to be in the paste material. Analytical methods would at minimum, be capable of achieving the required reporting values (RRV) listed in Department Circular WQB – 7.

c. Quality Assurance/Quality Control Plans. The QA/QC Plan must include but is not limited to a description of:
   i. Field QA/QC methods, including standard operating procedures, field documentation methods, QA/QC sample frequency and type, and field instrument calibration;
   ii. Chain of custody procedures;
   iii. Equipment of custody procedures;
   iv. Laboratory QA/QC program; and
   v. Data on documentation, validation, and tracking procedures.

If the Department comments on the Work Plan were to require substantive modifications of the Work Plan, a revised Work Plan would have to be submitted to the Department within 60 days of the Permittee's receipt of the Department's comments. Baseline monitoring would have to begin 365 days prior to activities related to construction to the paste storage facility.

Upon completion of the baseline phase, the permittee would be required to submit to the Department for review and approval a Draft Summary Report explaining the results of the Work Plan. The draft report would have to include but not be limited to:

a. Results of all chemical analyses; as well as, a summary and analysis of all this data and associated information;
b. A discussion of field observations;
c. Identification of deviations from the original work plan;
d. Monitor well construction drawings, and lithologic logs;
e. Monitor well location maps;
f. A discussion of the nature and extent of spatial and temporal variation in parameters monitored;
g. Evaluation of quality assurance and quality control measures; and
h. Copies of field notes, laboratory reports, and chain of custody documents;
i. A proposal for a compliance monitoring program including sampling frequency and data analysis protocols to identify exceedance of trigger levels, including trend analysis, and compliance limits;
j. Format for reporting monitoring data.

The permittee would be required to submit a final report within 45 days after receiving comment on the Draft Summary Report from the Department. The final report would have to address all comments provided by the Department.

F. Ground Water Work Plan – Interim Data Collection

Upon completion of the baseline-monitoring period, the permittee would be required to submit a Work Plan for collection of additional ground water data prior to the use of the facility for waste storage, if this interim period exceeded 180 days. Otherwise, the monitoring requirements of Part II.B.3 of this Statement of Basis would apply. Data collected during the interim period would be considered part of the baseline database.

G. Ground Water Work Plan – Exceedance of Action Levels

If the analytical results obtained from the downgradient monitoring wells for Outfall 002 exceed an action level, the permittee would be required to notify the Department of the exceedence within five working days. If the Department decided that additional action were necessary, it would provide written notification to the permittee requesting submittal of a Work Plan within 60 days. The Work Plan would have to contain a detailed assessment for the observed increase, recommendations for additional monitoring (spatial and/or temporal), a proposal to install ground water recovery wells, improvements, or modifications to the existing seepage collection system, or other actions that would address the situation. The Work Plan would contain a schedule for implementing the proposed action(s). Within 60 days, the Department may take any of the following actions:
(i) approve, in whole or part, the plan;

(ii) approve the plan with conditions; or,
(iii) disapprove, in whole or in part, directing that a revised work plan be submitted.

FACT SHEET AND STATEMENT OF BASIS
for Proposed Permit Limits

PERMITTEE: **Sterling Mining Company**
Rock Creek Project
424 S. Sullivan RD, Suite 300
Veradale, WA 99034

CONTACT: Wayne Schoomaker, Secretary-Treasurer
Phone: (509) 921-2294

PERMIT NO: MT-0030287

RECEIVING WATERS: Clark Fork River and associated alluvial ground water, Miller Gulch, and Rock Creek

FACILITY LOCATION: T26N, R32W, Section 28 (Waste Facility) and Section 10 (Mill) Sanders County, Montana

FACILITY DESCRIPTION:

Sterling Mining Company has proposed to construct and operate an underground copper and silver mine located approximately 5 miles northeast of Noxon, Montana, on the southern flanks of the Cabinet Mountains in Sanders County. The proposed project, known as the Rock Creek Project, would consist of 583 acres of surface disturbance and includes an underground mine, four adits (evaluation, service adits, and ventilation), utility and transportation corridors, a froth flotation mill facility, a tailings impoundment, wastewater treatment facility, and support facilities. The project involves four distinct phases: evaluation, preproduction, production, and post-production. Excess water from the project requiring discharge is predicted to range from 4 gpm in the early years of the project to a high of 2,300 gpm (post-production). The design capacity of the facility is 2,300 gpm (5.125 cfs). Underground storage of water would be used to reduce or temporarily eliminate spikes or seasonal increases in discharge volumes.

Wastewater would be treated to remove solids, metals, and nitrogen compounds. The company has submitted a conceptual level wastewater treatment design, which may include any or all of the following components. Physical flocculation and/or chemical coagulation followed by multimedia filtration for removal of metal and solids. Following this step, wastewater would undergo biological treatment for removal of ammonia (trickling filter) and inorganic nitrogen through anaerobic denitrification (anoxic biotreatment cells) and finally aeration. Sterling proposes to install and maintain a reverse osmosis (RO) unit on-site to provide additional treatment, as necessary, to meet effluent limitations.

Following treatment, the effluent would be discharged to the Clark Fork River at Outfall 001, approximately 750 feet above the mouth of Rock Creek. Effluent would be discharged to the river through an effluent diffuser, which consists of a perforated pipe running transverse to the flow of the river anchored to the bed of the river. The proposed design calls for a diffuser, extending the full width of the river (300 feet) in order to provide maximum dilution. Two-inch diameter ports would be spaced every 10 feet.

Permanent disposal of tailing and wastewater treatment sludge is at a proposed on-site paste storage facility. Tailings from the mill facility, along with other wastes, would be slurried to a dewatering plant. The paste plant would produce a tailing paste, approximately 80 percent solids by weight, which would be permanently disposed of in a 312-acre, unlined paste storage facility. Excess water from the paste plant would be recycled to the mill for use in the process water circuit. The paste storage facility is predicted by the applicant to reach a maximum seepage in year 40 of 22 gpm with sustained long-term seepage of 15 gpm. The primary source of seepage would be incident precipitation on the paste facility. Seepage from the paste facility would enter area ground water (Outfall 002).

Precipitation that falls on the paste storage facility and does not infiltrate would be collected by drainage ditches surrounding the facility and routed to lined storage pond(s) below the paste facility. Sediment retention structures, or other sediment control methods, might be used to reduce sediment input into the storage ponds. Under normal operating conditions, water collected in these ponds would be pumped to the mill and used as makeup water, or would be routed to the water treatment plant. If the treatment plant or mill were unable to accept water from the pond, or if the capacity of the ponds were exceeded by either a short duration high intensity storm (greater than 100-year, 24-hour event, 6.5 inches) or successive storms events of lesser intensity but greater duration (wet cycle), then discharge from the pond would occur through an engineered overflow structure. Discharge from this pond would enter an unnamed tributary to Miller Gulch and then may flow into the Clark Fork River below Outfall 001. The surface gradient is gentle in the vicinity of the discharge, and most of this water would infiltrate into soil. However, if the surface were frozen or if the infiltration capacity of the soils were exceeded, overland flow to Miller Creek could occur.

Any precipitation coming into contact with the paste storage facility is regulated as mine drainage [40 CFR 132(h)] and is subject to federal effluent limit guidelines. Mine drainage from the paste facility may be discharged to ground water (Outfall 002), to Miller Gulch from the storage ponds (Outfall 003), or treated and discharged to the Clark Fork River (Outfall 001). Permit MT0030287 does not authorize the discharge of storm water run-off from the paste storage site.

Ore processing would occur at the mill site located near the confluence of Rock Creek and West Fork Rock Creek. Any precipitation coming into contact with the mill area (active mine site) is considered mine drainage for the purposes of this permit. Storm water runoff from undisturbed land above the mill site would be diverted away from the mill to prevent run-on. Precipitation coming into contact with the mill area would be routed to lined, storm water retention ponds at the mill site and incorporated into the mill process water circuit. Precipitation not collected by the storm water retention ponds, along with runoff from the mill embankment and mill pad underdrains, would report to the underdrain containment pond. The underdrains would collect seepage, leakage, or spillage from the mill area, including the several lined ponds. Mine drainage wastewater is subject to federal effluent limit guidelines (ELG) at 40 CFR 440.104. Mine drainage from the underdrain containment pond may be discharged to Rock Creek (Outfall 004), subject to the terms and conditions of permit MT-0030287. The pond underdrain containment pond would be lined and would be sized to contain the 10-year, 24-hour storm event with a spillway sized to pass the 100-year, 24-hour event.

Uncontaminated storm water, that is, storm water that does not come into contact with the mill or paste facilities, waste rock, ore, adits, haul roads within the active mine area, or reclaimed portions of the mine site is not be covered by this permit at this time. These discharges may be covered under the Montana General Discharge Permit for Storm Water Associated with Mining and with Oil and Gas Activities (MTR300000) or through future modifications of this permit MT-0030287. Storm water at the evaluation adit site would be collected and percolated to groundwater under the authority of the operating permit; no surface water discharge from this area would be authorized.

On October 28, 1999, the original applicant, Asarco Inc., notified the Department that it had sold its interest in the Rock Creek Project to Sterling Mining Company and requested transfer of the application to Sterling Mining Company.

DESCRIPITION OF OUTFALLS:

001 Wastewater Treatment Plant Discharge (Outfall 001— Section I.)

The primary source of this effluent is ground water inflow to the underground mine (mine drainage) with lesser amounts of mill water bleed (Process Water), domestic wastewater, and storm water from the mill area and paste facility retention ponds. The maximum volume of wastewater discharged from these combined sources is predicted to be 2,300 gpm but would range from 4 gpm to 2,300 gpm during the life of the mine. Underground storage of water would be utilized to equalize flow to the treatment system as storage capacity becomes available. Effluent limitations developed herein apply at the end-of-pipe prior to mixing with the receiving water. Discharge to the Clark Fork River would be through an effluent diffuser located approximately 750 feet above the confluence with Rock Creek. The mixing zone would extend 300 feet downstream from the point of discharge.

002 Paste Storage Facility – Seepage to Ground Water (Outfall 002— Section II.)

Seepage of process water from the paste storage facility would enter into the underlying lacustrine, basal gravel, and bedrock aquifers. The underlying aquifers are hydrologically connected to the Clark Fork River. Compliance with ground water quality standards would be monitored in compliance wells located downgradient of the capture system and mixing zone. No numeric effluent limitations would be placed on the seepage from the impoundment. Ground water compliance would be monitored at compliance wells downgradient of a source-specific mixing zone, as addressed in Section II.

003 Paste Storage Facility—Storm Water Detention Pond (Section III.)

This outfall would consist of periodic overflow of mine drainage wastewater from the storm-water detention ponds below the paste storage facility. The lined pond(s) would be constructed to capture storm water runoff from the paste storage facility. Discharge is to an unnamed ephemeral tributary to Miller Gulch and, through infiltration, to alluvial ground water. Treatment of captured water would consist of settling prior to discharge.

004 Mill Area—Underdrain Containment and Storm Water Retention Pond (Section IV.)

This outfall consists of periodic overflow of commingled storm water and mine drainage from the mill area from the lined containment pond to Rock Creek. Treatment of captured water will consist of settling prior to discharge.

005 Domestic Wastewater Treatment Plant—Internal Discharge (Section V.)

This outfall consists of domestic sewage and wash water from the mill office discharged to the mill reservoir and ultimately to the treatment system for Outfall 001.

DEVELOPMENT OF EFFLUENT LIMITATIONS:

I. Outfall 001 - Waste Water Treatment Plant

A. Water Quality Based Effluent Limitations (WQBEL)

1. Background

Federal regulations [40 CFR § 122.44(d)(1)] require that WQBEL be established in permits when a discharge has a reasonable potential to cause, or contributes to, an excursion of a water quality standard. This section discusses background and resulting changes in the receiving water concentrations (RWC), effluent characteristics, and flow conditions used to develop WQBEL.

The Clark Fork River is classified as "B-1" water according to Montana Water-Use Classifications [ARM 17.30.607(1)]. B-1 waters are protected for the following uses: drinking water supply after conventional treatment; recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial supply. Dischargers issued permits shall conform with Montana Nondegradation Rules[ARM 17.30.7] and may not cause receiving water concentrations to exceed the applicable standards found in Department Circular WQB-7 and ARM

17.30.601 *et seq*. at the applicable stream flow. Montana's Nondegradation Policy [75-5-303, MCA] considers the quantity and strength of the pollutant and gives greater significance to carcinogens, toxins, and compounds that bioaccumulate and lesser significance to less harmful constituents. Increases in concentration of toxic constituents and nutrients that are less than the trigger level or 15 percent of the standard are not considered significant. Applicable water quality standards and nondegradation criteria are presented in Table I.A.1.1. Montana water quality standards for metals are based on total recoverable method of analysis.

Montana does not have water quality standards for nutrients (inorganic nitrogen and phosphorus). Nutrient effluent limits for new discharges are based on compliance with nondegradation criteria (trigger values given in DEQ Circular WQB-7 [DEQ, November 1998]. The allowable increase is calculated as the mean receiving water concentration (RWC) plus the trigger value. The Department may allow increases that exceed this amount in cases where the increase will not cause a harmful change in aquatic life or ecological integrity [ARM 17.30.715(g)]. However, due to the desire to limit nutrients in the Clark Fork River and Lake Pend Oreille, nutrient increases from the proposed discharge are limited to trigger values.

Montana's 303(d) list [DEQ 1996] identifies several water bodies in the Clark Fork basin as impaired due to excessive nutrients and in need of a Total Maximum Daily Load (TMDL). The Clark Fork River above the confluence with the Flathead River and Flathead Lake are listed as water quality limited due to nutrients. The Clark Fork below the confluence with the Flathead River is not listed as impaired due to nutrient enrichment. The 303(d) list identifies the lower Clark Fork as impaired due to habitat, thermal, and flow alteration. The proposed discharge would not contribute to impairment for these factors. The Permit MT-0030287 would be submitted to EPA Region VIII for approval as a TMDL under section 303(d) of the federal Clean Water Act.

Section 525 of the Federal Clean Water Act (FCWA) authorized a comprehensive study of the sources of pollution in Lake Pend Oreille. Pursuant to Section 525, a water quality management plan for the Clark Fork-Pend Oreille basin was developed in 1993. The Tri-State Implementation Council is responsible for implementation of this plan. A Nutrient Target Subcommittee was developed to address nutrient concerns in the upper basin and is responsible for development of Voluntary Nutrient Reduction Program (VNRP) [Tri-State Implementation Council 1998]. The goal of VNRP is to restore beneficial uses and eliminate nuisance algal growth in the Clark Fork from Warm Springs Creek to the Flathead River confluence. The VNRP identifies instream targets for chlorophyll-a, total phosphorus (0.039 mg/L), and total nitrogen (0.3 mg/L) for portions of the upper Clark Fork River. Although not applicable to this section of the river, the VNRP targets for total nitrogen and total phosphorus will be included in the analysis for comparative purposes.

Table I.A.1.1. Estimated receiving water quality (RW C) and water quality standards for Clark Fork River at Rock Creek, MT.

Parameter	Sample Size	Mean [1] RWC (mg/L)	Minimum RWC (mg/L)	Maximum RWC (mg/L)	Water Quality Standard [3] (mg/L)	Nondegradation Criteria (mg/L)
pH, S.U.	115	8.1	7.1	8.4	6.5 - 8.5	6.5 - 8.5
TSS	131	<2.8	<0.2	27	[2]	NS
Kjeldahl Nitrogen, as N	135	<1.17	<0.1	0.7	NS	NC
Ammonia, as N	137	<0.013	<0.01	0.07	1.33[3-c]	0.2/0.023[6]
Nitrite+Nitrate, as N	137	<0.034	<0.01	0.57	10[3-h]	1.5[6]
Total Inorganic Nitrogen, as N	137	<0.047	<0.02	0.64	[2]	0.057[6]
Total Nitrogen (TN), as N	135	<0.22	<0.13	1.41	[4]	NC
Ortho-phosphorus, as P	78	<0.002	<0.001	0.014	NS	0.003[6]
Total Phosphorus, as P	137	<0.011	<0.001	0.062	[4]	NC
Hardness, as $CaCO_3$	65	85	61	106	[2]	NC
Aluminum, Total Recoverable	17	0.07	0.008	0.43	0.087[3-c]	0.087[6] [7]
Arsenic, Total Recoverable	56	<0.0011	<0.001	0.003	0.018[3-h]	<0.0011[5]
Barium, Total Recoverable	13	0.078	0.02	<0.1	2. [3-h]	0.3[6]
Cadmium, Total Recoverable	63	<0.00023	<0.0002	0.001	0.0025[3-c]	0.00038/0.00033[6]
Copper, Total Recoverable	65	<0.0013	<0.001	0.010	0.0093[3-c]	0.0014/0.0018[6]
Lead, Total Recoverable	65	<0.0011	<0.001	0.003	0.0032[3-c]	0.00048/0.0012[6]
Iron, Total Recoverable	19	0.082	0.02	1.3	[2]	0.3 [8]
Manganese, Total Recoverable	17	0.02	0.008	0.067	[2]	0.05 [8]
Mercury, Total Recoverable	17	<0.0002	<0.00001	<0.005	0.000012[3-c]	<0.0002[5]
Silver, Total Recoverable	58	<0.0002	<0.0001	<0.0002	0.0041[3-a]	0.0006/0.0004[6]
Selenium, Total Recoverable [9]	67	<0.001	<0.001	0.003	0.005[3-c]	0.00075/0.0016[6]
Zinc, Total Recoverable	65	<0.0036	<0.0002	41	0.120[3-c]	0.018/0.0086[6]

NS= No Standard; NC= No Criteria; "<" indicates that some values used to calculate statistic were less than detection

(1) Arithmetic average used to estimate mean if sample size is greater than 30, otherwise median value used.

(2) Narrative Standard.

(3) Lowest applicable standard: chronic aquatic life (c), acute aquatic life (a), human health (h) or narrative (n) from DEQ Circular WQB-7 [DEQ 1998]. Standards for metal are based on total recoverable method of analysis.

(4) Clark Fork River Voluntary Nutrient Reduction Program (VNRP) targets for mainstem CFR above Flathead River are 0.3 mg/L total nitrogen and 0.039 mg/L total phosphorus [Tri-State Implementation Council, 1998].
(5) Classified as carcinogen or compound with BCF greater than 300; no increase above ambient allowed [ARM 17.30.715 (1)(b)].
(6) Classified as toxin or nutrient: increase limited to 15 percent of the applicable standard (first value) or trigger value [WQB-7] [ARM 17.30.715 (1)(c)].
(7) Aluminum, RWC exceeds 15 percent of standard; therefore, standard used to calculate maximum allowable increase.
(8) Nondegradation criteria for narrative parameters limited to measurable effect on beneficial uses [ARM 17.30.715(1)(g)].
(9) No data available at point of discharge; estimate based on USGS sites on Flathead River (12363000) and Clark Fork River (12353000).

Table I.A.1.2. Summary water quality statistics and Idaho water quality standards for Clark Fork River below Cabinet Gorge Dam, ID, for the period November 1989 to January 1998. Source: USGS - Idaho State Office, Boise, ID.

Parameter(1)	Sample Size	Mean (mg/L)	Standard Deviation (mg/L)	25^{th} Percentile (mg/L)	(median) 50^{th} Percentile (mg/L)	75^{th} percentile (mg/L)	Percent Less Than Detection (%)	Idaho(2) Numeric Standard (mg/L)
pH, S.U.	54	8	.3	7.9	8.1	8.3	0	6.5 - 9.5
Suspended Solids	40	9.1	17	2	3	7.5	0	-
Kjeldahl Nitrogen, as N	65	0.26	0.38	0.2	0.2	0.2	74	-
Ammonia, as N	57	0.024	0.017	0.015	0.02	0.03	30	1.36(3)
Nitrite+ Nitrate, as N	62	0.065	0.028	0.05	0.051	0.074	53	-
Ortho-phosphorus, as P	62	0.009	0.005	0.01	0.01	0.01	74	-
Total phosphorus, as P	65	0.013	0.008	0.01	0.01	0.014	41	
Hardness, as $CaCO_3$	27	88	9	81	91	93	0	-
Arsenic	24	0.001	0	0.001	0.001	0.001	50	50
Cadmium	24	0.001	0.0002	0.001	0.001	0.001	92	1.9(4)
Copper	24	0.013	0.036	0.003	0.003	0.0085	8	6.9(4)
Lead	24	0.0046	0.012	0.001	0.001	0.002	62	2.0(4)
Manganese	24	0.0035	0.004	0.002	0.002	0.003	17	-
Selenium	24	0.001	0	0.001	0.001	0.001	100	5
Zinc	24	0.013	0.009	0.006	0.011	0.018	4	89(4)

(1) In mg/L unless otherwise noted.
(2) Administrative Rules of the Idaho DHW [IDAPA 250.16.01.01, Effective Date April 4/8-96].
(3) IDAPA 250.02.C92) Table IV- Cold Water Biota, based on temperature 10ºC and pH 8.0.
(4) IDAPA 250.02.a.iv - Hardness dependent value is based on hardness of 70 mg/L $CaCO_3$

Background water quality was developed from two primary sources: (a) STORET station 5403CL01, located on the Clark Fork River below Noxon Rapids Dam at the USGS cable; and (b) baseline data collected by Asarco at various sites in the Clark Fork River near Rock Creek as presented in Asarco's Water Management Plan [June 1995] and baseline reports [Hydrometrics Inc. 1992 and 1994]. These data are summarized in Table I.A.1.1.

Because the Clark Fork River enters Idaho approximately 17 miles below the proposed point of discharge, potential impacts to Idaho water uses were also considered in the development of effluent limits. Idaho Water Quality Standards and Wastewater Treatment Requirements [IDAPA 16, Title 01, Chapter 20] designated certain waters within the State of Idaho as special resource water [Rule 02.054]. Regulations implementing this section prohibit any new point source discharge of pollutants to any water designated as a special resource water or to any tributary of or to the upstream segment of a special resource water, if pollutants significant to the designated beneficial uses can or will result in a reduction of the ambient water quality of the receiving special resource water as measured immediately below the applicable mixing zone [IDAPA 16.01.002.400]. The designated uses of the Clark Fork River in Idaho and Pend Oreille Lake are domestic water supply; agriculture; cold water biota; salmonid spawning; primary and secondary recreation; and special resource water. The Idaho DEQ has indicated that any measurable increase in ambient water quality would not be consistent with the special resource water regulations.

Water quality data collected by the USGS from the Clark Fork River below Cabinet Gorge Dam (Station Number 1239150) is summarized in Table I.A.1.2 for the period of record November 1989 to January 1998. Metal samples at this site were not collected after 1995. This data would be used to evaluate impacts to Idaho waters in Section I.E.

2. Effluent Characteristics

Estimates of effluent quality are provided in the Water Management Plan for Alternative 5 [Hydrometrics 1997]and are based on monitoring results at the Sterling (formerly Asarco) Troy mine and on estimated treatment efficiencies for the Rock Creek wastewater treatment system. To determine if the effluent has a reasonable potential to violate standards a statistical approach based on lognormal probability distribution was employed [EPA 1991]. The maximum effluent concentration was estimated based on the upper bound estimate of 99 percent confidence interval. Assuming a lognormal probability distribution. The mean and coefficient of variation (CV) were estimated from data provided by Asarco in the Alternative V Water Management Plan [Hyrometrics, 1997], Table 6-1. The standard deviation was estimated from the observed range of selected parameters, including, ammonia, nitrite plus nitrate, orthophosphate, copper, lead, and zinc. The average coefficient of variation based on this data was estimated to be 1.33. The average and maximum daily concentrations for the effluent parameters are sown in Table I.A.2.1.

3. Flow

Flow is measured by Avista Corporation (formerly Washington Water Power Co.) at the Noxon Rapids Dam and reported by the U.S. Geological Survey (USGS) at station number 12391400 (Clark Fork below Noxon Rapids Dam, near Noxon, MT) approximately 1 mile upstream of the proposed discharge location. Flow through the Noxon Rapids facility is measured on a continuous basis and reported as mean daily discharge in cubic feet per second (cfs). For the period of record (June 1960 to September 30, 1996), the average and median daily flow for this site are 20,183 and 15,300 cfs, respectively. Low flow statistics for the 10-year return period (${}_{x}Q_{10}$) are as follows: 164 cfs (1-day, 10-year); 3,610 cfs (7-day, 10-year); and 5581 cfs (30-day, 10-year).

Flow statistics for this station are highly variable and exhibit a strong negative skew. In part, the reason for this pattern is that water releases from Noxon Rapids Dam are regulated to track daily and seasonal demand for electricity and the limited storage capacity of reservoir. Releases may fluctuate from zero to 51,000 cfs (maximum turbine capacity) during a 24-hour period. Flow is reduced to zero daily for approximately 6 hours each day and longer on weekends to allow the reservoir to fill. The river below the dam is not dewatered due to encroachment of the Cabinet Gorge Reservoir into the tailrace of the dam, groundwater recharge, and minor leakage from the dam. The tailrace elevation below the dam averages 2,177 feet. Full pool elevation for Cabinet Gorge Reservoir, approximately 20 miles downstream, is 2,175 feet with an average pool elevation of 2,172 feet [Avista Company 1995].

In response to public comment on the draft permit regarding the lack of low flow data, the USGS, at the request of the DEQ, conducted their routine annual monitoring at the cableway during a critical flow condition. This measurement was taken September 10, 1998 between 0650 and 0936 hours. Hydrometrics, Inc. took another flow measurement, on behalf of the applicant on September 25, 1998, between 0200 and 0500 hours. The results of these measurements are summarized in Table I.A.3.1.

On both occasions field personnel reported negative velocity measurements at some locations. Although upstream currents are possible, the most probable causes for negative readings were cable movement (bounce), drift, and wind effects. The September 25 measurements made by Hydrometrics was a more sensitive estimate of flow because the electromagnetic flow meter is capable of measuring flows down to 0.01ft/sec. The "AA" meter used by the USGS is typically used when flow is expected to exceed 1.5 ft/sec. The September 25 measurements would be used to evaluate discharge impacts during critical low flow.

Table I.A.2.1. Effluent characteristics from application Part V.

Parameter	Average Daily Concentration [(1)] (mg/L)	Maximum Daily Concentration [(1)] (mg/L)	Calculated Maximum Daily [(2)] (mg/L)
Flow, gpm	2300	-	-
pH, S.U.	7.5	8.4	-
Temperature ºC	4	7	-
TSS	10	30	30
Kjeldahl Nitrogen, as N	1.6	4.	7.7
Ammonia, as N	1.4	2.8	6.8
Nitrite+Nitrate, as N	3.2	6.0	15.4
Total Inorganic Nitrogen, as N	4.6	8.8	22.1
Total Nitrogen (TN)	4.8	26	23.0
Ortho-phosphorus	0.1	0.1	0.48
Total Phosphorus	0.1	0.1	0.48
Sulfate	22.6	42	108
Aluminum, Total	0.163	0.122	0.78
Arsenic, Total	<0.005	<0.005	0.024
Barium, Total	2.2	2.2	10.5
Cadmium, Total	<0.001	<0.001	0.0048
Copper, Total	0.047	0.213	0.225
Lead, Total	0.017	0.060	0.082
Iron, Total	0.079	0.224	0.38
Manganese, Total	0.448	0.836	2.15
Mercury, Total	<0.0005	<0.0005	0.0024
Silver, Total	<0.005	<0.005	0.024
Zinc, Total	0.019	0.043	0.091

(1) Source: Hydrometrics, Inc. January, 1997.
(2) Based on lognormal distribution, CV-1.4 (1.33), n=20, 99 percent confidence level [Table 3-1, TSD, EPA 1991]; calculated Maximum Daily Concentration = Average Daily concentration X 4.8.

Table I.A.3.1 Summary of low flow measurements of the Clark Fork River [(1)]

Parameter	USGS	Hydrometrics
Date	9/10/98	9/25/98
Begin Time (hours)	0600	0210
Area (feet squared)	7,295	7,524
Width (feet)	296	304
Mean Velocity	0.01	0.05
Calculated Discharge	69	376
Number of Transects	19	30
Measurement Gear	AA Price	Marsh-McBirney

(1) Complete data available in project files

The estimated flow in Table I.A.3.1 is consistent with flow duration curves developed by Avista as part of the federal relicensing procedure for Noxon Rapids Dam. This data indicates that on an annual basis, hourly discharge from Noxon dam is less than 200 cfs at least 10 percent of the time [Avista 1999]. During these periods of low flow, water quality downstream would be affected by the discharge. The downstream extent of this impact would vary depending on the length of time the flow was curtailed. During a typical nightly shutdown of 6 to 8 hours, concentrations would be elevated for approximately 1,440 feet. Depending on the time of year and other factors, the dam might be shut down for 24 to 36 hours, particularly on weekends, in order for reservoir levels to recover. The reservoir might also be closed for longer periods for maintenance purposes.

Effluent limits developed for the draft permit were based on the ${}_{7}Q_{10}$ mean daily flow (3,610 cfs) for metals and the ${}_{30}Q_{10}$ mean daily flow (5,581 cfs) for nutrients. The revised ${}_{7}Q_{10}$ is 365 cfs based on the measured flow during shut down of the Noxon Rapids facility. Effluent limits based on a flow of 3,610 cfs might adversely affect beneficial uses during these critical periods. Because of this concern, the permittee has requested that two separate effluent limits for metals be developed [Davis Young, Asarco Inc. Letter to Ms. Jan Sensibaugh, DEQ, October 14, 1999]. These staged effluent limits would correspond to the two flow regimes observed in the river. Because these flow conditions are not predicable, the permittee would be required to develop a real-time method for monitoring instream flow and demonstrate the capability of providing additional treatment, or to reduce the volume of the discharge to meet the more restrictive effluent limits. Because the effluent limits for nutrients (nitrogen and phosphorus) are based on the 30-day average flow, they would not be subject to this condition.

4. Reasonable Potential Analysis

To determine the need for WQBEL for pollutants listed in the application, the following equation was used:

$$C_r = \frac{Q_d C_d + Q_s C_s}{Q_y} \qquad \textit{eq.1}$$

Where:

Q_s = critical receiving water flow, 365 cfs or 5,581 cfs for nutrients,
Q_d = discharge flow (5.125 cfs),
Q_r = flow after mixing ($Q_s + Q_d$), in cfs,
C_s = mean receiving water concentration, before discharge, mg/L [Table I.A.1.1],
C_d = effluent concentration, calculated maximum, mg/L [Table I.A.2.1],
C_r = receiving water concentration, after mixing, mg/L [Table I.A.4.1].

If the effluent is determined to exceed the nondegradation criteria then a water quality based effluent limit must be developed for the parameter. Based on this analysis, WQBEL are necessary for total inorganic nitrogen (TIN), arsenic, copper, manganese, mercury, and selenium. Limits are necessary for several of these parameters because the detection limit in either the effluent or receiving water was not adequate to determine the concentration of the analyte (e.g. arsenic, mercury, selenium).

Table I.A.4.1 Potential for discharge to cause exceedance of nondegradation based water quality standards.

Parameter	Nondegradation Criteria (1) (mg/L)	Instream Flow (cfs)	Concentration After Mixing (3) (mg/L)	WQBEL (4) Necessary (Y/N)
pH, S.U.	6.5 - 8.5	365	7.0 - 8.5	N
TSS	NS(2)	365	3.2	N
Ammonia, as N	0.2	365	0.11	N
Nitrite+Nitrate, as N	1.5	365	0.048	N
Total Inorganic Nitrogen, as N	0.057	5,581	0.067	Y
Total Nitrogen (TN)	-	5,581	0.23	N
Ortho-phosphorus	0.003	5,581	0.002	N
Total Phosphorus	-	5,581	0.011	N
Aluminum, Total	0.087	365	0.08	N
Arsenic, Total	<0.0011	365	0.0014	Y
Barium, Total	0.3	365	0.22	N
Cadmium, Total	0.00038(5)	365	0.00029	N
Copper, Total	0.0018(5)	365	0.004	Y
Lead, Total	0.0012(5)	365	0.002	Y
Iron, Total	0.3	365	0.09	N
Manganese, Total	0.05	365	0.05	Y
Mercury, Total	0.000012	365	0.00020	Y
Silver, Total	0.0006	365	0.0005	N
Zinc, Total	0.0086(5)	365	0.005	N

(1) From Table I.A.1.1.
(2) Narrative Standard.
(3) Based on equation (1), see text.
(4) Water Quality Based Effluent Limit (WQBEL); Y-Yes, N-No.
(5) Increase for toxics (metals) limited to background plus trigger value, if baseline data available [Table I.A.1.1].

5. Wasteload Allocations (WLA) and Proposed WQBEL

WLA are developed for parameters with a potential to violate water quality standards based on the analysis in Section I.A.3 and for those parameters subject to effluent limit guidelines in 40 CFR 440.104. A wasteload allocation was also developed for phosphorus and selenium based on comments received on the draft permit from the Idaho DEQ and others.

The wasteload allocation (C_{WLA}), in mg/L, is calculated as follows:

$$C_{WLA} = \frac{Cr(Q_d + Q_s) - C_s Q_s}{Q_d} \qquad eq.2$$

where:

Q_s = instream flow, in cfs [Table I.A.4.1],
Q_d = discharge flow [5.125 cfs],
C_s = mean receiving water concentration, 365 (metals - low flow), 3,610 (metals - high flow), or 5,581 (nutrients) cfs,
C_r = nondegradation-based water quality standard, mg/L [Table I.A.4.1],
C_{WLA} = wasteload allocation, mg/L [Table I.A.5.1].

The C_{WLA} represents the highest allowable concentration in the discharge that will not exceed the applicable nondegradation-based water quality standards at the applicable flow. The equation (2) is a single-value, steady-state model and was selected based on the following criteria:

a. Baseline data for the Clark Fork River presented in Table I.A.1.1 indicate that water quality standards are met for all parameters in this reach of the river. No additional wasteload allocations are necessary. Montana's nondegradation criteria limit increases to *de minimis* levels, which are intended to protect the assimilative capacity of the river and would not prevent new dischargers or other activities.

b. Steady state models tend to be more conservative than other models because they are based on a combination of worst-case assumptions of flow, effluent variability, and environmental effects [EPA 1991]. Effluent limits derived from a steady state model are generally lower than limits derived from dynamic models and are more stringent than necessary to meet the return frequency requirements of water quality criterion for the pollutant of concern [EPA 1991].

c. EPA recommends steady state models be used where few or no whole effluent toxicity or chemical specific measurements are available (i.e. new dischargers) and little or no data is available on receiving water flow [EPA 1991]. In this case, sufficient data is not available to develop a low flow frequency-duration curve for the receiving water, and no effluent toxicity data is available.

d. A single-value model was selected because the river is regulated above the point of discharge, and the measured flow value (365 cfs for metals) used in the model represents both the acute (short-term) and chronic (long-term or repeated exposure) condition. Further, chemical-specific limits are based on 15 percent of the chronic standard, or no increase for carcinogens and bioaccumulative constituents. Acute-to-chronic ratios for the metal constituents in the permit range from 1 (zinc) to 23 (lead).

Effluent limits are expressed as Average Monthly (AML) and Maximum Daily (MDL) concentrations to account for the variability in effluent and to minimize exceedances of the C_{WLA} AML and MDL are based on a 95 percent probability of nonexceedance (except arsenic and mercury), 0.6 coefficient of variation and a sampling frequency of 10 samples per month for metals and 30 samples per month for nutrients (nitrogen and phosphorus). Because Montana's nondegradation criteria do not allow any increase in the concentration of carcinogens and bioaccumulating constituents, a 99 percent probability of nonexceedance was used in the derivation of MDLs and AMLs for these parameters. The calculations follow recommended criteria in the EPA's Technical Support Document (TSD) for Water Quality Based Toxics Control [EPA 1991], Option 1, Box 5-1. The 95 percent probability of nonexceedance (for all parameters except mercury and arsenic) was selected in preference to the 99 percent nonexceedance probability due to the fact that these limits are based on nondegradation criteria that are generally set at 15 percent of the chronic standard.

The Idaho DEQ and others expressed concern regarding the lack of an effluent limit for phosphorus in the draft permit. Phosphorus was evaluated in the draft FS/SOB and results of that analysis indicated that there was no reasonable potential for phosphorus to exceed nondegradation based water quality standards. For the purposes of the Anoxic Biotreatment Cells (ABC) biological treatment system, phosphorus is considered a process reagent and is added to the treatment system to promote the biological conversion of nitrate to nitrogen gas. Approximately one milligram of phosphate (as PO_4) is added for every 30 milligrams of nitrate removed [Asarco 1997]. Phosphorus is not subject to federal effluent limit guidelines but technology-based limits may be developed based on Best Profession Judgement (BPJ). Based on pilot- scale testing, inorganic phosphate in the discharge would range between 0.01 and 0.1mg/L depending on the need for nitrogen reduction. The concentration of organic phosphorus was not reported. Based on the lack of long-term performance data on the treatment system, a technology-based phosphorus limit was not developed.

Since phosphorus is a constituent of concern in the Clark Fork, a numeric limit for phosphorus would be included in the permit. The phosphorus limit would be based on compliance with nondegradation criteria (total inorganic phosphorus) but would be expressed as total phosphorus due to uncertainty of total phosphorus concentration and concern for nutrients in the river. For purposes of determining compliance with this limit the applicant would be required to collect an unfiltered sample and to use EPA Method 365.3 or equivalent. The monitoring frequency is in Table I.D.1.1.

The Idaho DEQ also requested that an effluent limit be included for selenium in comments received on the draft permit. Analysis of wastewater at the Troy facility has not detected selenium. No analysis for selenium has been conducted for the Clark Fork River at the point of discharge. Chemical analysis reported by the USGS at on the Flathead River at gage 1236300 and the Clark Fork at gage 12353000 report selenium concentration at or below the limit of detection (generally, 1 microgram per liter). Therefore, for purposes of developing a wasteload allocation, it is assumed that selenium is present at the detection limit and increase was limited to trigger value (0.0006) [Table I.A.1.1]. This is similar to approach used for other metals.

Table I.A.5.1 Water quality-based effluent (WQBEL) for selected parameters.

Parameter	C_{WLA} Wasteload Allocation (1) (mg/L)		LTA Long-Term Average (2) (mg/L)		MDL Maximum Daily Limit (3) (mg/L)		AML Average Monthly Limit (4)(5) (mg/L)	
Total Inorganic Nitrogen, as N	10.9		7.0		15.0		8.4	
Total Nitrogen, as N	89.6		57.7		122.9		68.7	
Inorganic Phosphorus, as P	1.1		0.70		1.5		0.84	
Total Phosphorus, as P	9.8		6.32		13.5		7.53	
Flow Condition:	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Arsenic, Total	0.0011	0.0011	0.00035	0.00035	0.0011	0.0011	0.0004	0.0004
Cadmium, Total	0.0075	0.071	0.0048	0.045	0.0102	0.097	0.0066	0.063
Copper, Total	0.0374	0.354	0.0241	0.228	0.051	0.485	0.033	0.315
Lead, Total	0.0083	0.072	0.0024	0.046	0.0114	0.098	0.0074	0.064
Manganese, Total	2.40	2.3	1.54	14.8	3.29	31.9	2.13	20.7
Mercury, Total	0.000012	0.000012	0.000004	0.00001	0.000012	0.000012	0.000006	0.000006
Selenium, Total	0.043	0.42	0.0285	0.273	0.061	0.582	0.039	0.377
Zinc, Total	0.365	3.5	0.235	2.27	0.500	4.8	0.279	2.70

Source EPA 1991 Table 5-1 and 5-2, Technical Support Document for Water Quality-based Toxics Control
(1) From equation (2), except mercury. Mercury wasteload allocation set at standard.
(2) LTA = WLA x 0.644 (LTA = WLA x 0.321, for mercury and arsenic).
(3) MDL = LTA x 2.18 (MDL = LTA x 3.11, for mercury and arsenic).
(4) AML = LTA x 1.38, based on sample size of 10 for metals or AML = LTA x 1.19 based on a sample size of 30 for nutrients (AML = LTA x 1.28, for mercury and arsenic).
(5) Includes Outfall 003 [Section III FS/SOB].

6. Whole Effluent Toxicity (WET) Limits

Montana Water Quality Standards require receiving waters to be free from substances that will cause toxic or harmful conditions to human, animal, plant, or aquatic life [ARM 17.30.637(1)(d)]. Although numeric standards may be exceeded in the mixing zone, an effluent in its mixing zone may not block passage of aquatic organisms nor may it cause acutely toxic conditions [ARM 17.30.602(14)]. Acute whole effluent toxicity (WET) limits are typically applied at the end-of-pipe unless instantaneous mixing is demonstrated or a properly designed effluent diffuser is installed [EPA 1997]. The permittee has proposed, and would be required to, discharge all effluent for Outfall 001 via the effluent diffuser.

Several parameters (ammonia, copper, cadmium, lead, and silver) would exceed acute water quality standards in the discharge pipe (Table I.A.2.1). The WET limit would be included as a condition of this permit to prevent acute lethality in the mixing zone during critical flow periods. Critical flow conditions are those when no water is released through Noxon Rapids Dam [Section 1.A.3]. To prevent blockage of aquatic organisms, the mixing zone would be limited to 10 percent of the low flow (365 cfs) of 3.65 cfs. Montana regulations allow exceedance of acute standards in a portion of the mixing zone, provided that the minimal initial dilution would not threaten or impair existing beneficial uses [ARM 17.30.507(1)(b)].

Acute toxicity is defined as 50 percent or more mortality at any effluent concentration, or in terms of toxicity units 0.3 TU_a [EPA 1991]. The WET limit is calculated from the following:

$$WLA_a = 0.3TU_a + D_m \text{ x } (0.3TU_a - TU_{s)} \qquad \text{(eq.3)}$$

Where:
WLA_a = wasteload allocation, in TU_a ,
D_m = minimum probable initial dilution (36.5 cfs/5.125 cfs),\
TU_s = instream toxicity, assume 0.

This results in an acute WET limit of 2.4 TU_a in the discharge. No chronic WET limit would be included in this permit because effluent limits would be based on nondegradation criteria or 15 percent of the chronic water quality standard outside of the mixing zone. Acute toxicity is also recommended in EPA Region 8 Whole Effluent Toxics Control Policy for industrial discharges with effluent volumes greater than 10 million gallons per day [EPA 1997].

7. Nondegradation

The effluent limits proposed for Outfall 001 in this Fact Sheet are developed based on Montana's nondegradation rules, specifically, the criteria of ARM 17.30.715; therefore, the discharge would be considered nonsignificant. In addition to limits based on concentration, load-based limits (lbs. per day) were developed to comply with 75-5-301(5)(c)(ii), MCA, which requires that the Department consider both quantity and strength of the pollutant. In the future, the facility would not be considered an increased source of pollutants and would not be subject to review under ARM 17.15.715 as long as the facility stayed under these limits. Load limits are calculated as follows:

30-Day Average (lbs./day) = Average Monthly Limit (mg/L) x Average Monthly Flow (cfs) x 5.39.

8. Mixing Zone

The effluent would contain several constituents –primarily copper but also cadmium, lead and silver– that would be expected to exceed acute aquatic life standards. Tailings wastewater from the Troy facility has also exhibited acute whole effluent toxicity (WET). Montana water quality standards require state surface waters to be free from substances that are toxic to plant or animal life [ARM 17.30.637(1)(d)]. However, the Department may allow a zone of initial mixing where acute standards are exceeded, provided that this initial mixing would not threaten or impair existing beneficial uses [ARM 17.30.507(b)]. The applicant has proposed to discharge all wastewater from Outfall 001to the Clark Fork River through an effluent diffuser. The diffuser would maximize initial dilution of the effluent, and all applicable criteria, including nondegradation criteria would be met outside of the mixing zone. Acute lethality will be minimized in the mixing zone through the imposition of acute toxicity WET testing [Section I.A.6] of the effluent. Based on the analysis in this section, existing beneficial uses would be protected; therefore, the discharge satisfies the requirements for a site-specific mixing zone.

The applicant has submitted information on the design of the effluent diffuser (Hydrometrics, Inc. 1999). The diffuser would consist of a perforated pipe running perpendicular to the flow of the river and extending the full width of the river (300 feet). Two-inch diameter ports would be spaced every 10 feet, resulting in an exit velocity from the diffuser of 2.7 feet per second. The momentum and buoyancy characteristics of the effluent would ensure rapid initial mixing of the effluent with the receiving water.

Analysis of the applicant's diffuser design was conducted using the UM model under the control of EPA's PLUMES interface [Baumgarter, et al. 1994]. Mixing rates and distances were evaluated for copper at both low and high flow conditions using this model. Copper was evaluated because of its high toxicity to aquatic organisms and because the concentration in the effluent will exceed the acute water quality standard by a factor of 3.3 (235 percent) to 16 (1,500 percent). The results of this analysis are summarized in Table I.A.8.8. The analysis predicts that effluent concentrations would be diluted to below potentially toxic levels within 2 meters (6.5 feet) of the discharge ports and would meet nondegradation criteria within 6 meters (20 feet) of the point of discharge during low flow and 74 meters (243 feet) at higher flows. Mixing would be more rapid and would be completed within a shorter distance at low flow, primarily due to the reduced instream velocity during these periods. During high flow conditions, the velocity of the river (2 to 5 feet per second) would partially offset the exit velocity of the effluent. Under either flow condition, the individual plumes from the diffuser ports would initially merge laterally (horizontally) and the contact either the surface or bottom depending on the temperature of the receiving water and effluent, which would vary seasonally.

Table I.A.8.1 Summary of EPA PLUME model analysis for copper mixing in receiving water.

Parameter/Condition	Flow Condition	
	Low	High
River Flow, cfs	365	17,000
River Velocity, feet per second	0.05	2.5
Dilution Factor (S_a)	72	3,318
Effluent Limit (copper), mg/L	33	150
Distance (m) (1)(2) – nondegradation criteria	6	74
Distance (m) (1)(3) – horizon merge of plume	6	311
Distance (m) (1)(4) – vertical contact with bottom/surface	7	1,277/1,000
Distance (m) (1)(5) – complete mixing, meters	6	Greater than 2,000
Distance (m) (1)(6) – fish avoidance criteria, meters	0.5	1.4

(1) Distance in meters downstream from point of discharge to satisfy stated criteria.
(2) Nondegradation criteria is background concentration (1.3 mg/L) plus trigger values (0.5 mg/L), [Section I.A.1.1].
(3) Lateral mixing of plumes.
(4) Distance downstream for plume to contact either surface of bottom; low flow plume will contact surface, high flow plume distance given are summer/winter. During colder conditions when effluent is warmer it will contact surface first; during summer plume will contact bottom first.
(5) 100 percent dilution of effluent with receiving water.
(6) Total copper concentration (background plus effluent) less than 6 mg/L.

The mixing zone would extend downstream to the point where nondegradation criteria would be met, that is, 244 feet (74 meters) below the point of discharge. Because of the uncertainties involved with this analysis, the distance is rounded up to 300 feet, or approximately a distance equivalent to one river width.

The mixing zone would be approved subject to the following conditions:

1. The permittee would be required to submit complete plans and specifications, along with any site-specific information to support the diffuser design, for Department approval prior to construction.

2. The permittee would be required to obtain all necessary permits and approvals prior to initiating any construction activities on the effluent diffuser.

3. Within one year after installation of the effluent diffuser, the permittee would be required to conduct a verification study of the diffuser characteristics, using a tracer to demonstrate that complete mixing might occur within the approved distance. The actual length of the mixing zone might be modified in subsequent permit renewals based on this information.

Mixing would be nearly instantaneous, as defined in Montana Administrative Rules for mixing zones [ARM 17.30.502(7)]. The mixing zone might be modified upon renewal of the permit, based on the results of tracer studies and actual flow measurement results.

B. Technology Based Effluent Limitations (TBEL**)**

The discharge from the proposed project would be a New Source [ARM 17.30.1304(37)] and, therefore, subject to federal New Source Performance Standards (NSPS). NSPS are a set of federal limitations reflecting the greatest degree of effluent reduction achievable through the application of best available demonstrated control technology, processes, operating methods, or other alternatives, including where practicable, a standard permitting no discharge of pollutants [40 CFR 401.12 July 1, 1998]. There are no NSPS promulgated for nutrients (nitrogen and phosphorus). Stormwater discharges would not be addressed in this permit.

1. Mine Drainage (see Part I.A of permit)

The concentration of pollutants in wastewater from the active mine area (mine drainage) would not be allowed to exceed the limits established in Table I.B.1. These effluent limit guidelines would apply to Outfalls 001, 003 and 004, except that these limits might be waived as a result of precipitation or snowmelt runoff in accordance with federal regulations [40 CFR 440.131(b) July 1, 1998] and specifically identified in the discharge permit.

Table I.B.1 Effluent limitations for copper, lead, zinc, gold, silver, and molybdenum ores subcategory [Subpart J, 40 CFR 440.104 July 1, 1998]

Parameter	Maximum Daily (mg/L)	30-Day Average (mg/L)
Copper	0.30	0.15
Zinc	1.5	0.75
Lead	0.6	0.3
Mercury	0.002	0.001
Cadmium	0.1	0.05
pH	(1)	(1)
TSS	30	20

(1) Within the range 6.0 to 9.0

2. Process Water (see part I.A of permit).

No discharge of process water would be allowed, except as follows: 40 CFR 440.104(B)(2)(ii) allows 'bleed-off' from the process water circuit when the build-up of contaminates significantly interferes with ore recovery. The applicant has indicated that up to 324 gpm of mill water bleed might be directed to the treatment system at full production. Federal regulations at 40 CFR 440.104(a)(2)(ii) require that the permittee demonstrate that the discharge is necessary and can not be eliminated through appropriate treatment. This demonstration has not yet been made. The permittee would be allowed to demonstrate the need for this bleed-off concurrent with submittal of plans and specifications. The Department would have to approve this plan prior to implementation. Monitoring of this volume would be required as a condition of the permit. The annual volume of bleed off would not be allowed to exceed 170.3 million gallons.

Except as noted above, process water from the mill circuit would be subject to a zero discharge requirement because the paste facility would be located in a net evaporative (evaporation exceeds precipitation) climatic zone [40 CFR 440.104(b)(2)(I)].

Because the bleed water would be required to meet the applicable effluent limitations for Outfall 001, the permittee would only be required to demonstrate the need for bleed-off; the proposed treatment system has been determined to be appropriate treatment for this effluent.

C. Final Effluent Limits — Outfall 001

Wastewater effluent limitations for Outfall 001 would be based on the more stringent of the WQBEL developed in Section I.A. or the TBEL given in Section I.B. Table I.C.1 summarizes proposed effluent limits based on NSPS and nondegradation-based effluent limits for both low and high receiving water flow conditions. Final effluent limits would be based on low flow (365 cfs) and apply to Outfall 001 at all times except that the permittee might submit plans and specifications in a work plan proposing a system to monitoring receiving water (Clark Fork River) discharge. As a part of this work plan, the permittee would be required to develop a method to test the monitoring system to determine its effectiveness at monitoring instream flow. The Department's final approval would be required to be based on the permittee having demonstrated that the flow monitoring system can achieve a 99 percent success rate incorrectly detecting when river flow is less than 3,600 cfs. Upon written approval from the Department, the permittee would be allowed to implement the flow monitoring system in conjunction with the modified effluent limits for metals.

Final limits are expressed in terms of both concentration and load (mass/time) in order to prevent exceedance of the wasteload allocation (Section I.C.5). Since receiving water flow can change on an hourly basis, load limits are expressed in terms of pounds per hour (lbs./hr) for those metals, which are flow sensitive. Concentration-based limits were converted to load limits according to the following equation:

Load (lbs./hr) = Average Monthly Limit (mg/L) x Discharge Rate (cfs) x 0.2246   (eq.4)

Table I.C.1 Comparison of technology based limits and water quality based effluent limits for metals. Values used in final limit is underscored.

Parameter	Maximum Daily Limit (mg/L)			Average Monthly Limit (mg/L)		
	NSPS TBEL	High Flow WQBEL	Low Flow WQBEL	NSPS TBEL	High Flow WQBEL	Low Flow WQBEL
Arsenic	NA	<u>0.0011</u>	<u>0.0011</u>	NA	<u>0.0004</u>	<u>0.0004</u>
Cadmium	0.1	<u>0.097</u>	<u>0.0102</u>	<u>0.05</u>	0.063	<u>0.0066</u>
Copper	<u>0.30</u>	0.485	<u>0.051</u>	0.15	0.315	<u>0.033</u>
Lead	0.6	<u>0.098</u>	<u>0.0114</u>	0.3	<u>0.064</u>	<u>0.0074</u>
Manganese	NA	<u>31.9</u>	<u>3.29</u>	NA	<u>20.7</u>	<u>2.13</u>
Mercury	0.002	<u>0.000012</u>	<u>0.000012</u>	0.001	<u>0.000006</u>	<u>0.000006</u>
Selenium	NA	<u>0.582</u>	<u>0.061</u>	NA	<u>0.377</u>	<u>0.039</u>
Zinc	<u>1.5</u>	4.8	<u>0.50</u>	<u>0.75</u>	2.7	<u>0.279</u>

1. Final Effluent Limits – Outfall 001

There are two categories of final limits for Outfall 001. The first category includes those parameters that are not dependent on flow in the receiving water (nutrient, some metals, TSS, pH, and WET). The second category includes those parameters that are flow dependent, i.e. the remaining metals. Final effluent limits for Outfall 001 are grouped into three classes to reflect these conditions: Outfall 001A is not flow-dependent (non-dependent); Outfall 001B (base condition); and Outfall 001C (high flow).?

The effluent limits in Table I.C.2 and Table I.C.3 would apply to Outfall 001 at all times. The effluent limits in Table I.C.4 would apply to Outfall 001 when the flow in the receiving water exceeds 3,600 cfs as monitored by the permittee's flow monitoring system and when the permittee receives written authorization from the Department.

2. Other Requirements of Outfall 001

a. The total volume of process water would not be allowed to exceed 170.3 million gallons per year [Section I.B.2].

b. At least 180 days prior to construction, the permittee would be required to submit, for Department review and approval, complete plans, specifications, and schedule for construction of the wastewater treatment plant, including the results of any pilot test or other tests demonstrating the ability of the system to control pollutants regulated by this permit. The plan and specifications will have to show the exact location of all sample points and outfalls regulated in this permit. Concurrent with this submittal, the permittee would be required to develop an operation and maintenance plan for the facility. This plan would have to address the disposal of sludges, by-products, backwash, etc. that are generated by the facility and address the testing of these materials. The permittee would not be allowed to begin construction of this facility until the Department issued written approval of these plans and specifications. The

Department might deny, approve, or approve with modifications. The work plan required under this paragraph would be deemed approved if the Department were to fail to act within 60 days of the complete submittal.

Table I.C.2. Final effluent wastewater limits for Outfall001A (Flow nondependent).

Parameter	Maximum Daily Limit [1] (mg/L)	Average Monthly Limit [1] (mg/L)	Load Average Monthly [2] (lbs./day)	Rational
Total Inorganic Nitrogen, as N	15.0	8.4	232.0	WQBEL, Table I.A.5.1
Total Phosphorus, as P	1.5	0.84	23.2	WQBEL, Table I.A.5.1
.pH, S.U.		(3)-		WQBEL, Table I.A.5.1
TSS	30	20	552.	NSPS, Table I.B.1
Arsenic, Total Recoverable	0.0011	0.0004	0.011	WQBEL, Table I.A.5.1
Manganese, Total Recoverable	1.4	0.9	24	IDAPA 20.02.400.01.b[4]
Mercury, Total Recoverable	0.000012	0.000006	0.0002	WQBEL, Table I.A.5.1
WET, TU_a	2	NA	NA	ARM 17.30.637(1)(d), see SOB section I.A.

(1) See definitions in Part I.A of permit.
(2) Based on the 30-day average values of flow and concentration.
(3) Must be maintained with the range of 6.5 to 8.5 standard units (s.u.)
(4) Based on the State of Idaho, Special Resource Waters designation – no measurable change. See Section I.E discussion. For manganese, MDL = 1.5 x AML. See section I.E for details.

Table I.C.3. Final Effluent wastewater limits for Outfall 001B (Default Flow Condition).

Parameter	Maximum Daily Limit [1] (mg/L)	Average Monthly Limit [1] (mg/L)	Load Average Monthly [2] (lbs./hr)	Rational
Cadmium, Total Recoverable	0.0102	0.0066	0.0076	WQBEL, Table I.A.5.1
Copper, Total Recoverable	0.051	0.033	0.038	WQBEL, Table I.A.5.1
Lead, Total Recoverable	0.0114	0.0074	0.0085	WQBEL, Table I.A.5.1
Selenium, Total Recoverable	0.061	0.039	0.0449	WQBEL, Table I.A.5.1
Zinc, Total Recoverable	0.5	0.279	0.321	WQBEL, Table I.A.5.1

(1) See definitions in Part I.A of permit.
(2) Based on the 30-day average values of flow and concentration.

Table I.C.4. Final effluent wastewater limits for Outfall 001C (High flow) subject to Department approval.

Parameter	Maximum Daily Limit (1) (mg/L)	Average Monthly Limit (1) (mg/L)	Load Average Monthly (2) (lbs./hr)	MDL/AML Rational
Cadmium, Total Recoverable	0.097	0.05	0.057	WQBEL, Table I.A.5.1 NSPS, Table I.B.1 (AML)
Copper, Total Recoverable	0.30	0.15	0.172	NSPS, Table I.B.1
Lead, Total Recoverable	0.098	0.064	0.074	WQBEL, Table I.A.5.1
Selenium, Total Recoverable	0.582	0.377	0.43	WQBEL, Table I.A.5.1
Zinc, Total Recoverable	1.5	0.75	0.86	NSPS, Table I.B.1

(1) See definitions in part I.A. of permit.
(2) Based on the 30-day average values of flow and concentration.

D. Self-Monitoring Requirements – Outfall 001

1. Effluent Monitoring

Sample collection, preservation, holding times, and test procedures for the analysis of pollutants shall comply with 40 CFR 136 (July 1, 2001). The permittee shall monitor the quality of the effluent discharged from Outfall 001 for the parameters and at the frequencies listed in Table I.D.1. For those parameters requiring four composite samples per week, two samples shall be collected from each receiving water flow condition (base or high flow) during the week. For those parameters requiring two composite samples per week, a minimum of one sample would have to be taken from the effluent for each flow condition (high or low) during the week. If receiving water flow precluded the use of one effluent limit category during the reporting period, the permittee would have to indicate no discharge on the applicable DMR. For those parameters requiring grab or visual sampling, a sample would have to be taken daily during each flow condition.

Table I.D.1. Monitoring requirements for Outfall 001.

Parameter *(in mg/L unless noted)*	**Frequency**	**Type**[(1)]	**RRV**[(4)]
Mill Bleed, gallons[(3)]	Continuous	Recorder	NA
Effluent Flow Rate, gallons per minute[(3)]	Continuous	Recorder	NA
Duration of Discharge, Outfall 001B, hrs per month	Continuous	Recorder	NA
Duration of Discharge, Outfall 001C, hrs per month	Continuous	Recorder	NA
pH, s.u.	2/Day	Grab	0.1 SU
TSS	2/Day	Grab	5 mg/L
Hydrocarbon Sheen – Oil and Grease/Diesel Range Organics	2/Day	Visual[(6)]	NA
Ammonia, Total, as N	4/Week	Composite	0.05 mg/L
Nitrite + Nitrate, as N	4/Week	Composite	0.05 mg/L
Kjeldahl Nitrogen, as N	4/Week	Composite	0.1 mg/L
Total inorganic Nitrogen, as N	Per Sample Event	Calculated[(5)]	NA
Orthophosphate, as P	4/Week	Composite	0.005 mg/L
Total Phosphate, as P	4/Week	Composite	0.01 mg/L
Arsenic, Total Recoverable[(2)]	2/Week	Composite	0.003 mg/L
Cadmium, Total Recoverable[(2)]	4/Week	Composite	0.0001 mg/L
Copper, Total Recoverable[(2)]	4/Week	Composite	0.001 mg/L
Lead, Total Recoverable[(2)]	4/Week	Composite	0.003 mg/L
Manganese, Total Recoverable[(2)]	4/Week	Composite	0.01 mg/L
Mercury, Total Recoverable[(2)]	4/Week	Composite	0.0006 mg/L
Zinc, Total Recoverable[(2)]	4/Week	Composite	0.01 mg/L
Silver, Total Recoverable[(2)]	2/Week	Composite	0.003 mg/L
Selenium, Total Recoverable[(2)]	2/Week	Composite	0.001 mg/L
Acute Whole Effluent Toxicity	Quarterly	Grab	NA
Five-day biochemical oxygen demand	Weekly	Grab	NA
Group B and Group B Section 1 Priority Pollutants Scan[(7)]	Annual	Composite	NA
TSS, lbs./day	Monthly	Calculated	NA
Total inorganic Nitrogen, as N, lbs./day	Monthly	Calculated	NA
Total Phosphate, as P, lbs./day	Monthly	Calculated	NA
Arsenic, Total Recoverable, lbs./day	Monthly	Calculated	NA
Cadmium, Total Recoverable, lbs./hour	Monthly	Calculated	NA
Copper, Total Recoverable, lbs./hour	Monthly	Calculated	NA
Lead, Total Recoverable, lbs./hour	Monthly	Calculated	NA
Manganese, Total Recoverable, lbs./day	Monthly	Calculated	NA
Mercury, Total Recoverable, lbs./day	Monthly	Calculated	NA
Selenium, Total Recoverable, lbs./hour	Monthly	Calculated	NA
Zinc, Total Recoverable, lbs./hour	Monthly	Calculated	NA

(1) See the definitions in Part I.A. of the permit.

(2) Metals would have to be analyzed according to “Methods for the Chemical Analysis of Water and Wastes, EPA-600/4-79-020, revised 1983”, use Method 4.1.1 dissolved metal and Method 4.1.4 for total recoverable metals.

(3) If no discharge occurs during the reporting period, “no discharge” would have to be recorded on the DMR report form.

(4) Required Reporting Value (RRV) based on Department Circular WQB-7 (DEQ 11/98).

(5) Total Inorganic Nitrogen is calculated as sum of [Ammonia] and [Nitrite plus Nitrate] concentrations.

(6) If a visual examination of the discharge indicated the presence of hydrocarbons by sheen, odor, or other sign, the permittee will be required to sample to Oil & Grease and for Diesel Range Organic by EPA Method 8015 (modified). For this method, three quantities are reported: DRO, DRO as Diesel, and Total Extractable Hydrocarbons.

(7) See NPDES Application Form 2D. If parameters in this list were already monitored as a condition of this permit, they might be excluded.

2. Compliance with Effluent Limitations

For purposes of determining compliance with the effluent limits set forth in this permit, the permittee would have to use the Required Reported Values (RRV) listed Table I.D.1. For arsenic and mercury, the permittee would be required to use the following procedure for reporting compliance on the Discharge Monitoring Report (DMR).

Maximum Daily Limit (mg/L) – If all analytical results for the reporting period were less than the RRV, the reported value would be rounded to zero (“0”); otherwise, the maximum value is reported.

Average Monthly Limit (mg/L) – The permittee would be required to calculate the median (50th percentile) of all monthly values. If the analytical result given by the median were less than the RRV, the value reported would be reported as zero; otherwise the analytical result would be reported. For an even number of samples, both the N/2 and N/2 +1 values would have to be less that the RRV for the median to be reported as less than the RRV.

This modified procedure would be necessary for these parameters because then RRV would be greater than the applicable effluent limits. This procedure is based on EPA guidance (Michael Cook Memorandum, 3/18/98 EPA-OW) and is in effect until Minimum Levels can be established for approved analytical methods. The permittee would be required to maintain all actual analytical results according to the procedure specified in Part II of the discharge permit.

The Department might approve modified required reporting values (RRV) upon written report from the permittee. In no case shall the modified RRV be greater than 1/10 of the effluent limit.

In addition to reporting the concentration values, load limits would have to be be calculated and reported according to the following method.

$$\textbf{LOAD} = \left(\sum \frac{C_i}{n}\right) \times \left(\frac{V}{D}\right) \times CF \qquad eq.\ 4$$

Where:

1) For parameters with loads limits expressed as *pound per day* (lbs./day), use:

Load = 30-day calculated load, lbs./day,
C_i = measured concentration, mg/L,
N = number of samples,
V = total volume per reporting period, in millions of gallons,
D = number of days per reporting period,
CF = conversion factor, 8.345

2) For parameter with loads limits express as pound per hour (lbs./hr), use:

Load = 30-day calculated load, lbs./hr,
C_i = measured concentration at appropriate flow condition, mg/L,
N = number of samples,
V = total volume at high or low river flow, in millions of gallons,
D = duration of event, hours,
CF = conversion factor, 8.345

For load calculations involving arsenic and mercury, if the analytical result is less than the required reporting value, a zero ("0") shall be used in the calculation of the mean; for the remaining parameters, the RRV would have to be used.

3. Instream Monitoring

a. The permittee would be required submit a Work Plan for Department review and approval to accurately determine the instream concentration (mean and related parameters) for all parameters regulated by this permit or that might be found in the discharge at concentrations that exceed water quality standards and for supporting field parameters such as dissolved oxygen, pH, specific conductance, temperature and turbidity. The Work Plan would be required to address sampling of both high and low flow conditions and should address seasonal variation. Samples for analysis of metals would have to be conducted at a location above (upstream) of the proposed point of discharge. Monitoring for nutrients, including total nitrogen (ammonia, organic nitrogen, nitrite + nitrate) and total phosphorus (ortho-phosphorus organic), would have to be conducted at a location above (upstream) and below (downstream) of the proposed discharge. The location of the downstream sample location would have to be located below where the effluent had completely mixed (less than 10 percent bank-to-bank variation) and above any other significant source(s) of nutrients. In addition to the chemical analyses, the permittee would be required to monitor chlorophyll-a, total chlorophyll and ash-free dry weight above and below the point of discharge.

Field samples would have to be collected using an isokinetic depth-integrated sampler with sufficient number of adequately characterize the river. When river velocities were not sufficient to use isokinetic samplers, grab samples shall be taken at representative vertical locations and composited to obtain representative samples. Field sampling procedures would follow those outlined in USGS Techniques for Water-Resources Investigations of the U.S. Geological Survey (TWRI) series, specifically, Book 9.

Handbook for Water-Resources Investigations. Deviations from these methods would have to be noted in the Work Plan.

For metals parameters with expected mean concentrations less than the RRV in WQB-7 (DEQ 1998), the permittee have to use EPA 1600 series methods and employ sampling procedure consistent with EPA method 1669 (EPA, 1996). All other analytical methods shall conform to ARM 17.30.641 [Sampling Methods]. The Work Plan shall have to address flow measurement and report flow, in cfs, for each sample event, or would have to demonstrate flow values from a reliable source.

The plan would also have to address the following specific components:

i. Objectives
ii. Sample locations;
iii. Sampling supplies and equipment;
iv. Sampling methods, including QA/QC samples;
v. Analytical parameters, and test methods, including QA/QC samples;
vi. Shipping and handling arrangements;
vii. Field verifications; and
viii. Schedule.

b. The permittee shall submit a Work Plan for Department review and approval to verify the nature and extent of effluent mixing at low flow through the use of a tracer. The purpose of this study would be to demonstrate that the effluent is completely mixed (less than 10 percent bank variation) within the downstream boundary of the mixing zone. The permittee shall use procedures consistent with those published by the USGS [Kilpatrick and Cobb], or equivalent. The study would have to address both critical low-flow and normal-flow conditions.

E. Fish Avoidance

Comments submitted by the Montana DFWP expressed concern that elevated metals in either the Clark Fork or Rock Creek would cause fish, particularly bull trout, to avoid Rock Creek. Several species of trout are found in Cabinet Gorge and utilize tributaries such as Rock Creek for spawning or cold water refuge. Trout and other salmonid species, are known to avoid waters with elevated concentrations of metals, particularly copper and zinc. Avoidance thresholds cited by MDFWP are summarized in Table I.E.1. Avoidance thresholds for bull trout are not documented in the literature.

Metals concentrations in the Clark Fork would increase primarily as a result of the discharge from Outfall 001. This increase would depend on the rate of mixing and the volume of water available for dilution. These variables were analyzed in Section I.A.8. Seepage of metals from the paste storage facility (Outfall 002) and storm water discharges from the storm water detention pond (Outfall 003) below the paste storage facility via Miller Gulch might also contribute to the increased concentration of metals in the Clark Fork River.

Table I.E.. Selected Fish Avoidance criteria based on Montana DFWP (1998).

Species	Metal	Avoidance Concentrations (mg/L)	Source [1]
Rainbow Trout	Copper	0.1 – 70	Giattine, 1983
"	Zinc	5.6 – 50	Atehison, 1987
Cutthroat	Copper	6	Woodward, 1997
"	Zinc	28	"
Brown Trout	Copper	6.5	Woodward, 1995
"	Zinc	32	"
Atlantic Salmon	Copper	17 – 21	Saunders and Sprague, 1967
"	zinc	210 – 258	"

[1] See Montana DFWP comment letter for complete reference.

Rock Creek enters the Clark Fork approximately 750 feet downstream of proposed Outfall 001. The predicted increase in receiving water concentrations for copper and zinc from Outfall 001 at the mouth of Rock Creek are summarized in Table I.E.2. Seepage from the impoundment would not be detectable after mixing due to the high dilution factor (4,056). However, because this seepage might enter the Clark Fork in a diffuse manner along the banks, mixing would be incomplete and extend down river for several hundred yards. Localized increases might exceed avoidance criteria along backs, however, this zone would be limited in nature and not block fish migration. The discharge from the paste storm water detention pond would be required to meet effluent limits at the point of discharge to Miller Gulch and would have received additional dilution in Miller Gulch before entering the Clark Fork. Because this effluent would enter the river through a culvert and would not be instantaneously mixed, it might result in elevated metal concentrations after the discharge ceased. The resulting concentrations cannot be predicted because the exact flow conditions are not known. Because the detention pond would be sized to retain the 100-year storm event, any discharge would be of short duration and occur at a low frequency.

Based on the predicted concentrations in Table I.D.2 from Outfall 001 and the expected low frequency of discharge of Outfall 003, it would not be expected that metal concentrations in the Clark Fork River would cause fish to avoid the mouth of Rock Creek. The mitigation proposed by the MDFWP was to restrict the effluent discharge to the far bank (south side) of the Clark Fork with the expectation that the effluent plume would be restricted to the south side of the river. Based on the foregoing analysis, the suggested modification in the effluent diffuser would not be warranted.

The MDWFP also expressed concerns that metal concentrations in Rock Creek might be elevated as a result of ground water seepage from the paste facility, in combination with effluent from Outfall 004 and other point and nonpoint sources which would cause fish to avoid entering Rock Creek. The discharge from Outfall 004 would be restricted to the period April 1 to July 1 when receiving water flows are greatest. The effluent limits for copper and zinc would be 0.003 and 0.02 mg/L respectively. These limits would be based on background concentrations and would not be expected to cause avoidance problems after mixing.

Table I.E.2. Concentration (in mg/L) of copper and zinc at various flow conditions.

Parameter	Background	Critical Flow (365 cfs)	7-Q-10	Lowest Avoidance Criteria
Copper	<1.3	<1.7	<1.34	6. (0.1)
Zinc	<3.6	<7.4	<4.0	5.6

Rock Creek in the vicinity of the paste storage facility is a losing stream. Due to the low volume of seepage from the paste storage facility, ground water elevation is not predicted to rise; therefore, it would be unlikely that any metals from the paste facility would discharge into Rock Creek. Any discharge to Rock Creek from the paste facility would be a violation of permit MT-0030287. The ground water monitoring associated with Outfall 002 (paste facility) would detect any rise in ground water elevations that would threaten Rock Creek. Other sources of metals, such as storm water runoff and nonpoint sources, have not been quantified.

In order to ensure that metal concentrations would not cause fish avoidance problems in Rock Creek, the permittee shall submit a Work Plan for Department review and approval to accurately determine the instream concentration (seasonal mean and related parameters) of copper and zinc, as well as parameters for, such as, dissolved oxygen, pH, specific conductance, temperature, and turbidity. The Work Plan shall address sampling of both high and low flow conditions and seasonal variation. Samples would have to be collected at sites RC-3, RC-2, and RC-1 as identified of Exhibit 1, Hydrological Monitoring Sites [Hydrometrics 1999]. The Work Plan shall address statistical methods to determine if the concentrations of copper and zinc were to increase above background levels (prior to construction) or above the avoidance criteria for copper (0.006 mg/L) and zinc (0.006 mg/L). Should a statistically significant increase be detected, the permittee would be required to submit a Work Plan for agency review and approval. The Work Plan would identify the source(s) of the increase metals and propose controls to eliminate the source. This monitoring might be conducted in conjunction with other monitoring programs required of the permittee as long as the conditions outlined above were satisfied. The Work Plan would have address the QA/QC components identified in Section I.A.3.a.

F. Idaho Water Quality Standards

This section was added to the FS/SOB based on comments received from the State of Idaho, Division of Environmental Quality (DEQ). The Federal Clean Water Act and Montana State regulations require that the downstream state's water quality standards be considered in issuing discharge permits. The Idaho DEQ stated that any measurable increase in ambient water quality would not be consistent with the special resource water designation in the Clark Fork River in Idaho. Idaho DEQ requested the following analysis be included in the discharge permit:

> "Provide a table in the permit which show the estimated concentration (mg/L) and load (lbs./day) of nutrient and metals anticipated at the state line during low and high flow events when mine discharge is at its peak. Contrast these values with the detection limits. The detection limits used must be defensible and statistically proven at a 95% confidence interval. If this is not possible with existing data, describe how and when this will be accomplished and incorporated in the permit."

Background water quality characteristics and Idaho numeric water quality standards for the Clark Fork River are given in Table I.A.1.2. The projected increase in concentration at the Idaho-Montana border was calculated as the sum of the existing load (pounds per day) and the projected daily load from the Rock Creek discharge. Metal loads were based on the assumption that during the low-flow period (August-September), Noxon Rapids Dam would be closed nightly for 6 hours and release higher flows for 18 hours daily. This assumption resulted in a weighted daily load based on these projected durations.

Flow estimates are based on mean daily flow reported by USGS for station 1239200 [CFR at Whitehorse Rapids near Cabinet, ID] for the period 1961 to 1995. Low-flow calculations are based on either the calculated P_{90} value of 8,840 cfs (90 percent of the time flow exceed this value) or the 7-day, 10-year low flow of 4,611 cfs. The media flow at this site is 17, 100 cfs (50^{th} percentile) and the high flow estimate used in the loading analysis is 24,500 cfs (P_{25}). The Avista Corp. maintains a minimum flow of 3,000 cfs at this site, which might be voluntary increased to 5,000 cfs; however, these values were not used.

Any change in concentration would be pronounced during low flow. For this analysis the - day, 10-year low flow was selected. The results of this analysis are given in Table I.E.1. To determine if the projected increase could be measured (detectable) at the Idaho border, the method detection limit (MDL) and minimum level (ML) are shown in Table I.E.1 for approved analytical procedures (40 CFR 136.3). These procedures are approved for compliance monitoring under federal and state regulations [Montana (ARM 17.420.643) and Idaho (IDAPA 02.090.01)]. Analytical procedures are available which are capable of quantifying metals at lower levels, such as ICP/MS [EPA Method 200.8] and EPA 1600 series analytical methods in combination with clean sampling techniques [EPA Method 166]. However, these methods are not commonly employed in routine monitoring.

The MDL, as defined in 40 CFR 136, Appendix B, is the minimum concentration of an analyte that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero as defined determined by a specific laboratory method. The MDL reported in Table I.E.1 are for the most recent revision of the approved procedure and are based on laboratory reagent water. At the MDL, the analyte can be detected but not necessarily quantified. Since all of the parameters in the discharge occur naturally in the river, a more reliable measure of the delectability is the Minimum Level (ML). The ML is the concentration at which the analytical system produces a recognizable signal and acceptable calibration for the analyte. The ML shown in Table I.E.1 is the interim ML, which is equal to the MDL times 3.18 rounded to the nearest multiple of 1, 2, or 5 [EPA 1994b]. The predicted increase in concentration would not exceed the reported MDL/ML; therefore, it would not cause a measurable change in concentration based on these criteria.

These projected changes in concentration are theoretical and do not account for natural variation or other dynamic processes that might either magnify or reduce the concentration of nutrients, metals, and other constituents in a natural system. Processes that might reduce the actual concentration include biological assimilation, denitrification, absorption, and settling. Metals stored in the natural system might also be resuspended at certain times and contribute to already elevated metals concentrations in the river. In addition, the analysis is based on the Average Monthly Limit (AML) developed in Section I. C, which overestimates the actual discharge concentration. The long-term average (LTA) is a more accurate estimate of the actual discharge concentration; however because long-term performance data is not available from the system, this value is not available.

The wasteload allocation for manganese would be 443 pounds per day based on Montana nondegradation criteria in Table I.A.5.1. This amount of manganese would cause a measurable changed at the Idaho border based on the foregoing criteria. Idaho has not adopted a standard for manganese; however, the Clark Fork River in Idaho is protected for drinking water use. Because manganese may effect the suitability of water for drinking water purposes, it is subject to Idaho's "no measurable increase" provisions. The effluent limit was adjusted so that the resulting concentration at the border would be less that the ML. The average monthly limit for manganese was revised to 0.9 mg/L [Table I.E.1 and Table I.C.1], and the maximum daily limit would be 1.5 times the average monthly limit.

Based on the foregoing analysis, the projected increase at the Idaho border would not cause a measurable change in concentration for any parameter and is projected to comply with Idaho water quality standards, including the Special Resource Water designation. This determination would not restrict Idaho officials from making an independent assessment of the discharge. Should Idaho DEQ determine that the permit would violate state water quality standards, then Idaho would have authority under Section 402(b) and (d) of the Federal Clean Water Act and 40 CFR Section 123.44 to administratively appeal the permit to EPA.

In addition to the change in concentration at the border, the Idaho DEQ would also consider changes in loading at the Idaho-Montana border to determine if the Rock Creek project would comply with the Special Resource Water designation. Load (mass per time) is an important factor to consider when evaluating the impact of pollutants to reservoirs or lakes, such as Lake Pend Oreille. The Idaho DEQ requested that load (lbs./day) be calculated for high and low flow events. Based on this request, loading estimates for low flow were derived using the 90th percentile (P_{90}) flow (8,840 cfs) and the 25th percentile (P_{25}) flow (24,500 cfs). The median value [Table I.A.1.2] was used to estimate the concentration for both high and low flow loading estimates. Typically the concentration is inversely related to flow for the parameters in this analysis (metal and nutrients), however, plots for all the parameters in this analysis revealed no identifiable relationship with flow. This is likely due to the relatively small sample size, outliers in the data, the use of total (unfiltered) samples, and a significant number of analyses that were less than the detection limit. The results of the loading analysis can be found in Table I.E.1.2.

The foregoing analysis provides an estimate daily load for seasonal high or low flows, however, loading estimates are usually made to estimate the total mass, or change in mass, over a longer period of time, such as an annual loading [Helsel and Hirsch 1995]. Loading estimates are highly sensitive to the method of calculation due to the underlying distribution of the data. Significant errors may result if sufficient data is not available on flow and concentration [Preston, et. al 1989]. Annual load estimates for Lake Pend Oreille for total inorganic nitrogen and total phosphorus were calculated using a flow-weighted monthly average estimator. Based on this analysis, the increase in total inorganic nitrogen and total phosphorus would be 2 and 1.5 percent, respectively. Because metals were sampled on a quarterly or semiannual basis, there was not sufficient data to develop accurate loading estimates.

Table I.F.1 Estimated change in water quality for the CFR below Cabinet Gorge dam at the 7-day, 10- year flow resulting from the Rock Creek project discharge.

Parameter	Background Load (1) (lbs./day)	Rock Creek Projected load (lbs./day)	Projected concentration with Discharge (mg/L)	Net Increase at Border (mg/L)	ID Standard (mg/L)	Detection Criteria MDL/ML (mg/L)	EPA Method Number And Revision
Suspended Sediment	74,560	552	3,022	22.2	(5)	10/50	160.2(3)
Kjeldaho-N	4,970				(5)	30/100	351.1(3)
Ammonia	497				1,360	30/100	350.1(3)
Nitrite + Nitrate	1,267				(5)	10/50	353.3(3)
Total Inorganic N	1,765	232	80	9.3	(5)	10/50	NA
Total Phosphorus	248	23	10.9	0.9	(5)	1/5	365.1(3)
Arsenic	25	0.0005	1.0	0.00	50	0.5/2	200.9/R2.2(4)
Cadmium	25	1.0	1.0	0.04	1.9	0.05/0.2	200.9/R2.2(4)
Copper	75	3.3	3.1	0.13	6.9	0.7/2	200.9/R2.2(4)
Lead	25	1.4	1.1	0.06	2.0	0.7/2	200.9/R2.2(4)
Manganese	50	20	2.8	0.80	(5)	0.3/1	200.9/R2.2(4)
Mercury	-	0.000006		0.00002	0.012	0.2/0.5	245.1/R2.2(4)
Selenium	25	8	1.3	0.32	5	0.6/2	200.7/R4.4(4)
Zinc	275	17	11.7	0.70	89	1/5	200.9/R2.2(4)

(1) Based on estimated concentration [median, Table I.A.1.3] and a flow of 4,611 cfs. Value given is an upperbound estimate due to presence of nondetects in data set used to developed loading estimates.
(2) Metal load based on 6 hours per day at base flow limits (Outfall 001B) and 18 hours ver day at high flow limits (Outfall 001C).
(3) EPA, 1983.
(4) EPA, 1994.
(5) No numeric standard, narrative prohibition against toxic (IDAPA 250.01.02.02 and deleterious substances (IDAPA 250.01.02.03).

Table I.F.2. Estimated change in load (lbs./day) at the Idaho border resulting from the proposed discharge.

	Low Flow(1)			High Flow(1)		
Parameter	30-day Effluent Limit(2) (lbs./day)	Background Load (3) (lbs./day)	Percent Increase in Load at Border(4) (%)	30-day Effluent Limit(2) (lbs./day)	Background Load (3) (lbs./day)	Percent Increase in Load at Border(4) (%)
Kjeldahl – N	-	9,530	-		26,411	
Ammonia	-	953	-		2,641	
Nitrite + Nitrate	-	2,430	-		6,735	
Total Inorganic N	232	3,383	6.9	232	9,376	2.5
Total Nitrogen (N)		11,960			33,146	
Orthophosphate		476			1,321	
Total Phosphorus	23	476	4.9	23	1,321	1.8
Arsenic	0.0005	48	0.0	0.0005	132	0.00
Cadmium	1.1	48	2.2	1.4	132	1.0
Copper	3.3	405	0.8	4.1	1,142	0.4
Lead	1.4	95	1.5	1.8	264	0.7
Manganese	24.	143	17	24	396	6.
Mercury			0.000			
Selenium	8.0	48	17	10	132	7.8
Zinc	17.	881	2	21	2,443	0.8

(1) Based on flow statistics from station 1239200, 1962 – 1995 low flow is based on 8,840 cfs (90th percentile) and high flow is based on 24,500 cfs (25th percentile).

(2) Low flow discharge based on 6 hours at lower effluent limits per day and 18 hours per day at high limits; high flow estimates based on 24 hours per day at higher limits.

(3) Calculated as follows: lbs./day = concentration (mg/L) x flow (cfs) x conversion factor (0.00539) Value given is an upper bound estimate due to presence of nondetects in data set used to developed loading estimates.

(4) Calculated as ((total-background)/background) x 100.

I. Outfall 002 – Paste Storage Facility

A. Water Quality Based Compliance Limits

1. Background

Ground water below and downgradient of the paste facility are Class I waters according to Montana ground water standards [ARM 17.30.1006]. Class I ground waters have specific conductance values less than 1,000 µmhos cm^{-1} and are generally suitable, with little or no treatment, for public and private water supplies, culinary and food processing purposes, irrigation, livestock and wildlife watering, and for commercial and industrial purposes. Class I ground water are considered high quality waters and are subject to Montana's Nondegradation Policy [75-5-303, MCA] and rules [ARM 17. 30.701]. Montana Nondegradation rules allow changes in water quality that is nonsignificant.

The hydrogeology of the project area is described in the Water Management Plan [Hydrometrics 1995] and is summarized in the EIS for the Asarco Rock Creek Project. The primary hydrostratigraphic unit below the proposed paste storage facility is in the basal sand and gravel aquifer, which varies from 1 to 22 feet in thickness. This unit overlies and is hydrologically connected to fractured bedrock. Bedrock is this vicinity is argillitic Precambrian Wallace Foundation of the Belt Supergroup. Hydraulic conductivity of this basal unit is estimated to be 1.3×10^3 cm sec^{-1} . Based on an average thickness of 15 feet, the ground water flux in the basal unit is estimated to be 131 gpm. The basal gravel unit is overlain by up to 85 feet of low permeability lacustrine silt and clay deposits. Hydraulic conductivity of this unit is estimated to be 7.6×10^5 cm sec^{-1}.

It is assumed that groundwater in both the basal gravel and lacustrine units eventually mix with the alluvial aquifer associated with the Clark Fork River. Terrace deposits associated with this aquifer are encountered on the western perimeter of the study area. This aquifer is assumed to contain significant quantities of water. The nearest downgradient domestic wells are located in this unit approximately 1 mile below the paste storage site. These wells have been monitored annually since 1988. Several springs occur in this area and have also been monitored.

There are no state or federal technology-based requirements for discharges to ground water; therefore, compliance would be based on Montana ground water standards and protection of beneficial uses [ARM 17.30.1006]. Ground water standards may be exceeded within the mixing zone, provided that all existing and future beneficial uses of the state waters are protected [ARM 17.30.1005]. The Montana Water Quality Act states that it is not necessary to treat wastes to better than natural conditions (75-5-306, MCA).

2. Effluent characteristics

Estimates of effluent quality and seepage rates are provided by the applicant in the Water Management Plan for Alternative 5 [Hydrometrics 1997]. The projected quality of the paste seepage is reported in Table II.A.2.1.

Table II.A.2.1. Effluent characteristics

Parameter	Concentration (mg/L)
Total Inorganic Nitrogen	22.4
Copper, Dissolved	0.026
Cadmium, Dissolved	<0.001
Lead, Dissolved	0.005
Manganese, Dissolved	0.75
Mercury, Dissolved	<0.0004
Zinc, Dissolved	0.04

Seepage flux was estimated using the Hydrologic Evaluation Model of Landfill Performance (HELP) developed by EPA. Seepage estimates would vary over the life of the mine but are estimated to reach a maximum in year 40 at 20 gpm (Hyrdometrics, INC, 1997).

3. Mixing Zone

The permittee has requested a source-specific mixing zone extending approximately 750 feet downgradient of the footprint of the proposed paste storage facility (Figure 2). The mixing zone would encompass two ground water units: 1) shallow, lacustrine silt and clay aquifer; and 2) basal gravel/fractured bedrock aquifer. The basal gravel aquifer would be the primary conduit for pollutants discharging from the paste seepage site. However, the lower permeability of the overlying lacustrine unit would minimize the transport of pollutants to the more permeable basal unit below.

Pursuant to ARM 17.30.515, the Department has determined that a source-specific mixing zone is necessary and appropriate for the paste facility and that beneficial uses outside of the mixing zone would not be adversely affect. This mixing zone would be issued pursuant to the compliance limitation [Part II.B] and monitoring requirements [Part II.C], discussed below.

In fulfillment of ARM 17.30.518(5)(j) and (k), the applicant has submitted a preliminary monitoring plan and contingency pumpback system [Hydrometrics 1997]. The pumpback system would be initiated if compliance or action levels were to be exceeded in the ground water units.

Table II.A.4.1. Ground water quality baseline standards and criteria for unconsolidated aquifers below impoundment.

Parameter	Mean Background Concentration (mg/L)		Numeric Water Quality Standard	Nondegradation-Based Water Quality Standards		
	Lacustrine Aquifer	Basal Gravel Aquifer		Category	Compliance Limit	Rationale
PH, SU	8.0	8.1	NS	Narrative	6.5 – 8.5	SCML(1)
Total Dissolved Solids, mg/L	327	246	NS	Narrative	500	SCML(1)
Nitrite + Nitrate, as N, mg/L	0.04	0.05	10.0	Toxin	7.5	Nondegradation(2)
Sulfate, mg/L	8	5	NS	Narrative	250	SCML(1)
Arsenic, dissolved, mg/L	<0.009	<0.002	0.018	Carcinogen	No Increase	Nondegradation(4)
Cadmium, dissolved, mg/L	<0.001	<0.0013	0.005	Toxin	0.002	Nondegradation(3)
Copper, dissolved, mg/L	<0.005	<0.001	1.0	Toxin	0.150	Nondegradation(3)
Lead, Dissolved, mg/L	<0.002	<0.0016	0.015	Toxin	0.002	Nondegradation(3)
Manganese, dissolved, mg/L	0.4	0.06	0.05	Harmful	No Increase	Background (5)
Mercury, dissolved, mg/L	<0.0005	<0.0004	0.00014	BCF > 300	No Increase	Nondegradation(4)
Zinc, dissolved, mg/L	<0.03	<0.05	5.0	Toxin	.75	Nondegradation(3)

(1) Secondary Maximum Contaminant Level (SMCL) [EPA – Office of Drinking Water, May 1995].
(2) Nitrate from sources other than domestic sewage may exceed 7.5 mg/L, as N [ARM 17.30.715)(1)(d)(I)].
(3) Discharges of toxic parameters may not exceed 15 percent of the ground water standard [ARM 17.30.715(1)(c)].
(4) Discharges of carcinogens and bioconcentrating parameters may not exceed receiving water [ARM 17.30.715(1)(a)].
(5) Background exceeds SMCL; therefore, no statistically significant increase allowed.

4. Determination of Compliance Limitations

Acceptable concentrations of constituents in the ground water at the boundary of the proposed mixing zone are based on compliance with Montana water quality standards and nondegradation criteria [Table II.A.4.1]. For parameters that do not have numeric standards listed in WQB-7, no increase of a parameter would be allowed that would render the waters harmful, detrimental, or injurious to the designated beneficial uses [ARM 17.30.1006(1)(a)(ii)]. The Department may use any pertinent credible information to determine levels protective of the designated uses. Because Class I waters must be maintained suitable for public and private water supply with little or no treatment, the Department considers levels established by EPA – Office of Water [Drinking Water Regulations and Health Advisories May, 1995], including Secondary Maximum Contaminant Levels (SMCL) as applicable). SMCLs are used for pH, total dissolved solids (TDS), and sulfate).

Baseline manganese values in both the lascustrine and basal gravel units in the vicinity of the proposed paste disposal area, and in Miller Gulch, naturally exceed the standard (0.05 mg/L). Baseline manganese concentrations in the vicinity of the paste facility range from 0.005 to 3.2 mg/L. The concentration of manganese in the units to the south and west of the paste storage area would be significantly lower. This change is attributed to dilution and, to a lesser extent, attenuation [Thompson 1997]. Based on analysis of Troy tailing water, the average potential concentration of manganese is estimated to be 0.75 mg/L. Based on Synthetic Precipitation Leaching Procedure (SPLP) tests of the paste material, manganese concentrations are predicted to be significantly lower (0.011 mg/L). Because manganese concentrations vary widely in the vicinity of the paste facility, no increase (defined below) above naturally occurring levels would be allowed in compliance wells where baseline sampling has determined that manganese exceeds 0.05 mg/L. If manganese is below this level, then the concentration would have to be maintained at or below 0.05 mg/L.

5. Action Levels

Action levels are included to provide an early detection of adverse ground water conditions and verify the accuracy of the seepage predictions. Exceedance of these levels might require additional action by the permittee but are not considered a violation of the permit or Montana ground water standards. Potassium and sulfate are included in this group, because they are generally present at low levels in the downgradient aquifers but are elevated in process water. The concentration of these in Troy tailings water is 430 and 45 mg/L for sulfate and potassium, respectively, based on a October 22, 1993, DHES sample. Based on the projected seepage rate and mixing with 131 gpm of ground water, the predicted concentrations should not exceed 15 and 10 mg/L sulfate and potassium, respectively. Nitrate is also a good indicator of effluent due to its mobility in ground water. Action levels are contained in Table II.A.5.1.

If monitoring results were reveal to that these action levels had been exceeded in any downgradient monitoring well, the permittee would be required to notify the Department of the exceedence within five working days. If the Department decided that additional action were necessary, it would provide written notification to the permittee requesting submittal of a Work Plan within 60 days. The Work Plan would have to contain a detailed assessment for the observed increase, recommendations for additional monitoring (spatial and/or temporal), a proposal to install ground water recovery wells, improvements, or modifications to the existing seepage collection system, or other actions that would address the situation. The Work Plan would contain a schedule for implementing the proposed action(s). Within 60 days, the Department would be required to: (i) approve, in whole or part, the plan; (ii) approve the plan with conditions; or, (iii) disapprove, in whole or in part, directing that a revised work plan be submitted. If the Department were to disapprove the plan, a precise explanation would accompany the disapproval.

Table II.A.5.1. Action limits for ground water compliance wells.

Parameter	Background (mg/L)	Action Level[1] mg/L
Nitrite + Nitrate, as N	0.05	5.0
Sulfate	8	20
Potassium	3	10
Dissolved Metals	varies	(2)

(1) If background exceeded 50 percent of action level for any individual monitoring well, then action might be increased accordingly.
(2) Prior to permit renewal the permittee would be required to conduct a trend analysis of the data to determine if a statistically significant ($p< 0.05$) positive trend existed after accounting for seasonal and spatial variability.

6. Nondegradation

The Compliance Limits developed in Section II.A.4 are protective of all the designated and future beneficial uses of Class I water and comply with the criteria of ARM 17.30.715. Discharges from the paste facility in compliance with the limits established for Outfall 002 are consider nonsignificant.

B. Monitoring Requirements

Monitoring wells would be installed along the perimeter of the designated mixing zone approximately 500 to 750 feet downgradient of the facility footprint. Each monitoring location would provide ground water quality data for hydrostratigraphic units present at that location. For most locations, three monitoring wells would be necessary. One well would monitor the upper portion of the lacustrine aquifer, and the second well would evaluate water quality in the basal gravel or shallow fractured bedrock aquifer. The third well would be installed to monitor the deep bedrock. Ground water monitoring at several locations would require an additional well to monitor water quality within shallow alluvial deposits.

1. Baseline Monitoring

To ensure that the compliance surface (perimeter of mixing zone) is adequately delineated and a suitable baseline for the proposed compliance wells are developed in a timely manner, the permittee would be required to submit a Work

Plan to the Department for review and approval. The Work Plan would have to include a schedule for submittal of all deliverables identified in this section and address the following components. The baseline monitoring would have to be completed prior to construction and use of the paste storage facility.

a. Monitor Well Location, Construction, and Development. The Work Plan must contain recommendations for the location, design and development of monitoring wells to delineate the spatial and temporal variability in water quality parameters down gradient of the proposed impoundment. Monitoring wells would be located on land owned or controlled by the permittee, or if not owned or controlled by the permittee, the permittee must demonstrate access to these wells for the reasonable life of the facility. This work must include design drawings of proposed well installations, and a description of the proposed well development method. The Work Plan must also address upgradient reference wells to be located in the same hydrostratigraphic units outside of the influence of the tailing impoundment. If, due to geological conditions, upgradient wells in individual hydrostratigraphic units cannot be completed, the permittee must identify an alternative upgradient, or other suitable reference site not influenced by the paste storage facility.

b. The Work Plan would have to contain a detailed Sampling Plan and a Quality Assurance/Quality Control (QA/QC) Plan, including but not limited to:
    i. Objectives;
    ii. Sample locations and sequencing, including QA/QC samples;
    iii. Sampling supplies and equipment;
    iv. Sampling methods;
    v. Analytical parameters and test methods;
    vi. Shipping and handling arrangements;
    vii. Field verification; and
    viii. Schedule.

   Sampling of monitoring wells would be conducted on a monthly basis, at minimum. In addition to the parameters regulated in this permit [Section II.B.1], the Sampling Plan would have to include a suite of parameters sufficient to provide a complete geochemical assessment of the aquifer, including major cations and anions, as well as a trace elements known or suspected to be in the paste material. Analytical methods would at minimum, be capable of achieving the required reporting values (RRV) listed in Department Circular WQB – 7.

c. Quality Assurance/Quality Control Plans. The QA/QC Plan must include but is not limited to a description of:
    i. Field QA/QC methods, including standard operating procedures, field documentation methods, QA/QC sample frequency and type, and field instrument calibration;

ii. Chain of custody procedures;
iii. Equipment of custody procedures;
iv. Laboratory QA/QC program; and
v. Data on documentation, validation, and tracking procedures.

If the Department comments on the Work Plan were to require substantive modifications of the Work Plan, a revised Work Plan would have to be submitted to the Department within 60 days of the Permittee's receipt of the Department's comments. Baseline monitoring would have to begin 365 days prior to activities related to construction to the paste storage facility.

Upon completion of the baseline phase, the permittee would be required to submit to the Department for review and approval a Draft Summary Report explaining the results of the Work Plan. The draft report would have to include but not be limited to:

a. Results of all chemical analyses; as well as, a summary and analysis of all this data and associated information;
b. A discussion of field observations;
c. Identification of deviations from the original work plan;
d. Monitor well construction drawings, and lithologic logs;
e. Monitor well location maps;
f. A discussion of the nature and extent of spatial and temporal variation in parameters monitored;
g. Evaluation of quality assurance and quality control measures; and
h. Copies of field notes, laboratory reports, and chain of custody documents;
i. A proposal for a compliance monitoring program including sampling frequency and data analysis protocols to identify exceedance of trigger levels, including trend analysis, and compliance limits;
j. Format for reporting monitoring data.

The permittee would be required to submit a final report within 45 days after receiving comment on the Draft Summary Report from the Department. The final report would have to address all comments provided by the Department.

2. Interim Data Collection

Upon completion of the baseline-monitoring period, the permittee would be required to submit a Work Plan for collection of additional ground water data prior to the use of the facility for waste storage, if this interim period exceeded 180 days. Otherwise, the monitoring requirements of Part II.B.3 of this Statement of Basis would apply. Data collected during the interim period would be considered part of the baseline database.

3. Operational Monitoring

These monitoring requirements would apply after the baseline-monitoring period and upon use of the tailing impoundment as a waste disposal facility. Operational monitor requirements are presented in Table II.B.3.1.

Table II.B.3.1. Operational monitoring requirements for ground water compliance.

Parameter[(2)]	**Frequency**	**Type**[(1)]	**Minimum Level**
Static water level, elevation	Monthly	Instantaneous	0.01 feet
PH, s.u.	Monthly	Instantaneous	0.1 s.u.
Temperature, °C	Monthly	Instantaneous	0.1 °C
Specific Conductance, mg/L	Monthly	Grab	10 mg/L
Total Dissolved Solids	Quarterly	Grab	10 mg/L
Ammonia, Total, as N	Monthly	Grab	0.1 mg/L
Nitrite + Nitrate, as N	Quarterly	Grab	0.05 mg/L
Total Phosphorus	Monthly	Grab	0.01 mg/L
Potassium	Quarterly	Grab	1 mg/L
Sulfate	Quarterly	Grab	1 mg/L
Arsenic, dissolved	Quarterly	Grab	0.003 mg/L
Cadmium, dissolved	Quarterly	Grab	0.001 mg/L
Copper, dissolved	Quarterly	Grab	0.01 mg/L
Lead, dissolved	Quarterly	Grab	0.003 mg/L
Manganese, dissolved	Quarterly	Grab	0.01 mg/L
Mercury, dissolved	Quarterly	Grab	0.001 mg/L
Silver, dissolved	Quarterly	Grab	0.005 mg/L
Selenium, dissolved	Quarterly	Grab	0.005 mg/L
Zinc, dissolved	Quarterly	Grab	0.01 mg/L

(1) See the definitions in Part I.A. of the permit.
(2) In mg/L, unless noted otherwise.
(3) If specific conductance measurements were to indicate a significant change (greater than 25 percent from previous month's measurement), a sample would have to be collected and analyzed for these parameters. These parameters would have to be collected at all quarterly sampling events.

a. Operational Compliance with Limits. For those parameters for which no increase in concentration would be allowed in this permit, no sample concentration would be allowed to exceed the upper bound of a 95 percent prediction interval calculated for the individual well from baseline monitoring (Part II.B.1). For all parameters, the analytical result would be deemed in compliance with the terms of this permit if the sample concentration were less than the minimum level.

b. Check Sampling. If a compliance limit or action level were exceeded for Outfall 002, the permittee would be required to take an additional sample following approved procedures and methods within five working days of the receipt of the analytical result showing the exceedance. Both samples results would have to be reported. The Department might use the lower value to determine compliance if the permittee submits evidence that the original sample was contaminated. The Department might require additional sampling.

Beginning the first calendar quarter after the effective date of this permit, the permittee shall submit a quarterly report describing the activities undertaken pursuant to this part (Part II). The report would have to be submitted to the Department and postmarked not later than the 28th day of the month following the calendar quarter.

II. Outfall 003 – Paste Storage Facility – Storm Water Detention Pond Overflow

A. Water Quality Based Effluent Limits (WQBEL)

1. Background

The paste facility storm-water detention ponds would be located in an ephemeral drainage that enters Miller Gulch approximately 1,000 feet above the confluence of Miller Gulch and the Clark Fork River. The majority of this drainage is ephemeral with the exception of an intermittent spring (SP-12). These ephemeral channels convey water only during extreme precipitation events [Asarco 1993]. The ephemeral drainage enters Miller Gulch approximately 1,000 feet below the detention ponds.

Because Miller Gulch is ephemeral, it is not considered “high-quality waters,” according to 75-5-103(9), MCA; therefore, it is not subject to Montana Nondegradation Policy. Discharges to ephemeral streams are subject to minimum treatment standards [ARM 17.30.635] and general prohibitions [ARM 17.30.637] but are not subject to numeric water quality standards promulgated in Department Circular WQB-7 [ARM 17.30.637(7)].

Effluent characteristics are expected to be similar to those discussed in Section II.2 for paste tailings.

2. Water Quality Based Limits

Effluent limits for Outfall 003 would be based on achieving compliance with nondegradation and water quality standards in the Clark Fork River. These limits were developed in Part I.A of this Fact Sheet and would apply to Outfall 003 with the following modifications:

a. Because the discharge would be intermittent and would occur only as a result on extreme precipitation events, limits are expressed as Maximum Daily Limits, for Table I.A.5.1; and

b. The load discharge from Outfall 003 would be added to the load discharged and reported for Outfall 001.

c. Because of the beneficial uses that might be supported by the spring and associated wetlands, no acute toxicity would be allowed in the discharge.

Water quality based effluent limits are reported in Table III.A.2.1.

Table III.A.2.1. Effluent limits for Outfall 003.

Parameter	**Maximum Daily Limit (1) (mg/L)**	**Rational (2)**
Oil and Grease	10	MWQS; ARM 17.30.627(1)(b)
Acute, Whole Effluent Toxicity	1.0 TUA	MWQS; ARM 17.30.627(1)(d)
Arsenic, Total Recoverable	0.0011	WQBEL, Table I.C.1
Cadmium, Total Recoverable	0.0102	WQBEL, Table I.C.1
Copper, Total Recoverable	0.051	WQBEL, Table I.C.1
Lead, Total Recoverable	0.0114	WQBEL, Table I.C.1
Manganese, Total Recoverable	1.4	WQBEL, Table I.C.1
Mercury, Total Recoverable	0.000012	WQBEL, Table I.C.1
Selenium, Total Recoverable	0.061	WQBEL, Table I.C.1
Zinc, Total Recoverable	0.5	WQBEL, Table I.C.1

(1) See definition in Part I.A of permit.
(2) Montana Water Quality Standards (MWQS) as promulgated in the applicable section of ARM.

B. Technology Based Limits

The effluent from these pond(s) would be regulated as mine drainage and, therefore subject to effluent guidelines as defined in federal New Source Performance Standards and discussed Section Part I.B of this Fact Sheet/Statement of Basis. However, based on design specification submitted by the permittee [Asarco 1997], the lined retention pond would be sized to contain runoff resulting from the 100-year/24-hour storm event from the maximum active face (approximately 110 acres). This water would be used in the mill water process cycle. However, since the demand for makeup water in the mill circuit would vary seasonally and with the life of the mine, the discharge from Outfall 003 is limited to storm events exceeding the 10-year, 24-hour criterion (2.8 inches of precipitation or equivalent snowmelt) as measured at the paste facility. In addition to these considerations, capacity in the pond would have to be reserved to provide treatment of the effluent. It is anticipated that the effluent would meet the proposed limits through simple settling and dilution.

Other Limitations:

(1) There shall be no discharge allowed from this facility unless the measured precipitation exceeded 2.8 inches, or equivalent amount of snowmelt runoff, in a 24-hour period as recorded at the paste storage facility.

(2) The facility shall be designed, constructed, and maintained to contain the maximum volume of wastewater from the active surface (110 areas) that would result from a 100-year event during any 24-hour period, or the equivalent snowmelt, during a 24-hour period from all areas contributing runoff to the pond.

(3) The permittee shall submit to the Department for review and approval, 180 days prior to construction, complete plans, specifications and schedule, for the paste storage facility storm water detention pond and structures collection and transporting wastewater to the detention pond.

(4) The permittee would be required to construct and maintain the outfall structure for the detention ponds to prevent overland flow and excess erosion and to maintain structural control of Miller Gulch during discharge events. Plans and specifications for erosion control structures and/or Best Management Practices (BMPs) would have to be submitted concurrently with plans and specifications for the pond design as required in item (3) above.

Because the discharge is subject to a “no discharge” requirement for events not exceeding the 10-year, 24-hour event, the technology based effluent limits would not apply. The no discharge requirement is more stringent than federal NSPS.

C. Final Limitations for Outfall 003

Effluent limits for Outfall 003 are listed in Table III.A.2.1. The discharge also would be subject to the limitation of Section III.B.

D. Monitoring Requirements – Outfall 003

Monitoring requirements for Outfall 003 are listed in Table III.D.1. In addition to these requirements, the following monitoring conditions would apply:

(1) For Outfall 003 the permittee would be required to report all discharge events by separate letter submitted with the DMR, listing the time the discharge began, duration of the discharge, form of precipitation (rainfall or snow melt), and sampling history.

Table III.D.1 Monitoring Requirements for Outfall 003

Parameter *(in mg/L unless noted)*	**Frequency**	**Type** [(1)]
Precipitation, Total Daily[(4)]	Daily	Recorder
Effluent Flow Rate, gpm[(3)]	Continuous	Recorder
pH, s.u.	Daily	Instantaneous
TSS	Daily	Grab
Ammonia, Total, as N	Daily	Grab
Nitrite + Nitrate, as N	Daily	Grab
Kjeldahl Nitrogen, as N	Daily	Grab
Total Phosphorus, as P	Daily	Grab
Arsenic, Total Recoverable	Daily	Grab
Cadmium, Total Recoverable, mg/L	Daily	Grab
Copper, Total Recoverable	Daily	Grab
Lead, Total Recoverable	Daily	Grab
Manganese, Total Recoverable[(2)]	Daily	Grab
Mercury, Total Recoverable[(2)]	Daily	Grab
Selenium, Total Recoverable[(2)]	Daily	Grab
Zinc, Total Recoverable[(2)]	Daily	Grab
Silver, Total Recoverable	Daily	Grab
Acute Whole Effluent Toxicity Testing	Per Event	Grab

(1) See the definitions in Part I.A. of the permit.

(2) Metals would have to be analyzed according to "Methods for the Chemical Analysis of Water and Wastes, EPA-600/4-79-020, revised 1983.". Use Method 4.1.1 for dissolved metal and Method 4.1.4 for total recoverable metals.

(3) If no discharge occurs during the reporting period, "no discharge" shall be recorded on the DMR report form.

(4) If the event were snowmelt runoff, calculations would have to be submitted to justify equivalence in runoff to the 2.8 inches of precipitation.

(5) Load calculations would be calculated based on volume and concentration and reported for Outfall 001.

(6) The permittee would be obligated to use Required Reporting Values (RRV) listed in WQB – 7 [DEQ 1998].

IV. Outfall 004 – Mill Area Underdrain Containment and Storm Water Retention Pond

A. Water Quality Based Effluent Limits

1. Background

The mill underdrain containment pond would be located below the mill area near the confluence of the West Fork Rock Creek (WFRC) and Rock Creek. Rock Creek and its tributaries are classified as "B-1 water," according to Montana Water –Use Classifications [ARM 17.30.607(1)]. B-1 waters are protected for the following uses: drinking water supply after conventional treatment; recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl , and furbearers; and agricultural and industrial supply. Rock Creek is considered a high- quality water and, therefore, is subject to Montana's Nondegradation Policy. Dischargers issued permits must conform with Montana Nondegradation Rules, Title 17, Chapter 30, Sub-Chapter 7 and may not cause receiving water concentrations to exceed the applicable standards found in Department Circular WQB –7 and ARM 17.30.601 *et seq*.

The location of the proposed discharge is on Rock Creek above the confluence of the WFRC at the location of the baseline monitoring site ERC –1. However, the final location of this site might be adjusted upstream or downstream based on final design of the mill site. The permittee would have to include the location of the mill underdrain containment pond outfall in final plans and specifications and permanently mark the location of Outfall 004 in the field.

Effluent limits would be based on discharge to surface water. Discharge of mine wastes to groundwater at the mill site would be authorized by Permit MT-0030287.

2. Proposed Water Quality Based Limits

The discharge from this site would be intermittent and would be expected only during the period of spring snowmelt or high-intensity precipitation storm events. Due to lack of specific information on the quality and volume of the discharge at this site and receiving water flow, effluent limitations would be based on achieving compliance with the water quality standards in the effluent (prior to mixing). Additional dilution provided by the receiving water would ensure that the effluent would not exceed nondegradation criteria, which would apply after mixing. No reasonable potential analysis was calculated due to the lack of data on effluent quality. Effluent limits were developed for those parameters limited in Outfall 001, except phosphorus, which would not be added to the treatment system at Outfall 004 and, therefore, would not be limited at this site.

Maximum daily limits would be based on the maximum observed concentration in the baseline study, as identified in Table IV.A.1 for carcinogens and toxins.

The rationale for using background is that the Montana Water Quality Act states that treatment to purer than natural conditions is not necessary [75-5-306(1), MCA]. Elevated background concentrations are typically observed during storm events and spring snowmelt. The average monthly limit (AML) for toxics

Table IV.A.1 Baseline Concentrations for the East Fork Rock Creek (ERC –1)[Hydrometrics, Inc. 1996].

Parameter	Sample Size	Minimum Concentration (mg/L)	Maximum Concentration (mg/L)	Water Quality Standard (2) (mg/L)
Flow, cfs	14	0.59	174	-
pH, s.u.	9	5.7	8.6	6.5 to 8.5
TSS	24	0.3	2.0	-
Hardness, as $CaCO_3$	24	2.6	8	-
Ammonia, as N, Total	24	<0.01	0.5	2.3(4)
Nitrite + Nitrate, as N	24	<0.01	0.5(1)	10.
Arsenic, Total Recoverable	24	<0.001	0.009	0.018(3)
Cadmium, Total Recoverable	24	<0.0001	0.0016	0.0008(4)
Copper, Total Recoverable	24	<0.001	0.008	0.0029(4)
Lead, Total Recoverable	24	<0.001	0.005	0.0005(4)
Manganese, Total Recoverable	24	<0.008	0.018	0.05
Mercury, Total Recoverable	16	<0.0005	<0.0005	0.000012(3)
Silver, Total Recoverable	24	0.0002	0.0012	0.0004(4)
Selenium, Total Recoverable	18	<0.001	0.008	0.005(4)
Zinc, Total Recoverable	24	<0.001	<0.020	0.037(4)

(1) A single anomalous value of 10.0 nitrite plus nitrate, as N, was deleted from the data set.
(2) Hardness-based metals standards calculated using 25 mg/L $CaCO_3$ [Circular WQB –7, footnote 12].
(3) Nondegradation criteria allow no increase [ARM 17.30.715(1)(b)].
(4) Nondegradation criteria limit increases trigger value of 15% of standard [ARM 17.30.715(1)(c)].

(cadmium, copper, lead, selenium) would be based on the standard (Table IV.A.1) and for carcinogens, the AML would be based the lowest background concentration (arsenic) or standard (mercury). No AML was developed if the standard was greater than the maximum daily limit (ammonia and zinc) because the maximum limit would be controlling. Because the discharge would be limited to periods of high flow in the receiving water, a minimum dilution ratio of 10:1 would be maintained between the receiving water and effluent. Discharge of pollutants from Outfall 004 , which would comply with these limits, would satisfy Montana's nondegradation requirements after mixing with the receiving water.

The limit for total inorganic nitrogen would be based on 15 percent of the 10 mg/L numeric standard for nitrate plus nitrite. Effluent limits for nutrients (inorganic nitrogen) in Outfall 004 would not be based on algal growth considerations due to the short duration and intermittent nature of the discharge. Limits for nutrients and manganese would not have a measurable change in ecological integrity or beneficial uses [ARM 17.30.715(1)g)].

To ensure that adequate dilution would be available, the discharge from Outfall 003 would be restricted during the period April 1 to July 1 or at any time when a storm event exceeded the 10-year, 24-hour event (2.8 inches, or equivalent snowmelt). Baseline flow in Rock Creek at site ERC–1 ranged from 0.59 to 174 cfs. During the April 1 to July 1 period, the lowest observed flow was 42 cfs (June 27, 1985). The permittee would be required to measure precipitation at the mine site.

The permittee would be required to minimize ground water infiltration at the mill site. The rationale for this condition is the lack of information on ground water-surface water connection and potential degradation of Rock Creek during low flow.

3. Nondegradation

Discharge from Outfall 004 would be limited to spring runoff or storm events when the flow in Rock Creek is adequate to maintain dilution. No increase would be allowed in carcinogenic (arsenic) or bioconcentrating (mercury) parameters [ARM 17.30.715(1)(b)]. Effluent limits for toxic parameters and nutrients is based on background concentrations or water quality standards prior to mixing with receiving water.

4. Mixing Zone

Because the discharge is restricted to periods of high flow in the receiving water the discharge is considered to mix nearly instantaneous, or less than two stream widths [ARM 27.30.502(7)], and therefore qualifies for a standard mixing zone.

B. Technology-Based Effluent Limits

This Outfall would be subject to the federal New Source Performance Standards described 40 CFR 440.104 and discussed in Part I.B of this Fact Sheet/Statement of Basis. WQBEL for Outfall 004 would be more restrictive for all parameters, except TSS and pH. For those parameters, the TBEL would apply, except for storm water conditions where federal regulations provide for a storm exemption [40 CFR 440.131(b)]. The storm water 10-year, 24-hour event for the mill area is 2.8 inches, or equivalent snowmelt [NOAA 1973].

C. Final Effluent Limits for Outfall 004

The proposed final effluent limits for Outfall 004 are presented in Table IV.C.1. The effluent limits would be based on compliance with water quality standards and would consider the intermittent and infrequent nature of the discharge as discussed in Section IV.A.2.

Table IV.C.1. Final effluent limits for Outfall 004.

Parameter	**Maximum Daily Limit** (1) **(mg/L)**	**Average Monthly Limit (mg/L)**	**Rationale** (2)
TSS(4)	30	20	TBEL; Part 1.B, Table 5
pH(4)	Within the range 6.0 to 9.0		TBEL; Part 1.B, Table 5
Oil and Grease	10	NA	MWQS; ARM 17.30.627(1)(b)
Ammonia, as N, Total	0.5	-	ARM 17.30.623(2)(h)(I), (ii) & (iv)
Total Inorganic Nitrogen, as N	1.5	1.0	ARM 17.30.623(2)(h)(I), (ii) & (iv)
Arsenic, Total Recoverable(3)	0.009	0.001	ARM 17.30.623(2)(h)(I), (ii) & (iv)
Cadmium, Total Recoverable(3)	0.0016	0.0003	ARM 17.30.623(2)(h)(I), (ii) & (iv)
Copper, Total Recoverable(3)	0.008	0.003	ARM 17.30.623(2)(h)(I), (ii) & (iv)
Lead, Total Recoverable(3)	0.005	0.0004	ARM 17.30.623(2)(h)(I), (ii) & (iv)
Manganese, Total Recoverable(3)	0.05	0.025	ARM 17.30.623(2)(h)(I), (ii) & (iv)
Mercury, Total Recoverable(3)	0.0002	0.000012	ARM 17.30.623(2)(h)(I), (ii) & (iv)
Selenium, Total Recoverable	0.008	0.0005	ARM 17.30.623(2)(h)(I), (ii) & (iv)
Zinc, Total Recoverable(3)	0.020	-	ARM 17.30.623(2)(h)(I), (ii) & (iv)

(1) See definitions in Part I.A. of permit.
(2) Based on lowest applicable Montana Water Quality Standards (MWQS) as promulgated in Administration Rules of Montana (ARM) and Department Circular WQB-7.
(3) Total Recoverable metals would be analyzed according by Method 4.1.4; dissolved metal would be analyzed according to Method 4.1.1, see EPA-600/4-79-020, Revised March 1983, Method for Chemical Analysis of Water and Wastes, Series 200, Metals.
(4) The limits would not apply when the discharge was a result of a 2.8 inch precipitation event or equivalent snowmelt.

Other Limitations for Outfall 004:

(1) There would be no discharge allowed from Outfall 004 except during the period April 1 to July 1 or when the measured precipitation at the mill site exceeded 2.8 inches in a 24 hour period or equivalent snow melt.

(2) The facility would have to be designed, constructed, and maintained to contain the maximum volume of wastewater that would be generated and stored in the detention pond during a 24-hour period and the maximum volume of additional wastewater generated by 2.8 inches of precipitation during a 24-hour period from all areas contributing runoff to the pond.

(3) At least 180 days prior to construction, the permittee would be required to submit for Department review and approval complete plans, specifications, and schedule for the paste storage facility storm water detention pond and structures collection and transporting wastewater to the detention pond.

(4) Infiltration to ground water would have to be minimized.

(5) The permittee would be required to submit a Storm Water Management Plan for the mill facility for Department review and approval 90 days prior to construction of the mill detention pond.

(6) The permittee would be required to install a staff gage in Rock Creek in the vicinity of the discharge and to develop a stage-discharge relationship for the receiving water. Daily flow would have to be recorded twice daily during periods of discharge from Outfall 004.

D. Monitoring Requirements – Outfall 004

The monitoring requirements for Outfall 004 are presented in Table IV.D.1. In addition to these requirements, the following conditions would apply:

(1) For each discharge event, a grab sample shall be taken within the first 30 minutes. If the collection of a grab sample within the first 3 minutes was not practicable, a grab sample could be taken during the first hour of the discharge. The permittee would be required to submit with the monitoring report a description of why the sample could not be taken in the first 30 minutes.

(2) For Outfall 004 the permittee would be required to report all discharge events by separate letter submitted with the DMR, listing the time the discharge began, duration of the discharge, form of precipitation (rainfall or snowmelt), and sampling history.

Table VI.D.1. Monitoring requirements for Outfall 004.

Parameter (4) *(in mg/L unless noted)*	Minimum Frequency	Type (1)
Effluent Flow Rate, gpm (3)	Continuous	Recorder
pH, s.u.	Daily	Instantaneous
TSS	Daily	Grab
Ammonia, Total , as N	Daily	Grab
Nitrite + Nitrate, as N	Daily	Grab
Kjeldahl Nitrogen, as N	Daily	Grab
Total Phosphorus, as P	Daily	Grab
Arsenic, Total Recoverable	Daily	Grab
Cadmium, Total Recoverable	Daily	Grab
Copper, Total Recoverable	Daily	Grab
Lead, Total Recoverable	Daily	Grab
Manganese, Total Recoverable(2)	Daily	Grab
Mercury, Total Recoverable(2)	Daily	Grab
Selenium, Total Recoverable(2)	Daily	Grab
Zinc, Total Recoverable(2)	Daily	Grab
Silver, Total Recoverable(2)	Daily	Grab

(1) See the definitions in Part I.A. of the permit.
(2) Metals would be analyzed according to "Methods for the Chemical Analysis of Water and Wastes, EPA-600/4-79-020, revised 1983", use Method 4.1.1 for dissolved metal and Method 4.1.4 for total recoverable metals.
(3) If no discharge occured during the reporting period, "no discharge" would have to be recorded on the DMR report form.

V. Outfall 005 – Domestic Sewage – Internal Outfall

Domestic wastewater from the mill building and support facilities would be discharged to the mill reservoir makeup water pond. Excess wastewater from the mill pond would be bled off and discharged to the mine wastewater treatment plant (Outfall 001). Since this wastewater would ultimately be discharged to the Clark Fork River, EPA has determined that effluent from the domestic wastewater treatment plant would be an internal discharge point and subject to National Secondary Treatment Regulations at 40 CFR Part 133. No water quality based limits, whole effluent toxicity (WET) or load limits have been developed for this internal discharge point because these limits would be established for Outfall 001 prior to discharge to the Clark Fork River. The determination of significance would be considered in Section I.A.7 for Outfall 001.

A. Effluent Limitations

1. Wastewater Effluent Limitations

Parameter	**Concentration (mg/L)** (1)		**Annual Average Load (lb/day)**
	7-Day Average	**30-Day Average**	
BOD_5	45	30	Not Applicable
Total Suspended Solids	45	30	Not Applicable

(1) See the definitions in Part I.A for the explanation of terms.

Other Requirements

1. Effluent pH shall remain between 6.0 and 9.0. For compliance purposes, any single analysis and/or measurement beyond this limitation would be considered a violation of the conditions of this permit.

2. The 30-day average percent removal of BOD_5 would not be less than 85 percent.

3. Sewage Sludge Requirements

   a. The permittee would be required to handle and dispose of sewage sludge in a manner so as to protect public health and the environment.

   b. The permittee would be required to submit a plan for disposal of sewage sludge generated from this facility.

B. Self-Monitoring Requirements

As a minimum, upon the effective date of this permit, the following constituents would have to be monitored at the frequency and with the type of measurement indicated; samples or measurements would have to be representative of the volume and nature of the monitored discharge. If no discharge occured during the entire monitoring period, it would have to be stated on the Discharge Monitoring Report Form (EPA No. 3320-1) that no discharge or overflow had occurred.

Parameter	**Frequency**	**Type**(1)
Inffluent Flow Rate	Continuous	Recorder
Effluent Flow Rate	Continuous	Recorder
BOD_5(2)	Weekly	Grab
Total Suspended Solids(2)	Weekly	Grab
pH	Weekly	Instantaneous
Percent Removal BOD_5(3)	Monthly	Calculated
Percent Removal TSS(3)	Monthly	Calculated

(1) See the definitions in Part I.A. of the permit.
(2) In addition to monitoring the final discharge, influent samples would have to be taken and analyzed for this constituent at a frequency of once per week.
(3) Percent removal would have to be calculated using the monthly average values.

ENVIRONMENTAL IMPACTS

The environmental impacts of the Rock Creek project are analyzed in the Supplemental Draft Environmental Impact Statement ASARCO Rock Creek Project, Prepared By: Montana Department of Environmental Quality and U.S. Forest Service, issued December, 1997.

RESPONSE TO SIGNIFICANT COMMENTS [ARM 17.30.1377]

The responses to public comment on the draft MPDES permit and the Fact Sheet and Statement of Basis are included in Appendices in the final Environmental Impact Statement for the Asarco Rock Creek Project. This section discusses the changes in the statement of basis and additional analysis that was done in response to significant comments on the draft permit as required by ARM 17.30.1377. In addition to the significant comments received on the draft, numerous editorial changes were made in both the FS/SOB and permit.

1. Several comments pointed out numeric errors in the calculation of reasonable potential for aluminum [Asarco and others].

   Response: The original FS/SOB contained a numeric error in calculating the reasonable potential for aluminum to exceed water quality standards. This error was corrected, see Table I.A.4.1. Since there would be no reasonable potential for aluminum to exceed water quality standards, the effluent limit for aluminum was removed from the permit consistent with federal regulations and guidance.

2. Several comments noted that lack of actual flow measurements in the Clark Fork River when Noxon Rapids Dam was not discharging.

   Response: As a result of these concerns, the USGS, at the request of DEQ, conducted their annual routine monitoring during a shutdown of the Noxon Rapids Dam. Hydrometrics Inc., on behalf of the applicant, also conducted monitoring during this period. The results of these measurements are discussed in Section I.A.3 of FS/SOB and were incorporated into water quality based effluent limits for Outfall 001. Effluent limits in the draft permit were based on the 7-day, 10-year low flow (3,610 cfs). Measured flow in the river during closure of Noxon was determined to be 365 cfs, which is much lower than the original estimate of 1,440 cfs used in the draft permit for critical flow. During these periods of reduced flow, nondegradation based water quality standards for metals would be exceeded. Since the dam is closed nightly for up to 8 hours and longer on weekends, the effluent limits would be based on this the new lower flow.

3. The Montana DFWP expressed concern that elevated metals, primarily copper and zinc, from the paste storage facility and Outfall 001 would cause fish including bull trout to avoid Rock Creek. Trout, and other salmonids, are known to avoid water with elevated metals.

Response: Based on these concerns, additional analysis was conducted to determine if avoidance criteria would be exceeded. This analysis resulted in a new section in the FS/SOB (Section I.D) addressing this issue. Additional monitoring would be required in Rock Creek to determine if avoidance criteria would be exceeded. Based on the results of this analysis and the requirement for additional monitoring, DFWP personnel indicted that fish avoidance criteria would not be exceeded [Don Skarr, DFWP, personal communication, April 11, 1999].

4. EPA requested instream monitoring be added as a condition of the permit.

   Response: An instream monitoring requirement was added to Section I.D. of the FS/SOB. However, it was determined that monitoring upstream of the point of discharge for metals was of more value. Nutrient and related constituents would be monitored upstream and downstream of the discharge. The monitoring requirements contained in the permit for Outfall 001 would reliably assess the increase in concentration of load due to the discharge. Adequate baseline date for the river was not available; therefore, the permit would require upstream monitoring to correct this condition. The permittee would also be required to conduct tracer studies to verify the mixing zone predictions.

COMMENTS OF AFFECTED STATE OR TRIBE

Both state and federal regulations [40 CFR 122.2 and FCWA Section 402(b)(5)] require that written recommendations submitted by an affected state be incorporated into the permit to the extent there are deemed necessary. The state of Idaho submitted written comments on the tentative MPDES permit as it passes through Cabinet Gorge reservoir [Larry L Keonig, Assistant Administrator, Idaho Department of Health and Welfare, Division of Environmental Quality, April 10, 1998]. The State of Idaho raised five specific issues related to the permit. These issues are addressed below.

1. Provide a table in the permit showing the estimated concentration (mg/L) and loads (lbs./day) of nutrients and metals anticipated at the state line during low and high flow events when mine discharge would be at its peak. Contrast these values with detection limits. Detection limits must be defensible and statistically proven at the 95 percent confidence limit.

   Response: This analysis has been done and included in the FS/SOB. This analysis resulted in a new section in the FS/SOB (Section I.F) that analyzes the impacts of the proposed discharge in Idaho water quality standards and waters designated as special resource waters. The analysis has resulted in two new tables in the FS/SOB, the first addressing changes in concentration (Table I.F.1.1) and load (Table I.F.1.2). As a result of this analysis, one effluent limit, manganese, was modified and the new limit was incorporated into the permit.

2. Set an appropriate effluent limit and monitoring frequency for phosphorus and selenium for Outfall 001.

   Response: Effluent limits for these parameters have been included in the permit.

3. Add an additional monitoring location to the permit, on the Clark Fork River at the USGS monitoring location below Cabinet Gorge dam. Monitoring frequency should be sufficient to detect changes in concentration of the applicable parameters. The monitoring plan would be used to determine compliance with Idaho water quality standards and subject to approval by Idaho.

   Response: The Montana DEQ agrees that additional monitoring would be necessary in this reach of the Clark Fork River. However, because the projected increase in concentration would be less than the criteria of detection (MDL and ML, there would be little justification to require the permittee to conduct this monitoring.

4. Add a sentence that recognizes an EPA approved Idaho TMDL or a violation of Idaho water quality standards to the reopener provisions of the permit.

   Response: Part IV.N.2 states that the permit may be reopened and modified if a Department and/or EPA approved TMDL or wasteload allocation is developed, therefore, the Department believes that no additional language is necessary.

5. Modify the SOB (part I.A) regarding Idaho's narrative standard on excessive nutrients. The discharge must conform to the more stringent Special Resource Water designation, which prohibits degradation of existing water quality as defined by Idaho (no detectable increase over background levels).

   Response: The discussion regarding narrative standards for nutrients referred to ARM 17.30.637(1)(e), which is a general prohibition stating that state waters must be free from substances which produce undesirable aquatic life. A new section has been added to the SOB regarding Idaho's Special Resource Water designation.

Response to public comments that did not result in changes to the FS/SOB are included in the Final EIS for the Asarco Rock Creek project [USFS and DEQ 1999].

Figure 1. Site map and Outfall locations.

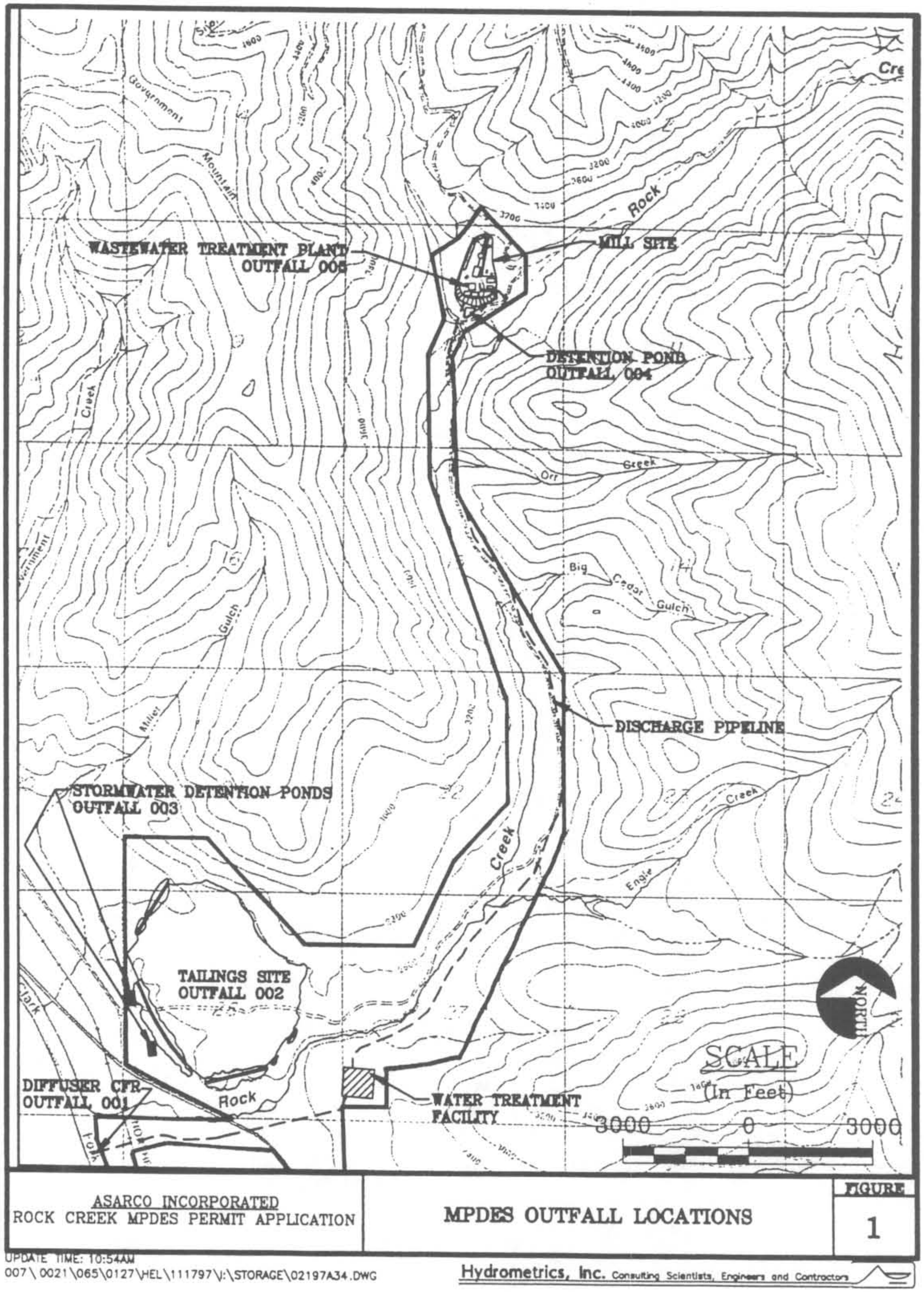
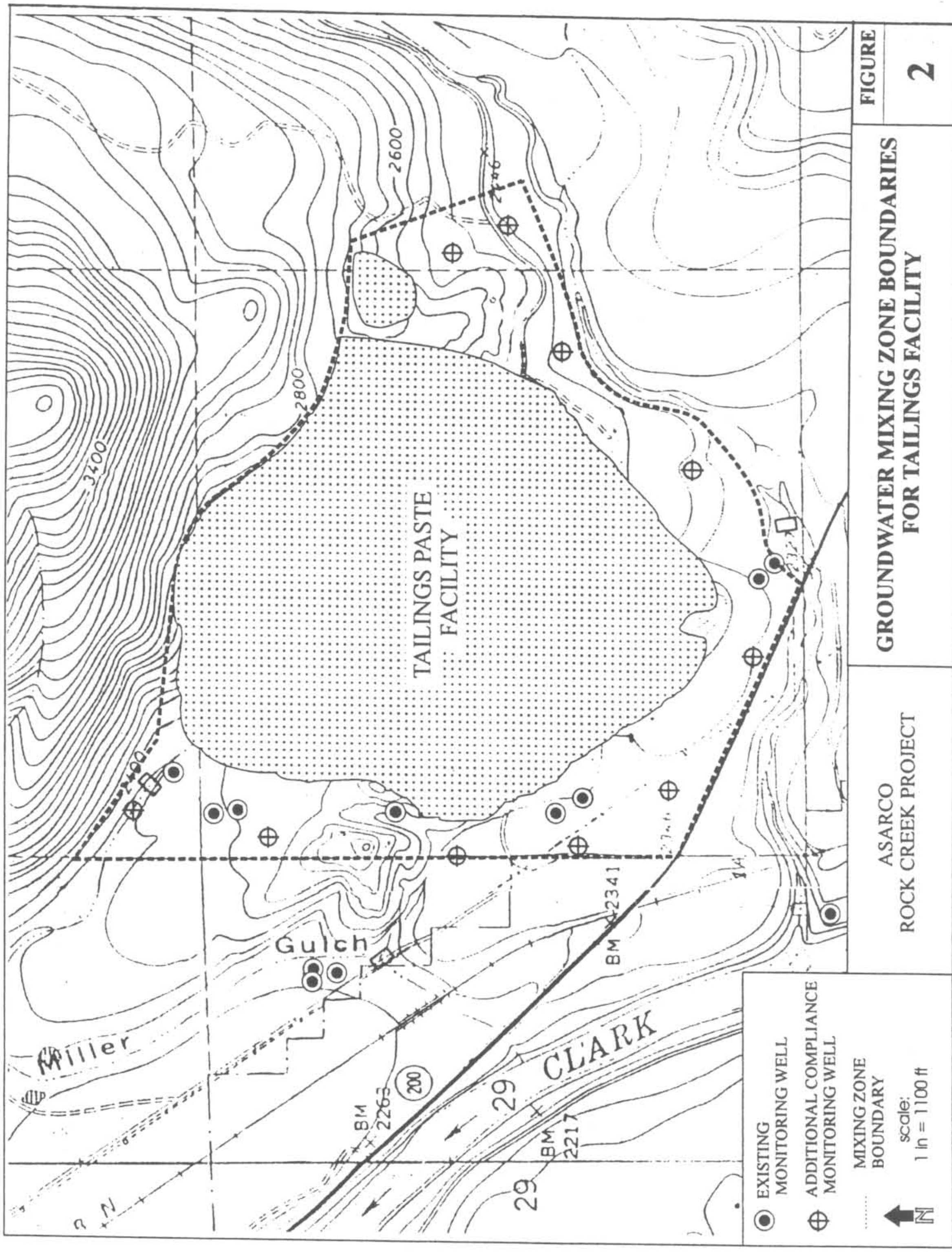


Figure 2. Paste storage facility (Outfall 002) and associated mixing zone.



REFERENCE MATERIAL

ASARCO, Incorporated. 1995. Revised Water Management Plan to Support MPDES Permit Application ASARCO Rock Creek Project Sanders County, Montana. Revised June, 1995.

ASARCO, Incorporated. 1993. Wetlands Inventory, Consideration of Alternatives and Mitigation Plan Rock Creek Project Sanders County, Montana. Revised September, 1995.

ASARCO, Incorporated. 1987. Application for a Hard Rock Operation Permit Rock Creek Project Sanders County, Montana. Volumes 1, 2 and 2A.

ASARCO Incorporated. 1987. Environmental Baseline Report Rock Creek Project Sanders County, Montana. Volumes 1 and 3.

Avista Corporation, 1999. Draft Collectively Prepared Environmental Assessment. Submitted by Avista Corporation to the Federal Energy Regulatory Commission. February, 1999.

Baumgarter, D.J., W.E. Frick, and P.J.W. Roberts, 1994. Dilution Models for Effluent Discharges – Third Edition. (Version 3.00) USEPA Office of Science and Technology, Standards and Applied Science Division. Available from Center for Exposure Assessment Modeling (CEAM), U.S. EPA, Athens, Georgia. December, 1994.

DEQ, 1998. Circular WQB –7 Montana Numeric Water Quality Standards. Montana Department of Environmental Quality. November, 1998.

DEQ. 1996. Montana List of Waterbodies in Need of Total Maximum Daily Load Development. Montana Department of Environmental Quality. 1996.

EPA, 1991. Technical Support Document for Water Quality-Based Toxics Control. EPA/505/2-30-001 March, 1991.

EPA, 1994. Methods for the Determination of Metals in Environmental Samples. Supplement I. USEPA Office of Research and Development. May, 1994.

EPA, 1996a. Method 1669 Sampling of Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. USEPA Office of Water. 1996 (draft).

EPA, 1996b. Guidance on the Documentation and Evaluation of Trace Metals Collected for Clean Water Act Compliance Monitoring. EPA – Office of Water. July, 1996 (draft).

EPA, 1997. Region VIII NPDES Whole Effluent Toxics Control Program. August, 1997.

Hydrometrics, Inc., 1992. 1990-1991 Annual Report – Water Resources Baseline Study for the ASARCO Rock Creek Project. June, 1992.

Hydrometrics, Inc. 1994. 1992-1993 Supplemental Baseline Water Resources Report for the ASARCO Rock Creek Project. June, 1994.

Hydrometrics, Inc. 1995. 1994 Supplement Baseline Water Resources Report for the ASARCO Rock Creek Project. June, 1995.

Hydrometrics, Inc. 1996. 1996 Supplement Baseline Water Resources Report for the ASARCO Rock Creek Project. December, 1996.

Hydrometrics, Inc. 1997a. (DRAFT) Asarco Rock Creek Project Water Management Plan for Alternative 5 – Surface Disposal of Tailing Paste. January, 1997.

Hydrometrics, Inc. 1997b. Preliminary Completeness Response for the Asarco Rock Creek Alternative 5 Water Management Plan. March, 1997.

Hydrometrics, Inc. 1999. 1999 Supplemental Baseline Water Resources Report for the Rock Creek Project. December, 1999.

Kilpatrick, F.A., and E.D. Cobb. Techniques of the Water-Resources Investigations of the USGS. Measurements of Discharge Using Tracers. Book 3, Application of Hydraulics. U.S. Department of the Interior, Reston, VA.

NOAA, 1973. NOAA Atlas 2: Precipitation- Frequency Atlas of the Western United States, Volume 1- Montana.

Thompson, 1997. Letter to Tom Reid, MDEQ from Bill Thompson, Hydrometrics, Inc. April 23, 1997.

Tri-State Implementation Council, 1998. Clark Fork River Voluntary Nutrient Reduction Program. Nutrient Target Subcommittee, August, 1998.

USFS and DEQ. 1999. The final Environmental Impact Statement for the Asarco Rock Creek Project. Kootenia National Forest, USFS and the Montana Department of Environmental Quality.

Washington Water Power Company, 1995. Initial Stage Consultation Document. September, 1995.

Prepared By: Tom Reid

Date: August 2001

APPENDIX E

USFWS
BIOLOGICAL OPINION

APPENDIX F

PRELIMINARY SECTION 404(b)(1) SHOWING

APPENDIX F

PRELIMINARY SECTION 404(b)(1) SHOWING

Rock Creek Mine Project

CONTENTS

Attachment

LIST OF TABLES

REVISED

PRELIMINARY SECTION 404(b)(1) SHOWING
DA Permit No.
Rock Creek Mine Project

This document represents the opinions of the Kootenai National Forest (KNF) and Montana Department of Environmental Quality (DEQ), hereinafter referred to as the Agencies, as to how Alternative V complies with the requirements of the 404(b)(1) guidelines. This Showing is not intended to represent the Corps of Engineers' conclusions or their Final 404(b)(1) Evaluation. Prior to finalzing a permit decision, the Corps of Engineers will need updated information on the wetland demonstration project as requested in year 2000 and 2001 (Schwartz 2001). This Showing is provided to solicit public input, comments, and foster increased public awareness and participation in the Environmental Impact Statement (EIS) process.

1.0 SUBPART A - GENERAL INTRODUCTION

The 404(b)(1) Guidelines (40 CFR 230) are the substantive criteria used in evaluating discharges of dredged or fill material in waters of the United States (waters of the U.S.) under Section 404 of the Clean Water Act, and are applicable to all 404 permit decisions. Fundamental to these Guidelines is the precept that dredged or fill material should not be discharged into an aquatic ecosystem unless it can be demonstrated that such discharges would not have unacceptable, adverse impacts either individually or in combination with known or probable impacts of other activities affecting the ecosystems of concern.

33 CFR Part 328 provides the definition of waters of the U.S. Specifically, Section 328.3 defines the term as follows:

(A) the term "waters of the United States" means

(1) All waters which are currently used, or were used in the past, or may be susceptible to use interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;

(2) All interstate waters including interstate wetlands;

(3) All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use degradation or destruction of which could affect interstate or foreign commerce including any such waters:

(I) Which are or could be used by interstate or foreign travelers for recreational or other purposes; or

(ii) From which fish or shellfish are or could be taken and sold in interstate of foreign commerce; or

(iii) Which are used or could be used for industrial purpose by industries in interstate commerce;

(4) All impoundments of waters otherwise defined as waters of the United States under the definition;

(5) Tributaries of waters identified in paragraphs (a) (1)-(4) of this section;

(6) The territorial seas;
(7) Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a) (1)-(6) of this section. Waste treatment systems, including treatment ponds or lagoons designed to met the requirements of CWA (other than cooling ponds as defined in 40 CFR 123.11(m) which also meet the criteria of this definition) are not waters of the United States.

Subpart B of the Guidelines outlines restrictions imposed on all discharges, the factual determinations required by the Guidelines and specifications for a determination of compliance or non-compliance with the Guidelines.

Section 230.10(a) states no discharge of dredged or fill material shall be permitted, except as provided under Section 404(b)(2) of the Clean Water Act, if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences.

Section 203.10(b) establishes three conditions, applicable to inland waters, which must be satisfied to make a finding that a proposed discharge complies with the Guidelines. No discharge of dredged or fill material shall be permitted if it:

a) Violates applicable state water quality standards;

b) Violates any applicable toxic effluent standard or prohibition under Section 307 of the Clean Water Act; or

c) Jeopardizes the continued existence of species listed as endangered or threatened under the Endangered Species Act of 1973, as amended, or results in likelihood of the destruction or adverse modification of a habitat which is determined to be a critical habitat.

Section 230.10(c) provides that no discharge of dredged or fill material shall be permitted if it will cause or contribute to significant degradation of the waters of the U.S., except as provided under Section 404(b)(2).

Section 230.10(d) prohibits the discharge of dredged or fill material, except as provided under Section 404(b)(2) of the Clean Water Act, unless appropriate and practicable steps have been taken which will minimize potential adverse impacts of the discharge on the aquatic ecosystem.

Section 230.11 requires the permitting authority to determine in writing the potential short-term or long-term effect of a proposed discharge of dredged or fill material on the physical, chemical, and biological components of the aquatic environment in light of subparts C-F. The determinations of effects of each proposed discharge shall include the following:

a) Physical substrate determinations;

b) Water circulation, fluctuation, and salinity determinations;

c) Suspended particulate and turbidity determinations;

d) Contaminant determinations;

e) Aquatic ecosystem and organism determinations;

f) Proposed disposal site determinations;

g) Determination of cumulative effects on the aquatic ecosystem; and

h) Determination of secondary effects on the aquatic ecosystem.

Subparts C through F lists the effects of the potential impacts on the physical and chemical characteristics of the aquatic ecosystem; the potential impacts on the biological characteristics of the aquatic ecosystem; the potential impacts on special aquatic sites; and the potential effects on human use characteristics to be considered in making the factual determinations and the findings of compliance or non-compliance in Subpart B. Subpart G sets forth evaluation and testing procedures to provide information necessary to reach the determinations in Subpart B. Subpart H lists actions to be undertaken to minimize the adverse effects of discharges of dredged or fill material.

This section 404(b)(1) showing includes a description of the proposed discharge of fill material to be evaluated under Section 404 of the Clean Water Act and an analysis of the discharge pursuant to Subparts B through H. For the purposes of this showing, primary effects are equated with direct impacts and secondary effects are equated with indirect impacts. Construction-related impacts are considered direct. Indirect impacts can occur at some distance from the project site or can be associated with actions that occur after the project is operational.

Additionally, the Corps of Engineers Regulations 33 CFR 320.4a(2)I-iii require consideration as to the relative extent of the public and private need; where there are unresolved conflicts as to resource use; and the extent and permanence of the beneficial and/or detrimental effect which the proposed structure or work is likely to have on the public and private uses to which the area is suited.

1.1 Rock Creek Mine Project - Alternative V Description

The Sterling Mining Company (Sterling) has requested permission to place fill material in various waters of the U.S. in conjunction with the Rock Creek mine project. This mining project is an underground hard rock copper and silver mine with the associated above ground processing and waste storage facilities located under and adjacent to the Cabinet Mountain Wilderness Area in the vicinity of Noxon, Montana. The Rock Creek Mine Project will have a design capacity of 10,000 tons per day and an anticipated 30-year life-of-mine. The project permit boundary encompasses 2,412 acres, of which approximately 514 acres will be disturbance, and 1,898 acres will remain undisturbed.

The main modifications distinguishing Alternative V from the other alternatives are described in detail in Chapter 2 of this supplemental EIS. The main modifications are the deposition of tailings as a paste and an alternate water treatment system. The use of paste landfill technology for tailings disposal eliminates the need for borrow materials outside of the paste facility site. The use of paste technology is a less damaging method of tailings disposal to wetlands because the direct and indirect impacts to the wetlands under the facility footprint would be phased-in throughout the 34-year project. In addition, the elimination of the borrow site #3 reduces impacts to the riparian area adjacent to Rock Creek where the borrow would have been excavated. The applicant has submitted design modifications in a report to the Corps titled "Preliminary Designs for Wetlands Mitigation, Alternative 5 - Paste Placement of Tailings" (ASARCO March 26, 1997) (see Appendix L). Changes in the Agencies' 404(b)(1) preliminary showing as a result of these modifications are contained in this Appendix.

The applicant prepared the first inventory of wetlands and nonwetland waters of the U.S. for the Rock Creek Mine in 1993 (ASARCO Incorporated 1993). An additional waters of the U.S. and Wetland Delineation for Copper Lake, Cliff Lake, and Potential Subsidence Areas, Cabinet Mountains Wilderness report was completed and submitted to the agencies and Corps of Engineers in January 1997 (ASARCO Incorporated 1997). Mapping units and their approximate acreage for the inclusive inventoried project areas include: (1) wetlands - 11 acres; (2) non-wetland waters of the U.S. - 56 acres; (3) wetland complex - 2 acres; and (4) riparian areas - 84 acres. Within the wetland complex and riparian areas are areas which may meet the technical criteria for wetlands but were not mapped because no mining-related impacts were proposed.

The wetlands and nonwetland waters of the U.S. inventory included only the areas designated to be either directly or indirectly affected by the proposed mine operations, including the potential subsidence areas in the Cabinet Mountains Wilderness Area. The Corps of Engineers conducted site inspections on September 19-21, 1994 and September 16, 1996 and determined that the inventories were accurate depictions of the jurisdictional wetlands and waters of the U.S.

Wetlands and nonwetland waters of the U.S. within the proposed mine project area were recognized as providing several important functions and values in their ecological role (ASARCO Incorporated 1993; 1997). Wetland functions and values were assessed using best professional judgement based upon the best available literature information (Marble 1992). A formal, standard, semi-quantitative evaluation assessment methodology, such as the habitat evaluation procedure (HEP) or Wetland Evaluation Technique (WET), was not used.

The functions and values of the wetlands within the project area that were considered to be of low importance were ground water recharge, flood-flow alteration, and recreation and uniqueness heritage. Wetlands functions considered to be of low to moderate importance were sediment and toxicant retention, nutrient removal and transformation, shoreline and streambank stabilization, and production export. Ground water discharge, aquatic diversity and abundance, and wildlife diversity and abundance were considered to be of moderate to high importance. The local importance of seeps and springs and the type and quality of habitat provided by the wetlands and adjacent streams and tributaries provide the higher functions.

Although wetlands in the mine permit area do not sustain fish populations, the waters of the U.S., including Rock Creek, east fork of Rock Creek, and west fork of Rock Creek, do support fish. Bull trout occur in all three streams and appears to be a permanent resident (ASARCO Incorporated 1993). Wetlands in the mine permit area and the Cabinet Mountains Wilderness Area provide habitat for wildlife, including amphibians, reptiles, mammals, and birds. Wetlands and adjacent waters of the U.S. provide habitat, seasonal forage, and breeding and resting areas. No bird or mammal species, that is thought to be dependent or wetlands, was recorded in the wetlands study area (ASARCO Incorporated 1993, 1997). Grizzly bear, which is listed as a threatened and endangered species, may also use the wetlands on a seasonal basis. With respect to wildlife, the impacted wetlands would constitute microsite habitats within a broader habitat component and thus, would not be critical to the wildlife's occurrence, distribution, or survival within the project area.

Approximately 5.6 of the total 6.2 impacted wetland acres are associated with the tailings impoundment (Table F-2). These wetlands are primarily located in broad shallow grassy swales in the ephemeral portions of the south fork of Miller Gulch drainage. The remaining 0.6 acres of impacted wetlands and the 0.4 acres of waters of the U.S. will be lost due to the construction of the mill site and waste rock dump, and the powerline, pipelines, and access road crossings of the Rock Creek channel.

The wetlands proposed to be filled under Alternative V can be placed in three main types, or classes of wetland habitats, based on the hierarchical system described by Cowardin et al. (1979). The three classes of wetlands are the Riverine Upper Perennial, the Palustrine Forested Wetland, and the Palustrine Emergent Wetland Systems. Wetlands located along the Rock Creek main channel and its tributaries have developed primarily on the low streamside terraces and would be classified as Riverine Upper Perennial and Palustrine Forested Wetland Systems. Localized wet areas downstream of isolated springs and seeps also occur and would be classified as Palustrine Forested Wetlands. These wetlands have developed primarily in poorly and very poorly drained glaciolacustrine sediments.

Wetlands along the Miller Gulch intermittent drainages are associated with the gentle rolling topography and have formed in the natural surface depressions that concentrate surface water runoff from adjacent areas and cause ponding. The low permeability of the near surface lacustrine clays and silts and the low hydraulic gradients in the area have created saturated soils and shallow standing water. Many areas of these broad shallow grassy swales have characteristics which meet the wetland criteria and would be classified as Palustrine Wetlands Emergent.

Proposed mining and reclamation plans for the Rock Creek Project are detailed in Volume 2, Sections II and III, of the Hard Rock Operating Permit Application submitted to the Montana DEQ and the Kootenai National Forest (KNF). A revised wetlands and waters of the U.S. mitigation plan, describing the construction of new wetlands is included in Section 3.0 of the applicant's Preliminary Designs for Wetlands Mitigation Alternative V (ASARCO Incorporated 1997) (Appendix L), and in Chapter 2 of this supplemental EIS. The primary functions and values of the created wetlands would be to reestablish diversity and abundance of habitat for aquatic and terrestrial species, reduce sediment transport to Rock Creek and Miller Gulch, and attenuate peak flows.

1.2 Description of filling activities associated with Alternative V, Rock Creek Mine Project

Construction and operation of the mine facilities will result in a direct impact through discharge of fill material to about 5.2 acres of wetlands and 0.4 acres of waters of the U.S. (see Table F-2). Approximately an additional 1.0 acre of wetland will be indirectly affected by the project throughout the project life. Therefore, the affected acreage would total approximately 6.2 acres of wetlands and 0.4 acres of nonwetland waters of the U.S. Construction and operation of the tailings paste facility will account for about 4.6 of the 6.2 acres of affected wetlands. The wet paste tailings disposal area will be constructed in nearly the same location (footprint) as the proposed tailings impoundment (Alternatives II, III, and IV). The remaining 0.6 acres of wetland and 0.4 acres of waters of the U.S. will be impacted along the Rock Creek channel by the construction of the mill site, waste rock dump, powerline, pipelines, and access road. Fifteen, large-formatted, detailed figures, were originally included in the Wetlands Inventory, Consideration of Alternatives, and Mitigation Plan (Wetlands Report) prepared by the applicant in 1993 (ASARCO Incorporated 1993). A revised Wetlands Inventory was prepared by the applicant in 1995 particularly for Alternative IV (ASARCO Incorporated 1995) and the mapped delineations were consolidated onto two large-formatted sheets. All of the figures show the location and extent of the Rock Creek Mine project development and operational activities and their relationship to the delineated wetlands and waters of the U.S.

The wetland acreage to be filled with wet paste tailings and other fill material is presented in Table F-3 for various scheduled phases of the "Life of Project." In general, it is not possible to identify the specific quantities of fill materials placed in the wetlands and nonwetland waters of the U.S. for the sites containing large quantities of fill. As much as 1.1 million yds^3 (1.3 million tons) of tailings may be directly placed on top of the approximate 4.6 acres of wetland located beneath the paste tailings footprint. Some smaller quantities of fill materials (estimated 800 yds^3) of on-site borrow materials will be placed in wetlands and crossings of waters of the U.S. channels during upgrading a portion of FDR No. 150 and constructing the utilities corridors. Some small wetland and waters of the U.S. may be temporarily impacted by construction equipment working near the areas, but will not be directly filled. Efforts will be made to minimize the impact to these wetlands through the use of silt fences. If necessary, restoration of these areas will be performed.

Conventional earth-moving equipment, such as front-end loaders, dump trucks, bulldozers, and rubber-tired scrapers, will be used to place fill material in the wetlands and waters of the U.S. for all sites except under the paste tailings disposal area. Wetland areas under the paste tailings disposal area will be filled with wet paste tailings discharged from a pipeline.

2.0 SUBPART B - COMPLIANCE WITH THE GUIDELINES

2.1 Section 230.10 - Restrictions on the discharge

2.1.1 Section 230.10(a): Practicable alternative analysis

Five mining alternatives (4 described and analyzed in the draft EIS; one additional included in this supplemental EIS) were developed in response to the significant environmental issues identified during the scoping process and Agencies' discussions. The effects on wetlands and nonwetland waters of the U.S. was identified as one of the potential significant issues to drive the development of the alternatives and evaluation of impacts. The affected acreage of wetlands and nonwetland waters of the U.S. for each of the four action mining alternatives (Alternatives II, III, IV, and V) is shown in Table F-2.

Under Alternative I, the no-action alternative, the project would be denied which provides the baseline for estimating the effects of the other alternatives. All action alternatives would fill wetlands and nonwetland waters of the U.S. The tailings impoundment and wet paste disposal area would impact the same acres of wetlands for all action alternatives. The location of the mill site, waste rock dumps (Alternatives II and III only), powerline, pipelines, and access road upgrade will determine the total amount of wetlands and waters of the U.S. impacted by the other action alternatives.

In addition to the five alternatives, a number of alternatives suggested during scoping were determined by the Agencies to be infeasible or otherwise unreasonable. The dismissed alternatives and their reasons for dismissal are discussed in detail in Chapter 2, Part III of the draft and supplemental EISs. The dismissed alternatives fall under the following topics:

- other recoverable ore bodies;
- mill and mine portal siting alternatives;
- tailings impoundment siting and construction methods;
- tailings paste deposition siting alternatives;
- McKay Creek impoundment alternative;
- McKay Creek water retention dam;
- other tailings disposal and transport methods, including backfilling;
- lined tailings disposal facility;
- rail siding (loadout) locations;

- joint venture mineral development; and
- alternate water treatment methods.

The tailings disposal location and method of placement was a critical factor for evaluating each alternative's impacts to wetlands because of the large quantity of tailings and the surface area required for the disposal area. Even though Alternatives IV and V have essentially the same acreage of impacts to wetlands and nonwetland waters of the U.S., Alternative V is a less damaging alternative for several reasons. Alternative V would result in up to a 25-year delay in the impacts to some wetlands. Successful re-contouring and reclamation of each successive paste panel would help minimize cumulative impacts. Another major advantage of Alternative V is the elimination of the need for large quantities of borrow materials which were to be excavated from a riparian area along Rock Creek.

A total of 21 potential tailings disposal sites were identified and evaluated by the MAC Report (USFS 1986). Four potential tailings disposal sites were further evaluated; a summary of these tailings disposal siting alternatives is presented in Table 2-9 of the draft EIS and in Table F-4 of this 404(b)(1) Showing. Agency evaluations combined the tailings disposal locations and geotechnical components for the further evaluation. Considering the environmental and geotechnical factors, the Rock Creek tailings disposal location was determined to be the practicable and least environmentally damaging tailings impoundment site. Alternative V was considered to be the least damaging practicable alternative. The Agencies considered and dismissed other tailings disposal methods (wet tailings, dry tailings, and backfilling of tailings into the mine). The dry tailings and backfilling alternatives were dismissed because they were either economically or environmentally impracticable. Specific reasons for their dismissal is presented in Chapter 2, Part III of the draft EIS.

2.1.2 Section 230.10(b) - Discharge compliance with guidelines

The 404(b)(1) guidelines Section 230.10(b) require that no discharge shall be authorized if it:

1. Causes or contributes to any violation of applicable water quality standards.

2. Violates any applicable toxic effluent standard or prohibition under Section 307 of the Act.

3. Jeopardizes the continued existence of species listed as threatened or endangered under the Endangered Species Act (ESA) of 1973, as amended, or results in likelihood of the destruction or adverse modification of critical habitat under the ESA of 1973.

The discharge of tailings material at the impoundment site and the discharge of other fill materials proposed for construction and operation of the mine facilities have been evaluated under the following:

State water quality standards: The Montana Department of Environmental Quality (DEQ), provides Section 401 certification pursuant to the state rules (ARM 16.20.1701 et seq.). The Montana DEQ will review this discharge of material and will make a determination for violations of applicable state water quality standards. Montana DEQ will not make its final ruling until the Corps of Engineers completes their final 404(b)(1) evaluation. Section 404 permits, issued by the Corps of Engineers, require Section 401 certification. Any conditions to the 401 certification will be conditions of the Section 404 permit. A Section 401 certification does not constitute a relinquishment of Montana DEQ Water Quality Division's authority, or any subsequent alterations or additions thereto, nor does if fulfill or waive any other local, state or federal regulations.

Toxic effluent standard or prohibition: Documentation of analysis of material to be discharged as a result of the project is contained in the draft EIS. Determination of compliance with Section 307 of the Clean Water Act is encompassed in the Montana DEQ review. Section 307 requires review of the project in light of the possible introduction of toxic pollutants. As indicated above, water quality certification pursuant to Section 401 of the Clean Water Act will be required. All conditions identified in the Section 401 certification will be included as conditions should the 404(b)(1) evaluation result in a recommendation to issue a permit.

Threatened or endangered species: Impacts to threatened or endangered species were addressed in the draft EIS and are addressed elsewhere in this evaluation. To comply with the Endangered Species Act, the Forest Service will prepare a biological assessment to evaluate the potential effects on threatened and endangered species that may be present in the project area. The U.S. Fish and Wildlife Service (USFWS) will review the biological assessment and render a biological opinion. If the USFWS determines that the preferred alternative may jeopardize the continued existence of a species, it may offer a reasonable and prudent alternative that would, if implemented, preclude jeopardy. Sterling must successfully meet the requirements of this section of the 404(b)(1) guidelines in order for the 404(b)(1) evaluation to result in a recommendation to issue a permit. The applicant realizes failure to meet the requirements of this section will result in a recommendation of denial.

2.1.3 Section 230.10(c) - Degradation of Waters of the U.S.

Project impacts which would cause or contribute to significant degradation of waters of the U.S. are addressed throughout the supplemental EIS and the draft EIS. The recommendation to issue a permit will be based on the assessment of the project impacts and the proposed mitigation. In order to conclude that the Rock Creek Mine project will not cause or contribute to a significant degradation of waters of the U.S., Sterling must successfully met the requirements of this section of the 404(b)(1) guidelines.

Section 230.10(c) of the guidelines prohibits the discharge of dredge or fill material which will cause or contribute to significant degradation of waters of the U.S. Findings of significant degradation must be based on factual determinations, evaluations, and testing. 33 CFR Part 320.4(b)1-3 also states that the unnecessary alteration or destruction of wetlands should be discouraged as contrary to the public interest.

From a national perspective, the degradation or destruction of wetlands, and other special aquatic sites, is considered to be the most severe environmental impact covered by the 404(b)(1) guidelines. Wetlands perform various functions that are vital to the integrity of the wetland system and contribute to the overall quality of the nation's waters. Examples of these wetland functions are ground water recharge and discharge, sediment stabilization, sediment/toxicant retention, and nutrient removal/transformation. Other wetland functions considered to be important to the public interest and which serve significant biological functions are the providing of: general habitat (nesting, spawning, rearing, and resting sites); aquatic diversity and abundance; wildlife diversity and abundance; recreation; and uniqueness in nature or scarcity in the region.

The applicant completed the identification and delineation of wetlands and nonwetland waters of the U.S. for the Rock Creek project area with technical assistance from Western Technology and Engineering Inc. and Hydrometrics, Inc. (Wetlands Inventory, ASARCO 1993; 1997). Only wetlands and nonwetland waters of the U.S. in areas designated to be either directly or indirectly affected by the proposed mine operations, including potential subsidence areas in the Cabinet Mountains Wilderness Area were inventoried. The Corps of Engineers conducted site inspections on September 19-21, 1994 and September 16, 1996 and determined that the inventories were accurate depictions of the jurisdictional wetlands and nonwetland waters of the U.S. Most of the delineation work was conducted using the intermediate-level onsite determination method.

Approximately 5.6 of the total 6.2 impacted wetland acres are associated with the wet paste tailings disposal area. These wetlands are primarily located in broad shallow grassy swales in the ephemeral portions of the south fork Miller Gulch drainage. The wetland areas directly under the wet paste tailings disposal area do not provide aquatic/fisheries habitat since they are generally isolated from the main stream channels. The remaining 0.6 acres of wetlands will be lost along the Rock Creek and Miller Gulch drainages due to the construction of the mill site, topsoil stockpile, diversion ditches, powerline, pipelines, and access road upgrade. These wetland sites may provide important aquatic habitat for fisheries; habitat for plant species of special concern (pointed broom sedge, black snake-root, and fringecup); and sensitive wildlife species habitat (such as the harlequin duck). Detailed information on aquatics/fisheries, plant species of special concern, and wildlife is included in chapters 3 and 4 of the draft and supplemental EISs.

The cumulative impacts from all action alternatives for the Rock Creek Mine project, combined with impacts from the Montanore project and projected timber sales in the Rock Creek drainage, may decrease the amount of wetlands and nonwetland waters of the U.S. and their ecological functions. Aquatic and wildlife diversity and abundance are considered to be the two most important wetland and waters of the U.S. functions. Development of the proposed tailings paste disposal area would impact more than 300 acres of the natural watershed in the Miller Gulch drainage. Temporary surface water collection channels and water management practices during paste deposition will alter the natural hydrology, particularly in tributary M-3. In addition to the direct impacts to the wetlands and nonwetland waters of the U.S. in the watershed, some indirect impacts can also be identified. Indirect impacts do not result from the actual placement of the fill, but are associated with the discharge, or caused by it. One indirect impact may be caused by the long-term decreased soil water infiltration rates for the paste tailings compared to the native soils. This decrease in soil water infiltration may potentially alter the frequency and duration of saturation, inundation, and ponding of water for some downgradient wetlands within the north fork of Miller Gulch drainage. Another expected indirect impact includes the disturbance and relocation of mobile wildlife species dependent on aquatic resources in the area. Indirect impacts to wetlands and nonwetland waters of the U.S. will be considered along with direct impacts in making the final permit decision. Long-term decreased soil water infiltration rates for the paste tailings compared to native soils may potentially alter the frequency and duration of saturation, inundation, and ponding of water for some downgradient wetlands within the south fork of Miller Gulch drainage.

2.1.4 Section 230.10(d) - Appropriate and practicable steps to minimize potential adverse impacts of the discharges on the aquatic ecosystem

The primary steps to minimize and delay potential adverse impacts to wetlands and waters of the U.S. pertain to locating the mine facilities to maximize wetland avoidance and implementing a wet paste tailings disposal (Alternative V). The paste tailings disposal alternative would result in an up to 25-year delay in the impacts to some wetlands and eliminate the need to operate a tailings impoundment seepage collection system. The major mine facilities which were located or modified to maximize wetland avoidance include:

(1) Main access road
(2) Utility corridors (powerline, pipelines)
(3) Mill site facilities
(4) Maintain 700 to 1,000 feet separation between top of mining room and surface.
(5) Successive wet paste tailings panel construction, topsoil stockpiles, and diversion ditches

In addition, several alternative facility locations were identified for the waste rock dump sites, mill facility, tailings impoundment sites, and access road upgrades. Other project-related alternatives were identified and considered to avoid or reduce impacts to wetlands and nonwetland waters of the U.S. They include (1) backfilling the underground mine with tailings, (2) backfilling the underground mine with waste rock, (3) underground milling, and (4) off-site milling.

Project impacts which would affect wetlands or nonwetland waters of the U.S. are addressed in the following text, in accordance with the 404(b)(1) guidelines. Appropriate and practicable steps have been developed to minimize potential adverse impacts on the wetlands and waters of the U.S. In the event a 404 permit is approved and issued, these steps, including permit conditions and best management practices, will be incorporated into the 404 permit to ensure the project complies with this section of the guidelines. In addition, the applicant has proposed wetland mitigation, to offset adverse impacts, which is describe in the following section.

Wetland Mitigation Plan

In compliance with Section 404(b)(1) of the Clean Water Act, the applicant has proposed a mitigation plan providing mitigation and compensation for the loss and potential diminishment of wetland functions and values associated with development of the proposed project (ASARCO Incorporated 1997). The applicant's mitigation plan is presented in Appendix L. In the most recent wetlands mitigation plan for Alternative V, Sterling proposes to create 7.0 acres of wetlands to compensate for a total loss of 6.7 acres of waters of the U.S. and wetlands. The primary functions and values of the created wetlands would be to re-establish diversity and abundance of habitat for aquatic and terrestrial species, reduce sediment transport to Rock Creek and Miller Gulch, and attenuate peak flows. In addition, the applicant has identified three optional wetland mitigation sites that could be developed if the proposed sites prove to be less successful than anticipated for replacing the lost wetland functions and values.

The applicant has identified three main wetland mitigation sites along with three additional wetland sites (see Figure 2-22). One additional site that could be developed is routing storm water around the tailings paste disposal site into an ephemeral drainage of the south fork of Miller Gulch. The proposed acreage and mitigation schedules for the created wetlands are provided in Table 2-7. Detailed descriptions, including site development, design specifications, and schedules, are presented in the applicant's wetlands mitigation plan (ASARCO Incorporated 1997). The proposed wetlands mitigation consists of creating: 1) 1.2 acres of wetlands at the Miller Gulch Tributary site; 2) 4.4 acres of wetlands at the Upper Rock Creek site; and 3) 1.4 acres of wetlands at the Lower Rock Creek site. All proposed wetland mitigation sites are within the proposed permit boundary.

The Miller Gulch Tributary wetland site will consist of a series of earthen flow barriers across a small side tributary to Miller Gulch. The flow barriers will be designed to retain surface water runoff and create seasonally saturated soils and wetland hydrologic conditions. The eight small earthen dikes will be constructed at approximately 200-foot intervals along a 1,500 foot segment of the tributary. Each dike will have a rock-lined spillway. The upstream soils and subsoils may be sealed or lined if the hydraulic conductivities are determined to be greater than about 1 X 10^{-6} to 10^{-7} centimeters per second. Hydric soils from wetland areas to be filled by the surface disposal of tailings paste will be salvaged and directly respread on the mitigation sites to provide organic matter and a plant material source. The site will be broadcast seeded using a wetland seed mix (Table L-3 in Appendix L). Containerized western red cedar or black cottonwood trees will also be planted in selected areas at densities provided in Table L-3 in Appendix L.

The Upper Rock Creek wetland site will consist of linear channels constructed in a non-wetland site. The channels will be excavated to depths which will allow saturation and inundation by shallow ground water. Demonstration pits were excavated with a backhoe at two locations in November 1996, and saturated gravels overlying clay were encountered at about eight feet below ground surface at both sites. Variable channel widths, small depressions, and benches on one or both sides of the channel bottoms will help create variable depths of saturation and inundation and a more natural looking configuration. Soils will be salvaged from the disturbed areas, respread on the regraded channel bottoms and sideslopes, and disced or harrowed to provide a proper seedbed. The Upper Rock Creek wetland site will be broadcast seeded with a wetland seed mix (Table L-3 in Appendix L). The sites will be mulched with noxious weed-free straw or cellulose fiber mulch.

The Lower Rock Creek wetland site will also consist of constructed linear channels, but will not be excavated to ground water. Instead, the Lower Rock Creek wetland sites will rely on concentrating seasonal runoff water and temporary retention of water to create wetland hydrology. Small flow barriers (detention dikes) may be added in the channel bottoms to create longer periods of inundation. Topsoil from the site will be salvaged and respread over all disturbed areas. The site will be broadcast seeded with a wetland seed mix (Table L-3 in Appendix L). The proximity of the site to Rock Creek wetland areas may allow for some natural invasion and establishment of hydrophytic species.

2.2 Section 230.11 - Factual determinations

The potential adverse impacts of discharging fill and wet paste tailings material on the physical, chemical, and biological components of the wetland and aquatic ecosystem have been evaluated. Mitigation efforts to offset adverse impacts have been considered in this 404(b)(1) showing and in the supplemental EIS. Determination of these impacts have included the following:

2.2.1 Section 230.11(a) Physical substrate determinations

The discharge and disposal of tailings paste from the Rock Creek Mine project will ultimately create a constructed tailings paste facility that covers approximately 305 acres with another 20 acres impacted by associated features (estimated total 325 acres). Approximately 4.6 acres of wetlands will be directly filled with the tailings paste and an additional 1.0 acre of wetlands downstream of the impoundment will be indirectly affected by the capture and diversion of surface water during construction and reduced surface soil infiltration under the facility. An additional 0.6 acres of wetland will be filled along Rock Creek due to construction of the mill site, powerline, pipelines, and access road upgrades.

Soils under the tailings impoundment area have developed in lacustrine materials (materials deposited in quiet waters) which occur on the higher terraces close to the confluence of Rock Creek and the Clark Fork River. These soils have ash-influenced surface horizons with high organic matter content. The soils along Rock Creek have developed predominantly in alluvial materials (deposited by moving water) and also have high organic matter contents in the upper ash-influenced surface horizons. Site specific soil information is presented in the draft EIS.

The mineralogical and physical composition of the tailings paste materials will be variable, but different than the lacustrine substrate. Characteristics of the waste rock material at the Troy and Rock Creek mine projects are provided in Table 4-17 of the draft EIS. Initial testing of the potential tailings material indicate a net neutralizing potential (see Table 4-13 in the draft EIS). The tailings materials have a low sulfide content. The results of analyses performed to date suggest that exposure of Rock Creek ore and waste rock by mining would not generate acid mine water. Additional Acid Base Accounting (ABA) would be performed during the construction of the exploration adit to ensure the adit and excavated material were not acid generating.

The types of fill material placed in the 0.6 acres of wetland along Rock Creek will include mine waste rock, local gravel, on-site borrow, topsoil, and subsoil. These fill materials may have similar mineralogical and physical characteristics as the substrate materials.

2.2.2 Section 230.11(b) Water circulation, fluctuation and salinity determinations

As described in this showing (See 4.4 Section 230.23) natural water circulation and fluctuations in the small ephemeral portions of the main portion and south fork of Miller Gulch drainage would be impacted by the capture and diversion of surface water around the tailings paste facility during construction and by the reduction of surface water infiltration in the 325 acre site. The discharge of fill materials along Rock Creek will be predominantly above the creek channel and will have limited impacts on circulation and fluctuations of Rock Creek water. Salinity levels are not expected to change.

2.2.3 Section 230.11(c) Suspended particulate/turbidity determinations

Discharges of fill materials and associated construction activities in the Rock Creek and Miller Gulch drainages would temporarily increase sediment contributions to wetlands and nonwetland waters of the U.S. Soil erosion and transport would occur primarily during filling (construction) activities and prior to vegetation establishment. Aquatic organisms would be impacted and a temporary decline in biological productivity can be expected. Inclusion of Montana DEQ Section 401 permit conditions, as well as other conditions to control sedimentation and turbidity, will minimize these impacts. In addition, the applicant's proposed best management practices will be implemented to control erosion and reduce sedimentation. Erosion control measures are described in detail throughout the applicant's permit application. These measures involve mechanical practices, soil-handling techniques to enhance stability, hydrologic measures to control runoff and sedimentation, and revegetation practices to provide a stabilizing cover.

2.2.4 Section 230.11(d) Contaminant determinations

See Section 7.0 - EVALUATION AND TESTING (230.60 and 230.61).

2.2.5 Section 230.11(e) Aquatic ecosystem and organism determinations

The mining project would result in impacts to aquatic organisms due to the direct discharge of fill materials to 5.2 acres of wetland and 0.4 acres of nonwetland waters of the U.S., and the indirect impacts to another 1.0 acre of wetland. In addition, other activities, such as constructing the water treatment facility, logging the proposed disturbed areas, salvaging topsoil and subsoil, and construction the wetland mitigation sites would likely create sedimentation which would result in impacts. The physical, chemical, and biological integrity of Rock Creek would be modified particularly at the locations where the mine access road and mine utilities (powerline, pipelines) cross the Rock Creek channel. Adverse impacts would also occur to the 4.6 acres of wetland to be directly filled with tailings paste. If the Corps of Engineers permit evaluation concludes that a 404 permit should be issued, special conditions may be attached to the permit requiring monitoring and restoration if the applicant's proposed best management practices are less than successful at erosion control.

Terrestrial wildlife species inhabiting areas near impacted stream segments and dependent on the aquatic ecosystem would be affected by the mining project. Species currently inhabiting the areas to be destroyed by tailings paste filling activities, will compete for existence in surrounding areas containing similar habitat.

2.2.6 Section 230.11(f) Proposed disposal site determinations

As previously stated, the Montana DEQ Water Quality Division provides Section 401 certification pursuant to Section 401 of the Clean Water Act. The Montana DEQ has reviewed this discharge of material and will make a determination for violations of applicable state water quality standards. However, Montana DEQ will not make its final ruling until Sterling submits a final Water Management Plan for the Rock Creek Mine project. No section 404 permits will be issued by the Corps of Engineers without the Section 401 water quality certification.

The proposed tailings paste disposal area would completely fill approximately 4.6 acres of wetlands. Criteria normally applied to mixing zone determinations is not applicable to these sites. The mixing zones at the locations where the mine access road and mine utilities (powerline, pipelines) cross the Rock Creek channel will be limited to the immediate areas of the discharge points. In addition, implementation of the best management practices will help reduce erosion and sedimentation, and limit the mixing zones to the immediate areas where the crossings occur on Rock Creek.

2.2.7 Section 230.11(g) Determination of cumulative impacts on the aquatic ecosystem

An analysis of cumulative impacts is contained for each resource area in Chapter 4 of the final EIS and in Attachment 1 to this appendix. Cumulative impacts are the collective impacts for the project when considered in conjunction with other past, present, and reasonably foreseeable activities. Cumulative impacts for the Rock Creek project include 730 acres of planned timber sales, potential land exchange, possible road closures, probable increase in recreation, and the Montanore project impacts.

The cumulative impacts from all action alternatives for the Rock Creek Mine project, combined with impacts from the Montanore project and projected timber sales in the Rock Creek drainage, may decrease the amount of wetlands and nonwetland waters of the U.S. and their ecological functions. Aquatic and wildlife diversity and abundance are considered to be the two most important wetlands and nonwetland waters of the U.S.functions. Development of the proposed tailings paste disposal area would remove more than 300 acres of natural watershed in the Miller Gulch drainage. Temporary surface water collection channels and water management practices during paste deposition will alter the natural hydrology in the Miller Gulch drainage. Long-term decreased soil water infiltration rates and soil hydraulic conductivities in the paste tailings materials compared to native soils and lacustrine sediments may alter the frequency and duration of saturation, inundation, and ponding of water for some downgradient wetlands within the Miller Gulch drainage.

2.2.8 Section 230.11(h) Determination of secondary effects on the aquatic ecosystem

A catastrophic failure of a tailings paste panel, considered a very low-probability event, would create an uncontrollable release to the environment. Should failure occur, tailings paste and waters would likely fill adjacent wetlands and nonwetland waters of the U.S. and create adverse impacts to the aquatic ecosystem. Portions of the tailings paste mass would probably remain in stream channels for an undefined period of time.

Other secondary effects on the aquatic ecosystem from the Rock Creek project support activities may result from an increased surface runoff (and sedimentation) from cleared areas and the face of the tailings paste facility. Also, the temporary surface water collection channels and water management practices during paste deposition may create secondary effects on the natural hydrology and aquatics ecosystems in the main portion and south fork of Miller Gulch drainage.

2.3 Section 230.12 Findings of compliance or non-compliance with the restrictions on discharge

Based on the Agencies' preliminary assessment, data contained in the draft EIS and supplemental EIS, the determinations of the preceding section, and the remainder of this showing, it appears that the discharge of the tailings paste and the road and utility crossings would comply with the requirements of these guidelines with the inclusion of appropriate and practicable implementation of Best Management Practices and the permit conditions to minimize any adverse effects of the discharge to the aquatic ecosystem. Alternative V would be the least damaging practicable action alternative because the tailings paste disposal method would result in up to a 25-year delay in the impacts to some wetlands. Also, this disposal method would eliminate the need for large quantities of borrow that would be excavated from a riparian area along Rock Creek.

3.0 SUBPART C - POTENTIAL IMPACTS ON THE PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE AQUATIC ECOSYSTEM

Potential impacts of the discharge of fill from the Rock Creek project on the physical, chemical, and biological components of the aquatic environment have been evaluated. Mitigation efforts to offset adverse impacts and the mitigation ratios have not been finalized. Additional mitigation may be considered in the final evaluation upon review and approval of detailed engineering designs and drawings. Determination of these impacts include the following:

3.1 Section 230.20 Physical substrate determinations

As previously stated, the disposal of tailings paste will ultimately create a tailings facility that covers approximately 305 acres in the Miller Gulch drainage. Approximately 4.6 acres of wetland will be directly filled with tailings. An additional 0.6 acres of wetland will be destroyed along Rock Creek from the construction of the mill site, powerline, pipelines, and access road upgrade. Surface soil materials from under the tailings paste disposal area will be salvaged and stockpiled prior to paste deposition activities. Stockpiled soils will be used for reclaiming the tailings paste surface and outer edges when final contours and grades are achieved. Hydric soils (wetland soils) will be salvaged from the 4.6 acres of delineated wetlands to be affected by the tailings paste facility. The hydric soils will be directly respread on the Miller Gulch wetland mitigation sites to provide increased organic matter and a plant materials source. Soil salvage is not proposed for the other wetland areas (0.6 acres) due to their small size, inaccessibility to heavy equipment, and the additional adverse impacts which could result from the use of heavy construction equipment necessary to salvage the small amount of material available from these sites. Site specific soil information is presented in the draft EIS.

3.2 Section 230.21 Suspended particulates/turbidity

An increase in the suspended particulates and turbidity in the waters of the U.S. (Rock Creek channel) and water flowing through the delineated wetlands will occur during fill (construction) activities. Of primary concern for the lower portion of Rock Creek, is the potential impact of increased sedimentation on Bull trout spawning. The Bull trout spawns in depositional areas and increased sedimentation could have a significant impact on their reproduction rates. Erosion control measures are described in detail throughout the Rock Creek Mine permit application. These measures involve mechanical practices, soil-handling techniques to enhance stability, hydrologic measures to control runoff and sedimentation, and revegetation practices to provide a stabilizing cover. With the inclusion of these best management practices and the Forest Service and state soil and water conservation practices as well as reduction of existing sediment sources outside the permit area within the Rock Creek drainage, any project-related increase in the suspended particulates and turbidity in Rock Creek should not have a significant impact on the fishery.

3.3 Section 230.22 Water clarity, nutrients, environmental characteristics and values (chemistry)

The discharge of tailings paste and construction of surface water runoff collection channels will create short-term impacts to water characteristics. During paste deposition activities, surface water will be channeled and diverted around the paste area and may have increased suspended solids and nutrients. The surface water runoff from the active paste panels will be routed to the storm water retention ponds and used in the process water loop. An increase in total nitrogen (nitrates, nitrites, and ammonia) from water discharge from the water treatment plant could lead to eutrophic or hypereutrophic conditions. Inclusion of Montana DEQ Section 401 permit conditions, as well as other conditions, will minimize these impacts. In addition, the applicant's proposed best management practices will be implemented to control erosion and reduce sedimentation.

3.4 Section 230.23 Current patterns and water circulation

The discharge of fill and construction of the powerline, pipelines, and access road crossings of the Rock Creek channel will modify water circulation and current patterns only at the points of discharge where the crossings of Rock Creek occur. The Rock Creek discharges will be predominantly above the creek channel and only minor impacts are expected. In addition, sound engineering and best management practices will help to minimize impacts.

Construction of the tailings paste facility will impact water patterns and circulation in the main portion and south fork of Miller Gulch. Water patterns and circulation would be impacted by the temporary surface water collection channels and water management practices during paste deposition in the Miller Gulch drainage. Long-term decreased soil water infiltration rates and soil hydraulic conductivities for the paste tailings compared to native soils may alter the frequency and duration of saturation, inundation, and ponding of water for some downgradient wetlands within the Miller Gulch drainage.

3.5 Section 230.24 Normal water fluctuations

The discharge of fill associated with the construction of the powerline, pipelines, and access road crossings of the Rock Creek channel will not impact normal water fluctuations because the discharges will be predominantly above the creek channel. The construction of the tailings paste facility will impact normal water fluctuations in the Miller Gulch drainage by increased peak flows from routing the surface water around the paste disposal area. However, there is the potential that the surface water diverted around the tailings paste facility could be used to develop a wetland mitigation site in an ephemeral drainage channel of the south fork of Miller Gulch. Higher peak surface water flows may also result from decreased soil water infiltration rates and reduced soil hydraulic conductivities for the paste tailings compared to native soils. The seepage collection system under the tailings paste disposal facility may impact natural ground water seepage rates and could increase surface water flow rates. This short term increase in available water supplied to downstream wetlands may actually increase the existing wetland area.

3.6 Section 230.25 Salinity gradients

The Rock Creek Mine project is not expected to have any impact or effect on salinity gradients because the fill would be predominantly nonsaline materials and would be placed above the creek channel.

4.0 SUBPART D - POTENTIAL IMPACTS ON BIOLOGICAL CHARACTERISTICS OF THE AQUATIC ECOSYSTEM

4.1 Section 230.30 Threatened and endangered species

A biological assessment (BA) of the on-site and off-site effects of the Rock Creek Mine project to threatened, endangered, and proposed wildlife species has been submitted to the USFWS (see final EIS, Appendix B). The BA concludes that the proposed mine project will have no effect on Water Howellia; is not likely to adversely affect gray wolf, bald eagle, and peregrine falcon; and may adversely affect the grizzly bear and bull trout. Additional information on Threatened and Endangered species is presented in Sections 2, 3, and 4 of the supplemental EIS. The USFWS will make recommendations to mitigate adverse effects that may include measures in addition to those discussed in the supplemental EIS. The USFWS will issue a formal biological opinion prior to the final EIS.

4.2 Section 230.31 Fish, crustaceans, mollusks, and other aquatic organisms in the aquatic food web

The Rock Creek drainage supports good diversity of invertebrates but relatively low total numbers. The most common types of macroinvertebrates are clean-water forms such as mayflies, stoneflies, and caddisflies. Four species of fish have been found in the Rock Creek drainage: westslope cutthroat trout, bull trout, brook trout, and rainbow trout. Cutthroat trout and bull trout are the dominant species. Additional information on fish and aquatic organisms is presented in Sections 2, 3, and 4 of the supplemental EIS. The deposition of the tailings paste and other fill materials would affect aquatic organisms as a result of inundation, flow alterations and construction activities. Mitigating the loss of wetlands, along with implementing the best management practices and the Forest Service and state soil and water conservation practices, should minimize the impacts on fish and other aquatic organisms.

4.3. Section 230.32 Other wildlife

Terrestrial wildlife species inhabiting areas near impacted stream segments and dependent on the aquatic ecosystem would be affected by the project, especially during the construction period. However, surrounding habitat within the riparian areas would be capable of absorbing displaced individuals. Due to the relatively small area of aquatic habitat being adversely affected, relative to the total available habitat in the project area, the impacts are not considered to be significant.

5.0 SUBPART E - POTENTIAL IMPACTS ON SPECIAL AQUATIC SITES

As discussed previously, the project would result in impacts to wetlands and nonwetland waters of the U.S. habitats due to inundation, flow alterations, and construction activities. The physical, chemical, and biological integrity of the aquatic ecosystem would be modified as described in the supplemental EIS and below.

5.1 Section 230.40 Sanctuaries and refuges

There are no sanctuaries or wildlife refuges in the project area which would be impacted by the project.

5.2 Section 230.41 Wetlands

Approximately 5.6 of the total 6.2 impacted wetland acres will be filled due to the construction of the tailings paste facility (see Alternative V; Table F-2). The remaining 0.6 acres of impacted wetland and the 0.4 acres of nonwetland waters of the U.S. will be impacted due to the construction of the mill site, and the powerline, pipelines, and upgraded access road crossings of the Rock Creek channel. Wetlands impacts are discussed in more detail in Chapter 4 of the final EIS and in the Wetland Mitigation Plan (ASARCO Incorporated 1997).

As required by Section 404(b)(1) of the Clean Water Act, the applicant has prepared preliminary designs for wetland mitigation to specifically address Alternative V (ASARCO Incorporated 1997) (Appendix L). The mitigation plan provides for the mitigation of and compensation for the unavoidable loss and potential diminishment of the wetland functions and values associated with development of the proposed project. The applicant identified three primary wetland mitigation areas and three optional mitigation areas (see Figure 2-22 in the final EIS). A brief description of the primary aspects of the applicant's wetland mitigation plan is discussed in Chapter 2 of this final EIS. Detailed descriptions, including site development, design specifications, and schedules, are presented in the revised Section 3 of the Wetland Mitigation Plan (ASARCO Incorporated 1997) (Appendix L).

5.3 Section 230.42 Mud flats

There are currently no mud flats at the project site and the project will not create any.

5.4 Section 230.43 Vegetated shallows

Vegetated shallows are permanently inundated areas that under normal circumstances support communities of rooted aquatic vegetation (Emergent Palustrine wetlands). Many areas of the south fork of Miller Gulch have characteristics which meet the wetland criteria and are classified as Emergent Palustrine wetlands. Wetlands impacts are discussed in more detail in Section 4 of the supplemental EIS and in the revised mitigation plan.

5.5 Section 230.44 Coral reefs

There are no coral reefs associated with this project.

5.6 Section 230.45 Riffle and pool complexes

Riffle and pool complexes occur within the Rock Creek channel but should have minimal impacts from the mine project. The discharge of fill associated with the construction of the powerline, pipelines, and access road crossings of the Rock Creek channel will be predominantly above the main creek channel. The south fork of Miller Gulch drainage contains no riffle and pool complexes.

6.0 SUBPART F - POTENTIAL EFFECT ON HUMAN USE CHARACTERISTICS

6.1 Section 230.50 Municipal and private water supplies

The existing beneficial uses for surface water from Miller Gulch include power generation, irrigation, and domestic uses (Water Rights P029428, W131977, and W131978). Sterling would be required, under the Metal Mine Reclamation Act, to repair or replace only existing use of surface or ground water that was affected by the proposed project, if it receives a permit.

6.2 Section 230.51 Recreational and commercial fisheries

The project area does not support a commercial fishery. Although there is a fishery in Rock Creek, the stream does not appear to be highly utilized. Portions of Rock Creek, primarily along the section above the confluence of Engle Creek up to the east and west forks of Rock Creek confluence, periodically dries up in the summer months. There are no fish in the portion of the south fork Miller Gulch.

The proposed project could potentially reduce surface water flows to Miller Gulch, however, the impacts from reduced flows cannot quantified. The existing beneficial uses for surface water from Miller Gulch include power generation, irrigation, and domestic uses (Water Rights P029428, W131977, W131978). Sterling will be required, under the Metal Mine Reclamation Act, to repair or replace any existing use of surface or ground water that was affected by the proposed project.

6.3 Section 230.52 Water related recreation

The project may have a minor impact on water-related recreational uses along Rock Creek. This impact may be offset by increased recreational uses created by the wetland mitigation sites. The project could also have an impact on sightseeing excursions in the project area. While the natural beauty of the Rock Creek drainage will be forever changed, revegetation and reforestation efforts will diminish the long term effect of this impact.

6.4 Section 230.53 Aesthetics

The project will impact the aesthetic serenity of the area, particularly during the initial construction phase. Some impacts will be long term, such as the landscape change caused by the tailings paste facility structure. The visual impacts of viewing the tailings paste disposal site will depend on the time of year and the visual orientation of the viewer. Most other impacts will disappear after project completion with revegetation and restoration activities.

6.5 Section 230.54 Parks, national and historical monuments, national seashores, wilderness areas, research sites, and similar preserves

The project area is adjacent to and under the Cabinet Mountains Wilderness Area. All aboveground project facilities would be located outside the wilderness area, except for one ventilation adit. The primary impact to the wilderness area would be one of aesthetics for wilderness users viewing the surface facilities of the project.

Six historic sites were documented during the cultural resources investigations. All of these properties were determined to be ineligible for listing on the National Register of Historic Places by consensus of the KNF and Montana State Historic Preservation Office. No mitigation measures will be necessary prior to impacting these sites.

7.0 SUBPART G - EVALUATION AND TESTING

7.1 Section 230.60 General evaluation of dredged or fill material

The tailings paste facility will be constructed using toe buttresses of rockfill (approximately 80 feet high) with paste tailings deposited from a pipeline in series of lifts and panels. A crawler crane will be used to position the paste pipeline and move the spigot locations. Successive layers of the tailings paste (1 to 4 feet in thickness) will be deposited in panels until the paste structure reaches a final height of 320 to 380 feet. The final upper surface will have some designed topographic relief created by preferential spigotting of the paste along with reshaped with a dozer.

Fill material associated with the construction of the powerline, pipelines, and access road crossings of the Rock Creek channel will be natural borrow materials from nearby mine facility disturbances. The fill materials will be placed predominantly above the main Rock Creek channel. During the construction period, water clarity in Rock Creek could be reduced due to increases in suspended solids entrained in the water column from diffuse sources. The schedule for these fill activities is presented in Table F-3.

7.2 Section 230.61 Chemical, biological, and physical evaluation and testing

Characteristics of Troy mine tailings solid and Rock Creek mine waste rock are presented in Tables 4-13 and 4-17 in Section 4 of the draft EIS. Initial testing of the tailings material indicate a net neutralizing potential (see Table 4-13). The tailings also have a low sulfide content. The results of analyses performed to date suggest that exposure of Rock Creek ore and waste rock by mining would not generate acid mine water. Additional Acid Base Accounting (ABA) would be performed during the construction of the exploration adit to ensure the adit and excavated material were not acid generating.

Drilling and blasting activities would contribute to high concentrations of suspended particulates in the adit water and mine effluent. Suspended solids contribute nearly all of the total metals load to mine effluent and must be removed. Initial removal of suspended solids could be accomplished using settling sump or sand filtration and make be performed either above or underground. Treated water will retain some dissolved metals and most of the nitrogen compounds. Mine water quality is expected to be similar to the adit water quality from the Troy mine (see Table 4-16, Section 4 of the draft EIS). The potential for acid mine drainage exists, but is not anticipated based on available static testing data. The Troy mine may be the best predictive model available for the proposed project. No acid mine drainage has been noted at the Troy mine during its 13-year construction and operation. If the Corps of Engineers recommend issuing a permit, they may attach permit conditions requiring Sterling to have a contingency operational plan in the event that acid drainage occurs.

A water treatment system is currently proposed under Alternative V. This water treatment would include removal of suspended and dissolved solids, ammonia nitrogen, and nitrate/nitrite nitrogen removal, prior to discharge to the Clark Fork River through a submerged outfall located downstream of Noxon Dam. The mine water treatment system would include sedimentation, filtration, and nitrogen removal. Two different nitrate removal systems would be installed including an anoxic biotreatment system and a reverse osmosis treatment system. Additional water treatment system information is provided in Chapter 4, Hydrology in the Surface Water Quality; Adit and Mine Water, Waste Rock, and Milling Process subsections.

8.0 SUBPART H - ACTIONS TO MINIMIZE ADVERSE EFFECTS

Project impacts which would affect wetlands or nonwetland waters of the U.S. are addressed in the following text, in accordance with the 404(b)(1) guidelines. Appropriate and practicable steps to minimize potential adverse impacts on the aquatic ecosystem have been developed and are addressed in the alternatives analyses in Section 4 of both the draft EIS and supplemental EIS. Wetlands and waters of the U.S. will be affected by the proposed project (see Table F-2). None of the alternatives would affect more than 1.5 acres of nonwetland waters of the U.S. Variable amounts of wetlands are affected but no more than 8.1 acres under any alternative.

The Rock Creek mining project will employ a number of best management construction methods to help prevent erosion and decrease sedimentation during construction activities. Methods may include using silt fencing wherever appropriate, diverting water flows around work areas, suppressing dust emissions during dry periods, and salvaging hydric soils from under the tailings impoundment for use in revegetation operations.

A revised wetland mitigation plan has been prepared by the applicant specifically to address Alternative V (ASARCO Incorporated 1997). The revised wetland mitigation plan is provided in Appendix L, summarized in Chapter 2 of this final EIS, and discussed in the various sections of this preliminary 404(b)(1) Showing.

8.1 Section 230.70 Actions concerning the location of the discharge

The Rock Creek proposed tailings paste disposal site was chosen from several alternative locations for environmental as well as engineering reasons. In the Agencies opinion, the Rock Creek location appears to be the least environmentally damaging practicable alternative site for a tailings impoundment. The Rock Creek location will result in less destruction of wetlands and waters of the U.S. than the McKay Creek impoundment site. The implementation of construction's best management practices will be employed to minimize soil erosion and sedimentation, and dust emissions during project activities.

The locations of the confluence mill site and the powerline, pipelines, and access road crossings of Rock Creek are being designed to avoid and minimize direct and indirect impacts to wetland and waters of the U.S. Design and operational limitations are constrained by the mountainous topography, stream channel location, and the size of the mining related facilities. The proposed and alternate locations for these facilities are discussed in the applicant's Wetland Report (ASARCO Incorporated 1997).

An increase in the suspended particulates and turbidity in the waters of the U.S. (Rock Creek channel) and water flowing through the delineated wetlands will occur during fill (construction) activities. Of primary concern for the lower portion of Rock Creek, is the potential impact of increased sedimentation on Bull trout spawning. The Bull trout is currently listed by the U.S. Fish and Wildlife Service as threatened. The Bull trout spawns in depositional areas and increased sedimentation could have a significant impact on their reproduction rates.

A Biological Assessment (Appendix B) was completed which considers impacts to the Bull trout. The conclusion of the Biological Assessment was that implementation of Alternative V is likely to adversely affect the Rock Creek population of Bull trout. As a result, the U.S. Fish and Wildlife Service is required to prepare a Biological Opinion and Takings document. Erosion control measures are described in detail throughout the Rock Creek Mine permit application. These measures involve mechanical practices, soil-handling techniques to enhance stability, hydrologic measures to control runoff and sedimentation, and revegetation practices to provide a stabilizing cover. With the inclusion of these best management practices and the Forest Service and state soil and water conservation practices, any increase in the suspended particulates and turbidity in Rock Creek should not have a significant impact on the fishery.

8.2 Section 230.71 Actions concerning the material to be discharged

Very little could be done to change the physical nature of the tailings paste material to be discharged. The tailings paste water content, additions of thickening agents, and thickness of the successive paste layers can be controlled to minimize the volume of tailings water to be rehandled and to ensure paste panel stability. Borrow materials used for the construction of the Rock Creek utility crossings will be similar to the natural alluvial materials in the vicinity.

8.3 Section 230.72 Actions controlling the material after discharge

The tailings paste disposal facility structure has been designed to fully contain all tailings paste materials. A tailings paste underdrain seepage collection system, consisting of underdrains and collection lines, will be constructed to minimize the potential contamination of ground water resources. Intercepted tailings paste seepage water would be returned to the impoundment.

Interim revegetation and stabilization would take place on all filled areas, along Rock Creek, that are associated with construction activities at the confluence mill site and the powerline, pipelines, and access road crossings of Rock Creek. The areas would be broadcast seeded, or hydroseeded, mulched, and fertilized.

8.4 Section 230.73 Actions affecting the method of dispersion

The wetland areas under the tailings paste disposal area will be completely covered by the proposed discharge. The tailings paste facility would be constructed using toe buttresses of rockfill (approximately 80 feet high) with paste tailings deposited from a pipeline in series of lifts and panels. A crawler crane would be used to position the paste pipeline and move the spigot locations. Successive layers of the tailings paste (1 to 4 feet in thickness) would be deposited in panels until the paste structure reaches a final height of 320 to 380 feet. The final upper surface would have some designed topographic relief created by preferential spigotting of the paste along with reshaped with a dozer. The implementation of best management practices during the salvaging of topsoil, construction of the toe buttresses, and construction of other project facilities would minimize the release and dispersion of any discharged materials off site.

8.5 Section 230.74 Actions related to technology

The implementation of best management techniques during construction would help to minimize adverse environmental impacts. Tailings paste slurry would be transported above ground via twin 10-inch, urethane-lines, high-pressure, steel pipelines to the impoundment for disposal. The lines would be encased in a larger steel pipe at the Rock Creek crossings to guard against spillage. Small emergency dump ponds would be excavated at the stream crossings, to contain potential spillage. Routine monitoring and inspection of the pipeline for leakage or breaks will be performed.

Hydric soils will be salvaged from the 4.6 acres of wetlands under the proposed impoundment and directly respread on the Miller Gulch wetland mitigation sites to provide increased organic matter and a plant materials source. Clay sealants or polyvinyl chloride (PVC) liners may be used to reduce deep percolation of water at the wetland mitigation sites, however, it is not expected that they will be needed. The use of clay-rich earthen and compacted materials will be preferred over the use of manufactured high density polyethylene or PVC liners.

8.6 Section 230.75 Actions affecting plant and animal populations

All plant populations in the tailings paste disposal area will be lost, while animal populations will be displaced or lost as a result of construction activities. Reclamation activities will, upon completion, replace some of the lost habitat and provide space for the reestablishment of some of the lost plant and animal populations. In addition, in the event a 404 permit is approved and issued, permit conditions and additional mitigation measures may be incorporated into the 404 permit to ensure the project complies with Section 230.10(d) of the guidelines. The applicant has proposed wetland mitigation to offset adverse impacts and provide reasonable mitigation for the loss of wildlife habitat.

8.7 Section 230.76 Actions affecting human use

The Rock Creek tailings paste disposal site was selected because it appears to be the least damaging to the aquatic ecosystem of the tailings disposal alternatives. While the project will have a permanent negative effect on the aesthetics of the area, reclamation activities upon project completion and the planting of visual screening, will minimize the overall visual impact. The completed project is not expected to increase human activities in the area which are incompatible with current use patterns. The tailings paste disposal is not expected to have any effect or impact on any public water supply intake.

Acid mine drainage is not expected to occur as a result of the tailings paste disposal. This opinion is based on 13 years of tailings impoundment water quality data from the Troy mine, and initial net neutralizing potential testing (acid-base potential) of the Rock Creek waste rock and tailings (see Tables 4-13 and 4-17 of the draft EIS). Following mining operations, Sterling would monitor water quality in the vicinity of the tailings paste facility. If the Corps of Engineers recommend issuing a permit, they may attach permit conditions requiring Sterling to have a contingency operational plan in the event that acid drainage occurs.

8.8 Section 230.77 Other actions

The design and contours of the final tailings paste surface, implementation of best management practices during construction and operations, and planned reclamation activities will minimize or eliminate any adverse environmental impacts which could be expected from future runoff or other discharges from activities to be conducted on the fill. The mitigation measures incorporated into this project are expected to offset any adverse environmental impacts caused by the discharge of fill material into Rock Creek, the main portion and south fork of Miller Gulch, and the adjacent wetlands.

9.0 PRELIMINARY CONCLUSIONS

The proposed Rock Creek mining project has been reviewed relative to the Section 404(b)(1) Guidelines and the Agencies have concluded the mining project will result in impacts to circulation and fluctuation patterns, substrate, suspended particulates/turbidity, water quality, and aquatic ecosystem structure and function. Several of these impacts will be permanent and long-term while others will occur primarily during the construction period and will be short-term. Cumulative effects from other mining activities, timber harvesting, and other forest related activities will be evaluated and considered prior to making the final permitting decision.

In the Corps of Engineers review of the project, all the alternatives considered in the Final EIS will be reviewed and evaluated to determine if there is a least damaging practicable alternative that could be permitted. Public interest factors, input from other state and federal agencies, and the proposed mitigation measures will also be considered by the Corps of Engineers in the evaluation process prior to their making a final permitting determination.

At the earliest, a final 404 permit evaluation cannot be made by the Corps of Engineers until 30 days after the Final EIS is published. However, based on the size and complexity of this project, the required detailed evaluation, and the preparation of required supporting documentation, the Corps of Engineers Final 404 permit evaluation will most likely not be completed until several months after the Final EIS is published.

TABLE F-1
Affected Acreage of Wetlands and Non-wetland Waters of the U.S. by Mining Alternatives

Mining Alternative	Affected Acreage (Direct + Indirect)		
	Wetlands	Non-wetland Waters of the U.S.	Total Acres
Alternative I - No Action	0	0	0
Alternative II - Proposed Project	8.1	1.5	9.6
Alternative III - Proposed Project with modifications and mitigations	6.2	1.5	7.7
Alternative IV - Modified Rock Creek Project with mitigations	6.2	0.4	6.6
Alternative V - Rock Creek Project with Tailings Paste Deposition and Alternative Water Treatment	6.2	0.4	6.6

TABLE F-2
Acreage of Wetlands and Non-wetland Waters of the U.S. Affected by Proposed and Alternative Facilities

ALTERNATIVE IMPACTS	Wetlands (acres)		Non-wetland Waters of the U.S. (acres)	
	Direct	Indirect	Direct	Indirect
ALTERNATIVE II				
Mill site area	0.3	0.0	1.1	0.0
Mill site waste rock dump	0.6	1.3	0.0	0.0
Access road upgrade (FDR No. 150)	<0.1[1]	0.0	<0.1	0.0
Utilities corridor (powerline/pipelines)	0.2	0.0	0.3	0.0
Rock Creek tailings impoundment	4.4	1.0	0.0	0.0
Topsoil stockpiles and diversion ditches	<0.1	0.0	0.0	0.0
Excess mine water pipeline	<0.1	0.0	0.0	0.0
Alternative II Totals	**5.8**	**2.3**	**1.5**	**0.0**
ALTERNATIVE III				
Alternative III Totals	**5.2**	**1.0**	**1.5**	**0.0**
ALTERNATIVE IV				
Alternative IV Totals	**5.2**	**1.0**	**0.4**	**0.0**
ALTERNATIVE V				
Confluence Mill Site and Waste Rock Dump	<0.1	0.0	0.0	0.0
Access road upgrade (FDR No. 150)	<0.1	0.0	<0.1	0.0
Utilities corridor (powerline/pipelines)	0.2	0.0	0.3	0.0
Wet Paste Tailing Disposal	4.6	1.0	0.0	0.0
Topsoil stockpiles and diversion ditches	<0.1	0.0	0.0	0.0
Excess mine water pipeline	<0.1	0.0	0.0	0.0
Alternative V Totals	**5.2**	**1.0**	**0.4**	**0.0**

[1] <0.1 acres rounded up to 0.1 acres for acreage totals

TABLE F-3
Fill Material Sites, Amounts, Types, Times, and Duration for the Rock Creek Mine

Fill Site	Fill Amount[1] (Cubic Yards)	Type of Fill	Time and Duration (Project Year)
Utilities corridor	0		
Excess mine water pipeline	0		
Access road upgrade	800	On-site borrow	1
Mill site, patio, facilities, and roads	300,000	Waste rock and on-site borrow	2 - 5
Topsoil stockpile and diversion ditches	430,000	Topsoil and subsoil	1
Waste rock dump	444,500	Mine waste rock	2 - 5
Tailings impoundment (Including paste disposal alternative)	82,304,500 735,000	Tailings (paste) Waste rock, rock, and on-site borrow	4 - 30 1

Note:

[1] It was not possible to identify the specific amount of fill to wetlands and nonwetland waters of the U.S. for these sites containing large quantities of fill. Fill amounts are total amounts for that activity, and not the amounts specific to the wetlands and nonwetland waters of the U.S. portions of the sites.

TABLE F-4
Tailings Impoundment Siting Alternative Summary

Site	Construction Option	Reason Dismissed from Further Consideration	Reference
Rock Creek (MAC Report Site 12)	Not Applicable	Insufficient capacity	MAC Report (USFS 1986)
Rock Creek (MAC Report Site 11A, proposed site)	Downstream Method	Excessive amount of borrow required (40 million cubic yards).	Thompson 1989
Noxon Bench (MAC Report Site 10)	Upstream Method	Tailings & reclaim water pipelines crossing the Clark Fork River.	Thompson 1989
Noxon Bench (MAC Report Site 10)	Downstream Method	Tailings & reclaim water pipelines crossing the Clark Fork River. Excessive amount of borrow required (35 million cubic yards).	Thompson 1989
Swamp Creek (MAC Report Site 21)	Upstream Method	Tailings & reclaim water pipelines twice as long as needed for the Rock Creek site. Disturbance area 200 acres larger than for the Rock Creek site. Site is privately owned and would require removal of residences. No distinct advantages over the Rock Creek Site.	Thompson 1989
Swamp Creek (MAC Report Site 21)	Downstream Method	Same as upstream. Excessive amount of borrow required (10 million cubic yards).	Thompson 1989
Swamp Creek/Rock Creek Combined Site	Downstream Method	Same as for Swamp Creek. Total disturbance area of approximately 700 acres .	Thompson 1989
Noxon Bench/Rock Creek	Downstream Method	Same as for Noxon Bench. Total disturbance area of approximately 700 acres.	Thompson 1989
McKay Creek	Downstream Method	Greater impact to waters of U.S. and wetlands and diversion of a perennial stream.	Thompson 1989

TABLE F-5
Available Acreage and Schedule for Created Wetlands

WETLAND MITIGATION SITES	CREATED ACREAGE	MITIGATION SITE CONSTRUCTION[1]	PROJECTED RESUMPTION OF COMPARABLE FUNCTIONS
Miller Gulch Tributary	1.2	Preproduction Year 3	Production Year 22[3]
Lower Rock Creek	1.4	Preproduction Year 5	Production Year 3
Upper Rock Creek			
Stage 1[2]	1.1	Preproduction Year 1	Preproduction Year 4
Stage 2	3.3	Preproduction Year 3	Production Year 1
Optional Wetland Mitigation Sites			
Upper Rock Creek Extension	1.60	Preproduction Year 3	Production Year 1
Miller Gulch Tributary Extension	1.00	Preproduction Year 5	Production Year 3
Lower Rock Creek Extension	0.30	Preproduction Year 5	Production Year 3
Access Road	3.0+	Preproduction Year 1	Production Year 4
Middle Rock Creek	1.00	Preproduction Year 3	Production Year 1
Clark Fork River Bench	5.0+	Preproduction Year 3	Production Year 1
TOTAL WETLAND CREATION	**18.9**		

Notes:

[1] Schedule based on 5 years preproduction activity, 25-30 years production, and 5 years post-production closure and reclamation.

[2] Upper Rock Creek Stage 1 will involve 1.1 acres of mitigation. Stage 2 will include the remaining 3.3 acres and will address any changes necessary based on results of Stage 1 mitigation.

[3] This mitigation site is proposed as a forested wetland and 25 years are projected to allow trees to develop to provide comparable functions as disturbed forested wetlands.

ATTACHMENT 1

CUMULATIVE IMPACTS SUMMARY

CUMULATIVE IMPACTS SUMMARY

Introduction

This appendix contains a summary of the Sterling Rock Creek projects's cumulative impacts on all resource areas evaluated in the final EIS. Cumulative impacts are defined as collective impacts for the project when considered in conjunction with other past, present, and reasonably foreseeable activities. (These activities are described in Chapter 2 of the final EIS.) Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. The Council on Environmental Quality (CEQ) Guidelines further state that, "cumulative impacts refer to two or more individual impacts that, when considered together, are considerable or that compound or increase other environmental impacts. The cumulative impact of several projects is the change in the environment that results from the incremental impact of the project when added to other closely related past, present, or reasonably foreseeable future projects. Cumulative impacts are discussed at the end of each resource impact section in Chapter 4 of the final EIS (Environmental Consequences).

Resource areas identified as having no significant cumulative impact issues associated with the project actions were air, geology, geotechnical engineering, and groundwater hydrology. Some of the more measurable, but potentially variable, cumulative impacts may occur to soils and reclamation (soil loss), surface water hydrology (nutrient loading to the Clark Fork River), wetlands (short term loss of aquatic and wildlife diversity and abundance functions), aquatic resources (nutrient loading and algae growth), biodiversity (increased human development), threatened and endangered species (increased habitat fragmentation), socioeconomics (population influx), transportation (increased traffic), recreation (increase recreational use), wilderness (short term increased human use), cultural resources (increased human disturbance to cultural resources), American Indian rights (increased use of treaty-related resources), and sound (increased area of human sounds in wilderness). These issues are discussed in the following sections of this document. Alternative V contains numerous monitoring and mitigation plans that would help identify and minimize impacts to all resource areas. See the Alternative V description in Chapter 2 and Appendix K in the final EIS for more detail.

Air

Cumulative air quality impacts under all action alternatives would be reviewed for specific proposed projects and developments that require air quality permits in the area. Logging and small scale mineral exploration activities typically do not require air quality permits; however, general air quality conditions would be analyzed through Sterling's ambient air quality monitoring program. Slash-burning activities are regulated by open burning rules. Particulate and gaseous emissions (primarily NOx and CO) would increase in proportion to increased vehicle activity associated with future logging and/or mineral development; however, it is not likely that ambient air quality standards would be approached. The air quality permit process and specifically the PSD regulations would act to regulate and possibly limit future development based on cumulative impact. Population growth unrelated to the project may increase vehicle traffic and home-heating/wood-burning emissions. Cumulative emissions likely would not exceed air quality standards. No measurable cumulative or additive impact would be expected with respect to Noranda's Montanore Project based on distance and topographic considerations. Noranda's Montanore Project was issued an air quality permit on November 5, 1992. The project's permitted allowable emissions are 38.58 tons/yr TSP, 140.54 tons/yr NOx, 22.15 tons/yr SO2, and 185.81 tons/yr of CO.

The air quality permit analysis, which includes the modeling analyses, increment consumption, and emission calculations, are based on the facility's potential to emit. However, the actual emissions from the facility would likely be less than the potential emissions. If the Class I increment were triggered for NO_2 the facility's potential increment consumption could be the majority of the NOx PSD Class I increment.

Geology

Both Sterling and Noranda would mine stratabound copper-silver deposits from metasedimentary rock under the CMW. The combined size of both the Rock Creek and the Montanore ore bodies may be as large as 279 million tons. The mineral deposits are sufficiently isolated from each other that no cumulative subsidence or related water impacts are expected.

Construction and operation of both mines would likely result in more stringent requirements on other future minerals activities in the area in order to ensure sufficient undisturbed habitat for several wildlife species. The result would be a slowdown in potential mineral exploration and permitting of potential future mineral developments in the area during the life of these projects.

Geotechnical Engineering

A risk assessment was conducted for Alternative V (Klohn-Crippen 1998) using the Failure Modes and Effects Analysis (FMEA) protocol, a quantitative process which is intended to identify and characterize risks associated with the design and performance of engineered systems (see Appendix P in the final EIS). The risk assessment was limited to an analysis of the Top-Down and Bottom-Up designs, and considered these systems' performance for a period of 1,000 years.

Impacts associated with a dam failure include the potential contamination of ground and surface water, and the associated impacts on aquatic life. However, if a slope failure were to occur, the mass evacuation of the paste from the impoundment would not be expected. Since the tailings have the consistency of a paste with relatively little free water available, a mass failure would not produce the kind of fluid flow that could be expected with tailings from a wet tailings impoundment where the tailings have little to no shear strength. Tailings discharge from a failed paste embankment would be minimal, probably localized in a small area, and not likely to reach the Clark Fork River or Rock Creek. There would not be the complete evacuation of retained material as one might expect should a water retention dam fail. However, as the moisture content of the paste increases, say from excessive precipitation or an elevation of the phreatic surface within the tailings pile, the more likely it is for the paste to flow greater distances in the event of a failure. This EIS does not include modeling for paste flow should a failure occur.

The FMEA looked at a complete failure of the paste facility nonetheless. The likelihood of failure of the paste pile with underdrains under seismic loading for the Bottom-Up design was assigned a likelihood of occurrence of 1 in 10,000 to 1 in 1,000,000; the likelihood of occurrence for the Top-Down approach was estimated at a 1 in a 100 chance to 1 in 10,000 chance. The consequences associated with a failure in both instances were designated as "high" to "extreme," which are defined as "short-term irreversible impact, long-term excursion of water quality," and "catastrophic event, long term impact" respectively. The socioeconomic impacts associated with a failure were estimated as "extreme" which was defined as an event garnering international scrutiny and a mitigation cost of in excess of $10 million.

Despite the estimated consequences associated with such an occurrence, there are several mitigating measures which could be implemented to reduce this risk of a failure. These include: employ the Bottom-Up construction sequence, install blanket and finger drains beneath the paste facility; continually model and monitor the moisture content of the paste pile during operations to better understand saturation levels, generate a detailed design of the paste plant operations and disposal system to ensure quality assurance and quality control during operation and post-closure. With these compensating factors fully employed, the FMEA analysis estimated the likelihood of failure under the Bottom-Up option as "negligible" (< 1 in 1,000,000 chance of occurring), and the confidence associated with this estimate was considered "high."

Alternative V also includes a technical panel review of all phases of the final design prior to design approval and construction. Stability issues previously identified as part of Alternatives II through IV, and which are germane to Alternative V as well, including foundation sliding, piping, liquefaction, and embankment erosion and estimates of parameters such as permeability and seepage can be addressed during the peer review and through a comprehensive quality control program as part of paste milling and tailings facility construction. Strict moisture content control during processing and placement would be required if the paste is to exhibit the physical characteristics which were modeled as part of the stability analyses. As part of Alternative V, the Agencies would require Sterling to submit a QA/QC plan for paste milling, paste placement and paste facility management so as to keep the paste within design tolerances.

<u>Soils and Reclamation</u>

Cumulative impacts to soils from other activities primarily would be associated with potential soil loss. Erosion would increase in the Rock Creek drainage by some unknown amount as a result of possible private timber harvests, new road construction, and possible commercial and residential development. Increased erosion may result in increased sediment rates to Rock Creek and the Clark Fork River. KNF requires the implementation of BMPs during logging and road-building operations. If these proposed erosion mitigation practices were properly implemented and maintained, on-site erosion and, in turn, potential increase in sedimentation to Rock Creek would be minimized. More acreage would become unproductive due to increases in roads and paved or graveled surfaces, however this additional loss is not expected to affect overall productivity in the region. Noxious weeds would continue to increase in the area (see Biodiversity in Chapter 4 of the final EIS). When combined with other developments associated with private land development in the region as a result of population increases spurred by development of the proposed project, the Montanore project and the general increase in the population in the area could reduce the long-term productivity of the region in terms of timber production and wildlife habitat (see Biodiversity in Chapter 4 of the final EIS).

<u>Hydrology</u>

Unknown private logging potentially may increase peak flows. The amount of these peak flow increases would depend on timing and site-specific information that are unknown at this time. Additional sediment could reach Rock Creek and the Clark Fork River from logging and road construction activities. The KNF and DNRC requires the implementation of BMPs during logging operations on federal and private lands respectively. BMPs would help minimize sediment transport into surface waters. Appendix H in the final EIS contains a discussion of the KNF BMP process. Proposed highway construction also may increase sediment reaching streams potentially affected by the Rock Creek Mine Project.

There may be impacts on Clark Fork River water quality from expansion of existing, near-capacity water treatment systems at Thompson Fall, Noxon, and Heron. However, without plans for those expansions it is impossible to determine what that impact would be. Any expansions with discharges to the river would have to be covered by an MPDES permit. The expansions would be necessary to handle increased populations resulting from mine employment, and would therefore apply to Alternatives II-V.

Also as part of the 1993 EPA report Idaho researchers concluded that phosphorus is the primary nutrient controlling algal and plant growth in Pend Oreille Lake. Phosphate in detergents is the source of much of the phosphorus discharged to municipal treatment plants, and approximately half of all soluble phosphorus loading to the Clark Fork River originates from wastewater discharges. Bans on the sale of phosphate detergents are already in effect in Montana in the Flathead River Basin, and in the communities of Missoula, Superior and Alberton as part of voluntary implementation of the Tri-State implementation's Proposed Plan. Bonner County, Idaho, has also adopted a phosphate detergent ban. These actions have been highly successful in reducing phosphorus discharges to the Clark Fork River from the respective municipal wastewater treatment facilities. For example, the phosphate detergent ban that was implemented by the City of Missoula in May 1989 resulted in greater than a 40 percent reduction in the phosphorus loading to the Clark Fork from the Missoula wastewater treatment plant. Concentrations of phosphorus in the river downstream of this facility have subsequently declined by a large margin. A modeling study conducted by the University of Montana predicted a reduction in algal standing crops in 110 miles of Clark Fork River as a direct result of this action. The increase of phosphorus loading from the Rock Creek discharge could minimally reduce these upstream efforts.

There is potential for additional nutrient loading to the Clark Fork River, from the expansion of water and waste water treatment facilities, both private and public, at nearby communities experiencing growth resulting from mine-related employment; however, the impact could not be quantified. Expansion of any such facilities would be subject to successful revision of its MPDES permit and compliance with Montana or Idaho water quality standards respectively depending upon where the facility was located.

No cumulative impacts would occur to ground water in the project area. The impacts of the proposed project would be limited to the vicinity of the project area, and the Rock Creek tailings impoundment site. No ground water effects would result from the proposed KNF timber sales. The Montanore Project includes underground mining and would affect bedrock ground water systems east of the proposed Rock Creek Project. However, it does not appear likely that the two operations would have any cumulative effects on ground water quantity or quality. In addition, no cumulative impacts are predicted as it related to TMDL requirements because these requirements would necessarily be equal to or more stringent than existing water quality standards. Cumulative impacts from Avista (formerly WWP) prelicensing are not expected because the operation of the dam is not expected to be significantly different than during the baseline period of measurement.

Wetlands and Nonwetland Waters of the U.S.

The impacts of implementing any of the action alternatives, combined with impacts from the Montanore Mine, may decrease the amount of wetlands and non-wetland waters of the U.S. and their ecological functions in the vicinity of the CMW. However, the combined totals of approximately 20 acres of wetlands and 6 acres of nonwetland waters of the U.S. comprise a very small component of the wetlands and nonwetland waters of the U.S. within the 94,000 acres of the CMW in addition to the surrounds areas. Aquatic and wildlife diversity and abundance are the two most important functions of wetlands and non-wetland waters of the U.S. in the immediate area. The wetlands mitigation plans could create wetlands that would help re-establish wetland functions to compensate for the loss and potential diminishment of habitat diversity and abundance. Alternative V could result in an up to 25 year delay for some impacts to wetlands within the tailings disposal footprint area depending on the paste construction option used. In addition, successfully re-contouring and reclaiming of each successive paste panel should help minimize the total cumulative impacts to wetlands. Cumulative impacts under all action alternatives would be potentially significant in the short term until wetlands mitigation sites are successfully established.

Aquatic Resources

There are 16 separate watersheds which are interrelated with respect to aquatic resources. In addition to the project described in this document, there are many other Forest Service projects occurring in these watersheds. Considering all these projects together, approximately 2 percent of the 650,000 acres in these watersheds will be disturbed. Approximately 80 percent of the 800-plus miles of linear disturbance is road reconstruction that will upgrade roads to present design standards or road decommissioning. The improvement of these roads should have the net effect of decreasing sediment loading.

Management actions in the Lower Clark Fork River could impact aquatic resources. The Tri-State Implementation Council's management plan (see Description of Reasonably Foreseeable Activities in Chapter 2 of the final EIS) includes water quality management objectives pertaining to the control of nutrient loading and algae growth. The achievement of these objectives should benefit aquatic resources in Cabinet Gorge Reservoir by reducing algae blooms.

The cumulative effect of these projects on bull trout was evaluated in the Biological Assessment for this species (see Appendix B in the final EIS). The conclusion reached in that document was that these projects, when considered together, would maintain the function of the bull trout meta-population. Since bull trout is most sensitive aquatic species found in the Rock Creek drainage, such a conclusion is also protective of all less sensitive aquatic species. The USFWS BO supports this determination.

Biodiversity

Cumulative effects are those which are greater when considered together with other impacts than when considered alone. Activities or factors that would have a greater impact to wildlife and plant species when considered together than alone are the increased human development beyond normal regional growth, the Montanore mine, timber sales within Compartment 711, and the loss of old growth on private and public lands. Increased human development also leads to loss of elk winter range, loss of habitat, increased traffic mortality and travel barriers.

Increased regional growth is by far the most important cumulative effect because it affects the most number of plant and animal species and is the most difficult to control. The intermountain west is a growing region, and human population will continue to reduce wildlife habitat in many locations, such as the Bull River Valley, that are now nearly pristine and relatively undeveloped. The effects of the proposed project and other regional activities to increase economic growth are likely to increase the rate of this growth many years before it would normally occur. It is probable that effects to wildlife and plants would occur at any point the regional human population reaches a certain point, regardless of whether that increase is created by the mine or not. Many animal species would find it difficult to coexist in locations with noisy houses, carnivorous pets such as cats and dogs (especially allowed to run untethered), and winter snowmobiling. The land used by houses is an irreversible and irretrievable commitment of wildlife habitat resources except in rare cases. Plant species of special concern as well as general plant species diversity could be cumulatively affected due to loss of plant populations or suitable habitat from construction of houses, roads, and other human developments. The increase in disturbed lands would also allow for the increased spread of noxious weeds in the region.

Threatened and Endangered Species

There are no foreseeable cumulative effects to bald eagles. With the Montanore project active in two of the three same BMUs, there would be very little available displacement habitat available for grizzly bears or wolves (see the revised Biological Assessment - Appendix B in the final EIS). The cumulative habitat effectiveness in BMUs 4 and 5 would be below the minimum 70 percent level for all alternatives (see EIS Chapter 4, Table 4-44). In addition, when the two mines are operating, the north-south corridor along the crest of the Cabinet Mountains becomes extremely narrow and could limit grizzly bear and wolf movements between the southern and northern portions of the Cabinet Mountains. Elimination of movement along the ecosystem is not likely, but changes in individual bear behavior is likely. Changes in behavior could result in increased competition for habitat or territory in the restricted area. It could also result in mortality to bears that are forced to move through the disturbed areas.

The BA indicates that a north to south movement corridor in the Cabinet Mountain portion of the CYE would be fragmented by having two large mining operations active at the same time. Additional analysis of the indirect recreational impacts and corridor assessment (see Appendix B) shows that complete fragmentation is not likely to occur. However, any grizzly bear with an established home range in the south half of the Cabinet Mountains would be impacted and may respond with changes in movement patterns and behaviors. At a minimum, this fracture zone (linear area of human activity that bisects grizzly habitat) would affect 31% (5 of 16) of the known grizzly bears in the CYE. The rate of increase in human activity is higher than projected 'normal' human population growth rates for this area, thus reducing the opportunity for grizzly bear to adjust their habitat use patterns. This is likely to result in more bear/human encounters that often end in bear mortality. Mitigation provides proportional displacement habitat (see revised mitigation plan in Appendix B of the final EIS). The north to south movement patterns of bears would be further impacted by fracture zones created with the proposed access to three private parcels (Way-UP, Fourth of July, and Bear Lakes properties).

Future timber sales would physically change additional grizzly habitat components, especially by removing conifer forest and creating shrub/forb openings. This type of activity also has the potential to decrease the percent of the BMU(s) available for undisturbed use by grizzly bear (reduce habitat effectiveness) (see Threatened and Endangered Species in Chapter 4 of the final EIS). Timber sales can also result in increased road densities, which contribute to increased human/bear encounters, that lead to more bear mortalities.

The cumulative effects evaluation for bull trout must consider the factors currently limiting the recovery of the bull trout meta-population. The six primary factors are:

1. Reservoir temperatures preclude any significant habitat value except as a travel corridor.
2. Meta-population has been fragmented due to the presence of three dams and unsuitable reservoir conditions.
3. Dewatering at the lower end of many tributaries.
4. Historic stream cleaning (i.e., loss of woody debris and deep pools) and stream sedimentation (i.e., road and channel erosion).
5. Channel instability in some powerline, pipeline, and road corridors that parallel the stream network.
6. Exceptionally low numbers of adfluvial and fluvial migrants.

Passage of fish from the Cabinet Gorge system to Lake Pend Oreille was discussed as part of the relicensing of Noxon Rapids and Cabinet Gorge hydroelectric dams. A specific proposal has not been put forth, so it is impossible to accurately predict the impacts from a fish passage facility. However, the facility could potentially improve the status of bull trout by reversing the trend of habitat fragmentation initiated by the construction of the dams. Sediment mitigations in the Rock Creek drainage would result in long-term reductions in sediment, which could eventually improve fisheries habitat in Rock Creek and aid in bull trout recovery. Under the Rock Creek project, a mitigation to study the effects of the mine discharge on bull trout migration past the diffuser could lead to changes in diffuser design or the MPDES permit to protect bull trout migration.

The USFWS is currently preparing a conservation plan for bull trout. The effect of this plan will be to establish principles and guidelines under which all projects can be evaluated. Although specific details of the plan have not been released, its implementation should benefit bull trout.

Ultimately, the prospect of recovery for the meta-population is good if connectivity to Lake Pend Oreille is restored. On a more local scale, recovery prospects are better for tributaries of Noxon Reservoir compared to tributaries of Cabinet Gorge Reservoir because of the larger foodbase and more stable water levels. In summary, although the meta-population is functioning at unacceptable risk in all the Lower Clark Fork watersheds which contain bull trout, the cumulative effect of all foreseeable projects in these watersheds is to maintain function.

Socioeconomics

The analysis presented in the preceding pages of the potential socioeconomic effects of the Rock Creek Mine proposal is based on the assumption that the “Reasonably Foreseeable Activities” identified in Chapter 2, Part IV of the final EIS, would not happen. Should those activities occur, most of them would not alter the projected socioeconomic effects of the Rock Creek Mine. That would not be true, however, of the Troy Mine or the Montanore Project. The cumulative socioeconomic effects of either or both of these projects in conjunction with the Rock Creek proposal would differ significantly in type and magnitude from those described for the Rock Creek project alone. These cumulative impacts would be highly variable, depending on which projects were in what stages of development or operation at any given point in time.

Rock Creek - Troy Unit Cumulative Effects

The Troy Mine is Sterling property and market conditions which would prompt the company to develop the Rock Creek project probably would also cause it to reopen the Troy Mine. In fact, the ASARCO 1997 Annual Report stated that, “The Company plans to restart Troy in conjunction with the development of the nearby Rock Creek silver-copper deposit...” and Sterling company officials have suggested that Troy would be used as a training facility for the Rock Creek work force. In other words, the Troy Mine would reopen about the time that Rock Creek evaluation adit construction would begin and would operate through the Rock Creek development period shutting down about the time Rock Creek reached full production (although its operation could continue beyond that point as long as the Troy deposit remained economically workable).

The Troy Mine would draw most of its expected 100 operating employees from southern Lincoln County with a few coming from western Sanders County. This mine employment would create about 40 new secondary jobs, most of which would be in the communities of Troy and Libby. Individuals employed at the Troy Mine would not be interested in short-term contract construction work at Rock Creek. Sterling would use some of them for Rock Creek evaluation adit construction and operations startup, but it would replace them at Troy so long as that facility remained in production. This would reduce the local labor pool available to take positions at Rock Creek, which would increase non-local hiring and local area immigration during Rock Creek construction and startup.

The short-term socioeconomic effects of the combination of Troy Unit operation with Rock Creek construction and startup on the Alternative IV or V schedule would be very similar to those predicted in the analysis of Rock Creek Alternatives II or III. Local area immigration numbers during contract construction would be similar to those expected for the same period under Alternatives II or III as would the exodus at the end of contract work.

If the Troy Unit were still operating when Rock Creek reached full production, then total immigration in the local area would exceed that projected under any Rock Creek alternative, but the additional population would tend to settle in southern Lincoln County and should not produce significant additional socioeconomic impacts. With most of the additional employment and immigration going to Lincoln County communities, the personal income increment derived from the combined effect of the two projects also would go to that county. Since the approximate remaining economic life of the Troy Unit is projected to be 5 to 6 years, its shutdown would not occur at the same time as that of Rock Creek, so the local area could be safe in expecting that the employment associated with both projects would not be lost at the same time. If Troy's shutdown did take place in a manner that resulted in most of its workforce transferring to Rock Creek, long-term cumulative socioeconomic effects from the two projects would be essentially identical to those expected for the Rock Creek Project alone.

Rock Creek - Troy Unit - Montanore Cumulative Effects

The greatest foreseeable socioeconomic effects would occur if the Troy mine were to reopen and the Rock Creek and Montanore projects were to begin simultaneous development. This is a scenario that could result from an increase in ore prices. If the peak construction periods for the two developing projects coincided, the result would be a sudden demand for nearly a thousand mining and construction workers plus more than 300 secondary employees. With all three facilities in production, nearly 900 workers would be employed by the mines, and secondary employment would total about 350 jobs. These employment demands would impinge on an area of southern Lincoln County, western Sanders County, and eastern Bonner County that has a population of 17,000-18,000 and a labor force of 7,500-8,000. This small labor pool would not be able to supply the demand for workers having the abilities (even with training programs) to meet the needs of the three mines. The result would be a very substantial influx of workers and their families from outside the local area. This population influx could easily total 2,000-2,500 individuals, and might go substantially higher depending on the timing of mine activities, the condition of local and regional labor markets, and other factors.

Lincoln County residents would fill the mining jobs at Montanore and the Troy Unit as well as the secondary positions with work sites in that county. Non-locals filling positions at Montanore or Troy would settle in southern Lincoln County. Because Lincoln County has the lion's share of the population base and the communities with the most housing and existing services, and because it is projected to see only very modest growth in the near future, it would be in the best position to absorb a substantial population influx. The Troy and Libby areas would see tight housing and employment markets, but they probably would avoid other detrimental effects frequently associated with employment and population booms.

With Lincoln County responding to Montanore and the Troy Unit, it would essentially drop out of the local area (for analysis purposes), leaving the communities of western Sanders County and eastern Bonner County as the potential base of labor, housing, and social services available to meet the demands created by the Rock Creek project. The much smaller population base and labor pool of this reduced area would result in reduced local hiring rates. In this setting local hiring for mine positions could fall to 40 percent, with contract construction and secondary employment rates dropping to 25 percent and 75 percent respectively.

These local hiring rates produce an estimate that during the peak of Rock Creek project contract construction Sanders and Bonner County residents would be hired for 161 direct and secondary jobs rather than the 108 projected under Alternative IV or V. More than half of this increase would be in secondary positions, and only a handful would be Sterling jobs. During this period population immigration numbers would reach 869 people rather than the 547 projected for western Sanders County and the Clark Fork area of Bonner County under Alternative IV or V (Chapter 4, Table 4-60). More than 730 of these 869 immigrants would arrive in a period of less than 6 months. This immigration total would be equivalent to a 14 percent increase over the area's 1995 population. Permanent housing for up to 113 families and 42 individuals would be needed, and contract personnel would need temporary housing for 124 families and 83 single or unaccompanied workers. The population influx would increase school enrollments by 190 students, 72 more than predicted by the Alternative IV or V analysis.

A population influx of this magnitude, occurring in a matter of months, would have the potential to produce a classic "boom town" situation in western Sanders and eastern Bonner counties. The severity of the impacts would depend to a large extent on how well local government and the company worked together to plan and prepare. Strong measures would be needed to deal with the demands for housing and public services. The very limited available housing stock combined with the absence of reserve capacity in existing domestic water and wastewater systems would make it essential to increase the housing supply by building both permanent housing and temporary work camps before mine contract construction got underway. It would be vital that the existing Hard-Rock Mining Impact Plan be revised, so that grants and tax pre-payments to local government would reflect the anticipated population influx (2.7 times that predicted in the Plan) and so that this assistance would be available before the event. The need for advance preparation based on a revised Impact Plan would apply in particular to the schools which could see enrollment increments nearly four times those predicted by the existing Plan. Because the Impact Plan provides no assistance to local government outside of Montana, some of the greatest difficulty in responding to increased demand for public services would be likely to emerge in the Clark Fork area of Bonner County.

Once the western Sanders and eastern Bonner County communities had weathered the contract construction boom, 275 contract construction workers would be laid off and almost immediately Sterling would hire more than a hundred mine production workers. Six months later another 140 mine workers would be hired. Some contract workers would be hired for production positions, either immediately or after 6 months of unemployment, but a good many would also leave the area. At the same time newly hired production workers would be arriving. Mine workers, whether they were drawn from the construction population or from other sources, would place different demands on the local communities. They would need permanent, not temporary, housing and would have more family members accompanying them. The expected population increment in western Sanders County and eastern Bonner County would be 1,100 individuals at full mine production (Chapter 4, Table 4-60). These immigrants would need long-term housing for 285 families and more than 90 single persons. They would add more than 300 students to school enrollments.

With 476 direct and secondary mine jobs at full production going to western Sanders and eastern Bonner Counties the mine would account for $13.4 million in annual personal income (in 1995 dollars) to the area. Somewhat over 400 of these jobs and $11.4 million in income would go to western Sanders County. These figures would be equivalent to 12 percent of total 1995 Sanders County employment and nearly 18 percent of personal income. The Sanders County economy would be extremely sensitive to any changes in mine employment. So long as the mine continued to operate at a high and stable rate of production, it would be a powerful factor underlying local prosperity. However, when the mine closed the local area impacts would be much more severe than those which were seen in southern Lincoln County when the Troy mine ceased operations. It also should be anticipated that the sudden development in a small economy of a facility that would have the projected demands on the available labor pool and would pay wages so far above existing local averages would cause a general increase in local wage rates. This increase in combination with housing price escalation could produce a substantial increase in the local cost of living.

None of the effects described in the above paragraphs would be conducive to attracting amenity immigrants or even to keeping those who have already arrived. Housing availability and pricing alone might be sufficient to send prospective amenity immigrants to other areas and to cause some who had already arrived to sell out and leave. Some, if not most, of the amenity-based income and employment gains projected for western Sanders County and the Clark Fork area, if the project is developed, would be foregone. The area's economy would shift abruptly to greater dependence on resource commodity production and substantially decreased reliance on retirement incomes and service industry employment. Local government and the entire community social structure would initially be very focused on dealing with the effects of mine development and the associated influx of direct and secondary workers and their families. Once these issues were dealt with, they would shift to agendas giving a high degree of consideration to the needs and interests of young working families. Some sectors of the community would benefit from this change in priorities while others would likely find their needs and interests carrying less weight in community affairs.

Transportation

The impacts of mine traffic and road construction when combined with the effects of future timber harvest and recreational activities would result in 1) cumulative increases in traffic on Montana Highway 200 and FDR Nos. 150 and 2741, 2) the potential for increased indirect effects of sediment and erosion, dust, noise, and 3) a slight increase in traffic safety hazard on roads associated with the project. Increased traffic associated with the rail loadout would mix residential with other rail-associated traffic at the Hereford loadout. Mine traffic accessing the Miller Gulch rail loadout would mix with residential and logging traffic.

Future Forest Service ecosystem management activities that would increase the open road density may require closure of some existing open roads within BMUs during mine operation. Roads to be restricted would depend on the activity needs at that time (see Threatened and Endangered Species in Chapter 4 of the final EIS).

Recreation

Cumulatively, access could increase in the area if additional roads were built for timber harvest. These roads would be restricted to nonmotorized access after timber harvest. Recreational use could increase as local populations increase due to natural immigration or from the Montanore Mine.

The quality of hunting and trapping would be affected by both timber and mineral activities and the potential increase in the number of hunters and trappers. Timber harvesting might displace big game to other areas within and/or out of the Rock Creek drainage. This movement of animals could reduce the quality of the hunting experience and the likelihood of a successful hunt. Once harvest activities were terminated, game could be expected to return to the areas provided suitable habitat remains.

Wilderness

Cumulatively, mining, timber harvest, and other existing or planned activities outside of the wilderness would alter some natural processes occurring in the wilderness in the short term; these processes would have negligible effects in the long term. Additional mineral activity that may occur within the wilderness is expected to consist primarily of surface sampling, surveying, and core drilling, although none is currently proposed. These activities have occurred in the past with some evidence that habitat use by goats has been altered. This could have a slight effect on natural integrity.

Many human activities that occur outside the wilderness are already seen and/or heard from the wilderness. The Rock Creek Project in combination with other future activities would slightly reduce the apparent naturalness of the CMW. Cumulative activities would not change the overall condition of this narrow wilderness.

The Rock Creek Project in combination with the Montanore Mine near the wilderness would increase the chances for wilderness visitors to see, hear, or smell human activities beyond what is currently evident. The apparent naturalness of the area would decrease slightly with increased human use. Evidence of these projects would not be apparent from the wilderness lakes most often visited by wilderness users. Rather, opportunities to experience solitude or a primitive recreation experience would decrease with human use of the area.

Cultural Resources

Human disturbance to cultural resources would increase from the project as well as from reasonably foreseeable activities within the drainage. All cultural resources cumulatively affected have been determined ineligible for listing on the NRHP and no mitigation measures would be necessary.

American Indian Rights

Increased access to the general project area could increase the use of treaty-related resources by the general public as well as Tribal members. Logging operations within the Rock Creek drainage would impact additional areas of potentially significant plant species and increase the impacts to grizzly bears. The regional wide effect the proposed action may have on American Indians traditional use with respect to treaty rights in conjunction with other proposed projects within the treaty rights boundary is not discussed as that is beyond the scope of this document.

Sound

The cumulative effect of the Rock Creek and Montanore projects would be to increase the acreage within the CMW where human sounds were noticeable. However, the two projects would not have any areas of noise overlap.

Scenic Resources

Timber sales on NFS and corporate lands and continued commercial and residential development in the Clark Fork Valley, in addition to project development, would alter existing views in the project area. Relicensing of Noxon and Cabinet Gorge hydroelectric projects is not expected to contribute to alteration of the existing visual character of the project area or cumulative effects. Direct cumulative visual impacts would occur for wilderness hikers visiting Ojibway Peak at a location where views extend both to the East Fork of Rock Creek on the west face of the Cabinets and Libby Creek on the east face of the Cabinets. From a small area on the peak, both the confluence mill site for the Rock Creek project and several LAD sites and the evaluation adit for the Montanore Mine would be visible. Indirect impacts may occur for CMW visitors to other wilderness peaks, as either project may be visible from some wilderness viewpoints. Proposed improvements for Montana Highway 200 and continued exploration for locatable minerals should have no major cumulative effects on the visual setting of the Clark Fork Valley or Rock Creek drainage. Cumulative visual impacts for any action alternative could be potentially significant depending on viewer expectations for the scenic integrity of the landscape and valued landscape attributes, as well as specific views from any viewpoint.

APPENDIX G

TAILINGS, SUBSIDENCE, AND HYDROFRACTURING

APPENDIX G - TAILINGS, SUBSIDENCE, AND HYDROFRACTURING

INTRODUCTION

This appendix contains discussion on three geotechnical topics: tailings disposal alternatives, impoundment location options, and impoundment construction alternatives. These topics are followed by a description of the impoundment alternatives which are discussed in the EIS. Discussion on a geology-related topic, subsidence, is also provided.

TAILINGS DISPOSAL ALTERNATIVES FOR THE STERLING ROCK CREEK PROJECT

The development of potential alternative tailings disposal options began very early in the planning phase for the proposed project. The process investigated a wide range of possible options. The options included three general categories of tailings disposal alternatives:

- Technological Alternatives - Consideration of various tailings disposal technologies,
- Setting Alternatives - Consideration of different locations for disposal of tailings in an impoundment, and
- Construction Alternatives - Consideration of different types of tailings impoundment construction.

TECHNOLOGICAL ALTERNATIVES

Sterling proposes to dispose of the tailings from the mill in an impoundment constructed with slurry-deposited tailings. This is the typical method for tailings containment for base metal mining ventures at the scale of the proposed project. The Agencies reviewed the potential for other tailings disposal technologies to reduce size or other potential impacts related to the proposed impoundment as the project involves the disposal of approximately 100 million tons of tailings requiring an impoundment structure about 325-feet high and covering 324 acres. The potential alternative tailings disposal technologies reviewed were:

- Tailings Disposal in the Underground Mine - Placement of tailings in the underground openings created by mining in order to eliminate or greatly reduce the size of the surface impoundment.
- Disposal of Dewatered Tailings - Use of tailings dewatering technology to avoid the slurry deposition of tailings and its attendant issues of seepage water quality and stability of saturated tailings.

Tailings Disposal in the Underground Mine

The placement of tailings in underground mine openings is common practice in the metal mining industry, but its primary purpose is to provide physical support of the underground openings rather than to provide a place for tailings disposal.

Historically, the use of tailings backfill has been employed in underground mines that follow narrow, vertically oriented, mineral veins unlike the thick, horizontally lying, ore zones of the proposed project. The first method developed for this involved separating the sand fraction of the tailings (sand) from the silt and clay sized portion of the material (slimes). The sand was pumped in a water slurry to the underground mine openings (stopes) where its sandy character allowed the water to drain away and the sand to settle into a compact mass in the stope. This sand-fill both supported the walls of the stope and provided a working floor for the miners to proceed with extraction of the vertically oriented ore vein.

A further development of the sand-fill technology was the addition of cementing agents, usually portland cement, to the sand-fill to create a weak concrete. This resulted in a stronger backfill material and allowed for the mining of narrow vertical stopes surrounded by very weak rock. This method of cemented sand-fill also found use in the mining of horizontal ore zones, similar to those of the proposed project, where initial support of the stope roof (back) was supplied by leaving wide pillars of ore to hold up the back. Filling the open stopes with cemented sand-fill allowed subsequent recovery of the ore pillars with the cemented sand-fill providing back support. For economic reasons, this method of recovering additional ore is generally limited to very high value ore.

The obvious question is: does this sand-fill technology afford an alternative tailings disposal method that can eliminate or significantly reduce the impacts of the proposed tailings impoundment? As discussed above, the method of sand-filling uses the sand fraction of the tailings; the slimes portion is unused and requires some form of disposal. In a modern base metal mill, the slimes fraction typically makes up 50 - 80 percent of the total tailings material. Sterling projects that approximately 60 percent of the tailings will be slimes (Dames & Moore 1993). Therefore, if sand-filling is used, only about 40 percent of the tailings can go back into the underground openings as a part of the mining procedure; the remaining 60 percent of tailings slimes must be disposed of in another way.

Disposal of the Rock Creek slimes in a surface impoundment would require construction of a retention dam to safely contain the fine-grained slimes. The overall size of the retention dam would not be significantly less than that of the proposed tailings impoundment because of the topography of the site. In addition, the material for the dam would need to be mined from some source near to the disposal site. Therefore, use of this method would result in no real reduction in the size of the surface tailings impoundment and add a very large additional surface disturbance to supply construction material for a slimes retention dam.

To assess the potential size of the borrow area needed to supply dam construction material for this option, it is reasonable to assume that the amount of dam construction material is roughly equal to the sand fraction of the tailings that was the original source of the dam material. This is approximately 40 percent of the 100 million tons of overall tailings, or 40 million tons of additional excavation. Conservatively assuming 2 tons/cubic yard for this material, results in a retention dam needing 20 million cubic yards of additional material to be mined from a location near the impoundment. For a sense of scale, this amount of material would require a vertically sided hole, 100-feet deep, covering about 120 acres. In the opinion of the Agencies, this is not a viable alternative for tailings disposal, as the borrow source itself would create a significant environmental disturbance.

Disposal of both the sand and slimes fraction in the underground mine would require both the removal of the ore pillars (to create more underground space) and the use of substantial bulkheads to contain the slimes in the stopes between the cemented sand-fill pillars. Based on discussion with specialists from the U.S. Bureau of Mines, this possible method of tailings disposal is not practiced in the mining industry for large room-and-pillar mines, is not a proven technology, and is not likely to be economically viable as a tailings disposal method (pers. comm. Lani Boldt, U.S. Bureau of Mines, June 5, 1993). In addition, since the proposed mine does not require back support beyond the use of ordinary pillars, use of backfill only as the means of support would require the applicant to undertake extensive and costly construction of backfill support underground structures and dewatering systems that are unnecessary for the proposed mining method. In the opinion of the Agencies, this is not a viable alternative for tailings disposal.

The problems with sand-fill as a potential tailings disposal alternative involves the need to dispose of the slimes fraction separate from the sand. Ongoing research in the use of the whole tailings for backfill is now beginning to move into industrial-scale applications. However, to date, such applications of whole tailings backfill at the scale of the proposed project are limited to those requiring cemented backfill for underground support and are integral to the economics of the mining method necessary for recovery of the ore (pers. comm. L. Boldt, June 5, 1993; pers. comm. Jim Vickery, Kennecott Copper Company, June 5, 1993). This is not the case for the proposed project and this technology is not proven as an economic tailings disposal method for large-scale room-and-pillar operations.

In addition, due to the increase in overall tailings volume versus in-place material that results from grinding the ore, it is not possible to return all the tailings to the underground openings from which it was mined. Therefore, even if this method were used, most (40% - 50%) of the tailings would need to be placed in a surface impoundment because it simply would not fit in the underground openings created by mining.

Moreover, due to practical mining considerations (e.g., maintaining ingress, egress, and work areas), not all of the underground space could be used for placement of cemented whole tailings. Perhaps as much as one-half of the tailings could be placed in the mine openings. Based on the height-capacity information for the tailings impoundment in the preliminary designs (Dames & Moore 1993), reducing the tailings in the surface impoundment by one-half would result in reducing the height of the impoundment by 132 feet under Alternative II and by 137 feet under alternatives III and IV.

Lowering the impoundment may provide some slight increase in stability. If such a small increase is required during the final design phase, it will be obtained through design changes other than mandating reduced tailings volume through underground disposal.

In addition, the practicabilities of tailings disposal design generally do not allow reducing the area of an impoundment by the same percentage as a potential height reduction, if the original height is retained. Therefore, if the optimistic estimate of one-half the tailings were placed underground, the overall area disturbed for the surface impoundment would likely be reduced by approximately 20 acres.

Cemented whole-tailings backfill is still an experimental technology. Even if it were a proven industrial process it would be very expensive and an unrealistic method of tailings disposal. The cost of conventional tailings disposal in a surface impoundment typically is $0.80 to $2.50 per ton as compared to $7 to over $12 per ton for cemented-sand backfill (MT DEQ 1999). The use of cemented backfill is not a viable option for tailings disposal.

Disposal of Dewatered Tailings

The use of dewatering methods to reduce the water content of slurried tailings and place the dewatered tailings as a moist soil rather than a hydraulically placed slurry is practiced at some mining operations. This technology has emerged over the last decade and is used in the metal mining industry primarily in the disposal of tailings from smaller operations in precious metal mining (i.e, gold and silver, rather than the larger base metal mines).

The dewatering of tailings is done with various types of filters that are used to squeeze, vacuum, or both, to extract water from slurried tailings and create a moist tailings material. This moist tailings is then mechanically placed using conventional earthmoving methods (i.e., trucks, conveyors, stackers, bulldozers, etc.) to construct an earthen fill from the tailings. Such a fill may, depending on specific engineering properties of the tailings and the disposal location, be retained behind a dam, be self-supporting, or a combination of the two.

In response to Agency and public concern with seepage from the tailings impoundment, a paste disposal option has been developed for Alternative V. Paste technology is a recent development in dewatered tailings management which involves using the whole tailings fraction (slimes and sand) to create a low moisture content material which does not express free water like a conventional tailings slurry. Paste tailings differs from the aforementioned whole tailings simply by its final moisture content. Moisture content is a significant determinant in how paste can be managed versus how whole tailings need to be managed. Paste is whole tailings with a lower moisture content. The whole tailings are dewatered to approximately 23% moisture, and cement, lime, fly ash or some other additive may be included to supplement the physical properties of the paste. The advantages of paste as a tailings alternative are that it reduces the amount of water liberated from the tailings and hence minimizes potential problems with water quality degradation. Similarly, the paste can exhibit improved strength characteristics sooner in the construction process and over time, thereby providing increased resistance to instability from seismic events.

Summary of Technological Alternatives

In addition to the company's proposed alternative and its corollaries, the Agencies reviewed two additional methods of tailings management: underground deposition and dewatered surface deposition. The Agencies determined that there would not be an appreciable reduction in surface disturbance area by placing a portion of the tailings underground due to the fact that no more than approximately 50% of the tailings could ultimately be put back underground, leaving roughly half the tailings to be placed on the surface. The net environmental benefit of this alternative was not evident to the Agencies. An alternative addressing seepage from the impoundment was explored through the use of a paste tailings, and ultimately this option was developed as Alternative V.

IMPOUNDMENT SITING ALTERNATIVES

Potential siting options were reviewed in detail by the Agencies. The first review considered potential tailings disposal sites in conjunction with several potential locations for the mill facility. Because the tailings must be transported from the mill to the disposal facility there are several location requirements that are controlled by the proposed mill site: 1) tailings sites should be located relatively near to the proposed mill, 2) typically they should be at an elevation lower than the mill to provide gravity-assisted flow of a tailings slurry, and 3) there should be a relatively unobstructed transportation corridor between the tailings and mill sites.

In 1986, the Forest Service published a report detailing the findings of a general tailings and mill facility setting study conducted for the Cabinet Mountains. This study, known as the MAC Report (USFS 1986), predated this EIS process and included an evaluation of various potential tailings and mill facility locations for the then-conceptual proposed Sterling Rock Creek Project and U.S. Borax (Noranda's now-permitted) Montanore Mine. The MAC Report identified seven potential mill sites, for the Rock Creek Project: two sites on the east fork Bull River, one site on Copper Creek, and four sites in the Rock Creek drainage. Based on these seven potential mill sites a survey was conducted to identify potential sites for tailings disposal impoundments. The following criteria were applied to identify potential tailings impoundment locations:

- Tailings location should be less than 10 miles from the mill site;
- Tailings location should be at a lower elevation than the mill site;
- Tailings location should have relatively gentle terrain (less than 10 percent slopes);
- Tailings location should have foundation conditions that could be reasonably expected to support an impoundment facility; and
- Use of the tailings location would not require diversion of a major stream.

Based on these criteria, the three potential mill sites inclusive of the east fork Bull River and Copper Creek locations have three alternative tailings locations in common. All these potential tailings sites are adjacent to the Bull River either within its valley (one site) or at its confluence with the Clark Fork River (two sites). For the four potential mill sites in Rock Creek, the MAC Report identified four common potential tailings disposal sites. All four of these alternative tailings sites are adjacent to the Clark Fork River with three sites located at the confluence of Rock Creek and the Clark Fork and one site located approximately 5 miles south of Rock Creek at the mouth of Swamp Creek.

As project definition proceeded the possible locations for the mill were reduced to sites in the Rock Creek drainage, thereby eliminating those tailings alternatives that were associated with the east fork Bull River and Copper Creek mill locations. As a result, the Mac Report identified four alternative tailings sites for the proposed project with its mill located in the Rock Creek drainage.

The four potential tailings impoundment sited identified in the Report are:

- Site 11A - A location immediately north of Rock Creek at its confluence with the Clark Fork River. This is the site selected by Sterling for the proposed tailings impoundment.

- Site 12 - A location near to Site 11A but located immediately south of Rock Creek. This site does not have adequate capacity to contain the life-of-mine tailings production and was not carried forward for further evaluation.

- Site 10 - A general location across the Clark Fork River from the mouth of Rock Creek. Using this site would require crossing the river with both tailings and reclaim water pipelines.

- Site 21 - A location immediately south of the mouth of Swamp Creek approximately 5 miles south of Site 11A.

During the EIS process, the Agencies expanded the review of potential tailings impoundments and developed an internal working document that combined both setting and construction method options. This document (Thompson 1989), evaluated the three candidate sites from the MAC Report for both upstream and downstream construction. It concluded that none of the three sites were reasonably suited to the downstream method of construction. It also concluded that, although all were probably suitable for upstream construction, none had sufficient environmental advantages over the proposed location to warrant their further assessment.

Therefore, of the potential tailings locations identified in the MAC Report, only the proposed site, north of Rock Creek, was evaluated as an alternative in the EIS (alternatives II, III, and IV). The subsequent document (Thompson 1989), however, did propose a location at McKay Creek that appeared to offer the potential for construction of a downstream tailings impoundment. The potential to directly mitigate the design issue of seismic liquefaction resistance by using the downstream construction method and the potential to reduce the visual impact of the impoundment resulted in McKay Creek being evaluated as an alternative in the EIS (Alternative V). This was done in spite of the fact that McKay Creek was not deemed suitable in the MAC Report because its use would have required diversion of a major stream.

Summary of Siting Alternatives

The Agencies reviewed many potential tailings sites for the Rock Creek Project. The review is summarized in Table G-1. Based on this review process, two tailings setting alternatives were developed for detailed impact analysis. These alternative sites are located at Rock and McKay creeks.

TABLE G-1.
TAILINGS IMPOUNDMENT SITING ALTERNATIVE SUMMARY

Site	Construction Option	Reason Dismissed from Further Consideration	Reference
Rock Creek (MAC Report Site 12)	Not Applicable	Insufficient capacity	MAC Report (USFS 1986)
Rock Creek (MAC Report Site 11A, Sterling proposed site)	Downstream Method	Excessive amount of borrow required (40 million cubic yards).	Thompson 1989
Noxon Bench (MAC Report Site 10)	Upstream Method	Tailings & reclaim water pipelines crossing the Clark Fork River.	Thompson 1989
Noxon Bench (MAC Report Site 10)	Downstream Method	Tailings & reclaim water pipelines crossing the Clark Fork River. Excessive amount of borrow required (35 million cubic yards).	Thompson 1989
Swamp Creek (MAC Report Site 21)	Upstream Method	Tailings & reclaim water pipelines twice as long as needed for the Rock Creek site. Disturbance area 200 acres larger than for the Rock Creek site. Site is privately owned and would require removal of residences. No distinct advantages over the Rock Creek Site.	Thompson 1989
Swamp Creek (MAC Report Site 21)	Downstream Method	Same as upstream. Excessive amount of borrow required (10 million cubic yards).	Thompson 1989
Swamp Creek/Rock Creek Combined Site	Downstream Method	Same as for Swamp Creek. Total disturbance area of approximately 700 acres.	Thompson 1989
Noxon Bench/Rock Creek	Downstream Method	Same as for Noxon Bench. Total disturbance area of approximately 700 acres.	Thompson 1989
McKay Creek	Downstream Method	Greater impact to Waters of U.S. and wetlands and diversion of a perennial stream.	Thompson 1989

The third-party engineering review of the proposed tailings site at Rock Creek determined that, based on the present level of knowledge, the site is suitable for construction of a tailings impoundment of the capacity proposed by Sterling (Chen-Northern 1990; Klohn Leonoff 1991; Klohn Leonoff 1992). The McKay Creek site was developed by the Agencies as a conceptual design and has not been subjected to a site-specific engineering analysis.

IMPOUNDMENT CONSTRUCTION ALTERNATIVES

Potential construction alternatives for a tailings impoundment at the Rock Creek site have received extensive review throughout the Agencies' evaluation of the application. The McKay Creek site is a conceptual location for a downstream structure and has not been reviewed for other construction options. All the construction alternatives use slurry transportation and deposition of tailings within an impoundment as the method of permanent disposal of the tailings. Typically, there are two general types of retention dams used to contain mill tailings:

1) an earthen embankment constructed entirely with material other than tailings; and

2) An embankment consisting of some mixture of tailings and other earthen materials.

The first general type of retention embankment is essentially similar to the type of dam used to impound a water reservoir and is typically used when the tailings require complete hydraulic isolation from the surrounding environment and/or the total amount of tailings is rather small. This kind of embankment is constructed prior to deposition of tailings and is built entirely with nontailings material. Due to the amount of tailings requiring disposal, this construction method is not considered to be a viable alternative because of the large amount of borrow material needed to build the embankment.

The second general type of tailings retention embankment is constructed using the sand fraction of the tailings as a portion of the embankment construction material. The general construction sequence for this kind of tailings impoundment involves the construction of starter dams with nontailings material, much like the water reservoir type of dam discussed above. However, unlike the water reservoir type, the starter dams serve only to provide the beginning of the tailings embankment structure and are typically much smaller in both height and lateral extent than the final tailings impoundment.

Using the starter dams as a beginning, tailings are pumped to the top of the dams where they are hydraulically deposited both on and upstream of the starter dams. During this hydraulic deposition, the sand fraction of the tailings is kept at the outside of the tailings impoundment and the finer slimes fraction is placed within the interior of the impoundment. As the amount of tailings placed in the impoundment increases over time, the height of the embankment increases due to the deposited sand fraction, and the tailings themselves become a primary component of the retention dam. In essence, the sand fraction of the tailings is used to construct the embankment to contain the slimes. In addition, it also contains the water from the slurry and any rain, snow, or undiverted runoff and maintains a reservoir of water for recycling to the mill.

This second general type of tailings retention structure is sequentially raised with stages of embankment construction rather than completely constructed prior to tailings deposition, therefore it is referred to as a staged embankment. There are three basic categories of staged embankments. They are named according to the horizontal direction the crest of the dam moves during its construction lifetime, they are: (1) upstream, (2) downstream, and (3) centerline (Figure G-1[a-c]). In addition, it is possible to combine methods to produce a hybrid construction method. One such method, modified centerline construction, is an alternative for this project (Figure G-1[d]).

As can be seen from careful inspection of Figure G-1, the upstream style of staged embankment construction requires the least amount of "sand" for the "dike raises" used to construct the embankment. Typically, there is always enough sand in the tailings themselves to provide the required amount of embankment construction material, therefore upstream construction requires no additional dam building material other than that needed for the starter dams.

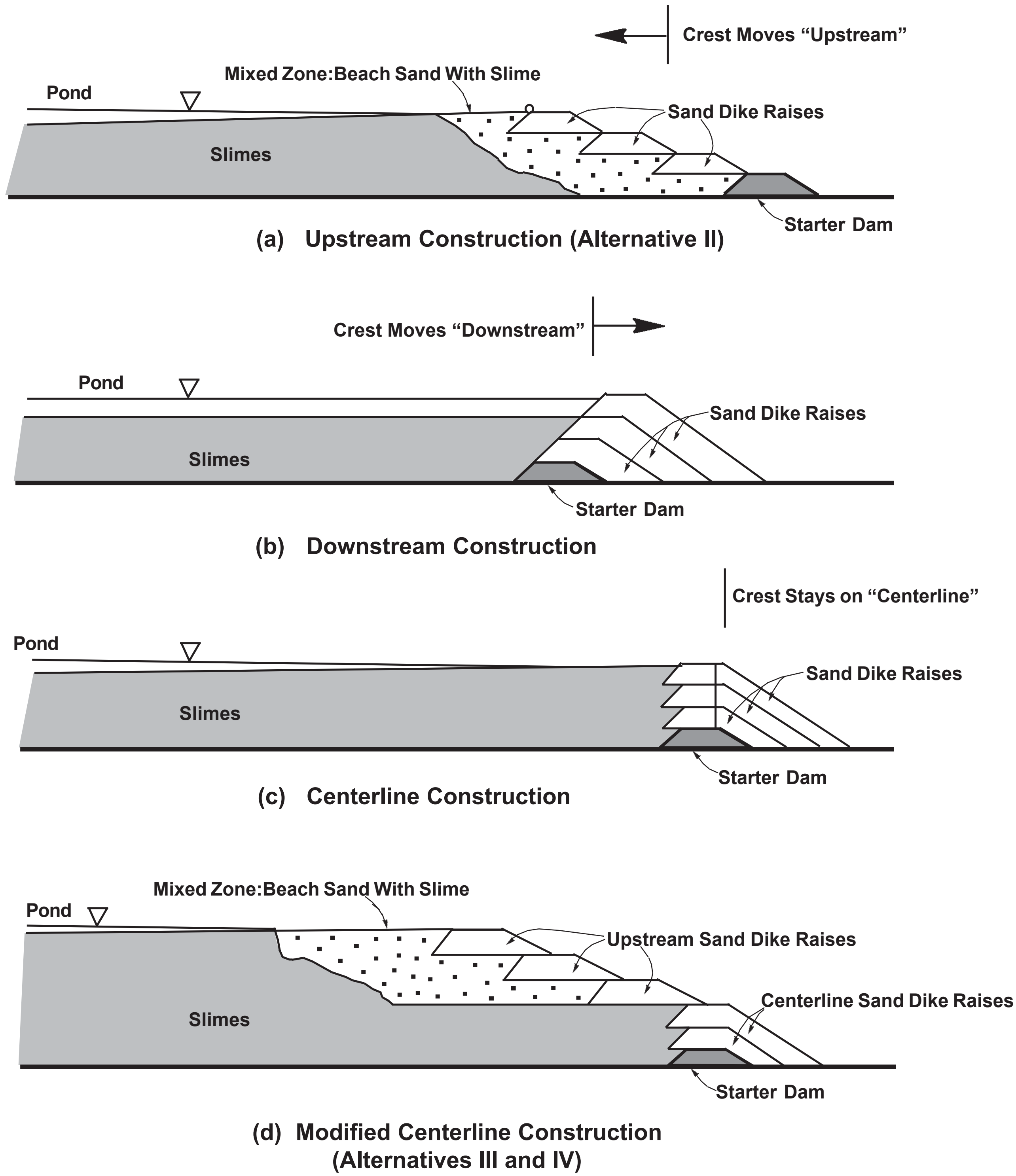


FIGURE G-1
Impoundment Construction Methods
Rock Creek Project

Further inspection of Figure G-1 reveals that the downstream style of embankment requires the most "sand" and that the centerline method uses an amount of "sand" intermediate between the upstream and downstream methods. Typically, the tailings do not provide enough "sand" to construct the "dike raises" needed for a downstream embankment and a substantial quantity of additional, nontailings fill material is needed to construct a downstream dam. The centerline method, using an intermediate amount of "sand", may or may not have its "sand" requirements met by the available tailings. In the case of a centerline dam, it is typical to avoid continuing addition of nontailings material over the construction life by increasing the size of the starter dam(s) to make up the amount during initial site preparation.

A second set of fundamental differences among the three types of staged embankments is the positioning of the "sand" relative to the "slimes". As can be seen on Figure G-1, the upstream movement of the crest in the upstream embankment places the top of the dam over previously deposited mixed sand and slime in the beach and the slimes beneath the pond. In essence, this includes these materials as a major part of the structural support for the retention embankment. However, the downstream movement of the crest of a downstream dam continually oversteps "sand," and the "slimes" are not included in the structural mass of the embankment. The centerline method of construction is intermediate between these two and may or may not rely on the beach materials to provide structural support for the impoundment.

The preceding descriptions address “wet” impoundments, whereby tailings are deposited as a slurry and allowed to dewater overtime through natural gravity draining and evaporation. Another construction alternative is to use a dewatered tailings material. The deposition in a surface repository and the tailings’ subsequent management differs from how the slurried tailings are handled. Dewatered tailings are often placed by truck or conveyor system and can be shaped and moved once on the ground using earth moving equipment. Depending on the inherent strength of the dewatered tailings, a retention dam may or may not be needed. Ultimately, the tailings pile is constructed much as an earthen embankment would be built, and the tailings themselves become somewhat self supporting. The principal differences between this style of tailings construction and management and that described earlier is that there is less water to contend with and the need for large retaining structures is reduced.

Summary of Construction Alternatives

Sterling has submitted two preliminary designs for construction of a tailings impoundment at the Rock Creek site. These preliminary designs, for an upstream embankment (Alternative II) and for a modified centerline structure (Alternatives III and IV) were originally submitted as separate documents, but at the Agencies' request, are available in a single reference volume (Dames & Moore 1993).

In addition, the Agencies developed the McKay Creek site as a conceptual downstream embankment, however, this conceptual alternative does not have a preliminary design to the same level as those at the Rock Creek site. The Agencies also developed a dewatered alternative (Alternative V) using tailings paste technology rather than filtering.

DESCRIPTION OF ALTERNATIVE IMPOUNDMENT DESIGNS EVALUATED IN THE EIS

Upstream Construction at the Rock Creek Site (Alternative II)

Alternative II is the originally proposed action of an upstream style staged embankment at the Rock Creek site (Dames & Moore 1993). Features of this tailings disposal alternative, including items from both the design and Agency review, are presented below.

Upstream Staged Embankment. The tailings impoundment is raised using the upstream method of construction (Dames & Moore 1993).

Location. The tailings disposal facility located at a single site near the confluence of Rock Creek and the Clark Fork River. The site covers approximately 324 acres (Dames & Moore 1993).

Disposal Technology. The tailings disposal facility is an impoundment built with slurry deposited tailings initially placed behind starter dams constructed of local soil and/or rock (Dames & Moore 1993). Through time, the height of the deposited tailings exceeds that of the starter dams and the tailings are a self-supporting structure.

Embankment Stability Issues. There are four primary issues that the tailings facility design must account for in order to demonstrate an acceptable level of stability: (1) adequate protection from overtopping and washout by a very large storm event, (2) accounting for the low strength of the soft clay zones known to exist in the embankment's foundation, (3) providing an adequate assessment of the tailings resistance to liquefaction during earthquake events, and (4) providing sufficient drainage within the embankment to control the water level within the tailings retention embankment. These issues are discussed in the following sections.

Storm Water Control. The tailings facility has two storm water control design elements: 1) diversion structures to route storm runoff from outside of the immediate impoundment area around the tailings facility, and 2) containment within the impoundment of storm water that falls directly in the tailings facility. The diversion structures are designed to pass the calculated probable maximum flood (PMF) (Dames & Moore 1993). The impoundment would also contain the PMF during its operational life, however, due to its construction sequencing, it cannot reach this goal without encroachment on the 200 foot minimum beach width (Dames & Moore 1993) until about year 3 of its life (Chen-Northern 1990).

Tailings Water Reclaim System. The tailings facility would have a tailings water reclaim system to recycle water from the tailings impoundment to the mill for continued mineral processing. The system will consist of a pumping station within the tailings impoundment and a pipeline to the mill. The reclaim pipeline would parallel the tailings slurry pipeline transporting tailings from the mill to the tailings impoundment (Dames & Moore 1993).

Tailings Embankment Seepage Collection/Return System. The embankment of the tailings impoundment will seep water from inside the impoundment. This embankment seepage will be collected at the toe of the embankment and returned to the impoundment via a pumping system (Dames & Moore 1993).

Material Segregation and Placement. Two methods of material segregation (separating the sand fraction from the slimes) and placement (depositing the materials in the impoundment) are proposed with the final selection of method postponed until the final design phase. The proposed methods are: 1) spigot discharge and hydraulic segregation, and 2) single-stage cyclone separation with separate discharges (Dames & Moore 1993).

Method 1, spigot discharge with hydraulic separation, discharges the entire tailings slurry from nozzles (spigots) located on the crest of the dam onto the upstream face of the impoundment. As the velocity of the discharging slurry decreases away from the spigots the larger sand particles begin to settle out from the slurry. As the slurry gets farther from the spigots, it deposits progressively finer and finer particles, resulting in the hydraulic segregation of sand near to the crest of the embankment progressive grading to slimes at the interior of the impoundment. This process creates a gently sloping sand beach adjacent to the embankment crest and places the slimes and the water pond in the interior of the impoundment.

Method 2, single-stage cyclone separation with separate discharges, results in a similar positioning of materials within the impoundment but replaces the simple gravity settling of hydraulic separation with mechanical size separating devices called cyclones. Typically, the cyclones are placed on a moveable base and positioned on the crest of the impoundment. They mechanically separate the sand from the slimes and discharge these two materials via pipelines to different parts of the impoundment; sands to the dam crest and beach, slimes to the interior of the impoundment beyond the sand beach. The moveable cyclones are repositioned to place tailings in the correct sequence to construct the impoundment.

Embankment Drainage. For stability purposes it is necessary to control the seepage of water from within the impoundment outward through the embankment. The general goal is to keep the water draining outward through the embankment from seeping out from the downstream face of the dam. For this reason, the embankments are designed to provide preferential seepage paths to direct the outwardly flowing water into drainage collection systems from which it is pumped back into the impoundment.

Alternative II proposes to place free-draining material in the starter dams and a series of blanket drains constructed along the toe of the embankment. These facilities could be connected to a series of pipe drains to route the intercepted drainage to collection stations from which it will be pumped back into the impoundment. These drains, combined with the sandy zone created by the beach and maintaining the operational water pond no closer than 400 feet from the dam crest, are intended to direct outward seepage to the drainage systems and prevent it from exiting on the face of the dam (Dames & Moore 1993).

Consolidation of Tailings. As previously discussed, the upstream style of tailings embankment incorporates tailings beach sand and slimes into the structural mass of the retention embankment. Therefore these materials must be sufficiently strong to ensure a safe structure. In general, as the wet beach sand and slimes are progressively buried by later deposits, the weight of the overlying material squeezes out the water and causes the tailings to compress and increase in density. This process, known as gravity consolidation, leads to increasingly closer contact between the tailings particles and increasing strength of the tailings.

This increase in strength with increasing density is important in providing a safe tailings embankment under normal conditions, and is especially vital to providing adequate safety during earthquake events. It is particularly important that the tailings be sufficiently strong to resist the occurrence of seismic liquefaction; a process where fully saturated, fine sand can lose most of its strength when subjected to the repeated shaking caused by a nearby strong earthquake. This form of strength loss has been responsible for the failure of poorly constructed tailings impoundments and is a primary design issue for upstream-style embankments.

The resistance of saturated tailings to seismic liquefaction is influenced by many factors, but the two most important are the density of the tailings and the level of earthquake shaking occurring at the tailings disposal site. In general, the greater the density of the tailings, the higher the level of earthquake shaking they can endure without undergoing liquefaction.

For Alternative II, it is proposed that gravity consolidation could result in sufficient tailings density to resist seismic liquefaction under the earthquake shaking expected at the site. Sterling commits to substantiate the required density during the final design phase of the project (Dames & Moore 1993).

Design Earthquake Acceleration. In order to design a liquefaction-resistant tailings impoundment it is necessary to define the level of earthquake shaking that may occur at the site. One accepted method to define this level is to estimate the peak acceleration of the shaking motion based on the length of active nearby faults and the distance between the faults and the site. This method results in the estimation of the ground acceleration expected from the maximum probable earthquake (MPE). For the proposed action, the design earthquake acceleration from the MPE is estimated to be 0.12g (in seismic engineering the acceleration of the ground caused by earthquake shaking is typically presented as a fraction of the acceleration of earth's gravity and denoted by the unit "g") (Dames & Moore 1993). This design acceleration is based on a magnitude 7.0 earthquake occurring on the Bull Lake Fault, approximately 18 miles from the site. Modeling used a vertical alignment of the fault.

Soft Foundation Conditions. Several of the preliminary investigative borings conducted along the alignment of the embankment have encountered layers of soft clay. To date, these soft clays appear to be primarily located in the northwest portion of the impoundment area in the vicinity of the north starter dam (Dames & Moore 1993). Clays of this type are commonly encountered when investigating foundation conditions and often require special consideration due to their strength behavior.

In a similar fashion to the tailings discussed above, soft clays are subject to gravity consolidation and will increase in strength as they densify under the weight of overlying material. Therefore, the weight of the tailings placed above any soft clay layers will cause an increase in both density and strength of the clay. However, because the water must be squeezed out of the clay in order to allow consolidation to occur, the speed of consolidation and hence the gain in strength is controlled by how fast the water can be forced from the clay. In addition, attempting to speed the process by quickly applying a very large load in order to more quickly force out the water will usually lead to a rapid loss of strength in the clay which may create instability in the foundation.

To account for the possible existence of soft clays in the foundation, Alternative II proposes two standard engineering remedies for the condition: 1) controlled loading, and 2) wick drains. Controlled loading involves placing the weight on the soft clays at a rate that causes consolidation but does not exceed the strength of the clay. In this case, this involves controlling the construction timing of the starter dams and the tailings embankment according to the consolidation of the foundation (Dames & Moore 1993).

Since the allowable rate of consolidation is controlled by the rate at which water can be safely forced out of the clay, the consolidation rate can be increased by affording the water short paths of flow from the clay. Wick drains are a standard engineering device to supply these short flow paths and enhance the rate of consolidation in clays. Wick drains are specialized fabric ribbons that are inserted on a close spacing into the clay layer. They act as a series of "wicks" to increase the flow of water from the clay to the surrounding more permeable soils.

Construction Monitoring. Construction of the tailings disposal facility continues throughout the entire mine life, therefore it must be monitored over this period to assess both its conformance to the initial design and it performance in meeting the design goals. A construction monitoring plan is part of this alternative. Due to the dependence of any such plan on the final design of the facility, the details of the plan must be developed in concert with the final design. However, a preliminary construction monitoring plan is included in the proposed design (Dames & Moore 1993) and is summarized in Chapter 2.

Agency Review and Approval of a Final Design. Agency review and approval is not specifically included in the proposed action (Dames & Moore 1993). However, because the design is still at a preliminary stage and the stability of the structure is critical, the Agencies would require review and approval of the final design prior to issuing a permit.

The purpose of Agency review of final design is to recognize that the tailings disposal alternatives are preliminary designs based on limited site data and that the final design is likely to include modified engineering elements as well as features not included in the preliminary designs. This is the expected evolution of an engineering design for a facility of the size and complexity of a 100-million-ton tailings impoundment. Therefore, the Agency review function is presented to indicate the scope of technical review the Agencies would exercise throughout the final design process for the tailings impoundment.

The Agencies would offer critical comments and suggestions about the developing design. The review would encompass the technical aspects of the design as they relate to both the short-term and long-term stability of the embankment. In addition, the review would determine if the final design conforms to the general range of engineering elements presented in the preliminary design to the extent that environmental impacts from construction of the final tailing facility are not significantly different from those described in this EIS.

If the final design met the above criteria, then it would be accepted by the Agencies and approved for construction without the need for further extensive NEPA or MEPA compliance activities.

Third-Party Design Evaluation

The proposed tailings disposal facility, an upstream impoundment located at the Rock Creek site (Alternative II), has been reviewed by two separate consulting engineering firms under contract to DEQ. The reviewers produced three reports at various stages of the EIS process. These reports are:

Chen-Northern. 1990. "Technical Feasibility Assessment, Preliminary Tailings Impoundment Design, ASARCO Rock Creek Project". February, 1990.

Klohn Leonoff. 1991. "ASARCO Rock Creek Project, Technical Evaluation of Preliminary Tailings Impoundment Design". December, 1991.

Klohn Leonoff. 1992. "Rock Creek Tailings Project, Review Update". March, 1992.

In general, these reviewers determined the following:

1. The Rock Creek site was suitable for construction of a staged embankment tailings impoundment of the size required by the proposed project, but the existence of soft clay in parts of the foundation would require special consideration in the final design.

2. The use of upstream construction was not adequately supported by the available information and that substantial engineering justification for the upstream method or modification of the design (such as using a centerline type of construction) with adequate engineering justification would be required before the design should be accepted by the Agencies.

Modified Centerline Construction at the Rock Creek Site (Alternatives III and IV)

Alternatives III and IV use the "Revised Alternative Impoundment Design" submitted by Sterling (Dames & Moore 1993). This alternative design is a modified centerline style. Features of this tailings disposal design are presented below.

Modified Centerline Embankment. The tailings impoundment is raised using a combination of the centerline and upstream methods. For the first seven years the impoundment is constructed using the centerline method followed by the upstream method for the remainder of the facility life (Dames & Moore 1993).

Location. The tailings disposal facility located at a single site near the confluence of Rock Creek and the Clark Fork River. The site covers approximately 324 acres (Dames & Moore 1993).

Disposal Technology. The tailings disposal facility is an impoundment built with slurry deposited tailings initially placed behind starter dams constructed of local soil and/or rock (Dames & Moore 1993). Through time, the height of the deposited tailings exceeds that of the starter dams and the tailings are a self-supporting structure.

Embankment Stability Issues. There are four primary issues that the tailings facility design must account for in order to demonstrate an acceptable level of stability: 1) adequate protection from overtopping and washout by a very large storm event, 2) accounting for the low strength of the soft clay zones known to exist in the embankment's foundation, 3) providing an adequate assessment of the tailings resistance to liquefaction during earthquake events, and 4) providing sufficient drainage within the embankment to control the water level within the tailings retention embankment. These issues are discussed in the following sections.

- *Storm Water Control.* The tailings facility has two storm water control design elements: 1) Diversion structures to route storm runoff from outside of the immediate impoundment area around the tailings facility, and 2) containment within the impoundment of storm water that falls directly in the tailings facility. The diversion structures are designed to pass the calculated probable maximum flood (PMF). The impoundment would also contain the PMF during its operational life, however due to its construction sequencing, this may encroach upon the 400-foot operational beach width during the early stages of the impoundment (Dames & Moore 1993).

- *Tailings Water Reclaim System.* The tailings facility would have a tailings water reclaim system to recycle water from the tailings impoundment to the mill for continued mineral processing. The system would consist of a pumping station within the tailings impoundment and a pipeline to the mill. The reclaim pipeline would parallel the tailings slurry pipeline transporting tailings from the mill to the tailings impoundment (Dames & Moore 1993).

- *Tailings Embankment Seepage Collection/Return System.* The embankment of the tailings impoundment would seep water from inside the impoundment. This embankment seepage would be collected at the toe of the embankment and returned to the impoundment via a pumping system (Dames & Moore 1993).

- *Material Segregation and Placement.* Two methods of material separation and placement are proposed depending on the season of year. The proposed methods of separation are: 1) double-stage cyclone separation during the warmer months (April through November), and 2) single-stage cyclone separation during the winter (December through March). Tailings are placed using pipe discharge of separated materials to the appropriate part of the impoundment (Dames & Moore 1993).

  The cyclone separation system would include two material separation facilities: 1) a central cyclone station permanently located immediately to the east of the impoundment, and 2) two secondary sets of cyclones located on the crest of the dam. These secondary cyclones would be skid-mounted and capable of being moved as the embankment grew.

  During warmer months, both cyclone system would operate to generate sufficient high-quality sand to construct the shell of the dam. During this time, the central cyclone station would initially split the whole tailings into a slimes fraction and a sand/slimes mixture. The slimes would be piped to the interior of the impoundment and the sand/slimes mixture would be piped to the secondary cyclones on the dam crest. The secondary cyclones would separate the sand/slime mixture into a clean sand product and a slimes fraction. The clean sand would be used in construction of the exterior sand shell of the embankment and the slimes would be deposited in the interior of the impoundment. Sufficient clean sand would be produced to allow all sand raises to be constructed during these warmer months.

During colder months, only the central cyclone station would be operated with the slimes continuing to be deposited in the interior of the impoundment and the sand/slime mixture being placed upstream of the previously constructed sand shell lift.

- *Embankment Drainage.* For the same stability reasons previously presented, the tailings embankment design must account for internal drainage of tailings water. This design proposes to replace the free-draining starter dams and blanket drains presented in Alternative II with a 200-foot-wide shell of free-draining sand placed on the outside of the embankment with material from the double-stage cycloning (Dames & Moore 1993). The intercepted seepage would be collected and returned to the impoundment as proposed in Alternative II.

  Consolidation of Tailings. As previously discussed, both the centerline and upstream methods of embankment construction may incorporate tailings beach material into the structural mass of the retention embankment. Therefore, this material must be sufficiently strong to ensure a safe embankment.

  The relationship between strength and density of tailings is previously discussed. The same gravity consolidation to achieve the required density of embankment tailings is proposed for this design, however there is an additional commitment to mechanically compact the beach tailings if construction monitoring indicated the necessary tailings density determined during final design was not occurring from gravity consolidation alone (Dames & Moore 1993).

Design Earthquake Acceleration. This preliminary design incorporates two levels of seismic acceleration in the design. The first level is for an MPE of magnitude 7.0 on the Bull Lake Fault 18 miles away, resulting in a maximum site shaking of 0.16g for postoperational analyses to determine the long-term seismic liquefaction susceptibility of the reclaimed tailings disposal facility (Dames & Moore 1993). This calculation assumes the fault dips towards the site, thus lessening the straight-line distance between the location of earthquake energy release and the site. The second level is for short-term analyses prior to reclamation of the facility. The short-term acceleration is based on the definition of the operational basis earthquake (OBE), or one that has a 90 percent risk of not being exceeded in any 50 years. This design estimates the peak seismic acceleration at the Rock Creek site to be 0.035g for the OBE (Dames & Moore 1993).

Soft Foundation Conditions. The alternative design presents three engineering elements to account for the soft clays located in the northwest portion of the impoundment area (site of the north starter dam) and suspected to exist at other locations. The primary method to deal with the suspected presence of soft clay elsewhere than in the northwest portion of the area is to excavate the weak soil and replace it with a compacted fill. In this design, this is proposed for areas beneath the main and south-wing starter dams if soft clays are determined to exist in these areas during final design (Dames & Moore 1993).

Two methods are proposed for the soft clay located in the northwest part of the area beneath the north starter dam. A berm of cycloned sand would be constructed along the toe of the embankment following completion of the initial sand shell in year 7 of construction. This berm would be constructed during years 8 through 13 of the impoundment life and would serve to flatten the overall downstream slope of the embankment in this area (Dames & Moore 1993). In essence, flattening the slope reduces the loads causing instability in the foundation and does not overload the soft clay. In addition, this design proposes to include a concrete keyway/shear wall in the foundation of the north starter dam. This concrete keyway/shear wall would be constructed beneath the upstream toe of the starter dam for the north starter dam and sized to provide additional resistance to a sliding failure through the foundation beneath the dam (Dames & Moore 1993).

Construction Monitoring. Construction of the tailings disposal facility would continue throughout the entire mine life, therefore it must be monitored over this period to assess both its conformance to the initial design and it performance in meeting the design goals. The same construction monitoring plan as proposed for Alternative II is included in this design (Dames & Moore 1993). Due to the dependence of any such plan on the final design of the facility, the details of the plan must be developed in concert with the final design. However, a preliminary construction monitoring plan is presented in Chapter 2.

Agency Review and Approval of a Final Design. The purpose of Agency review of the final design is to recognize that the tailings disposal alternatives are preliminary designs based on limited site data and that the final design is likely to include modified engineering elements as well as features not included in the preliminary designs. This is the expected evolution of an engineering design for a facility of the size and complexity of a 100-million-ton tailings impoundment. Therefore, the Agency review function is presented to indicate the scope of technical review the Agencies would exercise throughout the final design process for the tailings impoundment.

The Agencies would review the final design with the assistance of a technical review panel. The panel could include at technical specialists from both KNF and DSL as well as staff from interested state, federal, and local agencies. The agencies might retain the services of a qualified third-party consultant if additional technical expertise was required.

The review panel would be charged with reviewing the final design for the tailings impoundment as developed by Sterling, offering critical comment and suggestion to the developing design. The Agencies would have to approve the final design. The review would encompass the technical aspects of the design as they relate to both the short- and long-term stability of the embankment. In addition, the review would determine if the final design conformed to the general range of engineering elements presented in the preliminary design to the extent that environmental impacts from construction of the final tailing facility were not significantly different from those described in this EIS.

If the final design met the above criteria, then it would be accepted by the Agencies and approved for construction without the need for further extensive NEPA or MEPA compliance activities.

Third-Party Design Evaluation

The modified centerline design was reviewed by the same two consulting engineering firms under contract to DEQ to review the upstream design. Although no final report was produced during this review, the Agencies are satisfied that the modified centerline approach could lead to a prudent and acceptable final design.

Paste Disposal Facility Construction at the Rock Creek Site (Alternative V)

Alternative V uses paste technology as a tailings disposal method. Golder Associates (1996) provided the original conceptual design; it was further refined by Knight Piesold (1887). Features of this tailings disposal design are presented below.

Location. The tailings disposal facility located at a single site near the confluence of Rock Creek and the Clark Fork River. The site covers approximately 330 acres (Knight Piesold 1997).

Disposal Technology. The tailings are dewatered and placed in a surface repository. Starter dams are constructed using local borrow materials and/or waste rock. The paste can either be deposited from the bottom-up, top-down, or a combination of the two. Through time, the height of the deposited tailings exceeds that of the starter dams and the paste tailings become a self-supporting structure.

Paste Deposit Stability Issues. There are four primary issues that the paste tailings facility design must account for in order to demonstrate an acceptable level of stability: 1) adequate protection from washout by a very large storm event, 2) the low strength of the soft clay zones known to exist in the foundation, 3) adequate assessment of the tailings resistance to liquefaction during earthquake events, and 4) sufficient drainage within the deposit to control the water level within the deposit. These issues are discussed in the following sections.

- *Storm Water Control*. The paste tailings facility has two storm water control design elements: 1) Diversion structures to route storm runoff around the tailings facility, and 2) containment and off-site conveyance within the facility for storm water that falls directly on the tailings facility. The diversion structures are designed to pass the calculated probable maximum flood (PMF). Sediment traps are also incorporated into the design to collect and storm-related erosion.

- *Paste Tailings Deposit Seepage Collection/Return System*. The paste deposit would seep water. This seepage would be collected at the toe of the deposit and returned to the mill treatment facility via a pumping system.

- *Material Segregation and Placement*. Paste can be placed in either a top-down, bottom-up, or combination process.

- *Deposit Drainage*. For the same stability reasons previously presented, the paste tailings facility design must account for internal drainage of water liberated by the paste. This design proposes to construct a combination of finger drains and blanket drains below the deposit to convey seepage water to a collection sump. The intercepted seepage would be collected and returned to the mill for process water.

Consolidation of Tailings. The paste tailings would consolidate somewhat over time, however the stability of a paste embankment relies on the tailings inherent strength at the time of placement. While there would be some consolidation of the paste mass over time, the strength properties of the paste at the time it is deposited provides the necessary strength for stability in the short term, and can be considered the most critical time for stability. Additional consolidation would enhance the stability of the facility. Careful quality control would be necessary to ensure the moisture content of the paste is maintained at its optimum design level. Inclusion of water from snowmelt and rainfall could reduce the strength of the paste if not mitigated through tailings management practices.

Design Earthquake Acceleration. This preliminary design incorporates two levels of seismic acceleration in the design. The first level is for a maximum probable earthquake (MPE) of magnitude 7.0 on the Bull Lake Fault 18 miles away, resulting in a maximum site shaking of 0.16g for postoperational analyses to determine the long-term seismic liquefaction susceptibility of the reclaimed tailings disposal facility (Dames & Moore 1993). This calculation assumes the fault dips towards the site, thus lessening the straight-line distance between the location of earthquake energy release and the site. The second level is for short-term analyses prior to reclamation of the facility. The short-term acceleration is based on the definition of the operational basis earthquake (OBE), or one that has a 90 percent risk of not being exceeded in any 50 years. This design estimates the peak seismic acceleration at the Rock Creek site to be 0.035g for the OBE (Dames & Moore 1993).

Soft Foundation Conditions. The paste alternative conceptual design does not directly address compensating for the soft clays located in the northwest portion of the impoundment area (site of the north starter dam) and suspected to exist at other locations. The primary method to deal with the soft clay elsewhere than in the northwest portion of the area is to excavate the weak soil and replace it with a compacted fill. The Agencies would follow the recommendations outlined for Alternatives III and IV.

Construction Monitoring. Construction of the tailings disposal facility would continue throughout the entire mine life, therefore it must be monitored over this period to assess both its conformance to the initial design and its performance in meeting the design goals. A similar construction monitoring plan as proposed for Alternative II is included in this design (Dames & Moore 1993), of course adapted to paste technology. Due to the dependence of any such plan on the final design of the facility, the details of the plan must be developed in concert with the final design. A detailed QA/QC plan would be developed and presented for approval as part of the final design.

Agency Review and Approval of a Final Design. The purpose of Agency review of the final design is to recognize that the tailings disposal alternatives are preliminary designs based on limited site data and that the final design is likely to include modified engineering elements as well as features not included in the preliminary designs. This is the expected evolution of an engineering design for a facility of the size and complexity of a 100-million-ton tailings storage facility. Therefore, the Agency review function is presented to indicate the scope of technical review the Agencies would exercise throughout the final design process for the tailings deposit.

The Agencies would review the final design with the assistance of a technical review panel. The panel could include at technical specialists from both KNF and DSL as well as staff from interested state, federal, and local agencies. The agencies might retain the services of a qualified third-party consultant if additional technical expertise was required.

The review panel would be charged with reviewing the final design for the tailings facility as developed by Sterling, offering critical comment and suggestions to the developing design. The Agencies would have to approve the final design. The review would encompass the technical aspects of the design as they relate to both the short- and long-term stability of the deposit. In addition, the review would determine if the final design conformed to the general range of engineering elements presented in the preliminary design to the extent that environmental impacts from construction of the final tailing facility were not significantly different from those described in this EIS.

If the final design met the above criteria, then it would be accepted by the Agencies and approved for construction without the need for further extensive NEPA or MEPA compliance activities.

Third-Party Design Evaluation

The conceptual paste design was reviewed by two consulting engineering firms under contract to DEQ. References for final reports by Knight-Piesold (1997) and Klohn-Crippen (1998) can be found in the back of this Appendix.

SUBSIDENCE

Surface subsidence is the physical manifestation of the collapse of underground openings. The potential for, and amount of, surface subsidence is very much dependant on the strength of the rock, the amount of physical support provided to this rock mass, and the stress distribution in the surrounding area. The potential environmental consequences from the collapse of underground openings include surface subsidence, a change in the ground water regime, and drainage of surface waters.

Underground mining disrupts the established stress environment and changes the extent and direction of the stress field in the surrounding rocks, resulting in a period of stress redistribution.[1] Regardless of rate of stress redistribution, fracturing of the rock mass commonly occurs. Fracturing influences a rock's inherent strength and can affect the rock's ability to support itself. If the weight of the rock mass above the underground opening is more than the rock of the surrounding pillars and back (roof) can support, fracturing and/or collapse of the overlying rock can occur. Fractured rock around an underground opening, such as a mine tunnel or room, will fall into the opening over time gradually filling the space. Falling rock fragments do not fit together like a 3-dimensional jigsaw puzzle; numerous air pockets or voids between and around the rock fragments result in a bulking or swelling of the collapsed rock. The caving will continue until there is no more space for falling rock; it is stopped by interception of more competent rock above the caving.

[1]Crystalline rock, such as the Revett quartzite that hosts the Rock Creek ore body, is prone to explosive stress release, often occurring as rock bursts.

Sterling has not generated an extensive data base of analytical rock mechanics for the Rock Creek site with which to develop its mine plan. Most of this data would be obtained during the construction of the evaluation adit as well as both mine adits. Much of the information regarding rock strength, artificial support, and room-and-pillar dimensioning is extrapolated from experience gained at their Troy Mine. It is difficult to predict the consequences of Sterling's proposed plan at Rock Creek based on the current level of information, however, a preliminary assessment prepared by Camp, Dresser & McKee, Inc. (1989) concluded that the potential for subsidence was remote. Using rock strength information from the Montanore Project and the Troy Mine, the probability of subsidence at Rock Creek is extremely remote.

Two reports (Redpath 1991; Agapito 1991) addressed mine planning and included information on subsidence at the Montanore site. These reports concluded that given the proposed mine plan (which is also room-and-pillar) and geologic conditions, the potential for subsidence at Montanore is minimal provided adequate underground monitoring and rock analysis are carried out to refine the mine design once development is underway. Given similarities in rock strength and mining method between Rock Creek and Montanore, subsidence is not likely to occur at Rock Creek. Sterling has not committed to any specific level of monitoring and rock analysis. A monitoring and reporting plan would need to be developed with the Agencies prior to mine development.

Standard laboratory tests on rock samples from the Troy Mine and Montanore found high compressive strengths, and overall rock quality to be good to excellent (Redpath Engineering, Inc. 1991). Owing to the depth of the deposit, the strength of the overlying rock, and the relative thin ore horizon, neither subsidence nor extensive rock fracturing is expected at the mine. However, in those areas where the ore zone is near-surface or thicker, or there exist geologic anomalies such as faults, stresses may develop within the surrounding rock which could initiate subsidence-inducing fracturing that could effect both surface and ground water.

Sterling has identified thick ore horizons (over 150-feet thick) next to the Copper Lake and the Moran faults. An area south of Cliff Lake contains mineralization very near to the surface. Sterling's plan is to mine within 100 feet of the ground surface in areas where the ore body outcrops (ASARCO Incorporated 1994). There exists the minor possibility that these areas (see Figure G-2) could experience some surface subsidence under Alternative II if the stress field was larger than the strength of the local rock. A rule-of-thumb employed by the Agencies in their review assumed subsidence could potentially affect a height of 10 times the ore seam height. For an ore height of 20 feet, potentially 200 feet of ground above could be subject to collapse, so near surface ore horizons could induce subsidence at worst, and rock fracturing at best if mined.

Site-specific geologic discontinuities such as jointing, faults, sills or dikes affect the strength and response of the surrounding rock during mining. At Rock Creek, the nature and extent of such discontinuities, other than major faults, have not been identified in detail, hence their influence on the potential for subsidence is somewhat unknown. Experience from other mines exhibiting similarities (mining method, depth to ore, ore thickness) to Rock Creek, such as the White Pine Mine in Michigan and mines in the Missouri Lead District, indicates geologic conditions can have a profound influence on pillar performance and ultimately subsidence (pers. comm. D. Tesarik, U.S. Bureau of Mines, November 1994). This experience underscores the importance of assessing the geologic environment and identifying geologic features such as faults that can influence mine stability.

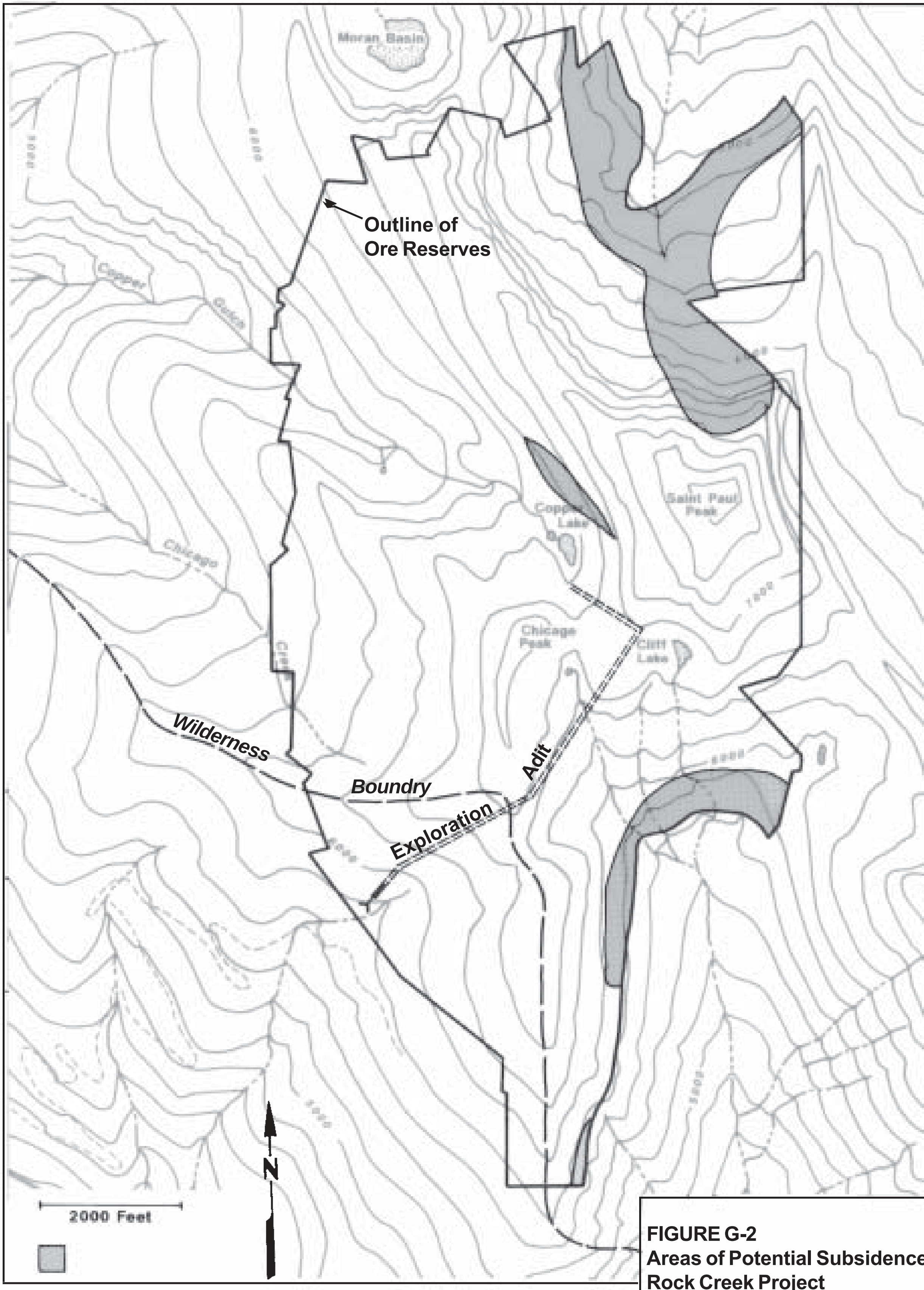


FIGURE G-2
Areas of Potential Subsidence
Rock Creek Project

The potential impacts to the ground surface, the ground water regime, or to any surface lakes or streams in the area are unknown. Preliminary drilling data from Cliff and Copper lakes suggest that the mineralization is at such a depth under the lakes that the probability of there being any fracturing or subsidence due to mining that could influence the lakes would be extremely small. If the mine is plugged at closure, the increase in hydraulic pressure could lead to hydrofracturing especially in areas where the ore horizon is near the surface, but the direction of ground water flow would be towards the surface. In the case of Cliff and Copper lakes, subsidence-induced fracturing is unlikely. The association between the lakes and the ground water regime is described in Chapter 4 of the final EIS, in the following section on hydrofracturing, and in a technical document on file with the Agencies (MT DEQ 2001). Other possible expressions of subsidence in the areas previously identified would probably be limited to minor surface disruption such as cracking or small surface depressions. In areas other than the Copper Lake Fault zone, the Moran Fault zone, and any near surface mineralized zones, subsidence is highly unlikely given the strength of the rock, thickness of the mineralization and the depth to ore. The potential for subsidence above thick or shallow ore bodies is minor but potentially significant.

Sterling's intention to remove select pillars towards the end of mining may cause rock fracturing and subsidence in areas not previously predisposed to subsidence. This phenomenon has been observed in other room-and-pillar operations, and is especially prevalent in coal mines. The likelihood for this happening would depend on the strength of the remaining pillars and the stress field in the surrounding rock. A comprehensive testing and monitoring program to provide the information necessary to fully assess the potential for such an event has not been proposed by Sterling. The potential for subsidence from removal of pillars is moderate and potentially significant.

HYDROFRACTURING

Sterling has proposed plugging the mine at closure. This would cause the mine to fill with water and the potentiometric surface would rebound in the overlying bedrock aquifer. Under this closure scenario, two potential types of leakage are possible at the outcrop zones in North and South Basins; (1) mine water could leak through rock zones of high permeability (below 5,800-ft and 5,200-ft elevations in South and North Basins respectively), and (2) water leakage could be caused or increased by hydrofracturing of the rock. Where the underground workings approach the mountainside, external ground water pressure falls below that of the internal pressure and water will tend to flow out. If the permeability of the rock is low, then the leakage will be small; however, if the permeability is high, for example along contacts between strata or through fracture systems, leakage rates will be high. Hydrofracture failure of the rock can occur when the pressure in the workings exceeds the compressive stress provided by the overlying rock mass. If this condition exists, cracks will propagate outward toward the surface resulting in excessive leakage. Assuming a static head of 800 feet, the minimum rock cover required to prevent hydrofracturing at the outcrop zones is 450 feet (MT DEQ 2001). The underground workings should not advance into areas that have less than 450 feet of rock cover. In-situ rock stress should be measured for final design and construction.

If, on the other hand, the mine were allowed to passively drain out the service adit, the void space would not completely fill and the potentiometric surface would not rebound in the overlying aquifer. The water level in the mine would rise to an elevation of about 5,500 feet where it would drain out the service adit. Only those portions of the mine below 5,500 feet, mainly the north and west portions of the deposit, would flood. Seepage from these areas of the mine could discharge to the North Basin and Copper Gulch. Assuming a static head of 500 feet, the minimum rock cover required to prevent hydrofracturing under this scenario would be 260 feet at the outcrop area in North Basin.

REFERENCES USED IN THIS APPENDIX

Abel, J.F. Jr. and F.T. Lee, 1980, Subsidence Potential in Shale and Crystalline Rocks. Open-File Report 80-1072, U.S. Department of Interior, Geological Survey.

Agipito and Associates, 1991, "Evaluation of Subsidence Potential Montanore Project, Noranda Minerals Corp., April, 1991.

Boldt, L., 1993, U.S. Bureau of Mines, Spokane Mining Research Center, Pers. Comm. with Dale Ortman, P.E.

Boldt, L. 1993, Pers. Comm. Lani Bodlt, USBM, with J. Vickery, Kennicot Copper Co. June 5.

Chen-Northern, 1990, "Technical Feasibility Assessment, Preliminary Tailings Impoundment Design, ASARCO Rock Creek Project", February, 1990.

Dames & Moore, 1993, "ASARCO Inc. Rock Creek Project, Preliminary Design Study Tailings Disposal System (December 1989) and Revised Alternative Impoundment Design (March 1993)"

Klohn Leonoff, 1991, "ASARCO Rock Creek Project, Technical Evaluation of Preliminary Tailings Impoundment Design", December, 1991.

Klohn Leonoff, 1992, "Rock Creek Tailings Project, Review Update", March, 1992.

Montana Department of Environmental Quality (MT DEQ), 1999, "Cemented backfill costs - 1999. Montana Department of Environmental Quality, Helena, MT.

MT DEQ, 2001, Technical Report, Rock Creek EIS, Hydrology and Chemistry of Wilderness Lakes and Evaluation of Impacts from Underground Mining by Joe Gurrierio.

Piggott, R.J. and P. Eynon, 1977, "Ground Movements Arising From the Presence of Shallow Abandoned Mine Workings", Proceedings, Conference at University of Institute of Science and Technology at Cardiff, New York.

Redpath Engineering, Inc., 1991, "Supplemental Information in Support of the Environmental Impact Statement", Feb. 1991.

Tedarik, D. 1994, Pers. Comm. D. Tesarik, USBM with P. Werner, MDEQ - subsidence, November.

Thompson, R.J., 1989, "Draft Evaluation of Alternative Disposal Sites and Disposal Methods for the ASARCO Rock Creek Project", Kootenai National Forest, Libby, Montana, November 22, 1989. Typescript.

USBM Personnel. 1994. Pers. Comm. With Dale Ortman, July 21.

USFS, 1986, "Cabinet Mountains Mineral Activity Coordination Report", Kootenai National Forest, February, 1986

Vickery, S., 1993, Kennecott Copper, Personal communication with Dale Ortman, P.E.

Young, D.K., 1994, ASARCO, Incorporated, Rock Creek Project, Noxon, Montana; Rock mechanics analysis. September 9, 1994.

APPENDIX H

KOOTENAI NATIONAL FOREST BMP PROCESS

Kootenai National Forest BMP Process

In 1990, the Montana Department of State Lands began the Forestry - Best Management Practices Implementation Monitoring Program. The thrust of this program has been to conduct IDT audits on all ownerships that are actively involved in timber harvest. Since that date, field audits have been completed state- wide in 1992, 1994, and 1996. Also beginning in 1990, the Kootenai National Forest began completing forestwide BMP implementation and effectiveness reviews and field audits. Results of these on-forest audits by KNF personnel are shown below. Table 1 identifies the success of the BMP Program from 1990-1997. Table 2 expands on Table 1, adding years 1990 through 1993, and documents the specific scores on the 1-5 point scale:

Table 1. BMP Monitoring by Kootenai Forest Personnel, 1990 - 1997.

YEAR	# of FORMS	TYPE	% BMP's Meeting	% BMP's Not Meeting
1990	255	Implementation	96	4
		Effectiveness	91	9
1991	328	Implementation	96	4
		Effectiveness	88	12
1992	401	Implementation	93	7
		Effectiveness	86	14
1993	491	Implementation	98	2
		Effectiveness	96	4
1994	461	Implementation	99	1
		Effectiveness	99	1
1995	198	Implementation	92	8
		Effectiveness	92	8
1996	409	Implementation	98	2
		Effectiveness	100	0
1997	594	Implementation	98	2
		Effectiveness	99	1

Table 2. KNF BMP Monitoring Ratings, 1990 - 1997.

Rating	Implementation (%) FY 90	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97	Effectiveness (%) FY 90	FY 91	FY 92	FY 93	FY 94	FY 95	FY 96	FY 97
Acceptable or Better	96	96	93	98	99	92	98	98	91	88	86	96	99	92	100	99
Unacceptable	4	3	6	2	1	8	2	1.9	8	12	13	3	1	8	0	1.2
Very Unacceptable	0.4	1	0	0.2	0.02	0	0.02	0.1	1	0	2	1	0	0	0	0.14
Grossly Unacceptable	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

The State audits identified that there are eight specific practices that have the potential to create the greatest adverse effects to the soil and water resource. These specific "high risk" BMPs have been tracked on the Kootenai National Forest and are displayed below in Table 3:

Table 3. High Risk BMP Evaluations, KNF, 1994 - 1997.

KNF BMP	State BMP	Description	1994		1995		1996		1997	
			I	E	I	E	I	E	I	E
14.06	**II.B.1**	**Riparian Area Designation (SMZ)**	95	95	81	78	96	97	96	91
14.08	**II.A.5**	**Tractor Skidding Design**	100	100	86	91	98	100	96	100
14.15	**II.C.2a**	**Erosion Control on Skid Trails**	100	100	70	78	98	95	97	95
15.05	**I.D.2**	**Slope Stabilization and Prevention of Mass Failures**	88	----	100	100	100	100	98	100
15.06	**I.C.1**	**Mitigation of Surface Erosion and Stabilization of Slopes**	95	----	91	86	100	100	92	97
15.08	**II.C.2a**	**Pioneer Road Construction**	91	100	100	100	100	100	100	100
15.12	**I.C.6**	**Control of Construction in Riparian Areas**	100	100	100	100	100	100	100	100
15.16	**III.C.3**	**Bridge and Culvert Installation**	90	100	100	100	100	100	100	100
15.21	**I.E.2**	**Erosion Control Structure Maintenance**	100	100	87	89	99	99	97	99
18.03	**II.D.9**	**Protection of Soil and Water From Prescribed Burning Effects**	----	----	100	100	----	----	100	----
18.05	**II.C.2a**	**Stabilization of Fire Suppression Related Watershed Damage**	----	----	----	----	----	----	----	----

Note:
Percent of BMP’s **meeting the intent** of the practive (by year)
* I = Implementation, *E = Effectiveness
---- = Practice not applied

From these tables, we can conclude that beginning in 1993, except for 1995, the Forest has generally done a good job in implementing and evaluating BMPs, including these "high risk" BMPs. It can also be seen from this data that additional BMP reviews need to be completed for fire- related high risk practices.

Libby Ranger District BMP Process

In 1998, the Forest began to implement a Revised 12-Step KNF BMP Process. Projects being initiated from now on should utilize this process, with the level of documentation commensurate with resource risks.

The following process is being implemented on the Libby Ranger District as part of the Forest BMP program. Project specific forms have been completed and the District BMP Monitoring Team is responsible for reviewing a wide range of activity types to document the implementation and effectiveness of numerous BMP's, including the "high risk" BMP's.

1) **Project Scoping Form** This form is very similar to completing a NFMA analysis on the district level. This form needs to compl eted by the enti re IDT to ensure that all conc erns are bein g met through the BMP process. This form should be completed by the end of the first IDT meeting for the project in question. This form should be kept in the NEPA Project File.

2) **BMP Tracking Form** This form will be almost entirely created by taking the information from number 11 of the Project Scoping Form. This form is used to create a list of any "watchout" areas that either need extra protection or strict adherence of our normal BMPs to maintain or improve watershed conditions. This form is to be completed by the IDT or the Watershed/Fisheries specialist by the end of the scoping process. This form should be kept in the NEPA Project File

3) **BMP Form 1** This form should be tailored to meet the needs determined by the IDT by either adding or deleting from the "base" form of listed BMPs. This form should be completed by the IDT after all public scoping has been completed and the activities have been decided upon. This form should be kept in the NEPA project file and a copy should also go to the District BMP Coordinator.

4) **BMP Form 2** This form can be broken into the specific section that needs to be reviewed (i.e. , planning, timbe r, engineerin g or fuels). Th is form should b e created by re viewing **BMP Form 1** and all the listed BMPs should be transferred to **BMP Form 2** for the specific section being reviewed. This form is for the field person responsible for the implementation of the listed BMPs. A copy of this completed form should go the District BMP Coordinator.

5) **BMP Form 3** This form can also be broken into the specific section that is being field reviewed but the reviewing team will usually be looking at all the BMPs that were applied for the activity or sale. This form is completed after the acti vity has been accomplished. This form will be completed by the IDT or the District BMP Review Team. A copy of this completed form should go the District BMP Coordinator.

6) **BMP Feedback Loop-** Information from analysis of the BMP Program will be fed back into the system so that problem practices can be improved or replaced; and activities needing additional protection practices can have them developed.

APPENDIX I

DESCRIPTION OF REAGENTS

APPENDIX I - DESCRIPTION OF REAGENTS

Table I-1 lists reagents used in the mill process and their estimated annual consumption. Table I-2 describes reagent handling. (ASARCO Incorporated 1987-1997)

Table I-1: Description of Reagents

Reagent	Purpose	Addition Point	Annual Consumption (Pounds)	Pounds Per Ton Ore
Xanthate	Flotation Collector	Primary Ball Mills Regrind Mill, All Flotation	216,000	0.06
Yarmor-F Pine Oil	Frother	All Flotation	54,000	0.015
Dow 250	Frother	All Flotation	10,800	0.003
Am Cy Superfloc S-5595	Flocculant	Concentrate and Tailings Thickener	108,000	0.03
Orzana A*	Binder	Railroad Cars of Concentrate	10,800	0.003

* Not needed under Alt. V

Table I-2: Handling of Reagents

Reagent	Delivery	Storage	Mixing Facility
Xanthate	Truck	275, 300 and 330 lb. drums	6' x 6' mixing tank 6' x 6' storage tank
Yarmor-F Pine Oil	Tank Truck	8,000 gallon storage tank	6' x 6' mixing tank
Dow 250	Truck	450 lb. drums	Mixed with pine oil to 15% solution
Am Cy Superfloc S-5595	Tank Truck	2,300 gallon storage tank	4,500 gallon mixing tank
Orzana A Binder *	Truck	50 lb. bags	3' x 6' mixing tank
Nalco 84DC225	Truck	571 lb. drums	None; direct addition

* Not needed under Alt. V

Chemical Composition of Reagents

Potassium amyl xanthate: C_5H_{11} - O - CS - SK^+
Yarmor F pine oil (terpene): Mostly a mixture of $C_{10}H_{18}OH$ and $C_{10}H_{16}$.
Dow 250: Polypropylene glycol methyl ether: CH_3 - $(O\text{-}C_3H_6)_N$ - OH
$N = 8\text{-}10^3$
Ammonium Cyanide Superfloc S-5595: Anionic polyacrylamide copolymer.
Orzana A: Ammonium lignosulfonate.

Toxicity of Process Reagents	Process Reagent	Aquatic Toxicity
Xanthate	Poisonous when absorbed through the skin, inhaled, or swallowed.	Moderately toxic to rainbow trout
Yarmor-F-Pine Oil	Not considered to be toxic but can cause irrigation to skin and mucous membranes, headaches, and palpitations if inhaled, and should not be ingested.	Moderately toxic to rainbow trout
Dow 250	Is not considered to be toxic but may cause moderate eye irritation and should not be ingested. Does not vaporize significantly at room temperature.	Relatively non-toxic to rainbow trout
Am Cy Superfloc S-5595	May irritate skin on contact. It is poisonous if ingested and the solvent vapors may cause chemical pneumonia. Minimal eye irritation may also result from contact.	Moderately toxic to rainbow trout
Orzana A	Not regarded as toxic. Inhalation and contact with skin and eyes should be avoided	Relatively non-toxic to rainbow trout

Spill Procedures for Process Reagents

Xanthate:

Spillage would be diluted with water and returned to the process. No drains in the reagent mixing and storage areas would permit release of spills outside the complex.

Yarmor-F Pine Oil:

Spills would be flushed with water and returned to the process.

Dow 250:

Spills would be diluted with water and returned to the process.

Am Cy Superfloc S-5595:

Spillage would be absorbed with a commercial absorbent and shoveled into waste cans to await permanent disposal.

Orzana A:

Spills would be swept with other contaminated material and shoveled into waste cans to await permanent disposal.

Exposure Limits to Flotation and Process Reagents for Employees

Reagents used in the extraction process are all commonly employed in flotation recovery plants worldwide. They are received either as liquids diluted with water or added directly to the process, or as solids diluted with water or added directly (e.g., Xanthate and Orzana A).

Depending on toxicity of the reagent, employees who mix reagents would be required to wear rubber gloves, aprons, dust masks or respirators, and safety glasses or full face shields. The plant would be designed to store reagents in clean, dry areas away from heat and sources of ignition. Handling and mixing facilities would be separate.

No gases are to be used in processes within the complex. The American Conference of Governmental and Industrial Hygienists (ACGIH) has issued Threshold Limit Values (TLV)[1] for Chemical Substances and Physical Agents in the Work Environment (1983-84). Of the reagents proposed, none have established TLVs. Therefore, employee exposure would be governed by suppliers' recommended procedures as outlined in various "Material Safety Data Sheets."

[1]TLV/TWA-Time weighted average concentration for a normal 8-hour work day and 40-hour work week, to which nearly all workers may be exposed, daily, without adverse effect.

<u>Behavior of Reagents in the Process</u>

Xanthate:

Used as collectors in the flotation process, xanthates attach to sulfide particles and remain with the concentrates. Negligible quantities would go into the tailings or paste.

Pine Oil and Dow 250:

These two reagents are mixed into a frother solution throughout the flotation process to maintain a stable froth bed. They would remain with the concentrates or degrade in the process circuit. Negligible amounts would go into tailings or paste.

Am Cy Superfloc S-5595:

This reagent is used in the concentrate and final tailings thickeners to settle suspended solids. The fraction used in the concentrate thickener would remain with the concentrate. The fraction fed to the final tailings thickener would go with solids to the tailings impoundment as a highly sheared (decomposed) hydrocarbon.

Orzana A:

This reagent is used at the railroad siding where final concentrates are shipped for sale. It is used as a glue to control dust losses of concentrate during transit and remains entirely with the concentrates.

APPENDIX J

REVEGETATION PLANS

APPENDIX J - REVEGETATION PLANS

I. SUMMARY OF STERLING'S REVEGETATION PLAN - ALTERNATIVE II

TABLE J-1.
Proposed Final Seeding Mixtures for the Tailings Impoundment Area, Facilities and Mine Areas, and the Transportation Corridor

Common Name	Scientific Name	Drill Seeding rate[1] (pounds/acre)	Seeds per square foot[2]
GRASSES[3]			
Redtop	*Agrostis alba*	0.1	11.0
Meadow foxtail	*Alopecurus pratensis*	1.0	13.0
Mountain brome	*Bromus marginatus*	5.0	10.0
Orchardgrass	*Dactylis glomerata*	1.0	15.0
Sheep fescue	*Festuca ovina duriuscula*	1.0	13.0
Common timothy	*Phleum pratense*	0.5	15.0
Big bluegrass	*Poa ampla*	0.5	10.0
Canada bluegrass	*Poa compressa*	0.2	11.0
Subtotal Grasses		**9.3**	**98.0**
FORBS[4]			
Common yarrow	*Achillea millefolium*		
Aster	*Aster* spp.		
Bunchberry dogwood	*Cornus canadensis*		
Lupine	*Lupinus* spp.		
Penstemon	*Penstemon* spp.		
Alsike clover[5]	*Trifolium hybridum*		
Subtotal Forbs		**1-2**	**10-20**
SHRUBS[4,6]			
Western serviceberry	*Amelanchier alnifolia*		
Snowbrush ceanothus	*Ceanothus velutinus*		
Red-osier dogwood	*Cornus stolonifera*		
Oceanspray	*Holodiscus discolor*		
Shrubby cinquefoil	*Potentilla fruticosa*		
Chokecherry	*Prunus virginiana*		
Currant	*Ribes* spp.		
Rose	*Rosa* spp.		
White spirea	*Spiraea betulifolia*		
Common snowberry	*Symphoricarpos albus*		
Subtotal Shrubs		**3-5**	**5-10**
TOTAL		**13.3-16.3**	**113-128**

[1]Drill seeding would be done on most slopes at 3:1 (33%) or less. Broadcast seeding methods would be used on steeper slopes or rocky areas in which case the seeding rate would be doubled. Hydroseeding (a broadcast method) would only be used where feasible.
[2]The seeding rate assumes pure live seed (PLS) which is a certified rating for each seed lot adjusted for purity and germination percentage. The target is for 120 PLS/sq.ft.
[3]Grasses would be seeded on the Tailings Impoundment, Facilities and Mine area, Transportation Corridor. Mountain brome would be seeded at a slightly higher rate on the transportation corridor. An annual cereal grain would be included for rapid initial stabilization, as appropriate.
[4]Rates given for forbs and shrubs are a combination of any or all species.
[5]To discourage wildlife use, alsike clover would not be seeded on the transportation corridor; it would be seeded in other areas upon completion of operations.
[6]Shrubs would be seeded on most disturbances but exceptions include: a) the tailings impoundment dam face - shrubs would be planted (not seeded); and b) the transportation corridor - shrubs would not be seeded or planted except as needed on road cut-and-fill slopes.
Source: Culwell, Larsen, and Scow *In* ASARCO, Incorporated 1987 - 1997.

TABLE J-2.
Proposed Final Seeding Mixtures for the Evaluation Adit

Common Name	Scientific Name	Seeding Rate[1] (pounds/acre)	Seeds[2] per square foot
GRASSES[3]:			
Redtop	*Agrostis alba*	0.2	22.0
Meadow foxtail	*Alopecurus pratensis*	1.0	21.0
Mountain brome	*Bromus marginatus*	5.0	10.0
Sheep fescue	*Festuca ovina duriuscula*	2.0	31.0
Big bluegrass	*Poa ampla*	1.0	20.0
Alsike clover	*Trifolium hybridum*	1.0	16.0
TOTAL		**10.2**	**120**

[1]Broadcast seeding methods would be used.
[2]The seeding rate assumes pure live seed (PLS) which is a certified rating for each seed lot adjusted for purity and germination percentage; the target is for 120 PLS/sq.ft.
[3]Beargrass (*Xerophyllum tenax*), a forb, may be seeded, if seed is available; shrubs and trees would not be seeded or planted.
The final revegetation seeding mixtures would be applied throughout the mine life (years 0-35) as areas are prepared for recontouring and topsoiling. Interim revegetation would be applied to areas that require stabilization; these areas would be reseeded with the final seed mixtures and/or plantings after recontouring and topsoiling.

TABLE J-3.
Proposed Final Tree Planting Rates for the Tailings Impoundment Area and Facilities and Mine Areas[1]

Common Name	Scientific Name	Stocking Rate[2] (trees/acre)
Tailings Impoundment Top and Associated Areas		
Western larch	*Larix occidentalis*	133
Western white pine	*Pinus monticola*	133
Ponderosa pine	*Pinus ponderosa*	133
Douglas-fir	*Pseudotsuga menziesii*	266
Tailings Impoundment Dam Face		
Ponderosa Pine	*Pinus ponderosa*	332
Douglas-fir	*Pseudotsuga menziesii*	333
Facilities and Mine Area		
Western larch	*Larix occidentalis*	133
Englemann spruce	*Picea engelmannii*	133
Lodgepole pine	*Pinus contorta*	133
Douglas-fir	*Pseudotsuga menziesii*	266

[1]No trees would be planted on the transportation corridor.
[2]Stocking rates would total 665 trees/acre on all sites.

II. AGENCY MITIGATIONS THAT WOULD BE IMPLEMENTED UNDER ALTERNATIVE III, IV, OR V

Sterling would develop a revised revegetation plan to be reviewed and approved by the Agencies. The detailed plan would address all elements currently proposed and those necessary to meet agency mitigations identified in the EIS. The overall goal is to achieve long-term ecosystem stability and potential while incorporating goals and mitigations for other resources. The plan elements would be thoroughly documented to ensure that the rationale for each element is well understood. This is particularly important for plant species selection. In view of the long-term nature of the proposed project, the following practices are identified with the intention of providing flexibility as environmental conditions and agency policies change and of ensuring that state-of-the-art knowledge is incorporated. The revegetation plan would be coordinated in conjunction with other resource mitigations and monitoring plans for all areas, including wetlands.

Species Selection

The objective would be to develop a revegetation plan that meets as well as balances a variety of short- and long-term needs including soil stabilization, restoration of soil productivity, species selection and plant community successional considerations for wildlife and wildlife habitat needs, and visual resource enhancement.

Grass and forb seed mixes and tree and shrub plantings would be reassessed to address site-specific objectives including:

- environmental conditions of recontoured areas
- visual setting of recontoured areas
- substrate (tailings, waste rock, etc.) and soil chemical and physical conditions
- short-term needs to stabilize soil but not be attractive to wildlife only in transportation and utility corridors
- long-term needs for visuals (rapid screening)
- long-term needs for wildlife
    - browse, forage and cover
    - arrangement of wildlife habitat components in the Rock Creek watershed (travel corridors, snags, winter range, etc.)
- long-term needs for fisheries (shading, food source base, etc.)
- seed collection from the permit area and propagate seeds and plantings to ensure locally adapted and genetically compatible stock
- choice of rapidly establishing grasses that will not hinder native colonization or that would spread off the reclaimed area and would not be persistent
- choice of locally native pioneer species (such as fireweed and pearly everlasting) for rapid stabilization
- hand planting of trees, shrubs, etc. on steep slopes
- consideration of successional changes in plantings and seedings to best achieve overall watershed and habitat conditions.

- innoculating shrub and tree plantings with appropriate mycorrhiza

Revegetation plan elements would be documented to ensure that the rationale for species choices and revegetation actions are well understood. For guidance, the Agencies suggest using Region 1 Native Plant Handbook (USDA Forest Service Northern Region 1995) and other appropriate guidelines in existence at the time of project implementation. The goal for tree stocking is to have a minimum of 150 live trees per acre 30 to 50 years after planting. Assuming 30% mortality, the proposed stocking rate of 240 trees per acre would result in 168 trees per acre.

Suggested seeding and planting mixes include:

TABLE J-4.
Agencies' Suggested Seeding Mixes for the Tailings Deposit (Slopes and top)[1]

Common Name	Scientific Name	Stocking Rate
		(trees/acre)[2]
TREE PLANTING		
Lodgepole pine[3]	*Pinus contorta*	80
Ponderosa pine [3]	*Pinus ponderosa*	20
Western larch	*Larix occidentalis*	20
Douglas-fir	*Pseudostuga menziesii*	20
Western white pine [3]	*Pinus monticola*	20
Aspen	*Populus tremuloides*	40
Black cottonwood [3]	*Populus trichocarpa*	40
	TOTAL TREES	240
SHRUB PLANTING		(shrubs/acre)[1]
Alder	*Alnus sinuata*	24
Snowbush ceanothus	*Ceanothus velutinus*[4]	10
Redstem ceanothus	*Ceanothus sanguineus*[4]	10
Mockorange	*Philadelphus lewisii*	8
Snowberry	*Symphoricarpos albus*	8
Kinnikinnik	*Arctostaphylos uva-ursi*	8
Buffaloberry	*Shepherdia canadensis*	8
White spirea	*Spirea betulifolia*	8
Ninebark	*Physocarpus malvaceus*	8
Woods rose	*Rosa woodsii*	8
Oceanspray	*Holodiscus discolor*	8
	TOTAL SHRUBS	108
GRASS/FORB SEEDING		Drill Seeding Rate (pounds per acre)
Annual rye	*Lolium multiflorum*	2.5
Sterile hydrid grain		2.5
Idaho fescue	*Festuca idahoensis*	1.5
Bluebunch wheatgrass	*Agropyron spicatum*	1.5
Pinegrass	*Calamagrostis rubescens*	1.0
Elk sedge	*Carex geyerii*	1.0
Fireweed	*Epilobium angustifolium*	1.5
Pearly everlasting	*Anaphalis margaritacea*	1.0
Yarrow	*Achillea millefolium*	1.0
Pussytoes	*Antennaria rosea*	0.5
Strawberry	*Fragria vesca*	0.5
Strawberry	*Fragaria virginiana*	0.5
	TOTAL GRASSES/FORBS	15

[1] Seed and planting mixtures can be modified at any time with agencies approval.
[2] Containerized stock would be preferable; include western red cedar (*Thuja plicata*) at 5 trees/acre on cooler/moister positions.
[3] Innoculated with appropriate mycorrhiza fungi.
[4] Inoculated with appropriate nitrogen-fixing bacteria.

TABLE J-5.
Agencies' Suggested Seeding Mixes for the Mill Site (Alternative III to V)[1]

Common Name	Scientific Name	Stocking Rate
		(trees/acre)[2]
TREE PLANTING		
Lodgepole pine [3]	*Pinus contorta*	80
Ponderosa pine [3]	*Pinus ponderosa*	5
Western larch	*Larix occidentalis*	20
Douglas-fir	*Pseudostuga menziesii*	20
Western white pine [3]	*Pinus monticola*	20
Aspen	*Populus tremuloides*	30
Black cottonwood [3]	*Populus trichocarpa*	30
Engelmann spruce [3]	*Picea engelmannii*	35
	TOTAL TREES	240
SHRUB PLANTING		(shrubs/acre)[2]
Alder	*Alnus sinuata*	20
Snowberry	*Symphoricarpos albus*	20
Oceanspray	*Holodiscus discolor*	20
Serviceberry	*Amelanchier alnifolia*	20
Snowbush ceanothus	*Ceanothus velutinus*[4]	10
Redstem ceanothus	*Ceanothus sanguineus*[4]	10
	TOTAL SHRUBS	100
GRASS/FORB SEEDING		Drill Seeding Rate (pounds per acre)
Annual rye	*Lolium multiflorum*	2.5
Sterile hybrid grain		2.5
Rough fescue	*Festuca scabrella*	1.5
Pinegrass	*Calamagrostis rubescens*	1.0
Elk sedge	*Carex geyerii*	1.0
Beargrass	*Xerophyllum tenax*	2.0
Fireweed	*Epilobium angustifolium*	1.5
Pearly everlasting	*Anaphalis margaritacea*	1.0
Yarrow	*Achillea millefolium*	0.5
Pussytoes	*Antennaria rosea*	0.5
Strawberry	*Fragria vesca*	0.5
Strawberry	*Fragaria virginiana*	0.5
	TOTAL GRASSES/FORBS	15

[1] Seed and planting mixtures can be modified at any time with agencies approval.
[2] Containerized stock would be preferable.
[3] Innoculated with appropriate mycorrhiza fungi
[4] Inoculated with appropriate nitrogen fixing bacteria.

TABLE J-6.
Agencies' Suggested Seeding Mixes for the Evaluation Adit[1]

Common Name	Scientific Name	Stocking Rate
		(trees/acre)[2]
TREE PLANTING		
Subalpine fir	*Abies lasiocarpa*	60
Engelmann spruce [3]	*Picea engelmannii*	60
Douglas-fir	*Pseudostuga menziesii*	60
Lodgepole pine [3]	*Pinus contorta*	60
	TOTAL TREES	240
SHRUB PLANTING		(shrubs/acre)[1]
Alder	*Alnus sinuata*	16
Snowberry	*Symphoricarpos albus*	16
Oceanspray	*Holodiscus discolor*	16
Serviceberry	*Amelanchier alnifolia*	16
Rocky Mountain maple	*Acer glabrum*	16
	TOTAL SHRUBS	80
GRASS/FORB SEEDING		Drill Seeding Rate (pounds per acre)
Annual rye	*Lolium multiflorum*	2.5
Sterile hybrid grain		2.5
Northwest sedge	*Carex concinoides*	1.5
Pinegrass	*Calamagrostis rubescens*	1.0
Elk sedge	*Carex geyerii*	1.0
Beargrass	*Xerophyluum tenax*	2.0
Fireweed	*Epilobium angustifolium*	1.5
Pearly everlasting	*Anaphalis margaritacea*	1.0
Yarrow	*Achillea millefolium*	0.5
Pussytoes	*Antennaria rosea*	0.5
	TOTAL GRASSES/FORBS	14

[1] Seed and planting mixtures can be modified at any time with agencies approval.
[2] Containerized stock would be preferable.
[3] Innoculated with appropriate mycorrhiza fungi
[4] Inoculated with appropriate nitrogen fixing bacteria.

APPENDIX K

AGENCIES' CONCEPTUAL MONITORING PLANS

INTRODUCTION

This appendix contains the Agency-modified or -generated conceptual monitoring plans for alternatives III through V. Sterling would develop a final monitoring plan for approval by the Agencies prior to project startup. All plans would need to identify trigger or alert levels, which, when reached, would require Sterling to implement a corrective action plan. Corrective action plans for the most likely scenarios also need to be developed and approved prior to project startup.

Reporting

All monitoring would require an annual report unless otherwise specified. The format and requirement needs for reporting would be reviewed and finalized by the Agencies. Reports would be submitted to other review agencies as identified by Kootenai National Forest (KNF) and Montana DEQ.

After submittal of a monitoring report, the Agencies may call a meeting with all other relevant agencies to review the monitoring plan and results, and to evaluate possible modifications to the plan or permitted operations.

AIR QUALITY MONITORING PLAN

Ambient air quality monitoring would be required as a condition of the air quality permit for the project. This most likely would include three to four particulate monitoring sites in the vicinity of the plant and tailings areas and a meteorological (wind speed and direction) monitoring system. All monitoring must be performed according to state and federal quality assurance procedures.

Performance testing (measurement of the particulate emission rate) on the wet scrubber controlling emissions from the secondary crusher would also be required to verify compliance with the applicable emission standard (0.05 grams per dry standard cubic meter). Following the initial tests, operational parameters of the scrubber would be monitored on an ongoing basis. These parameters include scrubbing liquid flow rate and the change in pressure of the gas stream through the scrubber.

DEQ's Air and Waste Management Bureau personnel would perform on-site inspections of the operation on a random basis on a frequency of at least once per year. Air monitoring reports would be submitted and reviewed on a quarterly basis. The overall effectiveness of the proposed air pollution control measures, with emphasis on the adequacy of wind erosion prevention at the tailings storage facility, would be evaluated in this way on an ongoing basis. Standard quality assurance/quality control procedures for air monitoring programs would be implemented as a condition of the air quality permit.

ACID ROCK DRAINAGE AND METALS LEACHING PLAN

The purpose of the Acid Rock Drainage and Metals Leaching Plan is:

- to provide a geochemical characterization plan that effectively satisfies goals outlined below,

- to provide safeguards from soil, surface and ground water contamination due to potential acid rock drainage (ARD)/metal leaching (ML)[1] effects until a representative geochemical data base of ore, waste rock and tailings is established during progression of the evaluation adit and mine development adits,
- to appropriately mitigate all potential poor quality waste rock, and
- to provide contingency alternatives for potential adverse scenarios involving ore, waste rock, and tailings geochemical behavior.

The goal of this plan is to obtain a representative database of ARD and ML static and kinetic testing characteristics of all potentially unique geologic units encountered (including tailings) in the Rock Creek Project evaluation and mine development adits. Mine rock handling procedures and prediction of drainage water quality would be derived from database trends. Comparison confidence to the Troy (Spar Lake) Mine for prediction purposes would be further defined through continued geochemical testing for waste rock and tailings at the Troy site. Potentially acid generating (PAG), acid generating (AG) and/or ML materials at the Rock Creek site would be conservatively contained until static and kinetic testing gives appropriate confidence these materials will not contaminate soil and waters. Mitigations are proposed that address long term protection of these resources from reactive waste rock, ore and tailings. Contingency plans are provided for unforeseen emergency situations regarding contamination from waste rock, ore and tailings. The development of this plan would require reviewer approval by the agencies in the form of an agency technical panel or a third party reviewer.

The objective of this plan is to provide appropriate long term protection of resources from contamination during and after the Rock Creek Project operations. The plan consists of eight components. They are:

- <u>Rock Characterization Program</u>
- <u>Evaluation Adit Testing and Monitoring</u>
- <u>Underground Adit and Mine Construction, Development, and Operations Testing and Monitoring</u>
- <u>Paste Tailings Storage Facility Testing and Monitoring</u>
- <u>Evaluation Adit Ore and Waste Rock Mitigations</u>
- <u>Paste Tailings Mitigations</u>
- <u>Contingencies</u>
- <u>Reporting</u>

Rock Characterization Program

The rock characterization program would allow classification of potentially unique geologic units for rock handling procedures. The components of this program are described below. As statistical confidence was developed through the sampling program, relaxation of the sampling frequency for specific tests and subsequent handling procedures may be possible. Verification with static and kinetic monitoring of rock geochemical behavior would always be a minimal requirement throughout operations. Technical changes in the overall mine plan may be required to reflect emerging geochemical data trends as statistical confidence was gained through database development.

[1] ML is described in Chapter 3 text as potential metal mobility in near neutral pH environments.

Waste rock characterization would be based on the "Mine Rock Guidelines for the Design and Control of Drainage Water Quality" (Report No. 93301) (Steffen, Robertson and Kirsten, Inc. 1992)[2]. The characterization program allows classification of geologic units either by lithology or by alteration zones in proximity to the ore deposit. The agencies expect initially (near evaluation adit and mine adits portals) that lithology would guide the selection of rock handling units. As the ore body is approached, alteration halos may dominate as geologic units classified for handling. Mine rock classification would identify geologic units requiring varying handling procedures based the level of ability to leach metals or generate an acid environment. Mine rock handling procedures would be determined from the combined evaluation of static and kinetic geochemical testing results.

Static test information can indicate potential, or preliminary estimates, of a rock or tailings sample's ability to leach metals or generate acid. Acid generation processes are dependent on a number of factors including a time and rate dependency, which are not addressed in static testing. Interpretation of static tests would involve consideration of multiple test results and site specific information. Appropriate static tests, as described by the Mine Rock Guidelines (1992), would be:

- Mineralogic evaluation (degree of alteration, mineralization type and occurrence)
- Whole rock (EPA 3050)
- Acid Base Accounting or ABA (including total sulfur content and paste pH)
- Leach testing

Acid Base Accounting defines the balance between the potentially acid generating and potentially acid consuming minerals in a sample as determined by lab testing.

Whole rock (EPA3050) and mineralogic analyses would also be required to provide a statistically defensible sample population to characterize spatial and lithologic trends. Due to the highly unstable and acid generating potential of the mineral pyrrhotite, particular attention would be given to identification and quantity of this mineral in ore, waste rock and tailings.

Short-term leach tests can determine the readily soluble component of a sample. Arsenic, antimony, barium, chromium, copper, lead, manganese, and zinc were identified by Klohn-Crippen (1998) as appropriate constituents to monitor in leach testing. Nitrates from use of blasting agents would also be monitored. Additional monitoring needs would be identified by routine whole rock analysis (EPA 3050). Drainage water quality from tested material cannot be quantitatively determined from leach testing due to the lack of temporal information. Suggestive metal loadings may be developed from leach tests as more site specific information is established.

For further description of static test analysis procedures and sampling protocol, see the Mine Rock Guidelines (1992). Sampling frequency for each of the tests would vary depending on characteristics of each unique geologic unit. Sampling frequency should satisfactorily describe statistical distributions of relevant geochemical parameters. It would be necessary for Sterling to develop test

[2] The draft and supplemental EISs for the Rock Creek Mine Project refer to the British Columbia Acid Mine Drainage Task Force Report (1989) as a guideline for ARD and ML issues. These documents are essentially similar and were prepared by the same consulting firm. The 1992 Guidelines provide more detail as technical understanding of ARD and ML issues evolved.

turnaround time into their excavation plans. Sterling may choose to core sample rock ahead of the blast and excavation schedule to obtain sample results on an accelerated basis.

Kinetic tests supplement and verify interpretations of static tests. Kinetic tests are complex procedures that allow determinations (under certain test conditions) of specific reaction rates of acid generation, neutralization and dissolution of metals. Kinetic tests also allow prediction of drainage chemistry and resultant downstream loadings in the above geochemical environments. This information is crucial to the design of an effective mine rock handling procedure and proper ARD/ML control technology.

Kinetic tests of representative samples from potentially unique geologic units, particularly those that are PAG /AG and ML (including tailings from the ore body), would begin immediately as they are encountered in the mining process. Test design would be subject to agency approval and would be required to progress indefinitely until site specific test lengths, based on mineralogic evaluation of test material, is established.

Evaluation Adit Testing and Monitoring

Non-acid generating (NAG)/ non-ML waste rock (as determined by static testing) would be used to build the evaluation adit portal pad. Runoff capture for this structure is described in the Chapter 2, Alternative II description, since this rock will have no kinetic testing verification.

Ore from the evaluation adit would be placed in an approved dump area that provides for drainage capture until project progression is determined.

Unique geologic units encountered in the evaluation adit would require kinetic testing to begin upon excavation in order to have sufficient data to make any necessary design and plan changes. Agency approval of the data sufficiency would be required before the project could proceed to the mine development stage.

Underground Adit and Mine Construction, Development, and Operations Testing and Monitoring

Geochemical representation and adequate kinetic evaluation for potentially unique geologic units to be encountered in the mine development/production adits prior to mine construction and in the mine during operation would be required to determine project advancement.

If the project proceeds to development of the twin mine access (development and production) adits, all ore from the evaluation adit would be removed from the portal storage area. The ore would then require transport through the evaluation adit once the mine intercepted the evaluation adit and out the mine development/production adits to the mill. Mine development adit project construction could cause the water table to be lowered. Evaluation waste rock, interpreted from static and kinetic testing to cause adverse impacts to water quality, would be required to be transported through the evaluation adit for underwater disposal in the mine workings.

NAG/non-ML waste rock determined from static and kinetic testing would be used to build the mill pad, paste storage facility embankment and used as crushed rock for finger drains beneath the paste storage facility. This rock may be transported from the evaluation adit, or excavated from the mine development adits and mine workings as needed.

The evaluation adit may not penetrate all rock types encountered in the development adit due to different angle of approach for each adit. The specific rock types not penetrated by the evaluation adit would require methods such as lateral/angle core drilling for sampling access. Failure to either test or develop appropriate mitigation for this waste may cause delay in the project.

If waste rock determined to cause adverse impacts to short-term and long-term water quality was encountered in the development production adits before appropriate underground storage was available, temporary storage in a lined, seepage contained dump storage facility may be necessary.

Paste Tailings Storage facility Testing and Monitoring

Paste tailings would be tested for paste pH, conductivity, and ABA (includes total sulfur). Leach testing and kinetic testing of the tailings would also be required. Testing design and frequency would be subject to agency approval.

Evaluation Adit Ore and Waste Rock Mitigations

Mitigation of potential adverse effects on short-term and long-term water quality from evaluation adit ore and waste rock would be dependent on project progression. Interpretation from static and existing kinetic data would attempt to quantify which geologic units would cause adverse impact.

If Sterling decided to shutdown the project at the completion of the evaluation adit excavation, additional mitigation options would be considered. Subaqueous disposal of some waste rock would be possible in the evaluation adit without project progression. Backfill preference would be given to ore and AG/PAG and ML mine waste rock as determined from static and kinetic testing. It is estimated that one half of the volume of the ore removed would fit back into the evaluation adit. The remaining ore would require proper encapsulation, capping and possible leachate capture and treatment. Encapsulation may be practicable at the portal site if initial waste rock from the evaluation adit (proposed for building the portal pad) meets NAG /non-ML definition. Methods such as blending PAG with NAG or the use of liming amendment for small but significant ARD uncertainty may also be practicable. The need for encapsulation would be determined based on testing results and Sterling would need to submit a plan for encapsulation, capping, and possible leachate capture and treatment to the agencies for review if any of these measures are determined to be necessary.

If mine development proceeds past the evaluation adit, all PAG/AG and or ML mine rock would be disposed underground beneath the fluctuating zone of the water table. All NAG/non-ML waste rock not used for construction and all unsuitable waste rock would be disposed of underground. If backfilling was not feasible for all NAG/ non-ML rock, it would be stored in an approved waste dump area within the tailings storage facility footprint with storm water controls and an appropriate cap.

The amount of metals loading contributed from mine support pillars and other exposed rock is difficult to estimate and requires site specific information not available at this time. Sterling would submit a proposal that addresses Sterling's approach to achieving no significant impacts to ground and surface water quality from water stored in the mined out workings. Sterling would obtain agency approval of this proposal in order to proceed with mine development and production.

Paste Tailings Mitigations

Sterling would be required to produce representative tailings from evaluation adit ore that must undergo static and kinetic testing. Evaluation adit tailings testing would need to verify no surface or ground water impacts greater than those disclosed in Chapter 4 of the final EIS in order for the construction of the mine development adits to progress into the ore body. If greater impacts are indicated then changes would need to be made to the paste process to modify the paste tailings makeup and reduce the impacts. Changes to the paste storage facility design (such as installing a liner) or the addition of cement may be necessary if predictions suggest an impact that could not otherwise be mitigated.

The addition of cement to paste tailings would be considered as a mitigation measure dependent initially on the results of data collected on processed ore excavated from the evaluation adit. The agencies believe this evaluation would occur concurrent with submittal of a detailed design of the paste impoundment (prior to implementation of a full-scale paste production program). There would be at least two to three and one-half years of mine development adit construction before the mine began to produce ore rock that would be processed and generate tailings. Further tailings geochemical testing would occur as ore is encountered in the evaluation adit and the mine and would continue for verification purposes throughout life of mine. This data would be used to modify the possible cement requirement over time as confidence in the data increases.

The paste tailings storage facility would receive a 2-foot soil cover at closure. This cover would address erosion and disturbance requirements of MMRA 82-4-336-7. If geochemical testing showed the need for a more protective cap/cover, Sterling would be required to submit a design for agency review and approval.

Contingencies

It is conceivable that a temporary or permanent shutdown of operations could occur from permit compliance situations requiring enforcement and violation abatement actions, such as failure to adhere to mine rock sampling and testing protocol, or improper implementation of approved mitigations where needed. It is also possible geochemical testing results could invoke at least temporary project cessation if unanticipated mitigation needs requiring agency approval were not in place. For example, if the potential for acid generation, as determined by lab testing, increased drastically from that implicated in the Klohn-Crippen (1998) review, approved mitigations must be in place for project advancement. Similarly, if unanticipated drainage flows or drainage quality did not have appropriate agency approved mitigations in place or ready to be implemented, project cessation may be an option. Once mitigation measures were in place operations could resume.

Rock testing geochemical trigger values would be determined during the evaluation of kinetic testing data. Depending on the method of kinetic testing selected and the objectives and scope of the testing, interpretation and extrapolation of test results would vary. Predicted drainage water quality controls for potentially unique geologic units and chemical processes (dissolution of readily soluble constituents vs. oxidation and metal leaching) would direct disposal and mitigation/contingency options, including project shutdown. These predictions would be site specific and dependent on the length of the test. There are also specific trigger values for metals and nitrogen written into the Water Resources Monitoring Plan in this Appendix and the MPDES permit in Appendix D.

If premature or temporary closure occurred during mine development /production adit excavation, thereby decreasing the capacity for underground disposal, all PAG/AG and ML waste rock would be encapsulated within the mill site or paste tailings storage facility site or another agency approved dump site. Currently there are no approved waste rock dumps under Alternative V besides the proposed waste rock dump at the evaluation adit. Disposal at these sites would require lining, drainage collection and treatment. An agency approved cap design would also be required.

It is highly unlikely, based on geologic understanding of the rock units encountered, that mine waste rock used for construction (mill pad, paste tailings storage facility embankment and crushed rock for blanket and finger drains beneath the paste tailings storage facility) would develop unpredicted ARD or ML characteristics over the long term. Nevertheless, should this geochemical condition occur, collection and treatment of waste rock leachate and runoff at these sites may be required in addition to an appropriate cap/cover at closure.

Reporting

For the evaluation adit development, all static testing results (which would include waste rock tonnage estimates for each geologic unit), would be reported quarterly. As statistical confidence was developed through the sampling program, relaxation of reporting requirements may be possible, as stated earlier for sampling frequency.

Kinetic testing results would be reported quarterly until the Agencies agreed to reduce the frequency. Solution analyses for metals must be carried out over the kinetic testing period and reported quarterly during all kinetic tests.

Testing results and QA/QC (similar to those described below in the Water Resources Monitoring Plan) for static and kinetic tests would be included in each annual report. Annual reports are public information although approval of the annual reports is under agency purview.

WATER RESOURCES MONITORING PLAN

This plan provides the conceptual framework necessary for development of a water resources monitoring program for the Rock Creek Mine Project. Sterling submitted its own version of a water resources monitoring plan, however, the Agencies believe that several important elements were missing from this plan.

Only a final Agency-approved monitoring plan would be implemented. Additional monitoring requirements are also specified in the MPDES permit Fact Sheet/Statement of Basis for the various outfalls (see Appendix D). The final approved plan would contain specific information on sample location, chemical parameters for analysis, laboratory detection limits, frequency of data collection, and reporting requirements. The water resources monitoring program would begin during the first quarter of construction of the evaluation adit, and would be maintained during the life of the project as well as after reclamation for a period of time to be specified by the Agencies.

The goals of the water resource monitoring are:

- to quantify any measurable environmental impacts accompanying construction, operation, or reclamation of the Rock Creek Mine project;
- to evaluate the accuracy of impacts described in the EIS; and
- to determine whether alterations of project operations or additional mitigative actions would be required to correct any unanticipated impacts encountered, or to prevent future violations of regulatory requirements.

A comprehensive monitoring system network would be established to evaluate potential impacts associated with the underground mine, mill, utility corridor, water treatment facility, and tailings storage facility. Data would be collected and evaluated in detail using standard statistical analyses to determine if differences exist between:

- an upstream (or upgradient) reference station and the corresponding downstream (or downgradient) station;
- sampling intervals (continuous, weekly, monthly, quarterly, annually);
- high and low flow events.

Operational data would also be compared to data collected during baseline conditions to document changes in water quality.

This conceptual monitoring plan is divided into several elements:

- hydrologic investigations during evaluation adit construction
- surface water monitoring
- ground water monitoring
- facility water balance and chemistry
- analytical parameters and methods
- a quality assurance and quality control program
- a remedial action plan
- reporting

These elements are discussed in detail below.

<u>Hydrologic Investigations During Evaluation Adit Construction</u>

The primary hydrologic issues of concern regarding assumptions used in the final EIS are inflow rates to the underground workings, seepage rates out of flooded underground workings, potential for effects on springs, lakes, or other surface waters, and the chemistry of water to be stored in the mine and/or discharged from the mine. These issues would be further investigated during evaluation adit development as described below.

The evaluation adit would be a decline passing through barren (waste) rock above the ore horizon, then following the ore zone for some distance near the Copper Lake fault. Water would constantly have to be pumped away from the working face of the decline during its development in order to keep the adit dry. Pumping (inflow) rates would be continually monitored and regularly reported. Chemistry of this water would also be routinely tested. Inflow rate data would be compared with the exploration adit inflow projections included in the final EIS. If there are substantial deviations from predicted inflows, the mine inflow estimates would be revised accordingly, and if appropriate, water management and treatment requirements for the life of the mine would be adjusted.

All discrete zones of inflow to the adit (presumably water would enter where the adit crosses zones of fractured bedrock) would be mapped and inflow rates would be documented. Field measurements of each inflow (pH, hydrostatic pressure, specific conductance) would also be documented. Additional water chemistry data (the same common ions and metals required by the MPDES permit for discharge into the Clark Fork River) would be collected from selected seeps, both from segments of the adit penetrating barren rock as well as ore. These data would be compared to predicted mine water chemistry (based upon sampling of the similar Troy mine) and if significantly different, loading evaluations from mine discharges and resultant environmental impacts would be reexamined. Areas of fractured rock not producing inflows to the adit would also be documented. Tests (e.g., bulkheading and flooding) may be performed in such areas to determine whether seepage out of the mine workings may occur. Piezometers would be installed in the Copper Lake fault and under Cliff Lake and Copper Lake and monitored for static head.

After completion of sampling and testing within the evaluation adit, dewatering would be discontinued. The rate of rise of water within the adit would be monitored weekly and compared with the known volume of the underground openings to determine the rate in gallons per minute at which the adit is flooding. Deviations from the previously documented adit inflow rates would be determined, and whether or not some of the mine water is leaking to surrounding ground water (and at what rates and locations), would be estimated. Chemistry of the reservoir forming within the flooding adit would also be frequently (monthly) tracked.

Prior to initiation of production-phase mine development, water in the flooded evaluation adit would be pumped to the treatment plant and the adit would be reopened. Whether or not the water level in the adit reaches steady state prior to draining depends upon several factors, including inflow rates, regional ground water table elevation, and duration of time between the exploration and development phases of the project.

Concurrent with initiation of evaluation adit construction would be a phase of renewed surface water baseline data collection. Extensive sampling has been conducted to date within the Clark Fork River, lower Rock Creek, and its west fork. The new phase would include previously monitored sites, sites which might be impacted by evaluation adit activities, and new sites (springs and seeps) near the ore body that would need to be added as they are identified. These new sites would be selected following a new spring and seep survey, subject to approval by the agencies, and would likely include sites located within tributaries to the East Fork of Rock Creek, Copper Gulch, and the East Fork of Bull River. Monitoring frequency would be selected so as to assure compilation of a statistically adequate database prior to initiation of mining of the ore body. Baseline water balance data would be collected on wilderness lakes. Monitoring at lake levels and water budget for Cliff, Copper, St. Paul, Rock, and Moran Basin would begin at this time also.

During evaluation adit construction, Sterling would also need to verify the location of potentially affected downgradient domestic wells and water supplies (within the area identified in the EIS) with the Montana Department of Natural Resources and Conservation (DNRC) in order to determine if any new wells or water sources had been filed with DNRC or if any wells had been misidentified and had information regarding them corrected. Any new domestic wells or water sources or misidentified wells would need to be sampled to provide baseline data prior to mine construction, if they had not already been sampled. Water samples would be analyzed for the same parameters as required for monitoring during operation.

Surface Water Monitoring

Surface water quality samples would be collected and analyzed during the construction, operation, and reclamation phases of the proposed project at a frequency that evaluates high and low flow conditions as well as seasonal trends. Water samples would also be collected during temporary facility shutdowns or mine closure. Surface water stations would be located on the east and west forks of Rock Creek, the main stem of Rock Creek, Miller Gulch, the Clark Fork River and other locations as determined by the Agencies. Prior to the construction of the development adit, a survey would be conducted to locate new springs or seeps and verify baseline locations. Any springs found that potential could be compacted by the progressing development would be sampled and included in the other sample sites as noted above, and sampled at the same frequency. If seeps or springs develop in the Cabinet Mountain Wilderness (CMW) as a result of the proposed mining operation or operation of the proposed underground storage reservoir, these discharges, if located, would be monitored for flow and water quality and would be subject to any applicable Montana water quality regulations. See DEQ technical report on file with the Agencies (MT DEQ 2001a) for most likely locations for mine seepage in the CMW. Sampling locations would be coordinated with the aquatic monitoring program. The surface water monitoring program, including the location of all stations evaluated during the baseline data collection program, would be finalized based on Agency review and approval. The rationale and requirements for monitoring surface water resources at specific stations during the construction, operation, and reclamation phases of the proposed project would be discussed in Sterling's final water resources monitoring plan.

Monitoring of lake levels and water budget at Cliff, Copper, St. Paul, Moran Basin, and Rock lakes would also be part of the surface water monitoring program. This plan would be coordinated with the aquatics monitoring plan and wetlands monitoring and mitigation plans. Details of lake monitoring methodology are described in a technical report (MT DEQ 2001a). A high elevation weather station would be maintained for use in lake water balance studies.

Ground Water Monitoring

Ground water monitoring data would be collected on a quarterly basis during construction, operation, and reclamation phases, as well as during temporary facility shutdowns. Ground water would be monitored in the underground mine, upgradient and downgradient of the mill, upgradient and downgradient of the proposed tailings storage facility, and from the tailings storage facility perimeter pump-back well system. Underground monitoring of hydraulic conditions in the bedrock aquifer would be intensified as designated buffer zones are approached. In addition, flow and quality of springs and seeps would be monitored, with particular emphasis on those sources of water that provide recharge to

Rock Creek and the East Fork Bull River. If elevated metals are seen through sampling of the post mining pool of water or the mine water reservoir during mining that could reach surface springs and seeps, then Sterling and the agencies would consider adding limestone or soda ash to the pooled water to help remove the metals from the system.

Monitoring well and perimeter pump-back well locations, and sampling frequency would be reviewed and finalized after consultation with the Agencies. Water quality and water level data from monitoring wells, static water level data from surface piezometers, and hydrostatic pressure data from underground piezometers would be collected. Static water level data from piezometers located along the perimeter of the tailings storage facility would be critical to evaluate potential seepage impacts to ground water or surface water resources. Ground water from all existing domestic water supply wells downgradient of the proposed tailings storage facility would also be collected and analyzed.

Split samples from monitoring and domestic wells would be periodically collected and analyzed by DEQ to verify Sterling's data. Split samples from domestic wells would be offered to owners. The Agencies would consider the actual facility water balance data, estimates of seepage, and results of the ongoing ground water monitoring program in determining how long monitoring of private domestic water supply wells should continue. At a minimum, ground water quality sampling and analysis would continue at least until bond release.

In addition, ground water quality sampling would be conducted at specified monitoring wells prior to construction of the proposed tailings storage facility to document water quality conditions in the tailings storage facility footprint downgradient of the decommissioned Noxon sanitary landfill. Samples would be analyzed for physical parameters, nutrients, common ions, metals, volatile organic compounds and semi-volatile organic compounds.

Facility Water Balance and Chemistry

A detailed facility water balance and analysis of water and waste water chemistry would be maintained, the details of which would be specified in the final water resources monitoring plan. The purpose of the facility water balance would be to provide an assessment of the inflow, outflow, and general water or waste water chemistry associated with the underground mine, water treatment facility, and tailings storage facility. Monitoring information would be used to modify, as necessary, operational water handling, and to develop a post-mining water management plan. As part of this monitoring, the following aspects of the project water balance would be measured:

- the volume of excess water stored underground
- mine reservoir water quality
- mine adit discharge and water quality
- the amount of tailings slurried or deposited as a paste
- the amount and source(s) of fresh makeup water to the mill
- the amount of reclaimed tailings water returned to the mill
- the water quality of tailings decant water
- the amount and quality of water pumped from the seepage collection ponds
- treatment facility influent flow and water quality
- flow rate and quality of water discharged to the Clark Fork River

- the amount and source of water used for dust suppression and irrigation
- pan evaporation and precipitation data at the tailings storage facility site

Parameters and Analytical Methods

At a minimum, the parameters evaluated in the EIS would be retained for analysis in the water resources monitoring program. All water samples would be analyzed using procedures with the lowest possible laboratory analytical detection limits, and using procedures described in 40 CFR 136, EPA-600/4-79-020, or methods shown to be equivalent. Collection, storage, and preservation of water samples would be in accordance with EPA procedures (EPA-600/4-4-82-029). Grab samples would be collected from streams and ground water samples would be obtained with a bailer or submersible pump. Samples would be cooled immediately after collection. Metals in water samples would be preserved by adding nitric acid in the field to lower the pH to less than 2.0. Ground water samples for metals analysis would be filtered through a 0.45 micron filter to allow measurement of dissolved constituents. All field procedures would be consistent with procedures in the U.S. Geological Survey's National Handbook of Recommended Methods for Water-Data Acquisition.

These parameters would initially be retained within the monitoring program. Subsequent to review of data collected during the initial years of the project, continued testing for the full parameter list may be restricted to analyses of mine and tailing deposit effluent before and after treatment. It is likely that other monitoring sites would be routinely analyzed only for contaminants likely to be released by the mining operation, including at a minimum physical parameters and common ions, nutrients (including ammonia, nitrate, and phosphate), and the following metals: copper, lead, zinc, antimony, and manganese. Other metals may be retained in the water quality monitoring program, depending on actual chemistry of mine and tailings water. Effluent from the mine and water recovered from the tailings would be required to be analyzed for the full parameter list, and for both dissolved and total recoverable metals.

Quality Assurance/Quality Control Program

Quality assurance (QA) assures the integrity and reliability of monitoring and measurement data. Quality control (QC) is the application of procedures to evaluate data acquisition techniques and analyses according to established criteria. QC procedures define whether sampling and analytical techniques are in or out of control with reference to applied standards and control limits.

A specific QA/QC program would be approved by the Agencies to guarantee the quality and source of all data collected. This program would include sample documentation, as well as sample control and data validation.

The documentation and sample control portion of the QA/QC plan would be designed to document and track samples from the time of collection through reporting of analytical results. Elements in this portion of the plan include sample identification protocol, the use of standardized field forms to record all field data and activities, and the use of chain-of-custody sample tracking and analysis request forms.

The purpose of data validation would be to ensure that data collected during the monitoring phase would be of known and acceptable quality. Quality control samples would include blind field standards, field cross-contamination blanks, and replicate samples.

Monitoring Alert Levels and Contingency/Corrective Action Plan

As part of this water resources monitoring plan, a monitoring alert levels and contingency/corrective action plan would be developed for the Rock Creek Project. Elements of the plan would include, but not be limited to the following:

- Adit water monitoring and contingencies for possible long-term post-closure adit water treatment;
- Geochemical assessment of waste rock and contingencies for possible production of leachate;
- Long-term monitoring and contingencies for possible uncontrolled discharge of drainage of contaminated water from sumps, waste rock used for construction, paste tailings deposit, process and paste tailings storage ponds, adit leaks and adit plug failures, seepage from the underground mine workings; and
- Long-term monitoring of wilderness lakes in the vicinity of the ore body.

Remedial Action Plan

As part of this water resource monitoring plan, a remedial action plan would be developed for the Rock Creek project. Objectives of the remedial action plan would be:

- to define remedial action criteria and statistically based methods for determining whether significant impacts to surface or ground water resources occur during the project's construction, operation, and reclamation phases;
- to identify key players and their respective roles and responsibilities for implementing the remedial action plan;
- to identify, illustrate, and schedule the decision-making process associated with remedial actions; and
- to prepare a list of potential remedial action alternatives for various degradation scenarios.

Reporting

Sterling would prepare quarterly and annual reports to summarize information and data obtained during implementation of the Rock Creek Mine water monitoring program. The report would include data tabulations, analysis of trends, statistical computations, maps, cross sections, and diagrams needed to clearly describe hydrologic conditions. Sterling would also submit computerized data and analyses in a format acceptable to the Agencies.

ROCK MECHANICS MONITORING PLAN

The rock mechanics monitoring plan as envisioned, has a dual purpose: (1) to acquire data pertinent to the site and use this data in mine planning, and; (2) to monitor the surrounding physical environment's response to mining in order to prevent environmental damage to the surface environment, to surface water and to ground water.

Sterling would develop this plan in conjunction with the Agencies, and the plan's details and implementation would be subject to Agency approval. The rock mechanics monitoring plan would be submitted to the Agencies prior to construction of the evaluation adit.

The goals of the monitoring plan are:

- To collect site specific data on the host environment.
- To confirm assumptions made by Sterling concerning physical parameters of the host rock.
- To assist in mine planning (e.g., room and pillar size and layout, areas of artificial support, location of monitoring devices, size of buffer zones, etc.)
- To provide data to Sterling and to the Agencies which would be used in the assessment of potential environmental damage due to mining.
- To provide data to assist in determining whether to alter the mine plan to prevent environmental damage.

The scope of this monitoring plan would evolve as the complexities related to construction and mining increase. Initially, the monitoring plan would concentrate on data collection during the evaluation adit phase. In time, as mine development increases, the focus of the monitoring plan would be on environmental monitoring in response to mining.

Evaluation Adit Phase

During the development of the evaluation adit, data collection to establish baseline conditions and to confirm physical parameters for the surrounding rock would be the principal objectives. Surface monitoring stations would also be established prior to adit development. These would be installed prior to any mining disturbance, and would be monitored using either conventional land based geodetic measuring systems, or global positioning devices (GPS). Surface monuments would be strategically placed near surface features that may be more susceptible to mine related activities. Areas around Cliff Lake and Copper Lake would have monitoring stations, as well as areas where the ore horizon is particularly thick or near to the surface.

Laboratory and In-Situ Testing

Laboratory testing on representative samples collected during the evaluation adit phase would confirm physical parameters of the local host rock. Tests and documentation of material properties would include, but are not limited to: specific gravity, Young's Modulus, Poisson's ratio, cohesion, angle of internal friction, uniaxial compressive strength, jointing, and other structural features. This data would be used to develop analytical models for the Rock Creek ore body that in turn would assist in mine design and layout. If mining proceeds beyond the evaluation adit phase, Sterling would continue to collect and test samples as the mine advances to confirm material properties as new areas are developed. The frequency of sampling may be determined by either changes in lithology or based on a certain number of samples per volume of material extracted.

In situ monitoring devices would also be installed during the evaluation adit development phase. These may include but are not limited to strain gauges, extensometers and micoseismic monitoring devices. These instruments collect data relating to the how the surrounding rock responds to mining and the excavation of cavities underground. As mining progresses, Sterling would continue to install and monitor in situ devices as part of their overall environmental monitoring program. The placement of these devices would be determined through consultation with the Agencies and their representatives. Areas of known or suspected instability, such as near geologic faults, may get a more concentrated array of devices. The frequency of monitoring would also be resolved with Agency counsel once the adit is underway, however it is difficult to predict both placement and frequency prior to development.

Active Mining Phase

During active mining, surface and in situ monitoring would be ongoing. Deviations from baseline conditions may be indicative of adverse ground reactions to mining. If such conditions occur, the Rock Mechanics Monitoring Plan would have as part of its program, steps and mitigations to retard and stop any deleterious effects. Possible mitigations may include the installation of supplemental supports such as rock bolts, grouting, backfilling the affected area, prohibiting mining in the affected area, or changing the room and pillar sizes to provide more underground support.

The evaluation adit phase would provide ample opportunity to refine the mine plan based on real data so that when active mining does commence, adequate sizing and spacing of pillars and rooms would have occurred. Drilling in advance of new development would intersect unfavorable ground conditions such as faults or extensive jointing, both of which could promote underground instability or ground water drainage stresses on overlying lakes, streams, and wetlands. Mining would not occur in areas where adverse ground conditions could lead to surface subsidence or effects on the wilderness lakes or hydrofracture at outcrop zones (MT DEQ 2001a). The monitoring employed during active mining would provide advance warning of deteriorating ground conditions in response to mining.

The operator or a third party would be responsible for monitoring device installation and data collection. Currently, much of the monitoring equipment is so advanced that mining companies often leave the rock mechanics programs to specialty firms, or at least have a third-party consultant oversee the installation and collection of data. Quality assurance and quality control protocols would be reviewed and authorized by the Agencies to maintain strict regulatory compliance and standards of practice. Sterling would submit the results of the monitoring to the Agencies as part of the monitoring plan. These reports may be submitted on an annual, semiannual or quarterly basis depending on what phase of development the mine is undergoing.

EVALUATION ADIT DATA EVALUATION PLAN

This plan would be developed to provide the agencies with data that could not be obtained prior to construction of the evaluation adit. Data from the evaluation adit would be used to verify the hydrologic, geochemical, and rock mechanics data used in the analyses described in the final EIS. It would also be used to modify facility designs and the mine plan to keep impacts at or below the level described for Alternative V, or whatever alternative the Agencies permitted if a decision to permit was made.

This plan consists of three components. The first is implementation of the evaluation adit portions of the Acid Rock Drainage and Metals Leaching Plan described above. This plan would provide the geological and geochemical data needed to insure that non-acid generating and non-metals leaching material was used for facility construction. The second plan would require the collection of hydrologic data during evaluation adit construction as described in the Water Resources Monitoring Plan above. This data would be used to better define where ground water is coming from, how much is being produced, and what the quality is to ensure the water treatment system operates as predicted and produce a discharge that would comply with MPDES permit limits (see Appendix D). A better understanding of the impacts of withdrawal of ground water on springs, seeps, and streams could be also obtained as well as the possible impacts the underground reservoir in the mine might have on those same springs, seeps, and streams. The Rock Mechanics Monitoring plan described above contains a description of the third component of the Evaluation Adit Data Evaluation Plan. The rock mechanics data from the evaluation adit would be used to modify the initial underground mine plan to prevent the occurrence of subsidence. All evaluation adit data would be supplemented by data collected during mine construction and operation which would be used to further modify and refine facility designs and operations.

If any data were substantially different from that anticipated and used in the analyses in the final EIS, all appropriate facility designs and mine plans would need to be modified and approved by the agencies to ensure that the impacts would be no greater than as disclosed in the final EIS. The modifications would be requested and processed as defined in the Metal Mine Reclamation Act (MMRA) (sections 82-4-337(4 through 7) MCA). If the changes to the permit were considered to be a major amendment, then the amendment would be subject to additional MEPA/NEPA analysis and public participation. The analysis may be disclosed in either an Environmental Assessment or an Environmental Impact Statement depending upon whether or not there was the potential for significant impacts as a result of implementing the change. Either of these documents would tier to the final EIS for the Rock Creek Mine Project. If the significant impacts could not be mitigated to or below the level of the impacts displayed in the final EIS, then an additional EIS would be required. The project could not proceed beyond the evaluation adit construction stage without approval from the Agencies on the facility designs and mine operation plans as modified due to the results and analysis of evaluation adit construction data.

WILDLIFE MONITORING PROGRAM

Monitoring plans would be developed for several wildlife subjects based on the conceptual plans provided below. Monitoring plans would vary depending upon the species or subject being monitored.

In some cases, monitoring would occur on subjects for which insufficient baseline data exist to fully estimate potential impacts or changes. Monitoring would identify the status of these subjects during or after mining activities but the data would not be compared with inadequate premine data.

Currently, the Forest Service and Montana FWP are developing or implementing monitoring plans or studies for some species or subjects. Where feasible and appropriate, Sterling would contribute funding to these efforts in place of initiating a separate and redundant monitoring activity.

The goal of the wildlife monitoring program is to determine project-related impacts on existing wildlife populations. If impacts were identified, then appropriate remedial action plans would be developed and implemented. This monitoring program would be started during the first quarter of evaluation adit construction and would consist of monitoring and reporting for the following elements:

- neotropical migrant bird;
- mountain goat;
- sensitive animal species; and
- road closure.

Neotropical Migrant Bird Monitoring

This plan would coordinate with current programs in place or initiated by state and federal agencies and private organizations. The goal of this monitoring would be to gain additional information about neotropical migrant birds, population trends, species composition changes, and their responses to mine-related impacts.

Mountain Goat Monitoring

Mountain goats would be monitored for their responses to mine-related impacts. Limited baseline data would hinder comparisons of premine status with mine-life or post-mine status. However, information gained would be useful in determining population trends, habitat use, and to some extent mine-related impacts. The monitoring plan would integrate aspects of a mountain goat monitoring plan/study that has already been developed by Montana FWP. The plan would need to specify the sampling and analysis methods to be used and would be reviewed and approved by the Agencies.

Sensitive Animal Species Monitoring

A forest-wide monitoring program for sensitive species including harlequin ducks is currently being implemented by KNF. Sterling would contribute funding to this existing effort. The goal of this monitoring item would be to gain more information about sensitive species, habitat use, and mine-related impacts.

Road Closure Monitoring

Road closures would be monitored for their effectiveness in excluding motorized access. This would include assessing KNF administrative and unauthorized road use and the ultimate effectiveness of closure. This monitoring plan would take into account road closures proposed for grizzly bear mitigation as well as existing road closures. The plan would be developed in coordination with KNF.

AQUATICS/FISHERIES MONITORING PLAN

A detailed monitoring plan is available in the project file at DEQ (dated November 18, 1994). The following is a summary of the highlights of that plan.

The primary reason for monitoring aquatic biota is to determine if mine project activities cause impacts to aquatic resources. Aquatic macroinvertebrates[3] are one of the most reliable organisms to monitor for water quality because they are almost always present in a stream under a wide range of conditions, from clean to polluted. In contrast, fish are more difficult to monitor on a regular basis because they are not found in all drainages, can be transient within a reach, excluded from areas by physical barriers (e.g., waterfalls), and generally have more limited habitat requirements. Aquatic monitoring serves the following additional functions:

- determines whether BMPs and other mitigation are working (e.g., is sediment being effectively controlled from roadway activities?).
- documents the presence of aquatic macroinvertebrates and periphyton[4] in the stream reflecting the short- and long-term quality of the water and sediments. In contrast, water samples, collected only at a specific time, may miss potential pollution events between sampling. Certain species can tolerate polluted conditions (e.g., metals, fine sediments) while others only exist in clean waters.
- determines whether aquatic life standards are successful at protecting the resident aquatic life.
- detects (periphyton monitoring) effects of nutrient loading (e.g., nitrate residues from blasting agents) to a stream.

Aquatics and fisheries monitoring would be required to determine if impacts occur to these resources. Sterling would need to monitor benthic macroinvertebrates, fine sediments, periphyton, fish populations, and metals accumulations in fish tissues. The timing and location of aquatic biological monitoring should be coordinated with the surface water quality monitoring program (Klemm et al. 1990). Monitoring would begin during the first quarter of evaluation adit construction and continue through postmining reclamation.

Sterling would compare data collected from the monitoring stations to that collected during preconstruction baseline studies. In addition, data collected from potential impact sampling stations also

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[3]Aquatic organisms, such as insects or worms, that inhabit stream bottoms.
[4]Algae attached to submerged surfaces such as rocks or logs.

would be compared to upstream reference stations. The monitoring plan may be modified by the agencies in response to the information collected to reflect concerns specific to the construction, operation, and postoperational time periods.

In the event of a temporary mine closure, monitoring would continue unless the agencies agreed to reduce or suspend monitoring requirements.

Preconstruction Baseline Studies

The purpose of the baseline program is to sufficiently describe the aquatic community that existed prior to mine development and compare the baseline data to construction and operations data. Without an adequate baseline, it is difficult to determine whether changes in an aquatic community are caused by mine disturbances or by natural occurrences (i.e., seasons). The aquatics baseline data collected within the Rock Creek Mine project area from 1985-1988 appears to be inadequate for the following reasons:

- reference sites would not be comparable to potential impact sites;
- seasonal data for some sites are incomplete;
- some baseline sites were not sampled consistently because of flow problems;
- the alternative mill site location at the confluence of the east and west forks of Rock Creek could require selection of additional sites (for Alternative IV or V); and
- additional surveys are needed to better understand bull trout populations and the amount and condition of spawning habitat.

Prior to the beginning of the proposed project, an updated baseline monitoring program would be developed and implemented with approval by the Agencies. This program would incorporated the components described below.

Benthic Macroinvertebrates

Sterling would maintain detailed maps and photographs of each sampling site so that the sties can be accurately relocated each year. In addition, permanent markers would be installed at each study site.

Quantitative macroinvertebrate data would be collected three times per year at approximately ten sampling stations. Sampling stations would be selected to represent a range of impacted and unimpacted conditions. In order to reduce variability, sampling areas should be restricted to those of a similar physical nature as much as possible (Klemm et al. 1990). It may be necessary to locate a suitable reference station outside the Rock Creek drainage. Samples would be taken in a quantity and manner approved by the Agencies. If possible, sampling would be done in the same or similar manner as the baseline samples.

Data analysis techniques would include, but are not limited to, the following:

- standing crop
- taxa richness

- percent dominant taxon
- ratio of functional feeding groups
- Shannon-Weaver diversity index
- equitability (Lloyd and Bhelardi 1964)
- community similarity index
- pollution tolerance indices
- EPT/C (total mayflies, stoneflies, and caddisflies divided by total chironomids)
- EPT abundance and richness

Data would be compiled by season and comparisons would be made between potential impact sites and reference sites. Data would also be compared with baseline data.

In addition, bioassays would be conducted with water samples taken from locations to be specified by the Agencies. Likely sampling locations are the mine adit waste water, tailings storage facility seepage water, and Rock Creek water downstream of the mill site. Test animals would be selected by the Agencies prior to the start of monitoring.

Fine Sediments

Fine sediment loading of spawning gravels in Rock Creek would be estimated using at least two different sediment analysis techniques[5] at a variety of sampling stations within the drainage. Sampling techniques, times, and locations were to be approved by the Agencies prior to the start of monitoring.

Periphyton

Monitoring would be done at the same times and locations as the benthic macroinvertebrates sampling, unless otherwise specified by the Agencies. Sample collection, processing, and analysis techniques (Protocol II, control site protocol) as described in Bahls (1993) would be used.

Fish Populations

Fish populations in Rock Creek would be monitored at 2-year intervals at a variety of stream reaches representing impacted and unimpacted conditions. Baseline sampling sites should be included in the monitoring plan sites. Population densities of each fish species would be estimated, where adequate sample sizes permit with snorkeling data, using the Seber-LeCren multiple pass method or comparable method to make population estimates.

Bioaccumulation of Metals in Fish Tissue

Fish would be collected from main stem Rock Creek and the east and west forks of Rock Creek for metals analysis. Tissue samples from collected fish would be analyzed to determine concentrations of zinc, copper, mercury, cadmium, and lead, which would then be compared to baseline concentrations. Baseline concentrations (from 1985) exist for zinc, copper, and mercury, but not for cadmium and lead.

[5]Recommended methods include substrate score and McNeil Core substrate sampling methods.

Data collected during the first quarter of adit construction would serve as baseline for cadmium and lead. Test procedures and analysis would be the same as those used for baseline testing, unless changed by the Agencies. Sampling would be done annually for 5 years and then every 3 years until reclamation was complete, unless otherwise required by the Agencies. If metal concentrations in fish tissue became elevated to a level of concern, an ecological risk assessment would be conducted at the discretion of the Agencies.

Bull Trout in the Clark Fork River

Sterling would work with FWP and USFWS to monitor the effects of the mine discharge from the diffuser on bull trout between Noxon Dam and the confluence of Rock Creek and the Clark Fork River. This would be necessary to determine if changes need to be made in diffuser design or requirements within the MPDES permit (mixing zone, effluent limits, etc.) to maintain migration of bull trout across the diffuser.

Spills and Accidents

In the event of an accidental discharge of toxic or hazardous materials or sediments, supplemental monitoring maybe required by the Agencies if there is a reasonable possibility that the environment could be adversely affected. Sterling would be required to immediately report all such accidental discharges to permitting Agencies. The type, frequency, and location of monitoring would be contingent on the circumstances of the accident. Mitigations and recommended monitoring for several likely spill or accident scenarios would be developed as part of an Emergency Action Plan prior to mine operation. This would facilitate the process should a spill or accidental discharge of toxic or hazardous material occur.

Quality Assurance/Quality Control

To provide QA/QC for these studies, Sterling would maintain a permanent taxonomic reference collection that contained all benthic species and representative samples of all dominant and indicator taxa of periphyton[6] collected from project area streams. Taxa identification in this collection must be documented and confirmed by taxonomic experts who must be selected in concurrence with the Agencies. This reference collection would be maintained by Sterling through the period of postoperational monitoring. Following this period, the collection should be transferred to a depository selected by the Agencies for permanent scientific reference.

Reporting

Sterling would submit an annual aquatic monitoring report that contained summaries of all aquatic monitoring data collected during the previous year. Each report must also discuss trends in plant and animal population patterns and evaluate changes and trends in terrestrial and aquatic habitat quality, based on all data collected to date for the project. Recommendations in these reports could include modification to increase monitoring efficiency or to improve the quality of the data.

[6]All non-diatom taxa would be preserved in vials and representative permanent slide mounts made for diatom taxa.

SPRINGS AND SEEPS VEGETATION MONITORING PLAN

The following guidelines would be used to develop a monitoring plan for potential vegetation changes as a result of changes in water quality or flow from mine development.

1. Initiate a survey to identify, document, monitor and evaluate wetland plant communities in non-surface disturbance areas (i.e., high/mid elevation springs and seeps) prior to the construction of the development adits. These wetland plant communities should be identified and monitored for their persistence in relation to ground water diversions associated with mining activities. Surveyed areas, should incorporate the identification of facultative and obligate wetland plants and associated hydrophilic sensitive, threatened and endangered plant species. This information would be related to and coincide with the water quality quantity sampling of springs as discussed in the Water Quality Monitoring Plan, Chapter 4.
2. A professional botanist/plant ecologist would design survey methodology and protocols.
3. Initial surveys should be semi-permanent and contain site photo points and GPS site locations.
4. Initial surveys should contain basic site descriptors, hydrophilic plant species (facultative and/or obligate) and their relative frequency.
5. One or two indicator hydrophilic plants (obligate) and their relative frequency should be chosen from the initial survey information - trigger plants.
6. A botanist/plant ecologist would gauge observable increases should use trigger plants and associated rapid observational percentage/frequency information or decreases in obligate plant species.
7. Trigger plants will serve as a basic “trigger” to begin additional monitoring in a particular site. Other water quantity and quality information will be used to facilitate or strengthen monitoring decisions.
8. If a change in flow or water quality is noted outside the baseline data for an individual site or set of sites, then a re-evaluation of those potentially affected plant communities would be conducted and documented for comparison against initial survey information. If water quality or flow remain within baseline parameters, then on a five year cycle a survey in areas of current development would be conducted and compared to the initial survey.
9. If, as a result of the proposed action, trigger plant percentages are declining to a level where population numbers may affect reproduction of the species for that site, then the agencies may require additional monitoring effort for the following year. Dependent on a combination of biological variables and/or the severity of plant indicator decline, the agencies can insist on a more in-depth monitoring effort. If a “trigger” plant declines two years in a row, then additional monitoring may be required for the following year.

RECLAMATION MONITORING PLAN

This plan provides the conceptual framework necessary for development of a reclamation monitoring program for the Rock Creek Mine Project. Sterling had included a revegetation and a soils and erosion control monitoring plan in its application, however, the Agencies believe that those plans needed to be expanded to reduce the risk of sedimentation and revegetation failure (see Chapter 2 and Appendix J).

The final plan would contain specific information on vegetation removal and deposition, soil salvage and handling, sampling methods, frequency of sampling, chemical parameters and analysis methods for any soil testing, and reporting. The reclamation monitoring program would begin as soon as construction activities were initiated and would continue until the Agencies released the reclamation bond.

The overall reclamation goal is to achieve short- and long-term stability and utility of the disturbed lands. The conceptual reclamation monitoring plan contains several elements:

- monitoring soil salvage, handling, segregation, quantity, and quality;
- soil erosion and construction monitoring; and
- revegetation monitoring.

Monitoring of Soil Salvage and Handling

Monitoring would take place throughout mine life during soil salvaging and replacement to ensure that adequate reclamation materials were salvaged, stored and respread according to a revised and expanded soil salvage and handling plan. Soil depths would be verified using standard USDA methods.

Soil salvage activities would be monitored to verify depth and suitability (primarily rock content) of each lift. Monitoring would also verify that each lift was stored in appropriate locations. Soil replacement activities would be monitored to verify that lifts were replaced in the proper sequence and with sufficient depths. A 100 x 100-foot grid would be established on reshaped landforms at final reclamation of disturbances. After soil replacement, the grid would be resurveyed to verify proper total soil replacement depths. The average of all sample points per reclaimed unit must meet the soil replacement depth identified for each disturbance area. In addition, no sample point on the grid should have less than 50 percent of the required replacement depth.

Stored soil would be tested before respreading to identify what, if any deficiencies or limitations in soil physical and chemical properties existed that may affect plant growth. Appropriate fertilizer, liming, organic matter, and other amendments would be determined.

Soil Erosion and Construction Monitoring

This component of the reclamation monitoring plan has two phases: monitoring of active construction and long-term maintenance monitoring. In general, monitoring would be done to identify areas where slumps, rills, gullies, and sheet wash were occurring. Any erosion problems identified would be immediately corrected.

Sterling would conduct annual audits of best management practices (BMPs) implemented during construction of roads and other project facilities. This monitoring would be ongoing throughout road and mine construction and into the operational period for the tailings storage area. If deviations from BMPs were found, Sterling would immediately correct the practice as well as resource damage that had occurred. In addition, sediment source surveys would be conducted in the Rock Creek and Bull River drainages. Sterling would be responsible for mitigating sediment sources on NFS lands in the Rock Creek drainage equivalent 400 tons of sediment per year.

Routine long-term maintenance monitoring would be conducted during spring and fall and after heavy storm events. This monitoring would focus on reclaimed and disturbed areas. If necessary, immediate erosion control measures would be applied such as reseeding, mulching and other appropriate BMPs.

<u>Revegetation Monitoring</u>

Revegetation would be monitored annually during the growing season to identify areas where vegetation was failing and determine the cause. Revegetation monitoring should be conducted in conjunction with the routine soil maintenance monitoring. Systematic visual inspections would be conducted to identify areas that have inadequate cover, poor seedling growth, damage, or poor nutrition.

If problem areas were identified, Sterling would need to identify the cause. If the cause appeared to be related to soil infertility or toxicity, then a soil testing program would need to be implemented for the problem area. Soil chemistry tests would be conducted to ascertain macro- and micronutrient status, pH, cation exchange capacity, and potential toxicity and heavy metal problems. Problems could also be caused by inadequate watering or inappropriate species or varieties being planted. Appropriate remedial actions would be taken to correct the problem.

Revegetation success of tree seedlings would be critical to mitigate the visual impacts of project facilities. A sampling design for monitoring tree stocking would be specified in the plan and approved by the Agencies. Other parameters such as ground cover, production or biomass, and plant density could be proposed by Sterling to quantitatively evaluate the revegetation success of grasses, shrubs and forbs. Tree establishment surveys are recommended at years 1, 3, and 5 after planting.

Post-closure monitoring of trees should be conducted for up to 20 years after mining to determine if visual mitigations have been achieved. Frequency and amount of monitoring would be approved by the Agencies.

<u>Reporting</u>

An annual report would describe any reclamation problems that were identified and remedial measures taken.

PLANT SPECIES OF SPECIAL CONCERN MONITORING PLAN

Monitoring pertains to all lands within the permit boundary for threatened and endangered plants but only to Forest Service lands within the permit boundary for sensitive plants. Additional on-site verification studies would be performed during development of final facility designs to precisely locate any additional KNF sensitive plant populations as well as populations of Montana Natural Heritage Program (MNHP) plant species of special concern for avoidance. Whenever the KNF sensitive species list was updated, the Kootenai Forest Botanist would alert Sterling with the updated list. Sterling would be responsible for ensuring that various plant surveys are revisited and conform to KNF program standards within the project area to determine whether or not newly listed species as well as any new MNHP plant species of special concern had been identified.

THREATENED, ENDANGERED, and PROPOSED TERRESTRIAL SPECIES MONITORING PLAN

This document outlines the basic monitoring elements to be designed in detail by the participating agencies and project proponent. The monitoring elements are connected to required mitigation items from the T&E mitigation plan which is found in the Biological Assessment. Monitoring will be conducted by the Proponent and the Agencies as indicated below.

Reporting Interval

The results of all monitoring efforts will be reported annually, unless specified other wise. An annual monitoring report will be written and given to the deciding officials by February 15th of each year.

Monitoring Elements (Proponent responsibility)

- ♦ Following proponent development and agency approval of the mine transportation plan, the proponent will monitor the effectiveness of reducing mine related traffic by bussing employees to mill site. Proponent will provide traffic counts (summarized by month) and traffic type (to the extent possible - commercial, employee personal, bus, company vehicle, agency, non-mine related traffic). Agency will review to determine if mine related traffic levels are above projected levels. Adjustments to traffic levels may be determined following completion of construction phase, but prior to full operation. (Based on mitigation item A-1)

- ♦ Proponent will provide an annual summary of the number and species of all dead animals found. Proponent will report the death of a listed or proposed species immediately! Agency will use random trips to assure this is occurring. (Based on mitigation item A-3)

- ♦ Timely service of bear proof containers at all Mine facility sites (Mitigation item A-7) will be monitored. Problems in timely service will be corrected immediately.

- Results of seed application will be monitored to assure compliance with Mitigation item A-8. Preferred bear foods found in the seed mix and resulting plants will be removed immediately by the proponent.

- Monitoring of mitigation item A-9 (no firearms) will be done by the proponent and results reported to the agencies.

- Random checks to assure feeding of wildlife (mitigation item A-10) is not occurring will be done by the proponent and the annual report to agencies will document the number of violations.

- Proponent will provide assurance to the agencies that all employees complete training on living in bear country on an annual basis (mitigation item A-12). Assurance can be a current (dated) list of employees along with an attendance sheet bearing employees original signatures.

- All road closures implemented as part of the mitigation plan (item C-1) will be monitored by the proponent to assure that closures are effective. The question to be answered by the monitoring is: Are roads actually closed or not, based on use levels during various seasons? Seasons are: spring (April 1 - June 15); Summer (June 16 - September 15); Fall (September 16- November 30); and winter (December 1 - March 31). Annual report will show the total number of counts on traffic passing by each road closure being monitored, and provide an interpretation on the number of round trips those counts represent by season.

- Proponent will monitor recreational use levels on the Rock Lake and St. Paul trails (mitigation item C-3). Trail counters and other methods will be used to determine if use levels reach the "high" category as defined by the Interagency Grizzly Bear Committee.

<u>Monitoring Elements</u> (Agency responsibility)

- Traction mixture used during winter operations will be monitored by Forest Service to assure salt is not used. (Based on mitigation item A-2)

- Forest Service will monitor compliance with the food storage order (mitigation item C-2).

- Grizzly bear movement across fracture zones (FDR # 154, FDR # 220 and E.F. Rock Creek Trail) will be monitored by the U.S. Fish and Wildlife Service using radio telemetry methods. Results from this monitoring will be included in the annual "Cabinet/Yaak Grizzly Bear Recovery Area Research and Monitoring Progress Report". (Based on mitigation item E-3)

- The Forest Service will monitor the proponents efforts to remove animals killed by vehicles traveling along routes used for the evaluation, construction, and operation of the mine. This will be done with random trips along those routes. When animals are found that were not removed in the time frames specified in the mitigation plan, Forest Service will immediately notify proponent.

- Construction of powerlines according to criteria specified in the mitigation plan (item A-4) will be monitored by the agencies to assure compliance. Compliance will be recorded in the annual monitoring report until power line construction completed.

CULTURAL RESOURCE MONITORING PLAN

Monitoring would be required during any land disturbing activity that has potential to adversely impact unidentified sites. The areas to be monitored for Alternative V are identified in Figure 4-9. Monitoring must be completed by a qualified archaeologist meeting the Secretary's Standards and Guidelines for Archeology and Historic Preservation (48 FR 44716) and all four tribes would be afforded an opportunity to monitor the activity. If a site is discovered during project implementation, activity would stop until the site is formally recorded and evaluated for eligibility to the National Register of Historic Places.

Should a historic site (non-aboriginal) be discovered on private lands during project implementation, that activity would stop and the on-site archaeologist would notify the Montana State Historic Preservation Officer. Should a prehistoric site (aboriginally- affiliated) be discovered on private lands during project implementation, activity would immediately stop and the on-site archaeologist would notify the Kootenai National Forest, the Montana State Historic Preservation Officer and the four tribes.

If an historic or prehistoric site were discovered on federal lands during project implementation, activity would immediately stop and the on-site archaeologist would notify the Kootenai National Forest, the Montana State Historic Preservation Officer and the four tribes (if the site were a prehistoric site). All sites would be formerly recorded and evaluated for eligibility to the National Register of Historic Places".

Evaluation should consider traditional tribal history. Should a site be determined to be eligible (in consultation with Tribes and formal review of the Montana State Historic Preservation Office (MTSHPO), consideration of effects of continuing with the project activities should be characterized (36 CFR 800.5). A determination of adverse effect should result in the design of mitigation measures. Mitigation measures will be described in a plan for site protection or data recovery. Mitigation plans require consultation with Tribes, and formal review by the MTSHPO and the Advisory Council on Historic Preservation, resulting in a Memorandum of Understanding. Failure to stop work and notify the proper authorities may result in criminal and civil penalty as prescribed by state and federal law. A determination of adverse effect would result in the design of mitigation measures.

A Memorandum of Understanding (MOU) would be drafted to outline a protocol to follow when aboriginally affiliated cultural materials are encountered during monitoring. The MOU would include a specific process for site evaluation, data collection, and curation of artifacts. This protocol must be in-place prior to surface disturbing activities as identified for monitoring areas in Figure 4-9.

In Montana, when human remains are found on non-federal lands, the Montana State Burial Law comes into effect. First the local coroner is called and then the State Burial Board. The State Burial Board is made up of tribal representatives, representatives of the MTSHPO, the State Coroners Association, physical anthropologists and archaeologists.

In the event that human remains are discovered on federal lands during monitoring, the Native American Graves Protection and Repatriation Act and its implementing regulations take effect. All land disturbing activity must stop until the following steps are taken. The federal process for meeting the intent of NAGPRA (Public Law 101-601 November 16, 1990) and it's implementing regulations (43 CFR

10) for inadvertent discoveries of human remains, funery objects, sacred objects and/or objects of cultural patrimony on federal land includes the following:

1. The KNF archaeologist or a designated representative would send a certified receipt notification of the inadvertent discovery to all four Tribal Officials, including the type of remains found, the status of law enforcement involvement, and the location of the discovery. This would take place no later than 3 working days after discovery [10.4(d) (i)]. They will also telephone each Tribal Official immediately, but no later than 3 working days after discovery [10.4 (d) (iii)].
2. The KNF Archaeologist or a designated representative will follow-up with a letter of consultation 10.5 (b) (iv) (3) to each designated Tribal NAGPRA Specialist detailing:
   a) A time and place for further consultation [10.5 (b) (iv) (2)].
   b) A list of tribes that have been notified [10.5 (c) (1)].
   c) Intent to forward any additional documentation [10.5 (c) (2)].

3. The Tribal NAGPRA Specialist will coordinate the identification of all lineal descendants and will keep of list of who has been contacted [10.5 (d) (2)].

4. The Tribal NAGPRA specialist will document the specific information used to determine custody (geographical, kinship, biological, archaeological, linguistic, folklore, oral tradition, historical) [10.5 (e) (2)]. First priority for custody will be given first to the lineal descendant [10.6 (a) (1)] and then to the Tribe with the closest cultural affiliation [10.6 (a) (2) (ii)].

5. The KNF Archaeologist will prepare reports [10.5 (d) (8)] to include:
   a) location of discovery
   b) description of discovery
   c) dates, times, and nature of consultation with the Tribes
   d) analysis reports
   e) archaeological records
   f) treatment and storage of human remains, funerary objects, sacred objects, or objects of cultural patrimony recovered
   g) the custody and disposition of human remains, funerary objects, sacred objects, or objects of cultural patrimony

6. The KNF will publish a notice of the proposed disposition of human remains, funerary objects, sacred objects, or objects of cultural patrimony at least two times at least one week apart in the Federal Register and tribal papers [10.6 (c)]. The notice will provide information as to the nature and affiliation of the human remains, funerary objects, sacred objects, or objects of cultural patrimony, and will solicit further claims to custody.

Consultation with each Tribe will determine proceedures on a case-by-case basis according to [10.5 (d) (3-9)].

1. Planned treatment, care and handling of human remains, funerary objects, sacred objects, or objects of cultural patrimony recovered.

2. Planned archeological recording of human remains, funerary objects, sacred objects, or objects of cultural patrimony recovered.

3. Planned analysis of human remains, funerary objects, sacred objects, or objects of cultural patrimony recovered.

4. The kind of traditional treatment to be afforded by the Tribes for human remains, funerary objects, sacred objects, or objects of cultural patrimony recovered.

TAILINGS PASTE FACILITY AND TAILINGS SLURRY LINE CONSTRUCTION AND OPERATION MONITORING PLAN

The intent of the construction monitoring plan for the tailings paste facility and associated tailings slurry lines would be to establish standard of care construction implementation, testing, and reporting guidelines. The plan would outline construction QA/QC protocols to ensure that any constructed facility was being constructed to the design and performance standards set forth in the application and the design documents. Prior to construction Sterling would submit a construction monitoring plan to the Agencies for approval. The construction monitoring plan for the tailings paste facility and the tailings slurry line is divided into four discrete time segments. The four time segments are as follows:

- Final Design Phase: Agency review and approval of final designs for tailing paste facility, paste plant, tailings slurry lines, and emergency dump ponds.
- Preproduction Construction Phase: Standard inspection and quality control procedures would be implemented with periodic interim construction reports submitted at 2-month intervals during construction of toe buttresses. A final construction report would be submitted prior to operation. This report would contain as-built drawings.
- Operational Phase: Monitoring would continue throughout project life and would include routine inspections and reports of facility geometry, material specification, embankment drainage, foundation pore pressure, and observational performance.
- Interim Facility Shutdown: In the unlikely event of a shutdown, the tailings facility monitoring plan would be continued.

WATER TREATMENT PLANT CONSTRUCTION AND OPERATION MONITORING PLANS

The intent of the water treatment construction and operation monitoring plan is to establish QA/QC practices and operational standards for the water treatment plant and associated activities. The operating plan will include operating protocols, water quality treatment standards, and contingency plans for system upset or malfunction. These plans would be submitted to the Agencies for approval prior to plant construction.

MINE, MILL AND ASSOCIATED FACILITIES CONSTRUCTION AND OPERATION MONITORING PLANS

All mine and mill facilities will have construction and operation monitoring plans. These plans will outline standard of care construction practices for these facilities, and will include information of testing, monitoring, and reporting. The site location of certain facilities may encroach on sensitive habitat, and construction practices will be clearly defined in regards to building in these areas so as to minimize impacts.

The intent of the operation monitoring plans is to establish protocols for the operation of all facilities to ensure standardized performance. The operating plans will address daily operations, contingency plans, system upsets and performance criteria. The plans will be submitted to the Agencies for approval prior to construction.

APPENDIX L

WETLANDS MITIGATION PLAN FOR ALTERNATIVE V

This appendix contains a copy of the wetlands mitigation plan associated with the Alternative V tailings paste deposition. The wetland mitigation designs presented in this appendix were originally prepared by the Applicant and are contained in the third Chapter of the Rock Creek Wetland Inventory, Consideration of Alternatives, and Wetland Mitigation Plan. This mitigation plan has been revised based on public input and comments from the supplemental EIS and Agencies participating in the EIS process.

APPENDIX L
WETLAND MITIGATION PLAN

This Wetland Mitigation Plan was originally submitted by the applicant (Rock Creek Project) in September 1995 as part of the mitigation under action Alternative 4 with modifications. The Agencies have revised this Plan to account for changes proposed under action Alternative 5 and to include the 6 optional wetland mitigation areas proposed by the applicant in 1998. The Agencies have also modified the proposed wetland revegetation mixture to include both native plant species (preferred) and non-natives (where other options are not feasible), as specified in the Kootenai National Forest Plan.

The Rock Creek Project, at the end of operations, will directly affect approximately 5.2 acres of jurisdictional wetlands and potentially indirectly affect about 1.0 acres of adjacent jurisdictional wetlands. The project will also directly affect about 0.4 acres of non-wetland Waters of the U.S. Therefore, the affected acreage would total approximately 6.2 acres of wetlands and 0.4 acres of non-wetland Waters of the U.S. The goal of the mitigation plan is to provide "no net loss" of wetland. Table L-1 summarizes acreage of wetland and non-wetland Waters of the U.S. to be affected and acreage to be created by mitigation. Table F-2 in Appendix F details, by project component, the amount of directly and indirectly affected wetland and non-wetland Waters of the U.S. In compliance with Section 404(b)(1) of the Clean Water Act, the mitigation plan provides appropriate mitigation and compensation of the unavoidable loss and potential diminishment of wetland values associated with development of the Rock Creek Project. About 18.9 acres have been identified as available and suitable for creating wetlands. Of the 18.9 acres, Sterling proposed to initially create about 10 acres of wetlands (1.5:1 ratio) to compensate for the loss of 6.6 acres of directly and indirectly affected wetland and non-wetland Waters of the U.S.

TABLE L-1
SUMMARY OF WATERS OF THE U.S. AFFECTED AND CREATED
ROCK CREEK PROJECT, SANDERS COUNTY, MONTANA

CATEGORY	ACREAGE AFFECTED		ACREAGE CREATED
	Direct	Indirect	
Wetland	5.2	1.0	>10.0
Non-Wetland Waters	0.4	0.0	0.0
TOTALS	5.6	1.0	>10.0

L.1 SELECTION OF WETLAND MITIGATION SITES

Mitigation by avoidance and minimization of impacts to Waters of the U.S. is discussed in Chapter 2 of the EIS. Wetland creation is proposed to mitigate unavoidable wetland losses. Wetland creation will be conducted at three (3) main sites and six (6) optional sites identified as:

Main Wetland Mitigation Sites

1. Miller Gulch Tributary: This site is an ephemeral-flow drainage west of the proposed tailing storage site (Sterling and USFS surface ownership);

2. Upper Rock Creek: This site is between Rock Creek and FDR No. 150 north of the proposed tailing storage site and south of the proposed mill site (Sterling surface ownership);

3. Lower Rock Creek: This site is east of the proposed tailing storage site and north of Rock Creek in the vicinity of the previously proposed Borrow Area 3 (USFS surface ownership). Borrow Area 3 was deleted as a result of design changes in the tailing storage facility.

Optional Wetland Mitigation Sites

1. Upper Rock Creek Wetland Mitigation Site Extension: This area is just north of the proposed Upper Rock Creek Wetland Mitigation Site. It was not proposed for wetland mitigation due to the proximity of the Exploration Support Facility. Since these facilities have been relocated, wetland mitigation can be expanded to the north.

2. Miller Gulch Tributary Wetland Mitigation Site Extension: Wetland hydrology at this site would rely on surface water provided by the diversion on the northwest side of the tailings storage facility.

3. Lower Rock Creek Wetland Mitigation Site Extension: This site represents a western extension of the proposed mitigation area and would rely on surface water provided by the diversion on the northeast side of the tailings storage facility.

4. Access Road Wetland Mitigation Site: This site (previously designated Optional Mitigation Site 2) lies along the lower portion of the proposed access road and contains soils with low percolation rates suitable for surface water retention with minimal surface manipulation.

5. Middle Rock Creek Wetland Mitigation Site: Previously designated Optional Mitigation Site 1, this area is between the Upper and Lower Rock Creek sites on a terrace above Rock Creek.

6. Clark Fork River Bench Wetland Mitigation Site: Previously designated Optional Mitigation Site 3, this site occurs east of the Clark Fork River and south of Rock Creek in an area of fine-textured soils previously disturbed by construction of the Noxon Rapids Dam.

Wetland creation (mitigation) sites are shown on Figure L-1. All figures are found at the end of this Appendix. Figure L-1 also depicts the optional sites for additional wetland creation should proposed sites prove unfeasible or should projected wetland creation acreage fail to meet proposed goals at any mitigation site. Acres of proposed wetland creation are listed by site in Table L-2.

As final design is completed for the Rock Creek Project, some mine-related components such as borrow areas for reclamation material, diversion ditches, or other storm water control structures may be found suitable for wetland mitigation. If proposed mitigation is not successful, these additional alternative sites will be evaluated in conjunction with involved agencies for suitability for wetland creation.

Criteria used for mitigation site selection included: 1) suitability for establishing similar functions and values as directly and indirectly affected wetland; 2) proximity to the project area yet sufficiently removed from activity to reduce project-related disturbance; 3) surface ownership; 4) cumulative acreage of sites to achieve a minimum acreage replacement ratio of one and one-half to one; and 5) relative cost of mitigation.

In general, there are two broad classes of wetlands based on hydrology: 1) wetlands which derive water from perennially shallow or seasonally shallow water tables and 2) wetlands which derive water from surface water run-on and/or precipitation. The mitigation site for groundwater supplied wetlands (Upper Rock Creek wetland mitigation site) was selected based on groundwater level observations for a well in the area and demonstration test sites. Suitability of the mitigation sites for surface water supplied wetlands (Miller Gulch Tributary and Lower Rock Creek) was based on a detailed water balance. Specific climatic and hydrologic factors evaluated in the design of surface water supplied mitigation wetland areas included:

- average monthly precipitation and evaporation
- average monthly runoff
- infiltration into soils
- retention period of inundation

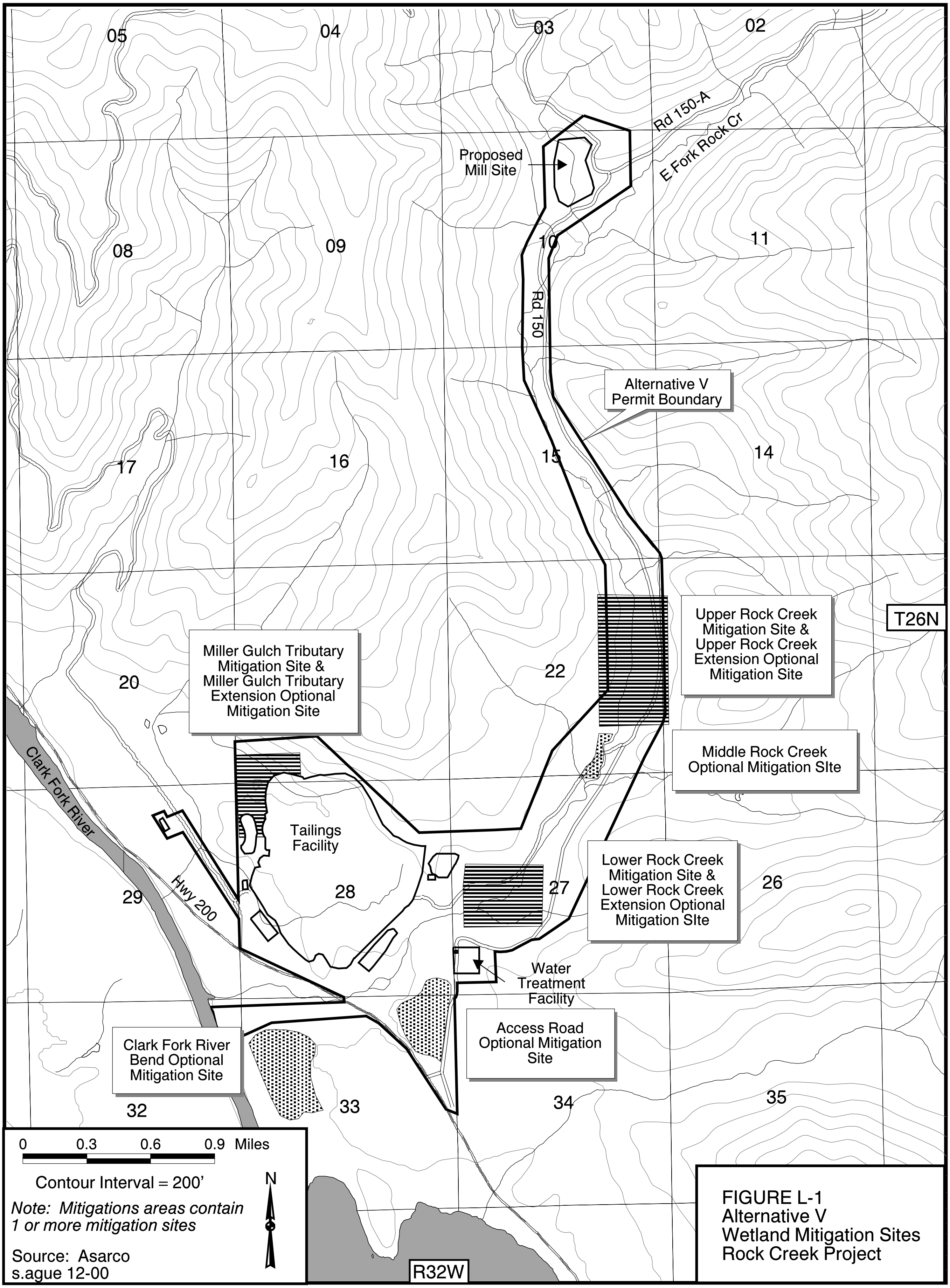


FIGURE L-1
Alternative V
Wetland Mitigation Sites
Rock Creek Project

TABLE L-2
ACRES OF PROPOSED WETLAND CREATION BY SITE,
ROCK CREEK PROJECT, SANDERS COUNTY, MONTANA

SITE NAME	SITE NUMBER	AREA (Acres)
Main Wetland Mitigation Sites		
Miller Gulch Tributary	1	0.06
	2	0.07
	3	0.10
	4	0.23
	5	0.15
	6	0.11
	7	0.31
	8	0.12
SUBTOTAL		**1.15**
Upper Rock Creek		4.42
Lower Rock Creek		1.43
Optional Wetland Mitigation Sites		
Upper Rock Creek Extension		1.60
Miller Gulch Tributary Extension		1.00
Lower Rock Creek Extension		0.30
Access Road		3.0+
Middle Rock Creek		1.00
Clark Fork River Bench		5.0+
TOTAL WETLAND CREATION		**18.90**

These factors were used to determine the average monthly volume of water stored in each wetland and, based on the configuration (shape and depth) of the wetlands, the areal extent of saturated/inundated soils for each wetland are estimated. Methods of calculation, and summary water balances for the proposed Miller Gulch Tributary and Lower Rock Creek mitigation wetland sites are presented in appendices to ASARCO (1993). As designed, these mitigation wetlands would be fully inundated for three to four months during snowmelt runoff (March through May or June) and partially inundated or saturated through July and August.

L.2 WETLAND MITIGATION DESIGN

Criteria used in developing wetland mitigation included:

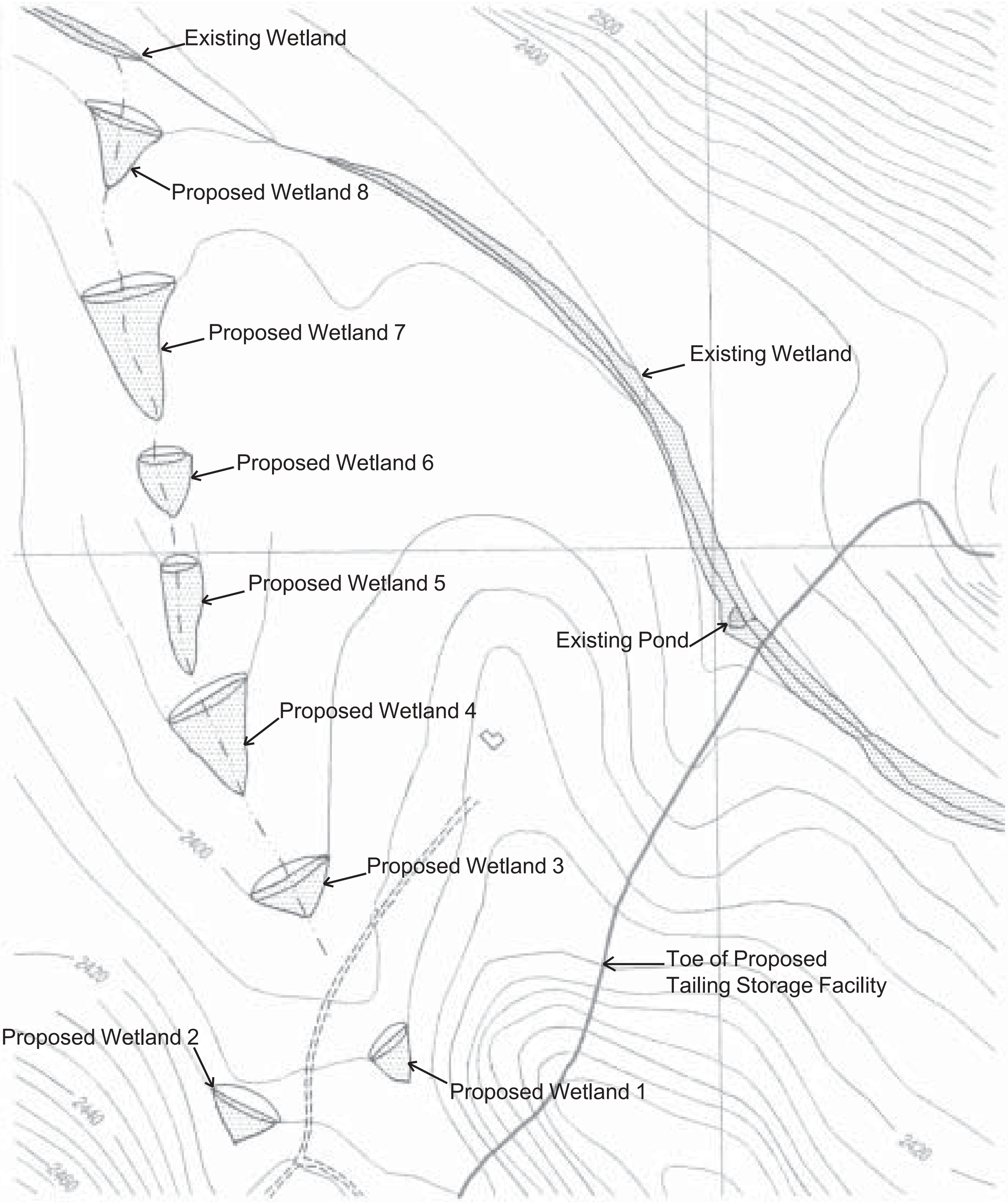
- Avoid disturbance to existing wetland;
- Select areas where wetland can be created with similar functions and values as those directly and indirectly affected by the operation;
- Select sites as close to disturbed wetland as possible;
- Select sites that have the hydrologic, edaphic and topographic capability to support and maintain wetland;
- Select areas where surface ownership favors long-term management of wetland;
- Develop mitigation plans that do not rely on periodic maintenance; and
- Minimize potential impacts of constructed wetland on adjacent or downstream land or to sensitive plant or animal species.

L.2.1 Miller Gulch Tributary

The main tributary of Miller Gulch (M-3) drains the northwestern portion of the proposed tailing storage facility. A narrow linear wetland in the upper portion of this drainage will be filled by construction of the tailing storage facility. A side drainage of this tributary in sections 21 and 28 (Figure L-2) does not currently contain wetlands and will not be filled by the operation. This side drainage will be used to create wetlands with functions and values similar to small, seasonally inundated or saturated wetlands affected by the tailing storage facility. Surface ownership of this mitigation site is Sterling and the USFS.

Establishment of Wetland Hydrology

Establishment of wetland hydrology in the side drainage will rely on duplication of hydrologic conditions which have resulted in existing wetland formation within the proposed tailing storage area. These hydrologic conditions are seasonal concentration and/or temporary retention of water on low permeability, poorly-drained lacustrine soils. Concentration or storage of water on these fine-grained lacustrine sediments results in saturated and occasionally inundated soils for a duration and frequency which allows the development of wetland vegetation communities.



Scale: 1"=200 ft. (approximately)

FIGURE L-2
Miller Gulch Tributary
Wetland Mitigation Site
Rock Creek Project

Surficial materials in the side drainage are low permeability lacustrine deposits of silty clay and sandy silt which also underlie the existing Miller Gulch wetlands immediately to the north. Although the area of the side drainage basin is not large (36.3 acres) and will be reduced by about 6.4 acres by the tailing impoundment, the drainage basin is similar in size to other nearby drainages that do support wetland areas. The primary reason that the drainage does not currently contain wetlands is that the drainage has a steeper gradient than other adjacent drainages supporting wetlands. As a result of this steeper gradient, retention of surface runoff and saturation/inundation of soils is of insufficient duration to support hydrophytic vegetation communities.

Establishment of wetland hydrology in the side drainage will rely on flow barriers designed to increase surface runoff retention and duration of soil saturation/inundation. Methods of calculation, and summary water balances for this mitigation site are in Appendix 3-1 of the Rock Creek Project Wetland Inventory, Consideration of Alternatives and Mitigation Plan (ASARCO 1995b). As designed, these mitigation wetlands would be fully inundated for three to four months during snowmelt runoff (March through May or June) and partially inundated or saturated through July and August.

Site Development

During wetland identification and delineation surveys, it was observed that minor depressions created by past logging disturbance in drainages and downed logs across drainage bottoms provided sufficient increased moisture retention to support localized hydrophytic vegetation. Creation of flow barriers in the tributary to Miller Gulch will increase water retention and allow hydrophytic vegetation development. Small detention dikes will be constructed at approximately 200-foot intervals along the length of the drainage (Figure L-2). The dikes will be 30 to 50 feet long with a maximum height of five feet (Figure L-3). The detention dikes will retain flows for sufficient time during seasonal precipitation events (and snowmelt) to allow establishment of hydrophytic vegetation. Rock-lined spillways will be designed for each dike.

Prior to dike construction, soils and substrate in the drainage will be evaluated to assess permeability. If hydraulic conductivity is greater than 10^{-6} or 10^{-7} cm/s, sealing or lining of the areas upstream of the dikes will be considered (the use of clay-rich earthen and compacted materials will be preferred over the use of manufactured HDPE or PVC liners). At some moisture retention sites, minor grading will be conducted to extend areal extent of the seasonally flooded area.

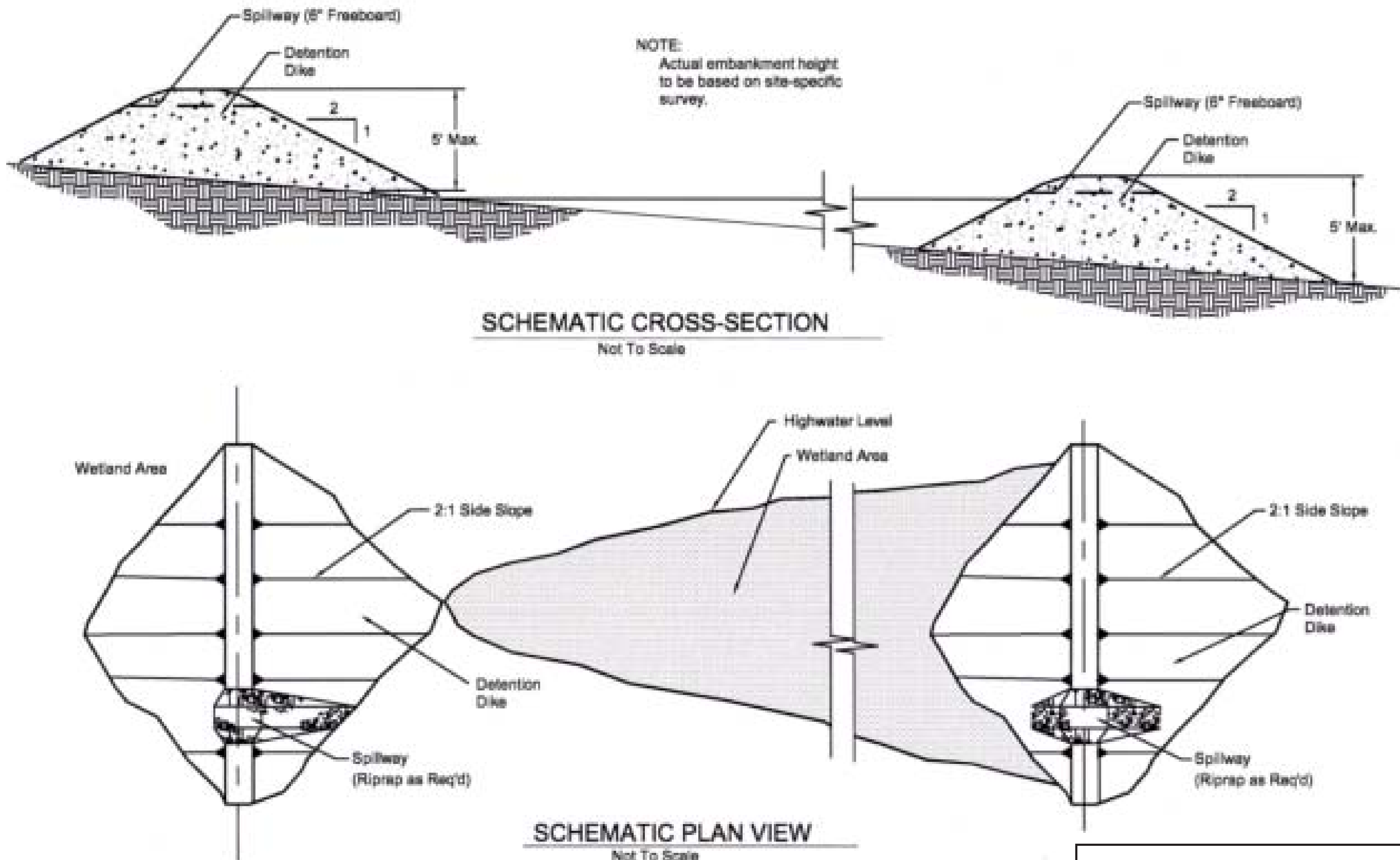


FIGURE L-3
Typical Detention Dike Design
Miller Gulch Tributary Wetland
Mitigation Site
Rock Creek Project

Soil Handling

Soils on this mitigation site have formed in silt loam to silty clay loam lacustrine sediments exhibiting good salvage quality to 11 inches. A portion of the soils in each retention area will be used for detention dike construction, and will provide suitable materials for dike revegetation and stabilization.

Hydric soils from the portion of Miller Gulch to be affected by the tailing storage facility will be salvaged and directly respread on the mitigation sites providing increased organic matter and a plant materials source.

Hydrophytic Vegetation Establishment

The hydrophytic vegetation community in the portion of Miller Gulch to be affected is a forested wetland dominated by western red cedar (*Thuja plicata*) and black cottonwood (*Populus trichocarpa*). Common understory species include alder (*Alnus* spp.), red-osier dogwood (*Cornus stolonifera*), bunchberry dogwood (*Cornus canadensis*), wild sarsaparilla (*Aralia nudicaulis*) and western goldthread (*Coptis occidentalis*).

The mitigation site will be revegetated using the wetland mixture in Table L-3. The following approach will be used for revegetation:

- Non-hydrophytic trees (all species except western red cedar and black cottonwood) will be salvaged prior to mitigation. Slash and stumps will be dozer-piled and burned.

- Following detention dike construction, available hydric soils salvaged from the tailing storage facility site will be spread along the drainage.

- After seedbed preparation (discing or harrowing), the area will be drill or broadcast seeded with the seeded species provide in the Wetland Mixture (Table L-3). The selected cuttings and tree species (from those listed in Table L-3) will be planted at the recommended planting rate. Containerized stock and rooted cuttings will be planted using materials collected in the vicinity of the project area, whenever possible. All stock will be dormant and in good condition when planted. Hand tools or mechanized equipment will be used to plant stock; proper planting procedures will be observed to maximize seedling survival. Planting densities are provided in Table L-3.

- Noxious weed-free straw mulch (2,000 pounds/acre) will be hydromulched (cellulose fiber mulch at 1,500 pounds/acre with tackifier at manufacturer's recommended rate).

TABLE L-3
WETLAND REVEGETATION MIXTURE[1]
ROCK CREEK PROJECT, SANDERS COUNTY, MONTANA

SPECIES		Planting Method	Wetland Status	Planting Rate[2]
Scientific Name	**Common Name**			**Pounds PLS or No. Transplants/acre**
GRAMINOIDS[3]:				
Agrostis alba	Redtop	Seed	FACW	0.25
Calamagrostis canadensis	Bluejoint Reedgrass	Seed	FACW+	0.25
Carex lenticularis	Lentil-fruit Sedge	Cuttings	FACW+	>200
Carex pachystachya	Sedge	Cuttings	FAC	>200
Deschampsia caespitosa	Tufted Hairgrass	Seed	FACW	0.50
Elymus glaucus	Blue Wildrye	Seed	FACU	1.00
Juncus tenuis	Rush	Cuttings	FAC	>200
Luzula parviflora	Small-flower Woodrush	Cuttings	FAC-	>200
Scirpus microcarpus	Small-fruit Bulrush	Cuttings	OBL	>200
FORBS[4]:				
Coptis occidentialis	Western goldthread	Cuttings	NI	>50
Epilobium angustifolium	Fireweed	Seed	FACU+	0.25
Epilobium ciliatum		Seed	FACW-	0.25
Equisetum arvense	Field Horsetail	Cuttings	FAC	>50
Galium triflorum	Bedstraw	Seed	FACU	0.25
Gymnocarpium dryopteris		Cuttings	FAC	>50
Habenaria saccata		Cuttings	FACW	>50
Habenaria viridis		Cuttings	FAC	>50

Senecio triangularis	Arrowleaf Groundsel	Seed	FACW+	0.25
Smilacina stellata	Lily of the Valley	Cuttings	FAC-	>50
Tiarella trifoliata	False Miterwort	Cuttings	FAC-	>50
Viola glabella	Smooth Yellow Violet	Cuttings	FACW+	>50
SHRUBS[5]:				
Acer glabrum	Rocky Mountain Maple	Cuttings	FAC	>33
Alnus sinuata	Mountain Alder	Cuttings	FACW	>33
Berberis repens	Oregon Grape	Cuttings	NI	>33
Cornus canadensis	Bunchberry Dogwood	Cuttings	FAC-	>33
Crataegus douglasii	Black Hawthorn	Cuttings	FAC	>33
Lonicera involucrata	Twin-berry Honeysuckle	Cuttings	FAC	>33
Rubus parviflorus	Thimbleberry	Cuttings	FACU+	>33
Rubus ursinus	Raspberry	Cuttings	NI	>33
Salix scouleriana	Scouler Willow	Cuttings	FAC	>33
Spiraea douglasii	Douglas Spiracea	Cuttings	FACW	>33
TREES[6]:				
Pinus contorta	Lodgepole pine	Cuttings	FAC-	>50
Populus trichocarpa	Black cottonwood	Cuttings	FAC	>100
Thuja plicata	Western red cedar	Cuttings	FAC	>50

[1]Seed and planting mixtures can be modified at any time with the agencies approvals.
[2]Pounds pure live seed per acre (PLS/acre). Rates are based on drilled seeding and should be doubled for broadcast seeding.
[3]Graminoid species to be planted include both seeded and transplanted cuttings. All four species with seed available to be seeded at a total rate of 2 pounds PLS/acre. Plus a minimum of 2 different graminoid species selected from the graminoid list and planted at a minimum of 200 cuttings per acre.
[4]Forbs to be planted include both seeded and transplanted cuttings. All four species with seed available should be seeded at a total rate of 1 pound PLS/acre. Plus a minimum of 2 different forb species selected from the forb list and planted at a minimum of 50 cuttings per acre.
[5]All shrubs planted using transplanted cuttings. A minimum of 3 different species selected from shrub list and planted at a minimum of 100 cuttings per acre.
[6]All trees planted using transplanted cuttings. All three species should be planted at their minimum number of cuttings per acre.

Re-establishment of Functions and Values

The wetlands proposed to be directly or indirectly affected in the upper portions of Miller Gulch Tributary M3, and nearby wetland areas not within this drainage, are located in intermittent drainages associated with gentle rolling topography, and have formed in natural low gradient drainages and surface depressions that concentrate surface water run-on from adjacent areas. Some of these wetland areas have formed in surface depressions caused by previous land disturbances (logging and skid trails). These wetlands are dependent on surface water run-on and/or precipitation, and are not dependent on perennially or seasonally shallow water tables. The low permeability of the near surface clays and silts, and the low hydraulic gradients in the area have created saturated soils and seasonal shallow standing water. For the purposes of wetland classification, many of these areas are considered to be Emergent Palustrine Wetlands.

The primary objective associated with the creation of the Miller Gulch Tributary wetland mitigation sites is to establish long-term wetland functions and values comparable to or greater than the wetland functions and values of the nearby directly or indirectly affected Miller Gulch area wetlands, as well as similar nearby affected wetlands not within the M3 Miller Gulch Tributary drainage. This objective includes the establishment of these functions and values in a manner that will not adversely affect the functions and values of other downgradient undisturbed wetlands.

Primary functions and values associated with the wetlands proposed to be directly and indirectly affected include sediment retention and aquatic and wildlife diversity/abundance. Additional discussion of the consideration of other functions and values for the affected wetlands is in Section 1.4 of the Rock Creek Project Wetland Inventory, Consideration of Alternatives and Mitigation Plan (ASARCO 1995b).

Sediment Retention: The low flow gradient and seasonal, shallow standing water characterizing many of these wetlands provide for the retention of sediments contributed by surface run-on from adjacent upgradient areas. These wetland areas, because of their generally small size and discontinuous pattern, are considered to have a moderate site-specific sediment retention function and value, and limited regional importance.

The several small wetland basins proposed to be established within the Miller Gulch Tributary wetland mitigation site will function to retain sediments associated with captured seasonal surface run-on from upgradient areas. The created basins will achieve this function immediately following construction (preproduction year 3), although the effectiveness of this function will likely be somewhat reduced until the proposed wetland vegetation has become established. Following the establishment of the wetland vegetation, the small wetland basins will provide a long-term function and value for sediment retention comparable to the directly and indirectly affected wetlands. The sediment load associated with the upgradient seasonal run-on is not heavy, and the created wetlands are anticipated to be functional for sediment retention for many years following the completion of the mining project.

The sediment retention functionality of the wetland basins will be visually monitored routinely during the life of the mining project. Should the monitoring indicate that sediment retention is adversely affecting site life expectancy, or other re-established functions and values of the wetlands, corrective measures will be developed in consultation with the COE, and other appropriate agencies. These measures could include the creation of additional wetlands in alternative locations.

Aquatic and Wildlife Diversify/Abundance: The wetlands proposed to be directly and indirectly affected provide seasonal habitat for a variety of wildlife species, including amphibians, as well as aquatic macroinvertebrates. These affected wetlands do not provide fish habitat. None of the wildlife habitat provided by these wetlands is rare or critical to the survival of any wildlife species. Because the affected wetlands are small in size, and wetlands providing similar habitat are common in the Rock Creek drainage area and adjacent regions, they are considered to have low to moderate site specific aquatic and wildlife diversity/abundance functions and values.

The small forested wetland basins proposed to be created within the Miller Gulch Tributary wetland mitigation site will provide aquatic and wildlife habitat functions and values comparable to the forested wetlands proposed to be directly or indirectly affected. These functions and values, however, will not be fully established until the successful establishment of forest wetland vegetation within each wetland basin (preproduction year 22). Prompt establishment of herbaceous wetland vegetation will be aided by direct application, during construction, of wetland soils salvaged from directly affected wetlands.

Because the upper-most portions of the proposed mitigation site are located near the toe of the tailing disposal area, human activity and equipment operation associated with tailing disposal activities can be expected to initially reduce the re-established wildlife functions and values of this portion of the site. This impact will be significantly reduced upon completion and successful reclamation of that portion of the tailing disposal area located upgradient (about production year 22). It is anticipated, however, that wildlife may habituate to the nearby human and equipment activity, and comparable wildlife use of the upper-most wetland basin sites could occur much earlier.

The tailing disposal area will occupy approximately 6.4 acres of the 36.3 acre drainage basin of the mitigation sites. During active tailing disposal, storm water runoff capture associated with the surface water management plan for upgradient areas affected by tailing disposal will route storm water runoff to detention ponds located in upland areas outside the mitigation site drainage. The water balance prepared for the Miller Gulch Tributary mitigation site has considered this loss of seasonal runoff contribution. This loss will not adversely affect the ability of the created wetlands to re-establish wildlife-related functions and values.

As discussed previously, the created wetlands in the Miller Gulch Tributary mitigation site are anticipated to provide beneficial wetland functions and values throughout the life of the mine project, and for many years thereafter. Monitoring of how well the wetlands are providing wetland functions and values will occur routinely throughout the mine project life, with the development of corrective measures if problems are noted.

L.2.2 Upper Rock Creek (Section 22)

This mitigation site, located in the E1/2 E1/2 of Section 22, T26N, R32W (Figure L-1), consists of a broad, gently sloping bench between Rock Creek and the proposed utility corridor. The site is owned by Sterling. Mitigation will create linear wetlands adjacent to Rock Creek (Figure L-4).

Establishment of Wetland Hydrology

Numerous riparian and/or wetland areas occur along Rock Creek on lower terraces or in stream channels either abandoned or occupied infrequently during high flow events. These areas derive their water from seasonally high water tables (i.e., groundwater at shallow depths) or from periodic overflow of Rock Creek. Higher terraces, benches and abandoned channels are elevated above the water table and do not support wetland hydrology or wetlands. Linear wetlands will be established in this non-wetland site by excavating to a depth which will allow saturation/inundation by shallow groundwater. Based on observation of a hand-dug domestic well (PW-6) located at the northern end of the mitigation area, groundwater level in this portion of the area is generally six feet or less below ground surface. Backhoe pits constructed in the area during November, 1996 encountered water-bearing gravels overlying clay at about 8 feet below ground surface.

In order to determine feasibility of the site to support wetlands, Demonstration Cells were constructed. Two Demonstration Cells were excavated on November 14, 1996 in depressional locations approximately 100 feet (Cell A) and 400 feet (Cell B) west of the Rock Creek drainage forest road (Figure L-4). Excavation at both locations encountered water-bearing gravels on a clay pan at approximately eight feet below the general grade of the recently logged area. This clay pan was left intact, and the area of each cell was expanded to accommodate slope reduction. Piezometers were installed at both locations.

The total disturbance area of Demonstration Cell A is approximately 600 square feet, including approximately 50 square feet at the bottom that had filled with shallow standing water within a few hours. The total disturbance area of Demonstration Cell B is approximately 1200 square feet, including approximately 100 square feet at the bottom that also filled with shallow standing water within a few hours. These cells will be revisited to record water levels, sample for water chemistry/quality, and establish wetland vegetation.

Site Development

Proposed wetland channels shown on Figure L-4 are conceptual. Actual locations will be determined in the field utilizing existing historical non-wetland channels and topographically lower areas.

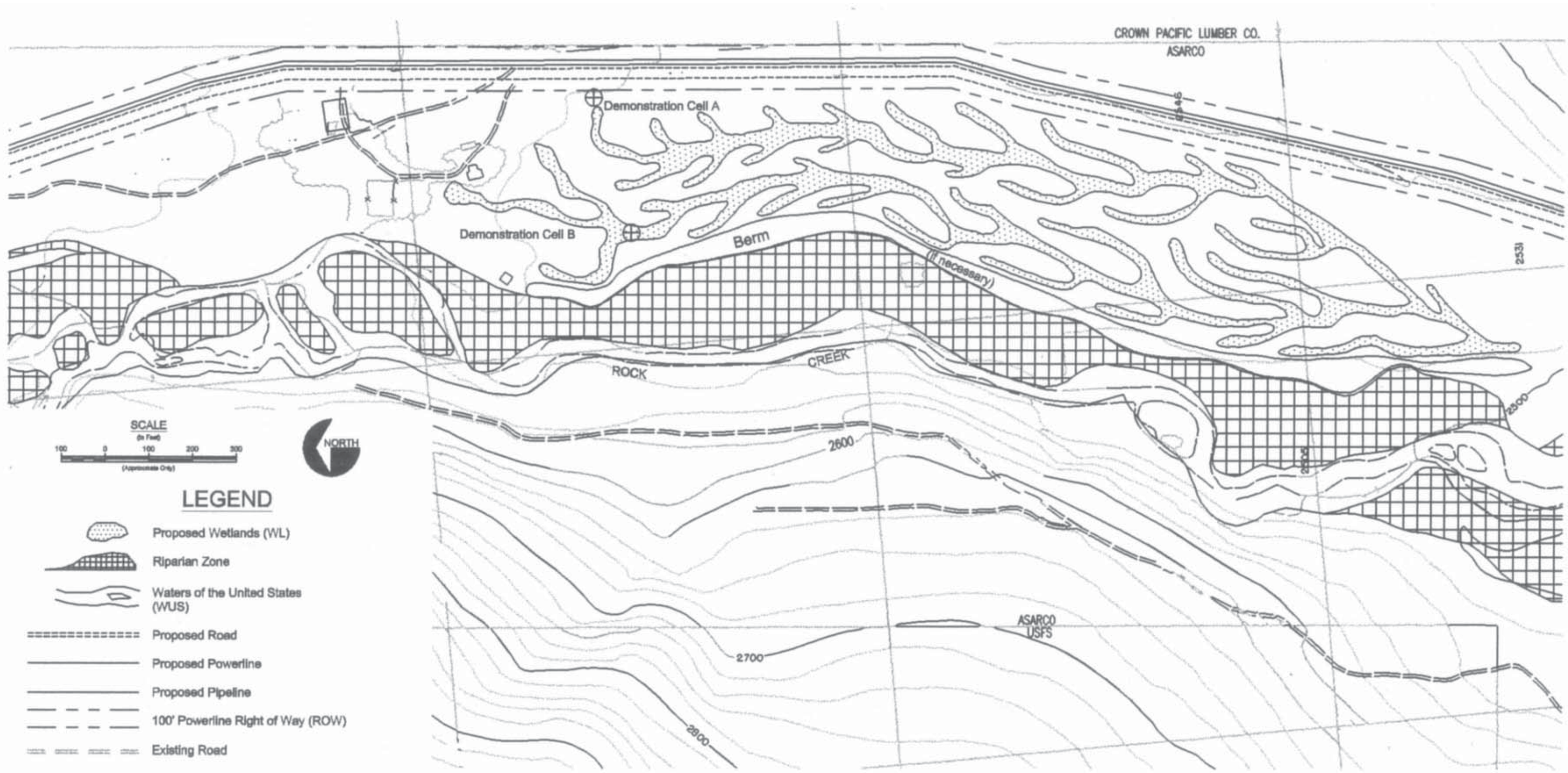


FIGURE L- 4
Upper Rock Creek Wetland
Mitigation Site
Plan View
Rock Creek Project

Prior to excavation and following tree and shrub removal, topsoil will be salvaged from all areas to be disturbed and stockpiled in non-wetland areas adjacent to the site. Material will be excavated in a linear configuration using scrapers, dozers or backhoes depending on availability and site conditions. Excavation depth will depend on groundwater levels encountered during construction but is anticipated to be about 6 to 8 feet based on observed pre-construction groundwater levels.

Excavated material will be used for fill on the access road or other project components. If not needed for construction, fill will be mounded after topsoil has been salvaged between the created wetlands and Rock Creek (in non-wetland areas outside the riparian zone). The berm will be graded to blend with natural topography, topsoiled and revegetated.

The mitigation sites will be constructed with a slight (less than 1 percent) slope toward the south. Constructed channels will not be connected to Rock Creek to minimize potential scour from high flows.

Width of the bottom of the linear sites will vary from 10 to 25 feet. Uniform width will be avoided to create a more natural configuration. Small depressions will be constructed along the longitudinal profile of each linear site to increase water retention late in the season when groundwater levels may decline. Benches will be constructed on one or both sides of the bottom (Figure L-5) to create zones with variable periods of saturation or inundation. The benches, at 6 to 12 inches above the bottom, will be saturated or inundated only during spring. The bottom will remain saturated later into the growing season. The shallow depressions will be inundated or saturated for the majority of the growing season. Sideslopes of the mitigation sites will vary reflecting excavation depth and natural topography.

In general, one side of the excavation will be constructed at a relatively steep slope (40 to 50 percent) with the opposite side constructed at a gentle to moderate slope (10 to 40 percent). Variable slopes will enhance topographic and resulting vegetative diversity.

Soil Handling

Soil salvaged from areas to be disturbed by wetland creation (channels, sideslopes and berm area) will be respread on all portions of the mitigation site (slopes, bottom, benches, depressions and berm). Soils in this area are formed in stream terrace sandy loam alluvium. These terrace soils exhibit good salvage quality to 13 inches. Respread soils will be disced or harrowed to provide a proper seedbed. Since soil storage would be of short duration, fertilization is not proposed.

Since wetland hydrology will be provided by groundwater, no amendments (such as silty lake sediments or clay) are proposed to decrease permeability of the constructed channel bottom.

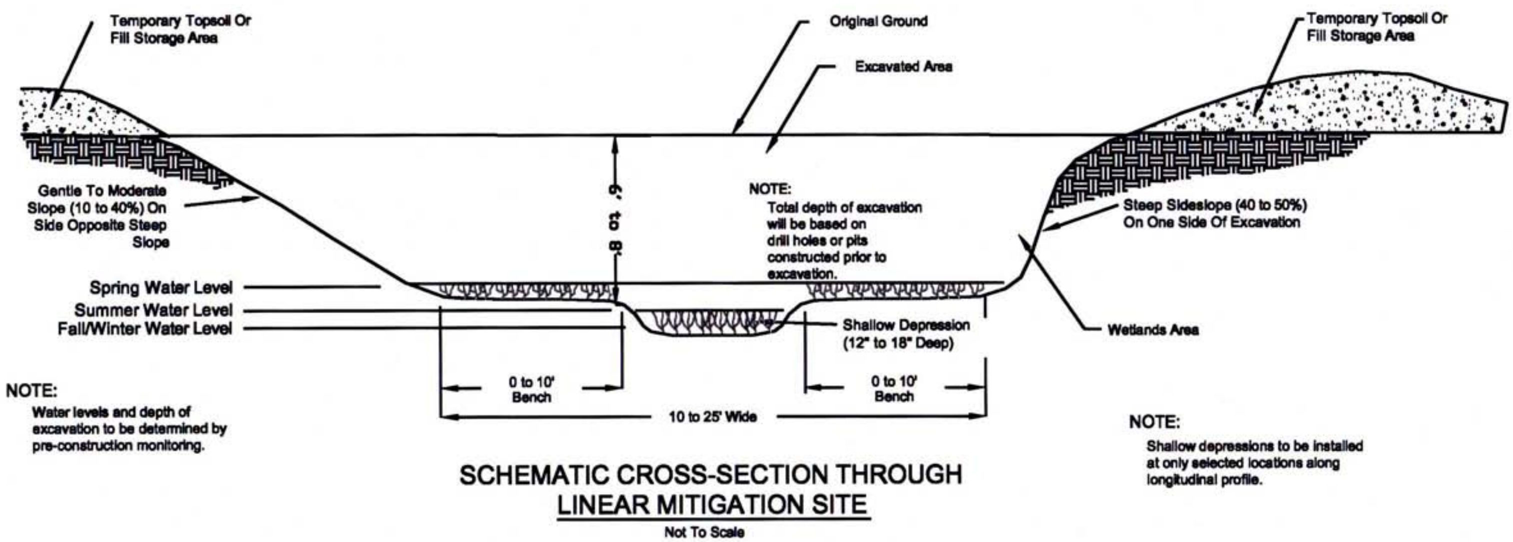


FIGURE L-5
Typical Cross-Section of Upper Rock Creek Wetlands Mitigation Site (Sect. 22, T 26 N, R 32 W)
Rock Creek Project

Hydrophytic Vegetation Establishment

The linear mitigation sites will be revegetated using the wetland revegetation mix (Table L-3). The proximity of Rock Creek to the area will allow for natural reinvasion of additional hydrophytic species. Channel sideslopes and the berm will be seeded with the upland herbaceous mix presented in the Rock Creek Project Application for Operating Permit/Plan of Operations.

Since the narrow configuration of the mitigation sites would preclude effective drill seeding, broadcast seeding (hand-held seeder or hydroseeder) will be used. The sites will be mulched with noxious weed-free straw (2000 pounds/acre) or cellulose fiber (hydromulch at 1500 pounds/acre).

Re-establishment of Functions and Values

The primary objective associated with wetland mitigation at the Upper Rock Creek site is to create wetland areas with long-term functions and values comparable to or greater than existing riparian/wetland areas located on lower terraces along Rock Creek or in stream channels either abandoned or occupied infrequently during high flow events. These existing wetlands are dependent on seasonally high water tables or from periodic overflow of Rock Creek, and are classified as palustrine, forested wetlands.

The primary function and value associated with riparian and/or wetland areas located on lower terraces along Rock Creek is wildlife diversity and abundance. With respect to wildlife, important wetland factors in the Rock Creek drainage are size and distribution; wetlands are common, are distributed throughout the study area, and are present in most larger blocks of wildlife habitat and/or habitat complexes, but individual wetlands are small. Thus occurrence and availability do not limit wildlife use of wetlands, but wetland size may be a limiting factor for some species or species groups.

Wildlife Diversity/Abundance: The existing riparian/wetland areas along the lower terraces of Rock Creek are the result of periodic overflow and the migration of the channel of Rock Creek, as well as overflow channels, in response to peak flow events. This has created a diversity of wildlife habitat in these areas adjacent to the main channel of Rock Creek, including cover and browse for larger species of wildlife (white-tailed deer, elk, moose and bears), habitat for lynx, fisher and other furbearers, and resting and foraging areas for several species of birds, including limited seasonal waterfowl and shorebird habitat. In addition, muskrat, beaver and river otter likely use these areas. These areas also provide habitat for herptiles and aquatic macroinvertebrates. One Federally listed endangered or threatened species, the grizzly bear, may also use these riparian/wetland areas as a microsite habitat source of succulent forage.

The objective of the design of the Upper Rock Creek wetland mitigation site is to create new wetlands that will provide additional long-term beneficial wildlife diversity/abundance functions and values to the adjacent (as well as upstream/downstream) Rock Creek riparian/wetland areas. The design of a series of linear wetland areas excavated to varying depths will provide for saturation/inundation by shallow groundwater, and will recreate wetland conditions characterizing the adjacent riparian/wetland areas. This will allow for the successful establishment of wetland vegetation and wildlife diversity/abundance functions and values currently being provided by the existing riparian/wetland areas along Rock Creek.

The functionality of the created wetlands to provide additional beneficial wildlife diversity/abundance values will not be fully established until successful wetland revegetation has occurred, including maturation of seeded species and the natural re-invasion of additional adjacent hydrophytic species. It is anticipated, however, that this process will likely be rapid, as Demonstration Cells constructed at the site in the fall of 1996 showed that sufficient shallow groundwater is present to allow the immediate establishment of wetland hydrology. Seeding of the Demonstration Cell areas scheduled for spring 1997 will provide additional information to access the rapidity of the establishment of wetland vegetation and associated wildlife diversity/abundance functions and values.

The upper-most portions of the Upper Rock Creek wetland mitigation site are located near to (south of) the proposed support facility for the exploration adit phase of the Rock Creek Project. The nearness of human activity to the created wetland site may initially reduce wildlife use of this portion of the new wetland site. Human activity at these facilities during the exploration phase, however, will be light, and the facilities will be removed following completion of the exploration adit project (preproduction year 5). Following removal of the facilities, human activity in the vicinity of the new wetland site will be reduced. In addition, it should be noted that the agencies are considering whether to include a relocation of the proposed exploration support facilities to the water treatment plant site at the lower end of the Rock Creek drainage as a component of Alternative V. If this relocation is selected by the agencies, construction of the support facility would not occur in the vicinity of the proposed Upper Rock Creek wetland mitigation site.

The eastern-most portions of the Upper Rock Creek wetland mitigation site would be located near to the main access road and utility corridor for the Rock Creek Project. This road would be used by the general public, as well as by project-related vehicles during the exploration and operational phase of the mine project. Use by project-related vehicles, however, will be significantly reduced by the incorporation of employee busing in Alternative V. Mine employees will be bused from an employee parking lot to be provided near the water treatment plant at the lower end of the Rock Creek drainage. The use of busing will significantly reduce the potential for vehicle-related disturbance to the newly created wetlands and their beneficial wildlife functions and values.

The proposed Upper Rock Creek wetland mitigation site will rely on the demonstrated availability of shallow groundwater to successfully achieve and maintain long-term wildlife functions and values. Once the wetland wildlife functions and values have been established through successful revegetation, the functional life of the wetlands is anticipated to extend well beyond the life of the mining project, and to be similar to the functional life of the adjacent riparian/wetland areas.

L.2.3 Lower Rock Creek

The Lower Rock Creek site, located in the W1/2 of Section 27, T26N, R32W (Figure L-1), consists of a gently sloping toeslope and bench north of Rock Creek. The site includes a portion of the area previously designated as Borrow Area 3. Since Borrow Area 3 was initially proposed for excavation of material for starter dike construction and tentative design modifications have eliminated the need for originally proposed volumes of borrow material, proposed wetland of the excavated borrow area near the elevation of Rock Creek, wetlands will be created by constructing linear channels in the existing topography (Figure L-6). It is possible that some borrow may be necessary at this site for construction of the tailing storage facility. If so, wetlands would be created at the bottom of the borrow area and wetland mitigation design would be modified to account for any topographic changes.

<u>Establishment of Wetland Hydrology</u>

Without the previously proposed borrow area excavation, ground water levels are substantially below the elevation of proposed mitigation and would not provide wetland hydrology. Establishment of wetland hydrology at this site, therefore, will rely on seasonal concentration and/or temporary retention of water on low permeability substrates, similar to existing wetlands in the proposed tailing storage facility.

On-site investigations with representatives of COE and ASARCO during fall, 1996 identified small sites in this vicinity where logging and road construction have created depressions that retain seasonal runoff resulting in creation of wetland hydrology. If necessary, flow barriers would be constructed at the proposed mitigation site to increase the period of inundation and saturation. Also, prior to construction, soil proposed for use in the channel bottom will be evaluated to assess permeability. If this evaluation concludes that soils would be too permeable to support wetland hydrology, the channel bottoms will be amended to provide conditions suitable for formation of wetland hydrology. Silts or clays formed from glacial lake sediments in the tailing storage facility would be used as a low permeability amendment in the channel bottoms.

An annual water balance for the Lower Rock Creek site is presented in ASARCO (1993). Mitigation wetlands would have wetland hydrology throughout the growing season.

<u>Site Development</u>

Channel locations depicted on Figure L-6 are conceptual. Actual locations will be selected in the field to take advantage of microtopography and to optimize surface water run-in.

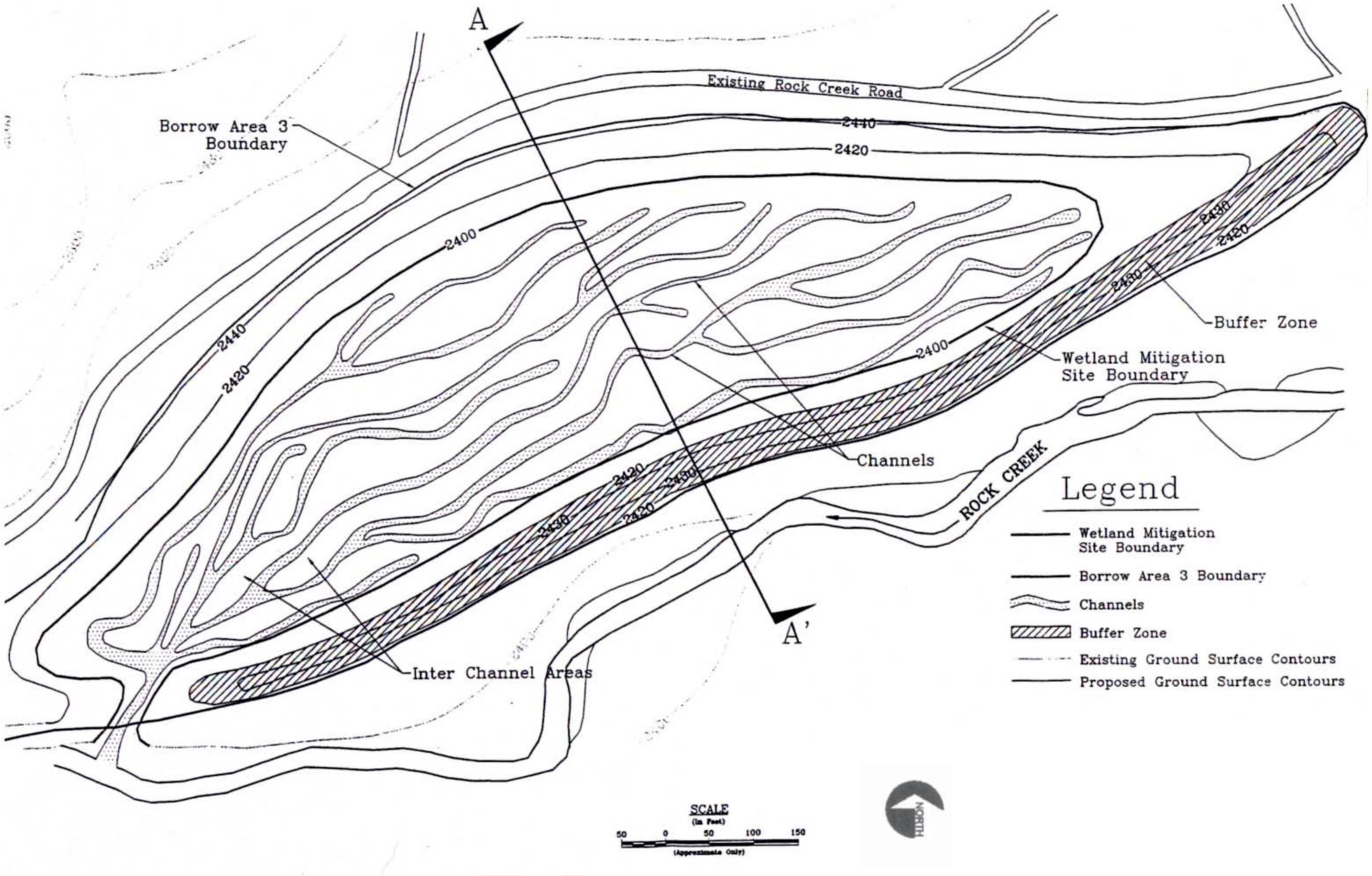


FIGURE L- 6
Plan View of Borrow Area 3
Wetland Mitigation Site
Rock Creek Project

Following tree removal, topsoil will be salvaged and stockpiled in non-wetland areas adjacent to the site. Subsoil material will be excavated to a depth of 2 to 3 feet and a width of 10 to 25 feet. Variable widths will be used to create a more natural configuration avoiding ditch-like or canal-like configurations. Sideslope angles will also be varied from 2H:1V (50 percent) to 5H:1V (20 percent). Small depressions will be constructed along the longitudinal profile of each channel to increase the water retention period at these locations. If necessary, small flow barriers (detention dikes) as proposed for the Miller Gulch Tributary mitigation site will be constructed to create additional diversity in wetland hydrology by creating longer periods of inundation or saturation upstream of the dike. If scouring occurs at the outlets of the channels, rock energy dissipators will be constructed. Figure L-7 presents a conceptual cross section at the Lower Rock Creek mitigation site.

Excavated material from the channels will be used in flow barrier construction, for fill on the access road or other mine or facility construction activity. If not needed for construction, the material will be bermed adjacent to the channels in non-wetland areas, be graded to blend with natural topography, and revegetated.

<u>Soil Handling</u>

Topsoil at the site will be salvaged to a depth of about 12 inches. The gravelly silty loam to sandy loam soils will be stored adjacent to the channels until excavation and grading are complete. The topsoil will then be respread over all disturbed areas at the site. Since soil storage would be of short duration, fertilization is not proposed. Respread soils will be disced or harrowed to prepare a proper seedbed.

<u>Hydrophytic Vegetation Establishment</u>

The linear mitigation sites will be revegetated using the wetland revegetation mix (Table L-3). The proximity of Rock Creek to the area will allow for natural reinvasion of additional hydrophytic species. Sideslopes will be seeded with the upland herbaceous mix presented in the Rock Creek Project Application for Operating Permit/Plan of Operations.

Since the narrow configuration of the mitigation sites would preclude effective drill seeding, broadcast seeding (hand-held seeder or hydroseeder) will be used. The sites will be mulched with noxious weed-free straw (2000 pounds/acre) or cellulose fiber (hydromulch at 1500 pounds/acre).

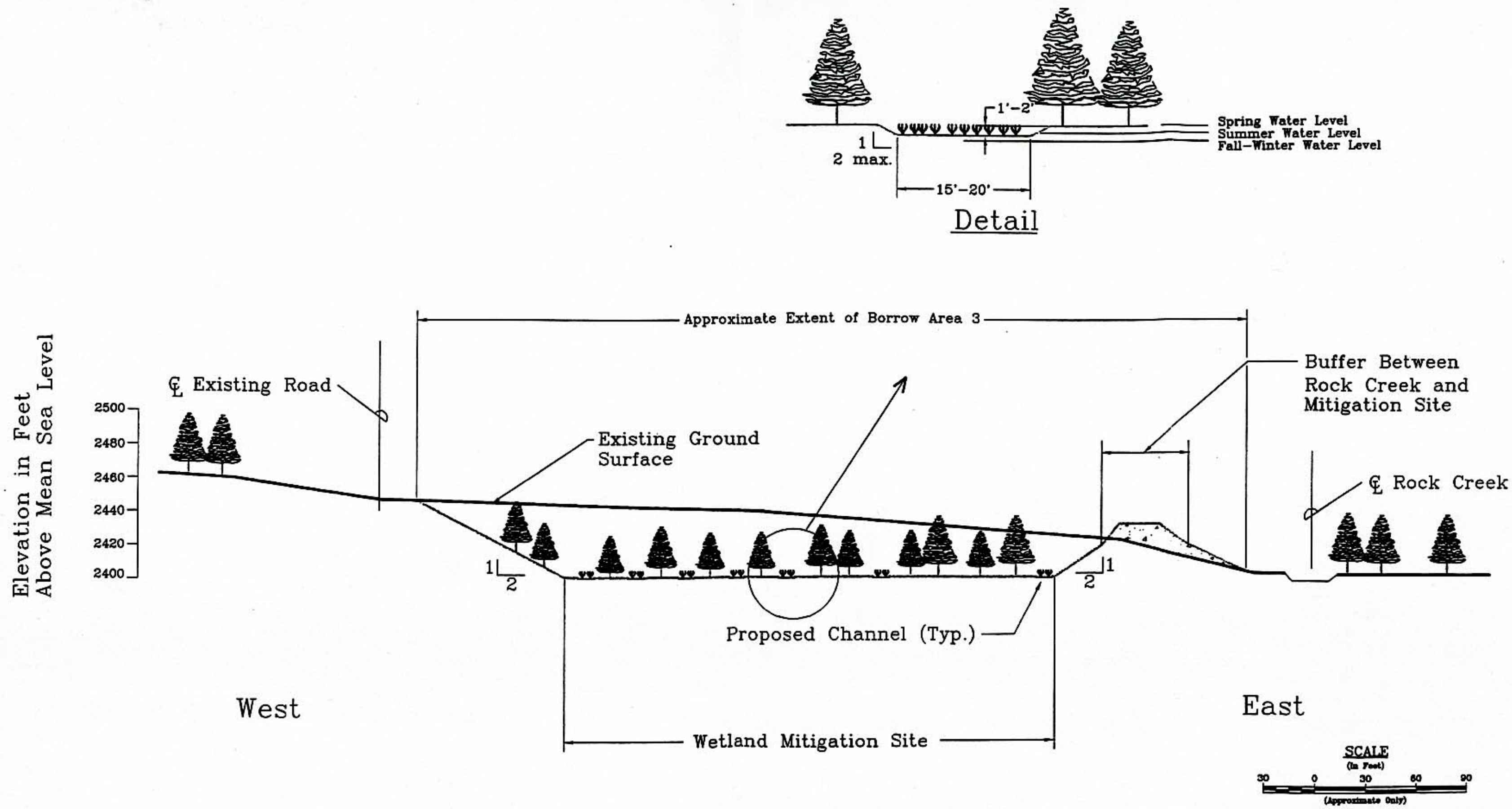


FIGURE L- 7
Typical Cross-Section of Borrow Area 3 Wetland Mitigation Site
Rock Creek Project

Re-establishment of Functions and Values

The Lower Rock Creek wetland mitigation site, in conjunction with the Miller Gulch Tributary wetland mitigation site, will function to replace the primary wetland functions and values associated with nearby linear wetlands filled during the placement of tailing within the tailing disposal area. A discussion of wetland functions and values associated with these existing wetlands is in Chapter 3 of the EIS. The re-establishment of wetland functions and values at the Miller Gulch Tributary wetland mitigation site is discussed in Chapter 4.

As characteristic of the nearby affected wetlands, wetland hydrology will be provided by precipitation, snowmelt runoff and temporary saturation or inundation during the growing season. Created wetlands will provide habitat diversity for herptiles, small and large mammals, and limited seasonal waterfowl and shorebird habitat. The site will also provide habitat for aquatic macroinvertebrates.

The Lower Rock Creek wetland mitigation site is generally located between FDR No. 150B and Rock Creek and its associated riparian/wetland areas along the lower portions of the Rock Creek drainage. Public access to the Rock Creek drainage during the life of the mining operations will be via the proposed new mine access road located on the east side of Rock Creek. Use of the FDR No. 150B will be limited to project-related vehicles necessary for operation and maintenance of the tailing disposal facilities. It is not anticipated that project-related vehicle use of FDR No. 150B will significantly affect the intended wildlife use of the new wetland site for beneficial habitat.

The life of the new wetland site is anticipated to extend well beyond the life of the mining project. Routine monitoring of the site during the life of the mining project will occur to determine whether sediment retention or other factors may be diminishing the functional life of the site. If problems are noted, corrective measures will be explored and implemented. These measures could include the creation of additional mitigation wetlands at other locations.

L.2.4 Optional Wetland Mitigation Sites

Sterling has identified six optional wetland mitigation sites that possess characteristics suitable for wetland creation necessary to achieve a minimum wetland mitigation ratio of 1.5:1. The six areas are described in this Appendix as well as listed in Table L-2.

The Upper Rock Creek Wetland Mitigation Site Extension and Middle Rock Creek Wetland Mitigation Site occur along Rock Creek on lower terraces or in stream channels either abandoned or occupied infrequently during high flow events. These areas derive their water from seasonally high water tables (i.e., groundwater at shallow depths) or from periodic overflow of Rock Creek. Higher terraces, benches and abandoned channels are elevated above the water table and do not support wetland hydrology or wetlands. Wetlands will be established in these non-wetland sites by excavating to depths which would allow saturation/inundation by shallow groundwater in much the same way as described in Section L.2.2.

The Miller Gulch Tributary Wetland Mitigation Site Extension and the Lower Rock Creek Wetland Mitigation Site Extension areas would both rely on the diversion of surface water around the tailings paste storage facility. The Miller Gulch area would be provided with wetland hydrology from surface water diverted from the northwest side of the tailings facility and the Lower Rock Creek area from surface water diverted from the northeast side of the facility.

The remaining two sites, the Access Road Wetland Mitigation Site and Clark Fork River Bench Wetland Mitigation Site, are located in areas that have soils with low percolation rates and that are suitable for surface water retention with some minor surface manipulations. Establishment of wetland hydrology in these areas would likely rely on some type of minor depressions or small flow barriers designed to increase surface runoff retention and duration of soil saturation/inundation. The applicant has observed that minor depressions created by past logging disturbance in drainages and downed logs across drainage bottoms provided sufficient increased moisture retention to support localized hydrophytic vegetation. The increased duration for surface water retention in these areas should allow hydrophytic vegetation to develop. Small detention dikes would likely be constructed in much the same manner as described for the Miller Gulch Tributary sites in Section L.2.1.

L.2.5 Conceptual Wilderness Wetland Mitigation

The existing wetland conditions, delineation results, and an evaluation of the functions and values of wetlands and non-wetlands waters of the U.S. for Copper Lake, Cliff Lake, and potential subsidence areas within the Cabinet Mountains Wilderness Area are contained in a report prepared for ASARCO by Hydrometrics in January 1997. ASARCO also responded in a letter dated March 5, 1997 to comments from the Corps of Engineers, Omaha District, (letter dated June 4, 1996) regarding wilderness wetland issues. The applicant has stated that any potential direct and indirect impacts to the wilderness wetlands from surface subsidence and mine dewatering activities at depth are very unlikely. Even though the potential for impacts to the wilderness wetland and nonwetland waters of the U.S. may be small, conceptual lake restoration and wetland mitigation plans are beneficial to the overall evaluation.
Cliff Lake and Copper Lake are alpine lakes that are apparently perched at several hundreds of feet above the regional water table. The water for these lakes comes primarily from runoff from rain and snow melt with some additional recharge from small fractures in the immediate vicinity of the lakes. Discharge from the lakes is primarily controlled by the outlet elevations with some seepage loss through the lake bottoms also occurring.

Conceptually, the most significant impact to the wilderness lakes would occur from a fault or fracture opening resulting in a conduit for draining the lakes. The Copper Lake Fault is located approximately 200 to 400 feet to the northwest of the lakes. The fine-grained sediments in the bottom of the lakes would likely be pulled into the fracture opening and would help to slow the seepage loss and potentially seal the conduit. Depending on the width and depth of the fault or fracture opening, grouting and cementing techniques could be employed to further seal the conduit. Directional drilling techniques and the use of kaolinitic clay-based grout would likely be employed because they have been used at ASARCO's abandoned Mike Horse Mine reclamation project near Lincoln, Montana.

The fault or fracture openings should be sealed to within a few feet of the surface and fine-grained materials (similar to pre-impacted sediments) used to restore the effected areas in the bottom of the lakes. The water levels and wetland hydrology of the wilderness lakes should be restored within several months, depending on actual precipitation events. The fringe of hydrophytic vegetation around the lake shore would likely be established within two to three years following the mitigation activities.

L.3 WETLAND MITIGATION SCHEDULE

Mitigation wetlands will be created prior to substantial impact to existing wetlands by project construction. Table 4-34 in Chapter 4 of the EIS lists wetlands impacted by project development. Proposed design modifications in the tailing storage facility result in incremented wetland impact over the life of the project as opposed to previous designs whereby most wetland impacts occurred earlier in project development.

The proposed mitigation schedule for the three (3) main and six (6) optional sites is:

Mitigation Site	Mitigation Site Construction[1]	Projected Resumption of Comparable Functions
Main Wetland Mitigation Sites		
Upper Rock Creek		
Stage 1[2]	Preproduction Year 1	Preproduction Year 4
Stage 2	Preproduction Year 3	Production Year 1
Lower Rock Creek	Preproduction Year 5	Production Year 3
Miller Gulch Tributary	Preproduction Year 3	Production Year 22[3]
Optional Wetland Mitigation Sites		
Upper Rock Creek Extension	Preproduction Year 3	Production Year 1
Miller Gulch Tributary Extension	Preproduction Year 5	Production Year 3
Lower Rock Creek Extension	Preproduction Year 5	Production Year 3
Access Road	Preproduction Year 1	Production Year 4
Middle Rock Creek	Preproduction Year 3	Production Year 1
Clark Fork River Bench	Preproduction Year 3	Production Year 1

[1]Schedule is based on 5 years of preproduction activity, 30 years of production and 5 years of post-production closure and reclamation.

[2]Upper Rock Creek Stage 1 will involve 1.1 acres of mitigation. Stage 2 will include the remaining 3.3 acres and will address any changes necessary based on results of Stage 1 mitigation.

[3]This mitigation site is proposed as a forested wetland and 25 years are projected to allow trees to develop to provide comparable functions as disturbed forested wetlands.

In order to determine feasibility of creating wetlands at the sites, Demonstration Cells have been constructed at the Upper Rock Creek site and are proposed at the other two main mitigation sites.

The proposed schedule for constructing the Cells is:

Mitigation Site	Demonstration Cell Construction	Seeding/Planting
Upper Rock Creek	November 1996	April-June 1997
Lower Rock Creek	Preproduction Year 3	Preproduction Year 3
Miller Gulch Tributary	Preproduction Year 1	Preproduction Year 1

L.4 WETLAND MITIGATION SITE MONITORING

L.4.1 Performance Criteria

The following minimal criteria for measuring success of wetland creation will be used:

1. The area of wetland creation should not be less than a 1.5:1 ratio to directly and indirectly impacted wetlands.

2. Reestablished wetlands should meet the 1987 COE criteria for a wetland.

3. Within a five-year period, percent vegetative cover should be equal to or greater than a) the percent cover of impacted wetlands or b) suitable reference area wetlands.

4. Within a five-year period, vegetative species composition and diversity should closely approximate the composition and diversity of impacted wetlands. This will be evaluated by field comparisons of plant species lists and cover of dominant species between created wetlands and either a) impacted wetlands or b) suitable reference areas.

L.4.2 As-Built Reporting

Within six weeks of the completion of each wetland mitigation site, a report will be submitted to the appropriate agencies describing as-built status of each mitigation site. Topographic maps showing as-built contours (at 2-foot intervals) of each mitigation area will be provided. The maps will identify the location and types of planting and any other installation of mitigation features.

L.4.3 Monitoring

Following construction, wetland mitigation sites will be monitored annually for five years to evaluate the success of mitigation to ensure that wetland functions and values are established and maintained. Thereafter, monitoring will be conducted every two years through the end of mining and production, unless it is mutually agreed with the regulatory agencies that final success criteria have been met. When it has been agreed that final success criteria have been met, Wetland Conservation Easements will be established for each new wetland site.

A photographic record will be established for wetland mitigation work. The record will include a) a photograph of affected wetlands prior to impact for documentation and comparison purposes, b) use of color film, c) photographs of mitigation wetlands during the mid-to-late growing season to depict development and diversity, d) photographs from fixed reference points, and e) photographs in monitoring reports.

Annual monitoring reports presenting monitoring results, including wetland hydrology, soils (fertility and stability) and vegetation establishment will be submitted to the U.S. Army Corps of Engineers. The schedule for submittal of the annual monitoring reports will be determined through consultation with the U.S. Army Corps of Engineers following approval of the mitigation plan. The reports will assess both attainment of yearly target criteria and progress toward final success criteria.

If the annual performance criteria are not met for all or any portion of the wetland mitigation plan in any year, or if the final success criteria are not met, an analysis will be prepared addressing the cause(s) of failure, and, if determined necessary by the appropriate agencies, a remedial action proposed for approval. The applicant has identified six (6) optional mitigation areas that will be used to achieve a minimum acreage replacement ratio of 1.5:1 and for remedial action in the event that additional areas of wetland creation become necessary (Figure L-1).

Hydrology

The most pragmatic measure of the success of wetland hydrology development will be observation of the development of wetland vegetation communities. In a very basic way, success of wetland vegetation will indicate if saturation/inundation of the mitigation areas satisfies wetland criteria. However, because vegetation communities may take several seasons to fully develop, duration and frequency of saturation/inundation will be monitored to determine if the wetlands are performing as designed and if wetland hydrologic criteria are met.

Staff gages and piezometers will be installed at each site to monitor depth of inundation and saturation. Monitoring will be conducted twice monthly through the snowmelt runoff and growing season (approximately March through October).

Soils

Topsoil stockpiled for longer than six months will be sampled for macronutrient content following redistribution to formulate any necessary amendments.

If plant nutritional deficiencies are noted during vegetation monitoring, macro- and micronutrient testing will be conducted and appropriate corrective measures will be implemented, e.g. fertilization, following consultation with involved agencies.

Soil monitoring will include:

- Measuring depth of respread soil;
- Noting soil color and texture; and
- Evaluating soil loss, especially in channels and slopes, to determine if corrective measures are necessary. Soil loss will be evaluated qualitatively using evidence such as rilling, gullying, plant pedestaling, removal of litter and percent bare ground.

Vegetation

Both qualitative and quantitative vegetation monitoring will be conducted to evaluate species composition, cover (by species and morphological class) and shrub and tree density on wetland mitigation areas. Vegetation monitoring will be conducted during summer to early autumn (June-October). Sampling sites will be established within each revegetation type (forested or herbaceous). U.S. Forest Service Ecodata methods (USDA Forest Service 1987) will be used, although plot size may need to be reduced from the standard 0.1-acre circular plot to reflect size or configuration of reestablished types.

Monitoring will also include qualitative assessments of noxious weeds, wildlife damage and other factors that may be influencing revegetation success. If such factors are identified, a plan for corrective action will be developed and implemented in consultation with the involved agencies.

L.5 WETLAND MITIGATION SITE MANAGEMENT

L.5.1 Short-Term Management

Following implementation of the wetland mitigation plans, wetland monitoring will be conducted to verify the establishment of appropriate wetland parameters. Post-establishment management of these wetland mitigation areas (to assure the perpetuation of wetland functions and values) will be carried out until it has been determined, based upon monitoring efforts, that the final success criteria have been met. Monitoring results will be reviewed with involved wetland regulatory agencies, and a decision reached cooperatively between the involved parties concerning the re-establishment of suitable wetlands.

Specific short-term management will address noxious weed control, grazing control and mitigation of any other conditions that may adversely affect wetland restoration.

Noxious weeds, especially spotted knapweed, are abundant in the vicinity of the mitigation sites. Most noxious weeds in the area, however, do not tolerate saturated soils and should not pose a significant threat to reestablished wetlands. Noxious weeds found during monitoring will be controlled. Control methods will stress mechanical or biological control in preference to chemical control, depending on site conditions and land ownership. The applicant will cooperate with the USFS and Sanders County Weed Control Board to develop and implement appropriate noxious weed control measures.

The wetland mitigation sites are not grazed by domestic livestock and fencing is not proposed for site protection. If wildlife grazing or browsing appears to be affecting revegetation success, site-specific control measures will be implemented, including but not limited to selective fencing, seedling protection caps or screens or chemical repellents.

If rills or gullies form on graded slopes or channels, selective filling and/or erosion control procedures (erosion control mats or nets, mulching, straw bales, filter fences or slash filter windrows) will be installed as necessary.

Specific remediation plans will be prepared for any site where problems develop. Such plans will be prepared in consultation with involved regulatory agencies.

L.5.2 Long-Term Management

Prior to a determination that final success criteria have been met, and release of any reclamation bond held for the wetland mitigation sites, management will be the primary responsibility of the applicant with input from the regulatory agencies and land owners or land management agency. Following a determination that final success criteria have been met, and bond release, management will revert to the landowner or management agency. For those wetland mitigation sites that are privately-owned, Wetland Conservation Easements will be established. The applicant will work with involved owners and agencies to develop long-term management plans providing for continued protection of the mitigation sites.

L.6 REFERENCES

ASARCO Incorporated, Northwest Mining Department. March 1993. Wetlands Inventory, Consideration of Alternatives and Mitigation Plan, Rock Creek Project, Sanders County, Montana.

ASARCO Incorporated. 1995. Wetlands Inventory, Consideration of Alternatives and mitigation Plan Rock Creek Project. Sanders County, Montana. Prepared for ASARCO by WESTECH and Hydrometrics. Revised September 1995.

ASARCO Incorporated. 1997. Report of Waters of the U.S. and Wetland Delineation for Copper Lake, Cliff Lake, and Potential Subsidence Areas, Cabinet Mountains Wilderness. Prepared for ASARCO by Hydrometrics, Inc. January.

ASARCO Incorporated. 1998. Letter to Rodney Schwartz, U.S. Army Corps of Engineers. Reevaluation of Proposed Wetland Mitigation for Rock Creek Project. August 11.

Hammer, D.A. (ed.). 1989. Constructed wetlands for wastewater treatment: municipal, industrial, and agricultural. Proceedings from the First International Conference on Constructed Wetlands for Wastewater Treatment, Chattanooga, TN. June 13-17, 1988. 831 pp.

Hammer, D.A. 1992. Creating freshwater wetlands. Lewis Publishers, Inc., Chelsea, Michigan. 298 pp.

Hydrometrics, Inc. 1992. 1990-1991 Annual report, water resources baseline study, ASARCO Rock Creek project. June 1992.

Kentula, M.E., R.P. Brooks, S.E. Gwin, C.C. Holland, A.D. Sherman and J.C. Sifneos. 1992. Wetlands: An approach to improving decision making in wetland restoration and creation. Edited by A.J. Hairston, USEPA, Corvallis, Oregon. Island Press, Washington, D.C. 151 pp.

Montana Department of Environmental Quality and Kootenai National Forest. September 1995. Draft Environmental Impact Statement. Rock Creek Project, ASARCO Incorporated, Sanders County, Montana.

Montana Native Plant Society (MNPS). 1992. Source guide for native plants. MNPS, Bozeman, Montana. 15 pp.

Reed, P.B., Jr. 1988b. National list of plant species that occur in wetlands: Montana. U.S. Fish and Wildlife Service, Washington, D.C. Biol. Rpt. NERC-88/18.26.

USDA Forest Service. 1987. Ecodata classification handbook 2090.11. USDA For. Serv. Region 1, Missoula, MT.

APPENDIX M

MCKAY CREEK ALTERNATIVE DESCRIPTION

APPENDIX M - MCKAY CREEK ALTERNATIVE DESCRIPTION

Alternative Description

Tailings Impoundment

This conceptual alternative tailings impoundment site would have been in the McKay Creek drainage, about 2 miles east of the mouth of Rock Creek. This location was selected because the topography allows a reasonable expectation that a downstream tailings impoundment could have been constructed at the site, thereby eliminating seismic liquefaction as a major engineering design issue. As indicated on Figure M-1, such a structure, sized to contain 100 million tons of tailings from the proposed mine, could have been placed across the narrow mouth of the valley. At project completion, this dam would have had a width of about 1,500 feet and would have been about 180 feet high. Tailings would have been impounded behind the dam for a distance of about 2 miles, covering approximately 510 acres.

Landownership

Portions of three sections of land would have been involved in siting an impoundment at this location. One section, Section 36, is owned by the State of Montana. The remaining two are corporately owned by two logging companies -- Crown Pacific and Pack River – and other smaller landowners.

The slurry and reclaim lines would have been routed from the confluence mill site parallel along FDR No. 150 then FDR No. 1022 to the impoundment. Two pump stations would have been needed because the slurry would have had to go up hill after leaving FDR No. 150 (see Figure M-1).

Tailings Impoundment Seepage and Storm Water Control

During operations, water that would have seeped through the dam would have been intercepted with a downstream seepage collection and containment system. Seepage would have increased over the life of the project. Ground water capture wells and corresponding monitoring wells would have been placed downgradient of the impoundment dam similar to Alternative II.

The McKay Creek drainage basin above the conceptual impoundment encompasses approximately 7,000 acres, with elevations up to 7,583 feet. McKay Creek would have been diverted into a 15,000-foot-long temporary channel on the south side of the valley at an elevation slightly higher than the final design height of the impoundment. This diversion would have been designed to handle the probable maximum flood during the mine's operational life. Based upon engineering estimates of a 100-year flood and slope, a concrete, trapezoidal channel, with side-slopes of 1.5 to 1 would have been approximately 40-feet wide at the top (assuming a bottom width of 20 feet) and would have ranged in depth between 7 and 10 feet. The outfall of the channel would have been engineered to dissipate the energy of the water prior to its return to the natural channel below the dam. A settling pond would need to have been constructed downstream of the spillway over the embankment face.

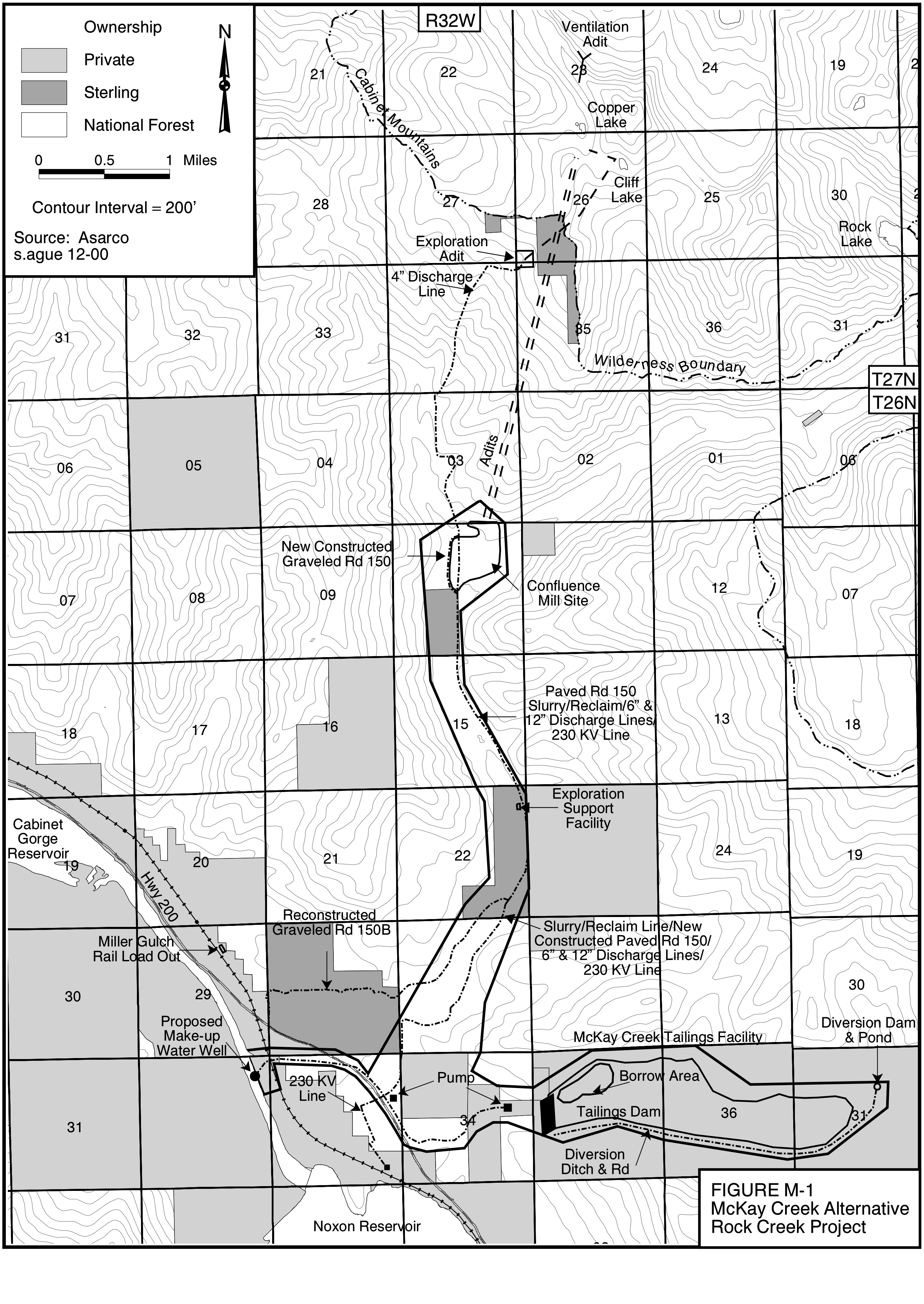


FIGURE M-1
McKay Creek Alternative
Rock Creek Project

Two intermittent drainages located north of the McKay Creek Valley would either have to have been diverted separately around the impoundment or allowed to drain into the impoundment. Two intermittent drainages south of the valley would have to have been directed into the diversion channel. These four drainages enter McKay Creek below the point of diversion of the main channel. Construction of the McKay Creek diversion dam, road, and ditches would have been concurrent with vegetation clearing for the tailings impoundment.

Transportation and Utilities

Existing roads would have to have been improved and several new roads would have been constructed to provide access to the McKay Creek tailings impoundment and for installation of the slurry, reclaim, and transmission lines. All lines would have paralleled roads to the tailings impoundment. In addition to the roadwork proposed for Alternative IV, about 4 miles of new roads would have to have been constructed and approximately 3 miles of existing roads would have been improved. FDR No.1022 would have been upgraded to a 14-foot wide gravel road with turnouts (see Figure M-1). An additional 6 feet beyond the usual cleared zone (approximately 12 feet for a single-lane road) would have been used for placement of slurry/reclaim pipelines and buried 4.16 kV powerline. To access the top of the dam a new segment of FDR No. 1022 would have been built. Sterling would have been responsible for building a 2,800-foot, 14-foot-wide gravel connector between FDR nos. 1022 and 2210. Sterling also would have constructed a 14-foot-wide road off of FDR No. 1022 to provide access to the southern half of sections 35 and 36. Eleven thousand feet of existing FDR No. 150 from Engle Creek to the rail load-out would have been upgraded to a 14-foot gravel surface with turnouts.

Reclamation

Based on soils information provided by KNF (Kuennen and Gerhardt 1984), average soil depth is 52 inches. Two soil lifts could have been salvaged. The first lift would have included the upper 23 inches of volcanic ash-influenced silt loams. This would result in roughly 1.6 million cu. yd. available for salvage. The second lift would include the next 29 inches. This would result in roughly 1.9 million cu. yd. available for salvage. The total volume would be approximately 3.6 million cu. yd. for salvage and replacement. Up to 4 feet of topsoil could have been replaced over the impoundment if all the soil was salvaged. Because there would have been no concurrent reclamation on the impoundment, all salvaged topsoil from within the McKay Creek drainage would have to have been stockpiled and temporarily revegetated until used for final reclamation. This large volume of topsoil would have been stored in several stockpiles whose locations would need to be identified.

Permanent revegetation of the impoundment face could not have begun until after operations ceased due to the downstream construction method. Revegetation of the surface would have been delayed until the impoundment had dried out enough to support heavy equipment needed for regrading and spreading of topsoil.

The tailings impoundment surface would have been regraded to desired shape, then soil respread and the area revegetated. An engineered streambed would have been constructed to flow across the top of the tailings. After the streambed was built, the diversion would have been removed, thus allowing the creek to flow through the impoundment and over a constructed spillway on the dam. The spillway would have to have been about 90 feet wide by 20 feet deep and engineered for the probable maximum flood (PMF).

Environmental Consequences

The following sections describe the environmental impacts that would have occurred with the development of the McKay Creek alternative.

Forest Plan Direction

Impacts to MAs for all facilities but the tailings impoundment would have been similar to Alternative IV. Roads and utilities associated with the McKay Creek impoundment would have been on private land and NFS lands designated as MAs 11 and 13. Several acres of MA 11 and 13 would need to have been redesignated as MAs 23 and 31.

Air Quality

Use of the alternative tailings impoundment site at McKay Creek would have resulted in a shift of related air emissions and impacts to that area. The downstream impoundment construction method would have caused an increase in potential particulate emissions from wind erosion as compared to the modified centerline construction method (Alternative III). Neither the slight changes in emissions nor the relocation of emissions points would have affected the overall air quality impact of the project.

Geotechnical Engineering

The McKay Creek impoundment, a downstream design, would have required the least amount of borrow material to supplement the waste rock and sand fraction of the tailings used to construct the embankment. This impoundment should have been the most resistant to earthquake-induced liquefaction without additional design and construction constraints. However, its location, spanning the mouth of a large drainage basin, made it extremely vulnerable to washout in a major flood. The potential results of a flood-induced washout of the McKay Creek impoundment would have been very much like those associated with the loss of either Rock Creek impoundment, except they would have been compounded by the large amount of additional flood water from the 7,000-acre watershed above the impoundment. Such a storm event could have stressed Noxon Rapids Dam from storm waters entering the Clark Fork River upstream.

Soils and Reclamation

Less borrow material would have been required for the McKay Creek impoundment. However, the exact amount of borrow material needed is unknown. Topsoil and subsoil resources were more than adequate for reclamation purposes. Storage of 3.5 million cu. yd. of topsoil may be difficult. Sterling would have had to determine how many stockpiles would be required and where they should be located. Stockpiles would have been located outside the footprint of the impoundment as there would be no concurrent revegetation.

A separate planting plan for the reconstructed stream plan would have been needed in conjunction with the stream channel relocation plan and wetlands mitigation plan to assist in stabilizing the streambanks.

Hydrology

Impacts to Miller Gulch would have been eliminated under this alternative because the impoundment would not be located in the Miller Gulch drainage. Impacts to surface water quality and quantity, springs and ground water wells, appropriated surface water users in Miller Gulch, and related to seepage of tailings slurry decant water into Miller Gulch would have been eliminated. However, there would still have been some impacts to Rock Creek associated with road construction and the mill operations. The impacts to Rock Creek would have been similar to those associated with the confluence mill site in Alternative IV.

The proposed tailings impoundment would have permanently altered about 510 acres of valley bottom area in the McKay Creek drainage. The diversion of this perennial stream would have resulted in the greatest hydrologic impact to this site by impacting wetlands and riparian habitat. Changes to water quality or water quantity in this stream reach would be minor. However, the impacts of tailings disposal in McKay Creek on water quality and quantity cannot be quantified due to a lack of baseline data for McKay Creek. Therefore, a qualitative analysis is provided.

Sediment may have entered surface waters during road and tailings impoundment construction but would have been minimized by applying BMPs, such as runoff and sediment control techniques. Most road construction activities would have been north of McKay Creek, but one stream crossings would have been necessary to provide access to lands south of the valley. Breaks in the slurry or reclaim pipeline during mine operation may have resulted in spills reaching surface waters and caused an increase in sediment load in the receiving stream.

The tailings water quality would have been similar to the Troy Mine tailings water used in the analysis of Alternative II. The rate of seepage would be a function of the permeability of the sediments underlying the impoundment and seepage control designs and would be proportional to the area of the impoundment and the depth of water (head) in the impoundment. Seepage downstream of the dam would have flowed either in ground water within the narrow McKay Creek valley, or discharged into McKay Creek, depending upon the local hydrogeology. The presence of relatively impermeable fine-grained lacustrine sediments over much of the valley floor should have limited the amount of seepage (Thompson 1989). Shallow alluvium is likely present along the valley floor; bedrock and colluvium are exposed along the hill slopes surrounding McKay Creek. Seepage may have migrated within the colluvium along the sides of the impoundment and along the bedrock contact. The depth of the alluvium downstream of the tailings dam and the hydrologic controls in the area are currently unknown. Seepage from the impoundment would have impacted about 1.5 miles of McKay Creek below the tailings impoundment. Water quality in McKay Creek above the tailings impoundment would have remained unaffected by the impoundment. Assuming seepage quantities (50-700 gpm) and qualities similar to those in Alternative II, and similar ground water capture from downgradient wells, impacts to the Clark Fork River from implementation of the McKay Creek alternative would have been similar to the impacts expected from alternatives II through IV.

Based on field inspection, surface water from McKay Creek does not appear to be appropriated for other uses. Therefore, no existing surface water users would have been affected.

The tailings material may not have been stable enough to support a reconstructed stream channel over the reclaimed surface. The fine-grained tailings sediment would have been easily eroded by streamflow and stream channel migration across the impoundment as the McKay Creek stream channel worked to attain an equilibrium. This would have hindered successful revegetation. Continual maintenance of the stream channel would have been necessary. Differential settling of the tailings material would have occurred indefinitely. Water from rerouted McKay Creek likely would have percolated into the tailings material, causing saturation of sediments, ponding, and interruption of the stream channel continuity. Seepage eventually may have drained out below the dam and into the existing McKay Creek channel. The settling pond constructed downstream of the spillway would have further reduced the total suspended sediment load potentially entering McKay Creek and the Clark Fork River after reclamation. However, this settling pond would have needed constant maintenance because sediment eroded from the tailings impoundment and transported over the spillway would have accumulated in this pond. The permanent concrete spillway in the embankment also would have required a long-term maintenance plan to ensure that it functioned.

Wetlands and Waters of the U.S.

This alternative would have involved the direct filling of 36.96 acres of wetlands and 5.89 acres of Waters of the U.S. in the McKay Creek drainage. Additional wetlands could have been indirectly impacted by the construction of access roads, diversion ditches, topsoil stockpiles, and other facilities associated with a tailings impoundment. Suitable mitigation acreage beyond that identified by the applicant for Alternative II may not have been in the vicinity to create new wetlands as required under the 404(b)(1) permit process.

Other direct effects generated by the confluence mill site, waste rock dump, exploration adit, and access roads would have been similar to those described for Alternative IV. The 5.36 acres of wetland associated with the Rock Creek tailings impoundment would not have been disturbed.

Indirect effects of this alternative on Waters of the U.S., wetlands, and nearby riparian areas with undelineated Waters of the U.S. and wetlands could not be quantitatively determined from the existing information. Seepage from the impoundment may have created or increased the size of existing Waters of the U.S. and wetlands below the impoundment, however, it is uncertain whether the additional water would have been of acceptable quality or if the functions and values of the existing wetlands would have been affected. Temporary indirect impacts on wetlands and Waters of the U.S. would have occurred during construction of the required tailings dam, impoundment, and associated roads and buildings due to increased sediment to the existing wetlands and Waters of the U.S. Diverting McKay Creek around the tailings impoundment would have caused additional impacts to Waters of the U.S. and associated riparian areas. Proposed BMPs would have reduced sediment contributions to wetlands and Waters of the U.S.

Aquatic Resources/Fisheries

The effects on the streamflow of Rock Creek would have been similar to Alternative IV. However, there would have been an additional aquatic impact from diverting 15,000 feet of McKay Creek into a channel on the south side of the valley. This could have resulted in the permanent loss of all fisheries and aquatic resources and stream habitat as well as indirect effects up- and downstream. The water would have stayed in this location until the project operation was complete, at which time a stream channel would have been built across the tailings.

When the stream was returned to a constructed channel, it would have flowed across the tailings impoundment. There still would be a fish passage barrier at the engineered spillway. During floods, the stream would have eroded tailings, increasing the level of suspended solids and negatively affecting fish and other aquatic life downstream in McKay Creek and the Clark Fork River (Noxon Reservoir).

Nitrogen-based nutrients in the tailings seepage would have entered McKay Creek (not Rock Creek) and the Noxon Reservoir. Impacts would have occurred to aquatic resources in these bodies of water.

Water temperatures would have been elevated in McKay Creek in the summer months because the stream would have been flowing in a large, open diversion with little shading by shrubs and trees. The exact temperature elevation could not be predicted, however, it is expected that no fish would have survived in this portion of the diversion. Water temperatures would have remained elevated even after the stream was returned to a reconstructed channel on top of the impoundment until vegetation was established to shade the stream.

Fish species such as those found in Rock Creek, may be found in McKay Creek. Due to a lack of data, however, it is not known at this time if bull trout live in McKay Creek although westslope cutthroat trout have been found there. If there were viable populations within the McKay Creek impoundment site area, then the impacts to bull trout as well as to westslope cutthroat trout would have been major and significant because of the loss of habitat, and loss of access between the lower and upper portions of McKay Creek. Conversely, the barrier could have helped isolate a genetically pure strain if a viable population was stranded.

Biodiversity

Up to seven known discrete sensitive plant populations would have been affected by the construction of the mill, pipelines, and roads. It is unknown if any sensitive plant species occur in the portion of McKay Creek drainage that would have been disturbed by the alternative tailings impoundment.

Four acres of old growth could have been physically affected at the confluence mill site. However, about 14 acres would have been rendered ineffective habitat. Effects on old growth at McKay Creek are unknown as the land belongs to the state and private industry and was not surveyed.

Other impacts would be the same as Alternative IV with the following exceptions. Tailings impoundment location at McKay Creek would have impacted more riparian and riverine habitat than other alternatives. Local populations of riparian- and riverine-associated species, such as songbirds, amphibians, and small mammals likely would have been eliminated. Other species that use the riparian and riverine habitat, such as deer, moose, elk, and bear would have been displaced and possibly stressed.

A major elk wintering ground would have been destroyed and rendered ineffective due to noise/activity disturbance. Slightly less destruction of white-tailed winter range in the Rock Creek drainage would have occurred but would have been reduced because of the impoundment relocation. Noise and activity from trucks traveling to the rail load-out would still impact that winter range.

Threatened and Endangered Species

The increase in road-killed deer and the associated risk of bald eagle mortality would have been the same as Alternative III. A small loss of potential peregrine falcon foraging habitat (37 acres of wetland) would have occurred within the McKay Creek tailings impoundment.

There would have been a direct, physical loss of 737 acres of grizzly bear habitat due to the mill site, tailings impoundment, and utility and access corridor locations compared to 585 for Alternative II. The increased level of human activity would have further displaced bears using Rock and McKay creeks' riparian areas. Habitat effectiveness would have been reduced on about the same acres as Alternative II) The open road (ORD) and total road densities (TRD) would have increased in BAA 7-6-1 from 0.77 and 0.98 miles/square mile to 0.82 and 1.17 miles/square mile, respectively. (The KNF ORD standard is 0.75 miles/square mile; there is no standard for TRD.) Habitat effectiveness in the affected bear management units (BMU 5 and 6) would have decreased to 63.4 and 65.5 percent, respectively. This is below the standard of 70 percent.

The closure of additional roads by the KNF to meet ORD standards for grizzly bear would have benefitted gray wolves, but that amount of area closed would not compensate for the habitat effectiveness losses created by this alternative (increased road mileage = 7.4 miles). Additional road closures would have been needed to retain current habitat effectiveness for wolves.

Socioeconomics

The impacts on employment, worker/family immigration, community services and government finances would have been similar to Alternative IV.

The impoundment, however, would have occupied a section of state land. Regulations require that the state manage school sections for maximum economic gain. The state would likely gain nothing from deposition of tailings on this land, and would likely regard the tailings impoundment as a potential liability. It is unlikely that the state would have approved a lease of this land to the applicant. Sterling would either have to have purchased the state-owned land or proposed a land exchange which could take several years to complete. Sterling also would have to have obtained leases for, or purchase, the privately owned lands.

Transportation

Soil disturbance necessary for roads associated with this alternative would have totaled about 47 acres; 35 acres for construction and 12 acres for reconstruction. Necessary clearing would have totaled about 60 acres; 45 acres for construction and 15 acres for reconstruction.

The tailings impoundment would have necessitated reconstruction of about 1 mile of FDR No. 1022. Construction of about 3.8 miles of new road would have been necessary to replace existing FDR nos. 1022 and 2210 and to install a non-numbered access road to south side of McKay Creek. The non-numbered road could have been within the dam impoundment area or connect to roads that the impoundment would isolate. It could have been located on either side of McKay Creek to connect to existing roads and/or to provide access to the creek diversion for maintenance and inspection. It also would have provided public access to an existing trailhead near the proposed diversion. Actual dam placement and height would be critical for determining access needs.

A second road would need to have been constructed to provide continued vehicle access to the south side of the creek. It would have required a bridge over McKay Creek somewhere downstream of the impoundment dam. A private, non-numbered road provides access for the landowner and to permittees for an electronic site located to the east of the dam site on NFS lands.

Up to 1 acre of additional clearing may have been needed to accommodate turnouts and sight distance. The 3.8 miles of new road would have disturbed about 12 acres of soil and require 16 acres of clearing. One bridge would have been needed to cross McKay Creek. While no actual site was reviewed on the ground, less than 1 acre of disturbance would have been anticipated. The impoundment eventually would have inundated a number of existing roads in the tailings impoundment area, reducing access to private timber and state lands in the area.

Traffic on these roads would have included Sterling maintenance and administration traffic, Forest Service administration traffic, and recreation vehicles. Estimated traffic volumes (under 30 ADT) and traffic patterns would have justified a single-lane, gravel road with turnouts.

Access to the Miller Gulch load-out would have been via existing FDR No. 150 to its junction (at Engle Creek) with reconstructed FDR No. 150B, then to Government Mountain Road, and finally to the load-out. All existing roads would have needed minor reconstruction and gravel surfacing to a single-lane width with turnouts. Two-tenths acres of soil disturbance and vegetation clearing for turnouts and sight-distance would have been required on existing roads. An existing treated timber bridge over Rock Creek would have needed replacement. Soil disturbance for bridge abutments replacement would have amounted to about 0.02 acres immediately adjacent to Rock Creek. The bridge-replacement impacts could have been mitigated by required BMPs in the contract, and by timing construction during normal low water flows.

Roads associated with load-out access would have been open to the public except for the small segment (0.3 mile) off of Government Mountain Road. This segment would have been limited to Sterling and Montana Rail Link vehicles and signed to discourage public use. About one-half of the load-out access route was under county jurisdiction. Estimated traffic on these roads is about 25 ADT.

Cumulative traffic impacts would be similar to alternatives III and IV except for the unrestricted public travel on FDR No. 150B. On this segment, potential conflicts between public and mine-related traffic would have been increased. During summer and fall, increased public recreation traffic would have mixed with the year-round facility maintenance traffic on the impoundment access road.

ORD potentially could have been affected by the addition or deletion of roads in the system. For instance, the impoundment could have inundated several existing roads that might not have been replaced. The actual road mileage decrease would need to be assessed in the field to determine the change in ORD in the context of overall changes in the drainage.

Recreation

Public access would have been restricted on about 580 acres associated with the tailings impoundment in McKay Creek and the mill site at the junction of the East and West forks of Rock Creek. The majority of the acreage in the McKay Creek drainage is owned by Crown Pacific, or the state. Some fishing opportunities would have been lost in McKay Creek since approximately 2.5 miles of the creek would have been rerouted. Hunting opportunities in McKay Creek drainage would have been affected since the majority of the bottomlands would be covered with tailings.

Mine and recreational use would have been mixed along approximately 5 miles of FDR No. 150, and along about 4 miles of access road in McKay Creek drainage. Recreational access to Forest Service Trail 924 in the McKay Creek drainage would have been affected during road reconstruction around the proposed tailings impoundment.

Wilderness

The McKay Creek tailings impoundment would have been visible from the Goat Ridge area within the wilderness. This tailings location in closer proximity to the CMW would have increased the opportunity for sounds from impoundment construction to reach the wilderness. Effects from the mill site are similar to those for Alternative IV.

Cultural Resources

Construction of the confluence mill site would have had direct impacts only on the Heidelberg Mine Road (24SA328) as discussed for Alternative IV. This road has been determined ineligible for listing on the NRHP and no mitigation measures would have been required. No other known cultural resources would have been impacted. The McKay Creek tailings impoundment and discharge lines area was not surveyed for cultural resources. Direct impacts to cultural resources in that area are unknown.

The types of indirect and cumulative effects to recorded cultural resources would have been similar to those described in Alternative II, but impacts to recorded sites would be less severe because of the decreased level of development in the vicinity of Rock Creek proposed under this alternative. Indirect and cumulative impacts to cultural resources in the vicinity of the McKay Creek tailings and discharge lines are unknown.

Native American Treaty Rights

Tribal members exercising their treaty fishing rights would have suffered some loss of fishing opportunity on Rock Creek, and a complete loss of fishing opportunity on 15,000 feet of McKay Creek. There also would have been a loss of berry picking and herb gathering sites buried under the impoundment as well as impacts to tribal hunting rights. The percentage of the original treaty lands that would have been impacted by the McKay Creek alternative would be minimal.

Sound

Project impacts would have been mitigated as described by the Alternative III as well as by the location of the tailings impoundment on McKay Creek. Impoundment construction and operations noise impacts to the Clark Fork River Valley, particularly to those residents near Noxon Dam would have been reduced. Since the impoundment was closer to the CMW, the potential for construction-related sounds to carry into the wilderness was increased.

Scenic Resources

This impoundment site would not have been visible from viewpoints in the Clark Fork Valley, including Montana Highway 200, but would in immediate foreground views from relocated FDR No. 1022 for a distance of 2.8 miles along the south side of the impoundment.

Under this alternative, slurry and reclaim pipelines -- two 10-inch steel above-ground pipelines -- would have extended an additional 2 miles along relocated FDR No. 150 from Engle Creek in the Rock Creek drainage to near Montana Highway 200 to avoid more visible cut-and-fill slopes before heading up the McKay Creek drainage. This additional paralleling of FDR No. 150 would have extended the developed character of this utility corridor and resulted in minor visual impacts as this portion of the corridor would already contain the 230-kV transmission line and buried 12-inch water discharge line to the Clark Fork.

Other elements of this alternative -- the construction of two short (0.3- and 0.5-mile) roads in the McKay Creek drainage to connect with existing roads and the upgrading of FDR No. 150 to access the Miller Gulch rail load-out -- would have created minor visual impacts. Visual impacts of the load-out would have been the same as Alternative III. Impacts of the upper utility corridor from Engle Creek to the confluence mill site would have been the same as Alternative IV.

The impoundment also would have been visible in middleground views (0.5 to 3 miles distant) from the trail systems in the McKay Creek drainage that access the CMW -- the Wanless Lake, Bear Paw, and Goat Ridge trails. Visibility of the impoundment would have been greater on higher reaches of these trails near the CMW where tree density was relatively low and views were more open. The impoundment also would have been visible in background views (3 miles or greater) from Goat and Engle peaks within the CMW. For all viewpoints, the grayish-white color and fine texture of the tailings covering the valley floor would have contrasted dramatically with adjacent tree-covered hillsides for the mine life. Visual impacts would have been adverse, long term, and significant to those recreationists and visitors who value the existing, natural-appearing landscape in this drainage.

APPENDIX N

DISCUSSION OF
R1-WATSED RESULT

Discussion of R1-WATSED Result
Rock Creek Mine

Watershed modeling was used to predict and evaluate the cumulative watershed effects of the existing harvest, roading and proposed mining alternatives within the Rock Creek watershed. The Kootenai National Forest uses the R1-WATSED model which is considered to be "state-of-the-art". The values produced are estimates, and are used to compare effects between the existing conditions and alternatives. The R1-WATSED model predicts the highest 30-day-average water yield increase and the annual sediment yield increase using naturally caused and human activities in the watershed as input. Water yield and sediment yield recovery is also predicted by the model. The model calculates disturbances based on the "ECA" (Equivalent Clearcut Acre) procedure, for example a 100 acre harvest area with 50 percent canopy removal would equate to a 50 acre clearcut. The project file contains information on how the model functions and the data it requires to complete an analysis. Included in the project file are the values the Kootenai National Forest has input into the various data bases required to run the model. The values for these data bases have been adjusted for site specific conditions found on the Kootenai National Forest. The predicted values generated by the model do not reflect rare or episodic weather events (such as the rain-on-snow events that have occurred in this area in the past), or the effects the predicted increases would have on water quality, fish or aquatic habitat.

R1-WATSED also requires the input of local adjustments for variables like delayed recovery for different disturbances, and canopy removal due to natural causes, like fire. The most recent local research and field data were used to generate these adjustments. The following adjustments have been used during the completion of the R1-WATSED model runs for this project.

Canopy Removal From Fire:

Fire Intensity	Percent Canopy Removed
High	80
Moderate	55
Low	25

Delayed Recovery (in years) by Habitat and Disturbance Type:

	Disturbance Types			
Habitat Type	Harvest and Site Prep.	Fire (low)	Fire(mod.)	Fire(high)
Fast Growing	5	0	5	8
Moderately Growing	7	0	7	11
Slow Growing	9	9	9	14

The Kootenai National Forest is currently reviewing and compiling data to begin the validation process for the R1-WATSED model for the forest. The initial efforts at validation have showed that the water yield portion of the model displays good correlation between collected data and the model predictions.

Additional intense sediment data collection is needed to get a better idea on the sediment volume predicting possibilities of the model. At the present, the values for sediment prediction should only be used for comparison purposes between different alternatives. The volumes predicted for sediment generation reflect increases of suspended sediment in the stream at the analysis point that is delivered to the stream from upslope activities only and do not include any in-channel generated sediment. The sediment values predicted are not exact amounts. Table 4-29 in the Hydrology section displays the information discussed below.

Discussion of the R1-WATSED Model Results for the Rock Creek Watershed

The Rock Creek watershed was initially divided into ten subwatersheds for this analysis (Figure N-1). The analysis looks at each subwatershed and then combinations of watersheds with a final analysis of the entire watershed. The analysis of the West Fork of Rock Creek, the East Fork of Rock Creek and the entire Rock Creek watershed are discussed below. These were the most natural analysis areas since the bulk of the activities occur in only two watersheds (West Fork and Lower Rock Creek). Four other watersheds have a minor amount of activities with the Rock Creek proposal. All The activities are analyzed cumulatively with the proposed activities (road reconstruction, new road construction, powerline corridors, and facility development) in a three year time span (1999- 2001). The model was run to the year 2031 to review hydrologic and sediment recovery over the life of the mine. Results from the three major watersheds are discussed below.

West Fork of Rock Creek
Existing Condition (1997):

There are 36.3 miles of road in this 3814 acre basin. This results in a road density of 6.5 miles of road per square mile of the watershed. This elevated amount of roading combined with the high watershed delivery efficiency has left the watershed in a condition where it responds to large storm events with negative effects. Snort Creek, a subwatershed of the West Fork has a road density of 10.8 miles of road per square mile of the watershed. Stream surveys of Snort Creek report that the combination of excessive roading, 23 percent of the basin in a clearcut condition and the presence of riparian harvest have left this stream in a degraded condition. The channel is not able to store the sediment it produces because of its degraded condition. Currently, 13% of the entire West Fork basin is in a clearcut condition. All the existing activities have resulted in a peak flow increase of 7 percent. Although this value is well within the forest plan standards, this watershed is showing negative effects of the past management. Surveys of the main West Fork channel show a decrease in stream habitat through the increase of riffle habitats and a loss of pool habitats. The amount of gravel and cobble sized substrates are increasing. These materials would eventually be transported to the stream in lower Rock Creek. R1-WATSED predicts an existing annual sediment increase of 288 percent. Because the sediment predicting capabilities of the model have not been validated, this value should not be reviewed as an exact amount of sediment. The prediction needs to be compared to existing conditions in the stream and compared to natural and or desired conditions. In this respect, the predicted value is correlated with the existing degraded in-channel conditions. It indicates that a sediment threshold has been crossed from the past activities and degraded conditions are present in the channel.

<u>East Fork of Rock Creek</u>
<u>Existing Condition (1997)</u>:

There are 7.2 miles of road in this 10,115 acre basin. This results in a road density of 0.5 miles of road per square mile of the watershed. The roads in this basin are mostly low standard roads that are closed year long to motorized travel. Even though the watershed has a high water delivery efficiency, this amount of roading has not resulted in negative impacts to the stream channel. Currently, less than 1 percent of the basin is in a clearcut condition. All the existing activities in this basin have resulted in no increase in peak flow. The model predicts an annual sediment increase of 32 percent. Because most of this basin is located in the Cabinet Mountains Wilderness, its condition is considered to be within the natural range with respect to watershed function and condition.

<u>Entire Rock Creek Watershed</u>
<u>Existing Condition (1997):</u>

There are 102.6 miles of road in this 21,162 acre watershed. This results in a road density of 3.1 miles of road per square mile of the watershed. This amount of roading combined with the high watershed delivery efficiency is within a range on the Kootenai National Forest where watersheds normally continue to function in an adequate manner. The lower portion of Rock Creek is classified as an intermittent drainage. Currently 6.5 percent of the watershed is in a clearcut condition. All the existing activities have resulted in a peak flow increase of 3 percent. One small tributary to the main stem of Rock Creek, Big Cedar Gulch, has an extremely high road density of 13 miles per square mile of watershed. This subwatershed has an existing ECA of 30 percent, a 17 percent peak flow increase and a 793 percent annual sediment increase. Stream surveys in this drainage have shown that the stable stream channel does not connect to Rock Creek because the water goes subsurface on the alluvial fan at the mouth of the valley. Water from this drainage only reaches Rock Creek during flood events as the water resurfaces about 200 yards from Rock Creek and makes its way to Rock Creek via overland flow without creating a channel. This discussion is intended to display the fact that just because the model run results in a high value, it does not always indicate that degraded conditions are present. The peak flow increase for the entire Rock Creek watershed is well within the forest plan standards for allowable peak flow increases. Stream "improvement" projects in the late 1980's, that removed all large woody debris in the stream, from Highway 200 to the East and West forks of Rock Creek have left the lower stream channel in an unstable condition. Material that has been transported to the stream from above has resulted in the formation of debris jams. Rather then help to concentrate the flow and provide habitat, these jams cause the stream to migrate laterally around them. This has resulted in increased sediment production, loss of habitat, and unstable channel banks. The channel substrate concentrations in the lower section of Rock Creek are heavily skewed to the large gravel and cobble sizes. These substrates are not well suited for the maintenance of perennial flow. Fish habitat surveys by Washington Water Power have determined that the loss of pools (rearing habitat) is the limiting factor controlling fish populations in this watershed. The model predicts an annual sediment increase of 129 percent. It is not clear at this time because of all the activities that have occurred in this stream channel which activity has had the greatest effect on the current documented instability in the lower portion of the stream channel. The lower portion of the stream channel has historically been intermittent and unable to sustain year-round flow.

Comparison of Alternatives

- **Alternative I - No Action**

The implementation of this alternative would result in a continuation of the existing condition and recovery rates within the Rock Creek watershed. The Cabinet Ranger District of The Kootenai National Forest has no activities planned in the near-future (5-10 years) for this watershed. The private lands in the watershed have seen harvest activities in the recent past which have already been accounted for in the existing condition, because of the limited amount of private lands in this watershed it is not expected that any additional activities would have a measurable effect on the watershed resource.

- **Alternative II - See Sterling Proposal**

West Fork of Rock Creek
Predicted Condition (1999 - 2031):

This alternative results in the construction of 3.4 miles of new road, 1.1 miles of road reconstruction, 1.0 miles of road paving, 3.5 miles of road tread improvement (gravel placement), and 117 ECA's generated from facility development. These actions result in a 1 percent increase in peak flows to 8%, and a 255 percent increase in annual sediment yield to 543%. At the end of the life of the mine, the peak flow value would drop back to the existing value and the annual sediment increase is predicted to drop to the 320 percent level. Because this would result in an overall increase within this watershed, it is expected that conditions would continue to worsen with the implementation of this alternative.

East Fork of Rock Creek
Predicted Condition (1999 - 2031):

This alternative results in the construction of .2 miles of new road, 1.1 miles of road reconstruction, 1.0 miles of road obliteration, 1.1 miles of road paving, .2 miles of road tread improvement (gravel placement), and 16 ECA's generated from facility development. These actions result in no increase in peak flows, and a 13 percent increase in annual sediment yield to 45%. At the end of the life of the mine, the peak flow value would still be at the existing value and the annual sediment increase is predicted to drop to the 26 percent level. Because this would result in no overall increase within this watershed, it is expected that conditions would continue to remain the same as those in the existing condition with the implementation of this alternative.

Entire Rock Creek Watershed
Predicted Condition (1999 - 2031):

This alternative results in the construction of 7.7 miles of new road, 6.8 miles of road reconstruction, 1.0 miles of road obliteration, 7.3 miles of road paving, 7.2 miles of road tread improvement (gravel placement), and 284 ECA's generated from facility development. These actions result in a 1 percent increase in peak flows to 4%, and a 72 percent increase in annual sediment yield to 201%. At the end of the life of the mine, the peak flow value would drop back to the existing value and the annual sediment increase is predicted to drop to the 122 percent level. Because this would result in a small overall increase within this watershed, it is expected that conditions would continue to remain the same or worsen with the implementation of this alternative.

- **Alternative III - Sterling Proposal with Agency Modifications and Mitigations**

West Fork of Rock Creek
Predicted Condition (1999 - 2031):

This alternative results in the construction of 1.5 miles of new road, 2.4 miles of road reconstruction, 0.9 miles of road paving, 3.0 miles of road tread improvement (gravel placement), and 106 ECA's generated from facility development. These actions result in a 1 percent increase in peak flows to 8%, and a 187 percent increase in annual sediment yield to 475%. At the end of the life of the mine, the peak flow value would drop one percent below the existing value and the annual sediment increase is predicted to drop to the 294 percent level. Because this would result in a very small change within this watershed, it is expected that conditions would continue to remain at the current condition with the implementation of this alternative.

East Fork of Rock Creek
Predicted Condition (1999 - 2031):

This alternative results in the construction of .2 miles of new road, 1.1 miles of road reconstruction, 1.0 miles of road obliteration, 1.1 miles of road paving, .2 miles of road tread improvement (gravel placement), and 15 ECA's generated from facility development. These actions result in no increase in peak flows, and a 14 percent increase in annual sediment yield to 46%. At the end of the life of the mine, the peak flow value would still be at the existing value and the annual sediment increase is predicted to drop to the 26 percent level. Because this would result in no overall increase within this watershed, it is expected that conditions would continue to remain the same as those in the existing condition the implementation of this alternative.

Entire Rock Creek Watershed
Predicted Condition (1999 - 2031):

This alternative results in the construction of 4.5 miles of new road, 8.1 miles of road reconstruction, 1.0 miles of road obliteration, 8.8 miles of road paving, 3.8 miles of road tread improvement (gravel placement), and 250 ECA's generated from facility development. These actions result in a 1 percent increase in peak flows to 4%, and a 48 percent increase in annual sediment yield to 177%. At the end of the life of the mine, the peak flow value would drop back to the existing value and the annual sediment increase is predicted to drop to the 114 percent level. Because this would result in a very small increase within this watershed, it is expected that conditions would continue to remain the same for the life of the mine with the implementation of this alternative.

- **Alternative IV - Agency Modified Rock Creek Project with Mitigations**

West Fork of Rock Creek
Predicted Condition (1999 - 2031):

This alternative results in the construction of 0 miles of new road, 0.5 miles of road reconstruction, 0.3 miles of road paving, .2 miles of road tread improvement (gravel placement), and 20 ECA's generated from facility development. These actions result in no increase in peak flows, and a 54 percent increase in annual sediment yield to 342%. At the end of the life of the mine, the peak flow value would drop 2 percent below the existing level to 5%, and the annual sediment increase is predicted to drop to the 255 percent level. Because this would result in a small decrease within this watershed, it is expected that conditions would continue to remain at the current condition or slightly improve over the life of the mine with the implementation of this alternative.

East Fork of Rock Creek
Predicted Condition (1999 - 2031):

This alternative results in the construction of 0 miles of new road, 1.1 miles of road reconstruction, 1.0 miles of road obliteration, 1.1 miles of road paving, 0 miles of road tread improvement (gravel placement), and 46 ECA's generated from facility development. These actions result in no increase in peak flows, and a 24 percent increase in annual sediment yield to 56%. At the end of the life of the mine, the peak flow value would still be at the existing value and the annual sediment increase is predicted to drop to the 30 percent level. Because this would result in a very small increase within this watershed, it is expected that conditions would continue to remain the same as those in the existing condition with the implementation of this alternative.

Entire Rock Creek Watershed
Predicted Condition (1999 - 2031):

This alternative results in the construction of 2.8 miles of new road, 6.5 miles of road reconstruction, 1.0 miles of road obliteration, 8.0 miles of road paving, 1.0 miles of road tread improvement (gravel placement), and 195 ECA's generated from facility development. These actions result in no increase in peak flows, and a 36 percent increase in annual sediment yield to 165%. At the end of the life of the mine, the peak flow value would drop one percent below the existing level to 2%. The annual sediment increase is predicted to drop to the 110 percent level. Because this would result in a small decrease within this watershed, it is expected that conditions would continue to remain the same or slightly improve with the implementation of this alternative.

- **Alternative V - Agency Modified Rock Creek Proposal with Tailings Paste Deposition and Alternative Water Treatment (as of 6/10/97).**

<u>West Fork of Rock Creek</u>
<u>Predicted Condition (1999 - 2031):</u>

This alternative results in the construction of 0 miles of new road, 0.4 miles of road reconstruction, 0.2 miles of road paving, 0.2 miles of road tread improvement (gravel placement), and 16 ECA's generated from facility development. These actions result in no increase in peak flows, and a 24 percent increase in annual sediment yield to 312%. At the end of the life of the mine, the peak flow value would drop 2 percent below the existing level to 5%, and the annual sediment increase is predicted to drop to the 245 percent level. Because this would result in a small decrease within this watershed, it is expected that conditions would continue to remain at the current condition or slightly improve over the life of the mine with the implementation of this alternative.

<u>East Fork of Rock Creek</u>
<u>Predicted Condition (1999 - 2031):</u>

This alternative results in the construction of 0 miles of new road, 0.5 miles of road reconstruction, 1.0 miles of road obliteration, .5 miles of road paving, 0 miles of road tread improvement (gravel placement), and 29 ECA's generated from facility development. These actions result in no increase in peak flows, and a 20 percent increase in annual sediment yield to 52%. At the end of the life of the mine, the peak flow value would still be at the existing value and the annual sediment increase is predicted to drop to the 28 percent level. Because this would result in no overall increase within this watershed, it is expected that conditions would continue to remain the same as those in the existing condition the implementation of this alternative.

<u>Entire Rock Creek Watershed</u>
<u>Predicted Condition (1999 - 2031):</u>

This alternative results in the construction of 2.7 miles of new road, 6.5 miles of road reconstruction, 1.0 miles of road obliteration, 6.5 miles of road paving, 2.6 miles of road tread improvement (gravel placement), and 170 ECA's generated from facility development. These actions result in no increase in peak flows, and a 30 percent increase in annual sediment yield to 159%. At the end of the life of the mine, the peak flow value would drop one percent below the existing level to 2%. The annual sediment increase is predicted to drop to the 109 percent level. Because this would result in a small overall decrease within this watershed, it is expected that conditions would continue to remain the same or slightly improve with the implementation of this alternative.

Additional Possible Mitigation Measures

(1) Restoration of roads in Snort Creek, and the West Fork of Rock Creek. Try to bring down the road densities to below 4 miles per square mile of the watersheds. Some stream restoration projects may also be available in this watershed to help reduce sediment concentrations.

(2) Addition of Large Woody Debris to Snort Creek, West Fork of Rock Creek and the main stem of Rock Creek.

(3) If surveys determine that the logjams on the main stem of Rock Creek are causing greater instability, channel restoration could be performed to increase the channel stability.

Steve Wegner
KNF - Libby Ranger District
District Hydrologist

Rationale for Alternative V Sediment Mitigation Calculations[1]

Alternative V includes various sediment abatement measures meant to minimize impacts to Rock Creek. These measures include containment around some facilities, revegetation requirements, best management practices, road drainage upgrades, and road resurfacing. However, analyses in the Biological Assessment for bull trout (included in Appendix B of the final EIS) found that additional sediment mitigations, beyond those already specified in Alternative V in the supplemental EIS, would be needed to offset project impacts. The added mitigation was needed to compensate for unavoidable effects that would result from implementing the sediment abatement program and less than 100 percent effectiveness of best management practices.

Additional sediment mitigations have been added to Alternative V based on the results of the WATSED analysis of the alternatives described earlier in this appendix. The agencies accepted the WATSED numeric prediction of change in sediment production for Alternative V and then inflated the estimate to compensate for two degrees of uncertainty. The objective was to arrive at an estimate of tons of new fine sediment resulting from Alternative V, and thus the tons of sediment from existing source areas that should be immobilized through a mitigation program. The goal was a high probability that Alternative V as described in the final EIS would result in no net increase in fine sediment in Rock Creek, and a reasonable certainty of an actual reduction in fine sediment transport over the life of the mine.

The sediment mitigation need was identified through the following steps:

1. Subtract the tons/year sediment estimate for the existing 1998 condition from the tons/year estimate for Alternative V at the height of project construction:

   469.6 tons/year - 403.5 tons/year = 66.1 tons/year estimated increase

2. Based on limited WATSED validation monitoring, inflate the result from step #1 by 300 percent to account for an apparent under-estimation of real-world effects on sediment production:

   66.1 tons/year * 3.0 = 198.3 tons/year probable increase in fine sediment

3. As an added measure of certainty, double the result in step #2 to compensate for the marginal accuracy of the model, the limited amount of validation data, and less than 100 percent effective mitigation:

   198.3 tons/year * 2.0 = 396.6 tons/year real increase in fine sediment

4. To dilute the aura of precision that 396.6 tons/year implies, round up the result in step #3 to the nearest hundred tons:

   369.6 tons/year ≈ 400 tons/year mitigation requirement

[1] Information taken from Memo to Rock Creek Project IDT, May 6, 1998, from R. Douglas Perkinson, KNF.

Three lines of evidence suggest that a 400 ton/year reduction in fine sediment would result in no net increase, or an actual long-term reduction, in Rock Creek fine sediment in transport and instream.

> First, WATSED predicts a 38 percent increase in sediment delivery from Alternative V at the height of construction, but then sediment transport falls below the present condition five years later due to hard surfacing of some roads, improved road drainage control and revegetation benefits (sediment abatement). Thus the model output matches our understanding of the processes involved, and it hypothesizes a net reduction over time. However, it does not account for stream channel sediment production or less than totally effective sediment abatement measures.
>
> Secondly, there is a decade of monitoring data that compares WATSED data modeled sediment production against streambed McNeil sediment cores for a stream near Libby. The trend line for these two data sets mirror each other, with a time lag of four years between a change in sediment input and a change in streambed fine sediment. This 4-year time lag nearly matches the WATSED assumption that the initial pulse of sediment from a disturbance lasts 5 years, and it also is what is expected when a disturbance occurs far upstream of the streambed monitoring site.
>
> The third line of evidence is several years of suspended sediment validation monitoring that compares WATSED-predicted to actual sediment output from a managed watershed nearly identical (size, flow, disturbance levels) to Rock Creek. This validation monitoring indicates WATSED under-predicted effects by 320 percent.

Given that these lines of evidence are instructive, but not conclusive, it has been concluded that WATSED can track real-world processes. However, numeric estimates need to be inflated before they can be considered reasonably accurate. Hence, the calculations described above.

Recommendations on where to mitigate for unavoidable fine sediment effects relies on the WATSED analysis and the floodplain sediment source survey conducted by ASARCO. The model indicates a short-term increase for the west fork of 46 percent as a result of evaluation adit and access road construction, a 20 percent increase for the east fork from mill site construction, and a cumulative 38 percent increase when the remainder of the road construction and reconstruction, powerline and pipeline construction, and the tailings facility construction are included. The baseline data for the project indicates three important bull trout habitat areas: the West Fork of Rock Creek, the lower end of the East Fork of Rock Creek, and the perennial main stem reach of Rock Creek around the confluence with Engle Creek. This indicates a need to require sediment mitigation at a minimum of two sites.

The first site is the main stem floodplain terrace (P-1) at the confluence with Engle Creek and an unidentified source area in the West Fork of Rock Creek drainage. If pre-mitigation monitoring of these two sites indicated they produce less than 400 tons of fine sediment in an average year, the next priority would be mitigation of a source within the East Fork of Rock Creek basin and then a site in or near the Orr Creek basin. Mitigations of the main stem site near Engle Creek would benefit migratory bull trout assumed to be using this area for spawning and mitigating sites along the west fork would benefit the population of resident bull trout.

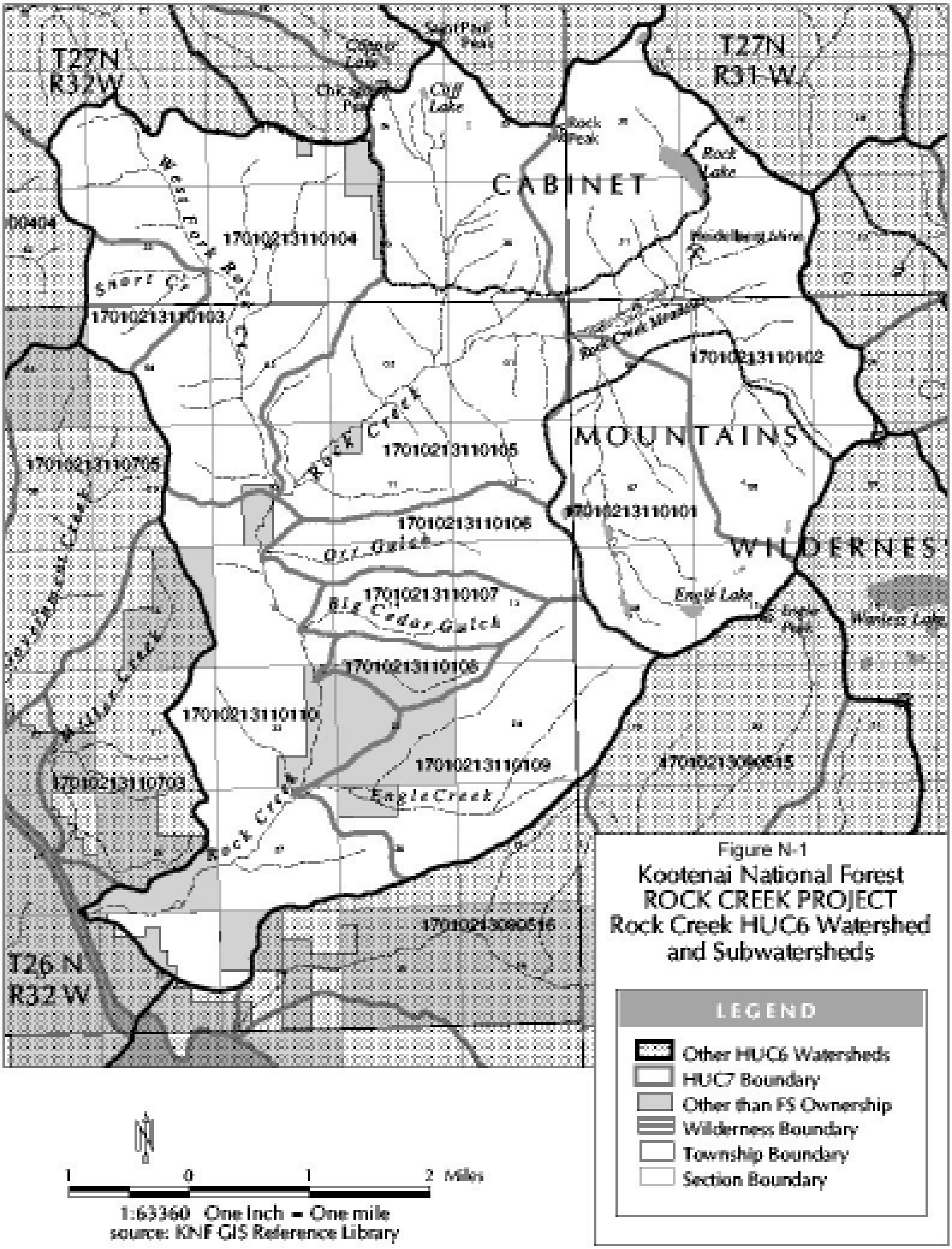


Figure N-1
Kootenai National Forest
ROCK CREEK PROJECT
Rock Creek HUC6 Watershed
and Subwatersheds

APPENDIX O

NEW MANAGEMENT AREA DESCRIPTIONS

I. MANAGEMENT AREA 23 - Electric Transmission Corridor

A. DESCRIPTION

This Management Area (MA) is composed entirely of the existing electric transmission corridor on the south end of the Forest that parallels FDR No.150. Vegetation is predominantly a conifer forest. Almost all acres are in grizzly bear situation 1 and 3.

B. GOALS

Provide for the transmission of electricity in a safe and efficient manner. Protect the adjacent wilderness character, contribute to the diversity of surrounding wildlife habitat, and provide as much security as possible for the grizzly bear.

C. STANDARDS

1. These standards will also apply to any future corridors which may be located and approved.
2. The Forest-wide management direction included in Chapter II of the Kootenai National Forest (KNF) Plan (U.S. Forest Service KNF 1987) applies to this MA.

<u>Recreation</u>

1. Due to the nature of the activity, VQOs do not apply during the life of the project. The long-term VQO to be applied after reclamation is Partial Retention.
2. Although VQOs do not apply, efforts should be made to reduce visual contrast, and as determined appropriate by the Agencies, initiate interim and final reclamation activities during mine operation.
3. The ROS class is predominantly rural.
4. Over-snow vehicles are allowed when conflicts with big game can be avoided.

<u>Wildlife and Fish</u>

1. Vegetation control will be coordinated with wildlife use to provide forage for winter range at lower elevations.
2. Security for wildlife will be provided by regulating access along the corridor. Regulation may include seasonal closures to all motorized vehicles but powerline maintenance personnel.
3. Any activity in this MA will be required to leave no trash or other grizzly attractant. Standards and guidelines specified in Appendix 8 (Grizzly Management Situation Guidelines *in* U.S. Forest Service KNF 1987) will be applied for all activities on grizzly habitat.
4. Controls will be determined site specifically, but any herbicide used may not enter any water course.

<u>Range</u>

Grazing domestic livestock is permitted on the portions where grazing is also permitted on the adjacent MA.

Timber

1. This MA is not suitable for timber production.
2. Culture and harvest of Christmas trees or other products which can safely be grown and harvested under the powerline is permitted.
3. Harvest units in adjacent MAs should be planned to add visual diversity to the corridor edges.

Soil, Water and Air

1. Soil and Water Conservation Practices will guide the implementation and mitigation of all land disturbing activities.
2. Comply with the Smoke Management Plan published by the DEQs Air and Waste Management Bureau and administered by the Montana State Airshed Group.
3. Public motorized access may be restricted because of the need to control erosion on steep grades.

Mineral and Geology

1. Refer to Forest Standards for locatable minerals. Seasonal restrictions may occur.
2. Seasonal restrictions may be required for oil and gas leases and geophysical activities.
3. Generally, disposal of common minerals will not be permitted.

Facilities

1. The powerline access roads will be open to maintenance crews at all times.
2. Public access may be restricted based on the access restrictions of adjacent MAs.
3. Open roads will be maintained at level 2 or better.
4. Because of some steep grades on access roads, erosion control measures including structures, drainage dips, etc. will be inspected annually and constructed or maintained to prevent soil loss.

Fire

Prescribed Fire

Planned Ignitions — Planned ignitions for disposal of activity fuels or wildlife habitat enhancement are permitted.

Unplanned Ignitions — Unplanned ignitions as prescribed fire are not permitted.

Wildfire

All seasons --All wildfires will be controlled.

D. SCHEDULE OF MANAGEMENT PRACTICES

Planned - First Decade
None planned
Projected - Second Decade
None projected

E. MONITORING AND EVALUATION REQUIREMENTS

The specific monitoring requirements from Chapter IV (USFS KNF 1987) that are applicable to this MA are:

Recreation A-3, A-5, A-7
Range D-1, D-2
Human & Comm Dev. H-3, H-4
Facilities L-1, L-2

The procedures outlined in Chapter IV will be followed to evaluate the data gathered during monitoring.

II. MANAGEMENT AREA 31- Mineral Development

A. DESCRIPTION

This MA consists of permitted land areas that are directly involved with mineral production facilities such as major mine portals, mineral ore processing facilities, mineral tailings impoundments, water diversion structures, percolation areas, pipelines, and long-term equipment occupancy areas. They can be located within or adjacent to other MAs, depending on the final approved location of the mine and the necessary supporting facilities.

B. GOALS

Provide for the safe and healthful working areas for mineral production workers that are in concert with the surrounding MAs as much as possible. Additional sites for this MA will be provided as demand and successful mineral discoveries permit.

C. STANDARDS

1. These standards will apply to all mineral development areas.
2. The Forest-wide management direction included in Chapter II of this plan applies to this MA.
3. Due to the nature of the activity, VQOs do not apply during life of the Project. The long-term VQO to be applied after reclamation is Partial Retention.
4. Although VQOs do not apply, efforts should be made to reduce visual contrast and, as determined appropriate by the Agencies, initiate interim and final reclamation activities during mine operation.

<u>Recreation</u>

1. ROS does not apply during life of the Project. The long-term ROS class to be applied after reclamation is Roaded Natural.
2. ORV use is not permitted in this MA.

<u>Wildlife and Fish</u>

1. Locate facilities, if possible, away from important winter range, calving areas, riparian areas and meadows.
2. Activities will be scheduled, if possible, to prevent conflict with wildlife use in adjacent MAs, particularly winter range use.
3. Activities will be conducted to prevent siltation in streams that provide spawning habitat for both resident and migratory fish.

<u>Range</u>

Domestic livestock grazing is generally not permitted.

Timber

1. This MA is not suitable for timber production.
2. Salvage harvest may occur to remove trees infested by insects or disease, to remove hazard trees, or for other land clearing necessary for mineral production purposes.
3. Landing areas for timber harvest on adjacent MAs are permitted if there is no conflict with the mineral production facility, soil protection, water quality, or cultural site protection.

Soil, Water and Air

1. Soil and Water Conservation Practices will be followed for any activity.
2. Comply with the Smoke Management Plan published by the Air Quality Bureau of the Montana Department of Health and Environmental Sciences and administered by the Montana State Airshed Group.

Riparian (See Riparian Area, Chapter III)

Mineral and Geology

1. Refer to Forest Standards for locatable minerals. Seasonal restrictions may occur.
2. Stipulate no surface occupancy for oil and gas leases.
3. Removal of common minerals will generally not be permitted unless it is consistent with the mineral production facility needs.

Lands

Special uses, rights-of way, easements, or cost-share agreements may be authorized on a case-by case basis, provided that they are consistent with the mineral production facility.

Facilities

1. Permanent roads are anticipated and will be maintained for safe use.
2. Temporary roads will be closed, drained, and revegetated.

D. SCHEDULE OF MANAGEMENT PRACTICES

Planned - First Decade
None planned
Projected - Second Decade
None projected

E. MONITORING AND EVALUATION REQUIREMENTS

The specific monitoring requirements from Chapter IV (U.S. Forest Service KNF 1987) that are applicable to this MA are:

Recreation	A-7
Range	C-9
Soil and Water	F-1
Minerals	G-1

The procedures outlined in Chapter IV will be followed to evaluate the data gathered during monitoring.

APPENDIX P

FAILURE MODES EFFECTS ANALYSIS

FAILURE MODES EFFECTS ANALYSIS

BACKGROUND

The Agencies, after considering comments on the draft EIS and in consideration of additional tailings handling data offered by the applicant, contracted for a third party review and Failure Modes Effects Analysis, or FMEA, to review tailings paste technologies and acid rock drainage potential. The FMEA is an engineering reliability technique used to systematically identify, characterize, and screen risks that derive from the failure of an engineered system to operate or perform as intended. Originally developed for use in nuclear safety, FMEA has been widely applied, for example, in the chemical industry since the Bhopal, India, disaster and by NASA since the space shuttle Challenger accident. Although FMEA does not by itself reduce risks, the systematic risk characterization provides an effective method for designing risk management and mitigation strategies that do. For the Rock Creek Project, FMEA provides for improved understanding and characterization of mining-related risk associated with paste tailings placement (Alternative V) and acid rock drainage (ARD). For more detailed information, copies of the Rock Creek Project FMEA are available from the Kootenai National Forest and Montana DEQ.

Fundamental to FMEA is the meaning of "risk" defined by Webster's Dictionary as "the possibility of loss". This concept of risk embodies two components: an uncertain state of knowledge about the occurrence of an event and adverse effects produced by the event should it occur. Expressed more simply:

Risk = (likelihood) x (consequences)

To characterize risk, both the relative likelihood of a failure event and its consequences must be considered. As a qualitative technique, likelihood and consequences are evaluated in FMEA using professional judgment and opinion. This is accomplished in a workshop format including not just technical experts, but also those more knowledgeable about baseline data and operation and maintenance of the actual system. The opportunity for interchange and interaction among the workshop participants, using risk as the common denominator, can be among the most important benefits that FMEA provides. For any complex system, risks derived from many sources. Failure of any one component can directly affect other components or the overall system. FMEA evaluates the failure likelihood and consequences for each individual component, allowing those with highest risk to be identified for further analysis or targeted for risk reduction measures. Only recently have FMEA techniques originally developed for electrical and mechanical systems been adapted to the environmental effects of mining (e.g. Ferguson and Roberston 1994; Dushnisky and Vick 1996), but these applications are not conceptually complex. They simply treat the structures and facilities of the mine as system components, and view the consequences of the component failure in terms of environmental damage. In this way, these environmental applications of FMEA may achieved the following purposes:

- to systematically identify and catalog those mine structures and facilities whose failure to operate or perform as intended would pose risk to the environment;
- to identify those mine features and potential occurrences that are the dominant risk contributors, as distinct from others that produce comparatively lesser risk; and

- to develop a sense of the overall reliability of the environmental protection features incorporated in mine planning, design, and operations.

At the same time, these FMEA applications function within the context of several assumptions and limitations including the following.

- FMEA does not serve as a quality assurance device, and it assumes that the facilities have been constructed as designed.
- FMEA is different from regulatory compliance or environmental audits and it does not fulfill their specific purposes.
- FMEA seeks to characterize risks in a systematic way and is intended to identify the main risks or failure modes. FMEA reflects the information, judgment, and professional opinion available and expressed in the workshop(s) at the time it was performed. Just as these factors may change over time, so too can the assessment of risk be expected to vary according to additional information or the evaluation of others.

FMEA FRAMEWORK

FMEA characteristically includes several steps performed in logical sequence. These are described below for the Rock Creek Project FMEA.

System Description

The project is typically subdivided into a number of key components which group together related facilities and provide a focus for "what can go wrong" with that component. Key components that were considered for the Rock Creek Project include Bottom-Up Paste Tailings Facility, Top-Down Paste Tailings Facility, and Mine Workings and Waste Rock.

Each of the main components were then further subdivided into sub-components, and failure modes identified for various aspects of each component. The failure modes also consider the development phases which included: construction, operation, decommissioning, and post closure land use.

Likelihood Categories

Although failure likelihoods are intended to be qualitative, broad numerical probability ranges are useful in promoting consistency among workshop participants in verbally expressed judgements. The categories are:

- Negligible - equivalent to a return period of more than 1 million years. Risk could be similar to the risk of being injured in an elevator ride;

- Very Low - a return period of 10,000 and 1 million years. This is the current range for the likelihood of failure of U.S. water dams and similar to the likelihood of being struck by lightning;
- Low - a return period of 100 and 10,000 year. This is the range associated with likelihood of death from cancer, mountaineering and suicide;
- Moderate - a return period of between 10 and 100 years. This is the range associated with likelihood of failure of mine pit slopes, and marine shipping accidents; and
- High - a return period of less than 10 years. Something that happens regularly.

Likelihood categories defined are generally understood to be on an annual basis, and thus must be accumulated over the relevant exposure period. For example, failure modes with a high likelihood are very likely to happen at least once over the operating life of the mine and failure modes with a low likelihood are very likely to happen at least once over the 1,000 year post closure analysis period.

Some risks are not cumulative with time and these include the potential for acid rock drainage in which the likelihood is determined by the actual geology, hydrogeology, and geochemistry.

Consequences

The consequence of any component failure is described as a mutually exclusive consequence set. For the Rock Creek Project, two categories of consequences were selected and these include: water quality and socio-economic consequences. Impact categories are negligible, low, moderate, high, and extreme.

Confidence Categories

Judgment on likelihood and consequences made by workshop participants may vary substantially in their associated degrees of confidence depending on the technical information available and how well that process or effect is understood. Confidence categories that apply to both the likelihood and the consequence categories are:

- Low - do not have confidence in the estimate, or could vary significantly;
- Moderate - have some confidence in the estimate, or moderate variability; and
- High - confident, or low variability

Binning

The workshop and FMEA tabulation provides the basic information for evaluating failure modes and developing risk management plans. The first step in this process is termed "binning" where likelihoods are paired with consequences to screen out the higher risk failure modes. The high likelihoods coupled with high consequences, for example, would "bin out" as a high risk. The binning of risk also considers the confidence category, for example a low confidence category could mean that the likelihood or consequence could increase and move it into a higher risk category. The time exposure period affects the binning for the post closure land use phase, and for this case all risks with a low likelihood were binned out.

Compensating Factors

During the FMEA process each risk item was assessed with respect to what compensating factors could reduce the risk. Compensating factors, for example, could include design changes or more detailed studies. These compensating factors would typically then be included in the risk management plan for the project. The risks after compensating factors are applied are then reassessed with compensating factors implemented.

Risk Management Plan

On the basis of the binning process and compensating factors, a risk management plan is developed for the high risk items. The risk management plan forms the basis for developing mitigations to the proposed operating plan. Included in this can be changes in designs, further investigative studies, monitoring requirements, quality assurance/quality control processes, or any other modification which would reduce the risk associated with a particular design feature.

Results

Results from the Failure Modes Effects Analysis are presented in the following excerpted table from the Klohn-Crippen (1998) FMEA report (see Table P-1).

Table P-1 Failure Modes Effects Analysis Summary

COMPONENT	ID CODES	FAILURE MODE OR POTENTIAL PROBLEM	EFFECTS	PROJECT STAGE*	LIKELIHOOD CATEGORY**	CONSEQUENCES***		CONFIDENCE LEVEL****	COMPENSATING FACTORS	POST-COMPENSATION	
						WATER QUALITY	SOCIO-ECONOMIC			LIKELIHOOD CATEGORY	CONFIDENCE LEVEL
Tailings Facility (bottom up construction)	1.1	Dam failure due to seismic loading	major slope failure	O,D,P	VL	H	E	M	Engineering/optimization	N	H
			minor deformation	O,D,P	L	N	N	M-H			
	1.2	Toe erosion from river	slumping/erosion of dam	O,D,P	N	L	L	H			
	1.3	Poor compaction in structural zone due to failure of PPSM to achieve moisture content	requires changes to dewatering system	O	M	-	L-M	L	- additional test work and analysis - filter tails for zones - borrow material		
	1.4	Plugging of blanket drains (filter criteria)	increase water table elevation and decrease stability of tailings facility	O,D,P	L	M	M	M	Engineering/QAIOC	N	H
	1.5	Differential settlement causes drain disruption	leads to increased phreatic level and increased groundwater seepage	O	L	L		L	Engineering	N	H
	1.6	Hydrologic event - exceed 100 year design event	erosion of tailings	O	M	L	L	M			
			damage to upslope ditch	O	VL	L	L	M			
			collection pond overflow and release of water	O	M	VL-L	VL	M			
	1.7	Erosional Events	contribute sediment to collection pond	O	M	L	VL	M	maintenance, clean out collection pond	N	H
	1.8	Mine Decommissioning	require recontouring	O	M	N	L		recontour/construct closure		
	1.9	Excess GW (Closure GW to surface)	metals and nitrogen concentrations exceed limits in downstream wells	O	L	L-M	M	L	collection system	L	M
				D,P	L-M	L-M	M	L	cap/surface on closure	L	M
	1.10	PPSM will not provide paste quality	need new system	O	L	L	M	L	pilot plant/testing		
	1.11	Construction snow inclusion leads to high moisture content in tailings	higher water level reduces stability	O	M-H	-	L-M	M	clarification on engineering, QA/QC	L	M
	1.12	PPSM "breakdown"	stop production	O	H	-	L	M	back-up system	L	M
	1.13	Leaching from waste rock berm	metal loading	O,D,P	L	L-M	-	M	emergency storage/treatment		
	1.14	Failure of reclamation growth (local erosion)	sediment loading	P	H	L	-	L	loading calcs/engin., long term maintenance	L	M
	1.15	Foundation failure on clay	slope instability	O	L	H	-	M	engineering	V-L	M
Tailings Facility (top down construction)	2.1	Seismic Deformation	major slope failure	O	L	H	E	L	engineer - drain, compact	N-VL	M-H
			major slope failure	P	L	H	E	L	engineer	N-VL	M-H
			minor deformation	O	L	N	-	L	engineer	N-VL	M-H
			minor deformation	P	L	N	-	L	engineer	N-VL	M-H
	2.2	Finger Drain Failure	slope failure, groundwater seepage	O,D,P	L	M	-	L	engineering, QA/QC	VL	H
Mine Components	3.1	Mine Openings	poor water quality	O	L	-	L-M	M	water treatment	VL	M-H
			poor water quality	P	VL-L	-	L-M	L-M	water treatment	VL	M-H
			increased flow	O	L	-	L-M	M	data assessment and bulkheads	VL	M-H
	3.2	Poor Quality of Seeps	degrades water quality	P	L	L	-	L-M	seep monitoring	L	L-M
	3.3	Lake Drainage	loss of habitat	O	VL	M-H	M-H	M-H			
	3.4	Bulkhead failure	release of water/metals	P	L	M-H	M	L			
	3.5	Mill pad waste piles - leaching	degrades water quality	O,P	L	M	-	M	collect and treat	VL	M-H
	3.6	Reduction in spring flow	affects habitat	O/P	H	L	L	L			

Notes: *O = operation, D = decommissioning of facilities, and P = postclosure

**Likelihood of failure: N=Negligible, <1 in 1,000,000; VL = Very Low; 1 in 1,000,000-1 in 10,000; L = Low, 1 in 10,000 - 1 in 100; M = Moderate, 1 in 100 - 1 in 10; H = High, > 1 in 10

***Consequences: N=Negligible, VL = Very Low; L = Low, M = Moderate, E = Extreme

****Confidence Levels: L = Low, do not have confidence in estimate and could vary significantly; M = Moderate, some confidence in estimate and moderate variability; H = High, confident in estimate and low variability