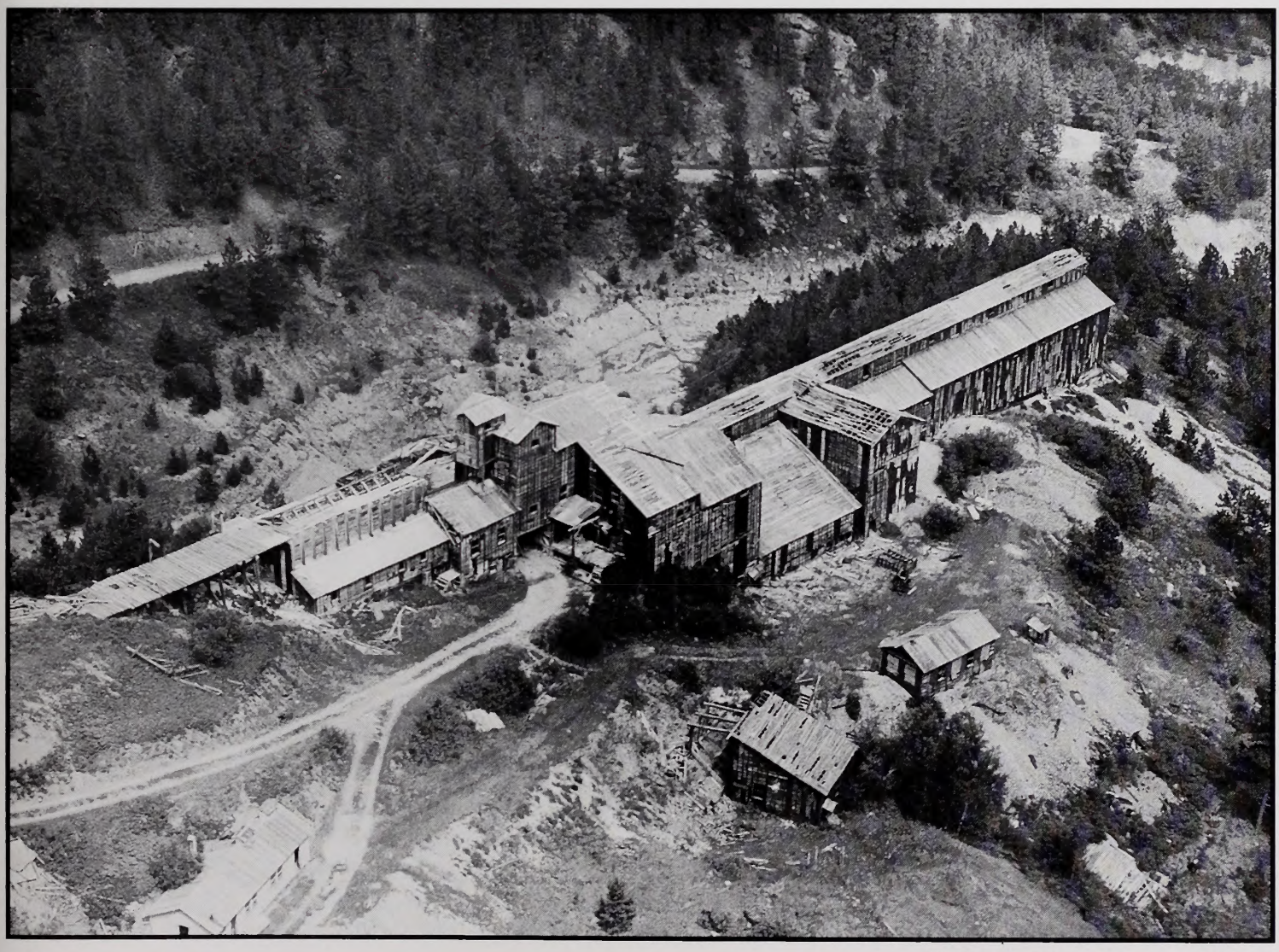
United States Department of the Interior
Bureau of Land Management
Lewistown District Office

State of Montana
Department of Environmental Quality
Hard Rock Bureau

March 1996

Executive Summary
Final Environmental Impact Statement
Zortman and Landusky Mines
Reclamation Plan Modifications and Mine Life Extensions



Historic Ruby Mill near the town of Zortman

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Dear Reader:

Enclosed is the Executive Summary for the Final Environmental Impact Statement (EIS) for the expansion of the Zortman and Landusky mines in north central Montana, and modified reclamation plans at both mines. The Final EIS presents a preferred alternative (Alternative 7) and six other alternatives including the company proposed action. The Final EIS discloses the possible environmental consequences associated with each alternative.

About 400 copies of the Draft EIS were distributed to the public and other federal and state agencies in August 1995 for a 75-day comment period. During the public comment period the agencies held five open houses/public hearings to receive oral and written comments. In addition to oral comments, the agencies received 368 letters on the Draft EIS. All comments, written and oral, were reviewed and considered in preparation of the Final EIS. Comments that presented new data, questioned facts or analysis, or raised questions or issues bearing directly upon the alternatives or environmental analysis are responded to in this Final EIS. Comments expressing personal opinions or statements were considered but not responded to directly.

A number of changes have been made to the Preferred Alternative between the Draft EIS and Final EIS, largely in response to public comments. Major changes include: removal of the Peregrine Falcon reintroduction study for the pit highwalls, relocation of the limestone quarries to avoid impacts to northern drainages, routing of all post-reclamation pit runoff to the south, updating of the water quality improvement plan presented in Appendix A, completion of the Programmatic Agreement for mitigation of impacts to cultural resources presented in Appendix E, and the inclusion of new Appendix F which presents the aquatic ecosystem mitigation plans. Alternative 3 has also been changed to evaluate the agencies' preferred reclamation cover in combination with a non-mining alternative.

The agencies involved wish to thank all those who provided suggestions and comments on the Draft EIS. Additional copies of the Executive Summary and copies of the Final EIS are available upon request from the Department of Environmental Quality or the Bureau of Land Management. A Record of Decision will be prepared no earlier than 30 days after the notice of receipt of the Final EIS is published in the Federal Register. A copy of the Record of Decision will be provided to everyone on the Final EIS mailing list.

EXECUTIVE SUMMARY

INTRODUCTION

This Summary of the Final Environmental Impact Statement (EIS), prepared by the Montana Department of Environmental Quality (DEQ) and the U.S. Department of the Interior, Bureau of Land Management (BLM), describes the evaluation of a proposal by Zortman Mining, Inc. (ZMI) to continue and expand mining operations at both the Zortman and Landusky mines in Phillips County, Montana.

DEQ and BLM (referred to as "the agencies") are the joint lead agencies responsible for preparation of the Final EIS, and for issuing a final decision regarding the mine permit application. For purposes of impact evaluation, technical expertise was provided by an independent third-party consultant selected by, and working under the direction of, DEQ and BLM. The agencies will consider the proposed action and alternatives presented in this EIS and issue a decision on the permits and approvals required from the agencies for the Zortman and Landusky mine expansion projects. The final decisions and rationale will be presented in a document or documents known as the Record of Decision(s). More details concerning various lead and supporting agency responsibilities are presented in Chapter 1.0 of the Final EIS.

This summary of the Final EIS contains a description of the proposed action and other alternatives; identifies the agencies' preferred alternative; summarizes existing environmental conditions in the study area; and discloses the major impacts and issues associated with the various alternatives. If more detail is desired regarding all or certain aspects of these topics, the relevant sections of the Final EIS should be reviewed.

PROJECT DESCRIPTION, PURPOSE, AND NEED

Project Description

On May 11, 1992, ZMI filed an application with the Lewistown District BLM and the Montana DSL (part of the DEQ as of July 1, 1995) to expand mining operations at the Zortman Mine in the Little Rocky Mountains, Montana (See Figure ES-1). The proposal includes: expansion of existing mine pits to access sulfide ore; a 150-acre, 60-million ton waste rock disposal area; crushing facilities; a 2 ½-mile conveyor system; a 200-acre, 80-million ton leach pad; a new processing plant and ponds; a limestone quarry; and other associated facilities. Total disturbance would increase from the existing 401 acres to about 1,292 acres. The operation is located on private and BLM-managed land. Issues of special note include Native American religious concerns, acid rock drainage, reclamation, and socioeconomics. In a March 9, 1994, Decision Record, the BLM and DEQ included the analysis of acid rock drainage corrective measures for the nearby Landusky Mine within the scope of the EIS for the Zortman Mine expansion, since acid rock drainage has been a problem at both mines. The Final EIS addresses additional mining at the Landusky and Zortman mines, plus modified reclamation plans for both facilities.

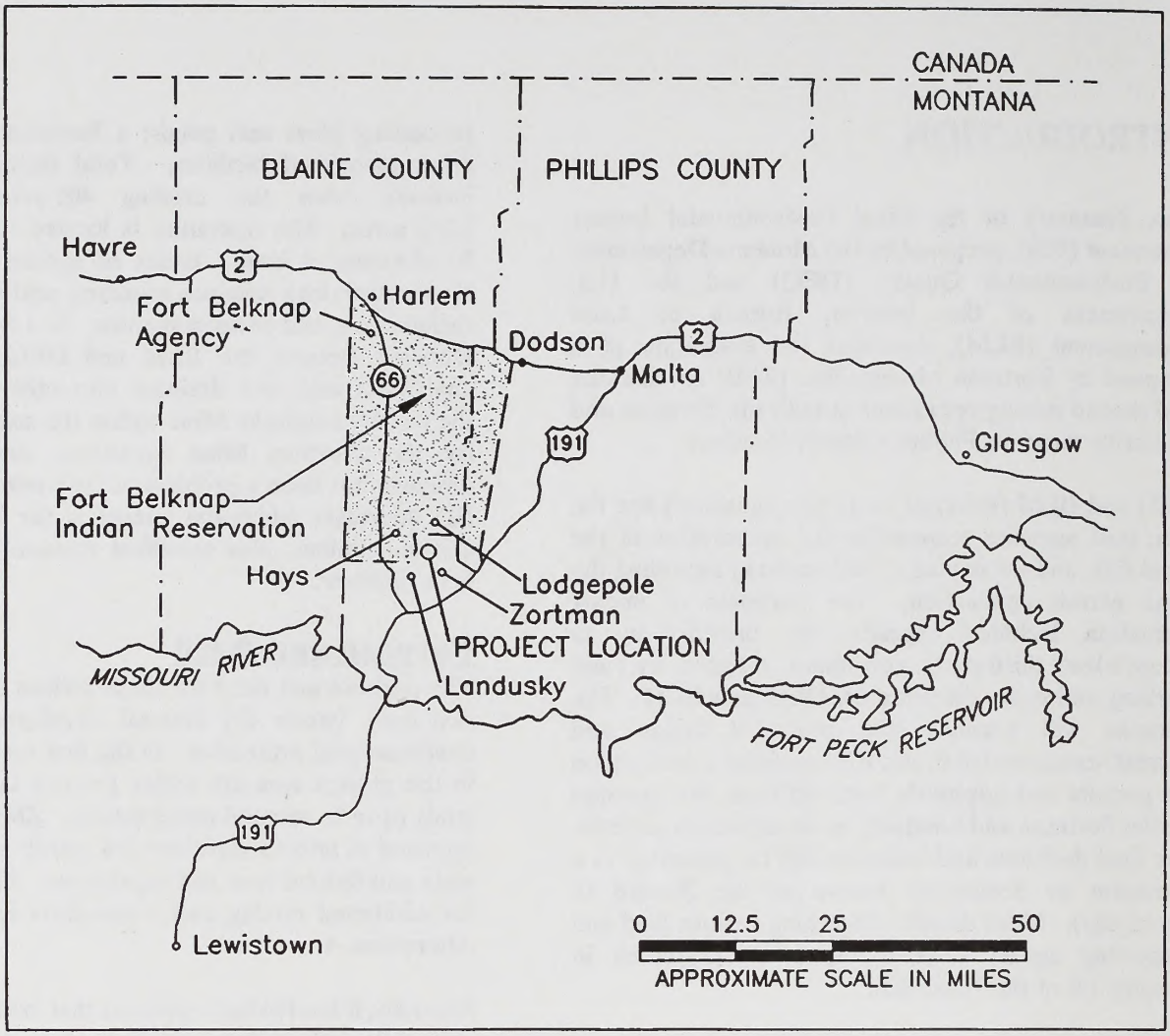
Purpose and Need

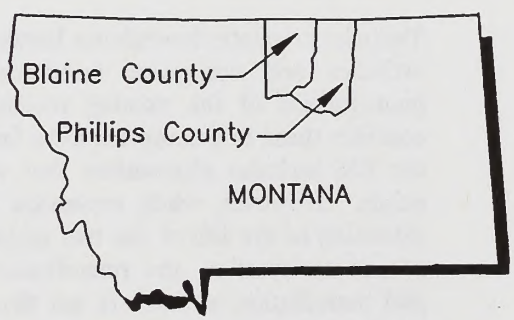
The purpose and need for these actions are to address two basic issues: (1) mineral development, and (2) environmental protection. In the first matter, the lands in the project area are either privates lands or public lands open to mineral development. ZMI has filed for approval of mineral development activity under relevant state and federal laws and regulations. ZMI's proposal for additional mining and reclamation is presented in Alternative 4.

Secondly, it has become apparent that existing operating and reclamation plans are not adequate to limit or prevent the development of acid rock drainage from the present mine facilities. In early 1993, the agencies informed ZMI that the reclamation plans had to be modified to mitigate existing acid rock drainage and to ensure successful surface reclamation. ZMI has submitted proposed modifications to the current reclamation plans. These are described under Alternatives 2 and 4.

There is some interdependence between mine expansion activities and corrective measures to address the inadequacies of the existing reclamation plans. To consider these in a comprehensive fashion, the scope of the EIS includes alternatives that address both these needs. However, while expansion of the mines and extension of the life of the two mines *is* dependent on proper reclamation and remediation, the reclamation and remediation actions are *not* dependent on further mining. In other words, adequate reclamation can be accomplished without further mining.

The EIS addresses impacts from past, present, and reasonably foreseeable future activities at the Zortman





SOURCE: DSL/BLM 1990

LOCATION OF ZORTMAN
AND
LANDUSKY MINE EXPANSIONS

MONTST

FIG. ES-1

and Landusky mines. Baseline for this analysis is circa 1979 which marks the beginning of modern, large-scale mining in the Little Rocky Mountains. Earlier baseline is used when discussing specific historic mining disturbances such as the Ruby Gulch tailing.

The EIS Process

The environmental analysis of ZMI's applications for a mine permit modification for the Zortman and Landusky mines is being conducted under requirements of the National Environmental Policy Act (NEPA) and the Montana Environmental Policy Act (MEPA) and the administrative rules and regulations implementing both these acts. An EIS is required because the proposed permit modifications constitutes federal and state actions which may significantly affect the quality of the human environment under NEPA and MEPA. The BLM and the DEQ are the joint lead agencies responsible for the preparation of the EIS and for issuing a final decision on the mine permit applications. The U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (COE) are cooperating agencies, and several other agencies have provided comments.

The EIS process includes the following steps:

1. Public and agency "scoping" during which issues and concerns are identified early in the process;
2. Alternatives development;
3. Data collection;
4. Impact analysis;
5. Completion of a Draft EIS;
6. Public review and comment period;
7. Completion of a Final EIS, including responses to public comment, and
8. Completion of a Record of Decision (Final Decision)

At the end of the process, it is the responsibility of the BLM and DEQ as the lead agencies to consider the proposed action and alternatives presented in the EIS and issue a decision on the permit and approvals required for both the Zortman and Landusky Mine expansion projects. The BLM must review the Plan of Operations (the Proposed Action) to determine whether it would result in unnecessary or undue degradation of the federal lands. Measures needed to prevent unnecessary or undue degradation are incorporated into mitigated alternatives and would be required as conditions of approval. If it is determined that the action would not cause unnecessary or undue degradation, the BLM has to approve the Plan of Operations with any required conditions.

The final decisions and rationale will be presented in a document known as the Record of Decisions.

Major Issues

Significant areas of concern were identified through public scoping and agency project review. Public scoping meetings were held at various locations in the study area to solicit public comment. Based on scoping and agency review, four primary issues were identified that reflect concerns or conflicts which could be partially or totally resolved through the EIS process. These issues are:

- Water Quality
- Reclamation Plans and Procedures
- Native American Traditional Cultural Values
- Socioeconomics

These four issues are by no means the complete list of environmental concerns identified during project review and public scoping or used to develop alternatives. However, they do represent the issues that, because of the potential magnitude, duration, or significance of their effect on the environment, have played the greatest role in the development of alternatives. The following discussion provides a brief summary of these issues.

Water Quality. The public and the agencies have expressed concern that existing and/or historic mining operations have impacted and are continuing to impact water quality, and therefore aquatic habitat, in the area. Releases of acidic and metal-bearing waters from the mines have resulted in the loss of aquatic habitat and have adversely impacted the streams and groundwater in the area. Cyanide and metals are mentioned most often as analytes of concern.

Of particular interest is acid rock drainage and its effects on both surface and groundwater. Concern has been expressed that some of the existing mine, heap leach, and waste rock facilities have acidified and are releasing dissolved metals to ground and surface waters. The proposed mine expansion would develop sulfide ore and waste to an extent not contemplated previously for the Zortman and Landusky mines. Concerns have been raised regarding both mitigation of existing impacts and possible additional adverse water quality impacts from mine expansion.

Other water quality issues include the potential leakage of heap leach process solution from storage ponds, contamination of water in pits and release of that water to surface drainages and groundwater, and the scope and adequacy of the water quality monitoring program.

Substantial comment on the Draft EIS was directed toward the ongoing litigation to enforce compliance with the Montana Water Quality Act and the Federal Clean Water Act. Compliance with these acts is independent of the EIS process and a statutory requirement under any of the alternatives. The methods to achieve compliance may vary, though, and alternatives in this EIS reflect different approaches to achieving compliance.

Reclamation Plans and Procedures. Some reclamation at the mines has proved to be inadequate and/or ineffective. For instance, acid rock drainage emanating from some heap leach facilities and waste rock dumps may be due to incomplete reclamation procedures, or a failure to use appropriate materials to prevent water infiltration into the acid-producing materials. ZMI has proposed various rock characterization methods, materials handling procedures, and engineering practices to enhance the potential for successful reclamation. The agencies have also developed alternatives which incorporate engineering and reclamation modifications and mitigations as further protection. The scope and adequacy of reclamation monitoring has also been raised as an issue.

Pit backfilling is a significant reclamation issue raised during scoping and public review of the Draft EIS. The BLM and DEQ have evaluated variable amounts of pit backfilling, from complete pit backfill to reclaiming the pits in the existing configurations. The amount of pit backfilling in an alternative was determined by how well it addressed environmental issues such as the need to dispose of excess waste materials from other facilities or adjacent drainages; the need to promote runoff away from the pit areas; the need to cover potentially acid generating surfaces; and the need to mitigate visual or aesthetic impacts.

Native American Traditional Cultural Values. Areas within the Little Rocky Mountains, and specific sites near the Zortman and Landusky mines, are culturally and historically important to various North American Indian peoples. Many Native Americans regard the entire Little Rocky Mountains as sacred, and the range has been determined eligible for listing on the National Register of Historic Places as a Traditional Cultural Property. Many public comments have expressed concerns about impacts to cultural resources resulting from mine actions. The agencies have included an analysis of impacts to cultural resources and the use of these resources as a result of mine noise, air quality and water resources degradation, and modification of the visual perspective from certain locations of traditional cultural practices and importance.

A Programmatic Agreement under Section 106 of the National Historic Preservation Act has been developed that includes measures to mitigate impacts to the Traditional Cultural Property by preservation of historic and traditional associations through recordation. This mitigation has been incorporated as a part of each mine expansion alternative.

Socioeconomics. The Zortman and Landusky mines have employed a large number of workers during the years 1979 through 1995. This employment represents a significant percentage of the total workforce in Phillips County, although the mines have had little direct economic impact on Blaine County or the Fort Belknap Indian Reservation. A concern to many people, expressed during project scoping and public review of the Draft EIS, is the socioeconomic impact mine closure would have upon mine workers and the area economic base. The Zortman and Landusky mines have stopped mining, and workforce reductions have occurred. At the same time, comments received during scoping and on the Draft EIS also stress the social and environmental costs of past and continued mining.

PROPOSED ACTION AND ALTERNATIVES

Development of Alternatives

The issues identified through agency review and public scoping efforts were used to formulate reasonable alternative actions pertaining to the proposed Zortman and Landusky mine expansion. These alternatives were evaluated based on engineering, environmental, and economic factors. The engineering evaluation included technical implementability and effectiveness, while the environmental evaluation considered potential impacts on air, water, and soil, with consideration of subsequent impacts to cultural resources, vegetation, wildlife, and human health. Cost was only considered as a factor in the elimination of an alternative where it would likely result in an uneconomic mine project, thus equating to the No Action Alternative. The following describes in more detail the considerations evaluated by the agencies in developing project alternatives.

Several alternatives were developed regarding the location of two major facility components of the proposed action: 1) the waste rock storage facility site and 2) the location for the ore heap leaching facility. At the Zortman Mine, seven alternatives to the proposed Carter Gulch waste rock storage site were evaluated. Two of these - the Ruby Flats site, and partial backfill of the mine pits with placement of waste rock on top of and adjacent to existing disturbances - were retained as

viable waste rock storage alternatives for detailed evaluation in addition to the proposed Carter Gulch location. At the Landusky Mine, the proposed waste rock storage alternative (Gold Bug site or backfilling in other pits) was considered the only reasonable alternative. Regarding heap leach locations at the Zortman Mine, five alternatives to the proposed Goslin Flats location were considered, but only Alder Gulch remains as a viable alternative heap leach site for detailed evaluation. At the Landusky Mine, alternative sites for expansion of the existing pad were considered but eliminated.

In addition to the two major facility components discussed above, several items were considered for incorporation into an agency-modified alternative. These included:

- mining methods
- reclamation
- ore transport
- beneficiation technology
- conveyor route
- process solution storage
- leach pad type
- processing
- waste rock transport
- water control, and
- reclamation materials sources.

Alternative actions were then developed by considering and evaluating:

- Company proposed action;
- Agency comments to the company proposed action, generated during completeness reviews;
- Public comments about the proposed expansion projects, solicited during scoping;
- Experiences at other mining projects;
- Technical literature and the relevant scientific database; and
- Past and present environmental concerns at the Zortman and Landusky mines.

Following review of engineering, environmental, and economic feasibility, seven alternatives were retained for detailed analysis. These include the No Action Alternative, Company Proposed Reclamation, Company Proposed Expansions and Reclamation, and four other agency-mitigated alternatives. Actions which were eliminated from further evaluation were considered to be unacceptable in terms of engineering feasibility or environmental protection. Complete backfilling of the pits was eliminated from consideration because it would create an economically non-viable mining alternative.

Summary Description of Alternatives

The seven alternatives (including the proposed action) are listed and described below. For ease of reading, these are arranged from the simplest (No Action) to the most complex (Expanded Mining with Imposed Mitigation). The exhibits enclosed in the pocket at the back of this document illustrate the current and proposed permit areas, and various facilities and disturbances associated with alternative actions.

Alternative 1: No Action - Mine Expansions Not Approved and Existing Reclamation Plans

Alternative 2: Mine Expansions Not Approved and Company Proposed Reclamation

Alternative 3: Mine Expansions Not Approved and Mitigated Reclamation

Alternative 4: Company Proposed Expansions and Reclamation (Company Proposed Action or CPA)

Alternative 5: Mitigated Expansion and Reclamation with Leach Pad Located in Upper Alder Gulch rather than on Goslin Flats

Alternative 6: Mitigated Expansion and Reclamation with Waste Rock Repository Located on Ruby Flats rather than in Carter Gulch

Alternative 7: Mitigated Expansion and Reclamation with Waste Rock Repository Located on Existing Mine Facilities rather than in Carter Gulch

Alternative 1 - No Action - Mine Expansions Not Approved and Existing Reclamation Plans. At the **Zortman Mine,** mine expansion plans would not be approved. At the **Landusky Mine**, expansion plans would not be approved. ZMI has reached the extent of permitted ore reserves at the Landusky Mine and only ore which has already been mined is being processed. Leaching and reclamation would continue as permitted.

Alternative 2 - Mine Expansions Not Approved and Company Proposed Reclamation. ZMI would continue already permitted activities at both the Zortman and Landusky mines. Mine expansion plans would not be approved. The existing reclamation plans for the mines would be revised as proposed by ZMI to mitigate the existing acid rock drainage problems. Company

proposed revisions include low permeability capping of unreclaimed heaps and waste rock dumps, redesign of diversion structures, water treatment contingencies, and enhanced monitoring for evaluating reclamation effectiveness.

Zortman Mine - Existing mine facilities would be tested to determine their acid generation potential. Those facilities that could generate acid rock drainage would be reclaimed with a 6-inch compacted clay infiltration barrier between the mine waste unit and the topsoil. Clay material for reclamation would be mined from the Seaford clay pit approximately 9 miles south of Zortman.

Landusky Mine - The existing Landusky Mine disturbances would be reclaimed using enhanced reclamation measures proposed by ZMI. The existing interim reclamation covers on the Mill Gulch and Gold Bug waste rock repositories would become the final covers. The other mine waste units would be tested to determine their acid generation potential. Those facilities that could generate acid rock drainage would be reclaimed with a 6-inch compacted clay infiltration barrier between the mine waste unit and the topsoil. Clay material for reclamation would be mined from the Williams clay pit approximately 2 miles west of Landusky.

Alternative 3 - Mine Expansions Not Approved and Mitigated Reclamation. This is similar to Alternative 2 described above, but with additional agency-imposed requirements on ZMI's proposed plans to ensure reclamation success. Significant mitigations at both mines include:

- The use of water balance reclamation covers on slopes greater than or equal to 25 percent to limit surface water infiltration and provide a better medium for revegetation,
- The use of a Geosynthetic Clay Liner (GCL) on slopes less than 25 percent to provide a low permeability barrier that is resistant to desiccation by freezing and thawing or dehydration,
- Placement of improved reclamation covers on waste rock facilities and ore heaps,
- Reduction of most facilities to an overall slope of 3H:1V,
- Improvement and enhancement of capture, pumpback, and treatment facilities to handle runoff/seepage from a 6.33-inch, 24 hour storm event, and
- Implementation of a more restrictive geochemical classification system for materials used in construction and reclamation.

Other mitigating measures specific to the two mines are described below.

Zortman Mine - Development of a limestone quarry at the LS-2 site to be used for reclamation materials; removing the existing Alder Gulch waste rock dump and using it for mine pit backfilling; removing the OK waste rock dump and Ruby Gulch waste rock dump (sulfide stockpile) and placing them in the mine pit as backfill; removing the 85/86 leach pad and retaining dike and using it as mine pit backfill; backfilling of the mine pit to about 4,900 foot msl, and grading and capping of the mine pits floors to achieve a free-draining surface that discharges into Ruby Gulch; and removal of the Ruby Gulch tailing for use in reclamation covers and restoration of the Ruby Gulch drainage.

Landusky Mine - Development of a limestone quarry in the Montana Gulch area in the southwest portion of the permit boundary to be used for reclamation materials; backfilling of the pits to about 4,740 foot msl, grading and capping of the pit floor; excavation of a drainage notch to route surface runoff from the reclaimed pit floors into Montana Gulch; construction of a drainage channel along the west margin of the 85/86 leach pad to allow unimpeded drainage from the western tributary of Montana Gulch; and redistribution of spent ore from the 87/91 pad to eliminate the potential for surface water runoff to the north.

Alternative 4 - Company Proposed Expansion and Reclamation (Company Proposed Action or CPA). This is ZMI's proposed Zortman Mine Expansion Plan contained in the application documents initially submitted to BLM and DSL on May 11, 1992 and revised through the completeness process. It also includes the smaller proposed expansion of the Landusky Mine detailed in the ZMI document of September, 1994 as amended. Enhanced reclamation measures for both operations are included in the proposals. These are collectively known as the Company Proposed Action (CPA).

Zortman Mine - Approximately 879 additional acres would be disturbed. Major disturbances would be from construction of the leach pad, the waste rock repository, crusher, conveyor system, and processing facilities. Mining activities would expand and deepen the current

pit areas. The proposed limestone quarry, shale pit expansion, Goslin Flats leach pad, Landusky powerline extension, and the conveyor would be outside the current mine permit boundaries.

ZMI proposes to mine and process oxide and non-oxide ore reserves. The proposed expansion would include mining 80-million tons of ore and 60-million tons of waste rock at the rate of 60,000-80,000 tons per day, 350 days per year for 5 to 8 years. The operation would enlarge the existing pits, combine run-of-mine oxide and crushed non-oxide ore, and transport the ore via a 12,000-foot overland conveyor to a cyanide heap leach facility located at Goslin Flats. Cyanide solution would be applied to the ore heap and the precious metal-enriched solution would be captured within the leach pad, and processed at an adjacent recovery facility. Precious metals from the recovery process would be smelted to a dore' bullion product on site.

Support facilities for mining and processing would include existing offices, shops, labs, warehouse, and explosive storage facilities. A new land application disposal area would be on Goslin Flats adjacent to the leach pad. Electrical power would be delivered to the operation along existing powerline corridors owned and operated by Big Flat Electric. A buried powerline would be constructed between the Zortman and Landusky mines to use available power supply from the Landusky Mine.

One million tons of limestone is proposed to be mined from a quarry in upper Beaver Creek (LS-1) to support drainage construction and mine waste unit reclamation. Shale would be mined from the Seaford clay pit for leach pad liner and reclamation cap construction.

In addition to expanding operations at the Zortman Mine, ZMI also proposes to change the present reclamation plan for existing facilities. ZMI proposes to enhance surface reclamation of all existing leach pads, containment dikes, and waste rock dumps to restrict infiltration of precipitation into these facilities, thereby preventing or limiting acid rock drainage. All existing facilities would be resloped to 3H:1V where topography allows. Where testing indicates acid generating materials are present, the surface would be reclaimed by placement of two compacted 6-inch clay layers, overlain with 36-inches of non-acid generating rock, followed by 8-inches of topsoil with surface revegetation. Where surface slopes are less than 5 percent, a PVC liner with a geotextile would be placed immediately above the clay liner.

ZMI also proposes to remove the existing Alder Gulch waste rock dump (an acid rock drainage source) before the area is covered by the proposed Carter Gulch waste rock facility and transport it to Goslin Flats. Some of the spent ore from the 85/86 leach pad would be used to backfill the mine pits at the end of mining to achieve a free-draining pit floor configuration.

All seepage capture and pumpback systems would be sized to accommodate the seepage resulting from a 6-inch, 24-hour storm event. A water treatment plant with a 2,000 gpm capacity would be used to improve the quality of effluent from the mine facilities. Active water treatment would be phased out as source controls proved effective. Passive methods such as wetlands and limestone drains would be used in the long term.

Landusky Mine - There are no remaining permitted ore reserves at the Landusky Mine. ZMI has proposed mining an additional 7.6 million tons of ore and 7 million tons of waste rock, which would extend the mine life by less than one year. Four million tons of the waste rock would be scheduled as backfill in the Gold Bug waste rock facility. The remaining waste rock would be stored in the mine pits for use in reclamation.

The 7.6 million tons of additional ore is proposed to be placed on the existing 87/91 leach pad extension. The ore would be stacked on top of the existing ore increasing the heap height by 50 feet. This would require no increase in surface disturbance.

Besides additional mining, ZMI proposes to enhance the existing reclamation plans for the Landusky Mine to address acid rock drainage concerns. ZMI proposes to enhance surface reclamation of all unreclaimed leach pads, containment dikes, and waste rock piles to restrict infiltration of precipitation into these facilities thereby preventing or limiting acid rock drainage. All existing facilities would be resloped to 3H:1V where topography allows. Where testing indicates acid generating materials are present, the surface would be reclaimed by placement of two compacted 6-inch clay layers, overlain with 36-inches of non-acid generating rock, followed by 8-inches of topsoil with surface revegetation. Where surface slopes are less than 5 percent, a PVC liner with a geotextile would be placed immediately above the clay liner. The existing interim reclamation covers on the Mill Gulch and Gold Bug waste rock repositories would become the final reclamation covers.

The existing acid rock drainage seepage and pumpback systems in Mill Gulch and Rock Creek would be sized to accommodate runoff/seepage from a 6-inch, 24-hour storm event. A water treatment plant with a 2,000 gpm

capacity would be constructed in the Montana Gulch area to improve the quality of effluent from the mine facilities if the need arises. Active water treatment would be phased out as source controls took effect. Passive methods such as wetlands and limestone drains could be used in the long term.

ZMI would mine approximately 50,000 tons of limestone from a 10-acre quarry to be developed on private land in the King Creek area. This material would be used to construct drains and diversions to aid in reclamation and maintenance of water quality.

Alternative 5 - Mitigated Expansion and Reclamation with Leach Pad Located in Upper Alder Gulch rather than on Goslin Flats. This alternative is similar to the CPA (Alternative 4) for both mine expansion and modification of reclamation plans, but with agency mitigation added to reduce or avoid potential environmental impacts. Significant mitigations at both mines include:

- Modification of the reclamation covers described in Alternative 4,
- Improvement and enhancement of capture, pumpback, and treatment facilities to handle runoff/seepage from a 6.33-inch, 24 hour storm event, and
- Implementation of a more restrictive geochemical classification system for materials used in construction and reclamation.

Other mitigating measures to be implemented at the two mines are described below.

Zortman Mine - The major change is that the Goslin Flats leach pad would be constructed in Upper Alder Gulch just west of the proposed waste rock dump. The conveyor system would not be constructed. Trucks would transport both ore and waste rock from the mine to their respective facilities.

The agencies would also require changes in ZMI's proposed reclamation plans to improve the potential for reclamation success.

Landusky Mine - No change would occur in mining operations from that proposed in Alternative 4.

Modification to the reclamation plans would be similar to Alternative 3, except that the post-reclamation pit drainage would include cutting a drainage channel or notch out of the pit wall so that all surface water runoff from the pit floor would drain into King Creek. Contingency water capture systems and settling ponds would be installed in King Creek. A drainage diversion would be constructed along the pit highwall so that highwall runoff would discharge into Montana Gulch. The mine pit would be backfilled to an elevation of approximately 4,850 feet msl or the minimum elevation necessary for free drainage to King Creek.

Alternative 6 - Mitigated Expansion and Reclamation with Waste Rock Repository Located on Ruby Flats rather than in Carter Gulch. This alternative is the same as the Company Proposed Action for both mine expansion and modification of reclamation plans, but with agency mitigation added to reduce or avoid potential environmental impacts. Significant mitigations at both mines include:

- Modification of the reclamation covers described in Alternative 4,
- Improvement and enhancement of capture, pumpback, and treatment facilities to handle runoff/seepage from a 6.33-inch, 24 hour storm event, and
- Implementation of a more restrictive geochemical classification system for materials used in construction and reclamation.

Other mitigating measures to be implemented at the two mines are described below.

Zortman Mine - The major modification is that the Alder Gulch waste rock repository would not be constructed. Instead, waste rock would be disposed at a repository site on Ruby Flats east of the proposed leach pad. The waste rock would be transported from the mine site by the conveyor to an off-load area near the leach pad. It would then be transported by truck to Ruby Flats waste rock repository for disposal. This waste rock facility would be reclaimed similar to the leach pad. To facilitate this action the county-owned Seven Mile Road that connects the town of Zortman with U.S. Highway 191 would have to be re-routed around the waste rock repository.

The agencies would also require changes in ZMI's proposed reclamation plans to improve the potential for reclamation success. These mitigation measures would be similar to those in Alternative 3.

Landusky Mine - No change would occur in mining operations from that proposed in Alternative 4.

Modification to the reclamation plan would be similar to those in Alternative 3. The post-reclamation pit drainage would involve cutting a drainage notch or channel out of the pit wall so that all surface water runoff from the pit floor would drain into Montana Gulch. Spent ore from the 85/86 leach pad and dike would be excavated from Montana Gulch and used to backfill the mine pits. This would raise the backfilled pit floor elevation, thus decreasing the size of the drainage notch needed to achieve a free-draining surface, and it would remove potentially acid generating material from close proximity with the Montana Gulch drainage.

Alternative 7 (Preferred Alternative) - Mitigated Expansion and Reclamation with Waste Rock Repository Located on Existing Mine Facilities rather than in Carter Gulch. This alternative is similar to the Company Proposed Action for both mine expansion and modification of reclamation plans, but with agency mitigation added to reduce or avoid potential environmental impacts. Significant mitigations at both mines include:

- The use of water balance reclamation covers on slopes greater than or equal to 25 percent to limit surface water infiltration and provide a better medium for revegetation,
- The use of a Geosynthetic Clay Liner (GCL) on slopes less than 25 percent to provide a low permeability barrier that is resistant to desiccation by freezing and thawing or dehydration,
- Placement of improved reclamation covers on waste rock facilities and ore heaps,
- Improvement and enhancement of capture, pumpback, and treatment facilities to handle runoff/seepage from a 6.33-inch, 24 hour storm event, and
- Implementation of a more restrictive geochemical classification system for materials used in construction and reclamation.

Other mitigating measures at the two mines are described below.

Zortman Mine - The major modification is that the company proposed Carter Gulch waste rock repository would not be constructed. Instead, waste rock would be disposed on top of and adjacent to existing disturbances at the Zortman Mine. This would mean placement of waste rock over some of the existing leach pads and retaining dikes. The waste rock repository would be constructed at a 3H:1V slope and concurrently reclaimed as it was built upward from the lower slopes. The Alder Gulch and OK waste rock dumps would be removed and leached on the new leach pad at Goslin Flats to remove precious metals, or used as pit backfill.

Additional mitigations identified in the Alternative 3 description would apply. These include: Development of a limestone quarry at the LS-2 site to be used for reclamation materials (instead of the site in upper Lodgepole Creek); removing the existing Alder Gulch waste rock dump and using it for mine pit backfilling; removing the OK waste rock dump and Ruby Gulch waste rock dump (sulfide stockpile) and placing them in the mine pit as backfill; backfilling of the mine pit to about 4,800 foot msl, and grading and capping of the mine pits floors to achieve a free-draining surface that discharges into Ruby Gulch; and removal of the Ruby Gulch tailing for use in reclamation covers and restoration of the Ruby Gulch drainage.

The agencies would also require other changes in ZMI's proposed plans to ensure reclamation success and mitigate impacts from mine expansions.

Landusky Mine - No change would occur in mining operations from that proposed in Alternative 4.

Modification to the reclamation plan would be similar to those in Alternative 3 with slope reduction and improved reclamation covers. The post-reclamation pit drainage would involve cutting a drainage notch or channel out of the pit wall so that all surface water runoff from the pit floor would drain into Montana Gulch. The final pit floor elevation at the outlet to Montana Gulch would be at approximately 4,740 feet msl.

Comparison of Alternative Components. Tables ES-1 and ES-2 are provided to facilitate a comparison of the seven alternatives described above. The tables compare the differences in the various project components (type, location, extent, method, etc.) among the seven alternatives. A comparison of impacts among alternatives is provided later in the summary.

Summary of Agency Mitigations

During the development and evaluation of project alternatives, the agencies identified a number of mitigations designed to eliminate or substantively reduce environmental impacts. Many of these mitigations are integral parts of one or more alternatives. The only mitigation which applies to Alternative 1 is implementation of the Water Quality Improvement Plan. This mitigation applies to all alternatives. No specific

TABLE ES-1
SUMMARY OF ALTERNATIVES - ZORTMAN MINE

Project Components	Alternative 1 - No Action (Permitted Operations and Reclamation)	Alternative 2 - Mine Expansion Not Approved and Company Proposed Reclamation	Alternative 3 - Mine Expansion Not Approved and Mitigated Reclamation	Alternative 4 - Company Proposed Expansion and Reclamation (Company Proposed Action)	Alternative 5 - Mitigated Expansion and Reclamation with Leach Pad in Upper Alder Gulch	Alternative 6 - Mitigated Expansion and Reclamation with Waste Rock Facility on Ruby Flats	Alternative 7 - Mitigated Expansion and Reclamation with Waste Rock Repository Located on Existing Mine Facilities (Preferred Alternative)
Mine							
Location	97 acres in 6 pits - Ross Pit - South Alabama Pit - North Alabama Pit - OK Pit - Ruby Pit - Mint Pit	97 acres in 6 pits - Ross Pit - South Alabama Pit - North Alabama Pit - OK Pit - Ruby Pit - Mint Pit	97 acres in 6 pits - Ross Pit - South Alabama Pit - North Alabama Pit - OK Pit - Ruby Pit - Mint Pit	Vertical and lateral expansion of mine pit complex; 103 additional acres	Company Proposed Action	Company Proposed Action	Company Proposed Action
Extraction	No additional mining	No additional mining	No additional mining	Open pit, drill, blast, load - 80 million tons ore - 60 million tons waste rock	Company Proposed Action	Company Proposed Action	Company Proposed Action
Ore Transport	Not applicable	Not applicable	Not applicable	Truck to primary crusher and conveyor to leach pad	Truck haul	Company Proposed Action	Company Proposed Action
Waste Rock Transport	Not applicable	Not applicable	Not applicable	Truck haul to Carter Gulch repository	Company Proposed Action	Conveyor to Goslin Flats and truck haul to Ruby Flats	Stage at mine site, backfill, cover facilities
Ore Prep, Handling, and Storage							
Location	None	None	None	Primary crush below truck shop near 84 leach pad; secondary & tertiary crushing at Goslin Flats	All ore crushing near mine site	Company Proposed Action	Company Proposed Action
Crushing	None	None	None	Crush oxide and unoxidized	Company Proposed Action	Company Proposed Action	Company Proposed Action
Stockpile	None	None	None	Separate piles at head of conveyor	At mine site or near Upper Alder leach pad; separate at truck load-out	Company Proposed Action	Company Proposed Action
Conditioning	None	None	None	Blend unoxidized ore with oxide ore	Company Proposed Action	Company Proposed Action	Company Proposed Action

TABLE ES-1 - SUMMARY OF ALTERNATIVES - ZORTMAN MINE
(Continued)

Project Components	Alternative 1 - No Action (Permitted Operations and Reclamation)	Alternative 2 - Mine Expansion Not Approved and Company Proposed Reclamation	Alternative 3 - Mine Expansion Not Approved and Mitigated Reclamation	Alternative 4 - Company Proposed Expansion and Reclamation (Company Proposed Action)	Alternative 5 - Mitigated Expansion and Reclamation with Leach Pad in Upper Alder Gulch	Alternative 6 - Mitigated Expansion and Reclamation with Waste Rock Facility on Ruby Flats	Alternative 7 - Mitigated Expansion and Reclamation with Waste Rock Repository Located on Existing Mine Facilities (Preferred Alternative)
Ore Transport							
Location	Not applicable	Not applicable	Not applicable	Alder Gulch route to Goslin Flats, 2.5 acre conveyor corridor	New truck haul route (Antoine Butte) to Upper Alder leach pad	Company Proposed Action	Company Proposed Action
Method	Not applicable	Not applicable	Not applicable	Overland conveyor to Goslin Flats heap leach pad	Haul trucks	Company Proposed Action	Company Proposed Action
Beneficiation (Heap Leaching)							
Location	116 current acres at 7 existing heap leach sites - 79 pad (inactive) - 80/81 pad (inactive) - 82 pad (inactive) - 83 pad (inactive) - 84 pad (inactive) - 85/86 pad (inactive) - 89 pad (active)	116 current acres at 7 existing heap leach sites - 79 pad (inactive) - 80/81 pad (inactive) - 82 pad (inactive) - 83 pad (inactive) - 84 pad (inactive) - 85/86 pad (inactive) - 89 pad (active)	116 current acres at 7 existing heap leach sites - 79 pad (inactive) - 80/81 pad (inactive) - 82 pad (inactive) - 83 pad (inactive) - 84 pad (inactive) - 85/86 pad (inactive) - 89 pad (active)	Goslin Flats heap leach 205 acres	Upper Alder Gulch, heap leach, 180 acres	Company Proposed Action	Company Proposed Action
Method	Valley leach	Valley leach	Valley leach	Modified flat pad	Valley leach	Company Proposed Action	Company Proposed Action
Process Solution Storage							
Location	Existing facilities	Existing facilities	Existing facilities	Goslin Flats	Upper Alder Gulch	Company Proposed Action	Company Proposed Action
Method	In heap and external lined ponds	In heap and external lined ponds	In heap and external lined ponds	In heap and external lined ponds	In heap and external lined ponds	In heap and external lined ponds	In heap and external lined ponds

TABLE ES-1 - SUMMARY OF ALTERNATIVES - ZORTMAN MINE
(Continued)

Project Components	Alternative 1 - No Action (Permitted Operations and Reclamation)	Alternative 2 - Mine Expansion Not Approved and Company Proposed Reclamation	Alternative 3 - Mine Expansion Not Approved and Mitigated Reclamation	Alternative 4 - Company Proposed Expansion and Reclamation (Company Proposed Action)	Alternative 5 - Mitigated Expansion and Reclamation with Leach Pad in Upper Alder Gulch	Alternative 6 - Mitigated Expansion and Reclamation with Waste Rock Facility on Ruby Flats	Alternative 7 - Mitigated Expansion and Reclamation with Waste Rock Repository Located on Existing Mine Facilities (Preferred Alternative)
Processing							
Location	Existing process plant, 8.5 acres, 1 site	Existing process plant, 8.5 acres, 1 site	Existing process plant, 8.5 acres, 1 site	Goslin Flats, 23 acres	Existing process plant	Company Proposed Action	Company Proposed Action
Method	Existing Facilities	Existing Facilities	Existing Facilities	Cyanide solution, carbon adsorption, electrowinning, smelting	Company Proposed Action	Company Proposed Action	Company Proposed Action
Mine Waste Disposal							
Waste Rock	25 acres in 3 Dumps - Alder Gulch (3,365,000 tons) - Ruby Gulch (850,000 tons) - OK Dump (1,235,000 tons)	25 Acres in 3 Dumps - Alder Gulch (3,365,000 tons) - Ruby Gulch (850,000 tons) - OK Dump (1,235,000 tons)	Alder Gulch, OK and Ruby Dumps backfilled into pit	New repository in Carter Gulch of Alder Gulch, 162 additional acres; truck haul, bottom-up construction. Alder Dump processed for ore	Company Proposed Action; OK and Ruby Dumps backfilled into pit; Alder Dump processed for ore	New repository on Ruby Flats; conveyor transport and truck haul, bottom-up construction lined impoundment; OK and Ruby Dumps backfilled into pit; Alder Dump processed for ore	New repository constructed over existing mine facilities; OK and Ruby Dumps backfilled into pit; Alder Dump processed for ore
Spent Heap Leach Ore or Tailings	Reclaim in place	Reclaim in place	85/86 leach pad/dike removed for pit backfill; Ruby Gulch tailing removed for use in reclamation; Other facilities reclaimed in place	Reclaim facilities in place; portion of 85/86 pad leached on Goslin Flats leach pad	85/86 leach pad & dike removed for pit backfill; Ruby Gulch tailing used in reclamation or construction; Other facilities reclaimed in place	85/86 leach pad & dike removed for pit backfill; Ruby Gulch tailing used in reclamation or construction; Other facilities reclaimed in place	Ruby Gulch tailing used in reclamation or construction; Other facilities reclaimed in place
Other Solid Waste	Lab wastes to ASARCO smelter, empty cyanide barrels crushed and buried in heap, sludge from water treatment plant to 89 leach pad	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

TABLE ES-1 - SUMMARY OF ALTERNATIVES - ZORTMAN MINE
(Concluded)

Project Components	Alternative 1 - No Action (Permitted Operations and Reclamation)	Alternative 2 - Mine Expansion Not Approved and Company Proposed Reclamation	Alternative 3 - Mine Expansion Not Approved and Mitigated Reclamation	Alternative 4 - Company Proposed Expansion and Reclamation (Company Proposed Action)	Alternative 5 - Mitigated Expansion and Reclamation with Leach Pad in Upper Alder Gulch	Alternative 6 - Mitigated Expansion and Reclamation with Waste Rock Facility on Ruby Flats	Alternative 7 - Mitigated Expansion and Reclamation with Waste Rock Repository Located on Existing Mine Facilities (Preferred Alternative)
Other Facilities							
Access Roads	24 acres existing	24 acres existing	24 acres existing	23 additional acres of access road disturbance	Company Proposed Action	Company Proposed Action	Company Proposed Action
Limestone Quarry	None	None	LS-2 site, northwest of Zortman, in permit boundary	13 acres disturbance, LS-1 site, south of Green Mountain	Company Proposed Action	Company Proposed Action	LS-2 site, northwest of Zortman in permit boundary
Clay Pit (borrow)	Seaford Clay Pit, 4.2 acres existing, no additional disturbance	Seaford Clay Pit, 4.2 acres existing, 3.0 acres additional disturbance	Seaford Clay Pit, 4.2 acres existing, no additional disturbance	Seaford Clay Pit, 4.2 acres existing, 10 acres additional disturbance	Seaford Clay Pit, 4.2 acres existing, 11.5 acres additional disturbance	Seaford Clay Pit, 4.2 acres existing, 12 acres additional disturbance	Seaford Clay Pit, 4.2 acres existing, additional disturbance for leach pad construction
Top Soil Stockpile	Various locations, 15.5 acres	Various locations, 15.5 acres	Existing stockpiles and Goslin Flats	Goslin Flats, 48 additional acres	Alder Gulch	Company Proposed Action and Ruby Flats	Company Proposed Action
Power Corridor	Existing Facilities	Existing Facilities	Existing Facilities	Buried construction, 9 additional acres	Company Proposed Action	Company Proposed Action	Company Proposed Action
Solution Pipeline	Existing Facilities	Existing Facilities	Existing Facilities	10" pipeline along conveyor route	Existing Facilities	Company Proposed Action	Company Proposed Action
Reclamation							
Mine Pits	Existing permit requirements	Existing permit requirements	Partial backfill pit and Enhanced Reclamation	Partial backfill pit to drain by gravity, revegetate, divert surface water inflows, cover and revegetate benches and pit floor	Enhanced Company Proposed Action Reclamation with additional backfill	Enhanced Company Proposed Action Reclamation with additional backfill	Enhanced Company Proposed Action Reclamation with additional backfill
Waste Rock Dumps and Repositories	Existing permit requirements	Existing permit requirements, cap modifications	Water balance and barrier covers, Alder Gulch and OK dumps used as pit backfill	Concurrent reclamation, capping, revegetation, waste segregation/ encapsulation, Covers A, B or C	Enhanced Company Proposed Action Reclamation, Covers B or Modified C, with OK dump used as pit backfill	Enhanced Company Proposed Action Reclamation, Covers B or Modified C with OK dump used as pit backfill	Enhanced reclamation water balance and water barrier covers
Leach Pads	Existing permit requirements	Existing permit requirements, geochemical testing, Reclamation Cover A	Water balance and barrier covers on heap leach pads, Company Proposed Action with minor modifications	Neutralize in-place with fresh water rinses, perforate liner, capping, revegetation	Enhanced Company Proposed Action Reclamation, Covers B or Modified C on heap leach pads	Enhanced Company Proposed Action Reclamation, covers B or Modified C on heap leach pads	Enhanced reclamation water balance and water barrier covers

TABLE ES-2
SUMMARY OF ALTERNATIVES - LANDUSKY MINE

Project Components	Alternative 1 - No Action (Permitted Operations and Reclamation)	Alternative 2 - Mine Expansion Not Approved and Company Proposed Reclamation	Alternative 3 - Mine Expansion Not Approved and Mitigated Reclamation	Alternative 4 - Company Proposed Expansion and Reclamation (Company Proposed Action)	Alternative 5 - Mitigated Expansion (Zortman Mine Leach Pad in Upper Alder Gulch) and Reclamation	Alternative 6 - Mitigated Expansion (Zortman Mine Waste Rock Facility at Ruby Flats) and Reclamation	Alternative 7 - Mitigated Expansion and Reclamation with Zortman Waste Rock Repository Located on Existing Mine Facilities (Preferred Alternative)
Mine							
Location	Existing disturbance of 235 Acres in 5 Pits - Queen Rose Pit - August Pit - Little Ben Pit - Gold Bug Pit - Niseka Pit	Same as Alternative 1	Same as Alternative 1	Vertical expansion of existing South Gold Bug pit	Company Proposed Action	Company Proposed Action	Company Proposed Action
Extraction	Open pit, drill, blast, load; permitted disturbance	Same as Alternative 1	Same as Alternative 1	Open pit, drill, blast, load; additional 7.6 million tons ore & 7.0 million tons waste rock	Company Proposed Action	Company Proposed Action	Company Proposed Action
Ore Transport	Truck to 87/91 heap leach pad	Same as Alternative 1	Same as Alternative 1	Truck to expanded 87/91 heap leach pad	Company Proposed Action	Company Proposed Action	Company Proposed Action
Waste Rock Transport	Truck to Gold Bug waste rock repository	Same as Alternative 1	Same as Alternative 1	Truck to expanded Gold Bug waste rock repository	Company Proposed Action	Company Proposed Action	Company Proposed Action
Ore, Prep, Handling, and Storage	All ore run of mine; no stockpiles, crushing, or conditioning	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Ore Transport							
Location	Existing Roads	Existing Roads	Existing Roads	Existing Roads	Existing Roads	Existing Roads	Existing Roads
Method	Truck Haul	Truck Haul	Truck Haul	Truck Haul	Truck Haul	Truck Haul	Truck Haul

TABLE ES-2 - SUMMARY OF ALTERNATIVES - LANDUSKY MINE
(Continued)

Project Components	Alternative 1 - No Action (Permitted Operations and Reclamation)	Alternative 2 - Mine Expansion Not Approved and Company Proposed Reclamation	Alternative 3 - Mine Expansion Not Approved and Mitigated Reclamation	Alternative 4 - Company Proposed Expansion and Reclamation (Company Proposed Action)	Alternative 5 - Mitigated Expansion (Zortman Mine Leach Pad in Upper Alder Gulch) and Reclamation	Alternative 6 - Mitigated Expansion (Zortman Mine Waste Rock Facility at Ruby Flats) and Reclamation	Alternative 7 - Mitigated Expansion and Reclamation with Zortman Waste Rock Repository Located on Existing Mine Facilities (Preferred Alternative)
Beneficiation (Heap Leaching)							
Location	280 Current Acres at 8 Existing Heap Leach Sites - 79 pad (inactive) - 80/81/82 pad (inactive) - 83 pad (inactive) - 84 pad (inactive) - 85/86 pad (leaching) - 87 pad (leaching) - 91 pad (loading & leaching) - 87/91 pad (loading & leaching)	Same as Alternative 1	Same as Alternative 1	87/91 pad expansion	Company Proposed Action	Company Proposed Action	Company Proposed Action
Method	Valley Leach	Valley Leach	Valley Leach	Valley Leach	Valley Leach	Valley Leach	Valley Leach
Process Solution Storage							
Location	Existing Facilities	Existing Facilities	Existing Facilities	Existing Facilities	Existing Facilities	Existing Facilities	Existing Facilities
Method	In Heap and External Lined Pond	In Heap and External Lined Pond	In Heap and External Lined Pond	In Heap and External Lined Pond	In Heap and External Lined Pond	In Heap and External Lined Pond	In Heap and External Lined Pond
Processing							
Location	2 sites - 87 pad - Landusky Plant	2 sites	2 sites	2 sites	2 sites	2 sites	2 sites
Method	Existing facilities, Merrill-Crowe and Carbon Adsorption	Same as Alternative 1	Same as Alternative 1	Same processes as currently used; Merrill-Crowe and Carbon Adsorption	Company Proposed Action	Company Proposed Action	Company Proposed Action

TABLE ES-2 - SUMMARY OF ALTERNATIVES - LANDUSKY MINE
(Continued)

Project Components	Alternative 1 - No Action (Permitted Operations and Reclamation)	Alternative 2 - Mine Expansion Not Approved and Company Proposed Reclamation	Alternative 3 - Mine Expansion Not Approved and Mitigated Reclamation	Alternative 4 - Company Proposed Expansion and Reclamation (Company Proposed Action)	Alternative 5 - Mitigated Expansion (Zortman Mine Leach Pad in Upper Alder Gulch) and Reclamation	Alternative 6 - Mitigated Expansion (Zortman Mine Waste Rock Facility at Ruby Flats) and Reclamation	Alternative 7 - Mitigated Expansion and Reclamation with Zortman Waste Rock Repository Located on Existing Mine Facilities (Preferred Alternative)
Mine Waste Disposal							
Waste Rock	171 acres existing disturbance, 184 acres permitted, in 3 facilities - Montana Gulch (8,000,000 tons) - Mill Gulch (17,000,000 tons) - Gold Bug Repository Plus Heap Leach Pad Embankments (14,000,000 tons)	Same as Alternative 1	Same as Alternative 1	Expand Gold Bug Repository; 7.0 million tons generated during expansion used as pit backfill	Company Proposed Action with additional backfill	Company Proposed Action with additional backfill	Company Proposed Action with additional backfill
Spent Heap Leach Ore	Reclaim in place	Reclaim in place	Reclaim in place, water balance and water barrier covers	Reclaim in place, Company Proposed Action barrier reclamation covers	Reclaim in place enhanced barrier reclamation covers	Reclaim in place enhanced barrier reclamation covers	Reclaim in place water balance and water barrier reclamation covers
Other Solid Waste	Lab wastes to ASARCO smelter, empty cyanide barrels crushed, buried in heap, municipal waste to County landfill	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Other Facilities							
Limestone Quarry	King Creek quarry, 3 acres existing disturbance, no additional disturbance	King Creek quarry, 3 acres existing disturbance, no additional disturbance	Montana Gulch Quarry, 3 acres disturbance	King Creek quarry, 3 acres existing disturbance, 3 acres additional disturbance	King Creek quarry, 3 acres existing disturbance, 3 acres additional disturbance	King Creek quarry, 3 acres existing disturbance, 3 acres additional disturbance	Montana Gulch Quarry, 2 acres disturbance
Clay Pit (borrow)	Williams Pit, 26 acres existing disturbance, no additional disturbance	Williams Pit, 26 acres existing disturbance, 6 acres additional disturbance	No acres additional disturbance	Williams Pit, 26 acres existing disturbance, 7 acres additional disturbance	Williams Pit, 26 acres existing disturbance, 9 acres additional disturbance	Williams Pit, 26 acres existing disturbance, 9 acres additional disturbance	Williams Pit, 26 acres existing disturbance, no additional disturbance

TABLE ES-2 - SUMMARY OF ALTERNATIVES - LANDUSKY MINE
(Concluded)

Project Components	Alternative 1 - No Action (Permitted Operations and Reclamation)	Alternative 2 - Mine Expansion Not Approved and Company Proposed Reclamation	Alternative 3 - Mine Expansion Not Approved and Mitigated Reclamation	Alternative 4 - Company Proposed Expansion and Reclamation (Company Proposed Action)	Alternative 5 - Mitigated Expansion (Zortman Mine Leach Pad in Upper Alder Gulch) and Reclamation	Alternative 6 - Mitigated Expansion (Zortman Mine Waste Rock Facility at Ruby Flats) and Reclamation	Alternative 7 - Mitigated Expansion and Reclamation with Zortman Waste Rock Repository Located on Existing Mine Facilities (Preferred Alternative)
Other Facilities, Continued							
Top Soil Stockpile	Various Locations	Various Locations	Various Locations	Various Locations	Various Locations	Various Locations	Various Locations
Power Corridor	Existing Facilities	Existing Facilities	Existing Facilities	Buried construction, 9 additional acres, line connecting to Zortman Mine	Company Proposed Action	Company Proposed Action	Company Proposed Action
Solution Pipeline	Existing Facilities	Existing Facilities	Existing Facilities	Existing Facilities	Existing Facilities	Existing Facilities	Existing Facilities
Reclamation							
Mine Pits	Existing permit requirements	Existing permit requirements	Partial backfill pit, water balance and barrier reclamation covers, drainage notch to direct surface water to Montana Gulch	Partial backfill pit to drain by gravity, revegetate, divert surface water inflows, cover and revegetate benches and pit floor; surface water to August drain tunnel	Partial backfill pit, enhanced reclamation covers, direct surface water to King Creek	Partial backfill pit, enhanced reclamation covers, drainage notch to direct surface water to Montana Gulch	Partial backfill pit, water balance and barrier covers, divert surface water and highwall runoff to Montana Gulch
Waste Rock Dumps and Repositories	Existing permit requirements	Existing permit requirements, geochemical testing, Reclamation Cover A	Enhanced reclamation water balance and water barrier covers	Concurrent reclamation, capping, revegetation, waste segregation/encapsulation	Enhanced Company Proposed Action Reclamation, Covers B or Modified C on waste rock facilities	Enhanced Company Proposed Action Reclamation, Covers B or Modified C on waste rock facilities	Enhanced reclamation water balance and water barrier covers
Leach Pads	Existing permit requirements	Existing permit requirements, geochemical testing, Reclamation Cover A	Enhanced reclamation water balance and water barrier covers	Neutralize in-piace with fresh water rinses, perforate liner, capping, revegetation	Enhanced Company Proposed Action Reclamation, Covers B or Modified C on heap leach pads	Enhanced Company Proposed Action Reclamation, Covers B or Modified C on heap leach pads	Enhanced reclamation water balance and water barrier covers

mitigations have been developed for Alternatives 2 or 4 since they were proposed by ZMI.

The following is a list of mitigations which have been incorporated into one or more agency-mitigated alternatives (Alternatives 3, 5, 6 and 7). The numbers in parentheses following each mitigation refer to the alternatives containing the mitigation, although each alternative should be read and considered for the context in which a particular mitigation is applied.

Mitigations Common to Both Mines

- Mine activities would be conducted in accordance with the Water Quality Improvement Plan described in Appendix A. (all alternatives)

- All mine expansion and reclamation activities would be conducted in accordance with the signed Programmatic Agreement developed under Section 106 of the National Historic Preservation Act (see Appendix E). (4, 5, 6, 7)

- ZMI's proposed Reclamation Cover C would be modified to include 6 inches of compacted clay (as opposed to 3 inches of compacted clay) between the bottom substrate and the PVC liner. The PVC liner thickness would be increased to 30 mil. For the purpose of discussion in this and future alternatives, this cover is known as "Modified Reclamation Cover C." (5, 6)

- To limit surface water infiltration and provide a better media for revegetation, water balance and water barrier reclamation covers would be used on most facilities and disturbances. (3, 7)

- Unless specifically identified below, mine waste rock facilities and ore heaps are assumed to be acid generating and would have improved reclamation covers installed. Cover soil on the facilities would be removed, stockpiled, and reused. (3, 5, 6, 7)

- To reduce erosion and soil loss, increase overall surface reclamation success, and increase stability most facilities would be reclaimed to an overall 3H:1V slope with constructed benches every 100 vertical feet between benches. In order to achieve the slope reductions while minimizing additional land disturbance some material may have to be off-loaded from existing facilities and used as pit backfill. (3, 5, 6, 7)

- To enhance the probability of long-term reclamation success, soil loss from reclaimed areas must be less than 2 tons/acre/year. (3, 5, 6, 7)

- To avoid impacts in northern drainages the limestone quarries would be sited within existing mine permit boundaries, at the Montana Gulch site for the Landusky Mine and LS-2 site for the Zortman Mine. (3, 7)

- In order to classify as "Non-Acid Generating" (NAG) and be used without restriction in construction and reclamation, waste rock (3, 5, 6, 7):

  1. Cannot be composed of breccia, felsic gneiss, monzonite, quartzite, or trachyte lithologies;

  2. If amphibolite, mafic gneiss, shale, dolomite, or limestone must have a total sulfur content less than or equal to 0.8 percent, and a Paste pH of 6.0 or greater;

  3. If syenite, must have a total sulfur content less than or equal to 0.2 percent, a Paste pH of 6.5 or greater, and a Net Neutralization Potential (NNP) of 0 or greater;

  4. Must meet the criteria above as demonstrated by sampling and analyzing lithologies from every blasthole providing non-acid generating material for total sulfur, Paste pH and Neutralizing Potential. All blastholes within a discrete mineable block (25 feet x 25 feet) must meet these criteria.

  5. If syenite, can only be used in reclamation covers and not for fill or other construction.

- To ensure that only non-acid generating materials are used in facilities transporting surface water or seepage water, material used as capillary break/drainage layers may be obtained from the unmineralized sources specified in the text. (3, 5, 6, 7)

- Rock underdrains would be built with durable, unmineralized limestone, as an additional precaution to buffer acidic drainage. (3, 5, 6, 7)

- No trees would be used in revegetation except on a limited basis for visual impact mitigation. Grasses, forbs and shrubs would be used to enhance wildlife habitat. In addition, crested wheatgrass could not be used in the reclamation seed mix. (3, 5, 6, 7)

- Vegetative cover must achieve 90 percent of that demonstrated in adjacent, natural communities of similar composition and location to be considered acceptable. (3, 5, 6, 7)

- An expanded monitoring program would be implemented and reclamation viability would be monitored by ZMI until the agencies have approved final closure and released the mine reclamation bond. (3, 5, 6, 7)

- A number of new monitoring wells and surface water monitoring stations would be installed north and south of the two mines. (3, 5, 6, 7)

- Prior to liner perforation, ZMI would undertake an expanded and more rigorous analysis of heap detoxification, to include additional sampling and monitoring requirements, water level measurements monthly, and agency notification. (3, 5, 6, 7)

- An expanded reclamation quality control program would be implemented to include such items as particle size restrictions for clay used in reclamation clay installation procedures, foundation preparation, testing of placed materials, inspection requirements, and construction reporting. (5, 6)

- All drainage and diversion ditches, and seepage water capture and treatment systems, would be sized to handle a 6.33 inch, 24-hour storm event with 1 foot of freeboard. (3, 5, 6, 7)

- For reclamation material haul trips using convoys that are routed through the communities of Zortman or Landusky, pilot cars would escort the convoys over the entire length of the haul routes and the speed of the convoys would be reduced to 15 mph. (3, 5, 6, 7)

- To the extent practicable, reclaimed facilities would be recontoured to provide a topography that blends into the surrounding landscape. Straight edges would be rounded. Large, flat surface areas would be broken with changes in contour resembling natural drainage patterns. The objective would be for the post-reclamation topography of the spent ore heaps and/or pits to meet VRM Class II criteria. ZMI would submit recontouring plans for review and comment prior to implementation. (5, 6, 7)

- Past and future impacts to wetland and non-wetland waters of the U.S. would be mitigated by implementing an Aquatic Ecosystem Mitigation Plan, similar to the plan for Alternative 7 in Appendix F of the EIS. (4, 5, 6, 7)

Zortman Mine Mitigations

- The 80-million ton capacity heap leaching facility would be constructed in Upper Alder Gulch as a valley fill leach pad, rather than at Goslin Flats. (5)

- The ore crushing facility would be sited in the vicinity of the pit complex. (5)

- Crushed ore would be transported to the heap leach pad by truck (rather than by conveyor system). (5)

- The 60-million tons of waste rock would be placed in a repository constructed on the Ruby Flats, just east of the Goslin Flats heap leach pad. (6)

- The waste rock repository would be lined on the bottom with a solution detection and collection system to reduce the potential for contamination of area water resources. (6)

- Rerouting of Phillips County Seven Mile Road around the Ruby Flats waste rock repository. (6)

- The Thermopolis shale could not be used without restriction in construction or reclamation purposes. Under-drains for the leach pad would have to be constructed using the native calcareous subsoil material or unmineralized limestones or carbonates from other sources. (5, 6, 7)

- The waste rock repository would be constructed mostly on existing facilities around the Zortman pit complex, rather than in Carter Gulch. (7)

- More rigorous construction quality control procedures would be applied to the leach pad construction. (5, 6, 7)

- The tailing in Ruby Gulch above the town of Zortman would be removed from the drainage and used in reclamation or construction. The drainage would be restored as mitigation for existing disturbance to waters of the United States by other Zortman and Landusky mines facilities. (3, 5, 6, 7)

- The Zortman Mine pits would be backfilled to a level which would allow free drainage of surface water, without impoundment in the pit, into the Ruby Gulch drainage. (3, 5, 6, 7)

- After detoxification, portions of the 85/86 leach pad and dike would be removed to create a free draining surface and placed in the pit as backfill material prior to pit floor reclamation. (3, 5, 6)

- The OK waste rock dump would be removed and used to backfill the pit complex or used as reclamation material. Cover soil would be re-salvaged and the waste rock footprint reclaimed. (3)

- The existing Alder Gulch waste rock dump would be removed and used to backfill the pit complex. The cover soil would be re-salvaged and the waste rock footprint reclaimed using this material. (3)

- The sulfide storage area would also be removed and used as backfill in the pit complex. (3)

- After detoxification, the Zortman 85/86 leach pad and dike would be removed to create a free draining surface to Ruby Gulch and placed in the pit as backfill material above the water table. The 85/86 leach pad footprint would become part of the new waste rock repository. (7)

- The OK and Upper Alder Gulch waste rock dumps would be removed and used to backfill the pit complex, or leached to remove precious metals. Cover soil would be re-salvaged and the waste rock footprints reclaimed. (5, 6, 7)

- The sulfide storage area would also be removed and leached to remove precious metals. (5, 6, 7)

- An alternate water source for bats (or other wildlife) would be constructed in Goslin Gulch between Azure Cave and the leach pad site to mitigate potential loss of wildlife drinking water on Goslin Flats. (6, 7)

- The 89 leach pad dike would be tested for sulfur content as described in Section 2.8.2.2, and re-reclaimed if sulfur exceeds 0.5 percent in more than 10 percent of the material tested. (5, 6, 7)

- To reduce visual impacts observed from areas north of the mine, the north/northwest facing pit highwalls would be reduced to an overall 3:1 slope, with vertical faces reduced such that no slopes are steeper than 2:1. (5, 6, 7)

- To maintain air emissions below the 24-Hour standard for particulates, the number of reclamation haul truck trips passing through the town of Zortman would be limited to 120 in a single day. (7)

Landusky Mine Mitigations

- Highwall runoff would be diverted from the mine pits into Montana Gulch and treated if necessary. (3, 5, 6, 7)

- The Landusky 91 leach pad dike would be re-reclaimed as appropriate to allow redistribution of spent ore to the south, west and east of the 87/91 pad. This action would eliminate the potential for surface water from the 87/91 pad to runoff north of the mine site into drainages on the Fort Belknap Indian Reservation. (3, 5, 6, 7)

- Existing reclamation covers on the Gold Bug waste rock repository and the Mill Gulch waste rock dump may require supplemental cover soil to limit infiltration. (3, 5, 6, 7)

- To unblock surface water drainage in the western tributary of Montana Gulch a drainage channel would be constructed along the west margin of the 85/86 leach pad. (3, 5, 6, 7)

- The Landusky Mine pit complex would be backfilled to a minimum elevation of 4,740 feet (at the south end of the pit complex/drainage ditch) to create a surface which would freely drain into Montana Gulch, thereby reducing the potential for precipitation and surface water runon to infiltrate through acidic materials and into the groundwater. Material used in backfill would come from existing waste rock dumps and leach pads, mined waste rock, or drainage channel construction. (3, 6, 7)

- Runoff from the Landusky Mine pit complex would be directed to Montana Gulch, immediately below the waste rock dump, by constructing a drainage notch between the August/Little Ben pit and Montana Gulch. This action would prevent pit water from flowing into the August tunnel. (3, 6, 7)

- The Landusky Mine pit complex would be backfilled to approximately 4,850 feet (at the midpoint of the drainage) or the minimum elevation necessary to create a surface which would freely drain into King Creek. Sources of pit backfill would include the Montana Gulch waste rock dump and the 85/86 heap leach pad. (5)

- Contingency water capture systems and settling ponds would be installed in upper King Creek to treat surface water runoff from the backfilled pit floors. (5)

PREFERRED ALTERNATIVE

There are two decisions that need to be made. One, how to mitigate environmental impacts from existing mine operations. Two, whether ZMI's proposed plans for expanded mining and mineral recovery are adequate to meet state and federal requirements, and if not, to identify mitigating measures that would be needed to meet these requirements. The two decision processes are related in that if expansion is approved it creates some additional options for dealing with impacts from existing mine operations. This does not mean that mine expansion is needed to mitigate existing impacts, just that mitigation could be accomplished differently if done in conjunction with mine expansion.

Alternative 7 has been *identified* as the agencies' (BLM and DEQ) preferred alternative. Alternative 7 satisfies the purpose and needs described in Chapter 1.

Of the seven alternatives in this Final EIS, a mine expansion alternative has been identified to meet the need for providing ZMI a means to develop precious metal deposits at the Zortman and Landusky mines and reclaim both mine facilities. Of the various possible waste rock and leach pad facility locations for mine expansion at the Zortman Mine, Alternative 7 is preferred.

Preferred reclamation measures are described under Alternative 7. Modified reclamation covers have been developed to enhance the potential for long-term reclamation success and reduce the potential for surface water to infiltrate into capped facilities. These measures, together with the other mitigations detailed in Alternative 7, would be used to address existing environmental problems, prevent unnecessary or undue degradation, and provide for comparable stability and utility of mined lands with adjacent areas.

No sooner than 30-days after this Final EIS is released, a Record of Decision (ROD) will be prepared (see Figure 1-5 of the final EIS). The ROD will consider the results of this Final EIS along with the implementation factors and options to *select* a preferred alternative.

Once selected, an alternative may be implemented in various ways. The alternative could be fully implemented, separate decisions could be issued for either of the mines, or implementation of mine expansion could be phased contingent on performance of certain corrective measures. The impact analysis presented in Chapter 4 is based on full implementation of each alternative described in Chapter 2. Implementation of the selected alternative will be decided in the ROD.

During implementation of the decision, the mine operator (ZMI) could propose waivers, exceptions, or modifications be made to the selected alternative. The purpose of this flexibility is to allow consideration of alternative mitigation technologies that may be developed during the life of the project, and to provide for changes that may be warranted due to better knowledge of site conditions gained during operations.

Any changes in operating practices, reclamation design, or mitigating measures would be reviewed by the agencies and accepted if they provide equal or greater resource protection than the original requirement, and did not result in significant impacts previously unidentified by this EIS. Proposed changes which would not achieve the same level of resource protection, or would result in previously undisclosed significant impacts, would require supplemental analysis under NEPA and MEPA prior to approval.

AFFECTED ENVIRONMENT

Chapter 3 of the EIS describes the natural resources and economic and social conditions found in the study area. Following is a brief summary of this affected environment.

The proposed project is located in the Little Rocky Mountains of north-central Montana, near the southern boundary of the Fort Belknap Indian Reservation in the southwest corner of Phillips County. Nearby towns include Hays and Lodgepole (in the southern portion of the Reservation), Landusky (approximately 0.5 miles south of the Landusky Mine), and Zortman (about 1 mile south of the Zortman Mine).

The study area is characterized by rolling prairie dissected by streams and interrupted by "island mountains" that rise out of the relatively flat plains like islands in the ocean. Elevations range from approximately 2,300 feet above sea level at Fort Peck Lake east of the Little Rocky Mountains, to 5,700 feet above sea level at Old Scraggy Peak, located approximately 1.5 miles east of the Zortman Mine. Topography within the mountains is rugged, with high outcrops and steep v-shaped valleys. Mining in the Little Rocky Mountains can be characterized as heavy during the 1800s through the turn of the century, cyclical from the 1920s through the 1940s, and sporadic through 1951. After 1951, little serious activity occurred in the Little Rocky Mountains until modern surface-mining operations were initiated in 1979.

Soil resources include young and relatively undeveloped soil in the mountain areas, and more developed soil in the plains areas, which are potential major sources of reclamation cover soil and subsoil.

Portions of the project area that have not been mined are mostly forested. Primary community types present include lodgepole pine forest, ponderosa pine forest, Douglas fir forest, deciduous tree forest, grassland, shrubland, and outcrop/scree communities. Small wetlands occur along the lower drainages. The area supports a wide variety of plants, and the Little Rocky Mountains are a source of plant materials for ethnobotanical uses. No plants listed as federally threatened or endangered or as of special interest or concern by the State of Montana are known to occur within the study area. A wide variety of wildlife species can also be found. Well-known species include big game animals, upland game birds, raptors, and bats. Eighteen species of special concern at either the federal and/or state level may potentially occur in the region.

The headwaters of several streams are located in the study area; most streams are ephemeral or intermittent in nature. These drainages and the subsurface aquifers in the area have been or can be affected by acid rock drainage associated with mining activities in this highly mineralized area. Surface water and groundwater have exhibited elevated chemical concentrations on specific occasions downstream as far as Zortman and Landusky since 1979. Water treatment systems are currently operating in all of the affected drainages, and significant improvement in downstream water quality has been observed.

The economy of the area is based primarily on the use of natural resources, which includes agriculture, mining, and outdoor recreation. Agriculture is the predominant land use in the study area. Public lands provide both developed and dispersed recreation opportunities. Fort Belknap Indian Reservation also provides some recreational facilities including Pow Wow grounds.

The affected environment for the Little Rocky Mountains includes both its spiritual and physical characteristics which are traditionally seen as inseparable. The mountains are viewed as one of the last refuges where traditionalists can practice spiritual activities such as prayer, fasting, and making offerings. A number of Native Americans have used the Little Rocky Mountains for subsistence, social, and religious activities, and the Little Rocky Mountains are considered eligible for listing on the National Register of Historic Places as a Traditional Cultural Property. The Alder Gulch Historic District, which contains historic mining remains, is also considered eligible for the National Register.

Other areas are recognized as Areas of Critical Environmental Concern (ACEC). These include Azure Cave and prairie dog towns 20 miles east of the Little Rocky Mountains. Three other areas nominated for ACEC consideration include Little Rocky Mountains, Saddle Butte, and Old Scraggy Peak.

ENVIRONMENTAL CONSEQUENCES

The seven alternatives were evaluated for their potential impact on various environmental, social, and cultural resources. A detailed discussion of these impacts, or environmental consequences, is contained in Chapter 4 of the Final EIS. The following discussions highlight the EIS material, with emphasis on the most significant impacts, especially impacts associated with the four primary issues of concern previously discussed: water quality, reclamation and its associated impacts, cultural resources, and socioeconomics.

The summary of impacts is presented in two ways. The first summary is a discussion of the relative impacts each alternative would have on an environmental resource. This provides a concise assessment of how well each alternative would prevent or mitigate impacts to each resource. The second portion of this section describes the impacts by alternative using a comprehensive summary table. This presents a comparative description of the resource impacts relating to implementation of each alternative.

Summary of Resource Impacts

This section summarizes the information presented in Chapter 4 of the Final EIS. The impacts to each environmental resource are described and, where possible, compared to discern relative differences in significance.

Geology and Topography

Mining in the Little Rocky Mountains during the past sixteen years has irreversibly altered the landscape and consumed local geologic resources. Approximately 20 million tons of gold and silver bearing ore have been removed from the Zortman Mine during the years 1979 to 1995, and about 110 million tons of ore have been removed from the Landusky Mine during the same years. It is estimated that about 1.4 million ounces of gold and 5.5 million ounces of silver have been recovered from that ore during the years 1979 through

1995. Other geologic resources, including clay and limestone, have been used in construction and reclamation at the mines.

Ore and waste rock removal has significantly altered the local topography of the southern portion of the Little Rocky Mountains. The most dramatic and significant impact to topography is the result of hardrock mining in the ore zones at both mines. The elevation of the pre-mining land surface at the current Zortman Mine pit was over 5,200 feet mean sea level (msl). Since large-scale mining began, two prominent hills have been reduced in elevation by 200 feet or more to an existing ground surface less than 5,000 feet msl in some areas. Topographic alteration to the Landusky Mine landscape has been greater than at Zortman because about five times as much ore and waste rock has been removed during the past 16 years of mining. The elevation of the pre-mining land surface at the current Landusky Mine pit was about 5,400 feet msl at the highest point. Up to 500 feet of relief has been removed as a result of large-scale mining.

Impacts to geologic resources and topography from the alternatives may be distinguished first by whether future mining would take place. No significant impact to geologic resources would occur for the non-expansion alternatives (1 through 3). No new ore would be mined and the only additional geologic resources consumed would be clay for use in reclamation covers. Alternative 3 would result in a significant new disturbance at Goslin Flats to provide material for use in reclamation covers. Topography would change little for any of the non-expansion alternatives, although Alternative 3 would require that facility slopes be reduced. This action would increase stability and reduce risks of facility failure. Mine pits would be partially backfilled with material from existing dumps and pad, to some extent reducing the magnitude of topographic impacts from past mining actions.

For all expansion alternatives, approximately 80 million tons of ore and 60 million tons of waste rock would be generated from the Zortman Mine, and about 7.6 million tons of ore and 7 million tons of waste rock would be generated at the Landusky Mine. Impacts to other geologic resources would vary between the alternatives. Alternatives 5 and 6 would require the use of more clay than Alternative 4, and Alternative 7 would use significantly less clay than any of the other expansion alternatives.

Topographic modifications would vary somewhat among expansion alternatives. Significant new disturbance would occur in the Goslin Flats area under Alternatives 4, 6, and 7 from leach pad construction and operation. Alternative 6 would have even greater impact on this area because the waste rock facility would be constructed on Ruby Flats. Alternatives 5, 6, and 7 would reduce the magnitude of past topographic impact and lessen geologic hazards by the removal of some existing facilities, and resloping of reclaimed areas to 3:1 where possible.

Water Resources

Non-Expansion Alternatives: Infiltration modeling of the non-expansion alternatives shows that Alternative 3 would provide the best long-term barrier to infiltration. The following average percentages of available precipitation are predicted to infiltrate into facilities over the first 20 years of reclamation:

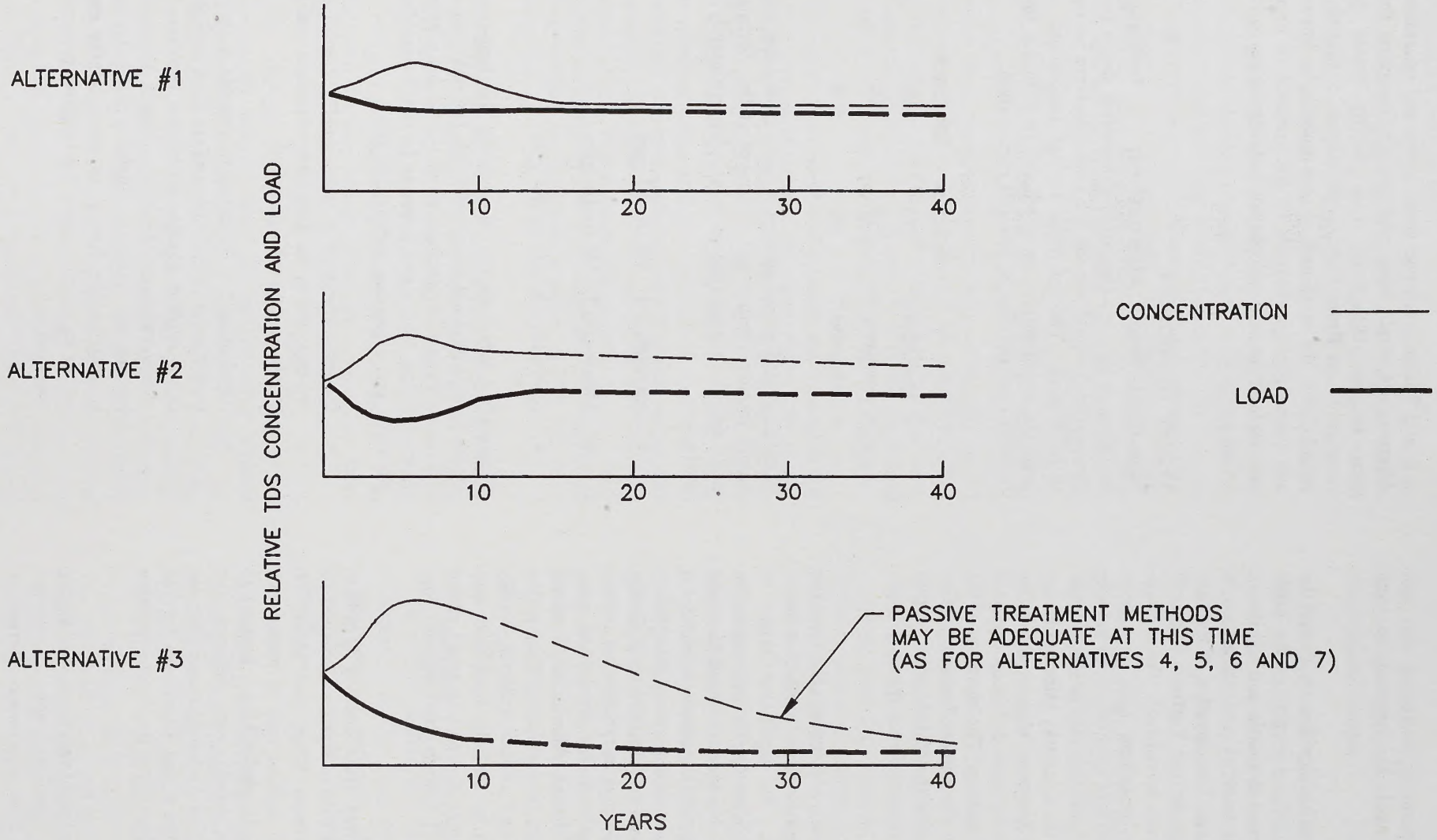
	Flat Area	Side Slopes
• Alternative 1	23%	23%
• Alternative 2	23%	23%
• Alternative 3	8%	11%

Total estimated annual average volumes of drainage that would require capture and treatment at the Zortman and Landusky mines in the short-term (approximately 20 years) are:

- Alternative 1: 378 to 450 gpm
- Alternative 2: 348 to 419 gpm
- Alternative 3: 211 to 284 gpm

Figure ES-2 schematically summarizes the long-term trends in relative total dissolved solids (an indicator of overall water quality) concentrations and loads seeping from facilities. The major points to be noted regarding the three non-expansion alternatives are:

- Under Alternative 1, water quality conditions are expected in the long-term to remain similar to what is presently observed.
- Alternative 2 is expected to provide a short-term barrier to infiltration where the 6-inch clay cap is applied, causing short-term increases in concentration and decreases in loads. However, because the long-term reliability of the clay cap is questionable, long-term water quality may return to conditions similar to those presently observed.



NOTE:
TDS AS SHOWN IS MEANT TO BE REPRESENTATIVE OF TOTAL WATER QUALITY INCLUDING SULFATE, METALS ETC.

Job No. :	23173E
Prepared by :	I.R.F
Date :	12/29/94

ESTIMATED LONG-TERM POST-RECLAMATION WATER QUALITY FOR NON EXPANSION ALTERNATIVES 1, 2 AND 3

FIG. ES-2

73001

- As part of Alternative 3, the Alder Gulch waste rock dump and the 85/86 leach pad and dike would be removed from southern drainages of the Zortman Mine. This would improve water quality in those drainages.

- Alternative 3 provides water balance and geosynthetic clay liner (GCL) barrier reclamation covers which efficiently reduce infiltration into the underlying facilities by enhancing the evapotranspiration of water held in storage by the significant thickness of soil. The GCL covers provide a low permeability barrier, which enhances lateral drainage and is not as susceptible to desiccation from freeze thawing or dehydration as compacted clay. This should provide better long-term performance at limiting infiltration.

- Under Alternative 3, short-term concentrations are expected to increase and loads are expected to reduce rapidly. In the long-term, the facilities are expected to reach static hydraulic conditions (little discharge), which would inhibit the generation and transportation of acid rock drainage.

In summary, among the non-expansion alternatives only under Alternative 3 would there be any opportunity to shut down active treatment of seepage, and replace it with passive treatment systems. However, Alternative 3 still has the potential to require long-term capture and treatment.

Expansion Alternatives: Infiltration modeling of Alternatives, 4, 5, 6, and 7 shows all four to result in the similar percentage of infiltration on facility side slopes. Although the water barrier covers proposed in Alternative 4, 5, and 6 appear to attain the best or smallest amount of infiltration into the facilities, in the short- to mid-term; it is anticipated that the long-term integrity of the reclamation covers proposed in Alternative 7 would be better.

The following average percentages of available precipitation are predicted to infiltrate into the facilities.

		Side Slopes	
	Flat Area	3:1	2:1
• Alternative 4	0.03%	7.8%	8.0%
• Alternative 5	0.005%	7.8%	-
• Alternative 6	0.005%	7.8%	-
• Alternative 7	8.0%	10.5%	-

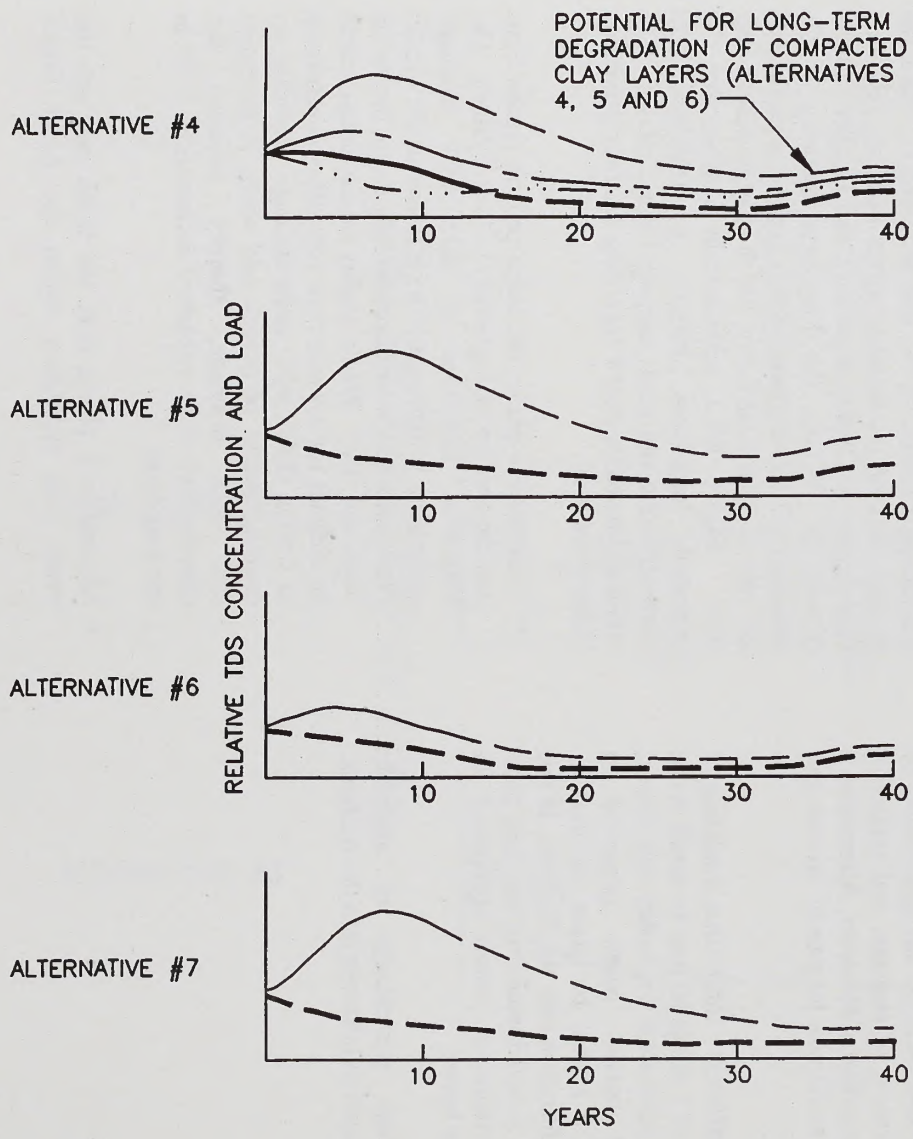
Estimated total average volumes requiring capture and treatment in the short-term (approximately 20 years) are:

- Alternative 4: 307 to 389 gpm
- Alternative 5: 322 to 423 gpm
- Alternative 6: 244 to 313 gpm
- Alternative 7: 258 to 321 gpm

The PVC/clay composite covers proposed for Alternatives 4, 5, and 6 obtain a lower infiltration rate than the GCL barrier covers proposed for Alternative 7. However, Alternative 7 avoids many other impacts associated with mining and hauling the clay needed for Reclamation Covers B, C, and Modified C. Also, the success of these reclamation covers does not rely on a high degree of Quality Assurance and Quality Control (QA/QC). Finally, the long-term integrity of the Alternative 7 reclamation cover is greater since they do not rely on compacted clay, which may desiccate over time. Figure ES-3 schematically summarizes the expected long-term trends in relative TDS concentrations and loads seeping from facilities. The major points to be noted regarding the four expansion alternatives are:

- Alternative 4 places the leach pad on Goslin Flats and the waste rock repository in Carter Gulch. The long-term reduction of acid rock drainage generation is expected to be effective at the Goslin Flats facility, as it would eventually drain, becoming "high and dry." Water quality management would be difficult for a waste rock repository constructed in Carter Gulch with underdrainage providing an ongoing source of oxygen and water to transport acid rock drainage, thereby reducing the effectiveness of its enhanced reclamation cover in the long-term.

- Alternative 5 places both the leach pad and the waste rock repository within the Alder Gulch



CARTER GULCH WASTE ROCK REPOSITORY CONCENTRATIONS

CARTER GULCH WASTE ROCK REPOSITORY LOAD

GOSLIN FLATS LEACH PAD CONCENTRATIONS

GOSLIN FLATS LEACH PAD LOADS

CARTER GULCH TRENDS SAME AS ALTERNATIVE #4

ALDER GULCH LEACH PAD CONCENTRATIONS

ALDER GULCH LEACH PAD LOADS

GOSLIN FLATS TRENDS SAME AS ALTERNATIVE #4

RUBY FLATS WASTE ROCK REPOSITORY CONCENTRATIONS

RUBY FLATS WASTE ROCK REPOSITORY LOADS

ALTERNATIVE 7 WASTE ROCK REPOSITORY AND GOSLIN FLATS LEACH PAD CONCENTRATIONS

ALTERNATIVE 7 WASTE ROCK REPOSITORY AND GOSLIN FLATS LEACH PAD LOADS

NOTES:

1. TDS AS SHOWN IS MEANT TO BE REPRESENTATIVE OF TOTAL WATER QUALITY INCLUDING SULFATE, METALS, ETC.
2. EXISTING FACILITIES WOULD HAVE SOME LONG-TERM WATER QUALITY TRENDS AS SHOWN IN ALTERNATIVE #3 (FIGURE 4.2-1)

ESTIMATED POST RECLAMATION WATER QUALITY FOR EXPANSION ALTERNATIVES 4, 5, 6, AND 7

73002A

FIG. ES-3

drainage. Although a significant reduction of infiltration and resultant acid rock drainage generation is expected, underdrainage would likely provide a significant source of acid rock drainage in the long-term. Construction of both facilities in this steep drainage with near perennial flow and sulfide rich bedrock also increases the potential for downstream impacts to water quality and constitutes a significant loss of high quality water resources.

- Alternative 6 places both the leach pad and the waste rock repository on Goslin Flats. Construction on flat land above the water table, combined with the proposed enhanced reclamation covers, is expected to allow both facilities to drain, essentially becoming "high and dry." The flat topography and resultant flat hydraulic gradient underlying these facilities would also allow effective monitoring and recovery of any unforeseen seepage from the facilities. Soil salvaging within the footprint of these facilities is expected to generate some short-term periods of elevated suspended solids in the surrounding drainages.

- Alternative 7 places the leach pad on the flats above the water table in an environment suited for effective, water quality management. It also places the waste rock repository on top of existing waste rock piles, leach pads and pits. This location creates little additional disturbance, concentrates the impact in drainage systems with existing mitigation measures and provides the reclamation cover required for the majority of the existing Zortman mine facilities. The combination of water barrier and water balance type-reclamation covers proposed with this alternative reduces infiltration and the volumes requiring treatment, but do not preclude the possible need for long-term capture and treatment of impacted waters.

In summary, under all four expansion alternatives, there is potential to scale down treatment of seepage at some point in the future. The long-term effectiveness of the enhanced reclamation covers is, however, better on the flat terrain surrounding the Little Rocky Mountains where the facilities would eventually drain in a controlled manner becoming "high and dry."

Implementation of the water control, capture and treatment measures described in Appendix A would cause mine discharges to achieve compliance with water quality standards. However, by incorporating selective waste rock handling, runon and runoff controls, and enhanced reclamation covers into the mine plan, the reliance on water capture and treatment to meet the discharge limits is minimized. Likewise, the consequences of a system failure in the water capture and treatment systems are reduced where source control has first been employed to limit the volume and contaminant load of water that must be treated. Therefore, long-term protection of water quality is most reliable when ARD source control measures are used in conjunction with seepage capture and treatment. This balance between ARD source control and water treatment is attained by Alternatives 3 and 7. Alternatives 4, 5, and 6 would be less balanced, but still effective. Alternatives 1 and 2 would depend heavily upon water capture and treatment to achieve and maintain water quality standards at the point of compliance. These two alternatives would have the least long-term reliability.

Soil and Reclamation Effectiveness

Past exploration and mining-related activities has resulted in the disturbance and alteration of in-place, natural soil in both the Zortman and Landusky mine areas. Direct negative effects on soil that have resulted from exploration, and the construction and operation of mine-related facilities include the following:

- Loss/interruption of pedogenic (soil) development, including breakdown of soil structure and mixing of distinct soil horizons

- Loss of soil material due to disturbance and exposure to forces of erosion

- Alteration of biological and nutrient conditions in soil materials stored in piles for extended periods

- Compaction of soil materials beneath facilities and in areas of natural soil crossed by vehicular traffic

- Loss or reduction of soil productivity

Direct impacts to soil from the period of large-scale mining, 1979 to the present, are classified as high.

Criteria to determine impacts to soil and reclamation success from alternative actions include:

- Restoration of less than 48 inches of suitable material, including at least 12 inches of cover soil, on final reclamation grades/surfaces to serve as an effective long-term plant growth medium.

- Soil loss as predicted by the Revised Universal Soil Loss Equation (RUSLE) (Renard et al. 1991) in excess of 2 tons/acre/year for reclaimed slopes and surfaces (EPA 1991, Richardson 1995).

Table ES-3 summarizes the amount of soil projected to be lost from the major facilities for each alternative. Soil loss on sideslopes would exceed significance criteria in the short-term for all of the alternatives. Of the non-expansion alternatives, only Alternative 3 reclamation measures would result in soil loss less than 2 tons/acre/year in the long term. Alternative 3 is also the only non-expansion alternative to provide 48 inches of cover as vegetative growth media over materials potentially acid generating. Therefore, potential for reclamation success in the long-term would be greatly increased under Alternative 3 as opposed to Alternatives 1 or 2. Alternative 3 would require more disturbance to be reclaimed than the other two non-expansion alternatives.

Soil loss estimated for Alternatives 4, 5, and 6 is roughly comparable, since these expansion alternatives use essentially the same type of reclamation covers and reclamation cover thickness. Because of the different reclamation cover employed, soil loss on relatively flat slopes would be greater under Alternative 7 than for the other expansion alternatives. However, long-term soil loss from side slopes, which constitute most of the disturbance to be reclaimed, would be at least 20 percent and in many cases 100 percent less than for Alternatives 4, 5, and 6. Disturbance associated with Alternative 7 would be approximately 10 percent less than for the other expansion alternatives.

Comparable stability and utility of most facilities would be achieved in the long-term for all of the expansion alternatives and Alternative 3. Alternatives 1 and 2 would likely not meet this statutory requirement due to the ineffectiveness of reclamation measures.

Vegetation and Waters of the U.S.

Impacts to vegetation were assessed based on the following factors:

- the loss of species diversity in disturbed areas,
- disturbance of threatened, endangered, or sensitive plant species or communities,
- the loss of sole sources of vegetation used by Native Americans for ceremonies, medicine, and food,
- the loss of riparian vegetation and habitat,
- the long-term loss of trees/forestry resources, and
- adequacy of the proposed reclamation programs to achieve an adequate environment for natural plant succession and return the vegetation on the site to pre-mining levels of canopy cover, productivity, and utility.

In the short-term, the loss of plant diversity in disturbed areas would be considered a significant impact for all alternatives because revegetation efforts would replace only about 8 percent of the species that naturally occur on the site.

There would be no impacts to threatened, endangered, or sensitive plant species or communities under any of the alternatives, nor any impacts to sole sources of vegetation used by the Native Americans.

Disturbance to riparian habitat would affect less than one percent of all riparian habitat in the study area for all alternatives except Alternative 5, which would affect approximately two percent of the riparian habitat in the study area. Based on the significance criteria, impacts are rated low. However, impacts to 17 acres of high quality riparian habitat in Upper Alter Gulch, as proposed in Alternative 5, could be considered significant locally. This alternative would eliminate a very diverse riparian community that provides good wildlife habitat and is relatively uncommon in the area.

Impacts to all vegetation resources were evaluated including those to grasslands, shrublands, as well as forested habitat. The loss of forest habitat would be considered the most significant though, due to the amount of time (70-80 years) necessary to regenerate stands of comparable utility (e.g., merchantable timber, wildlife cover, and visual screening of disturbances). The acreage of direct impacts to forest habitat was calculated for each alternative. Mining activities between 1979 and the present have been significant. Alternatives 1 and 2 would not result in any additional impacts to the forests, and Alternative 3 would affect 5 additional acres. For the expansion alternatives 4 through 7, acres of disturbance of forested habitat range from 216 (Alternative 6) to 521 (Alternative 5), and impacts would be moderate.

The proposed reclamation plan for each alternative was evaluated for its ability to achieve an adequate environment for natural plant succession that could be expected to be sustained in the long-term, and return the site to similar, pre-mining conditions. The reclamation plans proposed under Alternatives 1 and 2 would not be adequate to protect soils from erosion and acidification, and result in significant impacts to vegetation and failure of reclamation efforts over much of the disturbed area. Alternatives 3 and 7 include reclamation plans which would minimize erosion, prevent acidification of the soils, and would be capable of sustaining natural plant succession and productivity into the future. A minimal amount of revegetation failure would be expected and impacts would be low. The reclamation plans proposed under Alternatives 4 through 6 are better than those for Alternatives 1 and 2,

TABLE ES-3
SUMMARY OF SOIL LOSS RATE FOR EACH ALTERNATIVE AND MAJOR FACILITIES AT ZORTMAN AND LANDUSKY MINES[1]

	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6		Alternative 7	
Facility	Short Term (Tons/ Ac/Yr)	Long Term (Tons/ Ac/Yr)	Short Term (Tons/ Ac/Yr)	Long Term (Tons/ Ac/Yr)	Short Term (Tons/ Ac/Yr)	Long Term (Tons/ Ac/Yr)	Short Term (Tons/ Ac/Yr)	Long Term (Tons/ Ac/Yr)	Short Term (Tons/ Ac/Yr)	Long Term (Tons/ Ac/Yr)	Short Term (Tons/ Ac/Yr)	Long Term (Tons/ Ac/Yr)	Short Term (Tons/ Ac/Yr)	Long Term (Tons/ Ac/Yr)
Zortman														
• 79/80/81 Pad														
- Sideslopes	6.12	2.40	6.12	2.40	3.53	0.82	3.13	1.04	3.13	1.04	3.13	1.04	N/A	N/A
- Top Areas	0.15	0.06	0.15	0.06	1.58	0.46	0.10	0.03	0.10	0.03	0.10	0.03		
• 82 Pad														
- Sideslopes	6.12	2.40	6.12	2.40	3.53	0.82	3.13	1.04	3.13	1.04	3.13	1.04	N/A	N/A
- Top Areas	0.19	0.08	0.19	0.08	1.58	0.46	0.13	0.03	0.13	0.03	0.13	0.03		
• 83 Pad														
- Sideslopes	6.12	2.40	6.12	2.40	3.53	0.82	3.13	1.04	3.13	1.04	3.13	1.04	N/A	N/A
- Top Areas	0.21	0.09	0.21	0.09	1.58	0.46	0.14	0.04	0.14	0.04	0.14	0.04		
• 84 Pad														
- Sideslopes	6.12	2.40	6.12	2.40	3.53	0.82	3.13	1.04	3.13	1.04	3.13	1.04	N/A	N/A
- Top Areas	0.23	0.10	0.23	0.10	1.58	0.46	0.16	0.04	0.16	0.04	0.16	0.04		
• 85/86 Pad														
- Sideslopes	6.12	2.40	6.12	2.40	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
- Top Areas	0.22	0.09	0.22	0.09										
• 89 Pad														
- Sideslopes	6.12	2.40	6.12	2.40	3.53	0.82	3.13	1.04	3.13	1.04	3.13	1.04	N/A	N/A
- Top Areas	0.19	0.08	0.19	0.08	1.58	0.46	0.13	0.03	0.13	0.03	0.13	0.03		
• Alder Gulch WRD														
- Sideslopes	6.06	2.37	6.06	2.37	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
- Top Areas	0.22	0.09	0.22	0.09										
• OK WRD					N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
- Sideslopes	6.12	2.40	6.12	2.40										
- Top Areas	0.19	0.08	0.19	0.08										
• Goslin Flats Pad														
- Sideslopes	N/A	N/A	N/A	N/A	N/A	N/A	3.74	1.25	N/A	N/A	3.74	1.25	3.53	0.82
- Top Areas							0.24	0.06			0.24	0.06	1.58	0.46

TABLE ES-3 - SUMMARY OF SOIL LOSS RATE FOR EACH ALTERNATIVE
(Continued)

	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6		Alternative 7	
Facility	Short Term (Tons/ Ac/Yr)	Long Term (Tons/ Ac/Yr)	Short Term (Tons/ Ac/Yr)	Long Term (Tons/ Ac/Yr)	Short Term (Tons/ Ac/Yr)	Long Term (Tons/ Ac/Yr)	Short Term (Tons/ Ac/Yr)	Long Term (Tons/ Ac/Yr)	Short Term (Tons/ Ac/Yr)	Long Term (Tons/ Ac/Yr)	Short Term (Tons/ Ac/Yr)	Long Term (Tons/ Ac/Yr)	Short Term (Tons/ Ac/Yr)	Long Term (Tons/ Ac/Yr)
• Carter Gulch WRR														
- Sideslopes	N/A	N/A	N/A	N/A	N/A	N/A	4.48	1.50	3.13	1.04	N/A	N/A	N/A	N/A
- Top Areas							0.23	0.06	0.23	0.06				
• Upper Alder Gulch Pad														
- Sideslopes	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.13	1.04	N/A	N/A	N/A	N/A
- Top Areas									0.31	0.08				
• Ruby Flats WRR														
- Sideslopes	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.13	1.04	N/A	N/A
- Top Areas											0.24	0.06		
• Alt. #7 WRC														
- Sideslopes	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.53	0.82
- Top Areas													1.58	0.46
Landusky														
• 79 Pad														
- Sideslopes	6.12	2.40	6.12	2.40	3.53	0.82	3.13	1.04	3.13	1.04	3.13	1.04	3.53	0.82
- Top Areas	0.15	0.06	0.14	0.05	1.58	0.46	0.10	0.03	0.10	0.03	0.10	0.03	1.58	0.46
• 80/82 Pad														
- Sideslopes	6.12	2.40	6.12	2.40	3.53	0.82	3.13	1.04	3.13	1.04	3.13	1.04	3.53	0.82
- Top Areas	0.17	0.07	0.15	0.06	1.58	0.46	0.12	0.03	0.12	0.03	0.12	0.03	1.58	0.46
• 83 Pad														
- Sideslopes	6.12	2.40	6.12	2.40	3.53	0.82	3.13	1.04	3.13	1.04	3.13	1.04	3.53	0.82
- Top Areas	0.15	0.06	0.14	0.05	1.58	0.46	0.10	0.03	0.10	0.03	0.10	0.03	1.58	0.46
• 84 Pad														
- Sideslopes	6.12	2.40	6.12	2.40	3.53	0.82	3.13	1.04	3.13	1.04	3.13	1.04	3.53	0.82
- Top Areas	0.16	0.07	0.14	0.05	1.58	0.46	0.11	0.03	0.11	0.03	0.11	0.03	1.58	0.46
• 85/86 Pad														
- Sideslopes	6.12	2.40	6.12	2.40	3.53	0.82	3.13	1.04	3.13	1.04	3.13	1.04	3.53	0.82
- Top Areas	0.18	0.08	0.16	0.06	1.58	0.46	0.12	0.03	0.12	0.03	0.12	0.03	1.58	0.46

TABLE ES-3 - SUMMARY OF SOIL LOSS RATE FOR EACH ALTERNATIVE (Concluded)

	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6		Alternative 7	
Facility	Short Term (Tons/ Ac/Yr)	Long Term (Tons/ Ac/Yr)	Short Term (Tons/ Ac/Yr)	Long Term (Tons/ Ac/Yr)	Short Term (Tons/ Ac/Yr)	Long Term (Tons/ Ac/Yr)	Short Term (Tons/ Ac/Yr)	Long Term (Tons/ Ac/Yr)	Short Term (Tons/ Ac/Yr)	Long Term (Tons/ Ac/Yr)	Short Term (Tons/ Ac/Yr)	Long Term (Tons/ Ac/Yr)	Short Term (Tons/ Ac/Yr)	Long Term (Tons/ Ac/Yr)
• 87/91 Pad														
- Sideslopes	3.89	1.52	3.89	1.52	3.53	0.82	3.13	1.04	3.13	1.04	3.13	1.04	3.53	0.82
- Top Areas	0.18	0.07	0.16	0.06	1.58	0.46	0.12	0.03	0.12	0.03	0.12	0.03	1.58	0.46
• Gold Bug WRD														
- Sideslopes	5.92	2.32	5.92	2.32	4.76	1.59	4.76	1.59	4.76	1.59	4.76	1.59	3.53	0.82
- Top Areas	0.15	0.06	0.14	0.05	0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	1.58	0.46
• Mill Gulch WRD														
- Sideslopes	5.75	2.25	5.75	2.25	4.63	1.54	4.63	1.54	4.63	1.54	4.63	1.54	3.53	0.82
- Top Areas	0.17	0.07	0.15	0.06	0.12	0.03	0.12	0.03	0.12	0.03	0.12	0.03	1.58	0.46
• Montana Gulch WRD														
- Sideslopes	6.12	2.40	6.12	2.40	3.53	3.53	3.13	1.04	3.13	1.04	3.13	1.04	3.53	0.82
- Top Areas	0.15	0.06	0.14	0.05	1.58	1.58	0.10	0.03	0.10	0.03	0.10	0.03	1.58	0.46
• Sullivan Park WRD														
- Sideslopes	6.12	2.40	6.12	2.40	4.92	1.64	4.92	1.64	4.92	1.64	4.92	1.64	3.53	0.82
- Top Areas	0.16	0.07	0.14	0.05	0.11	0.03	0.11	0.03	0.11	0.03	0.11	0.03	1.58	0.46
• August #1, #2 WRD														
- Sideslopes	N/A	N/A	N/A	N/A	4.92	1.64	4.92	1.64	4.92	1.64	4.92	1.64	3.53	0.82
- Top Areas					0.10	0.03	0.10	0.03	0.10	0.03	0.10	0.03	1.58	0.46

*(0) A detailed presentation of the RUSLE calculations for the major Zortman and Landusky Mine Facilities is available in the Agencies' project file.

A rate of soil loss in excess of 2 tons/acre/year from reclaimed slopes and surfaces would be a significant impact (Section 4.3.1).

but not as good as for Alternatives 3 and 7. Some erosion and acidification of soils are expected to result in moderate impacts to vegetation.

Wetland and Non-Wetland Waters: Impacts to wetland and non-wetland waters were assessed for the period 1979-present and for each alternative by calculating acreage of direct and indirect impacts for the individual drainages in the study area. Then, using information from the baseline which indicated the functional "value" of the wetlands and drainages, impacts were rated as high (significant) if they resulted in a more than minimal loss or change in value to either a "high" or "moderate" value drainage or wetland. Mitigation proposed for each alternative was then taken into account, and a final rating was determined.

Alternatives 1 through 3 resulted in very little impact and no pre-mitigation significant impacts to wetlands. Alternatives 1 and 2 involved minor losses for placement of water capture structures only. Alternative 3 included this plus some indirect impacts to low value wetlands in Goslin Flats that would not be mitigated. For the expansion alternatives, Alternatives 4 and 7 are very similar in wetland impacts. They include about one acre of direct loss and approximately ½ acre of indirect impacts in Goslin Flats, and minor acreage of impacts from installation of water capture structures. Alternatives 5 and 6 have high pre-mitigation impacts because of losses in Alder Gulch and Camp Creek, two wetland systems that are of "moderate" value, with Alternative 6 causing the greatest area of disturbance overall. With replacement wetlands mitigation, impacts would be reduced to insignificant levels for all alternatives.

For non-wetland waters, there are significant impacts to several drainages that occurred since 1979, which carry through for all alternatives as potentially significant pre-mitigation impacts. This includes losses of headwaters in Alder Gulch, Montana Gulch, King Creek, and other drainages. For the non-expansion alternatives, these losses plus minor (low to moderate levels) impacts related to construction of water capture and treatment facilities, are the primary non-wetland effects, and all three are very similar. However, with the exception of the inclusion of Ruby Gulch restoration in Alternative 3, none of these provide mitigation for the past direct impacts to non-wetland waters. The water capture and treatment program would mitigate for past indirect water quality impacts.

Impacts to non-wetland waters for the expansion alternatives are greater due to the increase in disturbed area. Alternatives 4 and 7 are similar, and include some high impacts in Alder Gulch and mostly moderate to low impacts elsewhere, for a total of 7.4 acres (Alternative 7) or 7.9 acres (Alternative 4) of new direct fill. Indirect impacts would include approximately 7.3 acres of downstream drainages affected by sedimentation and water quality impacts. Alternative 5 would result in slightly less direct fill and some new indirect impacts in Alder Gulch, which is a "moderate" value resource and has an extensive non-wetland riparian area. Alternative 6 would result in approximately 7 acres of direct fill, but has the most extensive indirect impacts in the Camp Creek/Ruby Gulch areas. For all of the expansion alternatives, a mitigation plan would be required that includes 1.5:1 mitigation for past impacts and 1:1 mitigation for proposed impacts, with emphasis on replacement of lost functions and values, and replacement concurrent with impact (Appendix F). With successful implementation of this plan and the water quality improvement measures, impacts for any of Alternatives 4 through 7 would be reduced to insignificant levels.

Tables ES-4 and ES-5 summarize acreages of direct and indirect impacts to wetland and non-wetland waters for all alternatives. Table ES-6 summarizes impacts to vegetation, wetland waters, and non-wetland waters.

Wildlife and Aquatics

Mine activities have resulted in: 1) an overall loss of wildlife habitat; 2) increased wildlife mortality from mining-related traffic and process ponds; and 3) decreased abundance and diversity of macroinvertebrates from degraded water quality and increased sedimentation.

Existing habitat loss for the non-expansion Alternatives 1 and 2 would be inadequately reclaimed over the long-term, due to steep slopes, erosion, inadequate plant growth media, and acid rock drainage. Mine-related wildlife mortality would return to pre-mining levels as process ponds would be netted and closed, and traffic would cease after reclamation is completed. Water quality and sedimentation impacts on aquatic macroinvertebrates would continue to be moderate to high (significant) in the long-term due to expected acid rock drainage and failed reclamation.

Impacts to threatened, endangered, and sensitive wildlife species (special status species) and raptors would be negligible from Alternatives 1, 2, and 3.

Alternative 3 would disturb an additional 250 acres of wildlife habitat; however, improved reclamation success would re-establish habitat for bighorn sheep and other grassland wildlife species. Water quality and

TABLE ES-4
SUMMARY OF DIRECT IMPACTS TO WATERS OF THE U.S. (ACRES)
ALTERNATIVES 1 THROUGH 7

		Non-wetland				Wetland			
		Existing	Proposed	Total	TOTAL	Existing	Proposed	Total	TOTAL
Alt 1	Zortman	0.84	0.40	1.24	4.21	-	-	-	0.03
	Landusky	2.89	0.08	2.97		-	0.03	0.03	
Alt 2	Zortman	0.84	0.40	1.24	4.21	-	-	-	0.03
	Landusky	2.89	0.08	2.97		-	0.03	0.03	
Alt 3	Zortman	0.84	0.40	1.24	4.21	-	-	-	0.03
	Landusky	2.89	0.08	2.97		-	0.03	0.03	
Alt 4	Zortman	0.84	4.06	4.90	7.87	-	1.06	1.06	1.09
	Landusky	2.89	0.08	2.97		-	0.03	0.03	
Alt 5	Zortman	0.84	2.48	3.32	6.29	-	0.02	0.02	0.05
	Landusky	2.89	0.08	2.97		-	0.03	0.03	
Alt 6	Zortman	0.84	3.26	4.10	7.07	-	1.06	1.06	1.09
	Landusky	2.89	0.08	2.97		-	0.03	0.03	
Alt 7	Zortman	0.84	3.56	4.40	7.37	-	1.06	1.06	1.09
	Landusky	2.89	0.08	2.97		-	0.03	0.03	

TABLE ES-5
SUMMARY OF INDIRECT IMPACTS TO WATERS OF THE U.S. (ACRES)
ALTERNATIVES 1 THROUGH 7

		Non-wetland				Wetland			
		Existing[1]	Proposed[2]	Total	TOTAL[1]	Existing	Proposed	Total	TOTAL
Alt 1	Zortman	3.04	-	-	14.6	-	-	-	-
	Landusky	11.56	-	-		-	-	-	
Alt 2	Zortman	3.04	-	-	14.6	-	-	-	-
	Landusky	11.56	-	-		-	-	-	
Alt 3	Zortman	3.04	0.4	3.44	15.0	-	1.54	1.54	1.54
	Landusky	11.56	-	-		-	-	-	
Alt 4	Zortman	3.04	7.3	10.34	21.9	-	0.48	0.48	0.48
	Landusky	11.56	-	-		-	-	-	
Alt 5	Zortman	3.04	0.4	3.44	15.0	-	0.24	0.24	0.24
	Landusky	11.56	-	-		-	-	-	
Alt 6	Zortman	3.04	8.7	11.74	23.3	-	4.07	4.07	4.07
	Landusky	11.56	-	-		-	-	-	
Alt 7	Zortman	3.04	7.3	10.34	21.9	-	0.48	0.48	0.48
	Landusky	11.56	-	-		-	-	-	

1 The 14.6 acres listed (3.04 and 11.56) is part of a total of 16.0 acres that have been indirectly impacted since 1979. The 14.6 acre figure is what is used for mitigation purposes, based on the Corps of Engineers' regulatory authority.

2 Proposed acreage is that area above and beyond the 14.6 acres that would be affected by new disturbances associated with mine expansion (Alternatives 4-7) or the Goslin Flats borrow area (Alternative 3).

TABLE ES-6
IMPACTS SUMMARY - VEGETATION AND WETLANDS

Resource	Units	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
Threatened, endangered, sensitive species habitat	Acres	NI	NI	NI	NI	NI	NI	NI
Sole source of vegetation used by Native Americans	Acres	NI	NI	NI	NI	NI	NI	NI
Riparian vegetation[b]	Acres	--/16	--/16	--/16	10/26	27/43	10/26	9/25
Forest[b]	Acres	--/1029 (H)	--/1029 (H)	5/1034 (M)	358/1387 (M)	521/1550 (M)	216/1245 (M)	256/1285 (M)
Species diversity	% loss (in disturbed area)	92	92	92	92	92	92	93
Vegetative Cover	%	<80	<80	>90	80-89	80-89	80-89	>90
Effect of Reclamation Plan		H	H	L	M	M	M	L
Cumulative Impact Rating - Vegetation		H	H	L	M	M	M	L
Wetland[a] Direct impacts	Acres	0.03	0.03	0.03	1.09	0.05	1.09	1.09
Wetland[a] Indirect impacts	Acres	-	-	1.54	.48	.24	4.07	.48
Non-Wetland waters - Direct Impact[b]	Acres	.48/4.21	.48/4.21	.48/4.21	4.14/7.87	2.59/6.29	3.34/7.07	3.64/7.37
Non-Wetland waters - Indirect Impact[b]	Acres	0/16.0[c]	0/16.0[c]	0.40/16.0[c]	7.3/16.0[c]	0.40/16.0[c]	8.7/16.0[c]	7.3/16.0[c]
Cumulative Impact Rating - Wetlands - Pre-mitigation		L	L	M	M	H	H	M
Cumulative Impact Ratings - Wetlands - Post-mitigation		L	L	M	L	M/L	M/L	L
Cumulative Impact Rating - Non-wetland waters - Pre-mitigation		H	H	H	H	H	H	H
Cumulative Impact Rating - Non-wetland waters - Post-mitigation		H	H	M	M/L	M/L	M/L	M/L

[a] No previous disturbance to wetlands was identified.
[b] X/Y X - Acres disturbed as a result of implementing the alternative
Y - Cumulative acres disturbed - previous and proposed
[c] 16.0 total acres have been indirectly impacts from 1979-present; of this, 14.6 acres is used for mitigation purposes, based on the Corps of Engineers' regulatory authority.

H - High (Significant) Impact
M - Moderate Impact
L - Low Impact
NI - Negligible Impact

sedimentation impacts to aquatic macroinvertebrates would be less than those described for Alternatives 1 and 2 due to improvements in the reclamation cover, benefits of water capture and treatment measures, and limited new disturbance.

All of the expansion alternatives would result in additional loss of wildlife habitat. Alternative 6 would disturb the most additional habitat, while Alternative 7 would disturb the least habitat.

A conveyor from the Zortman Mine to Goslin Flats would be constructed under Alternatives 4, 6, and 7 that could restrict wildlife access to habitat. Densities of big game species and other wildlife that may be impeded are generally already low in the area of the proposed conveyor. Few bighorn sheep have ever been observed in the area.

Wildlife mortality from mine related traffic would be expected to increase under all expansion alternatives but traffic would not significantly impact wildlife populations. Mortality from process ponds would be negligible for all expansion alternatives as ponds would be netted or covered and fenced.

Sensitive bat species could be negatively impacted by removal and disturbance of riparian areas that provide foraging and breeding habitat. Alternative 5 would disturb riparian habitat in Alder Gulch, whereas Alternatives 4, 6, and 7 would disturb riparian habitat along the conveyor corridor.

Long-term water quality and sedimentation impacts to aquatic macroinvertebrates would be moderate for expansion alternatives 4, 5, and 6, due to the increased disturbance area, moderate reclamation success, coupled with the beneficial effects of water capture and treatment. Long-term water quality and sedimentation impacts to aquatic macroinvertebrates would be least negative under Alternative 7 due to the increase in reclamation success.

Impacts to raptors, special status species, and sensitive wildlife species other than bats would be negligible under all of the expansion alternatives. Noise impacts to wildlife would also be negligible.

Air Quality

Air quality impacts were assessed for each alternative by comparing modeled impacts of air pollutants resulting from mining activities with National Ambient Air Quality Standards, enforceable standards under Montana and federal regulations. The impacts are compared to the Average 24-Hour (150 ug/m^3) and Average Annual (50 ug/m^3) standards for respirable particulate matter, the pollutant of most concern from the mines. Table ES-7 summarizes the estimated PM_{10} concentrations for each alternative.

The most significant factor in air quality impacts to the towns of Zortman and Landusky (the two sensitive receptor locations modeled in the analysis) is truck traffic. The greater the number of truck trips traveling through town per day the higher the atmospheric emissions of particulate matter. None of the alternatives would result in significant impacts to the town of Landusky.

Alternative 3 would cause the greatest level of particulate emission of the non-expansion alternatives because of the more stringent mitigated reclamation requirements than Alternatives 1 or 2. However, significant impacts to air quality would not occur under any of the non-expansion alternatives, since air quality standards would not be exceeded.

Alternative 5 would cause the greatest level of air emissions of the expansion alternatives. No facilities would be located at Goslin Flats and all reclamation material haul trucks would have to drive through the town of Zortman to reach mine disturbances. Alternative 5 would result in significant air impacts since the 24-hour emissions would exceed standard. All of the expansion alternatives would exceed standard if the Pony Gulch ore deposit were developed (a reasonably foreseeable future activity). Alternative 7 has incorporated mitigation to preclude the mining of the Pony Gulch deposit concurrent with Zortman Mine reclamation activities.

Recreation and Land Use

Mining activities have generally resulted in: 1) a loss of access to dispersed use areas that were previously accessed by the Zortman/Landusky county road over Antoine Butte; 2) a reduction in the aesthetic quality of surrounding recreational use areas due to an increase in the amount of visible land disturbances; and 3) a reduction in the quality of recreational experience as a result of noise from mining and reclamation activities.

Under the non-expansion alternatives, access to lands currently within the mine operational areas would continue to be restricted until reclamation activities are complete. Alternative 1 would return lands to other potential uses sooner than Alternative 2, while Alternative 3 would take the longest because of more stringent reclamation requirements. However, Alternative 3 would have the most potential of the three non-expansion alternatives of returning lands to

TABLE ES-7
SUMMARY OF 24-HOUR AND ANNUAL PM_{10} IMPACTS ($\mu g/m^3$) AT SENSITIVE RECEPTOR LOCATIONS

	Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5		Alt 6		Alt. 7[6]	
	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual	24-hr	Annual
PM_{10} Standard	**150**	**50**	**150**	**50**	**150**	**50**	**150**	**50**	**150**	**50**	**150**	**50**	**150**	**50**
Zortman[2]														
Mining	n/a	n/a	n/a	n/a	n/a	n/a	76	4	**158**	6	59	5	118	5
Reclamation	32	8	57	14	100	4	n/a[3]	n/a[3]	n/a[3]	n/a[3]	n/a[3]	n/a[3]	n/a[3]	n/a[3]
RFD[4]	0	0	0	0	0	0	**189**	48	0	0	**189**	48	**189**	48
Background	30	9	30	9	30	9	30	9	30	9	30	9	30	9
Cumulative[5]	62	17	87	23	130	13	**295**	**61**	**188**	15	**278**	**62**	**148**[6]	**14**[6]
Landusky[2]														
Mining	85	1	85	1	85	1	85	1	85	1	85	1	85	1
Reclamation	14	4	25	6	31	8	31	8	32	8	32	8	32	8
RFD[4]	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Background	30	9	30	9	30	9	30	9	30	9	30	9	30	9
Cumulative[5]	129	14	140	16	146	18	146	18	147	18	147	18	147	18

n/a - not applicable.

1 Concentrations shown are for the maximum impact from any facility modeled. Concentrations above standards are highlighted in **bold**.
2 Concentrations shown are estimated for the applicable townsite, Zortman or Landusky.
3 Reclamation estimates for Zortman Mine expansion alternatives are incorporated in the values presented for mining.
4 RFD = Reasonably Foreseeable Development Activity (for example, Pony Gulch Mine development)
5 Values shown are the summation of mining, reclamation, and background concentrations.
6 Alternative 7 precludes mining of the Pony Gulch deposit concurrent with mining and reclamation at the Zortman Mine. This mitigation prevents exceedance of the air quality standards which would otherwise occur.

productive uses in the long-term. To access reclamation materials Alternative 3 would result in the disturbance of over 300 acres of currently undisturbed lands, while the other two non-expansion alternatives would result in virtually no new land disturbance.

All of the expansion alternatives would cause new disturbance. Alternatives 4, 5, and 6 would result in over 900 acres of combined new disturbance from the two mines, while Alternative 7 would result in about 772 acres of new disturbance. Alternative 5 would cause the most disturbance to public lands (about 535 acres) while Alternative 7 would result in the least disturbance to public lands (about 82 acres). The disturbances resulting from the expansion alternatives are shown on Figure ES-4.

None of the expansion alternatives would result in direct impacts to recreational facilities. The overland conveyor in Alternatives 4, 6, and 7 would restrict access to Goslin Gulch, which is occasionally used by recreationists and biologists to access Saddle Butte and Azure Cave. Hunters could also encounter access restrictions from the conveyor.

Indirect effects from all of the expansion alternatives would be significant, primarily due to the increase in visual, noise, and traffic impacts. Recreationists and sightseers would be exposed to alterations in the natural landscape from mine facilities, such as the leach pad on Goslin Flats. For users requiring scenic quality and natural appearing landscapes, impacts would be significant.

Land use would change in some areas, depending on the amounts of disturbance and disturbance location. In particular, grazing land on Goslin Flats (Alternatives 4, 6, and 7) and Ruby Flats (Alternative 6) would be lost to mining.

Visual Resources

The assessment of visual impacts was based upon impact significance criteria and methodology developed in the BLM's visual contrast rating system. The degree to which project facilities would impact the scenic qualities of the landscape depends on the amount of visible contrast created by project facilities in relation to the existing landscape character. Sensitive viewpoints within the study area, termed Key Observation Points (KOPs), were selected as representative views from travel routes, recreational areas, residential areas, and views from several sites of significance to Native Americans. A total of 21 KOPs were mapped within the study area. These KOPs and mine facilities and disturbances seen from each perspective are listed on Table ES-8.

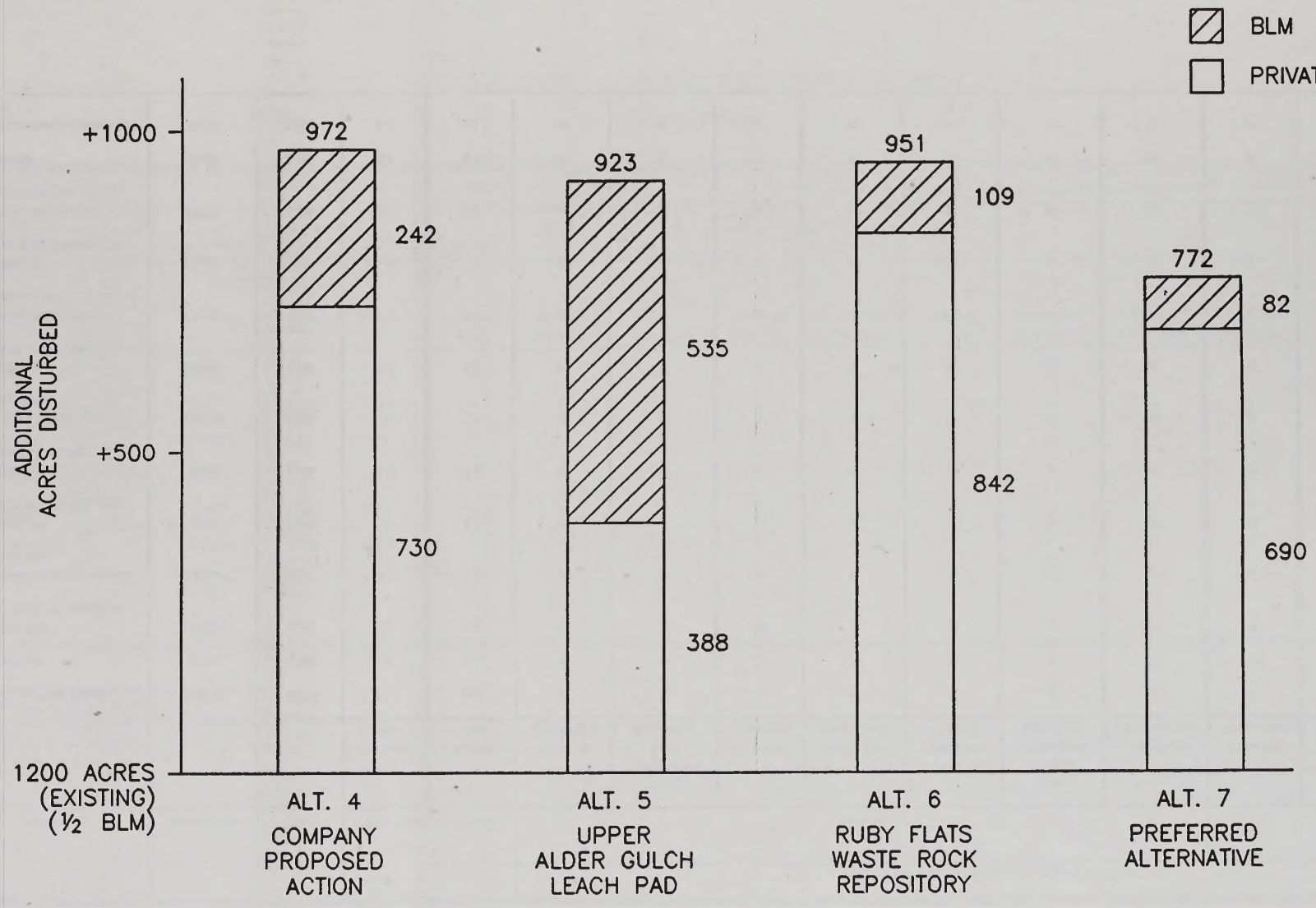
In addition, photographic simulations of the proposed action and alternative facilities were prepared from selected viewpoints. Simulations are from viewpoints with representative views from recreation areas, travel routes and areas traditionally used by Native Americans, and display the existing view and views with the proposed and/or alternative project facilities. Simulations were presented in Appendix D of the Draft EIS (1995).

Open pit mining has caused major changes in landforms, creating sharp contrasts in the line, form, color and textures visible in the landscape. Areas where rock and soil have been exposed contrast with color and texture of the surrounding natural vegetation. Unnatural looking landforms have been created by the excavation of the mine pits, and by the large heap leach pads and waste rock dumps. Roads, especially the downhill sidecast along the roads, create color and line contrasts visible for miles from the mine sites. Benches along the highwall create strong geometric lines and forms that contrast with the characteristic lines and shapes naturally occurring mountain landscapes. The scale of the disturbance dominates the viewers attention. The current disturbance at both the Zortman and Landusky mines is not compatible with the scenery management objectives of VRM Class II landscapes.

Visual impacts from all alternatives would continue to be significant as a result of the topographic alterations cause by mine pits and the large man-made landforms. These would be apparent, even after reclamation.

Visual impacts from the seven alternatives are most appropriately compared between non-expansion alternatives (1 through 3) and expansion alternatives (4 through 7). With both expansion and non-expansion alternatives, successful reclamation would reduce visual contrast. However, reclamation measures for Alternatives 1 and 2 would not be successful and the existing visual contrasts would continue in the long-term. Alternative 3 would also further reduce visual contrasts by removing some existing landforms (such as the Alder Gulch and OK waste rock dumps). These would be used as pit backfill, lessening the visual impact of the pits.

Visual impacts resulting from all of the expansion alternatives would be significant, resulting from the large increases in disturbances and the placement of new facilities in previously undisturbed areas. New facilities at Goslin Flats (Alternatives 4, 6, and 7) and Ruby Flats (Alternative 6) would cause major new disturbances in the landscape and significant visual contrast. Successful reclamation would not reduce the magnitude of these



MINE EXPANSION ALTERNATIVES
ADDITIONAL DISTURBANCE
BY OWNERSHIP

173E0025

FIG. ES-4

TABLE ES-8
KEY OBSERVATION POINTS

KOP No.[1]	Viewpoint	Jurisdiction[2]	Elevation (Feet)	View Distance (Miles)		Major Proposed and Alternative Project Facilities Seen[3]									
						Zortman							Landusky		
				Zortman Mine	Landusky Mine	Mine Pit Expansion	Carter Gulch Waste Rock Repository	Overland Conveyor	Goslin Flats Heap Leach	Limestone Quarry	Ruby Terrace Waste Rock Repository	Alder Gulch Heap Leach	Mine Pit Expansion	Heap Leach Pad Extension	Limestone Quarry King Creek
1	CMR-Auto Tour Route	USFW	2,953	17.6	16.3	N	N	N	N	N	N	N	Y	Y	N
2	DY Junction	BLM	3,220	10	8.4	N	N	N	N	N	N	N	Y	Y	N
3	U.S. Hwy. 191 ~3 mi. N of DY Junction	Private	3,120	8.4	7.4	N	N	N	N	N	N	N	Y	Y	N
4	U.S. Hwy. 191-Junction with Dry Fork Rd.	Private	3,220	8.1	8.3	N	N	N	Y	N	Y	N	N	N	N
5	U.S. Hwy. 191 ~3 mi. N of Dry Fork Rd.	State	3,380	8	8.9	Y	Y	N	Y	N	Y	N	N	N	N
6	Bear Gulch Road Junction w/U.S. Hwy. 191	FBIR	3,040	9.3	11.6	Y	N	N	N	N	N	N	N	N	N
7	Bear Gulch Road Landing Strip	Private	3,960	3	3.9	Y	N	Y	Y	N	Y	Y	N	N	N
8	7-Mile Road ~4 mi. N of U.S. Hwy. 191	Private	3,530	5.9	6.4	N	N	Y	Y	N	Y	N	N	N	N
9	State Hwy. 66-Junction w/Landusky Rd.	Private	3,500	6.7	4.5	N	N	N	N	N	N	N	Y	Y	N
10	State Hwy. 66 ~3.5 mi. N of Landusky Rd.	Private	3,880	5.9	3.2	N	N	N	N	N	N	N	Y	N	N
11	State Hwy. 66-Junction w/Lodge Pole Rd.	FBIR	3,280	10	9.5	N	N	N	N	N	N	N	Y	Y	N
12	Lodge Pole	FBIR	3,460	6.8	8.7	Y	N	N	N	N	N	N	N	N	N
13	Pow Wow Grounds-Mission Canyon	FBIR	4,040	3.5	2.1	N	N	N	N	N	N	N	N	Y	N

TABLE ES-8 - KEY OBSERVATION POINTS
(Concluded)

KOP No.[1]	Viewpoint	Jurisdiction[2]	Elevation (Feet)	View Distance (Miles)		Major Proposed and Alternative Project Facilities Seen[3]									
						Zortman							Landusky		
				Zortman Mine	Landusky Mine	Mine Pit Expansion	Carter Gulch Waste Rock Repository	Overland Conveyor	Goslin Flats Heap Leach	Limestone Quarry	Ruby Terrace Waste Rock Repository	Alder Gulch Heap Leach	Mine Pit Expansion	Heap Leach Pad Extension	Limestone Quarry King Creek
14	Landusky townsite	Private	4,000	3.6	1.1	N	N	N	N	N	N	N	Y	N	N
15	Eagle Child Mountain	FBIR	5,243	5.7	3.5	N	N	N	N	N	N	N	Y	N	N
16	Mission Peak	FBIR/BLM	5,480	3	3	N	N	N	N	N	N	N	Y	Y	Y
17	Saddle Butte	BLM	5,192	2.9	3.7	Y	Y	Y	Y	N	Y	N	N	N	N
18	Old Scraggy Peak	BLM	5,708	1.6	4.6	Y	Y	N	Y	Y	N	Y	N	N	N
19	Beaver Mountain	BLM	5,542	2.4	5	Y	N	N	N	Y	Y	N	N	N	N
20	Ricker Butte	FBIR/ Private	3,977	8.6	10.5	Y	Y	Y	Y	N	Y	Y	N	N	N
21	Thornhill Butte	BLM	4,636	7.6	5.1	N	N	N	N	N	N	N	Y	Y	N

[1] KOP number corresponds to numbers shown on Figure 4-8.
[2] USFW = United States Fish and Wildlife Service
BLM = Bureau of Land Management
FBIR = Fort Belknap Indian Reservation
[3] Y = seen; N = not seen; - = no data

impacts below significance. Alternative 7 would require that new facilities such as the Goslin Flats leach pad incorporate natural landscaping and recontouring to attempt to blend the facility into the surrounding landscape. However, even this mitigation would still not reduce impact magnitude below significance, although Class II VRM objectives may be met from more distant viewpoints. Alternative 5 would establish the new Zortman Mine heap leach pad and waste rock repository as valley fill structures near the mine; visual impacts for this alternative would therefore be less significant than for the other expansion alternatives.

The expansion of the Zortman pit complex would cause significant topographic and visual impacts at the mine site. Partial backfilling of the pits at both mines and successful reclamation would only partially offset these impacts. Other mine facilities and features such as new roads, pipelines, conveyors, and transmission lines would increase visual impact. These effects would be short-term, lasting for the duration of mining.

Noise

Noise impacts were assessed for each alternative by comparing expected noise levels from mining activities with guidelines designed to protect against the interference of the public's outdoor activities. The guidance level selected is 55 A-weighted decibels, shortened to "dBA." The dBA reflects a noise rating system which is adjusted to the human ear. Sensitive receptors considered in this analysis are the people in the towns of Zortman and Landusky, and the Pow Wow Grounds, and Azure Cave.

The estimated impacts have been rated as low, moderate, or high magnitude using the EPA noise guideline for outdoor activity as the rating criterion. Low noise impacts are those that are below 53 dBA. Moderate noise impacts were assigned to alternatives in which noise levels were estimated to be in the range of 53 to 57 dBA, and high noise impacts were assigned to alternatives in which substantial exceedances of the EPA guideline were estimated (above 57 dBA). Impacts are considered to be significant if the levels estimated at the receptor locations would interfere with outdoor activity, since outdoor recreation is a common activity of residents and visitors in the Little Rocky Mountains.

The frequency and duration of impacts are also evaluated. Noise caused by certain mining activities such as drilling or blasting could be of a short-term duration, in that the noise would occur for short, possibly intense periods then cease. Or, the impacts could be of long-term duration, such as the noise from reclamation which would extend after mine closure. The frequency of noise also varies. In particular, noise from most mining and reclamation activities would be constant. The loud noise resulting from blasting would be of very short duration and occur infrequently. The noise resulting from haul trucks passing through Zortman and Landusky would occur on a frequent, but short-duration basis. A conservative assumption for all alternatives is that combined noise from mining activities is continuous, and would occur until mine closure. Noise levels at the mines and receptor locations would only return to baseline conditions after mine operations, reclamation, and remediation is complete.

Table ES-9 summarizes the estimated noise levels for each of the alternatives. When added to background noise levels, all of the non-expansion alternatives would result in significant impacts at the Pow Wow Grounds, and Landusky and Zortman. Alternative 3 would also cause significant noise levels at Azure Cave because of mining reclamation materials at Goslin Flats. The frequency and duration of noise impacts would be greatest from Alternative 3, due to the higher number of truck traffic days through the town of Zortman, and because reclamation would take longer than for Alternatives 1 or 2.

Cumulative noise levels resulting from the expansion alternatives would result in significant impacts at all receptor locations, except for Alternative 5 impacts at Azure Cave. These would only be moderate (not significant) since new Zortman Mine facilities would be located near the mine area, and not on Goslin Flats. Impacts to the Pow Wow Grounds and the town of Landusky are generally the same for all expansion alternatives. Impacts to the town of Zortman and Azure Cave would be highest from Alternatives 4 and 6. Alternative 7 would cause lesser (but still significant) impacts at these locations because the Pony Gulch reasonably foreseeable development would not take place concurrent with mining.

Alternative 7 would have no truck traffic passing through the town of Landusky and no resultant short-term noise impacts since clay would not be used in reclamation covers. However, Alternative 7 would cause more frequent noise disturbance from trucks at the town of Zortman than for any of the other expansion alternatives.

TABLE ES-9
SUMMARY OF NOISE LEVELS AT SENSITIVE RECEPTORS FOR EACH ALTERNATIVE[1,2]

Receptor	Alt. 1	Alt. 2	Alt 3.	Alt. 4	Alt. 5	Alt. 6	Alt. 7[4]
Mining							
Pow Wow Grounds	57	57	57	59	59	59	59
Town of Landusky	61	61	61	61	61	61	61
Town of Zortman[3]	54	54	60	63	59	64	63
Azure Cave[3]	54	54	58	59	56	60	59
Cumulative							
Pow Wow Grounds	58	58	58	59	59	59	59
Town of Landusky	62	62	62	63	62	63	63
Town of Zortman	59	59	62	66	60	67	64
Azure Cave	55	55	59	66	57	66	60
Frequency of Truck Traffic at 98 dBA[5]							
Town of Landusky	12 days	27 days	none	27 days	27 days	27 days	none
Town of Zortman	none	12 days	53 days	17 days	26 days	14 days	40 days

1 All noise levels presented in A-weighted decibels, or dBAs. See text for assumptions and explanation.

2 Noise estimates do not account for attenuation from intervening terrain, which would reduce levels, or for atmospheric conditions which could result in higher noise levels downwind from the source.

3 For alternatives 3, 4, 6, and 7, includes noise from activities at Goslin Flats. For Alternative 6, also includes noise from Ruby Flats

4 Cumulative noise levels for Alternative 7 do not include a contribution from the Pony Gulch reasonably foreseeable development, as mining of that deposit would be precluded while mining and reclamation takes place at the Zortman Mine.

5 Estimate based on number of trucks in peak traffic year, divided by 10 convoys of 15 trucks per day, except that Alternative 7 would be limited to no more than 120 trucks per day.

Socioeconomics

The key difference in socioeconomic impact between the non-expansion alternatives (Alternatives 1 - 3) and the expansion alternatives (Alternatives 4 - 7) is the timing of the end of mineral development activity, and therefore the timing of impacts upon the social and economic environment. The end of mineral development activity occurs almost immediately under Alternatives 1 through 3 and is delayed for 5 to 7 years under Alternatives 4 through 7. Despite the difference in timing, it should be emphasized that the impacts that would occur as a result of the end of mineral development would be similar and would inevitably occur under all alternatives, even though these impacts would be delayed for a number of years under the expansion alternatives.

Under the non-expansion alternatives, Alternatives 1 through 3, mining would cease in the near future. Differences among the non-expansion alternatives in terms of projected employment, payroll, business purchases, and taxes reflect differing activities due to the modification of reclamation procedures proposed by ZMI under Alternative 2 and the mitigated reclamation procedures proposed under Alternative 3. ZMI's total tax liability is estimated to be virtually the same under the three non-expansion alternatives because they are similar in terms of capital spending and the outputs of gold and silver. These outputs are the economic characteristics which drive ZMI's liabilities for property taxes and the gross proceeds and metal mines license taxes.

The expansion alternatives, Alternatives 4 through 7, would permit continued mineral development activity and the construction of expanded or new facilities at the Zortman and Landusky mines. Differences among the expansion alternatives in terms of projected employment, payroll, business purchases, and taxes reflect the various locations and configurations of heap leaching and ore and waste rock handling facilities, as well as differing methods and intensities of reclamation activity. The timing of additional construction, mining, and reclamation is similar among the expansion alternatives although Alternative 6 lasts a year less overall compared to Alternatives 4, 5, and 7. Differences in the timing of additional construction, mining, and reclamation also account for the differences in how employment levels begin to decline as the transition is made from mineral development activity to the activities of the closure cycle. This effect is most noticeable in Alternatives 5 and 6, where employment levels for the year 2004 are substantially lower than the employment levels projected for Alternatives 4 and 7 for the same year. ZMI's tax liability would differ somewhat among the expansion alternatives, mainly because of varying levels of capital expenditure and productivity. In general, however, differences among Alternatives 4 through 7 fall within a relatively narrow range.

Figures ES-5 and ES-6 illustrate the similarities and differences across all seven alternatives in graphical terms by plotting employment and spending from 1996 to 2012, the time horizon encompassed by this assessment. The employment levels plotted in the figure represent direct ZMI employment. The spending levels represent the sum of operating and capital expenditures, plus expenditures for contracting, all expressed in 1994 dollars.

Transportation

The assessment of transportation related impacts associated with the alternatives focuses primarily on, 1) the effects of vehicle traffic on local roads and highways, and concerns regarding accident potential and safety of local residents, and 2) transportation of hazardous materials to and from the mines, and risks associated with potential accidents and spills.

Figure ES-7 charts the number of total truck trips associated with the seven alternatives. The majority of trips associated with mine activities result from hauling reclamation materials. For this reason, Alternative 3 would have the greatest number of truck trips in the short-term, much more than the other non-expansion alternatives. Truck trips are much less for Alternative 2, and relatively few trips would be made under Alternative 1, reflecting the lack of reclamation material import. Large numbers of truck trips would occur for about one year longer under Alternative 3 than for the other non-expansion alternatives, until the end of most active reclamation work.

Truck traffic among the expansion alternatives is more variable but the general trends are similar. An initial period of heavy truck traffic would occur, followed by some decrease in activity before a gradual increase in truck trips over the span of several years. Truck trips would begin to decline as Landusky Mine reclamation is completed, and most traffic would have ended by the years 2007 or 2008. Alternative 4 would result in the greatest number of reclamation truck trips over the life of the mine, about 40,000. The other expansion alternatives would have fewer than 35,000 truck trips during mine life.

There is no real difference in the numbers of trucks hauling hazardous materials among the non-expansion alternatives, and among the expansion alternatives. Alternative 3 would result in about 8,050 hazardous

Fig. ES-5. Direct ZMI Employment

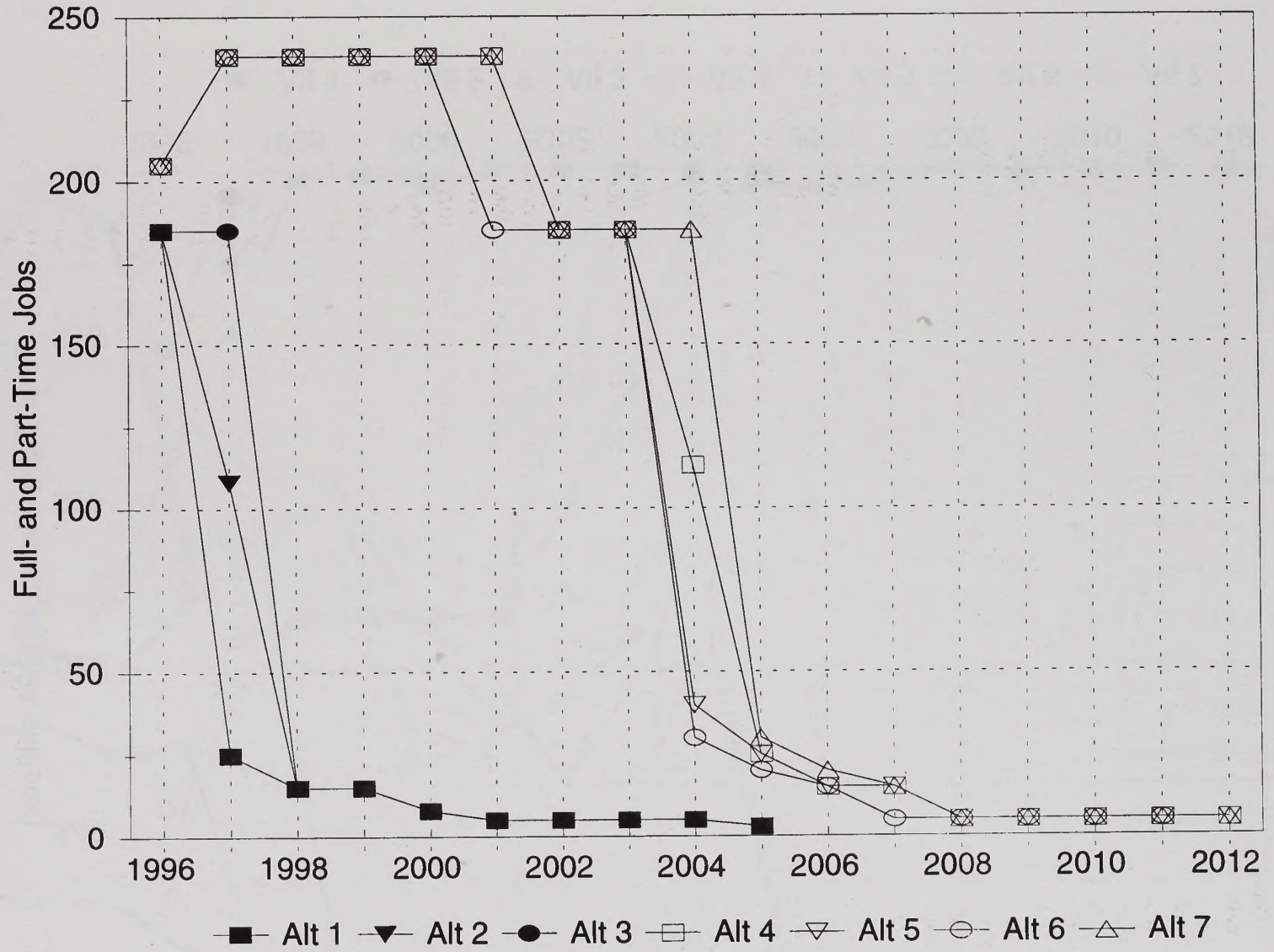


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Fig. ES-6. Total Expenditures by ZMI (in $1994 millions)

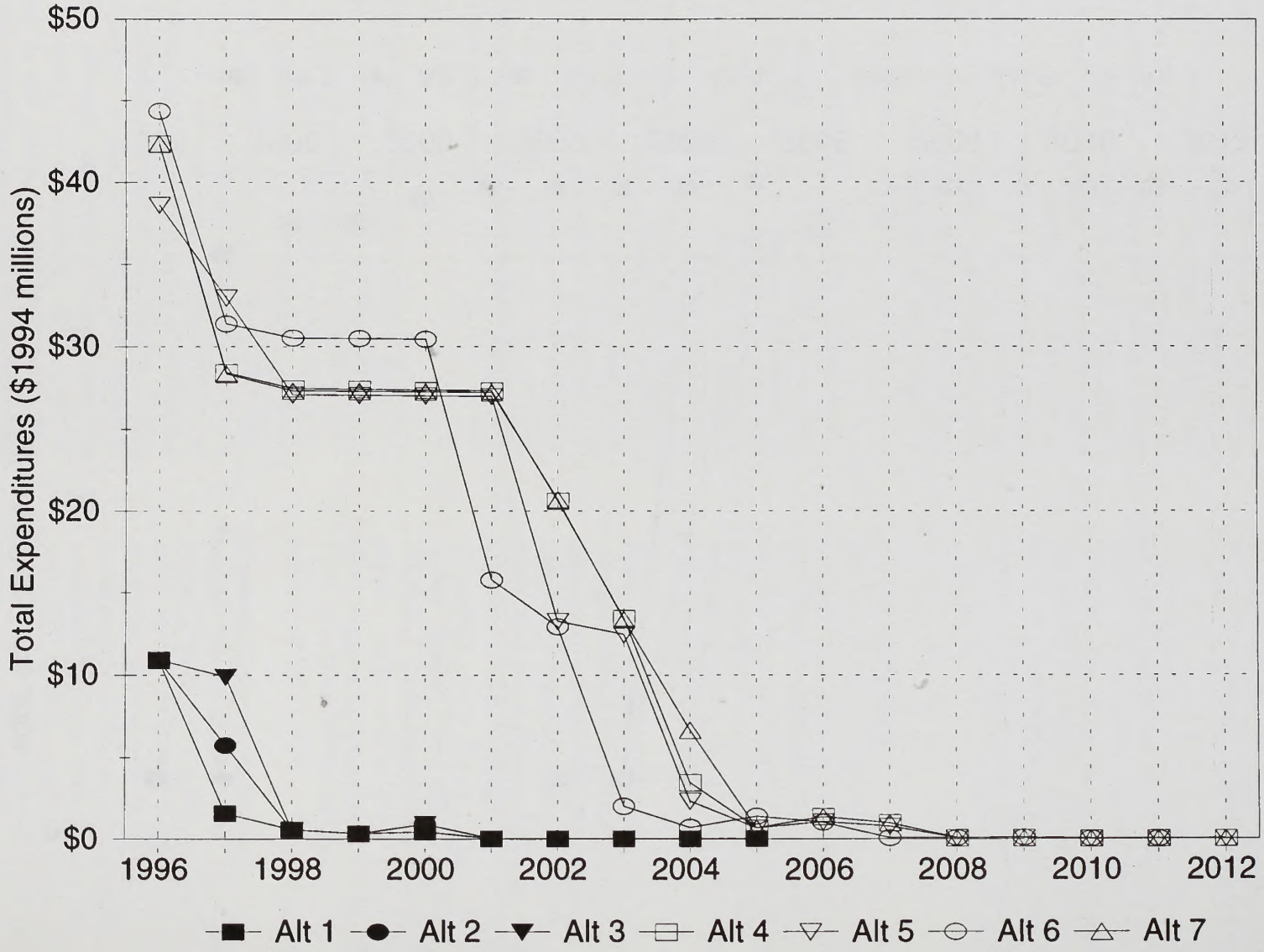

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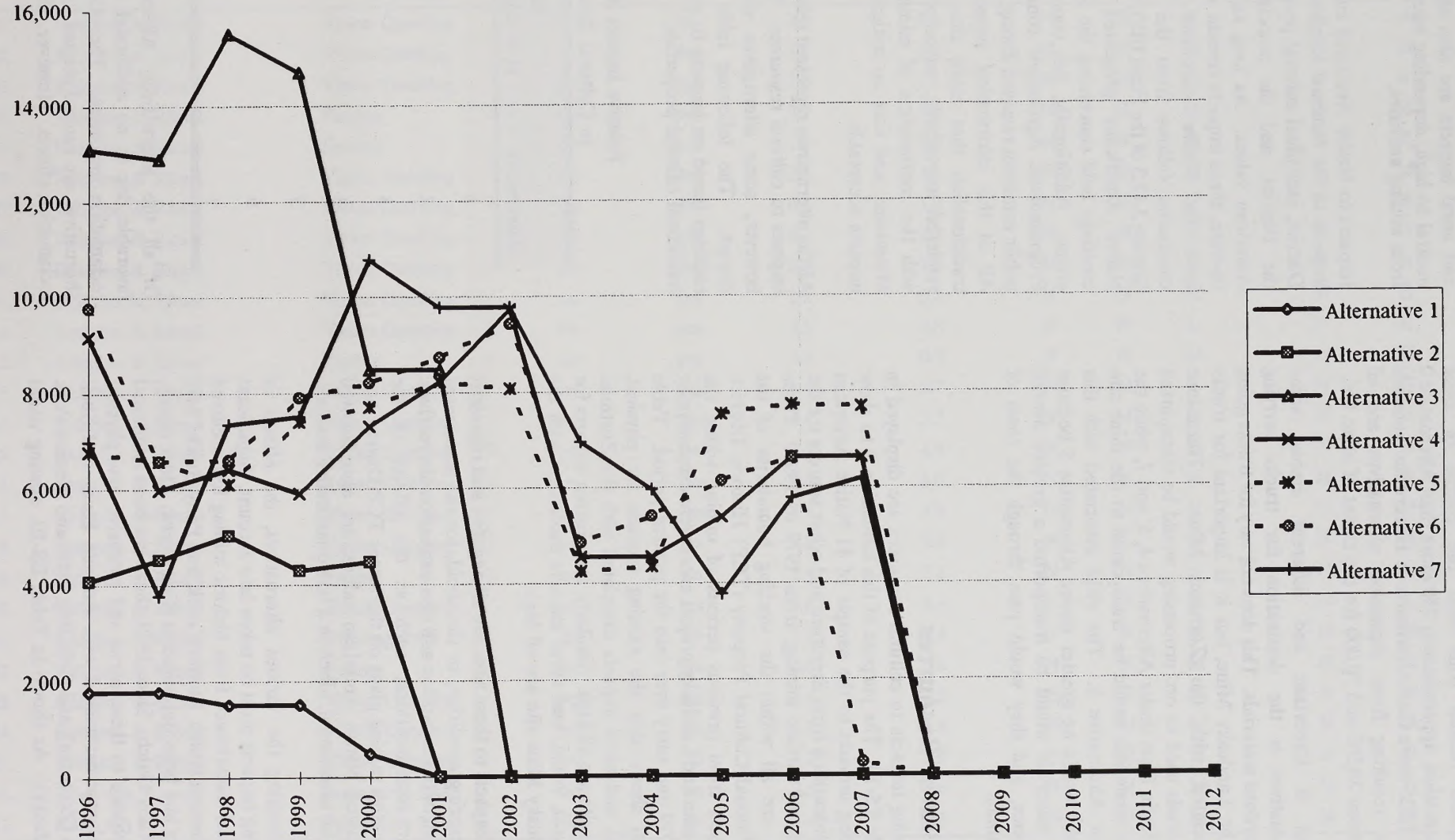
Figure ES-7. Total Annual Truck Trips



materials related trips over the course of mine reclamation, approximately 750 more than Alternative 2 and 1,025 more than Alternative 1. Hazardous materials trips resulting from expansion alternatives are all between 28,500 and 30,000 for the extent of mine life.

What is important and different among some alternatives is the destination for trucks carrying hazardous materials. This does not vary for trucks going to the Landusky Mine, but it is important for trucks associated with the Zortman Mine. Hazardous materials used in ore processing would be transported to Goslin Flats under Alternatives 4, 6, and 7, while the same materials would be transported to the mine site under Alternative 5. The risks associated with this activity would be greater under Alternative 5 because the materials would be transported a greater overall distance, and they would pass through the town of Zortman.

Cultural Resources

Existing impacts to cultural resources are displayed in Table ES-10. The purpose of this tabulation is to show existing impacts to the sample of 41 Native American sites identified from literature and other sources for the period of surface mining, from 1979 to 1995. These sites are all within the working boundaries of the Traditional Cultural Property (TCP) Historic District. Impacts from previous periods of mining within the Zortman and Landusky project areas were existent prior to 1979 and carry over into the present period. Table ES-10 shows that the existing impacts for physical, visual, and aural impacts associated with the Zortman Mine site are all high. Similarly, the existing impacts for physical, visual, and aural impacts associated with the Landusky Mine site are all high.

The impacts to these sites are all negative and represent the existing condition, or threshold, for the assessment of each of the expansion and non-expansion alternatives. Other considerations, such as the effects of the alternative mining plans on the larger TCP District and associated Native American values, are also factored into the assessment, albeit in a less quantitative manner.

In assessing the various alternatives, the effects of existing impacts must be taken into account. Significant physical disturbance from historic mining has occurred in Montana Gulch, Beaver Creek, and Pony Gulch. Mill tailing had been deposited in King Creek, Alder Gulch, and Ruby Gulch. Since 1979, there has been additional disturbance to these areas and extensive new physical disturbance associated with Antoine Butte and Shell Butte (Zortman), and Gold Bug Butte and Mission Peak (Landusky). As shown in Table ES-10, existing visual and aural impacts are also significant, ranging from neutral to high, depending upon visibility and distance from mining activities.

Impacts to Native American cultural resources include impacts to the National Register eligible TCP Historic District, individual cultural properties identified within the District, and the associated traditional Native American values. As long as the mines continue to operate, these impacts remain a significant and serious issue for Native American traditionalists. This conclusion follows from the literature review (see Section 3.12.3 of the Final EIS); and the comments from Native Americans presented at the many public meetings held concerning the Zortman and Landusky mines. Additionally, this conclusion is supported by Programmatic Agreement consultation meetings and public comment received during review of the Draft EIS. All of this information supports the perception to traditionalists that more sites and areas would be rendered unavailable, unacceptable, or less desirable with the continuation of mining in the Little Rocky Mountains, and that no mitigation could make these impacts acceptable.

All the alternatives represent relatively high and negative impacts to cultural resources. Relative to each other, however, some alternatives would create a greater impact. The following table shows these relative rankings based on impacts to prehistoric, historic, and traditional cultural properties.

Relative Impact Rankings to Cultural Resources

Alternative	Ranking (1 = most favorable)
1	2
2	2
3	1
4	4
5	3
6	4
7	4

Of all the alternatives, Alternative 3 is the most favorable due to no additional mining, and improved reclamation measures. The other two no expansion alternatives are ranked second for their lower intensity reclamation efforts. However, all of the non-expansion

TABLE ES-10
NATIVE AMERICAN CULTURAL RESOURCES: EXISTING IMPACTS

No.	Site Type (Primary)	Site Activity (Primary)	Visibility		Distance		Zortman			Landusky		
			Zortman	Landusky	Zortman	Landusky	P	V	A	P	V	A
01.	Religion & Ritual	Vision Questing	yes	no	2.0	4.0	N	H	H	N	N	M
02.	Religion & Ritual	Vision Questing	no	yes	2.2	0.0	N	N	M	H	H	H
03.	Religion & Ritual	Vision Questing	yes	no	1.0	3.1	N	H	H	N	N	M
04.	Religion & Ritual	Fasting	yes	yes	2.7	1.7	N	H	M	N	H	H
05.	Religion & Ritual	Fasting	no	no	1.5	3.5	N	N	H	N	N	M
06.	Religion & Ritual	Vision Questing	yes	yes	2.2	3.1	N	H	M	N	M	M
07.	Religion & Ritual	Vision Questing	yes	yes	0.4	1.0	N	H	H	N	H	H
08.	Religion & Ritual	Vision Questing	yes	no	0.2	2.2	H	H	H	N	N	M
09.	Religion & Ritual	Vision Questing	yes	no	5.8	7.8	N	M	L	N	N	N
10.	Religion & Ritual	Vision Questing	no	yes	2.8	0.2	N	N	M	H	H	H
11.	Religion & Ritual	Vision Questing	no	yes	5.5	2.8	N	N	L	N	H	M
12.	Religion & Ritual	Fasting	no	yes	4.0	0.7	N	N	M	N	H	H
13.	Religion & Ritual	Vision Questing	yes	yes	4.4	2.7	N	M	L	N	H	M
14.	Religion & Ritual	Vision Questing	yes	no	3.4	5.7	N	M	M	N	N	L
15.	Religion & Ritual	Vision Questing	no	no	7.2	4.4	N	N	N	N	N	L
16.	Religion & Ritual	Vision Questing	no	no	4.0	6.0	N	N	M	N	N	L
17.	Religion & Ritual	Vision Questing	no	yes	7.4	4.0	N	N	N	N	M	M
18.	Religion & Ritual	Vision Questing	yes	no	7.8	9.6	N	L	N	N	N	N
19.	Religion & Ritual	Fasting	no	no	6.4	7.2	N	N	N	N	N	N
20.	Religion & Ritual	Vision Questing	no	yes	6.6	8.4	N	N	N	N	L	N
21.	Religion & Ritual	Offering Area	no	no	3.7	1.4	N	N	M	N	N	H
22.	Religion & Ritual	Fasting	no	yes	2.6	0.6	N	N	M	N	H	H
23.	Religion & Ritual	Vision Questing	yes	yes	3.4	3.3	N	M	M	N	M	M
24.	Religion & Ritual	Vision Questing	yes	no	3.9	3.8	N	M	M	N	N	M
25.	Religion & Ritual	Vision Questing	yes	no	1.2	3.0	N	H	H	N	N	M
26.	Rock Art	Prehistoric Site	no	no	2.3	2.6	N	N	M	N	N	M
27.	Rock Art	Prehistoric Site	no	no	2.4	2.3	N	N	M	N	N	M

TABLE ES-10 - NATIVE AMERICAN CULTURAL RESOURCES: EXISTING IMPACTS (Concluded)

No.	Site Type (Primary)	Site Activity (Primary)	Visibility		Distance		Zortman			Landusky		
			Zortman	Landusky	Zortman	Landusky	P	V	A	P	V	A
28.	Rock Art	Prehistoric Site	no	no	3.2	2.3	N	N	M	N	N	M
29.	Rock Art	Prehistoric Site	no	no	2.3	2.7	N	N	M	N	N	M
30.	Burial	Burial	no	no	7.0	4.2	N	N	N	N	N	L
31.	LRM Burials	Burial	?	?	?	?	U	U	U	U	U	U
32.	Healing	Medicinal Spring	no	no	4.3	2.4	N	N	L	N	N	M
33.	Healing	Healing Waters	no	no	6.3	8.3	N	N	N	N	N	N
34.	Sundance	Sundance Site	no	no	4.3	3.3	N	N	L	N	N	M
35.	Sundance	Sundance Site	no	yes	3.2	1.8	N	N	M	N	H	H
36.	Resource Procurement	Fossil Gathering	no	no	3.4	5.4	N	N	M	N	N	L
37.	LRM Resource Procurement	Plant Gathering	yes	yes	0.0	0.0	H	H	H	H	H	H
38.	Historic Event	Historic Battle Site	no	no	4.9	2.8	N	N	L	N	N	M
39.	Historic Event	Coming Day's Route	?	?	?	?	U	U	U	U	U	U
40.	Pipe Offering	Flat Pipe Offering	no	no	7.0	4.2	N	N	N	N	N	L
41.	Powwow	Pow Wow Grounds	no	no	3.6	1.6	N	N	M	N	N	H
						Impact Score	3.00	2.53	2.03	3.00	2.61	2.12
						Impact Level	High	High	High	High	High	High
										IMPACT TOTALS		
										Zortman		High
										Landusky		High
										Combined Total		High

P = Physical Impact, V = Visual Impact, A = Aural Impact; H = High Impact, M = Moderate Impact, L = Low Impact, N = No Impact, U = Unknown Impact; High = 3, Moderate = 2, Low = 1.

To compute impact scores, the individual impact scores are summed and then divided by the number of individual impacts. Situations of No, Neutral, or Unknown impact are not used in computing impact scores. Low impacts are represented by a score of 0.0 - 1.0, Moderate impacts be a score of 1.0 - 2.0, and High impacts by a score of 2.0 - 3.0.

alternatives would have less impact than the mine expansion alternatives.

Of the mine expansion alternatives, Alternative 5 is most favorable due to lower impacts to historic and prehistoric sites. This is due to the fact that no conveyor system would be built through the Alder Gulch Historic District. Additionally, visual impacts to Saddle Butte would be slightly lower for Alternative 5 with no leach pad on Goslin Flats. However, impacts to Native American cultural resources (the Little Rocky Mountains TCP) would be essentially the same for Alternatives 4, 5, 6, or 7. Though Alternative 7 would disturb approximately 200 fewer acres within the TCP District than other alternatives, it is ranked the same due to its similar impacts to the Alder Gulch historic district. The other three expansion alternatives are all ranked approximately equal due to their anticipated levels of disturbance to prehistoric, historic and traditional cultural properties.

Areas of Critical Environmental Concern

Five areas within or in close proximity of the Little Rocky Mountains have been nominated or designated as ACECs. These areas include Azure Cave and prairie dog towns within the 7km Complex that have been designated ACECs by the BLM. The BLM has received nominations for the following areas: Little Rocky Mountains, Saddle Butte, and Old Scraggy Peak. The following sections summarize potential impacts to each of these existing and nominated ACECs.

Azure Cave: Azure Cave was designated as an ACEC based on its significant vertebrate biology, particularly hibernating bats, and geologic values such as the abundance of speleothems. Past and present mining are not known to have adversely impacted biologic and geologic resources of Azure Cave. No speleothems or limestone formations have been broken, and apparent declines in the number of hibernating bats may be explained by natural fluctuations and nationwide declines in bat populations.

The expansion alternatives would not have direct impacts on the cave or hibernating bats. However, several indirect impacts could occur including noise, mortality from consumption of cyanide solutions, and destruction of riparian foraging areas and drinking water sources. Mitigation for loss of drinking water sources and methods to prevent mortality from cyanide solution ponds are incorporated into the expansion alternatives and effects would not be significant.

The cumulative effects of noise, vibration, and habitat loss, particularly in riparian and mature Douglas fir along Alder, Carter, and Pony Gulches combined with habitat previously lost due to historic and existing mining, could adversely impact summer breeding bats by directly removing breeding and foraging habitat or causing bats to avoid the area (Taylor 1994). Cumulative impacts to Azure Cave resources would be short-term in nature.

Prairie Dog 7km Complex: The Prairie Dog 7km complex is more than 8 miles south of the Little Rocky Mountains, and previous mining activities have not impacted the ACEC. No impacts would occur to the Prairie Dog 7km complex under any alternative because the nearest prairie dog town is approximately 8 miles south of proposed mining activity.

Little Rocky Mountains: Impacts from recent mining (1979 to present) to Native American cultural resources have been significant and include physical, visual, and aural impacts. Previous impacts to ethnographic cultural resources include actual physical removal of parts of sacred places such as Shell Butte (Zortman) and Gold Bug Butte (Landusky).

Cultural resources impacts under all alternatives are relatively high and negative. Relative to each other, however, some alternatives would create a greater impact to cultural resources than others. Relative impacts would be greatest under Alternatives 4, 6, and 7; slightly less under Alternative 5 (primarily due to the lack of the conveyor system and facilities in Goslin Flats); still less under Alternatives 1 and 2; and least under Alternative 3.

Impacts to cultural resources would not change the relevance and importance of the Little Rocky Mountains and, hence, its nomination as an ACEC.

Saddle Butte: There have been no direct impacts to Saddle Butte from mining from 1979 to present. The ACEC nomination is approximately 2 miles south of existing and proposed mining activity under Alternatives 1, 2, 3, and 5. Because of this distance, impacts to vegetation, and hence ACEC nomination, would be negligible. Saddle Butte is located directly west of the proposed Goslin Flats heap leach pad and thus would be most impacted by Alternatives 4, 6 and 7, particularly the diversion ditches around the leach pad; however, the *Pseudotsuga menziesii/Andropogon scoparius* vegetation community would not be directly or indirectly impacted by disturbance. Therefore, impacts to the unique vegetation community that is the basis for ACEC

nomination would be negligible for all alternatives and would not affect potential ACEC designation.

Old Scraggy Peak: Impacts from mining 1979 to present on Native American cultural resources, including Old Scraggy Peak, have been significant though limited to visual and aural impacts; no direct disturbance has occurred. Impacts would consist of visual and aural impacts of mining at the Zortman Mine and would be greatest under Alternatives 4 through 7 and least for Alternative 1 through 3. Therefore, impact rankings range from negligible for Alternatives 1-3 to negative moderate for Alternatives 4-7, reflecting the relative cultural resource impact rankings. However, no impacts from any alternative would affect ACEC designation.

Hazardous Materials

A number of regulated and unregulated hazardous materials have been used at the Zortman and Landusky mines from 1979 to the present. Hazardous materials would continue to be used at the two mines under any of the alternatives, but the types and quantities of materials used would depend on whether an expansion or non-expansion alternative is selected. Examples of hazardous materials used include diesel fuel, oil and lubricants for mine vehicles, sodium cyanide for heap leaching of ore, ammonium nitrate for blasting, and various other reagents used for controlling the chemistry of the process solution and extraction of precious metals from the pregnant process solution. The toxic hazard characteristics of these materials vary considerably. The most toxic substances used at the mines include sodium cyanide, hydrochloric acid, and sodium hydroxide, which are extremely hazardous and can cause severe injury or death in small doses.

Potential project impacts that could arise from hazardous materials use at the Zortman and Landusky Mines are associated with, 1) normal or routine uses of hazardous materials and disposal practices, and 2) accidental spills or uncontrolled releases of hazardous materials into the environment.

Normal uses or disposal practices involving hazardous materials that could result in environmental impacts include the use of cyanide solution for heap leaching of ore, which could leave residual contamination (cyanide and other chemical reagents) in the spent ore heaps; disposal of laboratory wastes, fume scrubber runoff, and water treatment plant metal hydroxide sludge on leach pads at the mines; and potential nitrate pollution of water resources due to blasting with ammonium nitrate (a component of ANFO). It is possible that residual metals, cyanide compounds, nitrates, and other chemicals could be released into surface and groundwater resources from leach pad and waste rock dumps. Reclamation of heap leach pads and waste rock dumps would include covers that should reduce the amount of infiltration that would occur, thereby reducing the amount of potentially contaminated leachate generated. The reclamation cover performance is discussed in the summary of impacts to water resources in this document, and Section 4.2 of the EIS. Capture and treatment of leachate/seepage should prevent the release of these materials into the environment.

Another type of waste disposal practice used by the mines is land application disposal (LAD) of neutralized cyanide solution. If LAD is performed improperly, cyanide solution can run off the LAD area and enter adjacent drainages, thereby impacting water quality and possibly wildlife using the contaminated water resource. LAD areas require careful monitoring to ensure that soils are not "overloaded" with metals from the spent solution.

Accidental spills and releases of hazardous materials have occurred in the past at the mines and could occur again in the future under the various project alternatives. Depending on the material spilled and its concentration, these incidents can result in the exceedence of water quality standards and impact wildlife using the water resource.

Potential impacts associated with hazardous material use, storage, and disposal for Alternatives 1, 2, or 3 would be limited to existing facilities and relatively modest hazardous material usage during final leaching and reclamation. The potential for future impacts to the environment from hazardous materials management cannot be predicted with certainty, but reclamation measures including capture and treatment of contaminated leachate coupled with existing spill contingency measures, should greatly reduce the potential for adverse impacts. A low negative impact rating has been assigned for Alternatives 1,2, and 3.

For the mine expansion alternatives (Alternatives 4, 5, 6, and 7), additional mining would result in the use of substantial quantities of hazardous materials over the life of the mine expansions. Although various reclamation measures would be carried out and water capture and treatment may occur as needed to reduce impacts on the environment, the increase in quantities of hazardous materials that would be used, along with the construction of new facilities in new locations (e.g. Goslin Flats leach pad), would increase the potential for hazardous materials related impacts in the project area.

As a result, a moderate negative impact rating has been assigned for all of the expansion alternatives.

Summary of Impacts by Alternative

Table ES-11 is provided as an impact summary matrix. The table contains both quantitative information and/or relative impact rankings for each resource and for primary issues of concern under the resources. The relative impact rankings include high (which is considered a significant level of impact), moderate, low, and negligible. The rankings shown in Table ES-11 are based on professional and technical judgement in view of this particular project, its setting and context, and the effects of this project in both a site-specific and regional sense. More information is available in Chapter 4 of the Final EIS regarding methods and criteria used to assess impacts for each resource.

TABLE ES-11
SUMMARY OF IMPACTS[1]

Resource	ALT. 1		ALT. 2		ALT. 3		ALT. 4		ALT. 5		ALT. 6		ALT. 7	
	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L
WATER RESOURCES														
Surface Water Quality	-High		-High		-Low		-Moderate		-Moderate		-Low		-Low	
Groundwater Quality	-High		-High		-Low		-Moderate		-Moderate		-Low		-Low	
% Infiltration	Flats 23% Slopes 23%		23% 23%		8% 10.5%		0.03% (3:1) 7.8%		0.005% 7.8%		0.005% 7.8%		8% 10.5%	
Volume of Water Requiring Capture and Treatment (gpm average over 20 years)	378-450 gpm		348-419 gpm		211-284 gpm		307-389 gpm		322-423 gpm		244-313 gpm		253-321 gpm	
Overall Cumulative Impact Ranking	-High		-High		-Low to Neutral		-Moderate		-High		-Moderate		-Low	
"Long-Term" Reclamation Success (water quality)	-High		-High		+Moderate		+Low		+Low		+Low		+Moderate	
SOIL RESOURCES														
• Soil Disturbance (cumulative; in acres)	1248		1257		1498		2375		2364		2391		2195	
• Soil Productivity	-High		-High		-Moderate		-Moderate		-Moderate		-Moderate		-Moderate	
• Soil Erosion	-High		-High		-Moderate		-Moderate		-Moderate		-Moderate		-Moderate	
• Total Soil Loss from Major Facilities (tons/acre/year)	3.38		3.38		1.76		1.77		1.63		1.73		1.31	
RECREATION AND LAND USE														
Developed Recreation (campgrounds, picnic areas, Pow Wow grounds)	-Low	-Mod.	-Low	-Mod	-Low	-Low	-Low/ Mod	-Mod	-Low	-Mod	-Mod	-Mod	-Low/ Mod	-Mod
Dispersed Recreation (hiking, sightseeing, ORV, hunting, picnicking)	-Mod	-Mod	-Low/ Mod	-Mod	-Low	-Low	-Mod	-Mod	-Low	-Mod	-High	-Mod	-Mod	-Mod
Land Use	-High	-High	-Mod	-Mod	-Low	-Low	-Mod	-Mod	-Low	-Mod	-High	-Mod	-Mod	-Mod
CULTURAL RESOURCES														
• Overall Impact Level	-Moderate		-Moderate		-Low		-High		-High		-High		-High	
• Relative Ranking (1 = most favorable)	2		2		1		4		3		4		4	

TABLE ES-11 - SUMMARY OF IMPACTS[1]
(Continued)

Resource	ALT. 1		ALT. 2		ALT. 3		ALT. 4		ALT. 5		ALT. 6		ALT. 7	
	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L
WILDLIFE AND AQUATICS														
• Special Status Species	NI		NI		NI		-Low		-Low		-Low		-Low	
• Nesting Raptors	NI		NI		NI		NI		NI		NI		NI	
• Habitat Loss (in acres)	1248		1257		1498		2212		2282		2431		2064	
• Residual Long-term Water Quality Effects	-Moderate		-Moderate		NI		-Moderate		-Moderate		-Moderate		-Low/NI	
• Long-term Sedimentation Effects	-Moderate		-Moderate		-Low		-Moderate		-Moderate		-Moderate		-Low	
• Long-term Wildlife Mortality	NI		NI		NI		NI		NI		NI		NI	
• Noise Effects	NI		NI		NI		NI		NI		NI		NI	
• Long-term Reclamation Effects	-High		-High		NI		-Moderate		-Moderate		-Moderate		NI	
VEGETATION, WETLANDS AND OTHER WATERS OF THE U.S.														
• Special Status Species Habitat	NI		NI		NI		NI		NI		NI		NI	
• Sole Source of Veg. Used by Native Americans	NI		NI		NI		NI		NI		NI		NI	
• Forest Vegetation Impacted (cumulative, in acres disturbed)	1029		1029		1034		1387		1550		1245		1285	
• Riparian Vegetation Impacted (cumulative, in acres)	16		16		16		26		43		26		25	
• Predicted Revegetation Success, as Percent Vegetative Cover	<80%		<80%		>90%		80-89%		80-89%		80-89%		>90%	
• Overall Cumulative Vegetation Impacts	-High		-High		-Low		-Moderate		-Moderate		-Moderate		-Low	
• Cumulative Wetland Direct Impacts (in acres)	0.03		0.03		0.03		1.09		0.05		1.09		1.09	
• Cumulative Wetland Indirect Impacts (in acres)	---		---		1.54		.48		.24		4.07		.48	

TABLE ES-11 - SUMMARY OF IMPACTS[1]
(Continued)

Resource	ALT. 1		ALT. 2		ALT. 3		ALT. 4		ALT. 5		ALT. 6		ALT. 7	
	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L
• Cumulative Non-Wetland Waters Direct Impacts (in acres)	4.21		4.21		4.21		7.87		6.29		7.07		7.37	
• Cumulative Non-Wetland Waters Indirect Impacts (in acres)	16.0		16.0		16.4		23.3		16.4		24.7		23.3	
• Overall Cumulative Wetland Impacts														
Pre-Mitigation	-Low		-Low		-Moderate		-Moderate		-High		-High		-Moderate	
Post-Mitigation	-Low		-Low		-Moderate		-Low		-Moderate/Low		-Moderate/Low		-Low	
• Overall Cumulative Non-Wetland Waters														
Pre-Mitigation	-High		-High		-High		-High		-High		-High		-High	
Post-Mitigation	-High		-High		-Moderate		-Moderate/Low		-Moderate/Low		-Moderate/Low		-Moderate/Low	
SOCIOECONOMICS														
Employment														
• Montana employment (cumulative; in job-years)	561		744		909		5,000		4,821		4,524		5,156	
• Phillips County employment (cumulative; in job-years)	437		571		698		3,480		3,356		3,173		3,608	
• Blaine County employment (cumulative; in job-years)	20		26		32		144		139		133		133	
Earnings														
• Montana earnings (cumulative; in millions of 1994 dollars)	$14.8		$19.5		$23.8		$126.4		$121.8		$114.8		$130.6	
• Phillips County earnings (cumulative; in millions of 1994 dollars)	$12.3		$16.0		$19.6		$95.6		$92.2		$87.4		$99.3	
• Blaine County earnings (cumulative; in millions of 1994 dollars)	$0.4		$0.5		$.06		$2.6		$2.5		$2.4		$2.7	

TABLE ES-11 - SUMMARY OF IMPACTS[1]
(Continued)

Resource	ALT. 1		ALT. 2		ALT. 3		ALT. 4		ALT. 5		ALT. 6		ALT. 7	
	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L
Tax Revenues														
• Montana direct tax revenues (cumulative; in millions of 1994 dollars)	$0.44		$0.44		$0.44		$4.46		$4.30		$3.60		$4.29	
• Phillips County tax revenues (cumulative; in millions of 1994 dollars)	$0.25		$0.25		$0.25		$2.63		$2.57		$2.44		$2.61	
• Malta School Districts direct tax revenues (cumulative; millions of 1994 dollars)	$0.12		$0.12		$0.12		$1.25		$1.22		$1.15		$1.24	
• Dodson High School District direct tax revenues (cumulative; in millions of 1994 dollars)	$0.11		$0.11		$0.11		$1.12		$1.10		$1.03		$1.11	
• Landusky School District direct tax revenues (cumulative; in millions of 1994 dollars)	$0.07		$0.07		$0.07		$0.73		$0.72		$0.68		$0.73	
• City of Malta direct tax revenues (cumulative; in 1994 dollars)	Negligible		Negligible		Negligible		<$10,000		<$10,000		<$10,000		$10,000	
• County Hard Rock Trust Reserve district tax revenues (cumulative; in millions of 1994 dollars)	$0.06		$0.06		$0.06		$0.59		$0.57		$0.48		$0.57	
TRANSPORTATION														
• Traffic Capacity	-Low		-Low		-Low		-Low		-Low		-Low		-Low	
• Accidents	-Low		-Low		-Low		-Low		-Low		-Low		-Low	
• Transport of Hazardous Materials	-Low		-Low		-Low		-Low		-Low		-Low		-Low	
• Public Access to Parts of the LRM (duration of impact - until _year_)	-High (until 2001)		-High (until 2001)		-High (until 2002)		-High (until 2008)		-High (until 2008)		-High (until 2007)		-High (until 2008)	
• Safety in Local Communities	-Low	-Low	-Mod	-Mod	-Mod	-Mod	-Mod	-Mod	-Mod	-Mod	-Mod	-Mod	-Mod	NI
(# convoyed truck trips thru town per day; duration in peak year)	0	0	300 trip 12 days	300 trip 27 days	300 trip 14 days	300 trip 35 days	300 trip 17 days	300 trip 27 days	300 trip 25 days	300 trip 27 days	300 trip 14 days	300 trip 27 days	240 trip 42 days	0

TABLE ES-11 - SUMMARY OF IMPACTS[1]
(Continued)

Resource	ALT. 1		ALT. 2		ALT. 3		ALT. 4		ALT. 5		ALT. 6		ALT. 7	
	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L
VISUAL RESOURCES	-High		-High		-High		-High		-High		-High		-High	
NOISE[2] (in dBA; all impacts negative)														
• Cumulative Mine Noise Impacts, Town of Zortman	59 dBA High		59 dBA High		62 dBA High		66 dBA High		60 dBA High		67 dBA High		64 dBA High	
• Cumulative Mine Noise Impacts, Town of Landusky	62 dBA High		62 dBA High		62 dBA High		63 dBA High		62 dBA High		63 dBA High		63 dBA High	
• Cumulative Mine Noise Impacts, Pow Wow Grounds	58 dBA High		58 dBA High		58 dBA High		59 dBA High		59 dBA High		59 dBA High		59 dBA High	
• Cumulative Mine Noise Impacts, Azure Cave	55 dBA Moderate		55 dBA Moderate		59 dBA High		66 dBA High		57 dBA Moderate		66 dBA High		60 dBA High	
AIR[3] (in $\mu g/m^3$)														
• 24-hour and Annual PM_{10} Mining and Reclamation Impacts, Estimated at Town of Zortman	32 $\mu g/m^3$ NI 8 $\mu g/m^3$ NI		57 $\mu g/m^3$ Low 14 $\mu g/m^3$ NI		100 $\mu g/m^3$ Mod 4 $\mu g/m^3$ NI		76 $\mu g/m^3$ Low 4 $\mu g/m^3$ NI		158 $\mu g/m^3$ High 6 $\mu g/m^3$ NI		59 $\mu g/m^3$ Low 5 $\mu g/m^3$ NI		118 $\mu g/m^3$ Mod 5 $\mu g/m^3$ NI	
• Cumulative 24-Hour PM_{10} Impacts, Estimated at Town of Zortman	62 $\mu g/m^3$ Low		87 $\mu g/m^3$ Low		130 $\mu g/m^3$ Mod		295 $\mu g/m^3$ High		188 $\mu g/m^3$ High		278 $\mu g/m^3$ High		148 $\mu g/m^3$ Mod	
• 24-hour and Annual PM_{10} Mining and Reclamation Impacts, Estimated at Landusky Mine	85 $\mu g/m^3$ Mod 14 $\mu g/m^3$ NI		85 $\mu g/m^3$ Mod 25 $\mu g/m^3$ Low		85 $\mu g/m^3$ Mod 31 $\mu g/m^3$ Low		85 $\mu g/m^3$ Mod 31 $\mu g/m^3$ Low		85 $\mu g/m^3$ Mod 32 $\mu g/m^3$ Low		85 $\mu g/m^3$ Mod 32 $\mu g/m^3$ Low		85 $\mu g/m^3$ Mod 32 $\mu g/m^3$ Low	
• Cumulative 24-Hour PM_{10} Impacts, Estimated at Town of Landusky	129 $\mu g/m^3$ Mod		140 $\mu g/m^3$ Mod		146 $\mu g/m^3$ Mod		146 $\mu g/m^3$ Mod		147 $\mu g/m^3$ Mod		147 $\mu g/m^3$ Mod		147 $\mu g/m^3$ Mod	
HAZARDOUS MATERIALS	-Low		-Low		-Low		-Moderate		-Moderate		-Moderate		-Moderate	

TABLE ES-11 - SUMMARY OF IMPACTS[1]
(Concluded)

Resource	ALT. 1		ALT. 2		ALT. 3		ALT. 4		ALT. 5		ALT. 6		ALT. 7	
	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L	Z	L
GEOLOGY														
• Disturbance for Construction and Reclamation Materials (in acres)	3	0	3	6	65	0	23	10	25.5	12	25	12	17	3
• Cumulative Disturbance for Construction and Reclamation (in acres)	7.2	29	7.2	35	69.2	29	27.2	39	29.7	41	29.2	41	21.2	32
• Anticipated Gold Production (in Troy ounces)	0 oz.		0 oz.		0 oz.		960,000 oz.		960,000 oz.		804,000 oz.		960,000 oz.	
• Anticipated cumulative Gold Production plus Reasonably Foreseeable (in Troy ounces)	1.4 million oz.		1.4 million oz.		1.4 million oz.		2.64 million oz.		2.6 million oz.		2.48 million oz.		2.64 million oz	
ACECs (Areas of Critical Environmental Concern)														
• Azure Cave (and associated bat habitat)	NI		NI		NI		Low		NI		Low		Low	
• Prairie Dog Towns	NI		NI		NI		NI		NI		NI		NI	
• Little Rocky Mountains (proposed)	NI		NI		NI		-Moderate		-Low		-Moderate		-Moderate	
• Saddle Butte (proposed)	NI		NI		NI		NI		NI		NI		NI	
• Old Scraggy Peak (proposed)	NI		NI		NI		-Moderate		-Moderate		-Moderate		-Moderate	

Notes:
[1] Where applicable, impacts are differentiated by Zortman Mine (Z) and Landusky Mine (L)
[2] Significance threshold is 55 dBA, the estimated level above which noise would interfere with outdoor activity.
[3] Significance thresholds are the 24-Hour, PM_{10} standard of 50 $\mu g/m^3$; and the Annual PM_{10} standard of 150 $\mu g/m^3$.

Key:
- = Negative impact
+ = Positive impact

High = High level of impact (significant)
Mod/Moderate = Moderate level of impact
Low = Low level of impact
NI = Negligible impact

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Phillips Resource Area
HC 65 Box 5000
Malta, Montana 59538
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October 1996

Dear Reader,

Attached is your copy of the Record of Decision (ROD) regarding the Zortman and Landusky Mines Reclamation Plan Modifications and Mine Life Extensions. The decision was made to approve additional mining and modified reclamation plans using mitigation in the preferred alternative of the Final EIS (alternative 7).

The ROD contains a list of the stipulations that have been applied to Zortman Mining's proposed plans in order to implement alternative 7. Also included in the ROD are the agencies' rationale for the selection of the preferred alternative and information on appealing the decisions.

We wish to thank everyone who has participated in the EIS-process. Should you require additional copies of the ROD, Final EIS, or the Final EIS executive summary, please contact either Scott Haight (BLM) at 406/538-7461 or Sandi Olsen (DEQ) at 406/444-4988.

Mark A. Simonich, Director
State of Montana
Department of Environmental Quality

Richard M. Hotaling, Area Manager
Bureau of Land Management
Phillips Resource Area

Table of Contents

RECORD OF DECISION

ZORTMAN AND LANDUSKY MINES RECLAMATION PLAN MODIFICATIONS AND MINE LIFE EXTENSIONS

by

Montana Department of Environmental Quality

U.S. Department of the Interior
Bureau of Land Management

October 1996

Introduction & Background

The Zortman and Landusky mines are located in the Little Rocky Mountains of northcentral Montana. Modern mining within this historic mining district began in the late 1970s using the first cyanide heap leach process in the state. The State of Montana prepared an EIS on the Zortman and Landusky mining operations in 1979. After completion of the EIS, the Montana Department of State Lands approved Operating Permit 00096 for the Zortman Mine and Operating Permit 00095 for the Landusky Mine. The mines operate in close proximity on a mixture of private lands and public lands managed by the Bureau of Land Management (BLM). After the BLM surface management regulations went into effect in 1981, the BLM approved Plan of Operations MTM-77778 for the Zortman Mine and Plan of Operations MTM-77779 for the Landusky Mine. The permits for both mines have been amended approximately 10 times since 1979 as mine operations have expanded or been modified.

On May 11, 1992, Zortman Mining, Inc. (ZMI), operator of the Zortman and Landusky mines, filed an application with the Lewistown District BLM and the Montana Department of Environmental Quality (formerly the Department of State Lands) to expand mining operations at the Zortman Mine. The proposal includes: expansion of existing mine pits to extract additional ore; a 150-acre, 60-million ton capacity waste rock disposal area; ore crushing facilities; a 2½-mile ore conveyor system; a 200-acre, 80-million ton capacity leach pad; new processing plant and ponds; a limestone quarry; and other associated constructions, such as access roads and powerlines.

An Environmental Impact Statement (EIS) was initiated by the Montana Department of Environmental Quality (DEQ) and the BLM in response to ZMI's application to expand mine operations at the Zortman Mine. The BLM and DEQ (referred to as "the agencies") were co-lead agencies for preparation of the EIS. The Environmental Protection Agency (EPA) and the Army Corps of Engineers (COE) participated as cooperating agencies.

Acid rock drainage (ARD) has been identified as a major issue at both the Zortman and the Landusky mines. In early 1993, the BLM and the State of Montana required ZMI to modify its existing operating and reclamation plans at both mines in response to impacts created by ARD.

In August of 1993, the State of Montana filed suit in State District Court against ZMI and its parent company, Pegasus Gold Corporation, alleging violations of the Montana Water Quality Act, due in part to ARD. In June of 1995, EPA filed suit in Federal District Court alleging that discharges from the mines were in violation of the Federal Clean Water Act. Thereafter, the State of Montana filed suit in Federal District Court. Island Mountain Protectors and the Fort Belknap Community Council had also filed citizen suits which included these same charges. All parties to the case entered into negotiations and developed a Consent Decree that was lodged in Federal District Court on July 22, 1996, and made available for public comment. The Consent Decree was entered by the Judge as effective on September 27, 1996.

In November 1993, an environmental assessment on proposed ARD-related corrective measures

for the Landusky Mine was released for public comment. Corrective measures for the Zortman Mine were to be included in the Zortman Mine Expansion EIS. In March 1994, the agencies decided to combine analysis of the Landusky Mine corrective measures with the Zortman Mine EIS process. ZMI then submitted modified mining and reclamation plans for the Landusky Mine which included a relatively small amount (7.6 million tons) of additional ore mining and processing. As a result, the scope of the Draft and the Final EIS, includes expanded mining at both mines along with the reclamation and remediation plans needed at both mines for control of ARD.

There are two decisions that need to be made. The agencies must determine (1) how to mitigate impacts from existing mine operations, and (2) whether ZMI's proposed plans for expanded mining and mineral recovery are adequate to meet state and federal requirements, and if not, to identify any mitigating measures that would meet these requirements. The two decision processes are related in that mine expansion approval could change the options available for correcting impacts from the existing mine operations (that is *not* to say that mine expansion is necessary to achieve adequate reclamation of past mine disturbance). Therefore, these decisions have been considered in the same EIS.

Decisions

After considering all relevant issues, alternatives, potential impacts, and management constraints, it is the agencies' decision to select for implementation, the Preferred Alternative (Alternative 7) presented in the Final EIS; and to not approve the mine expansion plans and modified reclamation plans as proposed by ZMI in Alternative 4. Alternative 7 approves expansion of the Zortman and Landusky mines and approves modification of both mines' reclamation plans with added mitigation to reduce environmental impacts and to improve the potential for long-term reclamation success. Chapter 2 of the Final EIS provides a comprehensive description of Alternative 7.

Stipulations

Alternative 7 adds many mitigating measures to ZMI's proposed actions presented under Alternative 4. These have been developed through the EIS process to prevent unnecessary or undue degradation and achieve comparable stability and utility of mined lands with adjacent lands. These mitigation measures are required as conditions of approval (stipulations) to the Modified Plans of Operations and the Operating Permit Amendments. The following is a list of the stipulations that must be followed by the operator to implement the selected alternative. A brief rationale for each stipulation is also provided. These conditions will be included in the agencies' permit/approval documents.

Facility Location:

1. ZMI must construct the new waste rock repository so that it mostly overlies existing disturbance around the Zortman pit complex, rather than at the proposed location in Carter Gulch. ZMI must construct the waste rock repository with an overall 3:1 slope (horizontal:vertical), with at least 15-foot wide benches constructed (not pioneered) every 100 vertical feet. Benches must be backsloped and drain toward common surface water drainage ditches built along the edges of the repository. Reclamation of the repository is to be conducted concurrent with mining operations. The waste rock repository configuration, along with post-reclamation topography and drainage, is shown on Figure 2.11-3 of the Final EIS (Attachment 1). ZMI must build the new waste rock repository in accordance with the preliminary design and construction elements contained in the January 23, 1996, report produced by Golder Associates, Inc. (except where specifically noted differently by other conditions of approval). Final designs must be submitted at least 60 days in advance of repository construction for the agencies to verify compliance with this requirement.

   This stipulation limits the amount of surface disturbance and improves water management by reducing the number of drainages potentially impacted by waste rock from mine expansion. Concurrent reclamation will minimize the exposure of waste rock to precipitation that may generate undesirable leachate.

2. ZMI must remove and transport the existing Alder Gulch waste rock dump located in Carter Gulch, via the conveyor system, to the Goslin Flats leach pad. Once the waste rock has been removed, ZMI must reclaim the dump footprint consistent with the characterization and reclamation requirements of Stipulation 19.

   The existing dump is seeping poor quality water and removal of the dump will reduce impacts to the Carter Gulch/Alder Gulch drainages.

3. After cyanide detoxification, ZMI must remove portions of the Zortman 85/86 leach pad and place it on a lined area in the new repository above the water table. The required removal and placement of this spent ore is shown on Attachment 1. ZMI must cover the remainder of the 85/86 leach pad with the new waste rock repository identified in Stipulation 1 and cap the repository with the reclamation covers identified in Stipulation 17. If, after reclamation, the water quality objectives are not being met, ZMI must, upon written notice from DEQ or BLM, make additional modifications to the 85/86 leach pad material as set out in the notice.

   Relocation of some ore from the 85/86 leach pad is necessary to allow for construction of the new waste rock repository. Complete removal of the 85/86 leach pad is not necessary as the source of poor quality water in Ruby Gulch has been determined to be from the mine pits.

4. ZMI must remove the OK and Ruby waste rock dumps. The waste rock must be selectively placed as backfill in the pit complex, or leached at Goslin Flats to recover residual precious metals. ZMI must re-salvage cover soil and reclaim the waste rock footprints using the reclamation covers identified in Stipulation 17.

   These dumps contain acid-generating material that needs to be selectively handled to minimize acid formation.

5. ZMI may not mine limestone at the LS-1 limestone quarry. Instead, ZMI must mine limestone needed at the Zortman Mine from the LS-2 site located west of the Zortman townsite (see Exhibit 1 in Final EIS). This quarry must be reclaimed using the same procedures proposed by ZMI in their application for the limestone quarry site in Upper Lodgepole Creek.

   This reduces overall disturbance and avoids impacts to the Lodgepole Creek drainage from access road construction and mining of limestone.

6. ZMI may not mine limestone at the King Creek limestone quarry. Instead, ZMI must mine limestone needed at the Landusky Mine from the quarry located in Montana Gulch (see Exhibit 2 in Final EIS). This quarry must be reclaimed using the same procedures proposed by ZMI in their application for the limestone quarry site in Upper Lodgepole Creek.

This avoids impacts to the King Creek drainage from access road construction and mining of limestone.

Construction and Rock Characterization:

7. For general construction and use in reclamation covers, ZMI must classify "Non-Acid Generating" (NAG) waste rock, associated with the mining of ore, by using the following criteria:

   a) Rock may not be composed of breccia, felsic gneiss, monzonite, quartzite, or trachyte lithologies;

   b) Rock composed of amphibolite, mafic gneiss, shale, dolomite, or limestone must have a total sulfur content less than or equal to 0.8 percent, and a paste pH of 6.0 or greater;

   c) Rock composed of syenite must have a total sulfur content less than or equal to 0.2 percent, a paste pH of 6.5 or greater, and a Net Neutralization Potential (NNP) of 0 or greater;

   d) Rock composed of syenite may only be used in reclamation covers where NAG is specified and must not be used where it would be in contact with water such when used for riprap in drainage channels or as underdrains.

   e) ZMI must demonstrate that rock meets the above criteria by sampling and analyzing lithologies from every blasthole providing non-acid generating material for total sulfur, paste pH and Neutralizing Potential (Miller 1995). All blastholes within a discrete minable block (25 feet x 25 feet) must meet these criteria. Reports that document rock characterization must be submitted monthly to the agencies.

   These criteria are necessary to provide that rock with acid-forming potential is adequately identified and not placed where it will degrade waters or effect reclamation success.

8. ZMI must use only non-acid-generating materials in facilities conveying surface water or seepage water. Unmineralized limestone, or other suitable material, must be used by ZMI for fill in state waters. Underdrains constructed beneath the Goslin Flats leach pad and the new waste rock repository, and seepage collection systems must be built with coarse and durable unmineralized carbonates.

   Material which meets the above NAG criteria does not necessarily meet the state requirement for clean fill suitable for placement in waters of the state. Therefore, unmineralized limestone is required for fill in state waters as an additional precaution to

buffer acidic drainage and to minimize the potential for impacts to water quality.

9. ZMI must demonstrate to the agencies' satisfaction that any material excavated from the Goslin Flats leach pad site to be used for construction or reclamation purposes has suitable geotechnical and geochemical characteristics consistent with Stipulation 7.

   Material removed from the leach pad site may prove useful as a supplement or alternate to the cover soil, subsoil, or clay liner proposed for use in general construction and reclamation. However, this requirement is intended to prevent the material from being used without prior geotechnical or geochemical characterization.

10. ZMI must install the geosynthetic clay liner (GCL) according to the manufacturers' specifications. The installation is to be monitored by a third-party engineer, qualified with the expertise to effectively monitor the installation of this material, who must submit monthly reports directly to the agencies. The engineer conducting the oversight of GCL installation must keep a daily written record of the installation, including documentation of quality control testing. The testing is to follow the manufacturers' specifications and include testing of: bentonite mass per unit area of GCL, bentonite free swell, and bentonite mass per unit length of seam. These test results are to be included in the monthly reports. All reports must be submitted concurrently to DEQ, BLM and ZMI.

    A testing and reporting program is needed to ensure appropriate installation of the GCL and to attain maximum GCL performance under field conditions.

11. ZMI must use a non-calcareous material for the capillary break/drain layer placed over the GCL used in the reclamation covers.

    This is to avoid geochemical degradation of the low permeability character of the GCL.

12. ZMI must construct the capillary break/drain layer in the water barrier cover using NAG material at least 3 feet thick over 95 percent of the area covered, with a minimum thickness of 2.5 feet at any one location. If additional subsoil is available (after construction of the water balance covers), ZMI must substitute subsoils for the coarse NAG layer. If subsoil is substituted, the capillary break/drain layer above the GCL may be decreased accordingly, but must not be less than 12 inches at any location.

    This is to provide for adequate drainage above the GCL and maximize use of available soil materials.

13. ZMI must construct the new waste rock repository at the Zortman Mine in lifts from 5 to 25 feet thick. In areas where differential settlement may occur, such as between existing heaps, ZMI must place waste rock in 5-foot lifts.

    This requirement is to ensure minimal settlement of the new waste rock repository,

ensuring slope stability and reclamation cover integrity.

14. ZMI must seal the following two adits in the Zortman Mine pit area using concrete bulkheads prior to pit backfilling. One daylights north of the Ross pit in the Lodgepole drainage, the other is located southeast of the OK pit under the 85/86 leach pad in Ruby Gulch.

    Sealing of these adits, which connect old underground workings to the surface, minimizes oxygen flow and water movement in the backfilled waste rock. This reduces potential impacts to surface water and groundwater from acid-forming minerals within the waste rock. Any residual impacted water is to be managed by capture and treatment at the water treatment plant.

15. ZMI must construct the lowest layer of the mine pit backfill with a minimum 5-foot thick lift of acid-buffering material. Waste rock placed into the interval of the pits that have a fluctuating water table must be non-acid forming according to the criteria in Stipulation 7. Waste rock placed below the zone of fluctuating water table, in the lower portions of the pit which are always saturated, must contain less than 0.5 percent total sulfur.

    By using waste rock with low sulfide mineral content, impacts to groundwater beneath the reclaimed mine pits are reduced.

16. ZMI may not perforate leach pad liners until monitoring of heap effluent indicates that discharge effluent limits will be met through the spring runoff event. ZMI must engineer perforation of the heap leach pad liners to be reversible. Liner perforation design details must be submitted to the agencies at least 6 months prior to the intended perforation date to verify compliance with this requirement.

    Delayed liner perforation allows the agencies to ensure that the risk of post-reclamation water quality degradation is minimal before perforation. Reversible liner perforation is necessary to ensure that the discharge can be halted in the event that post-reclamation leachate quality should become unacceptable.

Surface Reclamation:

17. ZMI must use water balance and water barrier reclamation covers. These reclamation covers are shown on Figure 2.11-4 in the Final EIS (Attachment 2). Cover soil must be placed at least 12 inches thick on all disturbances, either directly over NAG surfaces (as defined by Stipulation 7) or as the uppermost layer of the reclamation covers. Where redisturbance of the site is necessary, cover soil on facilities that have previously had surface reclamation is to be removed and stockpiled for reuse. These covers are to be used on the new waste rock repository at the Zortman Mine, the Goslin Flats leach pad, the expanded Gold Bug waste rock repository and all other existing reclaimed or

unreclaimed facilities unless specified otherwise below.

These reclamation covers increase revegetation potential, reduce soil loss, and improve long-term surface stability with low infiltration rates and low maintenance requirements.

18. Unless specified elsewhere, ZMI must regrade facilities to an overall 3:1 slope with constructed benches every 100 vertical feet between benches. In order to achieve the slope reductions while minimizing additional land disturbance, ZMI may have to off-load some material from existing facilities and place it as fill in other areas. At least 60 days in advance of implementation, ZMI must submit for agency review its plans for placement of any off-loaded spent ore to verify compliance with off loading and fill requirements.

    The reduced slope angle and bench spacing are needed to reduce the rate of soil loss thus increasing overall surface reclamation stability and success.

19. ZMI must characterize the footprints of removed facilities, haul roads, or areas where sulfide materials have been stored or spilled by testing for total sulfur content on 100-foot centers. ZMI must reclaim areas with less than 0.5 percent total sulfur with 12 inches of cover soil and vegetation. ZMI must reclaim areas with greater than 0.5 percent total sulfur with a 12-inch layer of non-acid-generating material to be placed between the substrate and the 12 inches of cover soil.

    Reclamation over substrate with greater than 0.5 percent sulfur content can result in the acidification of the cover soil, dramatically reducing revegetation success. The additional 12 inches of non-acid-generating material prevents soil acidification.

20. ZMI must restrict long-term soil loss rates on reclaimed slopes to less than 2 tons/acre/year. ZMI must stabilize rills or gullies that might breach the cover soil layer by regrading, placement of additional cover soil, and installation of additional erosion control measures.

    This performance requirement keeps soil loss less than anticipated soil generation rates and will enhance long-term reclamation success.

21. The following are specific surface reclamation stipulations for the existing heap leach facilities at the Zortman Mine. These stipulations are required to minimize erosion, enhance revegetation establishment, and minimize infiltration, which may generate leachate.

    a) ZMI must remove and salvage the existing reclamation cover on the Zortman 79/80/81 leach pad prior to it being incorporated into the new waste rock repository required in Stipulation 1 and shown on Attachment 1. Ultimately, this area is to be reclaimed using the water balance and water barrier reclamation covers required in Stipulation 17 and shown in Attachment 2.

b) ZMI must reclaim the Zortman 82 leach pad using the water balance and water barrier reclamation covers required in Stipulation 17 and shown in Attachment 2.

c) ZMI must incorporate the Zortman 83 and 84 leach pads into the new waste rock repository required in Stipulation 1 and shown on Attachment 1. This area must be reclaimed using the water balance and water barrier reclamation covers required in Stipulation 17 and shown in Attachment 2. ZMI must remove and salvage the existing cover soil from the retaining dikes for these leach pads prior to construction of the new waste rock repository.

d) ZMI must incorporate that portion of the Zortman 85/86 leach pad and retaining dike not removed during construction of the new waste rock repository into the new waste rock repository required in Stipulation 1 and shown on Attachment 1, and must reclaim the repository using the water balance and water barrier reclamation covers required in Stipulation 17 and shown in Attachment 2.

e) ZMI must incorporate the Zortman 89 leach pad into the new waste rock repository required in Stipulation 1 and shown on Attachment 1. All portions of the leach pad surface are to be reclaimed using the water balance and water barrier reclamation covers required in Stipulation 17 and shown in Attachment 2. ZMI must test the Zortman 89 leach pad retaining dike for sulfur content as described in Section 2.8.2.2 of the Final EIS. If total sulfur exceeds 0.5 percent in more than 10 percent of the samples tested, ZMI must re-reclaim the dike using the water balance cover. ZMI must remove and salvage the existing reclamation cover soil prior to placement of the new reclamation cover.

22. The following are specific surface reclamation stipulations for the existing heap leach facilities at the Landusky Mine. These stipulations are required to minimize erosion, enhance revegetation establishment, and minimize infiltration which may generate leachate.

a) ZMI must remove and salvage the existing reclamation cover soil from the Landusky 79/80/81/82 leach pads. These leach pads must be reclaimed using the water balance and water barrier reclamation covers required in Stipulation 17 and shown in Attachment 2.

b) ZMI must reclaim the Landusky 83, 84, and 85/86 leach pads using the water balance and water barrier reclamation covers required in Stipulation 17 and shown in Attachment 2. ZMI must reslope the retaining dikes for these leach pads to at least 2.5:1, and sufficient to allow placement and retention of the water balance reclamation cover. ZMI must remove and salvage the existing reclamation cover soil prior to slope reduction and placement of the new reclamation cover.

23. ZMI must reclaim the Goslin Flats leach pad slopes at not steeper than 3:1, where

topography allows without pushing spent-ore into adjacent drainages. At no location are slopes to be steeper than 2.5:1. ZMI must construct benches every 100 vertical feet on all slopes with a minimum bench width 8 feet.

Spent ore might contain residual leaching products that might degrade water if placed directly in drainages. Lower slopes with benches will minimize erosion and enhance revegetation, especially in the fine-grained soils at this site.

24. ZMI must construct the expanded Gold Bug waste rock repository at an overall 3:1 slope with benches constructed every 100 vertical feet. ZMI must concurrently reclaim the repository during mining operations.

Concurrent reclamation minimizes exposure of waste rock to precipitation. Most of this repository is already built and reclamation can continue during waste rock placement.

25. Concurrent with regrading, ZMI must remove spent ore from the north side of the Landusky 87, 91 and 87/91 leach pads so that the entire regraded leach pad achieves the required 3:1 overall slope with benches every 100 vertical feet. ZMI may not push ore or waste rock off the liner into adjacent northern drainage areas. ZMI must redistribute the spent ore from the northern portions of the leach pad to the south, west and east of the 87/91 pad complex. This material may be placed off the liner, away from drainages, only if it has been verified by the agencies that it meets a detoxification criteria of less than 0.5 milligrams of weak acid dissociable cyanide per kilogram of spent ore.

This requirement is to prevent runoff from the reclaimed leach pad from discharging north of the mine site into drainages that eventually enter the Fort Belknap Indian Reservation. Any discharges will be directed to the south for capture and treatment. Sampling of the heap effluent, as done for total heap detoxification, is not appropriate for off-loading small ore segments from this large heap complex. Instead, a bottle roll test is to be used containing 1 to 2 kilograms of ore with an extraction solution to sample ratio of 2:1 adjusted to a pH of greater than 12 with sodium hydroxide (This is the standard test procedure used elsewhere for off-loading spent ore).

26. ZMI must reslope the Landusky 91 leach pad dike so it is not steeper than 2.5:1 with constructed benches every 100 vertical feet. The dike must immediately thereafter be reclaimed using the water balance reclamation cover required in Stipulation 17 and shown in Attachment 2.

This is needed to arrest erosion on the dike, enhance revegetation, and limit infiltration.

27. The existing reclamation covers on the Gold Bug waste rock repository and the Mill Gulch waste rock dump may be left in place. However, ZMI must place additional cover soil on these facilities should monitoring indicate the existing covers are not providing comparable performance to the water barrier and water balance reclamation covers

required in Stipulation 17 and shown in Attachment 2. ZMI must monitor comparable performance by monitoring vegetation cover, soil erosion, and infiltration rates.

These existing reclamation covers may need enhancement to achieve the same long-term performance as the preferred reclamation covers shown in Attachment 2.

28. ZMI must test and evaluate those portions of the Montana Gulch waste rock dump not excavated and leached, used for backfill, or used as reclamation material, for total sulfur content as described in Section 2.8.2.2 of the Final EIS. If the waste rock does not meet the criteria, ZMI must reclaim the remaining dump using the water barrier and water balance reclamation covers required in Stipulation 17 and shown in Attachment 2. ZMI must remove and salvage existing reclamation cover soil prior to excavation of any waste rock or placement of the new reclamation cover.

    If it is determined that this dump material can generate acid, the reclamation covers shown in Attachment 2 more effectively restricts long-term infiltration of precipitation.

29. Instead of proposed Reclamation Cover A, ZMI must cover mine pit benches with 12 inches of NAG material overlain by 12 inches of cover soil using retreat reclamation.

    This will prevent acidification of the cover soil by underlying rock on mine pit benches.

30. ZMI may not use crested wheatgrass in the reclamation seedmix. ZMI may not include trees in the general revegetation. Trees may only be used where visual impact mitigation is specifically needed as described in Stipulation 51.

    Increasing the use of grasses, forbs and shrubs is required to enhance wildlife habitat.

31. ZMI must achieve a canopy cover for revegetation equal to 90% of the canopy cover of adjacent natural grassland communities at similar elevations with similar slope and aspect, at the same time (Daubenmire 1959). ZMI may not graze livestock on revegetated areas until the cover criterion has been met or it is judged necessary by the agencies to enhance soil development.

    This success criteria for revegetation allows plant communities to become well established and natural vegetation succession processes to continue. Controlled livestock grazing can be used as an effective reclamation tool.

Water Management:

32. ZMI must conduct mine activities in accordance with both the Water Quality Improvement Plan contained in Appendix A of the Final EIS and the Water Quality Improvement and Monitoring Compliance Plan (Compliance Plan) contained in Appendix

A of the Consent Decree entered September 27, 1996, between EPA, the State of Montana, the Fort Belknap Community Council, and Island Mountain Protectors. Should the two plans conflict, the more protective measures must be followed. ZMI must construct water control, capture and treatment facilities for both of the existing mines and for the new mine facilities approved in these Operating Permit Amendments and modified Plans of Operations. This stipulation requires construction of any contingency water capture or handling facilities that may in the future be determined necessary for the Swift Gulch area. ZMI must submit capture and handling plans, and a bond adequate to fund the associated long-term operation and maintenance, within 60-days of notification by the agencies that capture and treatment has been determined necessary based upon review of the monitoring data.

While the Consent Decree addresses water management needs for the existing mining operations, it does not cover those that may be needed for expanded mining. Designs for water management at new or expanded mine facilities (e.g., Goslin Flats leach pad, Zortman Waste Rock Repository) are contained in Appendix A of the EIS and are required to be implemented by this decision. The water in Swift Gulch downgradient of mine facilities does not at this time require capture and treatment. If monitoring indicates deteriorating water quality conditions, this stipulation will mitigate the impacts.

33. ZMI must assume, for design purposes, that continual water treatment will be necessary in the post-closure mine environment. Any subsequent design, construction, and maintenance of water conveyance, capture and treatment systems is to be based upon the need for long-term water treatment.

While the use of the stipulated enhanced reclamation covers may reduce or even eliminate the need for long-term water capture and treatment to meet water quality objectives in many of the affected drainages, this is not certain.

34. ZMI must design and construct all permanent drainage and diversion ditches, and water capture and treatment systems to accommodate runoff from a 6.33-inch, 24-hour storm event with 1 foot of freeboard.

The 100-year storm event design criterion is needed to ensure adequate drainage capacity, and to protect reclaimed areas and adjacent water resources. This design criteria is consistent with design criteria for leaching process circuits.

35. ZMI must design and construct all seepage water capture and treatment systems to accommodate peak seepage rates generated by a 6.33-inch, 24-hour storm event.

The 100-year storm event design criterion is needed to protect area water resources. Increased pumping capacity and holding ponds can be used to meet this requirement to compensate for the limited space at some capture points.

36. ZMI must backfill the Zortman mine pit complex to approximately the 4800-foot elevation as shown in Attachment 1. ZMI must route all surface water runoff from the Zortman mine pit area and waste rock repository to be free draining to the south into Alder Spur and Ruby Gulch. ZMI may not discharge runoff from disturbance areas into Lodgepole Creek. Final designs showing the annual backfill level and drainage plans must be submitted to the agencies at least 60 days prior to implementation for agency review to verify ZMI compliance with this stipulation.

    This confines runoff which may come in contact with acid-forming materials to drainages that flow to the south and limits the potential for impacted waters to enter the Fort Belknap Reservation. This stipulation does not constitute authorization as required by the Montana Water Quality Act.

37. ZMI must construct a drainage channel along the west margin of the 85/86 leach pad to unblock surface water drainage in the western tributary of Montana Gulch.

    The current drainage configuration does not adequately convey water away from the leach pad and will not function for post-reclamation drainage.

38. ZMI must backfill the Landusky Mine pit complex to a minimum elevation of 4740 feet (at the south end of the pit complex) to create a surface which will freely drain into Montana Gulch. Material used in backfill must come from existing waste rock dumps and leach pads, mined waste rock, ore, limestone quarries, or be recovered during drainage channel construction. Final designs showing the annual backfill level and drainage plans must be submitted to the agencies at least 60 days prior to planned implementation for agency review to verify ZMI compliance with this stipulation.

    This reduces the potential for precipitation and surface water runon to infiltrate through acidic materials beneath the mine pit and into groundwater.

39. ZMI must direct runoff from the Landusky Mine pit complex to Montana Gulch by constructing a drainage notch between the August/Little Ben pit and Montana Gulch. The channel is to be sized to convey runoff from a 6.33 inch, 24-hour storm event. Runoff from the pit area must be routed through the channel and along the existing haul road route around the eastern perimeter of the Montana Gulch waste rock dump and the 85/86 leach pad. The water must flow into settling ponds and be held for treatment, if necessary, prior to discharge into Montana Gulch downstream of the leach pad. ZMI may not discharge runoff from the mine pits into King Creek. Final designs showing the annual backfill level and drainage plans must be submitted to the agencies at least 60 days prior to implementation for agency review to verify ZMI compliance with this stipulation.

    This is to prevent the routing of pit runoff into the August tunnel where it would recharge groundwater beneath the pits, or contact waste rock in the lower portions of the Montana

Gulch waste rock dump, and possibly generate contaminated leachate. Routing around the 85/86 leach pad is needed so as not to exceed the flow capacity of the underdrain.

40. ZMI must divert runon water away from portions of pit walls that have acid-forming potential and cannot be covered. ZMI must capture runoff from pit highwall areas using collection ditches at the base of the highwall and segregate it from stormwater which falls on the reclaimed pit floors. Highwall runoff is to be routed to collection areas for transport to the respective mine's water treatment plant.

    Highwall runoff has a greater chance of becoming contaminated than runoff from reclaimed surfaces. This stipulation is required to minimize the amount of highwall runoff and to keep what does occur from contaminating the relatively clean stormwater derived from reclaimed areas.

41. ZMI must construct runoff controls, using a 6.33-inch, 24-hour design storm event, for those portions of the Montana Gulch waste rock dump not used for reclamation material or pit backfill.

    This is the calculated 100-year storm event frequency. Runoff controls using this design criterion are necessary to convey stormwater away from, and off of, mine waste rock to minimize water contact with potentially acid-generating materials or stored reaction products.

42. ZMI may not treat land application disposal (LAD) solutions with hypochlorite. ZMI may use hydrogen peroxide as an acceptable reagent substitute, but if hydrogen peroxide is used, residual peroxide levels must be reduced so as to be non-toxic to vegetation.

    This requirement is to prevent LAD of treated process solutions from having an adverse impact to vegetation. Hypochlorite use is known to have killed some evergreen species and temporarily reduced understory growth.

Wildlife and Waters of the U.S.:

43. ZMI must implement the Aquatic Ecosystem Mitigation Plan in Appendix F of the Final EIS as modified in this stipulation. The 0.51 acre mitigation site in the western tributary of Montana Gulch is dropped from the plan due to the anticipated impact construction would have on waters of the U.S. and riparian habitat. In its place, the constructed wetland in Upper Goslin Gulch is increased in size by 0.51 acres. Instead of Cowboy reservoir, the Vern reservoir must be constructed to supply replacement wetlands. This stipulation is subject to implementation requirements of the U.S. Army Corps of Engineers.

    Implementation of this Mitigation Plan is needed in order to mitigate for past, present and

future impacts to wetland and non-wetland waters of the U.S. This addresses the cumulative impacts of past, present and future mining activity on the area aquatic ecosystems. Based upon the results of a joint field inspection by BLM, COE and ZMI on April 22, 1996, and on subsequent discussions regarding water rights, this mitigation plan is altered slightly as described above.

44. ZMI must remove the tailing in Ruby Gulch above the town of Zortman from the drainage and use the tailing for reclamation or construction materials, or as pit backfill. ZMI must restore the Ruby Gulch drainage as on-site, in-kind, mitigation for disturbance to waters of the U.S. by Zortman and Landusky mine facilities. Specific removal and reconstruction plans must be submitted to the agencies at least 60 days prior to each removal phase described in Appendix F of the Final EIS in order to verify compliance with this stipulation.

    Removal of the tailing restores a historically impacted drainage, improves watershed conditions, mitigates past impacts to waters of the U.S., and provides useful reclamation and construction material that would otherwise have to be obtained by additional mining or crushing.

45. ZMI must construct an alternate water source for bats and other wildlife in Goslin Gulch between Azure Cave and the leach pad site to replace the loss of wildlife drinking water on Goslin Flats. This water source must be constructed prior to disturbance of the existing Goslin Gulch pond.

    Recent surveys in June 1996 by the Montana Natural Heritage Program and BLM have documented the use of this pond by bats. By constructing an alternate water supply prior to disturbance, the loss of Goslin Flats water will have minimal effects on bats.

46. ZMI may not use artificial lighting over areas of the Goslin Flats leach pad where cyanide is being applied using sprinkler irrigation. This restriction does not apply from November 15 to April 1.

    This stipulation is to prevent bats from flying through cyanide spray. Lighting attracts insects, which would attract bats. If lighting is placed in areas where cyanide is being sprayed, bats may be affected. The restriction is not needed during the winter months because bats are in hibernation.

47. ZMI must construct an 8-foot high fence around the Goslin Flats process solution ponds and every capture pond containing water that is impacted by past or present operations.

    The 6-foot fence proposed by ZMI is not high enough to prevent some animals from entering the exclosure and coming in contact with toxic solutions.

Social, Cultural and Aesthetics:

48. ZMI must conduct all mine expansion and reclamation activities in accordance with the Programmatic Agreement developed under Section 106 of the National Historic Preservation Act, attached as Appendix E to the Final EIS. This includes preparation and submission of Treatment Plans for the Alder Gulch Historic Mining District, the Little Rocky Mountains Traditional Cultural Property District, the Ruby Mill, and archaeological site 24PH2905. Treatment Plans must be submitted to BLM within 90 days after receipt of this signed Record of Decision.

    Implementing the Programmatic Agreement is necessary to give appropriate consideration to cultural resources as required by the National Historic Preservation Act.

49. Upon 30 days advanced notice from the designated representative of the Fort Belknap Community Council and verification by BLM, ZMI must cease all blasting for up to a total of four days per calendar year.

    Each spring, for the life of the approved plan, BLM will request that the Fort Belknap Community Council identify an individual responsible for providing the 30 day advanced notice to ZMI, with a copy to BLM. BLM will then verify the dates blasting is not allowed with ZMI. This stipulation will reduce the disruption that blasting has on Native American community activities such as the pow wow or sundances that occur on the Fort Belknap Reservation.

50. ZMI must use pilot cars to escort haul truck convoys moving reclamation or construction materials over public roads. ZMI convoys may not exceed a speed of 15 mph when traveling through the communities of Zortman or Landusky.

    The lower speed will reduce the noise and dust nuisance. Pilot cars and a 15-mph speed limit will increase public safety.

51. ZMI must recontour all spent ore heaps and waste rock piles to provide a topography that blends into the surrounding landscape in a manner which meets visual resource management (VRM) Class II criteria. Straight edges are to be rounded. Large, flat surface areas are to be broken with changes in contour simulating natural drainage patterns. Trees are to be planted for visual screening at locations identified by the agencies. ZMI must submit detailed recontouring and planting plans for individual facilities to the agencies at least 60 days prior to regrading for review to verify compliance with this stipulation.

    This requirement is needed to minimize the post-reclamation visual impact of the mining operation. However, this requirement is subordinate to the primary reclamation objectives of stable reclamation surfaces that limit infiltration of precipitation into mine waste material, minimize erosion rates, and re-establish of natural plant succession processes.

52. ZMI must reduce the north/northwest facing pit highwalls at the Zortman Mine to an overall 3:1 slope, with vertical faces filled so that no slopes are steeper than 2:1, as shown in Attachment 1.

This requirement is to lessen visual impacts to observers in areas north of the Zortman Mine.

Air Quality:

53. ZMI is limited to 120 haul truck trips (one-way) in a single day moving reclamation or construction materials through the town of Zortman.

This requirement is necessary in order to maintain air emissions below the 24-hour standard for particulates.

Additional Monitoring:

54. ZMI must add the following water quality monitoring wells and stations to the mine wide water resources monitoring program presented in Section 2.5.3 of the Final EIS, those described by Appendix A of the Final EIS, and those required by the Consent Decree. Installation of these new groundwater monitoring wells and surface water monitoring stations must be initiated within 90 days of issuance of the amendments. Monitoring wells must be located as specified, recorded, and summarized in the field inspection reports by DEQ and BLM on May 15, 1996, and again on September 19, 1996.

a) ZMI must install a deep bedrock monitoring well northwest of the Ross Pit at the Zortman Mine on the ridge immediately west of Ross Gulch near the Pink Eye Pearl adit, or, if rock on the ridgetop is not competent, near the adit next to the drainage bottom.

b) ZMI must install a deep bedrock monitoring well north of the Zortman pit complex above Glory Hole Gulch, near the Lower (northernmost) Badger Adit.

c) ZMI must install a bedrock monitoring well north of the Zortman pit on the north side of the confluence of Glory Hole Gulch and Lodgepole Creek. This location is approximately 200 feet west of the Z-6 spring.

d) ZMI must maintain or replace the bedrock monitoring well south of the Zortman pit at the base of the removed Alder Gulch waste rock dump.

e) ZMI must install a deep bedrock well in the Narrows Fault Zone north of the Landusky pit complex above King Creek. This well may be located either at the

road turnout or in a reopened exploration road just uphill from the main mine access road in King Creek.

f) ZMI must install a deep bedrock well in the Suprise Shear Zone above Swift Gulch.

g) ZMI must install a deep bedrock well in the Gold Bug Shear Zone near the northeast corner of the Queen Rose Pit above Swift Gulch.

h) ZMI must install an alluvial and bedrock monitoring well pair northeast of the Landusky pit complex in the upper reaches of King Creek downstream from L-5 below the confluence of two tributaries, and upstream of the old tailings dam.

i) ZMI must locate a surface water monitoring station approximately 1/4 mile downstream of the confluence of Lodgepole Creek with Ross Gulch, north of the Zortman pit.

j) ZMI must install a bedrock monitoring well near existing surface monitoring station L-12.

k) ZMI must locate a surface water monitoring station in the mainstream of Montana Gulch where it enters the BLM campground.

l) ZMI must locate a surface water monitoring station in South Bighorn Creek at the boundary of the Fort Belknap Indian Reservation.

m) ZMI must locate a surface water monitoring station in Swift Gulch just upstream of the confluence with South Bighorn Creek.

n) ZMI must locate a surface water monitoring station in Swift Gulch upstream of where spring L-20 contributes flow and below the Gold Bug Shear Zone.

o) The wells to be installed north of the Zortman pit described above in a), b), and c) must be completed below the projected elevation of which the backfilled pit will flood, or in the first water bearing zone, whichever is deeper. ZMI must sample the monitoring wells in paragraphs a) and b), to be installed north of the pit, on a monthly basis for at least 6 months prior to expansion of mining in this area to establish the baseline for these well locations.

p) For all new groundwater wells, the screened interval is to be as small as practical and placed such that it does not connect individual hydrostratigraphic units. Wells must be developed so that initial groundwater monitoring samples are representative of the aquifer. Completion reports for these wells must be provided to the agencies within 60 days of construction to verify compliance with this stipulation.

The additional monitoring locations are necessary to evaluate water quality impacts and to provide information that will assist in directing remediation should it become necessary. An additional alluvial well in Lodgepole Creek at the confluence with Glory Hole Gulch was proposed in the Final EIS. However, examination of the site shows an alluvial well is not warranted as the alluvium is not very thick at this location and is confined to within the creek banks. Adequate data can be collected by the existing surface monitoring sites. A new surface water monitoring station was proposed in the Final EIS to be located in the tributary to Montana Gulch downgradient of the Landusky 83 leach pad. Examination of the site shows that a groundwater monitoring well will be more effective at this location (near L-12) as ephemeral surface flow conditions make consistent sample collection unreliable.

55. ZMI must sample all groundwater monitoring wells and surface water monitoring stations at least four times per year (quarterly) using an independent consulting service and monthly for April, May and June. ZMI must analyze these samples for the full suite of water quality parameters shown in Table 2.5-18 of the Final EIS. If requirements and detection limits under state law change, DEQ and BLM may change the required parameters. If a surface water monitoring station or groundwater monitoring well is found to be dry during five consecutive sampling events, alternative monitoring wells or stations are to be installed to provide consistent sample recovery.

    The increased monitoring frequency is to provide more continuous coverage to evaluate changes in water quality conditions, especially during spring runoff when increased flow volume occurs. Monitoring stations that cannot provide consistent sample recovery must be replaced in order to accurately evaluate water quality conditions.

56. ZMI must continually monitor the placement of waste rock according to its acid generating potential. Information on the waste rock lithology and its classification (required in Stipulation 7) must be maintained for each lift of the waste rock repositories, underdrains, or backfill. ZMI must submit quarterly reports to the agencies tracking waste rock placement and include maps in its annual reports that show the location of each waste category within the new constructions. ZMI shall submit reports more frequently if the agencies determine, based on monitoring, that more frequent reporting is necessary.

    This will allow the agencies to verify on the ground compliance with the rock placement restrictions and to locate the likely contaminant source should problems develop later at a particular site.

57. ZMI must expand the Reclamation Surface Performance Study to include monitoring of the seepage rates and concentrations from the base of mine waste units. This monitoring is to be conducted on a frequency adequate to develop long-term hydrographs for each site (Ruby Gulch, Alder Spur, King Creek, Montana Gulch, Mill Gulch and Sullivan Creek). This program must be implemented within 90 days of issuance of the

amendments. Flow data must be submitted monthly. Hydrographs must be submitted with the annual water resources report for each mine facility discharge.

The hydrographs are to be used to calculate response time to high runoff events, evaluate performance of the reclamation covers at limiting infiltration, and to predict opportune sampling times.

58. ZMI must submit a reclamation monitoring plan to the agencies within 120 days of issuance of the amendments that provides for monitoring of surface reclamation performance. This monitoring plan must include methods and techniques that will be used to monitor the performance of the reclamation covers, revegetation success and permanence, and erosion control measures. The plan must provide that reclaimed areas will be monitored for rilling, gullying, and excessive erosion which endangers the overall performance of the reclamation objectives. The monitoring program must include response actions that would be taken should monitored soil loss exceed 2 tons per acre per year, or should excessive rills or gullies develop (see Stipulation 20). The monitoring program must include yearly surveys of revegetation conditions until the agencies have approved final closure and released the mine reclamation bond.

    This monitoring program is needed to track actual performance of the reclamation with the stipulated reclamation objectives. It provides an evaluation mechanism to determine when release of the reclamation bond is appropriate and to identify reclamation problems that need remediation.

59. Within 180 days of issuance of the amendments, ZMI must submit a monitoring program for operation and maintenance of the LAD areas. This program must be accepted by the agencies as satisfying the requirements of this stipulation prior to initiating land application. ZMI's plan must include the following elements:

    a) Analysis of barren solution prior to treatment to determine optimum hydrogen peroxide rates.

    b) Analysis of treated solution prior to and during land application to determine the solution volume that will not exceed optimum metal attenuating capacity of the soil and that contaminant concentrations are below levels toxic to vegetation.

    c) Installation of lysimeters at varying depths in the land application area and collection of pore water samples for chemical analysis to document metal attenuation.

    d) Collection and analysis of LAD area soils to monitor metals loading and changes in soil chemistry.

    e) Monitoring of application rates.

f) Monitoring of land application operations to check for runoff or development of new or increased flow in adjacent springs or seeps.

g) Monitoring of groundwater beneath and downgradient of the LAD area to ensure compliance with Montana's nondegradation requirement.

h) Monitoring of vegetation condition.

60. ZMI must provide final engineering "as built" reports for the Goslin Flats leach pad, the 87/91 leach pad, the Zortman pit/waste rock repository, the Landusky Gold Bug waste rock repository, and the backfilled Landusky pit/Montana Gulch construction to the agencies within 180 days after completion of construction of such facility.

These reports are to verify that the facilities have been constructed as permitted and meet applicable stability requirements.

61. ZMI shall provide DEQ with securities having a stated value at maturity in 2017 of $15 million (US $) according to the following schedule:

On or before December 1, 1996, permitted securities with a stated value at maturity of not less than 3.3 million dollars ($3,300,000);

On or before December 1, 1997, permitted securities with a stated value at maturity of not less than 3.2 million dollars ($3,200,000);

On or before December 1, 1998, permitted securities with a stated value at maturity of not less than 3.0 million dollars ($3,000,000);

On or before December 1, 1999, permitted securities with a stated value at maturity of not less than 2.8 million dollars ($2,800,000);

On or before December 1, 2000, permitted securities with a stated value at maturity of not less than 2.7 million dollars ($2,700,000);

For purposes of this stipulation, permitted securities are United States Treasury zero coupon bonds with maturity dates between January 1 and December 31, 2017, and agency zero coupon bonds that are backed by the full faith and credit of the United States and that have maturity dates between January 1 and December 31, 2017. ZMI may comply with this stipulation by placing these securities in trust for the benefit of DEQ in accordance with this schedule, provided that the terms of the trust are acceptable to DEQ.

For the purposes of documenting that the conditions for termination of the trust have been met, ZMI must continue geochemical monitoring to the extent necessary to

document that geochemical rates of change, in the specific facility being evaluated, have, following correlation with regional climatic data, stabilized for 10 or more years, concurrent with the compliance of captured untreated waters with appropriate state and federal water quality standards. The 10-year requirement may be modified by the agencies if modeling of climatic data indicates a more appropriate hydrologic cycle should be used to assess long-term compliance.

This stipulation is to ensure the establishment of a trust fund for any long-term water treatment that may be associated with Task 1 as described below under Reclamation Bond

Implementation

These decisions are effective upon signing of the Operating Permit Amendments and the approval of the Plans of Operations by DEQ and BLM, respectively. Surface disturbing activities may be implemented by ZMI upon receipt by DEQ of the reclamation performance bond for the amount established by DEQ and BLM.

Approval of the modified Plans of Operations for the Zortman and Landusky mines by BLM does not constitute a determination regarding the validity or ownership of any unpatented mining claim involved in the mining operations. Similarly, approval of the permit amendments by DEQ and BLM does not convey or create any real property rights or use rights.

These approvals do not constitute authorization to discharge pollutants to state waters as defined in the Montana Water Quality Act, Title 75, Chapter 5, nor do they authorize a mixing zone as defined in ARM Title 17, Chapter 30. Those require separate authorizations from DEQ.

ZMI is responsible for obtaining any property rights, easements, mineral rights or water rights necessary to implement the selected alternative. ZMI is responsible for obtaining any other local, state or federal permits, licenses or reviews that may be necessary to implement the selected alternative.

The limestone that is to be quarried for construction and reclamation purposes is not a locatable mineral under the United States Mining Laws, but is a common variety material. ZMI must complete a mineral material sale contract with the BLM for the limestone on public lands at both the Montana Gulch and LS-2 limestone quarry sites where the right to use that common variety material is determined not to be provided for under the Mining Law. While the EIS does address the environmental impacts of limestone mining, this material may need to be obtained by purchase from the United States.

During implementation of this decision, the operator may propose waivers, exceptions, or modifications to the mining and reclamation plans, and associated stipulations or conditions. Such changes may be appropriate to provide for the use of alternate mitigation technologies that could be developed in the future, or to respond to an improved understanding of site conditions

gained through operational experience.

Any change proposed to the operating procedures, scheduling, reclamation design, or mitigating measures will be reviewed by the agencies and accepted if it were to provide equal or greater resource protection than the original requirement, and does not result in significant impacts previously unidentified in the EIS. Proposed changes which would not achieve the same level of resource protection, or would result in previously undisclosed significant impacts, would require supplemental analysis under NEPA and MEPA prior to determining their acceptability.

Reclamation Bond

A reclamation bond is to be posted and maintained at a level adequate for the agencies (BLM and DEQ) to implement the reclamation plans as stipulated above should ZMI be unable or unwilling to do so. This includes costs associated with the Water Quality Improvement Plans in Appendix A of the Final EIS and the Compliance Plan agreed to in the Consent Decree. The reclamation bond may be incrementally posted or released to reflect stages of mine development and performance of concurrent reclamation requirements, but shall always remain at an amount adequate to pay for the reclamation of any disturbances that may exist. The entire reclamation cost estimate will be reviewed and adjusted by the agencies at least every 5 years to account for changes in reclamation costs and inflation. The reclamation bond does not represent the limits of the operator's liability should actual reclamation performance not meet the requirements in the reclamation plan or comply with environmental laws.

The reclamation bond amount has been calculated based upon the requirements of the selected alternative. The total reclamation costs for both the Zortman and Landusky mines, including provisions for long-term water treatment, have been calculated at approximately $67.3 million.

The bond amount has been arrived at after considering five general categories of tasks to be performed.

Task 1 is water capture and treatment. This task includes costs associated with construction and maintenance of the water capture systems, water treatment plants, monitoring, and contingency actions necessary to ensure long-term water treatment after mine closure. The cost for this task is calculated at $32.3 million. These costs also include mobilization, engineering and redesign, administration and inflation for the first 5-year period. The reclamation bond for Task 1 is subject to administration per provisions of the Consent Decree entered September 27, 1996, between EPA, the State of Montana, ZMI, the Fort Belknap Community Council, and Island Mountain Protectors.

Task 2 is leach pad reclamation. This includes leach pad rinsing for detoxification, regrading, placement of the reclamation covers, and revegetation. The cost of Task 2 is calculated at $14.0 million.

Task 3 is reclamation of the waste rock facilities. This includes costs for regrading, placement of the reclamation covers, and revegetation. The cost of Task 3 is calculated at $4.9 million.

Task 4 is reclamation of the mine pits. This includes partial backfilling at the end of mining, grading of pit floors, construction of drainages, placement of the reclamation covers, and revegetation. The cost of Task 4 is calculated at $4.2 million.

Task 5 is reclamation of roads and support facilities. This includes recontouring of access and haul roads, demolition and removal of structures and equipment, and general revegetation of areas disturbed by these facilities. It also includes the costs for construction of the replacement wetlands. The cost of Task 5 is calculated at $3.0 million.

The subtotal for Tasks 2 through 5 is $26.1 million. Added to the subtotal are costs for mobilization at 1 percent ($0.3 million); engineering and redesign at 2 percent ($0.5 million); administration at 15 percent ($3.9 million); and inflation for the first 5-year period at 3 percent per year ($4.2 million).

This brings the total estimated cost for Tasks 1 through 5, including administrative and contingency costs, at both mines, to $67.3 million.

The above calculations are available in detail from DEQ or BLM.

Issues and Alternatives

Public Scoping and Comment

Extensive public involvement efforts were used for EIS scoping and during the Draft EIS comment period to identify and address relevant environmental issues. A Notice of Intent, formally announcing the beginning of the EIS process, was published in the Federal Register in November 1992. The public has been informed of, and involved in, the EIS process through additional Federal Register notices, news releases, direct mailings, and public meetings. Throughout the process, briefings were held with interested publics, the Fort Belknap Community Council, the Phillips County Commissioners, State Legislators and Congressional staffs.

To identify issues and concerns associated with the proposed action, public scoping meetings were conducted in the following communities:

- Dodson, December 15, 1992
  (26 people attended)
- Malta, December 16, 1992
  (39 people attended)
- Hays, December 17, 1992
  (27 people attended)
- Lodgepole, April 15, 1993
  (30 people at the afternoon meeting)
  (75 people at the evening meeting)

Advance notification of the meetings was provided through press releases, mailed notices, and public service announcements. Copies of ZMI's application were available in Harlem, Malta, Lewistown, Billings, and Helena for public review and summaries of the proposal were provided to the mailing list.

In November 1993, an environmental assessment on corrective measures for the Landusky Mine was released for public comment and a public meeting was held in Dodson, Montana. In March 1994, the agencies decided to combine analysis of the Landusky Mine corrective measures with the Zortman Mine EIS process. In April 1994, a Federal Register Notice was published and a letter that formally expanded the scope of the EIS to include the mining plans and modified reclamation plans at both mines was sent to the public.

Oral and written comments were used to prepare the Public Scoping Issues Report (October 1993) for the Zortman Mine Expansion EIS, and the Report Addendum (May 1994) for the Landusky Mine.

On August 18, 1995, the Draft EIS was issued for the *Zortman and Landusky Mines Reclamation Plan Modifications and Mine Life Extensions*. The Draft EIS presented seven alternatives including the no action alternative, the agencies' preferred alternative (Alternative 7) and the company proposed action (Alternative 4). The Draft EIS disclosed the affected environment and the environmental consequences of each alternative.

The Draft EIS was issued with an invitation to interested parties to submit oral and written comments. About 400 copies of the Draft EIS were distributed to the public and other federal and state agencies. The public comment period on the Draft EIS extended from August 18, 1995, through November 1, 1995.

Five open houses/public hearings were held in the following communities to receive oral and written comments on the Draft EIS:

- Medicine Bear Lodge in Lodgepole, September 18, 1995
  (129 people attended with 47 speakers),
- John Capture Center in Hays, September 19, 1995
  (153 people attended with 40 speakers),
- Guard Armory in Malta, September 20, 1995
  (186 people attended with 22 speakers),
- Community Hall in Landusky, September 21, 1995
  (108 people attended with 14 speakers), and
- East Middle School in Great Falls, September 26, 1995
  (280 people attended with 77 speakers)

Prior to the beginning of each hearing (except for the meeting in Great Falls) there was a 2-hour open house where the EIS Team specialists (geologists, hydrologists, mining engineers, archaeologist, wildlife biologists, and reclamation specialists) answered questions about the EIS and discussed the project impacts with the public. During the hearing, speakers were given 5-minutes to make comments. Individuals that exceeded 5-minutes were allowed additional time to continue their remarks after all speakers had been given an opportunity to comment. All participants were encouraged to submit written comments. These meetings were also a forum for the Army Corps of Engineers to collect public comments on ZMI's 404(b)(1) permit application for the Zortman and Landusky mine expansions and for DEQ to collect comments on the 401 certification. Written transcripts of the meetings were compiled in order to address and respond to comments in the Final EIS. In addition, 368 written comment letters were received by the agencies on the Draft EIS.

Concurrent with public involvement during EIS preparation, were public involvement efforts under Section 106 of the National Historic Preservation Act to identify and consider the effects of the undertaking on historic properties eligible for listing on the National Register of Historic Places. This process focused on the Little Rocky Mountains as a Traditional Cultural Property due to its association with Native American traditional cultural values and practices. Also, consultation under the American Indian Religious Freedom Act was conducted to collect and consider the views of Native Americans. Public involvement included soliciting input from Native Americans regarding location and frequency of use of religious sites, and suggestions for

mitigation of impacts to traditional cultural locations and practices. Many one-on-one discussions between BLM and Native American traditionalists were conducted. Often this included field visits to sites/areas of cultural significance. Direct input was solicited by BLM from tribal elders, traditionalists and political leaders. Over 50 individuals were interviewed for an ethnographic study used in EIS preparation. In addition to the five public meetings held on the Draft EIS, nine public meetings were held specifically to discuss the Little Rocky Mountains as a Traditional Cultural Property and to develop mitigation for impacts to traditional cultural resources. In July 1995, staff from the Advisory Council on Historic Preservation toured the project area and attended three of the meetings held to receive public input on a draft Programmatic Agreement.

All written and oral comments received on the Draft EIS were reviewed and considered in preparation of the Final EIS. Comments that presented new data, questioned facts or analysis, or raised questions or issues bearing directly upon the alternatives or environmental analysis are responded to in Sections 6.1 through 6.17 of the Final EIS. Comments expressing personal opinions or statements have been considered but not responded to directly. The EPA Notice of Availability for the Final EIS was published in the Federal Register on April 5, 1996.

Issues and Alternatives Development

A complete description of the issues identified through the public involvement process is presented in Section 1.7 of the EIS. A summary of the issues and concerns identified by the public which have been addressed in the EIS includes:

- Impacts to Native American traditional cultural values
- Protection of cultural resources
- Water quality and water supply concerns
- Acid rock drainage issues
- Wildlife protection and mortalities
- Protection of vegetation and wetlands
- Soil characteristics and reclamation issues
- Impacts to geology and mineral resources
- Noise and air quality issues
- Socioeconomic concerns
- Recreational issues and concerns
- Visual and aesthetic impacts and concerns
- Concerns regarding land use and recreation
- Safety hazards from transportation of hazardous materials
- Concerns with effects on human health
- Engineering concerns and potential impacts to human health and environment
- Environmental policy and planning issues
- Possible alternatives to the proposed action

The issues are grouped in six general categories: ARD/Water Resources, Soil and Reclamation,

Wildlife, Wetlands, Native American Traditional Cultural Values, and Socioeconomic Considerations. A description of how the significant issues were used in the development of alternatives is presented below.

ARD/Water Resources

Existing and potential future water quality problems at the mines, and the litigation regarding compliance with the Montana Water Quality Act and the Federal Clean Water Act is a significant issue. Compliance with these acts is a statutory requirement under any alternatives that are developed. There are different approaches available that may be used to promote protection of water quality and achieve compliance with the water quality laws. These formed the basis for alternative development.

The main water quality issue is degradation caused by acid rock drainage (ARD). There are three possible approaches to mitigating ARD; these are: 1) control of the acid generation process, 2) control of migration of acid drainage, and 3) the collection and treatment of acid drainage. The first two are collectively termed "source control." The third is called "capture and treatment" or "active treatment." Alternative degrees of reliance upon either source control, active treatment, or combinations of the two, were considered in the EIS. Approaches to classification of mine material as to its acid-generating potential, sorting and placement of this material, management of runon and runoff waters, types of reclamation covers and the location and design of water capture and treatment facilities were all factors used to develop alternatives that addressed water quality concerns.

Soil and Reclamation

The agencies had previously determined that the existing surface reclamation plans were inadequate for materials with acid-generating potential. Alternatives were developed to consider possible types of reclamation covers and slope configurations necessary to (1) limit the loss of cover soil due to erosion, (2) enhance revegetation, (3) minimize surface disturbance, (4) facilitate drainage of runoff, (5) minimize infiltration of precipitation into the underlying mine waste (which might result in ARD), and (6) function in the long-term post-reclamation environment with minimal maintenance. Alternatives evaluated included the use of the existing reclamation covers, the use of reclamation covers proposed by ZMI, the use of modified ZMI covers, and the use of several water barrier and water balance covers developed by the agencies with the assistance of third-party consultants.

Pit backfilling for reclamation is an issue. Pit reclamation scenarios considered in the EIS range from complete pit backfilling (See EIS Section 2.2.5) to reclaiming the pits in their current configurations. Pit backfilling was included in an alternative to the extent it mitigated other environmental issues, such as the need to dispose of mine materials, the need to direct runoff away from the pit areas so as not to accumulate ponded water that would infiltrate through acid-

forming material impacting groundwater, the need to cover potentially acid-generating surfaces, and the need to mitigate visual or aesthetic impacts.

Alternatives involving complete mine pit backfilling or large amounts of pit backfilling were considered in the EIS and eliminated from detailed analysis for several reasons. An economic screening showed that substantial amounts of pit backfilling would make the entire project uneconomic and hence it would not be implemented even if it was selected. It is therefore the same as one of the non-expansion alternatives which were analyzed in detail. The key technical issues in mine pit reclamation (waste rock placement, seepage water quality, and runoff control) are addressed by partial pit backfilling analyzed in Alternatives 3 through 7. It is also not technically feasible to completely backfill all mined material into the pit due to the swell factor of material once mined and the inability to replicate pre-mining slope configurations that are stable. In addition, there are increased environmental impacts associated with complete pit backfilling such as added dust and dust suppressant use, exhaust, noise, and fuel consumption from backfill equipment operation, and increased potential for public safety concerns with traffic through Zortman. For these reasons alternatives involving large amounts of pit backfilling were not considered to be reasonable alternatives to the proposed action and were not analyzed in detail.

Wildlife

Significant issues associated with wildlife include possible impacts to the bats of Azure Cave, wildlife and migratory bird mortality by process solutions, disruption of big game migration routes, and loss of habitat. The following alternatives address these issues.

Alternative 5, which relocates the leach pad and does not include use of a conveyor for ore transportation has been included in the EIS in order to address possible disruption of Bighorn Sheep migration, to avoid impacting a water source used by bats and other wildlife, and to avoid the Azure Cave area. Other alternatives considered include mitigation such as replacement of what is possibly a primary water source for bats and other wildlife that would be disturbed by leaching on Goslin Flats.

Netting and fencing of open cyanide solution to prevent wildlife and migratory bird mortality is contained in the Company Proposed Action. No alternative wildlife control technologies for these facilities were considered in the alternatives because application of the proposed mitigation reduced wildlife impacts to insignificant.

The limiting wildlife habitat factor in the Little Rocky Mountains is the lack of forage found in open parks and meadows. Alternative reclamation plans which focus on enhancing open parks and meadows in a post-mining environment have been considered. This involves limiting the amount of trees used in revegetation and emphasizing grasses, forbs, and shrubs.

Wetlands

Issues associated with disturbance and placement of fill by past, present and possible future mining operations in waters of the U.S. were used to develop alternatives. Alternatives that involve replacement of wetlands in the Goslin Flats area at various locations are considered. Alternatives that involve restoration of areas impacted by historic mining, as compensation for mine impacts to waters of the U.S., were also included in the EIS. An alternative (Alternative 5) which involves negligible additional disturbance of wetlands for mine expansion was included. An Aquatic Ecosystem Mitigation Plan has been included in the Final EIS (Appendix F) to address all past, present and potential future impacts (both direct and indirect) to wetland and non-wetland waters of the U.S.

Native American Traditional Cultural Values

Issues related to Native American traditional cultural values include the effects of mining on the Little Rocky Mountains which are eligible for listing on the National Register of Historic Places as a Traditional Cultural Property. In addition, Traditional Native Americans regard the Little Rocky Mountains as sacred. Practices such as vision questing, sundances and gathering of traditional plants occur in the range. On-the-ground inventory and consultation with Native Americans did not reveal any specific religious sites or gathering areas that would be directly impacted by the proposed action. Still, the Little Rocky Mountains as a whole are considered sacred, and any mining activity is regarded by some individuals as desecration which cannot be mitigated.

In addition to the mandatory No Action Alternative, non-mine expansion alternatives have been formulated, in part, to respond to this issue. These alternatives consider various approaches to final reclamation of existing mine facilities without any additional mine expansion. Other expansion alternatives include mitigating measures which address impacts to resources that contribute to the sacredness of the Little Rocky Mountains. These include measures to limit disturbance extent, limit visual intrusion, improve water quality, and promote long-term reclamation success.

Since some individuals consider mining by any means as a desecration that cannot be mitigated, there are no mine expansion alternatives that would completely resolve this issue. However, alternatives that address the environmental components of air quality, water quality, vegetation, wildlife, etc. which contribute to the sacredness of the Little Rocky Mountains have been developed. A Programmatic Agreement (FEIS, Appendix E) under Section 106 of the National Historic Preservation Act has been developed that includes measures to mitigate impacts to the Traditional Cultural Property by preservation of historic and traditional associations through recordation. This mitigation is part of the various mine expansion alternatives. This Programmatic Agreement also provides mitigation to the historic mining sites and an archaeological site that would be impacted by the expansion alternatives.

Social and Economic Considerations

Concerns expressed by the public over both the environmental degradation and the loss of economic benefits from mining were used in the development of alternatives.

Alternatives are considered that involve no additional mining and focus on reclaiming the existing impacts of mining in the Little Rocky Mountains. These alternatives address the concerns of those who feel that the environmental effects of mining in this area are not acceptable.

Conversely, alternatives which provide for expanded mining have been developed. This addresses the concerns of those who feel that the environmental impacts of mining are acceptable in exchange for the continued economic benefits. These alternatives also recognized the mineral development rights of the landowners and mining claimants.

Alternatives which attempt to balance mineral development needs and rights with environmental protection requirements have been developed. These alternatives involve some of the more intensive applications of mitigating measures, yet would allow for expanded mining. These include alternative facilities locations, improved plans for reclamation, set performance criteria, offsite mitigation and enhanced water management.

Alternatives Considered in Detail

A summary of the alternative project components considered, and the rationale for their inclusion or exclusion from detailed analysis, is presented in Table 2.2-1 of the Final EIS. The following seven alternatives were retained for detailed analysis in the EIS:

Non Mine Expansion Alternatives

Alternative 1: No Action, Existing Reclamation Plans

Alternative 2: ZMI Proposed Modified Reclamation Plans

Alternative 3: Agency Mitigation Added to ZMI Proposed Modified Reclamation Plans

Mine Expansion Alternatives

Alternative 4: ZMI Proposed Mine Expansions and Modified Reclamation Plans, *Company Proposed Action*

Alternative 5: Mine Expansions and Modified Reclamation Plans With Agency Mitigation, *New Leach Pad in Upper Alder Gulch*

Alternative 6: Mine Expansions and Modified Reclamation Plans With Agency Mitigation, *Zortman Waste Rock Disposal at Ruby Flats*

Alternative 7: Mine Expansions and Modified Reclamation Plans With Agency Mitigation, *Zortman Waste Rock Disposal Site Overlies Existing Disturbances*

Chapter 2 of the Final EIS contains a complete description of these alternatives. Tables 2.2-2 and 2.2-3 in the Final EIS summarize the major components of each of the seven alternatives. Table 2.3-1 in the Final EIS summarizes the environmental impact of the seven alternatives.

Environmentally Preferred Alternative

Alternative 3 is the environmentally preferred alternative. This alternative, as well as Alternatives 1 and 2, would avoid the impacts associated with expanded mining operations. In addition, Alternative 3 would utilize reclamation measures to restore lands that have been disturbed by past mining. These reclamation measures are superior to those contained in Alternatives 1 or 2 and would result in long-term reclamation success.

Rationale for the Decisions

Alternative 7, the preferred alternative identified in the Final EIS, has been selected by BLM for implementation. A mine expansion alternative has been chosen to address the operator's mineral development proposal in accordance with private property rights, public land law, and agency land use plans. All practical means to avoid or minimize environmental harm have been included in the selected alternative. Modified reclamation covers have been selected to enhance the potential for long-term reclamation success and reduce the potential for surface water to infiltrate into reclaimed facilities. These measures, together with other mitigation, are used to address existing environmental problems, prevent unnecessary or undue degradation, and provide for comparable stability and utility of mined lands with adjacent areas. However, some impacts are unavoidable. This is the case for resource components such as aesthetics, soils, vegetation, and Native American traditional cultural values.

Alternative 7 has been chosen by DEQ after considering the positive and negative impacts of all alternatives. DEQ has determined that Alternative 7 minimizes the adverse environmental impacts while preserving the beneficial socio-economic impacts of the proposal. DEQ recognizes that certain impacts are not avoided by Alternative 7. These impacts are listed above. DEQ has determined that these impacts can be avoided only by implementation of Alternative 3. Although there are positive impact which result from Alternative 3, DEQ has not chosen this alternative because the positive socio-economic impacts of the proposal are not preserved.

How the Selected Alternative Addresses the Issues

ARD/Water Resources

Alternative 7 has been selected because it includes an optimal combination of source control to prevent contamination from developing, migration control to limit the movement of degraded water, and water capture and treatment to supplement the first two control measures while preserving the positive aspects of the proposal. This multiple approach to water quality management has greater reliability than use of a single mitigation technique.

The geochemical criteria for identification of non-acid generating rock have been developed based upon the analysis of thousands of geochemical tests (Final EIS, Section 3.2.2). The multiple geochemical criteria in the selected alternative decrease the chances of misclassification of material compared to use of a single criterion as proposed in Alternative 4, the Company Proposed Action. These criteria provide for the identification of rock with low risk of acid formation and provide for accurate identification of material suitable for use in reclamation. Equally important, these criteria provide for identification of material with moderate to strong acid-forming potential. Such material is then selectively placed to limit its ability to acidify at a rate which would release unacceptable levels of contaminants to area waters.

Migration of acid products formed within mine waste is limited by the amount of water that

enters the waste and thus is available for flushing of reaction products. Water availability is minimized by diverting runon water away from disturbance areas, and by construction of surface reclamation covers which provide long-term stability and promote evapotranspiration of precipitation, thus limiting infiltration.

Seepage which does discharge from reclaimed mine waste units will be collected and controlled using recovery wells, holding ponds, and other capture systems. This seepage will then be treated, if necessary, to meet the effluent limitations in the discharge permits, and released.

By using this system of mine waste isolation, restriction of water infiltration, and seepage capture and treatment, the majority of mine waste water will be captured and treated, thus water quality standards will be met. Though there is always the possibility of a system upset or failure, the risk to water resources is minimal, and the approach is reasonable and prudent.

These same mitigation technologies also minimize the potential for impacts to groundwater. ARD discharges to groundwater are minimized by diverting runon waters, limiting infiltrating waters, and preventing the release of untreated water to surface drainages that may recharge the groundwater systems.

Adequate information regarding water resources has been an issue. It must be noted that though a groundwater study is included in the recent settlement of water quality litigation in order to resolve the lawsuit, this additional groundwater information is not needed to make a decision regarding the reclamation and mine expansion plans. The thousands of water quality analyses collected from the hundreds of monitoring sites over the past 17 years have provided adequate information on groundwater resources for the agencies to characterize resource conditions, evaluate alternatives, assess potential impacts, and develop mitigation. The only additional groundwater data requirements identified relative the proposed mining and reclamation plans are for the purpose of monitoring potential impacts.

The current groundwater system beneath the mine pits discharges mainly to the south. Data collected from the groundwater and surface water monitoring stations since modern mining began does not show significant groundwater contamination migrating northward and discharging in northern drainages. Since expansion of the mine pit at Zortman will move the perimeter of the pit northward, and will deepen the pit to beneath the water table, additional surface and ground water monitoring in the pit area is warranted to verify that expanded mining does not result in groundwater contamination in the northern drainages.

The selected alternative does not result in significant reductions in flow volumes in drainages which eventually enter the Fort Belknap Indian Reservation. Concurrently, this alternative protects water quality in northern drainages by relocating the limestone quarries south of the divide and routing all post reclamation runoff from the mine pits to southern drainages.

Soil and Reclamation

Alternative 7 has been selected because the amount of total disturbed acreage for mine expansion is minimized. This alternative also provides for a reclamation cover with long-term stability and preserves positive aspects of the proposal. By relocating the proposed waste repository over an existing disturbance, the selected alternative will disturb approximately 200 acres less than the Company Proposed Action. Reduced disturbance not only limits the direct impacts to soils and vegetation, but also the amount of reclamation materials that require transport and handling, thus reducing secondary impacts such as noise, dust and equipment emissions. Relocation of the waste rock repository also confines water management to a smaller area and thereby promotes operational efficiencies and limits the number of potentially affected drainages should an undesirable event occur.

The reclamation cover designs in the selected alternative are superior to those originally proposed by ZMI for several reasons. One reason is that no compacted clay is used in construction of the selected reclamation covers. The long-term permeability of clay can increase due to damage from freeze-thaw cycles and desiccation cracking due to drying, allowing infiltration of water into the underlying mine waste. The use of the geosynthetic clay layer (GCL) in the selected alternative, instead of compacted clay, requires less intensive quality control measures during installation and is not as susceptible to frost damage or desiccation. The GCL does not require clay mining in the immediate vicinity. This avoids cumulative dust, noise, and exhaust emission impacts associated with the thousands of haul trips to deliver the clay. It also alleviates safety concerns associated with hauling clay through the communities of Zortman and Landusky.

The selected reclamation covers use a thicker agricultural layer. This will promote long-term revegetation success and lower soil loss rates. The 2-ton per acre per year soil loss limit and the 90 percent revegetation cover requirement will ensure a stable reclamation surface suitable for return to natural plant succession processes. The lower slope angles with constructed benches improve the overall stability of the reclaimed facility and reduce potential for rilling or gullying which can breach reclamation covers.

The spread of noxious weeds will be controlled. ZMI has a Noxious Weed Control Plan approved by Phillips County in 1991 (See Appendix 15, ZMI Plan of Operations).

Wildlife

The BLM consulted with the U.S. Fish and Wildlife Service (FWS) for the selected alternative. The FWS concurred with the determination of no adverse effect to the species identified (bald eagle, peregrine falcon, black-footed ferret, and piping plover), and notified the BLM that formal consultation would not be required.

The selected alternative includes the construction of the conveyor system. One issue of concern was how this may impact big game migration and specifically bighorn sheep. However, the

analysis concluded that bighorn sheep in the Little Rocky Mountains are non-migratory, and only seasonal, short distance (3-5 miles) movement occurs primarily in the area west of the conveyor route. Bighorn sheep in the Little Rocky Mountains have acclimated to mining operations and have adopted the existing mine sites as "safe havens" from hunting and poaching. It is estimated that more than 90 percent of the observations of bighorn sheep occurs west of the conveyor route and bighorn sheep habitat will be minimally fragmented and few movement corridors will be blocked by the conveyor. The densities of other large ungulate wildlife, which may be impeded by the conveyor and the associated four-strand fence, are generally low in the location of the conveyor. These impacts are acceptable as they will not significantly affect the bighorn sheep or other wildlife populations.

The selected alternative includes netting of process ponds to reduce wildlife (bird and bat) mortality. Fencing height will be raised to 8-feet to prevent other wildlife from accessing process ponds and seepage collection ponds.

Azure Cave is located to the west of the Goslin Flats leach pad site. This cave is a hibernaculum for several species of bats. Impacts to the bats from the conveyor and leach pad operations will not be significant. Construction of the new leach pad on Goslin Flats will include draining and filling of two small livestock watering ponds. These ponds may be an important water source for area wildlife, especially for the bats that roost in Azure Cave. The selected alternative includes construction of a replacement water source in upper Goslin Gulch, close to Azure Cave, that will mitigate the loss of the existing ponds.

Since a limiting factor for wildlife in the Little Rocky Mountains is lack of forage found in open parks and meadows, the selected alternative will not utilize tree seedlings for general reclamation. Revegetation will consist primarily of grasses, forbs and shrubs to improve wildlife habitat. The post-reclamation vegetation may eventually attain a higher wildlife value than was the pre-mining value. However, the loss of forage during mining is still an irretrievable commitment of wildlife habitat.

Wetlands

The selected alternative will increase the direct and indirect disturbances to wetlands by 1.57 acres and to non-wetland waters of the U.S. by 10.94 acres (Table 4.4-10, Final EIS). However, mitigation plans to replace and restore past, present, and future impacts to wetland and non-wetland waters are part of this alternative. Foraging areas for bats in the wetlands associated with the stock ponds at Goslin Flats will be replaced by construction of other ponds and wetlands in the immediate area. There are no residual significant impacts.

Although Alternative 5 shows the least amount of wetlands directly impacted by a mine expansion alternative (0.05 acres), the Alternative 7 leach pad site, which directly impacts 1.09 acres of wetlands at Goslin Flats, has been selected for implementation. This is for several reasons.

Under Alternative 5, ZMI would construct the leach pad in Upper Alder Gulch. This drainage contains substantial near-perennial to perennial water flow. This flow considerably increases the difficulty of water management, and presents greatly increased risks to water resources. In comparison, surface flow at the Goslin Flats site is ephemeral to intermittent.

The Upper Alder Gulch area shows outcrops of sulfide bearing rock. This makes maintaining water quality difficult since disturbance of the basin for leach pad construction is very likely to result in ARD being released into the drainage upgradient of the aquifers that it recharges. While the Goslin Flat site is underlain by shales which contain sulfides, water quantity is limited and transmissivity through the shales is low, with no downstream recharge areas. In addition, most of the subsoils in the leach pad area are calcareous, providing some buffering of potential seepage.

And finally, there are 27 acres of high value riparian vegetation present in Upper Alder Gulch which would be lost to leach pad construction. This compares to only 9 acres of lesser value riparian vegetation present at the Goslin Flats site in the selected alternative.

Native American Traditional Cultural Values

The selected alternative will have significant adverse impacts to Native American traditional cultural resources and practices. Residual impacts to the Little Rocky Mountains as a sacred landform are unavoidable.

Consultation under Section 106 of the National Historic Preservation Act (NHPA) has been completed for all alternatives with the State Historic Preservation Office, the Advisory Council on Historic Preservation and the interested parties. The Advisory Council on Historic Preservation signed a Programmatic Agreement in November 1995 along with the BLM, SHPO, and ZMI. This constitutes completion of the requirements of Section 106 of the National Historic Preservation Act. The Programmatic Agreement is contained in Appendix E of the Final EIS. The Programmatic Agreement includes Treatment Plans for historic properties, including Native American Traditional Cultural Properties, an archaeological site, and historic mining properties. If previously undiscovered cultural resources are encountered, ZMI must notify the BLM, DEQ, and the State Historic Preservation Office and not proceed until the agencies give approval.

The Programmatic Agreement was developed in consultation with the interested parties. Specific input from Native Americans was elicited regarding location and frequency of use of religious sites, and suggestions for mitigation of impacts to traditional cultural locations and practices.

Attempts by BLM and staff from the Advisory Council on Historic Preservation to ask for suggestions as to "what would make the totally unacceptable even slightly less unacceptable" received only minimal response. The only satisfactory "mitigation" in the view of some individuals consulted is not to approve the mining. However, one suggestion was received; it involves the recordation and preservation of knowledge on traditional plant use. Provisions for

the preservation of knowledge on traditional plant use through documentation, and on other traditional cultural resource topics, are provided for in the Programmatic Agreement.

In conjunction with consultation under the NHPA, consultation under the American Indian Religious Freedoms Act (AIRFA) has also been completed. While the entire mountain range is regarded by Traditional Native Americans as sacred, no specific sites (vision quest sites, graves, sacred plant gathering areas, etc.) were identified that will be directly affected by mine expansion. Mining in the Little Rocky Mountains is regarded as desecration and cannot be mitigated in the view of some individuals, even with reclamation. Thus the agencies are unable to reduce impacts to Native American traditional cultural resources to less than significant.

Recognizing that any alternative which provides for mine expansion will be unacceptable to some individuals, an alternative has been selected that offers some relative advantages when compared to the other expansion alternatives. The selected alternative has the least amount of surface disturbance, provides the greatest probability for long-term reclamation success, avoids potential impacts to water resources by routing runoff from mine areas to the south and away from the Reservation, and has the least amount of haul-truck traffic from the clay pits with the associated noise and visual impacts.

Social and Economic Considerations

This alternative provides for continued mineral development that is an important component of the local and regional economy. The selected alternative will provide jobs, tax revenues, business activity, and community services supported by the mining company.

Despite the added mitigating measures, the selected alternative does not satisfy the individual concerns of many who feel that the environmental effects of mining are not compatible with other land uses. These concerns have been taken into account by BLM to the degree allowed for by federal law and regulation when considering these types of proposed actions. The DEQ has considered these concerns and weighed them along with other impacts and considerations in reaching its decision.

Management Rationale for the Selected Alternative

This section provides the management rationale used to select the alternative for implementation. It is not intended to be exhaustive as to all applicable management constraints, but is intended to explain how the selected alternative satisfies the agencies' major legal, regulatory, and policy mandates.

National Mineral Policy Conformance

The Mining and Minerals Policy Act of 1970, the Federal Land Policy and Management Act of 1976 (FLPMA), and the Natural Materials and Minerals Policy, Research and Development Act of 1980 direct that the public lands be managed in a manner which recognizes the Nation's need for domestic sources of mineral production. Under the Mining Law of 1872 claimants have a statutory obligation to perfect their claims and a right to develop their mineral deposits consistent with applicable environmental laws.

The selected alternative provides for continued domestic mineral production of gold and silver from the Zortman and Landusky mines. The preferred alternative was selected because it provides for the unpatented and patented mining claim holders to develop their mineral deposits consistent with the environmental laws of the State of Montana and the United States, while minimizing environmental impacts.

Prevention of Unnecessary or Undue Degradation

Section 302(b) of FLPMA amended the Mining Law of 1872 and directed the Secretary of the Interior to: "...prevent unnecessary or undue degradation of the lands." Unnecessary or undue degradation was defined in the implementing regulations at 43 CFR 3809 as: (1) surface disturbance greater than what would normally result when activity is being accomplished by a prudent operator in usual, customary, and proficient operations of similar character; (2) failure to take into consideration the effects of the operations on other resources and land uses, including those resources and uses outside the area of operations; (3) failure to initiate and complete reasonable mitigation measures, including reclamation of disturbed areas or creation of a nuisance; and (4) failure to comply with applicable environmental statutes and regulations.

The selected alternative addresses the first requirement by limiting surface disturbance to the smallest area of any of the mine expansion alternatives. Placement of the new waste rock repository at the Zortman Mine mostly over existing disturbance areas reduces potential impacts to soils and vegetation and reduces secondary impacts from transport of reclamation materials. Since these impacts are proportional to the amount of disturbance, they are lowest under the selected alternative of any of the expansion alternatives. Use of the existing leach pad and waste rock repository at the Landusky Mine does not disturb additional acreage. Conducting mine operations under the selected alternative will therefore satisfy the prudent operator requirement.

The selected alternative addresses the second requirement by taking into consideration the effects of the operations on other resources and land uses. The selected alternative includes measures to reduce or avoid impacts to water resources, air quality, wetlands, soils, vegetation, wildlife, visual resources, cultural resources, and social concerns. These measures are described in detail in Chapter 2 of the Final EIS and in the mitigation stipulated as part of this alternative. A brief description follows.

Water resource concerns are addressed by avoiding drainage to the north which is a concern to the residents of the Fort Belknap Reservation, by selective handling of waste rock with acid generating potential, by implementation of the Water Quality Improvement Plan (EIS Appendix A) and the Compliance Plan (from the Consent Decree), and by increased monitoring. These requirements ensure that water quality, quantity, and use are adequately protected.

Air quality effects are considered by limiting truck traffic and concurrent development so as to keep emissions within standards. Monitoring of air quality inside and outside the area of operations is to be continued.

Wetland and non-wetland waters of the U.S. are considered in the aquatic ecosystem mitigation plan. Mitigation includes both restoration of existing impacted drainages and construction of replacement wetlands.

Soils and vegetation are considered through limiting disturbance and use of improved reclamation plans with long-term stability. Thus, post-mining land uses are adequately protected.

Wildlife is concerns are addressed by measures preventing wildlife mortality in process and capture ponds. The revegetation seedmix is focused on improving wildlife forage in the area. Creation of an offsite water source is used to compensate for elimination of a water source in the area of operations.

Visual resource effects are considered by selectively using trees for screening of disturbed areas at reclamation, and by recontouring facilities to meet VRM Class II criteria where it does not interfere with the primary reclamation objectives. Reshaping of the northern portion of the Zortman pit maintains the scenic quality north of the mine.

Historic properties are considered by adopting the treatment plans in the Programmatic Agreement. These plans minimize effects to historic properties both within and outside of the area of operations. This includes impacts to traditional cultural properties utilized by Native Americans and historic, non-Native American, properties.

Adverse social effects are addressed by limiting the number and speed of haul truck trips through the communities of Zortman and Landusky and by providing for intervals without disruptions from blasting that are more conducive to community activities. Thus nuisance effects have been reduced.

Based on the above, the selected alternative satisfies the second requirement for preventing unnecessary or undue degradation by taking into consideration the effects of the operations on other resources and land uses and adopting reasonable mitigations to address the effects.

The selected alternative addresses the third requirement of FLPMA regulations to include reasonable mitigation for adverse impacts by requiring reclamation of lands disturbed by past and future mining. Mitigation is used to reduce most impacts to less than significant. However,

impacts to Native American traditional cultural values, vehicle access to selected areas, visual resources, and noise receptors remain significant (Table ES-11, Final EIS). No reasonable mitigation was available for these impacts and they will remain significant during the life of the mining operations.

The Final EIS has determined that the reclamation plans in the selected alternative will be highly successful at re-establishing natural plant and soil succession in the disturbed areas, at limiting long-term infiltration of precipitation into mine waste, and at maintaining stability of the reclaimed surfaces. These reclamation plans meet Montana and federal requirements, and meet or exceed the performance requirements for reclamation covers used not only elsewhere in the mining industry, but in the hazardous waste/landfill sectors as well. For these reasons the selected alternative satisfies the third requirement for preventing unnecessary or undue degradation by including reasonable mitigating measures and addressing reclamation of disturbed lands.

The selected alternative addresses the fourth requirement for preventing unnecessary or undue degradation by including measures needed to comply with applicable environmental laws and regulations. Specifically, measures to ensure compliance with the water quality laws and wetland protection.

The selected alternative includes measures necessary to address causes of past alleged violations of the Montana Water Quality Act and the Federal Clean Water Act. The selected alternative also includes requirements for ZMI to obtain the necessary N/MPDES permits. These plans are presented in Appendix A of the Final EIS and in the Compliance Plan under the Consent Decree entered on September 27, 1996.

Source controls to limit the generation of ARD from mined materials are included in combination with water monitoring, water capture, and water treatment measures under the selected alternative. These measures will provide for existing operations to meet water quality standards and prevent expanded operations from violating water quality standards. Since the selected alternative includes plans judged to be adequate for achieving and maintaining compliance with the water quality laws, the selected alternative satisfies the fourth requirement for preventing unnecessary or undue degradation.

In conclusion, the expanded mining and modified reclamation plans for the Zortman and Landusky mines in the selected alternative will not result in unnecessary or undue degradation. The selected alternative satisfies the requirements of the Federal Land Policy Management Act.

Land Use Plan Conformance

The majority of public lands in the Little Rocky Mountains are open to operation of the Mining Law in conformance with the Judith-Valley-Phillips Resource Management Plan/EIS. This includes public lands in the mining area. The selected alternative is consistent with the Hardrock

Mineral Resources Reasonably Foreseeable Development Scenario presented and analyzed in Appendix C of the Resource Management Plan. Approval of a Plan of Operations by BLM on lands open to mineral entry is nondiscretionary (i.e., BLM must approve such a plan) if it will not cause unnecessary or undue degradation.

Since Alternative 7 does not result in unnecessary or undue degradation and meets all other agency planning and management objectives, it has been selected for implementation and the modified Plans of Operations approved.

Executive Order 12898 on Environmental Justice

On February 11, 1994, President Clinton signed Executive Order 12898 that requires federal agencies to address environmental justice issues when implementing their respective programs. The Order directs the Department of the Interior to take the lead role in coordinating environmental justice issues associated with Federally-recognized Indian Tribes.

The question of Environmental Justice along with charges of "environmental racism" have been raised in connection with the mines.

Several different situations are often cited in defining Environmental Justice. The following is a summary of each:

- The targeted siting of potentially polluting facilities in areas with racial minorities or impoverished populations. The motives often attributed to the proponent are: 1) that they do not care about the affects on minority populations; and/or 2) that the site is desirable because minorities and the poor do not have the resources to oppose the project.

- Discrimination by regulatory agencies in enforcement of environmental standards where projects may be affecting low income or minority populations. The argument is that these groups cannot obtain the same level of regulatory protection as other groups that may be wealthier, more politically powerful or of a different race.

- The inequitable distribution of project benefits, primarily economic, with project impacts such as increased pollution or perceived risk of pollution.

Therefore, environmental justice considerations can be grouped into three general categories: 1) facility siting and opposition, 2) regulatory agency discrimination, and 3) equitable distribution of project benefits and risks.

The agencies have considered each of these factors in reaching the decision to approve the mine expansion and modified reclamation plans using the selected alternative. The following is a discussion of each concern.

1) Facility Siting and Opposition

Siting alternatives for mine facilities such as the ore heaps and waste rock repositories have been specifically included or excluded from consideration based on trying to avoid the potential or perceived potential for impacts to Native American communities or resources. However, the ore body is fixed by the geology, limiting any flexibility regarding the location of the mine pits.

The selected alternative maximizes avoidance of potential impacts to Native American communities from mine expansion. The location of mine waste rock facilities, reclamation quarries and leaching facilities have been structured in the selected alternative based on avoidance of disturbance in drainages that eventually flow onto the Fort Belknap Indian Reservation. Mine pits, which cannot be relocated, are to be reclaimed in the selected alternative so that runoff is directed away from the Reservation side of the mountain range and the potential for contamination is minimized.

Residents of Fort Belknap have had access to technical and legal resources to make their concerns about mining known and to participate in the permitting process. Native Americans opposed to mining have received advice and assistance from various attorneys, regional and national environmental groups, government agencies and technical professionals. They have participated in past administrative appeals before the Interior Board of Land Appeals, been involved in litigation against the mines in both state and federal courts, and have provided testimony during the public meetings. Numerous substantive and detailed legal and technical comments were provided on the Draft EIS from both government and private parties on behalf of the Fort Belknap residents.

2) Regulatory Agency Discrimination

EPA, DOJ, BIA, DEQ, BLM, and the Agency for Toxic Substances and Disease Registry (ATSDR) have all devoted considerable regulatory resources to studying the mines' potential effects on Fort Belknap and to providing the residents direct access to their agency representatives. Federal and state water quality enforcement actions and site investigations have been undertaken at least in part due to the potential for impacts to water quality on the Reservation. Likewise, BLM and DEQ have ordered that modified mining and reclamation plans be prepared due to similar concerns.

Though the majority of environmental impacts are directed away from the Reservation, the recent settlement agreement on water quality includes requirements for construction of new water systems for Reservation communities, performance of an aquatic resources study on and adjacent the Reservation, performance of a groundwater study, conducting a community health evaluation for residents of the Reservation and a payment of $1 million for other relief to Fort Belknap. While nothing was identified during the EIS process that required these studies in order to characterize resource conditions, evaluate alternatives, assess impacts, or develop mitigation, these measures were included in the settlement to satisfy the concerns of the parties involved.

An intensive effort has been made to provide opportunities for Native American input on mining issues. Since 1990, the agencies have held over a dozen public meetings, at least five briefings for the Fort Belknap Community Council, mine tours, numerous meetings or one-on-one visits, field trips, work groups, etc. to obtain Native American input and provide information on mining issues. Public meetings have been held in communities on or adjacent to the Reservation to promote the participation of those who may not have had transportation or those who may not have been comfortable traveling to a more central meeting location off the Reservation.

The water resources monitoring wells and surface stations are focused on mine facilities with the potential to degrade waters. This means that most monitoring wells and surface sites are located south of the drainage divide in the Little Rocky Mountains, away from the Reservation. This is because most of the mine facilities with the potential to release contaminants are located south of the drainage divide away from the Reservation. In order to provide assurance to the people of Fort Belknap, the selected alternative includes requirements for additional surface and groundwater monitoring north of the drainage divide.

3) Equitable Distribution of Project Benefits and Risks

Any formula to establish what would constitute an *equitable distribution* of project risks and benefits would be highly subjective. However, there do not appear to be any overwhelming imbalances either way.

The residents of Fort Belknap in Hays and Lodgepole are at less risk than non-Fort Belknap residents in the communities of Zortman or Landusky from possible environmental effects of the mines. However, Native Americans are also more susceptible to impacts to traditional cultural practices and heritage values than non-Native Americans. Disruptions related to mining, noise, dust, landscape alteration, etc. may be experienced by Native American religious practitioners in certain portions of the mountains. These "spiritual" impacts are unique to certain members of the Native American community. Statements by some individual Native Americans that these types of impacts cannot be mitigated is acknowledged.

The majority of economic benefits are directed away from the Reservation, though so are the majority of potential environmental impacts.

The risk of water contamination is highest in those drainages that flow away from the Reservation through the non-Reservation communities of Landusky and Zortman. The drainages most impacted by the current mining operations are Ruby Gulch, Alder Gulch, Mill Gulch, Sullivan Creek and Montana Gulch all of which flow to the south, away from the Reservation.

Streams emanating from the mining areas leading onto the Reservation are monitored and have been studied for potential contaminants. Results show these streams do not contain contaminant levels that would pose a human health risk. This has been verified in studies or monitoring events conducted by: The Council of Energy Resource Tribes (CERT), ATSDR, BIA, BLM, DEQ, EPA, Fort Belknap Community Council, and the USGS. Similarly, there is no evidence

that there are abnormal incidents of health ailments among those populations living in proximity to drainages leaving the mining areas. Should a higher frequency of health problems be identified in these communities, the studies and monitoring done to date suggest that the mines would not be the likely contaminant source.

Of the benefits associated with mining, most of the jobs are held by individuals that live outside the Reservation. Conversely, the mine jobs held by those that live on the Reservation may have a proportionally higher beneficial economic and social impact due to the lower average income on the Reservation.

In conclusion, there are no *Environmental Justice* issues relative to the Zortman and Landusky mines that violate or are inconsistent with the intent of Executive Order 12898. A primary mine facility siting criteria has been and continues to be the avoidance of even the perception of creating environmental impacts to the Reservation. Impacts to religious values or beliefs are not within the scope of the environmental justice initiative and cannot be resolved through environmental justice mandates. The regulatory agencies have actively pursued enforcement at this site, while non-Native American communities have experienced considerable economic impacts from mine slowdowns while these enforcement actions are resolved. Finally, although the non-Native American communities have experienced, and will continue to experience, most of the environmental impacts associated with mining, they will also receive most of the economic benefits from the mine expansions.

Native American Trust Responsibilities

Department of the Interior manual part 512 requires agencies of the Department to consult with Indian tribes on a government-to-government basis whenever plans or actions affect tribal trust resources, trust assets, or tribal health and safety. Though no such affect has been identified, BLM has conducted consultation with the Fort Belknap Community Council during review and environmental analysis of ZMI's proposed mining and reclamation plans. Briefings and meetings were held with Council members similar to those held with county and state government officials.

There are no lands owned by the Tribes involved in the mining activities. Mine expansion and reclamation under the selected alternative (or any alternative) occurs on lands that are either private, or public lands under the administration of the BLM. Approval of the Plans of Operations by BLM using the selected alternative is consistent with BLM's trust responsibilities.

The EIS has analyzed the potential offsite impacts that will occur to all aspects of the human environment both on and off the Fort Belknap Reservation. The selected alternative requires compliance with all environmental laws, with special emphasis on water quality laws. Mitigating measures in the selected alternative have been used to minimize the potential offsite impacts of mine expansion to affect trust resources. No impacts to trust resources have been identified that require the Department of the Interior to exercise special protective measures under its trust responsibilities to Native Americans.

Religious Freedom Restoration Act

The Religious Freedom Restoration Act of 1993 (RFRA) states that government may substantially burden a person's exercise of religion only if it demonstrates that application of the burden to the person is (1) in furtherance of a compelling government interest; and (2) is the least restrictive means of furthering that compelling governmental interest.

The compelling governmental interest in this case is ZMI's legal right to develop the minerals which it owns or controls under provisions of the Mining Law. However, the proposed mine expansion does not appear to have the potential to "substantially burden" the exercise of religion as considered under RFRA even though it is offensive to the traditional religious values of some individuals.

The Little Rocky Mountains are considered sacred by traditional Native Americans. Although specific locations of current religious use would not be physically altered by the project, mining itself is considered a desecration and it therefore cannot be mitigated from this point of view. Even so, expanded mining would not in anyway prohibit or condition current religious practices. Further, most of the affected lands associated with the mine expansion are privately owned and have been for many years. Any use of these lands has therefore been at the discretion of the property owner and this will remain constant with or without expanded mining.

It is recognized that the selected alternative cannot satisfy the concern that the entire mountain range is sacred and no amount of mitigation can make the project acceptable. However, the selected alternative does provide for the proponent to develop its mineral interest with the highest probability for reclamation success, and thus the least impact on the environment.

American Indian Religious Freedom Act

The American Indian Religious Freedom Act (AIRFA) was passed as a joint resolution of Congress. The resolution states that it shall be the policy of the United States to protect and preserve for the American Indian the inherent right of freedom to believe, express and exercise their traditional religions, to use sacred objects and to worship through ceremonies and ritual. BLM complies with this act by consulting with and considering the views of Native Americans when a proposed land use might conflict with traditional Native American religious beliefs or practices. The act does not require that land uses which conflict with Native American religious beliefs or practices be denied.

Conflicts identified for the selected alternative include visual and audible disruption of some Native American traditionalists who may be worshiping in portions of the mountains, and desecration of the sacred mountains by intrusive activities. While the entire mountain range is regarded by many Native Americans as sacred, no specific sites (vision quest sites, graves, sacred plant gathering areas, etc.) were identified that will be directly affected by mine expansion.

In spite of exhaustive efforts to accommodate the concerns of traditional Native Americans, the land use of mining is simply not compatible with some traditional Native American values. No mitigation to the impacts of mining was viewed as acceptable to some people since they consider surface disturbance an act of desecration. While many portions of the mountains will continue to be conducive for religious practices, residual impacts to the Little Rocky Mountains as a sacred landform are unavoidable.

In selecting the preferred alternative it is important to acknowledge these concerns while recognizing that complete mitigation is not possible since the impact is as much spiritual as it is physical. However, it is also important to note that this decision does not limit the Native Americans' freedom to believe, express or exercise their traditional religious beliefs, their right to possession of sacred objects and freedom to worship through ceremonies and traditional rites as required by AIRFA.

This decision is consistent with President Clinton's recent executive order (EO 13007) requiring each agency, to the extent practicable, to accommodate access to and use of sacred sites by Indian religious practitioners, and to avoid adversely affecting the physical integrity of such sacred sites. No "sacred site(s)" as defined in the executive order, have been identified that will be disturbed by implementation of the selected alternative.

National Historic Preservation Act

BLM has completed the process for considering the effect of the undertaking on Historic Properties as required by Section 106 of the National Historic Preservation Act. The area of potential effect has been inventoried, historic properties identified, interested parties consulted, and a Programmatic Agreement developed to mitigate impacts. The State Historic Preservation Office and Advisory Council on Historic Preservation have been participants throughout this process and are signatories to the Programmatic Agreement. Signing of the Programmatic Agreement by BLM and the Advisory Council documents BLM's completes the NHPA review process and allows BLM to proceed with decisionmaking on ZMI's proposal.

Montana Metal Mine Reclamation Act

Article IX, Section 2 of the Montana Constitution provides that the Legislature shall provide standards for reclamation of lands disturbed by mining. The Metal Mine Reclamation Act sets those standards for metal mines. To this end, the Act provides reclamation plans must achieve a post-mining land use of comparable stability and utility as that of the premining landscape, except for open pits and rock faces that cannot be reclaimed to this standard. For those open pits and rock faces, the Act requires that the reclamation plan must achieve structural utility to the extent feasible, and blending with the surrounding area to the extent feasible.

The post-mining land use for the Zortman and Landusky mines is wildlife habitat. This is

compatible with existing uses of the proposed expansion area as well as with land use in the area surrounding the mine. Wildlife use has been addressed previously in this document. The reclamation plans permitted under Alternative 7 will achieve this land use as described below.

ZMI's reclamation plan will be conducted concurrent with mining to the extent practical. The selected alternative includes concurrent reclamation of pit benches as they reach final configuration and reclamation of waste dumps, in lifts, from the bottom up. All other reclamation would be initiated immediately when an individual facility is no longer in use. Heap leach pads will be reclaimed. This includes the completion of cyanide detoxification of the heap effluent to 0.22 mg/L WAD. Due to the size of some individual facilities such as heaps and waste rock dumps, it may take longer than 2 years to complete all reclamation activities on an individual facility. However, the plan provides for effective use of personnel and equipment to achieve reclamation standards in timely fashion. Some one-track access roads will remain in place to provide access to monitoring sites. These will be reclaimed within 2 years of the determination that monitoring related to specific access routes is no longer needed. Similarly the water treatment plants will also be reclaimed within 2 years of the determination that they are no longer needed.

Erosion control during mining and reclamation will be achieved consistent with ZMI's stormwater management plan. The stormwater management plan is included as Appendix B of the Consent Decree. The contours of final reclamation, as modified by conditions in Stipulations 17 through 31 will effectively reduce long-term erosion to background levels. For the short term, ZMI must monitor reclamation, repair areas of excess erosion, and modify reclamation techniques as necessary to achieve long-term stability.

ZMI's postmining contour plan includes partial backfill of pits. This will prevent accumulations of stagnant water in the area of the pits. However, complete backfill is not part of the selected alternative closure plan. Based on the Final EIS analysis on page 2-6, and on Haight, 1996, complete backfill is not feasible. Partial backfill will provide a condition that is structurally competent, affords utility to the extent feasible, and blends with the surrounding landscape. Additional discussion of pit reclamation is presented on the following page.

The closure plans adopted under the selected alternative provide for capping of potentially acid-producing materials with subsoils and neutral waste rock. This is in compliance with the MMRA standard requiring final surface of non-noxious, nonflammable, noncombustible solids.

Capping and reclamation plans for heap leaches, waste rock repositories and other areas, as described in Stipulation 17, exceed the requirement to insulate problem materials with a minimum 2-foot covering of non-acid generating, not polluting material. Coverings will be constructed with subsoils and neutral waste rock which are not susceptible to the generation of objectionable effluent. Total capping depths will be adequate to prevent generation of objectionable effluent for the long term. However, for the short-term and an undefined period of time thereafter, collection and treatment of any objectionable effluent, for as long as necessary, will ensure that objectionable effluents are not discharged from the reclaimed minesites.

ZMI's revegetation plan includes native, perennial grasses, forbs, and shrubs which will support postmining wildlife use and restore a dynamic ecosystem capable of ecologic succession as described in Sections 2.8.2.8. and 2.11.2.8 of the Final EIS. ZMI will control noxious weeds until revegetated species are established. Thus, disturbed sites, excepting pits, which are described below, will be returned to a level of stability and utility comparable to adjacent areas. ZMI's reclamation plans for the pit area include a commitment to mitigate or eliminate any public nuisance that may exist at closure.

Some areas in the pits which might create objectionable effluent would still be exposed under the selected alternatives. While the pit floors and benches would be covered with the required 2-feet of reclamation material, areas such as the near-vertical rock faces between the benches would be left exposed. In addition, some of the older bench areas might not be safely accessible for cover placement. However, provisions have been included in the reclamation plans for capture and treatment, if necessary, of objectionable runoff from these areas. This satisfies the requirements of the MMRA pursuant to 82-4-336(5)(c), MCA.

Pit benches will be reclaimed concurrent with mining using 12 inches of NAG material overlain by 12 inches of topsoil. A grass seed mix will be used to revegetate the benches to provide wildlife habitat and to increase evapotranspiration. Pits will be partially backfilled (see Figure 2.11-3 of the Final EIS and Stipulations 36 and 38) to reduce potential acid drainage, to prevent the accumulation of stagnant water, to provide for drainage of runoff, to reduce the volume of waste to be disposed of elsewhere, and to increase the utility of the reclaimed pits.

Pit benches will also be reclaimed to withstand climatic and geologic conditions comparable to those currently existing in the area. Should a bench or portion of pit wall slump, it would create a localized angle-of-repose slope approximating one of the many talus slopes commonly seen in the Little Rocky Mountains and thus not pose a threat to public safety and the environment. Remaining pit walls and benches would replicate many of the naturally occurring cliff-forming rock outcrops in the area. The pit walls and benches would be subject to the same environmental conditions and processes that surrounding undisturbed areas are currently subject to. Rates of natural degradation for both disturbed and undisturbed areas are not expected to differ appreciably in the long-term. Recontouring and revegetation plans for pit benches have been designed to blend with the surrounding area to the extent feasible as shown in Figure 2.11-2 of the Final EIS. Revegetation will prevent air pollution. Potential water pollution and degradation of adjacent lands will be reduced by backfilling and capping of all materials and surfaces, other than the upper pit walls, which are potentially acid generating. Water capture and treatment will prevent water pollution and degradation of adjacent lands until postmining water quality returns to background levels.

Heap leaches and waste rock dumps will be recontoured to minimize infiltration of precipitation, beyond that necessary for successful revegetation of the specified plant communities. Heap leaching facilities will be lined to prevent objectionable groundwater discharges. Waste rock repositories and heap leaches will also be capped to prevent objectionable post-mining groundwater discharges.

This decision complies with the Metal Mine Reclamation Act (MMRA). This decision, through Stipulations 1-61 and the plan of operations ensures ZMI implements measures and plans to comply with the Montana Water Quality Act and the Montana Air Quality Act, both of which must be complied with in order to obtain approval under the MMRA. Thus, once ZMI submits a certification of compliance and the bond, DEQ will issue the amendments to Operating Permits 00095 and 00096 to implement this decision.

Montana Water Quality Act

The mining plans, reclamation plans, and water management plans selected by the agencies under Alternative 7, in combination with the water management plans specifically required under the Consent Decree, will effectively prevent the discharge of pollutants. Documentation is presented elsewhere in this decision and in the Final EIS. These plans limit the generation of objectionable effluent and provide for capture and treatment of any objectionable effluent that does develop. When properly implemented, these measures can be successfully used by ZMI to achieve and maintain compliance with the Montana Water Quality Act.

Montana Air Quality Act

The Department has determined that ZMI's activities would be in compliance with the Air Quality Act. The emission levels predicted, after application of the required mitigation, and after final reclamation, would not exceed the air quality standards.

Montana Hard Rock Impact Act

Mining at the Zortman and Landusky mines was permitted in 1979, which predates the passage of the Hard Rock Impact Act in 1981. Therefore ZMI is grandfathered from the need for a specific Hard Rock Impact Plan, consistent with Title 90, Chapter 6, Parts 3-4, MCA.

NEPA/MEPA Cumulative Effects Assessment

Both BLM and DEQ are required by their respective statutes, NEPA and MEPA, to assess the cumulative impacts of the proposed action and alternatives on the environment. In this case it is especially relevant since the project began in the late 1970s and much of the existing environment has already been impacted. The assessment of cumulative effects has been a major focus in the draft and final EIS. The cumulative effects of this project are described in Chapter 4 of the Final EIS for each resource component. Chapter 3 devotes considerable attention to identifying changes in water quality that have occurred since the mines began operation in 1979. The results of this cumulative effects analysis have been used to develop the selected alternative. Measures to mitigate impacts from past mining activity, in addition to the proposed future

mining, have been built into the selected alternative in order to minimize the cumulative impacts of the entire mining operation.

Though only a reasonably foreseeable future action, modeling of air emissions indicates that the cumulative impacts from mining in the Pony Gulch area, concurrent with mining at the Zortman Mine, would possibly exceed air quality standards. Any future proposals for mining in the Pony Gulch area will need to be designed so that mining of this deposit does not exceed air quality standards. Timing constraints or other mitigating measures would be used to keep the cumulative air emissions within standards.

Future mineral projects in the Little Rocky Mountains have the potential to generate cumulative impacts and will be evaluated pursuant to MEPA and NEPA if, and when, an application with sufficient detail is received by the agencies. Such analyses would be used to determine the full extent of cumulative effects prior to decisionmaking.

Monitoring and Compliance

This section describes the project monitoring that will be conducted during implementation of the selected alternative by both the agencies and the operator. The purpose of the monitoring is to assure compliance with the approved Plans of Operations and all Operating Permit Amendments, as stipulated, and to validate the impacts predicted by the EIS.

Agency Monitoring

Agency staff from DEQ and BLM will conduct compliance inspections at the Zortman and Landusky Mines at least once every quarter under the authority of the Metal Mine Reclamation Act and the Federal Land Management and Policy Act. These will be comprehensive mine-wide inspections. Inspections will consist of physical onsite examination of disturbance areas, verification sampling at water quality monitoring points of interest, and geochemical sampling of mine products, construction materials and reclamation materials. Annual examination of revegetation conditions will be conducted. Inspections more frequent than quarterly may be conducted during periods of intense activity (such as installation of liners) in localized portions of the mine or where compliance problems have been noted and corrective measures are being implemented. Additional compliance inspections pursuant to the Montana Water Quality Act and the Montana Air Quality Act will also be conducted. The results of these inspections will be documented in agency files and available to the public upon request.

Operator Monitoring Reports

The purpose of monitoring is to demonstrate compliance with the terms and conditions of the approved mining and reclamation plans, detect problems or unanticipated events early, and provide a basis for directing remediation of problems. The following is a list of monitoring reports that have either been committed to by ZMI in their proposal or are required by the selected alternative. All reports are to be submitted to both DEQ and BLM. These reports will be available to the public upon request.

Wildlife Mortality

Monthly reports on wildlife mortality, including migratory birds and bats, at the mines are required by ZMI's Plan of Operations. These reports identify species, number, cause of death, and proposed changes to prevent reoccurrence. Reports are submitted monthly whether or not there has been a mortality.

Monthly Water Resources Monitoring

This report contains results of the operational water tests (described in ZMI's Plan of Operations) taken by ZMI employees using field tests or in-house laboratory tests. The report is submitted by the 16th of the month following the monitoring period.

Quarterly Water Resources Monitoring

This is a report of the water sampling results conducted by an outside consultant and submitted to an outside lab for analysis. These tests are conducted at least four times a year. The report includes trend analysis and is submitted simultaneously to ZMI, BLM and DEQ (see Stipulation 55).

Annual Water Resources Monitoring Report

This report is submitted yearly and includes water resources monitoring results from all sampling events for each calendar year. This report also includes a summary of past annual monitoring results and a trend analysis for the year (see Plan of Operations and Stipulation 54).

Seepage Volume Monitoring

Development of hydrographs from each waste management unit is required as part of the selected alternative. Data on flow volumes will be included in the monthly reports. Hydrographs will be included in the annual water resources report for each waste unit discharge (see Stipulation 57).

LAD Area Use and Monitoring Reports

These reports are required during and after use of the land application areas. They include results of treated water volume, reagent usage, monitoring application rates, soil tests, pore water tests, vegetation condition, and adjacent runoff (see Stipulation 59).

Mine Waste Rock Placement and Characterization Report

At least quarterly, ZMI will provide reports and maps showing the placement of each classification of waste rock. This report will include information on the waste rock lithology and its' classification according to acid-generating potential (green, yellow, blue, or stipulated NAG) by lift (see Stipulation 56).

Surface Reclamation Performance

Monitoring of soil loss rate and remediation activities, precipitation infiltration, and revegetation conditions will be conducted concurrent with operations and reclamation. Monitoring reports will be submitted annually. More frequent reporting may be necessary should performance criteria be exceeded (see Stipulations 57 and 58).

Annual Operating and Reclamation Status Report

This is the annual report required by the Metal Mine Reclamation Act. This report describes overall mining and reclamation status. This report is to include ZMI tracking of the status and progress in meeting all agency-imposed stipulations.

Engineering Construction Quality Assurance Reports

These reports are submitted monthly and include results of the quality control tests conducted on the clay and synthetic liner installation during leach pad construction. Similar reports are required documenting construction of the reclamation covers. These reports include quality control documentation of GCL installation, reclamation cover thickness, and reclamation material character (see Stipulation 10).

Final "As Built" Engineering Reports

Final engineering reports are required for the Goslin Flats leach pad, the 87/91 leach pad, the Zortman pit/waste rock repository, the Landusky Gold Bug waste rock repository, and the backfilled Landusky pit/Montana Gulch construction. These reports are to verify that the facilities have been constructed as permitted and meet all applicable stability requirements (see Stipulation 60).

Appeal Processes

Appeals of the BLM Decisions

The authority for the BLM to approve the Plans of Operations is limited to the BLM-administered lands. The decision to approve a Plan of Operations, and the imposition of any associated stipulations, may be appealed by either the operator (ZMI) or by the public (third party). The following appeals processes apply:

Operator Appeals

Operators have the right to appeal to the Montana State Director, Bureau of Land Management in accordance with 43 CFR 3809.4. If the operator exercises this right, the appeal, accompanied by a statement of reasons and any arguments which would justify reversal or modification of the decision, must be filed in writing with the BLM Phillips Resource Area Office, HC 65, Box 5000, Malta, MT 59538, within 30 days after receipt of the decision. The decision will remain in effect during appeal unless a written request for a stay is granted.

Third Party Appeals

Any party, other than the operator, aggrieved by a decision of the authorized officer may appeal to the Interior Board of Land Appeals, Office of Hearings and Appeals, in accordance with the appeals procedures in 43 CFR, part 4 and the enclosed Attachment 3 (Form 1842-1). If an appeal is taken, a notice of appeal must be filed with the BLM Phillips Resource Area Office, HC 65, Box 5000, Malta, MT 59538, within 30 days after receipt of this decision. The appellant has the burden of showing that the decision appealed is in error. Under the surface management regulations in 43 CFR 3809.4(f), the filing of such an appeal shall not stop the authorized officer's decision from being effective.

Appeals of the DEQ Decisions

Under Montana law this record is subject to court appeal by the applicant and other parties for 90 days following issuance of the Operating Permit Amendments. Notice of permit issuance will be published in the Lewistown News Argus and the Phillips County News.

Approvals

This Record of Decision is effective for each agency upon signature of their respective agency official.

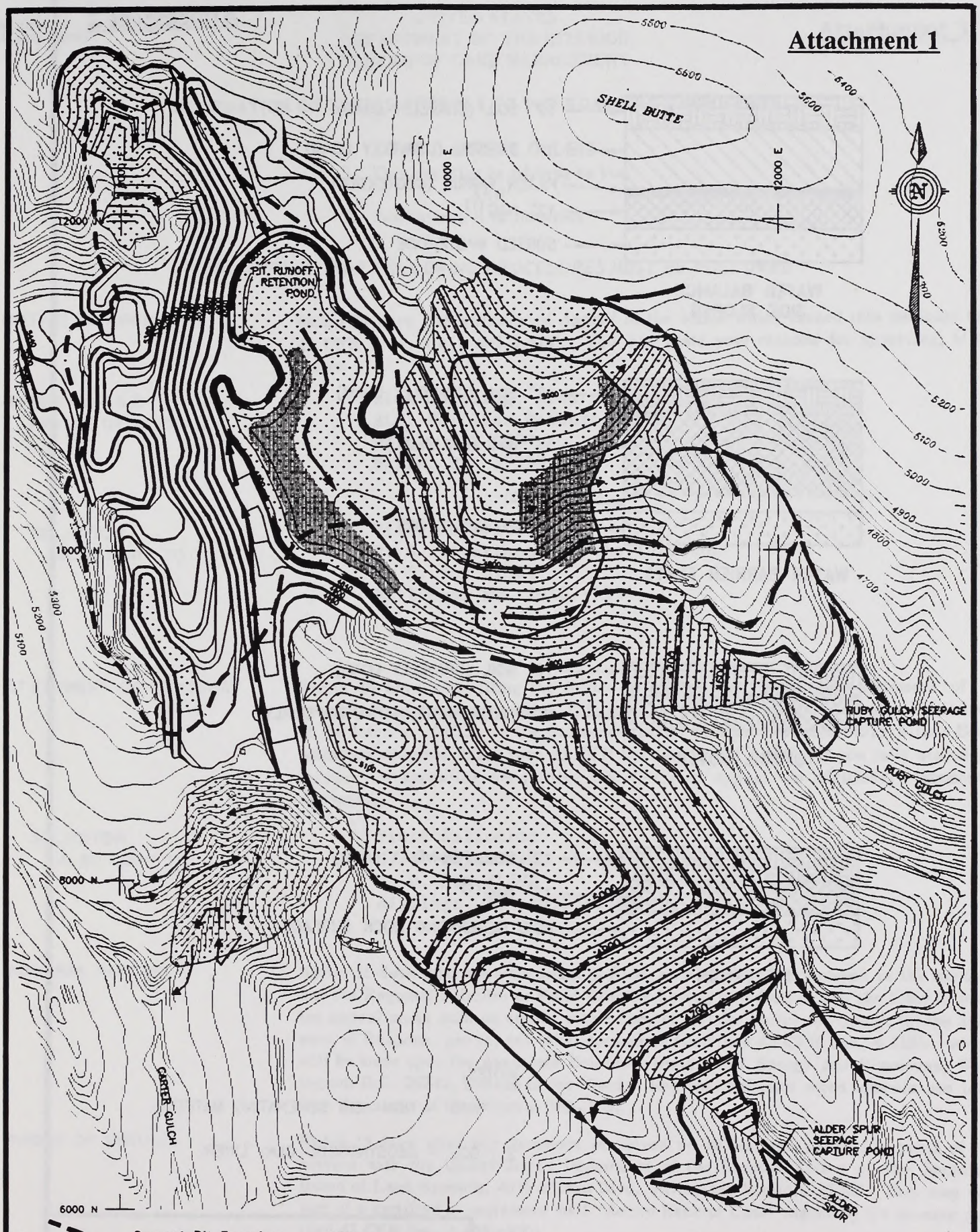
Mark A. Simonich, Director
Montana Department of Environmental Quality

10/25/96
Date

Richard M. Hotaling, Area Manager
Phillips Resource Area, BLM
(for the Authorized Officer)

10-25-96
Date

Attachment 1



Current Pit Boundary

85/86 Leach Pad Edge of Liner

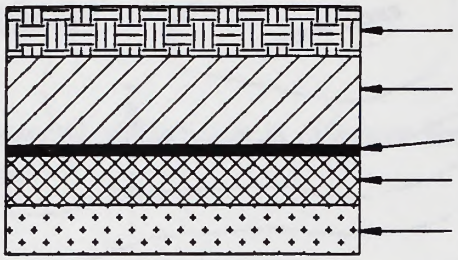
General Flow Direction

Spent Ore Placement

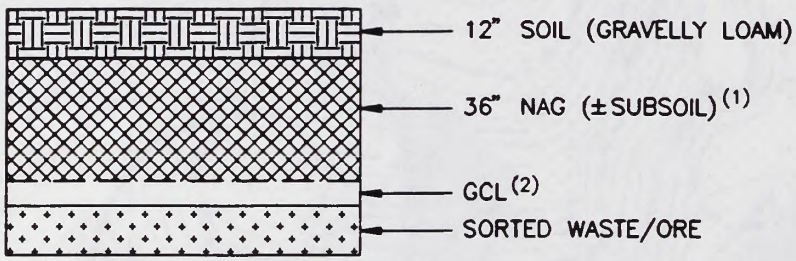
Reclamation

ALTERNATIVE 7
WASTE ROCK CAP, POST RECLAMATION TOPOGRAPHY AND DRAINAGE

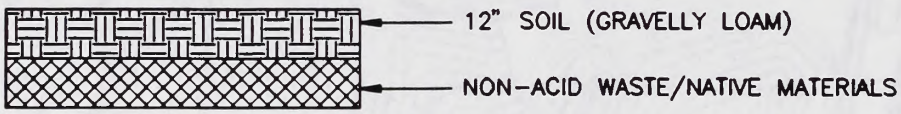
ZOR-211



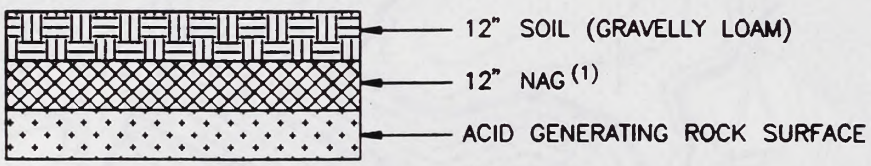
WATER BALANCE
SIDE SLOPES



WATER BARRIER FLATS



TOPSOIL COVER



PIT BENCH

NOTES:

1. NAG – NON ACID GENERATING MATERIAL
2. GCL – GEOSYNTHETIC CLAY LINER.

ALTERNATIVES 3 AND 7
WATER BALANCE RECLAMATION COVERS
FOR ZORTMAN-LANDUSKY MINES

FIG. 2.11-4

Form 1842-1
(February 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Attachment 3

INFORMATION ON TAKING APPEALS TO THE BOARD OF LAND APPEALS

DO NOT APPEAL UNLESS

1. This decision is adverse to you,
   AND
2. You believe it is incorrect

IF YOU APPEAL, THE FOLLOWING PROCEDURES MUST BE FOLLOWED

1. NOTICE OF APPEAL . . . . Within 30 days file a *Notice of Appeal* in the office which issued this decision (see 43 CFR Secs. 4.411 and 4.413). You may state your reasons for appealing, if you desire.

2. WHERE TO FILE NOTICE OF APPEAL . . .

Rick Hotaling, Area Manager
BLM, Phillips Resource Area
HC 65, BOX 5000
Malta, MT 59538

SOLICITOR ALSO COPY TO . . . .

Field Solicitor
U. S. Department of the Interior
P. O. Box 31394
Billings, MT 59107-1394

3. STATEMENT OF REASONS . . Within 30 days after filing the *Notice of Appeal*, file a complete statement of the reasons why you are appealing. This must be filed with the United States Department of the Interior. Office of the Secretary, Board of Land Appeals, 4015 Wilson Blvd., Arlington, Virginia 22203 (see 43 CFR Sec. 4.412 and 4.413). If you fully stated your reasons for appealing when filing the *Notice of Appeal*, no additional statement is necessary.

SOLICITOR ALSO COPY TO . . . .

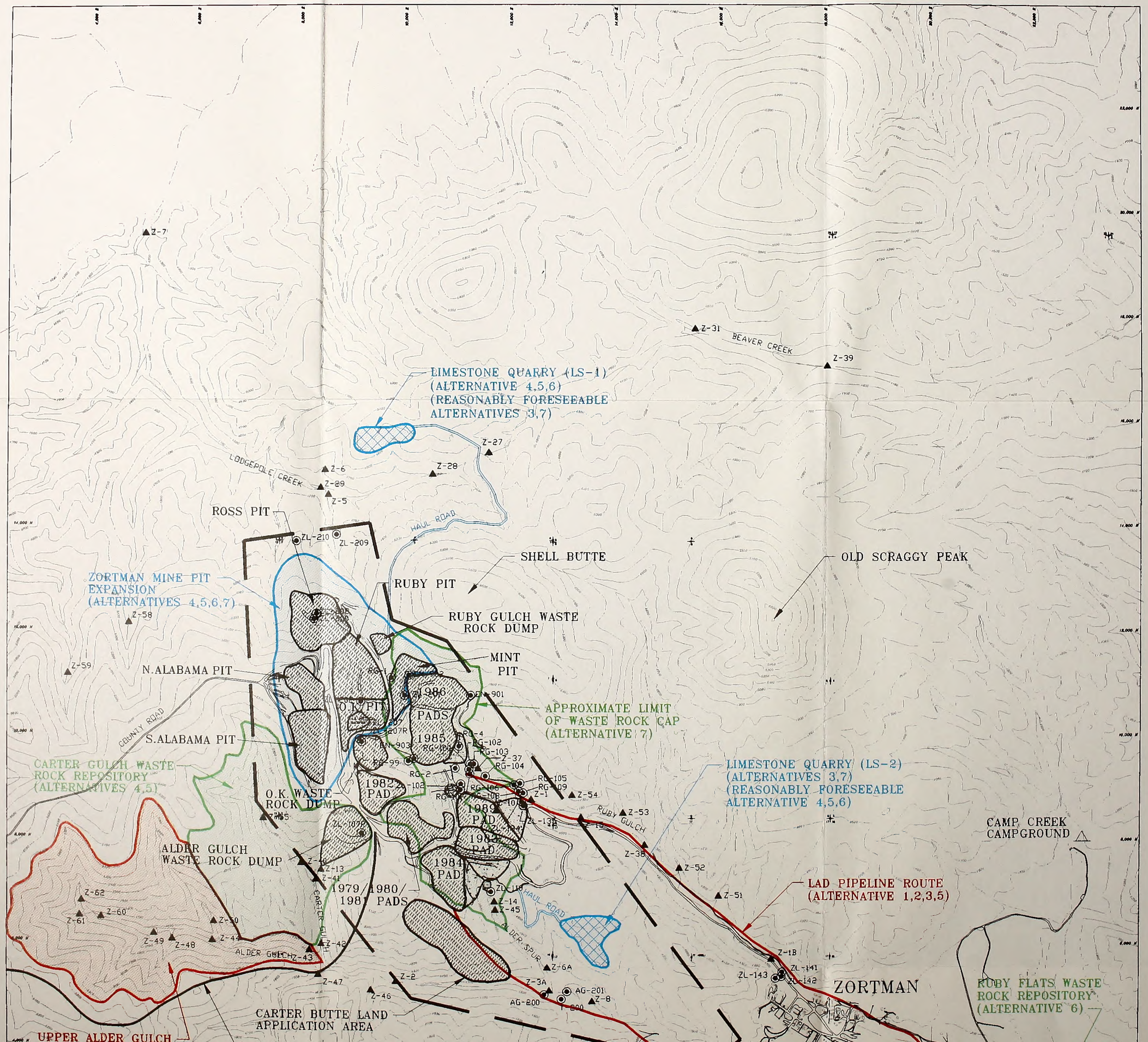
Field Solicitor
U. S. Department of the Interior
P. O. Box 31394
Billings, MT 59107-1394

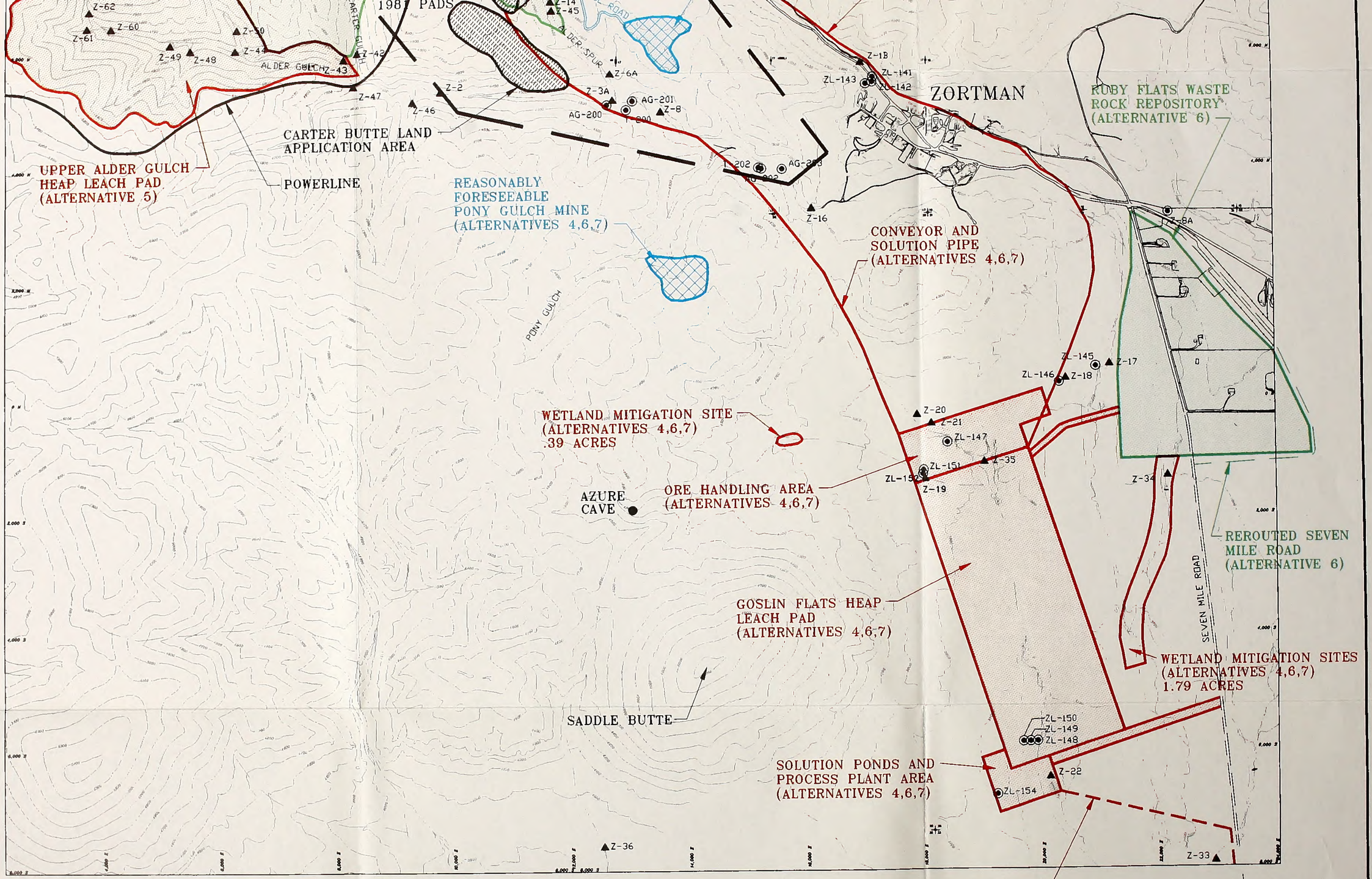
4. ADVERSE PARTIES . . . . Within 15 days after each document is filed, each adverse party named in the decision and the Regional Solicitor or Field Solicitor having jurisdiction over the State in which the appeal arose must be served with a copy of: (a) the *Notice of Appeal*, (b) the Statement of Reasons, and (c) any other documents filed (see 43 CFR Sec. 4.413). Service will be made upon the Associate Solicitor, Division of Energy and Resources, Washington, D.C. 20240, instead of the Field or Regional Solicitor when appeals are taken from decisions of the Director (WO-100).

5. PROOF OF SERVICE . . . . Within 15 days after any document is served on an adverse party, file proof of that service with the United States Department of the Interior, Office of the Secretary, Board of Land Appeals, 4015 Wilson Blvd., Arlington, Virginia 22203. This may consist of a certified or registered mail "Return Receipt Card" signed by the adverse party (see 43 CFR Sec. 4.401(c)(2)).

Unless these procedures are followed your appeal will be subject to dismissal (see 43 CFR Sec. 4.402). Be certain that all communications are identified by serial number of the case being appealed.

NOTE: *A document is not filed until it is actually received in the proper office (see 43 CFR Sec. 4.401(a))*


Z-7
Z-31
BEAVER CREEK
Z-39
LIMESTONE QUARRY (LS-1)
(ALTERNATIVE 4,5,6)
(REASONABLY FORESEEABLE
ALTERNATIVES 3,7)
Z-27
Z-28
LODGEPOLE CREEK
Z-6
Z-29
Z-5
ROSS PIT
ZL-210
ZL-209
HAUL ROAD
SHELL BUTTE
OLD SCRAGGY PEAK
ZORTMAN MINE PIT
EXPANSION
(ALTERNATIVES 4,5,6,7)
Z-58
RUBY PIT
RUBY GULCH WASTE
ROCK DUMP
MINT
PIT
Z-59
N.ALABAMA PIT
O.K. PIT
1986
PADS
EN-901
APPROXIMATE LIMIT
OF WASTE ROCK CAP
(ALTERNATIVE 7)
COUNTY ROAD
S.ALABAMA PIT
1985
PAD
RG-4
RG-102
RG-103
Z-37
RG-104
CARTER GULCH WASTE
ROCK REPOSITORY
(ALTERNATIVES 4,5)
1982
PAD
RG-105
RG-109
Z-1
Z-54
LIMESTONE QUARRY (LS-2)
(ALTERNATIVES 3,7)
(REASONABLY FORESEEABLE
ALTERNATIVE 4,5,6)
O.K. WASTE
ROCK DUMP
1989
PAD
RUBY
GULCH
Z-53
CAMP CREEK
CAMPGROUND
ALDER GULCH
WASTE ROCK DUMP
1982
PAD
Z-38
Z-52
1984
PAD
1979/1980/
1981
PADS
Z-51
LAD PIPELINE ROUTE
(ALTERNATIVE 1,2,3,5)
Z-62
Z-60
Z-61
Z-50
Z-49
Z-48
Z-44
ALDER GULCH
Z-43
Z-42
CARTER GULCH
HAUL ROAD
ALDER SPUR
Z-6A
Z-18
ZL-141
ZL-143
ZL-142
ZORTMAN
Z-47
Z-2
Z-46
Z-3A
AG-201
AG-200
Z-8
CARTER BUTTE LAND
APPLICATION AREA
RUBY FLATS WASTE
ROCK REPOSITORY
(ALTERNATIVE 6)
UPPER ALDER GULCH



0 600 1200 2400
SCALE IN FEET

LEGEND

- EXISTING FACILITY
- EXISTING DIKE FILL
- PROPOSED LEACH PADS COMPLEX AND CONVEYOR
- PROPOSED WASTE ROCK REPOSITORIES
- PROPOSED EXPANDED PIT COMPLEX AND QUARRIES
- REASONABLY FORESEEABLE FACILITY
- ▲ SURFACE WATER MONITORING STATION
- ◉ GROUND WATER MONITORING WELL
- EXISTING PLANT LOCATION
- PERMIT BOUNDARY (EXISTING)

BASE MAP FROM: ZORTMAN MINING, INC. 1994

EXISTING AND ALTERNATIVE FACILITIES LOCATION WITH SURFACE WATER AND GROUNDWATER MONITORING LOCATIONS AT ZORTMAN MINE

ZOR-FAC

EXHIBIT 1


Fort Belknap Indian Reservation Boundary
SOUTH BIGHORN CREEK
KING CREEK
SWIFT GULCH
ROCK CREEK
SULLIVAN CREEK
KING CREEK LIMESTONE QUARRY (ALTERNATIVE 4,5,6) (REASONABLY FORESEEABLE ALTERNATIVE 3,7)
LANDUSKY MINE PIT EXPANSION AND BACKFILL AREAS (ALTERNATIVES 4,5,6,7)
LEACH PAD EXPANSION AREA (ALTERNATIVES 4,5,6,7)
QUEEN ROSE PIT
AUGUST #1 WASTE ROCK DUMP
AUGUST #2 WASTE ROCK DUMP
MISSION PEAK
AUGUST LITTLE BEN PITS
MONTANA GULCH WASTE ROCK DUMP
GOLDBUG WASTE ROCK DUMP
GOLDBUG PIT BACKFILL (ALTERNATIVES 4,5,6,7)
SOUTH GOLD BUG PIT (ALTERNATIVES 4,5,6,7)
1991 PAD
1987 PAD
1985/1986 PADS
1984 PAD
1983 PAD
POWERLINE
L-6
L-39
L-21
L-19
L-20
L-5
L-38
L-31
L-32
L-35
L-37
L-27
L-29
ZL-139
ZL-140
95LH-11
95LH-13
95LH-8
95LH-9
95LH-12
ZL-206
ZL-105
ZL-119
ZL-116
ZL-125
ZL-124
ZL-155
ZL-156
ZL-132
ZL-131
ZL-165
ZL-164
EN-907
EN-904
EN-906
EN-908

1985/1986 PADS
1984 PAD
1983 PAD
1980/1981/1982 PADS
1979 PAD
SOUTH GOLD BUG PIT (ALTERNATIVES 4,5,6,7)
MILL GULCH WASTE ROCK DUMP
LAND APPLICATION AREA
MONTANA GULCH LIMESTONE QUARRY (ALTERNATIVES 3,7) (REASONABLY FORESEEABLE ALTERNATIVE 4,5,6)
LANDUSKY
MONTANA GULCH CAMPGROUND
WILLIAMS CLAY PIT (APPROX. 3.5 MILES) (ALTERNATIVES 2,4,5,6)
MONTANA GULCH
MILL GULCH
SULLIVAN CREEK
ROCK CREEK

0 400 800 1600
SCALE IN FEET

LEGEND

- EXISTING FACILITY
- EXISTING DIKE FILL
- PROPOSED LEACH PADS COMPLEX
- PROPOSED WASTE ROCK REPOSITORIES
- PROPOSED EXPANDED PIT COMPLEX AND QUARRIES
- REASONABLY FORESEEABLE FACILITY
- SURFACE WATER MONITORING STATION
- GROUND WATER MONITORING WELL
- EXISTING PLANT LOCATION
- PERMIT BOUNDARY (EXISTING)

BASE MAP FROM: ZORTMAN MINING, INC. 1994

EXISTING AND ALTERNATIVE FACILITIES LOCATION WITH SURFACE WATER AND GROUNDWATER MONITORING LOCATIONS AT LANDUSKY MINE

EXHIBIT 2

LAND-FAC

Printed on
Recycled Paper