Table 2.8-1. Summary of Environmental Impacts, Zortman Mine Reclamation

Affected Resource or Mine Feature	**Existing Condition** (February 2001)	***Alternative Z1***, Existing DEQ Reclamation Plans (FEIS Alt.3 & 1998 ROD)	***Alternative Z2***, Optimized Water Treatment within Bond Amounts	***Alternative Z3***, Optimize Source Control within Bond Amounts	***Alternative Z4***, Added Backfilling with Barrier Reclamation Covers	***Alternative Z5***, Extensive Backfilling with Soil Reclamation Covers	***Alternative Z6***, Optimize Grading for Source Control (Preferred Alt.)
Geotechnical Conditions (stability, erodibility and maintainability)							
Z79/80, Z83, Z84, & Z89 Leach Pads:							
Dikes	Intermediate, current condition is stable.	No Change	No Change	No Change	No Change	No Change	No Change
Heaps	Somewhat good. Interim reclamation has reduced heap slopes.	No Change	No Change	No Change	No Change	No Change	No Change
Liners	Intermediate, current liner is functioning.	No Change	No Change	No Change	No Change	No Change	No Change
Z82 Leach Pad:							
Heaps, Dike and Liner	Good. Leach pad was removed and backfilled during interim reclamation.	No Change	No Change	No Change	No Change	No Change	No Change
Z85/86 Leach Pad:							
Dike	Somewhat poor condition. Needs buttress for long-term stability.	Somewhat good. Dike resloped to 2.5H:1V would improve stability.	No Change	Somewhat good	Somewhat good	Good. Removal of pad dike for backfill eliminates stability concerns.	Somewhat good
Heap	Somewhat poor. Contains ungraded slopes.	Intermediate with heap slopes reduced to 3H:1V.	Somewhat poor with minimal reclamation cover and regrading.	Intermediate with regrading and reclamation cover.	Intermediate due to partial removal and slopes reduced to 3H:1V.	Good. Removal of heap backfill eliminates stability concerns.	Intermediate due to partial removal and slopes reduced to 3H:1V.

Affected Resource or Mine Feature	**Existing Condition** (February 2001)	***Alternative Z1***, Existing DEQ Reclamation Plans (FEIS Alt.3 & 1998 ROD)	***Alternative Z2***, Optimized Water Treatment within Bond Amounts	***Alternative Z3***, Optimize Source Control within Bond Amounts	***Alternative Z4***, Added Backfilling with Barrier Reclamation Covers	***Alternative Z5***, Extensive Backfilling with Soil Reclamation Covers	***Alternative Z6***, Optimize Grading for Source Control (Preferred Alt.)
Liner	Intermediate, current liner is functioning.	No change	No change	No change	No change	Good due to removal of leach pad	No change
Waste Rock Dumps:							
Alder Gulch Waste Rock Dump	Somewhat poor due to history of past erosion problems on dump slope.	Good stability conditions with dump removal and placement as pit backfill.	No change	No change	Same as Alt. Z1.	Same as Alt. Z1.	Somewhat good due to partial removal and improved reclamation cover.
O.K. Waste Rock Dump	Intermediate stability condition. Dump has not been reclaimed.	Good stability conditions with dump removal and placement as pit backfill.	No change	No change	Somewhat good stability with regrade to 3H:1V slopes and revegetation.	Same as Alt. Z4.	Same as Alt. Z4.
South Ruby Waste Rock Dump	Good condition. Dump removed and used for backfill in interim reclamation.	No change	No change	No change	No change	No change	No change
Open Pits:							
North Alabama Pit	Intermediate stability condition.	No change	No change	No change	Good stability due to partial backfilling.	Good stability due to total pit backfilling.	Somewhat good stability due to partial backfilling.
South Alabama Pit	Somewhat good stability due to highwall reduction and partial backfilling.	No change	No change	No change	Good stability due to additional backfilling.	Good stability due to additional backfilling.	No change
O.K./Ruby and Mint Pits	Condition intermediate due to interim reclamation.	No change	No change	No change	No change	Condition improved to good with additional backfill.	No change

Affected Resource or Mine Feature	**Existing Condition** (February 2001)	***Alternative Z1***, Existing DEQ Reclamation Plans (FEIS Alt.3 & 1998 ROD)	***Alternative Z2***, Optimized Water Treatment within Bond Amounts	***Alternative Z3***, Optimize Source Control within Bond Amounts	***Alternative Z4***, Added Backfilling with Barrier Reclamation Covers	***Alternative Z5***, Extensive Backfilling with Soil Reclamation Covers	***Alternative Z6***, Optimize Grading for Source Control (Preferred Alt.)
Ross Pit	Intermediate stability condition.	No change	No change	No change	Condition improved to good with additional backfill.	Condition improved to good with additional backfill.	No change
Tailings:							
Ruby Gulch Tailings	Existing tailings highly erodible.	Removal and use of tailings would reduce erodibility to a low condition.	No change	No change	Same as Alt. Z1.	Same as Alt. Z1.	Condition improved to average erodibility with most of the tailings removed.
Water Resources and Geochemistry							
Infiltration of Precipitation:							
Total Mine Ave. Infiltration (gpm)	266	126	156	149	138	143	127
% Reduction from Existing Infiltration	0%	53%	41%	44%	48%	46%	52%
Total Pit Ave. Infiltration (gpm)	55	17	33	31	22	29	21
% Reduction from Existing Infiltration	0%	69%	40%	44%	60%	47%	62%
Sulfate Load Reduction (% from existing load):							
Lodgepole Creek	0%	35%	0%	10%	increases by 2,650%	increases by 3,350%	50%
Carter Gulch	0%	88%	0%	0%	87%	88%	88%
Alder Spur	0%	0%	0%	0%	0%	0%	0%
Ruby Creek	0%	46%	8%	4%	35%	27%	35%
Surface Water Quality:							

Affected Resource or Mine Feature	**Existing Condition** (February 2001)	***Alternative Z1***, Existing DEQ Reclamation Plans (FEIS Alt.3 & 1998 ROD)	***Alternative Z2***, Optimized Water Treatment within Bond Amounts	***Alternative Z3***, Optimize Source Control within Bond Amounts	***Alternative Z4***, Added Backfilling with Barrier Reclamation Covers	***Alternative Z5***, Extensive Backfilling with Soil Reclamation Covers	***Alternative Z6***, Optimize Grading for Source Control (Preferred Alt.)
Alder Spur	Moderately low impacts due to capture system operation.	No change from existing conditions.	No change from existing conditions.	No change from existing conditions.	No change from existing conditions.	No change from existing conditions.	No change from existing conditions.
Carter Gulch	Intermediate impacts due to capture system operation.	Moderately low impacts with removal of Alder Gulch waste rock.	No change from existing conditions.	No change from existing conditions.	Same as Alt. Z1.	Same as Alt. Z1.	Moderately low impacts with partial dump removal and improved reclamation cover on dump top.
Ruby Gulch	Moderately high impacts due to uncaptured pit recharge.	Moderately low impacts due to significant reduction in pit and mine recharge.	Moderately high impacts due to lower quality covers and uncaptured pit recharge.	Moderately high impacts due to lower quality covers and uncaptured pit recharge.	Moderately low impacts due to use of HDPE/PVC liners resulting in decreased infiltration in the pits.	Moderately low impacts with use of water barrier covers and removal of the Z85/86 leach pad and dike.	Intermediate impacts with use of water balance water barrier covers and removal of the tailings.
Lodgepole Creek	Moderately low impacts due to runoff routed away from drainage.	No change from existing conditions.	No change from existing conditions.	No change from existing conditions.	Intermediate impacts due to poor quality backfill in Ross pit.	Same as Alt. Z4.	Low impacts due to use of thicker reclamation covers.
Surface Water Quantity:							
Alder Spur	High impacts due to need for ongoing seepage capture.	Moderately high impacts with increases in runoff from reclamation covers.	Same as Alt. Z1.	Same as Alt. Z1.	Same as Alt. Z1.	Same as Alt. Z1.	Same as Alt. Z1.

Affected Resource or Mine Feature	**Existing Condition** (February 2001)	***Alternative Z1***, Existing DEQ Reclamation Plans (FEIS Alt.3 & 1998 ROD)	***Alternative Z2***, Optimized Water Treatment within Bond Amounts	***Alternative Z3***, Optimize Source Control within Bond Amounts	***Alternative Z4***, Added Backfilling with Barrier Reclamation Covers	***Alternative Z5***, Extensive Backfilling with Soil Reclamation Covers	***Alternative Z6***, Optimize Grading for Source Control (Preferred Alt.)
Carter Gulch	Moderately low impacts due to stream water diversions and low flows into capture system.	Low impacts with removal of Alder Gulch waste rock dump and capture system.	No change from existing conditions.	No change from existing conditions.	Same as Alt. Z1.	Same as Alt. Z1.	No change from existing conditions.
Ruby Gulch	Moderately low impacts with release of treated water in upper Ruby Gulch.	No change from existing conditions.	Moderately high impacts from moving treatment plant and release point to Goslin Flats.	No change from existing conditions.	Intermediate impacts from moving treatment plant and release point to Goslin Flats.	Intermediate impacts from moving treatment plant and release point to Goslin Flats.	No change from existing conditions.
Lodgepole Creek	Moderately low impacts to water quantity due to the relatively small area impacted by Ross pit.	No change from existing conditions.	No change from existing conditions.	No change from existing conditions.	Low impacts to water quantity with restoration of the small runoff area into Lodgepole Creek.	Same as Alt. Z4.	No change from existing conditions.

Affected Resource or Mine Feature	**Existing Condition** (February 2001)	***Alternative Z1***, Existing DEQ Reclamation Plans (FEIS Alt.3 & 1998 ROD)	***Alternative Z2***, Optimized Water Treatment within Bond Amounts	***Alternative Z3***, Optimize Source Control within Bond Amounts	***Alternative Z4***, Added Backfilling with Barrier Reclamation Covers	***Alternative Z5***, Extensive Backfilling with Soil Reclamation Covers	***Alternative Z6***, Optimize Grading for Source Control (Preferred Alt.)
Groundwater Quality:							
Alder Spur	Intermediate impacts with function of capture system.	No change from existing condition.	No change from existing condition.	No change from existing condition.	No change from existing condition.	No change from existing condition.	No change from existing condition.
Carter Gulch	Intermediate impacts with function of capture system.	Low impacts with removal of Alder waste rock dump contaminant source from the drainage.	No change from existing condition.	No change from existing condition.	Same as Alt. Z1.	Same as Alt. Z1.	Moderately low impacts due to partial removal of the Alder waste rock dump from the drainage.
Ruby Gulch	Moderately high impacts with infiltration through pit floors reporting to Ruby Gulch.	Moderately low impacts with barrier cover on pit floors and use of water capture system.	Intermediate impacts with soil covers in pit areas and capture system.	Same as Alt. Z2.	Moderately low impacts with barrier covers over backfilled pit areas and use of water capture system.	Intermediate impacts with soil covers and removal of Z85/86 leach pad from drainage.	Moderately low impacts with improved grading and reclamation covers.
Lodgepole Creek	Moderately low impacts with routing of surface flow away from Lodgepole Creek which limits infiltration in the pit.	Low impacts due to covering sulfide pit benches and floors with NAG material and soil.	Same as Alt. Z1.	Same as Alt. Z1.	Intermediate impacts due to increased backfill in Ross pit at head of the drainage.	Same as Alt. Z4.	Same as Alt. Z1.
Water Management:							
Stormwater Control (stability and maintainability)	Intermediate stability of existing stormwater controls.	Somewhat good long-term stability of stormwater controls.	Same as Alt. Z1.	Same as Alt. Z1.	Same as Alt. Z1.	Same as Alt. Z1.	Same as Alt. Z1.

Affected Resource or Mine Feature	**Existing Condition** (February 2001)	***Alternative Z1***, Existing DEQ Reclamation Plans (FEIS Alt.3 & 1998 ROD)	***Alternative Z2***, Optimized Water Treatment within Bond Amounts	***Alternative Z3***, Optimize Source Control within Bond Amounts	***Alternative Z4***, Added Backfilling with Barrier Reclamation Covers	***Alternative Z5***, Extensive Backfilling with Soil Reclamation Covers	***Alternative Z6***, Optimize Grading for Source Control (Preferred Alt.)
Seepage Collection (operating and maintenance difficulty)	High operating requirements due to unreclaimed conditions. Intermediate maintenance needs.	Somewhat high operating requirements. Intermediate maintenance needs.	Intermediate operating requirements. Somewhat low maintenance needs due to easier pumping to Goslin Flats site.	High operating requirements. Intermediate maintenance needs.	Somewhat low operating requirement. Somewhat low maintenance requirements.	Somewhat low operating require-ments. Possible need for capture facility in Ross Gulch. Somewhat low maintenance requirements.	Same as Alt. Z1.
Water Treatment Plant Operations (operating and sludge disposal difficulty)	High operating requirements. Somewhat easy sludge disposal.	Somewhat low operating requirements. Somewhat easy sludge disposal.	Intermediate operating require-ments with easy access at Goslin Flats site. Sludge disposal somewhat difficult due to transport back to mine site.	Intermediate operating requirements. Somewhat easy sludge disposal.	Somewhat low operating requirements. Somewhat difficult sludge disposal.	Same as Alt. Z4.	Same as Alt. Z3.
Water Treatment Plant Acidity Load	High	Somewhat low	Somewhat high	Somewhat high	Intermediate	Intermediate	Intermediate
LAD Water Quality and Quantity	High quality due to acid, metal, nitrate & selenium pretreatments. Volume would be somewhat high due to unfinished heap reclamation.	Same quality as existing conditions. Volume somewhat low with use of barrier reclamation covers on heaps.	Same quality as existing conditions. Volume somewhat high with soil covers on heaps.	Same quality as existing conditions. Volume reduced to intermediate with better covers on heaps.	Same quality as existing conditions. Volume somewhat low with barrier reclamation covers on heaps.	Same quality as existing conditions. Volume somewhat low with Z85/86 and Z82 heaps used for backfill.	Same quality as existing conditions. Volume intermediate with improved reclamation covers on heaps.

Affected Resource or Mine Feature	**Existing Condition** (February 2001)	***Alternative Z1***, Existing DEQ Reclamation Plans (FEIS Alt.3 & 1998 ROD)	***Alternative Z2***, Optimized Water Treatment within Bond Amounts	***Alternative Z3***, Optimize Source Control within Bond Amounts	***Alternative Z4***, Added Backfilling with Barrier Reclamation Covers	***Alternative Z5***, Extensive Backfilling with Soil Reclamation Covers	***Alternative Z6***, Optimize Grading for Source Control (Preferred Alt.)
Soil and Reclamation Materials							
Reclamation Cover Durability	Somewhat good long-term durability of the present covers (which are just rock).	Somewhat poor durability due to potential breakdown of GCL.	Somewhat good durability with use of soil covers.	Same as Alt. Z2.	Somewhat poor durability due to potential breakdown of synthetics in barrier cover.	Same as Alt.Z2.	Intermediate long-term durability with the combination of reclamation covers.
New Disturbances	3.2 acres of new disturbance for construction of the Z85/86 drainage notch during interim reclamation.	Development of an 11-acre limestone quarry to supply reclamation material. 8-acre soil borrow Goslin Flats.	New 8 acres disturbance on Goslin Flats to relocate water treatment plant.	Same as existing conditions	New 13-acre disturbance for limestone quarry and to move water treat-ment plant. 8-acre soil borrow Goslin Flats.	Same as Alt. Z2.	Same as existing conditions
Vegetation and Revegetation							
Disturbance Area Revegetated	36%	84%	79%	79%	85%	88%	79%
Revegetation Density, Diversity and Sustainability	Somewhat poor. Not all areas adequate.	Somewhat good	Intermediate	Somewhat good	Good	Good	Good
Wildlife and Aquatics							
Reclamation Value as Wildlife Habitat	Somewhat low	Intermediate	Intermediate due to removal of water treatment plant and associated light and noise to Goslin Flats.	Intermediate	High	High	Somewhat high

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Land Use							
Long-Term Management Needs	High. Continual care and maintenance for unreclaimed lands.	Somewhat high with barrier cover maintenance and uphill pumping.	Intermediate	Somewhat high due to maintenance of pumping system and uphill pumping.	Same as Alt. Z2	Same as Alt. Z2	Somewhat high
Mineral Development Potential	Potential reduced from somewhat high at mine closure to intermediate with interim backfilling.	Somewhat low with increased backfilling of pit area.	Intermediate. Similar to existing conditions.	Same as Alt. Z2.	Low potential for future mineral development with the added backfill.	Low potential for future mineral development with the extensive backfill.	Somewhat low with partial backfilling of all pits.
Recreation and Visual Resources							
General Aesthetic Condition of Reclaimed Mines	Somewhat low due to unreclaimed areas and pit highwalls.	Intermediate due to backfilling of some pit areas.	Somewhat low	Intermediate. Impact similar to Alt. Z1, though less backfilling.	Somewhat high with the added pit backfilling.	High due to restored landform and elimination of pit highwalls.	Somewhat high with the added grading and pit backfilling.
Hunting, Tourism or other Recreational Suitability	Low to somewhat low suitability.	Intermediate	Intermediate to somewhat high	Same as Alt. Z1.	Somewhat high	Same as Alt. Z4.	Intermediate to somewhat high.

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Cultural Resources							
Usability for Traditional Cultural Practices	Low. Areas still unreclaimed. Equipment active.	Somewhat low	Somewhat low	Somewhat low	Intermediate	Somewhat high	Intermediate
Social and Economic Conditions							
Study Area Economy	Year 2000 averaged 31 jobs and $622,000 in total industry output.	21-40 jobs and $753,000 to $1.2 million annually in total industry output over 3-year period (2001-2003).	46 jobs and $1.5 million annually in total industry output over 1 year (2001).	54 jobs and $2.2 million annually in total industry output over 1 year (2001).	37-41 jobs and $1.1 million to $1.3 million annually in total industry output over 4-year period (2001-2004).	38-49 jobs and $1.1 million to $1.4 million annually in total industry output over 6-year period (2001-2006).	47-54 jobs and $1.3 million to $2.2 million annually in total industry output over 2-year period (2001-2002).
Zortman Community Infrastructure Condition	Low	Intermediate. Removal of tailings through town would improve distribution water system and reduce flooding potential.	No change	No change	Intermediate. Same as Alt. Z1.	Intermediate. Same as Alt. Z1.	Somewhat low with no tailings removal through town.
Reclamation Worker Health and Safety	High level of worker protection with just interim reclamation work.	Somewhat low protection. Alder Dump removal difficult.	Somewhat high protection with this reclamation effort.	Same as Alt. Z2	Somewhat low protection due to increased amount of reclamation duration.	Somewhat low worker protection. Similar to Alt. Z4.	Intermediate
Public Health and Safety Post-Reclamation	Intermediate. Existing conditions contain hazards.	Intermediate	Intermediate. Similar to Alt. Z1.	Intermediate. Similar to Alt. Z1.	Somewhat high with reduction of pit highwall height.	High public safety with elimination of pit highwalls.	Somewhat high with the reduction of the pit highwall height.
Long-Term Employment Value	Somewhat high due to need for continual water treatment plant operation.	Intermediate. Less need for water treatment plant operation over existing conditions.	Somewhat low. Treatment plant at Goslin Flats would require less personnel to operate.	Intermediate. Similar to Alt. Z1.	Somewhat low. Similar to Alt. Z2.	Somewhat low. Similar to Alt. Z2.	Intermediate. Similar to Alt. Z1.

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Total Reclamation Expenditures	$6.9 million spent on interim reclamation.	$25.6 million	$10.0 million	$10.0 million	$39.0 million	$47.2 million	$15.0 million
Percentage of Reclamation Costs Attainable within Bond Amount	na	39%	100%	100%	26%	21%	67%
Long-Term Water Collection and Treatment Costs (required net present value of trust fund)	$12.4 million	$11.8 million	$10.8 million	$12.3 million	$10.6 million	$10.6 million	$11.8 million
Long-Term Water Management Costs Attainable with Present Trust Fund	56%	58%	64%	56%	65%	65%	58%

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Alternative Ranking from Multiple Account Analysis Scores (from Appendix A)							
Technical Working Group's Overall Evaluation	7	4	4	6	3	1	1
Technical Working Group Evaluation without Economic Indicators	7	4	5	5	2	1	3
Cost-Benefit Evaluation Ranking. (environmental benefit vs. cost)	7	4	2	3	5	6	1