Joint Final Environmental Impact Statement

Montanore Project

December 2015

Cabinet Mountains *Photo by M. Holdeman*

Volume 4

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United States Department of Agriculture
Forest Service
Northern Region
Kootenai National Forest

Montana Department of
Environmental Quality

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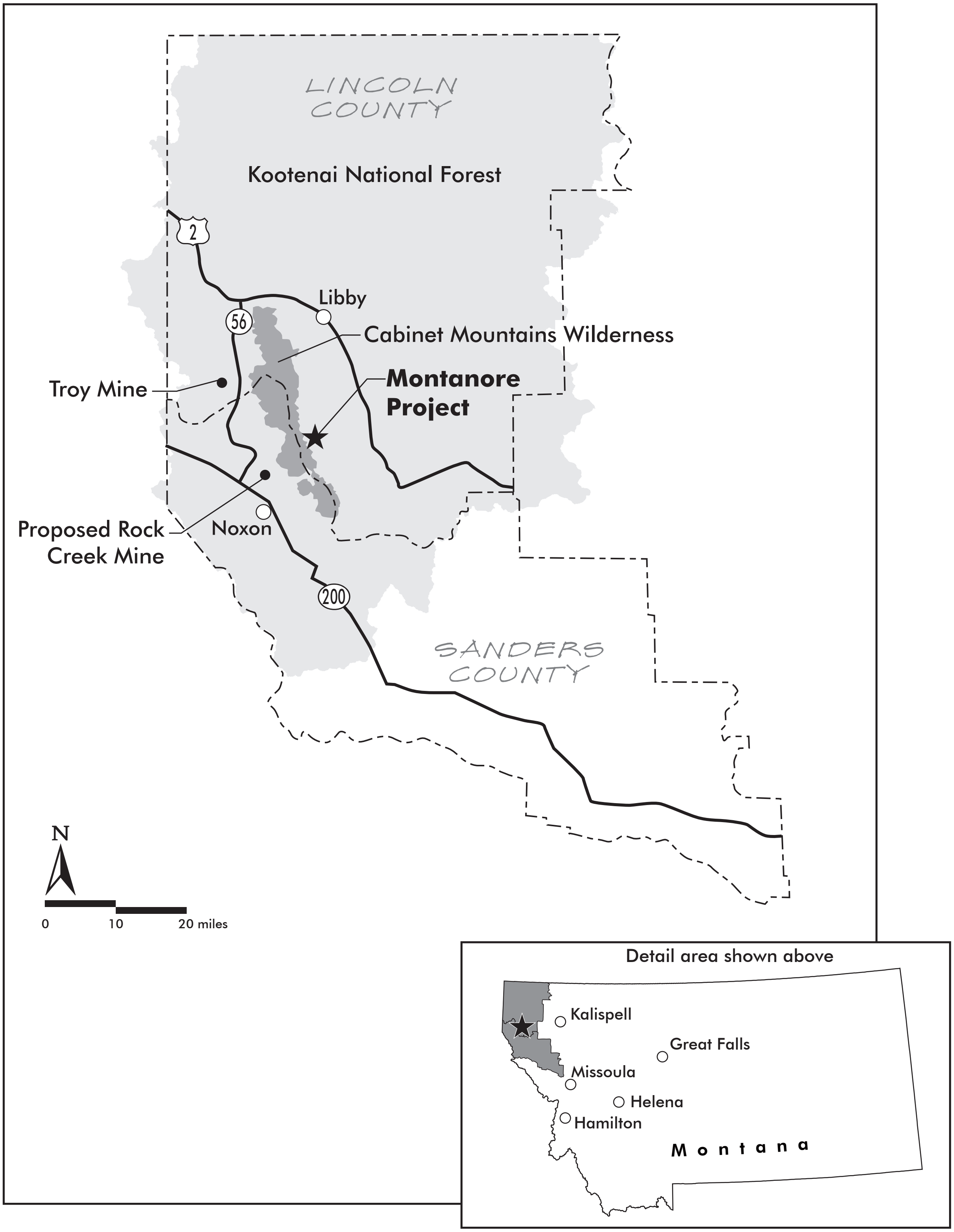

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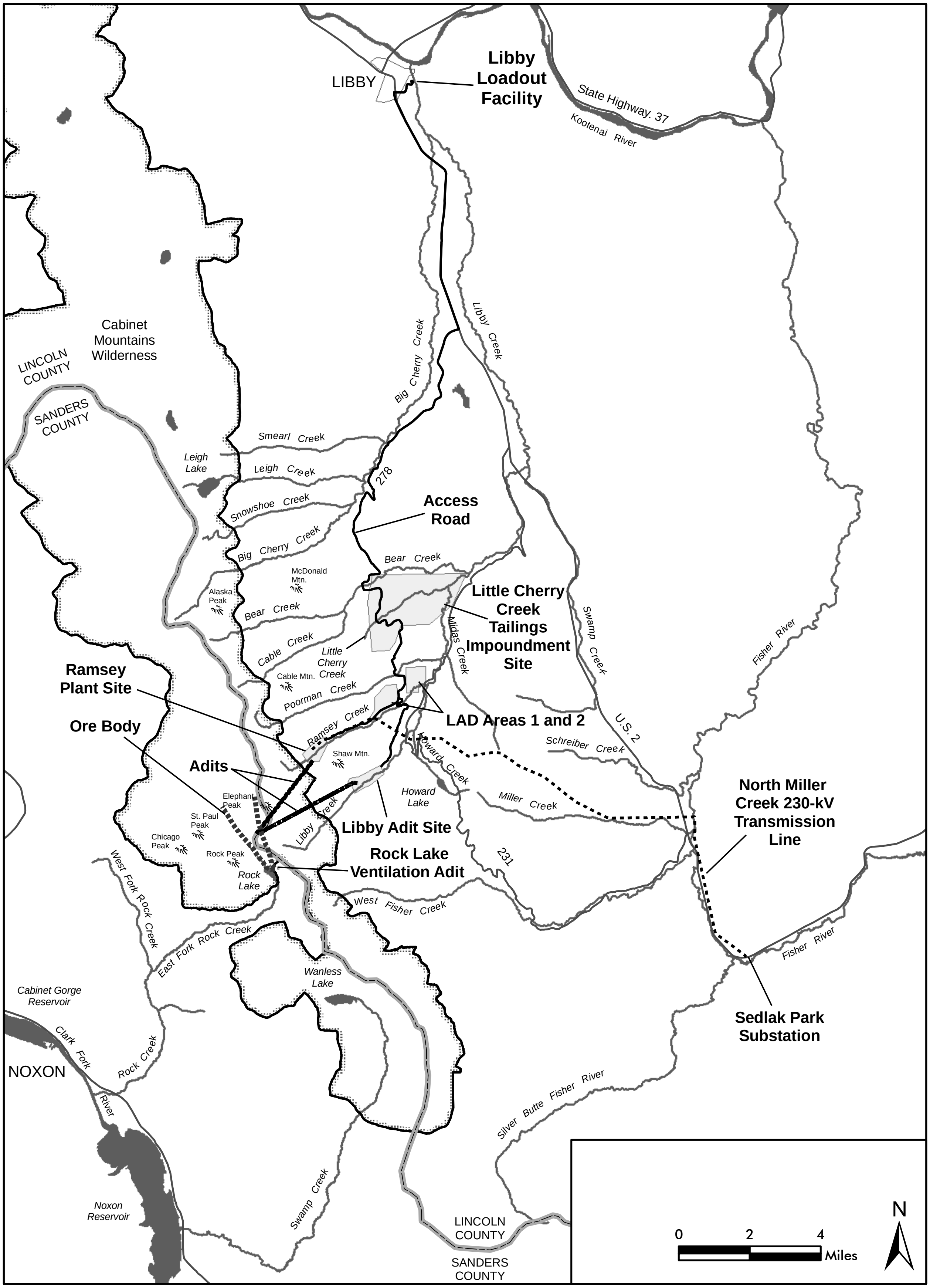

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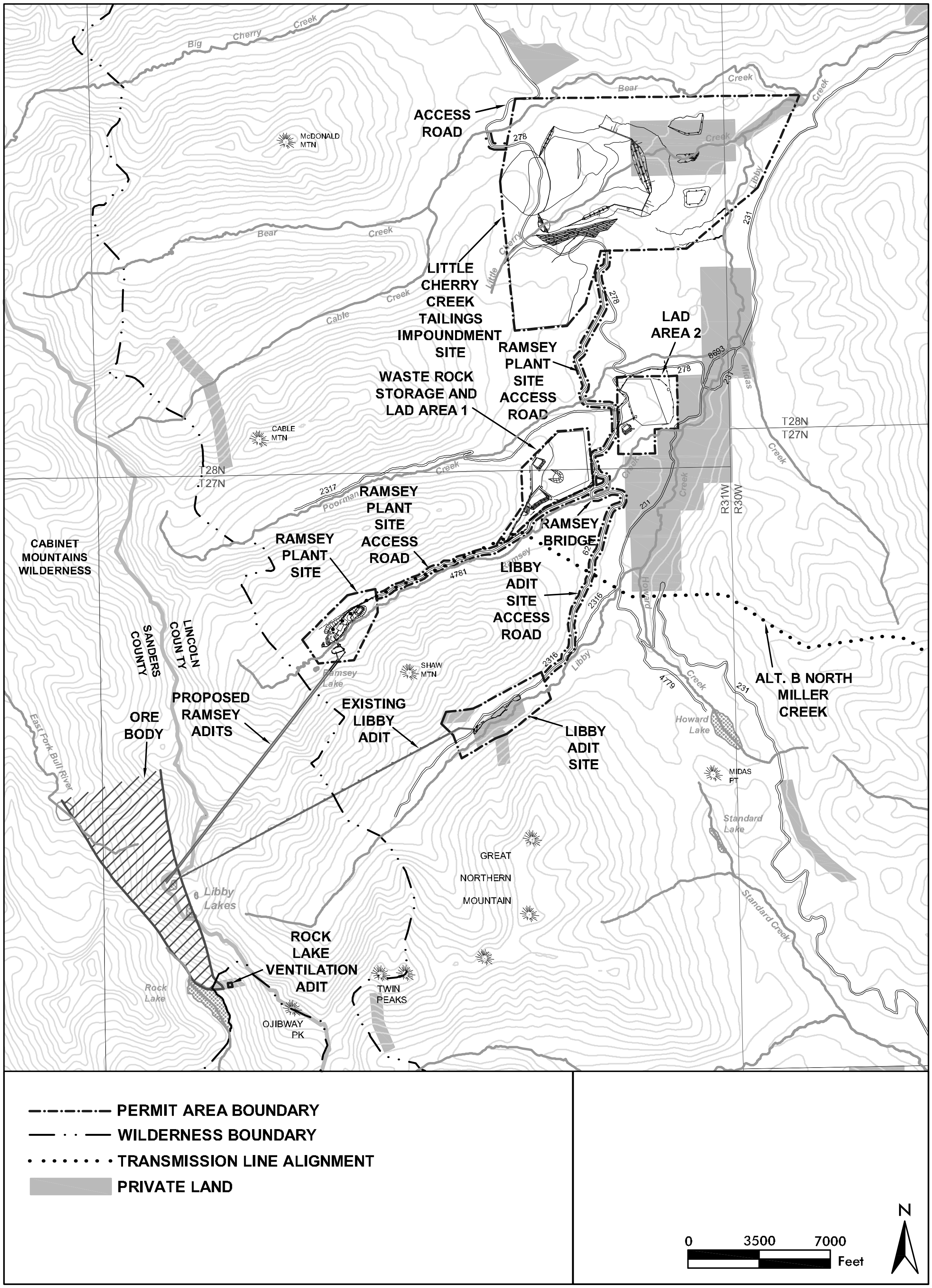

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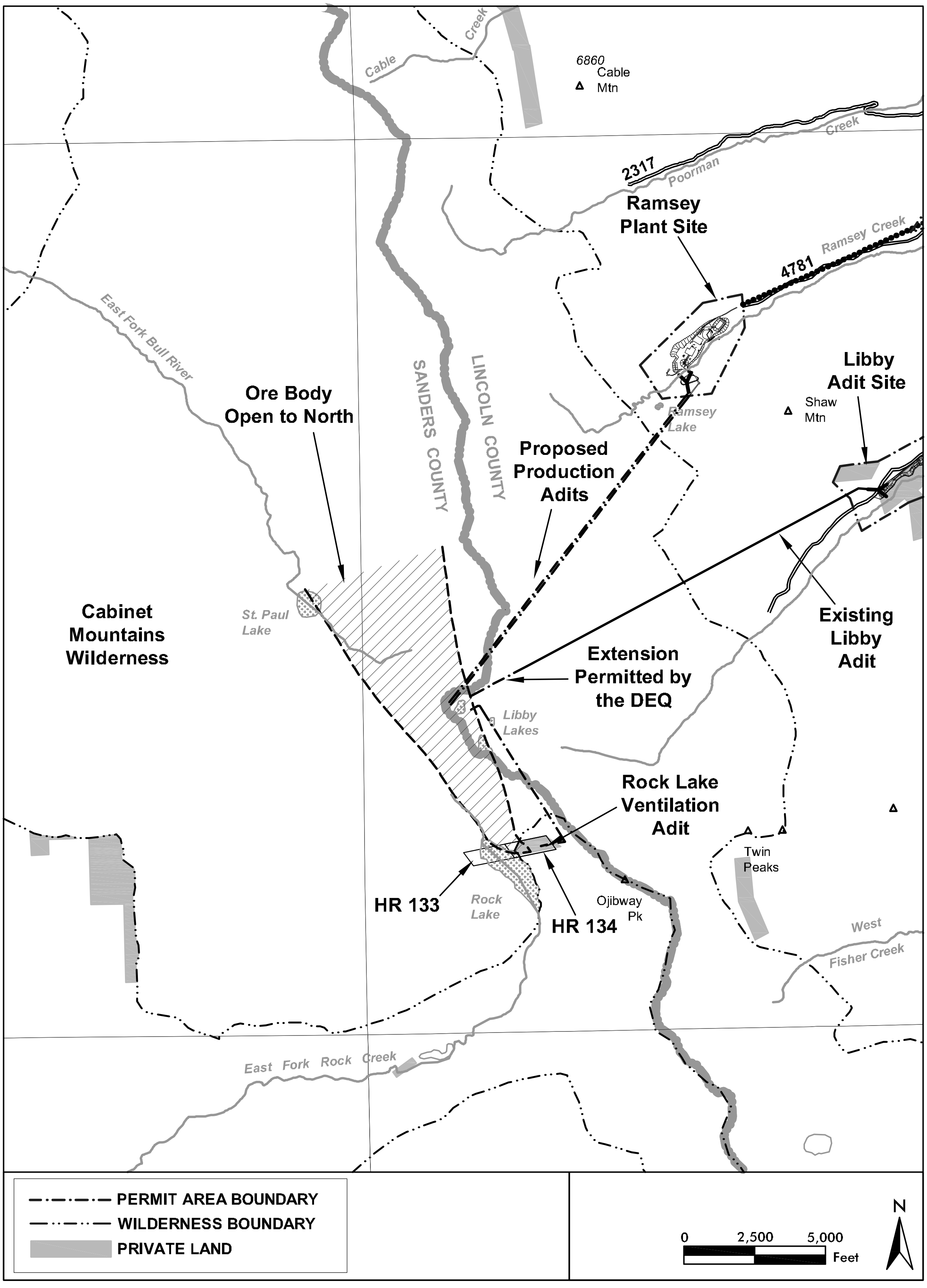

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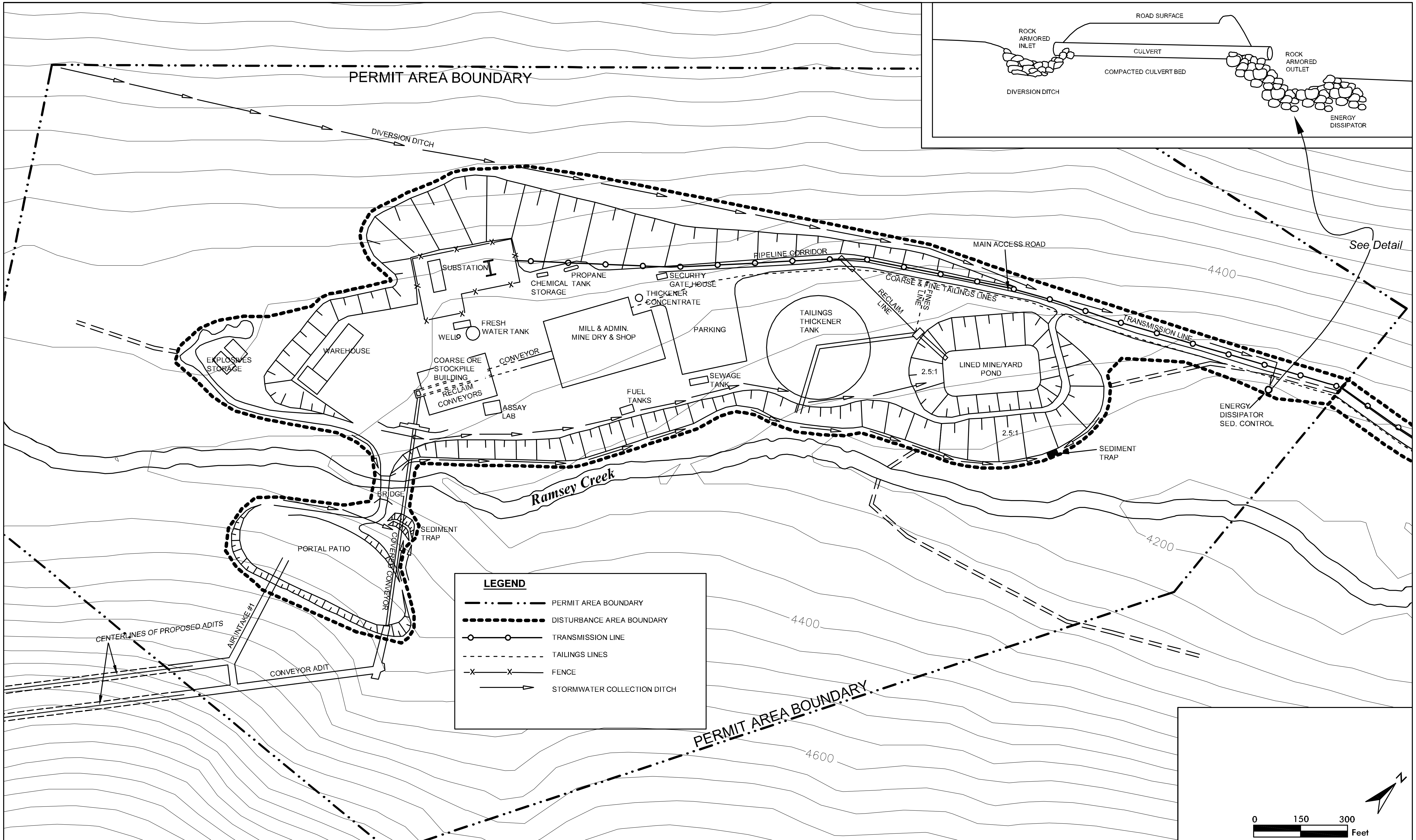

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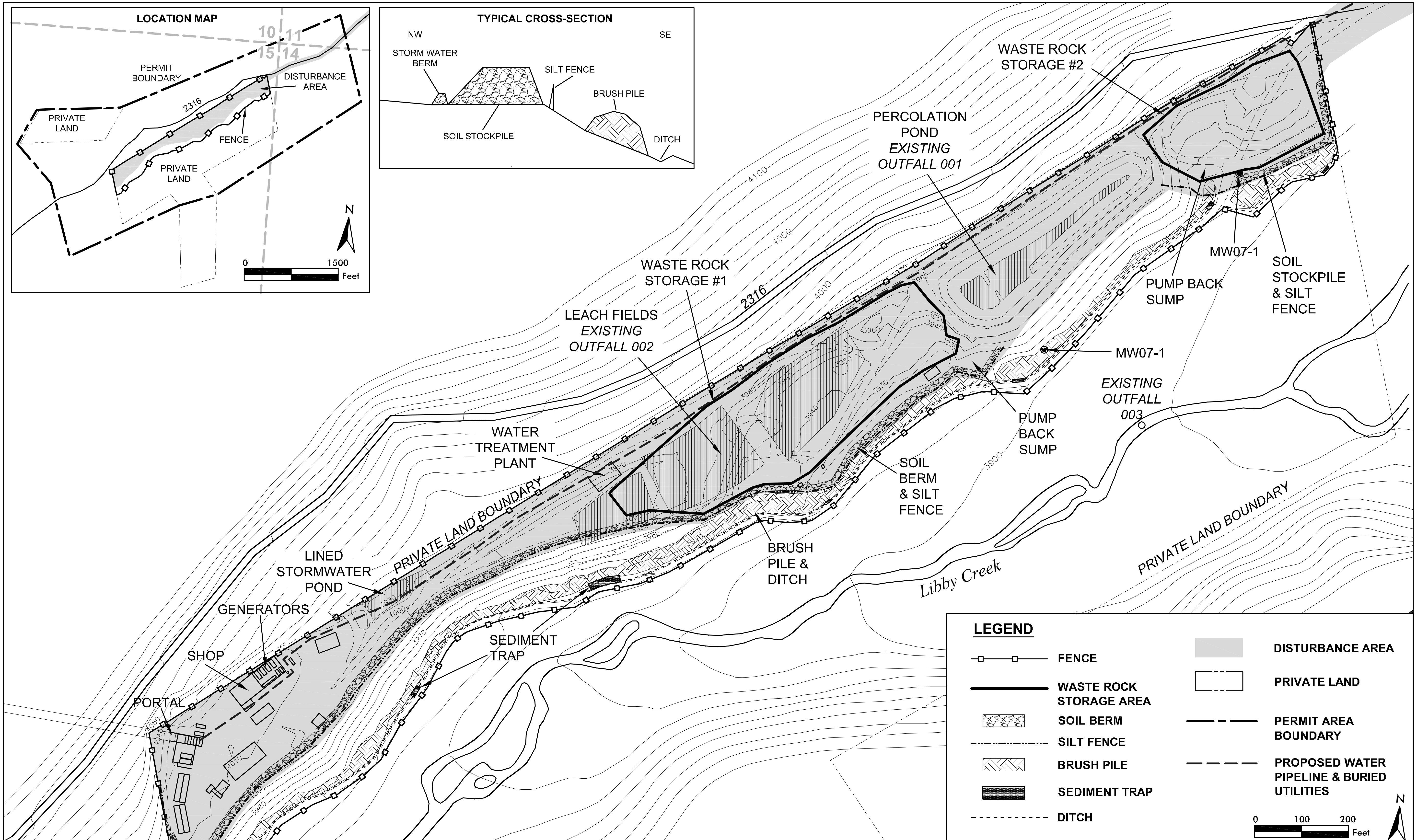

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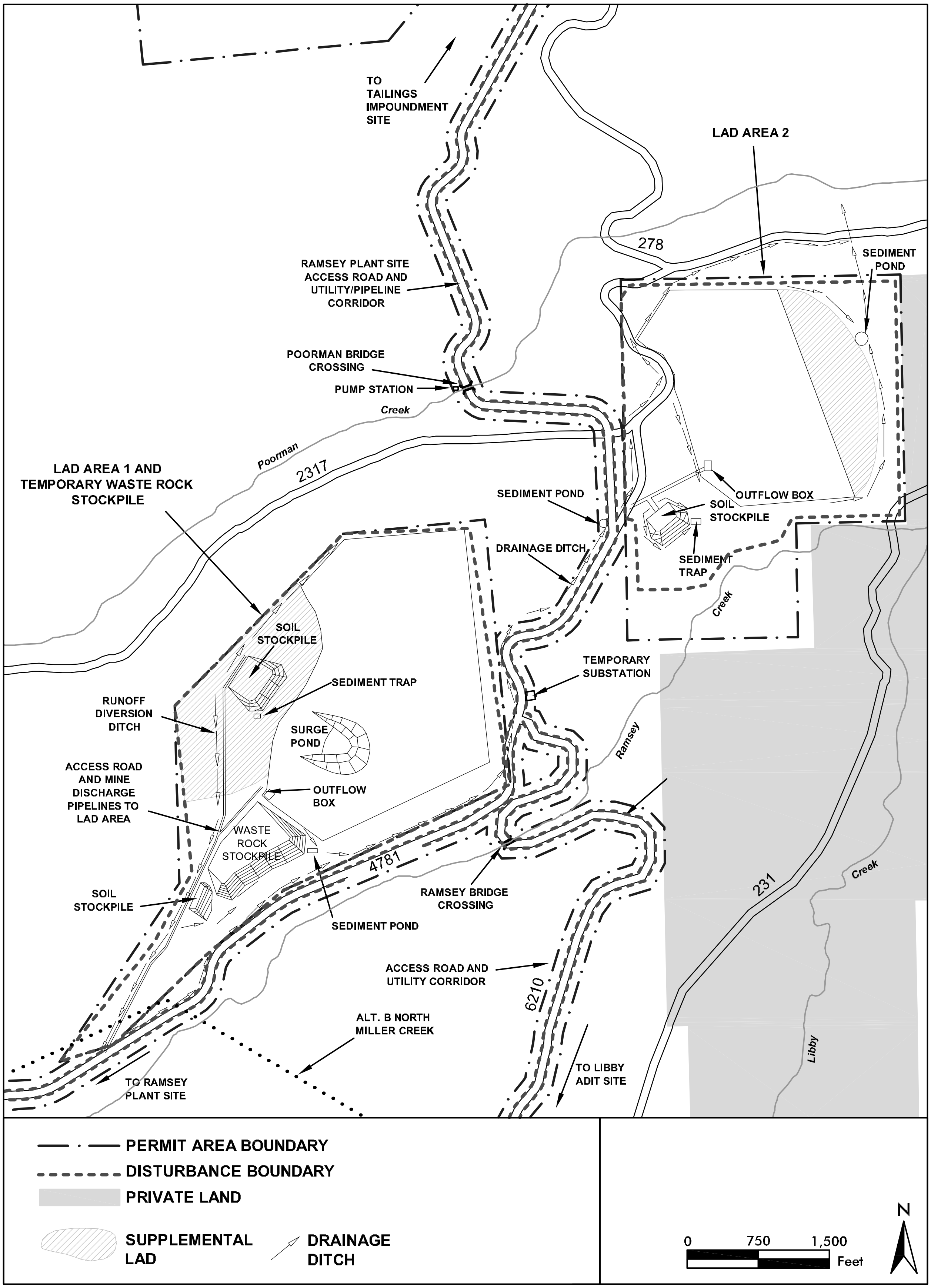

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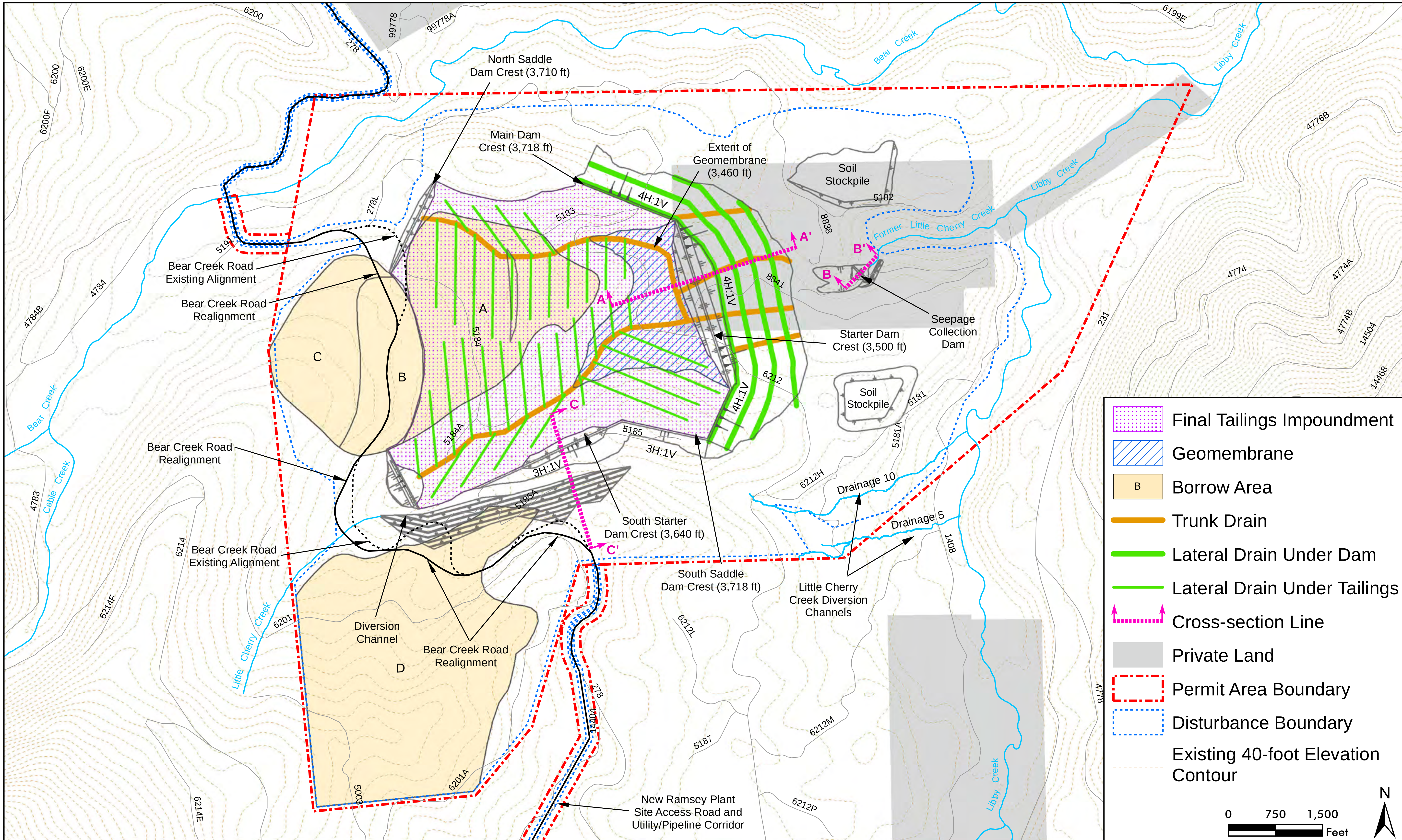

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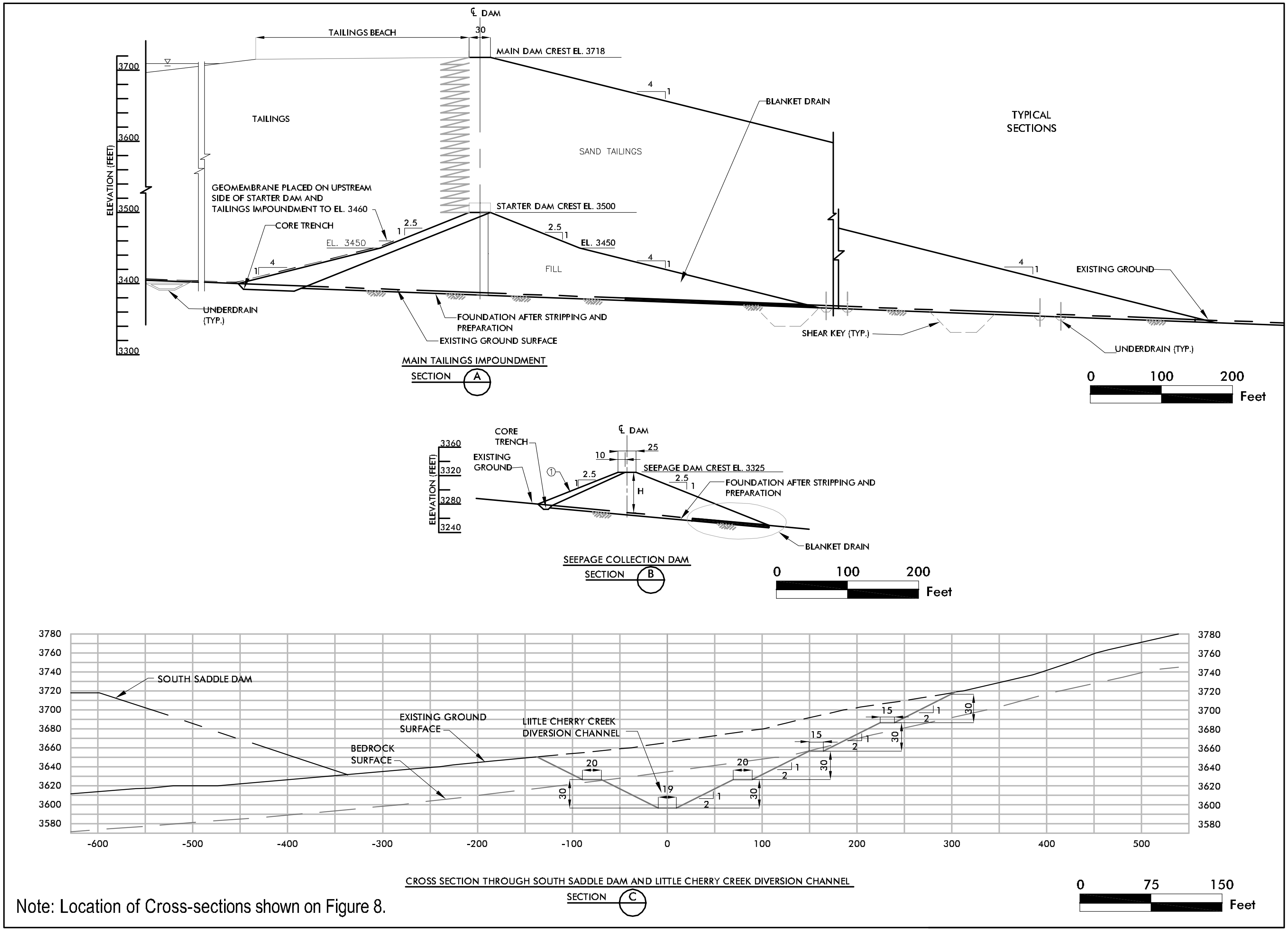

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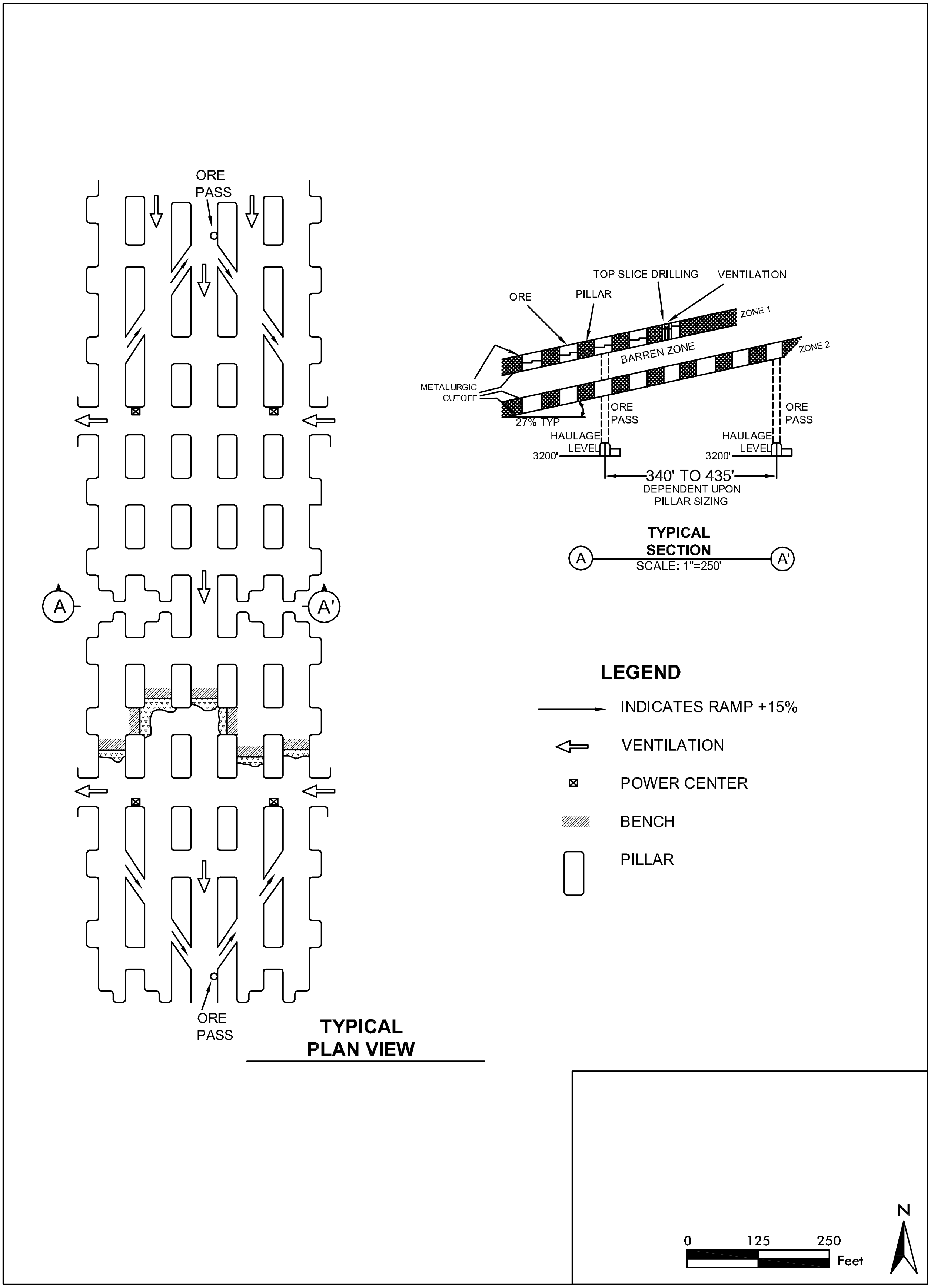

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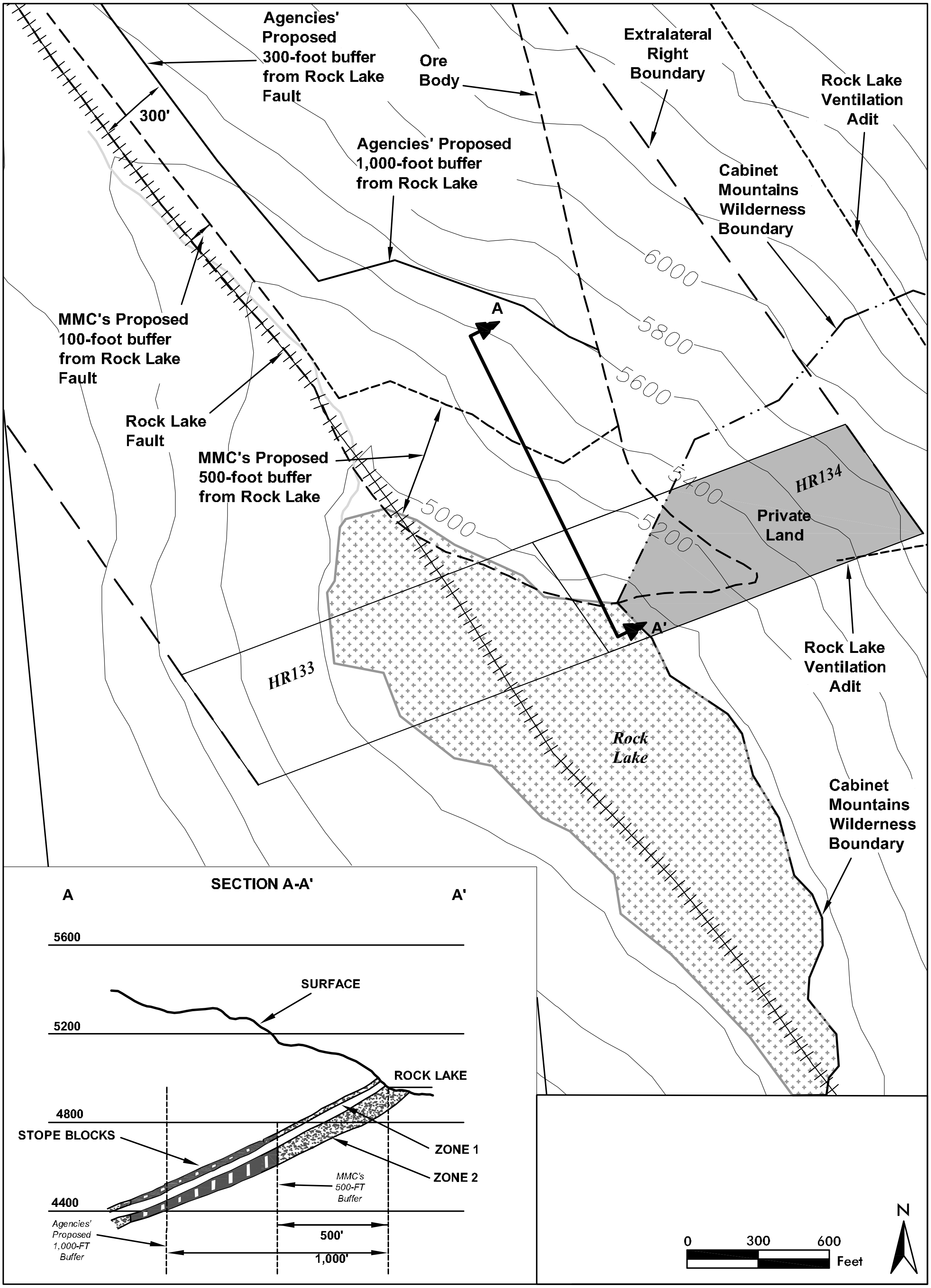

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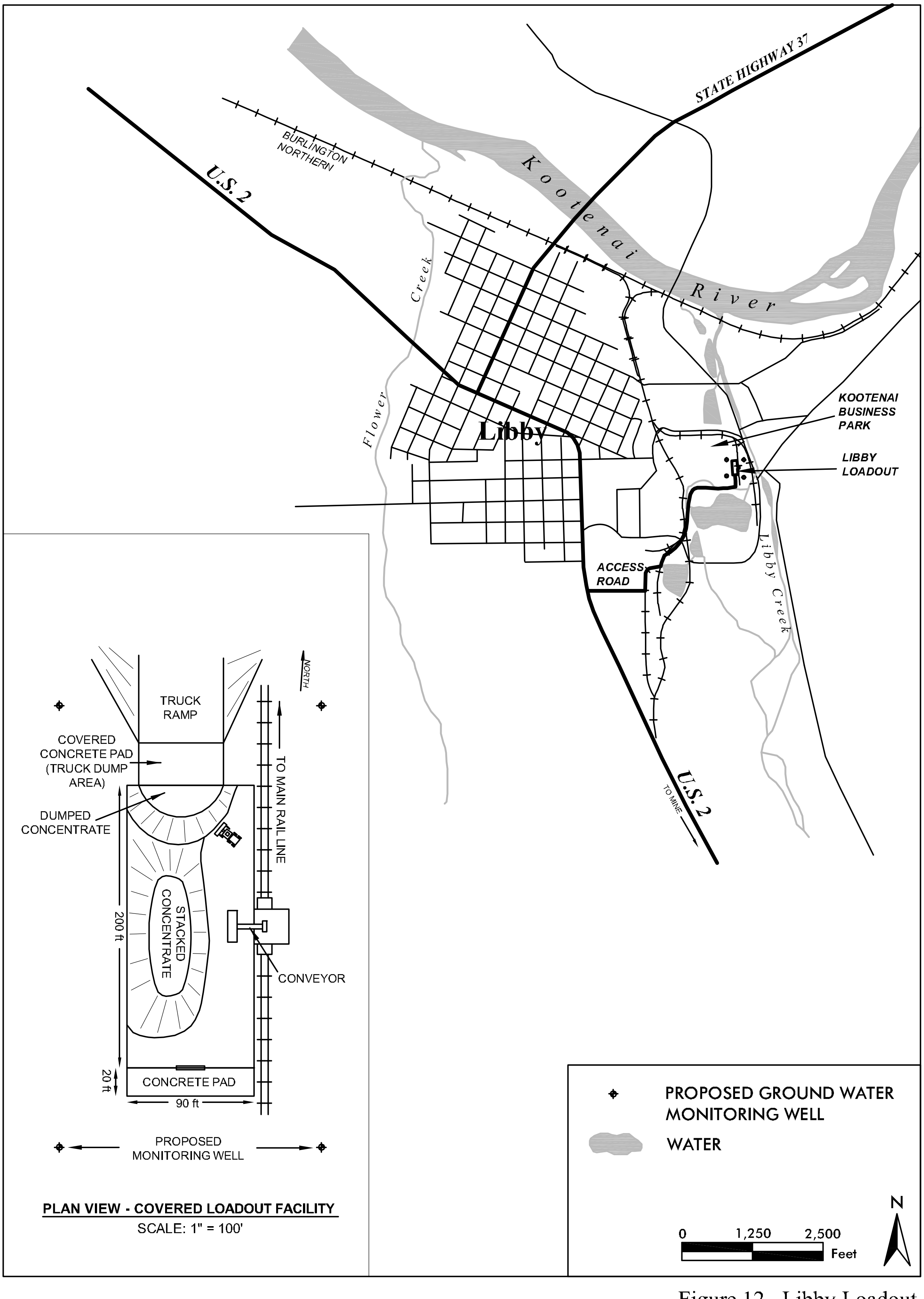

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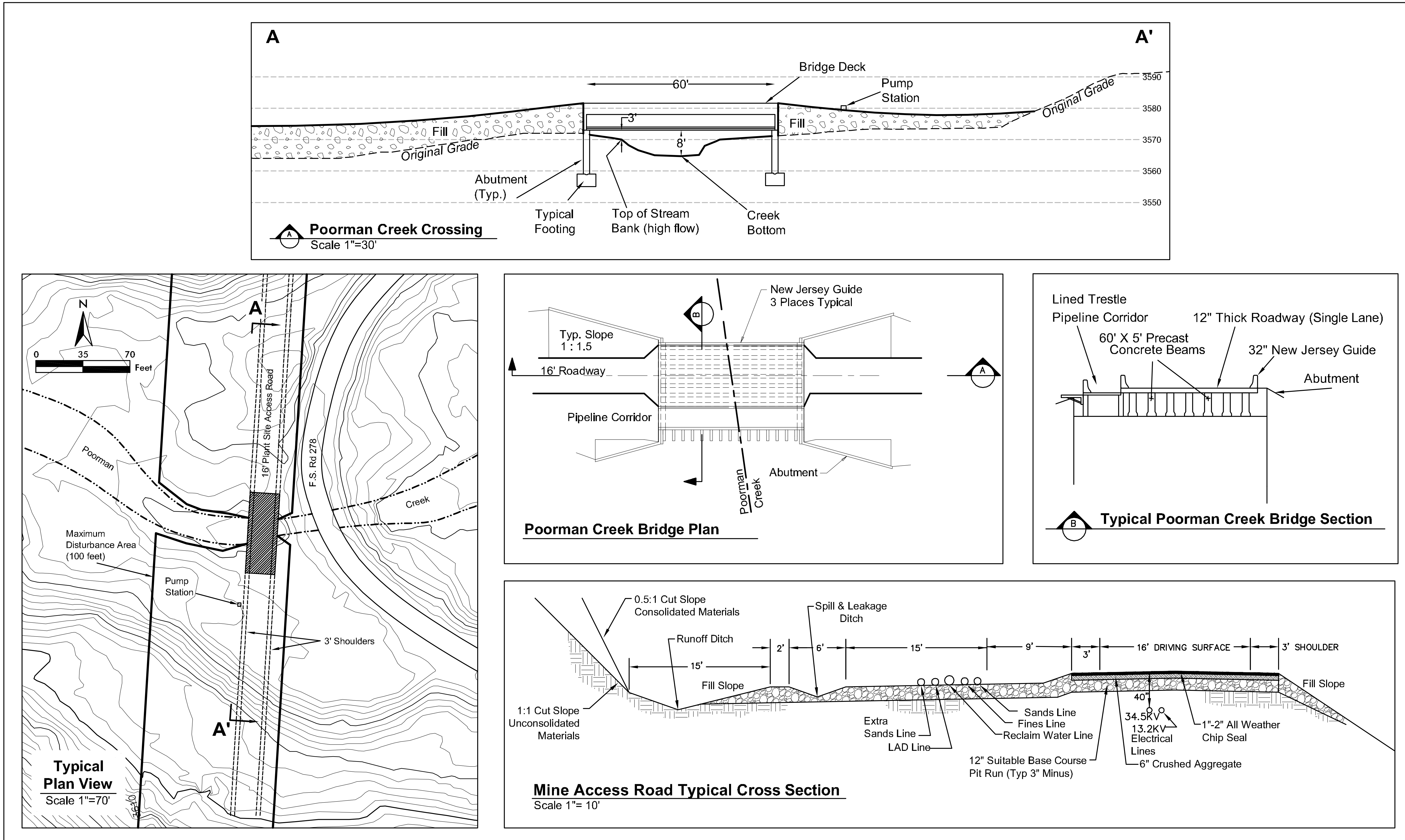

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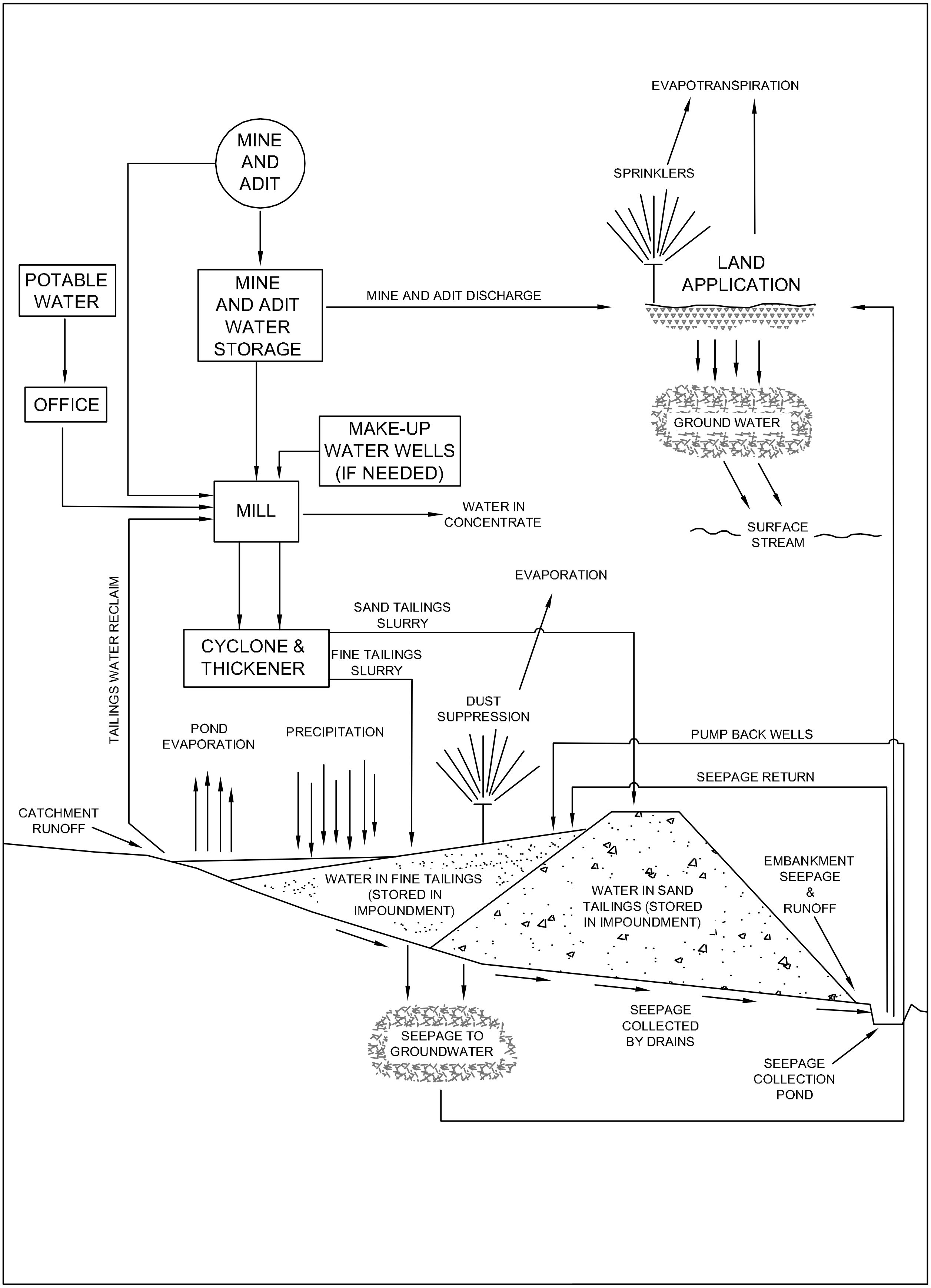

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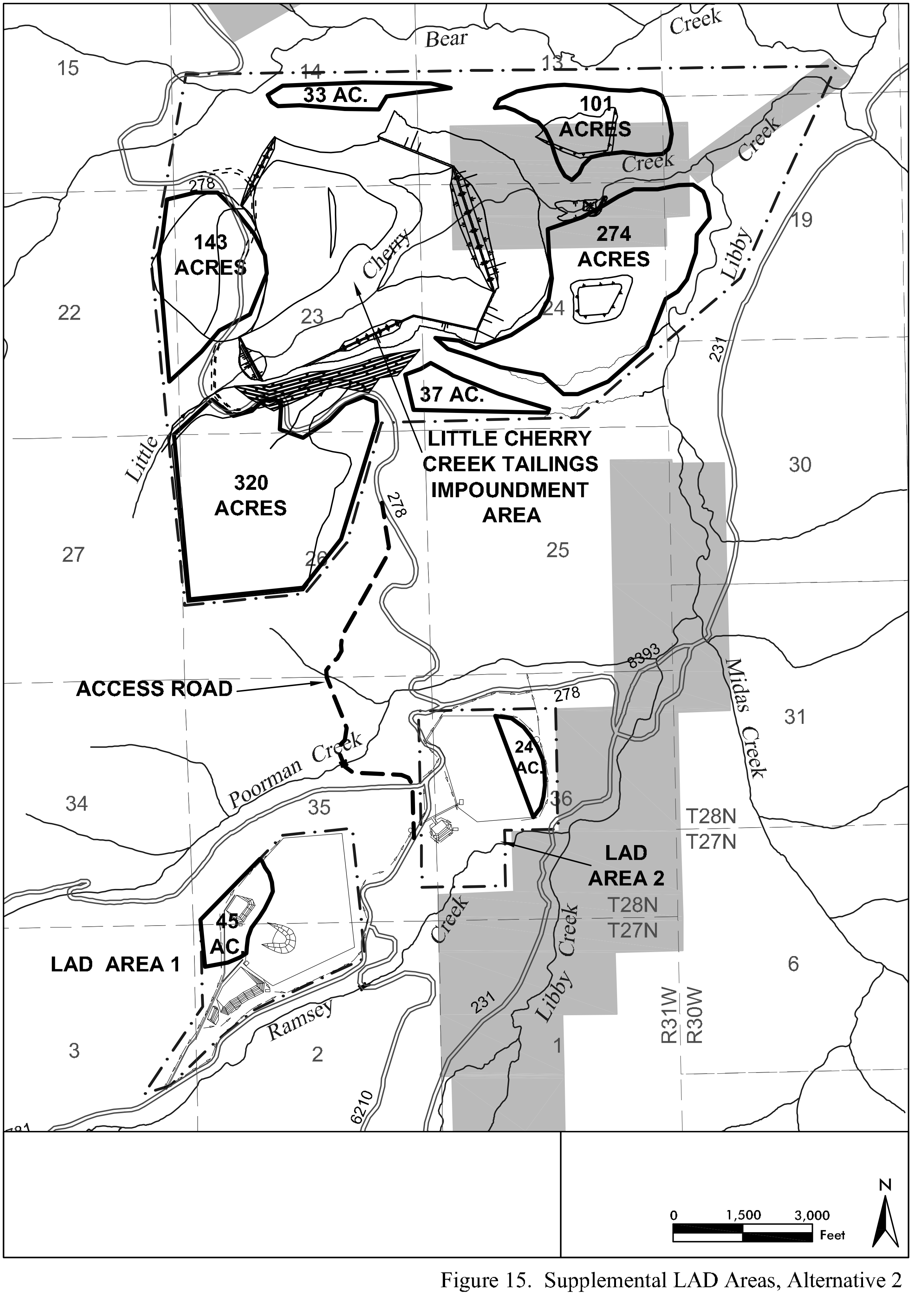

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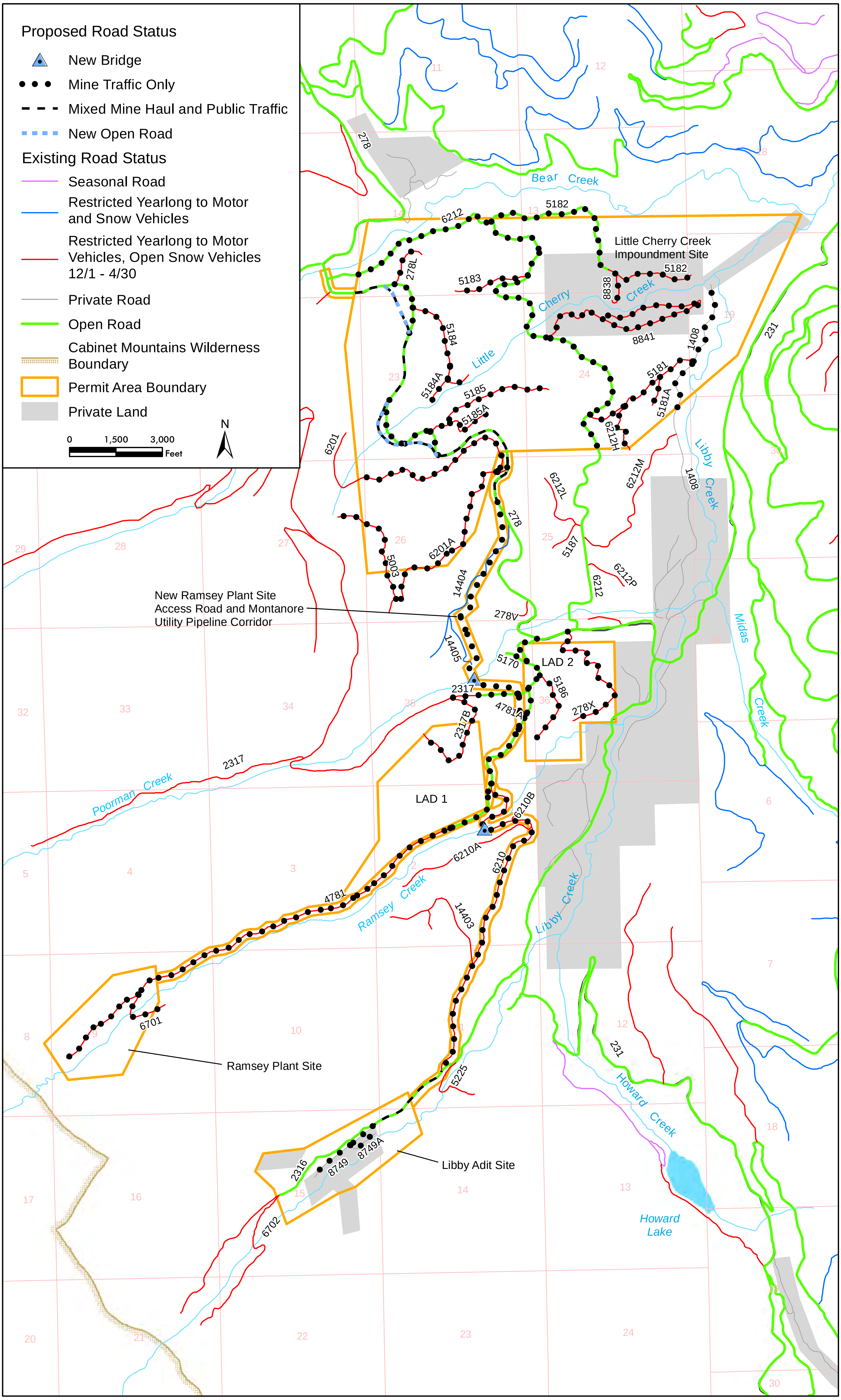

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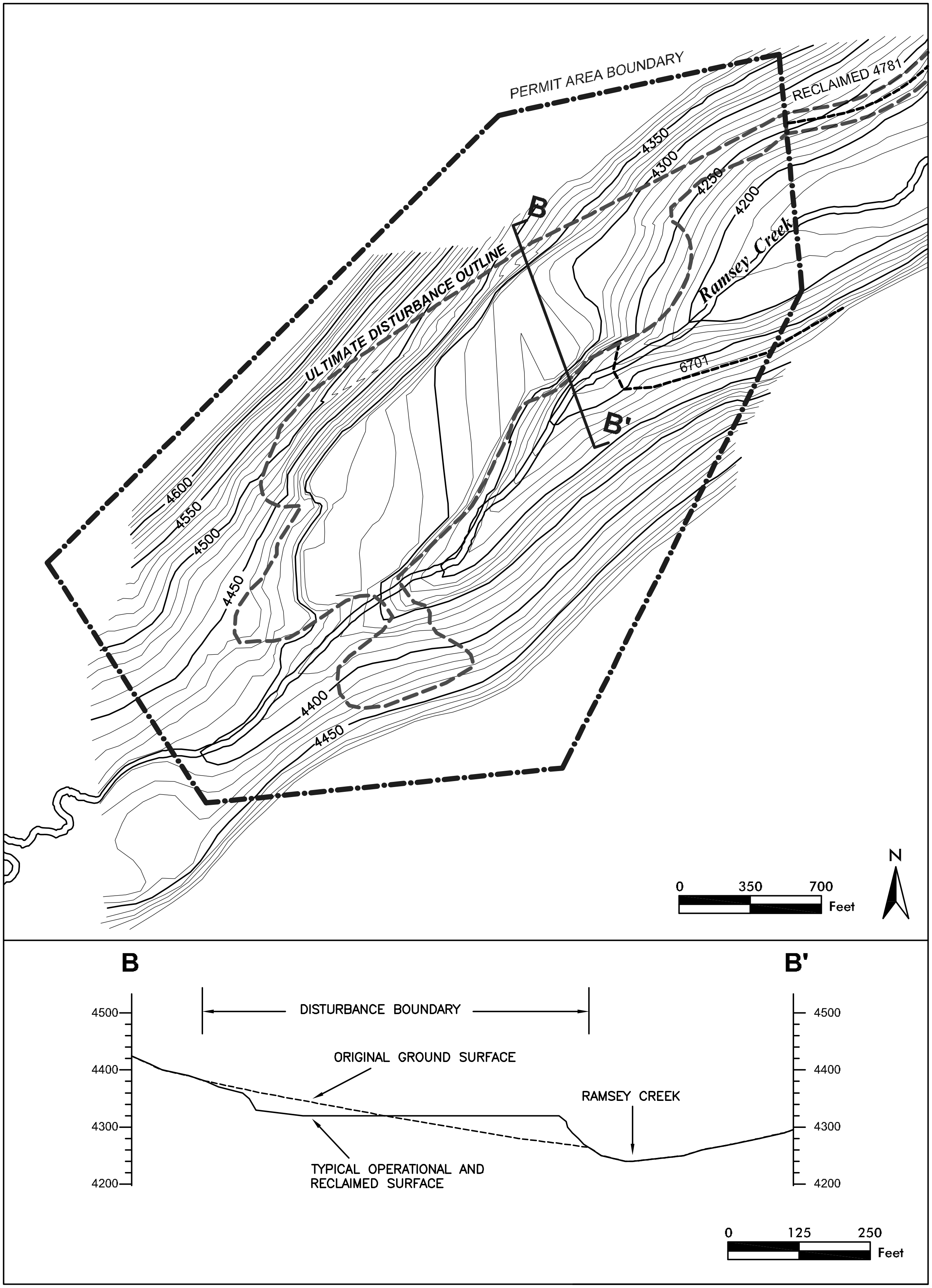

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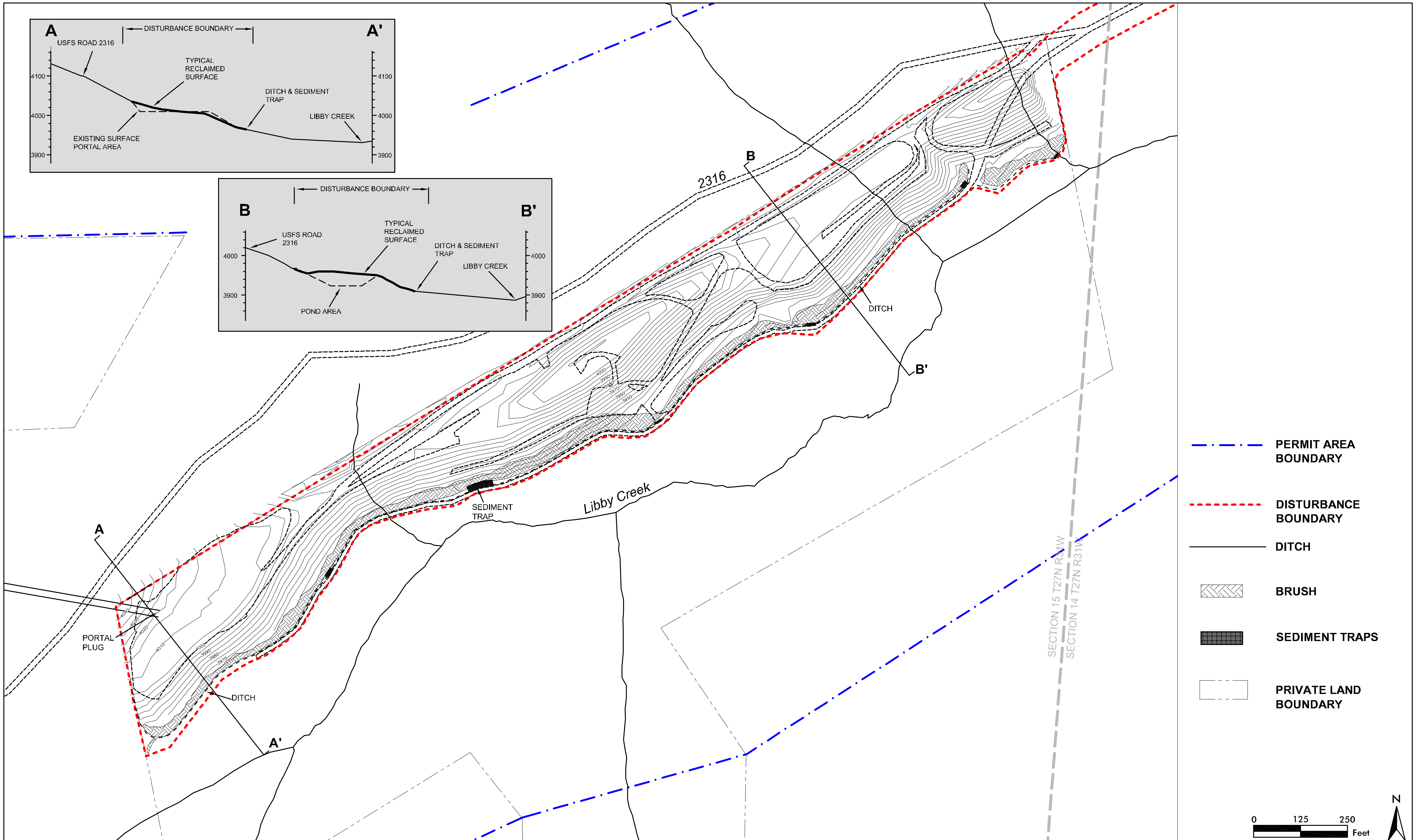

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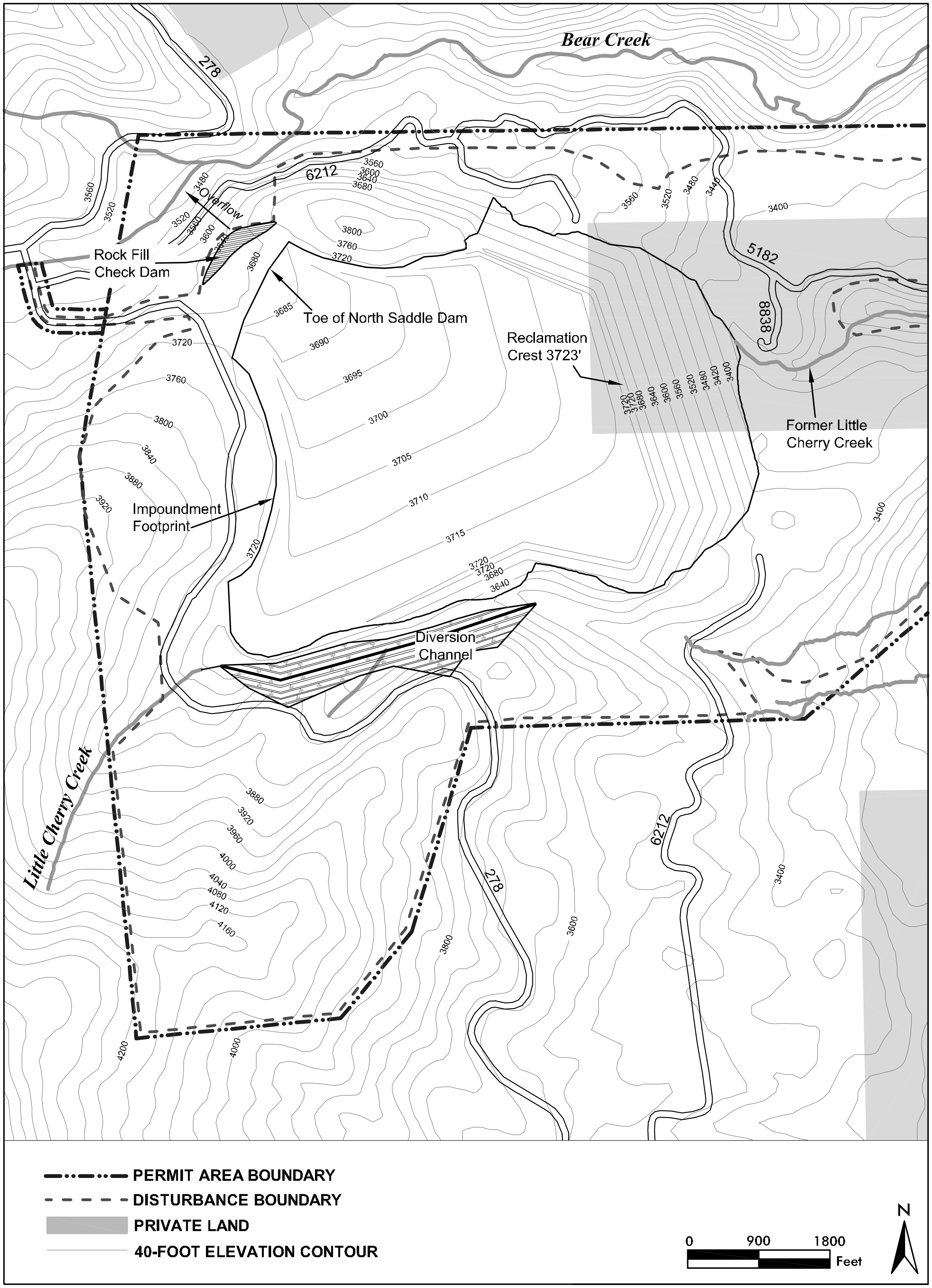

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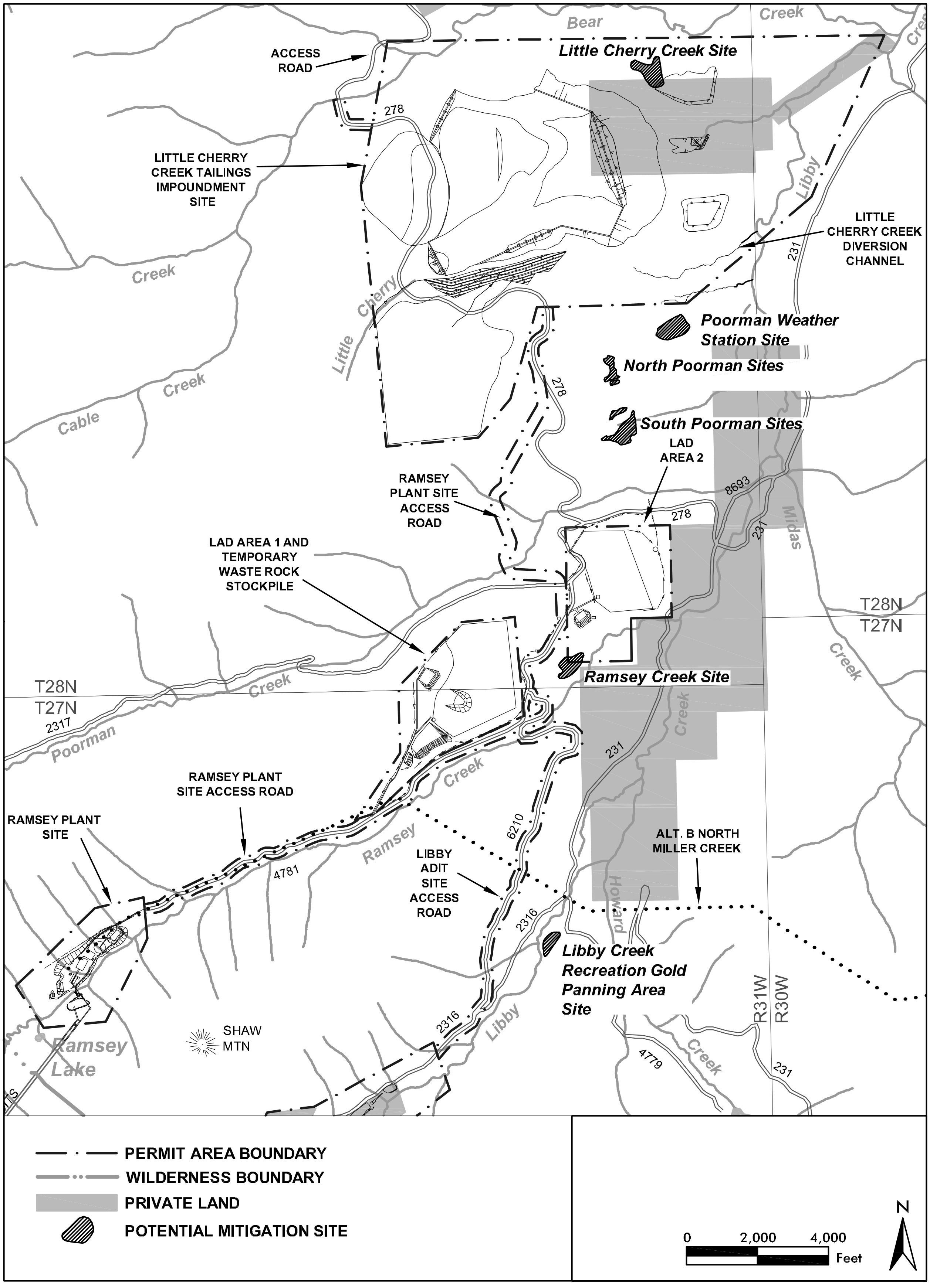

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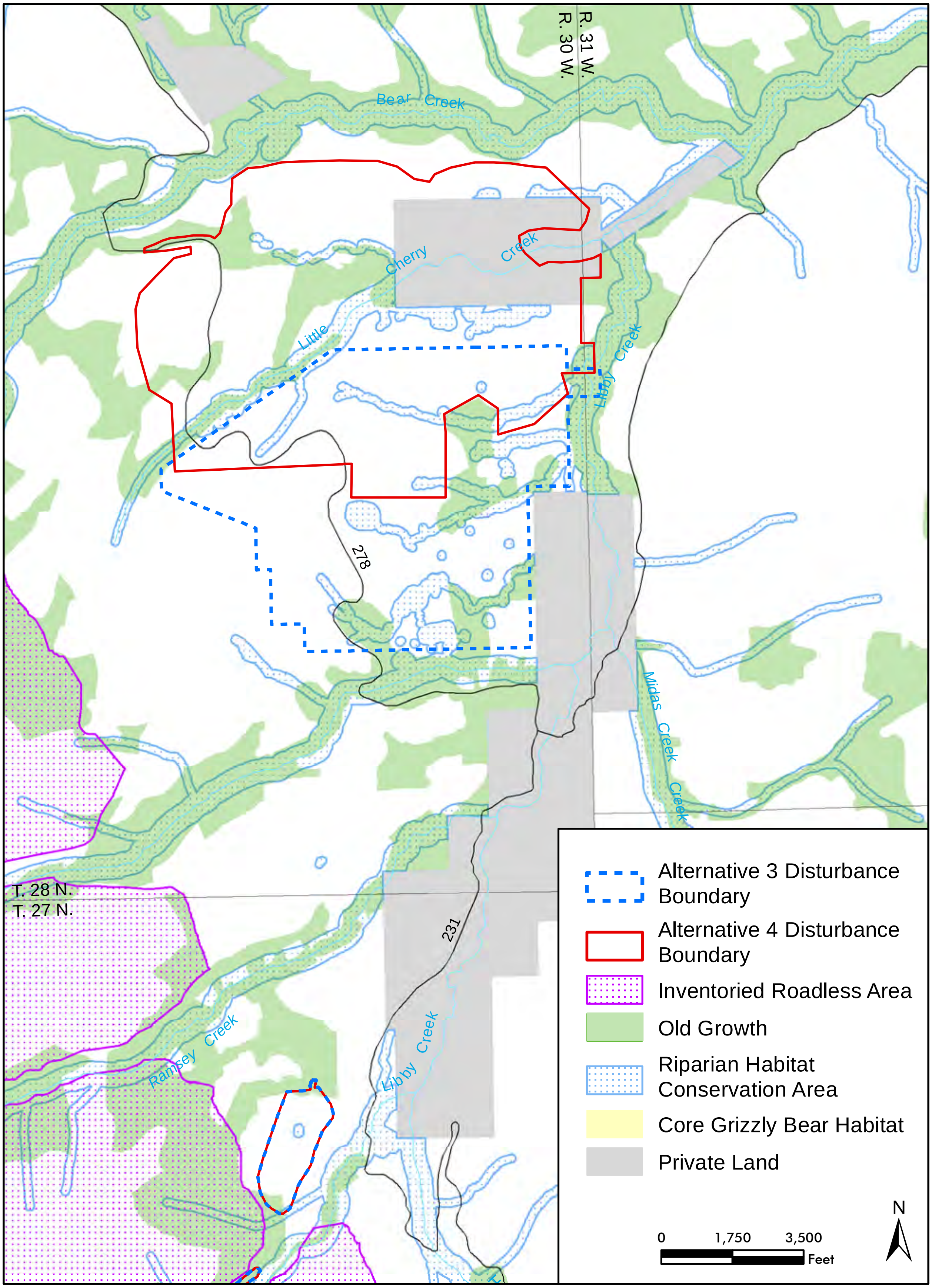

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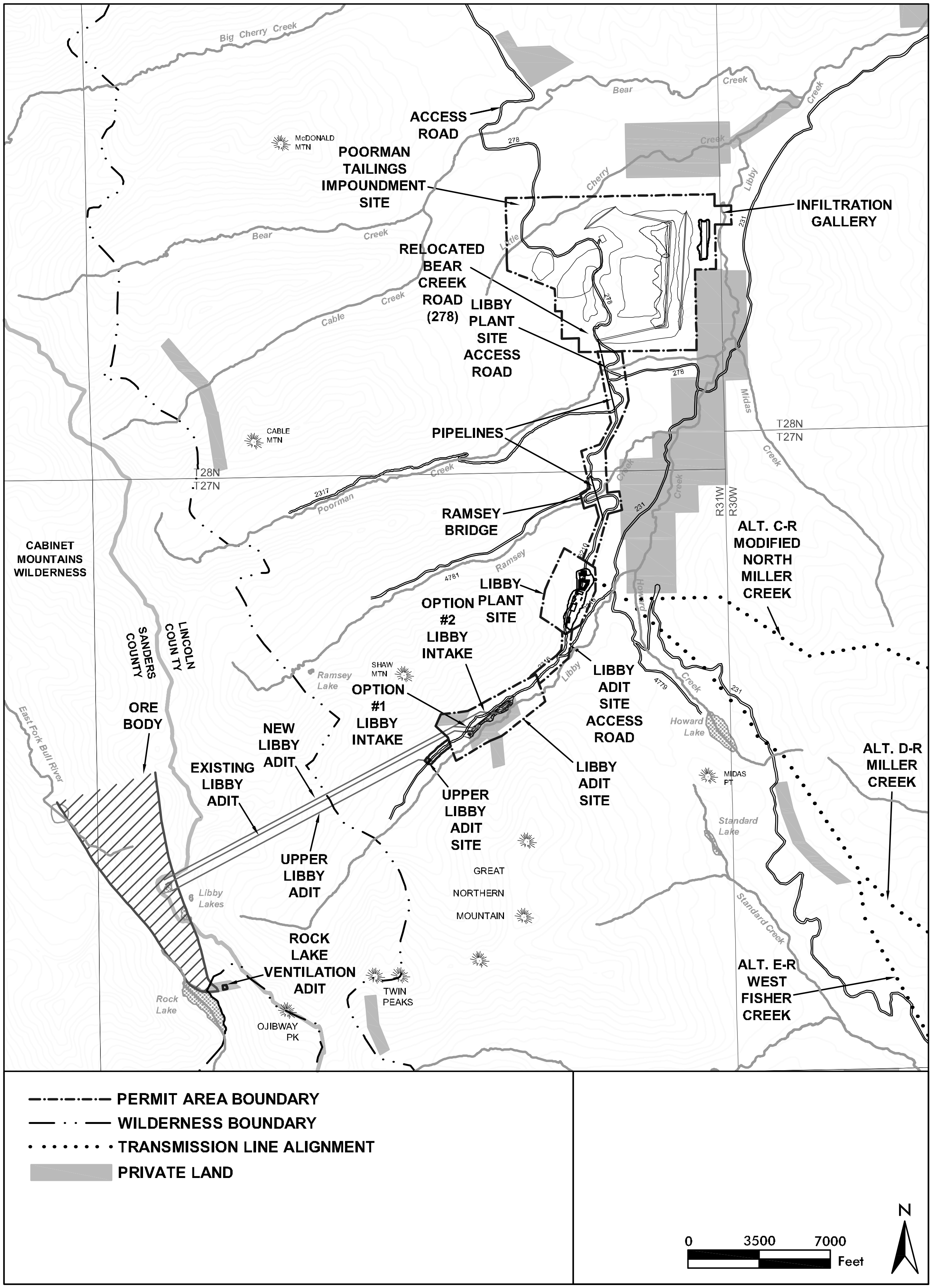

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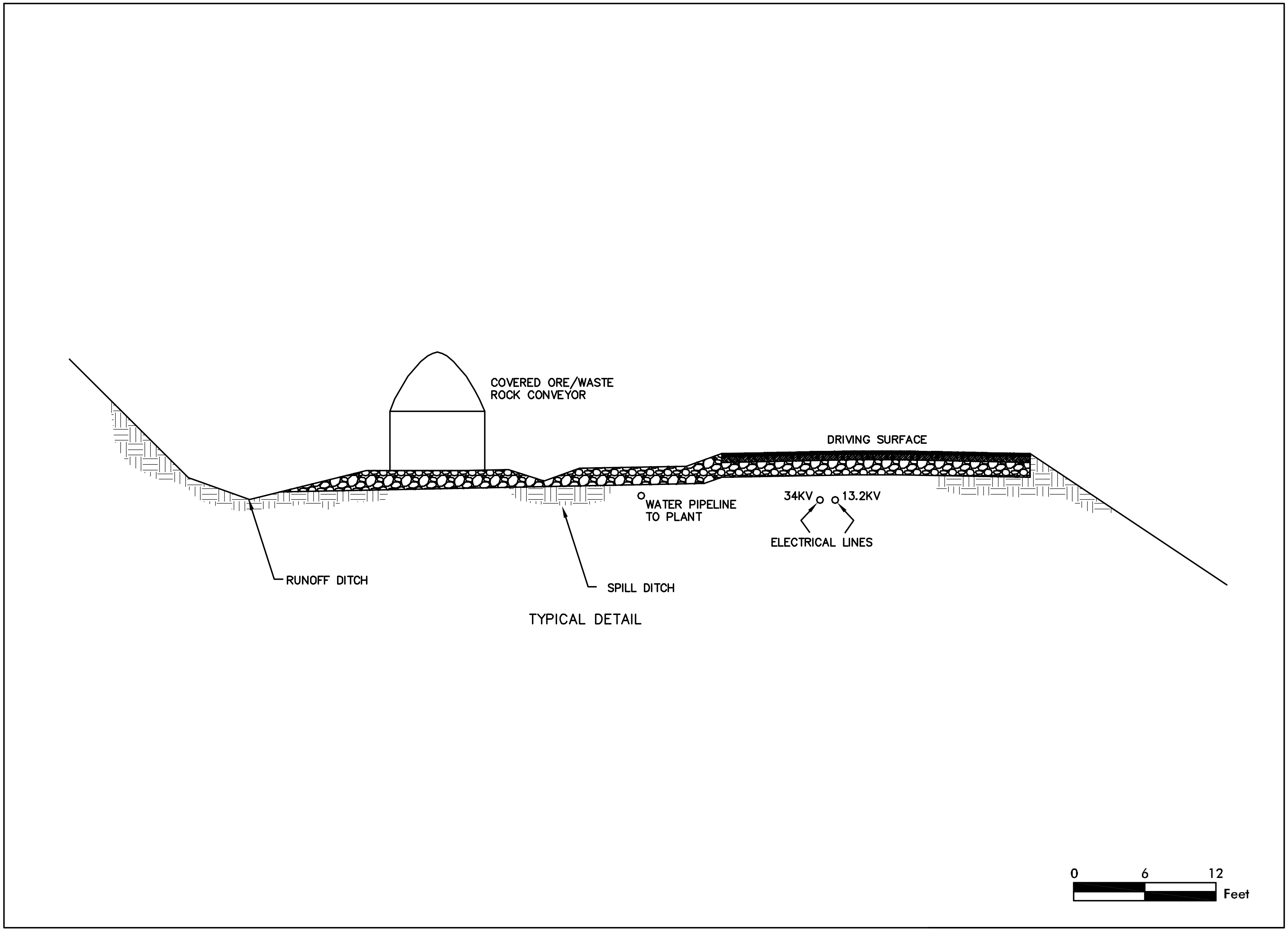

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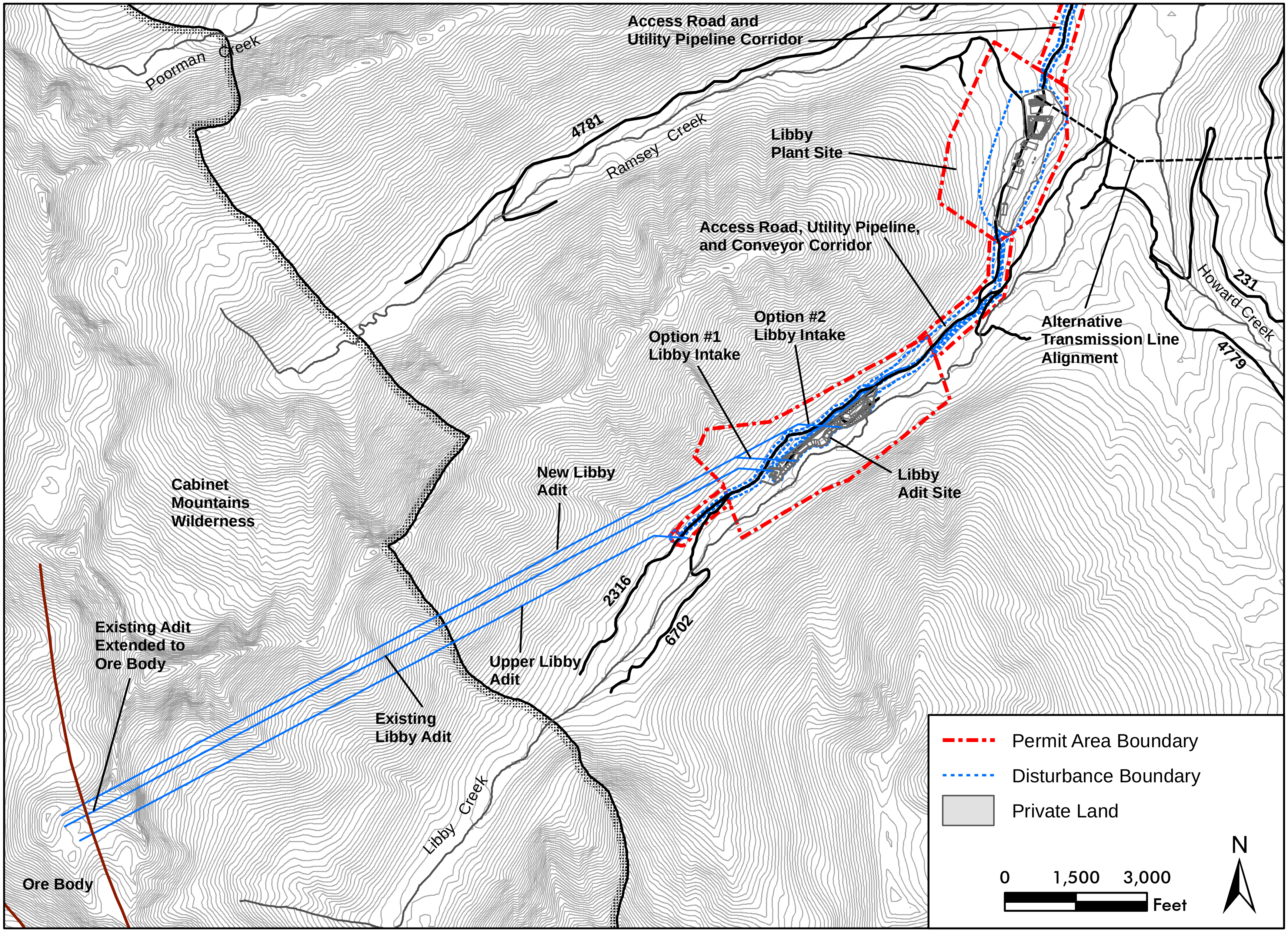

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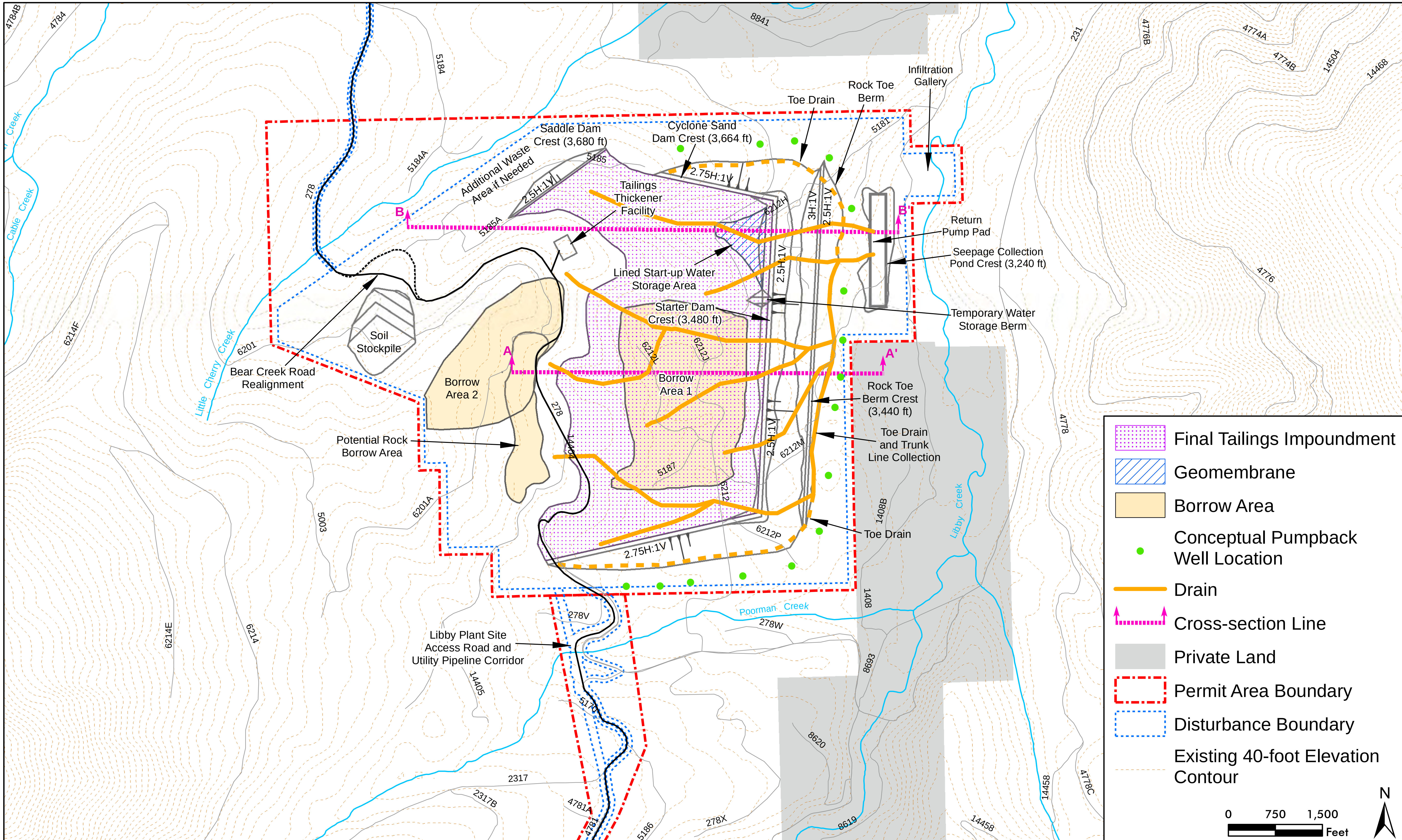

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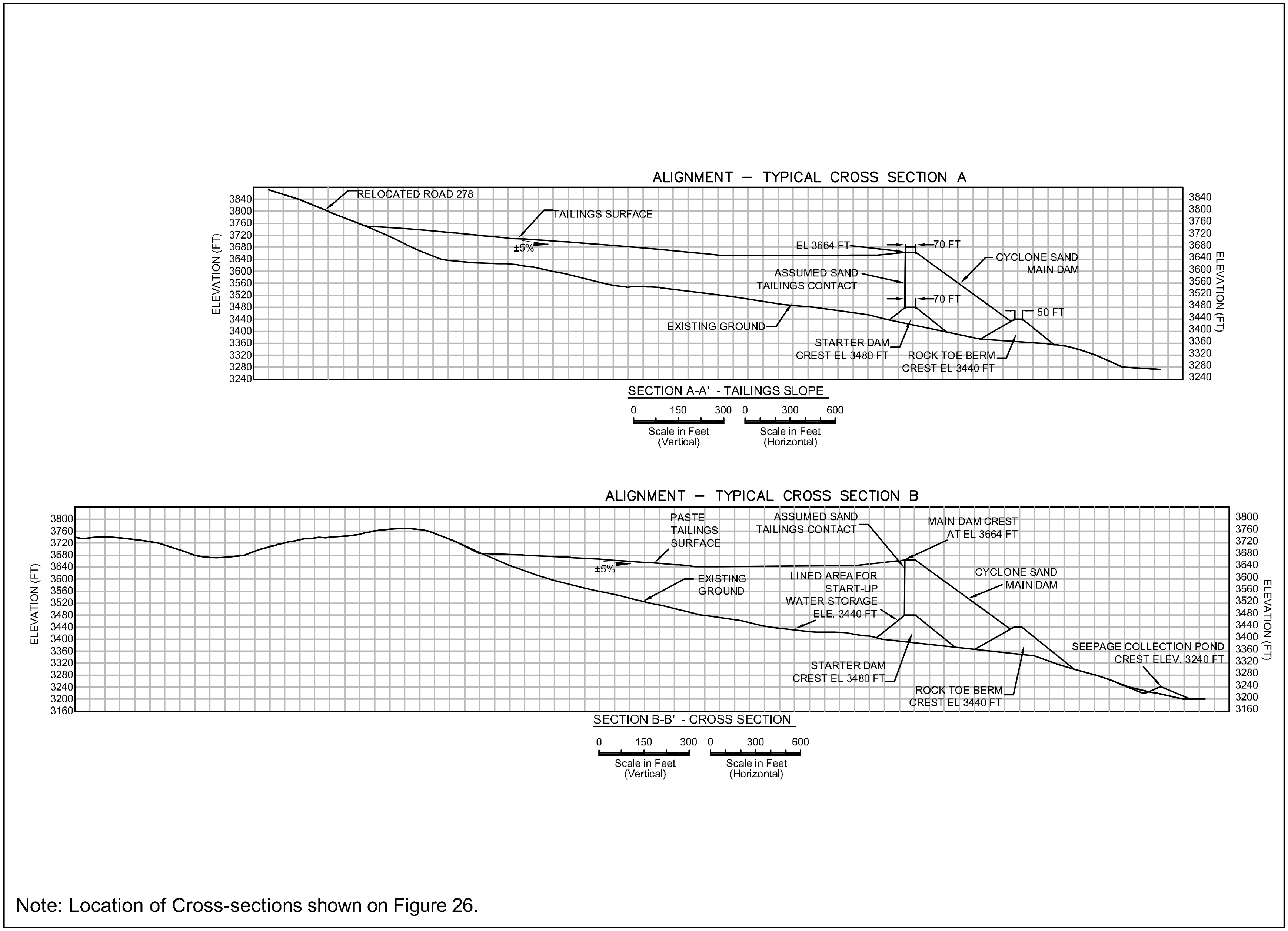

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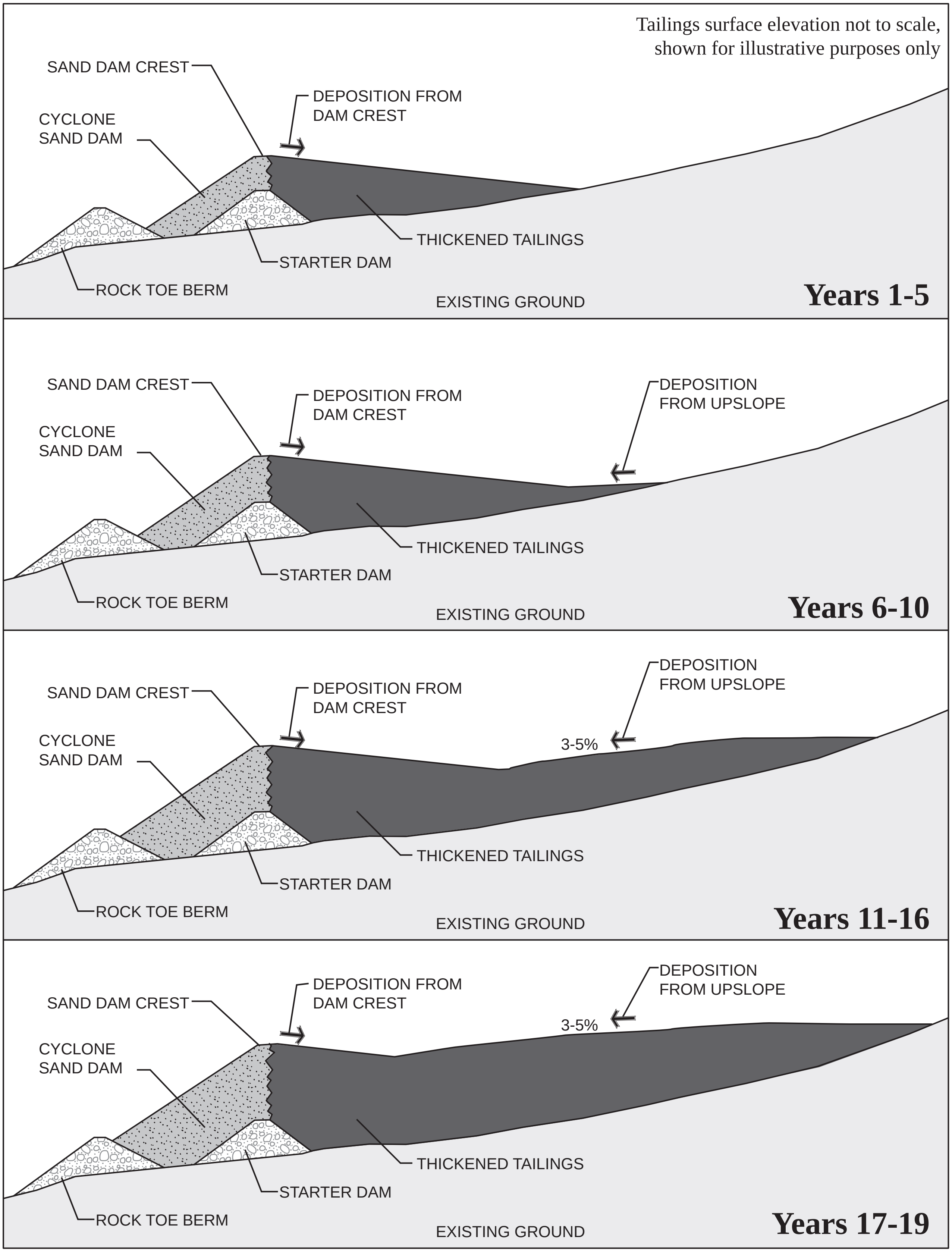

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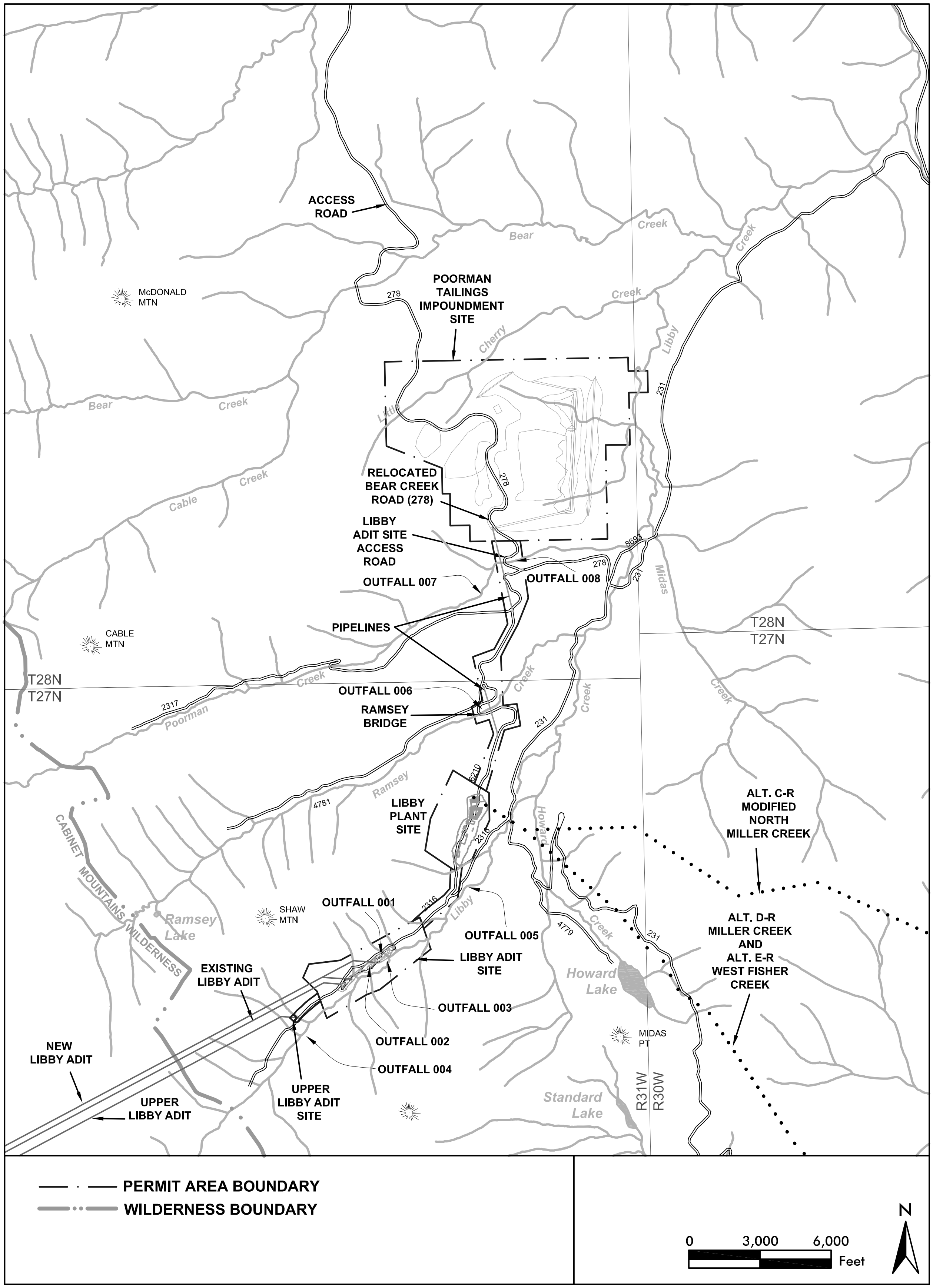

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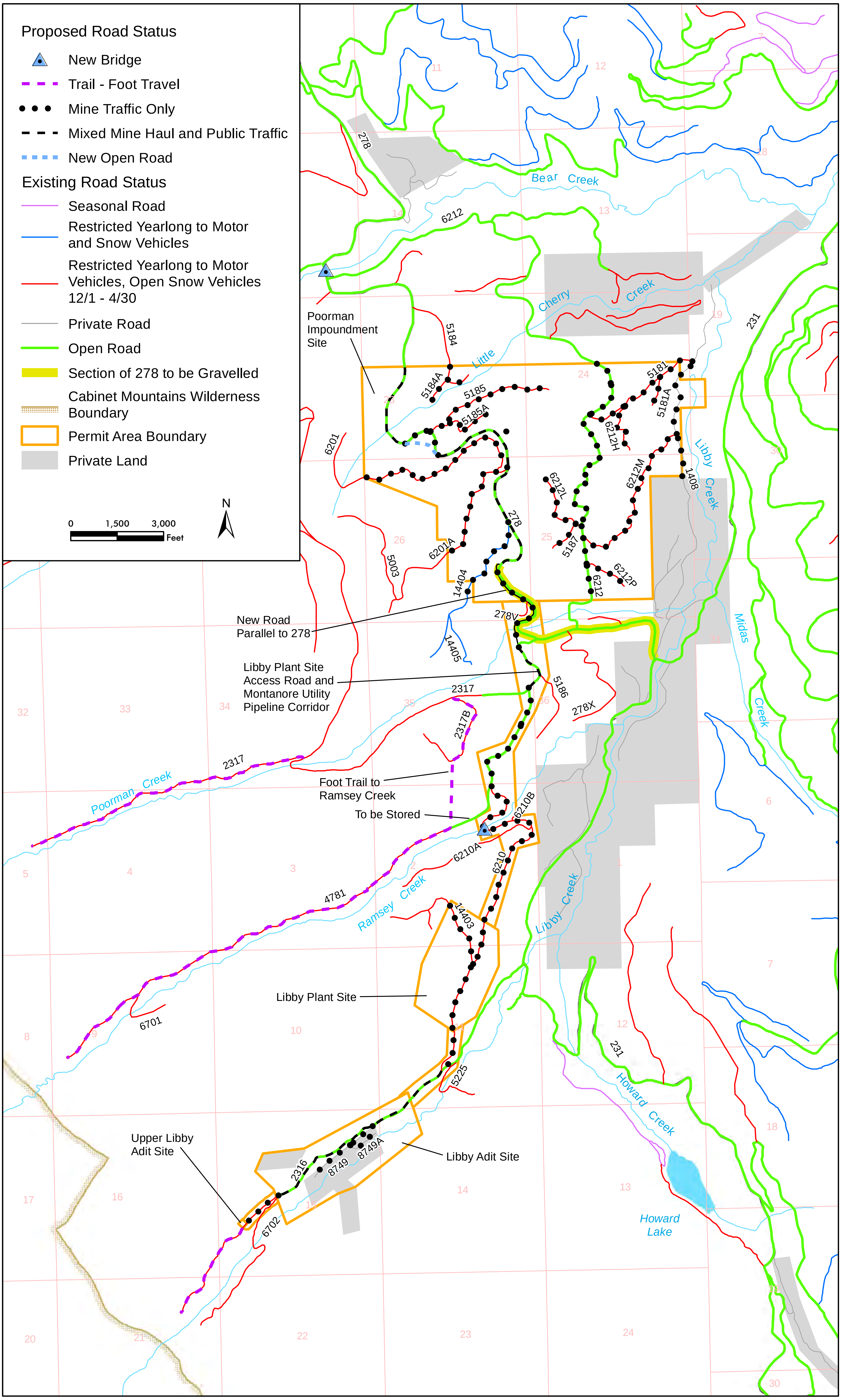

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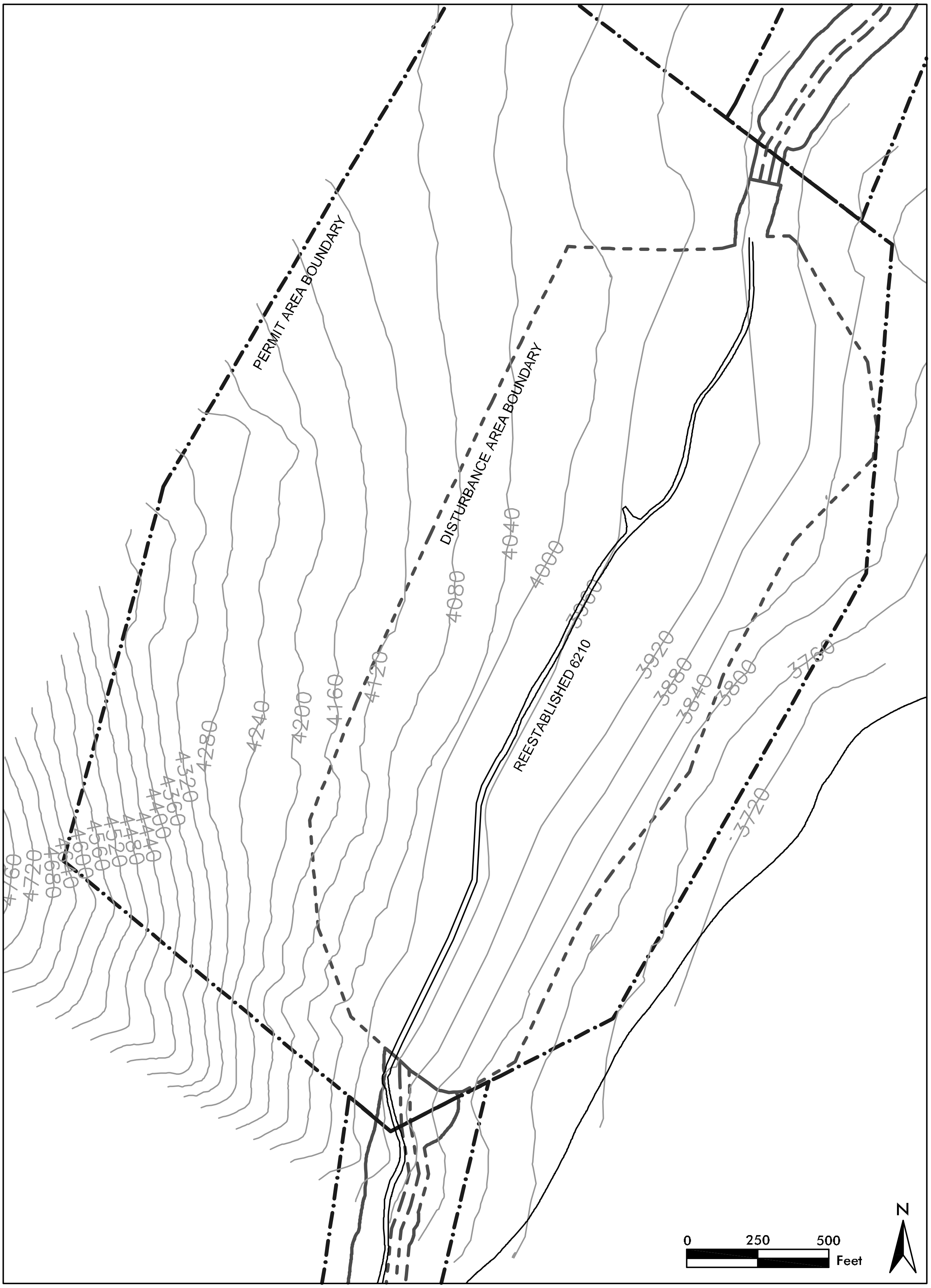

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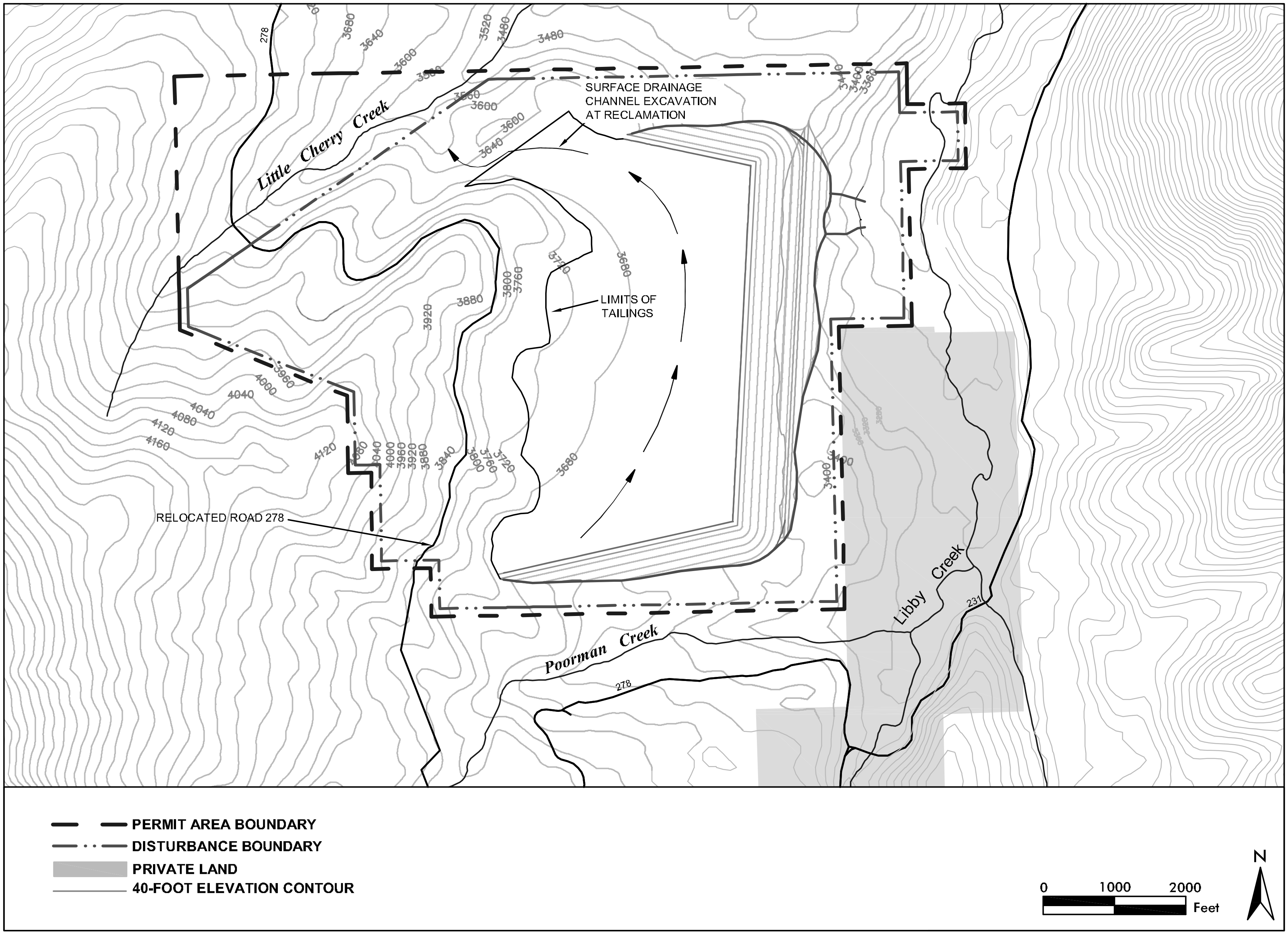

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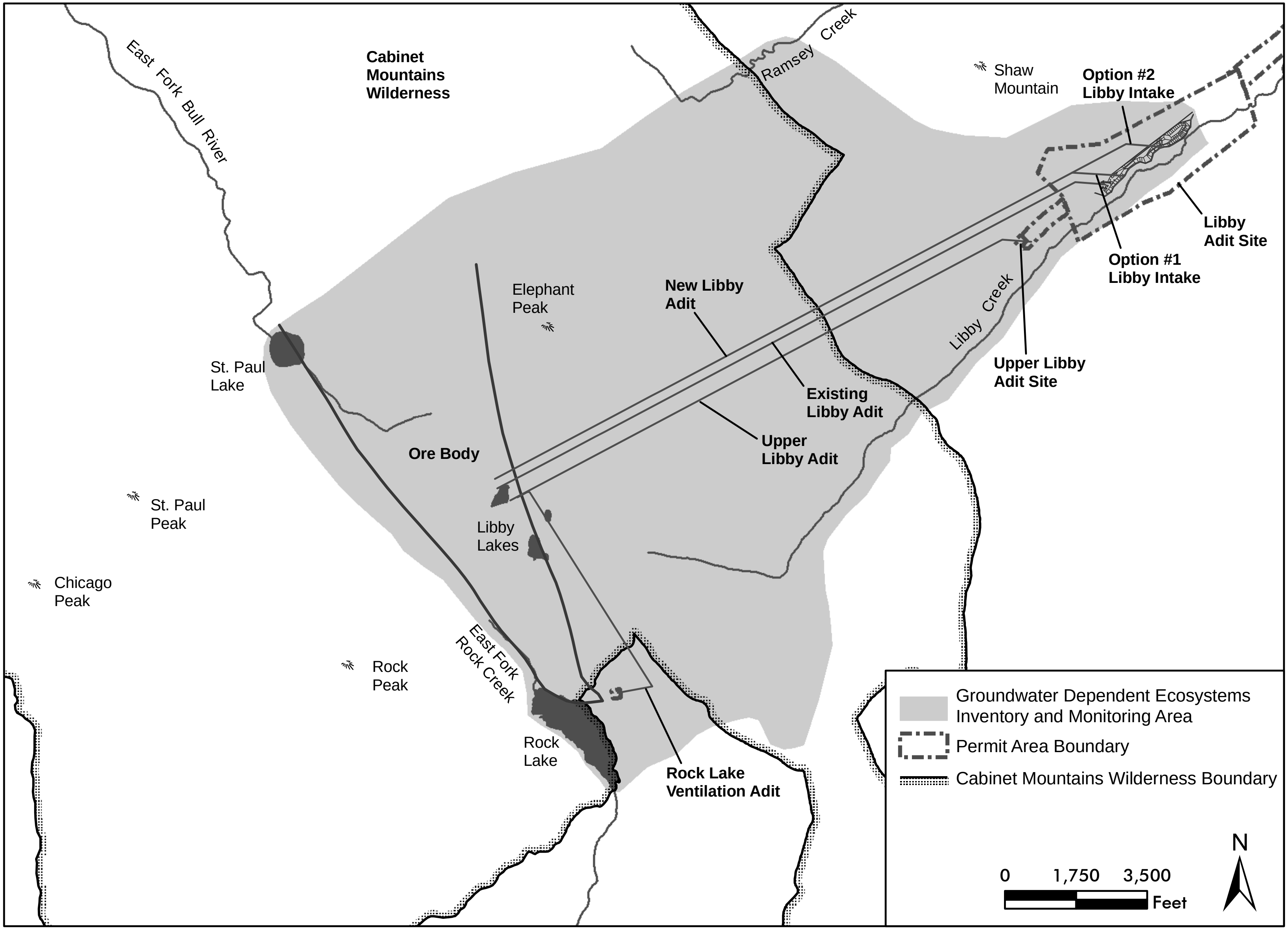

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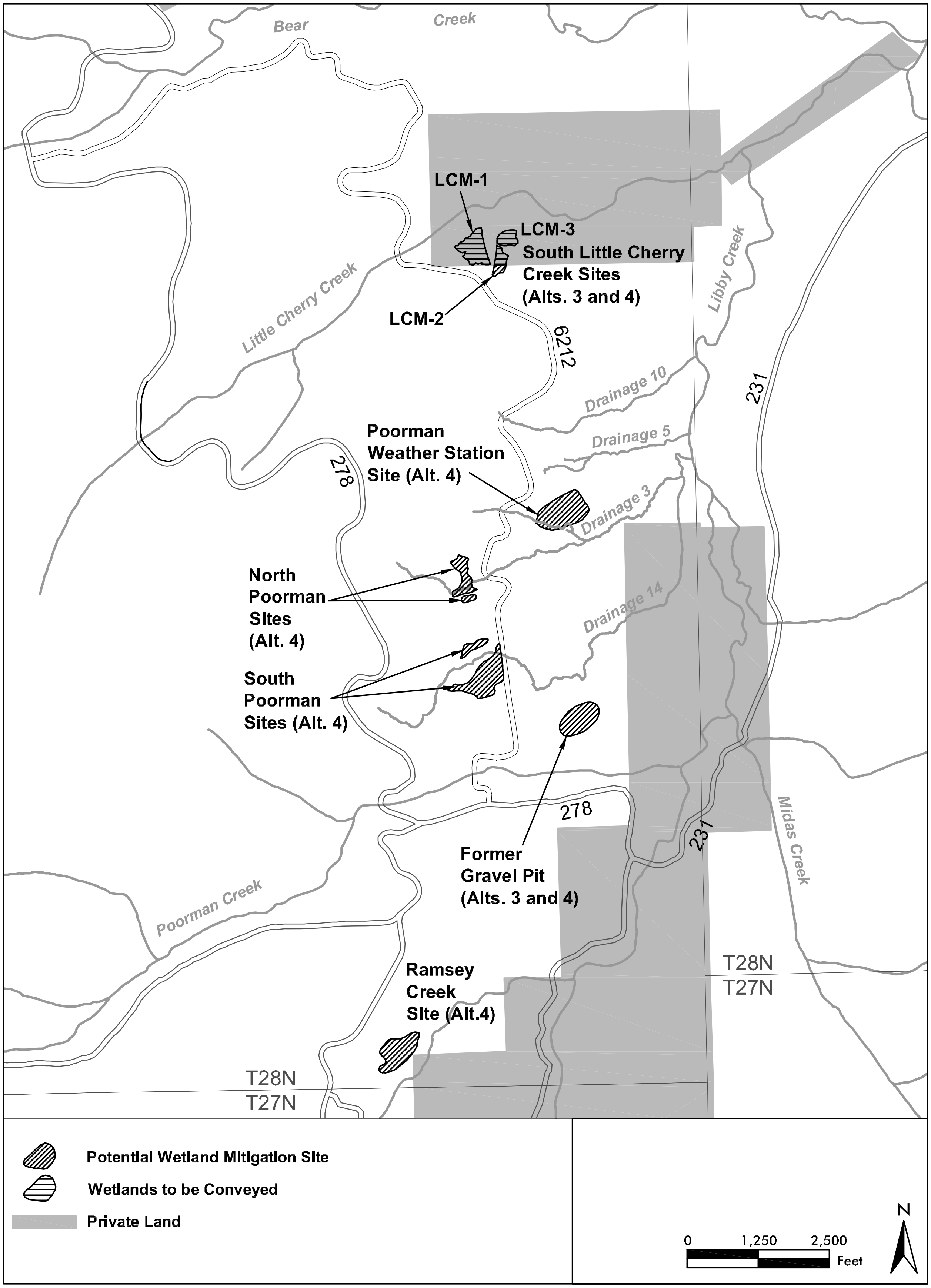

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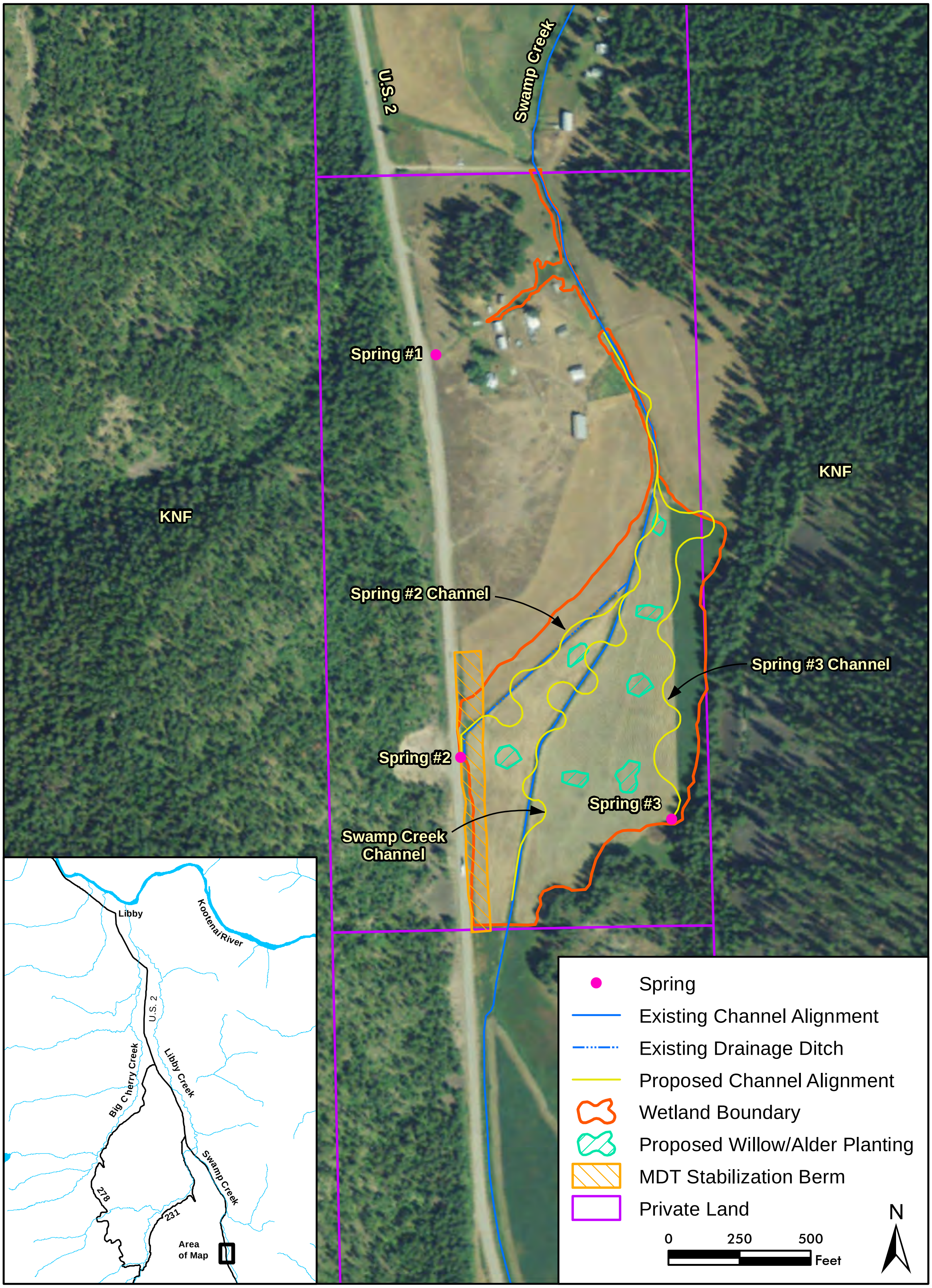

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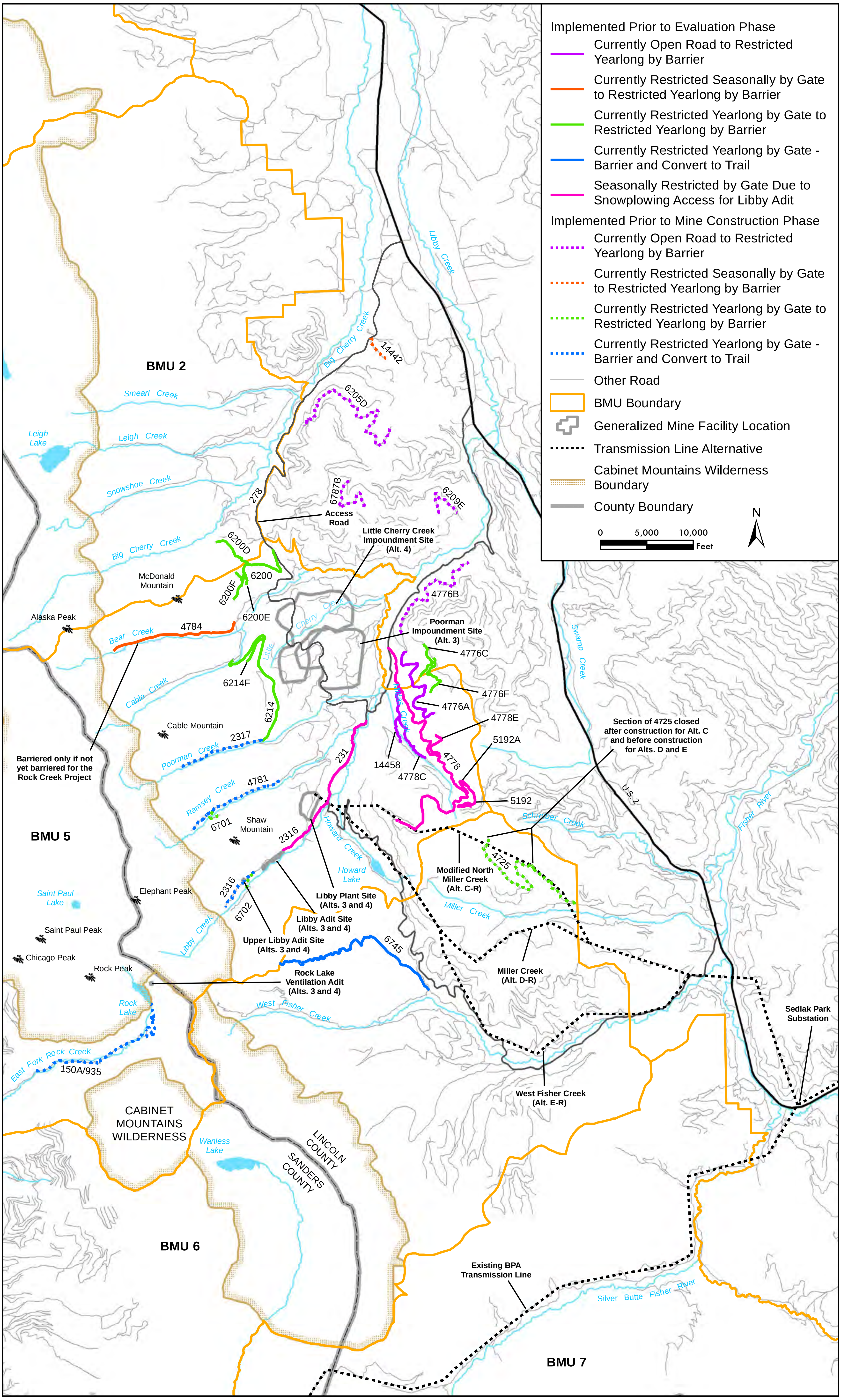

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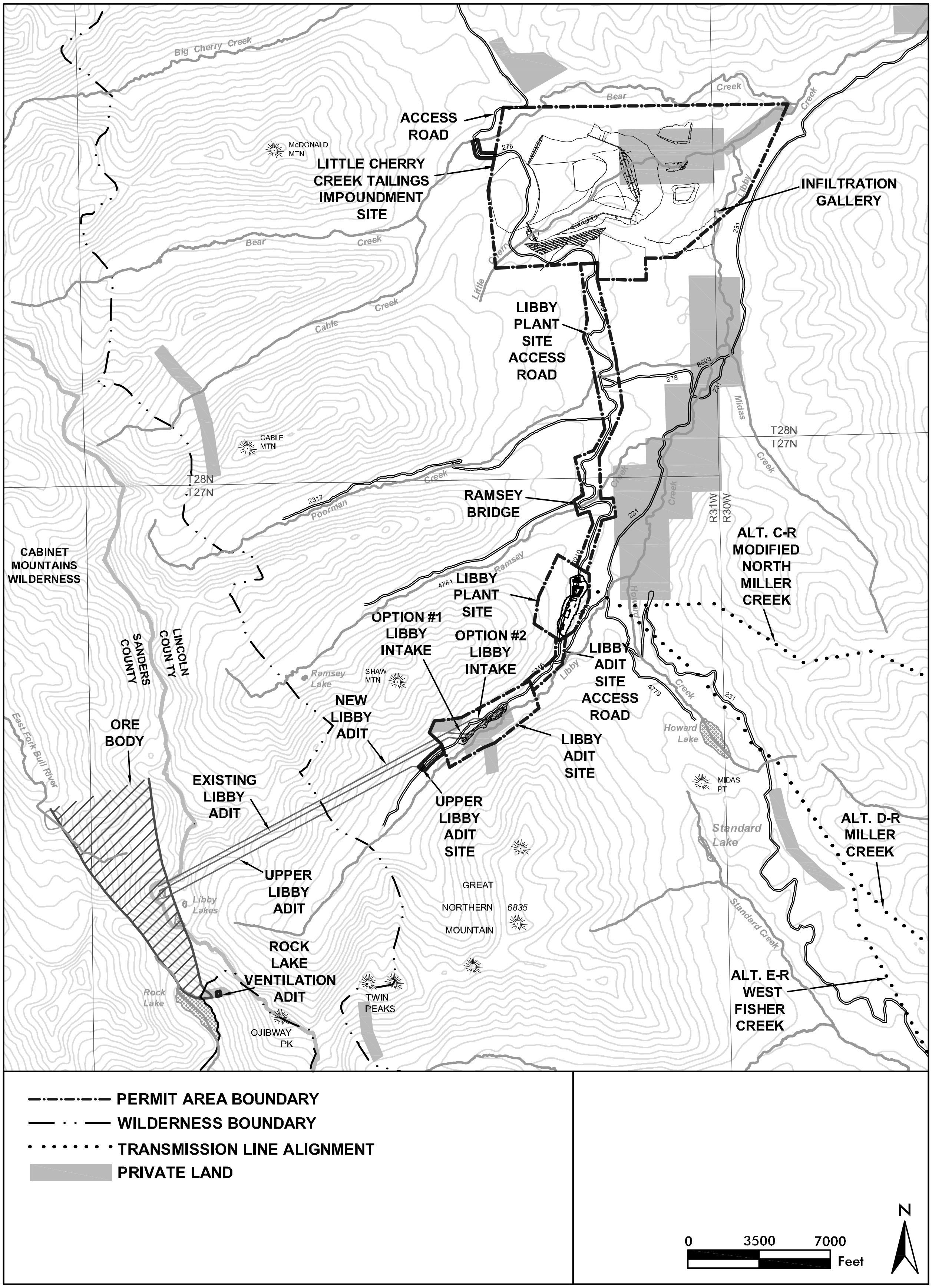

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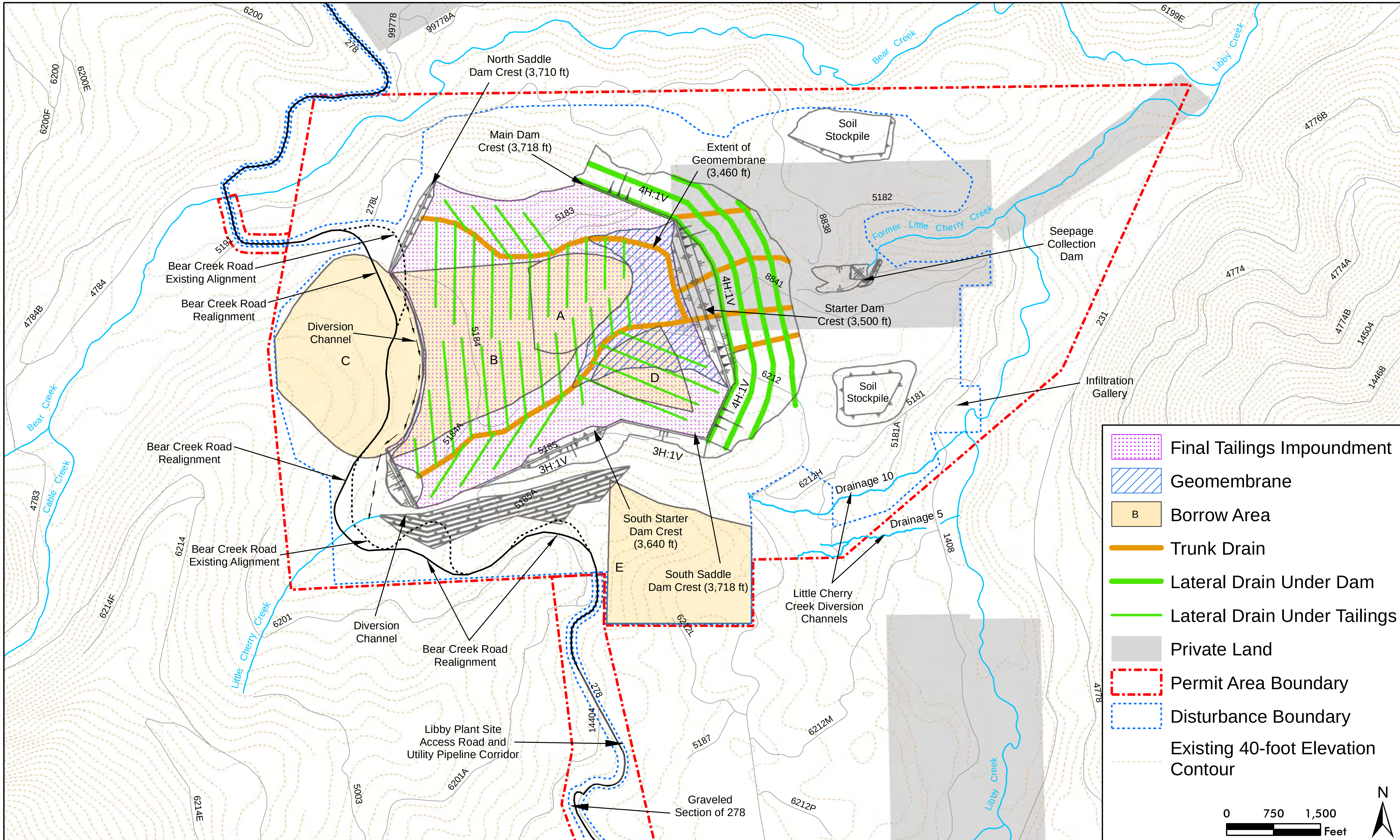

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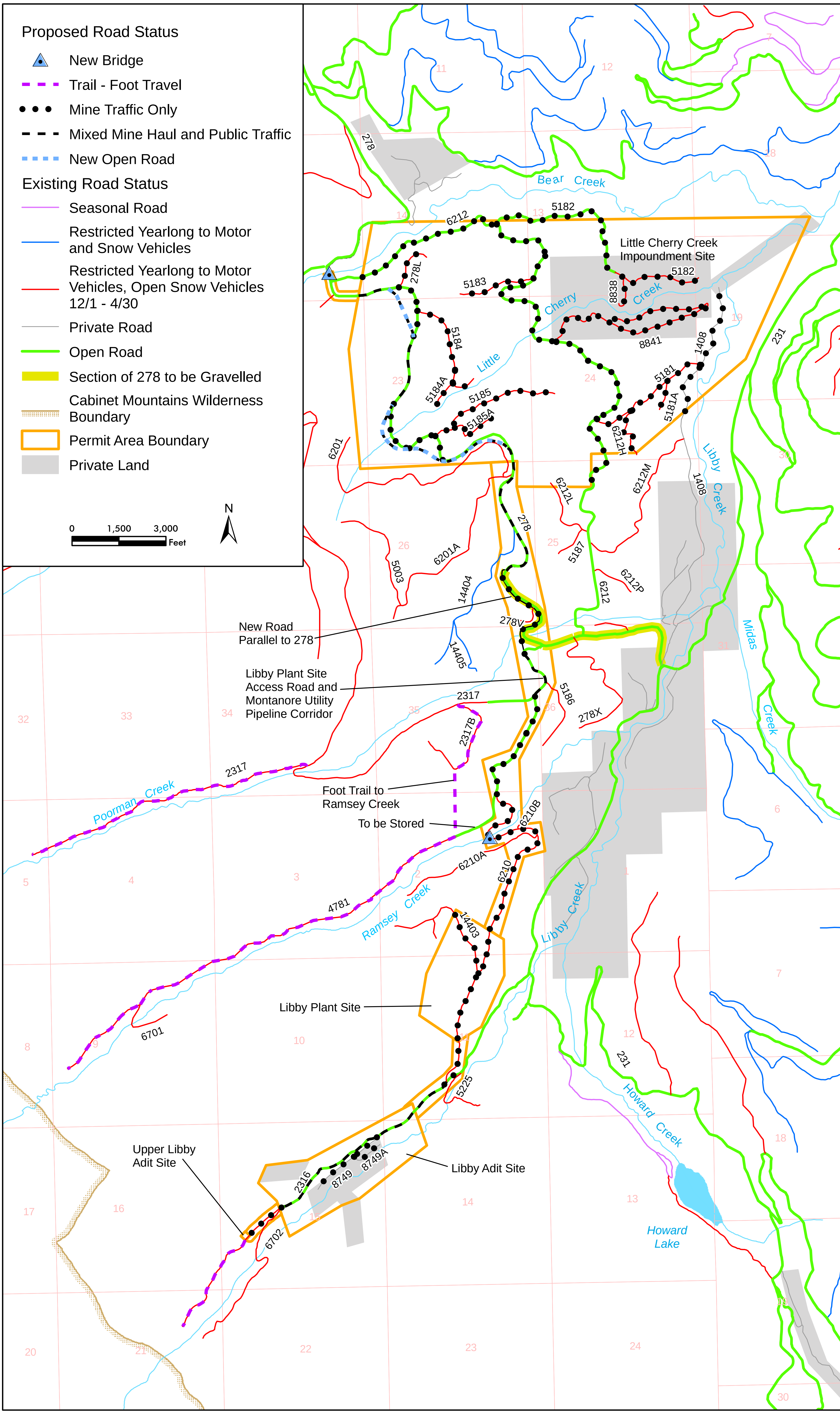

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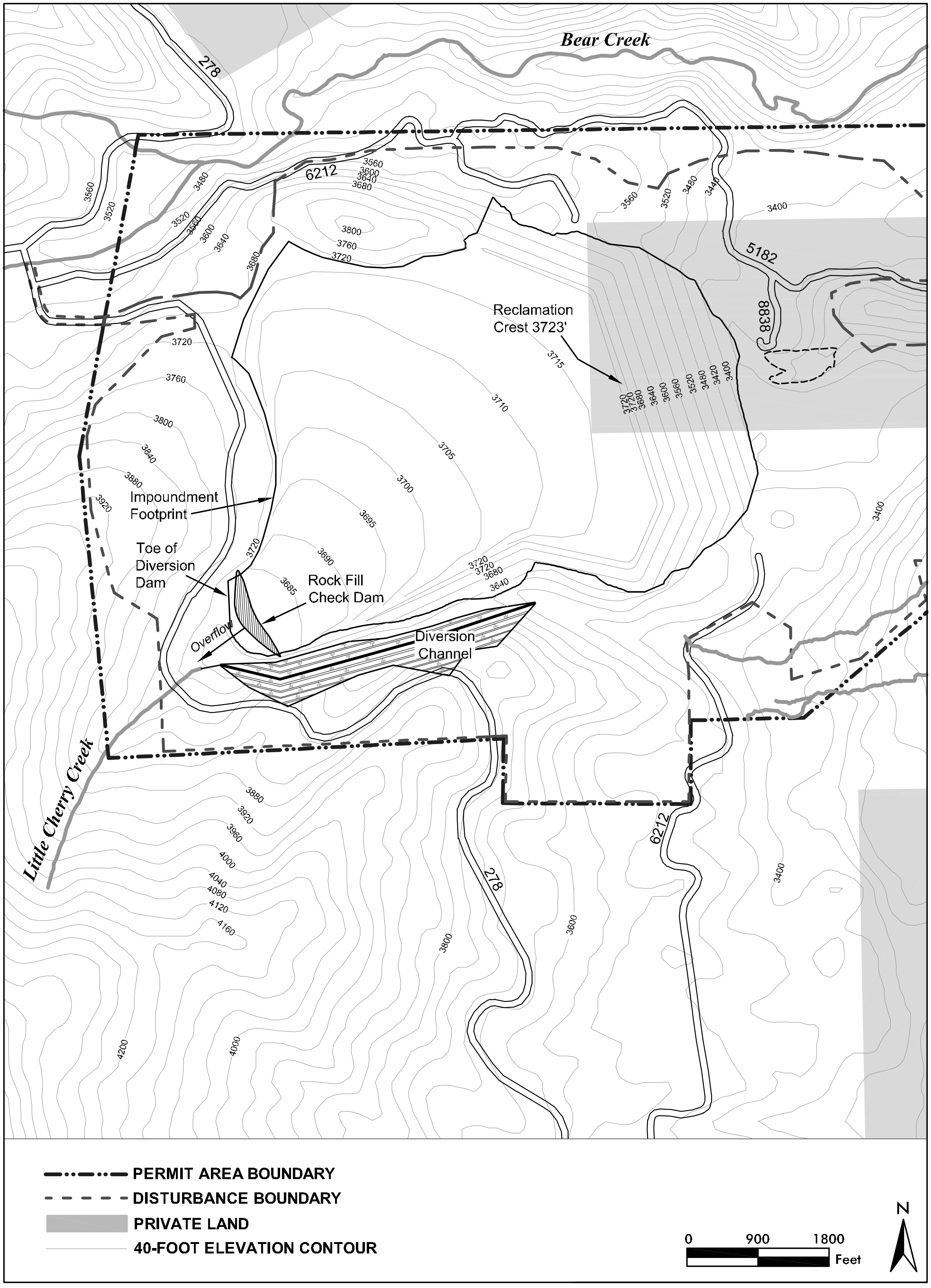

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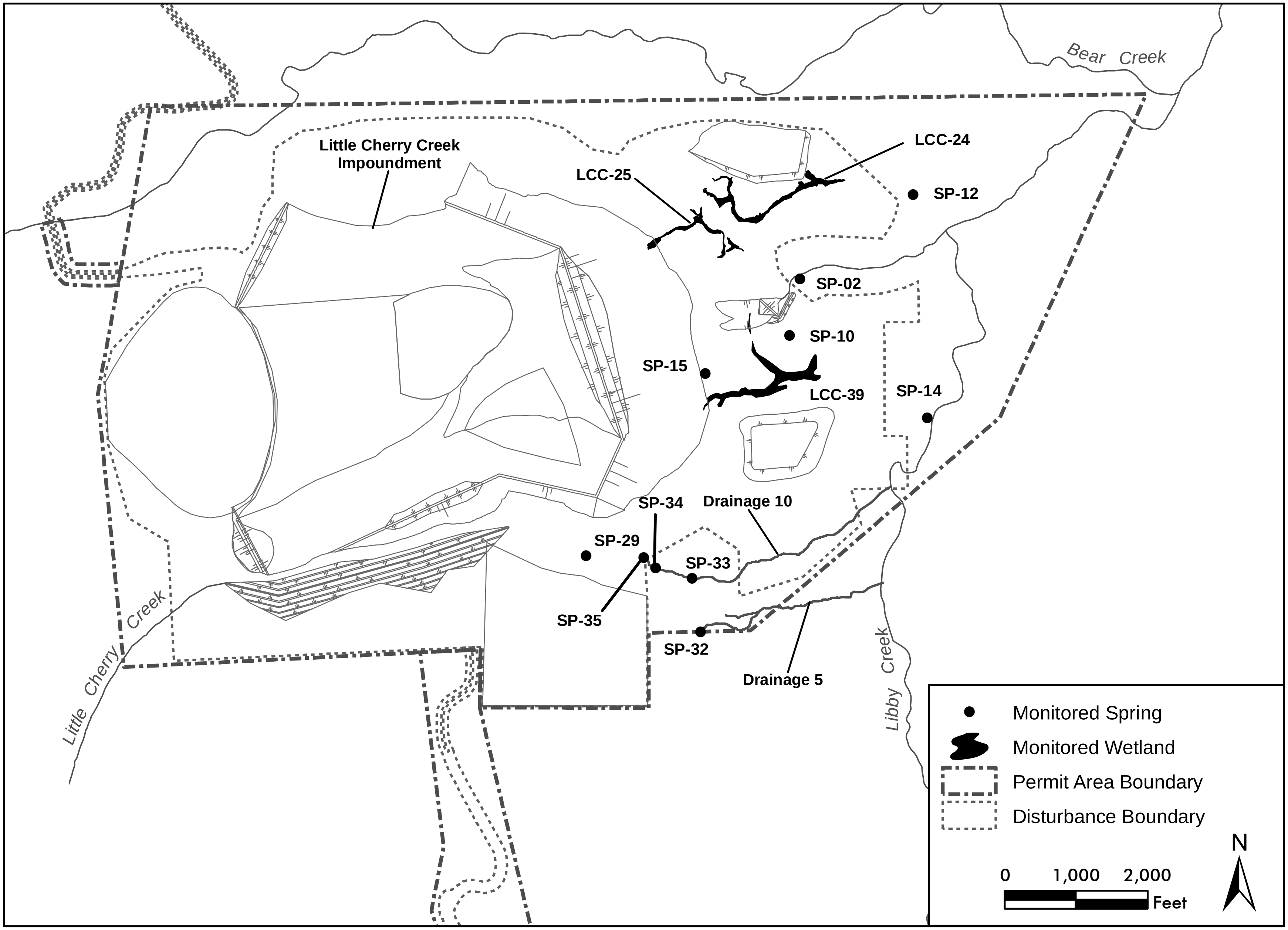

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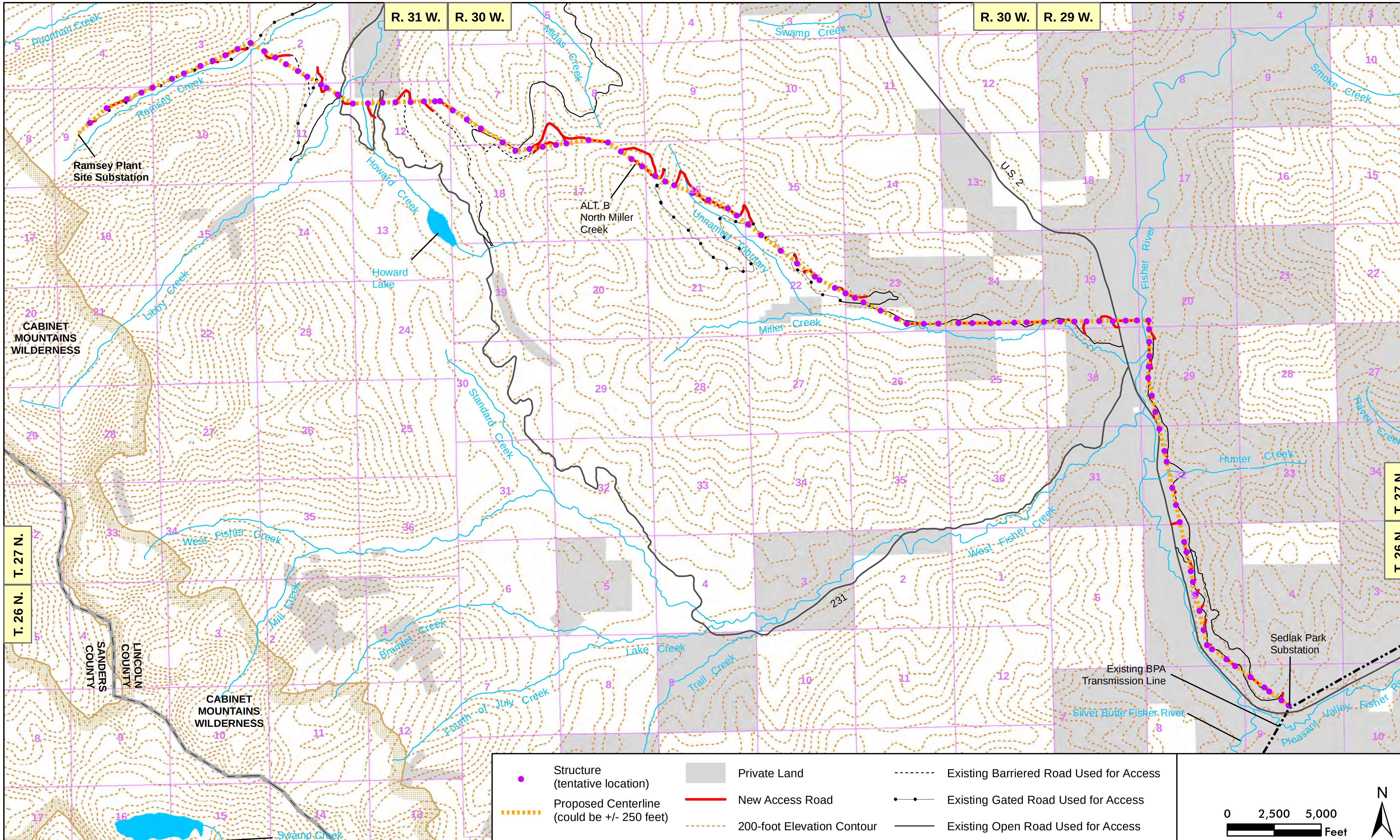

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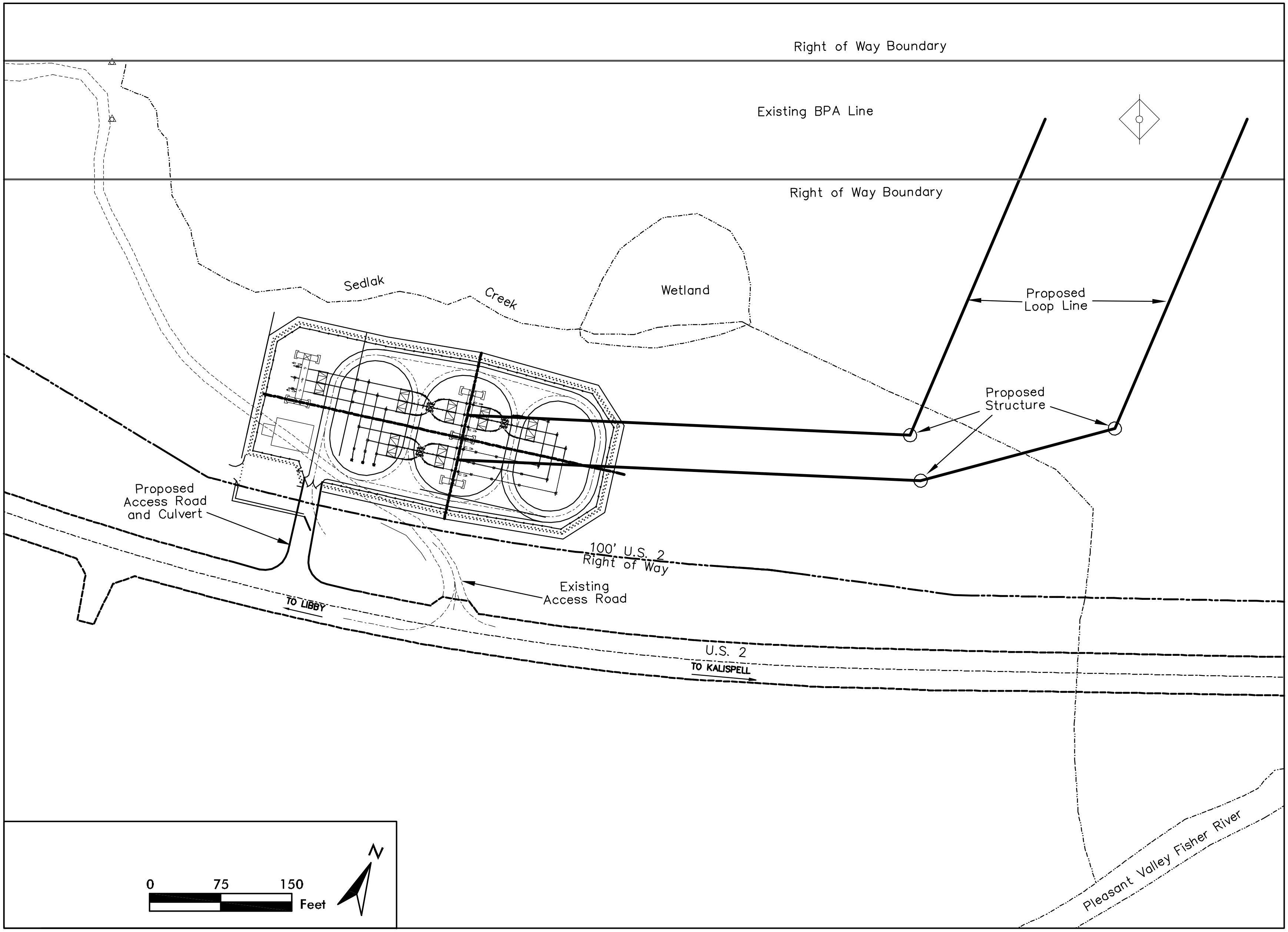

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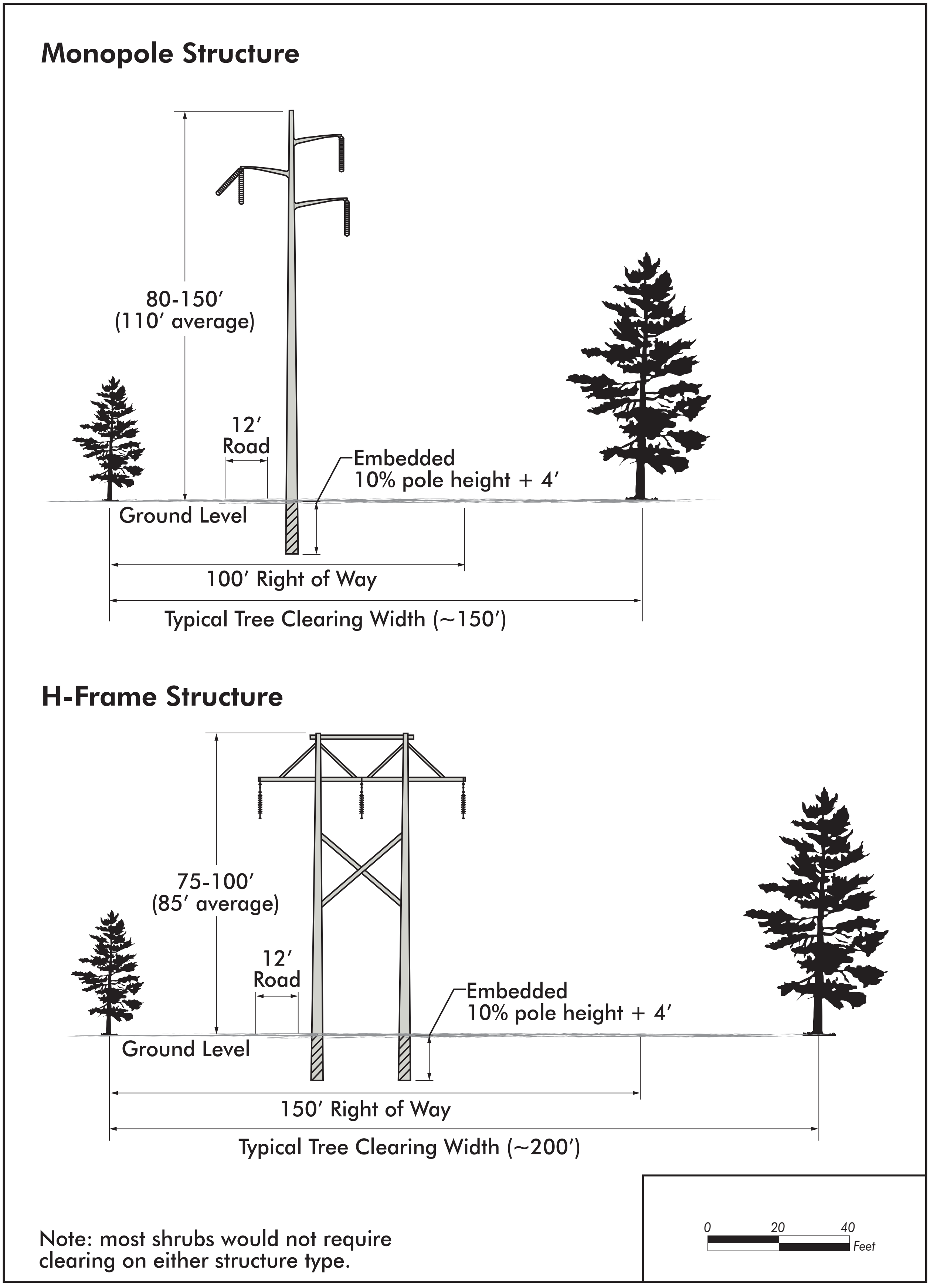

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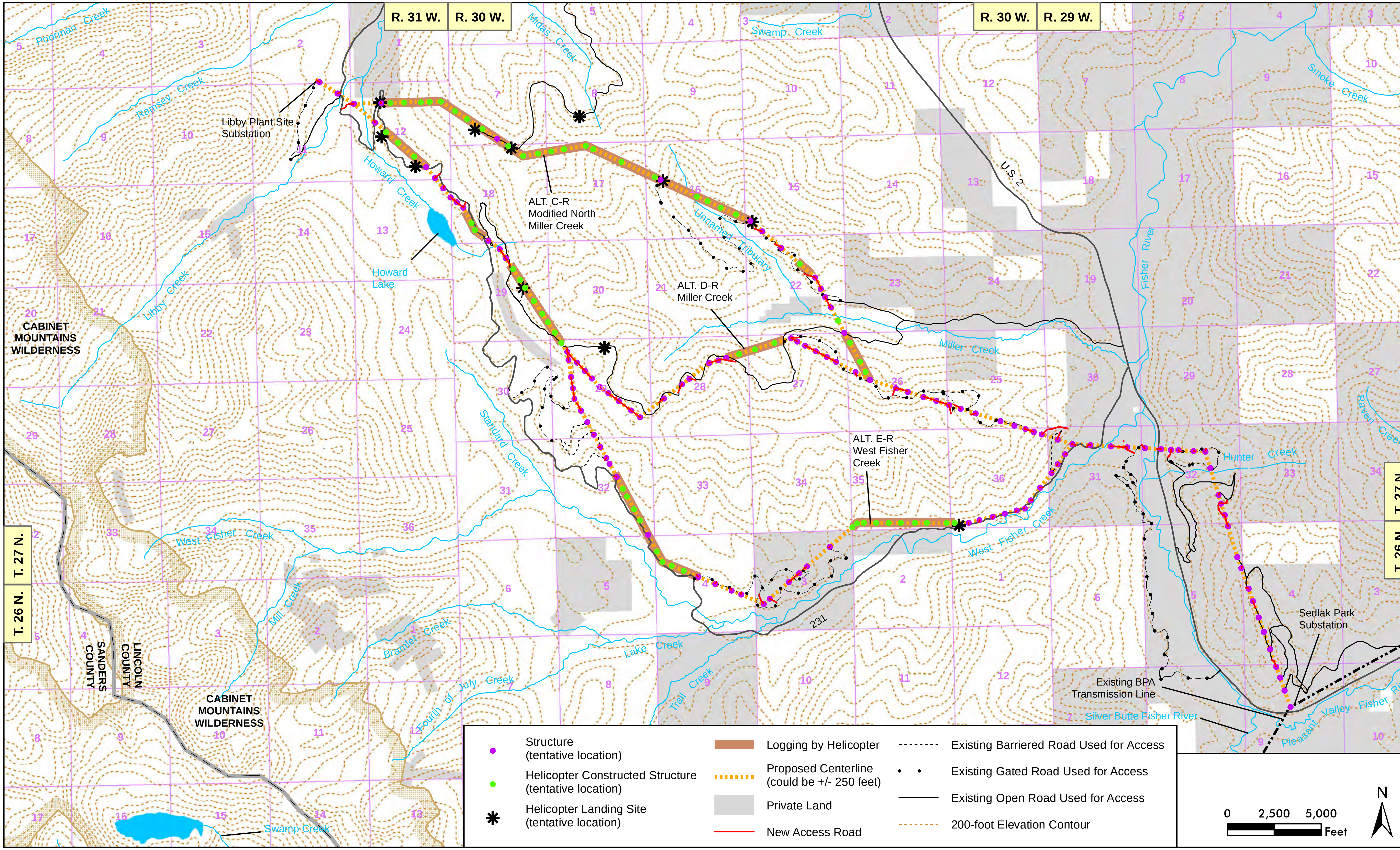

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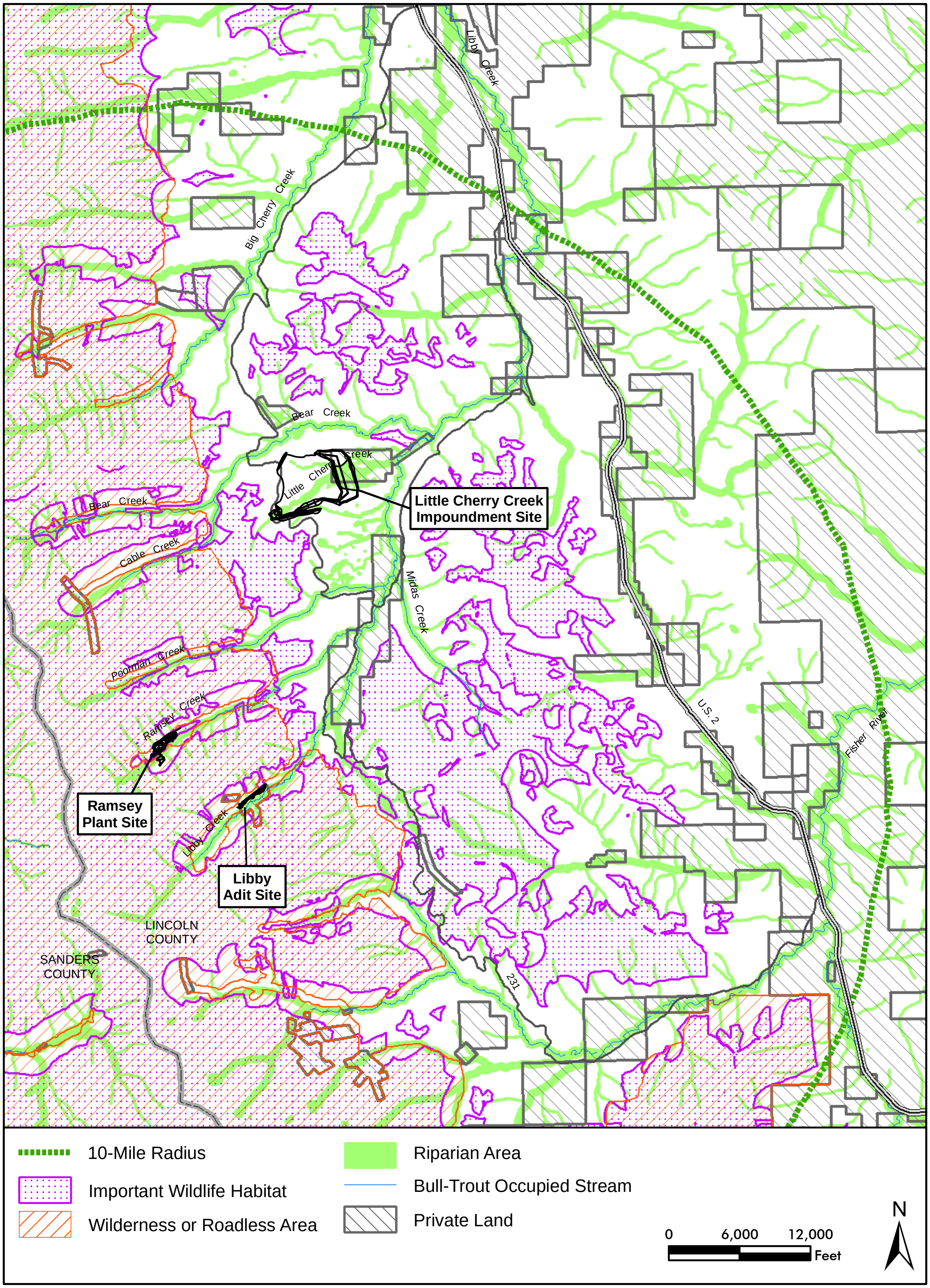

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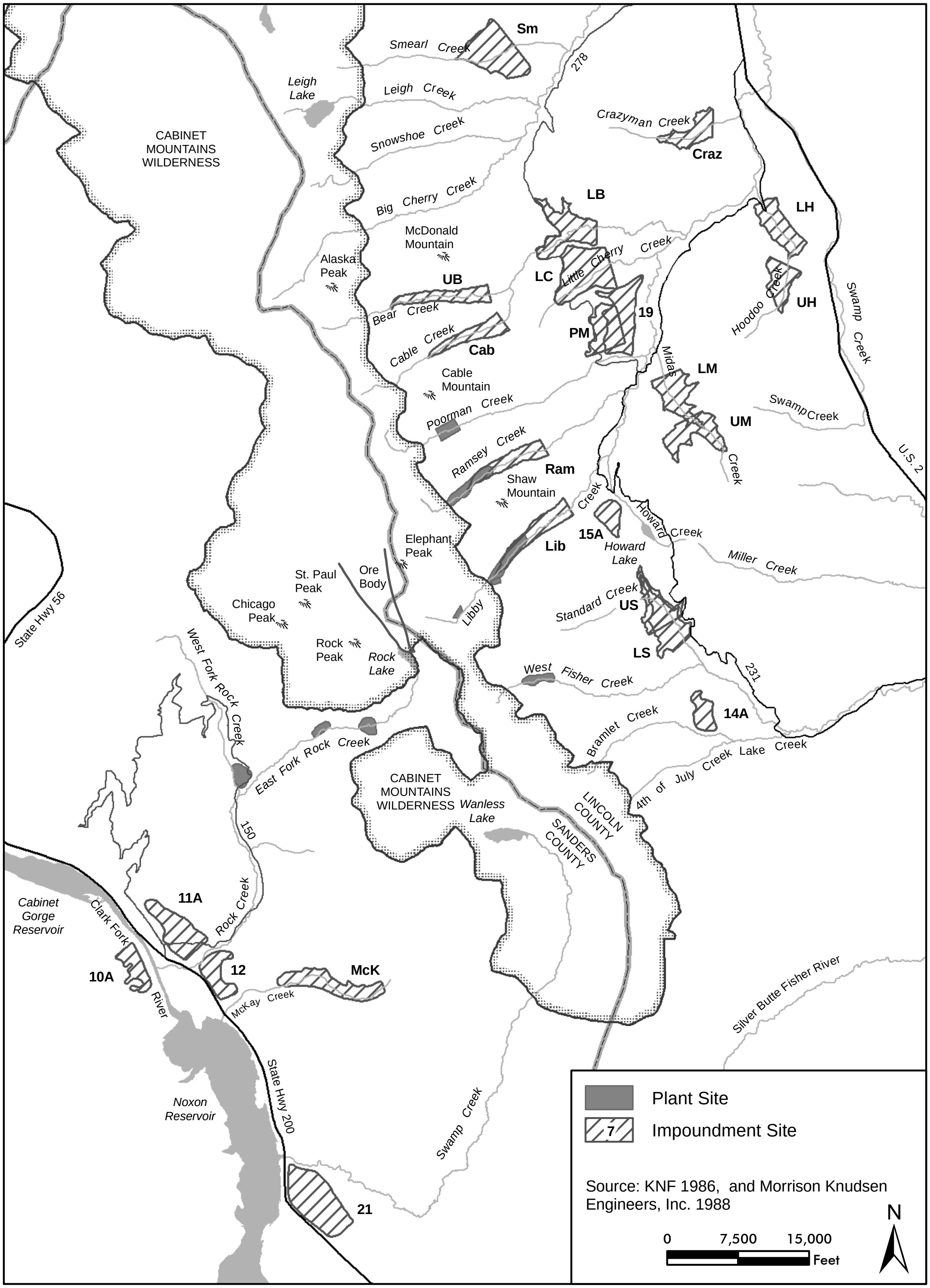

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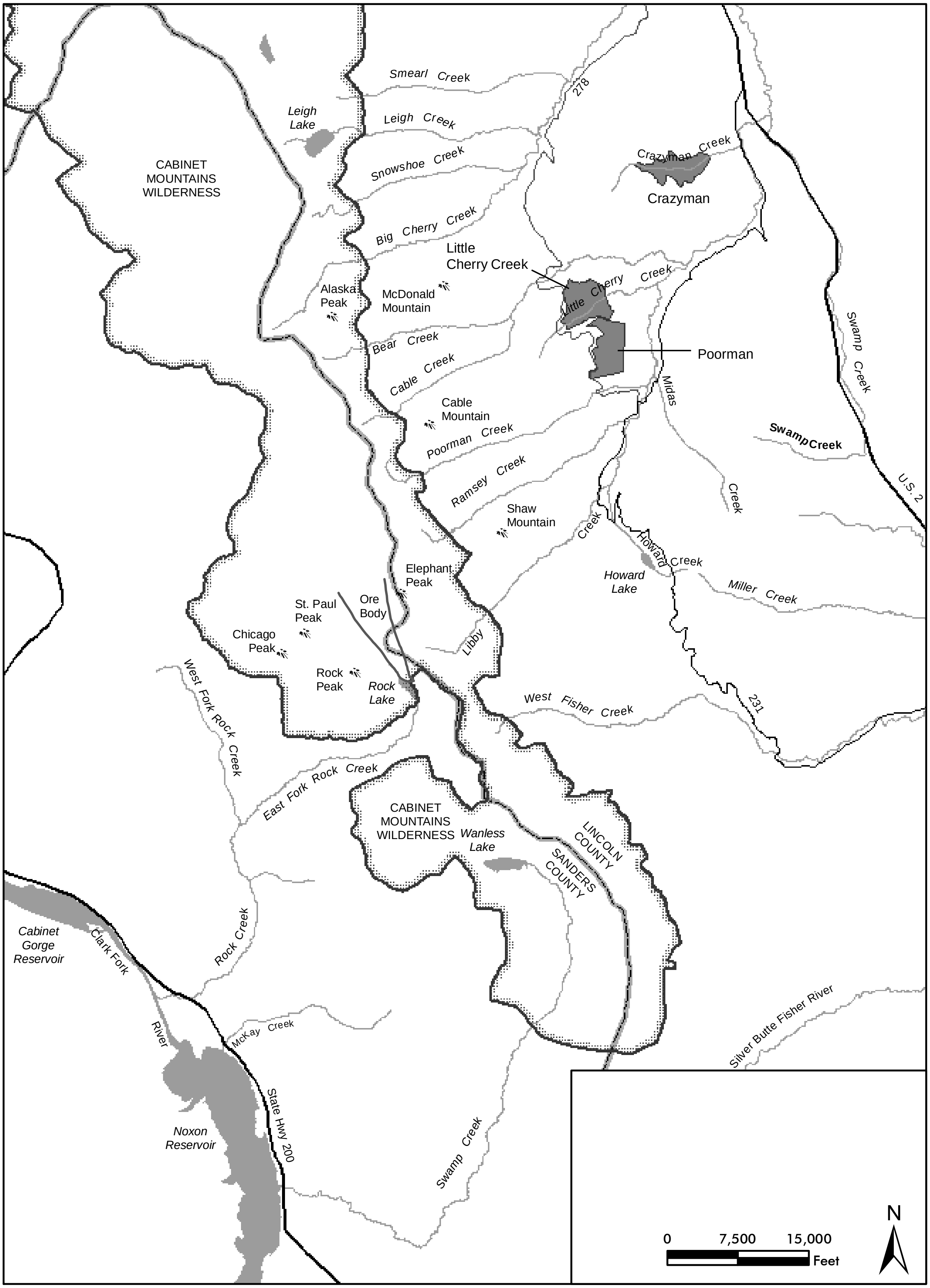

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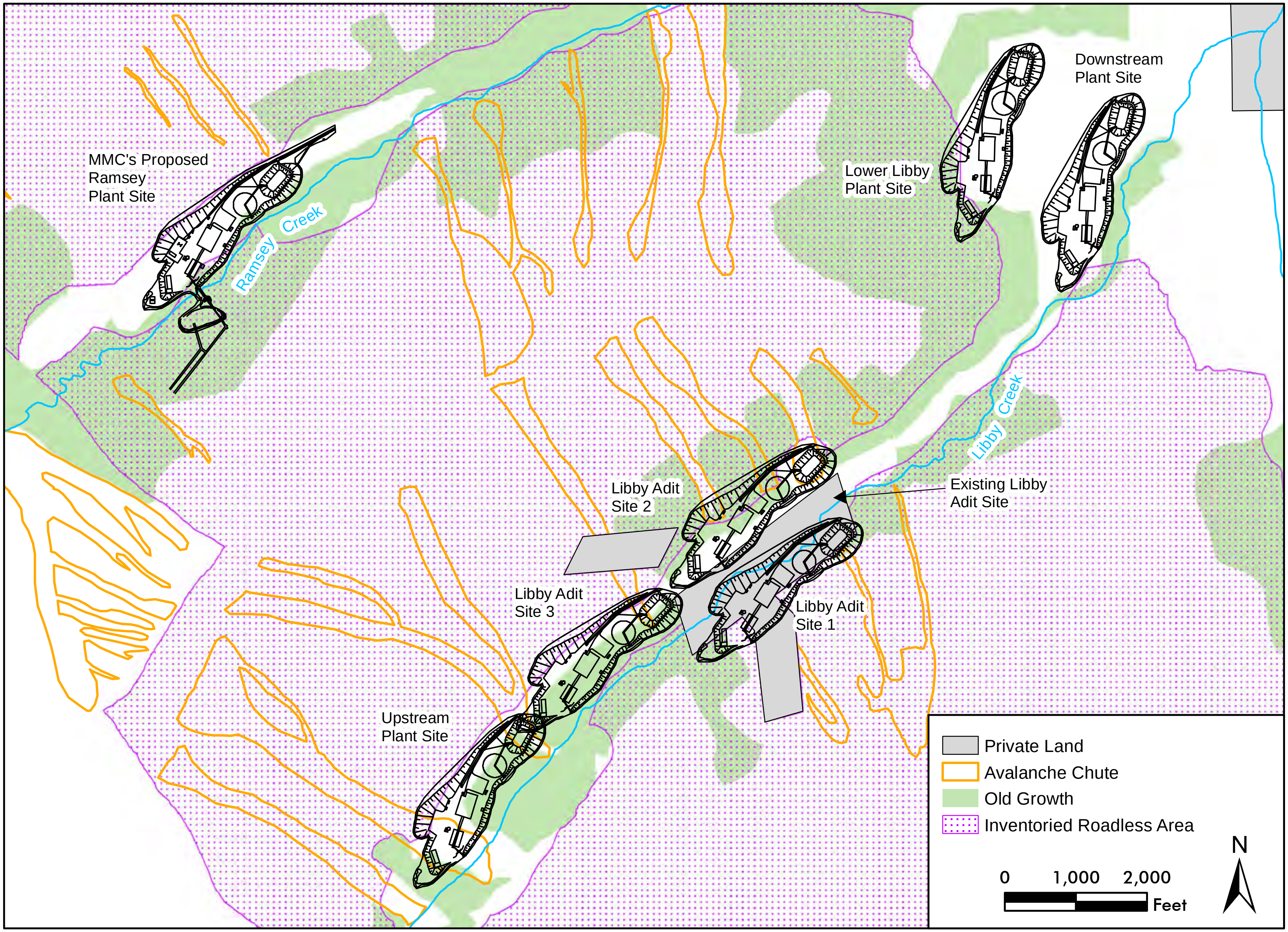

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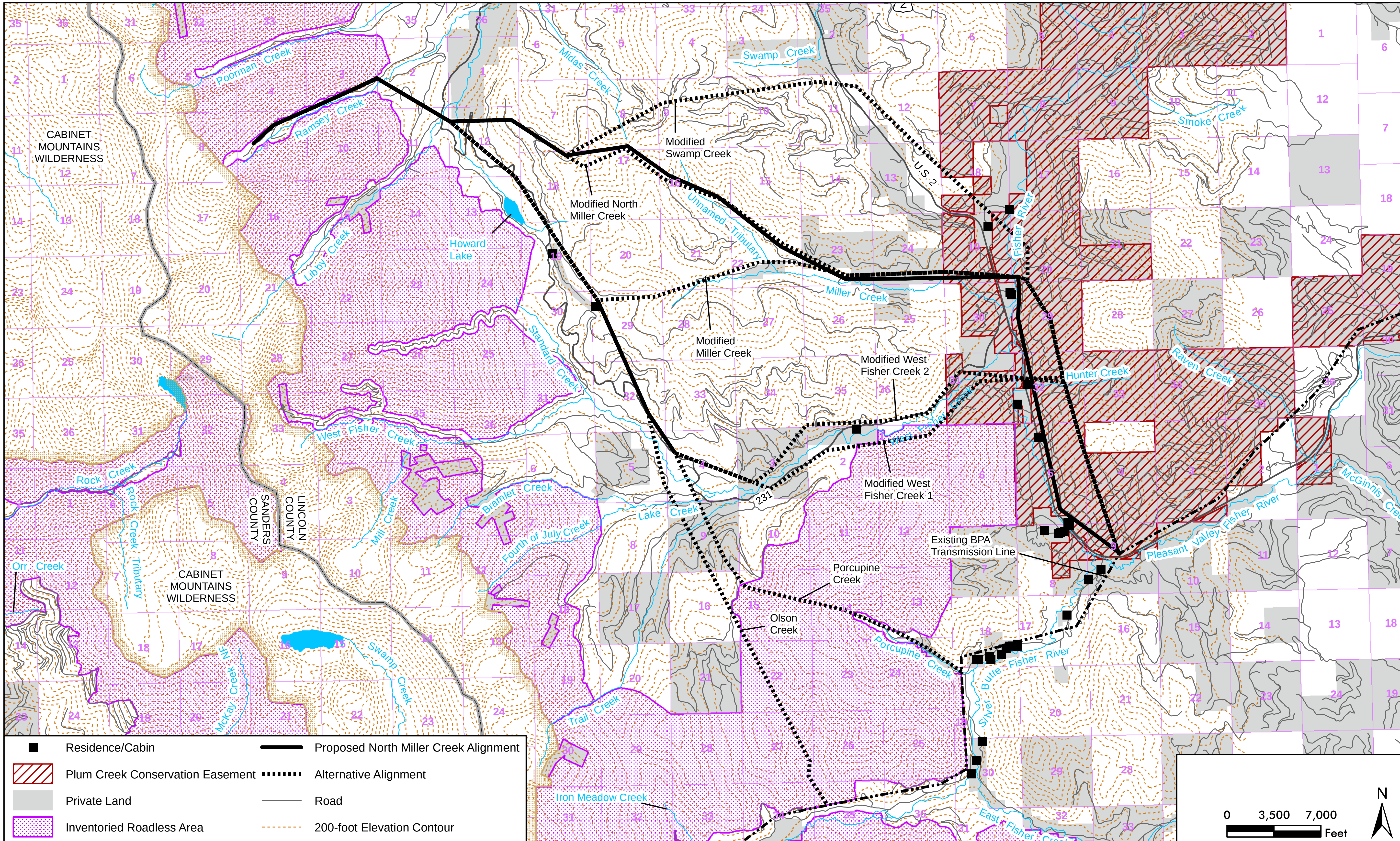

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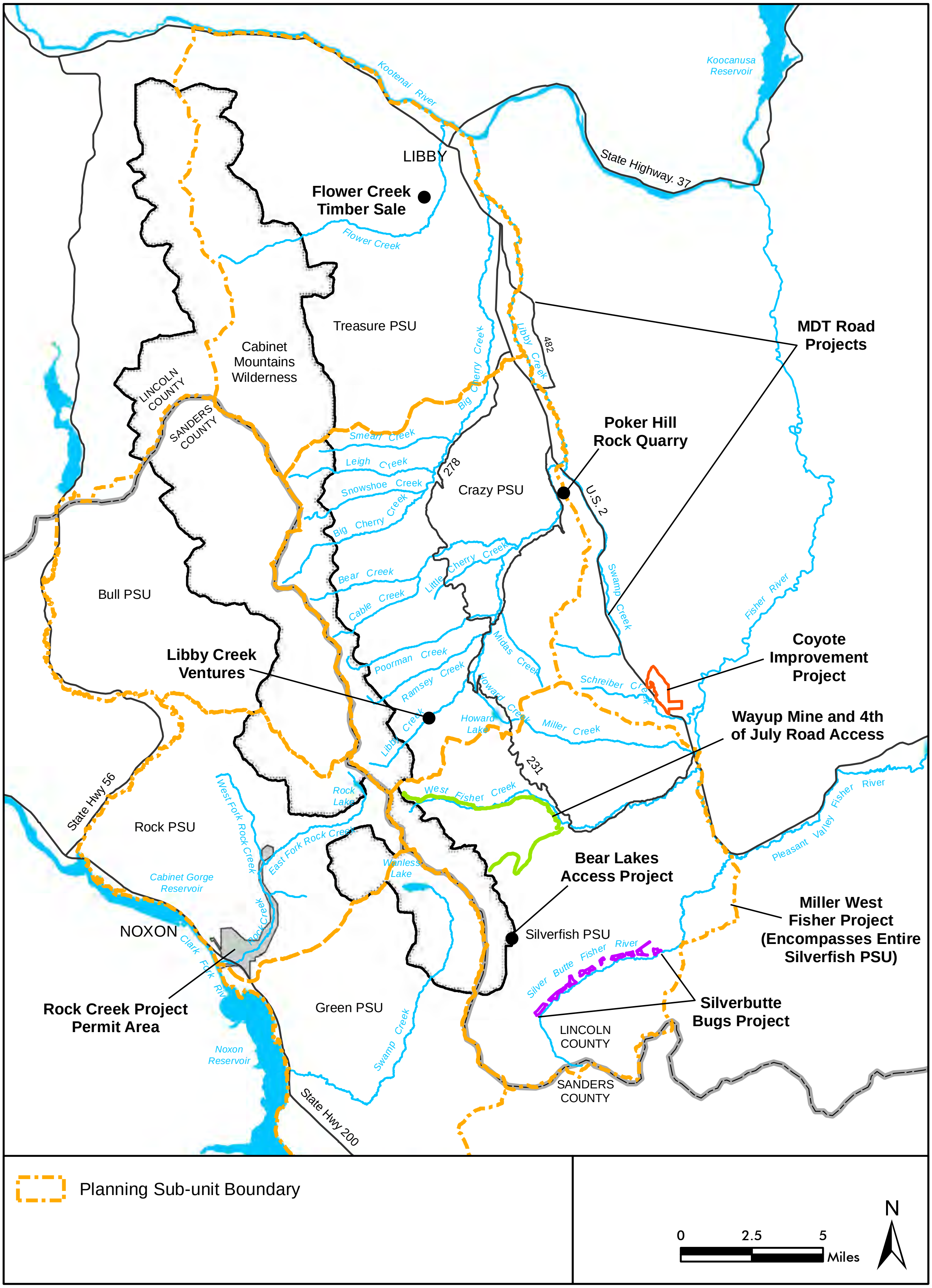

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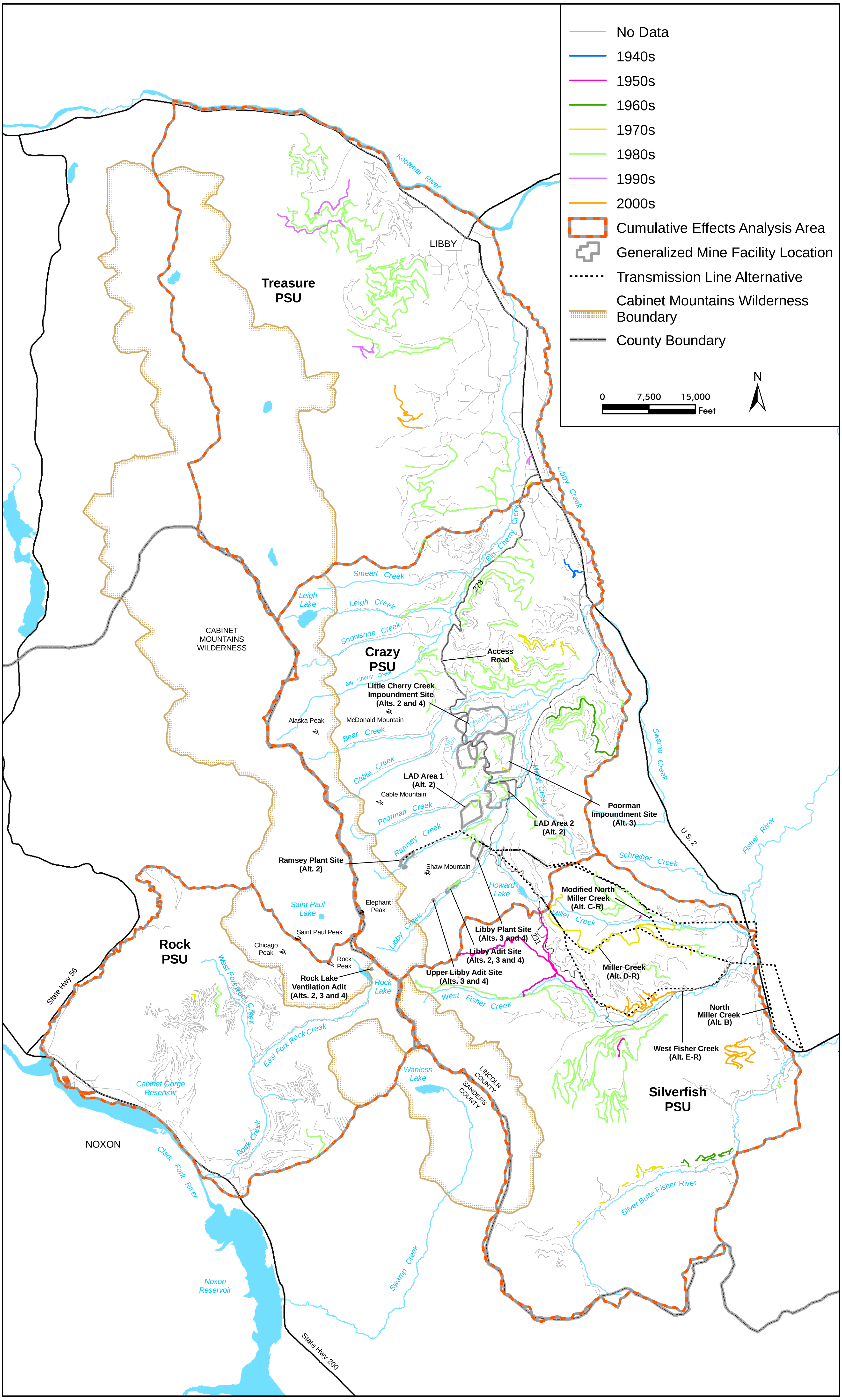

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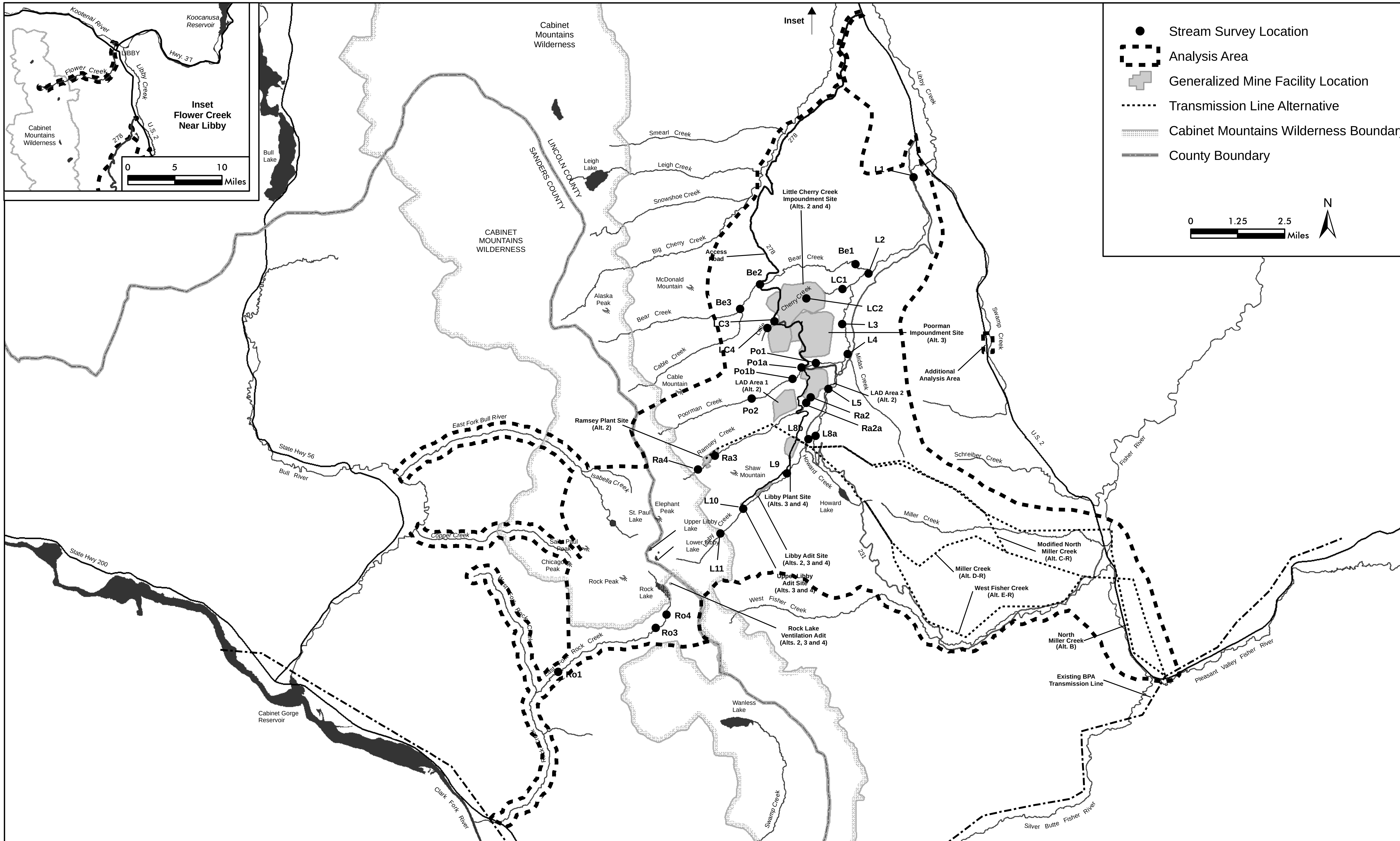

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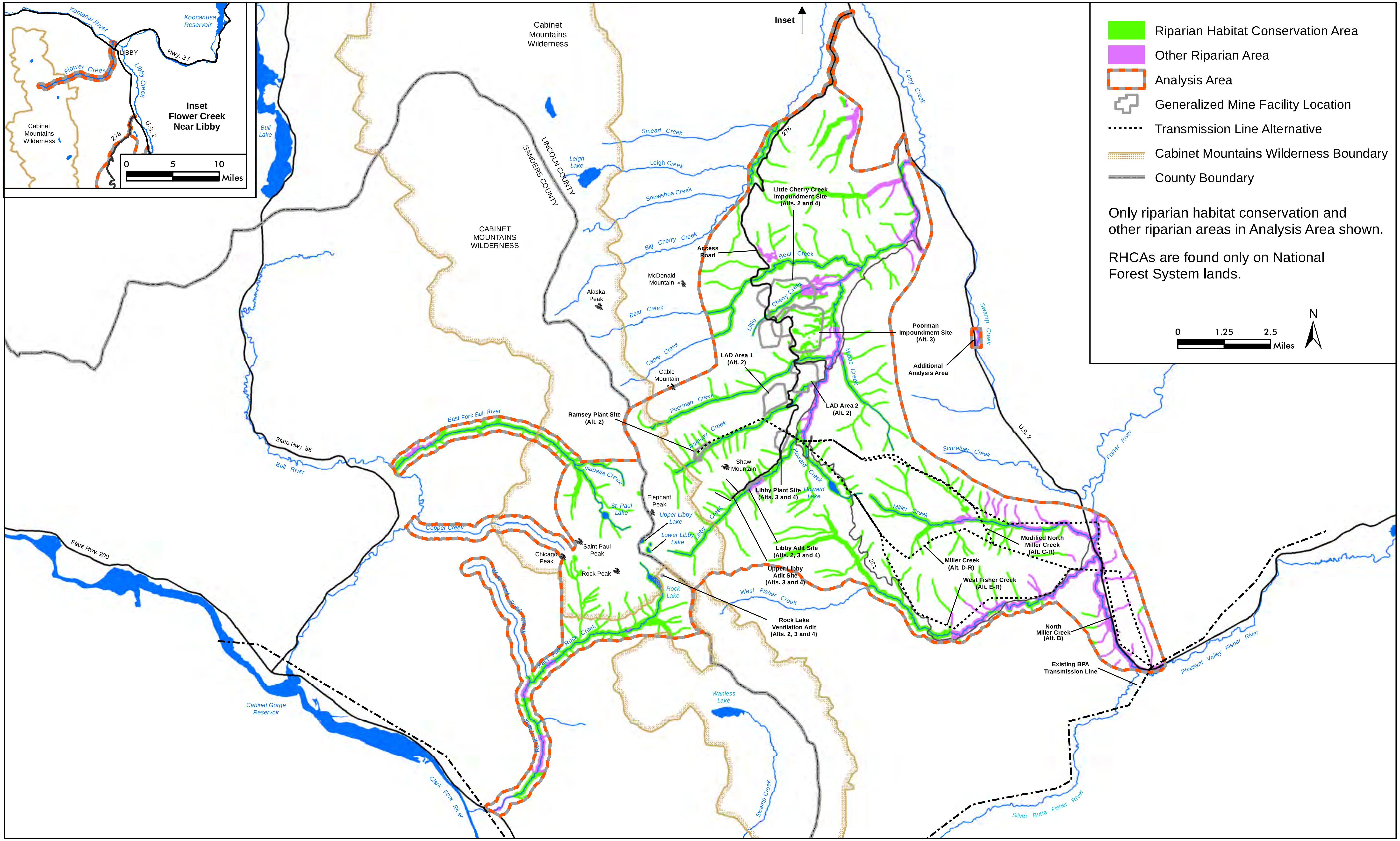

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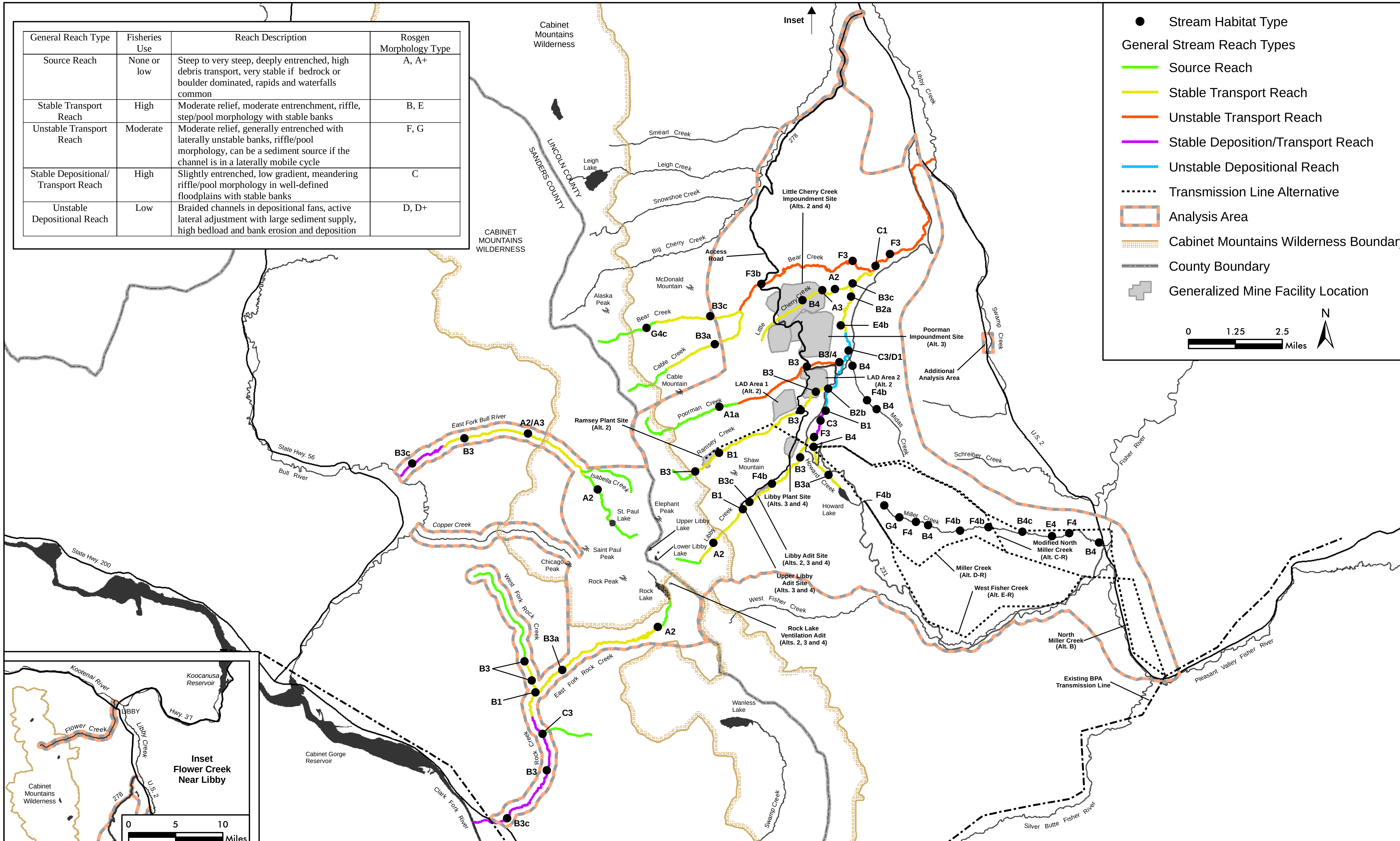

General Reach Type	Fisheries Use	Reach Description	Rosgen Morphology Type
Source Reach	None or low	Steep to very steep, deeply entrenched, high debris transport, very stable if bedrock or boulder dominated, rapids and waterfalls common	A, A+
Stable Transport Reach	High	Moderate relief, moderate entrenchment, riffle, step/pool morphology with stable banks	B, E
Unstable Transport Reach	Moderate	Moderate relief, generally entrenched with laterally unstable banks, riffle/pool morphology, can be a sediment source if the channel is in a laterally mobile cycle	F, G
Stable Depositional/ Transport Reach	High	Slightly entrenched, low gradient, meandering riffle/pool morphology in well-defined floodplains with stable banks	C
Unstable Depositional Reach	Low	Braided channels in depositional fans, active lateral adjustment with large sediment supply, high bedload and bank erosion and deposition	D, D+

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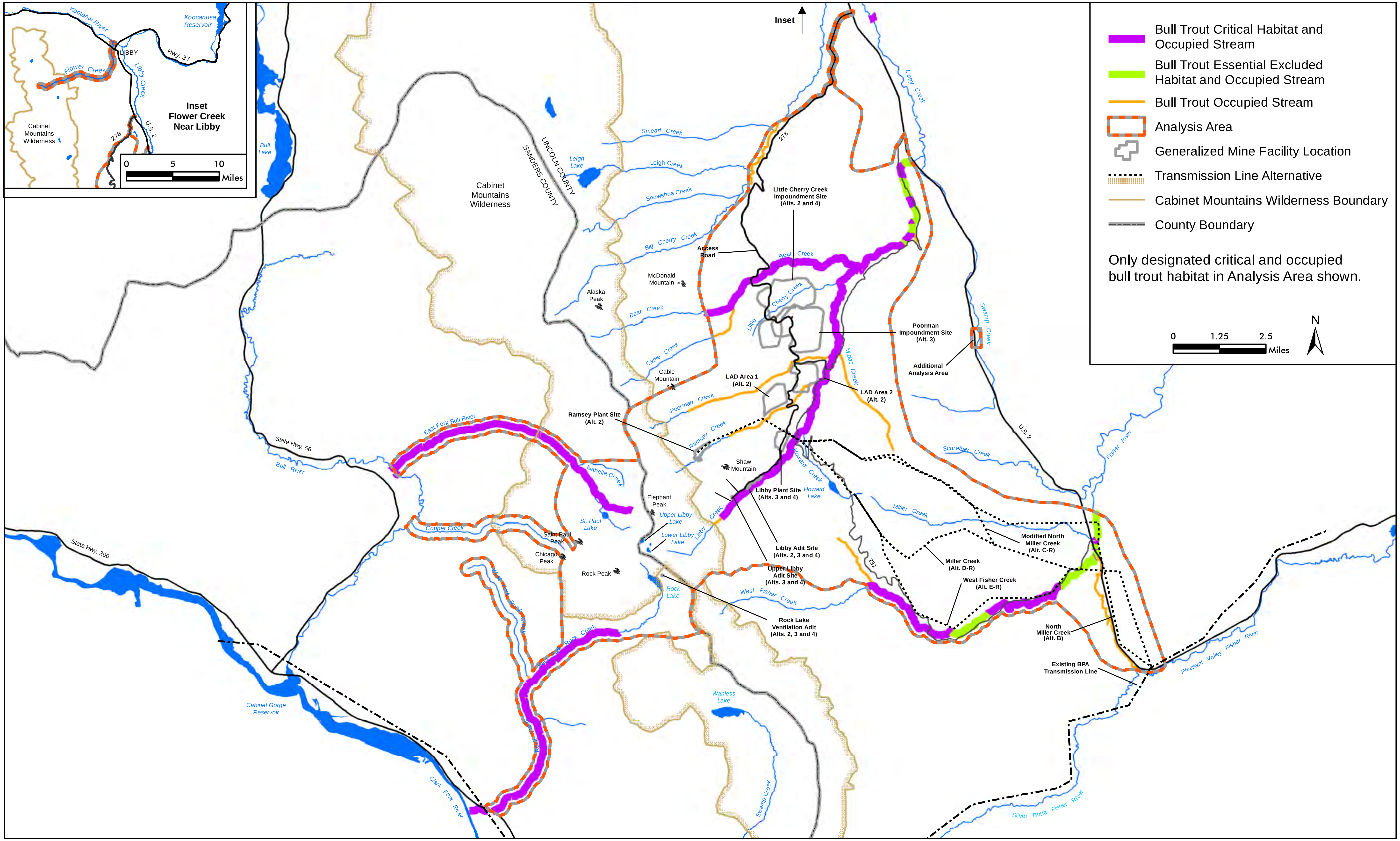

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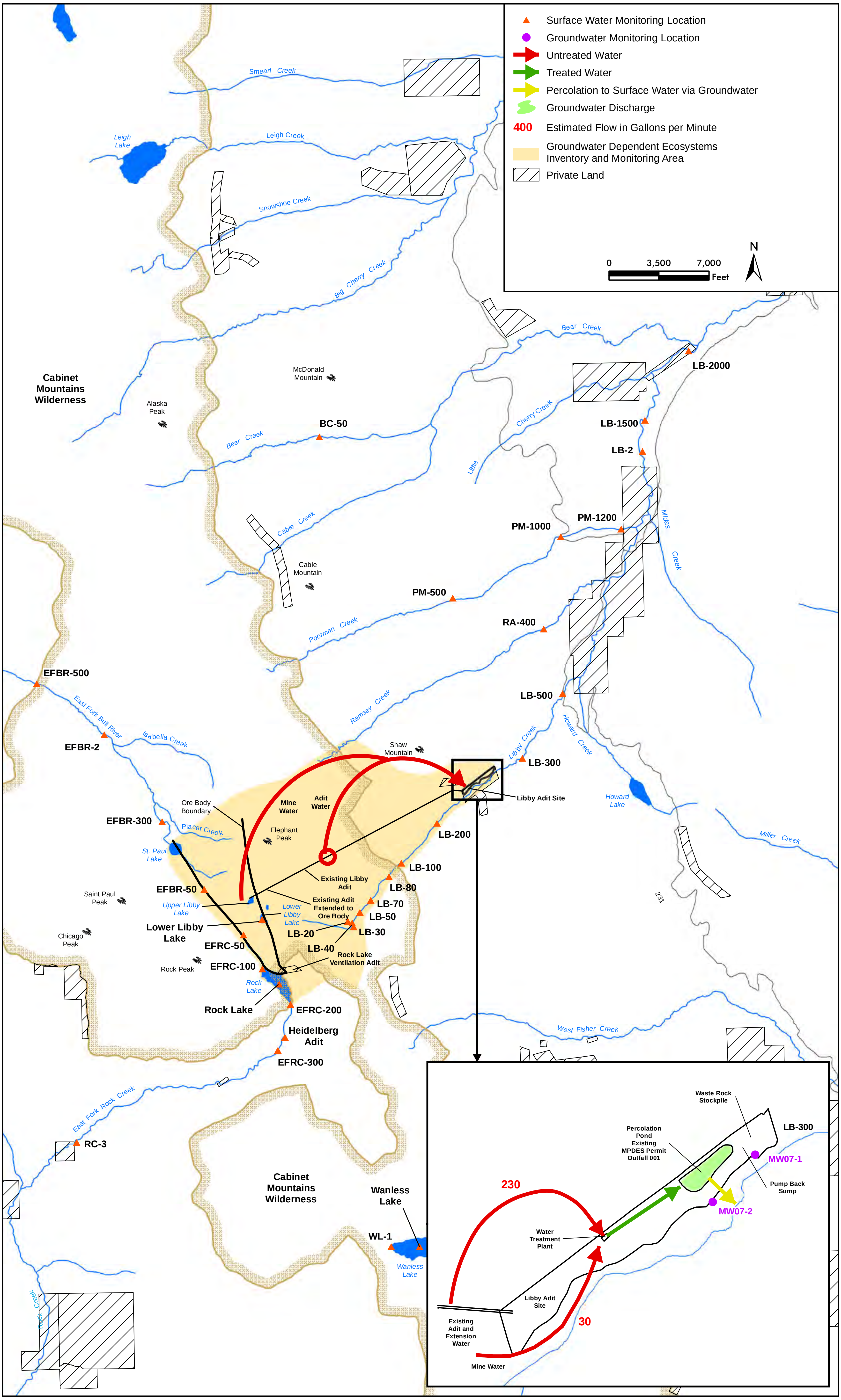

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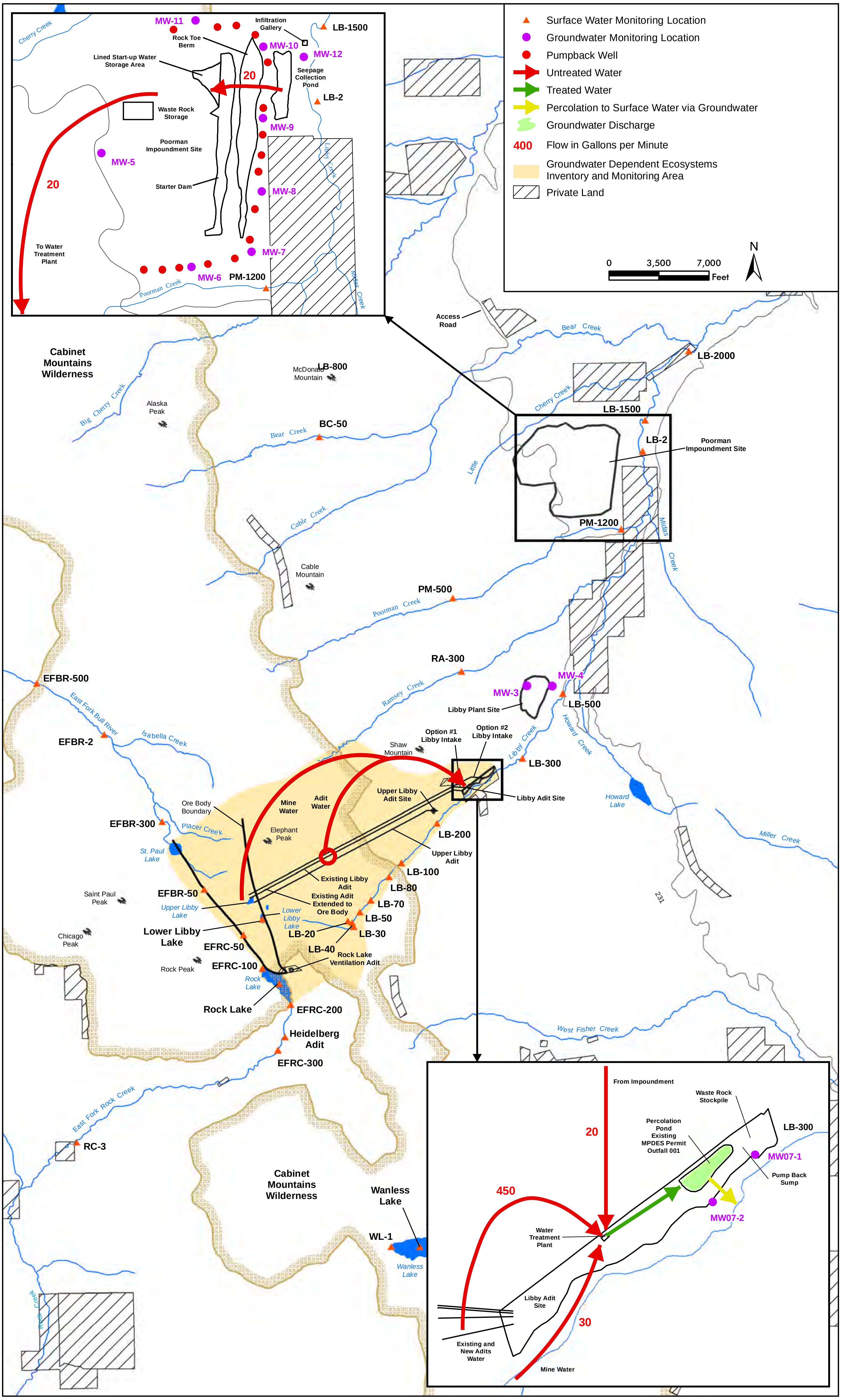

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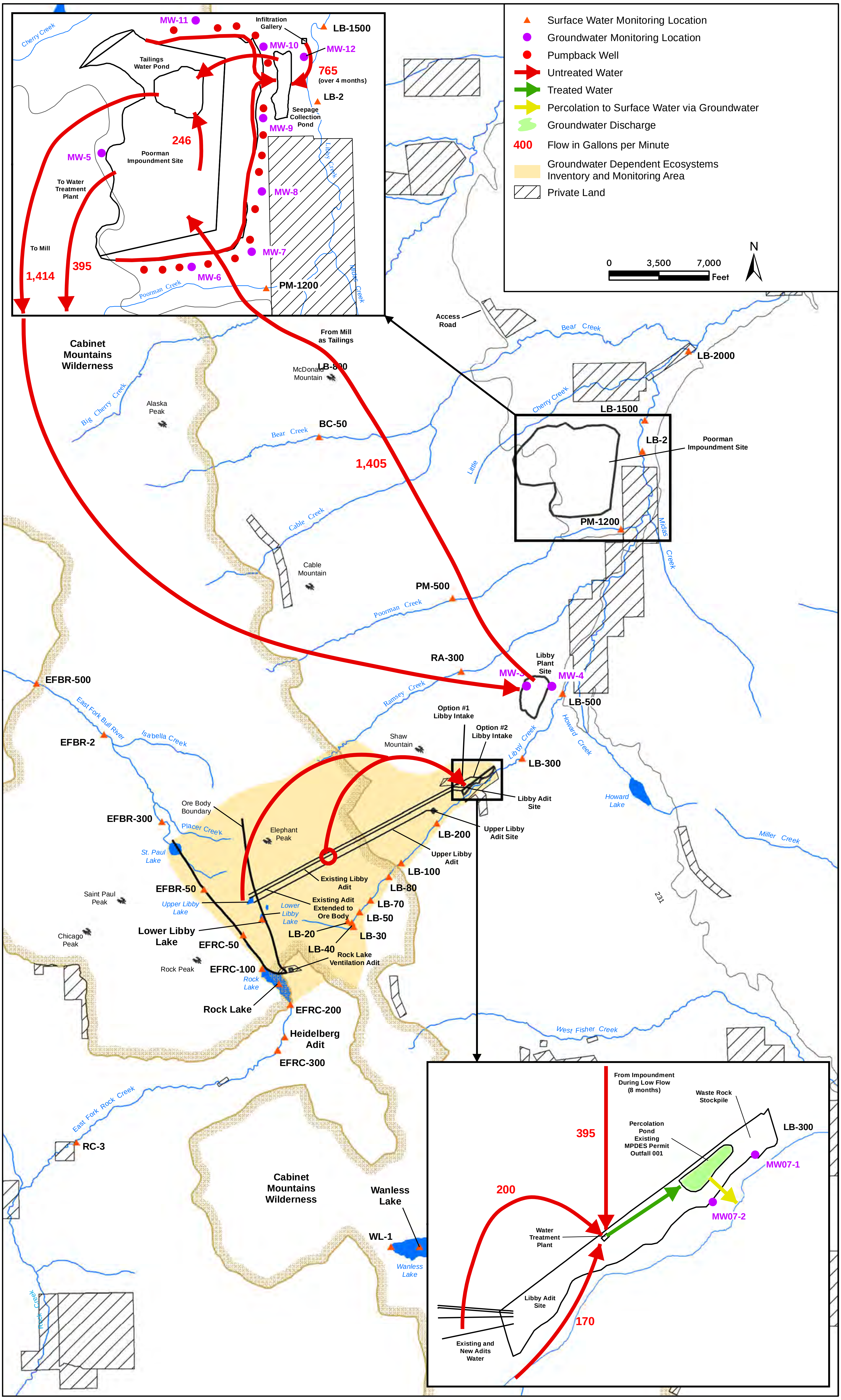

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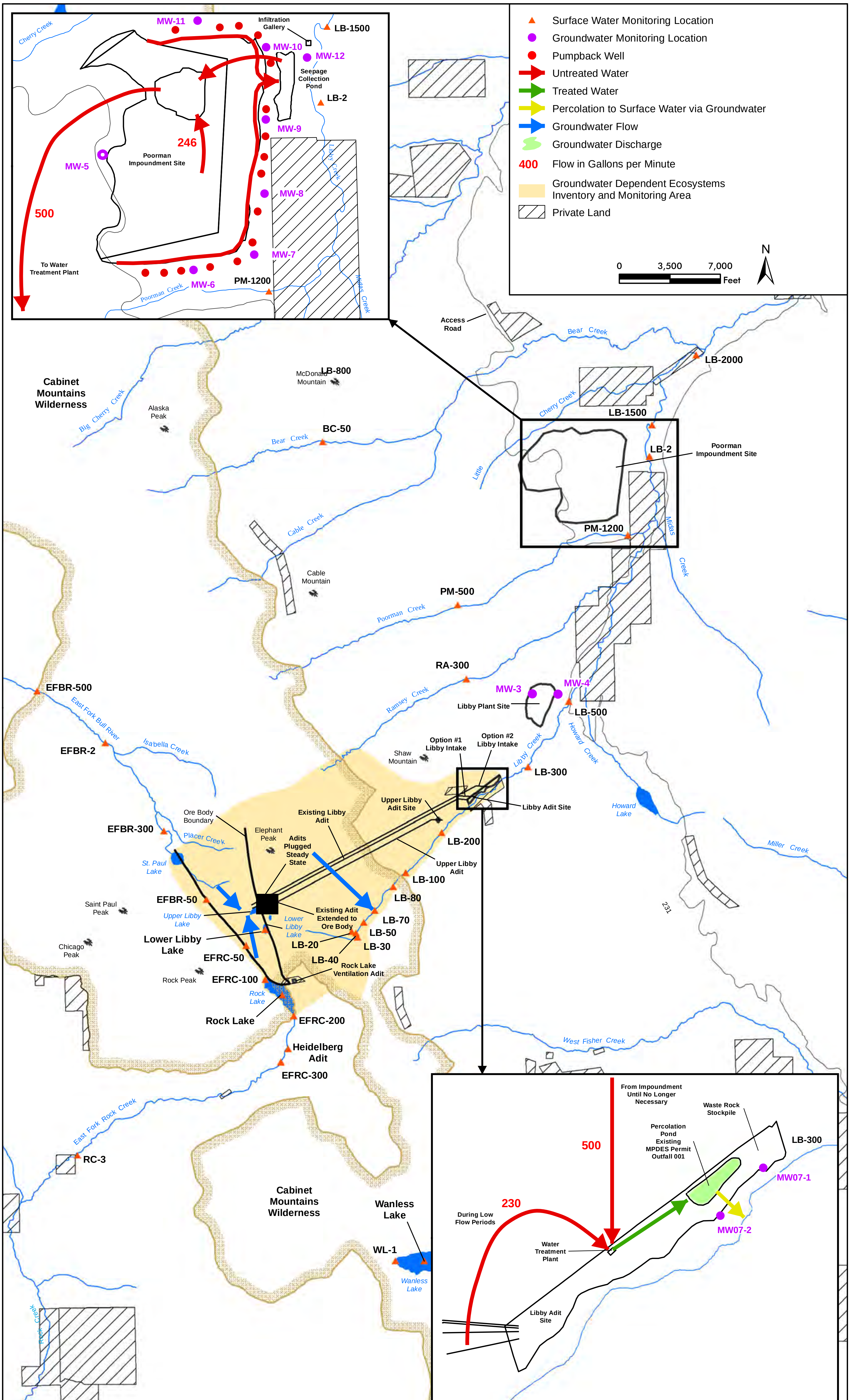

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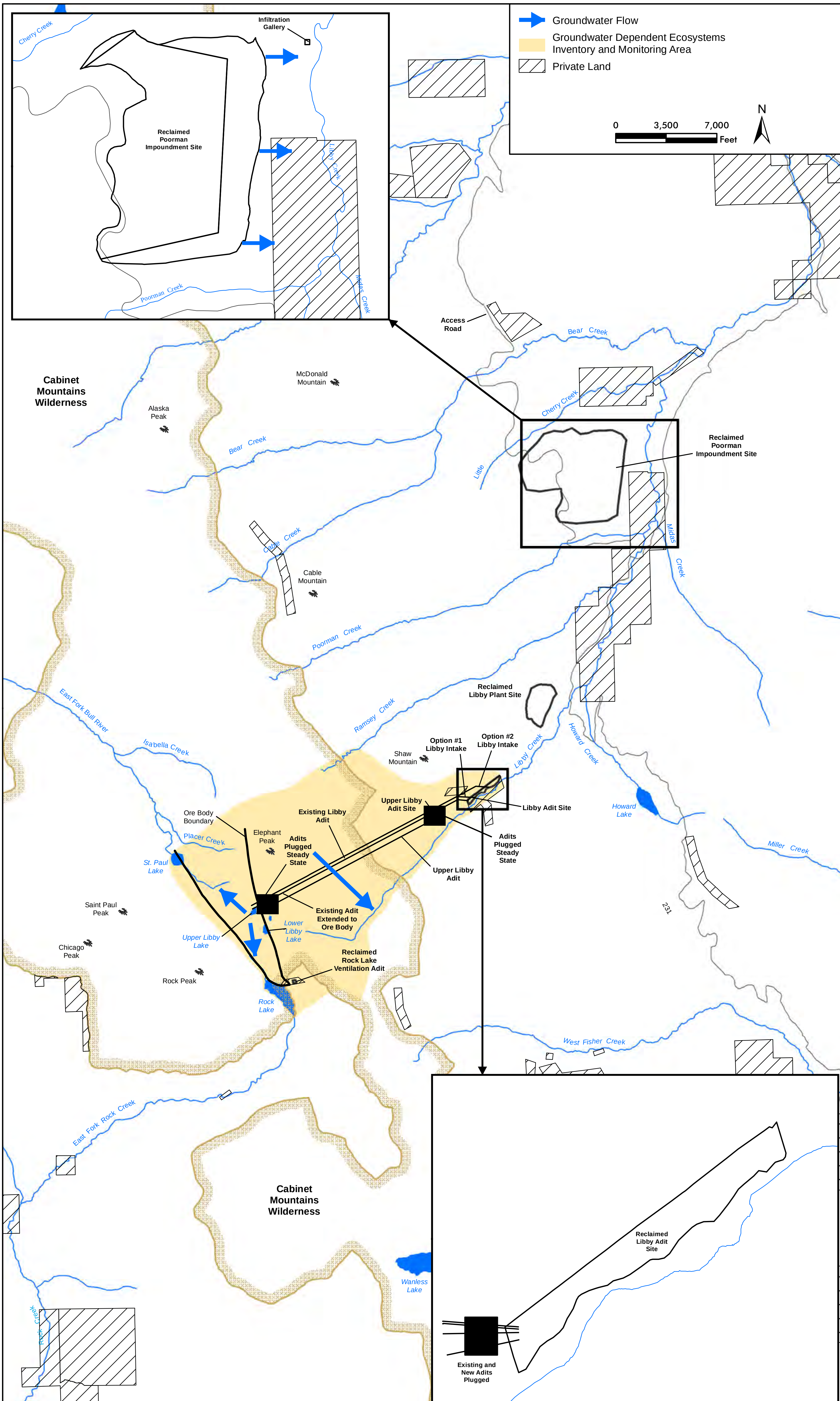

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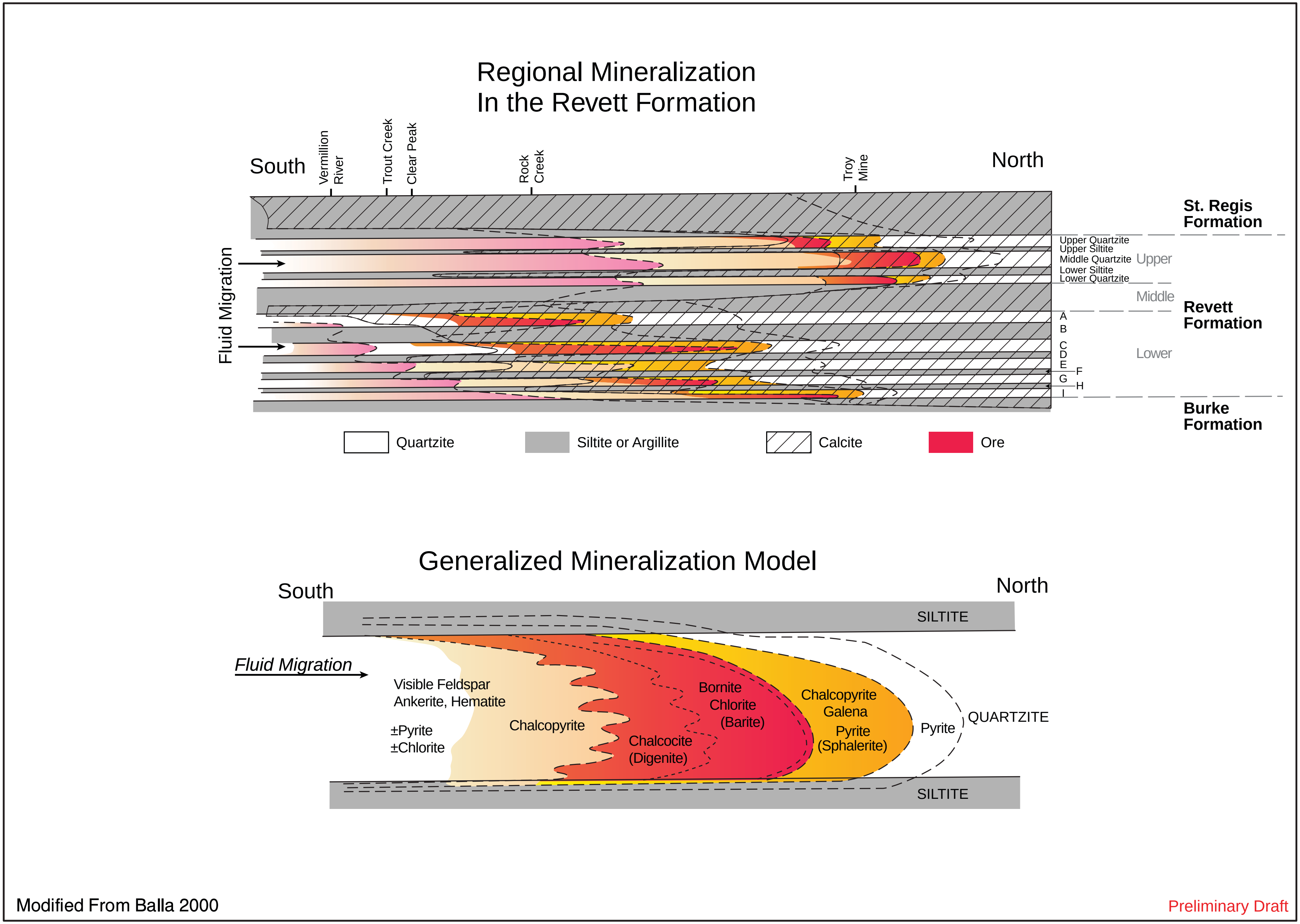

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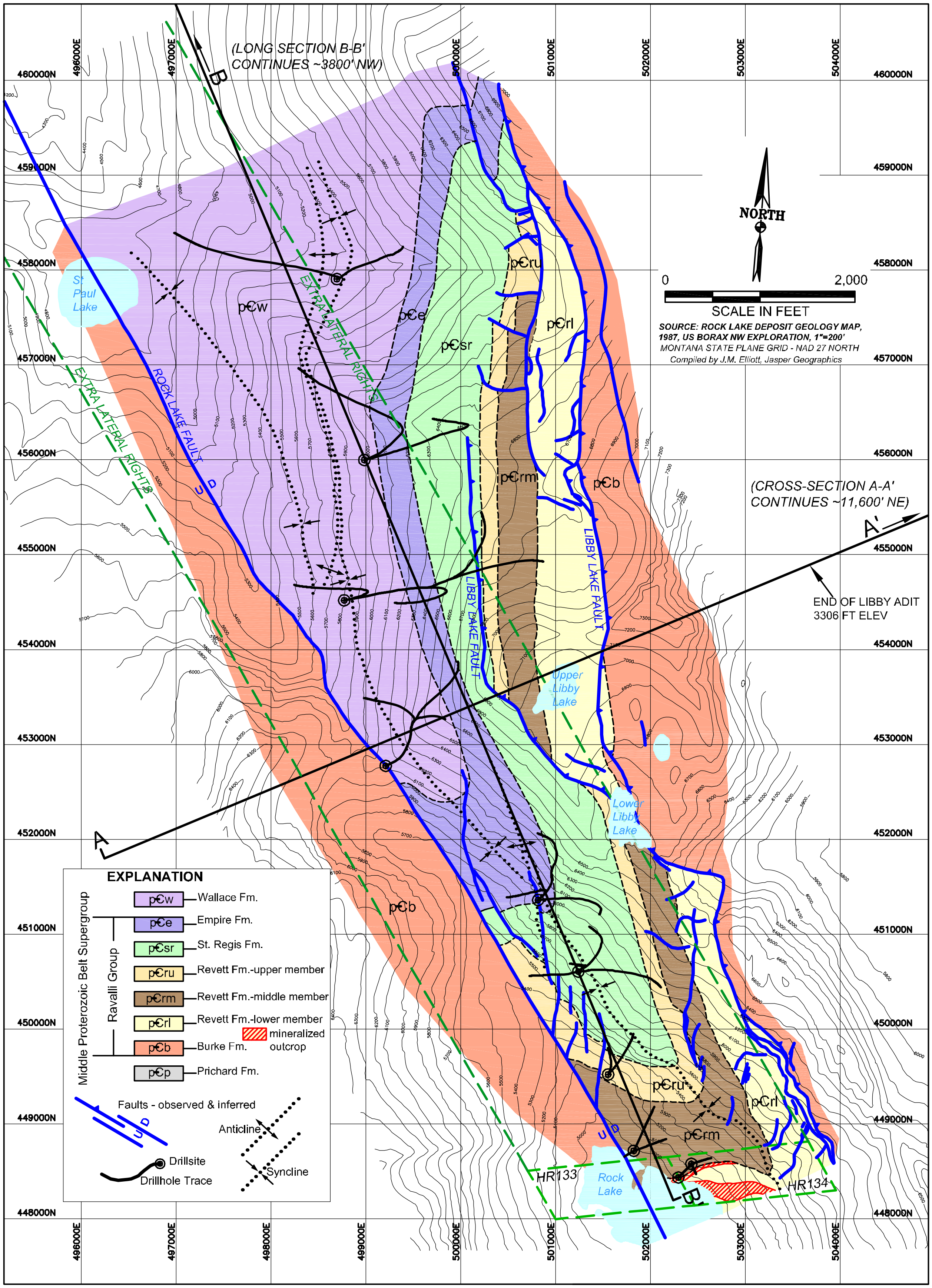


Figure 62. Bedrock Geology of the Rock Creek-Montanore Deposit

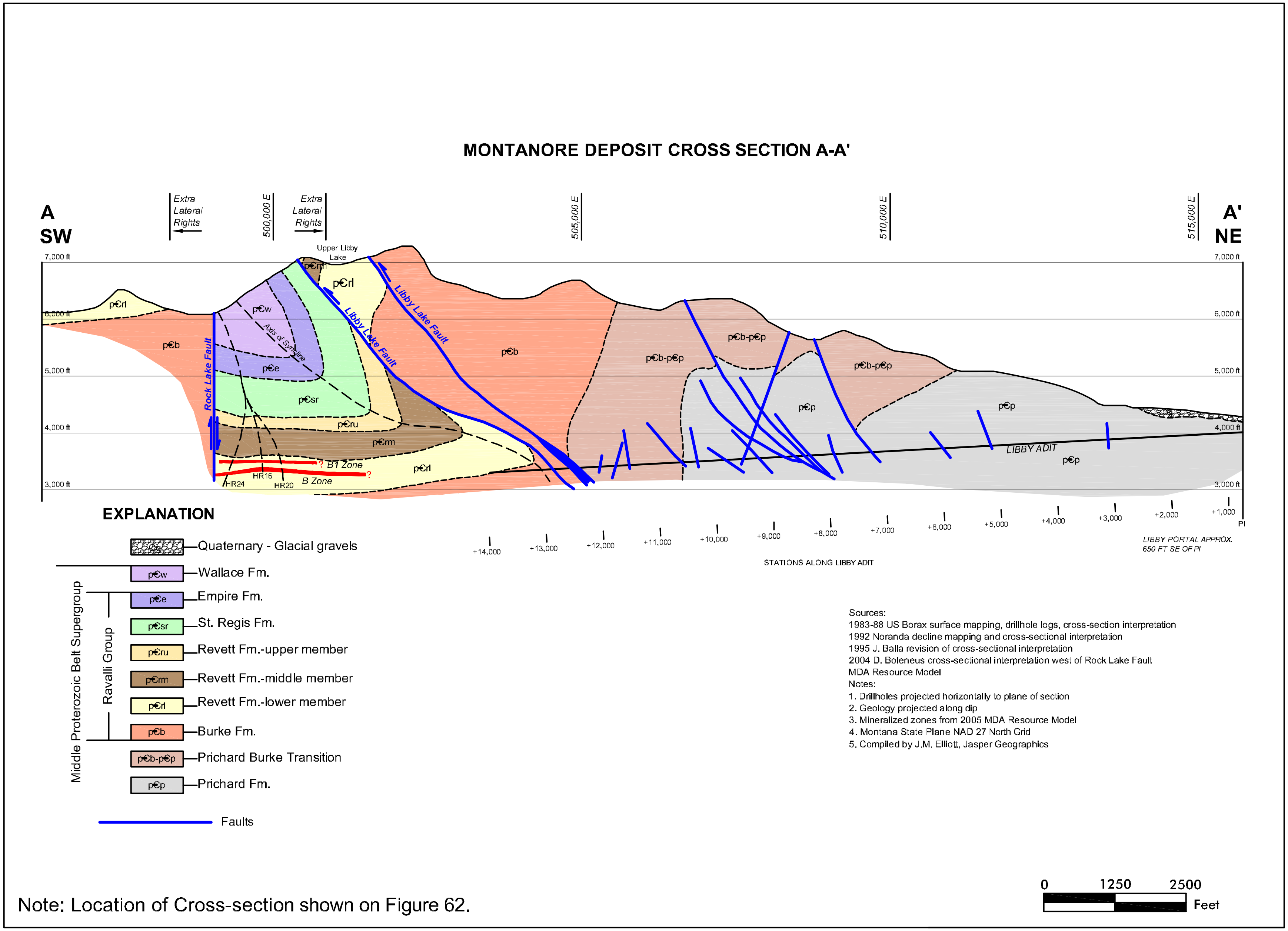
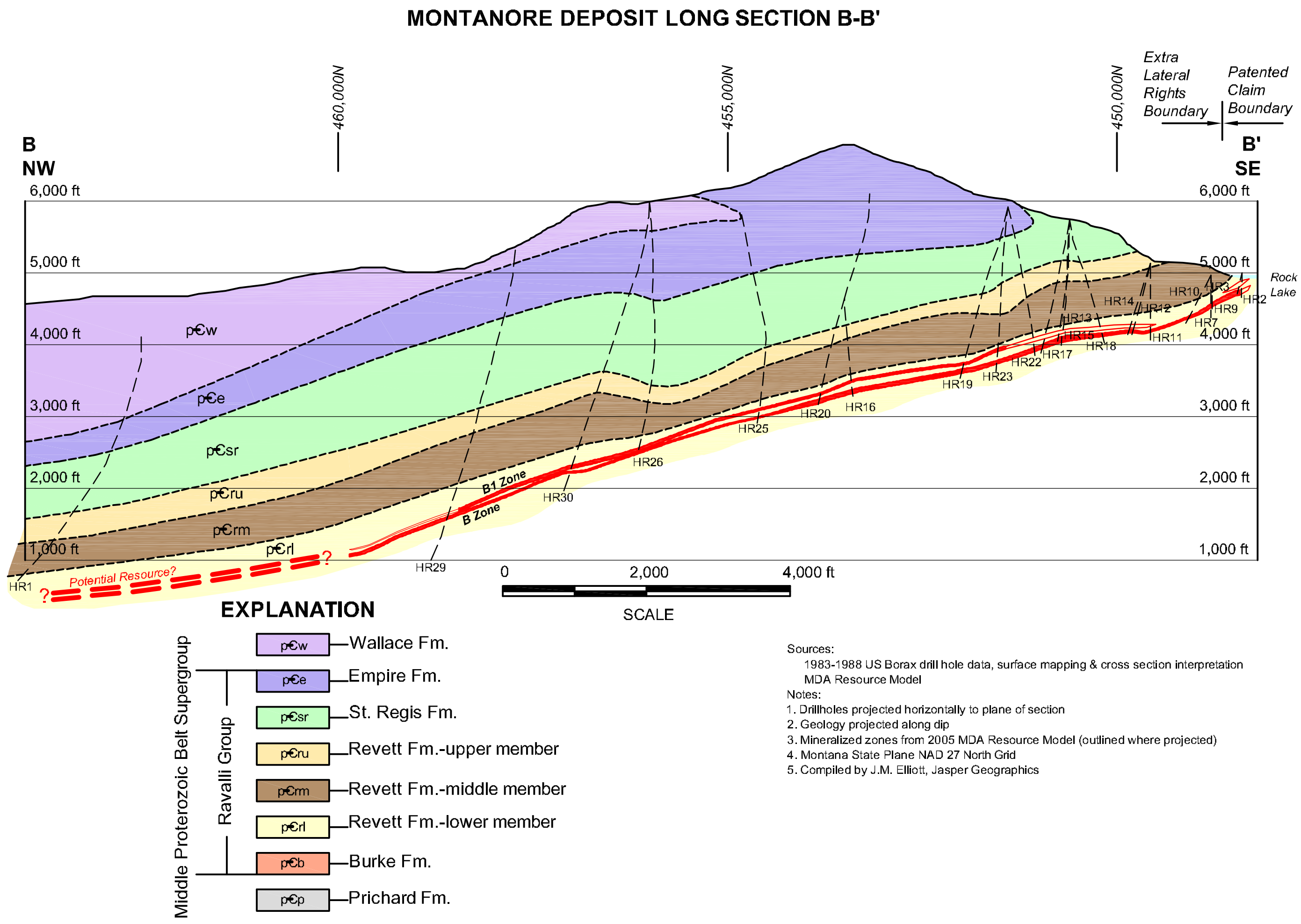


Figure 63. Geologic Cross Section-Libby Adit



Note: Location of Cross-section shown on Figure 62.

Figure 64. Geologic Cross Section-Montanore Sub-deposit

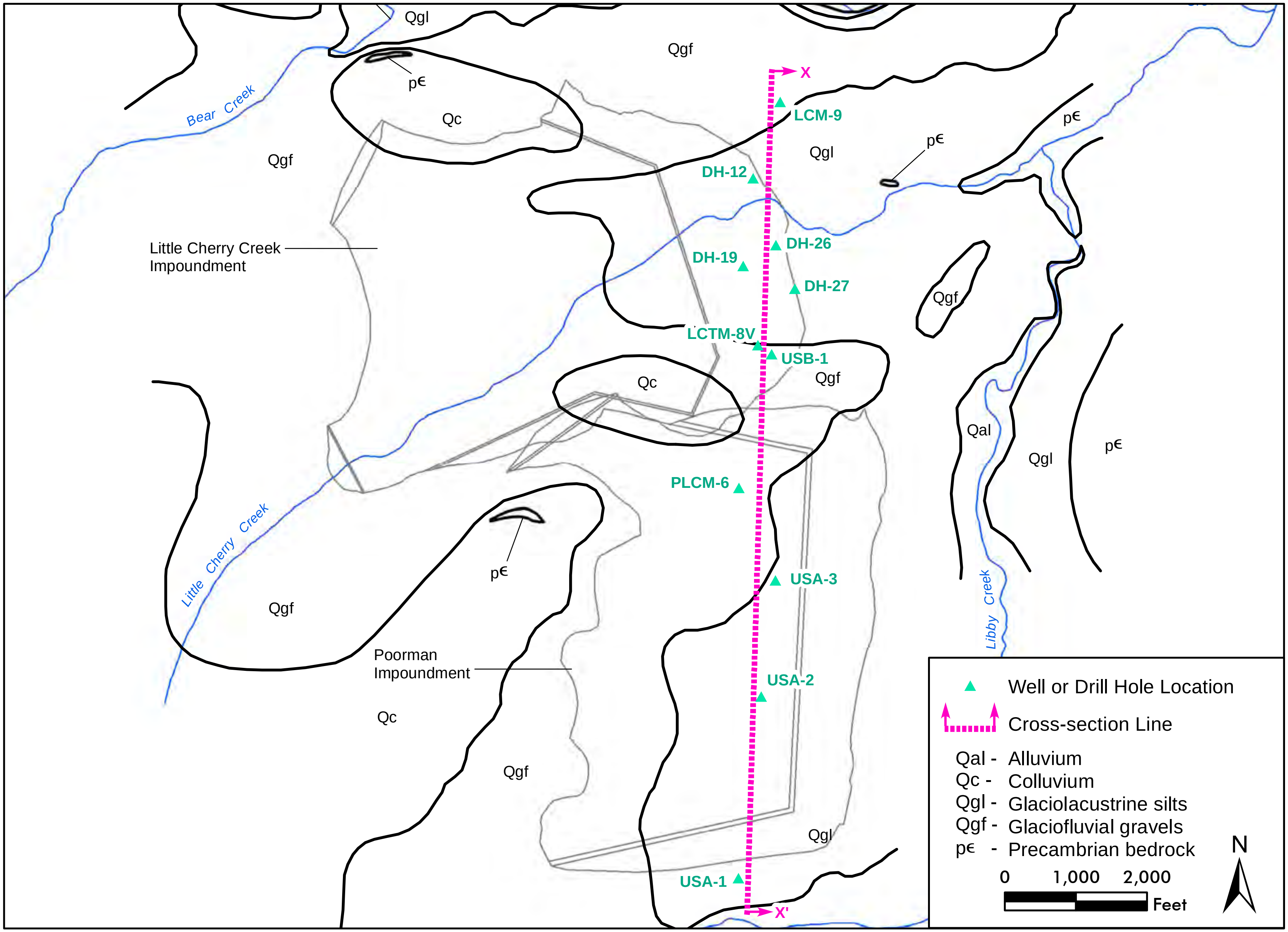


Figure 65. Geology of the Two Tailings Impoundment Sites

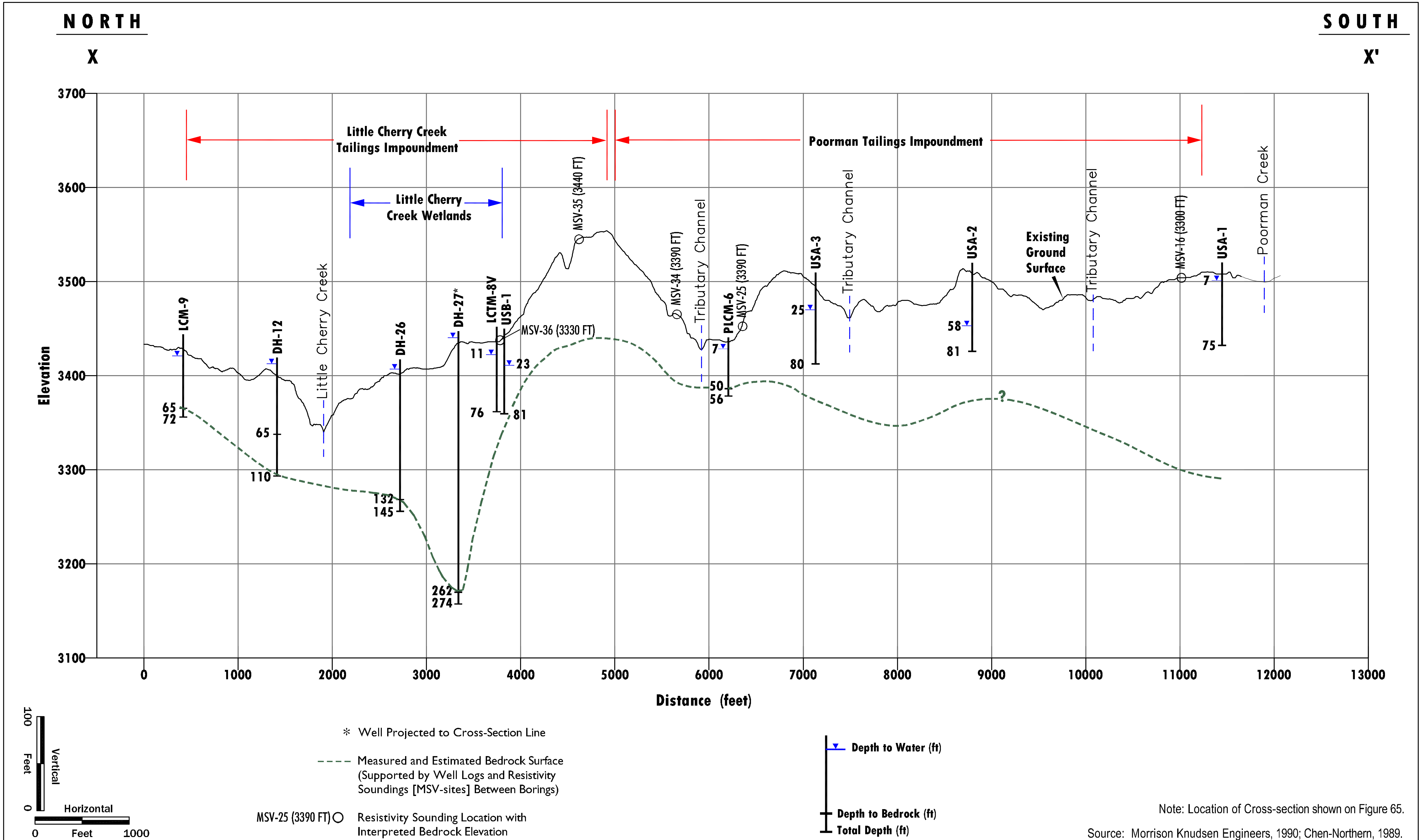


Figure 66. Geologic Cross Section of the Two Tailings Impoundment Sites

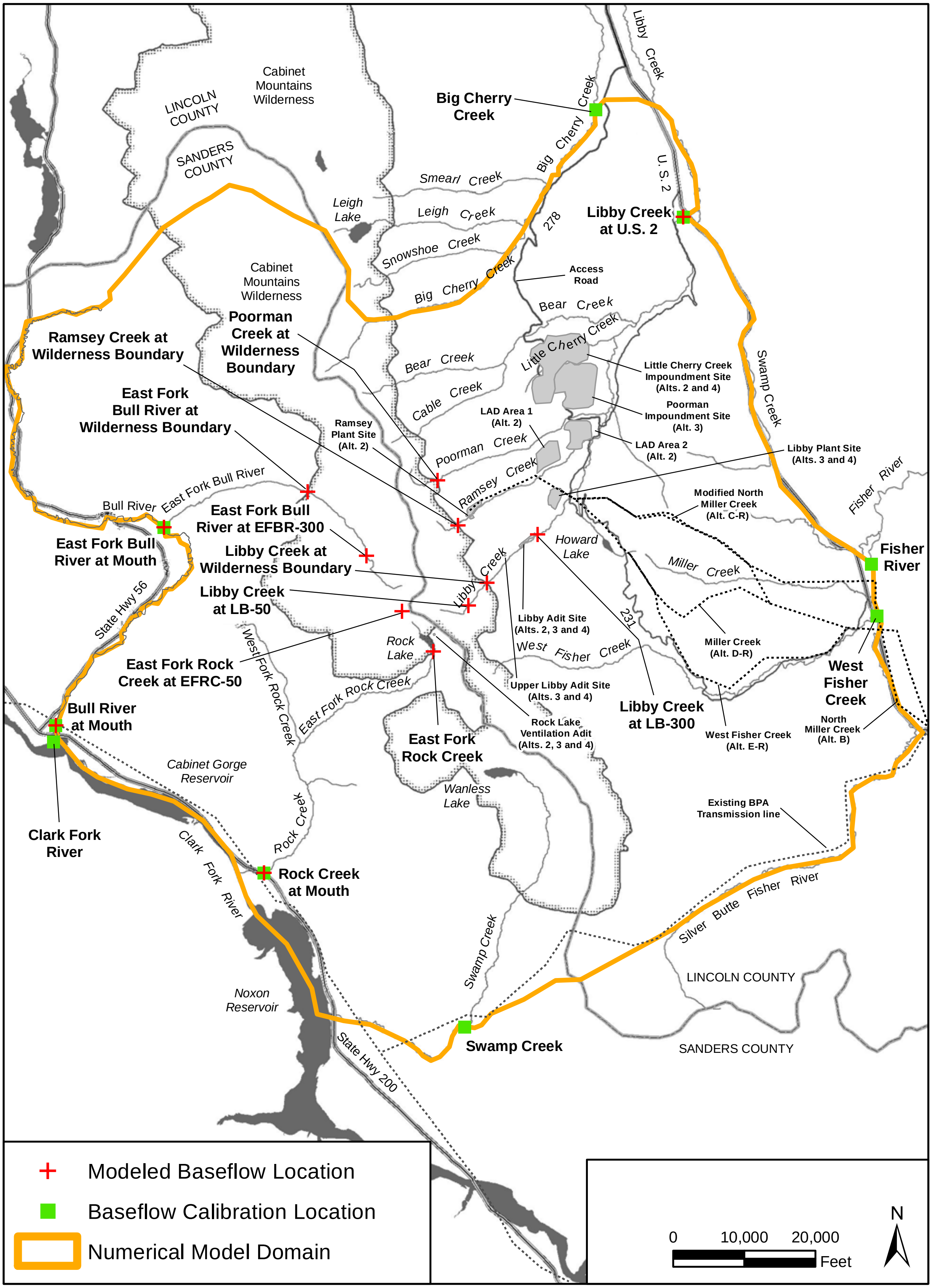


Figure 67. Numerical Model Domain and Groundwater Hydrology Analysis Area Location

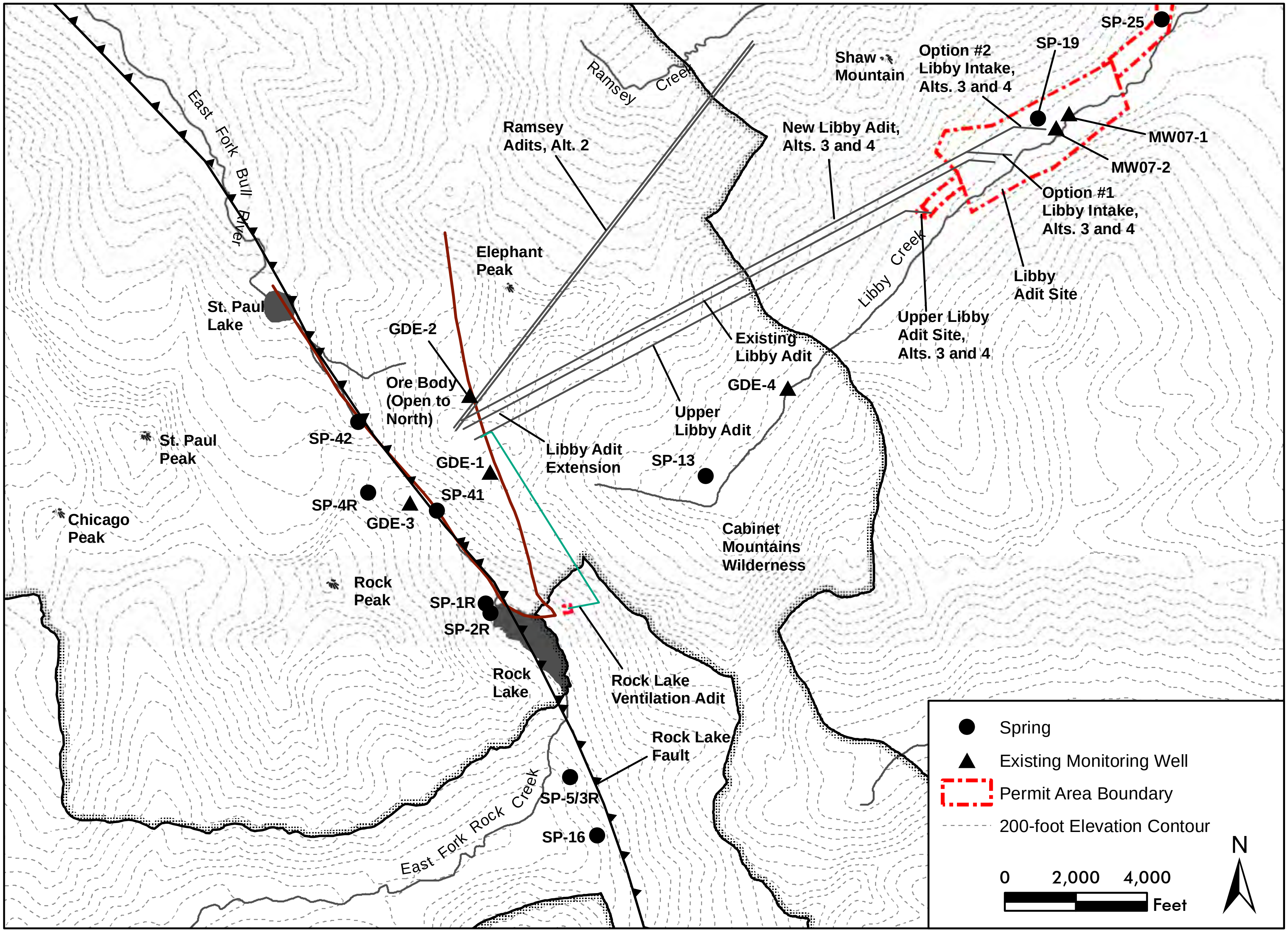


Figure 68. Existing Monitoring Wells and Identified Springs in the Mine Area

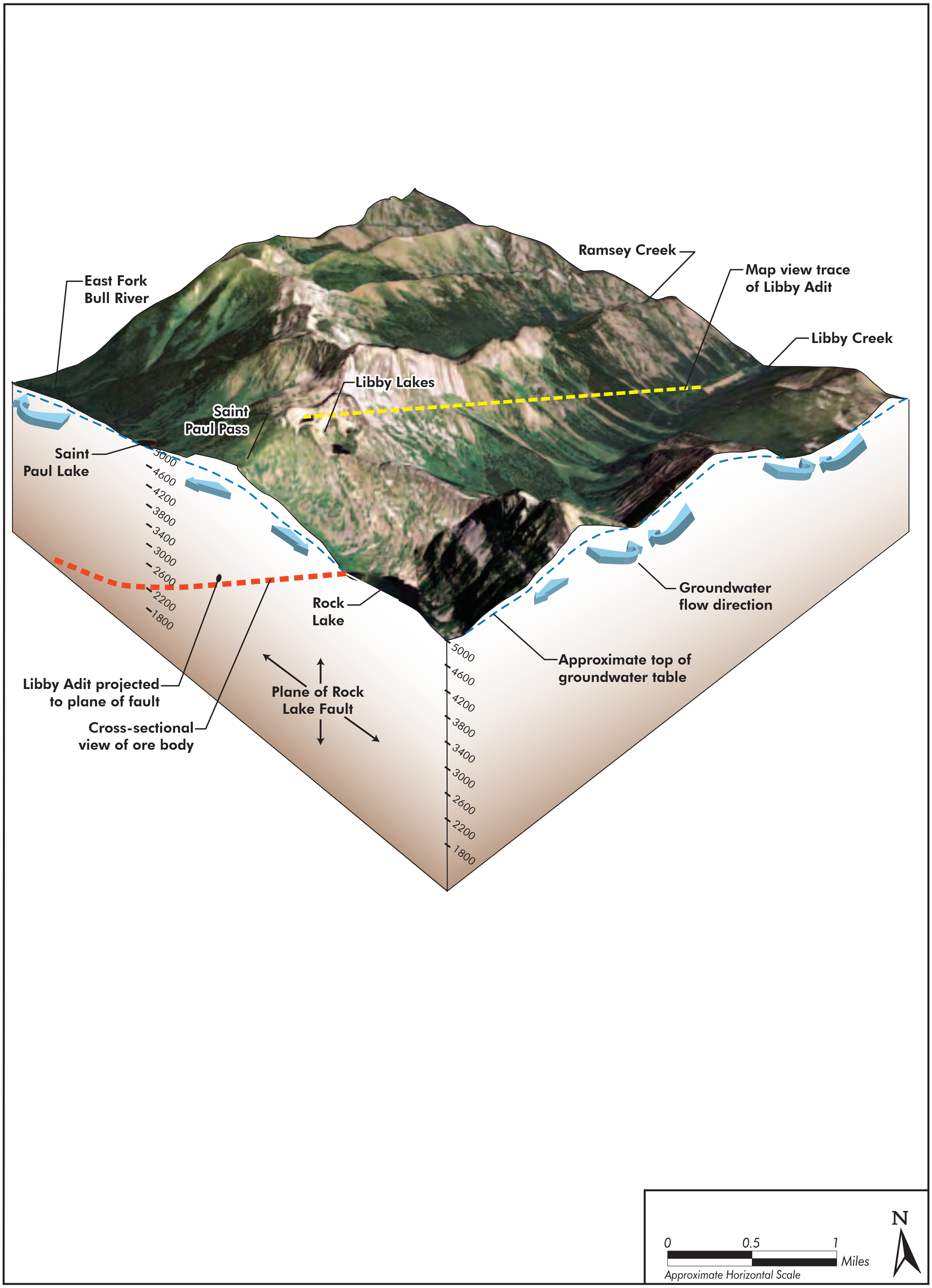


Figure 69. Three Dimensional Conceptual Model of the Montanore Mine Area Hydrogeology

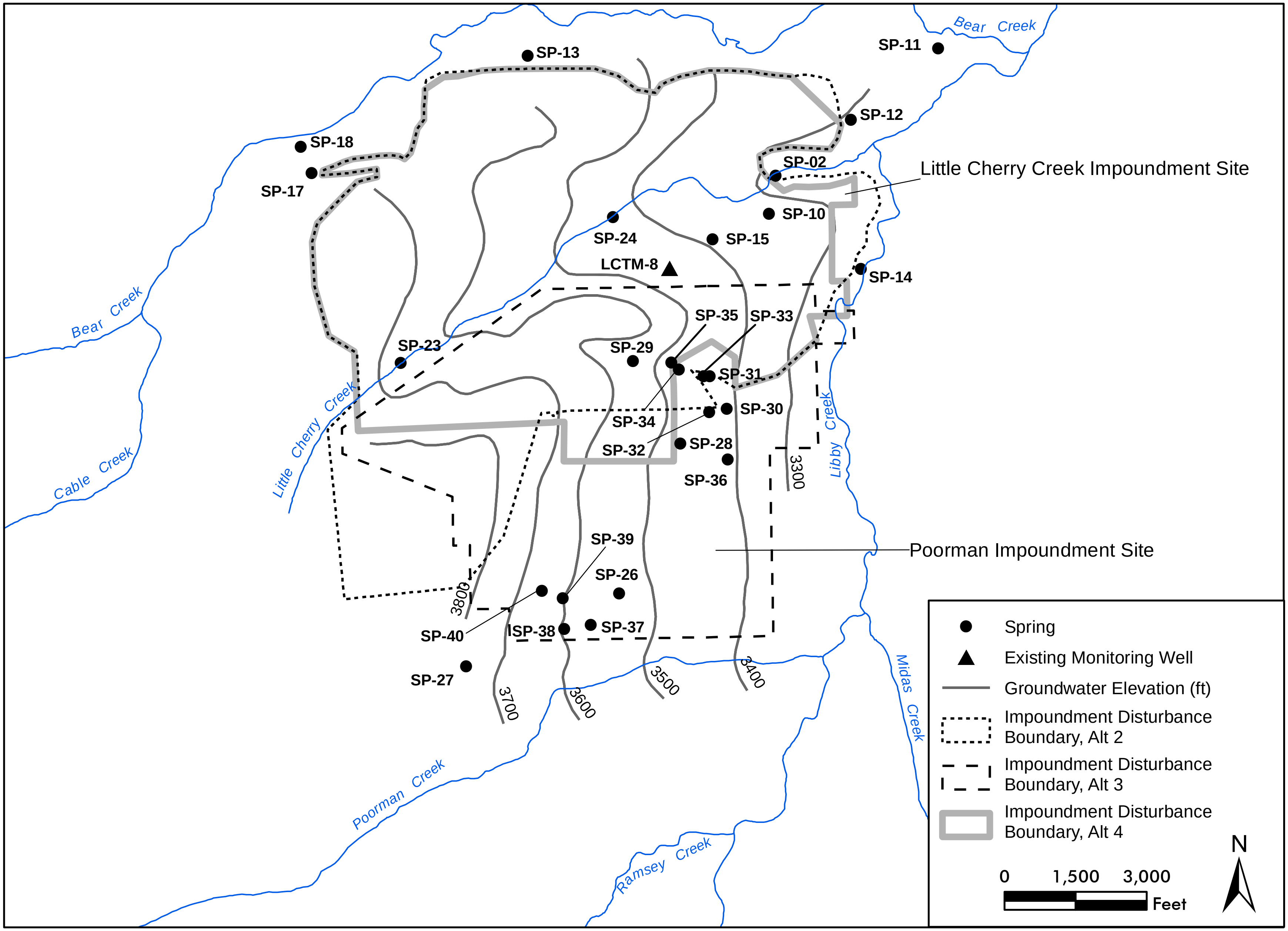


Figure 70. Existing Monitoring Wells, Identified Springs, and Groundwater Levels in the Tailings Impoundment Sites

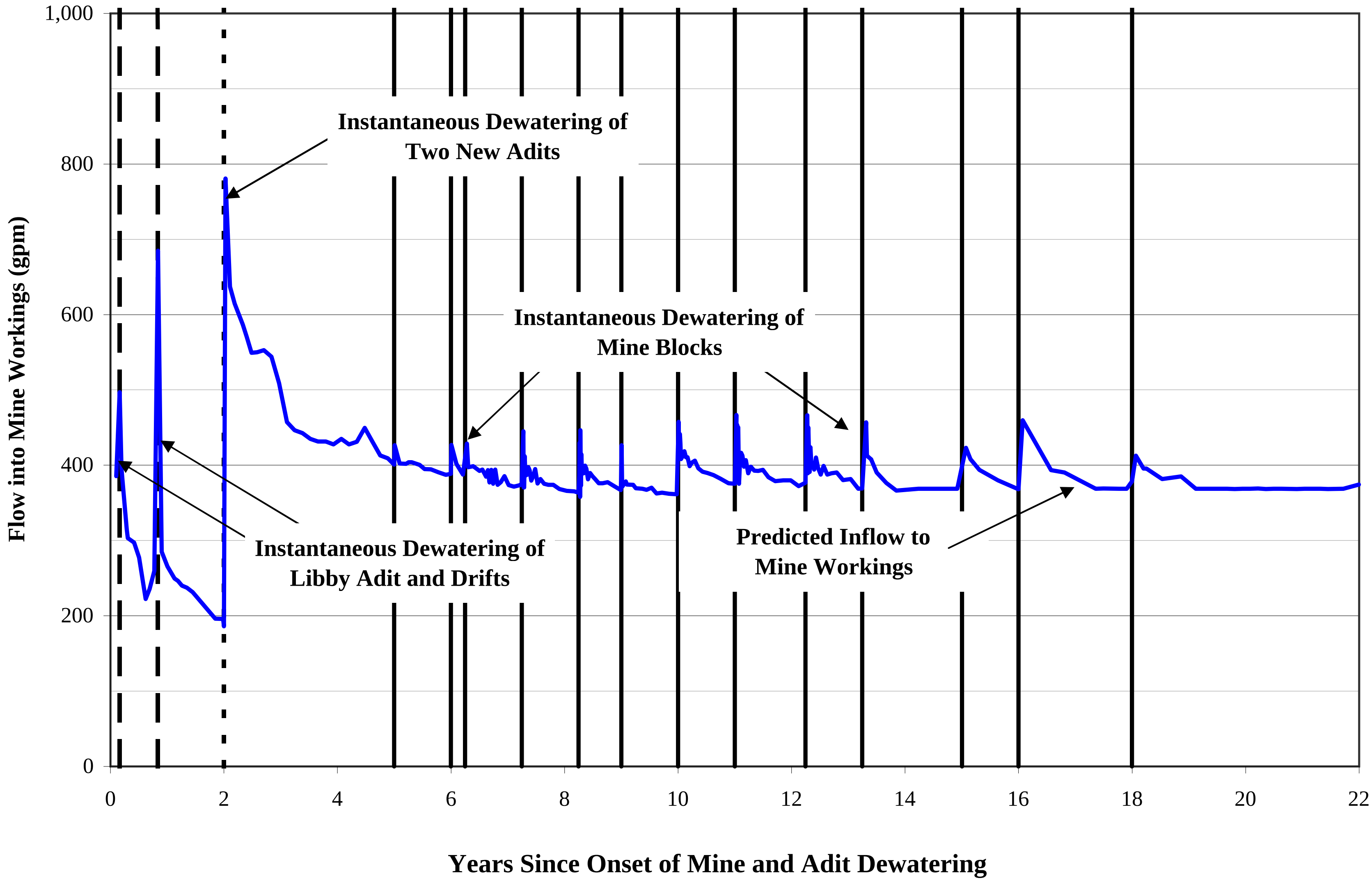


Figure 71. Predicted Dewatering Rates During Evaluation through Operations Phases

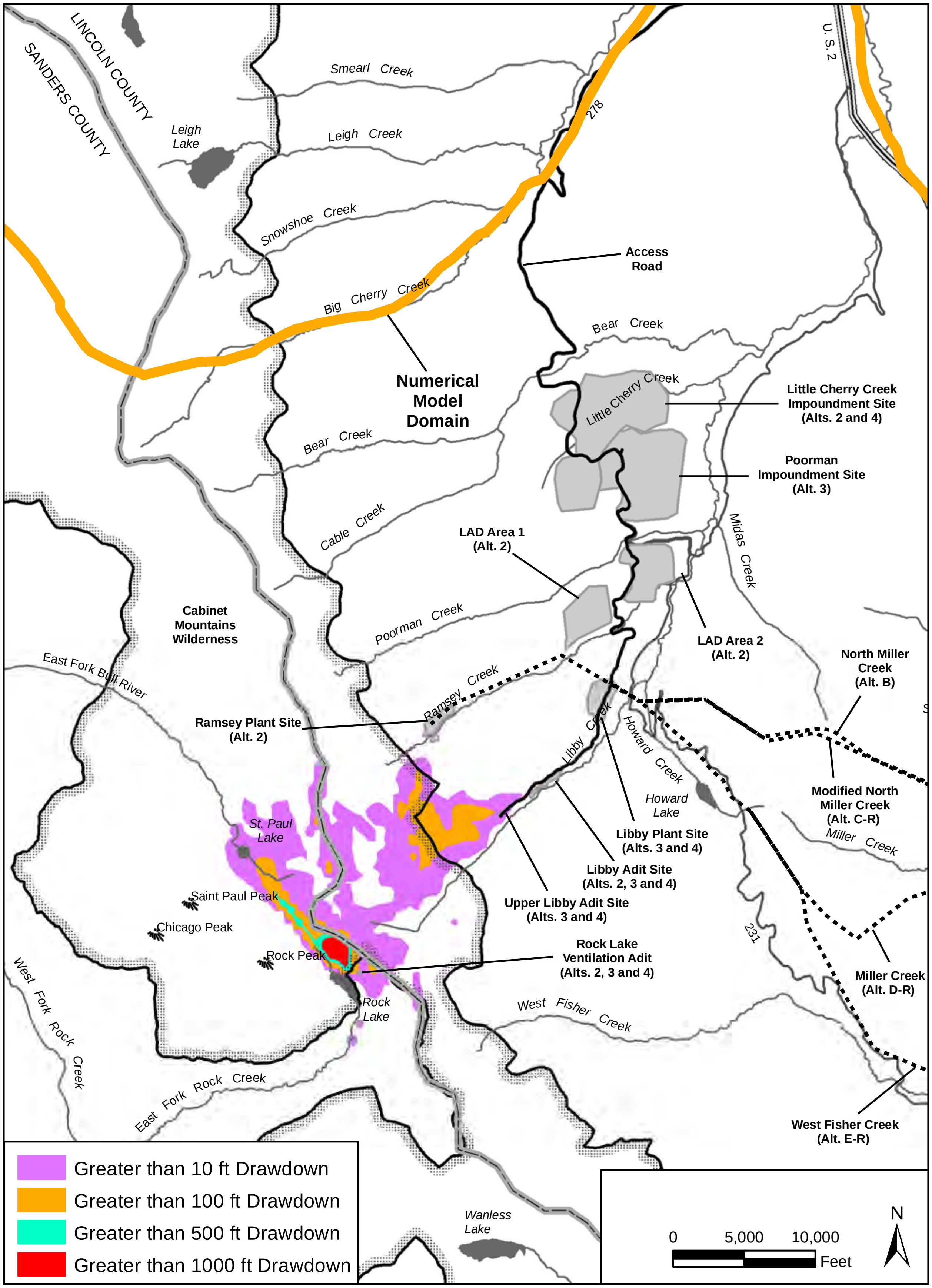


Figure 72. Predicted Area of Groundwater Drawdown Post-Closure Phase (Maximum Baseflow Change)

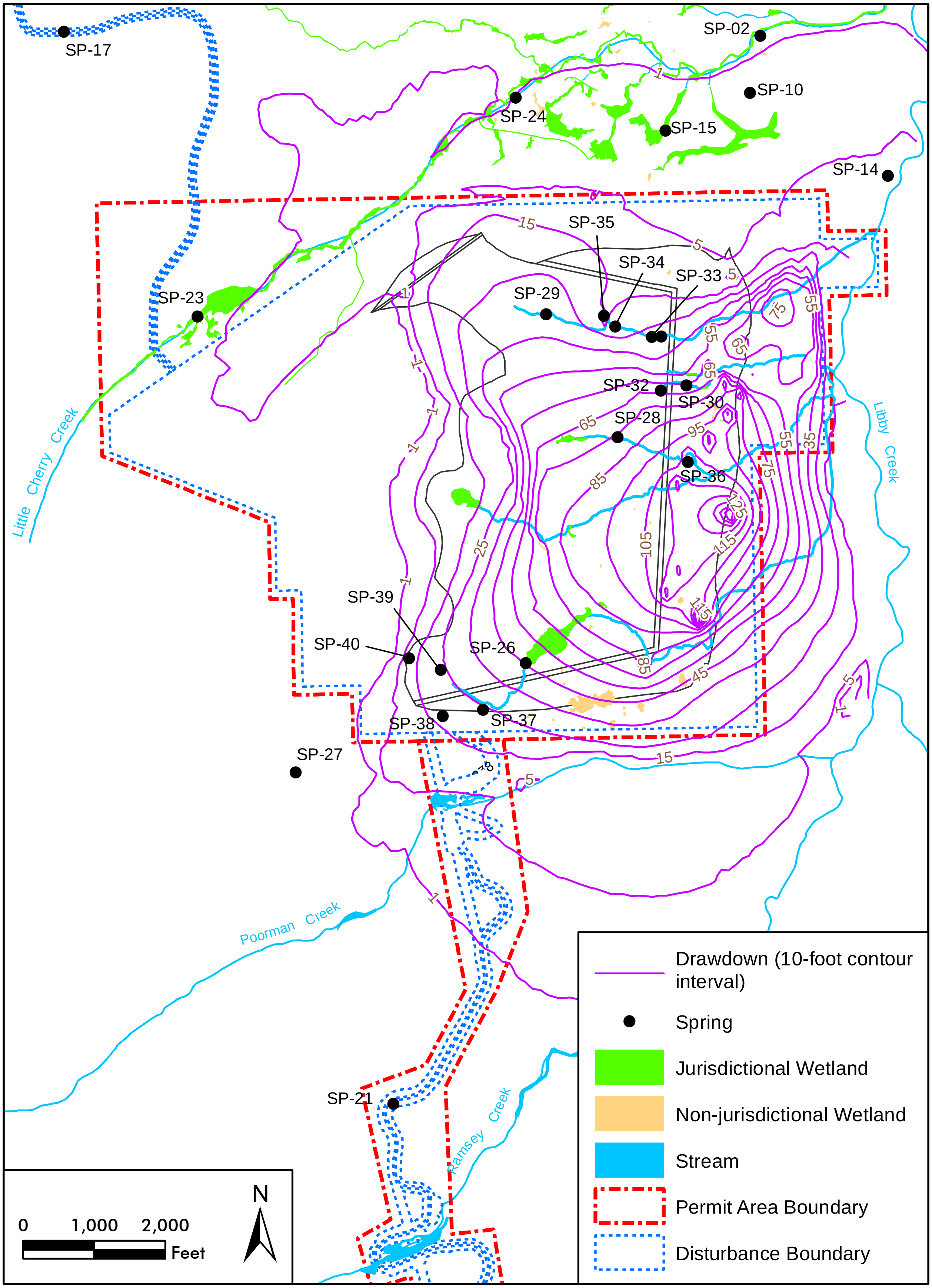


Figure 73. Predicted Area of Groundwater Drawdown in the Poorman Tailings Impoundment Area

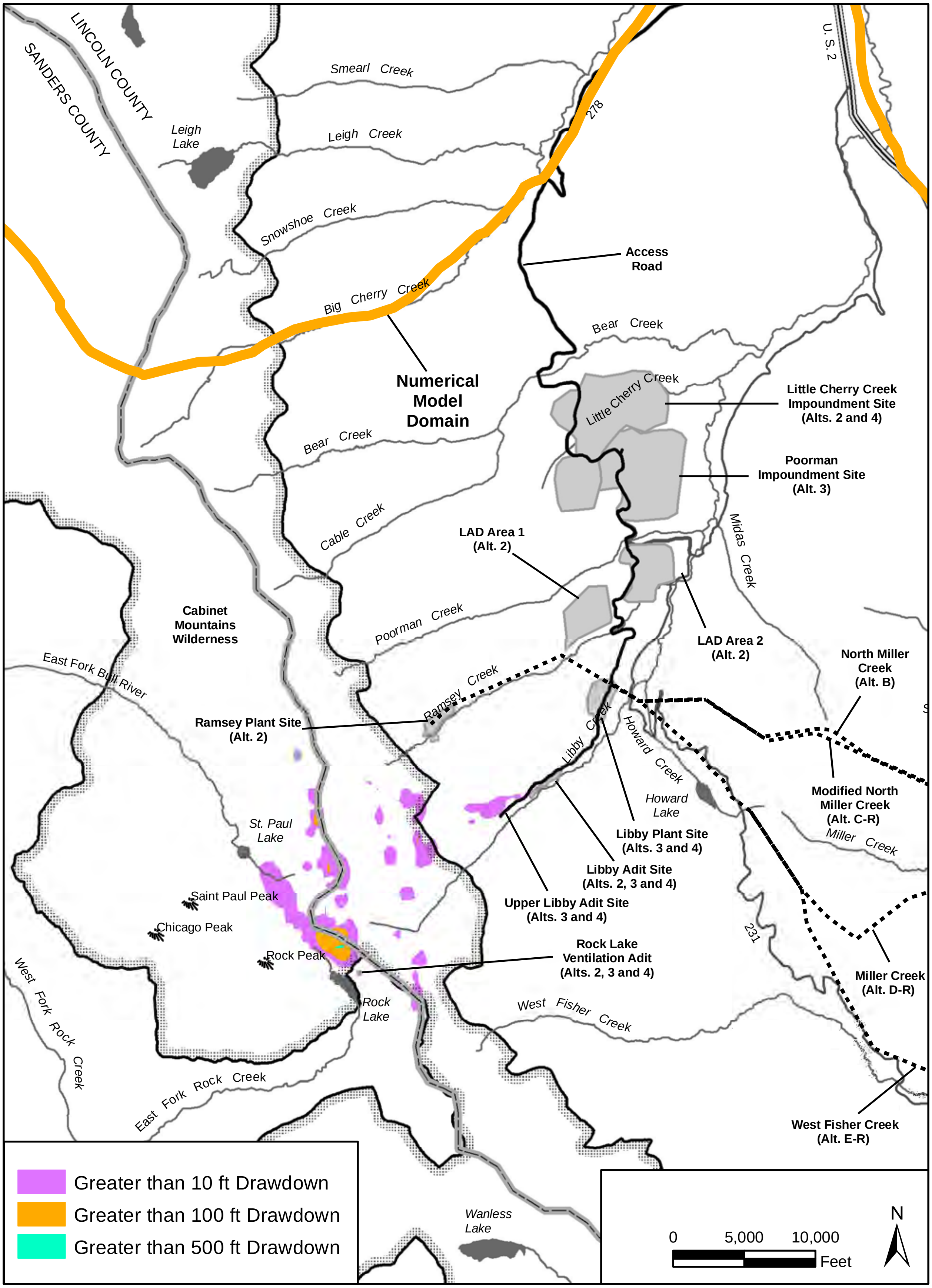


Figure 74. Residual Groundwater Drawdown Post-Closure Phase

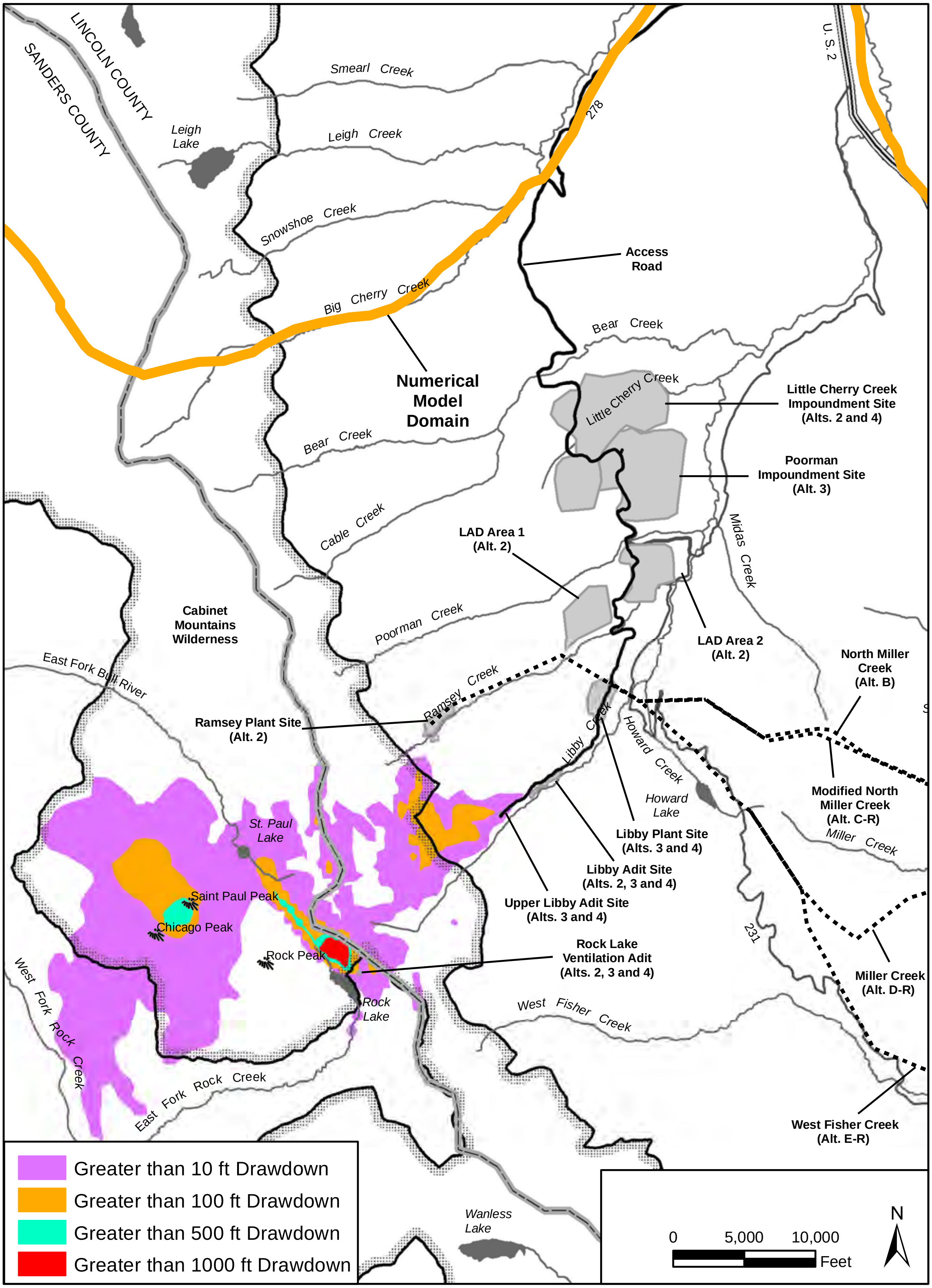


Figure 75. Cumulative Groundwater Drawdown Post-Closure Phase (Maximum Baseflow Change)

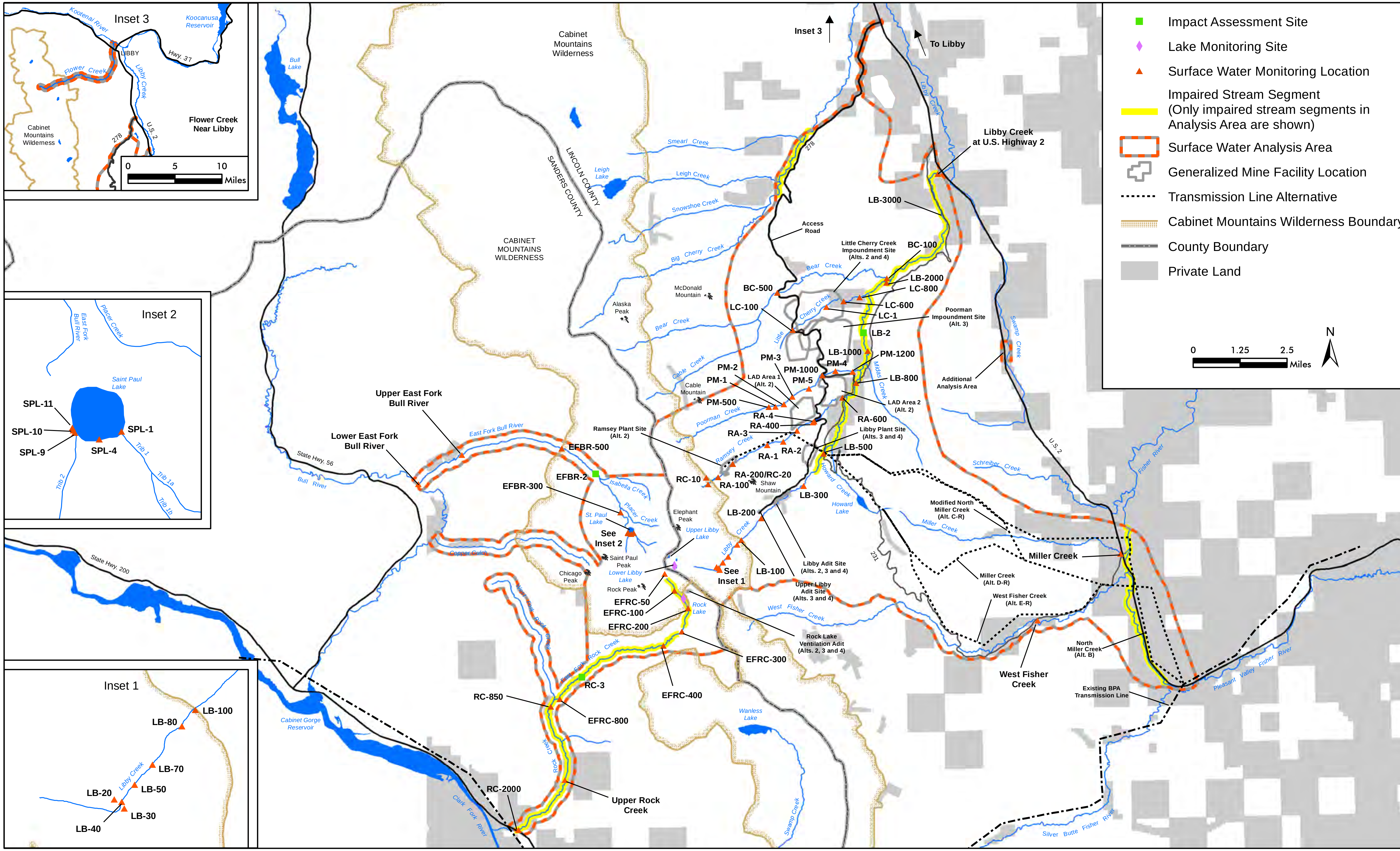


Figure 76. Surface Water Resources in the Analysis Area

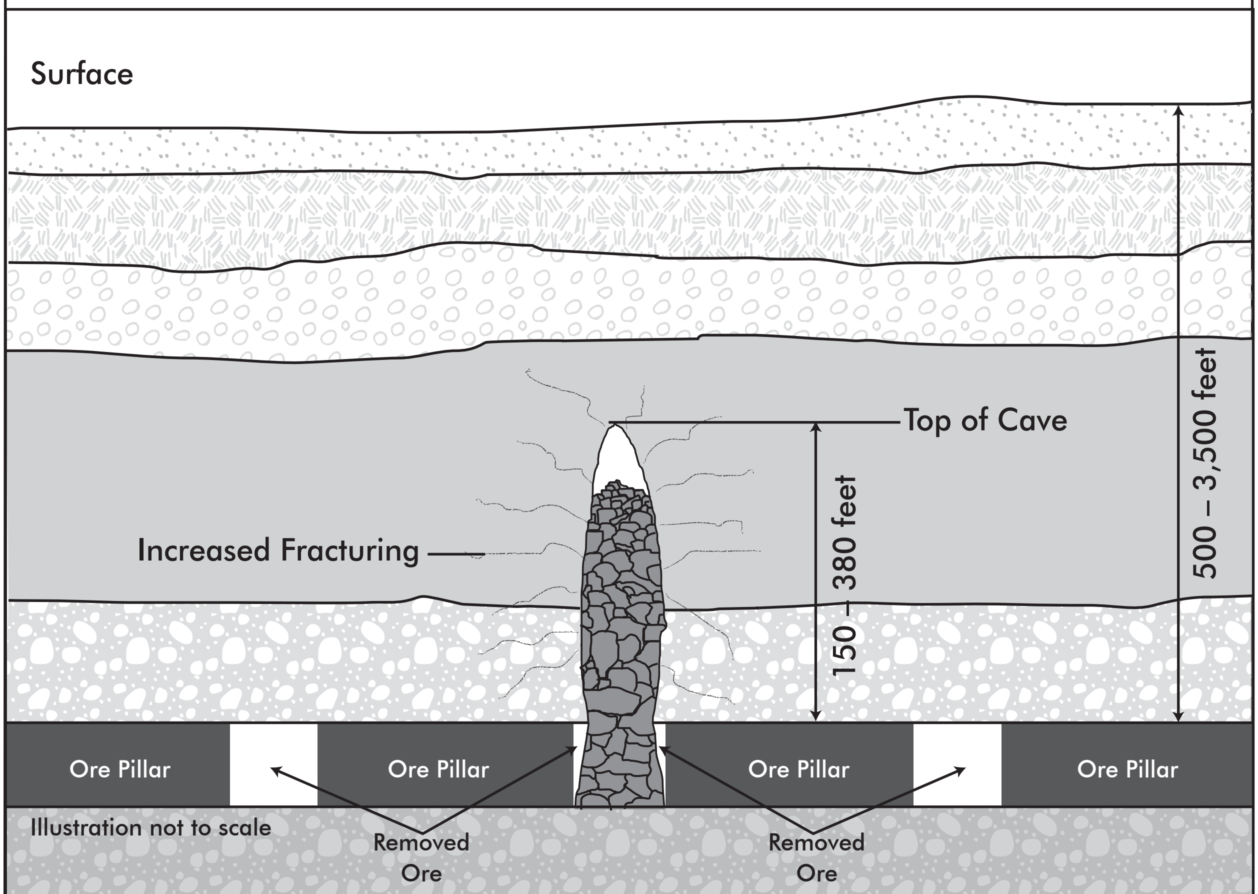


Figure 77. Typical Cross Sectional View of Chimney Subsidence

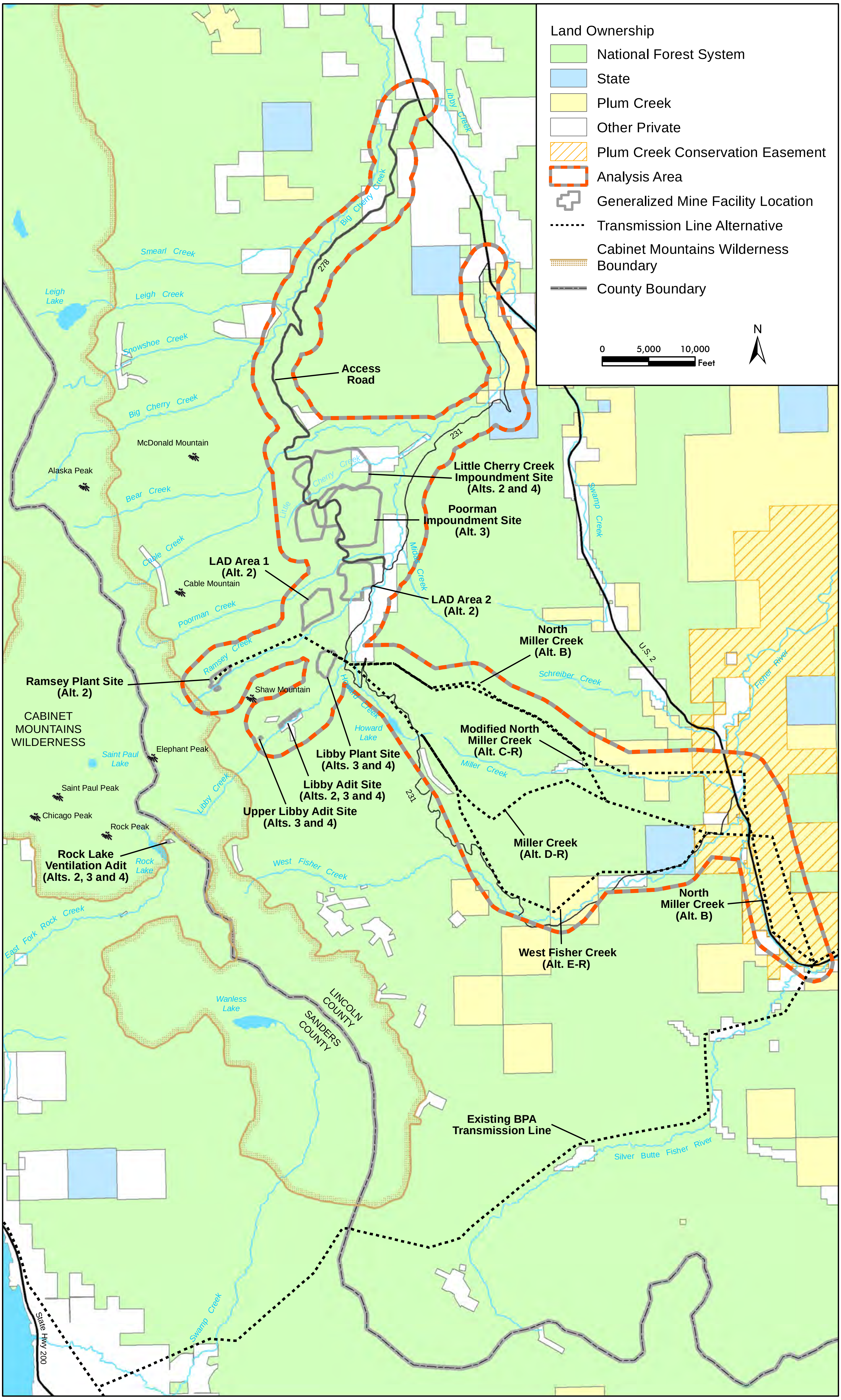


Figure 78. Land Ownership in the Analysis Area

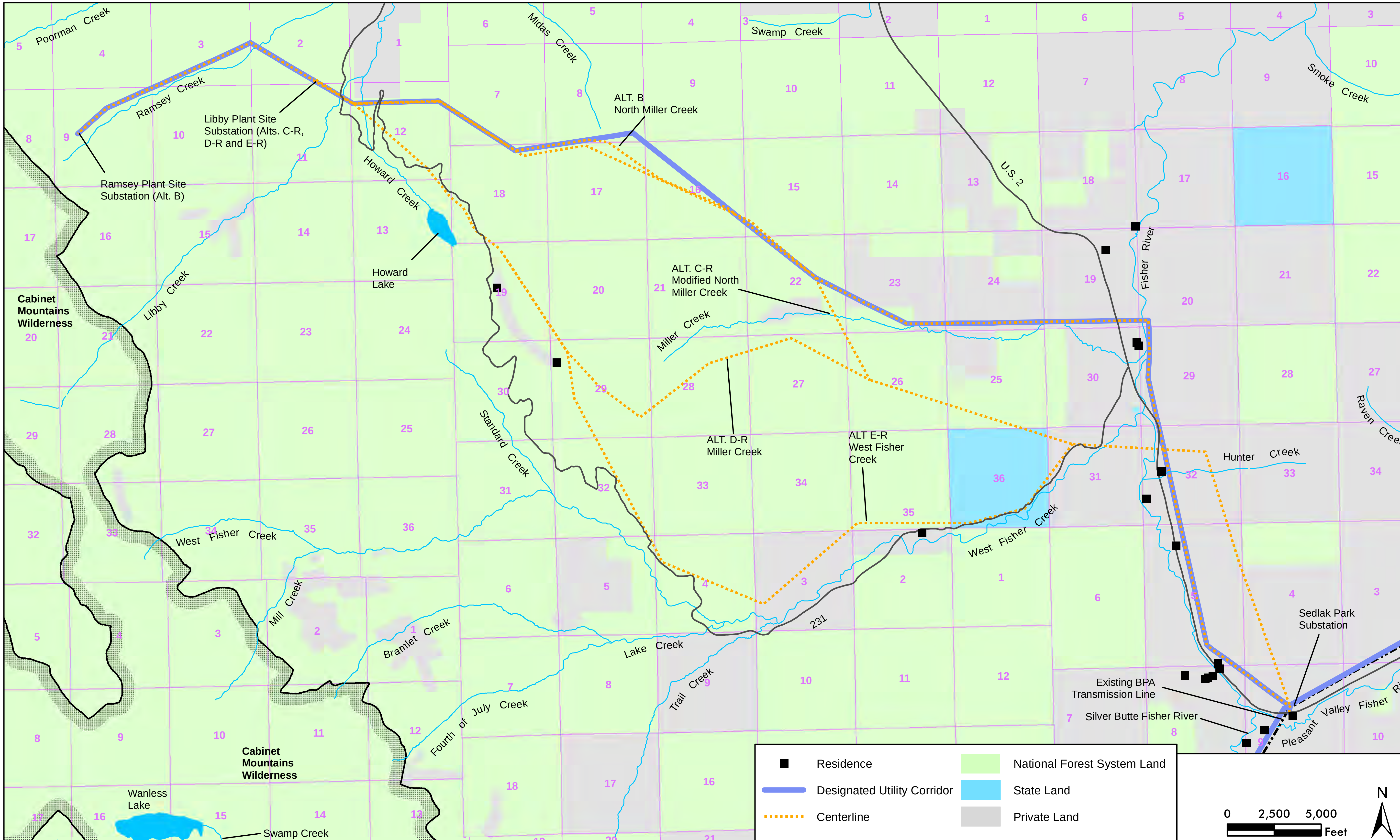


Figure 79. Residences and Designated Utility Corridors in Transmission Line Analysis Area

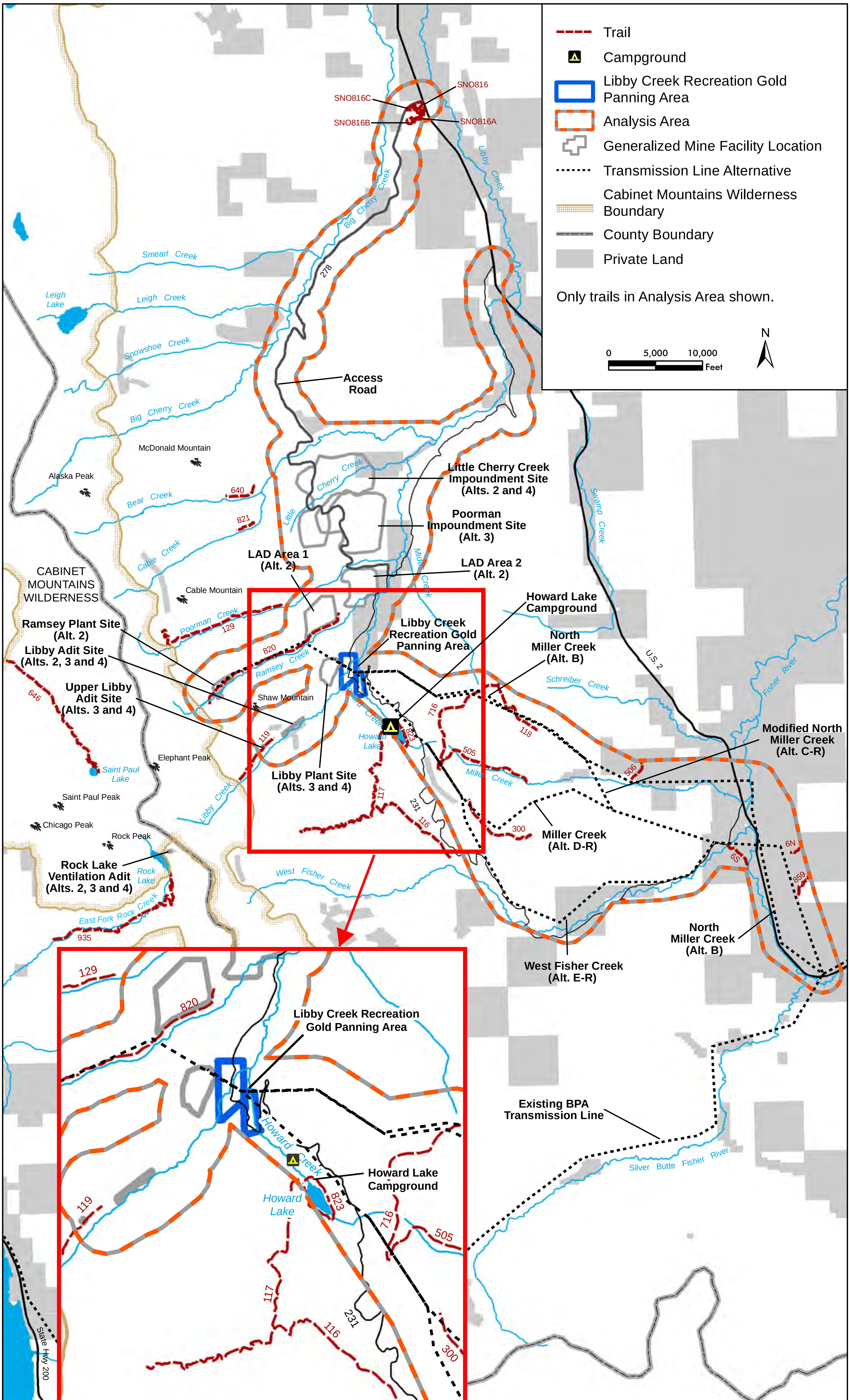


Figure 80. Key Recreation Resources in the Analysis Area

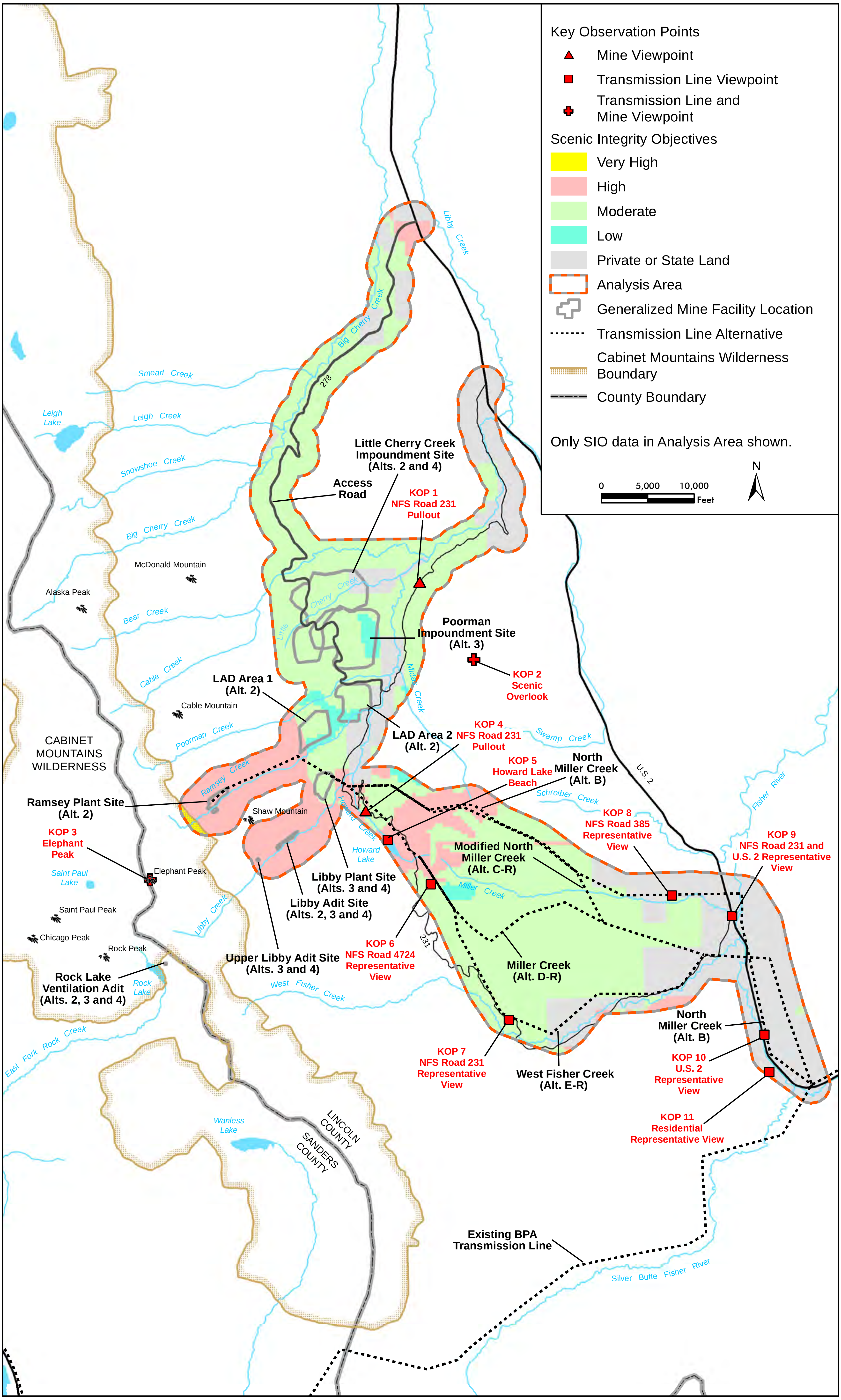


Figure 81. Scenic Integrity Objectives in Analysis Area

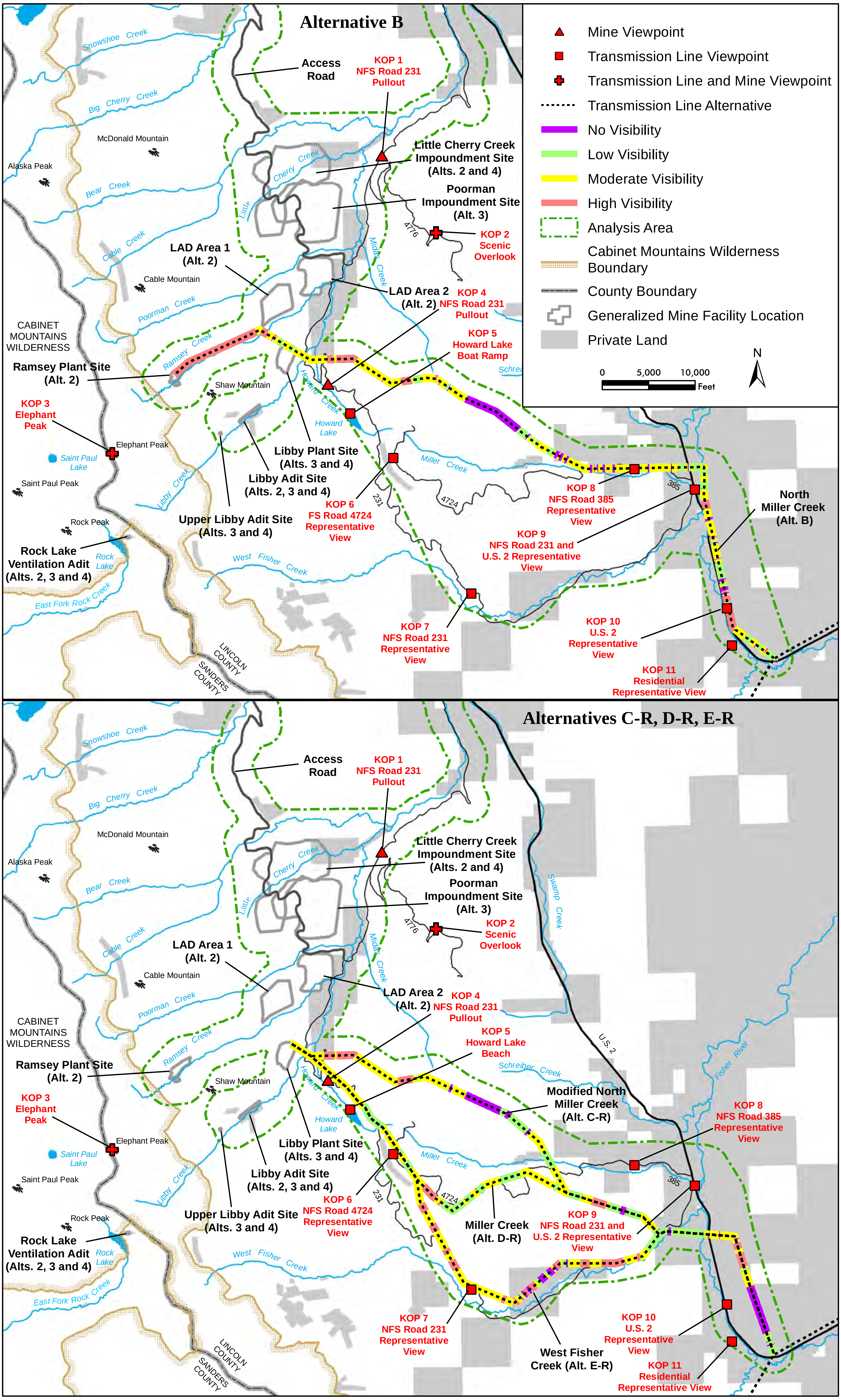


Figure 82. Transmission Line Segments Visible from KOPs, Roads and the CMW

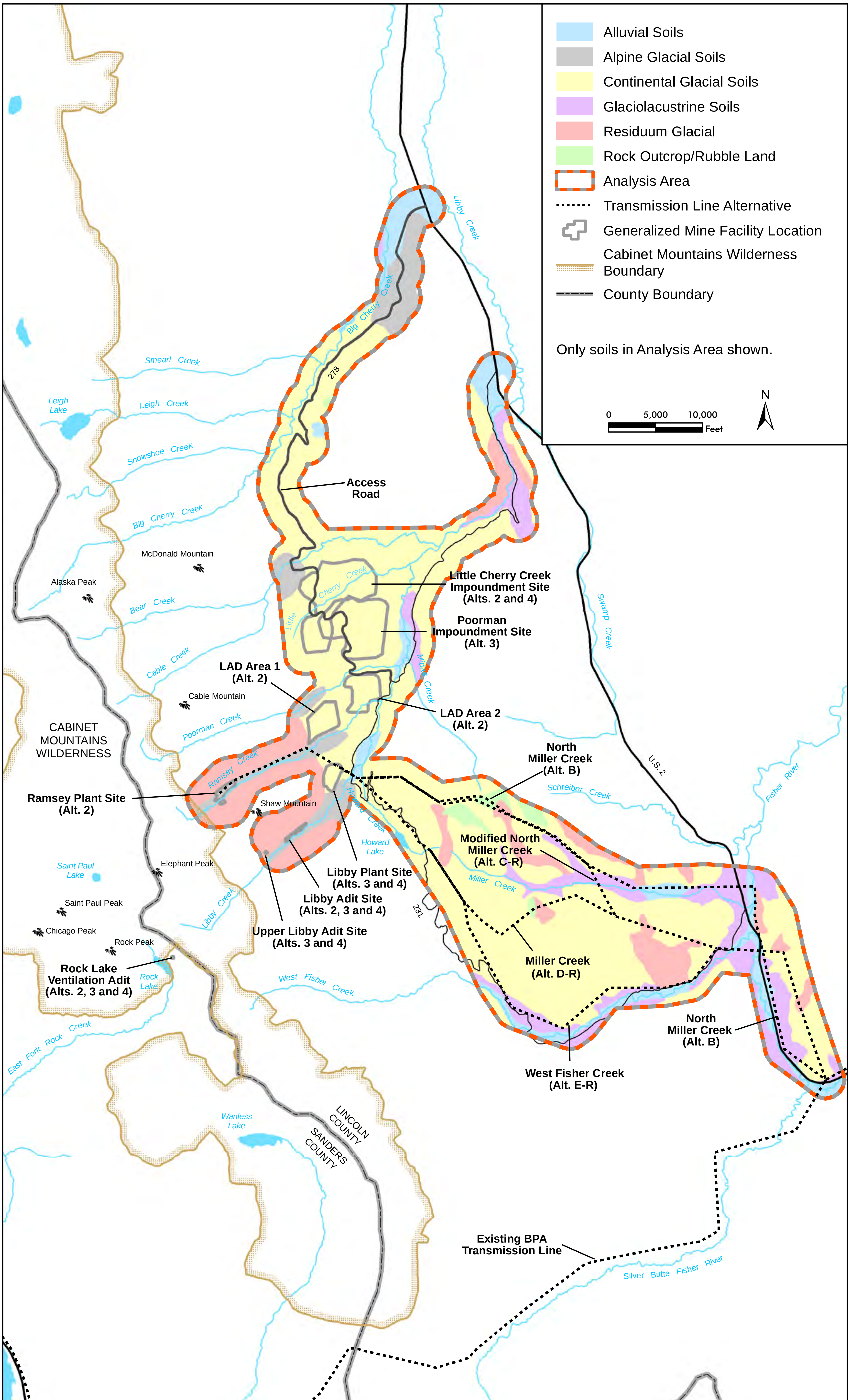


Figure 83. General Soil Types in the Analysis Area

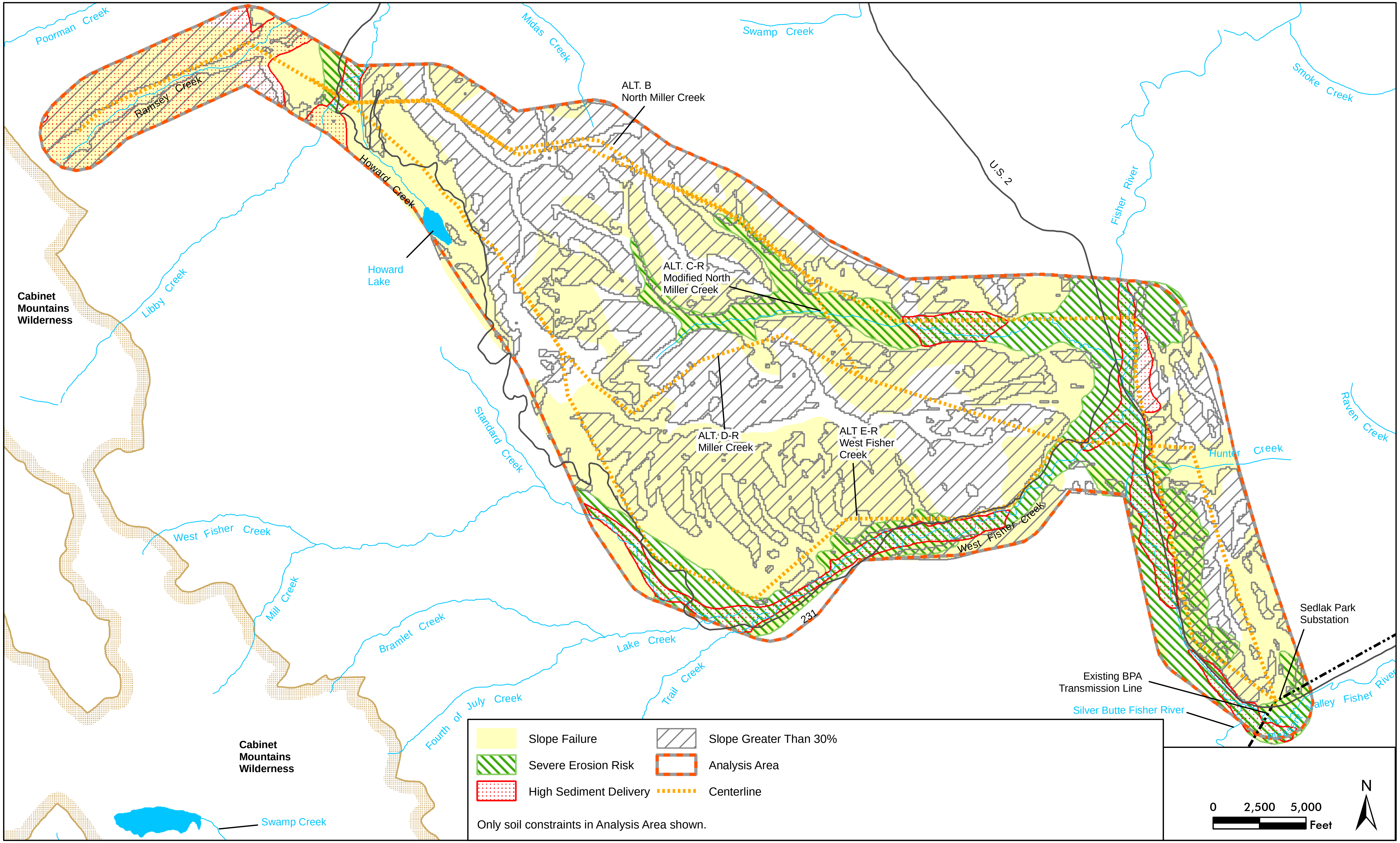


Figure 84. Soil Constraints Along Transmission Line Alternatives

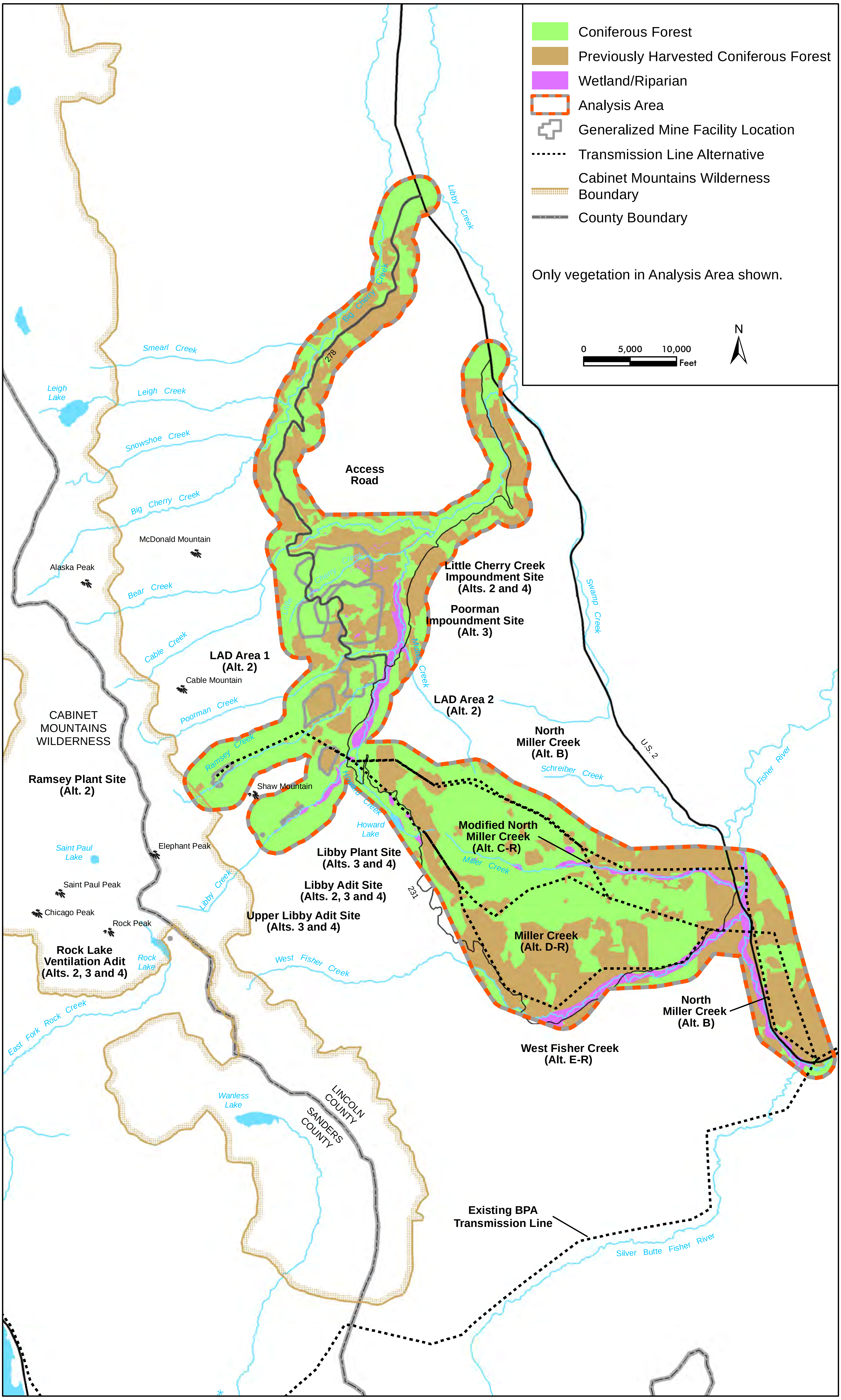


Figure 85. Vegetation Communities in the Analysis Area

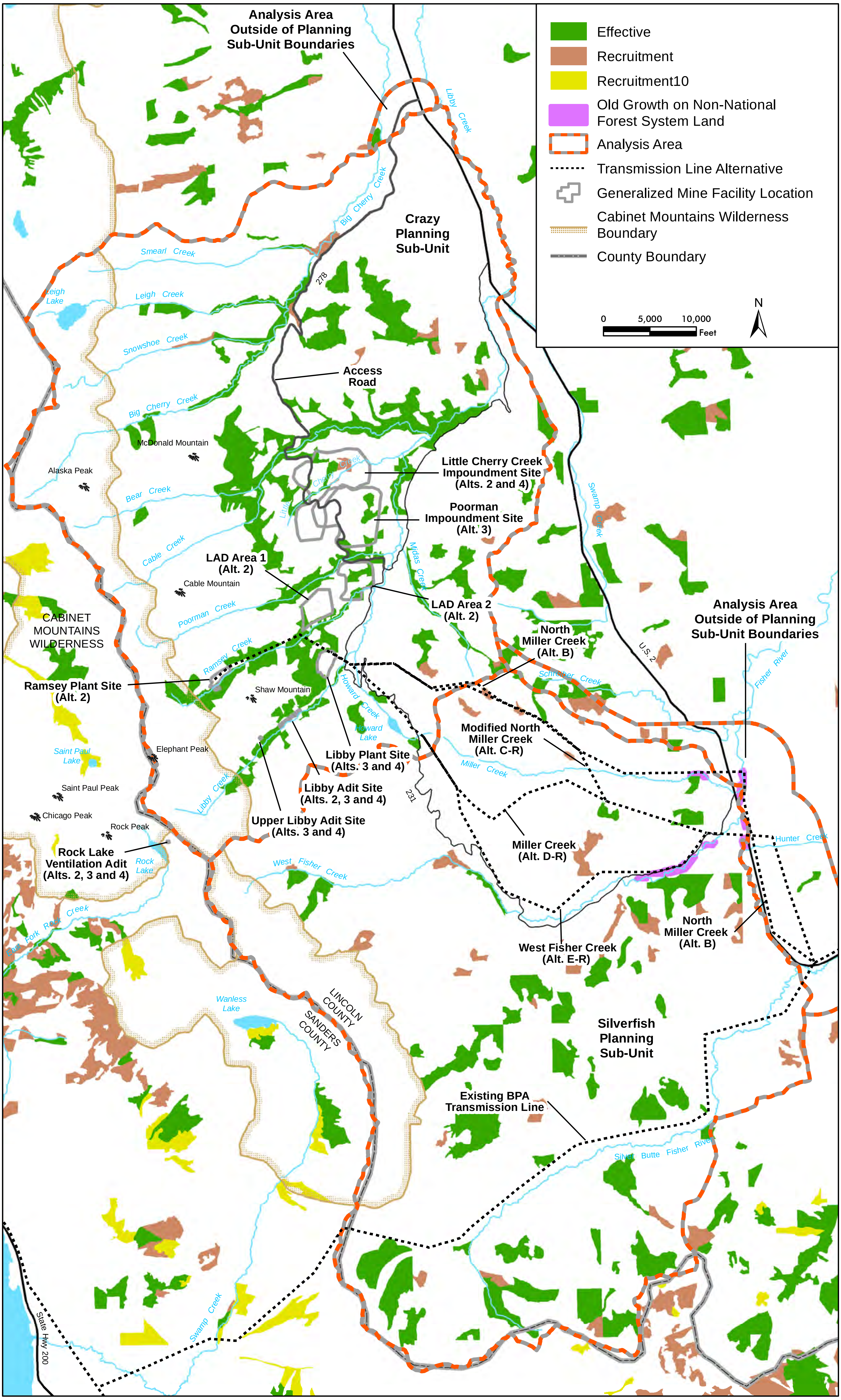


Figure 86. Old Growth Forest in the Analysis Area

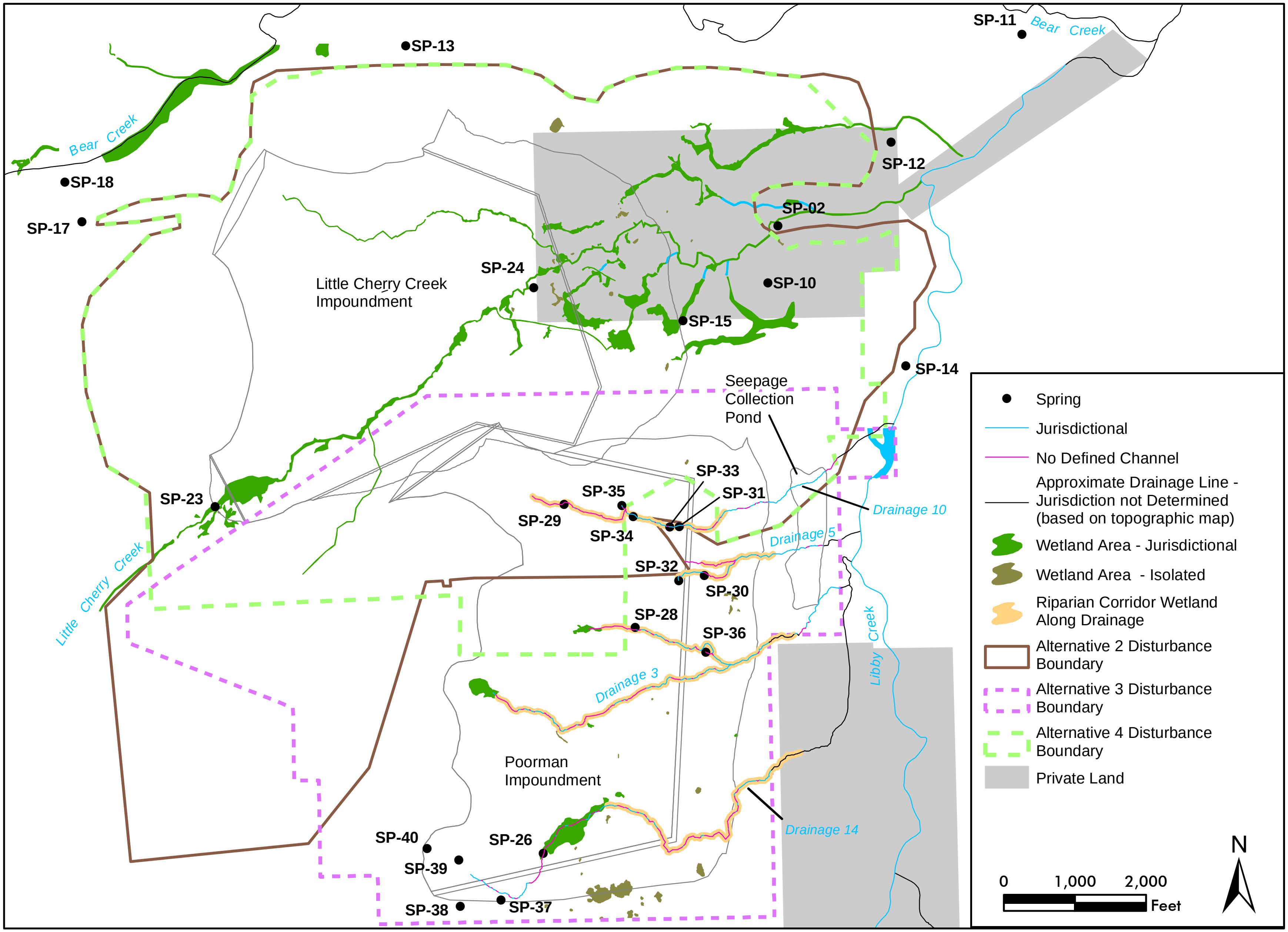


Figure 87. Wetlands in the Two Tailings Impoundment Sites

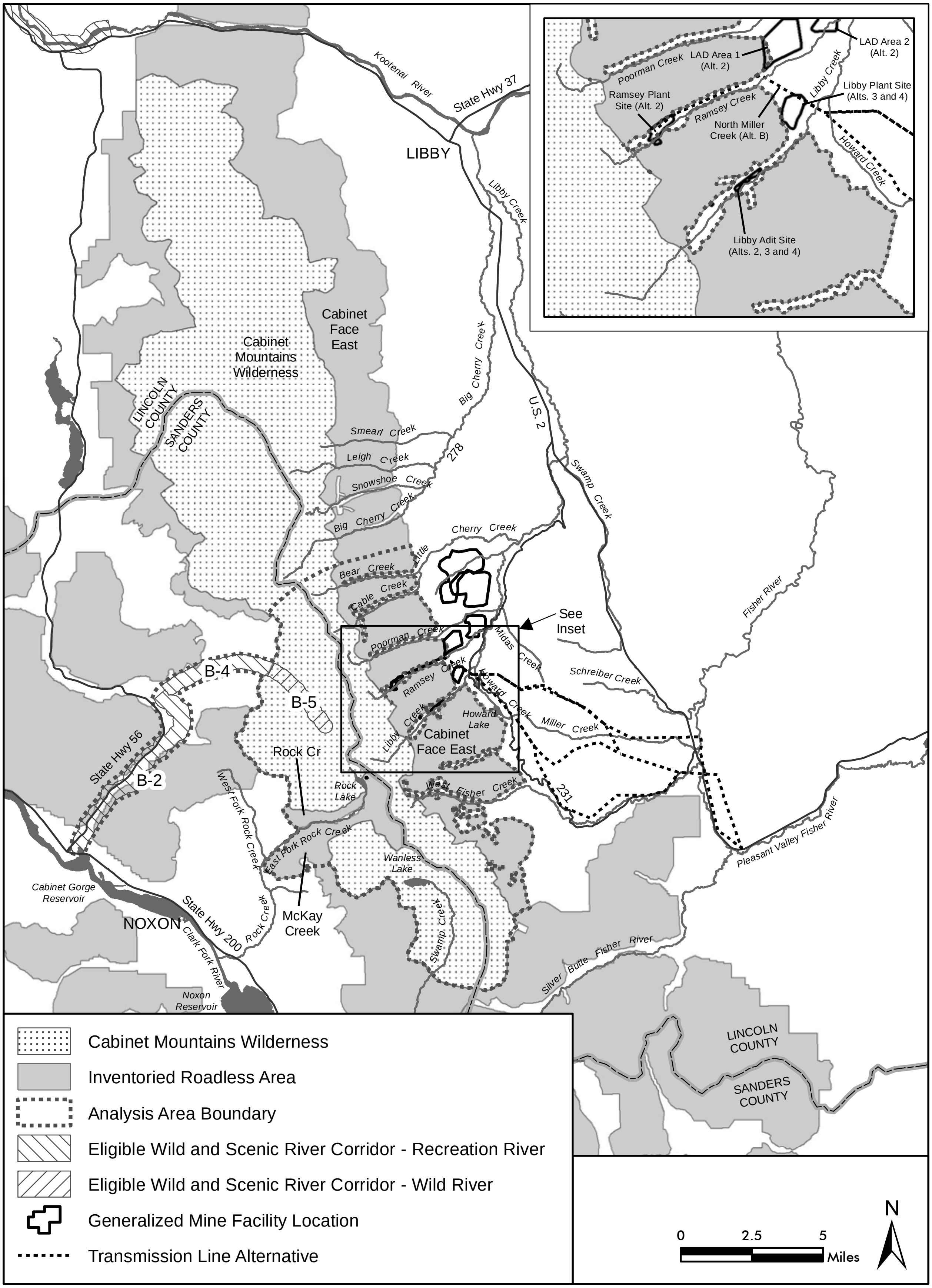


Figure 88. Cabinet Mountains Wilderness, IRAs and Wild and Scenic Rivers

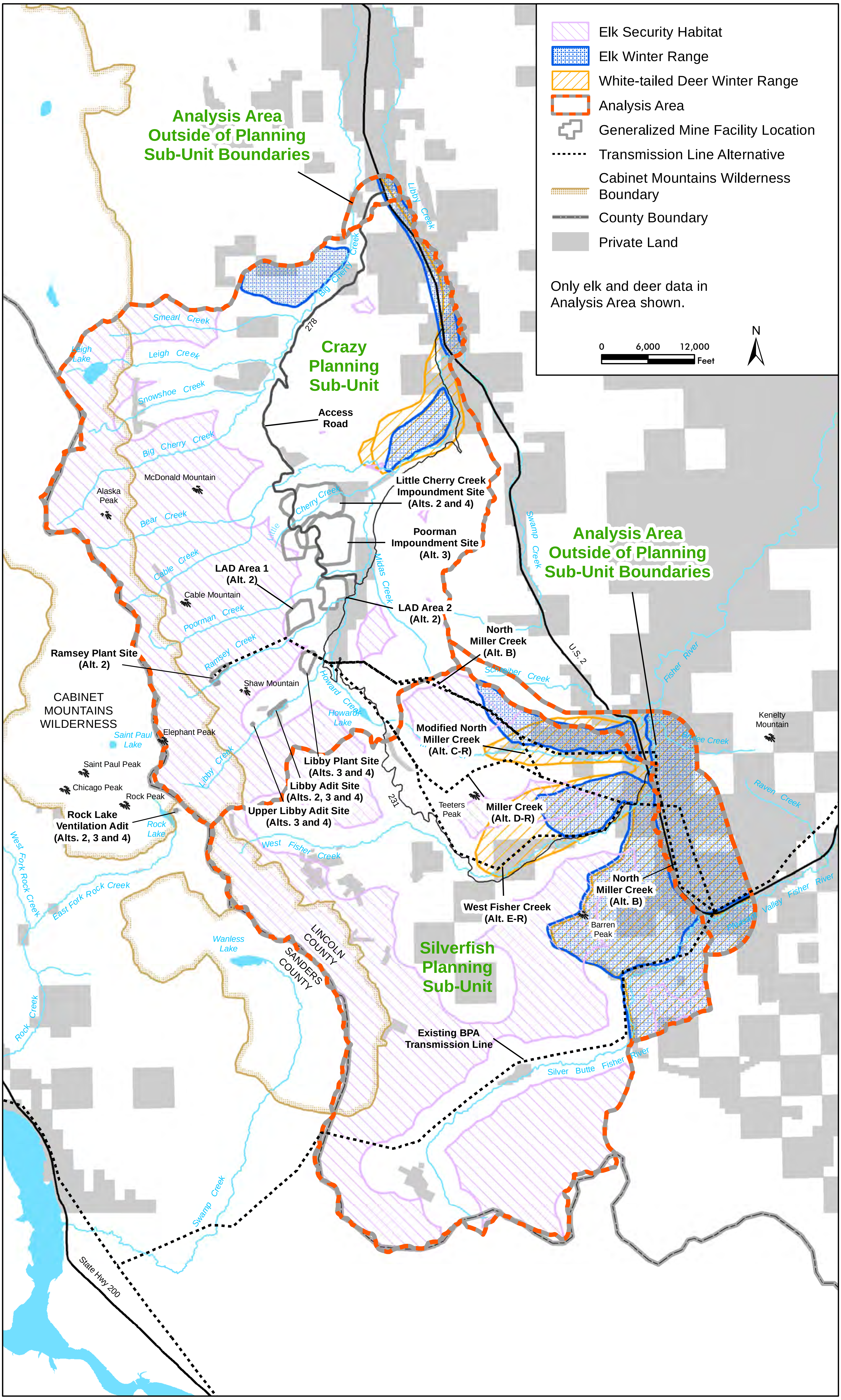


Figure 89. Elk and White-tailed Deer Habitat in the Analysis Area

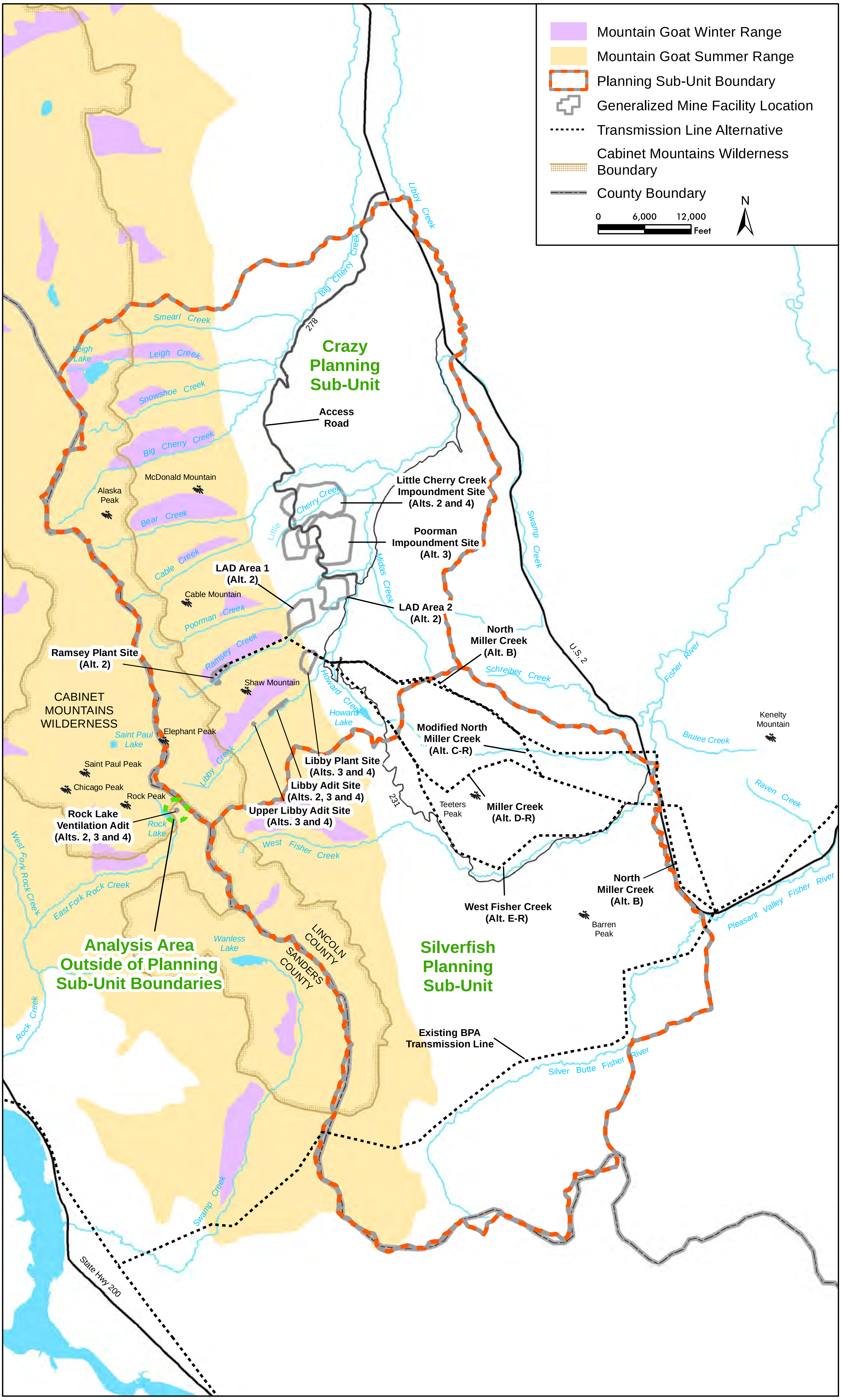


Figure 90. Mountain Goat Habitat in the Analysis Area

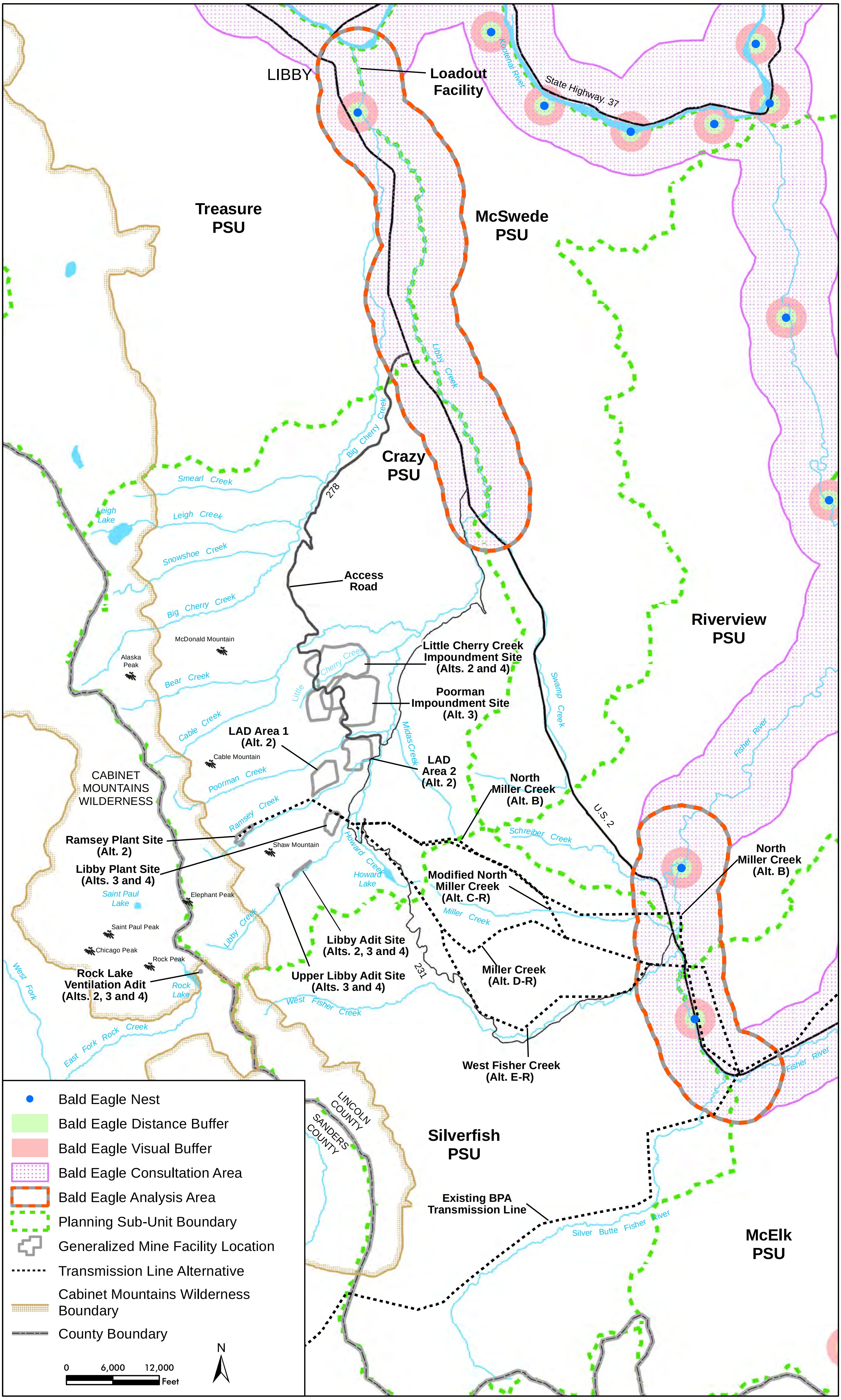


Figure 91. Bald Eagle Habitat Potentially Affected in the Analysis Area

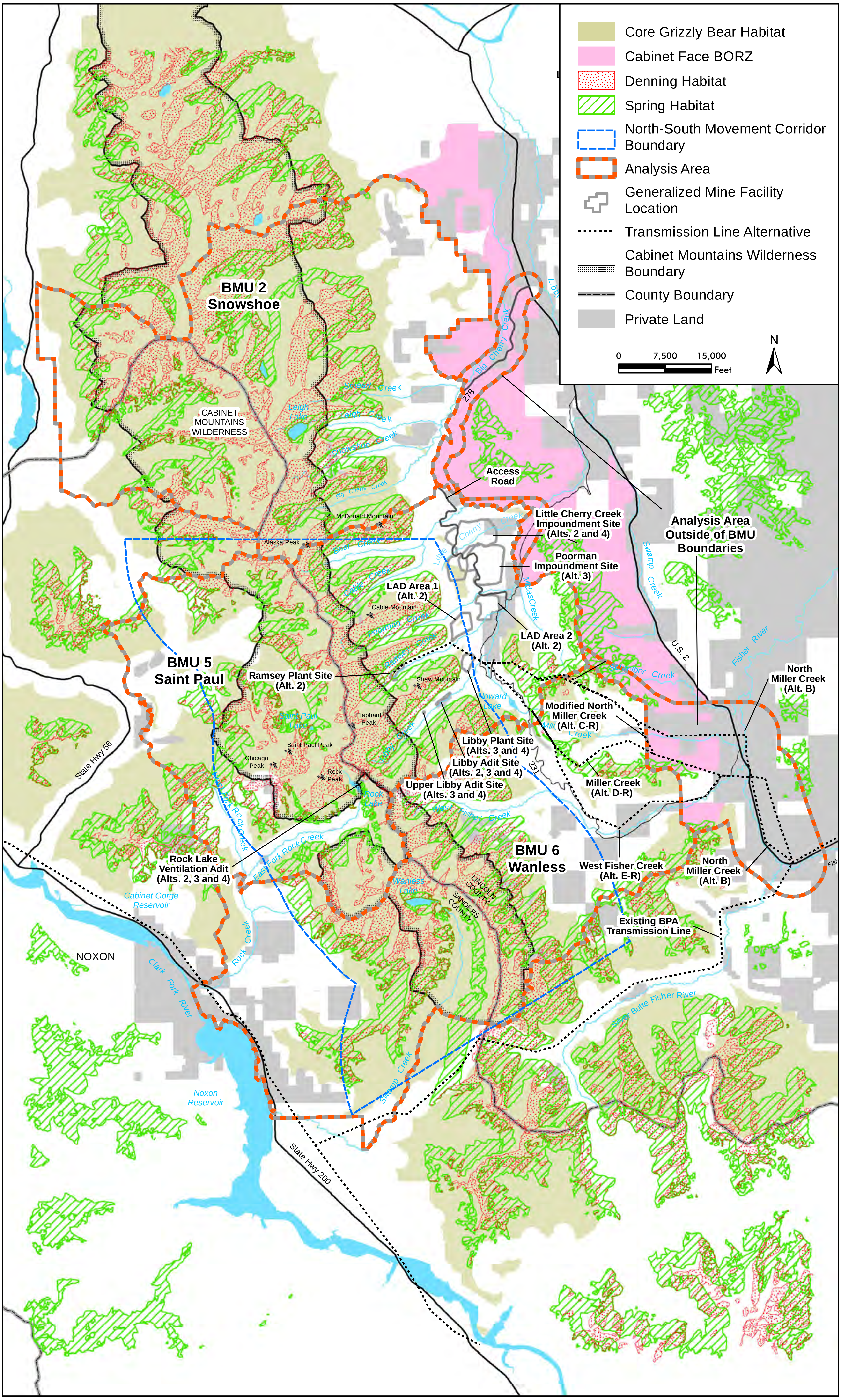


Figure 92. Grizzly Bear Habitat in the Snowshoe (2), Saint Paul (5), and Wanless (6) BMUs and the Cabinet Face BORZ

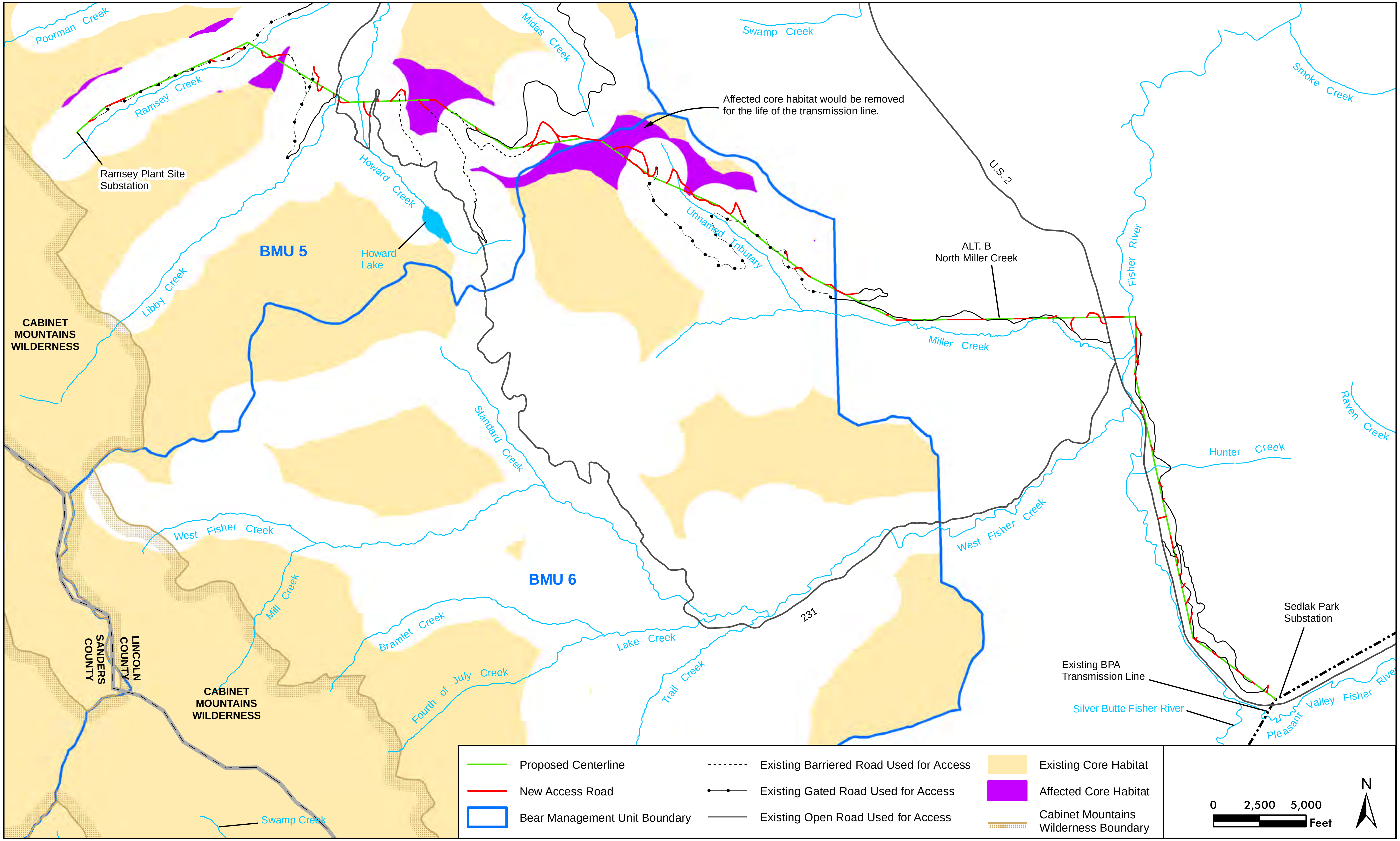


Figure 93. Effects on Grizzly Bear Core Habitat
in Transmission Line Alternative B

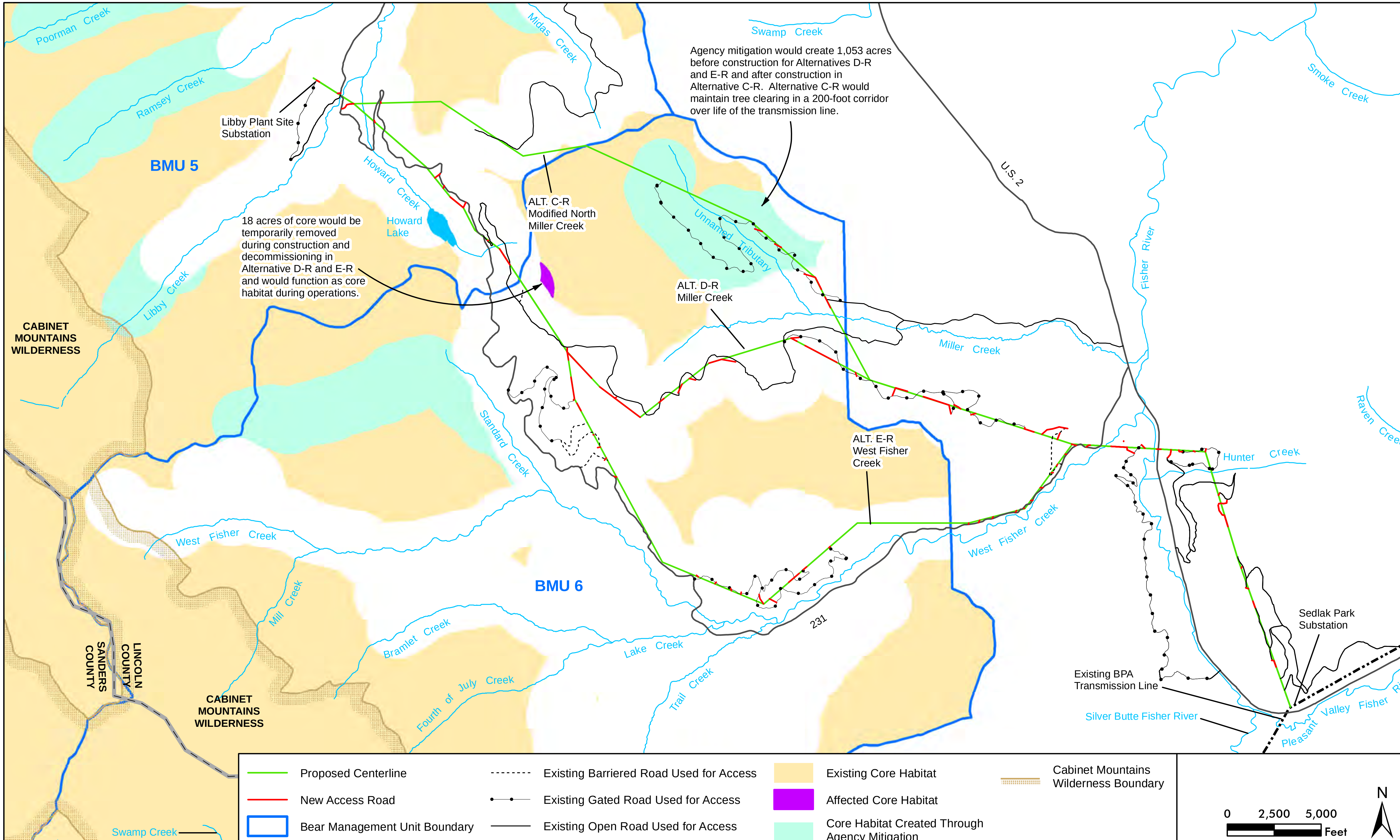


Figure 94. Effects on Grizzly Bear Core Habitat in Transmission Line Alternatives C-R, D-R and E-R.

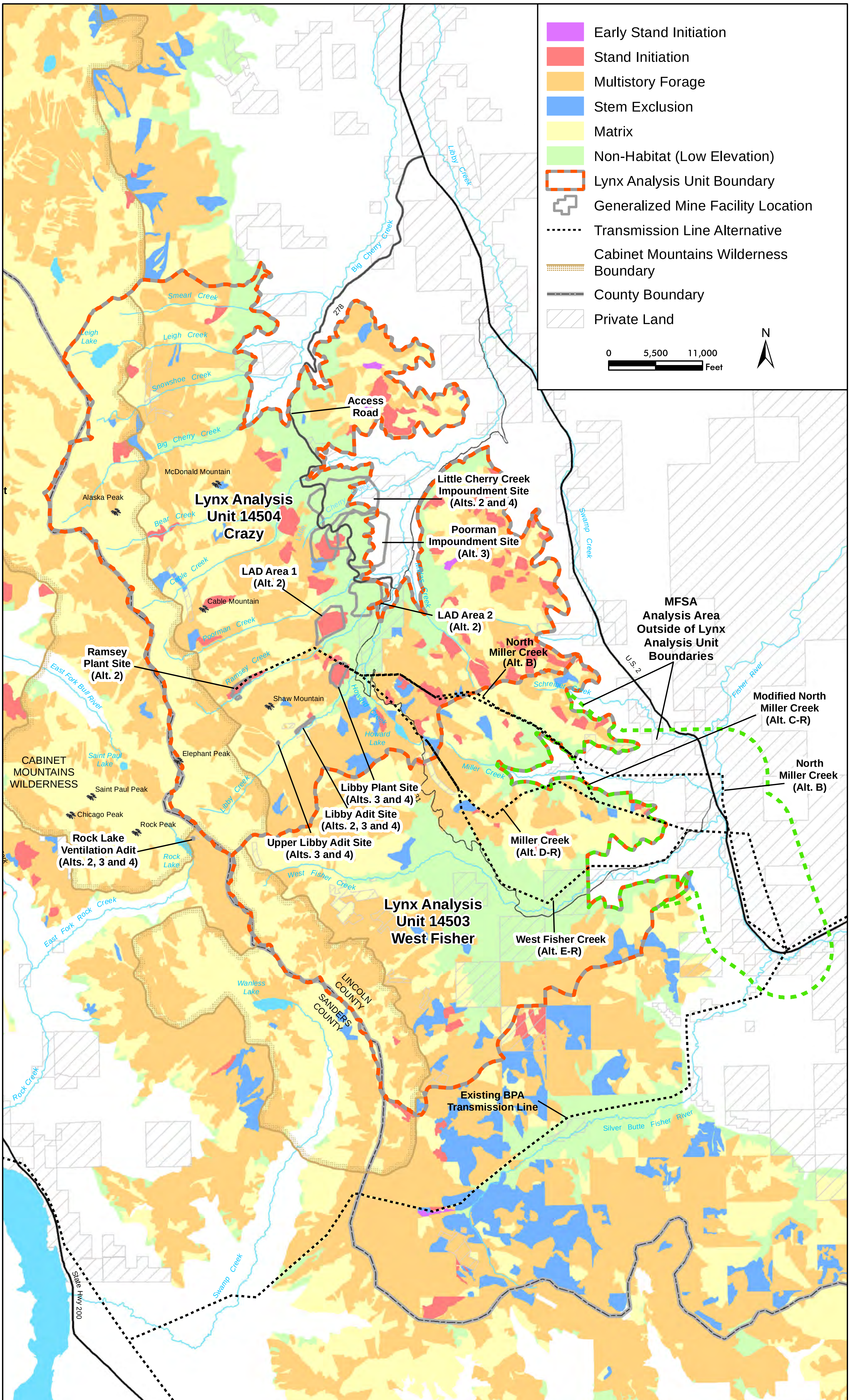


Figure 95. Lynx Habitat in the Analysis Area

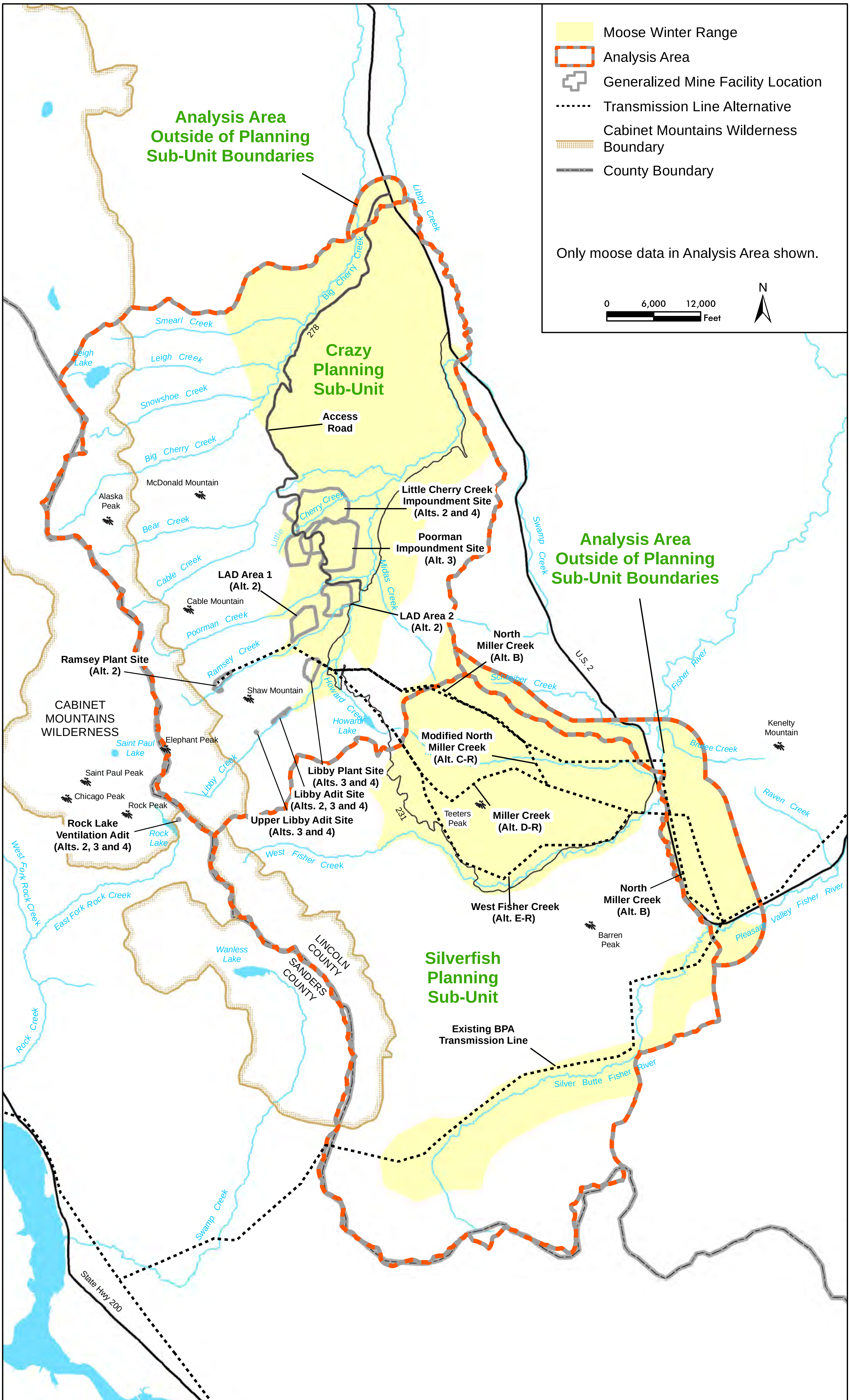


Figure 96. Moose Habitat in the Analysis Area

Appendix A—1992 Board of Health and Environmental Sciences Order

BEFORE THE BOARD OF HEALTH AND ENVIRONMENTAL SCIENCES
OF THE STATE OF MONTANA

In the Matter of the Petition for Modification of Quality of Ambient Waters Submitted by Noranda Minerals Corporation for the Montanore Project	)	Docket No. BHES-93-001-WQB

FINAL DECISION AND STATEMENT OF REASONS

BACKGROUND

1. The Montanore Project, a proposed underground copper and silver mine located in northwestern Montana, is a joint venture between Noranda Minerals Corporation (Noranda) and the Montana Reserves Company. The proposed project includes the development of a mine in Sanders County and the construction of a mill and associated mine waste disposal facilities in Lincoln County, 18 miles south of Libby, Montana.

2. On December 13, 1989, Noranda filed a petition for Change in Quality of Ambient Waters with the Montana Board of Health and Environmental Sciences (Board) for the proposed Montanore Project. Supplemental Information in Support of the Petition was submitted in May 1992. (The December 13, 1989 petition and the supplement submitted in May 1992 are hereinafter referred to as "Petition").

3. The Petition to allow lower water quality was submitted by Noranda because ". . . the proposed mining and milling operation cannot be designed without the expected occurrence of excess water from precipitation and mine flow." (December 13, 1989 Petition).

4. On November 20, 1992, the Board held a public hearing on

the petition to lower the quality of waters impacted by Noranda's proposed Montanore Project pursuant to ARM 16.20.705. The Board considered oral and written testimony offered prior to and at the hearing, the Petition, and the final environmental impact statement (FEIS) prepared for the proposed project by the Montana Department of Health and Environmental Sciences (Department), the Montana Department of Natural Resources and Conservation, the U.S. Forest Service, and the Montana Department of State Lands.

5. Noranda's proposed method of mine water discharge would lower the water quality for certain parameters in the surface and groundwater where the ambient quality for those parameters is higher than the applicable water quality standards. The ambient concentrations, Noranda's requested changes from ambient concentrations, and the Montana Water Quality Standards are shown in Table 1.

Table 1

Ambient quality, requested concentrations, and the Montana Water Quality Standards. All units are in mg/l.

	Existing Water Quality[a]	Noranda Requested Concentration[b]	Applicable Standard[c]
Surface Water			
Chromium	<0.02	0.005	0.011
Copper	0.002	0.003	0.003
Iron	0.08	0.1	0.3
Manganese	<0.02	0.05	0.05
Zinc	0.02	0.025	0.0271
NO3 + NO2 as N	0.13	5.5[e]	10[d]
Ammonia, Total	0.08	1.5	2.2
Tot. Diss. Solids	29	100.0	250
Groundwater			
Chromium	<0.02	0.02	0.05
Copper	<0.02	0.1	1
Iron	<0.19	0.2	0.3
Manganese	<0.45	0.05	0.05
Zinc	<0.06	0.1	5
NO3 + NO2 as N	0.36	10	10
Ammonia, Total	--	--	--
Tot. Diss. Solids	108	200	500

[a] Surface water values are based on data for Libby, Ramsey and Poorman creek given in tables 3-14 in the FEIS. Ground water values are based on data for wells in the adit, land application and tailing pond areas given in table 3-18 in the FEIS.

[b] Based on table 2-1(R) in the May 1992 Supplement to the petition.

[c] Except for nitrate these are based on the lowest applicable standard.

[d] The 10 mg/l standard is to protect public health; however, the highest allowable level which will not cause undesirable aquatic life is 1 mg/l [ARM 16.20.633 (1)(e)].

[e] Noranda changed their request to 1.0 mg/l at the Hearing

6. Pursuant to ARM 16.20.705(6), the Board's final decision on a petition to allow degradation must be accompanied by a statement of reasons stating the basis for the decision and explaining why degradation is or is not justified.

FINAL DECISION AND ORDER

The petition of Noranda to lower water quality in the groundwater and surface water adjacent to the proposed Montanore Project is granted with the following conditions:

(1) Petitioner shall provide secondary treatment or equivalent as required by ARM 16.20.631(3). The Department has determined that land treatment as proposed by the applicant, with at least 80% removal of nitrogen, will satisfy this requirement. In addition, this treatment will also satisfy the requirements of ARM 16.20.631(3) with regard to metals. Accordingly, the Department shall review Petitioner's design criteria and final engineering plans to determine that at least 80% removal of nitrogen shall be achieved.

(2) Design criteria and final engineering plans and specifications shall be submitted to the Department at least 180 days prior to any new or increased anticipated discharge from the Montanore Project and must be approved in writing by the Department prior to any activities that would cause degradation of surface or ground water.

(3) In determining allowable changes in nitrate concentration in receiving waters, the Board bases its decision on the site

specific facts of each case, taking into account the protection of beneficial uses.

In this case, the Board finds, based on the evidence presented, that the Department's recommended limit of 1.0 mg/l inorganic nitrogen in surface water should not be exceeded. The petition is therefore granted with the Department's recommended limit of 1.0 mg/l for total inorganic nitrogen in surface waters. The requested limit of 10.0 mg/l in ground water is granted subject to the following conditions. The concentration of total inorganic nitrogen in the ground water shall not exceed levels reflecting less than 80% removal by the treatment process and shall not cause exceedences of 1.0 mg/l total inorganic nitrogen in Libby, Ramsey or Poorman Creeks.

Surface and ground water monitoring, including biological monitoring, as determined necessary by the Department, will be required to ensure that the allowed levels are not exceeded and that beneficial uses are not impaired.

(4) The Board adopts into this Order the modifications developed in Alternative 3, Option C, of the Final EIS, addressing surface and ground water monitoring, fish tissue analysis and instream biological monitoring. Monitoring plans shall be submitted to the Department at least 180 days prior to any new or increased anticipated discharge from the Montanore Project and must be approved in writing by the Department prior to the commencement of any activity that would cause degradation of surface or ground water in the project area. The monitoring plan shall contain a

system of surface and ground water monitoring locations sufficient to determine compliance with this Order.

(5) Changes from ambient quality requested in the Petition for constituents, other than those containing nitrogen, will not, after treatment as specified in paragraph 1 of this Order, adversely affect beneficial uses and are therefore granted.

(6) Based on the evidence presented at the hearing, the Board has determined that Petitioner has affirmatively demonstrated that the changes granted herein are justifiable as the result of necessary social or economic development.

(7) Noranda shall provide annual funding to the department so that the department can perform sufficient independent monitoring to verify the monitoring performed by the company. Such funding shall not exceed the actual cost of such monitoring and in no case may it exceed $35,000 annually (in 1992 dollars).

(8) The provisions of this Order are applicable to surface and ground water affected by the Montanore Mine Project located in Sanders and Lincoln County, Montana, and shall remain in effect during the operational life of this mine and for so long thereafter as necessary.

STATEMENT OF REASONS

The Board's reasons for allowing a change in the ambient quality of waters impacted by the proposed Montanore Mining Project are as follows:

1. Under Section 75-5-303(1), MCA, of the Montana Water

Quality Act, the Board may authorize lower water quality if a demonstration is made that degradation is justified due to necessary economic or social development. If degradation is authorized, the Board must ensure that existing and anticipated uses are fully protected.

2. Section 75-5-303(2), MCA, requires ". . . the degree of waste treatment necessary to maintain that existing high water quality." Section 75-5-304, MCA, and ARM 16.20.631 require treatment and standards of performance for activities that may impair water quality. In particular, ARM 16.20.631(3) requires that industrial wastes, at minimum, must be treated using technology that is the best practicable control technology available (BPCTCA), or, if BPCTCA has not been determined by EPA, then the equivalent of secondary treatment as determined by the Department. If it has been demonstrated that there are no economically and technologically reasonable methods of treatment or practices that would result in no degradation, then the Board will determine whether lower water quality is justified due to necessary economic or social development. As part of this determination, the Board must require as a prerequisite BPCTCA (or if BPCTCA has not been determined by EPA, the equivalent of secondary treatment as determined by the Department). The Department has determined that land treatment as proposed by the applicant, with at least 80% removal of nitrogen shall be achieved, will satisfy the requirements of ARM 16.20.631(3) with regard to nitrogen and metals.

3. Application of treatment as discussed in the Petition would maintain existing water quality except for possible increases in nitrate, chromium, copper, iron, manganese, zinc, total dissolved solids (TDS), and ammonia. The requested increases would not adversely affect any beneficial uses except for the increase in nitrate. The effects of nitrate increases on beneficial uses are discussed below.

4. The proposal for mine wastewater disposal submitted by Noranda relies on a tailing impoundment, collection systems, and land treatment for wastewater disposal. Monitoring would be required to ensure that allowed levels of nitrate and other compounds would not be exceeded. This proposal would result in lower ambient water quality for all of the parameters that are the subject of this Petition.

5. The preferred alternative identified in the FEIS discusses land treatment prior to disposal. Water treated by the methods discussed under this alternative would substantially reduce the amounts of inorganic nitrogen in the surface and groundwater.

The testimony submitted at the hearing further confirms that land application is an appropriate treatment methodology for nitrogen reduction.

Because the land treatment proposed by Noranda would reduce suspended solids and metal concentrations on a year-round basis, the resulting concentrations of metals after dilution would not impair existing uses in these waters.

6. Published studies indicate that very low levels of

nutrients may stimulate algal growth, but that these studies have added both nitrogen and phosphorus (a situation not strictly applicable here since phosphorus would not be added in this case) and that to protect against the development of undesirable growth in streams and rivers, the Department believes inorganic nitrogen should not exceed 1.0 mg/l.

The Board, based upon the evidence submitted by the Department and by Petitioner, accepts 1.0 mg/l as the maximum allowable concentration of inorganic nitrogen in Libby, Ramsey and Poorman Creeks, for protection of all beneficial uses.

7. The analysis of land treatment in the FEIS demonstrates that this treatment (secondary treatment as defined by the Department), would achieve compliance with the allowable concentration of 1.0 mg/l of inorganic nitrogen in surface water. At the Hearing, Noranda changed its request from 5.5 mg/l of nitrate to 1.0 mg/l total soluble inorganic nitrogen. This level should adequately protect existing beneficial uses. However, biological monitoring is necessary to insure protection of beneficial uses and to assure compliance with ARM 16.20.633(1)(e), as well as other applicable standards.

8. Beneficial uses of the groundwater would not be impaired if a nitrate concentration of 10 mg/l was allowed, as requested in the petition. However, concentration of inorganic nitrogen in ground water at this level may cause violations of the standards imposed by the Board. Therefore, allowable amounts of inorganic nitrogen in ground water will be governed by the land application

treatment requirements and the surface water limits imposed by the Board.

9. Concerns were raised at the hearing regarding the ability of the Department to fund the cost of State-conducted monitoring at the Montanore Project to ensure compliance with limitations imposed by the Board in granting the Petition.

10. An analysis of the necessary economic or social development associated with the proposed project has been submitted by Noranda in its Petition and further discussed in the EIS. Further testimony was submitted by the Petitioner at the hearing regarding the importance of the Montanore Project for economic or social development in Lincoln and Sanders County. The need for the proposed project is to develop a source of copper and silver for the production of world wide commodities. Information presented to the Board indicates that the construction and operation of the Montanore Project will have beneficial economic and social impacts in Lincoln and Sanders Counties during the 18 years of its operation. Increased direct and indirect employment and increases in local government revenues associated with the mining project will benefit the impacted area. In addition, the lower water quality associated with the proposed development will be negligible.

For the reasons stated above, the Board finds that degradation resulting from the Montanore Mining Project is justified.

Dated this 20 day of November, 1992.

Raymond W Gustafson

RAYMOND W. GUSTAFSON, CHAIRMAN, BOARD
OF HEALTH AND ENVIRONMENTAL SCIENCES

Appendix B—Names, Numbers, and Current Status of Roads Proposed for Use in Mine or Transmission Line Alternatives

ID	NAME	IGBC CODE	MAP CODE
1408	LIBBY CREEK BOTTOM	4 - OPEN DURING BEAR SEASON	
14403	LOWER RAMSEY	3 - BARRIERED/LEGALLY NO ADMIN USE	09
14404	BARE ROAD	3 - BARRIERED/LEGALLY NO ADMIN USE	05
231	LIBBY CR FISHER RIVER	4 - OPEN DURING BEAR SEASON	
2316	UPPER LIBBY CREEK	2 - RESTRICTED/LEGALLY GATED ADMIN USE	09
2316	UPPER LIBBY CREEK	4 - OPEN DURING BEAR SEASON	11
2317	POORMAN CR	2 - RESTRICTED/LEGALLY GATED ADMIN USE	09
2317	POORMAN CR	4 - OPEN DURING BEAR SEASON	
2317B	POORMAN CR B	1 - IMPASSABLE TO MOTORIZED VEHICLES	09
231A	LIBBY CR FISHER RIVER A	3 - BARRIERED/LEGALLY NO ADMIN USE	05
231B	LIBBY CR FISHER RIVER B	2 - RESTRICTED/LEGALLY GATED ADMIN USE	05
278	BEAR CREEK	4 - OPEN DURING BEAR SEASON	
278L	BEAR CR L	3 - BARRIERED/LEGALLY NO ADMIN USE	09
278X	BEAR CR X	3 - BARRIERED/LEGALLY NO ADMIN USE	09
385	MILLER CREEK WEST FISHER	4 - OPEN DURING BEAR SEASON	
4724	S FORK MILLER CR	3 - BARRIERED/LEGALLY NO ADMIN USE	05
4724	S FORK MILLER CR	4 - OPEN DURING BEAR SEASON	
4725	N FORK MILLER CR	2 - RESTRICTED/LEGALLY GATED ADMIN USE	05
4726	MILLER CR RIDGE	2 - RESTRICTED/LEGALLY GATED ADMIN USE	05
4726F	MILLER CR RIDGE F	2 - RESTRICTED/LEGALLY GATED ADMIN USE	05
4773	HOWARD MIDAS CR	3 - BARRIERED/LEGALLY NO ADMIN USE	09
4773	HOWARD MIDAS CR	4 - OPEN DURING BEAR SEASON	
4777	LOWER MIDAS-HOWARD LK	3 - BARRIERED/LEGALLY NO ADMIN USE	09
4778	MIDAS HOWARD CREEK	3 - BARRIERED/LEGALLY NO ADMIN USE	05
4778	MIDAS HOWARD CREEK	4 - OPEN DURING BEAR SEASON	13
4778P	MIDAS HOWARD CREEK P	3 - BARRIERED/LEGALLY NO ADMIN USE	05
4780	HOWARD LAKE-MILLER CR	4 - OPEN DURING BEAR SEASON	
4781	RAMSEY CR	2 - RESTRICTED/LEGALLY GATED ADMIN USE	09
4781	RAMSEY CR	4 - OPEN DURING BEAR SEASON	
4782	STANDARD CR-MILLER CR	2 - RESTRICTED/LEGALLY GATED ADMIN USE	05
4782A	STANDARD CR-MILLER CR A	1 - IMPASSABLE TO MOTORIZED VEHICLES	
4782A	STANDARD CR-MILLER CR A	2 - RESTRICTED/LEGALLY GATED ADMIN USE	05
5003	CHERRY RIDGE A EXTENSION	3 - BARRIERED/LEGALLY NO ADMIN USE	09
5170	POORMAN CR UNIT	4 - OPEN DURING BEAR SEASON	
5181	L CHERRY LOOP H COWPATH	2 - RESTRICTED/LEGALLY GATED ADMIN USE	09
5181A	L CHERRY LOOP H COWPATH A	2 - RESTRICTED/LEGALLY GATED ADMIN USE	09
5182	LITTLE CHERRY BEAR CR	4 - OPEN DURING BEAR SEASON	
5183	LITTLE CHERRY VIEW	1 - IMPASSABLE TO MOTORIZED VEHICLES	
5184	BEAR-LITTLE CHERRY	2 - RESTRICTED/LEGALLY GATED ADMIN USE	09
5184A	BEAR-LITTLE CHERRY A	2 - RESTRICTED/LEGALLY GATED ADMIN USE	09
5185	S BEAR LITTLE CHERRY	2 - RESTRICTED/LEGALLY GATED ADMIN USE	09
5185A	S BEAR LITTLE CHERRY A	2 - RESTRICTED/LEGALLY GATED ADMIN USE	09
5186	RAMSEY CREEK BOTTOM	3 - BARRIERED/LEGALLY NO ADMIN USE	09
5187	L CHERRY LOOP L CLEARING	3 - BARRIERED/LEGALLY NO ADMIN USE	09

ID	NAME	IGBC CODE	MAP CODE
5326	STANDARD CR-MILLER CR OLDIE	3 - BARRIERED/LEGALLY NO ADMIN USE	05
6201	CHERRY RIDGE	3 - BARRIERED/LEGALLY NO ADMIN USE	09
6201A	CHERRY RIDGE A	3 - BARRIERED/LEGALLY NO ADMIN USE	09
6210	LIBBY RAMSEY	2 - RESTRICTED/LEGALLY GATED ADMIN USE	09
6210	LIBBY RAMSEY	4 - OPEN DURING BEAR SEASON	
6212	LITTLE CHERRY LOOP	4 - OPEN DURING BEAR SEASON	
6212H	LITTLE CHERRY LOOP H	2 - RESTRICTED/LEGALLY GATED ADMIN USE	09
6212L	LITTLE CHERRY LOOP L	3 - BARRIERED/LEGALLY NO ADMIN USE	09
6212M	LITTLE CHERRY LOOP M	2 - RESTRICTED/LEGALLY GATED ADMIN USE	09
6212P	POORMAN PIT	2 - RESTRICTED/LEGALLY GATED ADMIN USE	09
6701	SOUTH RAMSEY CR	2 - RESTRICTED/LEGALLY GATED ADMIN USE	09
6753	SEDLAK CREEK	4 - OPEN DURING BEAR SEASON	
763	MAIN FISHER RIVER	4 - OPEN DURING BEAR SEASON	
8749	NORANDA MINE	2 - RESTRICTED/LEGALLY GATED ADMIN USE	
8749A	NORANDA MINE A	2 - RESTRICTED/LEGALLY GATED ADMIN USE	
8770	4W RANCH (CACTUS WADE)	2 - RESTRICTED/LEGALLY GATED ADMIN USE	
8770	4W RANCH (CACTUS WADE)	4 - OPEN DURING BEAR SEASON	
8773	WADE'S BACK ENTRY	2 - RESTRICTED/LEGALLY GATED ADMIN USE	
8838	L CHERRY MS10377 8838	2 - RESTRICTED/LEGALLY GATED ADMIN USE	
8841	L CHERRY MS10377 8841	2 - RESTRICTED/LEGALLY GATED ADMIN USE	09
99760	BRULEE-HUNTER 99760	2 - RESTRICTED/LEGALLY GATED ADMIN USE	
99762	KENELTY JUMP-UP 99762	4 - OPEN DURING BEAR SEASON	
99763	HUNTER CREEK 99763	4 - OPEN DURING BEAR SEASON	
99763B	HUNTER CREEK 99763B	4 - OPEN DURING BEAR SEASON	
99764	KENELTY MTN 99764	4 - OPEN DURING BEAR SEASON	
99765	SEDLAK CREEK 99765	4 - OPEN DURING BEAR SEASON	
99765A	SEDLAK CREEK 99765A	4 - OPEN DURING BEAR SEASON	
99768	SEDLAK CREEK 99768	4 - OPEN DURING BEAR SEASON	
99768A	SEDLAK CREEK 99768A	4 - OPEN DURING BEAR SEASON	
99772	SHELLEY JUMP UP 99772	4 - OPEN DURING BEAR SEASON	
99806	WADE-KENELTY 99806	2 - RESTRICTED/LEGALLY GATED ADMIN USE	
99806	WADE-KENELTY 99806	4 - OPEN DURING BEAR SEASON	
99806D	WADE-KENELTY D 99806D	2 - RESTRICTED/LEGALLY GATED ADMIN USE	
99826	MIDDLE MILLER CR. 99826	4 - OPEN DURING BEAR SEASON	
99830	WEST FISHER 99830	3 - BARRIERED/LEGALLY NO ADMIN USE	02
99844	WEST FISHER 99844	2 - RESTRICTED/LEGALLY GATED ADMIN USE	05
99845	WEST FISHER 99845	2 - RESTRICTED/LEGALLY GATED ADMIN USE	05

Appendix C— Agencies' Conceptual Monitoring Plans, Alternatives 3 and 4

Appendix C. Agencies' Conceptual Monitoring Plans

Tables

Figures

C.1 Introduction

This appendix contains the agencies' conceptual monitoring plans for Alternative 3. MMC would develop final monitoring plans for the agencies' approval. Final monitoring plans would be incorporated as a component of appropriate permits and plans administered by the various agencies. Identification of these plans and the timing for their submittal and approval is discussed in the following sections of this Appendix. Where applicable, plans would include a section on quality assurance measures that ensure the reliability and accuracy of monitoring information as it was acquired. For example, surface water quality sampling would follow DEQ's *Quality Assurance Project Plan (QAPP), Sampling and Water Quality Assessment of Streams and Rivers in Montana, 2005* (DEQ 2005a). Each plan would describe data quality objectives for sampling, which would include specific methods for analysis and quantification, and criteria for assessment of the data. All plans would identify action levels, which when reached would require MMC to implement a corrective measure. MMC would update the closure plan, including long-term monitoring plan, during the Construction Phase in sufficient detail to allow development of a reclamation bond.

All monitoring would require an annual report unless otherwise specified. Final reporting requirements would be described in applicable permits or approvals or in MMC's final monitoring plans. The format and requirement needs for reporting would be finalized by the agencies. Reports would be submitted to other agencies as identified by the KNF and the DEQ. After submittal of a monitoring report, the agencies may call a meeting with all other relevant agencies to review the monitoring plan and results, and to evaluate possible modifications to the plan or permitted operations.

MMC would submit as part of its annual report to the lead agencies a discussion of its compliance with all the monitoring and mitigation requirements specified in the DEQ Operating Permit and the KNF's approved Plan of Operations. Each monitoring and mitigation requirement of the selected alternative would be listed in the report.

MMC's monitoring plans would have four overarching objectives: 1) to supplement available information in areas where there is uncertainty; 2) to validate predictions of impacts on each resource; 3) to assess if the alternative selected in the KNF's ROD is adversely affecting the environment; and 4) to monitor the effectiveness of the agencies' mitigation measures described in the EIS and ROD and any additional mitigation measures implemented by MMC to reduce adverse effects of mining. The monitoring plans are expected to be dynamic, and change as new data were collected and analyzed. Monitoring data would be used to assess the potential effects of mining, determine if additional monitoring was needed, update the 3D groundwater models to reassess effects to water resources, and, if needed, require corrective action by MMC to mitigate adverse effects of mining on analysis area resources. Monitoring data would be made available for public review.

C.2 Air Quality

Most of the following air monitoring is based on DEQ's supplemental Preliminary Determination issued in 2011. The DEQ may change the monitoring requirements when it issues a final Montana air quality permit.

C.2.1 Objective

The objectives of air monitoring are to monitor annual production information and emission sources, and to assess effectiveness of wind erosion control measures at the tailings impoundment site.

C.2.2 Locations, Parameters, and Frequency

MMC would submit to the agencies for approval a general operating plan for the tailings impoundment site including a fugitive dust control plan to control wind erosion from the site. The plan would include, at a minimum, the embankment and cell (if any) configurations, a general sprinkler arrangement, and a narrative description of the operation, including tonnage rates, initial area, and timing of future enlargement.

MMC would install, operate, and maintain three air monitoring sites in the vicinity of the mine and facilities. The exact location of the monitoring sites would be approved by the agencies and meet all applicable siting requirements contained in the Montana Ambient Air Monitoring Program Quality Assurance Project Plan (2013a), ARM 17.8.202 and 17.8.204; the EPA Quality Assurance Manual (EPA 2008a, 2008b); and 40 CFR 50, 53, and 58; or any other requirements specified by the DEQ.

MMC would begin air monitoring at the commencement of mill facilities or the tailings impoundment and continue air monitoring for at least 1 year after normal production was achieved. MMC would monitor nitrogen and sulfur emissions at the Libby Adit for a minimum of 2 years. MMC would analyze for metals shown in Table C-1 on the PM_{10} filters once the mill facilities and tailings impoundment were operational. At that time, the DEQ and the KNF would review the air monitoring data and determine if continued monitoring or additional monitoring

Table C-1. Air Monitoring Locations, Parameters, and Frequency.

Location	Site	Parameter	Frequency
Plant Area	Site #1	PM-10[1] As, Cu, Cd, Pb, Zn[2] PM-2.5[3]	Every 3rd day according to EPA monitoring schedule
Tailings Area (Up-drainage)	Site #2	PM-10[1] As, Cu, Cd, Pb, Zn[2] PM-2.5[3]	Every 3rd day according to EPA monitoring schedule
Tailings Area (Down-drainage)	Site #3	PM-10[1] / PM-10[1] Collocated As, Cu, Cd, Pb, Zn[2] PM-2.5[3] / PM-2.5[3]Collocated Wind speed, Wind Direction, Sigma theta[4]	Every 3rd day according to EPA monitoring schedule (Collocated every 6th day) Continuous
Libby Adit	Site #4	NOx and SO_2 Wind speed, Wind Direction, Sigma theta[4]	Daily Continuous

[1] PM-10 = particulate matter less than 10 microns.
[2] As = Arsenic, Cu = Copper, Cd = Cadmium, Pb = Lead, Zn = Zinc.
[3] PM-2.5 = particulate matter less than 2.5 microns.
[4] Sigma Theta = Standard Deviation of Horizontal Wind Direction.

was warranted. The DEQ and the KNF may require continued air monitoring to track long-term impacts of emissions for the project or require additional ambient air monitoring or analyses if any changes took place regarding quality and/or quantity of emissions or the area of impact from the emissions.

C.2.3 Inspections

DEQ's Air Resources Management Bureau personnel would perform on-site inspections of the operation on a random basis on a frequency of at least once per year. The overall effectiveness of the proposed air pollution control measures, with emphasis on the adequacy of wind erosion prevention at the tailings impoundment, would be evaluated on an ongoing basis.

C.2.4 Reporting

MMC would use air monitoring and quality assurance procedures that are equal to or exceed applicable requirements. MMC would provide the DEQ and the Forest Service with annual production information for all emission points in the annual emission inventory request. The request would include all sources of emissions identified in the emission inventory contained in the permit analysis. The following information would be provided:

- Amount of ore and waste handled
- Amount of diesel used (surface equipment and underground equipment separately)
- Amount of propane used
- Amount of explosives used (RU Emulsion explosive and High Explosive separately)
- An estimate of vehicle miles traveled on on-site access roads
- Amount of disturbed acreage (including tailings impoundment area)
- Other emission-related information the DEQ may request

MMC would submit quarterly data reports within 45 days after the end of the calendar quarter and an annual data report within 90 days after the end of the calendar year. The annual report may be substituted for the fourth quarterly report if all required quarterly information is included in the report. The quarterly report would consist of a narrative data summary and a data submittal of all data points in AIRS format. This data would be submitted electronically. The narrative data summary would include:

- A topographic map of appropriate scale with coordinates and a true north arrow showing the air monitoring site locations in relation to the plant, any nearby residences and/or businesses, and the general area
- A hard copy of the individual data points
- The quarterly and monthly means for PM_{10}, $PM_{2.5}$, and wind speed
- The first and second highest 24-hour PM_{10}, $PM_{2.5}$ concentrations and dates
- A quarterly and monthly wind roses
- A summary of the data collection efficiency
- A summary of the reasons for missing data
- A precision and accuracy (audit) summary
- A summary of any ambient air standard exceedances

- Calibration information

The annual data report would consist of a narrative data summary containing:

- A topographic map of appropriate scale with UTM coordinates and a true north arrow showing the air monitoring site locations in relation to the plant, any nearby residences and/or businesses, and the general area
- A pollution trend analysis
- The annual means for PM_{10}, $PM_{2.5}$, and wind speed
- The first and second highest 24-hour PM_{10}, $PM_{2.5}$ concentrations and dates
- The annual wind rose
- An annual summary of data collection efficiency
- An annual summary of precision and accuracy (audit) data
- An annual summary of any ambient standard exceedance
- Recommendations for future monitoring

Using the nitrogen and sulfur monitoring data, MMC would update the nitrogen and sulfur deposition analysis and compare the updated model results to the current FLM deposition analysis thresholds. MMC would also assess potential effects on lake ANC if appropriate methods were available. If modeled results using the Libby Adit monitoring data were greater than current FLM deposition analysis thresholds, MMC would develop a plan for agencies' review that evaluated all available control technologies to reduce pollutant emissions.

C.3 Cultural Resources

C.3.1 Objective

Cultural resources would be monitored to ensure protection for cultural resources or human remains not identified during initial surveys from adverse effects during construction, and that all cultural resources that were to be avoided were not adversely affected during construction.

C.3.2 Locations, Parameters, and Frequency

In Alternatives 3 and 4 before any ground-disturbing activities, MMC would complete an intensive cultural resources survey on all areas proposed for disturbance for any areas where such surveys have not been completed and that would be disturbed by the alternative. Surveys would meet the requirements of the 36 CFR 800 regulations, following the guidelines in the 2011 KNF Site Inventory Strategy. Eligibility assessments for historic properties within the selected alternatives, as outlined in the KNF's ROD, would be completed and formally resolved through the SHPO and/or the Keeper of the National Register pursuant to 36 CFR 800, before project impacts to properties occurred. MMC would prepare a mitigation plan for all NRHP-eligible properties determined through a formal determination of effect to be adversely affected by the project. The mitigation plan would be submitted for approval by the KNF if on National Forest System lands in consultation with the SHPO and the Advisory Council on Historic Preservation. The survey, eligibility assessment, and mitigation planning would be completed by a qualified archaeologist meeting the Secretary's Standards and Guidelines for Archeology and Historic Preservation (48 FR 44716).

In 2010, the KNF and Montana SHPO entered into a Programmatic Agreement that described certain requirements of the parties to mitigate the unavoidable adverse effects on historic properties and to manage inadvertent discovery of historic properties. Monitoring would be required during any land disturbing activity that has potential to adversely affect unidentified sites. Monitoring would be completed by a qualified archaeologist meeting the Secretary's Standards and Guidelines for Archeology and Historic Preservation (48 FR 44716). The KNF would contact the Confederated Salish & Kootenai Tribes and the Kootenai Tribe of Idaho (collectively the Tribes) to determine if they were interested in monitoring mine construction activities on National Forest System lands and transmission line construction on National Forest System, State or private lands. If either or both tribes expressed an interest, MMC would develop a Tribal Monitoring Plan in cooperation with the KNF, DEQ, and the Tribes. This plan would facilitate the presence of tribal monitors from the Tribes during construction. The plan would outline the tribal monitor's qualifications, responsibilities, and capabilities as well as establish funding, which would be MMC's responsibility. The plan would be submitted to the KNF and DEQ for review at least 90 days prior to the beginning of construction. The KNF and DEQ would have 30 days to review the plan. The KNF and DEQ would invite the SHPO and the DNRC to comment on the draft plan. The approved plan would be incorporated into the Environmental Specifications (Appendix D).

If previously unrecorded cultural properties, human remains, or funerary objects are discovered during any activity by MMC, MMC would immediately:

- Cease the activity in the area of the discovery and secure the area with a 100-foot (30-meter) buffer by attaching temporary fencing to trees. No disturbance would occur in securing the site.
- Notify the KNF Forest Archaeologist if the discovery was on National Forest System lands or the SHPO Archaeologist if the discovery was on lands other than National Forest System lands.
- If the discovery was human remains or funerary objects, notify the county coroner and the KNF Forest Archaeologist if the discovery was on National Forest System lands or the county coroner and the SHPO Archaeologist if the discovery was on lands other than National Forest System lands.

Following notification, the KNF would:

- Determine appropriate mitigation measures for the discovery of cultural properties following Native American Graves Protection and Repatriation Act procedures outlined in 43 CFR 10, if on National Forest System lands, or the Montana Human Skeletal Remains and Burial Site Protection Act procedures outlined in 22-3-801, MCA, if on lands other than National Forest System lands.
- Consult with Montana SHPO on the proposed mitigation measures, and the Tribes on the proposed mitigation measures if the properties were prehistoric.
- Follow procedures for submitting mitigation measures outlined in the Montana Human Skeletal Remains and Burial Site Protection Act in the event that the Native American remains or funerary objects were discovered on state or private lands.
- Oversee the implementation of any agreed upon mitigation measures.

C.3.3 Reporting

As part of the report submitted annually to the agencies, MMC would provide information on the mitigation implemented during the prior year pursuant to the Agreement. The report also would discuss any previously unidentified cultural resources encountered during construction.

C.4 Wetlands and Other Waters of the U.S.

C.4.1 Objective

The Corps would use monitoring to determine if the compensatory mitigation for jurisdictional wetlands and other waters of the U.S. was meeting the performance standards established in any 404 permit issued for the project. The monitoring described in this section may be modified in a Corps 404 permit. Monitoring would follow the Corps' Regulatory Guidance Letter (RGL 06-3) (Corps 2008a) that addresses monitoring requirements for compensatory mitigation projects. Final performance standards for the jurisdictional mitigation sites would be established in the 404 permit. Similarly, the KNF would use monitoring to determine if the compensatory mitigation for isolated wetlands was meeting the performance standards established in the approved Plan of Operations.

The objective of the wetlands monitoring also would be to evaluate the possible indirect effects of the project. Because the possible indirect effects on wetlands would be associated with the pumpback well system, wetland monitoring is discussed in section C.10.5.5.2, Pumpback Well System Monitoring. Wetland monitoring overlying the mine area is discussed in section C.10.3.2, Groundwater Dependent Ecosystem Inventory and Monitoring.

C.4.2 Locations, Parameters, Frequency, and Performance Standards

This section discusses monitoring of sites used for mitigation of impacts to waters of the U.S. Inventory and monitoring of groundwater dependent ecosystems, including wetlands, is described in section C.10.3.2.2, Continued GDE Monitoring. Monitoring of wetlands and springs in the impoundment area is described in section C.10.5.5.2, Pumpback Well System Monitoring.

C.4.2.1 Swamp Creek Wetland Mitigation Site

MMC's mitigation for impacts to wetlands is wetland rehabilitation at the Swamp Creek site. The following sections describe MMC's proposed maintenance, monitoring and performance standards for the site. The proposed maintenance, monitoring, and performance standards may be modified in accordance with any 404 permit issued for the project.

C.4.2.1.1 Maintenance and Monitoring

Maintenance would consist of inspecting the site on an at least monthly schedule to identify any maintenance control problems, such as erosion, sedimentation, instability, weeds, wetland vegetation degradation, and structure/fence damage. If any such problems were identified, corrective action would be initiated promptly. Inspection results would be described in the annual monitoring report. A weed monitoring and control program would be implemented to minimize invasive species. The following tasks would be performed and photo-documented during the non-winter period (May-October) for the wetland mitigation site:

- ***Vegetation:*** Determine boundaries of dominant, species-based vegetation communities once per year during the last half of the growing season. Characterize plant type and density in quadrats established along one or more transects (depending on wetland size) through the center of representative new wetlands in each of the three mitigation areas. Locations and types of noxious weeds would be identified and noted on a site map.
- ***Hydrology:*** Monitor groundwater levels monthly during the growing season in piezometers installed within the mitigation areas and in nearby wetland and upland areas. Delineate presence or evidence of moving and/or standing surface water within the wetland areas. This information would be compared to the existing dewatered state to assure water is present for an extended period of time to support rehabilitation of the degraded wetlands.
- ***Soil:*** Characterize shallow soil conditions at representative locations in the new wetland area using soil cores/samples obtained from a hand-auger or sharpshooter shovel.
- ***Wildlife:*** Record direct and indirect observations of site use by mammals, reptiles, amphibians, and bird species. Indirect use indicators include tracks, scat, burrow, eggshells, skins, and bones.
- ***Functional Assessment:*** Evaluate functions and services once per year during the last half of the growing season using established lists of site-specific functions and services to be achieved at the new wetland site.

Photo-points would be established at each wetland mitigation site to document site-specific conditions and changes from year to year. Field information obtained for each of the above-listed six monitoring categories would be recorded on monitoring forms. The monitoring period would be sufficient to demonstrate that the mitigation met the performance standards, but not less than 5 years. Some aspects of compensatory mitigation may require inspections or monitoring more frequently than annually during the early stages of development to identify and address problems that may develop. Annually, the Corps would review all monitoring results to determine if changes to the monitoring program were warranted, and whether other mitigation measures were necessary. The Corps would also determine when monitoring could be terminated after successful self-sustaining mitigation sites were established.

C.4.2.1.2 Performance Standards

The performance standards for the Swamp Creek wetland mitigation site proposed by MMC for Alternative 3 (MMC 2014a) could be modified by the Corps in accordance with any 404 permit issued for the project. MMC would request that monitoring cease and the site be transferred to the KNF when the follow performance standards were met for two consecutive years a minimum of 2 years after active management ceased:

Wetlands

- Water saturation levels are within 12 inches of the surface, and/or standing water
- Water is present for at least 12.5 percent of the growing season (20 consecutive days) at the far edges of the hayfield where conditions currently were dewatered for agricultural use
- Aerial cover of facultative or wetter species cover meets or exceeds 60 percent of combined cover

- State listed noxious weeds do not exceed 10% after 5 years and for at least 2 consecutive years without maintenance to demonstrate sustainability of the site
- More than three wetland species are present, one species does not exceed 30% of the total cover, and reed canarygrass was not a dominant species for the vegetation community
- Planted and volunteer native woody species (alder, willow and other wetland species) are at least 174 stems per acre in the planted areas

Upland Buffer

- Maintain a predominance of native vegetation communities (including trees and shrubs) in the upland buffer areas. Native vegetation is at least 80% of the plant communities compared to surrounding upland areas
- MT state listed noxious weeds do not exceed 10% after five years and for at least two consecutive years without maintenance to demonstrate sustainability of the site
- Buffers remain undisturbed to the maximum extent practicable allowing for sound management practices

C.4.2.2 Swamp Creek Stream Mitigation Site

C.4.2.2.1 Maintenance and Monitoring

Maintenance would consist of inspecting the site on an at least monthly schedule to identify any maintenance control problems, such as erosion, sedimentation, instability, weeds, wetland vegetation degradation, and structure/fence damage. If any such problems were identified, corrective action would be initiated promptly. Inspection results would be described in the annual monitoring report. A weed monitoring and control program would be implemented to minimize invasive species. The following monitoring would be performed and photo-documented during the non-winter period (May-October) for the stream mitigation project sites:

- ***Riparian Corridor:*** Characterize plant type and density, including locations and types of noxious weeds.
- ***Stream Channels:*** Assess stream cross-sections to monitor channel form and function, natural channel migration, vertical stability (down-cutting), sediment deposition, and stream bank vegetation development.
- ***Aquatic Life and Habitat:*** Characterize aquatic life and fisheries, where applicable, following accepted protocols.
- ***Functional Assessment:*** Evaluate functions and services based on site-specific goals.

C.4.2.2.2 Performance Standards

The performance standards for the Swamp Creek stream mitigation site proposed by MMC for Alternative 3 (MMC 2014a) could be modified by the Corps in accordance with any 404 permit issued for the project. The Montana NRCS Riparian Assessment Method (MT RAM) would be used to evaluate performance of stream and riparian buffer areas. The MT RAM incorporates geomorphological features and processes (pattern, dimension, profile, incisement, and bank stability) with ecological features (riparian vegetation composition and condition) to quantitatively establish the system as Unsustainable, At Risk, or Sustainable. The stream bank and riparian buffer would meet the following performance standards before release of all credits:

1) Attain a cumulative rating score on the MT RAM of “Sustainable” for two consecutive years, including the final year of monitoring. Since component criteria in Questions 1 – 3 and Question 10 can be somewhat qualitative, the following would be used as a refinement:
   - One cross-section per 1,000 feet of assessed reach, beginning at the edge of the designated floodplain, and extending perpendicular across the stream to the opposite floodplain edge. Evidence of active headcuts or low vertical edge (scarp) at the toe of the stream bank, particularly on the inside of a meander, as determined by this cross-section would affect scoring negatively.
   - The project must experience at least one observed bank-full event during the monitoring period to successfully complete this rating; should the project not experience a bank-full event during the initial five-year monitoring period, the USACE may require additional monitoring until a bank-full event occurs. In the situation where a bank-full event has not occurred but all other performance standards have been met, a partial bond release would occur. Regarding scoring the scrub-shrub component of the riparian buffer where this is a component of the climax community, a calculation must be made to determine eventual coverage class of the buffer at maturity.
   - Using the Cowardin et al. classification for scrub-shrub areas of 30% cover at maturity, the standard would be 174 stems per acre of native shrub species (alder and willow). Should other species be proposed for the community, a separate calculation would be required for this performance standard based on the estimated canopy cover at maturity of the proposed species assemblage.
2) Less than 10% cover of exotic/noxious species as listed by the Montana Department of Agriculture, state noxious weeds list; and
3) Buffers remain undisturbed to the maximum extent practicable allowing for sound management practices.

C.4.2.3 Culvert Removal and Replacement and Bridge Removal

Monitoring and performance standards described for the Swamp Creek wetland and stream mitigation site would be used for culvert removal and replacement and bridge removal sites.

C.4.2.4 Isolated Wetland Mitigation Sites

Wetland monitoring and performance standards for the compensatory mitigation for the isolated wetlands would be a component of the approved Plan of Operations for the Forest Service. MMC would be responsible for developing mitigation requirements for submittal to the KNF. Standards would be approved by the agencies prior to the Construction Phase of the project. The Forest Service would use the Corps and EPA’s compensatory mitigation regulations (33 CFR 332 and 40 CFR 298) and the Corps’ Regulatory Guidance Letter (RGL 06-3) as a guide for establishing monitoring and reporting requirements and performance standards. MMC would be responsible for the isolated wetland mitigation sites and the proper management of those sites until performance standards were met.

C.4.3 Reporting

MMC would submit monitoring reports to the Corps, KNF, and DEQ that follow the requirements described the Corps’ RGL 06-3. The Corps would review the reports annually to assess the status of the compensatory mitigation and to evaluate the likelihood of the mitigation to meet the performance standards. Monitoring would continue until all performance standards were met.

C.5 Wildlife

C.5.1 Objective

The objective of the wildlife monitoring would be to evaluate the effects of the mine and the effectiveness of mitigation measures during all mine phases. In addition, as described below, MMC would contribute to efforts to monitor grizzly bear movements between the Cabinet-Yaak Ecosystem and Northern Continental Divide Ecosystem. If appropriate, mitigation measures may be modified based on results of monitoring.

C.5.2 Locations, Parameters, and Frequency

C.5.2.1 Grizzly Bear

MMC would remove big game animals killed by any vehicles daily from road rights-of-way within the permit area and along roadways used for access or hauling ore (NFS roads #231, #278, #4781, and #2316 and new roads built for the project) for life of mine. Road-killed animals would be moved at least 50 feet beyond the right-of-way clearing or as far as necessary to be out of sight from the road. Beginning prior to the Evaluation Phase and continuing through construction and the first 3 years of mill operations, MMC would monitor the number of big game animals killed by vehicle collisions on these roads and report findings annually. The numbers of animals killed by vehicle collisions would be reviewed by the KNF, in cooperation with the FWP, and if necessary, mitigation measures would be developed and implemented to reduce mortality risks.

MMC would also monitor and report (within 24 hours) all grizzly bear, lynx, wolf, and black bear mortalities within the permit area and along the access roads for life of the mine. If a T&E species mortality occurred, MMC would be required to haul future road-killed animals to a disposal location approved by FWP (thus modifying the disposal requirement described in the previous paragraph), if deemed necessary by the grizzly bear specialists or law enforcement officer to avoid additional grizzly bear or other T&E species mortality.

Under the direction of the KNF, MMC would implement or fund access changes on numerous roads before either the Evaluation Phase or the Construction Phase for grizzly bear mitigation. For the life of the project, MMC would implement or fund monitoring of the effectiveness of the closure devices at least twice annually, and complete any necessary repairs immediately.

Prior to Forest Service approval to initiate the Construction Phase, MMC would provide funding for bear monitoring in the area along U.S. 2 between the Cabinets and the Yaak River and/or the area between the Cabinet-Yaak Ecosystem and Northern Continental Divide Ecosystem as identified by FWP. The linkage identification work along U.S. 2 would involve 3 years of monitoring movements of grizzly and black bears along the highway to identify movement patterns and key movement sites. Funding would cover aerial flights for 2 hours per week, 30 weeks per year for 3 years, salary for one seasonal worker for 6 months per year for 3 years, salary for one GIS technician for 6 months per year for 3 years, and 10 GPS collars and collar rebuilds each year for 3 years. Other monitoring methods may be considered if approved by the Oversight Committee. Should a permitted project be implemented or a future project be proposed that has adverse effects on the grizzly bear in the Cabinet-Yaak Ecosystem, funding for this monitoring could be required of those projects, potentially changing the funding required by MMC.

MMC would contribute funding to support monitoring of bear movements and population status in the Cabinet Mountains to confirm the effectiveness of mitigation measures implemented to provide a secure north to south movement corridor. The Forest Service would ensure that adequate funding, provided by MMC, is available to monitor bear movements and use of the Cabinet Mountains to confirm the effective implementation of mitigation measures. Information gained would be useful in determining whether the mitigation plan was working as intended. If not, the information would help in developing new management strategies that would be incorporated in the Biological Opinion through appropriate amendments. Funding would supplement ongoing research and monitoring activities in the Cabinet-Yaak Ecosystem, would be conducted or coordinated by the USFWS' grizzly bear researcher in Libby or the equivalent, and would focus on grizzly bears in the Cabinet Mountains. Funding would include money for the following (but not limited to): trapping, hair sampling and analysis, radio collars, flight time, monitoring native and augmented grizzly bears, and data analysis, including all equipment and support materials needed for such monitoring. The Forest Service would ensure that funding, provided by MMC, is available on an annual basis, 2 months in advance of the fiscal year (October) of the year it is to be used for the life of the mine. Details of the monitoring activities and budget would be outlined in the Management Plan. Funding would be provided prior to starting the Construction Phase and would continue throughout the life of the mine through the Closure Phase.

C.5.2.2 Lynx

The KNF would monitor new snow compaction activities (such as snowmobiling) in the project area and take appropriate action if compaction monitoring identified increased predator access to new areas.

C.5.2.3 Mountain Goat

MMC would fund surveys to monitor mountain goats to examine response to mine-related impacts. The surveys would be integrated into the current monitoring effort of the FWP. Aerial surveys would be conducted three times annually (winter-late spring-fall) by the FWP along the east front of the Cabinet Mountains from the Bear Creek drainage south to the West Fisher drainage. Surveys would be conducted for 2 consecutive years prior to construction, and every year during construction activities. Survey results would be analyzed by the KNF, in cooperation with the FWP, at the end of the construction period to determine the appropriate level and type of survey work needed during the Operations Phase. If the agencies determined that construction disturbance was significantly affecting goat populations, mitigation measures would be developed and implemented to reduce the impacts of mine disturbance. Surveys would be conducted using the current protocol of the FWP. Currently, the FWP conducts one aerial survey of the east Cabinet Mountains every other year. This additional level of monitoring would provide information on the status of mountain goat use adjacent to the project area, and potential effects of the project.

C.5.2.4 Migratory Birds

MMC would coordinate with the KNF and Regional bird monitoring partnership group to fund monitoring of landbird populations as part of the Forest Service Regional effort of the "Integrated

Monitoring in Bird Conservation Regions" (IMBCR). The KNF is located with the Northern Rockies Bird Conservation Region 10 (BCR 10), which is characterized by high-elevation mountain ranges with mixed conifer forests and intermountain regions dominated by sagebrush steppe and grasslands (Partners in Flight 2000). BCRs approximate an eco-province, and are the scale recommended by Partners in Flight for monitoring. Across the KNF, transects were identified in 2010, with at least 10 transects monitored each year. Two of these 10 annually monitored transects are located within the Crazy and Silverfish PSUs.

Prior to the Evaluation Phase, and continuing for the life of the mine, MMC would coordinate with the KNF and Forest Service Region 1 bird monitoring specialist to fund and initiate annual monitoring of up to 12 ICMBR transects; up to eight within a 1 mile influence zone of the proposed facilities or transmission lines (MT-BCR10-K078; MT-BCR10-KO271; MT-BCR10-KO102; MT-BCR10-KR53; MT-BCR10-KR229; MT-BCR10-KR133; MT-BCR10-KR277; MT-BCR10-KO138 if transmission line Alternative C-R was selected), and an additional four transects outside of the facilities and transmission line influence zones for comparison with the influence zone transects.

The monitoring effort would continue to provide data to the IMBCR project that would allow inferences to avian species occurrence and population trend from both the local level, such as the PSUs where project activities are proposed to Bird Conservation Regions (BCR) scales, facilitating conservation at local and national levels.

C.5.3 Reporting

Reporting requirements would be described in a Comprehensive Grizzly Bear Management Plan. This plan is discussed in greater detail in the agencies' wildlife mitigation plans for Alternatives 3 and 4 in Chapter 2.

C.6 Geotechnical

C.6.1 Objective

Prior to commencement of mine construction, MMC would prepare and present to the agencies a tailings impoundment (i.e., geotechnical) monitoring plan. Specific monitoring requirements such as information needs, monitoring location, instrument type, monitoring frequency, reporting requirements, and threshold values for remedial action would be finalized in a stand-alone geotechnical monitoring plan developed during the final design process for the tailings impoundment (See section 2.5.2.5.2, Final Design Process in Chapter 2). The plan would identify monitoring requirements for pre-construction, construction, operations, and closure. The plan would be submitted for agency approval prior to the agencies approving the Construction Phase and incorporated into a monitoring plan approved by the agencies and incorporated into an amended plan of operations or updated operating permit prior to project initiation.

The objectives of the geotechnical monitoring program as it pertains to the tailings impoundment, and appurtenances, and other facilities as appropriate, would be to:

- Collect additional analytical data for use in ongoing impoundment design and operations
- Identify previous unknown site conditions

- Confirm critical design assumptions
- Monitor site conditions during construction and operations
- Monitor impoundment performance during construction and operations
- Assist in assessing material used in dam construction
- Estimate tailings quantities and physical characteristics of impounded tailings
- Establish requirements and a schedule for annual reporting

C.6.2 Locations, Parameters, and Frequency

The monitoring program would emphasize the following tailings impoundment related components: foundation conditions, dam construction, operational stability, material balance, impoundment capacity, and water balance. Because the coarse (sand) fraction of the tailings would be used in the construction of the tailings embankment, a material mass balance would be carried out on an annual basis to assess embankment material needs and whether sufficient building materials would be available to meet the construction requirements. Quantities of tailings from the mill, waste rock from mine development, and borrow materials from on-site sources would be recorded to document material type and quantities used in embankment construction as well as the fine grained tailings material sent directly to the impoundment.

A geotechnical monitoring plan adopted for all action alternatives would incorporate many if not all of the monitoring elements listed in Table C-2. The exact type of monitoring technique used for data collection, location of monitoring devices and frequency of data collection would be finalized during the final tailings impoundment design process and incorporated into a monitoring plan presented to the agencies prior to project initiation. The monitoring plan would require MMC to submit an annual tailings impoundment construction and performance report.

The use of piezometers to monitor interstitial pore pressures is an industry accepted practice, and the array of available instrumentation for this purpose is extensive. Devices have been adapted for continuous recording and for monitoring from off-site locations. At Montanore, piezometers would be installed in the dam foundation to measure pore pressures during construction, with particular attention given to areas where the glaciolacustrine clay may be present in the foundation. Appropriate pore pressure “trigger” levels would be established based on stability analyses to provide a management tool to respond to higher than predicted pore pressures if encountered. Piezometers would be installed in the cycloned sand dam as it is constructed in order to monitor the pore pressure build-up and to assess “drawdown” of cyclone water within the dam embankment. The piezometer cables would be buried and lead to a common readout station at the toe of each dam where continuous data reading equipment would be installed out of the way of the embankment construction operation.

Inclinometers would be used to monitor potential deformation of the tailings embankment which could be an indication of foundation failure. The inclinometers would be extended up through the embankment as it was constructed. It is highly likely some inclinometers would be damaged during the embankment raising process and would have to be abandoned. They would be replaced as needed over the course of the impoundment life.

Table C-2. Geotechnical Monitoring.

Monitoring Location	Item	Monitoring Parameters	Frequency	Comments
Embankment Foundation	Piezometers	Pore pressures	Monthly	Simple standpipe, and electronic pressure transducers; monitoring during construction and operations; visual inspections by mine personnel
Impoundment Embankment	Piezometers - Main dam - Saddle dam - Beach area	Pore pressures	Monthly	Simple standpipe, and electronic pressure transducers; monitoring during construction and operations. Monitoring of potential pore pressures and phreatic surface in the embankment and tailings; visual inspections by Professional Engineer
	Inclinometers - Main dam	Deformation (inches)	Monthly	
	Material quantities: Cycloned sand, borrow, and mine waste rock	Tons, and cubic yards per year	Annually	Annual reconciliation of fill materials; visual inspections by Professional Engineer
	Material properties	Density and gradation	Weekly	A QA/QC program would be implemented to measure and monitor density and gradation; visual inspections by Professional Engineer
Impoundment Area	Pressure transducer Pond elevation	Tailings density Tailings water volume	Annually	Estimate of in situ tailings density; remaining impoundment capacity Tailings water volume

Visual observation would be a critical component of the monitoring program. Mine personnel would be assigned inspection responsibilities to be conducted as part of their assigned duties. A quarterly inspection report would be submitted to the agencies as part of the monitoring requirements. Items such as embankment seepage, freeboard adequacy, beach width, cracks in the embankment, evidence of slope failure, erosion features along the dam and abutments, and changing trends in seepage quantities, piping, and wet spots, are representative of the kinds of observational features which could be indicative of potential problems with the tailings impoundment and the kinds of features which would be noted and documented during a visual inspection.

During the construction phase of the impoundment, QA/QC of dam construction activities would be carried out by a qualified third party engineering consultant. Prior to the commencement of construction, the responsibilities of the third-party consultant would be detailed in an agency-approved field manual and would include standard field and laboratory quality control tests.

During the operation phase of the tailings impoundment, geotechnical monitoring would continue at the locations and frequency established in the monitoring plan. Of particular interest for monitoring during operations would be pore pressures in the impoundment embankment and foundation as the embankment was constructed. In situ tailings consolidation within the impoundment would also be monitored to assist with closure planning. The monitoring program would continue into the closure stage, although the frequency of monitoring would likely be reduced as steady state conditions within the impoundment and embankment were approached. The following type of monitoring could be incorporated into a closure monitoring program:

- Installation of piezometers within the tailings impoundment pond area to monitor the progressive “drawdown” of the phreatic surface
- Installation of settlement plates and in situ pressure transducers within the tailings to monitor the consolidation and settlement of the tailings to help confirm the predicted consolidation behavior of the tailings at closure.

C.6.2.1 Reporting and Third-Party Review

During the final tailings impoundment design, and during operations and closure, MMC would fund an independent technical advisor to assist the agencies in ongoing oversight and review of the tailings impoundment. The duties of the third-party technical advisor would be similar to those of consultants retained by the Technical Advisory Group as part of the review of the final tailings design. The technical advisor would be selected, directed by, and report to the agencies through an agreement with MMC. MMC would provide site access, logistical support, and all information required by the technical advisor to complete ongoing reviews of the tailings impoundment. MMC would submit an annual tailings impoundment construction and performance report to the agencies, which would detail tailings impoundment construction, monitoring, and performance.

C.7 Rock Mechanics

C.7.1 Subsidence

A subsidence (underground geotechnical) monitoring plan would be implemented as part of all action alternatives. A final subsidence monitoring plan would be developed during final design, and approved by the agencies and implemented before any underground development began during the Construction Phase. The subsidence monitoring would incorporate the geotechnical monitoring procedures and methods specified in DEQ’s Operating Permit #00150 and the 1993 ROD. MMC would submit a final subsidence monitoring plan for agency approval following completion of the Libby Adit evaluation program (Evaluation Phase). Subsidence monitoring would incorporate both a surface and underground monitoring with objectives to 1) identify pre-subsidence indicators in advance of their developing into surface subsidence so mitigations can be implemented to prevent subsidence, and 2) to collect data that will be used in refining mine design elements such as room and pillar size, pillar orientation, and buffer zone dimensions, during the course of operations to ensure underground mine stability is maintained and subsidence prevented.

C.7.1.1 Surface Monitoring

MMC would complete a pre-mining baseline topographic survey during the Evaluation Phase over the ore body using aerial methods (LiDAR, InSAR, or equivalent) approved by the agencies. This type of technology can measure small deviations over large surface areas which otherwise would be impossible or impractical to measure using standard geodetic surveying techniques. Surveys would be repeated periodically prior to production mining to 1) identify limitations with the survey technique and to make adjustments in its use to ensure accuracy, and 2) establish a pre-mine reference surface for comparing to the ground surface once mining has commenced. During operations, these surveys would be required to monitor for any surface movement that may be induced by the mining operation. The selection of surveying technique and the schedule for surface monitoring and reporting would be established as part of the subsidence monitoring plan developed during the final mine design phase.

MMC would also complete and provide to the agencies a detailed surficial geologic survey of lands overlying the mine area during the Evaluation Phase to map faults, rock joint patterns, and other geologic structures that may affect mine design.

C.7.1.2 Underground Monitoring

The specific details of a subsidence monitoring plan would be developed during final mine design, and would be subject to approval by the agencies prior to the agencies approving the Construction Phase. Should mining be approved, monitoring information would be evaluated in conjunction with data collected from a rock mechanics testing program and from underground and surface mapping of geologic structures and discontinuities (e.g., faults, joint sets) collected during the Evaluation Phase. Collectively, over time the data from these various sources would help develop a model of rock behavior in response to underground mining which could be used to guide ongoing mine development in an environmentally safe manner. Subsidence monitoring data would be reported to the agencies in an annual report.

The type of data collected would include logging drillholes and geologic mapping of mine workings and surface features to obtain an initial overview of the geologic profile of the site. More detailed data would include rock quality analysis, which would evaluate fracture and fault frequency, structure orientation, laboratory testing for rock strength parameters, and in situ geomechanical tests. Gaining a detailed understanding of rock strength, including the potential for shear failure at the pillar/roof or pillar/floor interface, and the overall mine structural setting, including faulting, jointing, bedding, horizontal stress regime, would improve the Montanore mine design.

Microseismic monitoring would be used to assess rock response to underground mining both during operations and post-closure, and would include installation of sensors in operating and abandoned sections of the mine. Stress monitors would be located near or on faults, barrier pillars, sill pillars, and other important geologic structures. Data would be compiled, assessed, and reported to the lead agencies in an annual report.

MMC has completed some initial numerical modeling to examine the issue of pillar and sill stability between the two ore zones as the influence and interaction of stacked workings may be critical to overall pillar and sill stability. Numerical modeling would part of the ongoing mine development during operations, and would be applicable to all areas of the mine and not just where the ore horizon is thick or where there are rooms stacked on one another.

During final design, the agencies would provide MMC with data from the Troy Mine, which has experienced pillar stability problems resulting in surface subsidence. The data collected and analyzed from the Troy Mine will aid the agencies in their evaluation of MMC's proposed design and monitoring plan. For example, data from the Troy Mine indicates that adverse pillar orientation with regard to bedding dip may have played a role in some of the pillar instability. Further, the Troy Mine sinkhole events appear to be related to encroaching too close to known faults. This information would be used to aid in the development of MMC's underground mine design.

The monitoring plan would be in a continual process of modification throughout the course of mining as new data was collected and analyzed. Due to the variability in geologic conditions and the physical response of the underground environment to mine development, modifications to the mine plan may need to be incorporated to safeguard against adverse environmental conditions.

C.7.1.3 Reporting and Third-Party Review

During the Evaluation, Construction, and Operations phases, MMC would fund an independent technical advisor to assist the agencies in review of MMC's subsidence monitoring plan, underground rock mechanics data collection program, and MMC's mine plan. The technical advisor would be selected and directed by the agencies through an agreement with MMC. MMC would provide the agencies and their representatives access to the underground workings to observe data collection and mine development. MMC would provide mine access, logistical support, and all information required by the technical advisor to complete a review of underground rock mechanics data and MMC's mine plan. The technical advisor would have no financial interest in the project.

Assessments of the underground workings by the technical advisor may occur as frequently as quarterly, with the results of the inspections compiled into an annual assessment report. This annual report from the technical advisor would incorporate data collected as part of the ongoing monitoring program, and would be in addition to the annual report prepared by MMC.

C.7.2 Underground Mining Boundary Monitoring

To ensure MMC only mined ore within its valid existing rights and that the underground mine development adhered to required buffer zone boundaries, the Plan of Operations and DEQ operating permit would include requirements for underground monitoring. MMC would fund and facilitate biannual surveys of the underground workings that would be completed by an independent certified mine surveyor. The surveyor would be selected and directed by the agencies through an agreement with MMC. The surveyor would have no financial interest in the Montanore Project. The agencies may also require more frequent surveys and/or as-built drawings if discrepancies arose. MMC would provide mine access, logistical support, and all information required by the surveyor to complete independent inspections and resulting documentation for the identified tasks. This would include all company-conducted mine surveys of the underground workings. After completing the monitoring survey, the independent surveyor would submit maps of the workings to the agencies and would report any ground disturbances that crossed the established extralateral rights boundary, entered into designated buffer zones, or deviated from agency approved mine design.

C.8 Reclamation

C.8.1 Objective

The objectives of reclamation monitoring would be to:

- Assess the success of reestablishing a viable vegetation community following reclamation
- Determine the appropriate fertilizer mix and organic amendments required for successful reclamation
- Assess the effectiveness of weed control measures
- Determine if the criteria for revegetation success and for bond release are met

C.8.2 Locations, Parameters, and Frequency

MMC would submit a reclamation monitoring plan that would establish the soil testing protocol to determine the appropriate fertilizer mix required for successful reclamation. The final monitoring plan would describe sample locations, frequency, and analysis. The fertilizer type, mix, and rate would be approved by the agencies before being used. Interim reclamation activities would provide opportunities to monitor and evaluate the most effective use of fertilizers for final reclamation.

The vegetation cover, species composition, and tree planting success would be evaluated during the first year following reseeding or replanting. In addition to a general evaluation, MMC would conduct vegetation monitoring every 2 years during operations at sites representative of various types of disturbance. Control sites in areas unaffected by the project would be established to provide information on site conditions. At the end of mine operations, MMC would conduct similar vegetation monitoring every year at sites representative of various types of disturbance until bond release. The number and location of representative sites would be approved by the agencies. The following characteristics would be evaluated:

- Plant species responses (germination, growth, competition)
- Total and vegetation cover
- Plant species and plant diversity (including weeds)
- Procedures to reclaim steep rocky slopes
- Soil redistribution depth
- Soil rock fragment content
- Effects of fertilizer rates
- Tree planting techniques
- Tree stocking rates
- Viability of bare-root versus containerized stock

Vegetation monitoring also would assess noxious weeds. MMC has a Weed Control Plan approved by Lincoln County Weed Control District. The plan would be modified as described in this section and submitted to the lead agencies during final design for their approval. Following KNF's and DEQ's approval of the final Weed Control Plan, MMC would submit it to the Lincoln County Weed Control District. These measures would be applied to all permit areas, and all currently unopened roads used for transmission line access. Measures outlined in MMC's Weed Control Plan approved by the Lincoln County Weed Control District and the KNF would be followed during operations and reclamation to minimize the spread of weeds to reclaimed areas. If weed content were above 10 percent, MMC would implement additional weed control methods and apply weed control treatment for 2 years.

C.8.3 Reporting

MMC would submit an annual report to the lead agencies describing weed control efforts. The report would provide a map showing areas of weed infestation that were treated in the preceding year. It also would provide a qualitative evaluation of the weed control efforts.

A report summarizing survey data would be submitted annually to the agencies. MMC would develop reclamation bond release criteria as part of the overall reclamation plan approved by the agencies. Part of the release criteria would involve specific, qualitative measurement of revegetation success.

MMC would report soil stockpile volumes and disturbance acres in each annual report to the lead agencies. MMC would prepare an annual soil reconciliation report to document that the soils in stockpiles were sufficient to reclaim the current disturbed acres. If a shortfall existed, MMC would submit a plan to make up for the soil shortfall in the following year (see next section regarding replaced soil thickness).

C.8.4 Reclamation Bond Release

The following criteria for all reclaimed areas, including the transmission line right-of-way and access roads, would be used to determine revegetation success and bond release for that component of the reclamation bond. Minimum vegetation cover would be 80 percent of the control site total cover. If the required minimum cover were not obtained, MMC would implement remedial action such as reseeding with a modified seed mixture, mulching, fertilizer, or other changes to address the issue. If after two remedial attempts the particular site still did not meet the minimum vegetation cover standard but met 80 percent of the average of selected control sites, did not exhibit rills or gullies, and met the weed standard, the bond would be released. If the site continued to fall short of meeting the cover requirement, a third remedial effort, approved by the lead agencies, would be applied. If the standard still were not met but the site had 70 percent of the control cover and did not exhibit rills and gullies and met the weed standard, the bond would be released.

MMC and the lead agencies would establish control sites for the project before operation activities. These sites should be similar to the reclaimed areas and be in close proximity to the mine area. MMC would develop a vegetation monitoring plan from these sites and collect vegetation data during the mine life. This information would be used to validate the release criteria numbers with respect to minimum cover requirements, tree/shrub density, weeds, and other provisions preliminarily set in the EIS. The intent is to provide long-term site-specific data to support the release criteria established for the project. The monitoring plan would be approved by the lead agencies and would require the report be submitted annually or as outlined in the plan or as approved by the lead agencies. Monitoring would continue for 20 years after planting or seeding to ensure revegetation requirements were met, or less if the project bond were released by the lead agencies before this period expired.

Category 1, 2, and 3 noxious weed species cover would have less than or equal to the cover of noxious weed species present on agency-approved disturbed/reclaimed control sites in the area. Category 2 and 3 (new invaders and potential invaders) are described in the latest edition of the KNF Noxious Weed Handbook. A minimum of 400 trees and 200 shrubs per acre would be living after 15 years (density may be lower in some areas where no trees or shrubs were planted, such as herbaceous wetlands and meadows).

C.9 Geochemistry

C.9.1 Introduction

Although the risk of acid generation and trace metal release from the project is generally low, some rock to be mined has the potential to affect surface water and groundwater resources. For this reason, the agencies' alternatives (3 and 4) would require additional geochemical characterization and monitoring of water flow and quality in the Libby Adit, to address uncertainty and validate predictions of future water quality provided in the EIS. Until such data became available, the agencies' alternatives require that rock be placed on a liner and managed to control potential impacts to water quality. This mitigation strategy recognizes that additional material needed for testing would be accessible during the Evaluation Phase. It also recognizes the value of historical Libby Adit and active Troy Mine workings as full-scale, real-time geochemical analogs for the proposed Montanore facilities. Waste rock management would be adapted as additional monitoring data become available to inform the mitigation strategy for various facilities under changing water balance conditions throughout mine life.

MMC presented a comprehensive summary of the available static geochemistry data characterizing rock for the proposed Montanore and Rock Creek mines by test method in tables appended to their waste rock management plan (Geomatrix 2007), as well in their review of waste rock characterization (MMC 2009). It also provided a general plan for additional geochemical characterization work including:

- Collection of representative waste rock samples from the adits, ore zones, barren zones, and above and below ore zones, at least every 500 feet in adits and for every 100,000 tons of waste rock produced in mine workings.
- Analysis of samples using static test methods (acid base accounting, total sulfur, and pH measurements).
- Kinetic or metal mobility testing of select samples, based on static test results.
- Characterization of residual water-soluble nitrate on waste rock mined during the Evaluation Phase, for use in predicting nitrate concentrations in meteoric water from waste rock placed outside the mine.
- Designation of fixed sampling points for in situ characterization of pH changes over mine life, based on rock sampling.
- Correlation of sample and analytical geochemistry data with water quality data.

- Re-evaluation of sampling and waste rock management plans based on cumulative data.
- Annual reporting of sampling, analysis, and results.

Review of the Draft EIS raised concern about perceived uncertainty in the data, and requested additional detail about the specific timing, intensity, and methods of proposed sampling and analysis. In particular, concern was raised about the coordinating the collection and interpretation of Evaluation Phase data with management of mined rock during operations, and a plan for integrating new information with baseline data was requested.

In response to these concerns, a hydrogeochemistry working group comprising agency and interdisciplinary team members reviewed all available hydrogeochemical data, discussed apparent uncertainties, and reconsidered sampling and analysis needs. A portion of that committee focused specifically on geochemistry issues. This Sampling and Analysis Plan (SAP) presents the recommendations of the geochemistry working sub-group and expands upon the approach described by Geomatrix (2007), with a goal of informing the development of risk-based mitigation strategy. MMC would develop a final SAP for the agencies' approval before the Evaluation Phase. The SAP would comply with the selected alternative as outlined in the KNF's Montanore Project ROD.

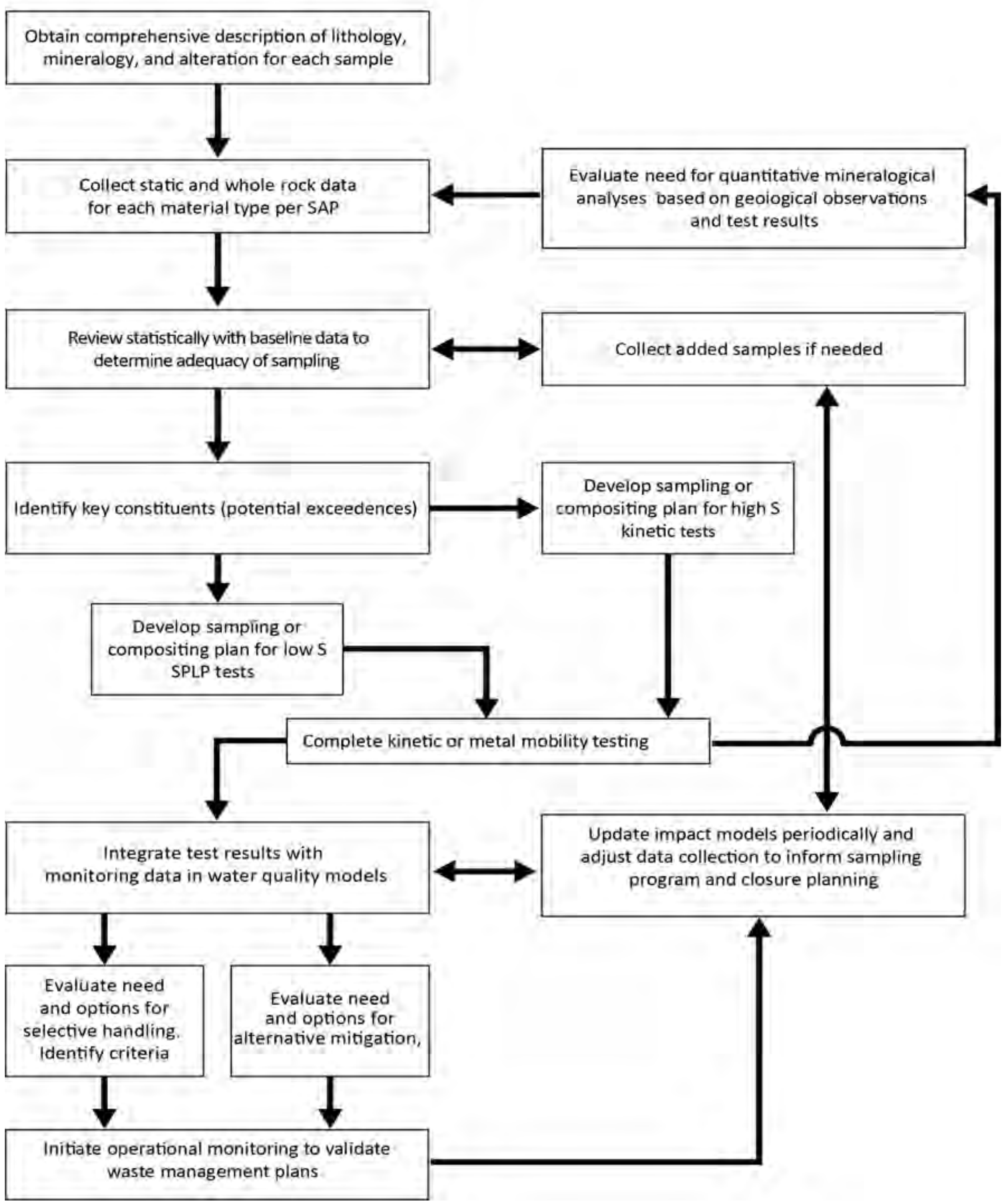
The goal of the SAP is to ensure adequate characterization of acid generation and metal release potential for each of the proposed mine facilities throughout the mine life cycle. The general approach to the sampling and analysis program is summarized in Figure C-1. Two distinct phases of data collection, during the Evaluation/Construction and Operations phases of mine life, are identified in this SAP. Data from both phases would be evaluated statistically to determine overall sampling adequacy and to update mass balance analysis periodically, thus ensuring appropriate mitigation and closure planning.

Data addressing perceived gaps that may influence water quality predictions and waste management practices would be collected during the Evaluation Phase, prior to initiation of construction and operations. During the Evaluation Phase, additional rock would be exposed for sampling and analysis of its potential to release metals, allowing the mine plan to be revised for any needed mitigation. This SAP also provides guidance for integration of Evaluation Phase with EIS analysis and waste rock management plans, prior to initiation of construction, as well as establishment of selective handling criteria as appropriate. This would ensure proper management of mined materials in protecting water resources. As the agencies' mitigation would require that all mined material be managed as though there is potential impact to water quality, until additional testing or monitoring data demonstrate otherwise, there is little risk to the environment using this approach.

An ore production-based strategy for operational verification of the EIS assessment is also provided, which mirrors the approach suggested by Geomatrix (2007) and described in the Draft EIS. Data collected during mine construction and operations would be used to update water quality predictions for comparison with water flow and quality monitoring data and reported for agency review, as suggested by Geomatrix (2007).

Data produced under the Operations Phase SAP would be integrated with the EIS and Evaluation Phase data going forward, to evaluate rock management effectiveness and provide data for facility closure.

Figure C-1. Decision Matrix for Geochemical Sampling and Analysis.



C.9.2 Mine Plan and Material Balance

Waste rock would be produced from the Prichard and Burke Formations during development of access, ventilation, and conveyor adits. Waste rock would also be produced from a barren lead zone that separates two copper-silver ore zones within the upper portion of the lower member of the Revett Formation, and from mineralized (non-ore) zones that lie between the ore zone and the underlying Prichard and Burke Formations. MMC's estimate of tonnage for waste rock, ore, and tailings production during each phase of mine life is summarized in Table C-3.

During the Evaluation Phase, MMC would sample the ore zone to revise resource models and facilitate metallurgical testing as needed. Rock would be exposed in all waste zones during the Evaluation Phase and can be sampled for characterization as appropriate. Metallurgical testing of bulk samples obtained during the Evaluation Phase could provide samples of tailings for additional environmental characterization.

Upon completion of the Evaluation Phase and receipt of the agencies' approval to proceed with the Construction Phase of the mine, MMC would proceed with construction of additional adits that would expose (similar to the Libby Adit) more of the Prichard and Burke Formations. Development would also begin in the lower Revett Formation during construction, which would continue and expand during mining operations. The volume of rock produced from each formation would vary over mine life (Table C-3).

C.9.3 Baseline Geochemistry and Water Quality Data

Geochemical and in situ monitoring data for Montanore available for inclusion in the impact analysis are summarized in Table C-4. Together with geochemical data from other Revett-type copper-silver deposits at Troy and Rock Creek, and monitoring data from the Libby Adit and Troy Mine, these data indicate low overall potential for acid generation, with low to moderate associated potential for metal release. Use of differing approaches to sampling and analysis over time has produced a data set that is inconsistent in terms of detection limits, suites of analytes, and frequency of sampling. Uncertainty that arises from these issues can be resolved through sampling of rock as it becomes available during the Evaluation Phase of development.

The specific type, quality, and adequacy of data available for incorporation into the EIS is discussed in detail in reports by Geomatrix (2007), Enviromin (2013), ERO Resources Corp. (2011), and discussions of the Montanore hydrogeochemistry workgroup (see minutes of meetings from 2009 and 2010 on file with the agencies). In-depth review of these data is not repeated in this plan.

In situ monitoring data collected within and adjacent to the Libby Adit, and water quality data from the Troy Mine, provide further information that can also be used to inform decisions about relative need for additional geochemical characterization and rock management. The Libby Adit provides a real-time, full-scale geochemical analog for Prichard and Burke Formation waste that is currently exposed in underground workings, and the Troy mine data describe a comparable analog for the Revett Formation where it is exposed underground. Available water quality data collected in and around the Libby and Troy adits were discussed in the Draft EIS, as well as in Geomatrix 2007. More recent data were integrated with pre-2007 data in a comprehensive water quality report (ERO Resources Corp. 2011). A statistical summary of these data, together the number of detected values and data reduction methods necessary to analyze baseline conditions, are provided in the report.

Table C-3. Estimated Material Balance, by Phase of Mine Life, Alternative 3.

Rock Type	Current	Evaluation	Construction	Operations Year 1-5	Operations Year 6+	Closure and Post-closure	Total	Proposed Placement Pending Analysis
Prichard waste rock	377,700	0	1,163,700	0	0	0	1,541,400	Tailings impoundment/ construction
Burke waste rock	42,500	0	151,200	0	0	0	193,700	Tailings impoundment/ construction
Revett waste rock (non-lead)	4,200	0	801,000	85,000	121,400	0	1,011,600	Tailings impoundment/ construction
Revett barren lead waste rock		0	134,900	245,000	231,300	0	611,200	Underground
Revett combined waste rock		545,300	0	0	0	0	545,300	Lined Libby Adit pad
Total waste rock	424,400	545,300	2,250,800	330,000	352,700	0	3,903,200	
Revett ore		Core	148,000	22,852,000	97,000,000	0	120,000,000	Mill
Tailings		Pilot	0	23,000,000	97,000,000	0	120,000,000	Tailings impoundment

All units are tons; conversion from bank cubic yards presented in MMC 2009 based on a density of 12.18 cubic feet/ton
Prichard includes Prichard-Burke transition rock
Revett waste reported as combined when data do not distinguish barren lead from other altered zones
Operational rock type defined by formation and mineralization
Source: MMC 2009.

Table C-4. Summary of Geochemical Analyses and In Situ Water Quality Data.

Test	Prichard	Burke	Revett Waste (non-lead)	Revett Barren Lead	Revett Combined	Revett Ore	Tailings
Static	70	19	41	25		35	1
Kinetic	2	0	1	1	1	1	ND
Metals	2	0	0	13	14	12	ND
Mineralogy	ND	ND			10	17	13
Intended location of rock	Adit, then tailings dam construction		Underground workings				Tailings
Source of *in situ* Monitoring	Libby Adit and Waste Rock Sump (WRS)				Troy Mine		
In situ Parameters	pH, metals, nutrients				pH, metals, nutrients		

ND = No data

C.9.4 Evaluation Phase Sampling and Analysis

This section describes sampling and analyses needed to address uncertainties in existing geochemical data and to delineate a plan for applying those data, together with water quality data, to rock management in a timely manner. Following review of available data by lithology and waste type throughout the mine life cycle, and review of chemistry data for geochemical analogs at Rock Creek, the Libby Adit and the Troy Mine, the geochemistry workgroup agreed that available in situ data reduce the need for further pre-construction characterization of the Revett ore, Prichard waste rock, and Burke waste rock zones that are already exposed. Confirmation sampling in zones that have not yet been mined is needed for these lithologies. The lower Revett altered waste and barren lead zones are also not addressed by these analogs and require further evaluation. The fundamental approach relies on a combination of available in situ water quality and geochemical data from all Revett copper-silver deposits, together with Evaluation Phase data, to reduce risk through adaptive waste rock management. The SAP seeks to prioritize sampling and testing to ensure that data needed to modify waste management plans are available at the start of construction. A decision matrix to be used in refining the SAP, based on data as they become available, is provided as Figure C-1. The following explanations are provided to guide sampling and analysis efforts.

Sample Type: The purpose of geochemical characterization is to describe the acid generation potential (using static and kinetic methods), metal/metalloid release potential, and nitrate release potential for mined ore, waste rock, and impounded tailings. Waste rock would be exposed in underground workings or used in surface construction at the proposed mine. There are multiple waste lithologies, which include the Prichard, Burke, and several altered waste zones within the Revett Formation. These materials would be exposed to changing weathering conditions throughout mine life; during active mining, or where placed above ground, rock would be exposed to oxygen; following closure, when underground workings would be flooded, oxygen exposure and related oxidation would be greatly reduced. Materials requiring geochemical characterization are summarized based on lithology, grade, geochemical conditions, and placement in Table C-5.

Table C-5. Summary of Material Types.

Location	Weathering Condition	Material Type	Lithology
Underground Rock left in back and rib, or backfilled within mined out workings. Rock exposed in adits	Partially saturated, aerobic, during dewatering and active mining	Ore	Revett – ore
		Waste	Revett – barren lead
			Revett – chalcopyrite
			Revett – pyrite
			Revett – sphalerite
			Burke
			Prichard
	Saturated, anaerobic, post-dewatering and following groundwater rebound	Ore	Revett – ore
		Waste	Revett – barren lead
			Revett – chalcopyrite
			Revett – pyrite
			Revett – sphalerite
			Burke
			Prichard
Surface Rock stockpiled at adit on liner Rock stockpiled within tailings impoundment footprint on liner Rock used in construction of tailings dam	Variably saturated, aerobic	Waste	Burke
			Prichard
Tailings impoundment	Saturated, anaerobic under active placement conditions Unsaturated tailings post-dewatering	Tailings	Processed Revett ore

Number: Number of samples to be collected is based on minimum requirements for a simple, normally-distributed data set, and would be modified in the context of observed lithological and mineralogical variability. Sampling density would also consider results of preliminary geochemistry analyses and in situ monitoring data. During baseline characterization, sampling would focus on covering the range of variability in mineralization, rather than on spatial or volumetric coverage which would be the focus during operational validation. Tonnage-based guidelines, such as those provided by the Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials (Price 2009), are more appropriate for operational monitoring programs. Determination of adequate sampling would be an iterative process, involving review of known information with new data to determine whether the number of samples is sufficient to describe the observed variability, such as suggested in the Global Acid Rock Drainage Guide (International Network for Acid Prevention 2008). Appropriate statistical tests of initial data, such as as T-test/ANOVA or Keyser-Meyer-Olkin tests, would be used to determine sampling adequacy.

The sufficiency of characterization would also be considered in context of the capacity of the mitigation strategy to address uncertainty as well as the potential cost of failed mitigation. For example, collection of more samples of a single rock type to identify variations in metal concentration that lie within the capacity of a planned water treatment plant may be less important than collecting samples from distinct rock types which may identify different metals that would need to be incorporated into the design of that treatment plant. Likewise, extensive characterization of a rock type that represents a small percentage of total mined material (like the lower Revett altered waste zones) is less likely to reduce future costs of water treatment than thorough characterization of rock (like the Prichard) that represents a large portion of the waste.

The number and type of geochemical tests are shown in Table C-6. The specific available geochemical and monitoring data, identified risk, uncertainty about existing information, conclusions of the geochemistry sub-group, requirements for additional geochemical sampling and analysis, and requirements for water quality monitoring for geochemistry during the Evaluation Phase are described below for each rock type.

The sampling and analysis plans would be reviewed, and if appropriate, modified by the geochemist charged with implementing this program, in consultation with the agencies. The intensity of future sampling and method of analyses would be determined by geological observation and review of available data. A thorough geological description by a qualified person, to obtain data describing lithology, mineralogy, and alteration data as a foundation for all subsequent sample collection and analysis, would be required. The need for more comprehensive

Table C-6. Evaluation Phase Geochemical Testing.

Test	Prichard	Burke	Revett Waste (non-lead)	Revett Barren Lead	Revett Ore	Simulated Bench-Scale Tailings	Total Samples
ABA	8[1]	8[1]	24[1]	8	8	5	61
Whole Rock	8[1]	8[1]	24[1]	8	8	5	61
Kinetic (acid)	1[2,3,4]		3[1,2,3,4]	2[2,3,4]			6[3,4]
Particle size	1[2]		3[1,2,3]	2[2,3,4]			6
SPLP (non-acid)	8[1]	1[1]			2	5	16
Mineralogy	4[5]	1[5]	3[5]	2[5]	2	5	17
In situ Monitoring	Libby Adit inflow quality; waste rock stockpile				Review of Troy Mine data		
In situ Parameters	pH, metals, nutrients						
Use of rock	Adit, construction, tailings impoundment		Underground workings			Tailings impound-ment	

[1]Or more as appropriate, per geological description
[2]Composite
[3]Unsaturated kinetic columns
[4]Saturated kinetic columns
[5]As appropriate

analytical mineralogy would be determined based on initial geological description as well as results of geochemical test work (Figure C-1).

C.9.4.1 Prichard Formation

C.9.4.1.1 Available Geochemical and Monitoring Data

Adequate static testing has been completed (n=70). Limited laboratory kinetic tests were completed, which included analysis of arsenic, cadmium, copper, iron, lead, manganese, silver and zinc (Geomatrix, 2007, Appendix B-2). Metal mobility tests and mineralogical analyses have not been completed. A better geological delineation of operational distinction between Burke and Prichard Formations, along with revised tonnage estimates, is needed. There is also a need to clarify factors influencing nitrate release from Prichard waste after blasting. Long-term in situ monitoring of pH, nutrients, and metal release from the Prichard has been conducted at the Libby Adit (sample IDs: RAW and RAW-1), and more recently for the waste rock stockpile on the pad outside of the Libby Adit (sample IDs: WRS and WRS-1). Monitoring has been conducted upgradient of the Libby Adit at LB-200 and downgradient, in monitoring wells MW-07-01 and MW-07-02 and at surface water station LB-300. These data are summarized statistically in the Surface Water Quality Technical Report (ERO Resources Corp. 2011).

C.9.4.1.2 Risk

The risk of acid generation by the Prichard Formation is low. The more important risk associated with waste mined from the Prichard is metal and nitrate release via adit water or seepage from surface facilities constructed with Prichard waste rock. Of particular concern is the tailings impoundment, which is planned to be constructed partly with Burke and Prichard waste rock. A secondary risk of metal and nitrate release from Prichard exposed within the adits also exists.

C.9.4.1.3 Uncertainty

Key issues include:

- Range of ABA values in Prichard Formation yielding NP/AP ratios that suggest a potential for acid generation that is inconsistent with results of in situ monitoring data, which show consistently neutral pH. This suggests mineralogical encapsulation of reactive minerals in non-reactive silica, similar to that observed in the Revett Formation, which has not been verified through mineralogical testing of the Prichard Formation.
- Limited humidity cell testing confirms the overall non-acid generating results of the more comprehensive in situ monitoring record.
- An incomplete list of metal analytes, which were measured in prior kinetic tests at relatively high detection limits (above concentrations currently needed to evaluate compliance), does not fully address metal release questions.
- Possible differences in metal release potential between expansion areas within the Prichard (*e.g.*, areas that have not yet been exposed) and areas that have already been characterized. This would be addressed using SPLP tests with analysis of a complete list of metals at appropriate detection limits. These data would support development of a composite for a humidity cell test to confirm previous findings and collect a complete metal analysis.

- The relatively massive and consistent character of the Prichard waste rock suggests that sub-handling of portions of this unit (based on selective handling criteria) may be problematic if future tests indicate that mitigation to meet water quality standards would be needed. This would be considered in light of any potential for long-term metal release.

C.9.4.1.4 Conclusions

- The available results of metal and nutrient release testing on the Prichard Formation as waste rock, particularly for antimony, arsenic, copper, lead, and nitrate, confirm the fact that additional monitoring is required.
- Historical, ongoing, and continued monitoring of water quality within and downgradient of the Libby Adit is more valuable in predictions of water quality than additional kinetic testing.
- As the mine expanded into undisturbed portions of the Prichard Formation, limited geological, mineralogical, and geochemical analyses would be conducted to test for geochemical variability within the formation and validate baseline analysis as mining proceeds.

C.9.4.1.5 Future Geochemical Analyses

- Additional characterization of metal release potential, either through SPLP, kinetic testing or monitoring work, is needed to validate the conclusions of existing mass balance analysis of potential impacts associated with water quality in adits and downgradient of facilities constructed with Prichard waste rock (such as the tailings impoundment). Analyses of effluent from short and long term leach testing (*e.g.*, SPLP, humidity cells, and *in situ* monitoring) would be reviewed to identify constituents of concern at appropriate levels of detection.
- Geological description and hand specimen mineralogy would be used to describe new exposures of Prichard and link those exposures to historically monitored Prichard exposed in the Libby Adit and on the waste rock pad outside the adit.
- QEMSCAN (quantitative evaluation of minerals by scanning electron microscopy) or petrography (XRD/SEM-EDS) of a small number of representative samples (here estimated as 4, which would be adjusted to fit geological observations) would be used to compare new and historically mined Prichard, and to explain observed differences between static and kinetic tests of ARD potential.
- Acid base account (Modified Sobek), whole rock (*e.g.* 55 element ICP using Chemex method MEMS41, aqua regia digestion) and SPLP (EPA Method 1312 as modified) testing of 8 to 10 representative samples collected from any portions of Prichard not currently exposed or previously sampled. One kinetic test of composited Prichard, with compositing based on ABA, whole rock, and SPLP results, to confirm non-acid characteristics and measure metal release potential.
- Nitrate and trace metal release would be monitored using data from mine and adit water before treatment (*e.g.*, RAW-1) and from waste rock stockpiles (*e.g.*, WRS-1).
- Particle size analysis of run-of-mine Prichard rock using standard ASTM methods would be needed to scale laboratory results to prediction of field scale processes.
- Compare laboratory test results with water quality sample results.

C.9.4.2 Burke Formation

C.9.4.2.1 Available Geochemical and Monitoring Data

There have been enough static tests completed (n=19) to describe the underlying range of acid generation characteristics, but no kinetic, metal release potential, or analytical mineralogy tests of the Burke Formation have been completed. Better geological delineation of operational distinction between Burke and Prichard Formations, with revised tonnage estimates is needed, along with clarification of potential for nitrate release. Burke rock mined from the Libby Adit is monitored in situ, as discussed above for the Prichard Formation.

C.9.4.2.2 Risk

The risks associated with the Burke Formation are negligible.

C.9.4.2.3 Uncertainty

A small quantity of Burke rock would be disturbed during adit development. Acid risk is low, and potential for nutrient and metal release is as described above for the Prichard Formation. Specific issues include:

- Range of ABA values in Burke Formation yield NP/AP ratios that suggest little potential for acid generation, consistent with results of in situ monitoring which show neutral pH.
- Potential metal release by Burke Formation rock where exposed underground or in constructed surface facilities requires evaluation. These data need to be sufficient to support mass balance analysis of adit water quality and predictions of water quality downgradient of facilities constructed with Burke Formation rock.

C.9.4.2.4 Conclusions

- No humidity cell testing is warranted for Burke rock due to consistently high ABA values. Historical, ongoing, and continued monitoring of water quality within and downgradient of the Libby Adit is more important to predictions of water quality than kinetic testing of the Burke Formation.
- Metal and nutrient issues, and sampling and analysis, are the same as those described for the Prichard Formation.
- As the mine expanded into undisturbed portions of the Burke Formation within the new adits, limited geological, mineralogical, and geochemical data would be collected to verify consistency within the formation as mining proceeds.

C.9.4.2.5 Future Geochemical Analyses

- Geological description and hand specimen mineralogy.
- Acid base and whole rock "fingerprint" analysis of 8 to 10 samples.
- SPLP testing of at least one composited sample that represent the range of mineralogy and chemistry observed in the Burke formation, based on geological mapping and the range of metal content observed in the whole rock analyses. Analyses of effluent from short and long term leach testing (*e.g.*, SPLP, humidity cells, and *in situ* monitoring) would be reviewed to identify constituents of concern at appropriate levels of detection.
- Use acid base, whole rock, and SPLP results to determine if kinetic tests also need to be performed.

- More detailed mineralogy, and additional SPLP tests, if elevated metal levels were to be noted in these tests, to understand metal mineral residence and mobility.
- Nitrate release would be predicted using in situ monitoring data from RAW-1, WRS-1, and runoff from any future waste rock stockpiles.
- Particle size analysis of run-of-mine Burke rock using standards ASTM methods would be conducted following kinetic tests to scale laboratory results to prediction of field scale processes.
- Water quality monitoring as described for the Prichard Formation.

C.9.4.3 Revett Formation – Waste Rock

Mineral zonation within the lower Revett was mapped in detail at Troy by Hayes (1983) and Hayes and Einaudi (1986), who identified multiple sulfide-carbonate facies surrounding the copper-sulfide mineralization of the ore body. These pyrite-calcite, chalcopyrite-calcite, and sphalerite-calcite sulfide altered waste zones, are likely to be intercepted by the Montanore adits below the ore zone. Zones of galena-calcite are also recognized, which occur as interbeds in immediate proximity to the ore zone, and are referred to as the “barren lead zone.” During exploration, the barren lead zone was sampled and characterized as potentially acid generating based on humidity cell tests. The other altered zones that are likely to exist below the ore zone have not yet been drill tested and their extent, character, and probable production volume are not well known, although preliminary data suggest that they are thin at Montanore. For this reason, testing of the “barren lead” zone are distinguished from the “non-barren lead” zones in the following discussion.

C.9.4.3.1 Revett Barren Lead Waste Zone (Galena)

Available Geochemical and Monitoring Data

Static (n=25) and kinetic (n=1) tests of acid drainage potential have been completed. Metal concentrations were measured in humidity cell effluent (n=1) for an incomplete list of analytes at relatively high detection limits and there is no analytical mineralogical characterization of this zone at Montanore, making comparison with geological analogs exposed at the Troy Mine less robust. Water quality data collected in the underground workings at Troy represent the cumulative effect of water interacting with all of the Revett waste and ore zones. It is not possible to assign water quality to individual altered waste zones.

Risk

Kinetic testing in a humidity cell indicates potential for acid generation and associated metal release from the lead zone. MMC has designated this material for special handling and would design underground facilities to minimize its disturbance. Barren zone (non-ore) containing galena that is mined and removed to surface would be placed on a lined pad, until it can be replaced underground. While on the pad and stored underground, this material would be exposed to partially saturated, aerobic conditions until dewatering ends and the backfilled mine void is saturated with groundwater. The extent of groundwater rebound may vary, and groundwater modeling results suggest that the entire void would not fill for 490 years. For the purposes of this SAP, it is assumed that barren lead waste would be exposed to weathering under both aerobic and anaerobic conditions. The potential for oxidation, with associated acid production and metal release, would change depending upon oxygen availability and encapsulation.

Uncertainty

It is likely that barren zone leachate would be acidic, with elevated metal concentrations. The principle uncertainty is about the magnitude of metal release, and its response to variable oxygen exposure.

Conclusions

- Although this material is designated for selective handling, further characterization under unsaturated, aerobic conditions is needed to understand its metal release potential within the underground workings during mining and the following refilling period.
- Further, as its geochemical behavior is expected to change as a result of saturation when groundwater rebounds at closure, additional characterization of acid generation and trace metal release potential under saturated conditions is also warranted.
- As the mine expands into undisturbed portions of the barren lead zone, limited geological, mineralogical, and conformational geochemical analysis would be conducted to verify mineralogical and geochemical consistency with the tested zones as mining proceeds.

Future Geochemical Analyses

- Geological description and hand specimen mineralogy.
- Acid base account and whole rock testing of 8 to 10 representative samples collected from the barren lead zone during Evaluation Phase. Number of samples would be adjusted to represent range of mineralization.
- Two kinetic tests (ASTM humidity cell test method, run until steady state chemistry is observed) of representative rock composited based on static tests to confirm magnitude of potential acid generation and analyze for a complete suite of metals at appropriate detection limits. One test would be run under unsaturated conditions and one would be saturated, to represent variable weathering conditions. Analyses of effluent from short and long term leach testing (*e.g.*, SPLP, humidity cells, and *in situ* monitoring) would be reviewed to identify constituents of concern at appropriate levels of detection.
- QEMS or petrography (XRD/SEM-EDS) of two samples, weathered under both aerobic and anaerobic test conditions (or more, based on geologic observations) would be used to establish baseline within barren lead zone for future mineralogical assessment of variability.
- Particle size analysis of run-of-mine Revett barren lead waste rock using standard ASTM methods is needed to scale laboratory results to prediction of field scale processes.

Water Quality Monitoring

- Continued evaluation of available monitoring data from Troy Mine.
- Water quality samples would be collected downgradient of barren lead zone material following underground placement.
- Chemistry of water in saturated zones would be monitored as they are developed to predict long-term chemistry for closure work.

- Changes in nutrient concentrations would be monitored in situ to predict underground nutrient loading from the barren lead waste.

C.9.4.3.2 Revett Formation–Non-Lead Barren Waste Zone

Available Geochemical and Monitoring Data

Limited geological description of volume and mineralogy is available. Static tests have been completed for lower Revett waste (n=41), but the relationship of these samples to the individual altered waste zones is unclear. Limited (n=1) kinetic tests of acid drainage potential for a composite of lower Revett waste has been completed, with analysis of a limited suite of metals at relatively elevated detection limits. No analytical mineralogy has been completed. Water quality data collected in the underground workings at Troy represent the cumulative effect of water interacting with all of the Revett waste and ore zones. It is therefore not possible to assign water quality to individual altered waste zones using Troy monitoring data.

Risk

Detailed mapping of the individual altered waste zones present at Montanore has not been completed and production volumes have not been calculated. It is possible that small (inconsequential) amounts of this rock would be intercepted, yet presence of divalent (iron) sulfide minerals in the altered waste zones as mapped at Troy suggests risk for sulfide oxidation and acid generation. Results of the available kinetic test data do not support acid risk or release of elevated metal concentrations.

Uncertainty

The risk associated with this material may be minimal due to anticipated small volumes of rock from each altered waste zone. Uncertainty exists about potential for acid, metal, and nutrient release.

Conclusions

- Characterization of Revett altered waste zone behavior under unsaturated, aerobic conditions is needed to understand its chemical behavior as a source term in the underground workings, as well as its behavior if used as construction material.
- As the geochemical behavior of this zone would be expected to change as a result of saturation when groundwater rebounds at closure, additional characterization of acid generation and trace metal release potential under saturated conditions could be useful if material is shown to be acid generating.
- The relative volume and extent of altered waste zone exposure, as well as static test results, would dictate whether saturated and unsaturated kinetic testing is warranted for the individual altered waste zones. The need for testing is contingent upon the volume identified during the Evaluation Phase.

Future Geochemical Analyses

- Detailed, well-documented geological description and hand specimen mineralogy, to map altered waste zones.
- Revise calculated production volumes for altered waste zones
- Acid base account and whole rock “fingerprint” analysis of 8 to 10 samples to characterize geochemical variability of rock for development of a composite for kinetic testing.

- Test a composited sample from each mapped altered waste zone in a kinetic test (including a complete suite of metals at appropriate detection limits). As this rock is likely to report to surface facilities, use standard unsaturated kinetic test methods. Analyses of effluent from short and long term leach testing (*e.g.*, SPLP, humidity cells, and *in situ* monitoring) would be reviewed to identify constituents of concern at appropriate levels of detection.
- If >1% of waste by volume were produced from an altered waste zone with static test results that suggest strong potential to generate acid, which would then trigger selective handling with subsequent underground placement, conduct additional column test work under saturated conditions to produce data representing underground long-term behavior of this material.
- As the mine expanded into undisturbed portions of the barren lead zone, limited geological, mineralogical, and conformational geochemical analysis would be conducted to verify consistency within the formation as mining proceeded.
- Particle size analysis of run-of-mine non-lead Revett waste rock using standard ASTM methods would be needed to scale laboratory results to prediction of field scale processes.

Water Quality Monitoring

- Evaluation of ongoing, publicly available monitoring data from Troy Mine.
- When possible, collect water quality samples downgradient of any reactive altered waste zone material following underground placement.
- Monitor chemistry of water from saturated zones as they were developed to predict long-term chemistry for closure work.
- Changes in nutrient concentrations in situ would be monitored to predict nutrient loading from the blasted portions of the non-ore altered waste zones.

C.9.4.4 Revett Formation – Ore

C.9.4.4.1 Available Geochemical and Monitoring Data

Static tests of ore have been completed (n=25). Kinetic testing (n=1) with characterization of metal release potential for an incomplete suite of metals at elevated detection limits has also been completed. More comprehensive characterization of metal release potential, together with analytical mineralogy, has been completed for ore within the Rock Creek portion of the Rock Creek-Montanore deposit (Enviromin 2013; Maxim Technologies, Inc. 2003). Water quality data collected in the underground workings at Troy represent the cumulative effect of water interacting with all of the Revett waste and ore zones. It is not possible to assign water quality specifically to ore zones.

C.9.4.4.2 Risk

Long-term monitoring of the mined underground workings at Troy, where ore left underground is exposed to groundwater, indicates neutral pH with low but increased concentrations of metals common in the ore zone, such as copper, silver, and lead.

C.9.4.4.3 Uncertainty

Uncertainty about the environmental geochemistry of ore left underground is primarily related to the prediction of metal concentrations post-mining.

C.9.4.4.4 Conclusions

- Static test results suggest that a portion of the ore zone has potential to generate acid, yet the kinetic test and in situ monitoring results do not support the potential for acid generation. This has been shown to be the result of non-acidic sulfide minerals and silica encapsulation of sulfide minerals within the Revett ore zone (Maxim Technologies, Inc. 2003).
- Characterization of ore behavior under unsaturated, aerobic conditions is needed to understand its chemical behavior as a source of metals in the underground workings.
- As its geochemical behavior would be expected to change as a result of saturation when groundwater rebounds, additional in situ monitoring of acid generation and trace metal release from backfilled waste under saturated conditions is needed to predict chemistry of the mine pool post closure.

C.9.4.4.5 Future Geochemical Analyses

- Acid base account and whole rock “fingerprint” analysis of 8 samples to characterize geochemical variability of samples for use in composite for kinetic testing.
- Metal mobility tests for one or more composited samples with a complete suite of metals at appropriate detection limits. Static test results would be used to develop composites. Analyses of effluent from short and long term leach testing (*e.g.*, SPLP, humidity cells, and *in situ* monitoring) would be reviewed to identify constituents of concern at appropriate levels of detection.
- Analytical mineralogy quantifying sulfide mineralogy and silica encapsulation would be completed for Montanore and Troy, to compare with that completed by Maxim (2003) for Rock Creek. This would support the use of the Troy and Rock Creek ore deposits as geochemical analogs for Montanore, and confirm the predicted lack of acid generating sulfides and low reactivity of encapsulated sulfides in the ore zone.

C.9.4.4.6 Water Quality Monitoring

- Evaluation of available monitoring data from Troy Mine.
- Monitor chemistry of water from saturated zones as they were developed
- Changes in nutrient concentrations in situ would be monitored to predict nutrient loading from the blasted portions of the ore zone.

C.9.4.5 Tailings

C.9.4.5.1 Available Geochemical and Monitoring Data

Static tests of tailings reject from the process proposed for Montanore (n=1) have been completed with no kinetic tests of acid drainage potential or characterization of metal release potential. Analytical mineralogy and whole rock analyses were completed for tailings that was produced using a similar process to float ore samples from the Rock Creek portion of the Montanore-Rock Creek deposit (n=13). Due to limited access to bulk samples for metallurgical testing, no tailings would be available for further environmental testing until the exploration adit was completed. Water quality data collected from the Troy tailings impoundment, and from downgradient water resources at Troy, are believed to represent conditions anticipated for Montanore, which would use a similar process to concentrate ore by flotation (Enviromin 2013).

C.9.4.5.2 Risk

Total sulfur analyses of tailings generated through bench-scale testing of ore from Rock Creek shows low concentrations of sulfur with little potential for acid generation. The relatively high surface area of the ground tailings does increase metal release in tailings effluent. Long-term monitoring of the impoundment at Troy indicates neutral pH with elevated concentrations of metals common in the ore zone, such as copper, silver and lead. The primary risk associated with tailings is metal release, with secondary risk of elevated nitrate concentrations.

C.9.4.5.3 Uncertainty

The potential for acid generation by Montanore tailings would likely be low based on negligible levels of post-flotation sulfur content in samples from Rock Creek, but would be confirmed through testing of Montanore tailings when samples were available. The geochemical behavior of tailings would be expected to change as a result of desaturation when dewatering occurred at closure, but no kinetic test data are available to represent this process.

C.9.4.5.4 Conclusions

- Tailings are highly homogeneous and therefore can be represented with a composite sample from the metallurgical testing reject sample.
- Characterization of its behavior under saturated, anaerobic conditions is needed to understand its chemical behavior as a source term in the operational impoundment.
- Additional characterization of acid generation and trace metal release potential under unsaturated conditions is also warranted.

C.9.4.5.5 Future Geochemical Analyses

- Acid base accounting and whole rock "fingerprint" analysis of a composited sample to characterize geochemical variability of tailings.
- Evaluate whether routine quality control measurements in mill could provide a measure of geochemical variability, thereby reducing the magnitude of this testing.
- Kinetic tests may not be necessary, due to low sulfide content, but metal release potential tests using SPLP methods would be conducted on a representative suite of samples. As metallurgical testing proceeds, tailings characteristics may vary. Possible classes of material to be studied using SPLP would include whole tailings, and coarse and fine tailings fractions. This would to a certain extent be defined by the metallurgical test work. As tailings are expected to be highly homogeneous, no compositing strategy would be required. Analyses of effluent from short and long term leach testing (*e.g.*, SPLP, humidity cells, and *in situ* monitoring) would be reviewed to identify constituents of concern at appropriate levels of detection.
- A particle size analysis of tailings, using standard ASTM sieving protocols, would be needed for evaluation of silica encapsulation influence on metal and sulfur reactivity in ground tailings.

C.9.4.5.6 Water Quality Monitoring

- Evaluation of ongoing, publicly available surface water and groundwater monitoring data from the Troy Mine impoundment.
- Monitoring of chemistry of water from the impoundment would continue as the impoundment water balance changes through mine life.
- Monitoring of changes in nutrient concentrations would facilitate prediction of tailings seepage chemistry.

C.9.5 Operations Phase Sampling and Analysis

Operational sampling and analysis would focus on validation of baseline conclusions, through periodic collection of Burke, Prichard, and Revett waste rock samples. Samples would be collected based on tonnage, at a rate that provides coverage of the mineralogical variability observed in mined rock. Geomatrix recommended sampling at least every 500 feet in adits and for every 100,000 tons of waste rock (Geomatrix 2007). This level is approximately consistent with guidelines provided by the Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials (Price 2009), which suggest 50 samples per 4 million tons of waste. Likewise, a sample of tailings can be collected periodically at the tailings line drop box, although collection of sampling can be less frequent than waste rock due to the relative homogeneity and characterization that is done for metallurgical processing. Ultimately, the relative frequency of sampling would be based on “variability within the analysis results for critical parameters, prediction objectives, and required accuracy” (Price 2009).

If test work conducted during the Evaluation Phase allowed rock mined during Construction and Operations phases to be classified for management (*e.g.*, there are no inconclusive kinetic tests, and rock requiring management is clearly delineated), static testing of volumetrically representative rock samples using mineralogical description, whole rock analysis, acid base accounting, with occasional metal mobility testing of composites, would provide an adequate basis for evaluating the consistency of mined rock with baseline samples. Water quality monitoring would be as described in section C.10, Water Resources. Following the Evaluation and Construction phases, and the first 5 years of Operations Phase, the agencies would review the data to determine adequacy of sampling and analysis, and management practices.

Of particular interest for operational sampling are locations where waste rock was exposed to oxidation, in surface stockpiles, constructed facilities, or as backfill in underground workings. Periodic collection of water quality samples downgradient of such facilities would allow long-term behavior to be evaluated in support of closure planning.

C.9.6 Sample Collection and Analysis

C.9.6.1 Collection

Sampling during the Evaluation Phase is focused on addressing specific gaps in existing knowledge, or on comparison of newly mined rock from a given lithology with rock that was mined and sampled historically. Sampling would specifically follow the guidelines provided in the SAP, as approved by the agencies, and would be focused on collection of samples across the range of observed mineralization and geological conditions observed. Sampling would proceed as follows:

- Sites would be located on a map and photographed
- Geological description, including lithology, structure, mineralogy, evidence of sulfide, carbonate, and iron oxide, would be completed at each site.
- A representative sample of at least 2 kilograms, allowing sufficient mass for preparation of splits suitable for completion of baseline static ABA, whole rock, and metal mobility tests with enough material archived for composite development and/or mineralogy would be collected.

- The number of samples would follow the guidelines provided in Table C-6, but may vary to accommodate the range of observed mineralogical variation.
- Material would be dried, bagged in plastic to prevent oxidation for shipment to a lab.
- Sample would be crushed to passing 3/8" sieve, and then randomly split using established protocol to obtain subsamples for relevant analyses.
- Care would be taken to document elements of sampling and analytical uncertainty.

C.9.6.2 Analytical Methods

Samples would be analyzed using the following methods, or by comparable methods approved in advance by the agencies:

- Whole rock metal content – EPA method 3050B http://www.epa.gov/wastes/hazard/testmethods/sw846/pdfs/3050b.pdf, or ALS Chemex method MEMS41 aqua regia digestion followed by ICP, contact www.alsglobal.com
- Acid Base Accounting (ABA) – modified Sobek Method, after Lawrence and Wang, 1997 http://technology.infomine.com/enviromine/ard/Acid-Base%20Accounting/acidbase.htm#Lawrence Sobek
- Synthetic Precipitation Leachability Procedure – EPA Method 1312, http://www.epa.gov/osw/hazard/testmethods/sw846/pdfs/1312.pdf
- Analyses of effluent from short and long term leach testing (*e.g.*, SPLP, humidity cells, and *in situ* monitoring) would be reviewed to identify constituents of concern at appropriate levels of detection.

C.9.7 Data Analysis

As operational data were collected, they would be summarized in an accessible spreadsheet or database format, and evaluated statistically to evaluate sampling adequacy and modify sampling goals as appropriate. Specifically, the distribution of values would be plotted and standard descriptive statistics would be calculated. The relative adequacy of sampling would be calculated, so that the need for additional sampling could be considered. As a general rule, greater characterization would be needed for material posing more risk to water quality.

Criteria to be used for evaluation of individual sample results include comparison of whole rock analyses with standard crustal abundance for elements of concern and comparison of metal mobility results with water quality standards. Metal concentrations in whole rock cannot be directly correlated with metal mobility due to solubility constraints imposed by the minerals that host the metals.

Acid base account results would be evaluating using the following criteria. Rock that is potentially acid generating has an NNP (calculated as NP minus AP, in units $TCaCO_3$/kTon) less than 20, or an NP/AP ratio of less than 1. Rock that is non-acid generating has an NNP greater than 20 or and NP/AP ratio greater than 3. Values that lie between these values are uncertain and require kinetic testing.

Kinetic tests using ASTM standard method D5744-96 would be conducted for a minimum of 20 weeks testing and terminated only with regulatory approval. For interpretation of the results, guidance is provided in the Global Acid Rock Drainage Guide (International Network for Acid

Prevention 2008) or Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials (Price 2009) for prediction of acid generation and metals mobility potential.

The mass loading analysis (Appendix G) used to predict future water quality would periodically be revised to incorporate new data. Results of this analysis would identify the need to adopt or modify selective handling criteria, if appropriate, to mitigate impact based on consultation between agencies and mine site geology staff. The analysis would be updated prior to start of construction, and every 5 years through mine life, if water quality standards change or if unanticipated changes in water quality were observed.

Data would be reviewed in the context of waste management and risk mitigation strategies, and used to evaluate the most relevant closure strategies (*e.g.*, bulkheads, flooding, etc.). Following completion of the Evaluation Phase, the need to handle material selectively would be reevaluated and criteria for material placement would be established. Where possible, trigger values that would enable mining personnel to identify rock for selective handling or to determine the need for mitigation would be identified. A routine reporting schedule would be developed in consultation with the agencies.

C.10 Water Resources

C.10.1 Introduction and Objectives

MMC and its predecessors have collected and reported ambient surface water and groundwater quantity and quality data as well as aquatic biology data (see Chapter 3). Additional monitoring would be required to supplement this original data collection and provide long-term monitoring for the project. The objective of the monitoring is to provide a long-term assessment of the water resources and groundwater dependent ecosystems that could be affected by the mine. Monitoring would be maintained during the life of the project. Post-mining surface water and groundwater monitoring would be continued for a period of time to be specified by the agencies during review of MMC's Final Closure Plan.

The following monitoring would be implemented in one or more of six phases of the project: Pre-Evaluation, Evaluation, Construction, Operations, Closure, and Post-Closure. The first phase would be a Pre-Evaluation Phase of data collection and monitoring to collect additional data before additional dewatering and extension of the Libby Adit started. Monitoring during the next phase, Evaluation Phase, would be designed to monitor the potential effects of the dewatering of the Libby Adit, and the storage of waste rock at the Libby Adit Site. The activities associated with the Evaluation Phase are described in section 2.5.2 in Chapter 2. Monitoring during the next two phases, Construction and Operations, would generally be the same, except for the addition of sediment monitoring, as discussed during those phases. The Closure Phase would cover the period when mill operations ceased, and site reclamation and closure were implemented. The last phase, Post-Closure, would be the monitoring conducted after the adits were plugged, and reclamation of mine facilities was completed. The objectives described in the following sections apply to facilities proposed in Alternative 3. Objectives would be similar for other alternatives and would reflect the facility location of each alternative. An overview of the hydrology and aquatic biology monitoring locations for Alternative 3 is shown in Figure C-2.

C.10.2 Funding

The Montana Board of Health and Environmental Sciences (the Board of Environmental Review's predecessor) approved a "Petition for Change in Quality of Ambient Waters" to increase the concentration of select constituents in surface water and groundwater above ambient water quality (Appendix A). The Order remains in effect and MMC would be responsible for ensuring compliance with the Order's provisions. One provision of the Order was the requirement that Noranda (now MMC) provide funding to the DHES (now DEQ) so that the DEQ could perform sufficient independent monitoring to verify monitoring performed by Noranda (now MMC). The funding would not exceed the actual cost of the agencies' independent monitoring, and or $35,000 annually, whichever was less (in 1992 dollars).

The monitoring may include independent collection or analysis of surface water, groundwater, or aquatic life samples, independent interpretation of monitoring data, or other activities the agencies deemed necessary to verify MMC's monitoring. Beginning in the year in which additional dewatering and extension of the Libby Adit began, MMC would provide $59,300 annually to the DEQ; $35,000 in 1992 dollars is $59,300 (2014 $), using the Consumer Price Index as the inflation factor. Any funding exceeding the agencies' actual cost would be returned to MMC annually or rolled over for the following year. The funding would increase annually in accordance with the Consumer Price Index. The funding would continue throughout the project until the Post-Closure Phase and final bond release, or the agencies' approval to cease monitoring.

C.10.3 Pre-Evaluation Phase

C.10.3.1 Objective

MMC is maintaining groundwater levels in the Libby Adit at 7,200 feet from the adit portal. Water from the adit is pumped to the surface, treated at the Water Treatment Plant, and then discharged at a MPDES-permitted outfall at the site. The Pre-Evaluation Phase covers monitoring up to when MMC would begin additional dewatering of the Libby Adit. The objectives of data collection and monitoring during this phase are to:

- Characterize groundwater conditions overlying portions of the Libby Adit
- Characterize groundwater quality flowing into the Libby Adit
- Identify and characterize groundwater dependent ecosystems (GDEs) in the upper Libby Creek, upper East Fork Rock Creek, and East Fork Bull River drainages
- Characterize water levels, water supply, and water quality of Rock Lake
- Characterize streamflow and water quality in upper East Fork Rock Creek, and East Fork Bull River
- Characterize flows and water quality of benchmark streams near, but outside of the range of influence of expected mine or adit inflows (such as Bear Creek east of the divide, and Swamp Creek west of the divide)
- Characterize changes in water levels and water quality in benchmark lakes near, but outside of the range of influence of expected mine or adit inflows (such as Wanless Lake)
- Assess effects of discharge of treated water on surface water and groundwater adjacent to the Libby Adit

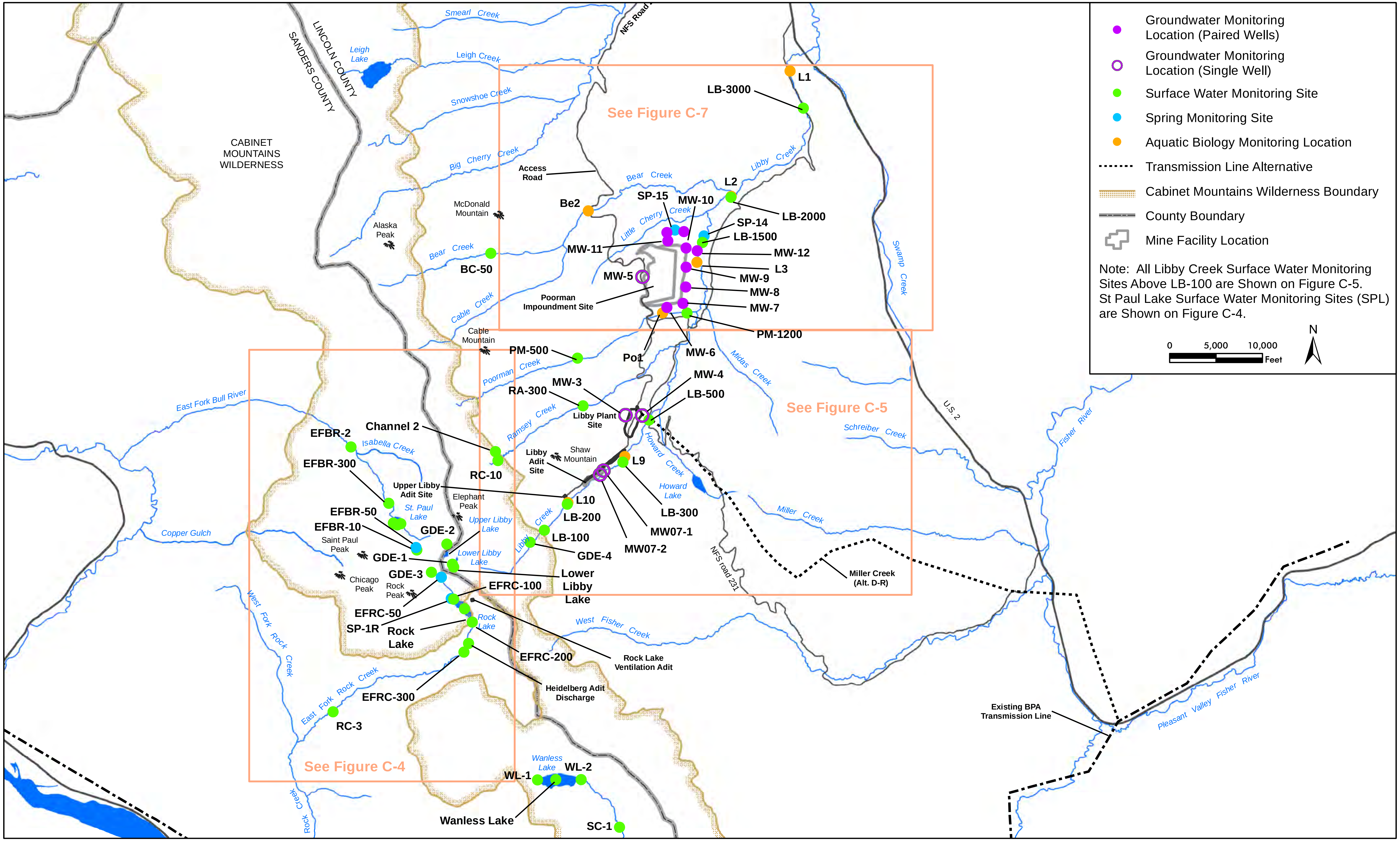


Figure C-2. Current and Proposed Hydrology and Aquatic Biology Monitoring Locations

C.10.3.2 Groundwater Dependent Ecosystem Inventory and Monitoring

C.10.3.2.1 Previous Inventory and Current GDE Monitoring

In 2009, MMC completed a groundwater dependent ecosystem (GDE) inventory focusing on areas at or below about 5,600 feet on the north side of the Libby Creek watershed (Geomatrix 2009a). Additional inventory in the Libby Creek drainage was conducted in 2010. The additional inventory consisted of inventorying GDEs identified in 2009 and the threatened, endangered, and Region 1 sensitive species lists (Geomatrix 2010b). An inventory of other mine areas, such as the Ramsey Creek, East Fork Rock Creek, and East Fork Bull River drainages, was conducted in 2012. Additional areas were inventoried by MMC in 2013, including upper Libby Creek, upper Ramsey Creek and Ramsey Lake, upper East Fork Bull River at and above St. Paul Lake, upper East Fork Rock Creek at and above Rock Lake, and the Libby Lakes basin (MMC 2014b). MMC provided data collected in 2013 and 2014 from GDE sites in the CMW (Klepfer Mining Services 2015a). GDE monitoring completed through 2014 in the CMW is summarized in Table C-7.

MMC completed surveys for wetlands, springs, and perennial and ephemeral streams in the Impoundment Sites in 2005 and 2007 and the Corps issued a preliminary jurisdictional determination for waters of the U.S. at both sites. Surveys for sensitive plants, amphibians, and reptiles also were completed at both sites. No additional GDE inventory of the impoundment sites is needed. In 2011 and 2012, MMC installed and measured water levels in shallow piezometers in wetlands in the Poorman Impoundment Site and the Little Cherry Creek Impoundment Site. Water samples and a snow sample also were collected and analyzed for isotopes.

East Fork Rock Creek

MMC is currently monitoring GDEs in the East Fork Rock Creek and Rock Lake areas (Figure C-4). GDE monitoring activities are:

- Measuring water levels in Rock Lake continuously using a pressure transducer data-logger in the lake and a nearby barometric pressure datalogger (minimum of one data point every hour) and downloading data twice per year (early summer and early fall)
- Measuring water levels using a permanent datum in Rock Lake in early summer and early fall
- Measuring flow and field parameters (pH, specific conductance, dissolved oxygen, and temperature) in Heidelberg Adit discharges in early summer and early fall

Upper Libby Creek

MMC and the KNF currently monitor GDEs and water quality in Libby Creek and Lower Libby Lake (Figure C-5). Monitoring activities are:

- Measuring water levels in Lower Libby Lake using a pressure transducer datalogger in the lake continuously (minimum of one data point every hour) and downloading data twice per year (early summer and early fall)
- Measuring flows and field parameters at seeps side of Lower Libby Lake (GDE-1)
- At the spring/seep complex in upper Libby Creek (located at GDE 4), measuring groundwater levels at two nested piezometer sites and collecting vegetation information annually at transects and quadrants using the Forest Service Level 2 monitoring protocol as a basis for a project specific protocol

Current surface water monitoring is discussed in section C.10.3.3, *Surface Water Monitoring*.

Table C-7. Summary of GDE Monitoring in the CMW.

Site	Dates	Data Collected	Report
Upper Libby Creek			
LB-50 and LB-100	2009-2014 (32x) 2009-2014 (27x)	Flow Field parameters	Geomatrix 2009a, 2010b, 2011d; NewFields 2013a; MMC 2014d; Klepfer Mining Services 2015a
LB-20, LB-30, LB-40, LB-70, and LB-80	2012-2014 (16x) 2012-2014 (14x)	Flow Field parameters	NewFields 2013a; MMC 2014d; Klepfer Mining Services 2015a
GDE-4 (formerly named Spring 8)	2010-2013 2010 and 2012 2010-2014 (7x) 2009-2013 (4x)	Flow and field parameters Isotopes Water levels Wetland indicator species transects	Geomatrix 2009a, 2010b, 2011d; NewFields 2013a; MMC 2014d; Klepfer Mining Services 2015a
Lower Libby Lake	2010-2014 (continuous)	Lake level	
GDE-1	2013	Partial GDE Level 2 inventory	MMC 2014d
Upper Ramsey Creek			
RC-10	2012 2013 (3x)	Flow and field parameters	NewFields 2013a; MMC 2014d
Channel #2	2013	Observation of flow	MMC 2014d
Ramsey Lake	2012 2013 (3x)	Flow and field parameters	NewFields 2013a; MMC 2014d
Upper East Fork Bull River and St. Paul Lake Area			
GDE-2	2013	Partial GDE Level 2 inventory	MMC 2014d
EFBR-10	2013 (1x)	Field parameters	MMC 2014d
EFBR-50	2013 (4x) 2013-2014 (continuous)	Field parameters Stage	MMC 2014d
EFBR-2 and EFBR-300	2013-2014	Flow and field parameters	Klepfer Mining Services 2015a
SPL-1 SPL-4 SPL-9 SPL-11	2012 (1x) 2013 (2x) 2013 (2x) 2013 (1x) 2013 (2x)	Flow and field parameters Flow and field parameters Isotopes (one time excluding SPL-9)	Kline Environmental Research and NewFields 2012 MMC 2014d
Upper East Fork Rock Creek and Rock Lake Area			
EFRC-50	2012 (2x) 2013 (1x)	Flow and field parameters Isotopes	NewFields 2013a; MMC 2014d
SP-1R	2012 (2x) 1999	Flow and field parameters Isotopes	NewFields 2013a; MMC 2014d
EFRC-100 and EFRC-200 (Rock Lake inlet and outlet)	2010-2012 (2x/year) 2009-2014 (4x/year) 2013	Flow and field parameters Water quality parameters Isotope	Geomatrix 2009a, 2010b, 2011d; NewFields 2013a; MMC 2014d; Klepfer Mining Services 2015a

GDE-3	2013 2013 (1x)	Partial GDE Level 2 inventory Isotope	MMC 2014d
Rock Lake	2009-2014 (continuous)	Lake level	Geomatrix 2009a, 2010b, 2011d; NewFields 2013a; MMC 2014d; Klepfer Mining Services 2015a
Benchmark Sites			
BC-50 (Bear Creek)	2013-2014 (6x) 2013 (4x) 2013-2014 (continuous)	Flow and field parameters Water quality parameters Stage	Klepfer Mining Services 2015a
Wanless Lake	2013-2014 (continuous)	Lake level	Klepfer Mining Services 2015a
WL-2 (Wanless Lake)	2013 (3x)	Water quality parameters	Klepfer Mining Services 2015a
SC-1 (Swamp Creek)	2013 (4x) 2013 (1x)	Flow and field parameters Water quality parameters	Klepfer Mining Services 2015a

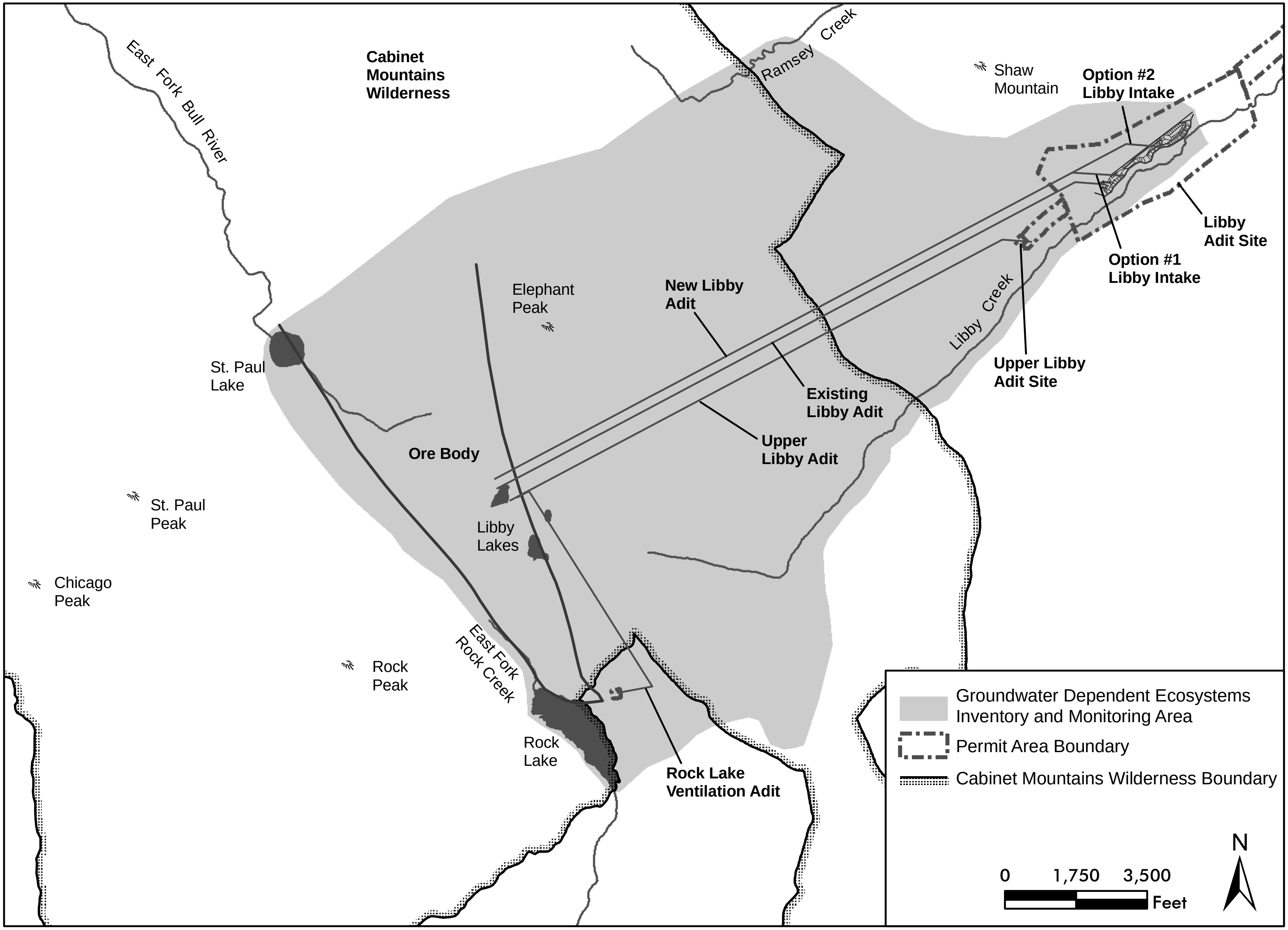


Figure C-3. Groundwater Dependent Ecosystems Inventory and Monitoring Area

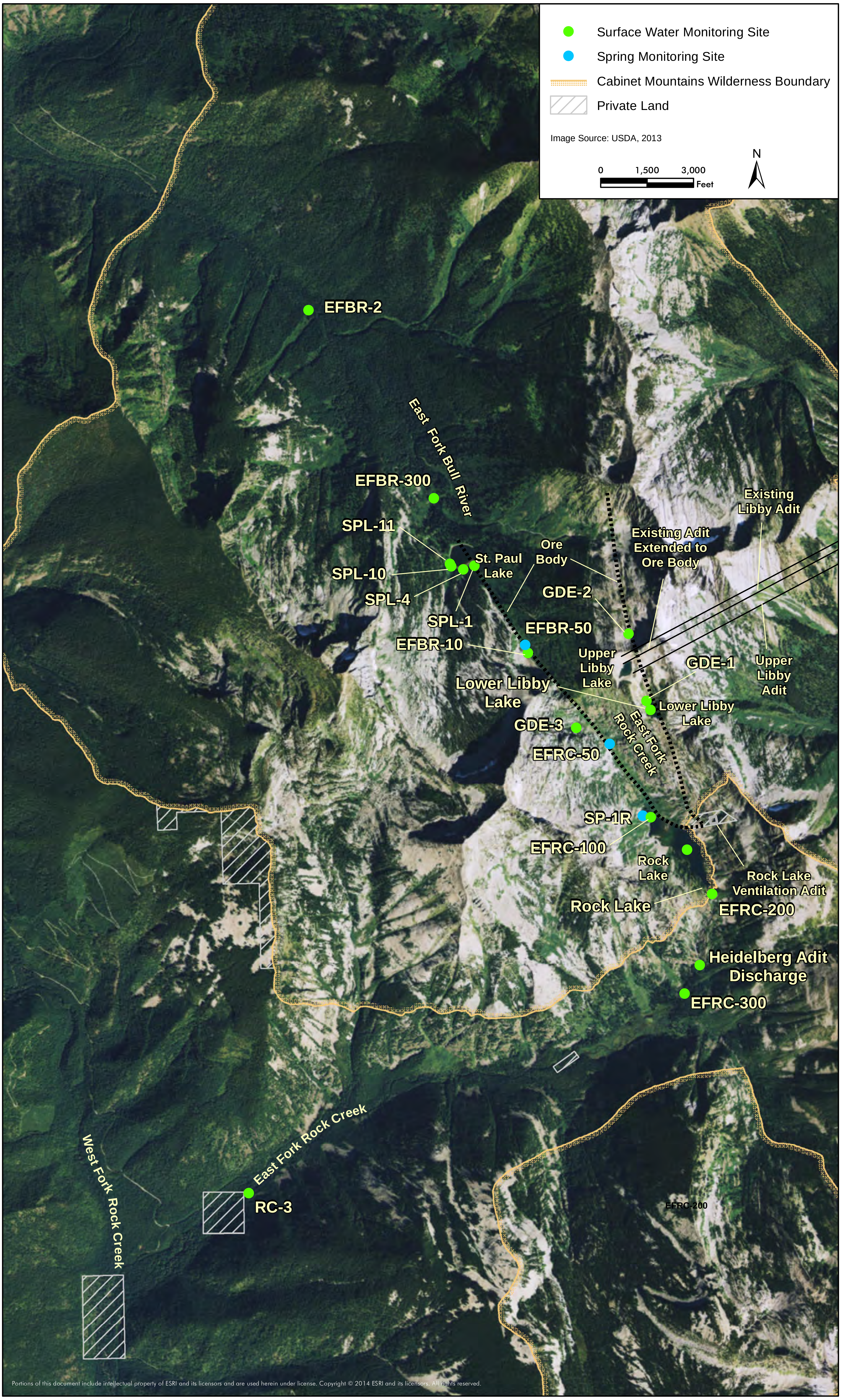


Figure C-4. Current and Proposed Hydrology and Aquatic Biology Monitoring Locations in Mine Area

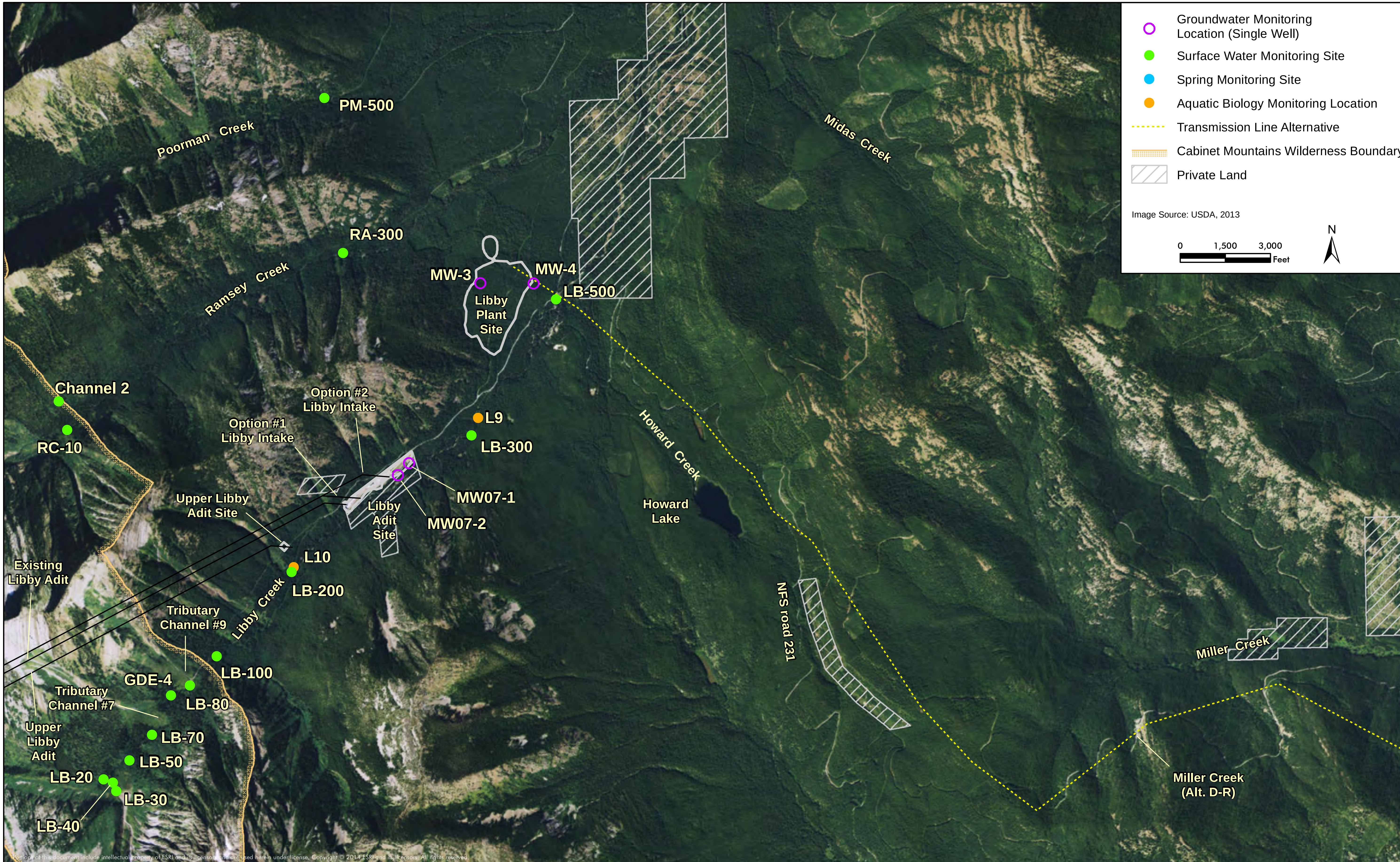


Figure C-5. Current and Proposed Hydrology and Aquatic Biology Monitoring Locations in Upper Libby Creek

C.10.3.2.2 Continued GDE Monitoring

GDE monitoring currently being conducted would continue. Additional GDE monitoring would have locations and frequency specified based on inventory data and on the local hydrogeology and proximity to the mine or adit void. MMC would submit to the agencies for approval a GDE Monitoring Plan for important GDEs found during the inventory. The plan would be incorporated into an overall Water Resources Monitoring Plan. The plan's objective is to effectively detect stress to flora and fauna from effects on surface water or groundwater due to mine dewatering so that mitigation could be implemented to minimize such stress. The plan would be submitted to the agencies for approval after the GDE inventory was completed and early enough for at least 1 year of data to be collected before additional dewatering and extension of the Libby Adit started. The plan would include piezometers in critical locations. The plan would include a monitoring schedule, potential mitigation measures, and identification of possible mitigation implementation triggers if stress to flora and fauna is detected and determined to be a result of mine dewatering. The results of the initial inventory, subsequent inventories, and monitoring would be reported in annual reports to the agencies.

Springs

The most accurate site-specific method for measuring spring flow would be used. Any spring with a measurable flow would be assessed for its connection to a regional groundwater system, based on flow characteristics (*e.g.* possible short-term sources of water supply, such as nearby late-season snowfields or recent precipitation), water chemistry, and the hydrogeologic setting (associated geology such as the occurrence or absence of colluvium or alluvium).

In addition to identifying springs in the GDE inventory area, MMC would locate and monitor springs outside of the area potentially affected by mine dewatering or other activities for use as benchmark springs. The number of springs to be monitored would be determined following completion of the initial GDE inventory. Springs would be categorized and benchmark springs chosen based on location (west side of the Cabinets and east side of Cabinets), altitude, and hydrogeologic setting. The flow of each spring would be measured between mid-August and mid-September during a time of little or no precipitation. The springs would be used for evaluating compliance with action levels.

Wetland and Riparian Vegetation

At each critical GDE wetland, fen and riparian area habitat identified from the inventory, a vegetation survey using the Forest Service Level 2 Sampling Protocol for GDEs (USDA Forest Service 2012b) would be completed. Initial survey data would include site photos and points, GPS site locations, basic site descriptors, and plant species composition, focusing on hydrophytes (plants that are able to live either in water itself or in moist soils).

Streamflow

The most accurate site-specific method for measuring stream flow would be used. Measurements would be taken so that gaining stream reaches could be mapped, and then monitoring locations would be refined to focus on gaining reach lengths and flow. An example of how to determine if stream segments are gaining water from the regional groundwater system is to collect synoptic flow measurements within as short a time period as possible at short intervals along the stream segments within the inventory area. Streams would be assessed for their connection to a regional groundwater system based on flow measurements, water chemistry, the associated hydrogeology, such as faults or the occurrence or absence of colluvium and/or alluvium, and possible short-term sources of water supply, such as nearby late-season snowfields or recent precipitation.

C.10.3.3 Surface Water Monitoring

C.10.3.3.1 On-going Discharge Monitoring

MMC is currently pumping water from the Libby Adit to the surface, treating it at the Water Treatment Plant, and then discharging it at a MPDES-permitted outfall at the site. MMC is collecting monthly or quarterly samples from Outfall 001 and LB-300 for flow rate, temperature, nutrients, metals, and other parameters. The on-going monitoring would continue during subsequent phases as long as there was a discharge of any mine drainage or process water to any MPDES-permitted outfall. Monitoring requirements described in any permit revision would be incorporated into the monitoring.

C.10.3.3.2 Benchmark Stream, Lake, and Spring Sites

It may be difficult to separate the effects of mine dewatering and other activities that could affect streamflow, spring flow, or the volume and water level of Rock Lake from natural variability and the effects of climate change. For this reason, benchmark sites located outside of the area potentially affected by the Montanore mine (Figure C-2) would also be monitored beginning during the Pre-Evaluation Phase and continuing through all phases or until agreed upon by the agencies that it was no longer necessary. Monitoring would begin at least 1 year before extending the Libby Adit to beneath the ore zone. MMC would locate and monitor springs outside of the area potentially affected by mine dewatering or other activities during the GDE inventory. Springs would be categorized and benchmark springs chosen based on location, elevation, and hydrogeologic setting.

Benchmark springs would be chosen based on location, elevation, water quality, and hydrogeologic setting. Benchmark streams would be chosen based on physiography (size, shape, slope, and aspect), gradient, stream type, climate, vegetation, geology, water quality, and land use. Benchmark sites would be monitored for flow and water quality as soon as they are chosen to determine if they are comparable to surface water sites affected by the mine, and then for at least 1 year prior to expansion of the Libby Adit. The agencies chose two streams for monitoring as benchmark streams, one in the Libby Creek watershed (Bear Creek), and one on the west side of the mountain divide (Swamp Creek), as examples of possible benchmark streams. Different sites and additional sites near the project area may be chosen for monitoring that would be benchmark locations for other stream types and hydrologic regimes. Benchmark sites would represent different stream types within the project area. The Bear Creek location, BC-50, is in upper Bear Creek at an elevation similar to LB-200 on Libby Creek and RA-200 on Ramsey Creek. The Bear Creek watershed above BC-50 is similar to the nearby watersheds of Poorman, Ramsey, and Libby creeks in physiography (size, shape, slope, and aspect), gradient, stream type, climate, vegetation, geology, and land use. The Swamp Creek location, SC-1, located in upper Swamp Creek below Wanless Lake, is near the East Fork Rock Creek, and is at an elevation similar to EFRC-300 below Rock Lake. The Swamp Creek watershed above SC-1 is similar to the nearby East Fork Rock Creek watershed above EFRC-300 in physiography (except for aspect), gradient, stream type, climate, vegetation, geology, and land use, and both have lakes (Rock Lake and Wanless Lake) above them. Swamp Creek drains Wanless Lake, which would be used as a benchmark lake for Rock Lake. Wanless Lake is slightly larger and has a slightly larger watershed than Rock Lake, but it is at a similar elevation, has similar topography, is located within the Revett formation, is bisected by the Rock Lake fault, and is within the 3D groundwater model domain. Monitoring at the benchmark sites would be the same and would occur at the same time and frequency as monitoring at the comparable sites with the area influenced by the mine. Bear Creek, Swamp Creek, and Wanless Lake would also be used for evaluating compliance with action levels.

C.10.3.3.3 Other Surface Water Monitoring

Past Monitoring

MMC completed a synoptic flow event along upper Libby Creek in September 2010. MMC also completed synoptic flow measurements in this same area on September 13, 2012. In 2010, streamflow was measured at LB-50, LB-100, and LB-200), as well as immediately upstream and downstream of the tributary channels entering Libby Creek. Flow also was measured in the tributary channels, if present. Additional measurements of Libby Creek also were completed between LB-50 and LB-100, and upstream of LB-50. Field parameters of pH, specific conductance, dissolved oxygen, and temperature were measured at selected sites. MMC also surveyed tributary channels #7 and #9 up to about 5,600 feet to determine if any springs were in the upper channel areas (Figure C-5).

Future Monitoring

In addition to monitoring required by the MPDES permit, MMC is conducting the following monitoring (Figure C-5). This monitoring would continue during the Pre-Evaluation Phase or would begin at that time:

- In the Pre-Evaluation Phase and all subsequent phases, collecting flow measurements using the most accurate site-specific method available at EFRC-50, EFRC-100, EFRC-200, RC-3, EFBR-300, EFBR-2 and the Swamp Creek site at the same time every year for the purpose of establishing long-term trends (on or about July 10, August 10, September 10 and October 10)
- In the Pre-Evaluation Phase and all subsequent phases, collecting water quality samples at EFRC-100 and EFRC-200 at the same time every year for the purpose of establishing long-term trends (on or about July 10, August 10, September 10 and October 10) of parameters listed in Table C-10 and Table C-11; complete the same sampling at the inlet and outlet of Wanless Lake
- Sampling Rock Lake and Wanless Lake as described in the following paragraph
- Measuring flow at spring SP-1R site in early summer and late fall
- Measuring streamflow synoptically and analyzing field parameters (Table C-10) at LB-20, LB-30, LB-40, LB-50, LB-70, LB-80, LB-100, LB-200, LB-300, LB-500 on Libby Creek and at frequent intervals on the East Fork Rock Creek from the headwaters to the confluence with the West Fork Rock Creek, and at frequent intervals on the East Fork Bull River from the headwaters to just below the confluence with the North Fork of the East Fork Bull River every two weeks from July 1 to October 15
- Measuring water stage in Libby Creek at LB-200 and continuous flow using a pressure transducer datalogger (minimum of one data point every hour) and downloading data twice per year (early summer and early fall)

- Collecting samples from LB-100, LB-200, LB-300, and LB-500 for field parameters (Table C-10) and analysis of major cations, nutrients, and metals (Table C-11), on a routine basis; complete the same sampling in the Pre-Evaluation Phase and all subsequent phases at the benchmark stream sites.

During the Pre-Evaluation Phase and during all subsequent phases, MMC would sample Rock Lake water quality monthly during July through October by vertical profile sampling, with an optimum of three sampling periods per season. A temperature/dissolved oxygen profile would be collected before any water quality samples were collected. Samples would be collected at the center of the lake from the epilimnion (upper, warmest layer of a stratified lake) and the hypolimnion (cooler, bottom layer of a lake). Samples would be analyzed for all parameters in Table C-11 except metals. A sample from a 5-foot depth would be analyzed for chlorophyll-a, or if bottom of the epilimnion was less than 5 feet based on the temperature/dissolved oxygen profile, would be collected at a shallower depth within the epilimnion. A secchi disk would be used to measure water clarity. USDA Forest Service field sampling and data analysis protocols would be followed (USDA Forest Service 2012c). Wanless Lake, the possible benchmark lake for Rock Lake, or any other possible benchmark lakes would be sampled in the same way during the same sample event. MMC would install pressure transducer dataloggers at the inlet to Wanless Lake and in Wanless Lake or any other possible benchmark lakes during the Pre-Evaluation Phase to monitor inflow and lake levels continuously (minimum of one data point every hour), and would measure outflows from Wanless Lake or any other possible benchmark lakes during the same period such measurements were collected at Rock Lake.

During the Pre-evaluation Phase, MMC would collect sufficient streamflow measures at LB-200 and benchmark site BC-50 on Bear Creek or other corresponding benchmark site (a minimum of 8 times per year during the increasing, peak and decreasing limb of the hydrograph and during low flows) to establish a stage/discharge relationship. After sufficient streamflow measures had been obtained, MMC would continuously record stage.

C.10.3.4 Groundwater Monitoring

MMC collected 1 year of monitoring data beginning in September 2010 and initiated monitoring in 2013 with significantly reduced monitoring frequency to limit the amount of redundant data collected and managed. In 2010, MMC collected representative samples from inside the Libby Adit (*e.g.* at 5,200-foot level) and from the spring at site 8 along upper Libby Creek and analyzed them for oxygen-18, deuterium, and tritium.

For water quality, samples are collected monthly at the raw water holding tank (sample ID: RAW-1) at the Libby Water Treatment Plant and at wells MW07-1 and MW07-2, and analyzed for the parameters shown in Table C-12. Monitoring at wells MW07-1 and MW07-2 would continue during subsequent phases whenever discharges from the Water Treatment Plant occurred. Water quality monitoring associated with the Libby Adit discharge would continue during the Pre-Evaluation Phase.

C.10.4 Evaluation Phase

C.10.4.1 Objectives

During the Evaluation Phase, MMC would dewater the existing Libby Adit to its full length and extend it to beneath the ore body. MMC would collect additional information about the deposit, as well as geotechnical, geochemical, and hydrological data to support a bankable feasibility study. Building on the inventory and monitoring completed during the Pre-Evaluation Phase, the objectives of monitoring during the Evaluation Phase are to:

- Monitor and characterize groundwater overlying the Libby Adit between the current dewatered location and the ore body
- Monitor and characterize the quality of groundwater entering the Libby Adit
- Characterize groundwater adjacent to the Rock Lake and Snowshoe faults
- Establish a relationship between establish a relationship between streamflow and wetted perimeter at one site each in the East Fork Rock Creek and East Fork Bull River drainages
- Assess potential effects on surface resources of additional dewatering of the Libby Adit
- Assess potential effects on GDEs in the upper Libby Creek, East Fork Rock Creek, and East Fork Bull River drainages
- Assess potential effects on Rock Lake, and upper East Fork Rock Creek, and East Fork Bull River drainages
- Assess potential effects of treated water discharge on surface water and groundwater adjacent to the effluent discharge points
- Characterize groundwater quality at the Libby Plant Site, Poorman Impoundment Site, and the Libby Loadout

C.10.4.2 Groundwater Dependent Ecosystem Monitoring

GDE monitoring currently being conducted and any additional GDE monitoring implemented during the Pre-Evaluation Phase would continue. The monitoring required as a result of the Pre-Evaluation Phase GDE inventory would be implemented. Criteria required to decide which characteristics to monitor are traits that: 1) *have a defined relationship with groundwater levels:* there needs to be confidence that a measured response within a parameter reflects altered ground-water levels rather than other abiotic/biotic factors; 2) *are logistically practical*: parameters should be practical to measure within the constraints of a wilderness setting; parameters that reflect landscape responses by GDEs of wide distribution, such as remote sensing of hydrophytic vegetation health, could be considered; and 3) *have early warning capabilities*: it is important to consider the lagtime between changed groundwater levels and environmental condition or health. The response of vegetation parameters influenced by changed groundwater levels can take a long time to become manifested and further reductions may occur before impacts of previous changes are realized; consequently, parameters with rapid responses are favored (*e.g.* groundwater levels in piezometers), as they provide advanced warning of significant stress or degradation on the system, as well as providing the opportunity to determine whether intervention or further investigation is required. Nevertheless, some GDE values may have to be measured through parameters with a greater lag time (*e.g.* hydrophytic vegetation community composition).

Table C-8 identifies the specific monitoring options for GDEs in the inventoried area. After the initial survey, this table would help to establish the methods that would be used to monitor GDEs. Additional monitoring of GDEs may be required, depending on the outcome of the GDE inventory.

Table C-8. Groundwater Dependent Ecosystem Monitoring Options.

Surface Resource Component	Look For:	Using:
Springs, Lakes, and Streams	Flow changes	Flow monitoring – continuous stage recording station and/or stream flow measurements
	Wetted perimeter/stage changes	Channel cross-section measurements
	Lake level changes	Continuous level recorder
	Groundwater level changes	Piezometers
Wetland and Riparian Vegetation	Groundwater level changes	Piezometers
	Dieback, early desiccation, habitat decline	Photo points, field surveys, remote sensing
	Soil moisture stress	Tensiometers
	Plant water potential/ turgor pressure changes	Pressure bomb technique
Amphibians, Mollusks, Macroinvertebrates, Fish	Population decline, community composition change	Field surveys
Terrestrial animals	Population/usage decline	Field surveys

Springs

In addition to the spring at site 8 along upper Libby Creek, the flow in any spring within the GDE monitoring area (Figure C-3) determined by the agencies to be supported by the regional groundwater system or whose connection to the deep bedrock groundwater might be uncertain would be measured annually between mid-August and mid-September during a period of little or no precipitation. Parameters shown in Table C-10 would be collected. During flow measurements, observations regarding possible short-term sources of water supply, such as nearby late-season snowfields, would be made. A spring that was determined by the agencies, after repeated flow measurements, not to be connected to the deep bedrock groundwater may be eliminated from additional monitoring.

Wetland or Riparian Areas

Monitoring of wetland and riparian areas would depend on the nature and location of the wetland or riparian area, and generally would include vegetation cover (woody, herbaceous, and bryophtyes), and groundwater level measurements. Level 2 GDE vegetation protocols would be used at GDEs.

Streamflow

Streamflow measurements are discussed in the following section on Surface Water Monitoring. For streams within the GDE monitoring areas determined to be supported by the regional groundwater system or whose connection to the regional groundwater system might be uncertain, such stream segments would be measured every two weeks between July 10 and October 10 each year using the most accurate site-specific method available. If the agencies determine, after repeated flow measurements, that a stream segment is not connected to the regional groundwater system, such locations may be given a reduced measurement cycle or eliminated from additional monitoring.

At EFBR-2 and RC-3, which are important aquatic life sites, MMC would collect streamflow and cross-section measurements during low flow periods to calculate wetted perimeters at these sites and establish a relationship between streamflow and wetted perimeter. At least 4 sets of measurements one or more weeks apart would be collected for 2 years during low flows (mid-August to mid-October). The data would be submitted for agency approval prior to the agencies approving the Construction Phase. The method for the field measurements and establishing this relationship used by the Forest Service is provided by Montana FWP (Nelson 1989). If the channels at either location were altered by large flow events after the initial relationship was established, MMC would collect new data to re-establish the wetted perimeter-discharge relationships at the affected location.

C.10.4.3 Surface Water Monitoring

Surface water monitoring would be required for the purpose of detecting water quality impacts from mine facilities and detecting flow changes due to mine dewatering. Locations, frequency, and the purpose of surface water monitoring locations are listed in Table C-9. New monitoring locations would be developed in collaboration with the agencies. Flow and field parameters shown in Table C-10 would be measured at monitoring locations in the upper part of various drainages. For locations where water stage would be measured with continuous electronic recording, the measuring device would also measure temperature continuously, and be capable of measuring low stages, and remain in place during high stage events. For continuously recorded sites, MMC would collect sufficient streamflow measurements (a minimum of 8 times per year during the increasing, peak and decreasing limb of the hydrograph and during low flows) to establish a stage/discharge relationship. It is from the established stage/discharge relationship that the 10% accuracy for flow measurements would be determined. Continuous temperature recording would follow DEQ's temperature data logger protocols (DEQ 2005b).

Parameters to be sampled for and analyzed at each surface monitoring location where quality was the focus are provided in Table C-11. Dissolved metal analyses (except for aluminum) are not needed because sufficient dissolved metals data have been collected at monitoring sites in Libby Creek during baseline monitoring. Laboratory analytical methods would conform to those listed in 40 CFR 136. Laboratory reporting limits would comply with the Required Reporting Values found in the most current Montana water quality standards (Circular DEQ-7; DEQ 2012a). The Required Reporting Value is DEQ's selection of a laboratory reporting limit that is sufficiently sensitive to meet the most stringent numeric water quality standard (DEQ 2012a). For parameters without a Circular DEQ-7 required reporting value, the achievable reporting limits from USDA Forest Service. 2012c, Table 3-1 would be used. If data collected under this plan were to be used for compliance purposes for the MPDES permit, minimum limits specified in the MPDES permit must be achieved. Flow measurements would be made using the most accurate site-specific method available and appropriate for the site.

Table C-9. Surface Water Monitoring Locations—Evaluation Phase.

Station	Location	Parameters	Frequency	Purpose
East Fork Rock Creek Drainage				
EFRC-50	Just below SP-41	Stage/flow; field parameters (Table C-10)	Continuous electronic recording for stage/flow; field parameters on or about 7/10, 8/10, 9/10, 10/10	Monitor mine dewatering
EFRC-100	Inflow to Rock Lake	Stage/flow (Table C-10)	Continuous electronic recording	Monitor mine dewatering
		Quality (Table C-11)	On or about 7/10, 8/10, 9/10, 10/10	
Rock Lake	Near south end of lake	Lake stage	Continuous electronic recording	Monitor mine dewatering
	Vertical profile sampling at center of lake	Quality (Table C-11 except metals)	On or about 7/10, 8/10, 9/10, 10/10	
EFRC-200	Below Rock Lake where measurable, such as at exposed bedrock slightly downstream from lake	Flow (Table C-10)	On or about 7/10, 8/10, 9/10, 10/10	Monitor mine dewatering
		Quality (Table C-11)	On or about 7/10, 8/10, 9/10, 10/10	
EFRC-300	Upstream of Rock Creek Meadows	Flow, field parameters (Table C-10)	On or about 7/10, 8/10, 9/10, 10/10	Monitor mine dewatering
RC-3	Upstream of confluence with West Fork Rock Creek	Flow (Table C-10), channel cross-section measurements	Flow on or about 7/10, 8/10, 9/10, 10/10, and flow/cross-section measurements at least 4 times/yr during mid-August to mid-October	Monitor mine dewatering
Heidelberg Adit	Below Rock Lake	Flow (Table C-10)	On or about 7/10, 9/10	Monitor mine dewatering
	Additional GDE sites	To be determined	To be determined	Monitor mine dewatering
East Fork Bull River Drainage				
EFBR-50	Just below SP-42	Stage/flow; field parameters (Table C-10)	Continuous electronic recording for stage/flow; field parameters on or about 7/10, 8/10, 9/10, 10/10	Monitor mine dewatering
EFBR-300	At base of steep slope below St. Paul Lake where measurable	Flow, field parameters (Table C-10)	On or about 7/10, 8/10, 9/10, 10/10	Monitor mine dewatering
EFBR-2	Just downstream Isabella Creek confluence	Flow (Table C-10), channel cross-section measurements	Flow on or about 7/10, 8/10, 9/10, 10/10, and flow/cross-section measurements at least 4 times/yr during mid-August to mid-October	Monitor mine dewatering
		Quality (Table C-11)	On or about 9/10	
	Additional GDE sites	To be determined	To be determined	Monitor mine dewatering

Station	Location	Parameters	Frequency	Purpose
Libby Creek Drainage				
Lower Libby Lake	Near outlet	Lake stage	Continuous electronic recording	Monitor mine dewatering
LB-20, LB-30, LB-40, LB-50, LB-70 LB-80, LB-100	Upstream of Wilderness boundary	Flow (Table C-10)	Every two weeks 7/1-10/15	Monitor mine dewatering
GDE 4	Upstream of Wilderness boundary	Level 2 GDE vegetation protocol	Annual	Monitor mine dewatering
		Water levels	Monthly 7/15-10/15	
LB-200	Upstream of Libby Adit	Stage/flow/ temperature	Continuous electronic recording	Monitor mine dewatering
		Quality (Table C-11) or as specified by MPDES permit	On or about 7/10, 8/10, 9/10, 10/10 or as specified by MPDES permit	
LB-300	Upstream of Howard Creek confluence	Stage/flow/ temperature	Continuous electronic recording	Monitor Libby Adit Site and Water Treatment Plant discharges
		Quality (Table C-11) or as specified by MPDES permit	On or about 7/10, 8/10, 9/10, 10/10, or as specified by MPDES permit	
LB-500	Near Libby Plant Site	Quality (Table C-11)	On or about 7/10, 8/10, 9/10, 10/10	Monitor Libby Adit Site and Libby Plant Site
Possible Benchmark Sites (Outside of Mining Influence)				
SC-1	Swamp Creek downstream of Wanless Lake	Flow (Table C-10)	On or about 7/10, 8/10, 9/10, 10/10	Monitor natural variability and climate change
		Quality ((Table C-11)	On or about 9/10	
BC-50	Bear Creek downstream of Wilderness boundary	Stage/flow Quality (Table C-11)	Continuous electronic recording On or about 7/10, 8/10, 9/10, 10/10	Monitor natural variability and climate change
Wanless Lake	To be determined Vertical profile sampling at center of lake	Lake stage	Continuous electronic recording	Monitor natural variability and climate change effects
		Quality (Table C-11 except metals)	On or about 7/10, 8/10, 9/10, 10/10	
WL-1	Inlet to Wanless Lake	Stage/flow	Continuous electronic recording	Comparison to EFRC-100
		Quality (Table C-11)	On or about 7/10, 8/10, 9/10, 10/10	
WL-2	Outlet from Wanless Lake	Stage/flow	Continuous electronic recording	Comparison to EFRC-200
		Quality (Table C-11)	On or about 7/10, 8/10, 9/10, 10/10	

Whole Effluent Toxicity (WET) testing would also be required quarterly for Outfalls 001 to 003. In the draft renewal MPDES permit, the DEQ preliminarily determined that the discharge from the Water Treatment Plant has a reasonable potential to violate numeric or narrative criteria prohibiting toxicity to humans or aquatic life. The WET test uses the most sensitive local or economically important species to implement aquatic life prohibition of toxicity in state waters. In the draft renewal MPDES permit, the effluent limitations for chronic toxicity were for *Ceriodaphnia dubia* and *Pimephales promelas.* If toxicity occurred in a routine WET test, an additional test would be conducted within 14 days of the first test, and if toxicity again occurred, WET testing would increase to monthly and additional testing would be required to determine the cause of the toxicity of the tested organisms. The final MPDES permit will contain final WET testing requirements.

Table C-10. Flow and Field Parameters for Surface Water Samples and Required Reporting Values.

Parameter	Current Required Reporting Value
Flow (cfs or gpm)	Within 10% accuracy
pH (s.u.)	0.1
Dissolved Oxygen (mg/L)	0.3
Specific Conductivity (μS/cm)	1.0
Turbidity (NTU)	1.0
Temperature (° F)	0.1

See note to Table C-11.

Table C-11. Monitoring Parameters and Required Reporting Values for Surface Water Samples.

Parameter	Current Required Reporting Value (mg/L unless otherwise specified)	Parameter	Current Required Reporting Value (mg/L)
Physical Parameters			
Flow (cfs or gpm)	Within 10% accuracy	Temperature	0.1
pH (s.u.)	0.1	Total alkalinity (as $CaCO_3$)	0.26
Dissolved oxygen	0.3	Total hardness (as $CaCO_3$)	1.0
Specific conductivity (μS/cm)	1.0	Turbidity (NTU)	1.0
Oil and grease	1.0		
Inorganic Parameters			
Total dissolved solids	1.0	Total Kjeldahl nitrogen	0.15
Total suspended solids	0.4	Nitrate, as N	0.02
Sodium	0.03	Nitrite, as N	0.01
Calcium	0.08	Nitrate+nitrite, as N	0.02
Magnesium	0.02	Ammonia, as N	0.07
Potassium	0.05	Total inorganic nitrogen	0.01
Bicarbonate	1.0	Total nitrogen	0.15
Chloride	0.1	Total phosphorus, as P	0.004
Sulfate	0.2	Ortho-phosphate	0.001
Silica	0.4		
Metals			
Aluminum, dissolved (0.45 μm filter)	0.009	Lead	0.0003
Antimony	0.0005	Manganese	0.005
Arsenic	0.001	Mercury	0.000005
Beryllium	0.0001	Nickel	0.001
Cadmium	0.00003	Silver	0.0002
Chromium	0.01	Thallium	0.0002
Copper	0.002	Zinc	0.008
Iron	0.02		

Note: Metals are total recoverable unless otherwise specified. For parameters without a Circular DEQ-7 (DEQ 2012a) required reporting value, the achievable reporting limits shown are from USDA Forest Service (2012c, Table 3-1). Required reporting values may differ from MPDES permit reporting levels. Any reporting values in Table C-10 or Table C-11 lower than MPDES permit Reporting Levels would meet USDA Forest Service requirements.

C.10.4.4 Groundwater

Groundwater monitoring would be required for the purpose of detecting potential water quality impacts from mine facilities and for detecting potential groundwater level changes from the underground mine and adits. A summary of all groundwater monitoring requirements are shown on Table C-12.

C.10.4.4.1 Mine Area Locations and Frequency

Piezometers

Because the mine workings (mine void and adits) would be located over a large area mostly beneath the CMW, the most efficient means for obtaining groundwater level data would be from within the mine voids. Numerous piezometers would be required. MMC would submit a plan for the installation of piezometers to be approved by the agencies.

During the dewatering of the Libby Adit, an array of small diameter boreholes would be installed from within the Libby Adit, and instrumented with continuous recording pressure transducers. In general, the boreholes would be drilled in a radial or fan pattern from the mine workings so that the degree of heterogeneity could be assessed as heads change in the fractures surrounding the mine. Each drill station would consist of two boreholes, drilled about 30 degrees from the horizontal from drift, 180 degrees apart, and a third borehole drilled vertically upward from the drift (Figure C-6). Boreholes to be drilled vertically upward from the drift are indicated in Figure C-6 with a "v" symbol. Because the intent of the underground piezometers is to obtain pre-mining pressure data and to track drawdown as MMC dewatered the mine void, the piezometers would be drilled out in front of the existing working face. At each station, the two inclined piezometers would be drilled from a cutout as close to the working face as possible without causing risk to the piezometers during subsequent blasting. The piezometers would be equipped with pressure recording devices before the drift or adit would be advanced. The locations shown on Figure C-6 or a similar approved pattern would be required to assess the variability in fracture spacing; additional piezometers would be installed when fractures transmitting higher flow rates are encountered (>25 gpm).

The first station would be located at the current terminus of the partially dewatered Libby Adit (about 14,000 feet from the portal). The purpose of these piezometers is to start recording water levels as soon as possible after dewatering the existing adit. Water levels in the fractures in the surrounding rock would begin responding as soon as dewatering began, and would be monitored at that time, rather than waiting until the extension of the adit. These piezometers would record hydraulic response as the adit was extended with the associated dewatering. A second station in the Libby Adit would be about 1,500 feet from the current terminus. All subsequent monitoring stations, as shown in Figure C-6, could use planned exploration boreholes so no additional boreholes would be required for piezometer installation.

The groundwater pressure would be continuously recorded using either a transducer with a built in datalogger or with separate transducers and dataloggers. The data would be recorded at least hourly and would be downloaded at least quarterly to ensure proper operation of the equipment, status of battery power for the dataloggers, and to establish groundwater pressure trends.

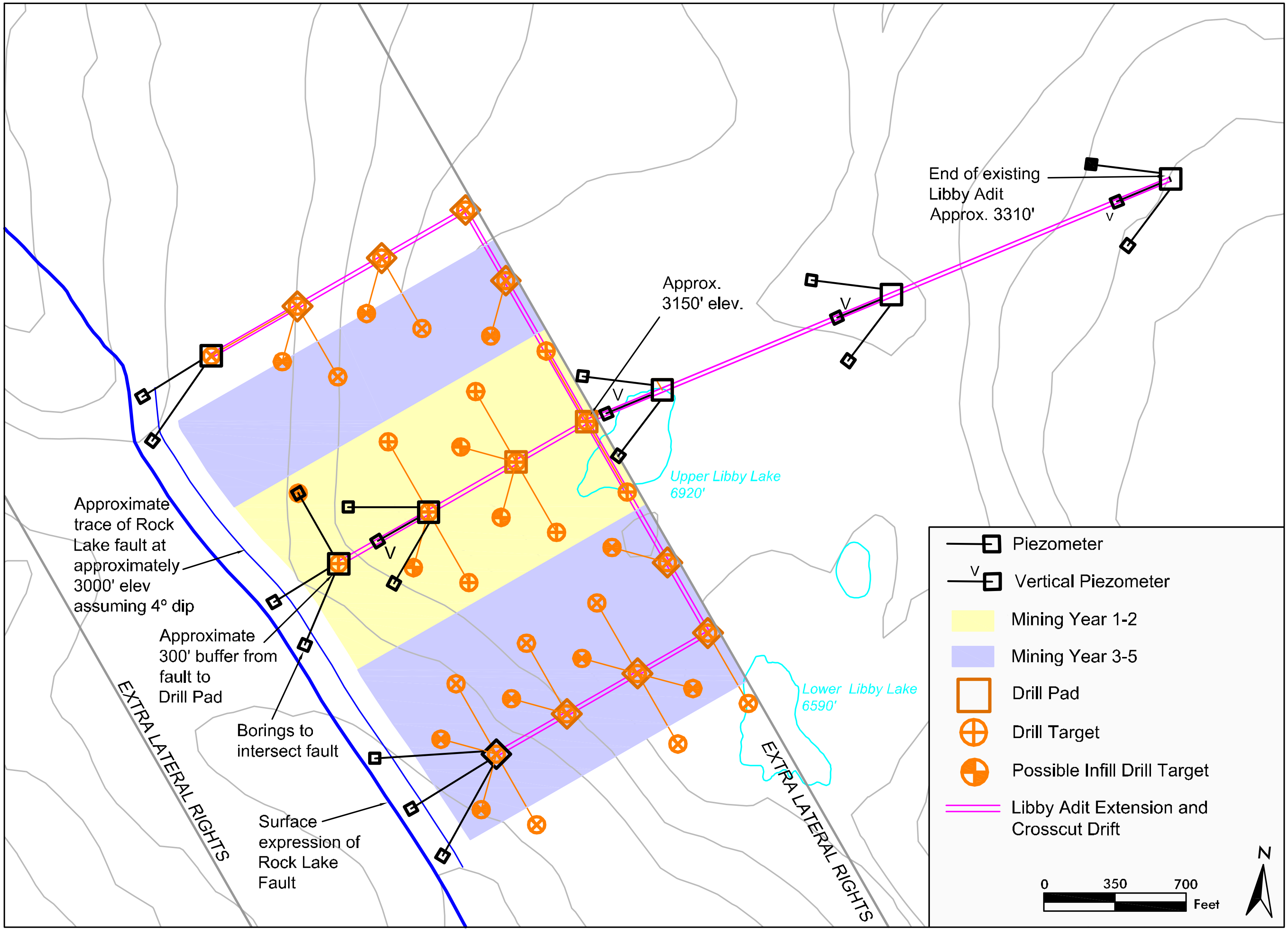


Figure C-6. Proposed Underground Piezometers

The location and number of sites would be determined after reviewing water level data collected during the first 2 years to evaluate any response of the groundwater system to dewatering and to determine whether the existing monitoring network density was sufficient. A plan would be developed for the additional piezometers to be installed in the remainder of the underground mine production area based on information gathered from the Evaluation Phase. This plan would be approved by the agencies.

Groundwater Isotope Analysis

During the late-summer/early-fall baseflow period, MMC would use stable isotope chemistry to compare seepages into Libby Adit or mine void to samples from GDEs and stream baseflow. Sample sites and frequency would be determined after the GDE inventory was completed. Isotopes analyzed would include oxygen-18 and deuterium. In addition, analytes such as tritium or chlorofluorocarbons would be used to establish approximate age of the water. Seepages into the Libby Adit or mine void would be used as benchmark chemistry for the deep aquifer. Major constituents (major anions and cations) would be used to determine relative residence time and travel distance in the aquifer when compared with other groundwater discharges from the same aquifer. The evolution of water chemistry would be graphically determined on trilinear plots. MMC would use age dating of groundwater to separate older groundwater from younger groundwater. Springs discharging older water would be assumed to be supplied by a deeper regional source.

C.10.4.4.2 Libby Adit Site, Libby Plant Site, Poorman Impoundment Site, and Libby Loadout

Location, Frequency, and Parameters

The monitoring of the two wells at the Libby Adit Site, MW07-01 and MW07-02, currently being conducted would continue during subsequent phases as long as there was a discharge to the MPDES-permitted outfalls to groundwater. MMC would submit a plan for the installation of new monitoring wells to be approved by the agencies. Two new wells would be established at the Libby Plant Site, one upgradient of the site and one downgradient (Figure C-5). Four new wells would be established at the Libby Loadout (see Figure 12 in the Final EIS). The monitoring wells at the plant site and Libby Loadout would be installed and sampled quarterly for parameters listed in Table C-12 for 1 year before the Construction Phase began in order to establish pre-operation conditions. Table C-13 lists monitoring requirements after initial characterization was completed.

Table C-12. Monitoring Parameters and Required Reporting Values for Groundwater and Mine and Tailings Water.

Parameter	Current Required Reporting Value (mg/L unless otherwise designated)	Parameter (Dissolved Metals)	Current Required Reporting Value (mg/L)
pH (s.u.)	0.1	Aluminum	0.03
Dissolved Oxygen	0.3	Antimony	0.0005
Specific Conductivity (µS/cm)	1.0	Arsenic	0.001
Total dissolved solids	1.0	Cadmium	0.00003
Sodium	0.03	Chromium	0.01
Calcium	0.08	Copper	0.002
Magnesium	0.02	Iron	0.02
Potassium	0.05	Lead	0.0003
Bicarbonate	1.0	Manganese	0.005
Chloride	0.1	Mercury	0.000005
Sulfate	0.2	Silver	0.0002
Nitrate+Nitrite, as N	0.02	Thallium	0.0002
Ammonia, as N	0.07	Zinc	0.008
Total Kjeldahl Nitrogen	0.15		
Total Phosphorus as P	0.004		
Ortho-phosphate	0.001		
Field Temperature	—		
Total Alkalinity (as $CaCO_3$)	0.026		
Total Hardness (as $CaCO_3$)	1.0		
Acrylamide[†]	0.01 or lowest possible		

[†]In tailings impoundment water and groundwater downgradient of the tailings impoundment during operations.

For parameters without a Circular DEQ-7 (DEQ 2012a) required reporting value, the achievable reporting limits shown are from USDA Forest Service (2012c, Table 3-1.)

Table C-13. Groundwater Monitoring Requirements.

Well Number	Location	Depth/Screen Interval	Required Data	Monitoring Frequency and Phase	Purpose
Libby Creek Drainage					
MW07-1 and MW07-2	Downgradient of adit facilities	Existing wells at Libby Adit	Water Levels, Water Quality	Quarterly during discharges	Assess potential impacts from Water Treatment Plant discharge
3	Upgradient Plant Site	Water table plus 20 feet or to bedrock, whichever is shallower	Water Levels, Water Quality	Quarterly Construction through Closure	Background data
4	Downgradient Plant Site	Water table plus 20 feet or to bedrock, whichever is shallower	Water Levels, Water Quality	Quarterly Construction through Closure	Assess potential impacts from Plant Site
Poorman Impoundment Site					
5	Upgradient of tailings impoundment	Water table plus 50 feet	Water Levels, Water Quality	Monthly Construction through Closure	Background data
6 – 12	Downgradient of tailings impoundment	Nested pairs – screened in surficial (if saturated) material and bedrock	Water Levels, Water Quality	Monthly Construction through Closure	Assess potential impacts from impoundment seepage and effectiveness of pumpback well system
Wetlands LCC-29, LCC-35A, LCC-36, and LCC-39A	Between Little Cherry Creek and Poorman Impoundment	Nested pairs – screened adequately to assess gradient	Water Levels	Monthly April through September Construction through Closure	Assess potential impacts from pumpback well system
Libby Loadout					
13 – 16	Around loadout facility	Water table plus 20 feet or bedrock, whichever is shallower	Water Levels, Water Quality	Quarterly Construction through Closure	Assess potential impacts from loadout activities
Mine and Adits					
Numerous (see Figure C-6)	From within adit(s) and mine void; drilled radially in all major directions	100's to 1,000 feet from the adit/mine	Water pressure above transducer	Continuously (at least one measurement per hour)	Monitor changes in groundwater pressure as adits/mine advance

A seepage collection system beneath the tailings impoundment and dam would be built to minimize seepage to groundwater from the tailings impoundment. Pumpback wells would be installed to capture seepage not collected by the seepage collection system. During the Evaluation Phase, MMC would complete aquifer testing at the Poorman Impoundment Site and finalize the design of the pumpback well system. After the system was designed, at least seven groundwater monitoring wells would be installed downgradient of the pumpback wells before construction of any of the impoundment facilities (Figure C-7). At least four of these wells would be constructed as nested pairs to monitor both shallow and deeper flow paths from the impoundment. The wells would be located so that the cross-sectional area below the impoundment was adequately covered by the monitoring wells. If any preferential flow paths were encountered during the construction of the impoundment or installation of monitoring wells, they would be monitored independently. The installation of pairs of nested wells is intended to monitor a reasonable vertical thickness of the saturated zone. To obtain a statistically valid set of existing water quality data, the monitoring wells at the impoundment site would be installed and sampled monthly for parameters listed in Table C-12 for 1 year before the initiation of the Construction Phase in order to establish pre-operation conditions. MMC may choose to sample quarterly for 3 years instead. Table C-13 lists monitoring requirements after initial characterization was completed.

Laboratory analytical methods would conform to those listed 40 CFR 136. Laboratory reporting limits would comply with the Required Reporting Values found in the most current Montana's water quality standards (Circular DEQ-7). For parameters without a Circular DEQ-7 required reporting value, the achievable reporting limits from USDA Forest Service. 2012c, Table 3-1 would be used. If data collected under this plan were to be used for compliance purposes for the MPDES permit, minimum limits specified in the MPDES permit must be achieved.

C.10.4.5 3D Groundwater Models Update

MMC developed separate 3D groundwater models for the mine area and the Poorman Impoundment Site. Before the Construction Phase started, MMC would update both models, incorporating the hydrologic and geologic information collected during the Evaluation Phase. MMC anticipates the mine area model's uncertainty for predicting inflows and water resource impacts would be reduced based on the empirical data obtained from underground testing. Effects on surface resources would be re-evaluated based on the revised modeling. The agencies would modify the monitoring requirements described in the following section for the Construction and Operations phases if necessary to incorporate the revised model results.

C.10.5 Construction and Operations Phases

C.10.5.1 Objectives

During the Construction and Operations phases, MMC would build and operate two new adits, an underground mine, the Libby Plant, the Poorman Impoundment, the Miller Creek transmission line alignment, access roads, and the Libby Loadout. Monitoring during the Construction and Operations phases would be the same as during the Evaluation Phase; suspended sediment monitoring (see section C.10.5.4, Stormwater, Suspended Sediment, and Best Management Practices Monitoring) would also be required. The objectives of monitoring during the Construction and Operations phases are to:

- Assess potential effects of continued dewatering of the Libby Adit and the dewatering of the mine void

- Assess potential effects on GDEs in the upper Libby Creek, East Fork Rock Creek, and East Fork Bull River drainages
- Assess potential effects on wilderness lakes, and upper East Fork Rock Creek, East Fork Bull River, Libby Creek, and Poorman Creek drainages
- Assess potential effects of discharge of treated water on surface water and groundwater adjacent to the Libby Adit
- Assess the effectiveness of the pumpback well system at the tailings impoundment
- Assess effects on groundwater quality at the Plant Site, Impoundment Site, and the Libby Loadout
- Assess compliance with the MPDES permit requirements.

C.10.5.2 Groundwater Dependent Ecosystem Monitoring

GDE monitoring would continue during the Construction and Operations phases. Any additional GDE monitoring implemented during the Evaluation Phase would continue.

C.10.5.3 Surface Water Monitoring

The monitoring of sites established during the Pre-Evaluation and Evaluation phases would continue, and additional sites on Poorman and Libby creeks would be monitored (Table C-15).

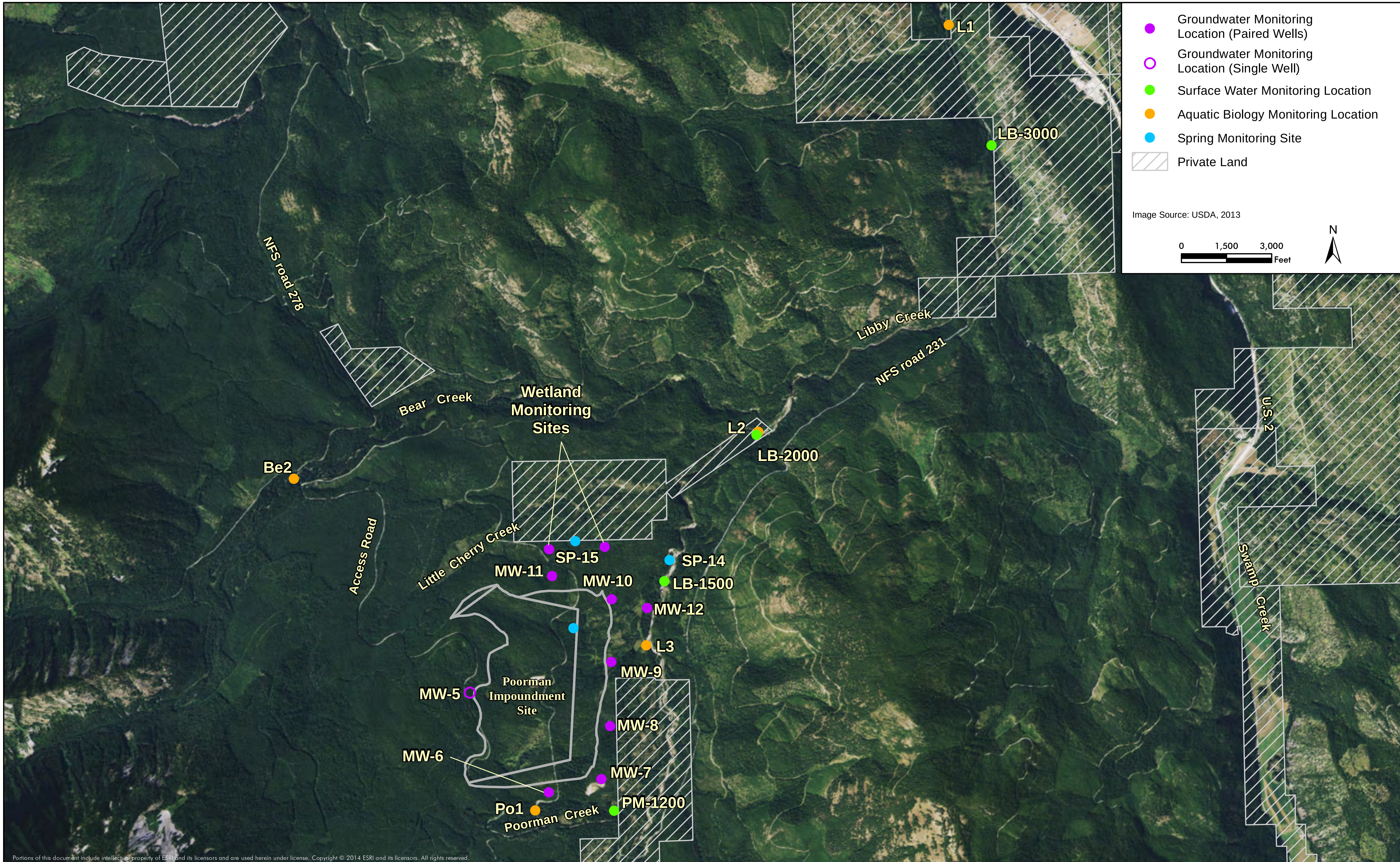


Figure C-7. Current and Proposed Hydrology and Aquatic Biology Monitoring Locations in Impoundment Area

Table C-14. Surface Water Monitoring Locations (Excluding Stormwater Monitoring)—Construction and Operations Phases.

Station	Location	Parameters	Frequency	Purpose
East Fork Rock Creek Drainage				
EFRC-50	Just below SP-41	Stage/flow; field parameters (Table C-10)	Continuous electronic recording for stage/flow; field parameters on or about 7/10, 8/10, 9/10, 10/10	Monitor mine dewatering
EFRC-100	Inflow to Rock Lake	Stage/flow (Table C-10)	Continuous electronic recording	Monitor mine dewatering
		Quality (Table C-11)	On or about 7/10, 8/10, 9/10, 10/10	
Rock Lake	Near south end of lake	Lake stage	Continuous electronic recording	Monitor mine dewatering
	Vertical profile sampling at center of lake	Quality (Table C-11)	On or about 7/10, 8/10, 9/10, 10/10	
EFRC-200	Downstream of Rock Lake where measurable, such as at exposed bedrock slightly downstream from lake	Flow (Table C-10)	On or about 7/10, 8/10, 9/10, 10/10	Monitor mine dewatering
		Quality (Table C-11)	On or about 7/10, 8/10, 9/10, 10/10	
EFRC-300	Upstream of Rock Creek Meadows	Flow, field parameters (Table C-10)	On or about 7/10, 8/10, 9/10, 10/10	Monitor mine dewatering
RC-3	Upstream of confluence with West Fork Rock Creek	Flow (Table C-10)	On or about 7/10, 8/10, 9/10, 10/10	Monitor mine dewatering
Heidelberg Adit	Downstream of Rock Lake	Flow (Table C-10)	On or about 7/10, 9/10	Monitor mine dewatering
	Additional GDE sites	To be determined	To be determined	Monitor mine dewatering
East Fork Bull River Drainage				
EFBR-50	Just downstream of SP-42	Stage/flow; field parameters (Table C-10)	Continuous electronic recording for stage/flow; field parameters on or about 7/10, 8/10, 9/10, 10/10	Monitor mine dewatering
EFBR-300	At base of steep slope below St. Paul Lake where measurable	Flow, field parameters (Table C-10)	On or about 7/10, 8/10, 9/10, 10/10	Monitor mine dewatering
EFBR-2	Just downstream of Isabella Creek confluence	Flow (Table C-10)	On or about 7/10, 9/10	Monitor mine dewatering
		Quality (Table C-11)	On or about 9/10	
	Additional GDE sites	To be determined	To be determined	Monitor mine dewatering

Station	Location	Parameters	Frequency	Purpose
Libby Creek Drainage				
Lower Libby Lake	Near outlet	Lake stage	Continuous electronic recording	Monitor mine dewatering
LB-20, LB-30, LB-40, LB-50, LB-70 LB-80, LB-100	Upstream of Wilderness boundary	Flow (Table C-10)	Every two weeks 7/10-10/10	Monitor mine dewatering
GDE 4	Upstream of Wilderness boundary	Level 2 GDE vegetation protocol	Annual	Monitor mine dewatering
		Water levels	Monthly 7/10-10/10	
LB-200	Upstream of Libby Adit	Stage/flow/temperature	Continuous electronic recording	Monitor mine dewatering
		Quality (Table C-11) or as specified by MPDES permit	On or about 7/10, 8/10, 9/10, 10/10 or as specified by MPDES permit	
LB-300	Upstream of Howard Creek confluence	Stage/flow/temperature	Continuous electronic recording	Monitor Libby Adit Site and Water Treatment Plant discharges
		Quality (Table C-11) or as specified by MPDES permit	On or about 7/10, 8/10, 9/10, 10/10 or as specified by MPDES permit	
LB-500	Near Libby Plant Site	Quality (Table C-11)	On or about 7/10, 8/10, 9/10, 10/10	Monitor Libby Plant Site
LB-1500	Downstream of Poorman Creek	Quality (Table C-11)	On or about 7/10, 8/10, 9/10, 10/10	Monitor Poorman Impoundment Site and pumpback well system
LB-2000	Downstream of Little Cherry Creek confluence	Stage/flow (Table C-10)	Continuous electronic recording	Monitor below Poorman Impoundment Site and pumpback well system
		Quality (Table C-11)	On or about 7/10, 8/10, 9/10, 10/10	
LB-3000	Upstream of Crazyman Creek confluence	Quality (Table C-11)	On or about 7/10, 8/10, 9/10, 10/10	Integrated effect site
Ramsey Creek Drainage				
RA-200	Upstream on Ramsey Creek	Flow (Table C-10)	On or about 7/10, 8/10, 9/10, 10/10	Monitor mine dewatering
		Quality (Table C-11)	On or about 7/10, 8/10, 9/10, 10/10	
RA-300	Mid-Ramsey Creek upstream of an existing point-of-diversion	Stage/flow ((Table C-10)	Continuous electronic recording	Monitor mine dewatering

Station	Location	Parameters	Frequency	Purpose
Poorman Creek Drainage				
PM-500	Upstream on Poorman Creek	Quality (Table C-11)	On or about 7/10, 8/10, 9/10, 10/10	Benchmark site; ambient quality
PM-1200	Upstream of Libby Creek confluence	Flow (Table C-10)	Every two weeks 7/1-10/15	Monitor mine dewatering
		Quality (Table C-11)	On or about 7/10, 8/10, 9/10, 10/10	Monitor Poorman Impoundment Site and pumpback well system
Possible Benchmark Sites (Outside of Mining Influence)				
SC-1	Swamp Creek downstream of Wanless Lake	Flow (Table C-10)	On or about 7/10, 8/10, 9/10, 10/10	Monitor natural variability and climate change
		Quality ((Table C-11)	On or about 9/10	
BC-50	Bear Creek downstream of Wilderness boundary	Stage/flow Quality (Table C-11)	Continuous electronic recording On or about 7/10, 8/10, 9/10, 10/10	Monitor natural variability and climate change
Wanless Lake	To be determined Vertical profile sampling at center of lake	Lake stage	Continuous electronic recording	Monitor natural variability and climate change effects
		Quality (Table C-11 except metals)	On or about 7/10, 8/10, 9/10, 10/10	
WL-1	Inlet to Wanless Lake	Stage/flow	Continuous electronic recording	Comparison to EFRC-100
		Quality (Table C-11)	On or about 7/10, 8/10, 9/10, 10/10	
WL-2	Outlet from Wanless Lake	Stage/flow	Continuous electronic recording	Comparison to EFRC-200
		Quality (Table C-11)	On or about 7/10, 8/10, 9/10, 10/10	

C.10.5.4 Stormwater, Suspended Sediment, and Best Management Practices Monitoring

The KNF conducts continuous suspended sediment monitoring during the ice-free period with an automated sampler near LB-3000 on Libby Creek (Figure C-2). The continuous suspended sediment monitoring would continue during construction and post-construction of the mine and transmission line facilities. MMC would either fund the existing KNF monitoring or they would implement their own monitoring efforts in Libby Creek. In lieu of collecting water samples for analysis of total suspended sediments (TSS), MMC may use a turbidity meter in concert with the TSS sampling to establish a relationship between turbidity and TSS. Once a statistically valid relationship between the turbidity meter results and the TSS results was established and approved by the agencies, MMC may use a turbidity meter.

This paragraph describes stormwater monitoring of Outfalls 004 through 008 required in the draft renewal MPDES permit. MMC would seek authorization to discharge stormwater from other disturbances associated with construction activity. Stormwater monitoring requirements for any new outfalls may differ from that described for Outfalls 004 through 008. Stormwater monitoring would be required at all stormwater outfalls whenever a measurable discharge occurred. Both grab and flow-weighted composite samples would be collected. Grab samples would be collected within the first 30 minutes of the stormwater discharge. Unless a grab sample was specified, a flow weighted composite sample would be taken for either the entire discharge or for the first 3 hours of the discharge. The flow-weighted composite sample for a stormwater discharge may be taken with a continuous sampler or as a combination of a minimum of three aliquots (with each aliquot separated by a minimum period of 15 minutes) taken in each hour of the discharge over the course of either the entire discharge or over the first 3 hours of the discharge. Aliquots may be collected manually or automatically. For a flow weighted composite sample, only one analysis of the composite of the aliquots is required. Flow weighted composite samples would not be allowed for pH, total phenols, and oil and grease. MMC may substitute a grab sample for a flow weighted composite sample provided that the grab sample is collected within the first 30 minutes of the discharge. Sample type and parameters to be analyzed for each stormwater outfall are provided in Table C-15.

Table C-15. Monitoring Parameters and Required Reporting Values for Stormwater Samples from Outfalls 004 through 008.

Parameter	Current Required Reporting Value (mg/L unless otherwise specified)	Parameter	Current Required Reporting Value (mg/L)
Physical and Biological Parameters			
Precipitation (storm event (inches) and duration)	0.01	Oil and grease	1.0
Maximum flow (gpm) and total volume (gals) of storm event	Within 10% accuracy	Chemical Oxygen Demand	1
pH (s.u.)	0.1		
Inorganic Parameters			
Total dissolved solids	1.0	Total Kjeldahl nitrogen	0.15
Total suspended solids	0.4	Total inorganic nitrogen	0.01
Ammonia, as N	0.07	Total nitrogen	0.01
Nitrate+nitrite, as N	0.02	Total phosphorus, as P	0.001
Metals			
Aluminum, dissolved (0.45 μm filter)	0.009	Lead	0.0003
Antimony	0.0005	Manganese	0.005
Arsenic	0.001	Mercury	0.000005
Beryllium	0.0001	Nickel	0.001
Cadmium	0.00003	Silver	0.0002
Chromium	0.01	Thallium	0.0002
Copper	0.002	Zinc	0.008
Iron	0.02		

Note: Metals are total recoverable unless otherwise specified.
For parameters without a Circular DEQ-7 (DEQ 2012a) required reporting value, the achievable reporting limits shown are from USDA Forest Service (2012c, Table 3-1). Required reporting values may be different from project MPDES permit reporting levels. Any reporting values in Table C-12 lower than MPDES permit Reporting Levels meet USDA Forest Service requirements.

In addition to the collection and analysis of a stormwater sample for an event, MMC would provide flow information for the storm event sampled and precipitation data for the event that generated the discharge. MMC would collect and report the total volume of the discharge and maximum flow rate (in gallons per minute) for the discharge event sampled. These parameters may be measured or estimated. If these values are estimated, the estimated values must follow those methods given in *Guidance Manual for the Preparation of NPDES Permit Application for Storm Water Discharges Associated with Industrial Activity* (EPA 1991) unless otherwise specified.

MMC would record the data and duration (in hours) of the storm event sampled, rainfall measurements or estimates, and the duration between the storm event sampled and the previous measurable storm event. A measurable storm event is any rainfall event that is greater than 0.1 inch. This information would not be required to be reported monthly but would subject to the record keeping and retention requirements of the MPDES permit.

MMC would maintain the BMPs so they remained effective. Drainage and conveyance systems would be inspected periodically for blockages and erosion. Fueling areas would be inspected to prevent problems before they occurred. MMC would conduct a facility inspection once every 14 days and within 24 hours of a significant precipitation event of 0.5 inches or greater. At a minimum, the documentation of each routine facility inspection would include: the inspection date and time; the name(s) and signature(s) of the inspector(s); weather information; a description of any discharges occurring at the time of the inspection; any previously unidentified discharges of pollutants from the site; any observations of obvious indicators of stormwater pollution; any control measures needing maintenance or repairs; any failed control measures that need replacement; any incidents of noncompliance observed; and any additional control measures needed to comply with MPDES permit requirements. An inspection for a significant storm event may also be used and credited toward one of the monthly inspections. If an inspection or other observation identified stormwater pollution or control measures needing repair or replacement, then MMC would document these conditions within 24 hours of making such discovery. Subsequently, within 14 days of such discovery, MMC would document any corrective action(s) taken or needed, any further investigation of the deficiency, or the basis for determining that no further action is needed. If it was determined that changes were necessary following the review, MMC would make any modifications to the control measures before the next storm event if possible, or as soon as practicable following that storm event. The final MPDES permit will contain final stormwater monitoring and BMP inspection requirements.

Disturbed areas such as access and haul roads, sedimentation ponds and other BMPs would be recontoured and revegetation would be performed to stabilize soils and prevent erosion. Inspection and monitoring of stormwater BMPs would continue until disturbed areas achieved final stabilization. Final stabilization is defined as when a vegetation cover has been established with a density of at least 70 percent of the pre-disturbance levels, or equivalent permanent, physical erosion control reduction methods have been employed. Final stabilization using vegetation would be accomplished using the seed mixture approved by the agencies for Alternative 3. The agencies expect that final stabilization would occur within 2 years of the completed activities.

C.10.5.5 Groundwater Monitoring

C.10.5.5.1 All Facilities

Groundwater monitoring conducted during the Evaluation Phase would continue through the Construction and Operations phases (Table C-13). At the Poorman Impoundment Site, flow measurement weirs would be installed downstream of the Seepage Collection Dam and, during operations, in any areas of observed flows. Any groundwater seeps adjacent to the impoundment would be sampled quarterly for parameters listed in Table C-12. Reclaim water in the tailings impoundment would be sampled monthly at the reclaim pond within the impoundment and analyzed for the parameters shown in Table C-12.

C.10.5.5.2 Pumpback Well System Monitoring

The intent of a pumpback well monitoring system would be to confirm that complete groundwater capture downgradient of the tailings impoundment had been established and that capture was maintained for as long as necessary to meet BHES Order limits or applicable nondegradation criteria of all receiving waters. The water level data from pumpback monitoring wells would be used to adjust pumping rates of the pumpback wells and/or add additional pumping capacity. Selected monitoring wells would be equipped with continuous water level measuring/recording devices to provide at least four measurements per day. The water levels in wells not equipped with recording devices would be measured by hand at least once per month. The measured water level data would be compared with predicted drawdown at these locations to determine whether full capture had been established. The pumpback well system would be modified, as necessary, to maintain capture, based on the water level data.

In 2012, MMC installed shallow piezometers in each of four wetlands (LLC-29, LCC-35A, LCC-36, and LCC-39) south of Little Cherry Creek. One piezometer was installed in wetlands LLC-29 and LLC-36, two piezometers were installed in wetland LLC-35A, and three piezometers were installed in wetland LLC-39. Wetland LLC-39 was divided in the delineation into three wetlands and labeled LLC-39A, LLC-39B, and LLC-39C. One year before mill operation started, MMC would measure water levels in the piezometers in wetlands LCC-29, LCC-35A, LCC-36, and LCC-39 (Figure C-7) four times over the annual hydrograph. The purpose of the monitoring would be to assess the potential effects of the pumpback well system. Vegetation in these two wetlands also would be monitored, following the methods used for the GDE monitoring (section C.10.4.2, Groundwater Dependent Ecosystem Monitoring. The monitoring would continue through the Closure Phase as long as the pumpback well system operated or until agreed upon by the agencies that it was no longer necessary.

Springs SP-14 and SP-15 adjacent to the impoundment site would be monitored for flow (Figure C-7). The flow of each spring would be measured twice, once in early June or when the area was initially accessible, and once between mid-August and mid-September during a time of little or no precipitation. The purpose of the monitoring would be to assess the potential effects of the pumpback well system. The monitoring would begin at least 1 year before construction and continue through the Closure Phase as long as the pumpback well system operated or until agreed upon by the agencies that it was no longer necessary. The most accurate site-specific method for measuring spring flow would be used.

C.10.6 Closure and Post-Closure Phases

Surface water and groundwater monitoring conducted during the Construction and Operational phases would continue into the Closure Phase or until agreed upon by the agencies that it was no longer necessary. Stormwater BMPs still in use would continue to be inspected and maintained. MMC would update the closure plan, including the long-term monitoring plan, during the Construction Phase in sufficient detail to allow development of a reclamation bond. A final closure and post-closure plan, including long-term monitoring plan, would be submitted 3 to 4 years before mine closure. The plan would incorporate monitoring information obtained during the mining period in the design of monitoring locations and sampling frequency. The objectives of monitoring during the Closure and Post-Closure are to:

- Assess potential effects of refilling of the mine void and adits on surface water and groundwater resources in upper Libby Creek, East Fork Rock Creek, and East Fork Bull River drainages
- Assess potential effects of discharge of treated water on surface water and groundwater adjacent to the Libby Adit until all direct discharges ceased
- Assess potential effects of stormwater discharges at outfalls 004 to 008 until DEQ issued a stormwater Notice of Termination.

- Assess potential effects on groundwater quality at the Plant Site, Impoundment Site, and the Libby Loadout until these facilities were reclaimed.

The plan would include measuring water levels in the mine void through the Rock Lake Ventilation Adit. Mine water quality and geochemical analysis of rock surrounding the mine void would be made during the Operations Phase. Hydrologic data would be collected in all phases through the Operations Phase, and would be integrated into the groundwater model. The need for continued monitoring beyond the Closure Phase would be based on these data. The Financial Assurance section of Chapter 1 describes the mechanisms available to the agencies for ensuring funds would be available should continued monitoring beyond the Closure Phase be required.

C.10.7 Water Balance

MMC would maintain an operational water balance throughout all phases of the project, including the Evaluation Phase. The detailed water balance would include inflows and outflows to the project facilities. The monitoring information would be used to modify, as necessary, operational water handling and to develop a post-mining water management plan. As part of this monitoring, MMC would measure and report the items listed in Table C-16.

MMC would install a DNRC-approved water use measuring device at one or more point of diversion locations approved by the DNRC. Water must not be diverted until the required measuring device is in place and operation. On a form provided by the DNRC, MMC would keep a written monthly record of the flow rate and volume of all water diverted including the period of time. Records would be submitted to the KNF, DEQ, and DNRC by January 31 of each year and upon request at other times during the year. MMC would maintain the measuring device so it always operated properly and measured flow rate and volume accurately.

During operations, annual surveys of the impoundment, including water stored in the pond, would be carried out to assist in the reconciliation of mass balance. The water balance would be reconciled on an annual basis, in conjunction with the mass balance. Records of all flows would be reconciled and the water balance also would use the measured precipitation and evaporation rates on site and observations of areas of beaches and water ponds. These measurements would be provided as monthly (or more frequently if requested by the agencies) and annual averages and totals in a quarterly hydrology report.

C.10.8 Action Levels

This section discusses the agencies' preliminary action levels, or some measurable change in a monitoring parameter that would require MMC action. Final action levels would be described in the final monitoring plan.

Table C-16. Water Balance Monitoring Requirements.

Item	Monitoring Parameters	Frequency	Comments
Thickener underflow feed line to tailings impoundment	Tons and Gallons	Daily	Compiled monthly and reconciled on an annual basis with the water balance; Reconcile mass balance with density of tailings (dam and impoundment)
Secondary cyclone feed line to dam.	Tons and Gallons	Daily	
Secondary cyclone - underflow and overflow	Tons and Gallons	Daily	
Approximate water storage in impoundment	Gallons	Semi-annually	
Precipitation and evaporation at impoundment site	Inches	Daily	Compiled monthly and reconciled on an annual basis
Treated sanitary waste discharged at impoundment	Gallons	Daily	
Approximate pond areas	Acres	Monthly	
Approximate wet and dry beach and dam areas	Acres	Monthly	
Mine and adit inflows	Gallons	Daily	
Libby Creek groundwater diversion	Gallons	Daily	
Potable water use	Gallons	Daily	
Dust suppression at the impoundment	Gallons	Daily	
Dust suppression at other facilities	Gallons	Daily	
Pumpback well groundwater/seepage collection	Gallons	Daily	
Seepage collection pond pumping rate	Gallons/day	Daily	
Seepage collection from any waste rock stockpile	Gallons	Daily	
Reclaim pumping rate	Gallons/day	Daily	
Discharge at any MPDES-permitted outfall	Gallons	Daily	

C.10.8.1 Surface Water Quality and Quantity

MMC would monitor discharges permitted under the MPDES permit and report any incidents of noncompliance in accordance with the permit. MMC would report any incidents of noncompliance as soon as possible, but no later than 24 hours from the time MMC first became aware of the circumstances. This would include any noncompliance which may endanger health or the environment, any unanticipated bypass which exceeds any effluent limitation in the permit, or any upset which exceeds any effluent limitation in the permit. MMC would provide a written report with 5 days of the time that MMC became aware of the circumstances. The written submission would contain a description of the noncompliance and its cause, the period of noncompliance, including exact dates and times, the estimated time noncompliance is expected to continue if it has not been corrected, and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. The MPDES permit also contains action levels for reporting of the discharge of toxic substances for which effluent limits were not established in the permit.

MMC would monitor flows and water quality in benchmark springs and streams outside of the area potentially affected by mine dewatering, as well as changes in the level and water quality of the benchmark lake. Based on the monitoring, MMC would establish a relationship between flows and/or water quality in benchmark springs and streams (described in the previous section on lakes and streams) and flows in any monitored spring or stream, as well as changes in the lake level and water quality of Rock Lake. Flows, lake level changes, and water quality in all monitored springs, lakes, and streams would also be evaluated using simple linear regression or other appropriate statistical analyses. MMC would provide the analysis in the annual report. The trend analysis would follow Forest Service protocols (USDA Forest Service 2012c), regarding trend analysis or another method approved by the agencies. If the relationship in quantity and quality between benchmark and monitored springs, lakes and streams after adit dewatering began was statistically significantly different compared to pre-mining or if the concentration of monitored parameters showed an increasing significantly trend, MMC would flag the flow change, lake level change or water quality parameter for agency review. If the agencies decided that some action were necessary, it would provide written notification to MMC, requesting submittal of a work plan within 30 days. The work plan would contain a detailed assessment of the changes, recommendations for additional monitoring (spatial and/or temporal), development of conceptual mitigation, or other actions to address the situation. The work plan would contain a schedule for implementing the proposed measures. Within 30 days, the agencies would: (i) approve, in whole or part, the plan; (ii) approve the plan with conditions; (iii) request clarifying information for the plan or additional review time or, (iv) disapprove, in whole or in part, directing that a revised work plan be submitted. If the agencies were to disapprove the plan, an explanation would accompany the disapproval.

C.10.8.2 Groundwater Quality

Action levels for groundwater compliance wells downgradient of the tailings impoundment pumpback well system are listed in Table C-17. Action levels for selected parameters are included to provide an early detection of adverse groundwater conditions and to verify the effectiveness of the tailings impoundment pumpback well system. Parameters selected for development of action levels are based on their presence at low concentrations in the downgradient aquifers, but at elevated concentrations in process water. Exceedance of these levels would require additional action by MMC, but would not be considered a violation of the MPDES permit, Hard Rock Operating Permit, or Montana groundwater standards. The action level would be increased accordingly if the pre-mining baseline concentration in any individual monitoring well consistently exceeded 50 percent of an action level. Action levels for the tailings impoundment monitoring wells would not be changed after construction of the tailings impoundment began.

In addition to assessing relationship of detected concentrations to action levels, MMC would present a trend analysis of all data for the parameters listed in Table C-17 in its annual report. A statistically significant increasing trend in concentration of any parameter would be discussed. Because arsenic is a carcinogen and changes in ambient concentrations are not allowed under Montana's nondegradation rules, MMC would assess if the arsenic concentration of each well was statistically significantly greater than the well's ambient concentration using an appropriate statistical test. For manganese, where ambient concentrations already sometimes exceed the BHES Order limit, if concentrations measured during mining exceeded the BHES Order limit and showed an increasing trend using an appropriate statistical test, this would be considered an exceedance of the action level.

If monitoring indicated that these action levels had been exceeded in any compliance well, MMC would notify the agencies of the exceedance within 5 working days. If the agencies decided that additional actions were necessary, the procedures regarding a work plan described for surface water quality would be implemented.

Table C-17. Action Levels for Groundwater Compliance Wells downgradient of the Tailings Impoundment Pumpback Well System.

Parameter	BHES Order Limit (mg/L)	Groundwater Standard (mg/L)	Ambient Concentration (mg/L)[†]	Action Level (mg/L)[§]
Nitrate + nitrite, as N	10	10	0.07	5
Total dissolved solids	200	—	60	150
Sulfate	—	—	<4.5	20
Potassium	—	—	<0.78	10
Antimony	—	0.0056	<0.003	0.0025
Arsenic	—	0.01	<0.003	See text
Chromium	0.02	0.1	<0.00074	0.01
Copper	0.1	1.3	<0.0012	0.05
Iron	0.2	—	<0.01	0.1
Manganese	0.05	—	<0.077	trend analysis showed increasing concentration trend exceeding 0.05 mg/L
Zinc	0.1	2	<0.0064	0.05

"—" = No applicable concentration.
mg/L = milligrams per liter.
[†]Ambient concentrations are from data collected in LCTM-8 through 2012 (Appendix K). Concentrations presented with a < symbol had at least one sample with a reported concentration less than the detection limit used in calculating representative values; detection limit used in calculating representative value when reported concentration was below the detection limit. For dissolved antimony, all sample results were below detection limits; detection limit for antimony is now lower (0.0005 mg/L).
[§]If the pre-mining baseline concentration in any individual monitoring well consistently exceeded 50 percent of an action level, the action level would be increased accordingly. Action levels in the tailings impoundment monitoring wells would not be changed after construction of the tailings impoundment began.

C.10.8.3 Groundwater Flow

C.10.8.3.1 Mine Area

MMC would monitor flows from the mine and adits, as well as from individual fractures in the vicinity of the Rock Lake Fault and Rock Lake. If mine and adit inflows greater than 500 gpm occurred for 10 days, MMC would notify the agencies on the 11th day. MMC would then implement excess water contingency plans described in Chapter 2, such as grouting or treatment and discharge at the Water Treatment Plant.

If the mine void encountered substantial groundwater inflows in the vicinity of the Rock Lake Fault or Rock Lake, MMC would notify the agencies within 5 business days. "Substantial groundwater inflows in the vicinity of the Rock Lake Fault or Rock Lake" means a flow from any individual fracture within 1,000 feet of either the Rock Lake Fault or Rock Lake with total flow greater than an average of 50 gpm over a 24-hour period. The agencies would evaluate the inflow data and direct MMC to take appropriate actions. MMC would then evaluate the possible effect to Rock Creek and Rock Lake and provide an evaluation report to the agencies within 30 days after initial agency notification.

MMC would monitor the flow in benchmark springs outside of the area potentially affected by mine dewatering, and establish a relationship between flows in benchmark springs (described in the previous section on springs) and flows in any monitored springs. Flow in all monitored springs would also be evaluated using simple linear regression or other appropriate statistical analyses. If the relationship in flow between benchmark springs and monitored springs after adit dewatering began was statistically significantly less than pre-mining, MMC would provide the analysis in the annual report. If the agencies decided that additional actions were necessary, the procedures regarding a work plan described for surface water quality would be implemented.

C.10.8.3.2 Tailings Impoundment Area

MMC would establish a pumpback well monitoring system adjacent to the pumpback wells in the impoundment area (see section C.10.5.5.2, Pumpback Well System Monitoring). Water levels would be measured continuously in some wells using electronic data recorders and monthly by hand in other wells. Within 30 days of the end of each month, MMC would analyze the performance of the pumpback well system and assess the extent of capture of any seepage entering the groundwater beneath the tailings impoundment. If monitoring indicated that full capture of the seepage was not being achieved, MMC would notify the agencies within 5 working days. If the agencies decided that additional actions were necessary, the procedures regarding a work plan described for surface water quality would be implemented.

C.10.8.4 Wetland or Riparian Areas

The initial GDE inventory information (see section C.10.3.2, Groundwater Dependent Ecosystem Inventory and Monitoring) would be used to develop a prevalence index (Corps 2008b) for monitored wetlands overlying the mine. Monitored wetlands north of the impoundment area also would use a prevalence index to assess effects. Many plant species have been given wetland indicator status of obligate wetlands, facultative wetlands, facultative, facultative upland, or upland based on probabilities of occurring in wetlands. The USDI Fish and Wildlife Service compiled a list of plants and their wetland indicator status (USDI Fish Wildlife Service 1993). If a drying trend were to occur at a wetland and riparian site, the composition of plants would be expected to shift from a dominance of obligate wetland and facultative wetlands species to a higher percentage of facultative wetland and facultative upland species. For example, sphagnum moss, an obligate wetlands species found at site 8, would be an indicator of slight shifts in hydrological conditions because this plant does not have roots and is dependent on water saturating the soil for all or most of the growing season. A prevalence index of 3.0 or less indicates that hydrophytic vegetation is present (Corps 2008b). A prevalence index would be identified for each wetland and riparian site monitored.

If the prevalence index of any monitored wetlands is 50 percent greater than its baseline index (such as 1.5 to 2.3) or is above 3 for 2 consecutive years, MMC would provide the analysis in the annual report. If the agencies decided that additional actions were necessary, the procedures regarding a work plan described for surface water quality would be implemented.

Other monitoring options such as piezometers would be used to facilitate or strengthen monitoring effectiveness. If a change in seep or spring flow, water level, or water quality were noted outside the baseline data for an individual site or set of sites, or a trend was observed that was not observed during pre-mining monitoring, then a re-evaluation of those potentially affected habitats would be conducted and documented for comparison against initial survey information. Depending on a combination of biological or physical variables or the severity of plant indicator decline, the agencies may require more rigorous monitoring.

C.10.9 Plan Management

C.10.9.1 Quality Assurance/Quality Control

As part of each plan for environmental monitoring, MMC would develop Sampling and Analysis Plan (SAP) and a Quality Assurance Project Plan (QAPP) and submit them to the agencies for approval. Collectively, these procedures would compose a plan that ensures the reliability and accuracy of monitoring information as it was acquired. QA/QC procedures would include both internal and external elements. Internal elements may include procedures for redundant sampling such as random blind splits or other replication schemes, chain of custody documentation, data logging, and error checking.

Written reports to document the implementation of the plan would be an integral part of monitoring reports. Any variances or exceptions to established sampling or data acquisition methods during monitoring would be documented. Documentation would include a discussion of the significance of data omissions or errors, and measures taken to prevent any occurrences. Reports would be submitted to the appropriate agencies with the annual report, unless otherwise requested.

C.10.9.2 Sample Collection and Data Handling

Field procedures would follow DEQ procedures (DEQ 2012b) and collection, storage, and preservation of water samples would follow EPA procedures (EPA 1982). Grab samples would be collected from streams and springs, and groundwater samples would be obtained using low flow sampling techniques. Samples would be cooled immediately after collection. Metals in water samples would be preserved by adding nitric acid in the field to lower the pH to less than 2.0 or as appropriate to meet standard industry sampling protocols.

Groundwater samples for metal analyses would be field filtered through a 0.45 micron filter to allow measurement of the dissolved constituents. Chemical analysis of water samples would be by procedures described in 40 CFR 136, EPA-600/4-79-020, or methods shown to be equivalent. All field procedures would follow standard sampling protocols as demonstrated through the quality assurance and quality control documentation.

MMC would use a sample control plan, which includes sample identification protocol, the use of standardized field forms to record all field data and activities, protocol for collecting field water quality parameters, and the use of chain-of-custody, sample tracking, and analysis request forms. MMC would develop a master file of all field forms and laboratory correspondence. MMC would meet the laboratory method-required holding time for each constituent being analyzed.

MMC would ensure representativeness of samples collected by locating sampling stations in representative areas and by providing quality control samples and analyses. Quality control samples would include blind field standards, field cross-contamination blanks, and replicate samples. Quality control samples would be at a minimum frequency of 1 in 10. In addition, MMC would use EPA-approved laboratories. If revised sampling methods or QA/QC protocols change, MMC would incorporate those as directed by the agencies.

C.10.9.3 Data Reporting

Any reporting required in the MPDES permit would continue as long as there was discharge of any mine drainage or process water to a MPDES-permitted outfall. MMC would submit water quality and flow measurement data to the KNF and DEQ in an electronic format acceptable to the agencies within 10 working days after receipt of final laboratory results. All submitted analytical data would comply with DEQ's minimum reporting requirements for analytical data (DEQ 2009). MMC would develop and maintain an agency-accessible, password-protected website that hosted electronic data. MMC would prepare a report briefly summarizing hydrologic information, sample analysis, and quality assurance/quality control procedures following each sample interval. The report would be posted on MMC's website within 4 weeks after receipt of final laboratory results.

The annual report, summarizing data over the year, would include data tabulations, maps, cross-sections, and diagrams needed to describe hydrological conditions. Raw lab reports and field and lab quality results also would be reported. In the annual report, MMC would present a detailed evaluation of the data. Data would be analyzed using routine statistical analysis, such as analysis of variance, to determine if differences exist:

- Between sampling stations
- Between an upstream benchmark station and the corresponding downstream station
- Between sampling time (monthly, growing season/non-growing season)
- Between stream flow at the time of sampling (for example, low flow during the fall compared to low flow during the winter)
- Between sampling years
- Trend analyses would be included where applicable and/or quantifiable

The annual report would be posted on MMC's website within 90 days after receipt of the final laboratory results for the final quarter of the year. A formal review meeting would be arranged within 2 weeks of MMC submitting the monitoring report to the agencies. The formal review meeting would involve representatives from the reviewing agencies and MMC. The review could result in various outcomes:

- Determine that no change in the monitoring programs or mine operation plans was needed
- Require modifications to the monitoring programs
- Require new treatment or mitigation measures to be implemented as part of the mine project
- Require MMC to implement necessary measures to ensure compliance with applicable laws and regulations

At the end of the first monitoring year and following submittal of the annual report, MMC would meet with the agencies to discuss the monitoring results. Following the annual review, the agencies would decide whether a change in monitoring or operations would be required.

C.11 Aquatic Biology

C.11.1 General Requirements

MMC would conduct aquatic biological monitoring before, during, and after project construction and operation at stream stations that are within and downstream of project disturbance boundaries and at benchmark stations that are upstream of potential influence from the project. At replicate sample locations within each station, multiple parameters that are likely to display small-scale variability and likely to be correlated would be assessed. Replicated sample locations would be selected to be as similar as possible across stations. This sampling design would allow analysis of data using a before-after/control-impact approach, and would allow use of univariate and multivariate statistical methods. This sampling design is intended to identify natural variability and isolate the influence of water quality and fine sediment deposition on stream biota and habitat.

MMC would collect surface water quality samples at each aquatic biological monitoring station during each monitoring period to assist in interpretation of the data. MMC would also conduct salmonid population surveys and salmonid tissue chemistry surveys to provide additional information to assess the influence of the project on stream biota.

C.11.2 Bull Trout Mitigation Monitoring

MMC would develop Bull Trout Core Area Mitigation Plans in accordance with the USFWS' Biological Opinion for aquatic species. MMC would develop the plans and submit them to the KNF and USFWS within six months of the KNF's approval to start the Evaluation Phase. Mitigation monitoring would include assessment of fish populations and stream habitat in mitigation streams. The Mitigation Plans would describe the monitoring locations, frequency, parameters, and reporting consistent with the requirements of the Biological Opinion.

C.11.3 Monitoring Locations and Times

MMC would conduct aquatic biological monitoring at seven stations (Table C-18 at the end of this section); Figure C-2; Figure C-4 through Figure C-7). Five stations are within or downstream of the proposed disturbance boundaries. Two stations are upstream of potential project impacts and would serve as benchmark stations. Stream reach length would vary depending on the monitoring task and station.

Monitoring frequency would vary, depending on the monitoring task and station (Table C-19). Some tasks would be conducted three times annually: prior to runoff from the higher elevations in the spring (typically April or May), during summer (typically early August to September), and prior to ice formation (typically October). Other tasks would be conducted annually during the summer period, or less frequently as described below.

C.11.4 Substrate and Fine Sediments

During the summer monitoring period, percent surface fines would be quantified using a grid sampling device as described in the R1/R4 methodology (Overton et al. 1997) at each quantitative macroinvertebrate sample (Surber sample) location. Embeddedness would be also quantified at each Surber sample location by tallying each stone within the Surber sampler frame that is <50% embedded. Substrate size would be quantified by measuring the narrow dimension of these same stones. By conducting these tasks at the Surber sample locations, the data would provide quantitative measures of substrate at all stations in similar habitat and under similar depth and flow conditions, and would improve the ability to isolate the influence of water quality and fine sediments on benthic macroinvertebrates (see below). Samples would be collected within the shortest reach available that meets the macroinvertebrate sample location criteria (see below).

Also during the summer period, in the fish monitoring reaches (L1, L3, L9, and Be2 see below), the substrate monitoring methods described above would be supplemented with the McNeil Core substrate sampling method. Ten representative core samples would be collected from potential spawning locations in scour pool tail crests and low-gradient riffles within the salmonid population survey reach at each of the four stations. Fewer core samples would be collected if 10 suitable locations are not located within the survey reach.

During all three monitoring periods, DEQ methods for assessing sediment impairment (DEQ 2013b) would be followed at all monitoring stations. These methods would include Wolman pebble counts, grid tosses, measurement of residual pool depth, and pool counts (Wolman 1954, DEQ 2013b). Reach lengths for this monitoring component would be 20 times the bankfull width in the sampling area.

C.11.5 Habitat

Habitat surveys would be conducted annually in the summer in the fish monitoring reaches (L1, L3, L9, and Be2 see below). Fish structures developed as mitigation also would be monitored. Instream habitat data collection would generally follow the R1/R4 methods developed by the FS (Overton et al. 1997). Habitat types within the stream reaches would be identified and measured individually. Measurements at recognized units within each habitat type would include length, wetted width, bank width, average depth, maximum depth, substrate type, type of bank vegetation, percent undercut bank, and percent eroded bank. These habitat measurements are consistent with the Inland Native Fish Strategy (INFS) goals. Additionally, other measurements, such as pool frequency, number of pieces of large woody debris, and lower bank angle, would be recorded to document further attainment of the riparian management objectives set by INFS (USDA Forest Service 1995).

C.11.6 Routine Physical/Chemical Features

MMC would measure the following routine physical and chemical parameters at all aquatic biological monitoring stations during all monitoring periods: stream discharge, air and water temperature, pH, total alkalinity, specific conductance, sulfate, and the metals listed in Table C-11. EPA approved methods or other acceptable methods specified in the monitoring plan would be used.

C.11.7 Benthic Macroinvertebrates

MMC would collect five quantitative samples and one qualitative sample of benthic macroinvertebrates from all aquatic biological monitoring stations during the summer period. Methods used would generally follow the guidelines described in the DEQ's macroinvertebrate sampling protocol (2012c) for the collection of quantitative Hess samples and semi-quantitative jab samples. Quantitative samples would be collected using a 500-micrometer mesh Surber sampler rather than a Hess net because Surber samplers have been used by the FWP in Libby Creek beginning in 2000 (Dunnigan et al. 2004). The continued use of the Surber sampler thus would allow for better comparisons with past data. Quantitative samples would be collected from the riffle/run habitats in the stream. Specific sampling locations at each station would be standardized, to the extent possible, for depths between 0.5 and 1.0 feet and flow velocities of less than 1.5 feet per second. MMC would collect the qualitative jab sample with a 500-micrometer mesh net in all micro-habitats not sampled during the collection of the quantitative samples, such as aquatic vegetation, snags, and bank margins. Benthic macroinvertebrates collected with the net would be used to provide supplemental information on species composition at the sites and to determine the relative abundance of the taxa inhabiting aquatic habitats at the sampling station.

Parameters analyzed would include density, number of taxa, number of *Ephemeroptera*, *Plecoptera*, and *Trichoptera* (EPT) taxa, number of Ephemeroptera taxa, number of Plecoptera taxa, percent non-insects, percent predators, percent burrower taxa, the EPT index, percent EPT individuals, Shannon-Weaver diversity index, Simpson diversity index, the Hilsenhoff Biotic Index (HBI) and the biotic condition index (BCI). Several of these parameters are among the metrics calculated by the DEQ as part of its data analysis (DEQ 2012c) and also allow for the calculation of the Montana multi-metric index for mountain stream (Jessup et al. 2006). The use of other metrics such as evenness, Simpson's diversity index, and the BCI have been recommended by FS personnel to allow for comparisons with previously collected data within this region (Steve Wegner, personal communication, 2006). Additionally, these data would be analyzed using the Observed/Expected (O/E) Model developed for Montana (Jessup et al. 2006). To summarize these data, four common statistical measures would be used (mean, standard deviation, coefficient of variation, and standard error of the mean), plus other appropriate measures (EPA 1990).

Quality assurance for macroinvertebrate data would follow DEQ guidelines (DEQ 2005a; 2012c) and would be conducted randomly on 10 percent of the samples, with 95 percent agreement for taxonomic and count precision required. MMC also would maintain a permanent taxonomic reference collection that contains all benthic species collected from project area streams. Taxa identification in this collection would be documented and confirmed by a qualified, independent macroinvertebrate taxonomist (DEQ 2012c). This reference collection would be maintained by MMC through the period of post-operational monitoring. Following this period, the collection would be transferred to a depository selected by the agencies for permanent scientific reference.

C.11.8 Periphyton and Benthic Chlorophyll-a

MMC would sample periphyton and benthic chlorophyll-a at all aquatic biological monitoring stations concurrent with the proposed benthic macroinvertebrate population sampling during the summer period. Qualitative periphyton would be collected following DEQ's standard operation procedure using the appropriate method for the stream type to be sampled (2011a). At stream locations with flowing water present at the time of sampling, the modified PERI-1 method would be used, which designates a specific longitudinal length of stream to be sampled at each site. The sampled stream length would be either 40 times the average wetted width at the mid-point of the stream reach or a minimum of 150 meters, whichever was greater. Eleven transects would be established throughout each site reach, and would be located equidistant from one another (shown on Figure 1.0 in DEQ 2011b). Algal material would be collected from each of the eleven transect locations, with all material composited into a single sample per site (DEQ 2011a). Collection methods would include using a toothbrush or knife to collect material from hard substrates and a turkey baster or spoon for soft substrates.

Quantitative benthic chlorophyll-a samples would be collected from each site sampled for periphyton following DEQ's standard operation procedure (2011b). Eleven transects would be established throughout the site reach as with the modified PERI-1 method. The samples collected at each transect would be kept separate rather than combining them into one composite sample as was recommended for the periphyton samples. The collection method used at each transect would be based on the substrate and conditions at each location. For example, the hoop method would be used for transects dominated by the presence of filamentous algae, regardless of stream substrate. If heavy filamentous algal growth was not observed, the template sampling method would be used at transects dominated by small boulders, cobble, and gravel, while the core method would be used at those transects dominated by silt-clay substrate. The collection tools used for each method differ, but they all result in a quantifiable area of the stream substrate being sampled at each transect (DEQ 2011b). If field personnel visually assessed the site and decided that benthic algal chlorophyll-a was low (<50 mg/m^2) at all transects of a stream site, photographs of the stream substrate at all 11 transects would be taken in accordance with Section 7 of DEQ's standard operation procedure (2011b) rather than taking chlorophyll-a samples.

Based on these methods, one composite periphyton sample and eleven chlorophyll-a samples would be collected at each site from the reach that included the Surber sample locations prior to collecting macroinvertebrates (see section C.11.7; Table C-19). In addition, L9 (LB-300) and L3 (LB-1000) would be sampled 3 times per year in the summer period to assess if nuisance algal was present. These sampling events would be scheduled approximately a month apart and within the first two weeks of July, August, and September. The summer sampling of all sites may suffice for one of the three sampling events at L9 and L3. As stated in the DEQ's procedures (2011b), the sampling method could be modified to scrub additional delimited areas from the same location for the chlorophyll-a samples if very little material on the filter was observed after filtration or if previous sampling efforts had a high percentage of below detection limit results, provided the use of appropriate methods and detection limits. The number of additional delimited areas scrubbed at each transect would be recorded.

C.11.9 Salmonid Populations

To determine possible changes in salmonid populations associated with development of the Montanore Project, MMC would monitor salmonid populations in Libby Creek and Bear Creek annually during the summer period. The FWP would complete the monitoring if they were conducting surveys at the approximate locations described below during summer. MMC would conduct the monitoring if the FWP was not already doing so and if the required permits were granted to MMC. If the required permits were not granted for some or all of the salmonid population monitoring, relative fish abundance by species and size class would be determined using the direct enumeration snorkeling technique (Thurow 1994 cited in Overton et al. 1997). Day and night snorkel surveys would be conducted in an upstream direction, using a dive light at night. Fish species and lengths would be documented to the extent practical without capturing fish. Fish counts, species identifications, and length determinations would be tallied for each macrohabitat type in each reach. If portions of reaches were too shallow for snorkeling, they would be surveyed from the banks. Bank surveys would also be conducted to tally young of the year fish.

MMC would monitor salmonid populations in Libby Creek in three stream reaches (L1, L3, L9), and in Bear Creek (Be2) using the following procedures. The stream reach would be blocked by netting at its upstream and downstream limits to prevent fish movement into or out of the sample reach during the sampling. Sampling procedures would include multiple-pass depletion electroshocking to collect salmonids from a 300-yard (or 300-meter) reach of stream. All salmonids would be identified, measured for length, and released. Population densities of each salmonid species captured during the study would be estimated, where adequate sample sizes permit, using a maximum-likelihood model (*e.g.*, Seber and Le Cren 1967, MicroFish 3.0). The condition of all captured salmonids would be recorded following an examination for overt signs of disease, parasites, or other indications of surface damage. Length-frequency data would be analyzed to determine whether species were naturally reproducing in or near the stream reaches. These methods may be modified if FWP conducted the monitoring. A monitoring report would be submitted annually to the KNF, the FWP, and the DEQ.

The same salmonid monitoring procedures would be used to monitor salmonid response to fish mitigation projects implemented by MMC. Beginning in the year prior to a fish mitigation project, salmonids would be monitored using the approved methods. In subsequent years (yearly), the mitigation monitoring at each site would be repeated. The salmonid population data from stations L1 and Be2 would be used as controls to assess if observed changes were a natural event.

C.11.10 Bioaccumulation of Metals in Fish Tissue

MMC would conduct monitoring studies that measure background concentrations of copper, cadmium, mercury, lead, and zinc in the fish in Libby Creek to provide a basis for comparison in order to document any potential changes in the concentrations of these metals due to construction and operation of the Montanore mine. Fish tissue monitoring would be conducted if the required permits were granted to MMC. If the required permits were not granted for some or all of the fish tissue monitoring, MMC would report the most relevant data that are available for the project area.

Prior to construction and once construction has begun, the FWP or MMC would collect five rainbow trout or rainbow trout hybrids (*Oncorhynchus* sp.) annually from Sites L1, L3, and Be2 for a period of 5 years, with each trout collected being greater than 4 inches in size. Collections would be completed during the summer period, concurrent with the fish population surveys.

Homogenized whole-fish tissue samples would be analyzed to determine copper, cadmium, mercury, zinc and lead concentrations. Thereafter, if no increasing trends in metal concentrations have been identified after the initial 5-year period, MMC would resample each site at a 3-year interval to document any trends in bioaccumulation of these metals. Test procedures would be the same as those used for baseline testing, unless changed by the agencies.

C.11.11 Sampling Trip and Annual Reporting

Within one week of completing biological sampling, MMC would submit a brief report to appropriate review personnel in the DEQ, the KNF, and the FWP. This report would include brief statements about stream conditions observed at each monitoring station and would alert the review personnel to any marked changes in monitoring data relative to the cumulative monitoring record.

On or before March 1 of each year, MMC would submit an annual aquatic monitoring report that contains summaries of all aquatic monitoring data collected during the previous year. Each report also would discuss trends in population patterns and evaluate changes in stream habitat quality, based on all data collected to date for the project. Reference to appropriate scientific literature would be included. Recommendations in these reports can include modifications to increase monitoring efficiency or to provide additional data needs.

C.11.12 Annual Review and Possible Revision of the Monitoring Plan

Within one month after MMC submits the annual report, an annual meeting would be held to review the aquatics monitoring plan and results, and to evaluate possible modifications to the plan. This meeting would include personnel from the DEQ, KNF, FWP, MMC, and other interested parties.

Table C-18. Aquatic Biology Monitoring Stations.

Reach	Nearest Upstream Activities	Station ID (surface water ID)	Station Comments	All Non-fish Monitoring	Fish Population and Habitat	Fish Tissue Metals
Bear Creek						
1	none	Be2 (BC-500)	Upstream benchmark	X	X	X
Poorman Creek						
2	Impoundment	Po1 (PM-1000)	Impact assessment	X		
Libby Creek						
1	Mine dewatering	L10 (LB-200)	Upstream of Upper Libby Adit	X		
2	Libby Adit	L9 (LB-300)	Impact assessment	X	X	
4	Impoundment	L3 (LB-1000)	Integrated impact assessment	X	X	X
5	Impoundment	L2 (LB-2000)	Integrated impact assessment	X		
6	All	L1 (LB-3000)	Integrated impact assessment	X	X	X

Additional monitoring stations would be developed in other streams, such as the East Fork Bull River and East Fork Rock Creek, in accordance with the Bull Trout Core Area Mitigation Plans discussed in section C.11.2, *Bull Trout Mitigation Monitoring*.

Table C-19. Aquatic Biology Monitoring.

Task category	Task	Timing			Number of Stations	Method	Replication per Station and Within-Station Locations
		Spring	Summer	Fall			
Benthic Biota	Macroinvertebrates, quantitative		X		all	Surber samples for lab taxonomy	5 sites with most similar microhabitat near station
	Macroinvertebrates, qualitative		X		all	kicknet sample for lab taxonomy	1 sample from all habitats in 100 ft reach that includes Surber sample locations
	Periphyton, quantitative		3X/season X		L9 and L3 all	samples from rock surface for chlorophyll-a determination (DEQ SOP 2011b)	11 samples from each transect location within stream reach that includes Surber sample locations
	Periphyton, qualitative		3X/season X		L9 and L3 all	picking and scraping all varieties for lab taxonomy (DEQ SOP 2011a)	1 sample comprised of a composite of 11 transect samples from each site within stream reach that includes Surber sample locations
Habitat	Canopy cover		X		all	densiometer	at each of the 5 Surber sites
	Water velocity		X		all	flow meter at 0.6 m depth	at each of the 5 Surber sites
	Stream discharge	X	X	X	all	velocity-area principle / 0.6 m depth	1 transect at station
	Fish habitat survey		X		4	R1/R4	same 100 yd reach as salmonid survey
Substrate	Embeddedness		X		all	Tally <50% embedded stones	at each of the 5 Surber sites
	Substrate size distribution		X		all	Measure <50% embedded stones	at each of the 5 Surber sites
	Surface fines		X		all	49 point grid	at each of the 5 Surber sites
	Spawning gravel		X		4	McNeil cores for lab analysis and field settling cone	maximum obtainable up to 10 samples within 100 yd salmonid survey reach
	Sediment impairment	X	X	X	all	DEQ 2010 SOP	20 bankfull widths
Water Quality	Conductivity	X	X	X	all	meter	1 measurement at station
	pH	X	X	X	all	meter	1 measurement at station
	Water temperature	X	X	X	all	meter	1 measurement at station
	Water chemistry sample	X	X	X	all	grab sample for comprehensive lab analysis	1 sample at station
Fish	Salmonid population survey		X		4	multiple-pass electrofishing or snorkel	extending from station to 100 yd upstream
	Salmonid tissue metals samples		X		3	*Oncorhynchus* sp. whole-fish Cu, Cd, Hg, Pb, Zn	5 fish per survey reach

C.12 Wilderness

All surface disturbances for the Montanore Project would be outside of the CMW boundary; some activities such as monitoring would occur within the CMW boundary. A summary of the types of monitoring activities that would occur in the wilderness is located in section 3.24.1.4.3 of the Final EIS. A description of monitoring of wilderness character is below.

C.12.1 Objective

The objective of monitoring for Wilderness is to determine if activities approved within the CMW boundary, such as the agencies' required monitoring described in this appendix (see sections C.5 *Wildlife*, C.7 *Rock Mechanics*, and C.10 *Water Resources*), are in conformance with mitigation and special provisions and if management is minimizing impacts to wilderness values.

C.12.2 Locations, Parameters, and Frequency

C.12.2.1 MRDG Process and Approval of Final Monitoring Plans

A Minimum Requirements Analysis (MRA) is required when prohibited use(s) are being considered in an administrative action (Wilderness Act, section 4.c). Prohibited uses in the CWM include motorized equipment and motorized or mechanized transportation. Motorized equipment is defined as any machine activated by a nonliving power source except small battery-powered hand carried devices such as flashlights, GPS, cameras, or cell phones (36 CFR 261.2). Small battery-powered equipment left on site for a period of time would be considered motorized equipment.

The Minimum Requirements Decision Guide (MRDG) is a tool to complete a minimum requirement analysis (Arthur Carhart National Wilderness Training Center 2014). The MDRG has two parts: 1) determine if administrative action is necessary, and if necessary, 2) determine the minimum activity necessary. As part of the project record, a 2015 Montanore Project MRDG has been completed for the conceptual monitoring plan through Step 1 (determination of an administrative action is necessary in the CMW). The determination made was that administrative action is necessary in the CWM due to existing rights, special provisions, and as a requirement of other statutes or regulations. Step 2, which is the determination of the minimum activity necessary, would be used to evaluate Final Plans as they are submitted to the agencies by MMC.

MMC would clearly identify any activities (monitoring, equipment, transport) that would occur within the CMW boundary in submitted plans (maps, tables, monitoring locations) as described under Section C.12.3). The KNF would complete MRDG Step 2, determination of the minimum tool necessary, prior to approving any monitoring activities. The MRDG would be completed for final plans and updated as the project progresses.

C.12.2.2 Wilderness Stewardship Performance

The Forest Service issued the National Wilderness Stewardship Performance Guidebook in 2015. (USDA Forest Service 2015). Two elements that apply to the Montanore Project are described below.

Other Special Provisions—includes management plan and monitoring of the special provisions for the protection of wilderness values for the project. Special Provisions of The Wilderness Act

Sec. 4(d)(3) allow for '*Mineral leases, permits, and licenses covering lands within national forest wilderness areas designated by this Act shall contain such reasonable stipulations as may be prescribed by the Secretary of Agriculture for the protection of the wilderness character of the land consistent with the use of the land for the purposes for which they are leased, permitted, or licensed*.'

The KNF would develop a Special Provision Monitoring plan, covering both management and monitoring within the CMW boundary. The Montanore Final Monitoring Plan would be used as a basis for the KNF Special Provision Monitoring Plan. The Special Provisions Monitoring Plan would be interactive and collaborative with MCC in determining priority management issues. If monitoring of the Special Provisions indicates resources are not in conformance with the plan, corrective actions would be taken.

Wilderness Character Baseline—establish a baseline and provide foundation for evaluating trends in wilderness character. These trends indicate the outcome of our stewardship actions and success at 'preserving wilderness character', as directed by the Wilderness Act. National protocol for monitoring wilderness character is currently under development. The KNF would develop a wilderness character narrative, select measures for each indicator, and gather data to establish a baseline. Once a baseline was established, Wilderness character monitoring would be conducted on a 5-year cycle.

The Forest Service has developed a National Minimum Protocol for Monitoring Outstanding Opportunities for Solitude (USDA 2014). The KNF would implement solitude monitoring in 2016 to establish pre-operation baseline information for the Montanore Project. The 2016 monitoring would focus on areas identified with possible '*increased visibility of mine disturbances as well as increased noise from mining facilities*' from specific locations including the following: viewpoint at Elephant Peak; between Elephant Peak and Bald Eagle Peak; CMW locations west of the facilities; and Rock Lake Ventilation Adit.

C.12.3 Reporting Requirements

MMC would submit the Final Monitoring Plan with activities (monitoring, equipment, transport) within the CMW boundary clearly identified. The KNF would complete Step 2 of the MRDG, and determination of minimal activity.

MCC would submit all activities (monitoring, equipment, transport) occurring within the CWM annually to the KNF using the Administrative and Special Provisions Authorization form by October 1 of every year. This form tracks motorized equipment/mechanical transport use authorizations to facilitate post-season data entry into Infra-WILD, which is part of the Natural Resource Manager (NRM), a system of database tools used by the Forest Service for managing agency data.

The KNF would complete a Special Provisions Monitoring Plan report annually (starting year Final Monitoring Plan was approved) by October 1 of every year.

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Appendix D— State of Montana/USDA Forest Service Environmental Specifications for the 230-kV Transmission Line

STATE OF MONTANA/USDA FOREST SERVICE
ENVIRONMENTAL SPECIFICATIONS FOR
MONTANORE 230-KV TRANSMISSION LINE

Contents

DEFINITIONS

ACCESS EASEMENT:	Any land area over which the OWNER has received an easement from a LANDOWNER allowing travel to and from the project. Access easements may or may not include access roads.
ACCESS ROAD:	Any travel course which is constructed by substantial recontouring of land and which is intended to permit passage by most four-wheeled vehicles.
ARM:	Administrative Rules of Montana
BEGINNING OF CONSTRUCTION:	Any project-related earthmoving or removal of vegetation (except for clearing of survey lines).
BOARD:	Montana Board of Environmental Review
CERTIFICATE:	Certificate of Compliance
CFR:	Code of Federal Regulations
CONTRACTOR:	Constructors of the Facility (agent of owner)
DAY:	Monday through Friday, excluding all state or federal holidays
DEQ:	Montana Department of Environmental Quality
DNRC:	Montana Department of Natural Resources and Conservation
FWP:	Montana Fish, Wildlife, and Parks
FS:	United States Department of Agriculture, Forest Service
INSPECTORS:	DEQ or KNF employee or their designee charged with inspecting the transmission line for compliance with the Environmental Specifications.
KNF:	Kootenai National Forest
KNF INSPECTOR:	KNF employee or designee charged with inspecting the transmission line for compliance with the KNF requirements.
LANDOWNER:	The owner of private property
MCA:	Montana Code Annotated

MDT:	Montana Department of Transportation
NFSL:	National Forest System Lands
OWNER:	The owner(s) of the facility, or the owner's agent.
ROD:	Record of Decision
SENSITIVE AREA:	Area which exhibits environmental characteristics that may make them susceptible to impact from construction of a transmission facility. The extent of these areas is defined for each project and may include any of the areas listed in Circular MFSA-2 (2004 Edition), Sections 3.2(1)(d) and 3.4(1).
SHPO:	State Historic Preservation Office
STATE SPECIAL: USE SITES	All locations other than structure locations and roads needed for the construction, operation, and decommissioning of the transmission line, and shall include, staging areas, helicopter landing and fueling sites, pulling and tensioning sites, stockpile sites, splicing sites, borrow pits, and storage or other building sites.
STATE INSPECTOR:	DEQ employee or DEQ's designee with the responsibility for monitoring the OWNER's contractor compliance with terms and conditions of the CERTIFICATE issued for the Project.

INTRODUCTION

The purpose of these specifications is to ensure the prevention or mitigation of potential environmental impacts during the construction and interim reclamation of the 230-kV transmission facility associated with the proposed Montanore Project. These specifications do not apply to the Sedlak Park substation, loop line, buried 34.5-kV powerline associated with the Montanore Mine, or to the mine itself. All other mine-related disturbances are covered by a Montana Department of Environmental Quality (DEQ) hard rock operating permit and Forest Service (FS) Plan of Operations. These specifications vary from those typically prepared by DEQ for other transmission line facilities because the specifications also incorporate FS requirements. These specifications are intended to be incorporated into the texts of contracts, plans, Plan of Operations, and specifications.

Decommissioning of the transmission line will be covered by the final reclamation and closure plan described in Appendix N at the end of this document.

Authority to determine compliance of the proposal facility with state and federal requirements for air and water quality standards, lies with the respective agencies. State laws for the protection of employees engaged in the construction, operation on maintenance of the proposal facility also remain in effect (Section 75-20-401, MCA).

Appendices at the end of these specifications refer to individual topics of concern and to site-specific concerns. Certain of these Appendices, shall be prepared by the OWNER working in consultation with DEQ and FS prior to the start of construction and submitted for approval by the DEQ and FS.

0.0. GENERAL SPECIFICATIONS

0.1. SCOPE

These specifications apply to all lands affected by the 230-kV transmission line, excluding the Sedlak Substation and loop line and the 34.5-kV power line. As provided in ARM 17.20.1902 (10), the certificate holder may contract with the LANDOWNER for revegetation or reclamation if the LANDOWNER wants different reclamation standards from (10)(a) applied on the property and that not reclaiming to the standards specified in (10)(a) and (b) would not have adverse impacts on the public and other LANDOWNERS. Where the LANDOWNER requests practices other than those listed in these specifications, DEQ may authorize such a change provided that the STATE INSPECTOR is notified in writing of the change and that the change will not be in violation of: (1) the Certificate; (2) any conditions imposed by the DEQ; (3) the DEQ's finding of minimum adverse impact or (4) the regulations in ARM 17.20.1701 through 17.20.1706, 17.20.1901, and 17.20.1902.

On private land, these specifications shall be enforced by the STATE INSPECTOR. On NFSL, enforcement shall be the joint responsibility of the STATE INSPECTOR and the KNF INSPECTOR.

0.2. ENVIRONMENTAL PROTECTION

The OWNER shall conduct all operations in a manner to protect the quality of the environment.

0.3. CONTRACT DOCUMENTS

It is the OWNER'S responsibility to ensure compliance with these specifications. If appropriate, these specifications can be part of or incorporated into contract documents to ensure compliance; in any case, the OWNER is responsible for its agent's adherence to these specifications in performing the work.

0.4. BRIEFING OF EMPLOYEES

The OWNER shall ensure that the CONTRACTOR and all field supervisors are provided with a copy of these specifications and informed of the applicability of individual sections to specific procedures. It is the responsibility of the OWNER to ensure its CONTRACTOR and CONTRACTOR's Construction Supervisors comply with these measures. The OWNER'S Project Supervisor shall ensure all employees are informed of the applicable environmental specifications discussed herein prior to and during construction. Site-specific measures provided in the appendices attached hereto shall be incorporated into the design and construction specifications or other appropriate contract document. The OWNER shall have regular contact and site supervision to ensure compliance is maintained.

0.5. COMPLIANCE WITH REGULATIONS

All project-related activities of the OWNER shall comply with all applicable local, state, and federal laws, regulations, and requirements that are not superseded by the Major Facility Siting Act.

0.6. LIMITS OF LIABILITY

The OWNER is not responsible for correction of environmental damage or destruction of property caused by negligent acts of DEQ or FS employees during construction, operation maintenance, decommissioning, and reclamation of the proposal project.

0.7. DESIGNATION OF SENSITIVE AREAS

DEQ and FS, in their evaluation of the transmission line, have designated certain areas along the right-of-way or access roads as SENSITIVE AREAS as indicated in Appendix A. The OWNER shall take all necessary actions including the measures listed in Appendix A to avoid adverse impacts in these SENSITIVE AREAS.

0.8. PERFORMANCE BONDS

To ensure compliance with these specifications, prior to any ground disturbing activity, the OWNER shall submit a transmission line construction and reclamation bond to the State of Montana or its authorized agent pertaining specifically to the reclamation of designated access roads, special use areas, and adjacent land disturbed during construction (Appendix B). The transmission line construction and reclamation bond shall be held to ensure cleanup and construction reclamation are complete and revegetation is proceeding satisfactory. At the time cleanup and construction reclamation are complete and revegetation is proceeding satisfactory, the OWNER shall be released from its obligation for transmission line construction reclamation and the transmission line construction and reclamation bond shall be released.

Concurrently, the OWNER shall submit a separate joint decommissioning bond to the DEQ and FS pertaining specifically to monitoring, decommissioning of the transmission line and reclamation following decommissioning. The joint decommissioning bond shall be subject to the FS and DEQ bond release provisions as outlined in the Reclamation Plan approved by the FS and DEQ. The approved Reclamation Plan shall contain reclamation standards as stringent as those found in ARM 17.20.1902(10).

0.9. DESIGNATION OF STRUCTURES

Each structure for the transmission line shall be designated by a unique number on plan and profile maps and referenced consistently. Any reference to specific poles or structures in the Appendices shall use these numbers. If this information is not available because the survey is not complete, station numbers or mileposts shall indicate locations along the centerline. Station numbers or mileposts of all angle points shall be designated on plan and profile maps.

0.10. ACCESS

When easements for construction access are obtained for construction personnel, provision shall be made by the OWNER to ensure that DEQ will be allowed access to the special use areas, right-of-way, and to any off-right-of-way access roads. Where such easements are obtained on private land to provide access to NFSL, such provisions shall also be made for the KNF INSPECTOR. Liability for damage caused by providing such access for the STATE INSPECTOR or KNF INSPECTOR shall be limited by section 0.6 LIMITS OF LIABILITY.

0.11. DESIGNATION OF STATE INSPECTOR AND KNF INSPECTOR

DEQ shall designate a STATE INSPECTOR(S) to monitor the OWNER'S compliance with these specifications and any other project–specific mitigation measures adopted by DEQ as provided in ARM 17.20.1901 through 17.20.1902. The FS shall designate a KNF INSPECTOR(S) to monitor the OWNER'S compliance with the Plan of Operations for activities on NFSL. The STATE INSPECTOR shall be the OWNER's liaison with the State of Montana on construction, post-construction, and construction reclamation activities for the certified transmission line on all lands. The KNF INSPECTOR and the STATE INSPECTOR shall coordinate lead roles for construction, post-construction, and reclamation activities for the certified transmission line on NFSL. All communications regarding the project shall be directed to the STATE INSPECTOR and on NFSL, to the KNF INSPECTOR and STATE INSPECTOR. The names of the INSPECTORS are in Appendix C.

1.0. PRECONSTRUCTION PLANNING AND COORDINATION

1.1. PLANNING

1.1.1. Planning of all stages of construction and maintenance activities is essential to ensure that construction-related impacts shall be kept to a minimum. The CONTRACTOR and OWNER shall, to the extent possible, plan the timing of construction, construction and maintenance access requirements, location of special use areas, and other details before the commencement of construction.

1.1.2. At least 45 days before the start of construction, the OWNER shall submit plan and profile map(s), both on paper and an electronic equivalent agreed to by the DEQ and FS, to DEQ and the FS depicting the location of the centerline and of all construction access roads, maintenance access roads, structures, clearing back lines, operational right-of-way width, vehicle wash or cleaning stations specified by county Weed Control Plan, and, to the extent known, STATE SPECIAL USE SITES. The scale of the map shall be 1:24,000 or larger. Specifications and typical sections for construction and maintenance access roads shall be submitted with the plan and profile maps(s) and an electronic equivalent agreed to by the DEQ and FS. When these materials are submitted, access road locations shall have been flagged on the ground for review by the KNF and STATE INSPECTORS.

1.1.3. At least 45 days before the BEGINNING OF CONSTRUCTION, the OWNER shall submit a Road Management Plan to the FS and DEQ. This plan shall detail the specific location of all roads that need to be opened, constructed, or reconstructed. The OWNER must receive written approval of the plan from the FS and DEQ prior to gaining access on any closed road or beginning any surface disturbing activity. This plan, once approved, shall be incorporated into Appendix D.

1.1.4. If special use areas are not known at the time of submission of the plan and profile, the following information shall be submitted no later than 5 days prior to the BEGINNING OF CONSTRUCTION. The location of special use areas shall be plotted on one of the following and submitted to the KNF and STATE INSPECTORS: aerial imagery of a scale 1:24,000 or larger, or available USGS 7.5' plan and profile maps of a scale 1:24,000 or larger, and an electronic equivalent agreed to by the DEQ and FS.

1.1.5. Changes or updates to the information submitted in 1.1.2 through 1.1.4 shall be submitted within 10 days to the DEQ and FS for approval. In no case shall a change be submitted less than 5 days prior to its anticipated date of construction. Where changes affect designated SENSITIVE AREAS, these changes must be submitted to DEQ and FS 15 days before construction and approved by the STATE INSPECTOR on all lands and the KNF on FS lands prior to construction.

1.2. PRECONSTRUCTION CONFERENCE

1.2.1. At least one week before the BEGINNING OF CONSTRUCTION, the OWNER shall schedule a preconstruction conference with DEQ and the FS. The KNF and STATE INSPECTORS shall be notified of the date and location for this meeting.

1.2.2. The OWNER's representative, the CONTRACTOR's representative, the designated INSPECTORS, and representatives of affected state and federal agencies who have land management or permit and easement responsibilities shall be invited to attend the preconstruction conference.

1.3. PUBLIC CONTACT

1.3.1. Written notification by the OWNER's field representative or the CONTRACTOR shall be given to local public officials in each affected community prior to the BEGINNING OF CONSTRUCTION to provide information on the temporary increase in population, when the increase is expected, and where the workers will be stationed. If local officials require further information, the OWNER shall hold meetings to discuss potential temporary changes. Officials contacted shall include the county commissioners, city administrators, and law enforcement officials. It is also suggested that local fire departments, emergency service providers, and a representative of the Chamber of Commerce be contacted.

1.3.2. The OWNER shall negotiate with the LANDOWNER in determining the best location for access easements and the need for gates.

1.3.3. The OWNER shall contact local government officials, MDT, or the managing agency, as appropriate, regarding implementation of required traffic safety measures.

1.4. PRECONSTRUCTION SURVEYS

1.4.1. The Construction Phase will begin after OWNER submits final design plans to the agencies described in Section 1.1, and received agency approval to implement the Construction Phase. Before OWNER receives agency approval to implement the Construction Phase and any ground-disturbing activities occurs, Owner shall complete the surveys described below on all areas where such surveys have not been completed and that will be disturbed by the transmission line.

1.4.2. OWNER shall complete an intensive cultural resource inventory of the Area of Potential Effect that will meet the requirements of the 36 CFR 800, the guidelines in the 2009 FS and DEQ Site Inventory Strategy, and Montana SHPO. An intensive cultural resource inventory is a pedestrian survey with transects no more than 100 feet apart that covers the entire Area of Potential Effect. The adequacy of past intensive cultural resource inventories shall be decided by the FS and DEQ in consultation with the Montana SHPO. OWNER shall submit to the FS and DEQ an inventory report meeting Montana SHPO requirements. The report shall include eligibility for listing on the National Register of Historic Places recommendations for all identified historic properties. When an adverse effect to an eligible historic property is anticipated, OWNER may choose to redesign the project to avoid the property. If avoidance is not feasible, OWNER shall undertake actions to mitigate any adverse effect following the requirements of 36 CFR 800.6. A mitigation plan shall be developed by OWNER, reviewed by the FS and DEQ, reviewed by culturally affiliated tribes, and submitted to the SHPO and the Advisory Council on Historic Preservation for approval. OWNER will implement the approved mitigation plan and receive FS and DEQ concurrence of mitigation implementation before any ground-disturbing activities. In addition, the OWNER shall adhere to all provisions outlined in the Programmatic Agreement, and Tribal Monitoring Plan (Appendix E), if developed.

1.4.3. The OWNER shall complete a survey for threatened, endangered, or Forest sensitive plant species on NFSL for any areas where such surveys have not been completed and that will be disturbed by transmission line construction. Similarly, the OWNER, in coordination with the DNRC and LANDOWNER, shall conduct surveys in habitat suitable for threatened, endangered, and state-listed plant species potentially occurring on non-NFSL lands. The surveys shall be submitted to the DEQ and FS for approval. If adverse effects could not be avoided, OWNER shall develop appropriate mitigation plans for agency approval. OWNER shall implement the approved mitigation plan and receive FS and DEQ concurrence of mitigation implementation before any ground-disturbing activities.

1.4.4. The OWNER shall complete a jurisdictional wetland delineation of all areas proposed for ground disturbance associated with the transmission line, including all crossings of waters of the U.S. by roads. The delineation shall be submitted to the U.S. Army Corps of Engineers for a jurisdictional determination. If discharge of dredge or fill material into waters of the U.S. cannot be avoided, OWNER shall develop appropriate mitigation plans for Corps, FS, and DEQ approval. OWNER shall implement the approved mitigation plan and receive FS and DEQ concurrence of mitigation implementation before any ground-disturbing activities. All conditions associated with a 404 permit shall be incorporated into these specifications.

1.4.4. The OWNER shall either fund or conduct field and/or aerial reconnaissance surveys to locate any new bald eagle or osprey nests along specific segments of the transmission line corridor or implement timing restrictions listed in Appendix I. Surveys shall be conducted between March 15 and April 30, one nesting season immediately prior to transmission line construction.

2.0. CONSTRUCTION

2.1. GENERAL

2.1.1. The preservation of the natural landscape contours and environmental features shall be an important consideration in the location of all construction facilities, including roads and special use areas. Construction of these facilities shall be planned and conducted so as to minimize destruction, scarring, or defacing of the natural vegetation and landscape. Any necessary earthmoving shall be planned and designed to be as compatible as possible with natural landforms.

2.1.2. Temporary special use areas shall be the minimum size necessary to perform the work. Such areas shall be located where most environmentally compatible, considering slope, fragile soils or vegetation, and risk of erosion. After construction, these areas shall be reclaimed as specified in Section 3.0 of these specifications unless a specific exemption is authorized in writing by the STATE INSPECTOR. On NFSL, these areas shall be reclaimed as specified in Section 3.0 of these specifications unless a specific exemption is authorized in writing by the KNF and STATE INSPECTOR.

2.1.3. All work areas shall be maintained in a neat, clean, and sanitary condition at all times. Trash or construction debris (in addition to solid wastes described in section 2.14) shall be regularly removed during the construction and reclamation periods.

2.1.4. If mixing of soil horizons will lead to a significant reduction in soil productivity, difficulty in establishing permanent vegetation, or an increase in weeds, mixing of soil horizons shall be avoided insofar as possible. This may be done by removing and stockpiling topsoil, where practical, so that it may be spread over subsoil during site reclamation.

2.1.5. Vegetation such as trees, plants, shrubs, and grass on or adjacent to the right-of-way that does not interfere with the performance of construction work or operation of the line itself shall be preserved. The Vegetation Removal and Disposition Plan (Appendix F) shall identify the specific areas where vegetation will be removed or retained to minimize impacts from the construction and operation of the transmission line. This plan must be approved by the inspectors in their areas of jurisdiction prior to construction.

2.1.6. The OWNER shall take all necessary actions to avoid adverse impacts to SENSITIVE AREAS listed in Appendix A and implement the measures listed in Appendix A in these areas. The STATE INSPECTOR shall be notified 5 days in advance of initial clearing or construction activity in these areas. In addition the KNF INSPECTOR shall be notified 5 days in advance of initial clearing or construction activity on NFSL in these areas. The OWNER shall mark or flag the clearing backlines and limits of disturbance in certain SENSITIVE AREAS as designated in Appendix A. All construction activities must be conducted within this marked area.

2.1.7. The OWNER shall either acquire appropriate land rights or provide compensation for damage for the land area disturbed by construction. The width of the area disturbed by construction shall not exceed a reasonable distance from the centerline as necessary to perform the work. For this project, construction activities except access road construction and use of special use areas shall be contained within the area specified in Appendix G.

2.1.8. Flow in a stream course may not be permanently diverted. If temporary diversion is necessary for culvert installation, flow shall be restored immediately after culvert installation, as determined by the STATE INSPECTOR on all lands, and KNF INSPECTOR on NFSL.

2.2. CONSTRUCTION MONITORING

2.2.1. The STATE INSPECTOR is responsible for implementing the compliance monitoring required by ARM 17.20.1902. The STATE and KNF INSPECTORS are responsible for implementing the compliance monitoring on NFSL. The plan specifies the type of monitoring data and activities required and terms and schedules of monitoring data collection, and assigns responsibilities for data collection, inspection reporting, and other monitoring activities. It is attached as Appendix H.

2.2.2. The INSPECTORS, the OWNER, and the OWNER'S agents shall attempt to rely upon a cooperative working relationship to reconcile potential problems relating to construction in SENSITIVE AREAS and compliance with these specifications. When construction activities cause excessive environmental impacts due to seasonal field conditions or damage to sensitive features, the designated INSPECTORS shall talk with the OWNER about possible mitigating measures or minor construction rescheduling to avoid these impacts and may impose additional mitigating measures. The INSPECTORS shall be prepared to provide the OWNER with written documentation of the reasons for the additional mitigating measures within 24 hours of their imposition. All parties shall attempt to adequately identify and address these areas and planned mitigation, to the extent practicable, during final design to minimize conflicts and delays during construction activities.

2.2.3. The INSPECTORS may require mitigating measures or procedures at some sites beyond those listed in Appendix A in order to minimize environmental damage due to unique circumstances that arise during construction, such as unanticipated discovery of a cultural site. The KNF INSPECTOR may require additional mitigating measures on NFSL. The INSPECTORS shall follow procedures described in the monitoring plan when such situations arise.

2.2.4. In the event that the STATE INSPECTOR shows reasonable cause that compliance with these specifications is not being achieved, and the OWNER has not taken reasonable efforts to remediate the situation, DEQ shall take corrective action as described in 75-20-408, MCA. In the event that the KNF INSPECTOR shows reasonable cause that compliance with these specifications is not being achieved, FS shall implement measures described in 36 CFR 228.7(b).

2.3. TIMING OF CONSTRUCTION

2.3.1. Construction and motorized travel may be restricted or prohibited at certain times of the year in certain areas. Exemptions to these timing restrictions may be granted by DEQ and FS in writing if the OWNER can clearly demonstrate that no significant environmental impacts will occur as a result. No waiver of winter range timing restrictions shall be approved on National Forest System or state trust lands where the grizzly bear mitigations apply. These areas are listed in Appendix I.

2.3.2. In order to prevent rutting and excessive damage to vegetation, construction shall not take place during periods of high soil moisture when construction vehicles will cause severe rutting deeper than four inches requiring extensive reclamation.

2.4. PUBLIC SAFETY

2.4.1. All construction activities shall be done in compliance with existing health and safety laws.

2.4.2. Requirements for aeronautical hazard marking shall be determined by the OWNER in consultation with the Montana Aeronautical Division, the Federal Aviation Administration the DEQ, and FS. These requirements are listed in Appendix J. Where required, aeronautical hazard markings shall be installed at the time the wires are strung, according to the specifications listed in Appendix J.

2.4.3. Noise levels shall not exceed established DEQ standards as a result of operation of the facility and associated facilities. For electric transmission facilities, the average annual noise levels, as expressed by an A-weighted day-night scale (Ldn) shall not exceed 50 decibels at the edge of the right-of-way in residential and subdivided areas unless the affected LANDOWNER waives this condition.

2.4.4. The facility shall be designed, constructed, and operated to adhere to the National Electrical Safety Code regarding transmission lines.

2.4.5. The electric field at the edge of the right-of-way shall not exceed 1 kilovolt per meter measured 1 meter above the ground in residential or subdivided areas unless the affected LANDOWNER waives this condition, and that the electric field at road crossings under the facility shall not exceed 7 kilovolts per meter measured 1 meter above the ground.

2.5. PROTECTION OF PROPERTY

2.5.1. Construction operations shall not take place over or upon the right-of-way of any railroad, public road, public trail, or other public property until negotiations and/or necessary approvals have been completed with the LANDOWNER or FS, and on lands subject to a conservation easement, FWP. Designated roads and trails as listed in Appendix A and Appendix D shall be protected and kept open for public use. Where it is necessary to cross a trail with access roads, the trail corridor shall be restored. Adequate signing and/or blazes shall be established so the user can find the route. All roads and trails designated by any government agency as needed for fire protection or other purposes shall be kept free of logs, brush, and debris resulting from operations under this agreement. Any such road or trail damaged by project construction or maintenance shall be promptly restored to its original condition.

2.5.2. Reasonable precautions shall be taken to protect, in place, all public land monuments and private property corners or boundary markers. If any such land markers or monuments are destroyed, the marker shall be reestablished and referenced in accordance with the procedures outlined in the “Manual of Instruction for the Survey of the Public Land of the United States” or, in the case of private property, the specifications of the county engineer. Reestablishment of survey markers shall be at the expense of the OWNER.

2.5.3. Construction shall be conducted so as to prevent any damage to existing real property including transmission lines, distribution lines, telephone lines, railroads, ditches, and public roads crossed. If such property is damaged during construction, operation, or decommissioning, the OWNER shall repair such damage immediately to a reasonably satisfactory condition in consultation with the LANDOWNER, the LANDOWNER shall be compensated for any losses to personal property due to construction, operation, or decommissioning activities.

2.5.4. In areas with livestock, the OWNER shall make a concerted effort to comply with the reasonable requests of LANDOWNERS regarding measures to control livestock. Unless requested by a LANDOWNER, care shall be taken to ensure that all gates are closed after entry or exit. Gates shall be inspected and repaired when necessary during construction and missing padlocks shall be replaced. The OWNER shall ensure that gates are not left open at night or during periods of no construction activity unless other requests are made by the LANDOWNER. Any fencing or gates cut, removed, damaged, or destroyed by the OWNER shall immediately be replaced with new materials. Fences installed shall be of the same height and general type as the fence replaced or nearby fence on the same property, and shall be stretched tight with a fence stretcher before stapling or securing to the fence post. Temporary gates shall be of sufficiently high quality to withstand repeated opening and closing during construction, to the satisfaction of the LANDOWNER.

2.5.5. The OWNER must notify the STATE INSPECTOR, KNF INSPECTOR and, if possible, the affected LANDOWNER within 2 days of damage to land, crops, property, or irrigation facilities, contamination or degradation of water, or livestock injury caused by the CONTRACTOR and/or the OWNER's activities, and the OWNER shall reasonably restore any damaged resource and/or replace where applicable damaged property. The OWNER shall provide reasonable compensation for damages to the affected LANDOWNER.

2.5.6. Pole holes and anchor holes must be covered or fenced in all locations if left open longer than eight hours or where a LANDOWNER's requests can be reasonably accommodated.

2.5.7. When requested by the LANDOWNER, all fences crossed by permanent access roads shall be provided with a gate. All fences to be crossed by access roads shall be braced before the fence is cut. Fences not to be gated should be restrung temporarily during construction and restrung permanently within 30 days following construction, subject to the reasonable desires of the LANDOWNER.

2.5.8. Where new access roads cross fence lines, the OWNER shall make reasonable effort to accommodate the LANDOWNER's wishes on gate location and width.

2.5.9. Any breaching of natural barriers to livestock movement by construction activities shall require fencing sufficient to control livestock.

2.6. TRAFFIC CONTROL

2.6.1. At least 30 days before any construction within or over any state or federal highway right-of-way or paved secondary highway for which MDT has maintenance, the OWNER shall notify the appropriate MDT field office to review the proposed occupancy and to obtain appropriate permits and authorizations. The OWNER must supply DEQ and FS with documentation that this consultation has occurred. This documentation shall include any measures recommended by MDT that apply to state highways and to what extent the OWNER has agreed to comply with these measures. In the event that recommendations or regulations will not be followed, DEQ shall resolve any disputes regarding state highways.

2.6.2. In areas where the construction creates a hazard, traffic shall be controlled according to the applicable MDT regulations. Safety signs advising motorists of construction equipment shall be placed on major state highways, as recommended by MDT. The installation of proper road signing shall be the responsibility of the OWNER.

2.6.3. The managing agency shall be notified, as soon practicable, when it is necessary to close public roads to public travel for short periods to provide safety during construction.

2.6.4. Construction vehicles and equipment shall be operated at speeds safe for existing road and traffic conditions.

2.6.5. Traffic delays shall be restricted on primary access routes, as determined by MDT on state or federal highways or FS on its roads.

2.6.6. Access for fire and emergency vehicles shall be provided for at all times.

2.6.7. Public travel through and use of active construction areas shall be limited at the discretion of the managing agency.

2.7. ACCESS ROADS AND VEHICLE MOVEMENT

2.7.1. Construction of new roads shall be the minimum reasonably required to construct and maintain the facility in accordance with the Road Management Plan in Appendix D. National Forest System, State, county, and other existing roads shall be used for construction access wherever possible. The location of access roads and structures shall be established in consultation with affected LANDOWNERS and LANDOWNER concerns shall be accommodated where reasonably possible and not in contradiction to these specifications or other appropriate FS and DEQ conditions.

2.7.2. All new roads, both temporary and permanent, shall be constructed with the minimum possible clearing and soil disturbance to minimize erosion, as specified in Section 2.11 of these specifications.

2.7.3. Where practical, all roads shall be initially designed to accommodate one-way travel of the largest piece of equipment required to use them; road width shall be no wider than necessary.

2.7.4. Roads shall be located as approved in the Road Management Plan (Appendix D). Travel outside the right-of-way to enable traffic to avoid cables and conductors during conductor stringing shall be kept to the minimum possible. Road crossings of the right-of-way shall be near support structures to the extent feasible.

2.7.5. Helicopter construction techniques shall be used as specified on Figure D-1 of this Appendix. Helicopter stringing shall also be used on the line. Where overland travel routes are used, they shall not be graded or bladed unless necessary and shall be flagged or otherwise marked to show their location and to prevent travel off the overland travel route. Where temporary roads are required, they shall be constructed on the most level land available.

2.7.6. In order to minimize soil disturbance and erosion potential, cutting and filling for access road construction shall be kept to a minimum to the extent practicable, in areas of up to 5 percent side slope. In areas of over 5 percent side slope, roads shall be constructed to prevent channeling of runoff.

2.7.7. The OWNER shall complete the measures necessary so the KNF could place all new roads constructed for the transmission line on NFSL into intermittent stored service. Such requirements are described in Appendix D. The OWNER shall restrict access to closed roads during construction. Closure devices shall be reinstalled following construction on existing closed roads. The OWNER shall cooperate with the LANDOWNER regarding private lands and the DNRC on State lands to develop a similar approach to meet the LANDOWNER's land use requirements while minimizing environmental impacts.

2.7.8. Any damage to existing private roads, including rutting, resulting from project construction, operation, or decommissioning shall be repaired and restored to a condition as good or better than original as soon as possible. Repair and restoration of roads shall be accomplished during and following construction as necessary to reduce erosion.

2.7.9. Any necessary snow removal shall be done in a manner to preserve and protect roads, signs, and culverts, to ensure safe and efficient transportation, and to prevent excessive erosion damage to roads, streams, and adjacent land. All snow removal shall be done in compliance with INFS standards.

2.7.10. At least 30 days prior to construction of a new access road approach intersecting a state or federal highway, or of any structure encroaching upon a highway right-of-way, the OWNER shall submit to MDT a plan and profile map showing the location of the proposed construction. At least five days prior to construction, the OWNER shall provide the designated INSPECTORS written documentation of this consultation and actions to be taken by the OWNER as provided in 2.6.1.

2.8. EQUIPMENT OPERATION

2.8.1. During construction, unauthorized cross-country travel and the development of roads other than those approved shall be prohibited. The OWNER shall be liable for any damage, destruction, or disruption of private property and land caused by his construction personnel and equipment as a result of unauthorized cross-country travel and/or road development.

2.8.2. To prevent excessive soil damage in areas where a graded roadway has not been constructed, the limits and locations of access for construction equipment and vehicles shall be clearly marked or specified at each new site before any equipment is moved to the site. CONTRACTOR personnel shall be well versed in recognizing these markers and shall understand the restriction on equipment movement that is involved.

2.8.3. Dust control measures on all roads used for construction shall be implemented in accordance with DEQ's air quality permit and the KNF's Plan of Operations. Where requested by residents living within 500 feet of the line, the OWNER shall control dust created by transmission line construction activities. Oil or similar petroleum-derivatives shall not be used to control dust.

2.8.4. Work crew foremen shall be qualified and experienced in the type of work being accomplished by the crew they are supervising. Earthmoving equipment shall be operated only by qualified, experienced personnel. Correction of environmental damage resulting from operation of equipment by inexperienced personnel shall be the responsibility of the OWNER. Repair of damage to a condition reasonably satisfactory to the LANDOWNER, FS, or if necessary, DEQ, shall be required.

2.8.5. Sock lines or pulling lines shall be strung using a helicopter to minimize disturbance of soils and vegetation.

2.8.6. Following construction in areas designated by the local weed control board, DEQ, or FS on NFSL as a noxious weed areas, the CONTRACTOR shall thoroughly clean all vehicles and equipment to remove weed parts and seeds immediately prior to leaving the area. Such areas are shown in Appendix K.

2.9. RIGHT-OF-WAY CLEARING AND SITE PREPARATION

2.9.1. The STATE INSPECTOR shall be notified at least 10 days prior to any vegetation clearing; the STATE INSPECTOR and KNF shall be notified at least 10 days prior to any vegetation clearing on NFSL. The STATE INSPECTOR shall be responsible for notifying the DNRC Forestry Division. All vegetation clearing shall be conducted in accordance with the Vegetation Removal and Disposition Plan (Appendix F).

2.9.2. Right-of-way clearing shall be kept to the minimum necessary to meet the requirements of the National Electrical Safety Code. Clearing shall produce a “feathered edge” right-of-way configuration, where only specified hazard trees and those that interfere with construction or conductor clearance are removed. Trees to be saved within the clearing back lines and danger trees located outside the clearing back lines shall be marked. Clearing back lines in SENSITIVE AREAS shall be indicated on plan and profile maps. All snags and old growth trees that do not endanger the line or maintenance equipment shall be preserved. In designated SENSITIVE AREAS, the INSPECTORS may approve clearing measures and boundaries that vary from the design plan prior to clearing.

2.9.3. During clearing of survey lines or the right-of-way, small trees and shrubs shall be preserved to the greatest extent possible in accordance with the Vegetation Removal and Disposition Plan and in compliance with the National Electrical Safety Code. Shrub removal shall be limited to crushing where necessary. Plants may be cut off at ground level, leaving roots undisturbed so that they may re-sprout.

2.9.4. In no case shall the cleared width be greater than that described in the Vegetation Removal and Disposition Plan and the National Electrical Safety Code, unless approved by the INSPECTORS on NFSL and the STATE INSPECTOR and LANDOWNER on State and private land.

2.9.5. Soil disturbance and earth moving shall be kept to a minimum.

2.9.6. The OWNER shall be held liable for any unauthorized cutting, injury or destruction to timber whether such timber is on or off the right-of-way.

2.9.7. Unless otherwise requested by the LANDOWNER or FS, felling shall be directional in order to minimize damage to remaining trees. Maximum stump height shall be no more than 8 inches or less above the existing grade. Trees shall not be pushed or pulled over. Stumps shall not be removed unless they conflict with a structure, anchor, or roadway.

2.9.8. Crane landings shall be constructed on level ground unless extreme conditions (such as soft or marshy ground) make other construction necessary. In areas where more than one crane landing per structure site is built, the STATE INSPECTOR shall be notified at least 5 days prior to the beginning of construction at those sites. Topsoil will be salvaged at crane landings and used in reclamation of these disturbed areas.

2.9.9. No motorized travel on, scarification of, or displacement of talus slopes shall be allowed except where approved by the STATE INSPECTOR on all lands, the KNF INSPECTOR on NFSL, and LANDOWNER.

2.9.10. To avoid unnecessary ground disturbance, counterpoise should be placed or buried in disturbed areas whenever possible. If ground conditions do not allow for the drilling of counterpoises and excavations are required, topsoil must be salvaged. The topsoil will be used in reclamation of these disturbed areas.

2.9.11. Slash resulting from project clearing that may be washed out by high water the following spring shall be removed and piled outside the floodplain before runoff. Any instream slash resulting from project clearing to be removed shall be removed within 24 hours. OWNER shall leave large woody material for small mammals and other wildlife species within the cleared area on NFSL.

2.9.12. Use of heavy equipment to clear and remove vegetation in riparian areas shall be minimized.

2.9.13. Topsoil shall be salvaged from excavated structure holes and reapplied to the base of the structures.

2.9.14. If material drilled out for structures is not used to backfill the structure holes, the material must first be offered to the landowner. If the landowner does not want the material, the OWNER shall dispose of the material in consultation with the STATE INSPECTOR.

2.10. GROUNDING

2.10.1 Grounding of fences, buildings, and other structures on and adjacent to the right-of-way shall be done according to the specifications of the National Electrical Safety Code.

2.11. EROSION AND SEDIMENT CONTROL

2.11.1. Clearing and grubbing for roads and rights-of-way and excavations for stream crossings shall be carefully controlled to minimize silt or other water pollution downstream from the rights-of-way. At a minimum, erosion control measures described in the OWNER's Storm Water Pollution Prevention Plan and INFS standards shall be implemented as appropriate following the review of the plan and profile map(s) required under Section 0.9 and 1.1.2.

2.11.2. Roads shall cross drainage bottoms at sharp or nearly right angles and level with the stream bed whenever possible. Temporary bridges, fords, culverts, or other structures to avoid stream bank damage shall be installed.

2.11.3. Under no circumstances shall stream bed materials be removed for use as backfill, embankments, road surfacing, or for other construction purposes.

2.11.4. No excavations shall be allowed on any river or perennial stream channels or floodways at locations likely to cause detrimental erosion or offer a new channel to the river or stream at times of flooding.

2.11.5. Installation of culverts, bridges, fords, or other structures at perennial stream crossings shall be done as specified by the INSPECTORS following on-site inspections conducted by the STATE INSPECTOR. The STATE INSPECTOR shall invite the OWNER, landowner, FWP, and local conservation districts to participate in these inspections. Installation of culverts or other structures in a water of the United States shall be in accordance with the U.S. Army Corps of Engineers 404. Activities affecting water of the State of Montana shall be in accordance with DEQ 318 permit conditions. All culverts shall be sized according to current KNF stream crossing flow calculations and the Revised Hydraulic Guide Kootenai National Forest (1990) and amendments. Where new culverts are installed, they shall be installed with the culvert inlet and outlet at natural stream grade or ground level. Water velocities or positioning of culverts shall not impair fish passage. Stream crossing structures need to be able to pass the 100 year flow event.

2.11.6. Following submittal of a plan and profile maps, but prior to construction of access roads, bridges, fill slopes, culverts, impoundments, or channel changes within the high-water mark of any perennial stream, lake, or pond, the OWNER shall discuss proposed activities with the STATE INSPECTOR, FWP, local conservation district, and KNF personnel. This site review shall determine the specific mitigation measures to minimize impacts appropriate to the conditions present. These measures shall be added to Appendix A by the STATE INSPECTOR and as appropriate by the KNF INSPECTOR.

2.11.7. No blasting shall be allowed in streams. Blasting may be allowed near streams if precautions are taken to protect the stream from debris and from entry of nitrates or other contaminants into the stream. No blasting debris shall be placed into a water of the United States without a U.S. Army Corps of Engineers 404 and DEQ 318 permit.

2.11.8. The OWNER shall maintain roads on private lands while using them. All ruts made by machinery shall be filled or graded to prevent channeling. In addition, the OWNER must take measures to prevent the occurrence of erosion caused by wind or water during and after use of these roads. Some erosion-preventive measures include but are not limited to, installing or using cross-logs, drain ditches, water bars, and wind erosion inhibitors such as water, straw, gravel, or combinations of these. Erosion control shall be accomplished as described in the OWNER's General Stormwater Permit (or MPDES Permit) and the Storm Water Pollution Prevention Plan.

2.11.9. The OWNER shall prevent material from being deposited in any watercourse or stream channel. Where necessary, measures such as hauling of fill material, construction of temporary barriers, or other approved methods shall be used to keep excavated materials and other extraneous materials out of watercourses. Any such materials entering watercourses shall be removed immediately.

2.11.10. The OWNER shall be responsible for the stability of all embankments created during construction. Embankments and backfills shall contain no stream sediments, frozen material, large roots, sod, or other materials that may reduce their stability.

2.11.11. No fill material other than that necessary for road construction shall be piled within the high water zone of streams where floods can transport it directly into the stream. Excess floatable debris shall be removed from areas immediately above crossings to prevent obstruction of culverts or bridges during periods of high water.

2.11.12. No skidding of logs or driving of vehicles across a perennial watercourse shall be allowed, except via authorized construction roads.

2.11.13. Skidding with tractors shall not be permitted within 100 feet of streams containing flowing water except in places designated in advance, and in no event shall skid roads be located on these stream courses. Skid trails shall be located high enough out of draws, swales, and valley bottoms to permit diversion of runoff water to natural undisturbed forest ground cover.

2.11.14. Construction methods shall prevent accidental spillage of solid matter, contaminants, debris, petroleum products, and other objectionable pollutants and wastes into watercourses, lakes, and underground water sources. Secondary containment catchment basins capable of containing the maximum accidental spill shall be installed at areas where fuel, chemicals or oil are stored. Any accidental spills of such materials shall be cleaned up immediately.

2.11.15. To reduce the amount of sediment entering streams, vegetation clearing in Riparian Habitat Conservation Areas on NFSL and other riparian areas on private lands shall be conducted in accordance with the Vegetation Removal and Disposition Plan and the Storm Water Pollution Prevention Plan, to be submitted for approval by the DEQ and the FS.

2.11.16. Damage resulting from erosion or other causes from construction activities and disturbance areas shall be repaired after completion of grading and before revegetation is begun.

2.11.17. Stormwater discharge of water shall be dispersed in a manner to avoid erosion or sedimentation of streams as required in DEQ permits.

2.11.18. Riprap or other erosion control activities shall be planned based on possible downstream consequences of activity, and installed during the low flow season if possible. Timing restrictions are presented in Appendix I.

2.11.19. Water used in embankment material processing, aggregate processing, concrete curing, foundation and concrete lift cleanup, and other wastewater processes shall not be discharged into surface waters without a valid discharge permit from DEQ.

2.12. CULTURAL AND PALEONTOLOGIC RESOURCES

2.12.1. All construction activities shall be conducted so as to prevent damage to significant archaeological, historical, or paleontological resources, in accordance with the requirements of 1.4.1 and the PA (Appendix E). Any Mitigation or Treatment plans involving privately owned property will be submitted to DEQ. DEQ will review submitted plans and then forward them to SHPO for approval. Both DEQ and SHPO require 30 days to review and approve any submitted plans.

2.12.2. In the event of any unanticipated discoveries, procedures outlined in the PA (Appendix E) will be followed. For notification purposes, the FS maintains jurisdiction on NFSL lands, DEQ maintains jurisdiction on private lands.

2.12.3. The OWNER shall conform to treatments recommended for cultural or paleontological resources by SHPO and DEQ on private land, with concurrence by the LANDOWNER, and the FS if on NFSL.

2.13. PREVENTION AND CONTROL OF FIRES

2.13.1. Burning, fire prevention, and fire control shall meet the requirements of the managing agency and/or the fire control agencies having jurisdiction. The STATE and KNF INSPECTORS shall be invited to attend all meetings with these agencies to discuss or prepare these plans. A copy of agreed upon plans shall be included in Appendix L

2.13.2. The OWNER shall direct the CONTRACTOR to comply with regulations of any county, town, state or governing municipality having jurisdiction regarding fire laws and regulations.

2.13.3. Blasting caps and powder shall be stored only in approved areas and containers and always separate from each other.

2.13.4. The OWNER shall direct the CONTRACTOR to properly store and handle combustible material that could create objectionable smoke, odors, or fumes. The OWNER shall direct the

CONTRACTOR not to burn refuse such as trash, rags, tires, plastics, or other debris, except as permitted by the county, town, state, or governing municipality having jurisdiction.

2.14. WASTE DISPOSAL

2.14.1. The OWNER shall direct the CONTRACTOR to use licensed solid waste disposal sites. Inert materials (Group III wastes) may be disposed of at licensed Class III landfill sites; mixed refuse (Group II wastes) must be disposed of at licensed Class II landfill sites.

2.14.2. Emptied pesticide containers or other chemical containers must be triple rinsed to render them acceptable for disposal in Class II landfills or for scrap recycling pursuant to ARM 44.10.803 for treatment or disposal. Pesticide residue and pesticide containers shall be disposed of in accordance with ARM 4.10.805 and 806.

2.14.3. All waste materials constituting a hazardous waste defined in Section 75-10-403, MCA, and wastes containing any concentration of polychlorinated biphenyls must be transported to an approved designated hazardous waste management facility (as defined in ARM 17.50.504) for treatment or disposal.

2.14.4. All used oil shall be hauled away and recycled or disposed of in a licensed Class II landfill authorized to accept liquid wastes or in accordance with 2.14.2 and 2.14.3 above. There shall be no intentional release of oil or other toxic substances into streams or soil. In the event of an accidental spill into a waterway, the INSPECTORS shall be contacted immediately. Any spill of refined petroleum products greater than 25 gallons must be reported to the State at the Department of Military Affairs, Disaster and Emergency Services Division at 406-841-3911. All spills shall be cleaned up in accordance with the OWNER's Emergency Spill Response Plan.

2.14.5. Sewage shall not be discharged into streams or streambeds. The OWNER shall direct the CONTRACTOR to provide refuse containers and sanitary chemical toilets, convenient to all principal points of operation. These facilities shall comply with applicable federal, state, and local health laws and regulations. A septic tank pump licensed by the State shall service these facilities.

2.14.6. Slash from vegetation clearing along the transmission line shall be managed in accordance with the Vegetation Removal and Disposition Plan, Montana law regarding reduction of slash (76-13-407, MCA) and, on NFSL, KNF objectives regarding fuels reduction.

2.14.7 On NFSL, merchantable timber shall be transported to designated landings or staging areas, and branches and tops shall be removed and piled. The FS shall be responsible for disposing of the piles on NFSL and the OWNER shall be responsible for disposal of the piles on other lands. All merchantable timber shall be removed from the transmission line clearing area on NFSL unless authorized in writing by an authorized FS representative. Non-merchantable trees and coniferous forest debris shall be removed using a brush blade or excavator to minimize soil accumulation. Excess slash shall be removed or burned in all timber harvest areas and within ½ mile of any residence. The FS shall be responsible for disposing of the piles on FS land and the OWNER shall be responsible for disposal of the piles on other lands. Non-merchantable material left within the transmission line clearing area shall be lopped and scattered unless otherwise requested by the KNF.

2.14.8. On private land, management of merchantable and non-merchantable trees as well as slash shall be negotiated between LANDOWNER and OWNER. On State land, management of merchantable and non-merchantable trees as well as slash shall be negotiated between DNRC and OWNER.

2.14.9. Refuse burning shall require the prior approval of the LANDOWNER and a Montana Open Burning Permit must be obtained from the DEQ. Any burning of wastes shall comply with section 2.13 of these specifications.

2.14.10. Burning of vegetation shall be in accordance with the Vegetation Removal and Disposition Plan. Piling and windrowing of material for burning shall use methods that shall prevent significant amounts of soil from being included in the material to be burned and minimize destruction of ground cover. Piles shall be located so as to minimize danger to timber and damage to ground cover when burned.

2.15. SPECIAL MEASURES

2.15.1 Structures with low reflectivity and non-specular conductors shall be used to reduce potential for visual contrast.

2.15.2 Crossings of rivers should be at approximately right angles. Strategic placement of structures should be done both as a means to screen views of the transmission line and right-of-way and to minimize the need for vegetative clearing.

2.15.3 Based on the analysis contained in the EIS and findings made by the DEQ, general mitigations also may apply to construction and operation of the project. These measures are found in Appendix A.

3.0. POST-CONSTRUCTION CLEANUP AND RECLAMATION

3.1. CLEANUP

3.1.1. All litter resulting from construction is to be removed, to the satisfaction of the LANDOWNER on private lands, the DNRC on State lands, and the FS on NFSL, from the right-of-way and along access roads leading to the right-of-way. Such litter shall be legally disposed of as soon as possible, but in no case later than 60 days following completion of wire clipping.

3.1.2. Insofar as practical, all signs of temporary construction facilities such as haul roads, work areas, buildings, foundations or temporary structures, soil stockpiles, excess or waste materials, or any other vestiges of construction shall be removed and the areas restored to as natural a condition as is practical, in consultation with the LANDOWNER and the FS on NFSL.

3.2. RECLAMATION

3.2.1 Revegetation of the right-of-way, access roads, all special use area, or any other disturbance shall be consistent with the reclamation and revegetation standards and provisions contained in ARM 17.20.1902 and the approved Plan of Operations on NFSL. This plan and any conditions to the certificate approved by DEQ shall be attached as Appendix M.

3.2.2 Scarring or damage to any landscape feature listed in Appendix A shall be reclaimed as nearly as practical to its original condition. Bare areas created by construction activities shall be reseeded in compliance with Appendix M to prevent soil erosion.

3.2.3 After construction is complete, NFSL roads shall be reclaimed as described in Appendix D. Roads on private lands shall be managed in accordance with the agreement between LANDOWNER and OWNER and between DNRC and OWNER on State land.

3.2.4. Fill slopes associated with access roads adjacent to stream crossing shall be regraded at slopes less than the normal angle of repose for the soil type involved.

3.2.5. All drainage channels, where construction activities occurred, shall be restored to a gradient and width that shall prevent accelerated gully erosion (see Section 2.11.11).

3.2.6. Drive-through dips, open-top box culverts, waterbars, or cross drains shall be added to roads at the proper spacing and angle as necessary to prevent erosion. The suggested spacing of drive thru dips and relief culverts is discussed in the KNF Revised Hydraulic Guide (1990) and Parrett and Johnson (2004) unless superseded by the Corps' 404 and DEQ 318 permit conditions and shall be used to establish the locations of these items.

3.2.7. Interrupted drainage systems shall be restored.

3.2.8. Sidecasting of waste materials may be allowed on slopes over 40 percent after approval by the LANDOWNER, DNRC, or FS, however, this will not be allowed within the buffer strip established for stream courses, in areas of high or extreme soil instability, or in other SENSITIVE AREAS identified in Appendix A. Surplus materials shall be hauled to sites approved by LANDOWNER, DNRC, or FS in such areas.

3.2.9. Seeding prescriptions to be used in revegetation, requirements for hydroseeding, fertilizing, and mulching, as jointly determined by representatives of the OWNER, DEQ, DNRC, FS, and other involved state and federal agencies, are specified in Appendix M.

3.2.10. During the initial reclamation of construction disturbance in areas where topsoil has been stockpiled, the surface shall be graded to a stable configuration and the topsoil shall be replaced on the disturbed area. The STATE INSPECTOR may waive the requirement for topsoil replacement on private lands on a site-specific basis where additional disturbance at a site increases erosion, sedimentation, or reclamation problems. Similarly, the KNF INSPECTOR may waive such requirements on NFSL.

3.2.11. Excavated material not suitable or required for backfill shall be evenly spread onto the cleared area prior to spreading any stockpiled soil. Large rocks and boulders uncovered during excavation and not buried in the backfill shall be disposed of as approved by the STATE and KNF INSPECTORS and/or LANDOWNER.

3.2.12. Application rates, timing of seeds and fertilizer, and purity and germination rates of seed mixtures shall be as determined in consultation with DEQ and FS. Reseeding shall be done at the first appropriate opportunity after construction ends.

3.2.13. Where appropriate, hydro seeding, drilling, or other appropriate methods shall be used to aid revegetation. Mulching with straw, wood chips, or other means shall be used where necessary. Areas requiring such treatment are listed in Appendix M.

3.3. MONITORING CONSTRUCTION AND RECLAMATION ACTIVITIES

3.3.1. Upon notice by the OWNER, the INSPECTORS shall schedule initial post-construction field inspections following clean up and road closure. Follow-up visits shall be scheduled as required to monitor the effectiveness of erosion controls, reseeding measures, and the Reclamation and Revegetation Plan (Appendix M). The OWNER shall contact the LANDOWNER for post-construction access and to determine LANDOWNER satisfaction with the OWNER'S reclamation measures.

3.3.2. The STATE INSPECTOR shall document observations on all lands for inclusion in monitoring reports regarding bond release required by DEQ. Such observations shall be coordinated with the KNF INSPECTOR on NFSL and the OWNER.

3.3.3. Release of the Transmission Line Construction and Reclamation Bond shall be based on completing the activities specified in the Reclamation and Revegetation Plan (Appendix M). Failure of the OWNER to complete the activities on disturbed areas in accordance with Appendix M and successfully revegetate disturbed areas shall be cause for forfeiture for the BOND or penalties described in Section 0.3. Failure of the OWNER to adequately reclaim all disturbed areas in accordance with section 3.2 and Appendix M of these specifications shall be cause for forfeiture of the BOND or penalties described in Section 0.9. Reclamation shall be in accordance with the standards established in ARM 17.20.1902 and in forested areas the right of way and unneeded roads shall be stocked naturally or planted with trees so that upon maturity, the canopy cover approximates that of adjacent undisturbed areas. Noxious weeds shall be controlled on disturbed areas.

4.0. OPERATION AND MAINTENANCE

4.1. RIGHT-OF-WAY MANAGEMENT

4.1.1. Maintenance of the right-of-way shall be as specified in the Weed Control Plan (Appendix K) and other monitoring and mitigation plans described in the KNF's Plan of Operations. This plan shall provide for the protection of SENSITIVE AREAS identified prior to and during construction. OWNER and CONTRACTOR activities off the right-of–way such as along access roads shall be consistent with best management practices and environmental protection measures contained in these specifications.

4.1.2. Vegetation that has been saved through the construction process and which does not pose a hazard or potential hazard to the transmission line, particularly that of value to fish and wildlife as specified in Appendix A, shall be allowed to grow on the right-of-way. Vegetation management shall be in accordance with the Vegetation Removal and Disposition Plan (Appendix F).

4.1.3. Vegetative cover along the transmission line and roads shall be maintained in cooperation with the LANDOWNER on private lands, DNRC on State lands, and the FS on NFSL.

4.1.4. Grass cover, water bars, cross drains, the proper slope, and other agreed to measures shall be maintained on permanent access roads on private lands and service roads in order to prevent soil erosion.

4.2. MAINTENANCE INSPECTIONS

4.2.1. The OWNER shall have responsibility to correct soil erosion or revegetation problems on the right-of-way or access roads as they become known. Maintenance of roads on NFSL shall be in accordance with the Road Management Plan. Appropriate corrective action shall be taken where necessary. The OWNER, through agreement with the LANDOWNER, DNRC, or FS, may provide a mechanism to identify and correct such problems.

4.2.2. Operation and maintenance inspections using ground vehicles shall be timed so that routine maintenance shall be done when access roads are firm, dry, or frozen, wherever possible. New roads, and existing barriered or impassable roads used for transmission line construction on NFSL shall not be used for routine maintenance; use of such roads shall be for emergency maintenance only. Maintenance vegetative clearing shall be done according to criteria described in Appendix F.

4.3. CORRECTION OF LANDOWNER PROBLEMS

4.3.1. When the facility causes interference with radio, TV, or other stationary communication systems, the OWNER shall correct the interference with mechanical corrections to facility hardware, or antennas, or shall install remote antennas or repeater stations, or shall use other reasonable means to correct the problem.

4.3.2. The OWNER shall respond to complaints of interference by investigating complaints to determine the origin of the interference. If the interference is not caused by the facility, the

OWNER shall so inform the person bringing the complaint. The OWNER shall provide the STATE INSPECTOR with documentation of the evidence regarding the source of the interference if the person brings the complaint to the STATE INSPECTOR or DEQ.

4.4. HERBICIDES AND WEED CONTROL

4.4.1. To minimize spreading weeds during construction, a joint weed inspection of the transmission line corridor and/or construction areas may be completed prior to construction areas. The joint inspection is intended to identify areas with existing high weed concentration. This joint review may include the OWNER, affected weed control boards, FS, DNRC and LANDOWNERS.

4.4.2. Weed control, including any application of herbicides in the right-of-way, shall be done by applicators licensed in Montana and in accordance with recommendations of the Montana Department of Agriculture, FS on NFSL, and in accordance with the Weed Control Plan in Appendix K.

4.4.3. Herbicides shall not be used in certain areas identified by DEQ, FS, and FWP, as listed in Appendix K.

4.4.4. Proper herbicide application methods shall be used to keep drift and nontarget damage to a minimum.

4.4.5. The OWNER shall notify the STATE and KNF INSPECTORS (if involving NFSL) in writing 30 days prior to any broadcast or aerial spraying of herbicides. The notice shall provide details as to the time, place, and justification for such spraying. DEQ, FWP, the Montana Department of Agriculture, and FS, if involving NFSL, shall have the opportunity to inspect the portion of the right-of-way or access roads schedule for such treatment before, during, and after spraying.

4.5. CONTINUED MONITORING

4.5.1. The KNF and DEQ may continue to monitor operation and maintenance activities for the life of the transmission line in order to ensure compliance with the KNF's Plan of Operations and the Certificate of Compliance.

5.0. ABANDONMENT, DECOMMISSIONING AND RECLAMATION FOLLOWING DECOMMISSIONING

When the transmission line is no longer used or useful, structures, conductors, and ground wires shall be removed, roads recontoured and disturbed areas reclaimed using methods outlined in Appendix N.

APPENDICES

Appendix A: Sensitive Areas for the Montanore Project.

The following sensitive areas have been identified on Figure D-1 of this Appendix where special measures will be taken to reduce impacts during construction and reclamation activities:

- Wetlands
- Riparian areas
- Bull trout critical habitat
- Old growth
- Core grizzly bear habitat
- Bald eagle primary use areas
- Areas with high risk of bird collisions
- Big game winter range
- Visually sensitive and high visibility areas
- Cultural and paleontological resources (not shown on Figure D-1)
- Additional areas for monitoring may be identified following the preconstruction monitoring trip by the INSPECTORS or preconstruction surveys by the OWNER (see Appendix I)

The following special measures will be incorporated into final design for these sensitive areas.

Wetlands and Riparian Areas

- Complete a jurisdictional delineation of waters of the U.S. in accordance with Section 1.4.3; avoid discharge of dredge or fill material into waters of the U.S. where practicable; develop and implement mitigation for all unavoidable impacts in accordance with Section 1.4.3.
- Construct all stream crossings in accordance with Section 2.11.5 and 2.11.6
- Locate structures outside of riparian areas if alternative locations are technically and economically feasible
- Minimize vegetation clearing and heavy equipment use in riparian areas in accordance with Sections 2.9.12 and 2.11.1

Bull Trout Critical Habitat

- Implement the timing restrictions described in Appendix I
- Implement measures for wetlands and riparian areas designed to minimize clearing adjacent to critical habitat

Old Growth

- Implement the vegetation removal procedures described in Appendix F designed to minimize clearing of old growth

Core Grizzly Bear Habitat

The OWNER shall not construct any road or trail that reduces core grizzly bear habitat.

Bald Eagle Primary Use Areas

- Implement the timing restrictions described in Appendix I

Areas with High Risk of Bird Collisions

To prevent avian collisions with the transmission lines, the visibility of conductors or shield wires shall be increased where necessary. This may include installation of marker balls, bird diverters, or other line visibility devices placed in varying configurations, depending on line design and location. Areas of high risk for bird collisions where such devices may be needed, such as major drainage crossings, and recommendations for type of marking device, shall be identified through a study conducted by a qualified biologist and funded by the OWNER.

Big Game Winter Range

- Implement the timing restrictions described in Appendix I

Cultural Resources

- Complete pre-construction surveys accordance with Section 1.4.1
- Conduct activities to prevent damage to significant archaeological, historical, or paleontological resources, in accordance with the requirements of 1.4.1, 2.12, and Appendix E.
- No roads, trails or overland travel is permitted with the boundaries of NRHP eligible or potentially eligible cultural sites unless appropriate mitigation has been applied.

Visually Sensitive and High Visibility Areas

- After completing a more detailed topographic survey, complete a detailed visual assessment of the alignment at three locations near residential properties: near the Fisher River and U.S. 2 crossing north of Hunter Creek (Section 32, T. 27 N., R. 29 W.), along West Fisher Creek (Section 2, T. 26 N., R. 30 W.), and between NFS roads 231 and 4725 southeast of Howard Lake (Section 19, T. 27 N., R. 30 W.)
- Keep the centerline at least 200 feet from private property at these locations, unless it is not technically feasible to do so.
- Based on the assessment, incorporate into the Vegetation Removal and Disposition Plan (Appendix F) measures to minimize vegetation clearing and visibility from residences and Howard Lake through modification of pole height, span length, and vegetation growth factor

- Based on the assessment, modify the quantity and location of poles to be installed by helicopter to minimize visible access roads
- Do not remove any shrub species 10 feet in height or less in the clearing corridor (see Section 2.1.5)

Appendix B: Performance Bond Specifications

The TRANSMISSION LINE CONSTRUCTION AND RECLAMATION BOND and JOINT DECOMMISSIONING BOND shall be used to ensure compliance with these specifications. The amount of the Construction and Reclamation Bond will be determined by the DEQ and FS within 45 days after the information required in Section 1.1 – 1.4 has been submitted. The Joint Decommissioning Bond will also be determined by the DEQ and FS within 45 days the information required in Section 1.1 – 1.3 has been submitted. These bonds must be submitted prior to the start of construction. The amount of the bonds will be reviewed and updated every 5 years by DEQ and FS.

Appendix C: Name and Address of Inspectors and Owner's Liaison

STATE INSPECTOR
Environmental Science Specialist
Montana Department of Environmental Quality
P.O. Box 200901, 1520 East Sixth Avenue
Helena, Montana 59620-0901
(406) 444-____

OWNER'S LIAISON
Environmental Specialist
Montanore Minerals Corp.
34524 U.S. Highway 2 West
Libby Montana 59923
(406) 293_____

KNF INSPECTOR
Kootenai National Forest
31374 U.S. Highway 2 West
Libby Montana 59923
(406) 293-_____

Appendix D: Road Management Plan

OWNER shall develop for the lead agencies' review and approval, and implement a final Road Management Plan that describes for all new and reconstructed roads used for the transmission line the following:

- Criteria that govern road operation, maintenance, and management
- Requirements for pre-, during-, and post-storm inspections and maintenance
- Regulation of traffic during wet periods to minimize erosion and sediment delivery and accomplish other objectives

- Implementation and effectiveness monitoring plans for road stability, drainage, and erosion control
- Mitigation plans for road failures

OWNER shall be responsible for implementing one or more of the following measures on newly constructed roads and reconstructed roads on NFSL so they cause little resource risk if maintenance is not performed on them during the operation period and prior to their future need:

- Conducting noxious weed surveys and performing necessary weed treatments prior to storage activities
- Blocking entrance to road prism
- Removing culverts determined by the KNF to be high-risk for blockage or failure; laying back stream banks at a width and angle to allow flows to pass without scouring or ponding so that revegetation has a strong chance of success
- Installing cross drains so the road surface and inside ditch will not route any intercepted flow to ditch-relief or stream-crossing culverts
- Removing and placing unstable material at a stable location where stored material will not present a future risk to watershed function
- Replacing salvaged soil and revegetating with grasses in treated areas and unstable roadway segments to stabilize reduce erosion potential

The OWNER shall decommission new transmission line roads on NFSL after removal of transmission line. OWNER shall be responsible for implementing one or more of the following measures on new roads on NFSL to minimize the effects on other resources:

- Conducting noxious weed surveys and performing necessary weed treatments prior to decommissioning
- Removing any remaining culverts and removing or bypassing relief pipes as necessary
- Stabilizing fill slopes
- Fully obliterating road prism by restoring natural slope and contour; restoring all watercourses to natural channels and floodplains
- Revegetating road prism
- Installing water bars or outsloping the road prism
- Removing unstable fills

On private lands the same measures shall be applied unless the certificate holder contracts with the landowner for revegetation or reclamation as allowed under ARM 17.20.1902.

Appendix E: Cultural Resources Protection and Mitigation Plan

The final Programmatic Agreement (PA) will be incorporated into these specifications.

The FS will contact the Confederated Salish & Kootenai Tribes and the Kootenai Tribe of Idaho (collectively the Tribes) to determine if they are interested in monitoring transmission line construction on Federal, State and private lands. If either or both Tribes express an interest, OWNER shall develop a Tribal Monitoring Plan in cooperation with the FS, DEQ, and the Tribes with for inclusion into this Appendix. This plan will facilitate the presence of tribal monitors from the SCKT and/or KTOI during transmission line construction. The plan will outline the tribal monitor's qualifications, responsibilities and capabilities as well as establish funding, which will be the OWNER's responsibility. The plan will be submitted to FS and DEQ for review at least 90 days prior to the BEGINNING OF CONSTRUCTION. The FS and DEQ will have 30 days to review the plan. The FS and DEQ will invite SHPO and DNRC to comment on the draft plan. The approved plan will be incorporated into these specifications.

Appendix F: Vegetation Removal and Disposition Plan

As part of final design, OWNER shall prepare a Vegetation Removal and Disposition Plan for lead agency review and approval. One of the plan's goals will be to minimize vegetation clearing. The plan will identify areas where clearing will be avoided, such as deep valleys with high line clearance, and measures that will be implemented to minimize clearing. For example, the growth factor used to assess which trees will require clearing could be reduced in sensitive areas, such as Riparian Habitat Conservation Areas, from 15 years to 5 to 8 years. OWNER will evaluate the use of monopoles to reduce clearing in select areas, such as old growth. The plan also will evaluate the potential uses of vegetation removed from disturbed areas, and describe disposition and storage plans during life of the line. The Vegetation Removal and Disposition Plan will be part of and incorporate details of the final design for the transmission line.

Appendix G: Variations in Right-of-Way Width

DEQ does not recommend specific widths for construction easements. In accordance with the specifications, construction activities shall be contained in the minimum area necessary for safe and prudent construction and approved by the FS on NFSL.

DEQ does not recommend specific variations in right-of-way widths beyond those required to meet the National Electric Safety Code for electric transmission line operations and those necessary to meet standards established in ARM 17.20.1607 (2).

Appendix H: Monitoring Plan

The STATE INSPECTOR is responsible for implementing this monitoring plan required by 75-20-303(b) and (c), MCA, and for reporting whether terms of the Certificate and Environmental Specifications (including but not limited to adequacy of erosion controls, successful seed germination, and areas where weed control is necessary) are being met, along with any conditions in the 404 permit and the MPDES General Permit for Storm Water Discharges Associated with Construction Activity and Authorization associated with the transmission line. Additional mitigating measures may be identified by the STATE INSPECTOR or by the KNF INSPECTOR on NFSL in order to minimize environmental damage due to unique circumstances that arise during construction.

In addition to participating in preconstruction conferences, the INSPECTORS shall conduct on-site inspections during the period of construction. At a minimum the INSPECTORS will be present at the start of construction and during the initiation of construction in sensitive areas. Subsequently INSPECTORS shall strive to conduct on-site reviews of construction activities on at least a weekly schedule. More frequent monitoring may be necessary.

INSPECTORS shall record the dates of inspection, areas inspected, and instances where construction activities are not in conformance with Environmental Specifications or terms and conditions of the Certificate of Compliance for the project. Inspection reports shall be submitted in a timely manner to the OWNER’s Liaison who will see that corrections are made or that such measures are implemented in a timely manner.

When violations of the Certificate are identified, the STATE INSPECTOR shall report the violation in writing to the OWNER, who shall immediately take corrective action. If violations continue, civil penalties described in 75-20-408, MCA may be imposed. In the event that the KNF INSPECTOR shows reasonable cause that compliance with the Plan of Operations is not being achieved, FS will implement measures described in 36 CFR 228.7(b).

Upon the completion of construction in an area, the INSPECTORS will determine that Environmental Specifications have been followed, and that activities described in Appendix M have been completed and vegetation is progressing in a satisfactory manner.

In the event the DEQ or FS finds that the OWNER is not correcting damage created during construction in a satisfactory manner or that initial revegetation is not progressing satisfactorily, DEQ may determine the amount and disposition of all or a portion of the reclamation bond to correct any damage that has not been corrected by the certificate holder.

Appendix I: Areas Where Construction Timing Restrictions Apply

All activities on NFSL and state trust lands for both construction seasons of the transmission line shall occur between June 16 and October 14.

Restrictions in the timing of tree removal and other transmission line construction activities are required on all lands between February 1 and August 15 around bald eagle or osprey breeding sites to assure compliance with the Montana Bald Eagle Management Plan, Bald and Golden Eagle Protection Act, Migratory Bird Treaty Act or FS requirements. Surveys for bald eagle or osprey nests shall be completed in appropriate habitat or timing restrictions shall be implemented in all areas of potential habitat. Surveys shall be conducted between March 15 and April 30, one nesting season immediately prior to transmission line construction.

If surveys conducted one nesting season immediately prior to construction activities did not find nesting of these species, such restrictions shall be rescinded. If an active nest was found, guidelines from the Montana Bald Eagle Management Plan (Montana Bald Eagle Working Group 1994) shall be followed to provide management guidance for the immediate nest site area (Zone 1), the primary use area (Zone 2), and the home range area (Zone 3). This includes delineating a ¼-mile buffer zone for the nest site area, along with a ½-mile buffer zone for the primary use area. High intensity activities, such as heavy equipment use, are not permitted during the nesting season (February 1 to August 15) within these two zones. The Montana Bald Eagle Working Group recommendations apply during the 5-year period following delisting of the bald eagle from the list of threatened and endangered species. If the Montana Bald Eagle Working Group recommendations lapse before the line was constructed, then the timing restrictions shall revert to the National Bald Eagle Management Guidelines issued by the US Fish and Wildlife Service in 2007.

Restrictions in the timing of transmission line construction activities in elk, white-tailed deer, or moose winter range are required between December 1 and April 30. These timing restrictions may be waived in mild winters if it can be demonstrated that snow conditions are not limiting the ability of these species to move freely throughout their range. Grizzly bear mitigations in the agency-mitigated alternatives include restrictions on the timing of transmission line construction and decommissioning. These restrictions shall apply to NFS and state trust lands. This grizzly bear mitigation requires that MMC be restricted to June 16 to October 14 for conducting these activities. No waiver of winter range timing restrictions shall be approved on NFS or state trust lands where the grizzly bear mitigations apply. The OWNER must receive a written waiver of these timing restrictions from the KNF, DEQ, and FWP, before conducting construction activities on elk, white-tailed deer, or moose winter range between December 1 and April 30 on private land. Timing restrictions shall not apply to substation construction.

Culvert or bridge installation is prohibited in areas of important fish spawning beds identified in Appendix A and during specified fish spawning seasons on less sensitive streams or rivers. Riprap or other erosion control activities on NFSL affecting bull trout spawning habitat can only occur during May 15 and September 1.

Other timing restrictions as negotiated by LANDOWNERS in individual easement agreements shall be incorporated into these specifications.

Appendix J: Aeronautical Hazard Markings

DEQ does not recommend aeronautical hazard markings at this time. If a potential hazard is identified during final design, DEQ will consult with the Federal Aviation Administration and Montana Aeronautics Division of MDT to determine appropriate action or aeronautical safety marking.

Appendix K: Weed Control Plan

The final Weed Control Plan will be incorporated into these specifications.

Appendix L: Fire Prevention Plan

The final Fire Prevention Plan will be incorporated into these specifications.

Appendix M: Reclamation and Revegetation Plan

An interim and final Reclamation and Revegetation Plan shall be developed and submitted to DEQ and FS for approval. This plan must, at a minimum, specify seeding mixtures and rates. It must satisfy LANDOWNER wishes, to the extent reasonable, requirements of the MPDES General Permit for Storm Water Discharges Associated with Construction Activity, and ARM 17.20.1902(10).

Because the reclamation of construction activities associated with the transmission line is considered interim and final reclamation will be required at mine closure, the primary objective of the interim reclamation plan is to provide long-term stability and control weed infestation during the operational phase of the project. The standards for interim reclamation used to determine construction bond release or to determine that expenditure of the reclamation bond is necessary to meet the requirements of the certificate for transmission lines will follow these primary objectives. The OWNER shall complete the following activities prior to release of the TRANSMISSION LINE CONSTRUCTION BOND:

- Implementation of the Weed Control Plan (Appendix K)
- Completion of all monitoring and mitigation described in the Cultural Resources Protection and Mitigation Plan and Tribal Monitoring Plan (Appendix E)
- Completion of all interim reclamation activities described in the Reclamation and Revegetation Plan (Appendix M)
- Completion of all activities associated with roads used for transmission line construction described in the Road Management Plan (Appendix D)
- Completion of all activities associated with vegetation removal and disposal for transmission line construction described in the Vegetation Removal and Disposition Plan (Appendix F)
- Revegetation is proceeding satisfactorily.

Appendix N: Abandoning and Decommissioning Plan

Prior to the start of construction, the OWNER shall submit to the lead agencies for their approval an abandonment and decommissioning plan. Based on this plan, the agencies shall then calculate the amount of the final reclamation bond.

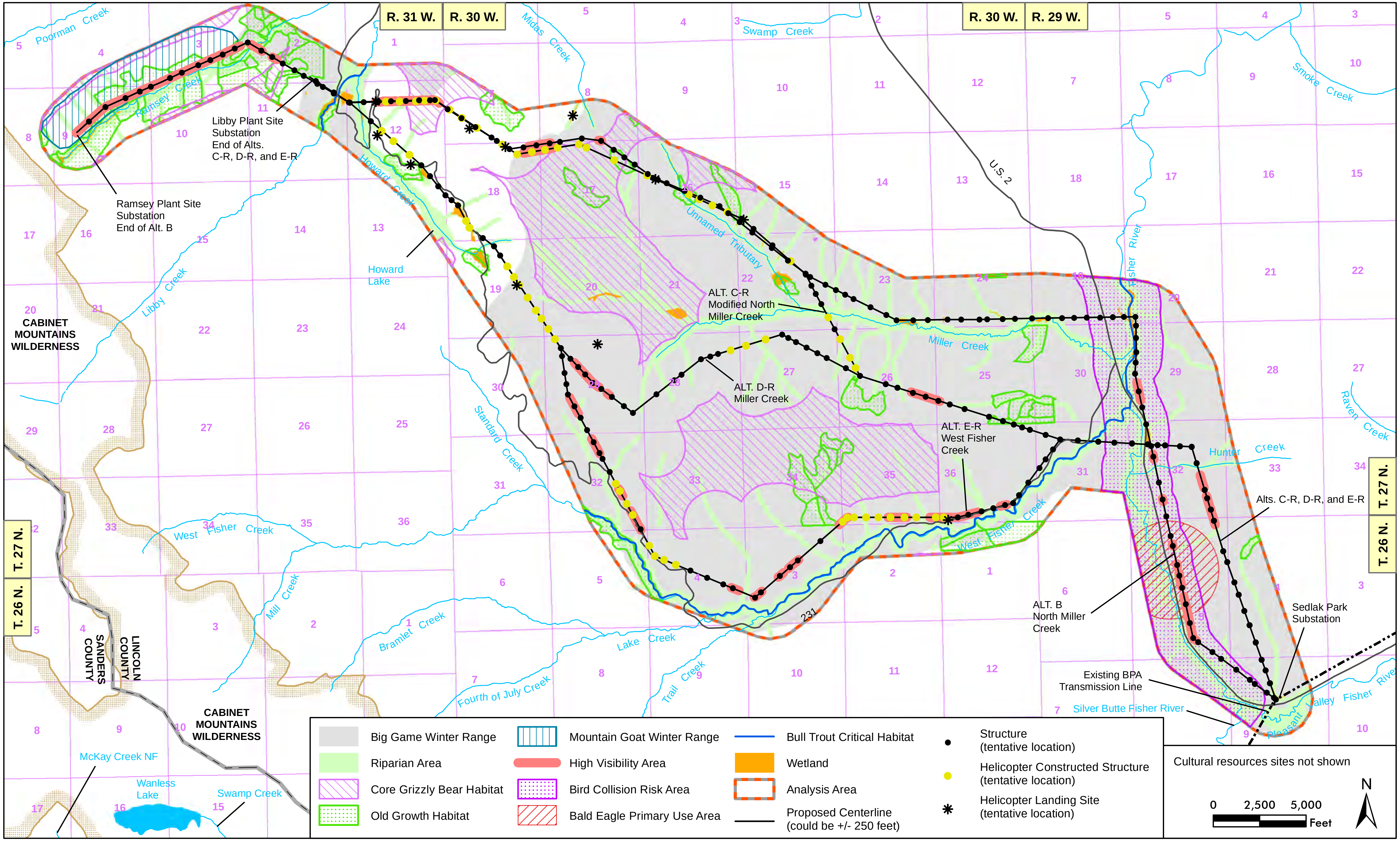

Figure D-1. Sensitive Areas Along Transmission Line Corridors

Appendix E—Past and Current Actions Catalog for the Montanore Project

Table E-1. Past and Current Actions Catalog for the Montanore Project (Alphabetical by Activity)

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, Number of permits)	PSU				BMU				BORZ	LAU		
				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
	Firewood Gathering														
Permits	1985		1312 permits												
Permits	1986		1550												
Permits	1987		1369												
Permits	1988		1122												
Permits	1989		1465												
Permits	1990		1405												
Permits	1991		1842												
Permits	1992		1687												
Permits	1993		1794												
Permits	1994		1805												
Permits	1995		1873												
Permits	1996		1942												
Permits	1997		1880												
Permits	1998		1543												
Permits	1999		1544												
Permits	2000		1762												
Permits	2001		1851												
Permits	2002		1775												
Permits	2003		1475												
Permits	2004		1837												
Permits	2005		1634												
Permits	2006		1765												
Permits	2007		1704												
Permits	2008		2121												
Permits	2009		2113												
Permits	2010		1938												
Permits	2011		1911												
Permits	2012		2201												
Permits	2013		1725												
	Because Fuelwood (Firewood) Permits purchased on the Kootenai National Forest may be used anywhere on the Forest, as well as anywhere within the boundaries of Region 1, statistical information regarding gathering locations is impractical to determine.														
	Grazing Allotments														
Swede Mountain	1956-1971	USFS	1500 Acres				X								
McMillan	1956-1971	USFS	200 Acres	X											
McMillan	1956-1971	PVT	300 Acres	X											
Granite-Cherry	1956-1986	USFS	4000 Acres				X								

Planning Subunit and LAU: C – Crazy, R – Rock, S – Silverfish, T – Treasure, W – West Fisher

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Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, Number of permits)	PSU				BMU				BORZ	LAU		
				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
Granite-Cherry	1956-1986	USFS	2000 Acres	X											
Libby Creek	1956-1989	USFS	3900 Acres	X											
Libby Creek	1956-1989	PVT	500 Acres	X											
Libby Creek	1956-1989	State of MT	150 Acres	X											
Barren	1958-1990	USFS	1500 Acres			X									
West Fisher	1956-1971	USFS	600 Acres			X									
West Fisher	1956-1971	St. Regis	300 Acres			X									
	Acres within Subunits are approximate.														
	Mineral Activities														
Gravel pit D5-30/ active/Miller Creek Pit	1994–present minimum	NFS lands	0.5 acre			X						X			
Rock quarry D5-35/ active/Miller Creek quarry	1994–present minimum	NFS lands	0.5 acre			X				X					
Gravel pit D5-14/ active/West Fisher River pit	1994–present minimum	NFS lands	0.5 acre			X				X					
Rock quarry D6-49/ active/Silver Butte Fisher quarry	1994–present minimum	NFS lands	0.1 acre			X					X				
Gravel pit D6-50/ active/Silver Butte Fisher pit	1994–present minimum	NFS lands	0.1 acre			X					X				
Gloria (Little Annie), West Fisher Creek	1930s 2001 last POO/adit closures completed 2007	NFS lands	40 acres active claim/surface disturbance less than 5 acres/mine road 1.5 miles			X				X					
Blacktail lode (aka Jumbo, Tip Top) claim – explore/ secure adits, Bramlet Creek	1909–1939 active underground mine Active POO 1993 – present/minor activities/adit closures planned 2012	NFS lands	40 acres claimed/ surface disturbance less than 5 acres/road to mine approx 1 mile			X				X					

Planning Subunit and LAU: C – Crazy, R – Rock, S – Silverfish, T – Treasure, W – West Fisher

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Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, Number of permits)	PSU				BMU				BORZ	LAU		
				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
Viking lode Inactive mine, Silver Butte Creek/aka Gold Hill	1934–1940s inactive mine/mill/tram – active claim held, possible adit closures 2014/POO 1993–1995	NFS lands	20 acres active claim/surface disturbance mine road (approx 2 miles), trails, millsite, collapsed stopes, 5-8 acres			X					X				
A-Far Placer Silver Butte Creek (near Viking) – placer exploration/suction dredge POO	Suction dredge POO 2009-2010; no activity	NFS lands	Less than 2 acres surface disturbance on one placer claim			X					X				
Gold Hill – *see Viking*															
American Kootenai Mine, W. Fisher (Bakie)	1890s–1906 active claims adjacent to private/one portal on claim – closure 2010/POO 1998	NFS lands	Less than 5 acres disturbance/mine road 1/2 mile			X				X					
American Kootenai claim group, West Fisher Creek	1890s–1906 patented group includes remnant of mill adj. to upper West Fisher Creek	PVT	162-acre parcel			X				X					
Mother Lode prospect (area of Gloria or Wayup) headwaters of West Fisher Creek	1915	NFS Lands	One adit 160 feet long			X				X					
Wayup lode claim/inactive/ motorized access in litigation (C. Harpole), W. Fisher	1902–1910/1937–1949 underground mine/several open portals	PVT	26 parcel/use of road behind gate approx 2 miles			X				X					
Branagan lode claim/inactive	1901–1905/1940–1950 mill/ underground workings	PVT	113-acre parcel			X				X					
Irish Boy (Rambler) lode claim/inactive/currently analyzing motorized access request	1930s mine/ analyzing access 2008 - present. In litigation.	PVT	30-acre parcel/ minor surface disturbances overgrown			X				X					

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Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, Number of permits)	PSU				BMU				BORZ	LAU		
				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
Fourth of July lode claim/inactive/access analyzed 1990s/in litigation (H. Skranak), Bramlet Creek	1960s motorized access in litigation late 1990s through 2008. NEPA outdated.	PVT	29-acre parcel			X				X					
King Mine lode claim/inactive	Early 1900s–1950 – site of mill and underground workings	PVT	200-acre parcel			X					X				
Golden West (New Mine) lode claim/abandoned mine, West Fisher Creek	1940s – shallow adits/tram; 3 portal closures 2009	NFS lands	40 acres(?) claimed/less than 5 acres surface disturbance			X				X					
Union	Pre-1955 – millsite between Bramlet and Mill Creek (tribs of West Fisher Creek)	PVT	Unknown			X				X					
Hannagan (Libby Prospect)	Pre-1948; aka Libby. West of Jumbo; caved adits; West Fisher Creek (part of American Kootenai private parcel)	PVT	Unknown			X				X					
Libby prospect – *see Hannagan*															
Mustang Mine ,Standard Creek	1930s–2003 intermittent Last POO 2003/reclaimed 2003	NFS lands	200 acres claimed/ surface disturbances reclaimed, portal closed			X				X					
Williams, Standard Creek	Pre-1948 – adits/cuts between Great Northern and Twin Peaks	NFS lands	Claim status – closed/minor surface disturbances			X				X					
Midas Mine, Standard Creek	1905–1948 extensive underground workings and mill/Standard Creek drainage	PVT	60-acre parcel			X				X					

Table E-1. Past and Current Actions Catalog for the Montanore Project (Alphabetical by Activity)

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, Number of permits)	PSU				BMU				BORZ	LAU		
				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
Midas Mine lode claim inactive, Standard Creek	POO – 1989–1990 on 3 adits near W. edge of private land–AC Lewis caved portals	NFS lands	520 acres claimed/ less than 5 acres surface disturbance			X				X					
Montezuma prospect (aka Silver Tip) /inactive – West Fisher Creek	1950s – shallow adits, pits, trenches, inactive (2 miles southeast of Midas mine) east side of West Fisher Creek. POO 1976–1992 (G.Shaw) Reclaimed 1993	NFS lands	20 acres (?) inactive claims/ surface disturbances (cabin site, prospects) reclaimed			X				X					
Silvertip-Lead prospect(part of Snowshoe group) between Big Cherry and Snowshoe creeks, above Cherry Creek Trail	Pre-1926	NFS lands	Pits, short adits/ less than 5 acres surface disturbance	X				X							
Miller Placer prospect/inactive – West Fisher Creek	1930s – one inaccessible shaft along West Fisher Creek, 2 miles S. of Teeters Peak	NFS lands	40 acres (?) claimed/minor surface disturbances			X				X					
Waylett Placer	1919 – lower Lyons Creek, trib. of Vermillion Creek east of Trout Creek, MT	NFS lands	Unknown												
Waylett group (aka Moose Hill, Royal) inactive-prospecting and reclamation aka Seclusion (AC Lewis) Miller Creek	1905–1960 prospect 1/2 mile SE of Midas Mine, Miller Creek near Teeters Peak/tungsten-qtz veins 1977 active; 1999 reclaimed POO – 1989–1998 (A.C. Lewis)	NFS lands	20 acres (?) inactive claims/ caved portals/ surface disturbances reclaimed			X				X					
Waylett North prospects	Pre-1948 – prospect east of Midas Mine	NFS lands	Claim status – closed/surface disturbances unknown			X				X					
Seclusion – *see Waylett*															

Table E-1. Past and Current Actions Catalog for the Montanore Project (Alphabetical by Activity)

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, Number of permits)	PSU				BMU				BORZ	LAU		
				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
Standard Lake area active lode claims	No POO/No activity	NFS lands	100 acres claimed/ no surface disturbances			X				X					
Sunrise prospect, near Silver Butte Pass (Rankin claims)	No POO	NFS lands	Unknown			X					X				
Silver Butte (NFS lands portion of King Mine)	No POO	NFS lands	40 acres closed claims/caved portals			X					X				
Snowfall Prospect – near Silver Butte Pass	No POO	NFS lands	1950s – 1.5 miles SE of King mine; 2 or more caved adits,disturbance unknown			X					X				
Illinois Montana group – *see Bear Lakes*		NFS lands				X				X					
Bear Lakes	2005 EA – trail construction (implement date unknown)	PVT	85-acre parcel/site of private cabin			X				X					
Bear Lakes mining claims adjacent to private land – no activity (aka Illinois Montana)	No POO	NFS lands	20 acres claimed/ unknown surface disturbances			X				X					
Silver Tip – *see Montezuma*															
Gravel pit D5 – 22/ reclamation/ Leigh Creek pit	Inactive since early/mid-1980s	NFS lands	0.25 acre	X				X							
Gravel pit D5 – 26/ reclamation/Libby Creek Pit	Active prior to 1994	NFS lands	0.3 acre	X								X			
Rock Quarry/D5 – 31/status pending/Crazyman Quarry	Active prior to 1994	NFS lands	0.25 acre	X								X			

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Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, Number of permits)	PSU				BMU				BORZ	LAU		
				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
Gravel Pit D5 – 39/ active/Little Cherry Pit	Active since between 1994–1999 / blasting for rip-rap 2012	NFS lands	less than 3 acres	X					X						
Gravel Pit D5 –13/ active/Poorman Creek Pit	Active prior to 1994 Material moved to pit for storage 2012	NFS lands	2 acres	X					X						
Seattle (leased to St. Paul Lead Co., Big Cherry Creek/ prospect	1958–1964	NFS lands	Cuts, pits, caved adits	X				X							
Snowshoe Mine – inactive mine	1890s–1964 underground mine and surface facilities	PVT	4 lode claims – approx 80 acres/ appprox 25 acres surface disturbances reclaimed	X				X							
Snowshoe Mine CERCLA clean-up site	2007–2009 tailings removal, adit closures, stream reconstruction	PVT	25 acres approx 180,000 cy tailings	X				X							
Snowshoe Mine Tailings along Snowshoe Creek/ CERCLA clean-up site	2007–2009 tailings removal	NFS lands	Approx 17,000 cy tailings/approx 2 acres	X				X							
Snowshoe CERCLA tailings "mixed tailings" repository site	Timber Cleared 2006/ construction 2007/ place tailings 2008, complete reveg 2009	NFS lands	17 acres distrubed	X				X							
Zollars aka St. Paul (Oro Mining, Silver Star Mine) claims contiguous with Snowshoe group – *see Raven (Shaw)*															
Texas Ranger group – *see Snowshoe Mine*															
Alpine Claim/Montana Silver-Lead/Big Sky Mining – Leigh Creek (near trailhead)	1897 located; 1915–1950s active; adits on steep slope/1994 proposal, no POO	NFS lands	Sloughed, overgrown, unknown	X				X							
Big Sky – *see Alpine/ Montana Silver-Lead*															

Table E-1. Past and Current Actions Catalog for the Montanore Project (Alphabetical by Activity)

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, Number of permits)	PSU				BMU				BORZ	LAU		
				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
Big Cherry Millsite	1950s	NFS lands	Approx 10 acres – mill and tailings ponds	X								X			
Big Cherry Millsite CERCLA tailings clean-up and repository construction	June–Oct. 2007 complete	NFS lands	Approx 15–20 acres millsite and repository and 5 acres of tailings along Big Cherry Creek	X								X			
Halfmoon – prospect on Poorman Creek side of Cable Mountain	1960s	NFS lands	Short tunnel, pits/ minor surface disturbance	X					X						
Cableway group – prospect	Unknown	NFS lands	Overgrown, unknown	X					X						
Statesman prospect – north side of Poorman Creek	Unknown	NFS lands	Shallow cuts; unknown	X					X						
John Bull – Uncle Sam inactive	Near Cable/Bear confluence	NFS lands	Collapsed adit, overgrown, minor surface disturbance	X					X						
Silver Cable Prospect/Mill (no production) Cable Creek	1930s	PVT	160 acre approx parcel size/one shallow open adit/use of approx 3 miles of road behind gate	X					X						
Silver Cable area unpatented claims (Wilbe claims Johnson/Prokop) Cable Creek	1993–present POO for access only (claim assessment work only) using road behind gate	NFS lands	One shallow adit/ less than 5 acres surface disturbance/use of approx 2 miles road use behind gate	X					X						

Planning Subunit and LAU: C – Crazy, R – Rock, S – Silverfish, T – Treasure, W – West Fisher

Table E-1. Past and Current Actions Catalog for the Montanore Project (Alphabetical by Activity)

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, Number of permits)	PSU				BMU				BORZ	LAU		
				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
Montanore (formerly Johnstone Placer patented claim) adit Libby Creek	Active 1989–1995 and 2006–present/ EIS in progress	PVT	Portal and surface facilities on approx 20 acres (89 acres total claimed in area)	X					X						
Betty Mae prospect upper Libby Creek	Pre-1948 – shallow lode prospects, upper Libby Creek	NFS lands	Caved adits/minor surface disturbance	X					X						
Diamond John prospect, north side of upper Libby Creek	Pre-1948 adit	NFS lands	1 adit – 60 feet long	X					X						
Lost Grouse (aka Skranak, Bolyard Placer, or Vaughn and Greenwell) Libby Creek	Mining – intermittent 1890s–1995/ POO 1992,95,96; Lost Grouse reclamation 2008	NFS lands	Claim approx 20 acres/less than 5 acres surface disturbance, drillhole/mine road 1/2 mile, underground workings intercepted by Lost Grouse in 2001.	X					X						
AUMCO (Peterson) instream suction dredge in Libby Creek	POO – 1979–present	NFS lands	3 placer claims/ instream only; use of 6199 Rd behind gate approx 2 miles	X								X			
ALPINE PLACER instream suction dredge in Libby Creek/dry placer exploration (Logan Pit) (B. Ericksmoen)	Suction dredge POO 1990–present /Logan Pit – 1914–1930s historic mining with POO 1982–present	NFS lands	2 placer claims/ surface disturbance Logan Pit less than 5 acres/use of 6199 Rd behind gate approx 2.5 miles	X								X			

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BACK ACRES (GPAA/ Taylor/White) instream suction dredge (formerly Ford Wilson placer)	Active POO 3 years 2004–present/prior activity pits near bank POO 1993-2001. Also pits/sluicing Dave White POO 2012	NFS lands	1 placer claim/pits less than 5 acres disturbance	X								X			
CRAZYMAN instream suction dredge (inactive) aka Getner Placer	POO 1993–2005 (Gross); Active - 2012 to present suction dredge as ‘Two Bits’ claim.(Walborn)	NFS lands	2 active placer claims/instream, less than 1 acre on bank-access	X											
Getner Placer – *see Crazyman*															
NWMGPA – Ace Placer Exploration	Mid-1990s–present POO	NFS lands	Less than 5 acres disturbance (pits), road approx 1/2 mile	X					X						
NWMGPA – LJ claims instream suction dredge	Mid-1990s–present POO	NFS lands	7 claims/instream only	X					X						
NWMGPA – Bent/99rs claims trenching; Big Cherry Creek	POO 2005–2006 pits/reclaimed	NFS lands	Reclaimed	X								X			
NWMGPA – Bent/99rs Claims – instream suction dredge Cherry Creek (includes Howard Placer active prior to 1955 (1929–1932)	1929–1932, 1955 – area active/POO 1993–present	NFS lands	2 claims/instream only	X								X			
Harry Howard Placer – *see NWMGPA Bent/99rs*															
LUCKY STRIKE instream suction dredge (previously L-Oro claims)	1992–present POO	NFS lands	Approx 500 feet of stream within 1 placer claim, instream only	X								X			
Nugget Placer (Beckstrom)	1929–1932 hydraulic mining/POO for access on 6199 Rd behind gate 1981–2004	NFS lands	Instream panning/access on approx 2.5 miles road behind gate	X								X			

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Zahav 1 – instream suction dredgeing (formerly Viona) at Bear/Libby Creek confluence/historic mining area, adjacent to Nugget	POO 2008-2010 for access, suction dredging POO 2010-present	NFS lands	1 placer claim, instream only/use of road behind gate 6199 Rd approx 2 miles	X								X			
Libby Creek Ventures (Bakie) Libby Creek	POO exploration drilling Jan. 2006–Oct. 2011	NFS lands	Proposed disturbance along Libby Creek Road less than 1/2 mile/no activity under POO as of Jan. 2008	X					X						
MYTEE FINE Placer – instream suction-dredge	New proposal in 2006 – POO 2007-present	NFS lands	Approx 500 feet of stream within 1 placer claim	X					X						
MYTEE FINE Placer – exploration pits and temp road	POO Sept. 2007–present.	NFS lands	Less than 5 acres to disturb includes temp road	X					X						
GOOD MEDICINE PLACER exploration pits (Jungst), formerly Dreamdust	previous POOs 1996–2005, 2007-2011. Trommel processing proposed 2011, possible implement 2012.	NFS lands	Less than 5 acres distrurbance	X					X						
Raven (aka St. Paul or Zollars Saint Paul Group) (above Snowshoe Creek – D. Shaw) underground mine & prospects	1955–? Adit closure – 2014?; POO 1990–1992	NFS lands	Approx 60 acres claimed/3 open adits, waste rock, mine road approx 2,000 feet	X				X							
Silvertip (above Cherry Creek)	1926–?	NFS lands	Approx 60 acres of claims/portals, waste rock, less than 5 acres	X											

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Libby Creek Recreational Gold Panning Area/primitive camp	Site of historic mining early 1900s–1950s/late 1980s land exchanged to NFS lands for rec. uses	NFS lands	Land designated for this purpose amounts to approx 175 acres	X					X						
Libby Placer Mining Co.–instream placer mining in Libby Creek	1889–1930s/large scale placer mine near 8.2-mile bridge Libby Creek	PVT	Approx 1,200 acre parcel, approx 3 miles of stream	X					X						
Libby Creek Gold Mining Co.	1930s–1940s placer, hydraulic mining Howard Creek, Libby Creek above Howard Creek confluence	NFS lands	Unknown	X					X						
Bolyard Placer – *see Vaughn/Greenwell, Lost Grouse*															
Copper-Iron occurrence	Unknown	NFS lands	Unknown	McSwede								X			
Copper-lead-iron-manganese occurrence	Unknown	NFS lands	Unknown	McSwede											
Copper Reward (aka Walker Group or Walker Tunnel) – prospect	Unknown	NFS lands	Caved adits above slope on Big Cherry Creek trail/ less than 5 acres disturbance	X				X							
Walker – *see Copper Reward*															
Fairbault prospect	Unknown	NFS lands	One adit 335 feet; status unknown	X				X							
Comet Placer – instream placer mining (aka Deadwood/Hogun)/Noranda Minerals/MMI	1908–1916/1931 hydraulic mining near mouth of Little Cherry Creek	NFS lands	Site of hydraulic mining; approx 350 acres in patented claims	X					X						
Red Gulch Placer (part of Comet) – *see Comet Placer*		NFS lands		X					X						

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				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
Grizzly/Missouri/McDonald on Leigh Creek near bridge and just above confluence with Big Cherry Creek	Pre-1948 adits/closures planned 2013 or 2014	NFS lands	3 (?) adits/minor surface disturbances, overgrown	X				X							
Glacier Silver/Lead aka Lukins/Hazel Mine – currently being subdivided	1910–1964, extensive underground mine, mill/subdivision planned-date unknown	PVT	Approx 700 acres/ 10,500 feet of workings, site of 325 T/day mill				X	X							
Loyal – *see Luken Hazel* (aka Shaughnessy Hill)															
Double Mac, north side Granite Creek near Victor Empire – prospect	Early 1900s	NFS lands	2 short caved adits/minor surface disturbance				X	X							
Victor Empire (north side of Granite Creek near trailhead) inactive – mining, milling	1908–1937/adit closure complete 2007	NFS lands	200 acres of mining claims, surface disturbances overgrown				X	X							
Silver Mountain Mine (south side Granite Creek)	1910–1950s/mill, flume, 3 adits, lower one open, adit closure planned 2013	NFS lands	Approx 150 acres of claims/surface disturbance less than 5 acres				X	X							
Mountain Rose aka Granite Creek (south side Granite Creek) see Silver Mountain		NFS lands					X	X							

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				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
Prospect Hill Mineral Exploration (explore existing portal)	In analysis – POO due winter 2012 or 2013/Herbert mine – 1930s/Orvana POO exploration 1990–1998	NFS lands	20-acre claim/less than 5 acres surface disturbance for minerals exploration/use/ minor reconstruct. of mine road .5 mile, approx less than 1 mile road construction				X	X							
Prospect Hill Private land access – easement and road construction	Special use permit (2012) pending road design approval.	PVT	20-acre parcel; less than 1 mile road construction to access; use/minor reconstruct. of mine road, approx .5 mile				X	X							
D&W group – inactive/ prospect	1930s adits on south side of Prospect Creek includes Ida V. and pits	NFS lands	Caved adits/less than 5 acres/ mining claim inactive				X	X							
Demonstrator Prospect	1930s	NFS lands	Small cuts – minor disturbance near Herbert Mine				X	X							
Denver #1 and #2	1930s	NFS lands	Pits, minor, near Herbert Mine				X	X							
Gravel pit D5-8/in reclamation status/Prospect Creek Pit	Inactive since mid-1980s ? at least – reclamation status	NFS lands	0.25 acre				X					X			
Gravel pit D5-21 – Deep-Granite pit reclamation status	Inactive since mid-1980s ? at least – reclamation status	NFS lands	0.1 acre				X								

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				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
Gravel pit D5-12/Big Cherry Creek Pit/Active status	Active at least since prior to 1994	NFS lands	2.5 acres				X					X			
Gravel pit D5-7/Deep Creek Pit/reclamation	Inactive at least since mid-1980s	NFS lands	0.5 acre				X					X			
Noxious Weeds Management															
1997 KNF Herbicide Weed Control Plan EA	2002	USFS	Acres	28.25		5.25	12.5								
1997 KNF Herbicide Weed Control Plan EA	2003	USFS	Acres	67.25		22.75	4.5								
1997 KNF Herbicide Weed Control Plan EA	2004	USFS	Acres	47.5		32.75	156								
1997 KNF Herbicide Weed Control Plan EA	2005	USFS	Acres	82.3		39.27	7								
1997 KNF Herbicide Weed Control Plan EA	2006	USFS	Acres	51.3		93.7	24.1								
KNF Herbicide Weed Control Plan EA 2002	2002	USFS	Acres sprayed		62										
KNF Herbicide Weed Control Plan EA 2002	2003	USFS	Acres sprayed		0										
KNF Herbicide Weed Control Plan EA 2002	2004	USFS	Acres sprayed		10										
KNF Herbicide Weed Control Plan EA 2002	2005	USFS	Acres sprayed		4										
KNF Herbicide Weed Control Plan EA 2002	2006	USFS	Acres sprayed		10.5										
KNF Herbicide Weed Control Plan EA 2007	2007	USFS	Acres sprayed	91.5		23.0	12.5								
KNF Herbicide Weed Control Plan EA 2007	2008	USFS	Acres sprayed	159.8		18.3	22.3								
KNF Herbicide Weed Control Plan EA 2007	2009	USFS	Acres sprayed	288.8		20	50.6								
KNF Herbicide Weed Control Plan EA 2007	2010	USFS	Acres sprayed	20.7		86.4	13.6								
KNF Herbicide Weed Control Plan EA 2007	2011	USFS	Acres sprayed	91.4		73.8	20.6								
KNF Herbicide Weed Control Plan EA 2007	2012	USFS	Acres sprayed	135	33	35	58								

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				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
KNF Herbicide Weed Control Plan EA 2007	2013	USFS	Acres sprayed	50	3	35	30								
Pre-commercial Thinning															
Pre-commercial Thin	1950s	FS	0 ACRES	X											
Pre-commercial Thin	1960s		79	X											
Pre-commercial Thin	1970s		557	X											
Pre-commercial Thin	1980s		597	X											
Pre-commercial Thin	1990s		1713	X											
Pre-commercial Thin	2000-2006		403	X											
Pre-commercial Thin	1950s	FS	0			X									
Pre-commercial Thin	1960s		980			X									
Pre-commercial Thin	1970s		312			X									
Pre-commercial Thin	1980s		152			X									
Pre-commercial Thin	1990s		51			X									
Pre-commercial Thin	2000-2006		0			X									
Pre-commercial Thin	1950s	FS	0				X								
Pre-commercial Thin	1960s		502				X								
Pre-commercial Thin	1970s		1083				X								
Pre-commercial Thin	1980s		264				X								
Pre-commercial Thin	1990s		891				X								
Pre-commercial Thin	2000-2006		271				X								
Pre-commercial Thin	2007-2011		308	X											
Pre-commercial Thin	2007-2011		377				X								
Pre-commercial Thin	2012		203	X											
Pre-commercial Thin	2013		10	X											
Pre-Commercial Thin	2012		87				X								
Pre-Commercial Thin	2013		10				X								
Prescribed Burning															
Fuels Treatment	1950s	FS	0	X											
Fuels Treatment	1960s		6	X											
Fuels Treatment	1970s		1455	X											
Fuels Treatment	1980s		799	X											
Fuels Treatment	1990s		760	X											
Fuels Treatment	2000-2006		0	X											
Fuels Treatment	1950s	FS	0			X									
Fuels Treatment	1960s		0			X									
Fuels Treatment	1970s		0			X									

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				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
Fuels Treatment	1980s		255			X									
Fuels Treatment	1990s		129			X									
Fuels Treatment	2000-2006		0			X									
Fuels Treatment	2007-2011		46	X											
Fuels Treatment	1950s	FS	0				X								
Fuels Treatment	1960s		00				X								
Fuels Treatment	1970s		75				X								
Fuels Treatment	1980s		258				X								
Fuels Treatment	1990s		275				X								
Fuels Treatment	2000-2006		130				X								
Fuels Treatment	2007-2011		46	X											
Fuels Treatment	2012		44		X										
Fuels Treatment	2013		77		X										
Recreational Building Maintenance															
Toilets		FS		2	7	2	1								
Pavillion		FS			2		1								
Pump House		FS		1											
Storage Shed		FS		1											
Lookout Tower		FS				1	1								
Old Cabin		FS				1									
Radio Buildings		Non-FS				1	1								
Many *Private* Buildings in all 4 Planning Subunits.															
Road Construction, Maintenance, and Obliteration															
Silver Butte Phase RAC 2	2007	FS	7.5 miles			X									
West Fisher Aggregate Placement	2007	FS/PC	4.2 miles			X									
Libby Creek Bridge Approach Paving	2007	FS	8 Bridges	X											
West Fisher RAC	2007	FS	1.5 miles			X									
Libby Creek ERFO	2008	FS	Washout site	X											
Big Cherry Millsite Cleanup	2007	FS	Hazmat cleanup site				X								
Snowshoe Cleanup	2008	State/Private	Hazmat cleanup site	X											
Big Cherry Bridge ERFO	2007	FS	1 Bridge Repair from flood				X								

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Midas Creek Fish Passage	2007	FS	Culvert replacement	X											
Rd 6205 BMP	2007	FS	BMP work on 1 mile	X											
NF Bull River ERFO	2007	FS	Washout site		X										
SF Bull River ERFO	2007	FS	Washout site		X										
Aggregate West Fisher	2010	FS	5 miles			X									
Upper Big Cherry Bridge	2010	County/FS	Reconstruct	X											
Crushing/Haul L.Cherry Pit	2010	FS	Crush/Haul/Pile	X											
Miller West Fish. Road Work	2010	FS	Re-construction			X									
Routine Road Mtce is likely to occur on many of the roads	Annually	FS		X	X	X	X								
Routine road maintenance is likely to occur on open roads in Silverfish subunit (Miller West Fisher EIS).	Annually	FS	Maintenance			X									
Special Forest Products															
Huckleberry gathering sesonal commercial permit	2002	FS	Unknown	X	X	X	X	X	X	X					
Huckleberry gathering sesonal commercial permit	2005	FS	Unknown	X	X	X	X	X	X	X					
Note: no commercial permits issued 2003-2013															
Special Use Permits															
FRTA Road – PCTC 401371	1982		8.0 ac.			X									
FRTA Road – PCTC 401373	1983		4.67 ac.			X									
FRTA Road – PCTC 497813	1965		22.0 ac.			X									
FRTA Road – PCTC 497817	1964		12.29 ac			X									

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FRTA Road – PCTC 401727	1979		12.08 ac.			X									
FRTA Road – PCTC 497860	1982		46.0 ac.			X									
FRTA Road – PCTC 497861	1982		1.52 ac.			X									
THR074 – Sp. Use Road	1994		0.14 ac.				X								
CAB062 – Water Qlty Station - Monitoring	1993		1 – Permit		X										
496801 – FRTA Road	1986		10.90 ac		X										
495601 – FRTA Road	1986		9.12 ac		X										
095502 – Powerline (BPA)	1950		1 - permit		X										
CAB049 – Sp Use Road	1980		1.61 ac		X										
095506 – Passive Reflector	1977		1 - permit		X										
CAB060 – Sp.Use Road	1980		1.61 ac.		X										
Outfitter & Guide	?		2 -Permit		X										
CAB064 – Water Transmission Pipeline <12”	1992		0.05 ac		X										
CAB048 – Water Transmission Pipeline <12”	1957		0.07 ac		X										
CAB116 - Water Transmission Pipeline <12”	1991		0.10 ac												
496607 – Powerline	1985		91.40 ac.		X										
510401 – FLPMA Easement	1993		0.09 ac		X										
CAB028 – Water Transmission Pipeline <12”	1981		0.41 ac.		X										
CAB111 – FLPMA Easement	2006		0.56 ac		X			X							
KNF006 – FRTA Road	2002		7.85 ac.		X			X							
LIB022 – FRTA Road	2002		112.0 ac	X			X	X							

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LIB094 – Water Conveyance system easement	1927		1.63	X				X							
LIB129 - Water Transmission Pipeline <12”	1963		0.13 ac.	X				X							
507601 – FLPMA Easement	1999		1.65 ac	X				X							
195222 – DOT Easement (2)	1984		130.10	X				X							
LIB135 – Sp Use Road	1996		0.39 ac	X				X							
533601 – Irrigation Water Ditch	1983		2.20 ac.	X				X							
529801 – Sp Use Road	1981		0.63 ac.	X					X						
LIB021 – FRTA Road	2000		3.84 ac.				X								
502201 – FLPMA Easement	1998		0.97 ac				X		X						
511901 – Sp Use Road	1998		3.38 ac.				X		X						
LIB050 – Target Range	1978		12.0 ac.				X								
LIB090 – Sp Use Road	1983		1.09 ac				X								
LIB128 – Sp Use Road	1996		0.34 ac.				X		X						
100134 – FRTA Road	1983		8.03 ac				X								
100144 – FRTA Road	1977		0.79 ac				X		X						
100137 – FRTA Road	1981		6.15 ac				X			X					
100138 – FRTA Road	1981		7.84 ac				X			X					
101001 – Water Diversion weir	1986		1.29 ac				X			X					
405706 – Passive Reflector	1966		1 permit				X			X					
300301 – Broadcast Translator/Low Power	1996		1 permit				X			X					
100152 – FRTA Road	1994		8.18 ac.				X			X					
KNF014 – Powerline (BPA)	1950		1 - permit				X			X					
Trail Mtce-Secondary	2004	FS	0.00												
Trail Mtce – Way	2004	FS	22.85 miles			X				X					
Paul Bunyan Refuse Cont.	2011	FS	1 permit				X								

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Residential Access - Bowe	2011	FS	1 permit	X								X			
Bear Lakes Access	2011	FS	1 permit			X									
No SU permits in these PSU 2012-2013															
Timber Sales															
Regeneration Harvests	1950s	FS	127 Acres	X											
Regeneration Harvests	1960s		1220	X											
Regeneration Harvests	1970s		3501	X											
Regeneration Harvests	1980s		2244	X											
Regeneration Harvests	1990s		826	X											
Regeneration Harvests	2000-2006		27	X											
Regeneration Harvests	2009		474			X									
Intermediate Harvests	1950's	FS	56	X											
Intermediate Harvests	1960s		608	X											
Intermediate Harvests	1970s		1312	X											
Intermediate Harvests	1980s		879	X											
Intermediate Harvests	1990s		850	X											
Intermediate Harvests	2000-2006		33	X											
Intermediate Harvests	2009		661			X									
Intermediate Harvests	2013		65	X											
All PVT Harvests	1950s	Private	509 Acres	X											
All PVT Harvests	1960s		139	X											
All PVT Harvests	1970s		204	X											
All PVT Harvests	1980s		1052	X											
All PVT Harvests	1990s		1295	X											
All PVT Harvests.	2000-2006		232	X											
Sum PVT Regen.			1617 Acres	X											
Sum PVT Intermed.			1814 Acres	X											
Libby Crk Placer Co. Harvest	2008-2010	Private	1066	X											
Regeneration Harvests	1950s	FS	Acres			X									
Regeneration Harvests	1960s		47			X									
Regeneration Harvests	1970s		97			X									
Regeneration Harvests	1980s		1004			X									

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				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
Regeneration Harvests	1990s		170			X									
Regeneration Harvests	2000-2006		0			X									
Intermediate Harvests	1950s	FS	0 Acres			X									
Intermediate Harvests	1960s		1549			X									
Intermediate Harvests	1970s		647			X									
Intermediate Harvests	1980s		536			X									
Intermediate Harvests	1990s	FS	384			X									
Intermediate Harvests	2000-2006		0			X									
All PVT Harvests	1950s	PVT	41 Acres			X									
All PVT Harvests	1960s		0			X									
All PVT Harvests	1970s		0			X									
All PVT Harvests	1980s		2561			X									
All PVT Harvests	1990s		426			X									
	2000-2006		566			X									
Sum PVT Regen			1808			X									
Sum PVT Intermed.			1786			X									
Regeneration Harvests	1950s	FS	0				X								
Regeneration Harvests	1960s		499				X								
Regeneration Harvests	1970s		379				X								
Regeneration Harvests	1980s		1502				X								
Regeneration Harvests	1990s		1221				X								
Regeneration Harvests	2000-2006		27												
IntermediateHarvests	1950s	FS	0 Acres				X								
IntermediateHarvests	1960s		105												
IntermediateHarvests	1970s		21												
IntermediateHarvests	1980s		579												
IntermediateHarvests	1990s	FS	686				X								
IntermediateHarvests	2000-2006		567												
All PVT Harvests	1950s	PVT	0 Acres				X								
All PVT Harvests	1960s		488				X								
All PVT Harvests	1970’s		708				X								
All PVT Harvests	1980’s		3196				X								
All PVT Harvests	1990s		1248				X								
All PVT Harvests	2000-2006		615				X								
Sum PVT Regen			3097				X								
Sum PVT Intermed.			3158				X								
BABY BEAR BUGS	1987	FS	111	X											

Table E-1. Past and Current Actions Catalog for the Montanore Project (Alphabetical by Activity)

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, Number of permits)	PSU				BMU				BORZ	LAU		
				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
BARE DOWN FUELWOOD	1996		11	X											
BARE FUEL	1986		27	X											
BEAR-POORMAN WP SALV	1990		86	X											
BEAR??	1982		57	X											
BIG CHERRY	1994		78	X											
BUGGY BEAR PC	1984		37	X											
BUNYAN BUGS	1988		55	X											
BUNYAN PULP	1997		13	X											
CAMPGROUND BUGS	1988		25	X											
CENTRAL PLACER S.T.	1985		45	X											
CRAZY BUGS	1985		20	X											
CRAZY CAB SALV	1998		126	X											
CRAZYMAN BLOWOUT	1982		27	X											
CRAZYMAN BUGS	1987		11	X											
CRAZYMAN SALE	1974		123	X											
CRAZYMAN SALE	1975		156	X											
CRAZYMAN SALE	1976		797	X											
GETNER	2013		65	X											
GOLDIELOCKS P C	1986		25	X											
GRANITE	1987		115	X											
GRANITE	1988		184	X											
HOODOO	1982		50	X											
HOODOO	1983		59	X											
HOODOO	1987		186	X											
HOODOO	1988		413	X											
HOODOO	1989		110	X											
HOODOO	1990		412	X											
HOODOO	1991		326	X											
HOODOO	1992		16	X											
HOODOO SALE	1978		12	X											
HORSE BUGGY PC	1984		9	X											
HORSE BUGGY PC	1986		7	X											
HORSE CABLE	1985		198	X											
HORSE CABLE	1986		267	X											

Planning Subunit and LAU: C – Crazy, R – Rock, S – Silverfish, T – Treasure, W – West Fisher

Table E-1. Past and Current Actions Catalog for the Montanore Project (Alphabetical by Activity)

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, Number of permits)	PSU				BMU				BORZ	LAU		
				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
HORSE CABLE	1987		130	X											
HORSE CABLE	1988		171	X											
HORSE CABLE	1989		34	X											
HORSE CABLE CLEANUP	1989		100	X											
HORSE CABLE CLEANUP	1991		12	X											
HOWARD W. FISHER	1978		93	X											
HOWARD W. FISHER	1984		38	X											
JUST RIGHT PC	1988		42	X											
LEIGH CR. BUGS	1989		99	X											
LIBBY CR SEED TREE	1989		125	X											
LIBBY CREEK	1973		67	X											
LIBBY CREEK	1976		134	X											
LIBBY CREEK STR	1982		16	X											
LIBBY-HORSE BLOWDOWN	1990		15	X											
LITTLE CHERRY BUG	1989		39	X											
MAMA BEAR BUGS	1987		133	X											
MIDAS	1990		160	X											
MIDAS	1991		258	X											
MIDAS BLOWDOWN	1998		81	X											
MIDAS SEED TREE	1989		194	X											
ONCE MORE SALVAGE	1991		29	X											
PAPA BEAR BUGS	1987		108	X											
PAUL BUNYAN P.C.	1986		81	X											
PAUL BUNYAN P.C.	1987		40	X											
POOR LITTLE RAMSEY	1982		42	X											
SKI TRAIL SALVAGE	1990		12	X											
SKIER DOWN SALV	1997		130	X											
SMEARL LITTLE CHERRY	1970		89	X											
SMEARL LITTLE CHERRY	1976		63	X											
SMEARL LITTLE CHERRY	1978		413	X											

Table E-1. Past and Current Actions Catalog for the Montanore Project (Alphabetical by Activity)

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, Number of permits)	PSU				BMU				BORZ	LAU		
				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
SMEARL LITTLE CHERRY	1980		25	X											
SMEARL LITTLE CHERRY	1981		25	X											
SMEARL LITTLE CHERRY	1982		287	X											
SNOWSHOE	2006		19	X											
SNOWSHOE PLANT BUGS	1991		3	X											
TREASURE 2 (STEWARDS)	2004		22	X											
TREASURE 2 (STEWARDS)	2005		8	X											
WHO DOWN SALVAGE	1993		231	X											
WILLIAMS MCMILLIAN	1981		39	X											
WINDY BEAR SALV	1997		89	X											
CEDAR CR POSTS #1	1992		11				X								
CEDAR CR POSTS #2	1992		16				X								
CEDAR CR POSTS #3	1991		6				X								
DEEP GRANITE	1979		290				X								
DEEP GRANITE	1980		303												
FLOWER BUGS	1987		11				X								
FLOWER CEDAR	1980		61				X								
FLOWER CEDAR	1981		114				X								
FLOWER CEDAR	1982		18				X								
FLOWER CEDAR	1984		251				X								
FLOWER CEDAR	1985		85				X								
FLOWER CEDAR	1986		183				X								
FLOWER CEDAR	1988		10				X								
FLOWER-CEDAR ST	1990		55				X								
GOLD DIGGER BUGS	1993		79				X								
GRANITE	1986		75				X								
GRANITE	1987		162				X								
GRANITE	1988		16				X								
GRANITE BRUSH BUGS	1987		24				X								

Table E-1. Past and Current Actions Catalog for the Montanore Project (Alphabetical by Activity)

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, Number of permits)	PSU				BMU				BORZ	LAU		
				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
GRANITE BRUSH BUGS	1990		140				X								
GRANITE BUGS	1986		32				X								
GRANITE CREEK BUGS	1988		102				X								
GUAGING STATION	1982		26				X								
INTAKE BUGS	1989		11				X								
INTAKE BUGS	1990		92				X								
ISOLATED BUGS	1987		20				X								
MAMA BEAR BUGS	1987		31				X								
NO CREEK BUGS	1987		74				X								
NO RESALE	1986		40				X								
NO RESALE	1987		13				X								
PARMENTER BLOWDOWN	1999		61				X								
PARMENTER HILL BUGS	1988		28				X								
PARMENTER TRASPASS	1989		7				X								
PROSPECT PARMENTER	1994		315				X								
PROSPECT PARMENTER	1995		22				X								
PROSPECT PARMENTER	1996		249				X								
PROSPECT PARMENTER	1997		96				X								
PROSPECT PARMENTER	1998		45				X								
PROSPECT PARMENTER	1999		108				X								
PROSPECT PEST 1	1989		12				X								
SCENERY SALVAGE	1997		36				X								
SNOWSHOE PLANT BUGS	1991		172				X								
SNOWSHOE PLANT BUGS	1992		109				X								

Table E-1. Past and Current Actions Catalog for the Montanore Project (Alphabetical by Activity)

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, Number of permits)	PSU				BMU				BORZ	LAU		
				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
SNOWSHOE ROAD BUGS	1990		314				X								
SOUTH FLOWER BUGS	1990		31				X								
TREASURE 1 (STEWARDS	2003		594				X								
WILLIAMS MCMILLAN	1981		54				X								
WILLIAMS MCMILLAN	1982		113				X								
CHECKERBOARD LE	1986		17			X									
CHECKERBOARD LE	1987		33			X									
CHECKERBOARD LE	1992		72			X									
CHECKERBOARD LE	1993		81			X									
CHECKERBOARD LE	1994		55			X									
CORRAL SALVAGE	1997		50			X									
CORRAL SALVAGE	1998		50			X									
HORSE CABLE	1987		18			X									
HORSE CABLE	1988		151			X									
HORSE CABLE	1989		139			X									
HORSE CABLE	1990		59			X									
HORSE CABLE	1991		359			X									
HOWARD W. FISHER	1976		61			X									
HOWARD W. FISHER	1977		15			X									
HOWARD W. FISHER	1978		72			X									
HOWARD W. FISHER	1980		12			X									
MIDAS TRESPASS	1993		13			X									
MILLER FIRE SALVAGE	1993		27			X									
MILLER POST & POLE	1987		10			X									
MILLER POST & POLE	1990		9			X									
MILLER POST & POLE	1991		6			X									
MILLER POST & POLE	1992		7			X									
MILLER STUD P.C.	1986		33			X									
RED BATTON PC	1985		143			X									
SWAMP SCHRIEBER	1989		15			X									
TEETERS BUGS P.C.	1985		47			X									
TEETERS BUGS P.C.	1986		15			X									
TEETERS BUGS RS	1985		26			X									
TEETERS BUGS RS	1987		112			X									

Table E-1. Past and Current Actions Catalog for the Montanore Project (Alphabetical by Activity)

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, Number of permits)	PSU				BMU				BORZ	LAU		
				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
TRAIL CR. BLOWDOWN	1987		8			X									
TRAIL CR. BLOWDOWN	1988		71			X									
TRAIL CREEK	1986		287			X									
TRAIL CREEK	1987		14			X									
WEST FISHER	1978		472			X									
WEST FISHER	1980		27			X									
WEST FISHER	1982		162			X									
WEST FISHER SEED	1988		116			X									
	Note; Green Mtn. Fuels Reduction project (DM 11/2006, Cabinet RS) is outside of analysis area (south of Rock PSU), but in BMU 6 and was included in Miller West Fisher EIS Current and Reasonably Forseeable Actions discussion. Project included 352 acres commercial thinning and 706 acres prescribed fire.														
	Trail Construction, Maintenance, and Obliteration														
Rock Lake trail # 935	Yearly Mtce.	FS	4 miles		X				X						
Moran Basin Tr #993	Yearly Mtce.	FS	3 miles		X				X						
Engle Pk Tr. # 932	Yrly mtce.	FS	4.5 miles		X				X						
Trail Mtce – Mailine	2011	FS	31.24 miles				X	X							
Trail Mtce-Secondary	2011	FS	8.42 miles				X	X							
Trail Mtce – Way	2011	FS	4.96 miles				X	X							
Trail Mtce - Mainline	2010	FS	31.24 miles				X	X							
Trail Mtce-Secondary	2010	FS	3.75 miles				X	X							
Trail Mtce – Way	2010	FS	20.17 miles				X	X							
Trail Mtce – Mainline	2011	FS	7.07 miles	X					X						
Trail Mtce-Secondary	2011	FS	0.00												
Trail Mtce – Way	2011	FS	0.00												
Trail Mtce – Mainline	2010	FS	7.07 miles	X					X						
Trail Mtce-Secondary	2010	FS	0.00												
Trail Mtce – Way	2010	FS	3.20 miles	X					X						
Trail Mtce – Mainline	2011	FS	10.37 miles			X				X					
Trail Mtce-Secondary	2011	FS	2.91 miles			X				X					
Trail Mtce – Way	2011	FS	26.06 miles			X				X					
Trail Mtce – Mainline	2010	FS	10.37 miles			X				X					
Trail Mtce-Secondary	2010	FS	0.00												
Trail Mtce – Way	2010	FS	22.85 miles			X				X					
Trail Mtce – Mainline	2009	FS	31.24 miles				X	X							
Trail Mtce-Secondary	2009	FS	2.92 miles				X	X							

Table E-1. Past and Current Actions Catalog for the Montanore Project (Alphabetical by Activity)

Activity/Project	Year	Ownership	Impact Unit of Measure (Acres, miles, Number of permits)	PSU				BMU				BORZ	LAU		
				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
Trail Mtce – Way	2009	FS	1.58 miles				X	X							
Trail Mtce – Mailine	2008	FS	31.24 miles				X	X							
Trail Mtce-Secondary	2008	FS	8.42 miles				X	X							
Trail Mtce – Way	2008	FS	4.96 miles				X	X							
Trail Mtce - Mainline	2007	FS	31.24 miles				X	X							
Trail Mtce-Secondary	2007	FS	3.75 miles				X	X							
Trail Mtce – Way	2007	FS	20.17 miles				X	X							
Trail Mtce – Mainline	2009	FS	7.07 miles	X					X						
Trail Mtce-Secondary	2009	FS	0.00												
Trail Mtce – Way	2009	FS	18.87 miles	X					X						
Trail Mtce – Mainline	2008	FS	7.07 miles	X					X						
Trail Mtce-Secondary	2008	FS	0.00												
Trail Mtce – Way	2008	FS	0.00												
Trail Mtce – Mainline	2007	FS	7.07 miles	X					X						
Trail Mtce-Secondary	2007	FS	0.00												
Trail Mtce – Way	2007	FS	3.20 miles	X					X						
Trail Mtce – Mainline	2009	FS	10.37 miles			X				X					
Trail Mtce-Secondary	2009	FS	7.57 miles			X				X					
Trail Mtce – Way	2009	FS	59.72 miles			X				X					
Trail Mtce – Mainline	2008	FS	10.37 miles			X				X					
Trail Mtce-Secondary	2008	FS	2.91 miles			X				X					
Trail Mtce – Way	2008	FS	26.06 miles			X				X					
Trail Mtce – Mainline	2007	FS	10.37 miles			X				X					
Trail Mtce-Secondary	2007	FS	0.00												
Trail Mtce – Way	2007	FS	22.85 miles			X				X					
Trail Mtce-Secondary	2006	FS	2.92 miles				X	X							
Trail Mtce – Way	2006	FS	1.58 miles				X	X							
Trail Mtce – Mailine	2005	FS	31.24 miles				X	X							
Trail Mtce-Secondary	2005	FS	8.42 miles				X	X							
Trail Mtce – Way	2005	FS	4.96 miles				X	X							
Trail Mtce - Mainline	2004	FS	31.24 miles				X	X							
Trail Mtce-Secondary	2004	FS	3.75 miles				X	X							
Trail Mtce – Way	2004	FS	20.17 miles				X	X							
Trail Mtce – Mainline	2006	FS	7.07 miles	X					X						
Trail Mtce-Secondary	2006	FS	0.00												
Trail Mtce – Way	2006	FS	18.87 miles	X					X						
Trail Mtce – Mainline	2005	FS	7.07 miles	X					X						

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Table E-1. Past and Current Actions Catalog for the Montanore Project (Alphabetical by Activity)

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				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
Trail Mtce-Secondary	2005	FS	0.00												
Trail Mtce – Way	2005	FS	0.00												
Trail Mtce – Mainline	2004	FS	7.07 miles	X					X						
Trail Mtce-Secondary	2004	FS	0.00												
Trail Mtce – Way	2004	FS	3.20 miles	X					X						
Trail Mtce – Mainline	2006	FS	10.37 miles			X				X					
Trail Mtce-Secondary	2006	FS	7.57 miles			X				X					
Trail Mtce – Way	2006	FS	59.72 miles			X				X					
Trail Mtce – Mainline	2005	FS	10.37 miles			X				X					
Trail Mtce-Secondary	2005	FS	2.91 miles			X				X					
Trail Mtce – Way	2005	FS	26.06 miles			X				X					
Trail Mtce – Mainline	2004	FS	10.37 miles			X				X					
Trail Mtce-Secondary	2004	FS	0.00												
Trail Mtce – Way	2004	FS	22.85 miles			X				X					
Mainline trails – annual maintenance schedule, most heavily used Secondary trails – maintained every 2 years Way Trals – maintained every 3 years (generally)															
Tree Planting															
Tree Planting	1915	FS	478 ACRES	X											
	1950s		0	X											
		1960s		38	X										
	1970s		3666	X											
	1980s		1905	X											
	1990s		2107	X											
	2000-2006		24	X											
SILVERFISH	1950s	FS	0			X									
	1960s		112			X									
	1970s		26			X									
	1980s		499			X									
	1990s		343			X									
	2000-2006		0			X									
TREASURE	1915-1948	FS	1622 ACRES				X								
	1950s		0				X								
	1960s		0				X								

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				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
	1970s		190				X								
	1980s		812				X								
	1990s		1088				X								
	2000-2006		192				X								
Note: no planting done on these subunits 2007-2013															
Watershed Restoration															
Upper Libby Creek Cleveland Project	2002	FS and private land, project by MT FWP	3,200 feet of stream and riparian area	X					X						
Snowshoe CERCLA tailings removal / stream reconstruct	2009	FS	400 Feet Stream and riparian area	X											
Shaughnessy Crk culvert replaced	2003-2011	FS					X								
4791 Stream alignment		FS					X								
Snow Crk culvert removed		FS					X								
S.Fk Flower culverts replace		FS					X								
Big Cherry rip-rap armoring		FS		X											
Midas Culvert replace		FS		X											
Upper Midas woody structures		FS		X											
West Fisher Crk		FS	Stream reconstruct			X									
Olsen Crk culvert replace		FS				X									
Colonite Creek		FS	300 feet Stream reconstruct			X									
N Fk FSRD 594		FS	Culvert replace			X									
Trib to Silverbutte FSRD 148		FS	Culvert replace			X									
Wildfires															
			Number of fires												
Wildfire	1960-1969	FS				9									
Wildfire	1970-1979	FS		24	11	14	60	18	16	9		17	11	6	6

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				C	R	S	T	2	5	6	7	Cabinet Face	C	R	W
Wildfire	1980-1989	FS		27	22	11	41	15	20	11		29	18	13	7
Wildfire	1990-1999	FS		34	20	15	92	31	34	16		20	25	14	7
Wildfire	2000-2009	FS		20	12	18	78	20	16	32		11	11	14	16
Wildfire	2010	FS		1	2	0	0	0	2	1		1	0	2	0
Wildfire	2011	FS		2	1	1	3	0	1	1		1	1	1	1
Wildfire	2012	FS		0	2	0	5	2	1	1		0	0	2	0
Wildfire	2013	FS		4	0	0	5	4	0	0		2	3	1	0
Note: wildfire data revised using FireFamily+data queried1/18/2012 and 4/30/2014. Lat/longdata to generate fire shapefile is not available through this program prior to 1986. (2011 data shapefile developed manually from KDC documents).															
Wildlife Habitat Improvement															
Miller Creek Wildlife Habitat Improvement Burn	1998	FS	1, 300 acres			X									
Plum Creek Native Fish Habitat Conservation Plan	2000	Plum Creek	1.6 million acres												
Plum CrK Cons. Easement	2003	Plum Creek	142,000			X									
DNRC State Trust Lands Habitat Conservation Plan (HCP)	2012 (50 Year Plan)	State Lands	na				X			X					
Avista –Funded Bull Trout Recovery Activities	2007 - present	Pvt/ minor FS	1,100 ft of channel		X										

Appendix F—Supplemental Macroinvertebrate Data

Appendix F: Macroinvertebrate Data, 1988- 2012
NC= Metric Not Calculated Due to Data Limitations
Exact site locations are uncertain from some sources; methods differ between studies and years as well.

Stream	Date of Sampling	Taxa Richness	EPT Taxa Richness	EPT Index	Percent EPT Abundance	Shannon-Weaver Diversity Index	Simpson's Diversity Index	Evenness	BCI	Source of Data
West Fork Rock Creek	Apr-85	17	12	71	67	NC	NC	NC	NC	USFS and Montana DEQ 2001
Mainstem Rock Creek	Aug-85	14	11	79	94	NC	NC	NC	NC	USFS and Montana DEQ 2001
Mainstem Rock Creek	Aug-85	19	14	74	90	NC	NC	NC	NC	USFS and Montana DEQ 2001
Mainstem Rock Creek	Aug-85	29	25	86	93	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Aug-85	15	13	87	85	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Aug-85	17	14	82	96	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Aug-85	23	17	74	86	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Aug-85	24	20	83	97	NC	NC	NC	NC	USFS and Montana DEQ 2001
East Fork Rock Creek	Aug-85	31	23	74	62	NC	NC	NC	NC	USFS and Montana DEQ 2001
East Fork Rock Creek	Oct-85	20	15	75	96	NC	NC	NC	NC	USFS and Montana DEQ 2001
East Fork Rock Creek	Oct-85	28	21	75	91	NC	NC	NC	NC	USFS and Montana DEQ 2001
Mainstem Rock Creek	Oct-85	15	11	73	95	NC	NC	NC	NC	USFS and Montana DEQ 2001
Mainstem Rock Creek	Oct-85	20	17	85	97	NC	NC	NC	NC	USFS and Montana DEQ 2001
Mainstem Rock Creek	Oct-85	29	24	83	94	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Oct-85	15	13	87	99	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Oct-85	18	17	94	91	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Oct-85	19	16	84	82	NC	NC	NC	NC	USFS and Montana DEQ 2001
East Fork Rock Creek	Apr-86	20	18	90	93	NC	NC	NC	NC	USFS and Montana DEQ 2001
Mainstem Rock Creek	Apr-86	21	20	95	99	NC	NC	NC	NC	USFS and Montana DEQ 2001
Mainstem Rock Creek	Apr-86	25	20	80	97	NC	NC	NC	NC	USFS and Montana DEQ 2001
Mainstem Rock Creek	Apr-86	25	23	92	99	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Apr-86	12	9	75	98	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Apr-86	22	17	77	93	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Apr-86	17	15	88	86	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Apr-86	35	30	86	68	NC	NC	NC	NC	USFS and Montana DEQ 2001
East Fork Rock Creek	Aug-86	27	24	89	95	NC	NC	NC	NC	USFS and Montana DEQ 2001
East Fork Rock Creek	Aug-86	31	22	71	84	NC	NC	NC	NC	USFS and Montana DEQ 2001
Mainstem Rock Creek	Aug-86	23	21	91	95	NC	NC	NC	NC	USFS and Montana DEQ 2001
Mainstem Rock Creek	Aug-86	29	23	79	93	NC	NC	NC	NC	USFS and Montana DEQ 2001
Mainstem Rock Creek	Aug-86	28	24	86	94	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Aug-86	31	22	71	95	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Aug-86	20	17	85	89	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Aug-86	28	24	86	70	NC	NC	NC	NC	USFS and Montana DEQ 2001
East Fork Rock Creek	Oct-86	22	18	82	59	NC	NC	NC	NC	USFS and Montana DEQ 2001
Mainstem Rock Creek	Oct-86	27	24	89	97	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Oct-86	23	19	83	94	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Oct-86	24	21	88	63	NC	NC	NC	NC	USFS and Montana DEQ 2001
East Fork Rock Creek	Apr-87	20	19	95	98	NC	NC	NC	NC	USFS and Montana DEQ 2001
Mainstem Rock Creek	Apr-87	26	22	85	96	NC	NC	NC	NC	USFS and Montana DEQ 2001
Mainstem Rock Creek	Apr-87	22	20	91	99	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Apr-87	20	16	80	92	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Apr-87	20	16	80	40	NC	NC	NC	NC	USFS and Montana DEQ 2001
East Fork Rock Creek	Aug-87	27	23	85	94	NC	NC	NC	NC	USFS and Montana DEQ 2001
Mainstem Rock Creek	Aug-87	20	18	90	39	NC	NC	NC	NC	USFS and Montana DEQ 2001
Mainstem Rock Creek	Aug-87	24	20	83	94	NC	NC	NC	NC	USFS and Montana DEQ 2001

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Stream	Date of Sampling	Taxa Richness	EPT Taxa Richness	EPT Index	Percent EPT Abundance	Shannon-Weaver Diversity Index	Simpson's Diversity Index	Evenness	BCI	Source of Data
Mainstem Rock Creek	Aug-87	26	24	92	97	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Aug-87	25	21	84	94	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Aug-87	21	18	86	89	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Aug-87	25	21	84	68	NC	NC	NC	NC	USFS and Montana DEQ 2001
East Fork Rock Creek	Oct-87	27	24	89	97	NC	NC	NC	NC	USFS and Montana DEQ 2001
Mainstem Rock Creek	Oct-87	24	19	79	98	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Oct-87	23	19	83	92	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Oct-87	32	27	84	82	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Apr-88	30	25	83	93	NC	NC	NC	NC	USFS and Montana DEQ 2001
Bear Creek	Aug-88	38	17	45	77	4.06	0.9158	0.7727	83	Western Resource Development 1989
Bear Creek	Aug-88	37	19	51	73	4.12	0.9243	0.7912	84	Western Resource Development 1989
Bear Creek	Aug-88	43	29	67	77	4.32	0.9266	0.7969	105	Western Resource Development 1989
East Fork Rock Creek	Aug-88	26	23	88	98	NC	NC	NC	NC	USFS and Montana DEQ 2001
East Fork Rock Creek	Aug-88	26	16	62	87	3.78	0.9050	0.8050	92	Western Resource Development 1989
East Fork Rock Creek	Aug-88	38	21	55	56	4.27	0.9153	0.8128	89	Western Resource Development 1989
East Fork Rock Creek	Aug-88	42	20	48	46	4.32	0.9242	0.8020	86	Western Resource Development 1989
Libby Creek Reach Between Ramsey and Poorman Creeks	Aug-88	46	21	46	40	3.90	0.8920	0.7195	78	Western Resource Development 1989
Libby Creek Reach Near Bear Creek confluence	Aug-88	49	28	57	66	3.87	0.8987	0.6900	87	Western Resource Development 1989
Libby Creek Reach Near Midas Creek Confluence	Aug-88	43	24	56	68	3.99	0.9091	0.7349	87	Western Resource Development 1989
Libby Creek Reach Near Howard Creek confluence	Aug-88	41	21	51	76	4.06	0.9106	0.7580	86	Western Resource Development 1989
Libby Creek Reach Upstream of Crazyman Creek Confluence	Aug-88	49	27	55	57	4.08	0.9180	0.7262	83	Western Resource Development 1989
Little Cherry Creek	Aug-88	48	23	48	32	4.02	0.8747	0.7193	85	Western Resource Development 1989
Little Cherry Creek	Aug-88	43	27	63	87	4.38	0.9214	0.8076	97	Western Resource Development 1989
Mainstem Rock Creek	Aug-88	30	27	90	97	NC	NC	NC	NC	USFS and Montana DEQ 2001
Mainstem Rock Creek	Aug-88	27	23	85	97	NC	NC	NC	NC	USFS and Montana DEQ 2001
Poorman Creek	Aug-88	47	23	49	80	4.19	0.8936	0.7538	79	Western Resource Development 1989
Poorman Creek	Aug-88	50	27	54	76	4.48	0.9318	0.7932	91	Western Resource Development 1989
Ramsey Creek	Aug-88	40	22	55	67	4.04	0.8944	0.7593	83	Western Resource Development 1989
Ramsey Creek	Aug-88	44	22	50	65	4.26	0.9138	0.7802	82	Western Resource Development 1989
Ramsey Creek	Aug-88	42	18	43	65	4.30	0.9332	0.7967	92	Western Resource Development 1989
Uppermost Libby Creek Reach	Aug-88	37	21	57	78	4.03	0.9132	0.7745	95	Western Resource Development 1989
Uppermost Libby Creek Reach	Aug-88	40	21	53	56	4.20	0.9223	0.7893	90	Western Resource Development 1989
West Fork Rock Creek	Aug-88	18	17	94	99	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Aug-88	24	21	88	91	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Aug-88	23	22	96	81	NC	NC	NC	NC	USFS and Montana DEQ 2001
Bear Creek	Oct-88	40	26	65	91	3.75	0.8836	0.7050	99	Western Resource Development 1989
Bear Creek	Oct-88	47	32	68	91	3.95	0.8950	0.7112	114	Western Resource Development 1989
Bear Creek	Oct-88	34	23	68	94	3.98	0.9132	0.7821	107	Western Resource Development 1989
East Fork Rock Creek	Oct-88	46	20	43	22	1.89	0.4817	0.3415	75	Western Resource Development 1989
East Fork Rock Creek	Oct-88	41	24	59	64	4.37	0.8164	0.8164	99	Western Resource Development 1989

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Stream	Date of Sampling	Taxa Richness	EPT Taxa Richness	EPT Index	Percent EPT Abundance	Shannon-Weaver Diversity Index	Simpson's Diversity Index	Evenness	BCI	Source of Data
East Fork Rock Creek	Oct-88	35	24	69	86	4.39	0.9423	0.8567	104	Western Resource Development 1989
Libby Creek Reach Between Ramsey and Poorman Creeks	Oct-88	35	25	71	91	3.70	0.8709	0.7222	115	Western Resource Development 1989
Libby Creek Reach Near Bear Creek confluence	Oct-88	38	25	66	94	3.54	0.8642	0.6753	106	Western Resource Development 1989
Libby Creek Reach Near Midas Creek Confluence	Oct-88	32	23	72	96	3.61	0.8843	0.7214	117	Western Resource Development 1989
Libby Creek Reach Near Howard Creek confluence	Oct-88	21	16	76	95	2.96	0.7908	0.6740	126	Western Resource Development 1989
Libby Creek Reach Upstream of Crazyman Creek Confluence	Oct-88	43	25	58	92	3.89	0.8962	0.7171	96	Western Resource Development 1989
Little Cherry Creek	Oct-88	40	26	65	66	4.08	0.9106	0.7662	104	Western Resource Development 1989
Little Cherry Creek	Oct-88	51	30	59	71	4.46	0.9355	0.7865	83	Western Resource Development 1989
Mainstem Rock Creek	Oct-88	21	17	81	97	NC	NC	NC	NC	USFS and Montana DEQ 2001
Poorman Creek	Oct-88	49	31	63	88	4.02	0.8956	0.7167	96	Western Resource Development 1989
Poorman Creek	Oct-88	43	25	58	87	4.08	0.8999	0.7527	95	Western Resource Development 1989
Ramsey Creek	Oct-88	34	24	71	79	3.73	0.8650	0.7327	106	Western Resource Development 1989
Ramsey Creek	Oct-88	30	21	70	95	3.78	0.9035	0.7700	111	Western Resource Development 1989
Ramsey Creek	Oct-88	33	17	52	74	3.83	0.8698	0.7588	102	Western Resource Development 1989
Uppermost Libby Creek Reach	Oct-88	33	17	52	79	3.37	0.8316	0.6682	84	Western Resource Development 1989
Uppermost Libby Creek Reach	Oct-88	38	27	71	95	3.69	0.8713	0.7031	116	Western Resource Development 1989
West Fork Rock Creek	Oct-88	23	20	87	87	NC	NC	NC	NC	USFS and Montana DEQ 2001
West Fork Rock Creek	Oct-88	24	23	96	65	NC	NC	NC	NC	USFS and Montana DEQ 2001
Bear Creek	Apr-89	49	27	55	90	4.01	0.9064	0.7139	88	Western Resource Development 1989
Bear Creek	Apr-89	40	21	53	64	4.09	0.9155	0.7684	83	Western Resource Development 1989
Bear Creek	Apr-89	36	18	50	64	4.28	0.9272	0.8277	86	Western Resource Development 1989
East Fork Rock Creek	Apr-89	37	23	62	91	3.07	0.7637	0.5885	89	Western Resource Development 1989
East Fork Rock Creek	Apr-89	50	18	36	39	3.68	0.8862	0.6526	66	Western Resource Development 1989
East Fork Rock Creek	Apr-89	NS	NS	NS	NS	NS	NS	NS	NS	Western Resource Development 1989
Libby Creek Reach Between Ramsey and Poorman Creeks	Apr-89	42	24	57	62	4.18	0.9205	0.7757	87	Western Resource Development 1989
Libby Creek Reach Near Bear Creek confluence	Apr-89	47	30	64	86	4.10	0.9005	0.7390	99	Western Resource Development 1989
Libby Creek Reach Near Midas Creek Confluence	Apr-89	37	20	54	70	3.98	0.8962	0.7635	86	Western Resource Development 1989
Libby Creek Reach Near Howard Creek confluence	Apr-89	33	17	52	77	3.69	0.8760	0.7317	82	Western Resource Development 1989
Libby Creek Reach Upstream of Crazyman Creek Confluence	Apr-89	51	27	53	81	4.08	0.8761	0.7198	83	Western Resource Development 1989
Little Cherry Creek	Apr-89	36	20	56	35	3.98	0.9025	0.7708	83	Western Resource Development 1989
Little Cherry Creek	Apr-89	50	24	48	33	4.03	0.8648	0.7133	77	Western Resource Development 1989
Poorman Creek	Apr-89	43	24	56	41	4.35	0.9325	0.8022	81	Western Resource Development 1989
Poorman Creek	Apr-89	51	27	53	71	4.37	0.9232	0.7711	85	Western Resource Development 1989
Ramsey Creek	Apr-89	46	24	52	64	4.00	0.8990	0.7250	100	Western Resource Development 1989
Ramsey Creek	Apr-89	55	28	51	53	4.04	0.9018	0.6981	80	Western Resource Development 1989

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Stream	Date of Sampling	Taxa Richness	EPT Taxa Richness	EPT Index	Percent EPT Abundance	Shannon-Weaver Diversity Index	Simpson's Diversity Index	Evenness	BCI	Source of Data
Ramsey Creek	Apr-89	46	27	59	52	4.26	0.9267	0.7710	93	Western Resource Development 1989
Uppermost Libby Creek Reach	Apr-89	39	22	56	63	4.03	0.9086	0.7625	90	Western Resource Development 1989
Uppermost Libby Creek Reach	Apr-89	38	19	50	65	4.15	0.9161	0.7917	79	Western Resource Development 1989
Libby Creek Reach Immediately Upstream of Falls	Apr-90	22	14	64	92	3.23	0.8493	0.7256	NC	Western Technology and Engineering, Inc. 1991
Libby Creek Reach Upstream of Crazyman Creek Confluence	Apr-90	24	19	79	61	3.61	0.8771	0.7678	NC	Western Technology and Engineering, Inc. 1991
Little Cherry Creek	Apr-90	26	18	69	87	3.17	0.8107	0.6748	NC	Western Technology and Engineering, Inc. 1991
Poorman Creek	Apr-90	24	19	79	87	2.81	0.7358	0.6128	NC	Western Technology and Engineering, Inc. 1991
Ramsey Creek	Apr-90	22	19	86	94	2.97	0.7880	0.6567	NC	Western Technology and Engineering, Inc. 1991
Uppermost Libby Creek Reach	Apr-90	16	14	88	96	2.99	0.8289	0.7465	NC	Western Technology and Engineering, Inc. 1991
Libby Creek Reach Immediately Upstream of Falls	Aug-90	26	18	69	89	3.60	0.8918	0.7654	NC	Western Technology and Engineering, Inc. 1991
Libby Creek Reach Upstream of Crazyman Creek Confluence	Aug-90	33	24	73	96	3.37	0.8549	0.6684	NC	Western Technology and Engineering, Inc. 1991
Libby Creek Reach Upstream of Little Cherry Creek	Aug-90	27	22	81	95	3.37	0.8641	0.7100	NC	Western Technology and Engineering, Inc. 1991
Poorman Creek	Aug-90	24	21	88	95	3.27	0.8636	0.7136	NC	Western Technology and Engineering, Inc. 1991
Ramsey Creek	Aug-90	30	25	83	88	3.85	0.8893	0.7765	NC	Western Technology and Engineering, Inc. 1991
Uppermost Libby Creek Reach	Aug-90	23	19	83	93	3.26	0.8382	0.7200	NC	Western Technology and Engineering, Inc. 1991
Libby Creek Reach Immediately Upstream of Falls	Oct-90	35	28	80	90	3.28	0.8132	0.6401	NC	Western Technology and Engineering, Inc. 1991
Libby Creek Reach Upstream of Crazyman Creek Confluence	Oct-90	34	27	79	98	2.84	0.7311	0.5589	NC	Western Technology and Engineering, Inc. 1991
Libby Creek Reach Upstream of Little Cherry Creek	Oct-90	34	27	79	98	2.94	0.7873	0.5774	NC	Western Technology and Engineering, Inc. 1991
Little Cherry Creek	Oct-90	35	28	80	92	3.71	0.8723	0.7227	NC	Western Technology and Engineering, Inc. 1991
Poorman Creek	Oct-90	24	22	92	99	2.58	0.6822	0.5561	NC	Western Technology and Engineering, Inc. 1991
Ramsey Creek	Oct-90	24	19	79	98	2.87	0.7996	0.6265	NC	Western Technology and Engineering, Inc. 1991
Uppermost Libby Creek Reach	Oct-90	27	23	85	95	3.00	0.7733	0.6313	NC	Western Technology and Engineering, Inc. 1991
Bear Creek	May-91	31	26	84	98	3.12	0.8297	0.6301	NC	Western Technology and Engineering, Inc. 1992
Libby Creek Reach Immediately Upstream of Falls	May-91	19	17	89	94	3.19	0.8559	0.7506	NC	Western Technology and Engineering, Inc. 1992
Libby Creek Reach Upstream of Crazyman Creek Confluence	May-91	34	27	79	95	3.33	0.8366	0.6545	NC	Western Technology and Engineering, Inc. 1992
Libby Creek Reach Upstream of Little Cherry Creek	May-91	25	19	76	92	3.13	0.8335	0.6740	NC	Western Technology and Engineering, Inc. 1992
Little Cherry Creek	May-91	24	20	83	95	3.37	0.8493	0.7356	NC	Western Technology and Engineering, Inc. 1992
Poorman Creek	May-91	25	22	88	94	3.56	0.8752	0.7668	NC	Western Technology and Engineering, Inc. 1992
Ramsey Creek	May-91	28	23	82	91	3.33	0.8528	0.6922	NC	Western Technology and Engineering, Inc. 1992
Uppermost Libby Creek Reach	May-91	29	22	76	87	3.28	0.8391	0.6745	NC	Western Technology and Engineering, Inc. 1992
Bear Creek	Aug-91	35	28	80	98	2.86	0.7981	0.5570	NC	Western Technology and Engineering, Inc. 1992
Libby Creek Reach Immediately Upstream of Falls	Aug-91	34	27	79	93	3.10	0.8150	0.6085	NC	Western Technology and Engineering, Inc. 1992

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Libby Creek Reach Upstream of Crazyman Creek Confluence	Aug-91	35	28	80	93	3.17	0.8158	0.6182	NC	Western Technology and Engineering, Inc. 1992
Libby Creek Reach Upstream of Little Cherry Creek	Aug-91	33	26	79	93	3.03	0.7947	0.6007	NC	Western Technology and Engineering, Inc. 1992
Little Cherry Creek	Aug-91	24	19	79	91	3.37	0.8593	0.7353	NC	Western Technology and Engineering, Inc. 1992
Poorman Creek	Aug-91	31	24	77	97	2.93	0.8185	0.5913	NC	Western Technology and Engineering, Inc. 1992
Ramsey Creek	Aug-91	33	26	79	96	3.34	0.8607	0.6614	NC	Western Technology and Engineering, Inc. 1992
Uppermost Libby Creek Reach	Aug-91	30	22	73	80	3.45	0.8709	0.7021	NC	Western Technology and Engineering, Inc. 1992
Bear Creek	Oct-91	37	30	81	99	3.24	0.8218	0.6227	NC	Western Technology and Engineering, Inc. 1992
Libby Creek Reach Immediately Upstream of Falls	Oct-91	32	27	84	99	2.17	0.5712	0.4332	NC	Western Technology and Engineering, Inc. 1992
Libby Creek Reach Upstream of Crazyman Creek Confluence	Oct-91	37	31	84	99	2.90	0.7939	0.5567	NC	Western Technology and Engineering, Inc. 1992
Libby Creek Reach Upstream of Little Cherry Creek	Oct-91	36	31	86	99	3.22	0.8396	0.6234	NC	Western Technology and Engineering, Inc. 1992
Little Cherry Creek	Oct-91	38	32	84	87	3.85	0.8680	0.7329	NC	Western Technology and Engineering, Inc. 1992
Poorman Creek	Oct-91	36	31	86	99	2.92	0.7535	0.5652	NC	Western Technology and Engineering, Inc. 1992
Ramsey Creek	Oct-91	34	29	85	98	3.39	0.8477	0.6656	NC	Western Technology and Engineering, Inc. 1992
Uppermost Libby Creek Reach	Oct-91	39	30	77	97	3.68	0.8913	0.6962	NC	Western Technology and Engineering, Inc. 1992
Bear Creek	Apr-92	38	29	76	84	3.63	0.8724	0.6908	NC	Western Technology and Engineering, Inc. 1993
Libby Creek Reach Immediately Upstream of Falls	Apr-92	35	28	80	73	3.39	0.8370	0.6616	NC	Western Technology and Engineering, Inc. 1993
Libby Creek Reach Upstream of Crazyman Creek Confluence	Apr-92	29	18	62	84	3.58	0.8866	0.7360	NC	Western Technology and Engineering, Inc. 1993
Libby Creek Reach Upstream of Little Cherry Creek	Apr-92	39	30	77	86	3.78	0.8895	0.7158	NC	Western Technology and Engineering, Inc. 1993
Little Cherry Creek	Apr-92	35	27	77	74	3.88	0.8990	0.7572	NC	Western Technology and Engineering, Inc. 1993
Poorman Creek	Apr-92	24	20	83	93	3.52	0.8836	0.7670	NC	Western Technology and Engineering, Inc. 1993
Ramsey Creek	Apr-92	36	29	81	72	3.39	0.8439	0.6564	NC	Western Technology and Engineering, Inc. 1993
Uppermost Libby Creek Reach	Apr-92	33	28	85	88	3.26	0.7890	0.6455	NC	Western Technology and Engineering, Inc. 1993
Bear Creek	Aug-92	39	32	82	91	3.73	0.8792	0.7055	NC	Western Technology and Engineering, Inc. 1993
Libby Creek Reach Immediately Upstream of Falls	Aug-92	29	22	76	90	3.48	0.8596	0.7170	NC	Western Technology and Engineering, Inc. 1993
Libby Creek Reach Upstream of Crazyman Creek Confluence	Aug-92	35	27	77	79	3.21	0.8093	0.6254	NC	Western Technology and Engineering, Inc. 1993
Libby Creek Reach Upstream of Little Cherry Creek	Aug-92	32	26	81	91	3.69	0.8953	0.7378	NC	Western Technology and Engineering, Inc. 1993
Little Cherry Creek	Aug-92	35	29	83	88	3.38	0.8438	0.6590	NC	Western Technology and Engineering, Inc. 1993
Poorman Creek	Aug-92	24	21	88	95	3.34	0.8664	0.7278	NC	Western Technology and Engineering, Inc. 1993
Ramsey Creek	Aug-92	35	28	80	94	3.87	0.9134	0.7538	NC	Western Technology and Engineering, Inc. 1993
Uppermost Libby Creek Reach	Aug-92	24	18	75	81	3.66	0.9042	0.7978	NC	Western Technology and Engineering, Inc. 1993
Bear Creek	Oct-92	43	35	81	90	3.62	0.8718	0.6650	NC	Western Technology and Engineering, Inc. 1993
Libby Creek Reach Immediately Upstream of Falls	Oct-92	34	29	85	96	3.01	0.7923	0.5919	NC	Western Technology and Engineering, Inc. 1993

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Libby Creek Reach Upstream of Crazyman Creek Confluence	Oct-92	38	27	71	91	3.57	0.8650	0.6802	NC	Western Technology and Engineering, Inc. 1993
Libby Creek Reach Upstream of Little Cherry Creek	Oct-92	70	30	43	89	3.98	0.9164	0.7482	NC	Western Technology and Engineering, Inc. 1993
Little Cherry Creek	Oct-92	41	34	83	88	3.81	0.8615	0.7118	NC	Western Technology and Engineering, Inc. 1993
Poorman Creek	Oct-92	42	33	79	88	3.42	0.8499	0.6337	NC	Western Technology and Engineering, Inc. 1993
Ramsey Creek	Oct-92	40	31	78	84	3.61	0.8744	0.6787	NC	Western Technology and Engineering, Inc. 1993
Uppermost Libby Creek Reach	Oct-92	34	27	79	89	3.73	0.8906	0.7334	NC	Western Technology and Engineering, Inc. 1993
Libby Creek Reach Immediately Upstream of Falls	Mar-93	36	29	81	79	3.62	0.8751	0.7006	NC	Western Technology and Engineering, Inc. 1994
Libby Creek Reach Upstream of Crazyman Creek Confluence	Mar-93	28	21	75	89	3.10	0.7904	0.6439	NC	Western Technology and Engineering, Inc. 1994
Libby Creek Reach Upstream of Little Cherry Creek	Mar-93	31	28	90	74	3.09	0.8155	0.6240	NC	Western Technology and Engineering, Inc. 1994
Uppermost Libby Creek Reach	Mar-93	33	27	82	52	3.05	0.7539	0.6040	NC	Western Technology and Engineering, Inc. 1994
Libby Creek Reach Immediately Upstream of Falls	Aug-93	37	26	70	78	3.83	0.9047	0.7353	NC	Western Technology and Engineering, Inc. 1994
Libby Creek Reach Upstream of Crazyman Creek Confluence	Aug-93	43	31	72	64	3.44	0.8427	0.6341	NC	Western Technology and Engineering, Inc. 1994
Libby Creek Reach Upstream of Little Cherry Creek	Aug-93	43	30	70	78	3.24	0.8473	0.5966	NC	Western Technology and Engineering, Inc. 1994
Uppermost Libby Creek Reach	Aug-93	40	29	73	78	3.83	0.8984	0.7202	NC	Western Technology and Engineering, Inc. 1994
East Fork Rock Creek	Oct-93	13	11	85	31	NC	NC	NC	NC	USFS and Montana DEQ 2001
Libby Creek Reach Immediately Upstream of Falls	Oct-93	41	31	76	94	3.47	0.8407	0.6474	NC	Western Technology and Engineering, Inc. 1994
Libby Creek Reach Upstream of Crazyman Creek Confluence	Oct-93	53	40	75	90	3.93	0.8909	0.6869	NC	Western Technology and Engineering, Inc. 1994
Libby Creek Reach Upstream of Little Cherry Creek	Oct-93	53	38	72	79	4.03	0.9119	0.7010	NC	Western Technology and Engineering, Inc. 1994
Mainstem Rock Creek	Oct-93	15	13	87	42	NC	NC	NC	NC	USFS and Montana DEQ 2001
Mainstem Rock Creek	Oct-93	19	14	74	27	NC	NC	NC	NC	USFS and Montana DEQ 2001
Uppermost Libby Creek Reach	Oct-93	33	27	82	86	3.59	0.8765	0.7115	NC	Western Technology and Engineering, Inc. 1994
Libby Creek Reach Immediately Upstream of Falls	Oct-94	52	43	83	75	3.73	0.8783	0.6555	NC	Western Technology and Engineering, Inc. and Phycologic, 1995
Libby Creek Reach Upstream of Crazyman Creek Confluence	Oct-94	48	34	71	95	3.21	0.7755	0.5755	NC	Western Technology and Engineering, Inc. and Phycologic, 1995
Uppermost Libby Creek Reach	Oct-94	49	38	78	63	3.46	0.8281	0.6163	NC	Western Technology and Engineering, Inc. and Phycologic, 1995
Bear Creek	Sep-98	32	23	72	86	2.73	0.1033	0.6200	97	USDA FS 2006c
Libby Creek Reach Immediately Upstream of Falls	Sep-98	24	17	71	77	2.29	0.1580	0.6240	91	USDA FS 2006c
Libby Creek Reach Upstream of Crazyman Creek Confluence	Sep-98	32	25	78	63	2.42	0.1543	0.5490	84	USDA FS 2006c
West Fisher Creek	Sep-98	28	19	68	72	2.38	0.1377	0.6450	119	USDA FS 2006c
Bear Creek	Aug-99	31	21	68	74	2.63	0.1013	0.7097	87	USDA FS 2006c

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Stream	Date of Sampling	Taxa Richness	EPT Taxa Richness	EPT Index	Percent EPT Abundance	Shannon-Weaver Diversity Index	Simpson's Diversity Index	Evenness	BCI	Source of Data
Libby Creek Reach Immediately Upstream of Falls	Aug-99	28	20	71	74	2.46	0.1407	0.5887	98	USDA FS 2006c
Libby Creek Reach Upstream of Crazyman Creek Confluence	Aug-99	32	22	69	85	2.22	0.2210	0.4390	89	USDA FS 2006c
West Fisher Creek	Aug-99	33	23	70	66	2.61	0.1207	0.5917	120	USDA FS 2006c
Bear Creek	Aug-00	32	24	75	68	2.75	0.0983	0.6500	90	USDA FS 2006c
Libby Creek Reach Immediately Upstream of Falls	Sep-00	24	16	67	60	2.26	0.1833	0.5633	92	USDA FS 2006c
Libby Creek Reach Near Midas Creek Confluence	Sep-00	33	25	76	95	NC	NC	NC	NC	Dunnigan et al., 2004, Hoffman et al., 2002
Libby Creek Reach Upstream of Crazyman Creek Confluence	Oct-00	29	22	76	89	2.25	0.1807	0.5537	96	USDA FS 2006c
West Fisher Creek	Oct-00	28	17	61	46	2.26	0.1800	0.5547	111	USDA FS 2006c
Bear Creek	Aug-01	33	23	70	64	2.66	0.1170	0.5710	85	USDA FS 2006c
Fisher River at Highway 2	Aug-01	34	19	56	28	2.62	0.1180	0.5910	84	USDA FS 2006c
Libby Creek Reach Immediately Upstream of Falls	Aug-01	39	28	72	56	2.55	0.1480	0.4860	89	USDA FS 2006c
Libby Creek Reach Upstream of Crazyman Creek Confluence	Aug-01	43	28	65	61	2.59	0.1310	0.5370	86	USDA FS 2006c
West Fisher Creek	Aug-01	39	26	67	63	2.83	0.0960	0.5960	122	USDA FS 2006c
Fisher River at Highway 2	Jul-02	10	7	70	67	2.02	0.1300	-	80	USDA FS 2006c
West Fisher Creek	Jul-02	29	19	66	40	2.64	0.1100	0.6210	100	USDA FS 2006c
Libby Creek Reach Upstream of Crazyman Creek Confluence	Aug-02	13	11	85	86	2.25	0.1180	0.8820	111	USDA FS 2006c
Fisher River at Highway 2	Aug-03	16	9	56	33	2.10	0.1910	0.5920	91	USDA FS 2006c
Libby Creek Reach Near Midas Creek Confluence	Aug-03	35	28	80	81	NC	NC	NC	NC	Dunnigan et al., 2004
West Fisher Creek	Aug-03	39	23	59	55	2.79	0.0910	0.6540	105	USDA FS 2006c
Bear Creek	Aug-03	39	29	74	60	3.01	0.0680	0.7150	85	USDA FS 2006c
Libby Creek Reach Immediately Upstream of Falls	Aug-03	41	28	68	51	2.47	0.1470	0.5340	82	USDA FS 2006c
Libby Creek Reach Upstream of Crazyman Creek Confluence	Aug-03	34	24	71	73	3.09	0.0580	0.7850	88	USDA FS 2006c
Fisher River at Highway 2	Jul-04	37	25	68	14	1.92	0.2760	0.4530	91	USDA FS 2006c
West Fisher Creek	Jul-04	27	20	74	84	2.51	0.1300	0.5970	125	USDA FS 2006c
Bear Creek	Jul-04	28	22	79	84	2.54	0.1170	0.6440	100	USDA FS 2006c
Libby Creek Reach Immediately Upstream of Falls	Jul-04	30	24	80	95	2.47	0.1350	0.5910	132	USDA FS 2006c
Libby Creek Reach Near Bear Creek confluence	Jul-04	21	18	86	92	2.63	0.0910	0.7720	122	USDA FS 2006c
Libby Creek Reach Upstream of Crazyman Creek Confluence	Jul-04	42	27	64	26	1.75	0.4310	0.2790	83	USDA FS 2006c
East Fork Rock Creek	Sep-05	9	4	44	80	1.53	0.5075	0.4819	NC	Geomatrix 2006d
East Fork Rock Creek	Sep-05	7	2	29	24	1.08	0.5894	0.3831	NC	Geomatrix 2006d
East Fork Rock Creek	Sep-05	11	4	36	3	0.69	0.8313	0.1986	NC	Geomatrix 2006d

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Stream	Date of Sampling	Taxa Richness	EPT Taxa Richness	EPT Index	Percent EPT Abundance	Shannon-Weaver Diversity Index	Simpson's Diversity Index	Evenness	BCI	Source of Data
Libby Creek Reach Downstream of Crazyman Creek Confluence	Aug-06	25	11	44	53	3.35	NC	NC	NC	Kline Environmental Research 2008
Libby Creek Reach Immediately Upstream of Falls	Aug-06	23	16	70	87	3.34	NC	NC	NC	Kline Environmental Research 2008
Uppermost Libby Creek Reach	Aug-06	33	18	55	72	3.78	NC	NC	NC	Kline Environmental Research 2008
Libby Creek Reach Downstream of Crazyman Creek Confluence	Oct-06	29	17	59	63	3.20	NC	NC	NC	Kline Environmental Research 2008
Libby Creek Reach Immediately Upstream of Falls	Oct-06	31	17	55	57	3..36	NC	NC	NC	Kline Environmental Research 2008
Uppermost Libby Creek Reach	Oct-06	22	11	50	62	3.05	NC	NC	NC	Kline Environmental Research 2008
Libby Creek Reach Downstream of Crazyman Creek Confluence	Apr-07	20	12	60	85	3.07	NC	NC	NC	Kline Environmental Research 2008
Libby Creek Reach Immediately Upstream of Falls	Apr-07	12	9	75	87	2.79	NC	NC	NC	Kline Environmental Research 2008
Uppermost Libby Creek Reach	Apr-07	13	10	77	82	3.38	NC	NC	NC	Kline Environmental Research 2008
Bear Creek	Aug-07	22	17	77	92	3.15	NC	NC	NC	Kline Environmental Research 2008
Libby Creek Reach Downstream of Crazyman Creek Confluence	Aug-07	37	19	51	39	3.16	NC	NC	NC	Kline Environmental Research 2008
Libby Creek Reach Immediately Upstream of Falls	Aug-07	32	18	56	65	4.09	NC	NC	NC	Kline Environmental Research 2008
Libby Creek Reach Near Bear Creek confluence	Aug-07	25	13	52	76	3.02	NC	NC	NC	Kline Environmental Research 2008
Libby Creek Reach Near Midas Creek confluence	Aug-07	23	16	70	86	2.96	NC	NC	NC	Kline Environmental Research 2008
Little Cherry Creek	Aug-07	26	13	50	59	3.86	NC	NC	NC	Kline Environmental Research 2008
Poorman Creek	Aug-07	32	19	59	64	3.85	NC	NC	NC	Kline Environmental Research 2008
Ramsey Creek	Aug-07	22	16	73	87	3.70	NC	NC	NC	Kline Environmental Research 2008
Uppermost Libby Creek Reach	Aug-07	24	14	58	79	3.38	NC	NC	NC	Kline Environmental Research 2008
Bear Creek	Oct-07	29	17	59	80	3.75	NC	NC	NC	Kline Environmental Research 2008
Libby Creek Reach Downstream of Crazyman Creek Confluence	Oct-07	25	14	56	78	3.23	NC	NC	NC	Kline Environmental Research 2008
Libby Creek Reach Immediately Upstream of Falls	Oct-07	32	20	63	65	3.27	NC	NC	NC	Kline Environmental Research 2008
Libby Creek Reach Near Bear Creek confluence	Oct-07	26	15	58	84	2.60	NC	NC	NC	Kline Environmental Research 2008
Libby Creek Reach Near Midas Creek confluence	Oct-07	23	16	70	92	2.69	NC	NC	NC	Kline Environmental Research 2008
Little Cherry Creek	Oct-07	38	19	50	72	4.11	NC	NC	NC	Kline Environmental Research 2008
Poorman Creek	Oct-07	32	21	66	83	3.80	NC	NC	NC	Kline Environmental Research 2008
Ramsey Creek	Oct-07	35	21	60	83	3.69	NC	NC	NC	Kline Environmental Research 2008
Uppermost Libby Creek Reach	Oct-07	25	16	64	45	2.90	NC	NC	NC	Kline Environmental Research 2008
Bear Creek	Apr-08	43	20	47	58	4.11	NC	NC	NC	Kline Environmental Research 2009
Libby Creek Reach Downstream of Crazyman Creek Confluence	Apr-08	32	16	50	81	3.40	NC	NC	NC	Kline Environmental Research 2009

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Libby Creek Reach Immediately Upstream of Falls	Apr-08	30	17	57	60	3.68	NC	NC	NC	Kline Environmental Research 2009
Libby Creek Reach Near Bear Creek confluence	Apr-08	35	18	51	69	4.05	NC	NC	NC	Kline Environmental Research 2009
Libby Creek Reach Near Midas Creek confluence	Apr-08	28	14	50	78	3.35	NC	NC	NC	Kline Environmental Research 2009
Little Cherry Creek	Apr-08	33	18	55	76	3.96	NC	NC	NC	Kline Environmental Research 2009
Poorman Creek	Apr-08	43	23	53	55	4.22	NC	NC	NC	Kline Environmental Research 2009
Ramsey Creek	Apr-08	32	16	50	56	3.94	NC	NC	NC	Kline Environmental Research 2009
Uppermost Libby Creek Reach	Apr-08	32	19	59	51	3.66	NC	NC	NC	Kline Environmental Research 2009
Bear Creek	Aug-08	34	NC	NC	74	NC	NC	NC	NC	Kline Environmental Research 2009
Libby Creek Reach Downstream of Crazyman Creek Confluence	Aug-08	32	NC	NC	55	NC	NC	NC	NC	Kline Environmental Research 2009
Libby Creek Reach Immediately Upstream of Falls	Aug-08	24	NC	NC	63	NC	NC	NC	NC	Kline Environmental Research 2009
Libby Creek Reach Near Bear Creek confluence	Aug-08	27	NC	NC	54	NC	NC	NC	NC	Kline Environmental Research 2009
Libby Creek Reach Near Midas Creek confluence	Aug-08	32	NC	NC	59	NC	NC	NC	NC	Kline Environmental Research 2009
Little Cherry Creek	Aug-08	36	NC	NC	55	NC	NC	NC	NC	Kline Environmental Research 2009
Poorman Creek	Aug-08	29	NC	NC	78	NC	NC	NC	NC	Kline Environmental Research 2009
Ramsey Creek	Aug-08	34	NC	NC	62	NC	NC	NC	NC	Kline Environmental Research 2009
Uppermost Libby Creek Reach	Aug-08	26	NC	NC	50	NC	NC	NC	NC	Kline Environmental Research 2009
Bear Creek	Oct-08	38	NC	NC	91	NC	NC	NC	NC	Kline Environmental Research 2009
Libby Creek Reach Downstream of Crazyman Creek Confluence	Oct-08	30	NC	NC	80	NC	NC	NC	NC	Kline Environmental Research 2009
Libby Creek Reach Immediately Upstream of Falls	Oct-08	26	NC	NC	86	NC	NC	NC	NC	Kline Environmental Research 2009
Libby Creek Reach Near Bear Creek confluence	Oct-08	33	NC	NC	46	NC	NC	NC	NC	Kline Environmental Research 2009
Libby Creek Reach Near Midas Creek confluence	Oct-08	37	NC	NC	58	NC	NC	NC	NC	Kline Environmental Research 2009
Little Cherry Creek	Oct-08	43	NC	NC	61	NC	NC	NC	NC	Kline Environmental Research 2009
Poorman Creek	Oct-08	34	NC	NC	95	NC	NC	NC	NC	Kline Environmental Research 2009
Ramsey Creek	Oct-08	34	NC	NC	76	NC	NC	NC	NC	Kline Environmental Research 2009
Uppermost Libby Creek Reach	Oct-08	34	NC	NC	61	NC	NC	NC	NC	Kline Environmental Research 2009
Libby Tributary 3 (WUS-3 Branch 2b)	May-11	6	3	50	44	2.42	0.1110	0.1700	NC	Kline Environmental Research and Newfields 2012
Libby Tributary 3 (WUS-3 Branch 2a)	May-11	16	10	63	51	3.34	0.1280	0.0860	NC	Kline Environmental Research and Newfields 2012
Libby Tributary 3 (WUS-3 Branch 1c)	May-11	7	NC	NC	5	NC	NC	NC	NC	Kline Environmental Research and Newfields 2012
Libby Tributary 3 (WUS-3 Branch 1a)	May-11	6	0	0	0	2.01	0.2940	0.1630	NC	Kline Environmental Research and Newfields 2012
Libby Tributary 5 (WSU-5 Branch 2a)	May-11	25	7	28	19	3.56	0.1360	0.0710	NC	Kline Environmental Research and Newfields 2012
Libby Tributary 5 (WSU-5 or 10?)	May-11	20	8	40	58	3.25	0.1600	0.0830	NC	Kline Environmental Research and Newfields 2012
Libby Tributary 10 (WUS-10 Branch 2c)	May-11	27	8	30	26	3.68	0.1300	0.0670	NC	Kline Environmental Research and Newfields 2012
Libby Tributary 10 (WUS-10 Branch 2c)	May-11	21	5	24	15	3.27	0.1800	0.0780	NC	Kline Environmental Research and Newfields 2012
Libby Tributary 10 (WUS-10 Branch 2a)	May-11	21	7	33	26	3.49	0.1120	0.0760	NC	Kline Environmental Research and Newfields 2012

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Stream	Date of Sampling	Taxa Richness	EPT Taxa Richness	EPT Index	Percent EPT Abundance	Shannon-Weaver Diversity Index	Simpson's Diversity Index	Evenness	BCI	Source of Data
Libby Tributary 14 (WUS-14 Branch 2c)	May-11	7	0	0	0	2.51	0.1750	0.1520	NC	Kline Environmental Research and Newfields 2012
Libby Tributary 14 (WUS-14 Branch 2c)	May-11	23	5	22	7	2.30	0.1560	0.0770	NC	Kline Environmental Research and Newfields 2012
Libby Tributary 14 (WUS-14 Branch 2a)	May-11	17	2	12	7	2.64	0.2660	0.0960	NC	Kline Environmental Research and Newfields 2012
Little Cherry Tributary 15	May-11	3	0	0	0	0.84	0.6670	0.1740	NC	Kline Environmental Research and Newfields 2012
Tributary to Libby Creek Tributary 3	May-11	7	1	14	5.26	2.14	0.2870	0.1450	NC	Kline Environmental Research and Newfields 2012
Swamp Creek Tributary 1	May-11	18	2	11	5.88	2.61	0.2860	0.0930	NC	Kline Environmental Research and Newfields 2012
Swamp Creek Tributary 2	May-11	9	0	0	0	1.65	0.4560	0.1210	NC	Kline Environmental Research and Newfields 2012
Swamp Creek Tributary 3	May-11	17	1	6	1.46	3.52	0.1060	0.0790	NC	Kline Environmental Research and Newfields 2012
Swamp Creek Tributary 4	May-11	18	3	17	3.88	3.07	0.1710	0.0920	NC	Kline Environmental Research and Newfields 2012
Swamp Creek Tributary 5	May-11	22	4	18	24.76	3.07	0.2050	0.0810	NC	Kline Environmental Research and Newfields 2012
Swamp Creek Tributary 1	May-11	18	3	17	11.11	2.93	0.2440	0.0830	NC	Kline Environmental Research and Newfields 2012
Swamp Creek Tributary 2	May-11	22	4	18	3.02	3.48	0.1520	0.0720	NC	Kline Environmental Research and Newfields 2012
Spring 1 Channel	May-11	7	2	29	18.37	2.30	0.2870	0.1320	NC	Kline Environmental Research and Newfields 2012
Highway Spring	May-11	17	0	0	0	2.81	0.2030	0.0950	NC	Kline Environmental Research and Newfields 2012
Libby Tributary 3 (WUS-3 Branch 2b)	Sep-11	17	9	53	57	3.76	0.0790	0.0700	NC	Kline Environmental Research and Newfields 2012
Libby Tributary 3 (WUS-3 Branch 2b)	Sep-11	7	2	29	56	2.73	0.0560	0.1460	NC	Kline Environmental Research and Newfields 2012
Libby Tributary 3 (WUS-3 Branch 1a)	Sep-11	1	NC	NC	0	NC	NC	NC	NC	Kline Environmental Research and Newfields 2012
Libby Tributary 5 (WSU-5 Branch 2a)	Sep-11	13	6	46	30	2.91	0.1930	0.0980	NC	Kline Environmental Research and Newfields 2012
Libby Tributary 5 (WSU-5 Branch 1b)	Sep-11	9	2	22	2	1.10	0.6940	0.0660	NC	Kline Environmental Research and Newfields 2012
Libby Tributary 5 (WSU-5 Branch 1b)	Sep-11	20	8	40	29	3.70	0.0930	0.0700	NC	Kline Environmental Research and Newfields 2012
Libby Tributary 10 (WUS-10 Branch 2c)	Sep-11	16	6	38	36	3.70	0.0740	0.0730	NC	Kline Environmental Research and Newfields 2012
Libby Tributary 10 (WUS-10 Branch 2c)	Sep-11	17	7	41	65	3.51	0.1010	0.0780	NC	Kline Environmental Research and Newfields 2012
Libby Tributary 10 (WUS-10 Branch 1c)	Sep-11	8	3	17	12	1.47	0.5630	0.0940	NC	Kline Environmental Research and Newfields 2012
Libby Tributary 14 (WUS-14 Branch 2c)	Sep-11	7	1	14	5	2.43	0.2030	0.1420	NC	Kline Environmental Research and Newfields 2012
Libby Tributary 14 (WUS-14 Branch 2a)	Sep-11	7	2	29	36	2.57	0.1280	0.1510	NC	Kline Environmental Research and Newfields 2012
Libby Tributary 14 (WUS-14 Branch 2a)	Sep-11	2	0	0	0	1.00	0.3330	0.5000	NC	Kline Environmental Research and Newfields 2012
East Fork Rock Creek	Aug-12	8	7	88	85	2.75	0.1180	0.1360	NC	Kline Environmental Research and Newfields 2012
St. Paul Lake Tributaries	Aug-12	1	0	0	0	NC	NC	NC	NC	Kline Environmental Research and Newfields 2012
St. Paul Lake Tributaries	Aug-12	2	1	50	50	NC	NC	NC	NC	Kline Environmental Research and Newfields 2012

Appendix G—Water Quality Mass Balance Calculations

LAD Area Groundwater Flux

ALTERNATIVE 2

Existing Conditions (natural gradient)

	K (ft/day)	i (gradient, unitless)	depth of mixing zone (ft)	width of mixing zone (ft)	cross sectional area (A) (ft^2)
MMC values	1	0.06	56	6,860	451,388
modified K	0.22				
Ramsey Creek - LAD #1				3,040	200,032
Ramsey Creek - LAD #2				840	55,272
Libby Creek - LAD #2				1,040	68,432
Poorman Creek - LAD #2				1,940	127,652
				6,860	

Pre-LAD GW Flux:

Q=KiA

		27083.28	cubic feet per day		
	K = 1 ft/day	0.31	cfs	140.68	gpm
		5958.3216	cubic feet per day		
	K = 0.22 ft/day	0.07	cfs	30.95	gpm

	cubic ft/day	cfs	gpm
Ramsey Creek - LAD #1	2,640	0.03	13.7
Ramsey Creek - LAD #2	730	0.01	3.8
Libby Creek - LAD #2	903	0.01	4.7
Poorman Creek - LAD #2	1,685	0.02	8.8
			31.0

Maximum total flux (pre-LAD plus LAD application):

Maximum gradient to have groundwater mounding to within ~10 bgs at LAD Areas is 0.122
(measured from topo map)

K = 1 ft/day	55069.336	cubic feet per day
	0.64	cfs
	286.05	gpm
K = 0.22 ft/day	12115.25392	cubic feet per day
	0.14	cfs
	62.93	gpm

LAD#1	cubic ft/day	cfs	gpm
Ramsey Creek - LAD #1	5,369	0.06	27.9
LAD#2			
Ramsey Creek - LAD #2	1,484	0.02	7.7
Libby Creek - LAD #2	1,837	0.02	9.5
Poorman Creek - LAD #2	3,426	0.04	17.8
			62.9

Allowable percolation to groundwater without flooding ground surface is:

K = 1 ft/day 145.4 gpm
K = 0.22 ft/day 32.0 gpm

	GPM
Ramsey Creek - LAD #1	14.2
Ramsey Creek - LAD #2	3.9
Libby Creek - LAD #2	4.8
Poorman Creek - LAD #2	9.0
	32.0

NOTES: Width is width of LAD area (normal to gw flow direction) + tan 5 degrees x the width added to both sides
Depth is based on avg depth to bedrock of 76' and avg depth to water of 20.'

LAD Application Rates

Maximum application rate for	200	acre LAD area		
ET during 6-mo growing season =	18	in/growing season, or	0.0082	ft/day
Precip during growing season =	13.24	in/growing season, or	0.0060	ft/day
Precip per year =	36	in/year	0.0060	ft/day

ET on 200 acres=		370.96 gpm				
Precip on 200 acres=		272.86 gpm				
		K= 1 ft/day		K = 0.22 ft/day		
Alternative 2 maximum groundwater flux rate=		145.4	gpm	32.0		gpm
		K = 1 ft/day		K = 0.22 ft/day		
Maximum LAD application rate= (for 200 acres)	ET+groundwater flux rate-precip=	**243**	gpm		**130**	gpm

Alternative 2	**Area (ac)**	**Percolation to groundwater**	**Proportion of total perc to groundwater**	**ET-PPT**	**Max Application Rate**	**LAD Total Max Application Rate**	
LAD#1		**gpm**		**gpm**	**gpm**	**gpm**	
Ramsey Creek	100	14.2	100%	49.0	63.2	63.2	LAD # 1
LAD#2							
Ramsey Creek	20	3.9	20%	9.8	13.7	66.9	LAD # 2
Libby Creek	30	4.8	30%	14.7	19.6		
Poorman Creek	50	9.0	50%	24.5	33.6		
	200					**130.1**	**total**

NOTES: Actual ET=12.71 inches is for average precipitation conditions, mountainous coniferous forest in NW Montana
Potential ET=26 inches, which is for unrestricted water availability (used by Geomatrix)
Actual ET=PET-actual soil moisture content

Calculation of 7Q10 low flows for Montanore site

7Q10 (cfs) = 0.0000728*A^(Reference: Hortness, 2006.
Standard error of prediction: +113 to -53.1
A=drainage area in square miles
P=precipitation in inches

Monitoring site	Drainage Area (sq miles)	Average Watershed Area Precipitation (inches)	Estimated 7Q10 (cfs)	Low range 7Q10 (cfs)	High range 7Q10 (cfs)	Average 7Q10 (gpm)
LB 300	7.8	71.7	3.03	1.42	6.46	1,361
LB 1000	34.9	54.4	8.59	4.03	18.30	3,855
LB 2000	40.8	51.2	8.99	4.22	19.15	4,035
PM 1200	6.5	56.3	1.55	0.73	3.30	695
RA 400	5.9	68.5	2.06	0.97	4.39	925
RA 600	6.7	64.1	2.07	0.97	4.40	928

Alt 2 and 4 Flows Used In Mass Balance Calculations

Note: LB-300 flow value is modeled base flow for average conditions, not 7Q10 flow.

Evaluation

	Average 7Q10	Mine Inflow*	Pumpback Wells	Potable Water	Subtotal	Flow Used in Calculations
LB 300	548	9	0	9	18	530
LB 1000	3,855	9	0	9	18	3,837
LB 2000	4,035	9	0	9	18	4,017
PM 1200	695	0	0		0	695
RA 400	925	0	0		0	925
RA 600	928	0	0		0	928

Construction

	Average 7Q10	Mine Inflow*	Pumpback Wells	Potable Water	Subtotal	Flow Used in Calculations
LB 300	548	58	0	9	67	481
LB 1000	3,855	67	0	9	76	3,779
LB 2000	4,035	76	0	9	85	3,950
PM 1200	695	0	0		0	695
RA 400	925	9	0		9	916
RA 600	928	9	0		9	919

Mining

	Average 7Q10	Mine Inflow*	Pumpback Wells	Potable Water	Subtotal	Flow Used in Calculations
LB 300	548	90	0	9	99	449
LB 1000	3,855	113	0	9	122	3,733
LB 2000	4,035	121	247	9	377	3,658
PM 1200	695	5	0		5	690
RA 400	925	13	0		13	912
RA 600	928	13	0		13	915

Closure

	Average 7Q10	Mine Inflow*	Pumpback Wells	Potable Water	Subtotal	Flow Used in Calculations
LB 300	548	81	0	9	90	458
LB 1000	3,855	86	0	9	95	3,760
LB 2000	4,035	112	247	9	368	3,667
PM 1200	695		0		0	695
RA 400	925	13	0		13	912
RA 600	928	13	0		13	915

*With mitigation

Alt 3 Flows Used In Mass Balance Calculations

Note: LB-300 flow value is modeled base flow for average conditions, not 7Q10 flow.

Evaluation

	Average 7Q10	Mine Inflow*	Pumpback Wells	Potable Water	Subtotal	Flow Used in Calculations
LB 300	548	9	0	9	18	530
LB 1000	3,855	9	0	9	18	3,837
LB 2000	4,035	9	0	9	18	4,017
PM 1200	695	0	0		0	695
RA 400	925	0	0		0	925
RA 600	928	0	0		0	928

Construction

	Average 7Q10	Mine Inflow*	Pumpback Wells	Potable Water	Subtotal	Flow Used in Calculations
LB 300	548	58	0	9	67	481
LB 1000	3,855	67	0	9	76	3,779
LB 2000	4,035	76	0	9	85	3,950
PM 1200	695	0	0		0	695
RA 400	925	9	0		9	916
RA 600	928	9	0		9	919

Mining

	Average 7Q10	Mine Inflow*	Pumpback Wells	Potable Water	Subtotal	Flow Used in Calculations
LB 300	548	90	0	9	99	449
LB 1000	3,855	113	123	9	245	3,610
LB 2000	4,035	121	247	9	377	3,658
PM 1200	695	5	81		86	609
RA 400	925	13	0		13	912
RA 600	928	13	0		13	915

Closure

	Average 7Q10	Mine Inflow*	Pumpback Wells	Potable Water	Subtotal	Flow Used in Calculations
LB 300	548	81	0	9	90	458
LB 1000	3,855	86	123	9	218	3,637
LB 2000	4,035	112	247	9	368	3,667
PM 1200	695	0	81		81	614
RA 400	925	13	0		13	912
RA 600	928	13	0		13	915

*With mitigation

MINE DISCHARGE RATES

Rates limited by groundwater horizontal K, so flow rates are same for construction, mining and post-mining at LAD areas

For natural groundwater flow, use 35 gpm for under tailings impoundment, 31 gpm for LAD areas in Alt 2, 46 gpm for LAD areas Alts 3&4.

	Evaluation	Construction	Mining	Closure
	Alt 2	Alt 2	Alt 2	Alt 2
Outflows				
@ LADs				
ET @ LADs	98	98	0	98
Seepage to GW	32	32	0	32
To Ramsey Creek				
RA 400	14	14	0	14
RA 600	4	4	0	4
To Poorman Creek				
PM 1000				
PM 1200	9	9	0	9
To Libby Creek LB 1000	5	5	0	5
Subtotal	32	32	0	32
Percent Sources--LAD Areas				
Evaluation	88.5% adit water, 11.5% mine water			
Construction	93% adit water, 7% mine water			
Mining	none			
Post-Mining	all from tailings			

Discharge from Treatment Plants

	Evaluation	Construction	Mining	Closure
Alt 2	263	500	0	500
Alts 3 and 4	263	500	921	540

GROUNDWATER QUALITY TREATMENT CALCULATIONS

WTP QUALITY

Alternative 2

LAD applicaton area=	200	acres
LAD application rate=	130	gpm
Precipitation on 200 acres=	273	gpm
ET on 200 acres=	371	gpm
Net applied water=	32	gpm

		Mine Wastewater		Adit Wastewater During Construction		Tailings Wastewater		Projected WTP Quality
	Treatment Rate for LAD	Mine wastewater concentration (mg/L)	Concentration of percolate to groundwater (mg/L)	Construction adit wastewater concentration (mg/L)	Concentration of percolate to groundwater (mg/L)	Tailings impoundment post-mining water (mg/L)	Concentration of percolate to groundwater (mg/L)	(mg/L)
TDS	0%	121	492	122	496	266	1080	110
Ammonia	50%	<1.6	<3.3	<0.65	<1.3	4.4	8.9	0.70
Nitrate	50%	3.1	6.3	<37	<75	13	26	0.60
Total Nitrogen	50%	<4.7	<9.5	<38.1	<77	17.4	35	0.155
Total Phosphorus	50%	0.096	0.200	<0.026	<0.053	0.086	0.170	0.007
Aluminum	10%	0.075	0.27	<0.014	<0.051	<0.13	<0.48	0.090
Antimony	50%	<0.0088	<0.018	<0.00069	<0.0014	0.023	0.047	0.0010
Arsenic	50%	<0.018	<0.037	<0.0057	<0.012	<0.0017	<0.0035	0.00010
Barium	10%	0.068	0.25	0.014	0.051	<0.11	<0.40	0.20
Beryllium	90%	<0.0010	<0.00041	<0.00080	<0.00033	<0.0010	<0.00041	0.00020
Cadmium	50%	0.0015	<0.0030	<0.000080	<0.00016	0.00097	0.0020	0.000010
Chromium	50%	<0.0010	<0.0020	<0.00047	<0.0010	<0.0010	<0.0020	0.0060
Copper	90%	0.042	0.017	<0.0012	<0.00049	0.026	0.011	0.0035
Iron	50%	<0.15	<0.30	<0.017	<0.035	0.050	0.10	0.13
Lead	90%	0.0080	<0.0033	<0.00010	<0.000041	<0.0044	<0.0018	0.00035
Manganese	10%	0.21	0.77	<0.0050	<0.018	0.51	1.9	0.070
Mercury	50%	<0.0000050	<0.000010	<0.000022	<0.000045	<0.0000050	<0.000010	0.000010
Nickel	90%	<0.010	<0.0041	<0.00075	<0.00030	<0.010	<0.0041	0.0030
Selenium	50%	0.0020	<0.0041	<0.0010	<0.00200	<0.0013	<0.0026	0.0015
Silver	50%	<0.075	<0.15	<0.00020	<0.00041	0.0017	0.0035	0.00040
Zinc	10%	<0.012	<0.044	<0.010	<0.037	<0.010	<0.037	0.030

Note: The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concer

Mine Wastewater = Samples Troy Service Adit-P and Service Adit-D used during period of operations

Adit Wastewater During Construction = Samples RAW-1 and WRS-1 used

Tailings Wastewater = Sample Troy Decant Pond used

Troy Nitrate data is based on Nitrate+Nitrite since nitrate alone was not analyzed

(orange) = total recoverable result used because all dissolved results below detection limit and detection limit greater than standard

(light blue) = value based on 100% below detection limit values

(yellow) = TN concentration is sum of nitrate + nitrite + ammonia concentrations, but does not include organic nitrogen (TKN and TN not sampled at Troy mine mine water or tailings water). (TN = TKN + nitrate + nitrite. TKN = ammonia + organic nitrogen).

RAMSEY CREEK at RA 400
Evaluation

Alternative 2

	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or significant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<17	925	496	12.4	492	1.6	110	0	1080	0	<24	939	BHES	Yes			100	
Ammonia	<0.010	925	<1.3	12.4	<3.3	1.6	0.70	0	8.9	0	<0.030	939						
Nitrate	0.080	925	<75	12.4	6.3	1.6	0.60	0	26	0	<1.1	939						
Total Inorganic Nitrogen	<0.090	925	<76	12.4	<9.6	1.6	1.3	0	35	0	<1.1	939	BHES				1	
Total Nitrogen	<0.155	925	<77	12.4	<9.50	1.6	0.155	0	35	0	<1.186	939	Trigger				0.01	0.275
Total Phosphorus	<0.008	925	<0.053	12.4	<0.200	1.6	0.007	0	0.170	0	<0.009	939	Trigger			Yes	0.001	0.025
Aluminum	0.016	925	<0.051	12.4	<0.27	1.6	0.090	0	<0.48	0	<0.017	939	Trigger			Yes	0.087	0.03
Antimony	<0.00025	925	<0.0014	12.4	<0.018	1.6	0.0010	0	0.047	0	<0.00030	939	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00025	925	<0.012	12.4	<0.0370	1.6	0.00010	0	<0.0035	0	<0.00047	939	Ambient					
Barium	<0.0093	925	<0.051	12.4	<0.25	1.6	0.20	0	<0.40	0	<0.010	939	Trigger			Yes	0.002	1.0
Beryllium	<0.00010	925	<0.00033	12.4	<0.00041	1.6	0.00020	0	<0.00041	0	<0.00010	939	Ambient		Yes			
Cadmium	<0.000040	925	<0.00016	12.4	<0.0030	1.6	0.000010	0	<0.0020	0	<0.000047	939	Trigger			Yes	0.0001	0.000097
Chromium	<0.00044	925	<0.0010	12.4	<0.0020	1.6	0.0060	0	<0.0020	0	<0.00045	939	BHES	Yes			0.005	
Copper	<0.0019	925	<0.00049	12.4	0.017	1.6	0.0035	0	0.011	0	<0.0019	939	BHES	Yes			0.003	
Iron	<0.20	925	<0.035	12.4	<0.300	1.6	0.13	0	0.10	0	<0.20	939	BHES	Yes		Yes	0.1	1.0
Lead	<0.00014	925	<0.000041	12.4	<0.0033	1.6	0.00035	0	<0.0018	0	<0.00014	939	Trigger			Yes	0.0001	0.000545
Manganese	<0.0060	925	<0.018	12.4	0.77	1.6	0.070	0	1.9	0	<0.0075	939	BHES	Yes			0.05	
Mercury	<0.000020	925	<0.000045	12.4	<0.000010	1.6	0.000010	0	<0.000010	0	<0.000020	939	Ambient		Yes			
Nickel	<0.00028	925	<0.00030	12.4	<0.0041	1.6	0.003	0	<0.0041	0	<0.00029	939	Trigger			Yes	0.0005	0.0161
Selenium	<0.00025	925	<0.0020	12.4	<0.0041	1.6	0.0015	0	<0.0026	0	<0.00028	939	Trigger			Yes	0.0006	0.005
Silver	<0.00025	925	<0.00041	12.4	<0.1500	1.6	0.00040	0	<0.0035	0	<0.00051	939	Trigger				0.0002	0.000374
Zinc	<0.0023	925	<0.037	12.4	<0.044	1.6	0.030	0	<0.037	0	<0.0028	939	BHES	Yes			0.025	

Notes:
The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.
Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.
Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

RAMSEY CREEK at RA 400
Construction

Alternative 2

															Applicable Outside of a Mixing Zone					
	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Method to determine BHES Order limit or significant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<17	916	496	12.4	492	1.6	110	0	1080	0	<24	930	BHES	Yes			100	
Ammonia	<0.010	916	<1.3	12.4	<3.3	1.6	0.70	0	8.9	0	<0.030	930						
Nitrate	0.080	916	<75	12.4	6.3	1.6	0.60	0	26	0	<1.1	930						
Total Inorganic Nitrogen	<0.090	916	<76	12.4	<9.6	1.6	1.3	0	35	0	<1.1	930	BHES				1	
Total Nitrogen	<0.155	916	<77	12.4	<9.50	1.6	0.155	0	35	0	<1.196	930	Trigger				0.01	0.275
Total Phosphorus	<0.008	916	<0.053	12.4	<0.200	1.6	0.007	0	0.170	0	<0.009	930	Trigger			Yes	0.001	0.025
Aluminum	0.016	916	<0.051	12.4	<0.27	1.6	0.090	0	<0.48	0	<0.017	930	Trigger			Yes	0.087	0.03
Antimony	<0.00025	916	<0.0014	12.4	<0.018	1.6	0.0010	0	0.047	0	<0.00030	930	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00025	916	<0.012	12.4	<0.0370	1.6	0.00010	0	<0.0035	0	<0.00047	930	Ambient					
Barium	<0.0093	916	<0.051	12.4	<0.25	1.6	0.20	0	<0.40	0	<0.010	930	Trigger			Yes	0.002	1.0
Beryllium	<0.00010	916	<0.00033	12.4	<0.00041	1.6	0.00020	0	<0.00041	0	<0.00010	930	Ambient		Yes			
Cadmium	<0.000040	916	<0.00016	12.4	<0.0030	1.6	0.000010	0	<0.0020	0	<0.000047	930	Trigger			Yes	0.0001	0.000097
Chromium	<0.00044	916	<0.0010	12.4	<0.0020	1.6	0.0060	0	<0.0020	0	<0.00045	930	BHES	Yes			0.005	
Copper	<0.0019	916	<0.00049	12.4	0.017	1.6	0.0035	0	0.011	0	<0.0019	930	BHES	Yes			0.003	
Iron	<0.20	916	<0.035	12.4	<0.300	1.6	0.13	0	0.10	0	<0.20	930	BHES	Yes		Yes	0.1	1.0
Lead	<0.00014	916	<0.000041	12.4	<0.0033	1.6	0.00035	0	<0.0018	0	<0.00014	930	Trigger			Yes	0.0001	0.000545
Manganese	<0.0060	916	<0.018	12.4	0.77	1.6	0.070	0	1.9	0	<0.0075	930	BHES	Yes			0.05	
Mercury	<0.000020	916	<0.000045	12.4	<0.000010	1.6	0.000010	0	<0.000010	0	<0.000020	930	Ambient		Yes			
Nickel	<0.00028	916	<0.00030	12.4	<0.0041	1.6	0.003	0	<0.0041	0	<0.00029	930	Trigger			Yes	0.0005	0.0161
Selenium	<0.00025	916	<0.0020	12.4	<0.0041	1.6	0.0015	0	<0.0026	0	<0.00028	930	Trigger			Yes	0.0006	0.005
Silver	<0.00025	916	<0.00041	12.4	<0.1500	1.6	0.00040	0	<0.0035	0	<0.00051	930	Trigger				0.0002	0.000374
Zinc	<0.0023	916	<0.037	12.4	<0.044	1.6	0.030	0	<0.037	0	<0.0028	930	BHES	Yes			0.025	

Notes:
The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.
Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.
Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

RAMSEY CREEK at RA 400
Mining

Alternative 2

	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or significant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<17	912	496	0	492	0	110	0	1080	0	<17	912	BHES	Yes			100	
Ammonia	<0.010	912	<1.3	0	<3.3	0	0.70	0	8.9	0	<0.010	912						
Nitrate	0.080	912	<75	0	6.3	0	0.60	0	26	0	<0.080	912						
Total Inorganic Nitrogen	<0.090	912	<76	0	<9.6	0	1.3	0	35	0	<0.090	912	BHES	Yes			1	
Total Nitrogen	<0.155	912	<77	0	<9.50	0	0.155	0	35	0	<0.155	912	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.008	912	<0.053	0	<0.200	0	0.007	0	0.170	0	<0.008	912	Trigger			Yes	0.001	0.025
Aluminum	0.016	912	<0.051	0	<0.27	0	0.090	0	<0.48	0	<0.016	912	Trigger			Yes	0.087	0.03
Antimony	<0.00025	912	<0.0014	0	<0.018	0	0.0010	0	0.047	0	<0.00025	912	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00025	912	<0.012	0	<0.0370	0	0.00010	0	<0.0035	0	<0.00025	912	Ambient		Yes			
Barium	<0.0093	912	<0.051	0	<0.25	0	0.20	0	<0.40	0	<0.0093	912	Trigger			Yes	0.002	1.0
Beryllium	<0.00010	912	<0.00033	0	<0.00041	0	0.00020	0	<0.00041	0	<0.00010	912	Ambient		Yes			
Cadmium	<0.000040	912	<0.00016	0	<0.0030	0	0.000010	0	<0.0020	0	<0.000040	912	Trigger			Yes	0.0001	0.000097
Chromium	<0.00044	912	<0.0010	0	<0.0020	0	0.0060	0	<0.0020	0	<0.00044	912	BHES	Yes			0.005	
Copper	<0.0019	912	<0.00049	0	0.017	0	0.0035	0	0.011	0	<0.0019	912	BHES	Yes			0.003	
Iron	<0.20	912	<0.035	0	<0.300	0	0.13	0	0.10	0	<0.20	912	BHES	Yes		Yes	0.1	1.0
Lead	<0.00014	912	<0.000041	0	<0.0033	0	0.00035	0	<0.0018	0	<0.00014	912	Trigger			Yes	0.0001	0.000545
Manganese	<0.0060	912	<0.018	0	0.77	0	0.070	0	1.9	0	<0.0060	912	BHES	Yes			0.05	
Mercury	<0.000020	912	<0.000045	0	<0.000010	0	0.000010	0	<0.000010	0	<0.000020	912	Ambient		Yes			
Nickel	<0.00028	912	<0.00030	0	<0.0041	0	0.003	0	<0.0041	0	<0.00028	912	Trigger			Yes	0.0005	0.0161
Selenium	<0.00025	912	<0.0020	0	<0.0041	0	0.0015	0	<0.0026	0	<0.00025	912	Trigger			Yes	0.0006	0.005
Silver	<0.00025	912	<0.00041	0	<0.1500	0	0.00040	0	<0.0035	0	<0.00025	912	Trigger			Yes	0.0002	0.000374
Zinc	<0.0023	912	<0.037	0	<0.044	0	0.030	0	<0.037	0	<0.0023	912	BHES	Yes			0.025	

Notes:
The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.
Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.
Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

RAMSEY CREEK at RA 400
Closure

Alternative 2

													Applicable Outside of a Mixing Zone					
	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Method to determine BHES Order limit or significant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<17	912	496	0	492	0	110	0	1080	14	<33	926	BHES	Yes			100	
Ammonia	<0.010	912	<1.3	0	<3.3	0	0.70	0	8.9	14	<0.14	926						
Nitrate	0.080	912	<75	0	6.3	0	0.60	0	26	14	<0.47	926						
Total Inorganic Nitrogen	<0.090	912	<76	0	<9.6	0	1.3	0	35	14	<0.61	926	BHES	Yes			1	
Total Nitrogen	<0.155	912	<77	0	<9.50	0	0.155	0	35	14	<0.682	926	Trigger				0.01	0.275
Total Phosphorus	<0.008	912	<0.053	0	<0.200	0	0.007	0	0.170	14	<0.010	926	Trigger				0.001	0.025
Aluminum	0.016	912	<0.051	0	<0.27	0	0.090	0	<0.48	14	<0.023	926	Trigger			Yes	0.087	0.03
Antimony	<0.00025	912	<0.0014	0	<0.018	0	0.0010	0	0.047	14	<0.00096	926	Trigger				0.0004	0.0056
Arsenic	<0.00025	912	<0.012	0	<0.0370	0	0.00010	0	<0.0035	14	<0.00030	926	Ambient					
Barium	<0.0093	912	<0.051	0	<0.25	0	0.20	0	<0.40	14	<0.015	926	Trigger			Yes	0.002	1.0
Beryllium	<0.00010	912	<0.00033	0	<0.00041	0	0.00020	0	<0.00041	14	<0.00010	926	Ambient		Yes			
Cadmium	<0.000040	912	<0.00016	0	<0.0030	0	0.000010	0	<0.0020	14	<0.000070	926	Trigger			Yes	0.0001	0.000097
Chromium	<0.00044	912	<0.0010	0	<0.0020	0	0.0060	0	<0.0020	14	<0.00046	926	BHES	Yes			0.005	
Copper	<0.0019	912	<0.00049	0	0.017	0	0.0035	0	0.011	14	<0.0020	926	BHES	Yes			0.003	
Iron	<0.20	912	<0.035	0	<0.300	0	0.13	0	0.10	14	<0.20	926	BHES	Yes		Yes	0.1	1.0
Lead	<0.00014	912	<0.000041	0	<0.0033	0	0.00035	0	<0.0018	14	<0.00017	926	Trigger			Yes	0.0001	0.000545
Manganese	<0.0060	912	<0.018	0	0.77	0	0.070	0	1.9	14	<0.035	926	BHES	Yes			0.05	
Mercury	<0.000020	912	<0.000045	0	<0.000010	0	0.000010	0	<0.000010	14	<0.000020	926	Ambient		Yes			
Nickel	<0.00028	912	<0.00030	0	<0.0041	0	0.003	0	<0.0041	14	<0.00034	926	Trigger			Yes	0.0005	0.0161
Selenium	<0.00025	912	<0.0020	0	<0.0041	0	0.0015	0	<0.0026	14	<0.00029	926	Trigger			Yes	0.0006	0.005
Silver	<0.00025	912	<0.00041	0	<0.1500	0	0.00040	0	<0.0035	14	<0.00030	926	Trigger			Yes	0.0002	0.000374
Zinc	<0.0023	912	<0.037	0	<0.044	0	0.030	0	<0.037	14	<0.0028	926	BHES	Yes			0.025	

Notes:
The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.
Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.
Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2)
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

RAMSEY CREEK at RA 600
Evaluation

Alternative 2

													Applicable Outside of a Mixing Zone					
	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Method to determine BHES Order limit or significant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<13	928	496	15.9	492	2.1	110	0	1080	0	<22	946	BHES	Yes			100	
Ammonia	<0.052	928	<1.3	15.9	<3.3	2.1	0.70	0	8.9	0	<0.080	946						
Nitrate	<0.081	928	<75	15.9	6.3	2.1	0.60	0	26	0	<1.4	946						
Total Inorganic Nitrogen	<0.13	928	<76	15.9	<9.6	2.1	1.3	0	35	0	<1.43	946	BHES				1	
Total Nitrogen	<0.25	928	<77	15.9	<9.50	2.1	0.155	0	35	0	<1.56	946	Trigger				0.01	0.275
Total Phosphorus	<0.0096	928	<0.053	15.9	<0.200	2.1	0.007	0	0.170	0	<0.011	946	Trigger				0.001	0.025
Aluminum	0.013	928	<0.051	15.9	<0.27	2.1	0.090	0	<0.48	0	<0.014	946	Trigger			Yes	0.087	0.03
Antimony	<0.0030	928	<0.0014	15.9	<0.018	2.1	0.0010	0	0.047	0	<0.0030	946	Trigger			Yes	0.0004	0.0056
Arsenic	<0.0020	928	<0.012	15.9	<0.0370	2.1	0.00010	0	<0.004	0	<0.0022	946	Ambient					
Barium	<0.0040	928	<0.051	15.9	<0.25	2.1	0.20	0	<0.40	0	<0.0053	946	Trigger			Yes	0.002	1.0
Beryllium	<0.0010	928	<0.00033	15.9	<0.00041	2.1	0.00020	0	<0.00041	0	<0.00099	946	Ambient		Yes			
Cadmium	<0.000017	928	<0.00016	15.9	<0.0030	2.1	0.000010	0	<0.0020	0	<0.000026	946	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	928	<0.0010	15.9	<0.0020	2.1	0.0060	0	<0.0020	0	<0.0010	946	BHES	Yes			0.005	
Copper	<0.0010	928	<0.00049	15.9	0.017	2.1	0.0035	0	0.01	0	<0.0010	946	BHES	Yes			0.003	
Iron	<0.050	928	<0.035	15.9	<0.300	2.1	0.13	0	0.1	0	<0.050	946	BHES	Yes		Yes	0.1	1.0
Lead	<0.00010	928	<0.000041	15.9	<0.0033	2.1	0.00035	0	<0.002	0	<0.00011	946	Trigger			Yes	0.0001	0.000545
Manganese	<0.0023	928	<0.018	15.9	0.77	2.1	0.070	0	1.9	0	<0.0043	946	BHES	Yes			0.05	
Mercury	<0.000020	928	<0.000045	15.9	<0.000010	2.1	0.000010	0	<0.0000	0	<0.000020	946	Ambient		Yes			
Nickel	<0.0051	928	<0.00030	15.9	<0.0041	2.1	0.003	0	<0.0041	0	<0.0050	946	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	928	<0.0020	15.9	<0.0041	2.1	0.0015	0	<0.0026	0	<0.0010	946	Trigger			Yes	0.0006	0.005
Silver	<0.00020	928	<0.00041	15.9	<0.1500	2.1	0.00040	0	<0.0035	0	<0.00054	946	Trigger				0.0002	0.000374
Zinc	<0.0038	928	<0.037	15.9	<0.044	2.1	0.030	0	<0.037	0	<0.0044	946	BHES	Yes			0.025	

Notes:
The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.
Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.
Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

RAMSEY CREEK at RA 600

Construction

Alternative 2

	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or significant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<13	919	496	16.7	492	1.3	110	0	1080	0	<22	937	BHES	Yes			100	
Ammonia	<0.052	919	<1.3	16.7	<3.3	1.3	0.70	0	8.9	0	<0.079	937						
Nitrate	<0.081	919	<75	16.7	6.3	1.3	0.60	0	26	0	<1.4	937						
Total Inorganic Nitrogen	<0.13	919	<76	16.7	<9.6	1.3	1.3	0	35	0	<1.5	937	BHES				1	
Total Nitrogen	<0.25	919	<77	16.74	<9.50	1.26	0.155	0	35	0	<1.63	937	Trigger				0.01	0.275
Total Phosphorus	<0.0096	919	<0.053	16.74	<0.200	1.26	0.007	0	0.170	0	<0.011	937	Trigger				0.001	0.025
Aluminum	0.013	919	<0.051	16.7	<0.27	1.3	0.090	0	<0.48	0	<0.014	937	Trigger			Yes	0.087	0.03
Antimony	<0.0030	919	<0.0014	16.7	<0.018	1.3	0.0010	0	0.047	0	<0.0030	937	Trigger			Yes	0.0004	0.0056
Arsenic	<0.0020	919	<0.012	16.7	<0.0370	1.3	0.00010	0	<0.0035	0	<0.0022	937	Ambient					
Barium	<0.0040	919	<0.051	16.7	<0.25	1.3	0.20	0	<0.40	0	<0.0052	937	Trigger			Yes	0.002	1.0
Beryllium	<0.0010	919	<0.00033	16.7	<0.00041	1.3	0.00020	0	<0.00041	0	<0.00099	937	Ambient		Yes			
Cadmium	<0.000017	919	<0.00016	16.7	<0.0030	1.3	0.000010	0	<0.0020	0	<0.000024	937	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	919	<0.0010	16.7	<0.0020	1.3	0.0060	0	<0.0020	0	<0.0010	937	BHES	Yes			0.005	
Copper	<0.0010	919	<0.00049	16.7	0.017	1.3	0.0035	0	0.011	0	<0.0010	937	BHES	Yes			0.003	
Iron	<0.050	919	<0.035	16.7	<0.300	1.3	0.13	0	0.10	0	<0.050	937	BHES	Yes		Yes	0.1	1.0
Lead	<0.00010	919	<0.000041	16.7	<0.0033	1.3	0.00035	0	<0.0018	0	<0.00010	937	Trigger			Yes	0.0001	0.000545
Manganese	<0.0023	919	<0.018	16.7	0.77	1.3	0.070	0	1.9	0	<0.0036	937	BHES	Yes			0.05	
Mercury	<0.000020	919	<0.000045	16.7	<0.000010	1.3	0.000010	0	<0.000010	0	<0.000020	937	Ambient		Yes			
Nickel	<0.0051	919	<0.00030	16.7	<0.0041	1.3	0.003	0	<0.0041	0	<0.0050	937	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	919	<0.0020	16.7	<0.0041	1.3	0.0015	0	<0.0026	0	<0.0010	937	Trigger			Yes	0.0006	0.005
Silver	<0.00020	919	<0.00041	16.7	<0.1500	1.3	0.00040	0	<0.0035	0	<0.00041	937	Trigger				0.0002	0.000374
Zinc	<0.0038	919	<0.037	16.7	<0.044	1.3	0.030	0	<0.037	0	<0.0044	937	BHES	Yes			0.025	

Notes:

The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.

Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.

Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).

Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

RAMSEY CREEK at RA 600
Mining

Alternative 2

	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or significant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<13	915	496	0	492	0	110	0	1080	0	<13	915	BHES	Yes			100	
Ammonia	<0.052	915	<1.3	0	<3.3	0	0.70	0	8.9	0	<0.052	915						
Nitrate	<0.081	915	<75	0	6.3	0	0.60	0	26	0	<0.081	915						
Total Inorganic Nitrogen	<0.13	915	<76	0	<9.6	0	1.3	0	35	0	<0.13	915	BHES	Yes			1	
Total Nitrogen	<0.25	915	<77	0	<9.50	0	0.155	0	35	0	<0.25	915	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.0096	915	<0.053	0	<0.200	0	0.007	0	0.170	0	<0.010	915	Trigger			Yes	0.001	0.025
Aluminum	0.013	915	<0.051	0	<0.27	0	0.090	0	<0.48	0	<0.013	915	Trigger			Yes	0.087	0.03
Antimony	<0.0030	915	<0.0014	0	<0.018	0	0.0010	0	0.047	0	<0.0030	915	Trigger			Yes	0.0004	0.0056
Arsenic	<0.0020	915	<0.012	0	<0.0370	0	0.00010	0	<0.0035	0	<0.0020	915	Ambient		Yes			
Barium	<0.0040	915	<0.051	0	<0.25	0	0.20	0	<0.40	0	<0.0040	915	Trigger			Yes	0.002	1.0
Beryllium	<0.0010	915	<0.00033	0	<0.00041	0	0.00020	0	<0.00041	0	<0.0010	915	Ambient		Yes			
Cadmium	<0.000017	915	<0.00016	0	<0.0030	0	0.000010	0	<0.0020	0	<0.000017	915	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	915	<0.0010	0	<0.0020	0	0.0060	0	<0.0020	0	<0.0010	915	BHES	Yes			0.005	
Copper	<0.0010	915	<0.00049	0	0.017	0	0.0035	0	0.011	0	<0.0010	915	BHES	Yes			0.003	
Iron	<0.050	915	<0.035	0	<0.300	0	0.13	0	0.10	0	<0.050	915	BHES	Yes		Yes	0.1	1.0
Lead	<0.00010	915	<0.000041	0	<0.0033	0	0.00035	0	<0.0018	0	<0.00010	915	Trigger			Yes	0.0001	0.000545
Manganese	<0.0023	915	<0.018	0	0.77	0	0.070	0	1.9	0	<0.0023	915	BHES	Yes			0.05	
Mercury	<0.000020	915	<0.000045	0	<0.000010	0	0.000010	0	<0.000010	0	<0.000020	915	Ambient		Yes			
Nickel	<0.0051	915	<0.00030	0	<0.0041	0	0.003	0	<0.0041	0	<0.0051	915	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	915	<0.0020	0	<0.0041	0	0.0015	0	<0.0026	0	<0.0010	915	Trigger			Yes	0.0006	0.005
Silver	<0.00020	915	<0.00041	0	<0.1500	0	0.00040	0	<0.0035	0	<0.00020	915	Trigger			Yes	0.0002	0.000374
Zinc	<0.0038	915	<0.037	0	<0.044	0	0.030	0	<0.037	0	<0.0038	915	BHES	Yes			0.025	

Notes:
The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.
Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.
Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

RAMSEY CREEK at RA 600

Closure

Alternative 2

	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or significant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<13	915	496	0	492	0	110	0	1080	18	<33	933	BHES	Yes			100	
Ammonia	<0.052	915	<1.3	0	<3.3	0	0.70	0	8.9	18	<0.22	933						
Nitrate	<0.081	915	<75	0	6.3	0	0.60	0	26	18	<0.58	933						
Total Inorganic Nitrogen	<0.13	915	<76	0	<9.6	0	1.3	0	35	18	<0.80	933	BHES	Yes			1	
Total Nitrogen	<0.25	915	<77	0	<9.50	0	0.155	0	35	18	<0.92	933	Trigger				0.01	0.275
Total Phosphorus	<0.0096	915	<0.053	0	<0.200	0	0.007	0	0.170	18	<0.013	933	Trigger				0.001	0.025
Aluminum	0.013	915	<0.051	0	<0.27	0	0.090	0	<0.48	18	<0.022	933	Trigger			Yes	0.087	0.03
Antimony	<0.0030	915	<0.0014	0	<0.018	0	0.0010	0	0.047	18	<0.0038	933	Trigger				0.0004	0.0056
Arsenic	<0.0020	915	<0.012	0	<0.0370	0	0.00010	0	<0.0035	18	<0.0020	933	Ambient		Yes			
Barium	<0.0040	915	<0.051	0	<0.25	0	0.20	0	<0.40	18	<0.012	933	Trigger			Yes	0.002	1.0
Beryllium	<0.0010	915	<0.00033	0	<0.00041	0	0.00020	0	<0.00041	18	<0.00099	933	Ambient		Yes			
Cadmium	<0.000017	915	<0.00016	0	<0.0030	0	0.000010	0	<0.0020	18	<0.000055	933	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	915	<0.0010	0	<0.0020	0	0.0060	0	<0.0020	18	<0.0010	933	BHES	Yes			0.005	
Copper	<0.0010	915	<0.00049	0	0.017	0	0.0035	0	0.011	18	<0.0012	933	BHES	Yes			0.003	
Iron	<0.050	915	<0.035	0	<0.300	0	0.13	0	0.10	18	<0.051	933	BHES	Yes		Yes	0.1	1.0
Lead	<0.00010	915	<0.000041	0	<0.0033	0	0.00035	0	<0.0018	18	<0.00013	933	Trigger			Yes	0.0001	0.000545
Manganese	<0.0023	915	<0.018	0	0.77	0	0.070	0	1.9	18	<0.039	933	BHES	Yes			0.05	
Mercury	<0.000020	915	<0.000045	0	<0.000010	0	0.000010	0	<0.000010	18	<0.000020	933	Ambient		Yes			
Nickel	<0.0051	915	<0.00030	0	<0.0041	0	0.003	0	<0.0041	18	<0.0051	933	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	915	<0.0020	0	<0.0041	0	0.0015	0	<0.0026	18	<0.0010	933	Trigger			Yes	0.0006	0.005
Silver	<0.00020	915	<0.00041	0	<0.1500	0	0.00040	0	<0.0035	18	<0.00026	933	Trigger			Yes	0.0002	0.000374
Zinc	<0.0038	915	<0.037	0	<0.044	0	0.030	0	<0.037	18	<0.0044	933	BHES	Yes			0.025	

Notes:

The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.

Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.

Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).

Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

POORMAN CREEK at PM 1200
Evaluation

Alternative 2

	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or significant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<23	695	496	8	492	1	110	0	1080	0	<29	704	BHES	Yes			100	
Ammonia	<0.050	695	<1.3	8	<3.3	1	0.70	0	8.9	0	<0.069	704						
Nitrate	<0.053	695	<75	8	6.3	1	0.60	0	26	0	<0.91	704						
Total Inorganic Nitrogen	<0.10	695	<76	8	<9.6	1	1.3	0	35	0	<0.98	704	BHES	Yes			1	
Total Nitrogen	<0.22	695	<77	8	<9.50	1	0.155	0	35	0	<1.11	704	Trigger				0.01	0.275
Total Phosphorus	<0.0099	695	<0.053	8	<0.200	1	0.007	0	0.170	0	<0.011	704	Trigger			Yes	0.001	0.025
Aluminum	<0.010	695	<0.051	8	<0.27	1	0.090	0	<0.48	0	<0.011	704	Trigger			Yes	0.087	0.03
Antimony	<0.00050	695	<0.0014	8	<0.018	1	0.0010	0	0.047	0	<0.00054	704	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00050	695	<0.012	8	<0.0370	1	0.00010	0	<0.0035	0	<0.00068	704	Ambient					
Barium	<0.0064	695	<0.051	8	<0.25	1	0.20	0	<0.40	0	<0.0073	704	Trigger			Yes	0.002	1.0
Beryllium	<0.00020	695	<0.00033	8	<0.00041	1	0.00020	0	<0.00041	0	<0.00020	704	Ambient		Yes			
Cadmium	<0.000040	695	<0.00016	8	<0.0030	1	0.000010	0	<0.0020	0	<0.000046	704	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	695	<0.0010	8	<0.0020	1	0.0060	0	<0.0020	0	<0.0010	704	BHES	Yes			0.005	
Copper	<0.0010	695	<0.00049	8	0.017	1	0.0035	0	0.011	0	<0.0010	704	BHES	Yes			0.003	
Iron	<0.050	695	<0.035	8	<0.300	1	0.13	0	0.10	0	<0.050	704	BHES	Yes		Yes	0.1	1.0
Lead	<0.000045	695	<0.000041	8	<0.0033	1	0.00035	0	<0.0018	0	<0.000050	704	Trigger			Yes	0.0001	0.000545
Manganese	<0.00089	695	<0.018	8	0.77	1	0.070	0	1.9	0	<0.0022	704	BHES	Yes			0.05	
Mercury	<0.000020	695	<0.000045	8	<0.000010	1	0.000010	0	<0.000010	0	<0.000020	704	Ambient		Yes			
Nickel	<0.00050	695	<0.00030	8	<0.0041	1	0.003	0	<0.0041	0	<0.00050	704	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	695	<0.0020	8	<0.0041	1	0.0015	0	<0.0026	0	<0.0010	704	Trigger			Yes	0.0006	0.005
Silver	<0.00020	695	<0.00041	8	<0.1500	1	0.00040	0	<0.0035	0	<0.00042	704	Trigger				0.0002	0.000374
Zinc	<0.0031	695	<0.037	8	<0.044	1	0.030	0	<0.037	0	<0.0035	704	BHES	Yes			0.025	

Notes:
The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.
Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.
Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

POORMAN CREEK at PM 1200
Construction

Alternative 2

	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or significant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<23	695	496	8.4	492	0.6	110	0	1080	0	<29	704	BHES	Yes			100	
Ammonia	<0.050	695	<1.3	8.4	<3.3	0.6	0.70	0	8.9	0	<0.068	704						
Nitrate	<0.053	695	<75	8.4	6.3	0.6	0.60	0	26	0	<0.95	704						
Total Inorganic Nitrogen	<0.10	695	<76	8.4	<9.6	0.6	1.3	0	35	0	<1.0	704	BHES	Yes			1	
Total Nitrogen	<0.22	695	<77	8.37	<9.5	0.63	0.155	0	35	0	<1.1	704	Trigger				0.01	0.275
Total Phosphorus	<0.0099	695	<0.053	8.37	<0.20	0.63	0.007	0	0.170	0	<0.011	704	Trigger			Yes	0.001	0.025
Aluminum	<0.010	695	<0.051	8.4	<0.27	0.6	0.090	0	<0.48	0	<0.011	704	Trigger			Yes	0.087	0.03
Antimony	<0.00050	695	<0.0014	8.4	<0.018	0.6	0.0010	0	0.047	0	<0.00053	704	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00050	695	<0.012	8.4	<0.0370	0.6	0.00010	0	<0.0035	0	<0.00067	704	Ambient					
Barium	<0.0064	695	<0.051	8.4	<0.25	0.6	0.20	0	<0.40	0	<0.0071	704	Trigger			Yes	0.002	1.0
Beryllium	<0.00020	695	<0.00033	8.4	<0.00041	0.6	0.00020	0	<0.00041	0	<0.00020	704	Ambient		Yes			
Cadmium	<0.000040	695	<0.00016	8.4	<0.0030	0.6	0.000010	0	<0.0020	0	<0.000044	704	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	695	<0.0010	8.4	<0.0020	0.6	0.0060	0	<0.0020	0	<0.0010	704	BHES	Yes			0.005	
Copper	<0.0010	695	<0.00049	8.4	0.017	0.6	0.0035	0	0.011	0	<0.0010	704	BHES	Yes			0.003	
Iron	<0.050	695	<0.035	8.4	<0.300	0.6	0.13	0	0.10	0	<0.050	704	BHES	Yes		Yes	0.1	1.0
Lead	<0.000045	695	<0.000041	8.4	<0.0033	0.6	0.00035	0	<0.0018	0	<0.000048	704	Trigger			Yes	0.0001	0.000545
Manganese	<0.00089	695	<0.018	8.4	0.77	0.6	0.070	0	1.9	0	<0.0018	704	BHES	Yes			0.05	
Mercury	<0.000020	695	<0.000045	8.4	<0.000010	0.6	0.000010	0	<0.000010	0	<0.000020	704	Ambient		Yes			
Nickel	<0.00050	695	<0.00030	8.4	<0.0041	0.6	0.003	0	<0.0041	0	<0.00050	704	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	695	<0.0020	8.4	<0.0041	0.6	0.0015	0	<0.0026	0	<0.0010	704	Trigger			Yes	0.0006	0.005
Silver	<0.00020	695	<0.00041	8.4	<0.1500	0.6	0.00040	0	<0.0035	0	<0.00034	704	Trigger			Yes	0.0002	0.000374
Zinc	<0.0031	695	<0.037	8.4	<0.044	0.6	0.030	0	<0.037	0	<0.0035	704	BHES	Yes			0.025	

Notes:

The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.

Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.

Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).

Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

POORMAN CREEK at PM 1200

Mining

Alternative 2

													Applicable Outside of a Mixing Zone					
	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Method to determine BHES Order limit or significant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<23	690	496	0	492	0	110	0	1080	0	<23	690	BHES	Yes			100	
Ammonia	<0.050	690	<1.3	0	<3.3	0	0.70	0	8.9	0	<0.050	690						
Nitrate	<0.053	690	<75	0	6.3	0	0.60	0	26	0	<0.053	690						
Total Inorganic Nitrogen	<0.10	690	<76	0	<9.6	0	1.3	0	35	0	<0.10	690	BHES	Yes			1	
Total Nitrogen	<0.22	690	<77	0	<9.50	0	0.155	0	35	0	<0.22	690	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.0099	690	<0.053	0	<0.200	0	0.007	0	0.170	0	<0.010	690	Trigger			Yes	0.001	0.025
Aluminum	<0.010	690	<0.051	0	<0.27	0	0.090	0	<0.48	0	<0.010	690	Trigger			Yes	0.087	0.03
Antimony	<0.00050	690	<0.0014	0	<0.018	0	0.0010	0	0.047	0	<0.00050	690	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00050	690	<0.012	0	<0.0370	0	0.00010	0	<0.0035	0	<0.00050	690	Ambient		Yes			
Barium	<0.0064	690	<0.051	0	<0.25	0	0.20	0	<0.40	0	<0.0064	690	Trigger			Yes	0.002	1.0
Beryllium	<0.00020	690	<0.00033	0	<0.00041	0	0.00020	0	<0.00041	0	<0.00020	690	Ambient		Yes			
Cadmium	<0.000040	690	<0.00016	0	<0.0030	0	0.000010	0	<0.0020	0	<0.000040	690	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	690	<0.0010	0	<0.0020	0	0.0060	0	<0.0020	0	<0.0010	690	BHES	Yes			0.005	
Copper	<0.0010	690	<0.00049	0	0.017	0	0.0035	0	0.011	0	<0.0010	690	BHES	Yes			0.003	
Iron	<0.050	690	<0.035	0	<0.300	0	0.13	0	0.10	0	<0.050	690	BHES	Yes		Yes	0.1	1.0
Lead	<0.000045	690	<0.000041	0	<0.0033	0	0.00035	0	<0.0018	0	<0.000045	690	Trigger			Yes	0.0001	0.000545
Manganese	<0.00089	690	<0.018	0	0.77	0	0.070	0	1.9	0	<0.00089	690	BHES	Yes			0.05	
Mercury	<0.000020	690	<0.000045	0	<0.000010	0	0.000010	0	<0.000010	0	<0.000020	690	Ambient		Yes			
Nickel	<0.00050	690	<0.00030	0	<0.0041	0	0.003	0	<0.0041	0	<0.00050	690	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	690	<0.0020	0	<0.0041	0	0.0015	0	<0.0026	0	<0.0010	690	Trigger			Yes	0.0006	0.005
Silver	<0.00020	690	<0.00041	0	<0.1500	0	0.00040	0	<0.0035	0	<0.00020	690	Trigger			Yes	0.0002	0.000374
Zinc	<0.0031	690	<0.037	0	<0.044	0	0.030	0	<0.037	0	<0.0031	690	BHES	Yes			0.025	

Notes:

The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.

Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.

Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).

Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

POORMAN CREEK at PM 1200

Closure

Alternative 2													Applicable Outside of a Mixing Zone					
	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Method to determine BHES Order limit or significant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<23	695	496	0	492	0	110	0	1080	9	<36	704	BHES	Yes			100	
Ammonia	<0.050	695	<1.3	0	<3.3	0	0.70	0	8.9	9	<0.16	704						
Nitrate	<0.053	695	<75	0	6.3	0	0.60	0	26	9	<0.38	704						
Total Inorganic Nitrogen	<0.10	695	<76	0	<9.6	0	1.3	0	35	9	<0.54	704	BHES	Yes			1	
Total Nitrogen	<0.22	695	<77	0	<9.50	0	0.155	0	35	9	<0.66	704	Trigger				0.01	0.275
Total Phosphorus	<0.0099	695	<0.053	0	0.20	0	0.007	0	0.17	9	<0.012	704	Trigger				0.001	0.025
Aluminum	<0.010	695	<0.051	0	<0.27	0	0.090	0	<0.48	9	<0.016	704	Trigger			Yes	0.087	0.03
Antimony	<0.00050	695	<0.0014	0	<0.018	0	0.0010	0	0.047	9	<0.0011	704	Trigger				0.0004	0.0056
Arsenic	<0.00050	695	<0.012	0	<0.037	0	0.00010	0	<0.0035	9	<0.00050	704	Ambient		Yes			
Barium	<0.0064	695	<0.051	0	<0.25	0	0.20	0	<0.40	9	<0.011	704	Trigger			Yes	0.002	1.0
Beryllium	<0.00020	695	<0.00033	0	<0.00041	0	0.00020	0	<0.00041	9	<0.00020	704	Ambient		Yes			
Cadmium	<0.000040	695	<0.00016	0	<0.0030	0	0.000010	0	<0.0020	9	<0.000065	704	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	695	<0.0010	0	<0.0020	0	0.0060	0	<0.0020	9	<0.0010	704	BHES	Yes			0.005	
Copper	<0.0010	695	<0.00049	0	0.017	0	0.0035	0	0.011	9	<0.0011	704	BHES	Yes			0.003	
Iron	<0.050	695	<0.035	0	<0.30	0	0.13	0	0.10	9	<0.051	704	BHES	Yes		Yes	0.1	1.0
Lead	<0.000045	695	<0.000041	0	<0.0033	0	0.00035	0	<0.0018	9	<0.000068	704	Trigger			Yes	0.0001	0.000545
Manganese	<0.00089	695	<0.018	0	0.77	0	0.070	0	1.9	9	<0.025	704	BHES	Yes			0.05	
Mercury	<0.000020	695	<0.000045	0	<0.000010	0	0.000010	0	<0.000010	9	<0.000020	704	Ambient		Yes			
Nickel	<0.00050	695	<0.00030	0	<0.0041	0	0.003	0	<0.0041	9	<0.00055	704	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	695	<0.0020	0	<0.0041	0	0.0015	0	<0.0026	9	<0.0010	704	Trigger			Yes	0.0006	0.005
Silver	<0.00020	695	<0.00041	0	<0.1500	0	0.00040	0	<0.0035	9	<0.00024	704	Trigger			Yes	0.0002	0.000374
Zinc	<0.0031	695	<0.037	0	<0.044	0	0.030	0	<0.037	9	<0.0035	704	BHES	Yes			0.025	

Notes:

The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.

Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.

Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).

Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

LIBBY CREEK at LB 300
Evaluation

Alternative 2

Parameter	Ambient Water Quality Conc. (mg/l)	Ambient Water Quality Flow (gpm)	Representative adit water from LAD percolation (construction) Conc. (mg/l)	Flow (gpm)	Representative mine water from LAD percolation Conc. (mg/l)	Flow (gpm)	Representative Water Treatment Plant effluent Conc. (mg/l)	Flow (gpm)	Representative tailings water from LAD percolation Conc. (mg/l)	Flow (gpm)	Projected final mixing concentration Conc. (mg/l)	Flow (gpm)	Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit (mg/L)	Lowest applicable standard (Toxic Parameters and Nutrients) (mg/L)
TDS	<25	530	496	0	492	0	110	133	1080	0	<42	663	BHES	Yes			100	
Ammonia	<0.050	530	<1.3	0	<3.3	0	0.70	133	8.9	0	<0.18	663						
Nitrate	<0.13	530	<75	0	6.3	0	0.60	133	26	0	<0.22	663						
Total Inorganic Nitrogen	<0.18	530	<76	0	<9.6	0	1.3	133	35	0	<0.40	663	BHES	Yes			1	
Total Nitrogen	<0.26	530	<77	0	<9.5	0	0.155	133	35	0	<0.24	663	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.0064	530	<0.053	0	<0.200	0	0.007	133	0.170	0	<0.007	663	Trigger			Yes	0.001	0.025
Aluminum	<0.012	530	<0.051	0	<0.27	0	0.090	133	<0.48	0	<0.028	663	Trigger			Yes	0.087	0.03
Antimony	<0.00050	530	<0.0014	0	<0.018	0	0.0010	133	0.047	0	<0.00060	663	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00035	530	<0.012	0	<0.0370	0	0.00010	133	<0.0035	0	<0.00030	663	Ambient		Yes			
Barium	<0.0026	530	<0.051	0	<0.25	0	0.20	133	<0.40	0	<0.0422	663	Trigger			Yes	0.002	1.0
Beryllium	<0.00020	530	<0.00033	0	<0.00041	0	0.00020	133	<0.00041	0	<0.00020	663	Ambient		Yes			
Cadmium	<0.0000088	530	<0.00016	0	<0.0030	0	0.000010	133	<0.0020	0	<0.0000090	663	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	530	<0.0010	0	<0.0020	0	0.0060	133	<0.0020	0	<0.0020	663	BHES	Yes			0.005	
Copper	<0.0010	530	<0.00049	0	0.017	0	0.0035	133	0.011	0	<0.0015	663	BHES	Yes			0.003	
Iron	<0.024	530	<0.035	0	<0.300	0	0.13	133	0.10	0	<0.045	663	BHES	Yes		Yes	0.1	1.0
Lead	<0.00025	530	<0.000041	0	<0.0033	0	0.00035	133	<0.0018	0	<0.00027	663	Trigger			Yes	0.0001	0.000545
Manganese	<0.0019	530	<0.018	0	0.77	0	0.070	133	1.9	0	<0.016	663	BHES	Yes			0.05	
Mercury	<0.000010	530	<0.000045	0	<0.000010	0	0.000010	133	<0.000010	0	<0.000010	663	Ambient		Yes			
Nickel	<0.00050	530	<0.00030	0	<0.0041	0	0.003	133	<0.0041	0	<0.0010	663	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	530	<0.0020	0	<0.0041	0	0.0015	133	<0.0026	0	<0.0011	663	Trigger			Yes	0.0006	0.005
Silver	<0.00020	530	<0.00041	0	<0.1500	0	0.00040	133	<0.0035	0	<0.00024	663	Trigger			Yes	0.0002	0.000374
Zinc	<0.0080	530	<0.037	0	<0.044	0	0.030	133	<0.037	0	<0.012	663	BHES	Yes			0.025	

Alternative 3

Parameter	Ambient Water Quality Conc. (mg/l)	Ambient Water Quality Flow (gpm)	Representative adit water from LAD percolation (construction) Conc. (mg/l)	Flow (gpm)	Representative mine water from LAD percolation Conc. (mg/l)	Flow (gpm)	Representative Water Treatment Plant effluent Conc. (mg/l)	Flow (gpm)	Representative tailings water from LAD percolation Conc. (mg/l)	Flow (gpm)	Projected final mixing concentration Conc. (mg/l)	Flow (gpm)	Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit (mg/L)	Lowest applicable standard (Toxic Parameters and Nutrients) (mg/L)
TDS	<25	530	496	0	492	0	110	263	1080	0	<53	793	BHES	Yes			100	
Ammonia	<0.050	530	<1.3	0	<3.3	0	0.70	263	8.9	0	<0.27	793						
Nitrate	<0.13	530	<75	0	6.3	0	0.60	263	26	0	<0.29	793						
Total Inorganic Nitrogen	<0.18	530	<76	0	<9.6	0	1.3	263	35	0	<0.55	793	BHES	Yes			1	
Total Nitrogen	<0.26	530	<77	0	<9.5	0	0.155	263	35	0	<0.23	793	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.0064	530	<0.053	0	<0.200	0	0.007	263	0.170	0	<0.007	793	Trigger			Yes	0.001	0.025
Aluminum	<0.012	530	<0.051	0	<0.27	0	0.090	263	<0.48	0	<0.038	793	Trigger			Yes	0.087	0.03
Antimony	<0.00050	530	<0.0014	0	<0.018	0	0.0010	263	0.047	0	<0.00067	793	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00035	530	<0.012	0	<0.0370	0	0.00010	263	<0.0035	0	<0.00027	793	Ambient		Yes			
Barium	<0.0026	530	<0.051	0	<0.25	0	0.20	263	<0.40	0	<0.068	793	Trigger			Yes	0.002	1.0
Beryllium	<0.00020	530	<0.00033	0	<0.00041	0	0.00020	263	<0.00041	0	<0.00020	793	Ambient		Yes			
Cadmium	<0.0000088	530	<0.00016	0	<0.0030	0	0.000010	263	<0.0020	0	<0.0000092	793	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	530	<0.0010	0	<0.0020	0	0.0060	263	<0.0020	0	<0.0027	793	BHES	Yes			0.005	
Copper	<0.0010	530	<0.00049	0	0.017	0	0.0035	263	0.011	0	<0.0018	793	BHES	Yes			0.003	
Iron	<0.024	530	<0.035	0	<0.300	0	0.13	263	0.10	0	<0.059	793	BHES	Yes		Yes	0.1	1.0
Lead	<0.00025	530	<0.000041	0	<0.0033	0	0.00035	263	<0.0018	0	<0.00028	793	Trigger			Yes	0.0001	0.000545
Manganese	<0.0019	530	<0.018	0	0.77	0	0.070	263	1.9	0	<0.024	793	BHES	Yes			0.05	
Mercury	<0.000010	530	<0.000045	0	<0.000010	0	0.000010	263	<0.000010	0	<0.000010	793	Ambient		Yes			
Nickel	<0.00050	530	<0.00030	0	<0.0041	0	0.003	263	<0.0041	0	<0.0013	793	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	530	<0.0020	0	<0.0041	0	0.0015	263	<0.0026	0	<0.0012	793	Trigger			Yes	0.0006	0.005
Silver	<0.00020	530	<0.00041	0	<0.1500	0	0.00040	263	<0.0035	0	<0.00027	793	Trigger			Yes	0.0002	0.000374
Zinc	<0.0080	530	<0.037	0	<0.044	0	0.030	263	<0.037	0	<0.015	793	BHES	Yes			0.025	

Notes:
The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.
Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.
Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

LIBBY CREEK at LB 300
Construction

Alternative 2

													Applicable Outside of a Mixing Zone					
	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<25	481	496	0	492	0	110	370	1080	0	<62	851	BHES	Yes			100	
Ammonia	<0.050	481	<1.3	0	<3.3	0	0.70	370	8.9	0	<0.33	851						
Nitrate	<0.13	481	<75	0	6.3	0	0.60	370	26	0	<0.33	851						
Total Inorganic Nitrogen	<0.18	481	<76	0	<9.6	0	1.3	370	35	0	<0.66	851	BHES	Yes			1	
Total Nitrogen	<0.26	481	<77	0	<9.5	0	0.155	370	35	0	<0.21	851	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.0064	481	<0.053	0	<0.200	0	0.007	370	0.170	0	<0.007	851	Trigger			Yes	0.001	0.025
Aluminum	<0.012	481	<0.051	0	<0.27	0	0.090	370	<0.48	0	<0.046	851	Trigger			Yes	0.087	0.03
Antimony	<0.00050	481	<0.0014	0	<0.018	0	0.0010	370	0.047	0	<0.00072	851	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00035	481	<0.012	0	<0.0370	0	0.00010	370	<0.0035	0	<0.00024	851	Ambient		Yes			
Barium	<0.0026	481	<0.051	0	<0.25	0	0.20	370	<0.40	0	<0.088	851	Trigger			Yes	0.002	1.0
Beryllium	<0.00020	481	<0.00033	0	<0.00041	0	0.00020	370	<0.00041	0	<0.00020	851	Ambient		Yes			
Cadmium	<0.0000088	481	<0.00016	0	<0.0030	0	0.000010	370	<0.0020	0	<0.0000093	851	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	481	<0.0010	0	<0.0020	0	0.0060	370	<0.0020	0	<0.0032	851	BHES	Yes			0.005	
Copper	<0.0010	481	<0.00049	0	0.017	0	0.0035	370	0.011	0	<0.0021	851	BHES	Yes			0.003	
Iron	<0.024	481	<0.035	0	<0.300	0	0.13	370	0.10	0	<0.070	851	BHES	Yes		Yes	0.1	1.0
Lead	<0.00025	481	<0.000041	0	<0.0033	0	0.00035	370	<0.0018	0	<0.00029	851	Trigger			Yes	0.0001	0.000545
Manganese	<0.0019	481	<0.018	0	0.77	0	0.070	370	1.9	0	<0.032	851	BHES	Yes			0.05	
Mercury	<0.000010	481	<0.000045	0	<0.000010	0	0.000010	370	<0.000010	0	<0.000010	851	Ambient		Yes			
Nickel	<0.00050	481	<0.00030	0	<0.0041	0	0.003	370	<0.0041	0	<0.0016	851	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	481	<0.0020	0	<0.0041	0	0.0015	370	<0.0026	0	<0.0012	851	Trigger			Yes	0.0006	0.005
Silver	<0.00020	481	<0.00041	0	<0.1500	0	0.00040	370	<0.0035	0	<0.00029	851	Trigger			Yes	0.0002	0.000374
Zinc	<0.0080	481	<0.037	0	<0.044	0	0.030	370	<0.037	0	<0.0176	851	BHES	Yes			0.025	

Alternative 3

													Applicable Outside of a Mixing Zone					
	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<25	481	496	0	492	0	110	500	1080	0	<68	981	BHES	Yes			100	
Ammonia	<0.050	481	<1.3	0	<3.3	0	0.70	500	8.9	0	<0.38	981						
Nitrate	<0.13	481	<75	0	6.3	0	0.60	500	26	0	<0.37	981						
Total Inorganic Nitrogen	<0.18	481	<76	0	<9.6	0	1.3	500	35	0	<0.75	981	BHES	Yes			1	
Total Nitrogen	<0.26	481	<77	0	<9.5	0	0.155	500	35	0	<0.21	981	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.0064	481	<0.053	0	<0.20	0	0.007	500	0.170	0	<0.0067	981	Trigger			Yes	0.001	0.025
Aluminum	<0.012	481	<0.051	0	<0.27	0	0.090	500	<0.48	0	<0.052	981	Trigger			Yes	0.087	0.03
Antimony	<0.00050	481	<0.0014	0	<0.018	0	0.0010	500	0.047	0	<0.00075	981	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00035	481	<0.012	0	<0.0370	0	0.00010	500	<0.0035	0	<0.00022	981	Ambient		Yes			
Barium	<0.0026	481	<0.051	0	<0.25	0	0.20	500	<0.40	0	<0.10	981	Trigger			Yes	0.002	1.0
Beryllium	<0.00020	481	<0.00033	0	<0.00041	0	0.00020	500	<0.00041	0	<0.00020	981	Ambient		Yes			
Cadmium	<0.0000088	481	<0.00016	0	<0.0030	0	0.000010	500	<0.0020	0	<0.0000094	981	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	481	<0.0010	0	<0.0020	0	0.0060	500	<0.0020	0	<0.0035	981	BHES	Yes			0.005	
Copper	<0.0010	481	<0.00049	0	0.017	0	0.0035	500	0.011	0	<0.0023	981	BHES	Yes			0.003	
Iron	<0.024	481	<0.035	0	<0.300	0	0.13	500	0.10	0	<0.078	981	BHES	Yes		Yes	0.1	1.0
Lead	<0.00025	481	<0.000041	0	<0.0033	0	0.00035	500	<0.0018	0	<0.00030	981	Trigger			Yes	0.0001	0.000545
Manganese	<0.0019	481	<0.018	0	0.77	0	0.070	500	1.9	0	<0.037	981	BHES	Yes			0.05	
Mercury	<0.000010	481	<0.000045	0	<0.000010	0	0.000010	500	<0.000010	0	<0.000010	981	Ambient		Yes			
Nickel	<0.00050	481	<0.00030	0	<0.0041	0	0.003	500	<0.0041	0	<0.0018	981	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	481	<0.0020	0	<0.0041	0	0.0015	500	<0.0026	0	<0.0013	981	Trigger			Yes	0.0006	0.005
Silver	<0.00020	481	<0.00041	0	<0.1500	0	0.00040	500	<0.0035	0	<0.00030	981	Trigger			Yes	0.0002	0.000374
Zinc	<0.0080	481	<0.037	0	<0.044	0	0.030	500	<0.037	0	<0.019	981	BHES	Yes			0.025	

Notes:
The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.
Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.
Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

LIBBY CREEK at LB 300
Mining

Alternative 2

													Applicable Outside of a Mixing Zone					
	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<25	449	496	0	492	0	110	0	1080	0	<25	449	BHES	Yes			100	
Ammonia	<0.050	449	<1.3	0	<3.3	0	0.70	0	8.9	0	<0.050	449						
Nitrate	<0.13	449	<75	0	6.3	0	0.60	0	26	0	<0.13	449						
Total Inorganic Nitrogen	<0.18	449	<76	0	<9.6	0	1.3	0	35	0	<0.18	449	BHES	Yes			1	
Total Nitrogen	<0.26	449	<77	0	<9.5	0	0.155	0	35	0	<0.26	449	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.0064	449	<0.053	0	<0.200	0	0.007	0	0.170	0	<0.006	449	Trigger			Yes	0.001	0.025
Aluminum	<0.012	449	<0.051	0	<0.27	0	0.090	0	<0.48	0	<0.012	449	Trigger			Yes	0.087	0.03
Antimony	<0.00050	449	<0.0014	0	<0.018	0	0.0010	0	0.047	0	<0.00050	449	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00035	449	<0.012	0	<0.0370	0	0.00010	0	<0.0035	0	<0.00035	449	Ambient		Yes			
Barium	<0.0026	449	<0.051	0	<0.25	0	0.20	0	<0.40	0	<0.0026	449	Trigger			Yes	0.002	1.0
Beryllium	<0.00020	449	<0.00033	0	<0.00041	0	0.00020	0	<0.00041	0	<0.00020	449	Ambient		Yes			
Cadmium	<0.0000088	449	<0.00016	0	<0.0030	0	0.000010	0	<0.0020	0	<0.0000088	449	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	449	<0.0010	0	<0.0020	0	0.0060	0	<0.0020	0	<0.0010	449	BHES	Yes			0.005	
Copper	<0.0010	449	<0.00049	0	0.017	0	0.0035	0	0.011	0	<0.0010	449	BHES	Yes			0.003	
Iron	<0.024	449	<0.035	0	<0.300	0	0.13	0	0.10	0	<0.024	449	BHES	Yes		Yes	0.1	1.0
Lead	<0.00025	449	<0.000041	0	<0.0033	0	0.00035	0	<0.0018	0	<0.00025	449	Trigger			Yes	0.0001	0.000545
Manganese	<0.0019	449	<0.018	0	0.77	0	0.070	0	1.9	0	<0.0019	449	BHES	Yes			0.05	
Mercury	<0.000010	449	<0.000045	0	<0.000010	0	0.000010	0	<0.000010	0	<0.000010	449	Ambient		Yes			
Nickel	<0.00050	449	<0.00030	0	<0.0041	0	0.003	0	<0.0041	0	<0.0005	449	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	449	<0.0020	0	<0.0041	0	0.0015	0	<0.0026	0	<0.0010	449	Trigger			Yes	0.0006	0.005
Silver	<0.00020	449	<0.00041	0	<0.1500	0	0.00040	0	<0.0035	0	<0.00020	449	Trigger			Yes	0.0002	0.000374
Zinc	<0.0080	449	<0.037	0	<0.044	0	0.030	0	<0.037	0	<0.0080	449	BHES	Yes			0.025	

Alternative 3

													Applicable Outside of a Mixing Zone					
	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<25	449	496	0	492	0	110	921	1080	0	<82	1370	BHES	Yes			100	
Ammonia	<0.050	449	<1.3	0	<3.3	0	0.70	921	8.9	0	<0.49	1370						
Nitrate	<0.13	449	<75	0	6.3	0	0.60	921	26	0	<0.45	1370						
Total Inorganic Nitrogen	<0.18	449	<76	0	<9.6	0	1.3	921	35	0	<0.94	1370	BHES	Yes			1	
Total Nitrogen	<0.26	449	<77	0	<9.5	0	0.155	921	35	0	<0.19	1370	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.0064	449	<0.053	0	<0.20	0	0.007	921	0.170	0	<0.0068	1370	Trigger			Yes	0.001	0.025
Aluminum	<0.012	449	<0.051	0	<0.27	0	0.090	921	<0.48	0	<0.064	1370	Trigger			Yes	0.087	0.03
Antimony	<0.00050	449	<0.0014	0	<0.018	0	0.0010	921	0.047	0	<0.00084	1370	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00035	449	<0.012	0	<0.0370	0	0.00010	921	<0.0035	0	<0.00018	1370	Ambient		Yes			
Barium	<0.0026	449	<0.051	0	<0.25	0	0.20	921	<0.40	0	<0.14	1370	Trigger			Yes	0.002	1.0
Beryllium	<0.00020	449	<0.00033	0	<0.00041	0	0.00020	921	<0.00041	0	<0.00020	1370	Ambient		Yes			
Cadmium	<0.0000088	449	<0.00016	0	<0.0030	0	0.000010	921	<0.0020	0	<0.000010	1370	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	449	<0.0010	0	<0.0020	0	0.0060	921	<0.0020	0	<0.0044	1370	BHES	Yes			0.005	
Copper	<0.0010	449	<0.00049	0	0.017	0	0.0035	921	0.011	0	<0.0027	1370	BHES	Yes			0.003	
Iron	<0.024	449	<0.035	0	<0.300	0	0.13	921	0.10	0	<0.10	1370	BHES	Yes		Yes	0.1	1.0
Lead	<0.00025	449	<0.000041	0	<0.0033	0	0.00035	921	<0.0018	0	<0.00032	1370	Trigger			Yes	0.0001	0.000545
Manganese	<0.0019	449	<0.018	0	0.77	0	0.070	921	1.9	0	<0.048	1370	BHES	Yes			0.05	
Mercury	<0.000010	449	<0.000045	0	<0.000010	0	0.000010	921	<0.000010	0	<0.000010	1370	Ambient		Yes			
Nickel	<0.00050	449	<0.00030	0	<0.0041	0	0.003	921	<0.0041	0	<0.0022	1370	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	449	<0.0020	0	<0.0041	0	0.0015	921	<0.0026	0	<0.0013	1370	Trigger			Yes	0.0006	0.005
Silver	<0.00020	449	<0.00041	0	<0.1500	0	0.00040	921	<0.0035	0	<0.00033	1370	Trigger			Yes	0.0002	0.000374
Zinc	<0.0080	449	<0.037	0	<0.044	0	0.030	921	<0.037	0	<0.023	1370	BHES	Yes			0.025	

Notes:
The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.
Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.
Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

LIBBY CREEK at LB 300
Closure

Alternative 2

	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<25	458	496	0	492	0	110	370	1080	0	<63	828	BHES	Yes			100	
Ammonia	<0.050	458	<1.3	0	<3.3	0	0.70	370	8.9	0	<0.34	828						
Nitrate	<0.13	458	<75	0	6.3	0	0.60	370	26	0	<0.34	828						
Total Inorganic Nitrogen	<0.18	458	<76	0	<9.6	0	1.3	370	35	0	<0.7	828	BHES	Yes			1	
Total Nitrogen	<0.26	458	<77	0	<9.5	0	0.155	370	35	0	<0.21	828	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.0064	458	<0.053	0	<0.200	0	0.007	370	0.170	0	<0.007	828	Trigger			Yes	0.001	0.025
Aluminum	<0.012	458	<0.051	0	<0.27	0	0.090	370	<0.48	0	<0.047	828	Trigger			Yes	0.087	0.03
Antimony	<0.00050	458	<0.0014	0	<0.018	0	0.0010	370	0.047	0	<0.0007	828	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00035	458	<0.012	0	<0.0370	0	0.00010	370	<0.0035	0	<0.00024	828	Ambient		Yes			
Barium	<0.0026	458	<0.051	0	<0.25	0	0.20	370	<0.40	0	<0.091	828	Trigger			Yes	0.002	1.0
Beryllium	<0.00020	458	<0.00033	0	<0.00041	0	0.00020	370	<0.00041	0	<0.00020	828	Ambient		Yes			
Cadmium	<0.0000088	458	<0.00016	0	<0.0030	0	0.000010	370	<0.0020	0	<0.0000093	828	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	458	<0.0010	0	<0.0020	0	0.0060	370	<0.0020	0	<0.0032	828	BHES	Yes			0.005	
Copper	<0.0010	458	<0.00049	0	0.017	0	0.0035	370	0.011	0	<0.0021	828	BHES	Yes			0.003	
Iron	<0.024	458	<0.035	0	<0.300	0	0.13	370	0.10	0	<0.071	828	BHES	Yes		Yes	0.1	1.0
Lead	<0.00025	458	<0.000041	0	<0.0033	0	0.00035	370	<0.0018	0	<0.00029	828	Trigger			Yes	0.0001	0.000545
Manganese	<0.0019	458	<0.018	0	0.77	0	0.070	370	1.9	0	<0.032	828	BHES	Yes			0.05	
Mercury	<0.000010	458	<0.000045	0	<0.000010	0	0.000010	370	<0.000010	0	<0.000010	828	Ambient		Yes			
Nickel	<0.00050	458	<0.00030	0	<0.0041	0	0.003	370	<0.0041	0	<0.0016	828	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	458	<0.0020	0	<0.0041	0	0.0015	370	<0.0026	0	<0.0012	828	Trigger			Yes	0.0006	0.005
Silver	<0.00020	458	<0.00041	0	<0.1500	0	0.00040	370	<0.0035	0	<0.00029	828	Trigger			Yes	0.0002	0.000374
Zinc	<0.0080	458	<0.037	0	<0.044	0	0.030	370	<0.037	0	<0.0178	828	BHES	Yes			0.025	

Alternative 3

	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<25	458	496	0	492	0	110	540	1080	0	<71	998	BHES	Yes			100	
Ammonia	<0.050	458	<1.3	0	<3.3	0	0.70	540	8.9	0	<0.40	998						
Nitrate	<0.13	458	<75	0	6.3	0	0.60	540	26	0	<0.38	998						
Total Inorganic Nitrogen	<0.18	458	<76	0	<9.6	0	1.3	540	35	0	<0.78	998	BHES	Yes			1	
Total Nitrogen	<0.26	458	<77	0	<9.5	0	0.155	540	35	0	<0.20	998	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.0064	458	<0.053	0	<0.20	0	0.007	540	0.170	0	<0.0067	998	Trigger			Yes	0.001	0.025
Aluminum	<0.012	458	<0.051	0	<0.27	0	0.090	540	<0.48	0	<0.054	998	Trigger			Yes	0.087	0.03
Antimony	<0.00050	458	<0.0014	0	<0.018	0	0.0010	540	0.047	0	<0.00077	998	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00035	458	<0.012	0	<0.0370	0	0.00010	540	<0.0035	0	<0.00022	998	Ambient		Yes			
Barium	<0.0026	458	<0.051	0	<0.25	0	0.20	540	<0.40	0	<0.11	998	Trigger			Yes	0.002	1.0
Beryllium	<0.00020	458	<0.00033	0	<0.00041	0	0.00020	540	<0.00041	0	<0.00020	998	Ambient		Yes			
Cadmium	<0.0000088	458	<0.00016	0	<0.0030	0	0.000010	540	<0.0020	0	<0.0000094	998	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	458	<0.0010	0	<0.0020	0	0.0060	540	<0.0020	0	<0.0037	998	BHES	Yes			0.005	
Copper	<0.0010	458	<0.00049	0	0.017	0	0.0035	540	0.011	0	<0.0024	998	BHES	Yes			0.003	
Iron	<0.024	458	<0.035	0	<0.300	0	0.13	540	0.10	0	<0.081	998	BHES	Yes		Yes	0.1	1.0
Lead	<0.00025	458	<0.000041	0	<0.0033	0	0.00035	540	<0.0018	0	<0.00030	998	Trigger			Yes	0.0001	0.000545
Manganese	<0.0019	458	<0.018	0	0.77	0	0.070	540	1.9	0	<0.039	998	BHES	Yes			0.05	
Mercury	<0.000010	458	<0.000045	0	<0.000010	0	0.000010	540	<0.000010	0	<0.000010	998	Ambient		Yes			
Nickel	<0.00050	458	<0.00030	0	<0.0041	0	0.003	540	<0.0041	0	<0.0019	998	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	458	<0.0020	0	<0.0041	0	0.0015	540	<0.0026	0	<0.0013	998	Trigger			Yes	0.0006	0.005
Silver	<0.00020	458	<0.00041	0	<0.1500	0	0.00040	540	<0.0035	0	<0.00031	998	Trigger			Yes	0.0002	0.000374
Zinc	<0.0080	458	<0.037	0	<0.044	0	0.030	540	<0.037	0	<0.020	998	BHES	Yes			0.025	

Notes:
The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.
Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.
Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

LIBBY CREEK at LB 300
Closure

Alternative 4

	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or significant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<25	458	496	0	492	0	110	540	1080	0	<71	998	BHES	Yes			100	
Ammonia	<0.050	458	<1.3	0	<3.3	0	0.70	540	8.9	0	<0.40	998						
Nitrate	<0.13	458	<75	0	6.3	0	0.60	540	26	0	<0.38	998						
Total Inorganic Nitrogen	<0.18	458	<76	0	<9.6	0	1.3	540	35	0	<0.79	998	BHES	Yes			1	
Total Nitrogen	<0.26	458	<77	0	<9.5	0	0.155	540	35	0	<0.20	998	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.0064	458	<0.053	0	<0.200	0	0.007	540	0.170	0	<0.007	998	Trigger			Yes	0.001	0.025
Aluminum	<0.012	458	<0.051	0	<0.27	0	0.090	540	<0.48	0	<0.054	998	Trigger			Yes	0.087	0.03
Antimony	<0.00050	458	<0.0014	0	<0.018	0	0.0010	540	0.047	0	<0.00077	998	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00035	458	<0.012	0	<0.0370	0	0.00010	540	<0.0035	0	<0.00022	998	Ambient		Yes			
Barium	<0.0026	458	<0.051	0	<0.25	0	0.20	540	<0.40	0	<0.11	998	Trigger			Yes	0.002	1.0
Beryllium	<0.00020	458	<0.00033	0	<0.00041	0	0.00020	540	<0.00041	0	<0.00020	998	Ambient		Yes			
Cadmium	<0.0000088	458	<0.00016	0	<0.0030	0	0.000010	540	<0.0020	0	<0.0000094	998	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	458	<0.0010	0	<0.0020	0	0.0060	540	<0.0020	0	<0.0037	998	BHES	Yes			0.005	
Copper	<0.0010	458	<0.00049	0	0.017	0	0.0035	540	0.011	0	<0.0024	998	BHES	Yes			0.003	
Iron	<0.024	458	<0.035	0	<0.300	0	0.13	540	0.10	0	<0.081	998	BHES	Yes		Yes	0.1	1.0
Lead	<0.00025	458	<0.000041	0	<0.0033	0	0.00035	540	<0.0018	0	<0.00030	998	Trigger			Yes	0.0001	0.000545
Manganese	<0.0019	458	<0.018	0	0.77	0	0.070	540	1.9	0	<0.039	998	BHES	Yes			0.05	
Mercury	<0.000010	458	<0.000045	0	<0.000010	0	0.000010	540	<0.000010	0	<0.000010	998	Ambient		Yes			
Nickel	<0.00050	458	<0.00030	0	<0.0041	0	0.003	540	<0.0041	0	<0.0019	998	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	458	<0.0020	0	<0.0041	0	0.0015	540	<0.0026	0	<0.0013	998	Trigger			Yes	0.0006	0.005
Silver	<0.00020	458	<0.00041	0	<0.1500	0	0.00040	540	<0.0035	0	<0.00031	998	Trigger			Yes	0.0002	0.000374
Zinc	<0.0080	458	<0.037	0	<0.044	0	0.030	540	<0.037	0	<0.020	998	BHES	Yes			0.025	

Notes:

The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.

Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.

Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).

Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

LIBBY CREEK at LB 1000
Evaluation

Alternative 2

Parameter	Ambient Water Quality Conc. (mg/l)	Ambient Water Quality Flow (gpm)	Representative adit water from LAD percolation (construction) Conc. (mg/l)	Representative adit water from LAD percolation (construction) Flow (gpm)	Representative mine water from LAD percolation Conc. (mg/l)	Representative mine water from LAD percolation Flow (gpm)	Representative Water Treatment Plant effluent Conc. (mg/l)	Representative Water Treatment Plant effluent Flow (gpm)	Representative tailings water from LAD percolation Conc. (mg/l)	Representative tailings water from LAD percolation Flow (gpm)	Projected final mixing concentration Conc. (mg/l)	Projected final mixing concentration Flow (gpm)	Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit (mg/L)	Lowest applicable standard (Toxic Parameters and Nutrients) (mg/L)
TDS	<33	3837	496	28.3	492	3.7	110	133	1080	0	<39	4002	BHES	Yes			100	
Ammonia	<0.030	3837	<1.3	28.3	<3.3	3.7	0.70	133	8.9	0	<0.060	4002						
Nitrate	<0.034	3837	<75	28.3	6.3	3.7	0.60	133	26	0	0.59	4002						
Total Inorganic Nitrogen	<0.064	3837	<76	28.3	<9.6	3.7	1.3	133	35	0	<0.65	4002	BHES	Yes			1	
Total Nitrogen	<0.11	3837	<77	28.3	<9.5	3.7	0.155	133	35	0	<0.66	4002	Trigger				0.01	0.275
Total Phosphorus	<0.007	3837	<0.053	28.3	<0.200	3.7	0.007	133	0.170	0	<0.008	4002	Trigger			Yes	0.001	0.025
Aluminum	<0.017	3837	<0.051	28.3	<0.27	3.7	0.090	133	<0.48	0	<0.020	4002	Trigger			Yes	0.087	0.03
Antimony	<0.00050	3837	<0.0014	28.3	<0.018	3.7	0.0010	133	0.047	0	<0.00054	4002	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00020	3837	<0.012	28.3	<0.0370	3.7	0.00010	133	<0.0035	0	<0.00032	4002	Ambient					
Barium	0.0066	3837	<0.051	28.3	<0.25	3.7	0.20	133	<0.40	0	<0.014	4002	Trigger			Yes	0.002	1.0
Beryllium	<0.00020	3837	<0.00033	28.3	<0.00041	3.7	0.00020	133	<0.00041	0	<0.00020	4002	Ambient		Yes			
Cadmium	<0.000060	3837	<0.00016	28.3	<0.0030	3.7	0.000010	133	<0.0020	0	<0.000062	4002	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	3837	<0.0010	28.3	<0.0020	3.7	0.0060	133	<0.0020	0	<0.0012	4002	BHES	Yes			0.005	
Copper	<0.00046	3837	<0.00049	28.3	0.017	3.7	0.0035	133	0.011	0	<0.00058	4002	BHES	Yes			0.003	
Iron	<0.017	3837	<0.035	28.3	<0.300	3.7	0.13	133	0.10	0	<0.021	4002	BHES	Yes		Yes	0.1	1.0
Lead	<0.000054	3837	<0.000041	28.3	<0.0033	3.7	0.00035	133	<0.0018	0	<0.000067	4002	Trigger			Yes	0.0001	0.000545
Manganese	<0.00099	3837	<0.018	28.3	0.77	3.7	0.070	133	1.9	0	<0.0041	4002	BHES	Yes			0.05	
Mercury	<0.000020	3837	<0.000045	28.3	<0.000010	3.7	0.000010	133	<0.000010	0	<0.000020	4002	Ambient		Yes			
Nickel	<0.00050	3837	<0.00030	28.3	<0.0041	3.7	0.003	133	<0.0041	0	<0.00058	4002	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	3837	<0.0020	28.3	<0.0041	3.7	0.0015	133	<0.0026	0	<0.0010	4002	Trigger			Yes	0.0006	0.005
Silver	<0.00020	3837	<0.00041	28.3	<0.1500	3.7	0.00040	133	<0.0035	0	<0.00035	4002	Trigger			Yes	0.0002	0.000374
Zinc	<0.0044	3837	<0.037	28.3	<0.044	3.7	0.030	133	<0.037	0	<0.0055	4002	BHES	Yes			0.025	

Alternative 3

Parameter	Ambient Water Quality Conc. (mg/l)	Ambient Water Quality Flow (gpm)	Representative adit water from LAD percolation (construction) Conc. (mg/l)	Representative adit water from LAD percolation (construction) Flow (gpm)	Representative mine water from LAD percolation Conc. (mg/l)	Representative mine water from LAD percolation Flow (gpm)	Representative Water Treatment Plant effluent Conc. (mg/l)	Representative Water Treatment Plant effluent Flow (gpm)	Representative tailings water from LAD percolation Conc. (mg/l)	Representative tailings water from LAD percolation Flow (gpm)	Projected final mixing concentration Conc. (mg/l)	Projected final mixing concentration Flow (gpm)	Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit (mg/L)	Lowest applicable standard (Toxic Parameters and Nutrients) (mg/L)
TDS	<33	3837	496	0	492	0	110	263	1080	0	<38	4100	BHES	Yes			100	
Ammonia	<0.030	3837	<1.3	0	<3.3	0	0.70	263	8.9	0	<0.073	4100						
Nitrate	<0.034	3837	<75	0	6.3	0	0.60	263	26	0	0.070	4100						
Total Inorganic Nitrogen	<0.064	3837	<76	0	<9.6	0	1.3	263	35	0	<0.14	4100	BHES	Yes			1	
Total Nitrogen	<0.11	3837	<77	0	<9.5	0	0.155	263	35	0	<0.11	4100	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.007	3837	<0.053	0	<0.200	0	0.007	263	0.170	0	<0.007	4100	Trigger			Yes	0.001	0.025
Aluminum	<0.017	3837	<0.051	0	<0.27	0	0.090	263	<0.48	0	<0.0216	4100	Trigger			Yes	0.087	0.03
Antimony	<0.00050	3837	<0.0014	0	<0.018	0	0.0010	263	0.047	0	<0.00053	4100	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00020	3837	<0.012	0	<0.0370	0	0.00010	263	<0.0035	0	<0.00020	4100	Ambient		Yes			
Barium	0.0066	3837	<0.051	0	<0.25	0	0.20	263	<0.40	0	<0.019	4100	Trigger			Yes	0.002	1.0
Beryllium	<0.00020	3837	<0.00033	0	<0.00041	0	0.00020	263	<0.00041	0	<0.00020	4100	Ambient		Yes			
Cadmium	<0.000060	3837	<0.00016	0	<0.0370	0	0.000010	263	<0.0020	0	<0.000057	4100	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	3837	<0.0010	0	<0.0030	0	0.0060	263	<0.0020	0	<0.0013	4100	BHES	Yes			0.005	
Copper	<0.00046	3837	<0.00049	0	0.017	0	0.0035	263	0.011	0	<0.00065	4100	BHES	Yes			0.003	
Iron	<0.017	3837	<0.035	0	<0.300	0	0.13	263	0.10	0	<0.024	4100	BHES	Yes		Yes	0.1	1.0
Lead	<0.000054	3837	<0.000041	0	<0.0033	0	0.00035	263	<0.0018	0	<0.000073	4100	Trigger			Yes	0.0001	0.000545
Manganese	<0.00099	3837	<0.018	0	0.77	0	0.070	263	1.9	0	<0.0054	4100	BHES	Yes			0.05	
Mercury	<0.000020	3837	<0.000045	0	<0.000010	0	0.000010	263	<0.000010	0	<0.000019	4100	Ambient		Yes			
Nickel	<0.00050	3837	<0.00030	0	<0.0041	0	0.003	263	<0.0041	0	<0.00066	4100	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	3837	<0.0020	0	<0.0041	0	0.0015	263	<0.0026	0	<0.0010	4100	Trigger			Yes	0.0006	0.005
Silver	<0.00020	3837	<0.00041	0	<0.1500	0	0.00040	263	<0.0035	0	<0.00021	4100	Trigger			Yes	0.0002	0.000374
Zinc	<0.0044	3837	<0.037	0	<0.044	0	0.030	263	<0.037	0	<0.0060	4100	BHES	Yes			0.025	

Notes:
The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.
Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.
Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

LIBBY CREEK at LB 1000
Construction

Alternative 2

													Applicable Outside of a Mixing Zone					
	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<33	3779	496	29.8	492	2.2	110	370	1080	0	<43	4181	BHES	Yes			100	
Ammonia	<0.030	3779	<1.3	29.8	<3.3	2.2	0.70	370	8.9	0	<0.10	4181						
Nitrate	<0.034	3779	<75	29.8	6.3	2.2	0.60	370	26	0	0.62	4181						
Total Inorganic Nitrogen	<0.064	3779	<76	29.8	<9.6	2.2	1.3	370	35	0	<0.72	4181	BHES	Yes			1	
Total Nitrogen	<0.11	3779	<77	29.8	<9.5	2.2	0.155	370	35	0	<0.66	4181	Trigger				0.01	0.275
Total Phosphorus	<0.0070	3779	<0.053	29.8	<0.20	2.2	0.007	370	0.17	0	<0.0074	4181	Trigger			Yes	0.001	0.025
Aluminum	<0.017	3779	<0.051	29.8	<0.27	2.2	0.090	370	<0.48	0	<0.024	4181	Trigger			Yes	0.087	0.03
Antimony	<0.00050	3779	<0.0014	29.8	<0.018	2.2	0.0010	370	0.047	0	<0.00056	4181	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00020	3779	<0.012	29.8	<0.0370	2.2	0.00010	370	<0.0035	0	<0.00030	4181	Ambient					
Barium	0.0066	3779	<0.051	29.8	<0.25	2.2	0.20	370	<0.40	0	<0.024	4181	Trigger			Yes	0.002	1.0
Beryllium	<0.00020	3779	<0.00033	29.8	<0.00041	2.2	0.00020	370	<0.00041	0	<0.00020	4181	Ambient		Yes			
Cadmium	<0.000060	3779	<0.00016	29.8	<0.0030	2.2	0.000010	370	<0.0020	0	<0.000058	4181	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	3779	<0.0010	29.8	<0.0020	2.2	0.0060	370	<0.0020	0	<0.0014	4181	BHES	Yes			0.005	
Copper	<0.00046	3779	<0.00049	29.8	0.017	2.2	0.0035	370	0.011	0	<0.00074	4181	BHES	Yes			0.003	
Iron	<0.017	3779	<0.035	29.8	<0.300	2.2	0.13	370	0.10	0	<0.027	4181	BHES	Yes		Yes	0.1	1.0
Lead	<0.000054	3779	<0.000041	29.8	<0.0033	2.2	0.00035	370	<0.0018	0	<0.000082	4181	Trigger			Yes	0.0001	0.000545
Manganese	<0.00099	3779	<0.018	29.8	0.77	2.2	0.070	370	1.9	0	<0.0076	4181	BHES	Yes			0.05	
Mercury	<0.000020	3779	<0.000045	29.8	<0.000010	2.2	0.000010	370	<0.000010	0	<0.000019	4181	Ambient		Yes			
Nickel	<0.00050	3779	<0.00030	29.8	<0.0041	2.2	0.003	370	<0.0041	0	<0.00072	4181	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	3779	<0.0020	29.8	<0.0041	2.2	0.0015	370	<0.0026	0	<0.0011	4181	Trigger			Yes	0.0006	0.005
Silver	<0.00020	3779	<0.00041	29.8	<0.1500	2.2	0.00040	370	<0.0035	0	<0.00030	4181	Trigger			Yes	0.0002	0.000374
Zinc	<0.0044	3779	<0.037	29.8	<0.044	2.2	0.030	370	<0.037	0	<0.0069	4181	BHES	Yes			0.025	

Alternative 3

													Applicable Outside of a Mixing Zone					
	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<33	3779	496	0	492	0	110	500	1080	0	<42	4279	BHES	Yes			100	
Ammonia	<0.030	3779	<1.3	0	<3.3	0	0.70	500	8.9	0	<0.11	4279						
Nitrate	<0.034	3779	<75	0	6.3	0	0.60	500	26	0	0.10	4279						
Total Inorganic Nitrogen	<0.064	3779	<76	0	<9.6	0	1.3	500	35	0	<0.21	4279	BHES	Yes			1	
Total Nitrogen	<0.11	3779	<77	0	<9.5	0	0.155	500	35	0	<0.11	4279	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.007	3779	<0.053	0	<0.20	0	0.007	500	0.170	0	<0.0070	4279	Trigger			Yes	0.001	0.025
Aluminum	<0.017	3779	<0.051	0	<0.27	0	0.090	500	<0.48	0	<0.025	4279	Trigger			Yes	0.087	0.03
Antimony	<0.00050	3779	<0.0014	0	<0.018	0	0.0010	500	0.047	0	<0.00056	4279	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00020	3779	<0.012	0	<0.0370	0	0.00010	500	<0.00	0	<0.00019	4279	Ambient		Yes			
Barium	0.0066	3779	<0.051	0	<0.25	0	0.20	500	<0.40	0	<0.029	4279	Trigger			Yes	0.002	1.0
Beryllium	<0.00020	3779	<0.00033	0	<0.00041	0	0.00020	500	<0.00041	0	<0.00020	4279	Ambient		Yes			
Cadmium	<0.000060	3779	<0.00016	0	<0.0030	0	0.000010	500	<0.0020	0	<0.000054	4279	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	3779	<0.0010	0	<0.0020	0	0.0060	500	<0.0020	0	<0.0016	4279	BHES	Yes			0.005	
Copper	<0.00046	3779	<0.00049	0	0.017	0	0.0035	500	0.011	0	<0.00082	4279	BHES	Yes			0.003	
Iron	<0.017	3779	<0.035	0	<0.300	0	0.13	500	0.10	0	<0.030	4279	BHES	Yes		Yes	0.1	1.0
Lead	<0.000054	3779	<0.000041	0	<0.0033	0	0.00035	500	<0.0018	0	<0.000089	4279	Trigger			Yes	0.0001	0.000545
Manganese	<0.00099	3779	<0.018	0	0.77	0	0.070	500	1.9	0	<0.0091	4279	BHES	Yes			0.05	
Mercury	<0.000020	3779	<0.000045	0	<0.000010	0	0.000010	500	<0.000010	0	<0.000019	4279	Ambient		Yes			
Nickel	<0.00050	3779	<0.00030	0	<0.0041	0	0.003	500	<0.0041	0	<0.00079	4279	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	3779	<0.0020	0	<0.0041	0	0.0015	500	<0.0026	0	<0.0011	4279	Trigger			Yes	0.0006	0.005
Silver	<0.00020	3779	<0.00041	0	<0.1500	0	0.00040	500	<0.0035	0	<0.00022	4279	Trigger			Yes	0.0002	0.000374
Zinc	<0.0044	3779	<0.037	0	<0.044	0	0.030	500	<0.037	0	<0.0074	4279	BHES	Yes			0.025	

Notes:
The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.
Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.
Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

LIBBY CREEK at LB 1000
Mining

Alternative 2

	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<33	3733	496	0	492	0	110	0	1080	0	<33	3733	BHES	Yes			100	
Ammonia	<0.030	3733	<1.3	0	<3.3	0	0.70	0	8.9	0	<0.030	3733						
Nitrate	<0.034	3733	<75	0	6.3	0	0.60	0	26	0	<0.030	3733						
Total Inorganic Nitrogen	<0.064	3733	<76	0	<9.6	0	1.3	0	35	0	<0.060	3733	BHES	Yes			1	
Total Nitrogen	<0.11	3733	<77	0	<9.5	0	0.155	0	35	0	<0.11	3733	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.007	3733	<0.053	0	<0.200	0	0.007	0	0.170	0	<0.007	3733	Trigger			Yes	0.001	0.025
Aluminum	<0.017	3733	<0.051	0	<0.27	0	0.090	0	<0.48	0	<0.017	3733	Trigger			Yes	0.087	0.03
Antimony	<0.00050	3733	<0.0014	0	<0.018	0	0.0010	0	0.047	0	<0.00050	3733	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00020	3733	<0.012	0	<0.0370	0	0.00010	0	<0.0035	0	<0.00020	3733	Ambient		Yes			
Barium	0.0066	3733	<0.051	0	<0.25	0	0.20	0	<0.40	0	<0.0066	3733	Trigger			Yes	0.002	1.0
Beryllium	<0.00020	3733	<0.00033	0	<0.00041	0	0.00020	0	<0.00041	0	<0.00020	3733	Ambient		Yes			
Cadmium	<0.000060	3733	<0.00016	0	<0.0030	0	0.000010	0	<0.0020	0	<0.000060	3733	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	3733	<0.0010	0	<0.0020	0	0.0060	0	<0.0020	0	<0.0010	3733	BHES	Yes			0.005	
Copper	<0.00046	3733	<0.00049	0	0.017	0	0.0035	0	0.011	0	<0.00046	3733	BHES	Yes			0.003	
Iron	<0.017	3733	<0.035	0	<0.300	0	0.13	0	0.10	0	<0.017	3733	BHES	Yes		Yes	0.1	1.0
Lead	<0.000054	3733	<0.000041	0	<0.0033	0	0.00035	0	<0.0018	0	<0.000054	3733	Trigger			Yes	0.0001	0.000545
Manganese	<0.00099	3733	<0.018	0	0.77	0	0.070	0	1.9	0	<0.0010	3733	BHES	Yes			0.05	
Mercury	<0.000020	3733	<0.000045	0	<0.000010	0	0.000010	0	<0.000010	0	<0.000020	3733	Ambient		Yes			
Nickel	<0.00050	3733	<0.00030	0	<0.0041	0	0.003	0	<0.0041	0	<0.00050	3733	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	3733	<0.0020	0	<0.0041	0	0.0015	0	<0.0026	0	<0.0010	3733	Trigger			Yes	0.0006	0.005
Silver	<0.00020	3733	<0.00041	0	<0.1500	0	0.00040	0	<0.0035	0	<0.00020	3733	Trigger			Yes	0.0002	0.000374
Zinc	<0.0044	3733	<0.037	0	<0.044	0	0.030	0	<0.037	0	<0.0044	3733	BHES	Yes			0.025	

Alternative 3

	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<33	3610	496	0	492	0	110	921	1080	0	<49	4531	BHES	Yes			100	
Ammonia	<0.030	3610	<1.3	0	<3.3	0	0.70	921	8.9	0	<0.17	4531						
Nitrate	<0.034	3610	<75	0	6.3	0	0.60	921	26	0	<0.15	4531						
Total Inorganic Nitrogen	<0.064	3610	<76	0	<9.6	0	1.3	921	35	0	<0.32	4531	BHES	Yes			1	
Total Nitrogen	<0.11	3610	<77	0	<9.5	0	0.155	921	35	0	<0.12	4531	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.007	3610	<0.053	0	<0.20	0	0.007	921	0.170	0	<0.0070	4531	Trigger			Yes	0.001	0.025
Aluminum	<0.017	3610	<0.051	0	<0.27	0	0.090	921	<0.48	0	<0.032	4531	Trigger			Yes	0.087	0.03
Antimony	<0.00050	3610	<0.0014	0	<0.018	0	0.0010	921	0.047	0	<0.00060	4531	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00020	3610	<0.012	0	<0.0370	0	0.00010	921	<0.0035	0	<0.00018	4531	Ambient		Yes			
Barium	0.0066	3610	<0.051	0	<0.25	0	0.20	921	<0.40	0	<0.046	4531	Trigger			Yes	0.002	1.0
Beryllium	<0.00020	3610	<0.00033	0	<0.00041	0	0.00020	921	<0.00041	0	<0.00020	4531	Ambient		Yes			
Cadmium	<0.000060	3610	<0.00016	0	<0.0030	0	0.000010	921	<0.0020	0	<0.000050	4531	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	3610	<0.0010	0	<0.0020	0	0.0060	921	<0.0020	0	<0.0020	4531	BHES	Yes			0.005	
Copper	<0.00046	3610	<0.00049	0	0.017	0	0.0035	921	0.011	0	<0.0011	4531	BHES	Yes			0.003	
Iron	<0.017	3610	<0.035	0	<0.300	0	0.13	921	0.10	0	<0.040	4531	BHES	Yes		Yes	0.1	1.0
Lead	<0.000054	3610	<0.000041	0	<0.0033	0	0.00035	921	<0.0018	0	<0.00011	4531	Trigger			Yes	0.0001	0.000545
Manganese	<0.00099	3610	<0.018	0	0.77	0	0.070	921	1.9	0	<0.015	4531	BHES	Yes			0.05	
Mercury	<0.000020	3610	<0.000045	0	<0.000010	0	0.000010	921	<0.000010	0	<0.000018	4531	Ambient		Yes		0.0005	0.0161
Nickel	<0.00050	3610	<0.00030	0	<0.0041	0	0.003	921	<0.0041	0	<0.0010	4531	Trigger			Yes	0.0006	0.005
Selenium	<0.0010	3610	<0.0020	0	<0.0041	0	0.0015	921	<0.0026	0	<0.0011	4531	Trigger			Yes	0.005	0.0006
Silver	<0.00020	3610	<0.00041	0	<0.1500	0	0.00040	921	<0.0035	0	<0.00024	4531	Trigger			Yes	0.0002	0.000374
Zinc	<0.0044	3610	<0.037	0	<0.044	0	0.030	921	<0.037	0	<0.010	4531	BHES	Yes			0.025	

Notes:
The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.
Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.
Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

LIBBY CREEK at LB 1000
Closure

Alternative 2

	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<33	3760	496	0	492	0	110	500	1080	32	<50	4292	BHES	Yes			100	
Ammonia	<0.030	3760	<1.3	0	<3.3	0	0.70	500	8.9	32	<0.17	4292						
Nitrate	<0.034	3760	<75	0	6.3	0	0.60	500	26	32	0.29	4292						
Total Inorganic Nitrogen	<0.064	3760	<76	0	<9.6	0	1.3	500	35	32	<0.46	4292	BHES	Yes			1	
Total Nitrogen	<0.11	3760	<77	0	<9.5	0	0.155	500	35	32	<0.37	4292	Trigger				0.01	0.275
Total Phosphorus	<0.007	3760	<0.053	0	0.20	0	0.007	500	0.17	32	<0.0082	4292	Trigger				0.001	0.025
Aluminum	<0.017	3760	<0.051	0	<0.27	0	0.090	500	<0.48	32	<0.029	4292	Trigger			Yes	0.087	0.03
Antimony	<0.00050	3760	<0.0014	0	<0.018	0	0.0010	500	0.047	32	<0.00090	4292	Trigger				0.0004	0.0056
Arsenic	<0.00020	3760	<0.012	0	<0.0370	0	0.00010	500	<0.004	32	<0.00022	4292	Ambient					
Barium	0.0066	3760	<0.051	0	<0.25	0	0.20	500	<0.40	32	<0.032	4292	Trigger			Yes	0.002	1.0
Beryllium	<0.00020	3760	<0.00033	0	<0.00041	0	0.00020	500	<0.00041	32	<0.00020	4292	Ambient		Yes			
Cadmium	<0.000060	3760	<0.00016	0	<0.0030	0	0.000010	500	<0.00200	32	<0.000069	4292	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	3760	<0.0010	0	<0.0020	0	0.0060	500	<0.0020	32	<0.0016	4292	BHES	Yes			0.005	
Copper	<0.00046	3760	<0.00049	0	0.017	0	0.0035	500	0.01	32	<0.00089	4292	BHES	Yes			0.003	
Iron	<0.017	3760	<0.035	0	<0.300	0	0.13	500	0.1	32	<0.031	4292	BHES	Yes		Yes	0.1	1.0
Lead	<0.000054	3760	<0.000041	0	<0.0033	0	0.00035	500	<0.002	32	<0.00010	4292	Trigger			Yes	0.0001	0.000545
Manganese	<0.00099	3760	<0.018	0	0.77	0	0.070	500	1.9	32	<0.023	4292	BHES	Yes			0.05	
Mercury	<0.000020	3760	<0.000045	0	<0.000010	0	0.000010	500	<0.00001	32	<0.000019	4292	Ambient		Yes			
Nickel	<0.00050	3760	<0.00030	0	<0.0041	0	0.003	500	<0.0041	32	<0.00082	4292	Trigger			Yes	0.0161	0.0005
Selenium	<0.0010	3760	<0.0020	0	<0.0041	0	0.0015	500	<0.0000	32	<0.0011	4292	Trigger			Yes	0.005	0.0006
Silver	<0.00020	3760	<0.00041	0	<0.15	0	0.00040	500	<0.0035	32	<0.00025	4292	Trigger			Yes	0.0002	0.000374
Zinc	<0.0044	3760	<0.037	0	<0.044	0	0.030	500	<0.04	32	<0.0076	4292	BHES	Yes			0.025	

Alternative 3

	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<33	3637	496	0	492	0	110	540	1080	0	<43	4177	BHES	Yes			100	
Ammonia	<0.030	3637	<1.3	0	<3.3	0	0.70	540	8.9	0	<0.12	4177						
Nitrate	<0.034	3637	<75	0	6.3	0	0.60	540	26	0	<0.11	4177						
Total Inorganic Nitrogen	<0.064	3637	<76	0	<9.6	0	1.3	540	35	0	<0.23	4177	BHES	Yes			1	
Total Nitrogen	<0.11	3637	<77	0	<6.3	0	0.155	540	26	0	<0.11	4177	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.007	3637	<0.053	0	<9.6	0	0.007	540	35	0	<0.0070	4177	Trigger			Yes	0.001	0.025
Aluminum	<0.017	3637	<0.051	0	<0.27	0	0.090	540	<0.480	0	<0.026	4177	Trigger			Yes	0.087	0.03
Antimony	<0.00050	3637	<0.0014	0	<0.018	0	0.0010	540	0.047	0	<0.00056	4177	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00020	3637	<0.012	0	<0.0370	0	0.00010	540	<0.0035	0	<0.00019	4177	Ambient		Yes			
Barium	0.0066	3637	<0.051	0	<0.250	0	0.200	540	<0.400	0	<0.032	4177	Trigger			Yes	0.002	1.0
Beryllium	<0.00020	3637	<0.0003	0	<0.00	0	0.0002	540	<0.00	0	<0.00020	4177	Ambient		Yes			
Cadmium	<0.000060	3637	<0.00016	0	<0.0030	0	0.000010	540	<0.0020	0	<0.000054	4177	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	3637	<0.0010	0	<0.0020	0	0.0060	540	<0.0020	0	<0.0016	4177	BHES	Yes			0.005	
Copper	<0.00046	3637	<0.00049	0	0.017	0	0.0035	540	0.011	0	<0.00085	4177	BHES	Yes			0.003	
Iron	<0.017	3637	<0.035	0	<0.300	0	0.13	540	0.10	0	<0.032	4177	BHES	Yes		Yes	0.1	1.0
Lead	<0.000054	3637	<0.000041	0	<0.0033	0	0.00035	540	<0.0018	0	<0.000092	4177	Trigger			Yes	0.0001	0.000545
Manganese	<0.00099	3637	<0.018	0	0.77	0	0.070	540	1.9	0	<0.010	4177	BHES	Yes			0.05	
Mercury	<0.000020	3637	<0.000045	0	<0.000010	0	0.000010	540	<0.00001	0	<0.000019	4177	Ambient		Yes			
Nickel	<0.00050	3637	<0.00030	0	<0.0041	0	0.0030	540	<0.0041	0	<0.00082	4177	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	3637	<0.0020	0	<0.0041	0	0.0015	540	<0.0000	0	<0.0011	4177	Trigger			Yes	0.0006	0.005
Silver	<0.00020	3637	<0.00041	0	<0.15	0	0.00040	540	<0.0035	0	<0.00023	4177	Trigger			Yes	0.0002	0.000374
Zinc	<0.0044	3637	<0.037	0	<0.044	0	0.030	540	<0.04	0	<0.0077	4177	BHES	Yes			0.025	

Notes:

The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.
Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.
Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

LIBBY CREEK at LB 1000
Closure

Alternative 4

	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or significant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	<33	3760	496	0	492	0	110	540	1080	0	<43	4300	BHES	Yes			100	
Ammonia	<0.030	3760	<1.3	0	<3.3	0	0.70	540	8.9	0	<0.11	4300						
Nitrate	<0.034	3760	<75	0	6.3	0	0.60	540	26	0	0.11	4300						
Total Inorganic Nitrogen	<0.064	3760	<76	0	<9.6	0	1.3	540	35	0	<0.22	4300	BHES	Yes			1	
Total Nitrogen	<0.11	3760	<77	0	<6.3	0	0.155	540	26	0	<0.11	4300	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.007	3760	<0.053	0	<9.600	0	0.007	540	34.900	0	<0.007	4300	Trigger			Yes	0.001	0.025
Aluminum	<0.017	3760	<0.051	0	<0.270	0	0.090	540	<0.480	0	<0.0261	4300	Trigger			Yes	0.087	0.03
Antimony	<0.00050	3760	<0.0014	0	<0.018	0	0.0010	540	0.047	0	<0.00056	4300	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00020	3760	<0.012	0	<0.0370	0	0.00010	540	<0.0035	0	<0.00019	4300	Ambient		Yes			
Barium	0.0066	3760	<0.051	0	<0.250	0	0.200	540	<0.400	0	<0.0309	4300	Trigger			Yes	0.002	1.0
Beryllium	<0.00020	3760	<0.0003	0	<0.00	0	0.000	540	<0.00	0	<0.0002	4300	Ambient		Yes			
Cadmium	<0.000060	3760	<0.00016	0	<0.0030	0	0.000010	540	<0.0020	0	<0.000054	4300	Trigger			Yes	0.0001	0.000097
Chromium	<0.0010	3760	<0.0010	0	<0.0020	0	0.0060	540	<0.0020	0	<0.0016	4300	BHES	Yes			0.005	
Copper	<0.00046	3760	<0.00049	0	0.017	0	0.0035	540	0.011	0	<0.00084	4300	BHES	Yes			0.003	
Iron	<0.017	3760	<0.035	0	<0.300	0	0.13	540	0.10	0	<0.031	4300	BHES	Yes		Yes	0.1	1.0
Lead	<0.000054	3760	<0.000041	0	<0.0033	0	0.00035	540	<0.0018	0	<0.000091	4300	Trigger			Yes	0.0001	0.000545
Manganese	<0.00099	3760	<0.018	0	0.77	0	0.070	540	1.9	0	<0.0097	4300	BHES	Yes			0.05	
Mercury	<0.000020	3760	<0.000045	0	<0.000010	0	0.000010	540	<0.00001	0	<0.000019	4300	Ambient		Yes			
Nickel	<0.00050	3760	<0.00030	0	<0.0041	0	0.0030	540	<0.0041	0	<0.00081	4300	Trigger			Yes	0.0005	0.0161
Selenium	<0.0010	3760	<0.0020	0	<0.0041	0	0.0015	540	<0.0000	0	<0.0011	4300	Trigger			Yes	0.0006	0.005
Silver	<0.00020	3760	<0.00041	0	<0.15	0	0.00040	540	<0.0035	0	<0.00023	4300	Trigger			Yes	0.0002	0.000374
Zinc	<0.0044	3760	<0.037	0	<0.044	0	0.030	540	<0.04	0	<0.0076	4300	BHES	Yes			0.025	

Notes:

The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.
Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.
Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

LIBBY CREEK at LB 2000
Evaluation

Alternative 2

	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	29	4017	496	28.3	492	3.7	110	133	1080	0	35	4182	BHES	Yes			100	
Ammonia	<0.050	4017	<1.3	28.3	<3.3	3.7	0.70	133	8.9	0	<0.080	4182						
Nitrate	<0.044	4017	<75	28.3	6.3	3.7	0.60	133	26	0	0.57	4182						
Total Inorganic Nitrogen	<0.094	4017	<76	28.3	<9.6	3.7	1.3	133	35	0	<0.65	4182	BHES	Yes			1	
Total Nitrogen	<0.15	4017	<77	28.3	<9.5	3.7	0.155	133	35	0	<0.67	4182	Trigger				0.01	0.275
Total Phosphorus	<0.011	4017	<0.053	28.3	<0.200	3.7	0.007	133	0.170	0	<0.011	4182	Trigger			Yes	0.001	0.025
Aluminum	0.0060	4017	<0.051	28.3	<0.27	3.7	0.090	133	<0.48	0	<0.009	4182	Trigger			Yes	0.087	0.03
Antimony	<0.0016	4017	<0.0014	28.3	<0.018	3.7	0.0010	133	0.047	0	<0.0016	4182	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00033	4017	<0.012	28.3	<0.0370	3.7	0.00010	133	<0.0035	0	<0.00043	4182	Ambient					
Barium	0.0070	4017	<0.051	28.3	<0.25	3.7	0.20	133	<0.40	0	<0.0137	4182	Trigger			Yes	0.002	1.0
Beryllium	<0.00055	4017	<0.00033	28.3	<0.00041	3.7	0.00020	133	<0.00041	0	<0.00054	4182	Ambient		Yes			
Cadmium	<0.000041	4017	<0.00016	28.3	<0.0030	3.7	0.000010	133	<0.0020	0	<0.000043	4182	Trigger			Yes	0.0001	0.000097
Chromium	<0.0021	4017	<0.0010	28.3	<0.0020	3.7	0.0060	133	<0.0020	0	<0.0022	4182	BHES	Yes			0.005	
Copper	<0.00038	4017	<0.00049	28.3	0.017	3.7	0.0035	133	0.011	0	<0.00049	4182	BHES	Yes			0.003	
Iron	<0.037	4017	<0.035	28.3	<0.300	3.7	0.13	133	0.10	0	<0.040	4182	BHES	Yes		Yes	0.1	1.0
Lead	<0.000074	4017	<0.000041	28.3	<0.0033	3.7	0.00035	133	<0.0018	0	<0.000085	4182	Trigger			Yes	0.0001	0.000545
Manganese	<0.0014	4017	<0.018	28.3	0.77	3.7	0.070	133	1.9	0	<0.0044	4182	BHES	Yes			0.05	
Mercury	<0.000017	4017	<0.000045	28.3	<0.000010	3.7	0.000010	133	<0.000010	0	<0.000017	4182	Ambient		Yes			
Nickel	<0.0051	4017	<0.00030	28.3	<0.0041	3.7	0.003	133	<0.0041	0	<0.0050	4182	Trigger			Yes	0.0005	0.0161
Selenium	<0.00063	4017	<0.0020	28.3	<0.0041	3.7	0.0015	133	<0.0026	0	<0.00067	4182	Trigger			Yes	0.0006	0.005
Silver	<0.00023	4017	<0.00041	28.3	<0.1500	3.7	0.00040	133	<0.0035	0	<0.00037	4182	Trigger			Yes	0.0002	0.000374
Zinc	<0.0020	4017	<0.037	28.3	<0.044	3.7	0.030	133	<0.037	0	<0.0032	4182	BHES	Yes			0.025	

Alternative 3

	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	29	4017	496	0	492	0	110	263	1080	0	34	4280	BHES	Yes			100	
Ammonia	<0.050	4017	<1.3	0	<3.3	0	0.70	263	8.9	0	<0.090	4280						
Nitrate	<0.044	4017	<75	0	6.3	0	0.60	263	26	0	0.078	4280						
Total Inorganic Nitrogen	<0.094	4017	<76	0	<9.6	0	1.3	263	35	0	<0.17	4280	BHES	Yes			1	
Total Nitrogen	<0.15	4017	<77	0	<9.5	0	0.155	263	35	0	<0.15	4280	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.011	4017	<0.053	0	<0.200	0	0.007	263	0.170	0	<0.011	4280	Trigger			Yes	0.001	0.025
Aluminum	0.0060	4017	<0.051	0	<0.27	0	0.090	263	<0.48	0	<0.0112	4280	Trigger			Yes	0.087	0.03
Antimony	<0.0016	4017	<0.0014	0	<0.018	0	0.0010	263	0.047	0	<0.0016	4280	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00033	4017	<0.012	0	<0.0370	0	0.00010	263	<0.0035	0	<0.00032	4280	Ambient		Yes			
Barium	0.0070	4017	<0.051	0	<0.25	0	0.20	263	<0.40	0	<0.02	4280	Trigger			Yes	0.002	1.0
Beryllium	<0.00055	4017	<0.00033	0	<0.00041	0	0.00020	263	<0.00041	0	<0.00053	4280	Ambient		Yes			
Cadmium	<0.000041	4017	<0.00016	0	<0.0030	0	0.000010	263	<0.0020	0	<0.000039	4280	Trigger			Yes	0.0001	0.000097
Chromium	<0.0021	4017	<0.0010	0	<0.0020	0	0.0060	263	<0.0020	0	<0.0023	4280	BHES	Yes			0.005	
Copper	<0.00038	4017	<0.00049	0	0.017	0	0.0035	263	0.011	0	<0.00057	4280	BHES	Yes			0.003	
Iron	<0.037	4017	<0.035	0	<0.300	0	0.13	263	0.10	0	<0.043	4280	BHES	Yes		Yes	0.1	1.0
Lead	<0.000074	4017	<0.000041	0	<0.0033	0	0.00035	263	<0.0018	0	<0.000091	4280	Trigger			Yes	0.0001	0.000545
Manganese	<0.0014	4017	<0.018	0	0.77	0	0.070	263	1.9	0	<0.0056	4280	BHES	Yes			0.05	
Mercury	<0.000017	4017	<0.000045	0	<0.000010	0	0.000010	263	<0.000010	0	<0.000017	4280	Ambient		Yes			
Nickel	<0.0051	4017	<0.00030	0	<0.0041	0	0.003	263	<0.0041	0	<0.0050	4280	Trigger			Yes	0.0005	0.0161
Selenium	<0.00063	4017	<0.0020	0	<0.0041	0	0.0015	263	<0.0026	0	<0.0007	4280	Trigger			Yes	0.0006	0.005
Silver	<0.00023	4017	<0.00041	0	<0.1500	0	0.00040	263	<0.0035	0	<0.00024	4280	Trigger			Yes	0.0002	0.000374
Zinc	<0.0020	4017	<0.037	0	<0.044	0	0.030	263	<0.037	0	<0.0037	4280	BHES	Yes			0.025	

Notes:
The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.
Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.
Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

LIBBY CREEK at LB 2000
Construction

Alternative 2

	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	29	3950	496	29.8	492	2.2	110	370	1080	0	39	4352	BHES	Yes			100	
Ammonia	<0.050	3950	<1.3	29.8	<3.3	2.2	0.70	370	8.9	0	<0.12	4352						
Nitrate	<0.044	3950	<75	29.8	6.3	2.2	0.60	370	26	0	0.61	4352						
Total Inorganic Nitrogen	<0.094	3950	<76	29.8	<9.6	2.2	1.3	370	35	0	<0.73	4352	BHES	Yes			1	
Total Nitrogen	<0.15	3950	<77	29.8	<9.5	2.2	0.155	370	35	0	<0.68	4352	Trigger				0.01	0.275
Total Phosphorus	<0.011	3950	<0.053	29.8	<0.200	2.2	0.007	370	0.170	0	<0.011	4352	Trigger			Yes	0.001	0.025
Aluminum	0.0060	3950	<0.051	29.8	<0.27	2.2	0.090	370	<0.48	0	<0.014	4352	Trigger			Yes	0.087	0.03
Antimony	<0.0016	3950	<0.0014	29.8	<0.018	2.2	0.0010	370	0.047	0	<0.0016	4352	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00033	3950	<0.012	29.8	<0.0370	2.2	0.00010	370	<0.0035	0	<0.00041	4352	Ambient					
Barium	0.0070	3950	<0.051	29.8	<0.25	2.2	0.20	370	<0.40	0	<0.0238	4352	Trigger			Yes	0.002	1.0
Beryllium	<0.00055	3950	<0.00033	29.8	<0.00041	2.2	0.00020	370	<0.00041	0	<0.00052	4352	Ambient		Yes			
Cadmium	<0.000041	3950	<0.00016	29.8	<0.0030	2.2	0.000010	370	<0.0020	0	<0.000041	4352	Trigger			Yes	0.0001	0.000097
Chromium	<0.0021	3950	<0.0010	29.8	<0.0020	2.2	0.0060	370	<0.0020	0	<0.0024	4352	BHES	Yes			0.005	
Copper	<0.00038	3950	<0.00049	29.8	0.017	2.2	0.0035	370	0.011	0	<0.00065	4352	BHES	Yes			0.003	
Iron	<0.037	3950	<0.035	29.8	<0.300	2.2	0.13	370	0.10	0	<0.045	4352	BHES	Yes		Yes	0.1	1.0
Lead	<0.000074	3950	<0.000041	29.8	<0.0033	2.2	0.00035	370	<0.0018	0	<0.00010	4352	Trigger			Yes	0.0001	0.000545
Manganese	<0.0014	3950	<0.018	29.8	0.77	2.2	0.070	370	1.9	0	<0.0077	4352	BHES	Yes			0.05	
Mercury	<0.000017	3950	<0.000045	29.8	<0.000010	2.2	0.000010	370	<0.000010	0	<0.000017	4352	Ambient		Yes			
Nickel	<0.0051	3950	<0.00030	29.8	<0.0041	2.2	0.003	370	<0.0041	0	<0.0049	4352	Trigger			Yes	0.0005	0.0161
Selenium	<0.00063	3950	<0.0020	29.8	<0.0041	2.2	0.0015	370	<0.0026	0	<0.00072	4352	Trigger			Yes	0.0006	0.005
Silver	<0.00023	3950	<0.00041	29.8	<0.1500	2.2	0.00040	370	<0.0035	0	<0.00032	4352	Trigger			Yes	0.0002	0.000374
Zinc	<0.0020	3950	<0.037	29.8	<0.044	2.2	0.030	370	<0.037	0	<0.0046	4352	BHES	Yes			0.025	

Alternative 3

	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	29	3950	496	0	492	0	110	500	1080	0	38	4450	BHES	Yes			100	
Ammonia	<0.050	3950	<1.3	0	<3.3	0	0.70	500	8.9	0	<0.12	4450						
Nitrate	<0.044	3950	<75	0	6.3	0	0.60	500	26	0	0.11	4450						
Total Inorganic Nitrogen	<0.094	3950	<76	0	<9.6	0	1.3	500	35	0	<0.23	4450	BHES	Yes			1	
Total Nitrogen	<0.15	3950	<77	0	<9.5	0	0.155	500	35	0	<0.15	4450	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.011	3950	<0.053	0	<0.200	0	0.007	500	0.170	0	<0.011	4450	Trigger			Yes	0.001	0.025
Aluminum	0.0060	3950	<0.051	0	<0.27	0	0.090	500	<0.48	0	<0.0154	4450	Trigger			Yes	0.087	0.03
Antimony	<0.0016	3950	<0.0014	0	<0.018	0	0.0010	500	0.047	0	<0.0015	4450	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00033	3950	<0.012	0	<0.0370	0	0.00010	500	<0.0035	0	<0.00030	4450	Ambient		Yes			
Barium	0.0070	3950	<0.051	0	<0.25	0	0.20	500	<0.40	0	<0.03	4450	Trigger			Yes	0.002	1.0
Beryllium	<0.00055	3950	<0.00033	0	<0.00041	0	0.00020	500	<0.00041	0	<0.00051	4450	Ambient		Yes			
Cadmium	<0.000041	3950	<0.00016	0	<0.0030	0	0.000010	500	<0.0020	0	<0.000038	4450	Trigger			Yes	0.0001	0.000097
Chromium	<0.0021	3950	<0.0010	0	<0.0020	0	0.0060	500	<0.0020	0	<0.0025	4450	BHES	Yes			0.005	
Copper	<0.00038	3950	<0.00049	0	0.017	0	0.0035	500	0.011	0	<0.00073	4450	BHES	Yes			0.003	
Iron	<0.037	3950	<0.035	0	<0.300	0	0.13	500	0.10	0	<0.047	4450	BHES	Yes		Yes	0.1	1.0
Lead	<0.000074	3950	<0.000041	0	<0.0033	0	0.00035	500	<0.0018	0	<0.00011	4450	Trigger			Yes	0.0001	0.000545
Manganese	<0.0014	3950	<0.018	0	0.77	0	0.070	500	1.9	0	<0.0091	4450	BHES	Yes			0.05	
Mercury	<0.000017	3950	<0.000045	0	<0.000010	0	0.000010	500	<0.000010	0	<0.000016	4450	Ambient		Yes			
Nickel	<0.0051	3950	<0.00030	0	<0.0041	0	0.003	500	<0.0041	0	<0.0049	4450	Trigger			Yes	0.0005	0.0161
Selenium	<0.00063	3950	<0.0020	0	<0.0041	0	0.0015	500	<0.0026	0	<0.0007	4450	Trigger			Yes	0.0006	0.005
Silver	<0.00023	3950	<0.00041	0	<0.1500	0	0.00040	500	<0.0035	0	<0.00025	4450	Trigger			Yes	0.0002	0.000374
Zinc	<0.0020	3950	<0.037	0	<0.044	0	0.030	500	<0.037	0	<0.0051	4450	BHES	Yes			0.025	

Notes:
The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.
Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.
Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

LIBBY CREEK at LB 2000
Mining

Alternative 2

	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	29	3658	496	0	492	0	110	0	1080	0	29	3658	BHES	Yes			100	
Ammonia	<0.050	3658	<1.3	0	<3.3	0	0.70	0	8.9	0	<0.050	3658						
Nitrate	<0.044	3658	<75	0	6.3	0	0.60	0	26	0	<0.040	3658						
Total Inorganic Nitrogen	<0.094	3658	<76	0	<9.6	0	1.3	0	35	0	<0.090	3658	BHES	Yes			1	
Total Nitrogen	<0.15	3658	<77	0	<9.5	0	0.155	0	35	0	<0.15	3658	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.011	3658	<0.053	0	<0.200	0	0.007	0	0.170	0	<0.011	3658	Trigger			Yes	0.001	0.025
Aluminum	0.0060	3658	<0.051	0	<0.27	0	0.090	0	<0.48	0	<0.006	3658	Trigger			Yes	0.087	0.03
Antimony	<0.0016	3658	<0.0014	0	<0.018	0	0.0010	0	0.047	0	<0.0016	3658	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00033	3658	<0.012	0	<0.0370	0	0.00010	0	<0.0035	0	<0.00033	3658	Ambient		Yes			
Barium	0.0070	3658	<0.051	0	<0.25	0	0.20	0	<0.40	0	<0.0070	3658	Trigger			Yes	0.002	1.0
Beryllium	<0.00055	3658	<0.00033	0	<0.00041	0	0.00020	0	<0.00041	0	<0.00055	3658	Ambient		Yes			
Cadmium	<0.000041	3658	<0.00016	0	<0.0030	0	0.000010	0	<0.0020	0	<0.000041	3658	Trigger			Yes	0.0001	0.000097
Chromium	<0.0021	3658	<0.0010	0	<0.0020	0	0.0060	0	<0.0020	0	<0.0021	3658	BHES	Yes			0.005	
Copper	<0.00038	3658	<0.00049	0	0.017	0	0.0035	0	0.011	0	<0.00038	3658	BHES	Yes			0.003	
Iron	<0.037	3658	<0.035	0	<0.300	0	0.13	0	0.10	0	<0.037	3658	BHES	Yes		Yes	0.1	1.0
Lead	<0.000074	3658	<0.000041	0	<0.0033	0	0.00035	0	<0.0018	0	<0.000074	3658	Trigger			Yes	0.0001	0.000545
Manganese	<0.0014	3658	<0.018	0	0.77	0	0.070	0	1.9	0	<0.0014	3658	BHES	Yes			0.05	
Mercury	<0.000017	3658	<0.000045	0	<0.000010	0	0.000010	0	<0.000010	0	<0.000017	3658	Ambient		Yes			
Nickel	<0.0051	3658	<0.00030	0	<0.0041	0	0.003	0	<0.0041	0	<0.0051	3658	Trigger			Yes	0.0005	0.0161
Selenium	<0.00063	3658	<0.0020	0	<0.0041	0	0.0015	0	<0.0026	0	<0.00063	3658	Trigger			Yes	0.0006	0.005
Silver	<0.00023	3658	<0.00041	0	<0.1500	0	0.00040	0	<0.0035	0	<0.00023	3658	Trigger			Yes	0.0002	0.000374
Zinc	<0.0020	3658	<0.037	0	<0.044	0	0.030	0	<0.037	0	<0.0020	3658	BHES	Yes			0.025	

Alternative 3

	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	29	3658	496	0	492	0	110	921	1080	0	45	4579	BHES	Yes			100	
Ammonia	<0.050	3658	<1.3	0	<3.3	0	0.70	921	8.9	0	<0.18	4579						
Nitrate	<0.044	3658	<75	0	6.3	0	1	921	26	0	<0.16	4579						
Total Inorganic Nitrogen	<0.094	3658	<76.3	0	<9.6	0	1.3	921	34.9	0	<0.34	4579	BHES	Yes			1	
Total Nitrogen	<0.15	3658	<77	0	<9.5	0	0.155	921	35	0	<0.15	4579	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.011	3658	<0.053	0	<0.200	0	0.007	921	0.170	0	<0.010	4579	Trigger			Yes	0.001	0.025
Aluminum	0.0060	3658	<0.051	0	<0.27	0	0.090	921	<0.48	0	<0.0229	4579	Trigger			Yes	0.087	0.03
Antimony	<0.0016	3658	<0.0014	0	<0.018	0	0.0010	921	0.047	0	<0.0015	4579	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00033	3658	<0.012	0	<0.0370	0	0.0001	921	<0.004	0	<0.00028	4579	Ambient		Yes			
Barium	0.0070	3658	<0.051	0	<0.25	0	0.20	921	<0.40	0	<0.05	4579	Trigger			Yes	0.002	1.0
Beryllium	<0.00055	3658	<0.00033	0	<0.00041	0	0.00020	921	<0.00041	0	<0.00048	4579	Ambient		Yes			
Cadmium	<0.000041	3658	<0.000160	0	<0.0030	0	0.00001	921	<0.00200	0	<0.000035	4579	Trigger			Yes	0.0001	0.000097
Chromium	<0.0021	3658	<0.0010	0	<0.0020	0	0.0060	921	<0.0020	0	<0.0029	4579	BHES	Yes			0.005	
Copper	<0.00038	3658	<0.00049	0	0.017	0	0.0035	921	0.01	0	<0.0010	4579	BHES	Yes			0.003	
Iron	<0.037	3658	<0.04	0	<0.300	0	0	921	0.1	0	<0.056	4579	BHES	Yes		Yes	0.1	1.0
Lead	<0.000074	3658	<0.00004	0	<0.0033	0	0.00035	921	<0.002	0	<0.00013	4579	Trigger			Yes	0.0001	0.000545
Manganese	<0.0014	3658	<0.018	0	0.77	0	0.070	921	1.9	0	<0.015	4579	BHES	Yes			0.05	
Mercury	<0.000017	3658	<0.000045	0	<0.000010	0	0	921	<0.00001	0	<0.000016	4579	Ambient		Yes			
Nickel	<0.0051	3658	<0.00030	0	<0.0041	0	0.003	921	<0.0041	0	<0.0047	4579	Trigger			Yes	0.0005	0.0161
Selenium	<0.00063	3658	<0.0020	0	<0.0041	0	0.0015	921	<0.0026	0	<0.0008	4579	Trigger			Yes	0.0006	0.005
Silver	<0.00023	3658	<0.00041	0	<0.1500	0	0.00040	921	<0.0035	0	<0.00026	4579	Trigger			Yes	0.0002	0.000374
Zinc	<0.0020	3658	<0.037	0	<0.044	0	0.030	921	<0.04	0	<0.0076	4579	BHES	Yes			0.025	

Notes:
The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.
Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.
Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

LIBBY CREEK at LB 2000
Closure

Alternative 2

	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	29	3667	496	0	492	0	110	500	1080	32	47	4199	BHES	Yes			100	
Ammonia	<0.050	3667	<1.3	0	<3.3	0	0.70	500	8.9	32	<0.19	4199						
Nitrate	<0.044	3667	<75	0	6.3	0	0.60	500	26	32	0.31	4199						
Total Inorganic Nitrogen	<0.094	3667	<76	0	<9.6	0	1.3	500	35	32	<0.50	4199	BHES	Yes			1	
Total Nitrogen	<0.15	3667	<77	0	<9.5	0	0.155	500	35	32	<0.41	4199	Trigger				0.01	0.275
Total Phosphorus	<0.011	3667	<0.053	0	<0.200	0	0.007	500	0.170	32	<0.012	4199	Trigger			Yes	0.001	0.025
Aluminum	0.0060	3667	<0.051	0	<0.27	0	0.090	500	<0.48	32	<0.020	4199	Trigger			Yes	0.087	0.03
Antimony	<0.0016	3667	<0.0014	0	<0.018	0	0.0010	500	0.047	32	<0.0019	4199	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00033	3667	<0.012	0	<0.0370	0	0.00010	500	<0.0035	32	<0.00033	4199	Ambient		Yes			
Barium	0.0070	3667	<0.051	0	<0.25	0	0.20	500	<0.40	32	<0.0330	4199	Trigger			Yes	1.0	0.002
Beryllium	<0.00055	3667	<0.00033	0	<0.00041	0	0.00020	500	<0.00041	32	<0.00051	4199	Ambient		Yes			
Cadmium	<0.000041	3667	<0.00016	0	<0.0030	0	0.000010	500	<0.0020	32	<0.000052	4199	Trigger			Yes	0.0001	0.000097
Chromium	<0.0021	3667	<0.0010	0	<0.0020	0	0.0060	500	<0.0020	32	<0.0026	4199	BHES	Yes			0.005	
Copper	<0.00038	3667	<0.00049	0	0.017	0	0.0035	500	0.011	32	<0.00083	4199	BHES	Yes			0.003	
Iron	<0.037	3667	<0.035	0	<0.300	0	0.13	500	0.10	32	<0.049	4199	BHES	Yes		Yes	0.1	1.0
Lead	<0.000074	3667	<0.000041	0	<0.0033	0	0.00035	500	<0.0018	32	<0.00012	4199	Trigger			Yes	0.0001	0.000545
Manganese	<0.0014	3667	<0.018	0	0.77	0	0.070	500	1.9	32	<0.024	4199	BHES	Yes			0.05	
Mercury	<0.000017	3667	<0.000045	0	<0.000010	0	0.000010	500	<0.000010	32	<0.000016	4199	Ambient		Yes			
Nickel	<0.0051	3667	<0.00030	0	<0.0041	0	0.003	500	<0.0041	32	<0.0048	4199	Trigger			Yes	0.0005	0.0161
Selenium	<0.00063	3667	<0.0020	0	<0.0041	0	0.0015	500	<0.0026	32	<0.00075	4199	Trigger			Yes	0.0006	0.005
Silver	<0.00023	3667	<0.00041	0	<0.1500	0	0.00040	500	<0.0035	32	<0.00028	4199	Trigger			Yes	0.0002	0.000374
Zinc	<0.0020	3667	<0.037	0	<0.044	0	0.030	500	<0.037	32	<0.0056	4199	BHES	Yes			0.025	

Alternative 3

	Ambient Water Quality		Representative adit water from LAD percolation (construction)		Representative mine water from LAD percolation		Representative Water Treatment Plant effluent		Representative tailings water from LAD percolation		Projected final mixing concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or nonsignificant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters and Nutrients	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	29	3667	496	0	492	0	110	540	1080	0	39	4207	BHES	Yes			100	
Ammonia	<0.050	3667	<1.3	0	<3.3	0	0.70	540	8.9	0	<0.13	4207						
Nitrate	<0.044	3667	<75	0	6.3	0	0.60	540	26	0	0.12	4207						
Total Inorganic Nitrogen	<0.094	3667	<76	0	<9.6	0	1.3	540	35	0	<0.25	4207	BHES	Yes			1	
Total Nitrogen	<0.15	3667	<77	0	<9.5	0	0.155	540	35	0	<0.15	4207	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.011	3667	<0.053	0	<0.200	0	0.007	540	0.170	0	<0.010	4207	Trigger			Yes	0.001	0.025
Aluminum	0.0060	3667	<0.051	0	<0.27	0	0.090	540	<0.48	0	<0.0168	4207	Trigger			Yes	0.087	0.03
Antimony	<0.0016	3667	<0.0014	0	<0.018	0	0.0010	540	0.047	0	<0.0015	4207	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00033	3667	<0.012	0	<0.0370	0	0.00010	540	<0.0035	0	<0.00030	4207	Ambient		Yes			
Barium	0.0070	3667	<0.051	0	<0.25	0	0.20	540	<0.40	0	<0.03	4207	Trigger			Yes	0.002	1.0
Beryllium	<0.00055	3667	<0.00033	0	<0.00041	0	0.00020	540	<0.00041	0	<0.00051	4207	Ambient		Yes			
Cadmium	<0.000041	3667	<0.00016	0	<0.0030	0	0.000010	540	<0.0020	0	<0.000037	4207	Trigger			Yes	0.0001	0.000097
Chromium	<0.0021	3667	<0.0010	0	<0.0020	0	0.0060	540	<0.0020	0	<0.0026	4207	BHES	Yes			0.005	
Copper	<0.00038	3667	<0.00049	0	0.017	0	0.0035	540	0.011	0	<0.00078	4207	BHES	Yes			0.003	
Iron	<0.037	3667	<0.035	0	<0.300	0	0.13	540	0.10	0	<0.049	4207	BHES	Yes		Yes	0.1	1.0
Lead	<0.000074	3667	<0.000041	0	<0.0033	0	0.00035	540	<0.0018	0	<0.00011	4207	Trigger			Yes	0.0001	0.000545
Manganese	<0.0014	3667	<0.018	0	0.77	0	0.070	540	1.9	0	<0.010	4207	BHES	Yes			0.05	
Mercury	<0.000017	3667	<0.000045	0	<0.000010	0	0.000010	540	<0.000010	0	<0.000016	4207	Ambient		Yes			
Nickel	<0.0051	3667	<0.00030	0	<0.0041	0	0.003	540	<0.0041	0	<0.0048	4207	Trigger			Yes	0.0005	0.0161
Selenium	<0.00063	3667	<0.0020	0	<0.0041	0	0.0015	540	<0.0026	0	<0.0007	4207	Trigger			Yes	0.0006	0.005
Silver	<0.00023	3667	<0.00041	0	<0.1500	0	0.00040	540	<0.0035	0	<0.00025	4207	Trigger			Yes	0.0002	0.000374
Zinc	<0.0020	3667	<0.037	0	<0.044	0	0.030	540	<0.037	0	<0.0056	4207	BHES	Yes			0.025	

Notes:

The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.
Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.
Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

LIBBY CREEK at LB 2000
Closure

Alternative 4

													Applicable Outside of a Mixing Zone					
	0		0		0		0		0		0		Method to determine BHES Order limit or significant changes	0	0	0	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters and Nutrients)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	(mg/L)
TDS	29	3667	496	0	492	0	110	540	1080	0	39	4207	BHES	Yes			100	
Ammonia	<0.050	3667	<1.3	0	<3.3	0	0.70	540	8.9	0	<0.13	4207						
Nitrate	<0.044	3667	<75	0	6.3	0	0.60	540	26	0	0.12	4207						
Total Inorganic Nitrogen	<0.094	3667	<76	0	<9.6	0	1.3	540	35	0	<0.25	4207	BHES	Yes			1	
Total Nitrogen	<0.15	3667	<77	0	<9.5	0	0.155	540	35	0	<0.15	4207	Trigger			Yes	0.01	0.275
Total Phosphorus	<0.011	3667	<0.053	0	<0.200	0	0.007	540	0.170	0	<0.010	4207	Trigger			Yes	0.001	0.025
Aluminum	0.0060	3667	<0.051	0	<0.27	0	0.090	540	<0.48	0	<0.0168	4207	Trigger			Yes	0.087	0.03
Antimony	<0.0016	3667	<0.0014	0	<0.018	0	0.0010	540	0.047	0	<0.0015	4207	Trigger			Yes	0.0004	0.0056
Arsenic	<0.00033	3667	<0.012	0	<0.0370	0	0.00010	540	<0.0035	0	<0.00030	4207	Ambient		Yes			
Barium	0.0070	3667	<0.051	0	<0.25	0	0.20	540	<0.40	0	<0.03	4207	Trigger			Yes	0.002	1.0
Beryllium	<0.00055	3667	<0.00033	0	<0.00041	0	0.00020	540	<0.00041	0	<0.00051	4207	Ambient		Yes			
Cadmium	<0.000041	3667	<0.00016	0	<0.0030	0	0.000010	540	<0.0020	0	<0.000037	4207	Trigger			Yes	0.0001	0.000097
Chromium	<0.0021	3667	<0.0010	0	<0.0020	0	0.0060	540	<0.0020	0	<0.0026	4207	BHES	Yes			0.005	
Copper	<0.00038	3667	<0.00049	0	0.017	0	0.0035	540	0.011	0	<0.00078	4207	BHES	Yes			0.003	
Iron	<0.037	3667	<0.035	0	<0.300	0	0.13	540	0.10	0	<0.049	4207	BHES	Yes		Yes	0.1	1.0
Lead	<0.000074	3667	<0.000041	0	<0.0033	0	0.00035	540	<0.0018	0	<0.00011	4207	Trigger			Yes	0.0001	0.000545
Manganese	<0.0014	3667	<0.018	0	0.77	0	0.070	540	1.9	0	<0.010	4207	BHES	Yes			0.05	
Mercury	<0.000017	3667	<0.000045	0	<0.000010	0	0.000010	540	<0.000010	0	<0.000016	4207	Ambient		Yes			
Nickel	<0.0051	3667	<0.00030	0	<0.0041	0	0.003	540	<0.0041	0	<0.0048	4207	Trigger			Yes	0.0005	0.0161
Selenium	<0.00063	3667	<0.0020	0	<0.0041	0	0.0015	540	<0.0026	0	<0.0007	4207	Trigger			Yes	0.0006	0.005
Silver	<0.00023	3667	<0.00041	0	<0.1500	0	0.00040	540	<0.0035	0	<0.00025	4207	Trigger			Yes	0.0002	0.000374
Zinc	<0.0020	3667	<0.037	0	<0.044	0	0.030	540	<0.037	0	<0.0056	4207	BHES	Yes			0.025	

Notes:
The wastewater treatment plant effluent concentrations shown are for NEPA analysis purposes only, and vary from MPDES permitted effluent limits. It is unknown if the concentrations are technologically or economically feasible.
Because nitrate would be the dominant nitrogen form, the analysis assumes the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.
Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA.

LAD--Evaluation

Alternative 2

Mass Balance Calculations for groundwater below LAD Areas

	Ambient Water Quality		Representative Adit Water Input from LAD Percolation (construction)		Projected Final Mixing Concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or significant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	(mg/L)					(mg/L)	
TDS	63	31	496	32	283	63	BHES				200	
Nitrate	0.060	31	<75	32	<38	63	BHES				10	
Antimony	<0.0030	31	<0.0014	32	<0.0022	63	Trigger			Yes	0.0004	0.006
Arsenic	<0.0030	31	<0.012	32	<0.0076	63	Ambient					
Barium	<0.0067	31	<0.051	32	<0.029	63	Trigger			Yes	0.002	1.0
Beryllium	<0.0010	31	<0.00033	32	<0.00066	63	Ambient		Yes			
Cadmium	<0.00010	31	<0.00016	32	<0.00013	63	Trigger			Yes	0.0001	0.005
Chromium	<0.0010	31	<0.0010	32	<0.0010	63	BHES	Yes			0.02	
Copper	<0.0010	31	<0.00049	32	<0.00074	63	BHES	Yes			0.1	
Iron	<0.052	31	<0.035	32	<0.043	63	BHES	Yes			0.2	
Lead	<0.00034	31	<0.000041	32	<0.00019	63	Trigger			Yes	0.0001	0.015
Manganese	<0.081	31	<0.018	32	<0.049	63	BHES	Yes			0.05	
Mercury	<0.000020	31	<0.000045	32	<0.000033	63	Ambient					
Nickel	<0.010	31	<0.00030	32	<0.0051	63	Trigger			Yes	0.0005	0.1
Selenium	<0.0010	31	<0.0020	32	<0.0015	63	Trigger			Yes	0.0006	0.05
Silver	<0.00050	31	<0.00041	32	<0.00045	63	Trigger			Yes	0.0002	0.1
Zinc	<0.010	31	<0.037	32	<0.024	63	BHES	Yes			0.1	

Notes

Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA

LAD--Construction

Alternative 2

Mass Balance Calculations for groundwater below LAD Areas

	Ambient Water Quality		Representative Adit Water Input from LAD Percolation (construction)		Projected Final Mixing Concentration		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or significant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc.	Flow (gpm)	Conc. (mg/l)	(mg/L)					(mg/L)	
TDS	63	31	496	32	283	63	BHES				200	
Nitrate	0.060	31	<75	32	<38	63	BHES				10	
Antimony	<0.0030	31	<0.0014	32	<0.0022	63	Trigger			Yes	0.0004	0.006
Arsenic	<0.0030	31	<0.012	32	<0.0076	63	Ambient					
Barium	<0.0067	31	<0.051	32	<0.029	63	Trigger			Yes	0.002	1.0
Beryllium	<0.0010	31	<0.00033	32	<0.0007	63	Ambient		Yes			
Cadmium	<0.00010	31	<0.00016	32	<0.00013	63	Trigger			Yes	0.0001	0.005
Chromium	<0.0010	31	<0.0010	32	<0.0010	63	BHES	Yes			0.02	
Copper	<0.0010	31	<0.00049	32	<0.00074	63	BHES	Yes			0.1	
Iron	<0.052	31	<0.035	32	<0.043	63	BHES	Yes			0.2	
Lead	<0.00034	31	<0.000041	32	<0.00019	63	Trigger			Yes	0.0001	0.015
Manganese	<0.081	31	<0.018	32	<0.049	63	BHES	Yes			0.05	
Mercury	<0.000020	31	<0.000045	32	<0.000033	63	Ambient					
Nickel	<0.010	31	<0.0003	32	<0.0051	63	Trigger			Yes	0.0005	0.1
Selenium	<0.0010	31	<0.002	32	<0.00151	63	Trigger			Yes	0.0006	0.05
Silver	<0.00050	31	<0.00041	32	<0.00045	63	Trigger			Yes	0.0002	0.1
Zinc	<0.010	31	<0.037	32	<0.024	63	BHES	Yes			0.1	

Notes

Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA

LAD—Closure

Alternative 2

Mass Balance Calculations for groundwater below LAD Areas

							Applicable Outside of a Mixing Zone					
	Ambient Water Quality		Representative Tailing Water Input from LAD Percolation (post-mining)		Projected Final Mixing Concen.		Method to determine BHES Order limit or significant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	
TDS	63	31	1080	32	580	63	BHES				200	
Nitrate	0.060	31	26	32	13	63	BHES				10	
Antimony	<0.0030	31	0.047	32	<0.025	63	Trigger				0.0004	0.006
Arsenic	<0.0030	31	<0.0035	32	<0.0033	63	Ambient					
Barium	<0.0067	31	<0.40	32	<0.21	63	Trigger				0.002	1.0
Beryllium	<0.0010	31	<0.00041	32	<0.0007	63	Ambient		Yes			
Cadmium	<0.00010	31	<0.0020	32	<0.0011	63	Trigger				0.0001	0.005
Chromium	<0.0010	31	<0.0020	32	<0.0015	63	BHES	Yes			0.02	
Copper	<0.0010	31	0.011	32	<0.0061	63	BHES	Yes			0.1	
Iron	<0.052	31	<0.10	32	<0.076	63	BHES	Yes			0.2	
Lead	<0.00034	31	<0.0018	32	<0.0011	63	Trigger			Yes	0.0001	0.015
Manganese	<0.081	31	1.9	32	<1.0	63	BHES				0.05	
Mercury	<0.000020	31	<0.000010	32	<0.000015	63	Ambient		Yes			
Nickel	<0.010	31	<0.0041	32	<0.0070	63	Trigger			Yes	0.0005	0.1
Selenium	<0.0010	31	<0.0026	32	<0.0018	63	Trigger			Yes	0.0006	0.05
Silver	<0.00050	31	<0.0035	32	<0.0020	63	Trigger			Yes	0.0002	0.1
Zinc	<0.010	31	<0.037	32	<0.024	63	BHES	Yes			0.1	

Notes

Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).

Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA

Tailings Impoundment--Mining
Well LCTM-8V between Little Cherry Creek and Poorman Impoundment Sites Used for Existing Conditions

Alternatives 2 & 4

Mass Balance Calculations for groundwater below TI							Applicable Outside of a Mixing Zone					
	Ambient Water Quality		Representative Tailing Water Input from Seepage		Projected Final Mixing Concen.		Method to determine BHES Order limit or significant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	
TDS	60	35	266	25	146	60	BHES	Yes			200	
Nitrate	<0.10	35	13	25	5.5	60	BHES	Yes			10	
Antimony	<0.0030	35	0.023	25	<0.011	60	Trigger				0.0004	0.006
Arsenic	<0.0030	35	<0.0017	25	<0.0025	60	Ambient		Yes			
Barium	<0.040	35	<0.11	25	<0.069	60	Trigger			Yes	0.002	1.0
Beryllium	<0.0010	35	<0.001	25	<0.001	60	Ambient		Yes			
Cadmium	<0.00010	35	<0.00097	25	<0.00046	60	Trigger			Yes	0.0001	0.005
Chromium	<0.00074	35	<0.0010	25	<0.00085	60	BHES	Yes			0.02	
Copper	<0.0012	35	0.026	25	<0.012	60	BHES	Yes			0.1	
Iron	<0.010	35	<0.050	25	<0.027	60	BHES	Yes			0.2	
Lead	<0.00028	35	<0.0044	25	<0.0020	60	Trigger			Yes	0.0001	0.015
Manganese	<0.077	35	0.51	25	<0.26	60	BHES				0.05	
Mercury	<0.000030	35	<0.0000050	25	<0.000020	60	Ambient		Yes			
Nickel	<0.010	35	<0.010	25	<0.010	60	Trigger			Yes	0.0005	0.1
Selenium	<0.0010	35	<0.0013	25	<0.0011	60	Trigger			Yes	0.0006	0.05
Silver	<0.00050	35	<0.0017	25	<0.0010	60	Trigger			Yes	0.0002	0.1
Zinc	<0.0064	35	<0.010	25	<0.0079	60	BHES	Yes			0.1	

Alternative 3

Mass Balance Calculations for groundwater below TI							Applicable Outside of a Mixing Zone					
	Ambient Water Quality		Representative Tailing Water Input from Seepage		Projected Final Mixing Concen.		Method to determine BHES Order limit or significant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	
TDS	60	41	266	25	138	66	BHES	Yes			200	
Nitrate	<0.10	41	13	25	5.0	66	BHES	Yes			10	
Antimony	<0.0030	41	0.023	25	<0.011	66	Trigger				0.0004	0.006
Arsenic	<0.0030	41	<0.0017	25	<0.0025	66	Ambient		Yes			
Barium	<0.040	41	<0.11	25	<0.066	66	Trigger			Yes	0.002	1.0
Beryllium	<0.0010	41	<0.001	25	<0.001	66	Ambient		Yes			
Cadmium	<0.00010	41	<0.00097	25	<0.00043	66	Trigger			Yes	0.0001	0.005
Chromium	<0.00074	41	<0.0010	25	<0.00084	66	BHES	Yes			0.02	
Copper	<0.0012	41	0.026	25	<0.011	66	BHES	Yes			0.1	
Iron	<0.010	41	<0.050	25	<0.025	66	BHES	Yes			0.2	
Lead	<0.00028	41	<0.0044	25	<0.0018	66	Trigger			Yes	0.0001	0.015
Manganese	<0.077	41	0.51	25	<0.24	66	BHES				0.05	
Mercury	<0.000030	41	<0.0000050	25	<0.000021	66	Ambient		Yes			
Nickel	<0.010	41	<0.010	25	<0.010	66	Trigger			Yes	0.0005	0.1
Selenium	<0.0010	41	<0.0013	25	<0.0011	66	Trigger			Yes	0.0006	0.05
Silver	<0.00050	41	<0.0017	25	<0.00095	66	Trigger			Yes	0.0002	0.1
Zinc	<0.0064	41	<0.010	25	<0.0078	66	BHES	Yes			0.1	

Notes

Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA

Tailings Impoundment—Post-Closure at stabilized flow conditions
Well LCTM-8V between Little Cherry Creek and Poorman Impoundment Sites Used for Existing Conditions

Alternatives 2 & 4

Mass Balance Calculations for groundwater below TI

	Ambient Water Quality		Representative Tailing Water Input from Seepage		Projected Final Mixing Concen.		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or significant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	
TDS	60	35	266	5	86	40	BHES	Yes			200	
Nitrate	<0.10	35	13	5	1.7	40	BHES	Yes			10	
Antimony	<0.0030	35	0.023	5	<0.0055	40	Trigger				0.0004	0.006
Arsenic	<0.0030	35	<0.0017	5	<0.0028	40	Ambient		Yes			
Barium	<0.040	35	<0.11	5	<0.049	40	Trigger			Yes	0.002	1.0
Beryllium	<0.0010	35	<0.001	5	<0.001	40	Ambient		Yes			
Cadmium	<0.00010	35	<0.00097	5	<0.00021	40	Trigger			Yes	0.0001	0.005
Chromium	<0.00074	35	<0.0010	5	<0.00077	40	BHES	Yes			0.02	
Copper	<0.0012	35	0.026	5	<0.0043	40	BHES	Yes			0.1	
Iron	<0.010	35	<0.050	5	<0.015	40	BHES	Yes			0.2	
Lead	<0.00028	35	<0.0044	5	<0.00080	40	Trigger			Yes	0.0001	0.015
Manganese	<0.077	35	0.51	5	<0.13	40	BHES				0.05	
Mercury	<0.000030	35	<0.0000050	5	<0.000027	40	Ambient		Yes			
Nickel	<0.010	35	<0.010	5	<0.010	40	Trigger			Yes	0.0005	0.1
Selenium	<0.0010	35	<0.0013	5	<0.0010	40	Trigger			Yes	0.0006	0.05
Silver	<0.00050	35	<0.0017	5	<0.00065	40	Trigger			Yes	0.0002	0.1
Zinc	<0.0064	35	<0.010	5	<0.0069	40	BHES	Yes			0.1	

Alternative 3

Mass Balance Calculations for groundwater below TI

	Ambient Water Quality		Representative Tailing Water Input from Seepage		Projected Final Mixing Concen.		Applicable Outside of a Mixing Zone: Method to determine BHES Order limit or significant changes	Below BHES Order limit	Nonsignificant Change in Ambient Water Quality -- Carcinogenic Parameters	Nonsignificant Change in Ambient Water Quality -- Toxic Parameters	Trigger Value or BHES Order Limit	Lowest applicable standard (Toxic Parameters)
Parameter	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)	Conc. (mg/l)	Flow (gpm)					(mg/L)	
TDS	60	41	266	5	82	46	BHES	Yes			200	
Nitrate	0.100	41	13	5	1.5	46	BHES	Yes			10	
Antimony	<0.0030	41	0.023	5	<0.0052	46	Trigger				0.0004	0.006
Arsenic	<0.0030	41	<0.0017	5	<0.0029	46	Ambient		Yes			
Barium	<0.040	41	<0.11	5	<0.048	46	Trigger			Yes	0.002	1.0
Beryllium	<0.0010	41	<0.001	5	<0.001	46	Ambient		Yes			
Cadmium	<0.00010	41	<0.00097	5	<0.00019	46	Trigger			Yes	0.0001	0.005
Chromium	<0.00074	41	<0.0010	5	<0.00077	46	BHES	Yes			0.02	
Copper	<0.0012	41	0.026	5	<0.0039	46	BHES	Yes			0.1	
Iron	<0.010	41	<0.050	5	<0.014	46	BHES	Yes			0.2	
Lead	<0.00028	41	<0.0044	5	<0.00073	46	Trigger			Yes	0.0001	0.015
Manganese	<0.077	41	0.51	5	<0.12	46	BHES				0.05	
Mercury	<0.000030	41	<0.0000050	5	<0.000027	46	Ambient		Yes			
Nickel	<0.010	41	<0.010	5	<0.010	46	Trigger			Yes	0.0005	0.1
Selenium	<0.0010	41	<0.0013	5	<0.0010	46	Trigger			Yes	0.0006	0.05
Silver	<0.00050	41	<0.0017	5	<0.00063	46	Trigger			Yes	0.0002	0.1
Zinc	<0.0064	41	<0.010	5	<0.0068	46	BHES	Yes			0.1	

Notes

Determination of nonsignficance does not consider that under ARM 17.30.715(2), the DEQ may determine that a change in water quality is significant based on factors in ARM 17.30.715(2).
Determination of signficance does not consider that under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA

Appendix H—Various Streamflow Analyses

Appendix H. Water Yield Discussion for Montanore Mine Alternatives and Transmission Line Alternatives

H.1 Peak Flow Discussion

The 2015 Kootenai National Forest Plan includes the following desired condition:

> FW-DC-WTR-03. Stream flows provide for channel and floodplain dimensions that mimic reference conditions. Stream flows allow for water and sediment conveyance and overall channel maintenance. Sediment deposits from over-bank floods allow floodplain development and the propagation of flood-dependent riparian plant species. Surface and groundwater flows recharge riparian aquifers, provide late-season stream flows, cold water temperatures, and sustain the function of surface and subsurface aquatic ecosystems.

The 1987 Forest Plan included direction using the Equivalent Clearcut Area (ECA) method to analyze the effects of timber harvest and road construction on average annual water yield. Although, the 2015 KFP did not carry that specific direction forward, it is still appropriate to measure the effects of the Montanore activities across alternatives.

Timber harvest often alters normal streamflow dynamics, particularly the volume of peak flows (maximum volume of water in the stream) and baseflows (the volume of water in the stream representing the groundwater contribution). The degree these parameters change depends on the road density, percentage of total tree cover removed from the watershed, and the amount of soil disturbance caused by the harvest, among other things. For example, if harvest activities remove a high percentage of tree cover and cause light soil disturbance and compaction, rain falling on the soil will infiltrate normally. However, due to the loss of tree cover, evapotranspiration (the loss of water by plants to the atmosphere) will be much lower than before. Thus, the combination of normal water infiltration into the soil and decreased uptake of water by tree cover results in higher stream flows. In general, timber harvest on a watershed scale results in more water in the watershed available for runoff because of decreased soil infiltration and evapotranspiration. The creation of openings in a forested canopy tends to increase snow deposition (Christner and Harr 1982) and wind speeds (Chamberlin 1982). An increase in wind speeds could increase the rate of snowmelt during cloudy and rainy conditions, resulting in greater streamflow (Harr 1981).

Water yield increases due to timber harvest activities are a function of canopy reduction and miles of road. Hydrologic responses to these activities will depend on the natural characteristics of the watershed. They can include increases in snowpack depth, melting rates, surface runoff, subsurface flow interception and landform energy aspects. Rain-on-snow events occur in the project area drainages.

H.1.1 Direct and Indirect Effects to Water Yield

Water yield estimates for analysis area streams were determined for the Montanore mine alternatives using the KNF beta version of the Equivalent Clearcut Acres Calculator (ECAC). The ECAC was designed as a quick-analysis tool to enable watershed professionals to estimate the potential effects of forest management (harvest and roading). The utility of the model is that it offers a quick and consistent method of providing information on past and proposed management activities. The values generated by the model are used, in concert with other water resource information, to interpret the potential effects to a stream channel as a result of implementing a proposed land management activity. Values generated by the model are not to be considered as an absolute measure against verifiable standards, nor by themselves provide an answer as to the effects of implementing the proposed land management activity.

The ECAC process is a GIS interface between management activity databases (Oracle and TSMRS) that allows watershed specialists to estimate the current equivalent clearcut acres (ECA) within a watershed of interest. The model calculates disturbances based on the "ECA" (Equivalent Clearcut Acre) procedure. For example, a 100-acre harvest area with 100 percent canopy removal would equate to 100 ECAs; a 100-acre harvest with a 52 percent crown removal would equate to 48 ECAs. The ECAC model calculates ECA for a specified watershed based on the most recent management activities with the greatest crown removal associated with roads, timber harvest, and land conversion from a timbered to a permanently cleared state. The ECAC model does not provide peak flow estimates or sediment production and transport estimates. Watershed specialists use additional models, indices, measures, monitoring, site-specific data, and professional experience to analyze those watershed effects. The development of flow estimates from ECAC output generally involves separating watersheds by size class and precipitation regime that have already been run through the R1-WATSED model (also an ECA based program) and comparing the results with the above mentioned ECAC process to develop water yield estimates. This procedure allows a more simplified analysis based on ECAs to generate water yield estimates that have been validated by comparison with the R1-WATSED model output. Regression equations created from R1-WATSED outputs are used to determine the number of ECAs required to generate a 1 percent increase in peak flow and also the number of ECAs that recover each year in a watershed. Copies of the regression equations are included in the project file.

In an analysis of effects of forest harvest activities on peak flows and channel morphology in the Pacific Northwest, Grant *et al.* (2008) identified a detection limit for changes in peak flow measurements of about ±10 percent. They indicated that percentage changes in peak flow falling in this range are within the error of flow measurement and cannot be ascribed as an effect.

H.1.1.1 Mine Disturbances

Potential disturbances for each watershed for the proposed Montanore Project mine alternatives were analyzed using the ECAC model; the results are displayed in Tables H-1 and H-2. Mine disturbance acreages are equated to ECAs in the tables. Peak flow increases for existing conditions are for recent, existing disturbances such as timber harvests that have presumably increased peak flows. For example, the existing peak flow increase in the Little Cherry Creek watershed is related to the clearing of land in that relatively small watershed by Noranda after the original Montanore EIS was approved. None of the mine or transmission line alternatives would measurably increase peak flow in any project area watershed. Alternative 2 would have the greatest effect in the Ramsey Creek watershed (8.1 percent), which may be an unmeasurable peak flow change (Grant *et al.* 2008).

Table H-1. Projected Water Yield Increase by Mine Alternative.

Drainage	Existing		Alt 2		Alt 3		Alt 4	
	ECAs*	PFI**	ECAs	PFI	ECAs	PFI	ECAs	PFI
Bear	610	4.1	172	1.1	18	0.1	169	1.1
Big Cherry	5,145	3.0	58	<0.1	58	<0.1	58	<0.1
Getner	347	13.3	3	<0.1	3	<0.1	3	<0.1
Little Cherry‡	387	32.2	1,252	104	250	20.8	1,088	90.2
Poorman	216	5.4	214	5.3	71	1.8	26	0.7
Ramsey	166	3.6	373	8.1	31	0.7	31	0.7
Rock	1,376	3.0	1	0.0	1	0.0	1	0.0
Upper Libby†	4,038	3.2	2,522	2.0	1,507	1.2	1,865	1.5
Libby Total	28,467	4.1	2,580	0.4	1,565	0.2	1,923	0.3

Note: These values do not include the various transmission line alternatives.
†The Upper Libby Creek watershed boundary is the bridge where Libby Creek is crossed by U.S. 2.
‡In Alternatives 2 and 4, the Little Cherry Creek watershed would be altered for the construction of a tailings impoundment. These acres would not discharge water to the lower section of Little Cherry Creek. This would result in a much lower PFI (similar to existing) to the lower section of Little Cherry Creek than what is displayed.
*ECA= Equivalent Clearcut Acres.
** PFI= Percent Peak Flow Increase.

Because Alternatives 2 and 4 include the construction of a tailings impoundment in the watershed the disturbed area of the watershed would be captured within the tailings impoundment or seepage collection pond and the water would be used in the milling process for the mine. For this reason, the values shown in Tables H-1 and H-2 for Alternatives 2 and 4 for Little Cherry Creek are not realistic because water would not discharge from the impoundment during or after mining to lower Little Cherry Creek. The actual percent flow increase to Little Cherry Creek would be similar to existing conditions (32.2 percent). Little Cherry Creek below the tailings impoundment site is a bedrock dominated channel that has not shown any negative effects from the existing peak flow levels. Based on the proposed project design for the tailings impoundments after closure, the impoundment area would act as a sink for the water it captures until the water reached a level where it would then begin to flow down a lined channel off the impoundment surface toward the new diversion channel in Alternatives 2 and 4 (or into a tributary to Little Cherry Creek in Alternative 3). This process would have a dampening effect on flows from the impoundment area. There would be no impact to peak flows in the Little Cherry system because of runoff from the impoundment surface area.

Alternative 3 includes an additional 250 acres of disturbance (soil stockpile areas) in the Little Cherry Creek watershed. This soil stockpile area would be graded to retain water and sediment on the site, so the additional acres of disturbance are not expected to impact surface water flows. The cumulative PFI estimate for Alternative 3, while technically higher based on the model results, would actually mimic the existing condition level and would not be expected to change the existing channel conditions.

Table H-2. Projected Total (Existing plus Proposed) Mine Related Water Yield Increase by Alternative.

Drainage	Alt 2		Alt 3		Alt 4	
	ECAs	PFI	ECAs	PFI	ECAs	PFI
Bear	782	5.2	628	4.2	779	5.2
Big Cherry	5,203	3.0	5,203	3.0	5,203	3.0
Getner	350	13.4	350	13.4	350	13.4
Little Cherry‡	1,639	136.2	637	53.0	1,475	122.8
Poorman	430	10.7	398	10.0	348	8.7
Ramsey	539	11.7	287	7.2	242	6.0
Rock	1,377	3.0	1,377	3.0	1,377	3.0
Upper Libby†	6,560	5.2	5,545	4.4	5,948	4.7
Libby Total	31,047	4.5	30,032	4.3	30,390	4.4

Note: These values do not include the various transmission line alternatives.
†The Upper Libby Creek watershed boundary is the bridge where Libby Creek is crossed by U.S. 2.
‡ In Alternatives 2 and 4, the Little Cherry Creek watershed would be altered for the construction of a tailings impoundment. These acres would not discharge water to the lower section of Little Cherry Creek. This would result in a much lower PFI (similar to existing) to the lower section of Little Cherry Creek than what is displayed.
ECA= Equivalent Clearcut Acres, PFI= Percent Peak Flow Increase.

H.1.1.2 Transmission Line Disturbances

Potential disturbances for each watershed for the proposed Montanore Project transmission line alternatives were analyzed using the ECAC model; the results are displayed in Table H-3. Depending on which mine alternative is chosen and which transmission line alignment alternative is chosen, the total mine related impact to water yield will need to be added from Tables H-2 and H-3 for the selected watersheds. The combination of Alternative 2 and Alternative B would have the highest probability of resulting in a measurable impact to Ramsey Creek (11.7 + 0.5 = 12.2 percent increase in peak flows). Considering the previous discussion about impacts to Little Cherry Creek, the remaining mine and transmission line alternatives all have predicted peak flow increases of less than 10 percent, which may be unmeasurable. Reviewing the data in Tables H-1 and H-2, the cumulative water yield increases for Alternative 2 may be measurable in Ramsey and Poorman creeks, but none of the transmission line alternatives would affect the Poorman drainage, so the impacts would not be greater than those displayed in Tables H-1 and H-2.

Table H-3. Projected Water Yield Increase by Transmission Line Alternative.

Drainage	Alt B		Alt C-R		Alt D-R		Alt E-R	
	ECAs	PFI	ECAs	PFI	ECAs	PFI	ECAs	PFI
Howard	16	1.1	20	1.4	59	4.2	59	4.2
Ramsey	27	0.5	0	0	0	0	0	0
Midas	36	0.9	40	1.0	0	0	0	0
Miller	104	0.6	115	0.7	122	0.7	21	0.1
Upper Libby†	95	<0.1	69	<0.1	69	<0.1	69	<0.1
West Fisher	0	0	48	<0.1	57	<0.1	190	0.3
Fisher Tribs‡	10	<0.1	63	n/a	63	n/a	63	n/a
Fisher Total	199	<0.1	247	<0.1	263	<0.1	295	<0.1

‡Fisher River tributaries include Hunter and Sedlak creeks, and a small side drainage. These areas were all combined in the Fisher Total value.
†The Upper Libby Creek watershed boundary is where Libby Creek is crossed by U.S. 2.
ECA= Equivalent Clearcut Acres, PFI= Percent Peak Flow Increase.

H.1.2 Cumulative Effects to Peak Water Yield

H.1.2.1 West Fisher Creek Watershed

An analysis for cumulative effects that includes activities beyond those associated with the proposed mine was completed in the *Miller-West Fisher EIS* (KNF 2009). A summary of that analysis is included here; please see that document for a complete review of the analysis. The analysis included the following activities:

- Private Timber Company (PCTC) timber harvest
- Forest-Wide Fuels burn units
- Miller Creek Wildlife Habitat Improvement Burn Units
- Montanore and Libby Adit Projects
- Green Mountain Fuel Reduction Units
- Rock Creek Mine Project
- Bear Lakes Estate Access
- Wayup and Fourth of July Mines Access
- Other small activities such as outfitter and guide use, and monitoring activities.

These activities were analyzed in combination with the Miller West Fisher EIS (Alternative 6 activities). The results of those combined activities are displayed below for the larger Fisher River watershed and assume that PCTC and the approved USFS timber sales would have been completed in one year (2010). The analysis used the E-R transmission line route, and because of potential impacts to Miller Creek, Alternative D-R was also included for analysis for that basin and is displayed in Table H-4.

Table H-4. Miller West Fisher EIS Cumulative Water Yield Results - Alternative 6 (2010).

Drainage	Watershed Size (acres)	ECA (acres)	Cumulative Peak Water Yield Increase (%)	Road Density (miles/mi^2)
Miller Creek	7,563	2,275	13.4 (14.1 D-R)	2.56
West Fisher Creek	28,950	3,122	4.5	2.25
Silver Butte Creek	29,934	1,157	1.6	1.07
Fisher River	250,551	64,927	5.0	4.2

The cumulative effects associated with the Fisher River basin have been lumped into one year (2010). Based on the Fisher Physiographic Area NFMA analysis (2003), approximately 250 acres of recovery occur in both the West Fisher and Silver Butte watersheds per year. For the entire Fisher River watershed, over 4,000 acres of recovery occur each year in the 250,000 acre watershed. Because the proposed harvest would extend to 2020, the amount of recovering ECAs in that time period would more than offset the additional harvest acres from the PCTC activities. Even with all the ECAs being lumped into one year, the resulting increase is 0.7 percent. This level of water yield increase would be very difficult to separate from natural variability in the system and would be negligible in the Fisher basin. It is not expected that the projected peak flow increases in West Fisher, Silver Butte and the Fisher River would cause a change in existing channel stability.

Grant *et al.* (2008) suggested that when the cumulative impacts to a watershed result in an increase in water yield above 10 percent that the change may be measurable in that watershed.

The worst case flow estimated cumulative peak flow increase (Alternative D-R) of 14.1 percent in Miller Creek would still be below reference conditions. Based on field reviews and past stream monitoring, it is expected that the projected water yield increase would not result in a degraded channel condition. The projected portion of the increase in peak flow from the Montanore project transmission line in the Miller Creek basin is 0.7 percent above the project existing condition.

H.1.2.2 Libby Creek Watershed

A cumulative analysis for water yields in the entire Libby Creek watershed was completed in 2004 for the Treasure Interface EA (KNF 2004a). That analysis has been updated using existing data supplied by the USFS. Exact acreages of private harvest in the basin were not available, but average harvest rates have been used to update the prior cumulative effects analysis for water yields in the larger Libby Creek watershed.

Table H-5. Treasure Interface Cumulative Water Yield Results – 2004.

Drainage	Acres	Predicted PFI**	ECA*** USFS	ECA Other	Road Miles
Prospect	4,005	25.5	340	806	14
Big Cherry*	23,538	4.7	804	1,640	40
Libby	150,017	4.1	18,032	10,435	661

* That portion of Big Cherry Creek from Libby creek up to and including Granite Creek.
** PFI = Peakflow Increase (%).
***ECA = Equivalent Clearcut Acres.

It is assumed that 400 acres per year of harvest for the last 8 years equals 3,200 acres of new harvest. Prior analyses (the Libby NFMA, KNF 2004b) has shown that approximately 440 acres of vegetative recovery occur each year. This equates to 3,520 acres of recovery in the past 8 years. Overall, the updated analysis would suggest that there has been an equal amount of harvest and recovery, so the values from the Treasure Interface EA for the entire Libby Creek watershed (which are displayed in Tables H-1 and H-2) remain valid for reviewing cumulative impacts in this watershed.

Water yield increases like the ones estimated for the Libby Creek watershed fall into a zone of natural variability and would be difficult to separate from natural changes. The level of water yield increase in Prospect Creek is expected to be measurable and was discussed in the Treasure Interface EA. There are no proposed activities from any of the Montanore alternatives in the Prospect Creek watershed.

H.2 Annual Water Yield Discussion

H.2.1 Direct and Indirect Increases to Annual Water Yield

The removal of vegetation on a landscape has been shown to impact watersheds in numerous ways. Besides increasing peak water yields, annual water yields are also increased. These effects have been documented by numerous researchers (Stednick 1996, 2008; Keppler and Zimmer 1990; Rothacher 1970). Modeling of these predictable changes was completed for the Montanore and Rock Creek mining proposals. Generally, land managers are most concerned with changes in the amount of water that would be available during the peak runoff period because it has the highest potential to have channel changing impacts.

Annual water yield predictions for the Montanore Project are based on both water yield modeling programs (ECAC and WATSED) used by the KNF. The ECAC process is used by the KNF to evaluate potential impacts to water yield from land management activities. The ECAC is based on outputs from relationships developed from the R l-WATSED model. The WATSED model also includes a sediment prediction element and an annual water yield component. Numerous WATSED model outputs with similar watershed characteristics were used to calculate annual water yield increases and predicted peak flow increase. The agencies completed such an analysis for all the Montanore alternatives. The annual water yield factor displayed in the following tables was used to estimate annual water yield for basins which did not have a WATSED model run. The water yield factor was multiplied by the basin acreage to determine the estimate of the annual water yield in acre-feet (af). This value was then converted to a discharge (cfs) value. This results in an estimated average daily flow volume in cfs for each basin. The precipitation values in Table H-4 were generated using climate data available when the WATSED model runs were completed prior to new updated climate information.

Table H-6. WATSED Generated Water Yield and Precipitation Data on the KNF.

Drainage	Size (acres)	Yearly Precip. (inches)	Annual Water Yield (AF)	Percent of Precip. as Runoff	Water Yield Factor (annual water yield / basin size)	Average Daily Flow Volume (cfs)	Annual Water Yield Increase (percent)	Peak Flow Increase (percent)
WF Rock Creek	3,814	48.8	7,851	51	2.1	10.9	6	7
EF Rock Cr. Total	10,115	54.2	24,401	53	2.4	33.8	0	0
Rock Creek Total	21,162	48.8	43,366	50	2.0	60	3	3
Rock Creek Upper Trib.	347	42.1	553	45	1.6	0.8	3	3
Engle Creek	2,092	44.8	3,701	48	1.8	5.1	6	6
Big Cedar Gulch	620	44.3	1,083	47	1.7	1.5	17	23
Orr Creek	950	47.3	1,848	49	1.9	2.6	6	8
EF Rock Creek (lower section)	3,950	50.5	8,524	51	2.1	11.8	1	1
Lower Rock Creek (subwatershed)	7,233	41.1	11,114	45	1.5	15.4	1	1
Bristow Creek	14,976	26.1	9,931	31	0.7	13.7	6	4
Quartz Creek	21,808	40.8	34,084	46	1.6	47.2	7	6
Upper Little Wolf Creek	14,344	24.8	8,556	29	0.6	11.8	18	21

Table H-7 displays the proposed major facilities and disturbed acres for each alternative. Table H-8 displays estimated changes to annual water yields and to the amount of estimated change expected to occur during the baseflow period for mine activities only. Ziemer and Lisle (1998) found that in the Rocky Mountains, approximately 85 percent of annual streamflow occurs from May through July, with less than 5 percent occurring during the winter months. It is assumed that typically about 15 percent of annual streamflow in the project area occurs during the baseflow period in late summer and fall.

Table H-7. Major Facilities and Disturbed Acres of Each Mine Alternative by Watershed.

Drainage	Alt 2		Alt 3		Alt 4	
	Facilities	Disturbed Acres	Facilities	Disturbed Acres	Facilities	Disturbed Acres
Bear Creek	Roads, Borrow Area	164.5	Roads	11	Roads, Borrow Area	162
Bear Creek Trib.	Roads	7	Roads	7	Roads	7
Big Cherry Cr.	Roads	44	Roads	44	Roads	44
Big Cherry Trib.	Roads	14	Roads	14	Roads	14
Getner Cr.	Roads	3	Roads	3	Roads	3
Libby Creek Lower	Roads	3	Roads	3	Roads	3
Libby Creek Upper	Libby Adit, Roads	258	Libby Adit, Plant Site, Roads	298	Libby Adit, Plant Site, Roads	309
Upper Libby Trib.	Diversion Channel	248	Tailings Impoundment, Borrow Areas	833	Diversion Channel	236
Little Cherry Cr.	Tailings Impoundment, Borrow Areas, Soil stockpiles	1,252	Soil Stockpiles	250	Tailings Impoundment, Borrow Areas, Soil stockpiles	1,088
Poorman Cr.	LAD Area, Roads	214	Roads	71	Roads	26
Ramsey Cr.	Plant Site, LAD Areas, Roads	373	Roads	31	Roads	31
Rock Cr.	Ventilation Adit	<1	Ventilation Adit	<1	Ventilation Adit	<1

Table H-8. Annual Water Yield Data for Mine Only Activities by Alternative.

Drainage	Size (acres)	Predicted Mine Related Peak Flow Increase (percent)	Average Annual Precip. (in) /water yield factor	Predicted Mine Related Annual Increase (percent)			Average Daily Annual Flow (cfs)	Predicted Mine Related Flow Increase During the Baseflow Period * (cfs)		
				Alt 2	Alt 3	Alt 4		Alt 2	Alt 3	Alt 4
Bear Cr.	9,517	Alt 2- 1.1 Alt 3- 0.1 Alt 4- 1.1	56 / 2.4	1	0.1	1	32	<.1	<.1	<.1
Big Cherry Cr.	54,828	All Alts- <.1	48 / 2.0	<.1	<.1	<.1	152	0	0	0
Getner Cr.	2,709	All Alts- <.1	54 / 2.4	<.1	<.1	<.1	9	0	0	0
Little Cherry Cr.	1,682	Alt 2-104 Alt 3-20.8 Alt 4-90.2	38 / 1.5	80	17	72	4	0.5	0.1	0.4
Poorman Cr.	3,985	Alt 2-5.3 Alt 3- 1.8 Alt 4- 0.7	59 / 2.4	5	1.5	.5	13	<.1	<.1	<.1
Ramsey Cr.	4,330	Alt 2-8.1 Alt 3-0.7 Alt 4- 0.7	55 / 2.4	8	.5	.5	14	<.2	0	0
Rock Cr.	21,162	All Alts - 0	48.8 / 2.0	0	0	0	60	0	0	0
EF Bull River	24,054	All Alts - 0	63 / 2.4	0	0	0	80	0	0	0
Upper Libby Cr.	42,832	Alt 2- 2.0 Alt 3- 1.2 Alt 4- 1.5	44 / 1.8	2	1	1	107	0.3	0.2	0.2
Libby Cr. Total	150,018	Alt 2- 0.4 Alt 3- 0.2 Alt 4- 0.3	26 / 0.7	.4	.2	.3	145	<.1	0	<.5

*Approximately 15 percent of the annual flow occurs during the baseflow period (Ziemer and Lisle, 1998). For example, in the Bear Cr. Watershed, 15 percent of the predicted 0.1 percent annual flow increase would equal a 0.00015 percent increase in the daily average flow ; .00015 x 32 cfs = .0048 cfs, which was rounded to <0.1.

H.2.1.1 Cumulative Effects to Annual Water Yield

To evaluate cumulative effect in the watersheds of all management activities (private and federal), including the proposed mine activities out to the end of mine life (year 2040), it was assumed that future forest management activity levels would remain at the same general levels they have for the past 50 years. Table H-9 displays the cumulative predicted changes to the annual water yield and average daily flow volume for the project watersheds. The predicted cumulative annual baseflow increase levels in Table H-9 would most likely be similar to levels expected after the mine closed. All the transmission line alternatives have very similar projected impacts in the project watersheds. The majority of the predicted increases are well below 1 percent, with only one subwatershed having an impact of a 4 percent increase. Because all transmission line alternatives had very similar effects, the largest impact was chosen to be included in this cumulative effects analysis and was included for each mine alternative for the Upper Libby and Fisher River watersheds. The analysis locations for all the watersheds are outside of the Cabinet Mountains Wilderness because only man-caused land disturbing activities were used in the analysis process and there would be none in the Cabinet Mountains Wilderness. The analysis location for the East Fork Bull River is at the confluence with the Bull River, and the analysis location for Upper Libby Creek is where it crosses US Highway 2. The analysis location for the Fisher River is where it meets the Kootenai River.

Table H-9. Predicted 2040 Cumulative Base Flow Increases for Project Area Watersheds by Mine Project Alternative.

Drainage	Size (acres)	Cumulative Peak Flow Increase (percent)	Average Annual Precipitation (inches) and Water Yield Factor	Existing and Projected Annual Increase (percent)	Average Daily Annual Flow (cfs)	Cumulative Increase in Flow During Base Flow Period* (cfs)
Bear Creek	9,517	Alt 2 – 5.2 Alt 3 – 4.2 Alt 4 – 5.2	56 and 2.4	Alt 2 – 5.0 Alt 3 – 4.0 Alt 4 – 5.0	32	Alt 2 – 0.24 Alt 3 – 0.20 Alt 4 – 0.24
Big Cherry Cr	54,828	All Alts – 3.0	48 and 2.0	All Alts – 3.0	152	All Alts – 0.7
Getner Creek	2,709	All Alts –13.4	54 and 2.4	All Alts – 13.0	9	All Alts - 0.2
Little Cherry Cr**	1,682	Alt 2 – 136.2 Alt 3 – 53.0 Alt 4 – 122.8	38 and 1.5	Alt 2 – 130 Alt 3 – 50 Alt 4 - 120	3.5	Alt 2 – 0.7 Alt 3 – 0.3 Alt 4 – 0.6
Poorman Creek	3,985	Alt 2 – 10.7 Alt 3 – 10.0 Alt 4 – 8.7	59 and 2.4	Alt 2 – 10 Alt 3 – 9 Alt 4 - 8	13	Alt 2 –0.2 Alt 3 – 0.2 Alt 4 – 0.2
Ramsey Creek	4,330	Alt 2 – 11.7 Alt 3 – 7.2 Alt 4 – 6.0	55 and 2.4	Alt 2 – 11 Alt 3 – 7 Alt 4 - 5	14	Alt 2 – 0.2 Alt 3 – 0.2 Alt 4 – 0.1
Upper Libby Cr	42,832	Alt 2 – 5.2 Alt 3 – 4.4 Alt 4 – 4.7	44 and 1.8	Alt 2 – 5.0 Alt 3 – 4.0 Alt 4 – 4.0	107	Alt 2 – 0.8 Alt 3 – 0.6 Alt 4 – 0.6
Rock Creek	21,162	All Alts – 3.0	48.8 and 2.0	All Alts – 3.0	60	All Alts – 0.3
EF Rock Creek	3,950	All Alts – 1.0	50.5 and 2.1	All Alts – 1.0	12	All Alts <0.1
EF Bull River	24,054	All Alts - 6.5	63 and 2.4	All Alts – 6.0	80	All Alts – 0.7
Fisher River	250,551	All Alts – <0.1	22 and 0.6	All Alts< 0.1	200	All Alts < 0.1

*Approximately 15 percent of the annual flow occurs during the baseflow period (Zimmer and Lisle, 1998). For example in the Big Cherry Cr. Watershed, 15 percent of the predicted 3 percent annual flow increase would equal a 0.0045 percent increase in the daily average flow ; .0045 x 152 cfs = 0.7 cfs.
**Most of the surface flows in the Little Cherry Creek watershed would be captured by the tailings impoundment and Seepage Collection Pond in Alts 2 and 4 and used in the mining process. In Alternative 3, only a portion of the watershed would be disturbed and that area would have a flow and sediment containment BMP set up around the soil stockpiles to prevent any movement of materials off the disturbed site.

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January 4, 2010

To: Montanore Mine Project EIS

From: Jack Denman, Richard Trenholme, ERO Resources Corporation

Re: **Montanore Tailings Impoundment Watershed Analysis**

This memorandum presents the findings of an analysis of the changes to watershed boundaries resulting from the various tailings impoundment locations for each of the three alternatives (Alternatives 2, 3, and 4) for the Montanore Project. The purpose of the analysis is to assess changes in watershed areas as an indicator of possible streamflow changes.

The primary assumption of this analysis is that watershed area, as a direct measure of catchment area, is directly related to streamflow of the receiving stream in each watershed. Additional assumptions are:

1. Differences in precipitation and runoff due to elevation, soil type, vegetative cover, slope, aspect or other physical, biological, or geologic characteristics of the watershed are negligible across the analysis area. Within the small watersheds of the tailings impoundment sites, differences in elevation are slight.
2. All surface runoff in contact with tailings during operational periods would be intercepted and pumped to the mill for use.
3. The South Saddle Dam and Main Dam (Alternatives 2 and 4) and the Main Dam and Seepage Collection Dam (Alternative 3) would be constructed of tailings, and surface runoff would be pumped to mill.
4. The North Saddle Dam and Diversion Dam (Alternatives 2 and 4) and the Saddle Dam (Alternative 3) would be constructed of local soil and rock, not tailings, and surface runoff would be managed as stormwater and flow into nearby streams.
5. Surface runoff associated with soil stockpiles located across existing watersheds would remain within the respective existing watershed.
6. Surface runoff from the borrow areas outside of the impoundment footprint in Alternatives 2 and 4 would be channeled to Bear Creek during operations and graded to flow into the tailings impoundment upon closure.
7. Seepage collection dams would be removed as part of mine closure.

Watershed Calculations

For the purpose of this analysis, the existing proposed footprints for the three tailings impoundments and associated facilities were plotted over the Hydrographic Unit boundaries. The boundaries were a GIS coverage provided by the Kootenai National Forest (KNF). ERO altered one hydrographic unit, the Libby Creek Upper Tributary, from that provided by the KNF. The altered unit is between Little Cherry Creek and Poorman Creek, and is the unit in which most of the Poorman Tailings Impoundment in Alternative 3 would be located. ERO altered the boundary based on studies of the Diversion Channel and the Poorman Impoundment Site. Kline (2005) reported that the USGS topographic map indicates the diverted stream (between National Forest Service (NFS) roads #6212 and #5181) would flow to the southeast. The field survey revealed that the stream would flow to the northeast and discharge to Libby Creek 1,900 feet downstream of the location indicated on the topographic map. Geomatrix (2006) labeled this stream Channel A. Kline (2005) reported that a closed spur of NFS road #5181 has a culvert to convey the diverted stream and another culvert 1,157 feet to the south. The diverted stream would not naturally flow to the south culvert. According to Kline (2005), it was often difficult to judge where water would flow downgradient of NFS road #5181. Geomatrix (2006) described this south channel as Channel B. In a wetland delineation of the Poorman Impoundment Site, Geomatrix (2007) identified four channels between Little Cherry Creek and Poorman Creek. MMC proposes to divert flows up to about 20 cfs into Channel A, and higher flows into both channels (Geomatrix 2007). Based on these reports and air photo-interpretation, ERO delineated a watershed for Channel A, and a separate watershed for Channel B and the other two channels. The watershed for Channel A is labeled Channel A for this analysis; the watershed for Channel B and the other two channels is labeled Channel BCD.

Each impoundment feature and associated "sub-watershed" was mapped as a polygon using ArcGIS. The mapping enabled an impact area to be calculated for each feature by watershed. For example, precipitation intercepted by the impoundment surface, Main Dam, South Saddle Dam, and Seepage Collection Dam in Alternatives 2 and 4 would be intercepted and sent to the mill. For Alternative 2, this sub-watershed is labeled LCC-2. Likewise, precipitation upstream of the Diversion Dam in Alternative 2 would be diverted into Channel A. This sub-watershed is labeled LCC-5. For purposes of analysis, it was assumed all water upstream of the Diversion Dam in Alternatives 2 and 4 would be diverted into Channel A. This assumption would accurately reflect relative change except during high flow periods, when some flow would flow to Channel B in the Channel BCD watershed. Changes to all watersheds were either added or subtracted from the existing watershed area, depending on whether the change would add watershed area, and therefore "water" to the watershed, or remove it. Total watershed areas were calculated from the location on the receiving stream that would receive diverted "watershed area." As a quality control check, the summation of all diversion areas equal to zero was checked for each scenario to ensure that areas were not counted twice. Finally, percent change in the watershed was calculated for each measurement location of receiving streams to qualitatively estimate potential changes in flow associated with the diversions. Calculations for all three alternatives were performed, for both operational periods and post-closure based on the general conditions of operation and closure discussed in this memorandum.

Watershed Analysis – Alternative 2

Changes to watershed areas during Alternative 2 operations are shown on Figure 1. Surface runoff from the west face of the Diversion Dam and the Little Cherry Creek watershed upstream of the tailings impoundment (LCC-5) would be diverted to Channel A via the engineered diversion channel. This diversion would become the "new" Little Cherry Creek. The watershed of Channel A would increase during operations from 237 acres to 974 acres. Some high flows would be directed into Channel B. During operations, all surface water in contact with tailings and within the sub-watershed of the Seepage Collection Dam (LCC-2, CHA-2, and BC-1) would be pumped to the mill. These diversions would reduce the watershed of the former Little Cherry Creek from 1,682 acres to 225 acres. The watersheds of two locations in Bear Creek would increase slightly (Table 1). Surface runoff from the borrow area uphill from the tailings impoundment (LCC-4) would be diverted around the Diversion Dam, ultimately into Channel A. Surface runoff from the north face of the North Saddle Dam (LCC-3) would be treated as storm runoff and diverted to Bear Creek.

Alternative 2 post-closure changes to watershed areas are shown on Figure 2. The surface of the tailings impoundment would be graded so that drainage west of the Main Dam crest and north of the South Saddle Dam crest would flow toward Bear Creek. The diversion channel that allowed drainage from the borrow area (LCC-4) would be removed to allow flow into the tailings impoundment and north to Bear Creek with the tailings impoundment surface flow (LCC-6). The watershed area in Bear Creek would increase by 560 acres.

The Seepage Collection Dam would be removed and the former Little Cherry Creek watershed would extend west to the crest of the Main Dam. Runoff east of the Main Dam crest would remain in the former Little Cherry Creek watershed (LCC-8). Similarly, surface runoff upstream of the Diversion Dam face (LCC-7) and south of the South Saddle Dam face (CHA-13) would remain in the Channel A watershed upon closure. After closure, Channel A would have a watershed 678 acres larger than its current 237 acres (Table 1). The Libby Creek watershed at the confluence of Channel A would have a slightly larger watershed (678 acre or 3 percent). Between the confluence of the former Little Cherry Creek and Bear Creek, the Libby Creek watershed would have a slightly smaller watershed (560 acres or 2 percent) compared to existing areas. The Libby Creek watershed above the confluence with Bear Creek, would remain unchanged (Table 1).

Table 1. Changes in Watershed Areas during Operations and Closure, Alternative 2.

	Bear Creek		Former Little Cherry Creek	Channel A	Libby Creek		
Measurement Location	BC-7208	BC-8281	LCC-1682	CHA-A-237	LC-23245	LC-25637	LC-35853
Existing Watershed Area (ac.)	7,208	8,281	1,682	237	23,245	25,637	35,853
Operations							
Change in Watershed (ac.)	8	2	-1,457	737	737	-720	-720
New Watershed Area (ac.)	7,217	8,283	225	974	23,982	24,917	35,135
% Change	<1%	<1%	-87%	311%	3%	-3%	-2%
Closure							
Change in Watershed (ac.)	560	560	-1,238	678	678	-560	0
New Watershed Area (ac.)	7,768	8,841	445	915	23,923	25,077	35,853
% Change	8%	7%	-74%	286%	3%	-2%	0%

Watershed Analysis – Alternative 3

Alternative 3 operational changes to the existing watersheds are shown in Figure 3. During operations, surface runoff from below the access road, in contact with tailings, the Main Dam face, and within the Seepage Collection Dam sub-watershed (CHBD-b2a, CHBD-3b, CHA-4, CHBD-1, LC-3, LC-4, LCC-9, LCC-10, and LCC-11), would be diverted to the mill. Surface runoff from the Saddle Dam face (CHA-5) would be diverted to Little Cherry Creek. Surface runoff from the western watershed boundary of Channels BCD to the access road would be diverted as storm water based on a topographic divide between Channels C and D, with runoff from the northern sub-watershed (CHA-6 and CHBD-3a) diverted to Little Cherry Creek; and runoff from the southern sub-watershed (CHBD-2a) diverted to Poorman Creek. Runoff from the southern portion of the Channel BCD watershed (CHBD-4) would be diverted to Libby Creek because of topographic isolation from the remaining Channel BCD watershed by the Main Dam. These diversions would reduce the watershed of Channel BCD from 759 acres to 100 acres. The watersheds of Poorman Creek and Little Cherry Creek would increase during operation by 112 and 53 acres, respectively (Table 2). The Libby Creek watershed between Poorman Creek and Channels BCD would increase slightly (132 acres or <1 percent), and decrease slightly between Channels BCD and the confluence of Channel A and Libby Creek (744 acres or 3 percent).

Alternative 3 post-closure changes to existing watersheds are shown on Figure 4. After closure, the surface of the tailings impoundment would be graded to allow surface runoff from the impoundment to flow toward Little Cherry Creek. A portion of the northern face of the Main Dam (CHA-12) would flow into the Little Cherry Creek drainage because of the elevation of the final dam face. The drainage channel that allowed surface runoff from the western portion of the Channel BCD watershed to flow to Poorman Creek (during operations) would be removed and graded to allow all surface drainage to flow toward Little Cherry Creek (CHBD-6, CHBD-8, and CHA-8). These changes would increase the watershed of Little Cherry Creek from 1,457 to 2,101 acres. The Poorman Creek watershed would remain unchanged at closure/post-closure, compared to the pre-operation size of the watershed.

Surface runoff from the face of the Main Dam would remain in the respective watersheds of final construction (sub-watersheds CHA-7, CHBD-5, CHBD-7, LCC-9, LCC-10 and LC-3). The Seepage Collection Dam would be removed prior to post-closure. Surface runoff from the south face of the Main Dam (CHBD-7) and the southern extent of the Channel BCD watershed (CHBD-4) would flow to Libby Creek because of the topographic isolation described above during operations. The Libby Creek watershed above the confluence with Little Cherry Creek, would remain unchanged (Table 2).

Table 2. Changes in Watershed Areas during Operations and Closure, Alternative 3.

	Poorman Creek	Little Cherry Creek		Channel A	Channel BCD	Libby Creek		
Measurement Location	PC-3651	LCC-940	LCC-1457	CHA-A-237	CHA-BCD-759	LC-21482	LC-23245	LC-25637
Existing Watershed Area (ac.)	3,651	940	1,457	237	759	21,482	23,245	25,637
Operations				-207	-659	132	-744	-689
Change in Watershed (ac.)	112	53	55	30	100	21,614	22,501	24,948
New Watershed Area (ac.)	3,763	993	1,512	-87%	-87%	0.61%	-3%	-3%
% Change	3%	6%	4%	237	759	21,482	23,245	25,637
Closure								
Change in Watershed (ac.)	0	633	644	-157	-561	74	-644	0
New Watershed Area (ac.)	3,651	1,573	2,101	80	198	21,556	22,601	25,637
% Change	0%	67%	44%	-66%	-74%	<1%	-3%	0%

Watershed Analysis – Alternative 4

Alternative 4 operational changes to existing watersheds are shown in Figure 5. Surface water drainage during operations is similar to Alternative 2, with all surface runoff in contact with tailings to be pumped to the mill (LCC-14, CHA-2, and BC-1). Surface runoff from the North Saddle Dam face (LCC-3) would flow to Bear Creek. The watershed of Bear Creek would increase by about 2 to 8 acres (Table 3). A diversion ditch at the base of the borrow area (LCC-15) would divert surface runoff as stormwater to the diversion dam. Surface runoff from the Little Cherry Creek watershed above the Diversion Dam (LCC-13) and the soil borrow area (LCC-15) would be conveyed to Channel A. Tailings runoff diversion to the mill and Channel A diversions would reduce the watershed of Little Cherry Creek by 1,457 acres and increase the watershed of Channel A by 737 acres.

Alternative 4 changes to existing watersheds after closure are shown in Figure 6. The primary difference between Alternatives 2 and 4 is in closure. In Alternative 4, the Tailings Impoundment would be sloped to allow drainage to the southwest, around the

Diversion Dam. The diversion ditch at the base of the borrow area would allow flow to the Tailings Impoundment and subsequently to Channel A. Flows from the Tailings Impoundment (LCC-15 and LCC-16), and from the Little Cherry Creek watershed above the Diversion Dam (LCC-18), would be diverted to Channel A. The Seepage Collection Dam would be removed prior to closure. Surface flow from the dam faces would flow downhill to the receiving watershed, post-closure. These changes would decrease the watershed of Little Cherry Creek by 1,242 acres. The Channel A watershed would increase by 1,234 acres. The Libby Creek watershed, above the confluence with Bear Creek, would remain unchanged (Table 3).

Table 3. Changes in Watershed Areas during Operations and Closure, Alternative 4.

	Bear Creek		**Little Cherry Creek**		**Channel A**	**Libby Creek**		
Measurement Location	BC-7208	BC-8281	LCC-1457	LCC-1682	CHA-A-237	LC-23245	LC-25637	LC-35,853
Existing Watershed Area (ac.)	7,208	8,281	1,457	1,682	237	23,245	25,637	35,853
Operations								
Change in Watershed (ac.)	8	2	-1,457	-1,457	737	737	-720	-720
New Watershed Area (ac.)	7,216	8,283	0	225	974	23,982	25,242	35,102
% Change	<1%	<1%	-100%	-87%	311%	3%	-3%	-2%
Closure								
Change in Watershed (ac.)	8	8	-1,242	-1,242	1,234	1,234	-8	0
New Watershed Area (ac.)	7,216	8,289	215	440	1,470	24,478	25,629	35,853
% Change	<1%	<1%	-85%	-74%	520%	5%	<1%	0%

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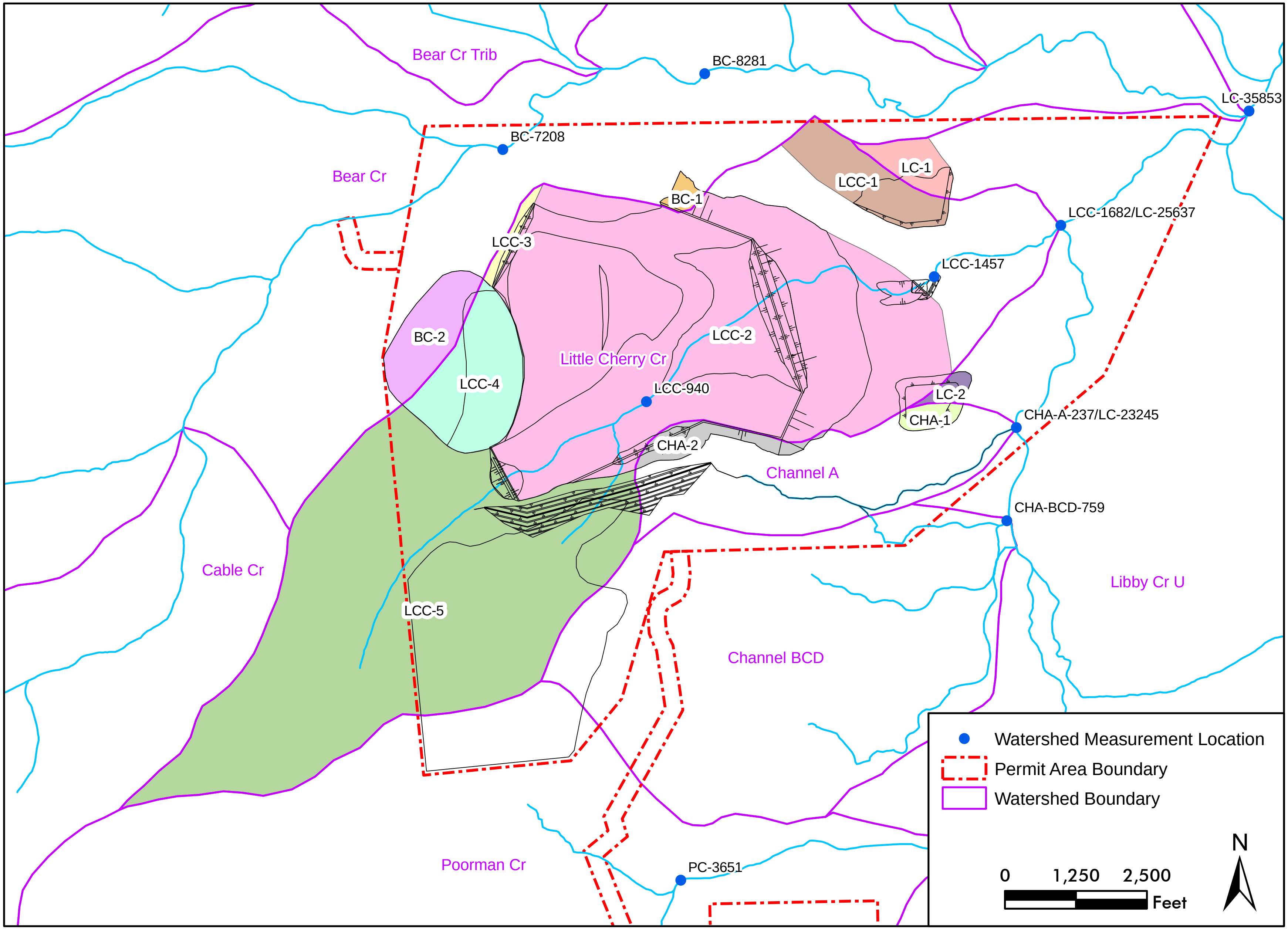

Figure 1. Watershed Analysis, Alternative 2 Operations

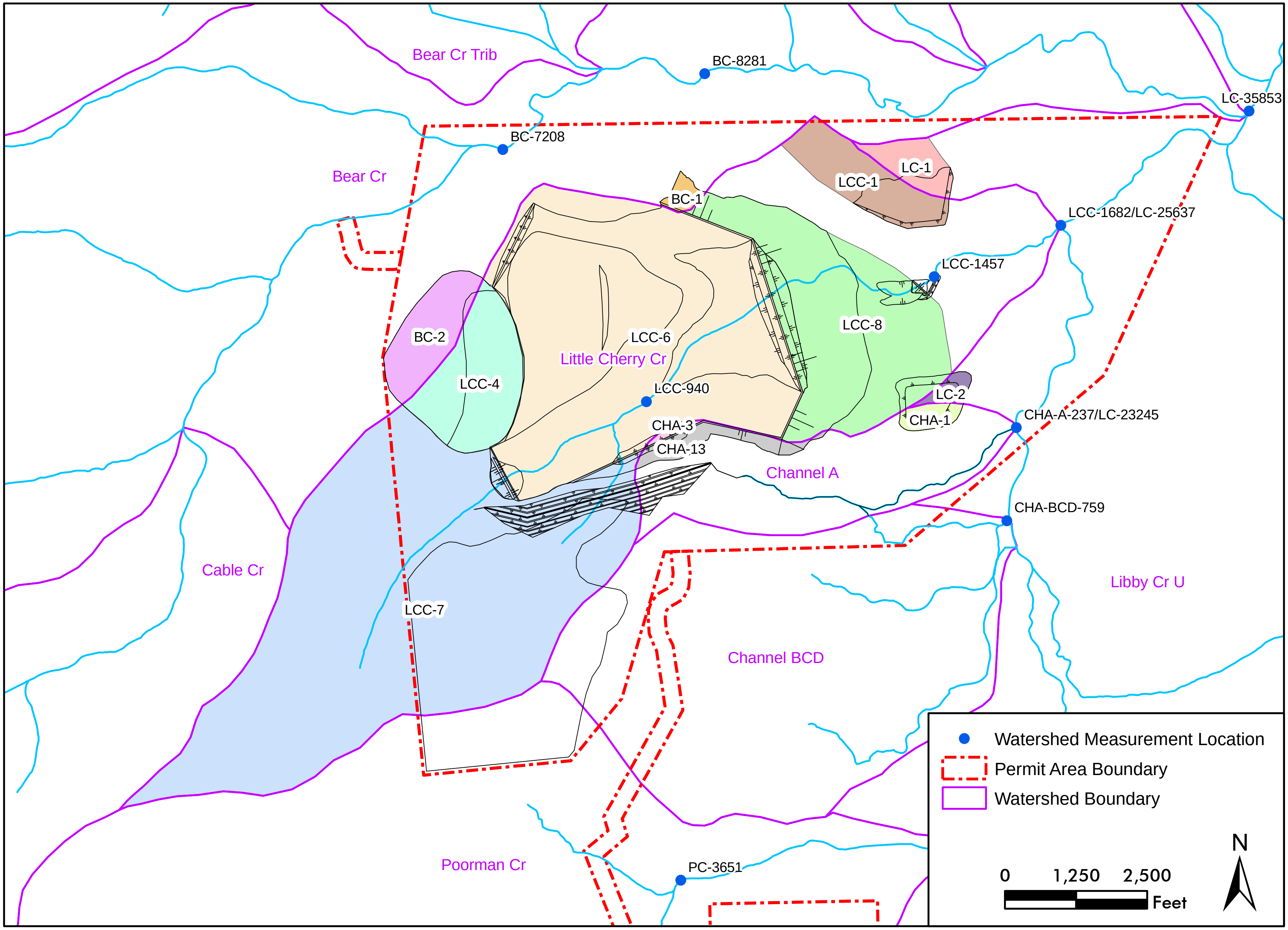

Figure 2. Watershed Analysis, Alternative 2 Closure

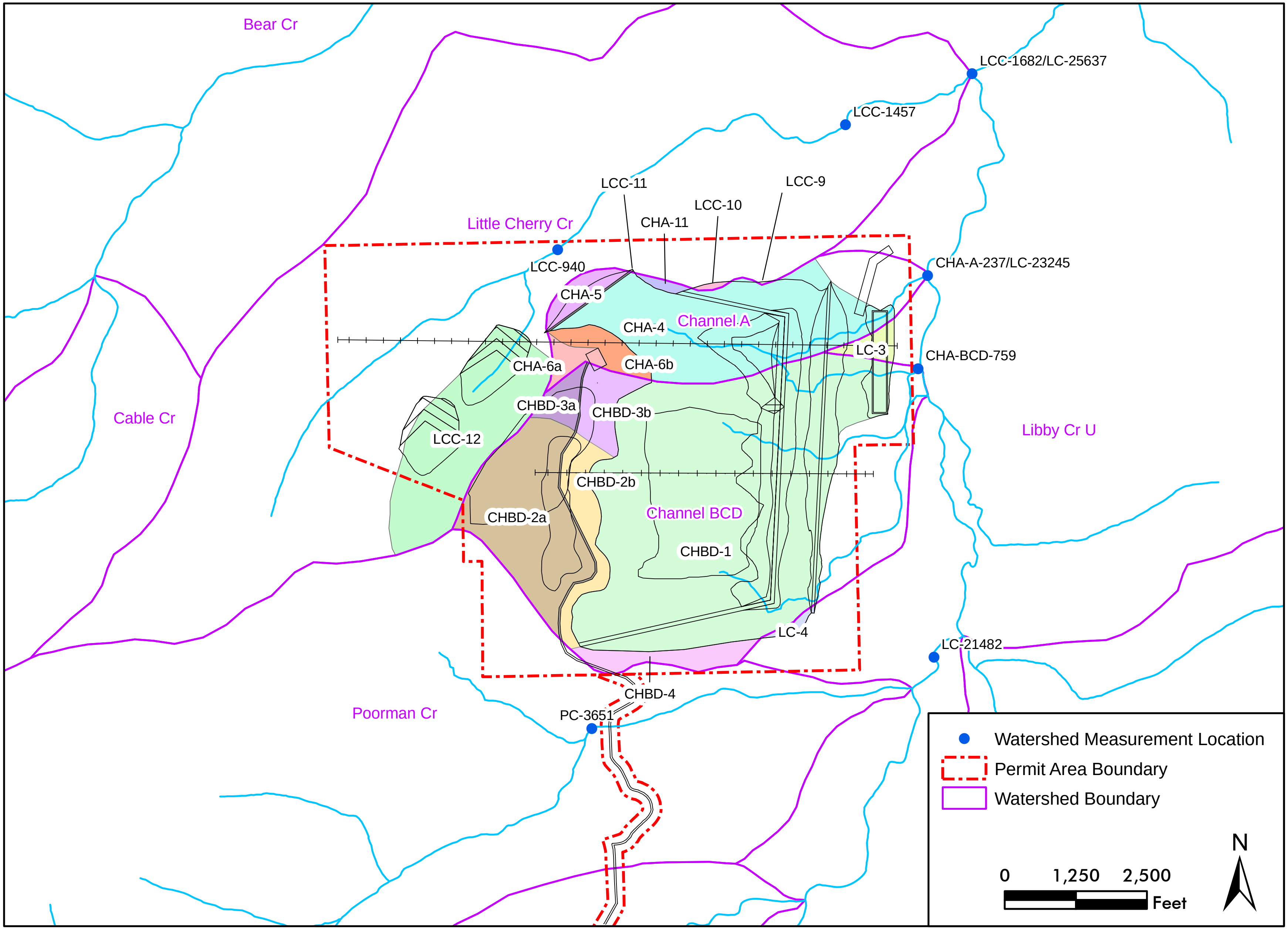

Figure 3. Watershed Analysis, Alternative 3 Operations

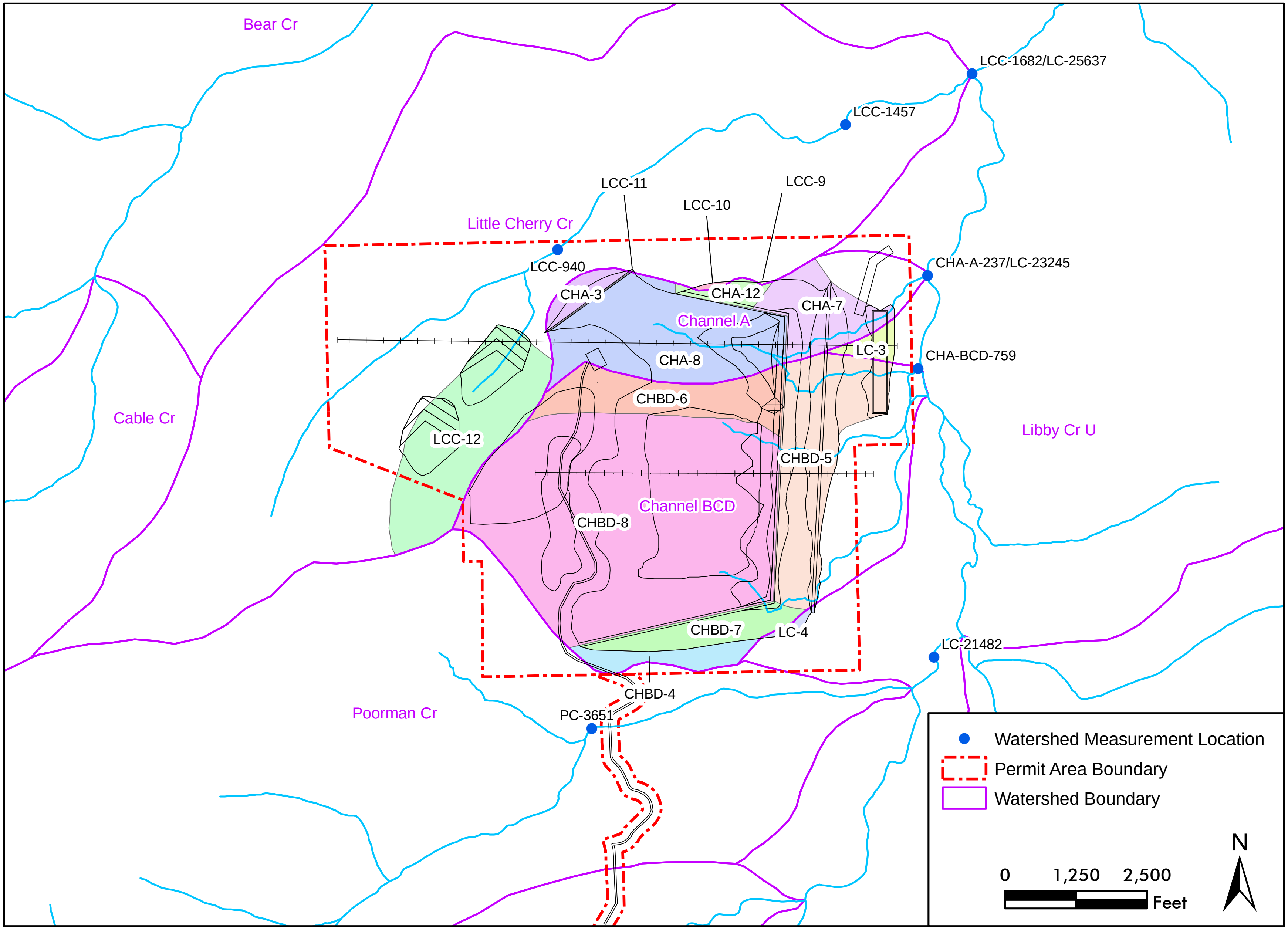

Figure 4. Watershed Analysis, Alternative 3 Closure

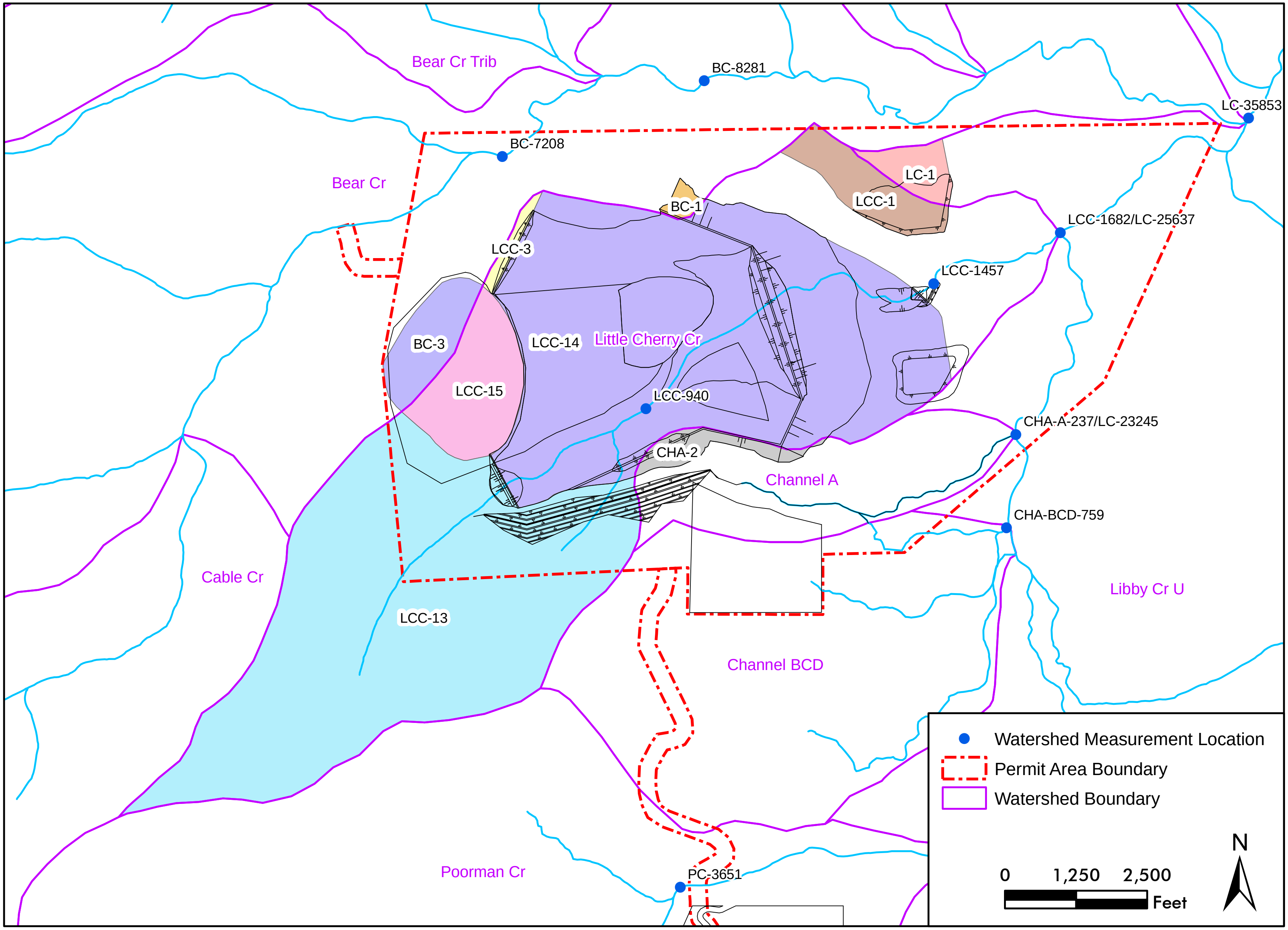

Figure 5. Watershed Analysis, Alternative 4 Operations

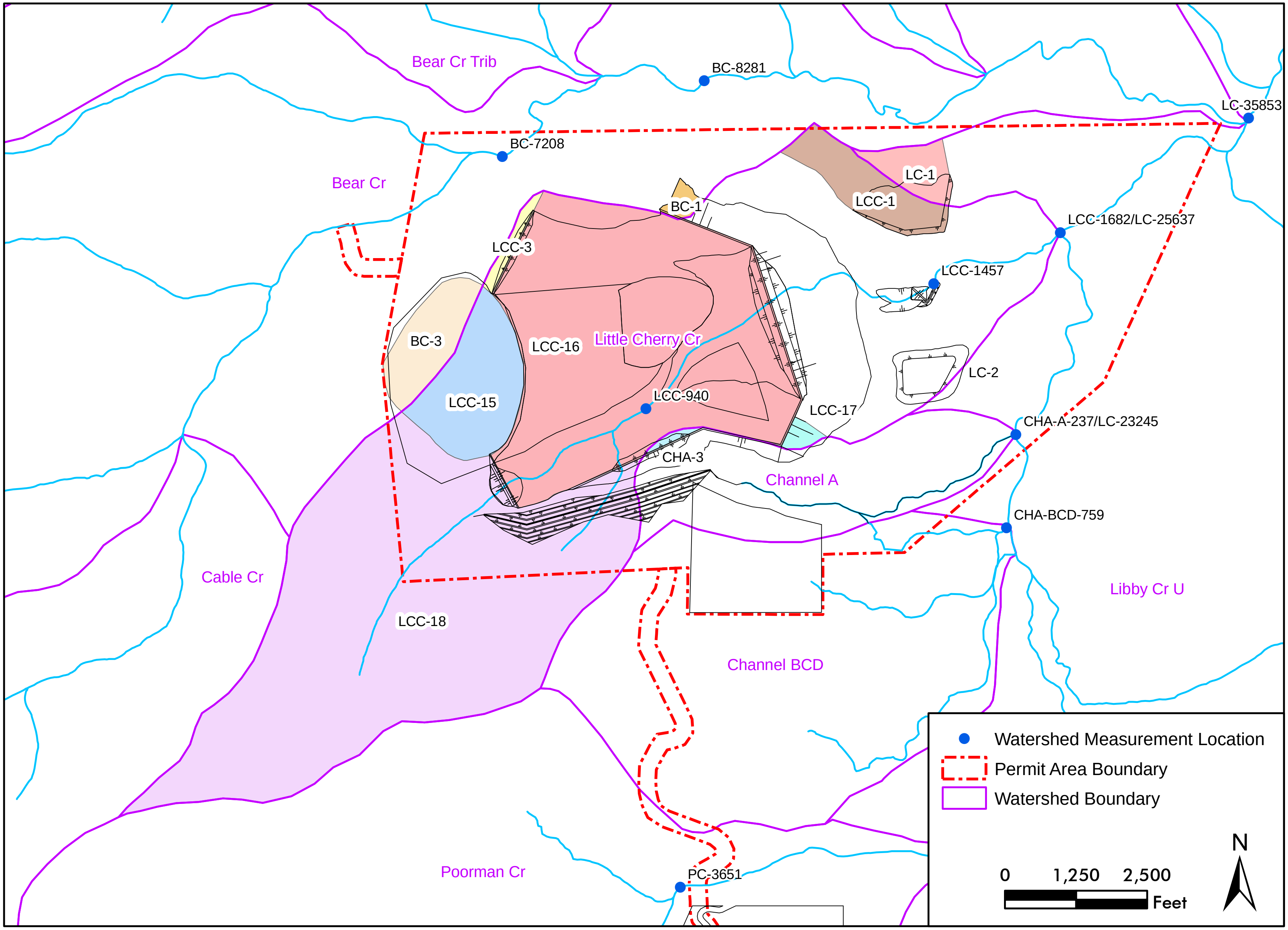

Figure 6. Watershed Analysis, Alternative 4 Closure

Appendix I—Visual Simulations

Figure I-1. Visual Simulation of the Little Cherry Creek Impoundment Looking West from the Scenic Overlook on NFS Road #4776

Figure I-2. Visual Simulation of the Poorman Impoundment Looking West from the Scenic Overlook on NFS Road #4776

Figure I-3. Existing View Looking Southeast from Howard Lake

Figure I-4. Visual Simulation of the Miller Creek or West Fisher Creek Transmission Line Alignments Looking Southeast from Howard Lake

Appendix J— Montanore 230-kV Transmission Line Minimal Impact Standard Assessment

Appendix J
Montanore 230-kV Transmission Line Minimum Impact Assessment

Criteria	Transmission Line Unit of Measure	Access Road Unit of Measure	Alternative B-MMC's Proposal				Alternative C-R		Alternative D-R		Alternative E-R		Alternatives C-R, D-R and E-R	
			Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation
Circular MFSA-2, section 3.2(d)(1)(d)(i) through (xi)														
i. National wilderness areas	N/A	N/A	No direct effects. See compatibility with visual management plans for indirect visual effects.	No direct effects	None	No direct effect on wilderness attributes	No direct effects. See compatibility with visual management plans for indirect visual effects.	No direct effects	No direct effects. See compatibility with visual management plans for indirect visual effects.	No direct effects	No direct effects. See compatibility with visual management plans for indirect visual effects.	No direct effects	None	No direct effect on wilderness attributes
ii. National primitive areas	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
iii. National wildlife refuges and ranges	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
iv. State wildlife management areas and wildlife habitat protection areas	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
v. National parks and monuments	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
vi. State parks	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
vii. National recreation areas	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
viii. Designated or eligible national wild and scenic rivers system	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
ix. Roadless areas over 5,000 acres	Acres in clearing width/ low, moderate, high effect	Miles of new and high-upgrade roads	2, moderate effect	0.1	None	moderate effect	No effect	No effect	No effect	No effect	No effect	No effect	Avoidance of inventoried roadless areas	No effect
x. Rugged topography (areas with slopes >30%)	Miles of centerline/ low, moderate, high effect	Acres/ low, moderate, high effect	7.4	16.5	None	moderate effect	7.2	4.4	6.4	7.9	4.7	2.5	Helicopter use for vegetation clearing and structure construction adjacent to grizzly bear core habitat to decrease number of access roads	Minor effect
xi. Specially managed buffer areas	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
Circular MFSA-2, section 3.4(1)(b) through (w)														
b. state or federal waterfowl production areas	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
c. Designated natural areas	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect

Criteria	Transmission Line Unit of Measure	Access Road Unit of Measure	Alternative B-MMC's Proposal				Alternative C-R		Alternative D-R		Alternative E-R		Alternatives C-R, D-R and E-R	
			Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation
d. Critical habitat for federal T&E species														
Bull trout	# structures within 1 mile of bull trout critical habitat	Acres new and high-upgrade road disturbance within 1 mile of bull trout critical habitat	36	9.6	Implementation of Storm Water Pollution Prevention Plan and structural and nonstructural BMPs. Construction of stream crossings per KNF and DEQ requirements; minimization of disturbance on active floodplains; curtailement of construction activities during heavy rains. Additional measures described under "severe erosion risk" below.	May affect, and likely to adversely affect bull trout critical habitat.	28	3.9	25	4	67	7.4	In addition to measures described for Alternative B: re-routing to avoid highly erosive soils; use of H-frame poles, allowing longer spans and fewer structures and access roads; helicopter construction in grizzly bear core habitat to decrease number of access roads; placement of NFS road #4725 into long-term intermittent stored status; where feasible, location of structures outside of riparian areas; new culverts to allow fish passage; stream-crossing structures designed to withstand a 100-year flow event; completion of habitat inventory and development of instream structures in Libby Creek. Additional measures described under "severe erosion risk" below.	May affect, and likely to adversely affect bull trout critical habitat.
e. Seasonally occupied habitat for federal and state T&E species														
Grizzly bear habitat physically removed on all lands	N/A	Acres of new and High-upgrade roads	N/A	34	Acquire or protect 68 acres of grizzly habitat in the Cabinet-Yaak Ecosystem. Compensation for direct habitat loss is at a 1:1 ratio.	Alt. 2B may affect, likely to adversely affect grizzly bear	N/A	13	N/A	20	N/A	15	Acquire or protect through conservation easement 28 to 40 acres of grizzly bear habitat on non-forest system lands. This compensates for direct habitat loss at a 2:1 ratio	Combined mine-transmission line alternatives may affect, are likely to adversely affect grizzly bear.
Grizzly bear habitat cleared on all lands	Acres	N/A Included in clearing width impacts	297	N/A	No mitigation specified for transmission line, and vegetation within the corridor is at contractor's discretion.	Same as above.	316	N/A	330	N/A	362	N/A	Require Vegetation Removal and Disposition Plan to minimize vegetation removal within corridor and riparian zones.	Effects determination same as above. Within transmission line corridor, some vegetation is expected to be maintained or recover during operations phase to provide some level of hiding cover
Acres of core lost for life of transmission line	Acres	Acres	778		No mitigation specified for core lost due to transmission line and access roads for life of project	Same as above.	0	0	0	0	0	0	No core lost for life of transmission line	Effects determination same as above.
Acres of core temporarily removed during construction phase and decommissioning	N/A	NA	N/A	N/A	No core temporarily lost. Core lost due to Alt B would begin at construction and would remain lost for life of project. See above.	Same as above	0	0	0	18	0	18	18 acres of core temporarily lost due to Alt. D-R and E-R access road during construction. Mitigated for at 2:1 ratio prior to activity	Effects determination same as above. Short term displacement effects mitigated by core creation prior to activity. Affected core block increases to 2,763 acres, providing for ample adjacent secure habitat during construction.
Miles of transmission line located in existing core	Miles	N/A	0.9	N/A	Existing core affected by the 0.9 miles would be lost at start of construction. See above	Same as above	0.9	N/A	NA	N/A	NA	N/A	Alt C-R requires use of helicopter and no wheeled motorized access in cores	Effects determination same as above. Location of Alt. C-R would have greater potential for displacement of bears within existing core during construction than Alts. D-R and E-R which would not be within core habitat
Miles of transmission line in core during operations	Miles	Included in clearing width impacts	N/A	N/A	Same as above	Same as above	3 miles	N/A	0	0	0	0	Same as above for Alt. C-R	Effects determination same as above. Alt. C-R would maintain corridor clearing for life of TL, providing for easier recreational/hunter access resulting in a potential higher risk of mortality & displacement to grizzly bears within core compared to Alts. D-R and E-R

Criteria	Transmission Line Unit of Measure	Access Road Unit of Measure	Alternative B-MMC's Proposal				Alternative C-R		Alternative D-R		Alternative E-R		Alternatives C-R, D-R and E-R	
			Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation
Core creation deferred to post construction phase due to transmission line construction	N/A	N/A	N/A	N/A	No core created due to road access changes	Same as above	1,053		0	0	0	0	None specified for Alt. C-R deferral of road access change	Effects determination same as above. Alt. C-R would defer the access change on Road #4725, delaying creation of 1,053 acres of core to post construction. As a result, BMU 6 core would remain at 55% during construction and less secure habitat would be available during this phase compared to D-R and E-R. Alts. D-R and E-R would not delay road access changes associated with the mine alternatives and achieve 57% core prior to construction in BMU 6
Miles existing; closed, opened & new roads in grizzly habitat	N/A	Total Miles	N/A	17.3	None specified for transmission line.	Same as above	N/A	17.3	N/A	15.6	N/A	16.6	None specified for transmission line	Effects determination same as above. Effects of Increased open or total roads resulting from construction of Alts. C-R, D-R and E-R would be offset by road access changes associated with the mine alternatives.
Additional temporary effects on grizzly bears due to helicopter use in currently affected habitat	Acres in areas where influence zones of existing disturbance and new disturbance overlap	N/A – all roads included in helicopter constructed influence zone	4,582	N/A	Motorized activity associated with transmission line construction would not occur from April 1 to June 15 within spring bear habitat in the Miller Creek (BMU 6) and Midas Creek (BMU 5) drainages. Big game winter range timing mitigation may provide some benefit to grizzly bears	May affect, and likely to adversely affect grizzly bear	4,442	N/A	5,180	N/A	6,718	N/A	Transmission line construction and decommissioning on National Forest System and State trust lands limited to between June 16 and October 14, minimizing disturbance on grizzly bear spring use (April 1-June 15) and denning (December 1-March 31) seasons	Effects determination same as above. See displacement and effects to seasonal habitat discussion in grizzly bear section
New temporary displacement effects on grizzly bears due to helicopter use in currently undisturbed habitat	Acres in influence zone of new disturbance only	N/A – all roads included in helicopter constructed influence zone	5,962	N/A	Same as above	May affect, and likely to adversely affect grizzly bear	5,136	N/A	5,171	N/A	5,698	N/A	Transmission line construction on National Forest System and State lands limited to between June 16 and October 14	Effects determination same as above. See displacement and effects to seasonal habitat discussion in grizzly bear section

Montanore 230-kV Transmission Line Minimum Impact Assessment

Criteria	Transmission Line Unit of Measure	Access Road Unit of Measure	Alternative B-MMC's Proposal				Alternative C-R		Alternative D-R		Alternative E-R		Alternatives C-R, D-R and E-R	
			Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation
Clearing of lynx overall habitat	Acres in clearing width and width of new and high upgrade roads	Included in clearing width impacts	85	N/A	None specified for transmission line. Potential benefits to lynx from land acquisitions for grizzly bear and other big game mitigation	Alt. 2B May affect, is likely to adversely affect Canada lynx	63	N/A	107	N/A	86	N/A	Fund habitat enhancement of lynx stem exclusion habitat at 2:1 ratio. Potential benefits to lynx from other mitigation, including Vegetation Removal and Disposition plan to minimize vegetation removal within corridor, land acquisitions for grizzly bear and other grizzly bear and big game mitigation timing mitigation. potential	Combined mine-transmission line alternatives may affect but not likely to adversely affect Canada lynx. Lynx habitat would be improved with habitat enhancement in stem exclusion habitat and vegetation retained in the transmission line corridor would provide hiding cover allowing for lynx movement
Occupied bull trout habitat	Acres in clearing width and width of new and high-upgrade roads in watersheds with occupied bull trout habitat	Included in clearing width impacts	182	N/A	Same as bull trout critical habitat above.	May affect, and likely to adversely affect bull trout	101	N/A	70	N/A	177	N/A	Same as bull trout critical habitat above.	May affect, and likely to adversely affect bull trout
f. National historic landmarks, districts, or sites	# of sites	Included in transmission line analysis buffer	0	N/A	N/A	No effect	0	N/A	0	N/A	0	N/A	N/A	No effect
g. Eligible or recommended eligible historic landmarks, districts, or sites	# of sites	Included in transmission line analysis buffer	12	N/A	Review and consultation with the SHPO to receive consensus determinations and to develop a plan of action for site 24LN1818. Additional fieldwork may be necessary prior to SHPO consultation.	Because there would be no direct effects, a determination of no adverse effect may be achieved through SHPO consultation.	9	N/A	11	N/A	15	N/A	Review and consultation with the SHPO to receive consensus determinations and to develop a plan of action for site 24LN1818. Additional fieldwork may be necessary prior to SHPO consultation.	Because there would be no direct effects, a determination of no adverse effect may be achieved through SHPO consultation.
h. Municipal watersheds	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
i. FWP Class I or II streams or rivers	Acres in clearing width within watershed of affected streams	Acres of roads within watershed of affected streams	107	7	Same as described above for "occupied bull trout habitat" and below for "severe erosion risk".	Minor short-term increases and long-term decreases in sediment	72	1	47	<1	47	<1	Same as described above for "occupied bull trout habitat" and below for "severe erosion risk".	Minor short-term increases and long-term decreases in sediment
j. impaired streams	Acres in clearing width within watershed of affected streams	Acres of roads within watershed of affected streams	97	4	Same as described above for "occupied bull trout habitat"and below for "severe erosion risk".	Minor short-term increases and long-term decreases in sediment	34	<1	34	<1	34	<1	Same as described above for "occupied bull trout habitat"and below for "severe erosion risk".	Minor short-term increases and long-term decreases in sediment
k. Highly erodible soils/reclamation constraints														
Severe erosion risk	Miles of centerline	Acres of roads	6.7	8.9	Erosion and sediment control BMPs; interim reclamation (replacing soil where it was removed and reseeding) of access roads ; immediate stabilization of cut-and-fill slopes; seeding, application of fertilizer, and stabilization of road cut-and-fill slopes and other disturbances along roads as soon as final grades post-construction grades are achieved; at the end of operations, decommissioning of new roads and reclamation of most other currently existing roads to pre-operational conditions; ripping of compacted soils prior to soil placement, and disking and harrowing of seedbeds.	Minor losses of soil until re-establishment of vegetation.	1.8	2.4	1.3	1.8	3.4	2.3	In addition to measures described for Alternative B: development and implementation of a Road Management Plan; where feasible, soil salvage in 2 lifts; after removal of transmission line, soil salvage before reclamation of decomissioned roads. Additional measures described above for "bull trout occupied habitat".	Minor losses of soil until re-establishment of vegetation.
High sediment delivery	Miles of centerline	Acres of roads	5.1	6.3	Same as for erosion risk above	Minor contributions of sediment until re-establishment of vegetation	0.5	0.6	0.5	0.6	0.5	0.6	Same as for erosion risk above	Minor contributions of sediment until re-establishment of vegetation

Montanore 230-kV Transmission Line Minimum Impact Assessment

Criteria	Transmission Line Unit of Measure	Access Road Unit of Measure	Alternative B-MMC's Proposal				Alternative C-R		Alternative D-R		Alternative E-R		Alternatives C-R, D-R and E-R	
			Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation
l. Compatibility with visual management plans/regulations														
Compatibility with visual management plans	Yes/No	Yes/No	No	No	None	Out of compliance	Yes	Yes	Yes	Yes	Yes	Yes	Forest Plan amendment	In compliance
Indirect visual impacts to the CMW	Acres within CWA from which transmission line can be seen	N/A	1,630	N/A	None	No effect on wilderness attributes	1,480	N/A	1,360	N/A	1,380	N/A	None	No effect on wilderness attributes
m. Winter habitat for elk, deer, moose, pronghorn, mountain goat or bighorn sheep														
elk	Acres in clearing width and width of new and high-upgrade roads	Included in clearing width impacts	124	N/A	Transmission line construction and associated motorized travel would be prohibited from December 1 to April 30.	Minor effects	161	N/A	128	N/A	103	N/A	Potential benefits to elk from land acquisitions and road access changes for grizzly bear and big game mitigation. No transmission line construction or decommissioning between December 1 to April 30. Exemptions to these timing restrictions may be granted by DEQ and FS in writing if MMC can clearly demonstrate that no significant environmental impacts would occur.	Minor effects
white-tailed deer	Acres in clearing width and width of new and high-upgrade roads	Included in clearing width impacts	149	N/A	Same as described above for elk	Minor effects	162	N/A	144	N/A	188	N/A	Same as described above for elk	Minor effects
moose	Acres in clearing width and width of new and high-upgrade roads	Included in clearing width impacts	235	N/A	Same as described above for elk	Minor effects	264	N/A	266	N/A	298	N/A	Same as described above for elk	Minor effects
goat	Acres in clearing width and width of new and high-upgrade roads	Included in clearing width impacts	24	N/A	Same as described above for elk	Minor effects	0	N/A	0	N/A	0	N/A	Same as described above for elk	
n. Elk security areas Reduction in elk security	Acres	Included in clearing width impacts	0	N/A	Security habitat maybe created through road access changes that may occur on land acquired as part of the grizzly bear mitigation.	No effect	0	N/A	0	N/A	0	N/A	Same as described above for Alternative B	No effect
Clearing in elk security	Acres of security habitat in clearing width	Included in clearing width impacts	84	N/A	Security habitat maybe created through road access changes that may occur on land acquired as part of the grizzly bear mitigation.	Minor effects	59	N/A	11	N/A	11	N/A	Same as described above for Alternative B	Minor effects
o. Occupied mountain goat habitat habitat physically impacted	Acres in clearing width	Included in clearing width impacts	47	N/A	Potential benefits to mountain goat from land acquisitions and road access changes for grizzly bear mitigation.	Minor effects	0	N/A	0	N/A	0	N/A	Potential benefits to mountain goat from land acquisitions and road access changes for grizzly bear mitigation.	Minor effects
construction displacement effects	Acres in 1-mile helicopter influence zone	N/A – all roads included in helicopter constructed influence zone	3,362	N/A	Potential benefits to mountain goat from land acquisitions and road access changes for grizzly bear mitigation.	Minor effects	743	N/A	766	N/A	766	N/A	Potential benefits to mountain goat from land acquisitions and road access changes for grizzly bear mitigation.	Minor effects
p. Sage and sharp-tailed grouse breeding areas and winter range	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
q. High waterfowl population areas	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
r. Areas of unusual scientific, educational, or recreational signficance	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect

Appendix J
Montanore 230-kV Transmission Line Minimum Impact Assessment

Criteria	Transmission Line Unit of Measure	Access Road Unit of Measure	Alternative B-MMC's Proposal				Alternative C-R		Alternative D-R		Alternative E-R		Alternatives C-R, D-R and E-R	
			Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Trans-mission line	Access Roads	Proposed Mitigation	Effect After Mitigation
s. Areas with high probability of including significant paleontological resources	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
t. Sites with religious or heritage signifi-cance/value to Indians	# of sites	# of sites	No sites identified	No sites identified	Ongoing tribal consultation	To be determined during consultation	No sites identified	No sites identified	No sites identified	No sites identified	No sites identified	No sites identified	Ongoing tribal consultation	To be determined during consultation
u. Water bodies	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
v. Potable surface water supplies	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect
w. Active faults (for substation)	N/A	N/A	No effect	No effect	N/A	No effect	No effect	No effect	No effect	No effect	No effect	No effect	N/A	No effect

Appendix K—Water Quality Data

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Non-Detects	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
BC-100	Field Conductivity	73	2	0	2	0%	41	105
BC-100	Field pH	6.9	2	0	2	0%	6.8	7
BC-100	Field Temp	6.8	2	0	2	0%	5.5	8
BC-100	Flow	1.9	2	0	2	0%	1.8	1.9
BC-100	Lab pH	7.6	2	0	2	0%	7.5	7.6
BC-100	Lab SC	79	2	0	2	0%	40	118
BC-100	TDS	50	2	0	2	0%	29	70
BC-100	TSS	< 1	2	2	0	100%		
BC-100	Turbidity	0.21	2	0	2	0%	0.11	0.31
BC-100	Alkalinity, Bicarbonate as HCO3	49	2	0	2	0%	24	73
BC-100	Alkalinity, Total as CaCO3	40	2	0	2	0%	20	60
BC-100	Calcium, as Ca Total	11	2	0	2	0%	6	15
BC-100	Chloride, as Cl	< 1	2	2	0	100%		
BC-100	Fluoride, as F	< 0.05	2	2	0	100%		
BC-100	Hardness, as CaCO3	< 33	2	1	1	50%	50	50
BC-100	Magnesium, as Mg Total	< 2	2	1	1	50%	3	3
BC-100	Potassium, as K Total	< 1	2	1	1	50%	1	1
BC-100	Sodium, as Na Total	< 1	2	1	1	50%	1	1
BC-100	Sulfate, as SO4	1.5	2	0	2	0%	1	2
BC-100	Ammonia	< 0.06	2	1	1	50%	0.07	0.07
BC-100	Nitrate	0.15	2	0	2	0%	0.07	0.23
BC-100	Nitrate + Nitrite, as N	0.15	2	0	2	0%	0.07	0.23
BC-100	OrthoPhosphorus	< 0.007	2	1	1	50%	0.009	0.009
BC-100	TKN	< 0.2	2	2	0	100%		
BC-100	Total Phosphorus	0.008	2	0	2	0%	0.007	0.009
BC-500	Dissolved Oxygen	11	8	0	8	0%	9.6	13.32
BC-500	Field Conductivity	71	28	0	28	0%	34	104.8
BC-500	Field pH	7.5	27	0	27	0%	5.1	7.85
BC-500	Field Temp	5.0	27	0	27	0%	1.5	13.9
BC-500	Flow	12	27	0	27	0%	2.77	110.1
BC-500	Lab pH	7.4	27	0	27	0%	5.9	7.8
BC-500	Lab SC	70	28	0	28	0%	36	87
BC-500	TDS	43	28	0	28	0%	14	59
BC-500	TSS	< 1.0	26	19	7	73%	0.49	4.3
BC-500	Turbid	< 0.27	28	5	23	18%	0.09	1.6
BC-500	Alkalinity, Bicarbonate as HCO3	39	28	0	28	0%	18.5	58
BC-500	Alkalinity, Total as CaCO3	37	28	0	28	0%	17	47
BC-500	Calcium, as Ca Dissolved	11	16	0	16	0%	4.8	13
BC-500	Calcium, as Ca Total	10	11	0	11	0%	6.7	12.1
BC-500	Chloride, as Cl	< 0.56	28	19	9	68%	0.097	1
BC-500	Fluoride, as F	< 0.050	6	6	0	100%		
BC-500	Hardness, as CaCO3	35	28	0	28	0%	1	43
BC-500	Magnesium, as Mg Dissolved	2.2	16	0	16	0%	1.1	2.5
BC-500	Magnesium, as Mg Total	< 1.8	12	1	11	8%	1	2.6
BC-500	Potassium, as K Dissolved	< 0.37	15	4	11	27%	0.28	0.46
BC-500	Potassium, as K Total	< 0.24	12	7	5	58%	0.2	0.3
BC-500	Sodium, as Na Dissolved	< 0.74	16	4	12	25%	0.39	1
BC-500	Sodium, as Na Total	< 0.77	12	5	7	42%	0.4	2
BC-500	Sulfate, as SO4	< 1.7	28	9	19	32%	1	5
BC-500	Ammonia	< 0.048	28	17	11	61%	0.01	0.35
BC-500	Nitrate	< 0.16	28	2	26	7%	0.05	0.62
BC-500	Nitrate + Nitrite, as N	0.13	25	0	25	0%	0.05	0.62
BC-500	Nitrite	< 0.010	19	19	0	100%		
BC-500	OrthoPhosphorus	< 0.0020	28	19	9	68%	0.00070	0.015
BC-500	TKN	< 0.23	26	13	13	50%	0.05	2
BC-500	Total Inorganic Nitrogen	0.15	16	0	16	0%	0.07	0.46
BC-500	Total Phosphorus	< 0.0060	28	9	19	32%	0.002	0.022
BC-500	Aluminum, as Al Dissolved	< 0.0089	10	5	5	50%	0.004	0.013
BC-500	Aluminum, as Al Total	0.016	12	0	12	0%	0.0041	0.042
BC-500	Antimony, as Sb Dissolved	< 0.0010	16	15	1	94%	0.000055	0.000055
BC-500	Antimony, as Sb Total	< 0.0005	17	16	1	94%	0.00013	0.00013
BC-500	Arsenic, as As Dissolved	< 0.00038	16	10	6	63%	0.00034	0.00046
BC-500	Arsenic, as As Total	< 0.00037	17	11	6	65%	0.00025	0.00056
BC-500	Barium, as Ba Dissolved	< 0.0063	16	1	15	6%	0.0042	0.0083
BC-500	Barium, as Ba Total	< 0.0063	17	1	16	6%	0.0041	0.014
BC-500	Beryllium, as Be Dissolved	< 0.00080	16	15	1	94%	0.000035	0.000035
BC-500	Beryllium, as Be Total	< 0.00020	17	17	0	100%		
BC-500	Cadmium, as Cd Dissolved	< 0.000028	12	8	4	67%	0.000018	0.000091
BC-500	Cadmium, as Cd Total	< 0.000060	12	9	3	75%	0.000018	0.000033
BC-500	Chromium, as Cr Dissolved	< 0.0010	15	12	3	80%	0.00027	0.00034
BC-500	Chromium, as Cr Total	< 0.0010	17	14	3	82%	0.00020	0.00055
BC-500	Copper, as Cu Dissolved	< 0.0010	15	12	3	80%	0.00020	0.00037
BC-500	Copper, as Cu Total	< 0.0010	17	16	1	94%	0.002	0.002
BC-500	Iron, as Fe Dissolved	< 0.017	15	10	5	67%	0.0022	0.04
BC-500	Iron, as Fe Total	< 0.026	17	11	6	65%	0.0027	0.12
BC-500	Lead, as Pb Dissolved	< 0.000060	13	8	5	62%	0.000025	0.00025
BC-500	Lead, as Pb Total	< 0.000089	16	5	11	31%	0.000049	0.00028
BC-500	Manganese, as Mn Dissolved	< 0.00065	15	10	5	67%	0.00030	0.0012
BC-500	Manganese, as Mn Total	< 0.00096	17	11	6	65%	0.00026	0.0013
BC-500	Mercury, as Hg Dissolved	< 0.000020	8	6	2	75%	0.000021	0.000033

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Non-Detects	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
BC-500	Mercury, as Hg Total	< 0.000020	11	10	1	91%	0.00011	0.00011
BC-500	Nickel, as Ni Dissolved	< 0.0080	15	13	2	87%	0.00027	0.00035
BC-500	Nickel, as Ni Total	< 0.00050	17	17	0	100%		
BC-500	Selenium, as Se Dissolved	< 0.0010	16	15	1	94%	0.00018	0.00018
BC-500	Selenium, as Se Total	< 0.0010	17	17	0	100%		
BC-500	Silver, as Ag Dissolved	< 0.00020	10	10	0	100%		
BC-500	Silver, as Ag Total	< 0.00020	11	9	2	82%	0.000090	0.00026
BC-500	Thallium, as Tl Dissolved	< 0.00010	13	13	0	100%		
BC-500	Thallium, as Tl Total	< 0.00010	14	14	0	100%		
BC-500	Zinc, as Zn Dissolved	< 0.0023	15	10	5	67%	0.0021	0.0032
BC-500	Zinc, as Zn Total	< 0.0030	17	12	5	71%	0.0013	0.023
EFBR-300	Field Temp	2	1	0	1	0%	2	2
EFBR-300	Lab pH	7.6	1	0	1	0%	7.6	7.6
EFBR-300	Lab SC	42	1	0	1	0%	42	42
EFBR-300	TDS	51	1	0	1	0%	51	51
EFBR-300	TSS	< 1	1	1	0	100%		
EFBR-300	Turbidity	0.46	1	0	1	0%	0.46	0.46
EFBR-300	Alkalinity, Bicarbonate as HCO3	22	1	0	1	0%	22	22
EFBR-300	Alkalinity, Total as CaCO3	18	1	0	1	0%	18	18
EFBR-300	Calcium, as Ca Total	6	1	0	1	0%	6	6
EFBR-300	Chloride, as Cl	2	1	0	1	0%	2	2
EFBR-300	Fluoride, as F	< 0.1	1	1	0	100%		
EFBR-300	Hardness, as CaCO3	19	1	0	1	0%	19	19
EFBR-300	Magnesium, as Mg Total	1	1	0	1	0%	1	1
EFBR-300	Potassium, as K Total	< 1	1	1	0	100%		
EFBR-300	Sodium, as Na Total	< 1	1	1	0	100%		
EFBR-300	Sulfate, as SO4	< 5	1	1	0	100%		
EFBR-300	Ammonia	0.05	1	0	1	0%	0.05	0.05
EFBR-300	Nitrate	0.16	1	0	1	0%	0.16	0.16
EFBR-300	Nitrate + Nitrite, as N	0.16	1	0	1	0%	0.16	0.16
EFBR-300	Nitrite	< 0.01	1	1	0	100%		
EFBR-300	OrthoPhosphorus	0.009	1	0	1	0%	0.009	0.009
EFBR-300	TKN	< 0.2	1	1	0	100%		
EFBR-300	Total Phosphorus	0.014	1	0	1	0%	0.014	0.014
EFBR-300	Aluminum, as Al Total	< 0.05	1	1	0	100%		
EFBR-300	Antimony, as Sb Total	< 0.003	1	1	0	100%		
EFBR-300	Arsenic, as As Total	< 0.003	1	1	0	100%		
EFBR-300	Barium, as Ba Total	0.015	1	0	1	0%	0.015	0.015
EFBR-300	Beryllium, as Be Total	< 0.001	1	1	0	100%		
EFBR-300	Chromium, as Cr Total	< 0.001	1	1	0	100%		
EFBR-300	Copper, as Cu Total	< 0.001	1	1	0	100%		
EFBR-300	Iron, as Fe Total	0.01	1	0	1	0%	0.01	0.01
EFBR-300	Manganese, as Mn Total	< 0.005	1	1	0	100%		
EFBR-300	Selenium, as Se Total	< 0.001	1	1	0	100%		
EFBR-300	Silver, as Ag Total	< 0.0003	1	1	0	100%		
EFBR-300	Zinc, as Zn Total	< 0.01	1	1	0	100%		
EFBR-500	Field Temp	2	1	0	1	0%	2	2
EFBR-500	Lab pH	7.7	1	0	1	0%	7.7	7.7
EFBR-500	Lab SC	53	1	0	1	0%	53	53
EFBR-500	TDS	49	1	0	1	0%	49	49
EFBR-500	TSS	< 1	1	1	0	100%		
EFBR-500	Turbidity	0.34	1	0	1	0%	0.34	0.34
EFBR-500	Alkalinity, Bicarbonate as HCO3	31	1	0	1	0%	31	31
EFBR-500	Alkalinity, Total as CaCO3	26	1	0	1	0%	26	26
EFBR-500	Calcium, as Ca Total	7	1	0	1	0%	7	7
EFBR-500	Chloride, as Cl	7	1	0	1	0%	7	7
EFBR-500	Fluoride, as F	< 0.1	1	1	0	100%		
EFBR-500	Hardness, as CaCO3	26	1	0	1	0%	26	26
EFBR-500	Magnesium, as Mg Total	2	1	0	1	0%	2	2
EFBR-500	Potassium, as K Total	< 1	1	1	0	100%		
EFBR-500	Sodium, as Na Total	< 1	1	1	0	100%		
EFBR-500	Sulfate, as SO4	< 5	1	1	0	100%		
EFBR-500	Ammonia	< 0.05	1	1	0	100%		
EFBR-500	Nitrate	0.13	1	0	1	0%	0.13	0.13
EFBR-500	Nitrate + Nitrite, as N	0.13	1	0	1	0%	0.13	0.13
EFBR-500	Nitrite	< 0.01	1	1	0	100%		
EFBR-500	OrthoPhosphorus	0.008	1	0	1	0%	0.008	0.008
EFBR-500	TKN	< 0.2	1	1	0	100%		
EFBR-500	Total Phosphorus	0.01	1	0	1	0%	0.01	0.01
EFBR-500	Aluminum, as Al Total	< 0.05	1	1	0	100%		
EFBR-500	Antimony, as Sb Total	< 0.003	1	1	0	100%		
EFBR-500	Arsenic, as As Total	< 0.003	1	1	0	100%		
EFBR-500	Barium, as Ba Total	0.017	1	0	1	0%	0.017	0.017
EFBR-500	Beryllium, as Be Total	< 0.001	1	1	0	100%		
EFBR-500	Chromium, as Cr Total	< 0.001	1	1	0	100%		
EFBR-500	Copper, as Cu Total	< 0.001	1	1	0	100%		
EFBR-500	Iron, as Fe Total	0.01	1	0	1	0%	0.01	0.01
EFBR-500	Manganese, as Mn Total	< 0.005	1	1	0	100%		
EFBR-500	Selenium, as Se Total	< 0.001	1	1	0	100%		
EFBR-500	Zinc, as Zn Total	< 0.01	1	1	0	100%		

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Non-Detects	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
EFRC-100	Dissolved Oxygen	11	3	0	3	0%	11.1	11.8
EFRC-100	Field Conductivity	6	7	0	7	0%	1	14
EFRC-100	Field Eh	240	3	0	3	0%	200	309
EFRC-100	Field pH	7	6	0	6	0%	5.6	7.55
EFRC-100	Field Temp	6.4	6	0	6	0%	4.4	12.2
EFRC-100	Flow	0.54	7	0	7	0%	0.01	27.9
EFRC-100	Lab pH	6.8	2	0	2	0%	6.2	7.5
EFRC-100	Lab SC	8.8	2	0	2	0%	7.6	10
EFRC-100	TDS	< 54	2	1	1	50%	98.7	98.7
EFRC-100	TSS	< 5.3	2	1	1	50%	0.61	0.61
EFRC-100	Turbidity	0.29	1	0	1	0%	0.29	0.29
EFRC-100	Alkalinity, Bicarbonate as HCO3	5.2	2	0	2	0%	4.4	6
EFRC-100	Alkalinity, Total as CaCO3	4.7	2	0	2	0%	4.4	5
EFRC-100	Calcium, as Ca Dissolved	0.82	2	0	2	0%	0.64	1
EFRC-100	Chloride, as Cl	< 0.99	2	1	1	50%	0.98	0.98
EFRC-100	Hardness, as CaCO3	2.4	1	0	1	0%	2.4	2.4
EFRC-100	Potassium, as K Dissolved	< 0.53	2	1	1	50%	0.067	0.067
EFRC-100	Sodium, as Na Dissolved	< 0.59	2	1	1	50%	0.17	0.17
EFRC-100	Sulfate, as SO4	< 1	2	1	1	50%	0.99	0.99
EFRC-100	Ammonia	< 0.054	2	2	0	100%		
EFRC-100	Nitrate	0.018	1	0	1	0%	0.018	0.018
EFRC-100	Nitrate + Nitrite, as N	< 0.035	2	1	1	50%	0.02	0.02
EFRC-100	Nitrite	0.0022	1	0	1	0%	0.0022	0.0022
EFRC-100	OrthoPhosphorus	< 0.0053	2	2	0	100%		
EFRC-100	TKN	< 0.27	2	2	0	100%		
EFRC-100	Total Inorganic Nitrogen	0.02	1	0	1	0%	0.02	0.02
EFRC-100	Total Phosphorus	< 0.008	2	1	1	50%	0.006	0.006
EFRC-100	Aluminum, as Al Dissolved	0.013	1	0	1	0%	0.013	0.013
EFRC-100	Aluminum, as Al Total	0.02	1	0	1	0%	0.02	0.02
EFRC-100	Antimony, as Sb Dissolved	< 0.00016	1	1	0	100%		
EFRC-100	Antimony, as Sb Total	< 0.00016	1	1	0	100%		
EFRC-100	Arsenic, as As Dissolved	< 0.000062	1	1	0	100%		
EFRC-100	Arsenic, as As Total	< 0.000062	1	1	0	100%		
EFRC-100	Barium, as Ba Dissolved	0.0044	1	0	1	0%	0.0044	0.0044
EFRC-100	Barium, as Ba Total	0.0042	1	0	1	0%	0.0042	0.0042
EFRC-100	Beryllium, as Be Dissolved	< 0.000069	1	1	0	100%		
EFRC-100	Beryllium, as Be Total	< 0.000069	1	1	0	100%		
EFRC-100	Cadmium, as Cd Dissolved	0.000024	1	0	1	0%	0.000024	0.000024
EFRC-100	Cadmium, as Cd Total	< 0.00002	1	1	0	100%		
EFRC-100	Chromium, as Cr Dissolved	0.00031	1	0	1	0%	0.00031	0.00031
EFRC-100	Chromium, as Cr Total	< 0.00024	1	1	0	100%		
EFRC-100	Copper, as Cu Dissolved	0.00037	1	0	1	0%	0.00037	0.00037
EFRC-100	Copper, as Cu Total	0.0003	1	0	1	0%	0.0003	0.0003
EFRC-100	Iron, as Fe Dissolved	< 0.0045	1	1	0	100%		
EFRC-100	Iron, as Fe Total	0.0073	1	0	1	0%	0.0073	0.0073
EFRC-100	Lead, as Pb Dissolved	0.00016	1	0	1	0%	0.00016	0.00016
EFRC-100	Lead, as Pb Total	0.0001	1	0	1	0%	0.0001	0.0001
EFRC-100	Magnesium, as Mg Dissolved	< 0.6	2	1	1	50%	0.19	0.19
EFRC-100	Manganese, as Mn Dissolved	0.00074	1	0	1	0%	0.00074	0.00074
EFRC-100	Manganese, as Mn Total	0.00068	1	0	1	0%	0.00068	0.00068
EFRC-100	Mercury, as Hg Dissolved	< 0.000021	1	1	0	100%		
EFRC-100	Mercury, as Hg Total	0.000029	1	0	1	0%	0.000029	0.000029
EFRC-100	Nickel, as Ni Dissolved	< 0.00019	1	1	0	100%		
EFRC-100	Nickel, as Ni Total	< 0.00019	1	1	0	100%		
EFRC-100	Selenium, as Se Dissolved	< 0.0001	1	1	0	100%		
EFRC-100	Selenium, as Se Total	< 0.0001	1	1	0	100%		
EFRC-100	Silver, as Ag Dissolved	< 0.000071	1	1	0	100%		
EFRC-100	Silver, as Ag Total	< 0.000071	1	1	0	100%		
EFRC-100	Thallium, as Tl Dissolved	< 0.00005	1	1	0	100%		
EFRC-100	Thallium, as Tl Total	< 0.00005	1	1	0	100%		
EFRC-100	Zinc, as Zn Total	0.0016	1	0	1	0%	0.0016	0.0016
EFRC-200	Dissolved Oxygen	11	3	0	3	0%	10.3	11.5
EFRC-200	Field Conductivity	5.5	8	0	8	0%	1	7
EFRC-200	Field Eh	258	3	0	3	0%	196	286
EFRC-200	Field pH	6.8	7	0	7	0%	6.3	7.2
EFRC-200	Field Temp	11	7	0	7	0%	6	13
EFRC-200	Flow	< 9.4	8	1	7	13%	0.474	27.3
EFRC-200	Lab pH	6.5	4	0	4	0%	6.3	6.6
EFRC-200	Lab SC	7.8	4	0	4	0%	7	9
EFRC-200	TDS	< 9.3	4	2	2	50%	8	9
EFRC-200	TSS	< 2.5	4	4	0	100%		
EFRC-200	Turbid	0.37	3	0	3	0%	0.26	0.44
EFRC-200	Alkalinity, Bicarbonate as HCO3	5.0	4	0	4	0%	4.6	6
EFRC-200	Alkalinity, Total as CaCO3	< 4.4	4	1	3	25%	4	5
EFRC-200	Calcium, as Ca Dissolved	< 0.86	2	1	1	50%	0.71	0.71
EFRC-200	Calcium, as Ca Total	< 1.0	2	2	0	100%		
EFRC-200	Chloride, as Cl	< 1.0	4	3	1	75%	1	1
EFRC-200	Fluoride, as F	< 0.05	2	2	0	100%		
EFRC-200	Hardness, as CaCO3	< 4.9	3	2	1	67%	2.6	2.6
EFRC-200	Magnesium, as Mg Dissolved	< 0.60	2	1	1	50%	0.2	0.2

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Non-Detects	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
EFRC-200	Magnesium, as Mg Total	< 1.0	2	2	0	100%		
EFRC-200	Potassium, as K Dissolved	< 0.54	2	1	1	50%	0.089	0.089
EFRC-200	Potassium, as K Total	< 1.5	2	1	1	50%	2	2
EFRC-200	Sodium, as Na Dissolved	< 0.61	2	1	1	50%	0.21	0.21
EFRC-200	Sodium, as Na Total	< 1.0	2	1	1	50%	1	1
EFRC-200	Sulfate, as SO4	< 1.0	4	3	1	75%	1	1
EFRC-200	Ammonia	< 0.060	4	3	1	75%	0.07	0.07
EFRC-200	Nitrate	< 0.019	3	1	2	33%	0.018	0.03
EFRC-200	Nitrate + Nitrite, as N	< 0.028	4	2	2	50%	0.02	0.03
EFRC-200	Nitrite	0.0023	1	0	1	0%	0.0023	0.0023
EFRC-200	OrthoPhosphorus	< 0.0050	4	3	1	75%	0.005	0.005
EFRC-200	TKN	< 0.20	4	3	1	75%	0.2	0.2
EFRC-200	Total Inorganic Nitrogen	0.020	1	0	1	0%	0.02	0.02
EFRC-200	Total Phosphorus	< 0.0055	4	2	2	50%	0.005	0.007
EFRC-200	Aluminum, as Al Dissolved	0.015	1	0	1	0%	0.015	0.015
EFRC-200	Aluminum, as Al Total	0.022	1	0	1	0%	0.022	0.022
EFRC-200	Antimony, as Sb Dissolved	< 0.00016	1	1	0	100%		
EFRC-200	Antimony, as Sb Total	< 0.00016	1	1	0	100%		
EFRC-200	Arsenic, as As Dissolved	< 0.000062	1	1	0	100%		
EFRC-200	Arsenic, as As Total	< 0.000062	1	1	0	100%		
EFRC-200	Barium, as Ba Dissolved	0.0042	1	0	1	0%	0.0042	0.0042
EFRC-200	Barium, as Ba Total	0.0043	1	0	1	0%	0.0043	0.0043
EFRC-200	Beryllium, as Be Dissolved	< 0.000069	1	1	0	100%		
EFRC-200	Beryllium, as Be Total	< 0.000069	1	1	0	100%		
EFRC-200	Cadmium, as Cd Dissolved	< 0.000020	1	1	0	100%		
EFRC-200	Cadmium, as Cd Total	< 0.000020	1	1	0	100%		
EFRC-200	Chromium, as Cr Dissolved	0.00038	1	0	1	0%	0.00038	0.00038
EFRC-200	Chromium, as Cr Total	< 0.00024	1	1	0	100%		
EFRC-200	Copper, as Cu Dissolved	0.0010	1	0	1	0%	0.001	0.001
EFRC-200	Copper, as Cu Total	0.0010	1	0	1	0%	0.001	0.001
EFRC-200	Iron, as Fe Dissolved	0.0045	1	0	1	0%	0.0045	0.0045
EFRC-200	Iron, as Fe Total	0.0099	1	0	1	0%	0.0099	0.0099
EFRC-200	Lead, as Pb Dissolved	0.000077	1	0	1	0%	0.000077	0.000077
EFRC-200	Lead, as Pb Total	0.000066	1	0	1	0%	0.000066	0.000066
EFRC-200	Manganese, as Mn Dissolved	0.0014	1	0	1	0%	0.0014	0.0014
EFRC-200	Manganese, as Mn Total	0.0017	1	0	1	0%	0.0017	0.0017
EFRC-200	Mercury, as Hg Dissolved	< 0.000021	1	1	0	100%		
EFRC-200	Mercury, as Hg Total	0.000037	1	0	1	0%	0.000037	0.000037
EFRC-200	Nickel, as Ni Dissolved	0.00026	1	0	1	0%	0.00026	0.00026
EFRC-200	Nickel, as Ni Total	< 0.00019	1	1	0	100%		
EFRC-200	Selenium, as Se Dissolved	< 0.00010	1	1	0	100%		
EFRC-200	Selenium, as Se Total	< 0.00010	1	1	0	100%		
EFRC-200	Silver, as Ag Dissolved	< 0.000071	1	1	0	100%		
EFRC-200	Silver, as Ag Total	< 0.000071	1	1	0	100%		
EFRC-200	Thallium, as Tl Dissolved	< 0.000050	1	1	0	100%		
EFRC-200	Thallium, as Tl Total	< 0.000050	1	1	0	100%		
EFRC-200	Zinc, as Zn Total	< 0.0013	1	1	0	100%		
EFRC-300	Field Conductivity	15	2	0	2	0%	12	18
EFRC-300	Field pH	6.7	2	0	2	0%	6.7	6.7
EFRC-300	Field Temp	8.5	2	0	2	0%	8	9
EFRC-300	Flow	3.5	2	0	2	0%	0.4	6.5
EFRC-300	Lab pH	6.7	2	0	2	0%	6.5	6.8
EFRC-300	Lab SC	20	2	0	2	0%	11	28
EFRC-300	TDS	18	2	0	2	0%	17	19
EFRC-300	TSS	< 1	2	1	1	50%	1	1
EFRC-300	Turbidity	< 0.17	2	1	1	50%	0.23	0.23
EFRC-300	Alkalinity, Bicarbonate as HCO3	11	2	0	2	0%	6	16
EFRC-300	Alkalinity, Total as CaCO3	9	2	0	2	0%	5	13
EFRC-300	Calcium, as Ca Total	1	2	0	2	0%	1	1
EFRC-300	Chloride, as Cl	< 1	2	2	0	100%		
EFRC-300	Fluoride, as F	< 0.05	2	2	0	100%		
EFRC-300	Hardness, as CaCO3	< 3	2	2	0	100%		
EFRC-300	Magnesium, as Mg Total	< 1	2	2	0	100%		
EFRC-300	Potassium, as K Total	< 1.5	2	1	1	50%	2	2
EFRC-300	Sodium, as Na Total	< 1	2	1	1	50%	1	1
EFRC-300	Sulfate, as SO4	1.5	2	0	2	0%	1	2
EFRC-300	Ammonia	< 0.06	2	1	1	50%	0.07	0.07
EFRC-300	Nitrate	0.075	2	0	2	0%	0.04	0.11
EFRC-300	Nitrate + Nitrite, as N	0.075	2	0	2	0%	0.04	0.11
EFRC-300	OrthoPhosphorus	< 0.005	2	2	0	100%		
EFRC-300	TKN	< 0.2	2	2	0	100%		
EFRC-300	Total Phosphorus	0.006	2	0	2	0%	0.005	0.007
EFRC-400	Field Conductivity	16	2	0	2	0%	15	16
EFRC-400	Field pH	6.6	2	0	2	0%	6.6	6.6
EFRC-400	Field Temp	11	2	0	2	0%	7	15
EFRC-400	Flow	12	2	0	2	0%	1.9	21
EFRC-400	Lab pH	6.5	2	0	2	0%	6.2	6.7
EFRC-400	Lab SC	16	2	0	2	0%	12	19
EFRC-400	TDS	16	2	0	2	0%	13	19
EFRC-400	TSS	1	2	0	2	0%	1	1

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Non-Detects	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
EFRC-400	Turbidity	0.44	2	0	2	0%	0.4	0.48
EFRC-400	Alkalinity, Bicarbonate as HCO3	10	2	0	2	0%	7	13
EFRC-400	Alkalinity, Total as CaCO3	8.5	2	0	2	0%	6	11
EFRC-400	Calcium, as Ca Total	< 1.5	2	1	1	50%	2	2
EFRC-400	Chloride, as Cl	< 1	2	2	0	100%		
EFRC-400	Fluoride, as F	< 0.05	2	1	1	50%	0.05	0.05
EFRC-400	Hardness, as CaCO3	< 5.5	2	2	0	100%		
EFRC-400	Magnesium, as Mg Total	< 1	2	2	0	100%		
EFRC-400	Potassium, as K Total	< 1	2	1	1	50%	1	1
EFRC-400	Sodium, as Na Total	< 1	2	2	0	100%		
EFRC-400	Sulfate, as SO4	< 1	2	1	1	50%	1	1
EFRC-400	Ammonia	< 0.06	2	1	1	50%	0.07	0.07
EFRC-400	Nitrate	< 0.03	2	1	1	50%	0.05	0.05
EFRC-400	Nitrate + Nitrite, as N	< 0.03	2	1	1	50%	0.05	0.05
EFRC-400	OrthoPhosphorus	0.0055	2	0	2	0%	0.005	0.006
EFRC-400	TKN	< 0.25	2	1	1	50%	0.3	0.3
EFRC-400	Total Phosphorus	0.008	2	0	2	0%	0.007	0.009
EFRC-800	Field Conductivity	14	2	0	2	0%	12	15
EFRC-800	Field pH	6.8	2	0	2	0%	6.5	7
EFRC-800	Field Temp	10	2	0	2	0%	8	12
EFRC-800	Flow	13	2	0	2	0%	0.3	26
EFRC-800	Lab pH	6.7	2	0	2	0%	6.5	6.9
EFRC-800	Lab SC	14	2	0	2	0%	11	16
EFRC-800	TDS	16	2	0	2	0%	13	19
EFRC-800	TSS	< 1	2	1	1	50%	1	1
EFRC-800	Turbidity	< 0.13	2	1	1	50%	0.15	0.15
EFRC-800	Alkalinity, Bicarbonate as HCO3	8.5	2	0	2	0%	7	10
EFRC-800	Alkalinity, Total as CaCO3	7	2	0	2	0%	6	8
EFRC-800	Calcium, as Ca Total	< 1	2	1	1	50%	1	1
EFRC-800	Chloride, as Cl	< 1	2	2	0	100%		
EFRC-800	Fluoride, as F	< 0.05	2	2	0	100%		
EFRC-800	Hardness, as CaCO3	< 4.5	2	2	0	100%		
EFRC-800	Magnesium, as Mg Total	< 1	2	2	0	100%		
EFRC-800	Potassium, as K Total	< 1.5	2	1	1	50%	2	2
EFRC-800	Sodium, as Na Total	< 1	2	1	1	50%	1	1
EFRC-800	Sulfate, as SO4	1.5	2	0	2	0%	1	2
EFRC-800	Ammonia	< 0.05	2	2	0	100%		
EFRC-800	Nitrate	0.04	2	0	2	0%	0.02	0.06
EFRC-800	Nitrate + Nitrite, as N	0.04	2	0	2	0%	0.02	0.06
EFRC-800	OrthoPhosphorus	< 0.006	2	1	1	50%	0.007	0.007
EFRC-800	TKN	< 0.2	2	2	0	100%		
EFRC-800	Total Phosphorus	0.009	2	0	2	0%	0.009	0.009
LB-100	Dissolved Oxygen	9.8	2	0	2	0%	9.5	10
LB-100	Field Conductivity	< 9.8	4	1	3	25%	8.0	13
LB-100	Field pH	6.8	5	0	5	0%	5.8	7.3
LB-100	Field Temp	7.7	5	0	5	0%	5.5	9.98
LB-100	Flow	3.9	5	0	5	0%	1.1	32.9
LB-100	Lab pH	6.7	2	0	2	0%	6.4	6.9
LB-100	Lab SC	12	2	0	2	0%	10	13
LB-100	TDS	8	2	0	2	0%	4	12
LB-100	TSS	< 1.5	2	1	1	50%	2	2
LB-100	Turbidity	< 0.25	2	1	1	50%	0.4	0.4
LB-100	Alkalinity, Bicarbonate as HCO3	6	2	0	2	0%	6	6
LB-100	Alkalinity, Total as CaCO3	5	2	0	2	0%	5	5
LB-100	Calcium, as Ca Total	< 1	2	1	1	50%	1	1
LB-100	Chloride, as Cl	< 1	2	2	0	100%		
LB-100	Fluoride, as F	< 0.055	2	1	1	50%	0.06	0.06
LB-100	Hardness, as CaCO3	< 4.5	2	2	0	100%		
LB-100	Magnesium, as Mg Total	< 1	2	2	0	100%		
LB-100	Potassium, as K Total	< 1	2	1	1	50%	1	1
LB-100	Sodium, as Na Total	< 1	2	2	0	100%		
LB-100	Sulfate, as SO4	1.5	2	0	2	0%	1	2
LB-100	Ammonia	< 0.05	2	2	0	100%		
LB-100	Nitrate	0.16	2	0	2	0%	0.12	0.19
LB-100	Nitrate + Nitrite, as N	0.16	2	0	2	0%	0.12	0.19
LB-100	OrthoPhosphorus	< 0.005	2	2	0	100%		
LB-100	TKN	< 0.2	2	2	0	100%		
LB-100	Total Phosphorus	< 0.005	2	2	0	100%		
LB-1000	Dissolved Oxygen	10.69999981	7	0	7	0%	9.5	13.22
LB-1000	Field Conductivity	36.59999847	15	0	15	0%	19	82.7
LB-1000	Field pH	7.4	30	0	30	0%	6.3	7.91
LB-1000	Field Temp	8.349999905	32	0	32	0%	0.5	18
LB-1000	Flow	19.2	29	0	29	0%	2.89	121.69
LB-1000	Lab pH	7.049999952	26	0	26	0%	6	7.8
LB-1000	Lab SC	44	15	0	15	0%	22	74
LB-1000	TDS	< 33.44	15	2	13	13%	21	58
LB-1000	TSS	< 1	27	23	4	85%	0.49	3
LB-1000	Turbidity	< 0.4522222	27	5	22	19%	0.16	2.3
LB-1000	Alkalinity, Bicarbonate as HCO3	20.2	27	0	27	0%	8	39.3
LB-1000	Alkalinity, Total as CaCO3	19	27	0	27	0%	7	39.3

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Non-Detects	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
LB-1000	Calcium, as Ca Dissolved	4.45	14	0	14	0%	2.4	8.4
LB-1000	Calcium, as Ca Total	4.9	1	0	1	0%	4.9	4.9
LB-1000	Chloride, as Cl	< 1	26	19	7	73%	0.19	1
LB-1000	Fluoride, as F	< 0.05	7	7	0	100%		
LB-1000	Hardness, as CaCO3	17.5	15	0	15	0%	9	33.2
LB-1000	Magnesium, as Mg Dissolved	1.5	14	0	14	0%	0.74	6
LB-1000	Magnesium, as Mg Total	< 1.6	13	1	12	8%	0.5	2.6
LB-1000	Potassium, as K Dissolved	< 0.5418182	13	1	12	8%	0.16	4
LB-1000	Potassium, as K Total	< 0.2333333	13	7	6	54%	0.2	0.3
LB-1000	Sodium, as Na Dissolved	< 1.2551429	14	1	13	7%	0.47	5
LB-1000	Sodium, as Na Total	1.2	1	0	1	0%	1.2	1.2
LB-1000	Sulfate, as SO4	< 1.5555556	14	5	9	36%	1	2.5
LB-1000	Ammonia	< 0.03	14	10	4	71%	0.01	0.02
LB-1000	Nitrate	< 0.0335333	15	2	13	13%	0.01	0.098
LB-1000	Nitrate + Nitrite, as N	0.03	12	0	12	0%	0.01	0.04
LB-1000	Nitrite	< 0.01	15	12	3	80%	0.00060	0.036
LB-1000	OrthoPhosphorus	< 0.005	27	20	7	74%	0.001	0.024
LB-1000	TKN	< 0.0772212	14	7	7	50%	0.055	0.14
LB-1000	Total Inorganic Nitrogen	< 0.0500714	14	3	11	21%	0.02	0.15
LB-1000	Total Phosphorus	< 0.0071804	27	9	18	33%	0.0016	0.05
LB-1000	Aluminum, as Al Dissolved	< 0.017	12	4	8	33%	0.0041	0.061
LB-1000	Aluminum, as Al Total	0.0115	12	0	12	0%	0.0062	0.1
LB-1000	Antimony, as Sb Dissolved	< 0.001	14	11	3	79%	0.000057	0.00031
LB-1000	Antimony, as Sb Total	< 0.0005	15	15	0	100%		
LB-1000	Arsenic, as As Dissolved	< 0.000218	14	9	5	64%	0.00021	0.00023
LB-1000	Arsenic, as As Total	< 2.03E-04	15	10	5	67%	0.00014	0.00033
LB-1000	Barium, as Ba Dissolved	< 0.00625	14	1	13	7%	0.0038	0.0089
LB-1000	Barium, as Ba Total	0.0066	15	0	15	0%	0.0039	0.0096
LB-1000	Beryllium, as Be Dissolved	< 0.0008	14	13	1	93%	0.000022	0.000022
LB-1000	Beryllium, as Be Total	< 0.00020	15	15	0	100%		
LB-1000	Cadmium, as Cd Dissolved	< 0.00006	12	10	2	83%	0.000014	0.000033
LB-1000	Cadmium, as Cd Total	< 0.00006	12	12	0	100%		
LB-1000	Chromium, as Cr Dissolved	< 0.001	13	11	2	85%	0.00016	0.00021
LB-1000	Chromium, as Cr Total	< 0.001	15	13	2	87%	0.00045	0.00058
LB-1000	Copper, as Cu Dissolved	< 0.00038381	14	9	5	64%	0.00027	0.0013
LB-1000	Copper, as Cu Total	< 4.60E-04	15	8	7	53%	0.00021	0.0014
LB-1000	Iron, as Fe Dissolved	< 0.0078	13	9	4	69%	0.00092	0.026
LB-1000	Iron, as Fe Total	< 1.70E-02	15	9	6	60%	0.0031	0.1
LB-1000	Lead, as Pb Dissolved	< 0.00012404	14	6	8	43%	0.000030	0.00063
LB-1000	Lead, as Pb Total	< 5.43E-05	15	10	5	67%	0.000028	0.00019
LB-1000	Manganese, as Mn Dissolved	< 0.00057667	14	8	6	57%	0.00034	0.001
LB-1000	Manganese, as Mn Total	< 9.90E-04	15	9	6	60%	0.00043	0.003
LB-1000	Mercury, as Hg Dissolved	< 0.000040	8	5	3	63%	0.000033	0.000073
LB-1000	Mercury, as Hg Total	< 0.000020	9	9	0	100%		
LB-1000	Nickel, as Ni Dissolved	< 0.008	14	11	3	79%	0.00020	0.00054
LB-1000	Nickel, as Ni Total	< 0.00050	15	13	2	87%	0.00029	0.00074
LB-1000	Selenium, as Se Dissolved	< 0.001	14	13	1	93%	0.00015	0.00015
LB-1000	Selenium, as Se Total	< 0.0010	15	14	1	93%	0.00015	0.00015
LB-1000	Silver, as Ag Dissolved	< 0.000225	8	6	2	75%	0.00012	0.00066
LB-1000	Silver, as Ag Total	< 0.0002	9	9	0	100%		
LB-1000	Thallium, as Tl Dissolved	< 0.0001	11	11	0	100%		
LB-1000	Thallium, as Tl Total	< 0.0001	12	12	0	100%		
LB-1000	Zinc, as Zn Dissolved	< 0.0025646	14	8	6	57%	0.0013	0.0088
LB-1000	Zinc, as Zn Total	< 0.0044	15	11	4	73%	0.002	0.014
LB-200	Dissolved Oxygen	12	66	0	66	0%	9.8	14.65
LB-200	Field Conductivity	< 14	122	1	121	1%	3	27
LB-200	Field pH	6.9	129	0	129	0%	5	8.5
LB-200	Field Temp	4.3	140	0	140	0%	0.1	23
LB-200	Flow	8.8	89	0	89	0%	0.77	130.6
LB-200	Lab pH	6.7	127	0	127	0%	5.2	7.7
LB-200	Lab SC	14	130	0	130	0%	7	42
LB-200	TDS	< 13	133	43	90	32%	1	87
LB-200	TSS	< 1.0	133	112	21	84%	0.49	8
LB-200	Turbidity	< 0.34	132	31	101	23%	0.04	3.8
LB-200	Alkalinity, Bicarbonate as HCO3	< 4.8	131	19	112	15%	1	27.7
LB-200	Alkalinity, Total as CaCO3	< 4.7	132	11	121	8%	1	27.7
LB-200	Calcium, as Ca Dissolved	1.2	72	0	72	0%	0.7	17.5
LB-200	Calcium, as Ca Total	< 1.3	71	17	54	24%	0.8	17.9
LB-200	Chloride, as Cl	< 1.0	132	96	36	73%	0.087	2
LB-200	Fluoride, as F	< 0.05	52	47	5	90%	0.05	0.06
LB-200	Hardness, as CaCO3	< 4.5	130	26	104	20%	1	22.9
LB-200	Magnesium, as Mg Dissolved	< 0.36	72	4	68	6%	0.2	4.07
LB-200	Magnesium, as Mg Total	< 0.32	71	45	26	63%	0.1	4.13
LB-200	Potassium, as K Dissolved	< 0.16	70	11	59	16%	0.084	0.389
LB-200	Potassium, as K Total	< 1.0	70	50	20	71%	0.1	1
LB-200	Sodium, as Na Dissolved	< 0.54	71	10	61	14%	0.27	1.3
LB-200	Sodium, as Na Total	< 0.66	70	33	37	47%	0.1	3
LB-200	Sulfate, as SO4	< 1.8	132	59	73	45%	0.681	11.2
LB-200	Ammonia	< 0.050	137	104	33	76%	0.01	0.15

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Non-Detects	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
LB-200	Nitrate	< 0.17	137	10	127	7%	0.0077	1.7
LB-200	Nitrate + Nitrite, as N	0.14	121	0	121	0%	0.01	0.523
LB-200	Nitrite	< 0.010	84	73	11	87%	0.00053	0.27
LB-200	OrthoPhosphorus	< 0.0028	132	89	43	67%	0.00050	0.074
LB-200	TKN	< 0.14	129	73	56	57%	0.005	1.33
LB-200	Total Inorganic Nitrogen	< 0.18	63	1	62	2%	0.01	0.996
LB-200	Total Phosphorus	< 0.0068	130	48	82	37%	0.00056	0.12
LB-200	Aluminum, as Al Dissolved	< 0.016	69	27	42	39%	0.0065	0.072
LB-200	Aluminum, as Al Total	< 0.024	71	10	61	14%	0.0091	0.16
LB-200	Antimony, as Sb Dissolved	< 0.0010	75	71	4	95%	0.000054	0.0022
LB-200	Antimony, as Sb Total	< 0.0005	79	78	1	99%	0.000051	0.000051
LB-200	Arsenic, as As Dissolved	< 0.00031	75	50	25	67%	0.00020	0.00047
LB-200	Arsenic, as As Total	< 0.00032	79	50	29	63%	0.000087	0.00073
LB-200	Barium, as Ba Dissolved	< 0.0024	73	41	32	56%	0.0017	0.006
LB-200	Barium, as Ba Total	< 0.0023	79	23	56	29%	0.00046	0.006
LB-200	Beryllium, as Be Dissolved	< 0.0030	75	73	2	97%	0.000054	0.000081
LB-200	Beryllium, as Be Total	< 0.00020	79	78	1	99%	0.000032	0.000032
LB-200	Cadmium, as Cd Dissolved	< 0.000080	68	63	5	93%	0.000023	0.00014
LB-200	Cadmium, as Cd Total	< 0.000080	70	65	5	93%	0.000017	0.00010
LB-200	Chromium, as Cr Dissolved	< 0.0010	72	57	15	79%	0.00021	0.00081
LB-200	Chromium, as Cr Total	< 0.0010	79	72	7	91%	0.00021	0.00049
LB-200	Copper, as Cu Dissolved	< 0.0010	73	53	20	73%	0.00020	0.0019
LB-200	Copper, as Cu Total	< 0.0010	79	62	17	78%	0.00020	0.002
LB-200	Iron, as Fe Dissolved	< 0.049	74	56	18	76%	0.0024	0.086
LB-200	Iron, as Fe Total	< 0.014	79	51	28	65%	0.0034	0.18
LB-200	Lead, as Pb Dissolved	< 0.00022	71	38	33	54%	0.000033	0.004
LB-200	Lead, as Pb Total	< 0.00027	76	34	42	45%	0.000024	0.005
LB-200	Manganese, as Mn Dissolved	< 0.00095	72	46	26	64%	0.00033	0.004
LB-200	Manganese, as Mn Total	< 0.0011	79	49	30	62%	0.00027	0.0094
LB-200	Mercury, as Hg Dissolved	< 0.000026	34	19	15	56%	0.000016	0.000072
LB-200	Mercury, as Hg Total	< 0.000025	35	21	14	60%	0.000015	0.00013
LB-200	Nickel, as Ni Dissolved	< 0.0080	73	55	18	75%	0.00026	0.00081
LB-200	Nickel, as Ni Total	< 0.00050	79	73	6	92%	0.00019	0.0011
LB-200	Selenium, as Se Dissolved	< 0.0010	75	71	4	95%	0.00016	0.00017
LB-200	Selenium, as Se Total	< 0.0010	79	77	2	97%	0.00013	0.00014
LB-200	Silver, as Ag Dissolved	< 0.00020	34	31	3	91%	0.000085	0.00074
LB-200	Silver, as Ag Total	< 0.00020	36	33	3	92%	0.00029	0.001
LB-200	Thallium, as Tl Dissolved	< 0.00010	62	62	0	100%		
LB-200	Thallium, as Tl Total	< 0.00010	66	66	0	100%		
LB-200	Zinc, as Zn Dissolved	< 0.0033	73	50	23	68%	0.00093	0.037
LB-200	Zinc, as Zn Total	< 0.008	79	62	17	78%	0.0012	0.028
LB-2000	Field Conductivity	40	8	0	8	0%	21	71
LB-2000	Field pH	7	25	0	25	0%	5.5	8.1
LB-2000	Field Temp	5.4	28	0	28	0%	0	18
LB-2000	Flow	43	24	0	24	0%	5.8	193
LB-2000	Lab pH	7.1	27	0	27	0%	5.4	7.9
LB-2000	Lab SC	47	8	0	8	0%	23	76
LB-2000	TDS	< 29	8	1	7	13%	21	47
LB-2000	TSS	< 1.5	28	16	12	57%	0	13
LB-2000	Turbidity	< 1.4	28	3	25	11%	0.09	12
LB-2000	Alkalinity, Bicarbonate as HCO3	24	28	0	28	0%	6	41
LB-2000	Alkalinity, Total as CaCO3	20	28	0	28	0%	5	38
LB-2000	Calcium, as Ca Dissolved	4.5	5	0	5	0%	3.4	8.6
LB-2000	Calcium, as Ca Total	4.9	3	0	3	0%	3	7
LB-2000	Chloride, as Cl	< 1	28	23	5	82%	0.27	4
LB-2000	Fluoride, as F	< 0.05	17	17	0	100%		
LB-2000	Hardness, as CaCO3	< 19	8	1	7	13%	8	35
LB-2000	Magnesium, as Mg Dissolved	1.5	5	0	5	0%	1.2	3.3
LB-2000	Magnesium, as Mg Total	< 1.6	23	8	15	35%	0.6	3.1
LB-2000	Potassium, as K Dissolved	< 0.64	4	2	2	50%	0.26	0.31
LB-2000	Potassium, as K Total	< 0.81	23	16	7	70%	0.2	1
LB-2000	Sodium, as Na Dissolved	< 1.1	5	1	4	20%	0.9	1.5
LB-2000	Sodium, as Na Total	1	3	0	3	0%	1	1.3
LB-2000	Sulfate, as SO4	< 2.2	8	2	6	25%	1	2
LB-2000	Ammonia	< 0.05	8	6	2	75%	0.02	0.07
LB-2000	Nitrate	< 0.044	8	1	7	13%	0.01	0.099
LB-2000	Nitrate + Nitrite, as N	< 0.035	6	1	5	17%	0.01	0.09
LB-2000	Nitrite	< 0.01	6	5	1	83%	0.032	0.032
LB-2000	OrthoPhosphorus	< 0.005	28	21	7	75%	0.0015	0.017
LB-2000	TKN	< 0.11	7	6	1	86%	0.11	0.11
LB-2000	Total Inorganic Nitrogen	< 0.056	6	2	4	33%	0.03	0.15
LB-2000	Total Phosphorus	< 0.011	28	12	16	43%	0.0018	0.12
LB-2000	Aluminum, as Al Dissolved	0.006	3	0	3	0%	0.0046	0.055
LB-2000	Aluminum, as Al Total	< 0.029	6	3	3	50%	0.0099	0.12
LB-2000	Antimony, as Sb Dissolved	< 0.00025	5	4	1	80%	0.000063	0.000063
LB-2000	Antimony, as Sb Total	< 0.0016	6	5	1	83%	0.00017	0.00017
LB-2000	Arsenic, as As Dissolved	< 0.00025	5	2	3	40%	0.0002	0.00029
LB-2000	Arsenic, as As Total	< 0.00033	6	3	3	50%	0.00025	0.00037
LB-2000	Barium, as Ba Dissolved	< 0.0066	5	1	4	20%	0.0053	0.0092
LB-2000	Barium, as Ba Total	0.007	6	0	6	0%	0.0067	0.0093

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Non-Detects	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
LB-2000	Beryllium, as Be Dissolved	< 0.0001	5	5	0	100%		
LB-2000	Beryllium, as Be Total	< 0.00055	6	5	1	83%	0.000098	0.000098
LB-2000	Cadmium, as Cd Dissolved	< 0.000013	3	3	0	100%		
LB-2000	Cadmium, as Cd Total	< 0.000041	3	2	1	67%	0.000071	0.000071
LB-2000	Chromium, as Cr Dissolved	< 0.00025	5	4	1	80%	0.00021	0.00021
LB-2000	Chromium, as Cr Total	< 0.0021	6	5	1	83%	0.00016	0.00016
LB-2000	Copper, as Cu Dissolved	< 0.00031	5	3	2	60%	0.00025	0.00044
LB-2000	Copper, as Cu Total	< 0.00038	6	4	2	67%	0.0003	0.00054
LB-2000	Iron, as Fe Dissolved	< 0.013	5	3	2	60%	0.0018	0.035
LB-2000	Iron, as Fe Total	< 0.037	6	3	3	50%	0.011	0.11
LB-2000	Lead, as Pb Dissolved	< 0.00019	5	3	2	60%	0.000076	0.00065
LB-2000	Lead, as Pb Total	< 0.000074	6	3	3	50%	0.00005	0.00017
LB-2000	Manganese, as Mn Dissolved	< 0.00082	5	2	3	40%	0.0006	0.00097
LB-2000	Manganese, as Mn Total	< 0.0014	6	3	3	50%	0.00046	0.0029
LB-2000	Mercury, as Hg Dissolved	< 0.000020	5	4	1	80%	0.000088	0.000088
LB-2000	Mercury, as Hg Total	< 0.000017	6	6	0	100%		
LB-2000	Nickel, as Ni Dissolved	< 0.00025	5	5	0	100%		
LB-2000	Nickel, as Ni Total	< 0.0051	6	6	0	100%		
LB-2000	Selenium, as Se Dissolved	< 0.00025	5	4	1	80%	0.00017	0.00017
LB-2000	Selenium, as Se Total	< 0.00063	6	6	0	100%		
LB-2000	Silver, as Ag Dissolved	< 0.00025	5	5	0	100%		
LB-2000	Silver, as Ag Total	< 0.00023	6	5	1	83%	0.0002	0.0002
LB-2000	Thallium, as Tl Total	< 0.0002	3	3	0	100%		
LB-2000	Zinc, as Zn Dissolved	< 0.002	5	3	2	60%	0.0019	0.0025
LB-2000	Zinc, as Zn Total	< 0.002	6	5	1	83%	0.0032	0.0032
LB-250	Field Temp	2	1	0	1	0%	2	2
LB-250	Lab pH	7	1	0	1	0%	7	7
LB-250	Lab SC	16	1	0	1	0%	16	16
LB-250	TDS	34	1	0	1	0%	34	34
LB-250	TSS	3	1	0	1	0%	3	3
LB-250	Turbidity	< 0.2	1	1	0	100%		
LB-250	Alkalinity, Bicarbonate as HCO3	7	1	0	1	0%	7	7
LB-250	Alkalinity, Total as CaCO3	5	1	0	1	0%	5	5
LB-250	Calcium, as Ca Total	2	1	0	1	0%	2	2
LB-250	Chloride, as Cl	< 1	1	1	0	100%		
LB-250	Fluoride, as F	< 0.1	1	1	0	100%		
LB-250	Hardness, as CaCO3	< 7	1	1	0	100%		
LB-250	Magnesium, as Mg Total	< 1	1	1	0	100%		
LB-250	Potassium, as K Total	< 1	1	1	0	100%		
LB-250	Sodium, as Na Total	< 1	1	1	0	100%		
LB-250	Sulfate, as SO4	< 5	1	1	0	100%		
LB-250	Ammonia	< 0.05	1	1	0	100%		
LB-250	Nitrate	0.08	1	0	1	0%	0.08	0.08
LB-250	Nitrate + Nitrite, as N	0.08	1	0	1	0%	0.08	0.08
LB-250	Nitrite	< 0.01	1	1	0	100%		
LB-250	OrthoPhosphorus	< 0.001	1	1	0	100%		
LB-250	TKN	0.2	1	0	1	0%	0.2	0.2
LB-250	Total Phosphorus	0.017	1	0	1	0%	0.017	0.017
LB-250	Aluminum, as Al Total	< 0.03	1	1	0	100%		
LB-250	Antimony, as Sb Total	< 0.003	1	1	0	100%		
LB-250	Arsenic, as As Total	< 0.003	1	1	0	100%		
LB-250	Barium, as Ba Total	< 0.005	1	1	0	100%		
LB-250	Beryllium, as Be Total	< 0.001	1	1	0	100%		
LB-250	Cadmium, as Cd Total	< 0.00008	1	1	0	100%		
LB-250	Chromium, as Cr Total	< 0.001	1	1	0	100%		
LB-250	Copper, as Cu Total	0.002	1	0	1	0%	0.002	0.002
LB-250	Iron, as Fe Total	0.02	1	0	1	0%	0.02	0.02
LB-250	Lead, as Pb Total	< 0.00005	1	1	0	100%		
LB-250	Manganese, as Mn Total	< 0.005	1	1	0	100%		
LB-250	Mercury, as Hg Total	< 0.000010	1	1	0	100%		
LB-250	Nickel, as Ni Total	< 0.01	1	1	0	100%		
LB-250	Selenium, as Se Total	< 0.001	1	1	0	100%		
LB-250	Thallium, as Tl Total	< 0.0002	1	1	0	100%		
LB-250	Zinc, as Zn Total	< 0.01	1	1	0	100%		
LB-300	Dissolved Oxygen	12	70	0	70	0%	2.6	14.4
LB-300	Field Conductivity	19	84	0	84	0%	9.1	31.8
LB-300	Field pH	7.0	178	0	178	0%	5	8.48
LB-300	Field Temp	4.0	209	0	209	0%	0.80	19.5
LB-300	Flow	12	96	0	96	0%	1.63	148.08
LB-300	Lab pH	6.7	155	0	155	0%	5.0	7.9
LB-300	Lab SC	21	91	0	91	0%	11	45.2
LB-300	TDS	< 25	93	23	70	25%	7	330
LB-300	TSS	< 1.0	141	103	38	73%	0.5	18.9
LB-300	Turbidity	< 0.37	141	36	105	26%	0.05	4.8
LB-300	Alkalinity, Bicarbonate as HCO3	< 5.9	139	14	125	10%	1	20.8
LB-300	Alkalinity, Total as CaCO3	< 5.8	141	6	135	4%	1	20.8
LB-300	Calcium, as Ca Dissolved	1.9	74	0	74	0%	0.9	3.3
LB-300	Calcium, as Ca Total	< 1.7	28	3	25	11%	1	2.66
LB-300	Chloride, as Cl	< 0.61	141	95	46	67%	0.108	9
LB-300	Fluoride, as F	< 0.050	57	54	3	95%	0.11	0.14

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Non-Detects	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
LB-300	Hardness, as CaCO3	< 6.4	90	10	80	11%	3	14.6
LB-300	Magnesium, as Mg Dissolved	< 0.46	74	4	70	5%	0.2	1
LB-300	Magnesium, as Mg Total	< 0.51	77	47	30	61%	0.3	2
LB-300	Potassium, as K Dissolved	< 0.18	69	11	58	16%	0.1	0.355
LB-300	Potassium, as K Total	< 1.0	76	54	22	71%	0.1	0.7
LB-300	Sodium, as Na Dissolved	< 0.83	74	8	66	11%	0.36	1.9
LB-300	Sodium, as Na Total	< 0.90	28	7	21	25%	0.53	2
LB-300	Sulfate, as SO4	< 2.5	92	41	51	45%	1	9
LB-300	Ammonia	< 0.050	92	73	19	79%	0.01	0.23
LB-300	Nitrate	< 0.13	87	9	78	10%	0.007	0.67
LB-300	Nitrate + Nitrite, as N	0.11	72	0	72	0%	0.03	0.56
LB-300	Nitrite	< 0.01	84	75	9	89%	0.00090	1.42
LB-300	OrthoPhosphorus	< 0.0029	137	84	53	61%	0.00056	0.05
LB-300	TKN	< 0.15	89	42	47	47%	0.035	0.96
LB-300	Total Inorganic Nitrogen	< 0.14	65	3	62	5%	0.03	0.748
LB-300	Total Phosphorus	< 0.0064	135	44	91	33%	0.00039	0.08
LB-300	Aluminum, as Al Dissolved	< 0.012	69	31	38	45%	0.0047	0.064
LB-300	Aluminum, as Al Total	< 0.034	79	17	62	22%	0.0061	0.77
LB-300	Antimony, as Sb Dissolved	< 0.0010	76	73	3	96%	0.000063	0.001
LB-300	Antimony, as Sb Total	< 0.00050	85	84	1	99%	0.000074	0.000074
LB-300	Arsenic, as As Dissolved	< 0.00027	76	47	29	62%	0.00015	0.00040
LB-300	Arsenic, as As Total	< 0.00035	87	54	33	62%	0.00022	0.001
LB-300	Barium, as Ba Dissolved	< 0.0024	73	42	31	58%	0.0017	0.0042
LB-300	Barium, as Ba Total	< 0.0026	84	25	59	30%	0.0017	0.016
LB-300	Beryllium, as Be Dissolved	< 0.00080	76	75	1	99%	0.000022	0.000022
LB-300	Beryllium, as Be Total	< 0.00020	84	84	0	100%		
LB-300	Cadmium, as Cd Dissolved	< 0.000020	75	62	13	83%	0.0000060	0.000019
LB-300	Cadmium, as Cd Total	< 0.0000088	90	63	27	70%	0.0000050	0.00012
LB-300	Chromium, as Cr Dissolved	< 0.0010	65	55	10	85%	0.00018	0.00078
LB-300	Chromium, as Cr Total	< 0.0010	87	76	11	87%	0.00016	0.0022
LB-300	Copper, as Cu Dissolved	< 0.0010	76	56	20	74%	0.00020	0.0048
LB-300	Copper, as Cu Total	< 0.0010	87	69	18	79%	0.00020	0.003
LB-300	Iron, as Fe Dissolved	< 0.0094	73	50	23	68%	0.0015	0.035
LB-300	Iron, as Fe Total	< 0.024	87	54	33	62%	0.0033	0.42
LB-300	Lead, as Pb Dissolved	< 0.00018	84	42	42	50%	0.0000060	0.004
LB-300	Lead, as Pb Total	< 0.00025	98	39	59	40%	0.0000080	0.005
LB-300	Manganese, as Mn Dissolved	< 0.0016	75	42	33	56%	0.00028	0.0063
LB-300	Manganese, as Mn Total	< 0.0019	87	54	33	62%	0.00023	0.02
LB-300	Mercury, as Hg Dissolved	< 0.0000064	54	26	28	48%	0.00000019	0.000061
LB-300	Mercury, as Hg Total	< 0.000010	71	27	44	38%	0.00000016	0.00016
LB-300	Nickel, as Ni Dissolved	< 0.0080	76	61	15	80%	0.00027	0.0014
LB-300	Nickel, as Ni Total	< 0.00050	81	71	10	88%	0.00019	0.01
LB-300	Selenium, as Se Dissolved	< 0.0010	76	71	5	93%	0.00011	0.00024
LB-300	Selenium, as Se Total	< 0.0010	84	82	2	98%	0.00013	0.00014
LB-300	Silver, as Ag Dissolved	< 0.00020	36	34	2	94%	0.000079	0.00032
LB-300	Silver, as Ag Total	< 0.00020	42	41	1	98%	0.000080	0.00008
LB-300	Thallium, as Tl Dissolved	< 0.00010	60	60	0	100%		
LB-300	Thallium, as Tl Total	< 0.00010	64	64	0	100%		
LB-300	Zinc, as Zn Dissolved	< 0.0030	73	50	23	68%	0.00095	0.019
LB-300	Zinc, as Zn Total	< 0.0080	86	66	20	77%	0.0013	0.031
LB-3000	Dissolved Oxygen	12	8	0	8	0%	8.98	13.74
LB-3000	Field Conductivity	59	33	0	33	0%	25	152.8
LB-3000	Field pH	7.5	44	0	44	0%	5.9	8.5
LB-3000	Field Temp	6.0	43	0	43	0%	1	18
LB-3000	Flow	67	41	0	41	0%	10.6	747.7
LB-3000	Lab pH	7.3	44	0	44	0%	5.7	8.4
LB-3000	Lab SC	60	35	0	35	0%	16	215
LB-3000	TDS	40	35	0	35	0%	13	135
LB-3000	TSS	< 2.0	45	28	17	62%	0.48	34
LB-3000	Turbid	< 1.4	45	5	40	11%	0.15	21
LB-3000	Alkalinity, Bicarbonate as HCO3	< 38	44	1	43	2%	12	125
LB-3000	Alkalinity, Total as CaCO3	29	45	0	45	0%	10	102
LB-3000	Calcium, as Ca Dissolved	8.9	15	0	15	0%	5	18
LB-3000	Calcium, as Ca Total	5.0	21	0	21	0%	3	28
LB-3000	Chloride, as Cl	< 0.78	44	29	15	66%	0.25	6
LB-3000	Fluoride, as F	< 0.050	25	20	5	80%	0.01	0.06
LB-3000	Hardness, as CaCO3	< 30	35	3	32	9%	8	115
LB-3000	Magnesium, as Mg Dissolved	2.8	15	0	15	0%	1.6	7
LB-3000	Magnesium, as Mg Total	< 2.6	31	6	25	19%	1	11
LB-3000	Potassium, as K Dissolved	< 0.35	14	3	11	21%	0.24	0.4
LB-3000	Potassium, as K Total	< 1.0	31	26	5	84%	0.3	1
LB-3000	Sodium, as Na Dissolved	< 1.1	15	1	14	7%	0.58	2
LB-3000	Sodium, as Na Total	< 1.9	21	4	17	19%	1	4
LB-3000	Sulfate, as SO4	< 2.1	34	10	24	29%	1	7
LB-3000	Ammonia	< 0.035	35	24	11	69%	0.01	0.21
LB-3000	Nitrate	< 0.058	35	5	30	14%	0.01	0.16
LB-3000	Nitrate + Nitrite, as N	< 0.057	31	4	27	13%	0.01	0.16
LB-3000	Nitrite	< 0.010	18	15	3	83%	0.00060	0.02
LB-3000	OrthoPhosphorus	< 0.0033	45	31	14	69%	0.00090	0.043
LB-3000	TKN	< 0.14	34	18	16	53%	0.04	0.47

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Non-Detects	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
LB-3000	Total Inorganic Nitrogen	< 0.052	14	5	9	36%	0.03	0.12
LB-3000	Total Phosphorus	< 0.027	45	15	30	33%	0.0015	0.82
LB-3000	Aluminum, as Al Dissolved	< 0.020	14	5	9	36%	0.0035	0.068
LB-3000	Aluminum, as Al Total	< 0.032	15	2	13	13%	0.0057	0.12
LB-3000	Antimony, as Sb Dissolved	< 0.0010	16	15	1	94%	0.000051	0.000051
LB-3000	Antimony, as Sb Total	< 0.00050	18	17	1	94%	0.0002	0.0002
LB-3000	Arsenic, as As Dissolved	< 0.00030	16	10	6	63%	0.00028	0.00034
LB-3000	Arsenic, as As Total	< 0.00028	18	12	6	67%	0.00014	0.00040
LB-3000	Barium, as Ba Dissolved	< 0.014	16	1	15	6%	0.0071	0.026
LB-3000	Barium, as Ba Total	0.014	18	0	18	0%	0.0072	0.037
LB-3000	Beryllium, as Be Dissolved	< 0.00080	16	16	0	100%		
LB-3000	Beryllium, as Be Total	< 0.00020	18	18	0	100%		
LB-3000	Cadmium, as Cd Dissolved	< 0.000080	14	13	1	93%	0.0001	0.0001
LB-3000	Cadmium, as Cd Total	< 0.000080	16	14	2	88%	0.000013	0.00020
LB-3000	Chromium, as Cr Dissolved	< 0.0010	14	13	1	93%	0.00058	0.00058
LB-3000	Chromium, as Cr Total	< 0.0010	18	17	1	94%	0.00042	0.00042
LB-3000	Copper, as Cu Dissolved	< 0.0010	16	12	4	75%	0.00023	0.00037
LB-3000	Copper, as Cu Total	< 0.0010	18	14	4	78%	0.00020	0.0015
LB-3000	Iron, as Fe Dissolved	< 0.014	16	10	6	63%	0.0054	0.043
LB-3000	Iron, as Fe Total	< 0.028	18	8	10	44%	0.0054	0.1
LB-3000	Lead, as Pb Dissolved	< 0.000055	15	8	7	53%	0.000031	0.00010
LB-3000	Lead, as Pb Total	< 0.00023	18	6	12	33%	0.000023	0.003
LB-3000	Manganese, as Mn Dissolved	< 0.00074	16	10	6	63%	0.00035	0.0013
LB-3000	Manganese, as Mn Total	< 0.0019	18	12	6	67%	0.00062	0.012
LB-3000	Mercury, as Hg Dissolved	< 0.000020	8	7	1	88%	0.000044	0.000044
LB-3000	Mercury, as Hg Total	< 0.000020	11	10	1	91%	0.000066	0.000066
LB-3000	Nickel, as Ni Dissolved	< 0.0080	14	12	2	86%	0.00026	0.00027
LB-3000	Nickel, as Ni Total	< 0.00050	18	17	1	94%	0.00027	0.00027
LB-3000	Selenium, as Se Dissolved	< 0.0010	16	14	2	88%	0.00011	0.00018
LB-3000	Selenium, as Se Total	< 0.0010	18	18	0	100%		
LB-3000	Silver, as Ag Dissolved	< 0.00020	8	7	1	88%	0.0002	0.0002
LB-3000	Silver, as Ag Total	< 0.00020	9	5	4	56%	0.000098	0.00052
LB-3000	Thallium, as Tl Dissolved	< 0.00010	13	13	0	100%		
LB-3000	Thallium, as Tl Total	< 0.00010	15	15	0	100%		
LB-3000	Zinc, as Zn Dissolved	< 0.0026	15	10	5	67%	0.0015	0.0082
LB-3000	Zinc, as Zn Total	< 0.0019	18	12	6	67%	0.0014	0.0031
LB-500	Dissolved Oxygen	12	79	0	79	0%	5.45	15.9
LB-500	Field Conductivity	19	99	0	99	0%	6	36.1
LB-500	Field pH	7.2	157	0	157	0%	4.8	8.5
LB-500	Field Temp	4.7	151	0	151	0%	0.1	18
LB-500	Flow	10	75	0	75	0%	0.47	173.6
LB-500	Lab pH	6.8	78	0	78	0%	5.2	7.4
LB-500	Lab SC	19	75	0	75	0%	11	26.5
LB-500	TDS	< 16	75	13	62	17%	4	36
LB-500	TSS	< 1.0	162	118	44	73%	0.49	13.1
LB-500	Turbid	< 0.45	80	17	63	21%	0.05	3.7
LB-500	Alkalinity, Bicarbonate as HCO3	< 7.2	77	5	72	6%	2	26
LB-500	Alkalinity, Total as CaCO3	< 6.9	78	3	75	4%	2	21
LB-500	Calcium, as Ca Dissolved	1.8	57	0	57	0%	0.9	2.4
LB-500	Calcium, as Ca Total	< 1.2	21	13	8	62%	1	2.19
LB-500	Chloride, as Cl	< 1.0	80	57	23	71%	0.1	1.2
LB-500	Fluoride, as F	< 0.050	23	20	3	87%	0.01	0.03
LB-500	Hardness, as CaCO3	< 6.5	67	11	56	16%	3	38.4
LB-500	Magnesium, as Mg Dissolved	< 0.50	58	2	56	3%	0.2	2.7
LB-500	Magnesium, as Mg Total	< 1.0	26	19	7	73%	0.4	0.9
LB-500	Potassium, as K Dissolved	< 0.21	53	9	44	17%	0.11	1.2
LB-500	Potassium, as K Total	< 0.29	26	18	8	69%	0.17	1
LB-500	Sodium, as Na Dissolved	< 0.86	58	7	51	12%	0.39	2.2
LB-500	Sodium, as Na Total	< 1.7	21	6	15	29%	0.766	4
LB-500	Sulfate, as SO4	< 2.4	75	33	42	44%	1	21.9
LB-500	Ammonia	< 0.050	74	54	20	73%	0.01	0.14
LB-500	Nitrate	< 0.11	73	9	64	12%	0.02	0.4
LB-500	Nitrate + Nitrite, as N	0.10	64	0	64	0%	0.02	0.38
LB-500	Nitrite	< 0.010	59	54	5	92%	0.00050	0.009
LB-500	OrthoPhosphorus	< 0.0021	76	39	37	51%	0.00056	0.013
LB-500	TKN	< 0.15	74	40	34	54%	0.05	1.21
LB-500	Total Inorganic Nitrogen	< 0.13	54	2	52	4%	0.03	0.4
LB-500	Total Phosphorus	< 0.0067	73	16	57	22%	0.0018	0.029
LB-500	Aluminum, as Al Dissolved	< 0.013	53	20	33	38%	0.0051	0.049
LB-500	Aluminum, as Al Total	< 0.031	52	2	50	4%	0.0068	0.28
LB-500	Antimony, as Sb Total	< 0.00050	58	55	3	95%	0.000057	0.00034
LB-500	Arsenic, as As Dissolved	< 0.00026	58	34	24	59%	0.00014	0.00038
LB-500	Arsenic, as As Dissolved	< 0.00026	58	34	24	59%	0.00014	0.00038
LB-500	Arsenic, as As Total	< 0.00041	59	32	27	54%	0.00018	0.004
LB-500	Barium, as Ba Dissolved	< 0.0027	56	26	30	46%	0.0018	0.0045
LB-500	Barium, as Ba Total	< 0.0028	59	10	49	17%	0.0016	0.0045
LB-500	Beryllium, as Be Dissolved	< 0.00080	59	58	1	98%	0.0001	0.0001
LB-500	Beryllium, as Be Total	< 0.00020	59	58	1	98%	0.00003	0.00003
LB-500	Cadmium, as Cd Dissolved	< 0.000080	48	43	5	90%	0.000017	0.000025
LB-500	Cadmium, as Cd Total	< 0.000080	49	44	5	90%	0.000013	0.00010

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Non-Detects	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
LB-500	Chromium, as Cr Dissolved	< 0.0010	55	43	12	78%	0.00017	0.00048
LB-500	Chromium, as Cr Total	< 0.0010	59	53	6	90%	0.00019	0.0032
LB-500	Copper, as Cu Dissolved	< 0.0010	55	42	13	76%	0.00023	0.00070
LB-500	Copper, as Cu Total	< 0.0010	59	47	12	80%	0.00025	0.0019
LB-500	Iron, as Fe Dissolved	< 0.050	57	41	16	72%	0.004	0.021
LB-500	Iron, as Fe Total	< 0.028	59	33	26	56%	0.0038	0.32
LB-500	Lead, as Pb Dissolved	< 0.026	56	32	24	57%	0.000024	1.42
LB-500	Lead, as Pb Total	< 0.0011	55	24	31	44%	0.000020	0.056
LB-500	Manganese, as Mn Dissolved	< 0.00094	55	34	21	62%	0.00023	0.0021
LB-500	Manganese, as Mn Total	< 0.0017	59	31	28	53%	0.00012	0.012
LB-500	Mercury, as Hg Dissolved	< 0.000026	30	17	13	57%	0.000018	0.000056
LB-500	Mercury, as Hg Total	< 0.000020	26	17	9	65%	0.000014	0.000046
LB-500	Nickel, as Ni Dissolved	< 0.0080	55	43	12	78%	0.00024	0.00060
LB-500	Nickel, as Ni Total	< 0.00050	59	52	7	88%	0.00020	0.0047
LB-500	Selenium, as Se Dissolved	< 0.0010	58	57	1	98%	0.00013	0.00013
LB-500	Selenium, as Se Total	< 0.0010	59	56	3	95%	0.00013	0.00017
LB-500	Silver, as Ag Dissolved	< 0.00023	30	29	1	97%	0.00063	0.00063
LB-500	Silver, as Ag Total	< 0.00025	33	29	4	88%	0.00030	0.00091
LB-500	Thallium, as Tl Dissolved	< 0.00010	45	44	1	98%	0.0018	0.0018
LB-500	Thallium, as Tl Total	< 0.00010	45	44	1	98%	0.0024	0.0024
LB-500	Zinc, as Zn Dissolved	< 0.0080	51	38	13	75%	0.00096	0.0031
LB-500	Zinc, as Zn Total	< 0.0025	59	48	11	81%	0.0014	0.0087
LB-800	Field Conductivity	28	16	0	16	0%	11	37
LB-800	Field pH	6.8	24	0	24	0%	4.6	8.2
LB-800	Field Temp	4	25	0	25	0%	0	18
LB-800	Flow	37	25	0	25	0%	2.9	250
LB-800	Lab pH	6.4	24	0	24	0%	5.4	7.1
LB-800	Lab SC	25	17	0	17	0%	14	41
LB-800	TDS	19	17	0	17	0%	6	46
LB-800	TSS	< 2.6	25	17	8	68%	1	30
LB-800	Turbidity	< 0.86	24	2	22	8%	0.17	10
LB-800	Alkalinity, Bicarbonate as HCO3	11	24	0	24	0%	0	26
LB-800	Alkalinity, Total as CaCO3	9	24	0	24	0%	2	21
LB-800	Calcium, as Ca Total	< 1.9	17	3	14	18%	1	4
LB-800	Chloride, as Cl	< 1	25	22	3	88%	1	3
LB-800	Fluoride, as F	< 0.05	25	20	5	80%	0.01	0.05
LB-800	Hardness, as CaCO3	< 3	17	9	8	53%	0	8
LB-800	Magnesium, as Mg Total	< 1	25	24	1	96%	2	2
LB-800	Potassium, as K Total	< 1	25	24	1	96%	1	1
LB-800	Sodium, as Na Total	< 2	17	4	13	24%	1	4
LB-800	Sulfate, as SO4	< 1.5	17	5	12	29%	1	2
LB-800	Ammonia	< 0.074	17	11	6	65%	0.05	0.23
LB-800	Nitrate	0.04	17	0	17	0%	0.02	0.51
LB-800	Nitrate + Nitrite, as N	0.04	17	0	17	0%	0.02	0.51
LB-800	OrthoPhosphorus	< 0.005	25	18	7	72%	0.005	0.013
LB-800	TKN	< 0.28	17	9	8	53%	0.16	0.7
LB-800	Total Phosphorus	< 0.01	25	10	15	40%	0.005	0.088
LC-100	Field Conductivity	20	26	0	26	0%	12	40
LC-100	Field pH	6.5	25	0	25	0%	5.2	8.4
LC-100	Field Temp	5.5	28	0	28	0%	0	15
LC-100	Flow	0.98	29	0	29	0%	0.02	50
LC-100	Lab pH	6.6	28	0	28	0%	5.5	7.3
LC-100	Lab SC	23	28	0	28	0%	10	42
LC-100	TDS	< 24	28	1	27	4%	11	50
LC-100	TSS	< 1	28	24	4	86%	1	5
LC-100	Turbidity	< 0.32	28	2	26	7%	0.13	1.1
LC-100	Alkalinity, Bicarbonate as HCO3	10	27	0	27	0%	0	28
LC-100	Alkalinity, Total as CaCO3	8	28	0	28	0%	3	23
LC-100	Calcium, as Ca Total	< 1.9	28	10	18	36%	0.2	4
LC-100	Chloride, as Cl	< 1	28	25	3	89%	1	1
LC-100	Fluoride, as F	< 0.05	23	19	4	83%	0.01	0.06
LC-100	Hardness, as CaCO3	< 4.8	28	10	18	36%	0	15
LC-100	Magnesium, as Mg Total	< 1	28	20	8	71%	0.3	1.2
LC-100	Potassium, as K Total	< 1	28	20	8	71%	0.2	1
LC-100	Sodium, as Na Total	< 1.9	28	4	24	14%	0.6	6
LC-100	Sulfate, as SO4	< 1.8	28	10	18	36%	1	4
LC-100	Ammonia	< 0.064	28	19	9	68%	0.05	0.23
LC-100	Nitrate	< 0.021	28	15	13	54%	0.01	0.16
LC-100	Nitrate + Nitrite, as N	< 0.022	28	15	13	54%	0.01	0.16
LC-100	OrthoPhosphorus	< 0.007	28	15	13	54%	0.005	0.025
LC-100	TKN	< 0.23	28	16	12	57%	0.17	0.67
LC-100	Total Phosphorus	< 0.013	28	5	23	18%	0.005	0.049
LC-600	Field Conductivity	26	25	0	25	0%	10	85
LC-600	Field pH	6.8	24	0	24	0%	5.2	8
LC-600	Field Temp	5	26	0	26	0%	0	16
LC-600	Flow	3.2	25	0	25	0%	0.2	13
LC-600	Lab pH	6.7	26	0	26	0%	5.2	7.6
LC-600	Lab SC	26	26	0	26	0%	15	93
LC-600	TDS	27	26	0	26	0%	8	66
LC-600	TSS	< 3.9	26	6	20	23%	1	26

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Non-Detects	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
LC-600	Turbidity	1.1	26	0	26	0%	0.47	19
LC-600	Alkalinity, Bicarbonate as HCO3	13	25	0	25	0%	6	57
LC-600	Alkalinity, Total as CaCO3	11	26	0	26	0%	5	47
LC-600	Calcium, as Ca Total	< 2.9	26	3	23	12%	1	9
LC-600	Chloride, as Cl	< 1	26	22	4	85%	1	1
LC-600	Fluoride, as F	< 0.05	26	22	4	85%	0.02	0.06
LC-600	Hardness, as CaCO3	< 7.7	26	14	12	54%	0	35
LC-600	Magnesium, as Mg Total	< 1	26	20	6	77%	1	3
LC-600	Potassium, as K Total	< 1	26	23	3	88%	1	2
LC-600	Sodium, as Na Total	< 2.3	26	4	22	15%	1	5
LC-600	Sulfate, as SO4	< 1.6	26	8	18	31%	1	5
LC-600	Ammonia	< 0.064	26	18	8	69%	0.05	0.23
LC-600	Nitrate	< 0.01	26	20	6	77%	0.02	2
LC-600	Nitrate + Nitrite, as N	< 0.01	26	20	6	77%	0.02	2
LC-600	OrthoPhosphorus	< 0.0063	26	12	14	46%	0.005	0.012
LC-600	TKN	< 0.22	26	14	12	54%	0.2	0.34
LC-600	Total Phosphorus	< 0.015	26	6	20	23%	0.005	0.1
LC-800	Dissolved Oxygen	11	8	0	8	0%	9.55	13.45
LC-800	Field Conductivity	56	29	0	29	0%	17.6	95
LC-800	Field pH	7.3	31	0	31	0%	6.12	8
LC-800	Field Temp	4.8	32	0	32	0%	1.2	15.5
LC-800	Flow	0.58	21	0	21	0%	0.15	52
LC-800	Lab pH	7.2	28	0	28	0%	6.1	7.9
LC-800	Lab SC	45	29	0	29	0%	10	102
LC-800	TDS	< 38	31	3	28	10%	10	73
LC-800	TSS	< 6.7	31	14	17	45%	0.57	118
LC-800	Turbid	< 5.4	32	4	28	13%	0.05	89
LC-800	Alkalinity, Bicarbonate as HCO3	29	32	0	32	0%	9	55.3
LC-800	Alkalinity, Total as CaCO3	26	32	0	32	0%	7	55.3
LC-800	Calcium, as Ca Dissolved	5.3	13	0	13	0%	1.5	10
LC-800	Calcium, as Ca Total	4.7	19	0	19	0%	1.2	9.9
LC-800	Chloride, as Cl	< 0.73	30	15	15	50%	0.2	4
LC-800	Fluoride, as F	< 0.058	11	7	4	64%	0.05	0.11
LC-800	Hardness, as CaCO3	< 21	32	2	30	6%	5.82	42.2
LC-800	Magnesium, as Mg Dissolved	< 1.9	13	1	12	8%	0.34	4.2
LC-800	Magnesium, as Mg Total	< 2.3	19	1	18	5%	0.82	4
LC-800	Potassium, as K Dissolved	< 0.46	11	5	6	45%	0.31	0.61
LC-800	Potassium, as K Total	< 0.58	19	12	7	63%	0.2	3
LC-800	Sodium, as Na Dissolved	< 1.6	13	1	12	8%	0.39	2.3
LC-800	Sodium, as Na Total	< 1.6	19	1	18	5%	0.8	3
LC-800	Sulfate, as SO4	< 2.0	31	13	18	42%	0.5	16.1
LC-800	Ammonia	< 0.12	32	19	13	59%	0.01	2.74
LC-800	Nitrate	< 0.032	29	14	15	48%	0.01	0.34
LC-800	Nitrate + Nitrite, as N	< 0.030	26	15	11	58%	0.01	0.34
LC-800	Nitrite	< 0.010	19	16	3	84%	0.001	0.017
LC-800	OrthoPhosphorus	< 0.0054	31	15	16	48%	0.00090	0.048
LC-800	TKN	< 0.22	31	16	15	52%	0.11	0.7
LC-800	Total Inorganic Nitrogen	< 0.032	13	6	7	46%	0.01	0.07
LC-800	Total Phosphorus	< 0.011	30	7	23	23%	0.002	0.074
LC-800	Aluminum, as Al Dissolved	0.017	8	0	8	0%	0.0052	0.091
LC-800	Aluminum, as Al Total	< 0.076	16	3	13	19%	0.0081	0.5
LC-800	Antimony, as Sb Dissolved	< 0.00025	12	12	0	100%		
LC-800	Antimony, as Sb Total	< 0.0030	19	19	0	100%		
LC-800	Arsenic, as As Dissolved	< 0.00016	13	9	4	69%	0.000089	0.00037
LC-800	Arsenic, as As Total	< 0.0010	21	17	4	81%	0.00020	0.00034
LC-800	Barium, as Ba Dissolved	0.012	13	0	13	0%	0.0059	0.02
LC-800	Barium, as Ba Total	0.012	18	0	18	0%	0.0031	0.022
LC-800	Beryllium, as Be Dissolved	< 0.00010	11	11	0	100%		
LC-800	Beryllium, as Be Total	< 0.0010	18	18	0	100%		
LC-800	Cadmium, as Cd Dissolved	< 0.000027	6	6	0	100%		
LC-800	Cadmium, as Cd Total	< 0.000030	10	8	2	80%	0.00020	0.00040
LC-800	Chromium, as Cr Dissolved	< 0.00019	13	9	4	69%	0.00016	0.00025
LC-800	Chromium, as Cr Total	< 0.0010	21	17	4	81%	0.00022	0.004
LC-800	Copper, as Cu Dissolved	< 0.00071	11	9	2	82%	0.00032	0.00071
LC-800	Copper, as Cu Total	< 0.00048	21	13	8	62%	0.00026	0.002
LC-800	Iron, as Fe Dissolved	< 0.026	13	8	5	62%	0.0069	0.11
LC-800	Iron, as Fe Total	< 0.069	21	9	12	43%	0.0099	0.49
LC-800	Lead, as Pb Dissolved	< 0.000050	11	9	2	82%	0.000095	0.00012
LC-800	Lead, as Pb Total	< 0.00013	14	8	6	57%	0.000062	0.00036
LC-800	Manganese, as Mn Dissolved	< 0.0015	11	5	6	45%	0.00057	0.004
LC-800	Manganese, as Mn Total	< 0.0048	21	8	13	38%	0.001	0.019
LC-800	Mercury, as Hg Dissolved	< 0.000020	9	8	1	89%	0.000031	0.000031
LC-800	Mercury, as Hg Total	< 0.000020	13	11	2	85%	0.000032	0.000060
LC-800	Nickel, as Ni Dissolved	< 0.0051	10	10	0	100%		
LC-800	Nickel, as Ni Total	< 0.00025	15	15	0	100%		
LC-800	Selenium, as Se Dissolved	< 0.00025	13	12	1	92%	0.00017	0.00017
LC-800	Selenium, as Se Total	< 0.0010	18	18	0	100%		
LC-800	Silver, as Ag Dissolved	< 0.00023	12	12	0	100%		
LC-800	Silver, as Ag Total	< 0.00020	18	17	1	94%	0.00030	0.0003
LC-800	Thallium, as Tl Dissolved	< 0.00020	6	6	0	100%		

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Non-Detects	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
LC-800	Thallium, as Tl Total	< 0.00020	7	6	1	86%	0.0003	0.0003
LC-800	Zinc, as Zn Dissolved	< 0.0045	13	9	4	69%	0.0019	0.032
LC-800	Zinc, as Zn Total	< 0.0025	21	16	5	76%	0.0011	0.0037
Midas Cr	Field Temp	2	1	0	1	0%	2	2
Midas Cr	Lab pH	8	1	0	1	0%	8	8
Midas Cr	Lab SC	170	1	0	1	0%	174	174
Midas Cr	TDS	81	1	0	1	0%	81	81
Midas Cr	TSS	3	1	0	1	0%	3	3
Midas Cr	Alkalinity, Bicarbonate as HCO3	120	1	0	1	0%	115	115
Midas Cr	Alkalinity, Total as CaCO3	95	1	0	1	0%	95	95
Midas Cr	Calcium, as Ca Dissolved	16	1	0	1	0%	16	16
Midas Cr	Calcium, as Ca Total	20	1	0	1	0%	20	20
Midas Cr	Chloride, as Cl	2	1	0	1	0%	2	2
Midas Cr	Hardness, as CaCO3	73	1	0	1	0%	73	73
Midas Cr	Magnesium, as Mg Dissolved	8	1	0	1	0%	8	8
Midas Cr	Magnesium, as Mg Total	10	1	0	1	0%	10	10
Midas Cr	Potassium, as K Dissolved	< 1	1	1	0	100%		
Midas Cr	Potassium, as K Total	< 1	1	1	0	100%		
Midas Cr	Sodium, as Na Dissolved	3	1	0	1	0%	3	3
Midas Cr	Sodium, as Na Total	3	1	0	1	0%	3	3
Midas Cr	Sulfate, as SO4	< 5	1	1	0	100%		
Midas Cr	Ammonia	< 0.05	1	1	0	100%		
Midas Cr	Nitrate + Nitrite, as N	< 0.01	1	1	0	100%		
Midas Cr	Total Phosphorus	0.017	1	0	1	0%	0.017	0.017
Midas Cr	Aluminum, as Al Dissolved	< 0.03	1	1	0	100%		
Midas Cr	Aluminum, as Al Total	0.2	1	0	1	0%	0.2	0.2
Midas Cr	Antimony, as Sb Dissolved	< 0.003	1	1	0	100%		
Midas Cr	Antimony, as Sb Total	< 0.003	1	1	0	100%		
Midas Cr	Arsenic, as As Dissolved	< 0.003	1	1	0	100%		
Midas Cr	Arsenic, as As Total	< 0.003	1	1	0	100%		
Midas Cr	Barium, as Ba Dissolved	0.026	1	0	1	0%	0.026	0.026
Midas Cr	Barium, as Ba Total	0.026	1	0	1	0%	0.026	0.026
Midas Cr	Beryllium, as Be Dissolved	< 0.001	1	1	0	100%		
Midas Cr	Beryllium, as Be Total	< 0.001	1	1	0	100%		
Midas Cr	Cadmium, as Cd Dissolved	< 0.00008	1	1	0	100%		
Midas Cr	Cadmium, as Cd Total	< 0.00008	1	1	0	100%		
Midas Cr	Chromium, as Cr Dissolved	< 0.001	1	1	0	100%		
Midas Cr	Chromium, as Cr Total	< 0.001	1	1	0	100%		
Midas Cr	Copper, as Cu Dissolved	< 0.001	1	1	0	100%		
Midas Cr	Copper, as Cu Total	0.002	1	0	1	0%	0.002	0.002
Midas Cr	Iron, as Fe Dissolved	< 0.05	1	1	0	100%		
Midas Cr	Iron, as Fe Total	0.21	1	0	1	0%	0.21	0.21
Midas Cr	Lead, as Pb Dissolved	0.00014	1	0	1	0%	0.00014	0.00014
Midas Cr	Lead, as Pb Total	0.0003	1	0	1	0%	0.0003	0.0003
Midas Cr	Manganese, as Mn Dissolved	< 0.005	1	1	0	100%		
Midas Cr	Manganese, as Mn Total	< 0.005	1	1	0	100%		
Midas Cr	Mercury, as Hg Dissolved	< 0.000010	1	1	0	100%		
Midas Cr	Mercury, as Hg Total	< 0.000010	1	1	0	100%		
Midas Cr	Nickel, as Ni Dissolved	< 0.01	1	1	0	100%		
Midas Cr	Nickel, as Ni Total	< 0.01	1	1	0	100%		
Midas Cr	Selenium, as Se Dissolved	< 0.001	1	1	0	100%		
Midas Cr	Selenium, as Se Total	< 0.001	1	1	0	100%		
Midas Cr	Thallium, as Tl Dissolved	< 0.0002	1	1	0	100%		
Midas Cr	Thallium, as Tl Total	< 0.0002	1	1	0	100%		
Midas Cr	Zinc, as Zn Dissolved	< 0.01	1	1	0	100%		
Midas Cr	Zinc, as Zn Total	< 0.01	1	1	0	100%		
PM-1000	Dissolved Oxygen	12	15	0	15	0%	9.35	15.6
PM-1000	Field Conductivity	26	50	0	50	0%	14	51.8
PM-1000	Field pH	7.2	50	0	50	0%	5.6	8.7
PM-1000	Field Temp	5.0	52	0	52	0%	1	13.5
PM-1000	Flow	6.2	45	0	45	0%	0.7	91.2
PM-1000	Lab pH	7.0	50	0	50	0%	5.5	7.8
PM-1000	Lab SC	26	51	0	51	0%	16	49
PM-1000	TDS	< 23	53	5	48	9%	10	55.4
PM-1000	TSS	< 1.0	53	43	10	81%	0.48	4
PM-1000	Turbid	< 0.23	53	15	38	28%	0.11	1
PM-1000	Alkalinity, Bicarbonate as HCO3	14	51	0	51	0%	7	26
PM-1000	Alkalinity, Total as CaCO3	12	53	0	53	0%	6	21.4
PM-1000	Calcium, as Ca Dissolved	4.1	21	0	21	0%	1.9	5.4
PM-1000	Calcium, as Ca Total	< 2.8	32	1	31	3%	1	7
PM-1000	Chloride, as Cl	< 1.0	52	38	14	73%	0.15	2
PM-1000	Fluoride, as F	< 0.050	25	21	4	84%	0.01	0.09
PM-1000	Hardness, as CaCO3	< 10	53	8	45	15%	3	26
PM-1000	Magnesium, as Mg Dissolved	< 0.94	21	1	20	5%	0.53	1.5
PM-1000	Magnesium, as Mg Total	< 0.77	32	20	12	63%	0.5	2
PM-1000	Potassium, as K Dissolved	< 0.26	19	5	14	26%	0.2	0.47
PM-1000	Potassium, as K Total	< 1.0	32	30	2	94%	0.2	0.2
PM-1000	Sodium, as Na Dissolved	< 0.86	21	5	16	24%	0.44	1.7
PM-1000	Sodium, as Na Total	< 1.4	32	12	20	38%	0.5	6
PM-1000	Sulfate, as SO4	< 1.6	52	17	35	33%	0.78	7

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Non-Detects	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
PM-1000	Ammonia	< 0.050	53	41	12	77%	0.01	1.17
PM-1000	Nitrate	< 0.053	50	2	48	4%	0.01	0.15
PM-1000	Nitrate + Nitrite, as N	0.050	47	0	47	0%	0.01	0.12
PM-1000	Nitrite	< 0.010	28	28	0	100%		
PM-1000	OrthoPhosphorus	< 0.0021	52	34	18	65%	0.00080	0.012
PM-1000	TKN	< 0.17	51	25	26	49%	0.03	1
PM-1000	Total Inorganic Nitrogen	< 0.060	21	4	17	19%	0.03	0.16
PM-1000	Total Phosphorus	< 0.0099	53	18	35	34%	0.0011	0.22
PM-1000	Aluminum, as Al Dissolved	< 0.010	14	5	9	36%	0.005	0.019
PM-1000	Aluminum, as Al Total	< 0.025	24	7	17	29%	0.0053	0.2
PM-1000	Antimony, as Sb Dissolved	< 0.0010	21	20	1	95%	0.00028	0.00028
PM-1000	Antimony, as Sb Total	< 0.00050	29	21	8	72%	0.00018	0.00028
PM-1000	Arsenic, as As Dissolved	< 0.00024	20	12	8	60%	0.00019	0.00029
PM-1000	Arsenic, as As Total	< 0.00050	29	21	8	72%	0.00018	0.00028
PM-1000	Barium, as Ba Dissolved	< 0.0060	21	2	19	10%	0.004	0.012
PM-1000	Barium, as Ba Total	< 0.0064	26	3	23	12%	0.00096	0.018
PM-1000	Beryllium, as Be Dissolved	< 0.00080	21	19	2	90%	0.000020	0.000080
PM-1000	Beryllium, as Be Total	< 0.00020	26	26	0	100%		
PM-1000	Cadmium, as Cd Dissolved	< 0.000040	16	14	2	88%	0.000022	0.000049
PM-1000	Cadmium, as Cd Total	< 0.000040	16	14	2	88%	0.000018	0.000070
PM-1000	Chromium, as Cr Dissolved	< 0.0010	19	15	4	79%	0.00019	0.00034
PM-1000	Chromium, as Cr Total	< 0.0010	29	26	3	90%	0.00039	0.00097
PM-1000	Copper, as Cu Dissolved	< 0.0010	19	15	4	79%	0.00024	0.00026
PM-1000	Copper, as Cu Total	< 0.0010	29	24	5	83%	0.00024	0.002
PM-1000	Iron, as Fe Dissolved	< 0.050	21	15	6	71%	0.0011	0.0082
PM-1000	Iron, as Fe Total	< 0.050	29	22	7	76%	0.0018	0.039
PM-1000	Lead, as Pb Dissolved	< 0.000050	19	14	5	74%	0.000028	0.00013
PM-1000	Lead, as Pb Total	< 0.000045	22	15	7	68%	0.000029	0.00010
PM-1000	Manganese, as Mn Dissolved	< 0.00048	19	12	7	63%	0.00011	0.00089
PM-1000	Manganese, as Mn Total	< 0.00089	29	20	9	69%	0.00019	0.0034
PM-1000	Mercury, as Hg Dissolved	< 0.000020	10	8	2	80%	0.000025	0.000035
PM-1000	Mercury, as Hg Total	< 0.000020	15	12	3	80%	0.000013	0.000069
PM-1000	Nickel, as Ni Dissolved	< 0.0080	21	17	4	81%	0.00023	0.0011
PM-1000	Nickel, as Ni Total	< 0.00050	23	22	1	96%	0.00034	0.00034
PM-1000	Selenium, as Se Dissolved	< 0.0010	21	20	1	95%	0.00013	0.00013
PM-1000	Selenium, as Se Total	< 0.0010	26	26	0	100%		
PM-1000	Silver, as Ag Dissolved	< 0.00020	15	14	1	93%	0.0009	0.0009
PM-1000	Silver, as Ag Total	< 0.00020	20	19	1	95%	0.00056	0.00056
PM-1000	Thallium, as Tl Dissolved	< 0.00010	14	14	0	100%		
PM-1000	Thallium, as Tl Total	< 0.00010	15	15	0	100%		
PM-1000	Zinc, as Zn Dissolved	< 0.0030	21	15	6	71%	0.0016	0.033
PM-1000	Zinc, as Zn Total	< 0.0031	29	25	4	86%	0.002	0.0056
PM-500	Field Conductivity	23	17	0	17	0%	15	33
PM-500	Field pH	6.6	17	0	17	0%	5.3	8.4
PM-500	Field Temp	3.5	18	0	18	0%	0	13
PM-500	Flow	5.9	18	0	18	0%	0.51	85
PM-500	Lab pH	6.7	18	0	18	0%	5.6	7.2
PM-500	Lab SC	23	18	0	18	0%	15	39
PM-500	TDS	< 18	18	1	17	6%	5	48
PM-500	TSS	< 1	18	16	2	89%	1	1
PM-500	Turbidity	< 0.23	18	2	16	11%	0.13	0.35
PM-500	Alkalinity, Bicarbonate as HCO3	11	17	0	17	0%	0	21
PM-500	Alkalinity, Total as CaCO3	9	18	0	18	0%	1	17
PM-500	Calcium, as Ca Total	< 2.3	18	1	17	6%	1	4
PM-500	Chloride, as Cl	< 1	18	17	1	94%	1	1
PM-500	Fluoride, as F	< 0.049	15	10	5	67%	0.02	0.08
PM-500	Hardness, as CaCO3	< 6.7	18	6	12	33%	5	14
PM-500	Magnesium, as Mg Total	< 1	18	17	1	94%	1	1
PM-500	Potassium, as K Total	< 1	18	18	0	100%		
PM-500	Sodium, as Na Total	< 2	18	8	10	44%	1	5
PM-500	Sulfate, as SO4	< 2.3	18	2	16	11%	1	4
PM-500	Ammonia	< 0.067	18	12	6	67%	0.05	0.23
PM-500	Nitrate	0.1	18	0	18	0%	0.04	0.22
PM-500	Nitrate + Nitrite, as N	0.1	18	0	18	0%	0.04	0.22
PM-500	OrthoPhosphorus	< 0.005	18	14	4	78%	0.005	0.01
PM-500	TKN	< 0.29	18	9	9	50%	0.22	0.54
PM-500	Total Phosphorus	< 0.0074	18	8	10	44%	0.005	0.018
RA-100	Field Conductivity	12	13	0	13	0%	7	16
RA-100	Field pH	5.9	13	0	13	0%	5.3	7
RA-100	Field Temp	6	13	0	13	0%	1	14
RA-100	Flow	1.6	12	0	12	0%	0	31
RA-100	Lab pH	6.1	13	0	13	0%	5.6	7.1
RA-100	Lab SC	< 16	13	1	12	8%	7	47
RA-100	TDS	< 19	13	2	11	15%	8	54
RA-100	TSS	< 1	13	10	3	77%	1	7
RA-100	Turbidity	< 0.59	13	1	12	8%	0.15	3.6
RA-100	Alkalinity, Bicarbonate as HCO3	5	13	0	13	0%	2	6
RA-100	Alkalinity, Total as CaCO3	4	13	0	13	0%	2	5
RA-100	Calcium, as Ca Total	< 1.1	13	3	10	23%	0.6	2
RA-100	Chloride, as Cl	< 1	13	12	1	92%	2	2

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Non-Detects	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
RA-100	Fluoride, as F	< 0.05	9	8	1	89%	0.06	0.06
RA-100	Hardness, as CaCO3	< 4.9	13	6	7	46%	3.8	9
RA-100	Magnesium, as Mg Total	< 0.71	13	9	4	69%	0.2	0.3
RA-100	Potassium, as K Total	< 0.65	13	8	5	62%	0.1	1
RA-100	Sodium, as Na Total	< 0.92	13	7	6	54%	0.2	3
RA-100	Sulfate, as SO4	< 2.3	13	3	10	23%	1	5
RA-100	Ammonia	< 0.05	13	10	3	77%	0.05	0.09
RA-100	Nitrate	0.1	13	0	13	0%	0.04	0.26
RA-100	Nitrate + Nitrite, as N	0.1	13	0	13	0%	0.04	0.26
RA-100	OrthoPhosphorus	< 0.005	13	10	3	77%	0.005	0.01
RA-100	TKN	< 0.23	13	6	7	46%	0.21	0.3
RA-100	Total Phosphorus	< 0.008	13	4	9	31%	0.005	0.02
RA-200	Field Conductivity	14	14	0	14	0%	6	24
RA-200	Field pH	6.5	14	0	14	0%	5.1	7.3
RA-200	Field Temp	5.3	14	0	14	0%	1	13
RA-200	Flow	5.1	13	0	13	0%	1.1	44
RA-200	Lab pH	6.3	14	0	14	0%	4.8	6.9
RA-200	Lab SC	< 12	15	1	14	7%	7	26
RA-200	TDS	< 12	15	3	12	20%	7	23
RA-200	TSS	< 1	15	12	3	80%	1	3
RA-200	Turbidity	< 0.33	15	1	14	7%	0.18	0.55
RA-200	Alkalinity, Bicarbonate as HCO3	6	15	0	15	0%	2	7
RA-200	Alkalinity, Total as CaCO3	5	15	0	15	0%	2	6
RA-200	Calcium, as Ca Total	< 1.1	15	4	11	27%	0.6	2
RA-200	Chloride, as Cl	< 1	15	13	2	87%	2	2
RA-200	Fluoride, as F	< 0.05	10	10	0	100%		
RA-200	Hardness, as CaCO3	< 4.2	15	7	8	47%	1.9	10
RA-200	Magnesium, as Mg Total	< 0.7	15	9	6	60%	0.1	1
RA-200	Potassium, as K Total	< 0.65	15	10	5	67%	0.1	0.2
RA-200	Sodium, as Na Total	< 0.99	15	5	10	33%	0.3	3
RA-200	Sulfate, as SO4	< 2.1	15	6	9	40%	1	4
RA-200	Ammonia	< 0.066	15	9	6	60%	0.05	0.12
RA-200	Nitrate	0.12	15	0	15	0%	0.02	0.37
RA-200	Nitrate + Nitrite, as N	0.12	15	0	15	0%	0.02	0.37
RA-200	OrthoPhosphorus	< 0.0061	15	9	6	60%	0.005	0.016
RA-200	TKN	< 0.2	15	12	3	80%	0.21	0.36
RA-200	Total Phosphorus	< 0.0082	15	4	11	27%	0.005	0.02
RA-400	Dissolved Oxygen	11	6	0	6	0%	2.7	13
RA-400	Field Conductivity	17	6	0	6	0%	12	19
RA-400	Field pH	7.1	7	0	7	0%	6.4	7.2
RA-400	Field Temp	4.3	7	0	7	0%	1.4	8
RA-400	Flow	5.9	6	0	6	0%	1.7	52
RA-400	Lab pH	6.9	7	0	7	0%	6.7	7
RA-400	Lab SC	15	7	0	7	0%	11	24
RA-400	TDS	< 17	7	1	6	14%	15	25
RA-400	TSS	< 0.84	7	4	3	57%	0.5	2.2
RA-400	Turbidity	< 0.3	7	2	5	29%	0.16	0.85
RA-400	Alkalinity, Bicarbonate as HCO3	7.6	7	0	7	0%	6	17
RA-400	Alkalinity, Total as CaCO3	7	7	0	7	0%	5	17
RA-400	Calcium, as Ca Dissolved	1.5	7	0	7	0%	1.1	1.7
RA-400	Chloride, as Cl	< 0.69	7	3	4	43%	0.14	1
RA-400	Hardness, as CaCO3	< 5.1	7	1	6	14%	3.7	6.1
RA-400	Magnesium, as Mg Dissolved	< 0.41	7	1	6	14%	0.14	0.43
RA-400	Potassium, as K Dissolved	< 0.6	6	3	3	50%	0.16	0.27
RA-400	Sodium, as Na Dissolved	< 0.8	7	3	4	43%	0.19	1
RA-400	Sulfate, as SO4	< 1.6	7	2	5	29%	1	2.8
RA-400	Ammonia	< 0.01	7	6	1	86%	0.01	0.01
RA-400	Nitrate	0.08	7	0	7	0%	0.04	0.15
RA-400	Nitrate + Nitrite, as N	0.055	4	0	4	0%	0.04	0.08
RA-400	Nitrite	< 0.005	7	6	1	86%	0.0033	0.0033
RA-400	OrthoPhosphorus	< 0.00088	6	4	2	67%	0.0008	0.001
RA-400	TKN	< 0.1	7	6	1	86%	0.06	0.06
RA-400	Total Inorganic Nitrogen	< 0.088	7	1	6	14%	0.05	0.17
RA-400	Total Phosphorus	< 0.008	6	1	5	17%	0.0038	0.018
RA-400	Aluminum, as Al Dissolved	0.016	4	0	4	0%	0.011	0.02
RA-400	Aluminum, as Al Total	< 0.025	7	3	4	43%	0.018	0.034
RA-400	Antimony, as Sb Dissolved	< 0.00025	7	7	0	100%		
RA-400	Antimony, as Sb Total	< 0.00025	7	7	0	100%		
RA-400	Arsenic, as As Dissolved	< 0.00025	7	5	2	71%	0.000093	0.00011
RA-400	Arsenic, as As Total	< 0.00025	7	5	2	71%	0.00011	0.00017
RA-400	Barium, as Ba Dissolved	< 0.0027	7	3	4	43%	0.0018	0.0037
RA-400	Barium, as Ba Total	< 0.0093	7	3	4	43%	0.0019	0.05
RA-400	Beryllium, as Be Dissolved	< 0.0001	7	7	0	100%		
RA-400	Beryllium, as Be Total	< 0.0001	7	6	1	86%	0.000031	0.000031
RA-400	Cadmium, as Cd Dissolved	< 0.000033	4	3	1	75%	0.000025	0.000025
RA-400	Cadmium, as Cd Total	< 0.00004	5	4	1	80%	0.0001	0.0001
RA-400	Chromium, as Cr Dissolved	< 0.00036	7	4	3	57%	0.00028	0.00049
RA-400	Chromium, as Cr Total	< 0.00044	7	6	1	86%	0.00044	0.00044
RA-400	Copper, as Cu Dissolved	< 0.001	7	5	2	71%	0.00034	0.0014
RA-400	Copper, as Cu Total	< 0.0019	7	3	4	43%	0.00027	0.0099

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Non-Detects	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
RA-400	Iron, as Fe Dissolved	< 0.025	7	5	2	71%	0.0056	0.0098
RA-400	Iron, as Fe Total	< 0.2	7	4	3	57%	0.011	1.3
RA-400	Lead, as Pb Dissolved	< 0.00005	7	6	1	86%	0.00007	0.00007
RA-400	Lead, as Pb Total	< 0.00014	7	4	3	57%	0.0001	0.00039
RA-400	Manganese, as Mn Dissolved	< 0.0012	7	3	4	43%	0.00017	0.0034
RA-400	Manganese, as Mn Total	< 0.006	7	3	4	43%	0.00071	0.037
RA-400	Mercury, as Hg Dissolved	< 0.000027	6	3	3	50%	0.00002	0.000043
RA-400	Mercury, as Hg Total	< 0.000020	6	5	1	83%	0.000021	0.000021
RA-400	Nickel, as Ni Dissolved	< 0.00034	7	4	3	57%	0.00025	0.0006
RA-400	Nickel, as Ni Total	< 0.00028	7	6	1	86%	0.00028	0.00028
RA-400	Selenium, as Se Dissolved	< 0.00025	7	7	0	100%		
RA-400	Selenium, as Se Total	< 0.00025	7	7	0	100%		
RA-400	Silver, as Ag Dissolved	< 0.00025	7	7	0	100%		
RA-400	Silver, as Ag Total	< 0.00025	7	6	1	86%	0.0004	0.0004
RA-400	Thallium, as Tl Dissolved	< 0.0002	3	3	0	100%		
RA-400	Thallium, as Tl Total	< 0.0002	3	3	0	100%		
RA-400	Zinc, as Zn Dissolved	< 0.002	7	5	2	71%	0.0011	0.0084
RA-400	Zinc, as Zn Total	< 0.0023	7	3	4	43%	0.0012	0.007
RA-600	Dissolved Oxygen	12	4	0	4	0%	10.4	13.65
RA-600	Field Conductivity	16	44	0	44	0%	8	31
RA-600	Field pH	6.8	45	0	45	0%	5.3	8
RA-600	Field Temp	4.5	47	0	47	0%	0.2	17
RA-600	Flow	13	39	0	39	0%	1.21	119.5
RA-600	Lab pH	6.4	47	0	47	0%	5.2	7.2
RA-600	Lab SC	15	48	0	48	0%	7	21
RA-600	TDS	< 13	50	10	40	20%	1	40
RA-600	TSS	< 1.0	50	36	14	72%	0.58	5.1
RA-600	Turbid	< 0.31	49	8	41	16%	0.09	1.7
RA-600	Alkalinity, Bicarbonate as HCO3	6.0	49	0	49	0%	1	11
RA-600	Alkalinity, Total as CaCO3	5.9	50	0	50	0%	1	10.2
RA-600	Calcium, as Ca Dissolved	1.6	6	0	6	0%	1.2	1.8
RA-600	Calcium, as Ca Total	< 1.1	44	19	25	43%	0.2	4
RA-600	Chloride, as Cl	< 1.0	49	35	14	71%	0.1	3
RA-600	Fluoride, as F	< 0.050	37	34	3	92%	0.01	0.02
RA-600	Hardness, as CaCO3	< 5.2	45	22	23	49%	3.62	10
RA-600	Magnesium, as Mg Dissolved	0.41	6	0	6	0%	0.3	0.49
RA-600	Magnesium, as Mg Total	< 1.0	44	34	10	77%	0.249	0.8
RA-600	Potassium, as K Dissolved	< 0.18	5	2	3	40%	0.15	0.23
RA-600	Potassium, as K Total	< 1.0	44	39	5	89%	0.1	0.2
RA-600	Sodium, as Na Dissolved	< 0.85	6	2	4	33%	0.61	1
RA-600	Sodium, as Na Total	< 1.5	44	13	31	30%	0.4	4
RA-600	Sulfate, as SO4	< 1.8	49	11	38	22%	0.91	6
RA-600	Ammonia	< 0.052	50	34	16	68%	0.01	0.98
RA-600	Nitrate	< 0.081	47	1	46	2%	0.02	0.5
RA-600	Nitrate + Nitrite, as N	< 0.080	47	1	46	2%	0.02	0.5
RA-600	Nitrite	< 0.010	12	12	0	100%		
RA-600	OrthoPhosphorus	< 0.0050	50	36	14	72%	0.00050	0.21
RA-600	TKN	< 0.17	49	27	22	55%	0.04	0.82
RA-600	Total Inorganic Nitrogen	< 0.051	7	1	6	14%	0.03	0.093
RA-600	Total Phosphorus	< 0.0096	50	19	31	38%	0.001	0.13
RA-600	Aluminum, as Al Dissolved	0.013	4	0	4	0%	0.0096	0.02
RA-600	Aluminum, as Al Total	< 0.027	11	6	5	55%	0.02	0.046
RA-600	Antimony, as Sb Dissolved	< 0.00021	6	5	1	83%	0.000056	0.000056
RA-600	Antimony, as Sb Total	< 0.0030	12	12	0	100%		
RA-600	Arsenic, as As Dissolved	< 0.00013	6	3	3	50%	0.000079	0.00017
RA-600	Arsenic, as As Total	< 0.0020	14	11	3	79%	0.00013	0.00019
RA-600	Barium, as Ba Dissolved	< 0.0030	6	2	4	33%	0.0027	0.0033
RA-600	Barium, as Ba Total	< 0.0040	11	4	7	36%	0.002	0.01
RA-600	Beryllium, as Be Dissolved	< 0.000085	6	6	0	100%		
RA-600	Beryllium, as Be Total	< 0.0010	11	11	0	100%		
RA-600	Cadmium, as Cd Dissolved	< 0.000017	4	4	0	100%		
RA-600	Cadmium, as Cd Total	< 0.000017	4	3	1	75%	0.000014	0.000014
RA-600	Chromium, as Cr Dissolved	< 0.00025	6	5	1	83%	0.00024	0.00024
RA-600	Chromium, as Cr Total	< 0.0010	14	13	1	93%	0.0004	0.0004
RA-600	Copper, as Cu Dissolved	< 0.00040	6	4	2	67%	0.00039	0.00043
RA-600	Copper, as Cu Total	< 0.0010	14	10	4	71%	0.00031	0.002
RA-600	Iron, as Fe Dissolved	< 0.0091	6	4	2	67%	0.0041	0.014
RA-600	Iron, as Fe Total	< 0.050	14	10	4	71%	0.026	0.1
RA-600	Lead, as Pb Dissolved	< 0.000065	6	3	3	50%	0.000054	0.000093
RA-600	Lead, as Pb Total	< 0.000099	7	3	4	43%	0.000052	0.00032
RA-600	Manganese, as Mn Dissolved	< 0.00074	6	2	4	33%	0.00047	0.00098
RA-600	Manganese, as Mn Total	< 0.0023	14	9	5	64%	0.00077	0.0063
RA-600	Mercury, as Hg Dissolved	< 0.000035	6	4	2	67%	0.000035	0.000036
RA-600	Mercury, as Hg Total	< 0.000020	7	5	2	71%	0.000024	0.000059
RA-600	Nickel, as Ni Dissolved	< 0.00026	6	5	1	83%	0.00026	0.00026
RA-600	Nickel, as Ni Total	< 0.0051	8	8	0	100%		
RA-600	Selenium, as Se Dissolved	< 0.00020	6	5	1	83%	0.00014	0.00014
RA-600	Selenium, as Se Total	< 0.0010	11	11	0	100%		
RA-600	Silver, as Ag Dissolved	< 0.00023	6	6	0	100%		
RA-600	Silver, as Ag Total	< 0.00020	11	11	0	100%		

Appendix K-1. Statistical summary of stream data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Non-Detects	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
RA-600	Thallium, as Tl Dissolved	< 0.00020	3	3	0	100%		
RA-600	Thallium, as Tl Total	< 0.00020	4	4	0	100%		
RA-600	Zinc, as Zn Dissolved	< 0.0039	6	2	4	33%	0.002	0.011
RA-600	Zinc, as Zn Total	< 0.0038	14	11	3	79%	0.00096	0.0025
RC-2000	Field Temp	2	2	0	2	0%	2	2
RC-2000	Flow	0	2	0	2	0%	0	0
RC-850	Field Conductivity	7	1	0	1	0%	7	7
RC-850	Field pH	6.6	1	0	1	0%	6.6	6.6
RC-850	Field Temp	5	2	0	2	0%	2	8
RC-850	Flow	12	2	0	2	0%	0	24.2
RC-850	Lab pH	6.9	1	0	1	0%	6.9	6.9
RC-850	Lab SC	11	1	0	1	0%	11	11
RC-850	TDS	8	1	0	1	0%	8	8
RC-850	TSS	1	1	0	1	0%	1	1
RC-850	Turbidity	0.15	1	0	1	0%	0.15	0.15
RC-850	Alkalinity, Bicarbonate as HCO3	6	1	0	1	0%	6	6
RC-850	Alkalinity, Total as CaCO3	5	1	0	1	0%	5	5
RC-850	Calcium, as Ca Total	1	1	0	1	0%	1	1
RC-850	Chloride, as Cl	< 1	1	1	0	100%		
RC-850	Fluoride, as F	< 0.05	1	1	0	100%		
RC-850	Hardness, as CaCO3	< 3	1	1	0	100%		
RC-850	Magnesium, as Mg Total	< 1	1	1	0	100%		
RC-850	Potassium, as K Total	1	1	0	1	0%	1	1
RC-850	Sodium, as Na Total	1	1	0	1	0%	1	1
RC-850	Sulfate, as SO4	1	1	0	1	0%	1	1
RC-850	Ammonia	< 0.05	1	1	0	100%		
RC-850	Nitrate	0.02	1	0	1	0%	0.02	0.02
RC-850	Nitrate + Nitrite, as N	0.02	1	0	1	0%	0.02	0.02
RC-850	OrthoPhosphorus	< 0.005	1	1	0	100%		
RC-850	TKN	< 0.2	1	1	0	100%		
RC-850	Total Phosphorus	< 0.005	1	1	0	100%		

Units are mg/L, except pH in standard units, temperature in degrees celsius, turbidity in NTUs, conductivity and SC (specific conductivity) in μmhos/cm, and flow in cfs.
One result per location per analyte per day evaluated
Detection limit used in calculating the representative concentration
Representative concentration is the median if the percentage of non-detects is 0 or greater than 70
Representative concentration is the Kaplan Meier mean if the percentage of non-detects is greater than 0 but less than or equal to 70
< = one or more nondetect values were included in the representative concentration determination
RA-600 is a combination of RA-500, RA-550, and RA-600 data (See ERO 2011c for further discussion)
Statistics updated with data collected through 2012

Appendix K-2. Statistical summary of spring data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
SP-1R	Field Conductivity	8.5	2	2	0	0%	4.0	13
SP-1R	Field pH	7.8	2	2	0	0%	7.4	8.2
SP-1R	Field Temp	5.0	5	5	0	0%	0.90	14
SP-1R	Flow	< 2.6	4	3	1	25%	0.50	9.0
SP-1R	Lab pH	6.7	3	3	0	0%	6.4	7.3
SP-1R	Lab SC	13	4	4	0	0%	6.2	19
SP-1R	TDS	9.4	3	3	0	0%		
SP-1R	Alkalinity, Bicarbonate as HCO3	< 1	1	0	1	100%		
SP-1R	Alkalinity, Total as CaCO3	< 76	3	2	1	33%	83	144
SP-1R	Calcium, as Ca Total	1.2	3	3	0	0%		
SP-1R	Chloride, as Cl	< 0.74	3	2	1	33%	0.022	0.21
SP-1R	Fluoride, as F	< 0.05	2	0	2	100%		
SP-1R	Magnesium, as Mg Total	< 0.69	3	2	1	33%	0.36	0.72
SP-1R	Potassium, as K Total	< 0.41	3	2	1	33%	0.07	0.15
SP-1R	Sodium, as Na Total	< 0.59	3	2	1	33%	0.29	0.48
SP-1R	Sulfate, as SO4	< 2	3	2	1	33%	0.47	0.59
SP-1R	Ammonia	< 0.05	2	0	2	100%		
SP-1R	Nitrate	1	2	2	0	0%	0.56	1.5
SP-1R	Total Phosphorus	< 0.005	2	0	2	100%		
SP-2R	Field Conductivity	8.8	1	1	0	0%	8.8	8.8
SP-2R	Field Temp	6.5	1	1	0	0%	6.5	6.5
SP-2R	Flow	4	1	1	0	0%	4	4
SP-2R	TDS	5.2	1	1	0	0%	5.2	5.2
SP-4	Field Conductivity	26	2	2	0	0%	24	27
SP-4	Field pH	7.1	2	2	0	0%	6.8	7.4
SP-4	Field Temp	7.3	2	2	0	0%	7	7.6
SP-4	Flow	15	2	2	0	0%	9	20
SP-4	Lab pH	7.5	2	2	0	0%	7.4	7.5
SP-4	Lab SC	30	2	2	0	0%	27	33
SP-4	TDS	20	2	2	0	0%	15	25
SP-4	Alkalinity, Bicarbonate as HCO3	16	2	2	0	0%	13	18
SP-4	Alkalinity, Total as CaCO3	13	2	2	0	0%	11	15
SP-4	Calcium, as Ca Total	2	2	2	0	0%	2	2
SP-4	Chloride, as Cl	< 1	2	0	2	100%		
SP-4	Hardness, as CaCO3	< 5	2	0	2	100%		
SP-4	Magnesium, as Mg Total	< 1	2	0	2	100%		
SP-4	Potassium, as K Total	< 1	2	1	1	50%	1	1
SP-4	Sodium, as Na Total	1.5	2	2	0	0%	1	2
SP-4	Sulfate, as SO4	< 1.5	2	1	1	50%	2	2
SP-4	Nitrate + Nitrite, as N	0.025	2	2	0	0%	0.02	0.03
SP-4	Aluminum, as Al Total	< 0.1	2	0	2	100%		
SP-4	Arsenic, as As Total	< 0.005	2	0	2	100%		
SP-4	Cadmium, as Cd Total	0.001	1	1	0	0%	0.001	0.001
SP-4	Chromium, as Cr Total	< 0.02	2	0	2	100%		
SP-4	Iron, as Fe Total	< 0.05	2	0	2	100%		
SP-4	Manganese, as Mn Total	< 0.02	2	0	2	100%		
SP-4	Molybdenum, as Mo Total	< 0.05	2	1	1	50%	0.05	0.05
SP-4	Zinc, as Zn Total	< 0.02	2	0	2	100%		
SP-4R	Field Temp	2	1	1	0	0%	2	2
SP-4R	Flow	5	1	1	0	0%	5	5
SP-4R	Lab pH	6.2	1	1	0	0%	6.2	6.2
SP-4R	Lab SC	2.6	1	1	0	0%	2.6	2.6
SP-4R	Alkalinity, Bicarbonate as HCO3	< 1	1	0	1	100%		
SP-4R	Alkalinity, Total as CaCO3	< 1	1	0	1	100%		
SP-4R	Calcium, as Ca Total	< 1	1	0	1	100%		
SP-4R	Chloride, as Cl	< 2	1	0	1	100%		
SP-4R	Magnesium, as Mg Total	< 1	1	0	1	100%		
SP-4R	Potassium, as K Total	< 1	1	0	1	100%		
SP-4R	Sodium, as Na Total	< 1	1	0	1	100%		
SP-4R	Sulfate, as SO4	< 5	1	0	1	100%		
SP-5/3R	Field Conductivity	25	2	2	0	0%	18	31
SP-5/3R	Field pH	7.1	3	3	0	0%	6.2	7.5
SP-5/3R	Field Temp	2	4	4	0	0%	2	8.5
SP-5/3R	Flow	14	2	2	0	0%	5	22
SP-5/3R	Lab pH	7.2	4	4	0	0%	6.2	7.6
SP-5/3R	Lab SC	24	4	4	0	0%	21	26
SP-5/3R	TDS	12	3	3	0	0%	6	32
SP-5/3R	Alkalinity, Bicarbonate as HCO3	16	3	3	0	0%	12	20
SP-5/3R	Alkalinity, Total as CaCO3	13	4	4	0	0%	10	16
SP-5/3R	Calcium, as Ca Total	2.5	4	4	0	0%	1	3.1
SP-5/3R	Chloride, as Cl	< 1	4	1	3	75%	0.082	0.082
SP-5/3R	Fluoride, as F	0.05	1	1	0	0%	0.05	0.05
SP-5/3R	Hardness, as CaCO3	< 6.7	3	1	2	67%	8	8

Appendix K-2. Statistical summary of spring data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
SP-5/3R	Magnesium, as Mg Total	< 1	4	1	3	75%	0.67	0.67
SP-5/3R	Potassium, as K Total	< 0.81	4	2	2	50%	0.24	1
SP-5/3R	Silica, as SiO2 Total	5.6	1	1	0	0%	5.6	5.6
SP-5/3R	Sodium, as Na Total	< 1	4	3	1	25%	1	1
SP-5/3R	Sulfate, as SO4	1.5	4	4	0	0%	1	3
SP-5/3R	Nitrate + Nitrite, as N	0.1	4	4	0	0%	0.08	0.42
SP-5/3R	Aluminum, as Al Total	< 0.1	3	0	3	100%		
SP-5/3R	Arsenic, as As Total	< 0.005	3	0	3	100%		
SP-5/3R	Cadmium, as Cd Total	0.001	2	2	0	0%	0.001	0.001
SP-5/3R	Chromium, as Cr Total	< 0.02	3	0	3	100%		
SP-5/3R	Iron, as Fe Total	< 0.05	3	0	3	100%		
SP-5/3R	Manganese, as Mn Total	< 0.02	3	0	3	100%		
SP-5/3R	Molybdenum, as Mo Total	< 0.05	3	0	3	100%		
SP-5/3R	Zinc, as Zn Total	< 0.02	3	0	3	100%		
SP-10	Field pH	6.4	1	1	0	0%	6.4	6.4
SP-10	Field Temp	2	1	1	0	0%	2	2
SP-10	Lab pH	6.7	1	1	0	0%	6.7	6.7
SP-10	Lab SC	91	1	1	0	0%	91	91
SP-10	TDS	97	1	1	0	0%	97	97
SP-10	Alkalinity, Bicarbonate as HCO3	60	1	1	0	0%	60	60
SP-10	Alkalinity, Total as CaCO3	49	1	1	0	0%	49	49
SP-10	Calcium, as Ca Total	10	1	1	0	0%	10	10
SP-10	Chloride, as Cl	1	1	1	0	0%	1	1
SP-10	Fluoride, as F	0.07	1	1	0	0%	0.07	0.07
SP-10	Hardness, as CaCO3	46	1	1	0	0%	46	46
SP-10	Magnesium, as Mg Total	5	1	1	0	0%	5	5
SP-10	Potassium, as K Total	1	1	1	0	0%	1	1
SP-10	Sodium, as Na Total	2	1	1	0	0%	2	2
SP-10	Sulfate, as SO4	3	1	1	0	0%	3	3
SP-10	Nitrate + Nitrite, as N	0.01	1	1	0	0%	0.01	0.01
SP-10	Aluminum, as Al Total	< 0.01	1	0	1	100%		
SP-10	Arsenic, as As Total	< 0.005	1	0	1	100%		
SP-10	Chromium, as Cr Total	< 0.02	1	0	1	100%		
SP-10	Iron, as Fe Total	< 0.05	1	0	1	100%		
SP-10	Manganese, as Mn Total	0.03	1	1	0	0%	0.03	0.03
SP-10	Molybdenum, as Mo Total	< 0.05	1	0	1	100%		
SP-10	Zinc, as Zn Total	< 0.02	1	0	1	100%		
SP-11	Field pH	7.2	1	1	0	0%	7.2	7.2
SP-11	Field Temp	2	1	1	0	0%	2	2
SP-11	Lab pH	7.2	1	1	0	0%	7.2	7.2
SP-11	Lab SC	68	1	1	0	0%	68	68
SP-11	TDS	79	1	1	0	0%	79	79
SP-11	Alkalinity, Bicarbonate as HCO3	48	1	1	0	0%	48	48
SP-11	Alkalinity, Total as CaCO3	39	1	1	0	0%	39	39
SP-11	Calcium, as Ca Total	12	1	1	0	0%	12	12
SP-11	Chloride, as Cl	< 1	1	0	1	100%		
SP-11	Fluoride, as F	0.07	1	1	0	0%	0.07	0.07
SP-11	Hardness, as CaCO3	38	1	1	0	0%	38	38
SP-11	Magnesium, as Mg Total	2	1	1	0	0%	2	2
SP-11	Potassium, as K Total	< 1	1	0	1	100%		
SP-11	Sodium, as Na Total	< 1	1	0	1	100%		
SP-11	Sulfate, as SO4	2	1	1	0	0%	2	2
SP-11	Nitrate + Nitrite, as N	< 0.01	1	0	1	100%		
SP-11	Aluminum, as Al Total	< 0.01	1	0	1	100%		
SP-11	Arsenic, as As Total	< 0.005	1	0	1	100%		
SP-11	Chromium, as Cr Total	< 0.02	1	0	1	100%		
SP-11	Iron, as Fe Total	< 0.05	1	0	1	100%		
SP-11	Manganese, as Mn Total	< 0.02	1	0	1	100%		
SP-11	Molybdenum, as Mo Total	< 0.05	1	0	1	100%		
SP-11	Zinc, as Zn Total	< 0.02	1	0	1	100%		
SP-12	Field pH	5.8	1	1	0	0%	5.8	5.8
SP-12	Field Temp	13	1	1	0	0%	13	13
SP-12	Lab pH	5.7	1	1	0	0%	5.7	5.7
SP-12	Lab SC	42	1	1	0	0%	42	42
SP-12	TDS	86	1	1	0	0%	86	86
SP-12	Alkalinity, Bicarbonate as HCO3	27	1	1	0	0%	27	27
SP-12	Alkalinity, Total as CaCO3	22	1	1	0	0%	22	22
SP-12	Calcium, as Ca Total	6	1	1	0	0%	6	6
SP-12	Chloride, as Cl	1	1	1	0	0%	1	1
SP-12	Fluoride, as F	< 0.05	1	0	1	100%		
SP-12	Hardness, as CaCO3	19	1	1	0	0%	19	19
SP-12	Magnesium, as Mg Total	1	1	1	0	0%	1	1
SP-12	Potassium, as K Total	< 1	1	0	1	100%		

Appendix K-2. Statistical summary of spring data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
SP-12	Sodium, as Na Total	2	1	1	0	0%	2	2
SP-12	Sulfate, as SO4	2	1	1	0	0%	2	2
SP-12	Nitrate + Nitrite, as N	< 0.01	1	0	1	100%		
SP-12	Aluminum, as Al Total	< 0.1	1	0	1	100%		
SP-12	Arsenic, as As Total	< 0.005	1	0	1	100%		
SP-12	Chromium, as Cr Total	< 0.02	1	0	1	100%		
SP-12	Iron, as Fe Total	0.36	1	1	0	0%	0.36	0.36
SP-12	Manganese, as Mn Total	< 0.02	1	0	1	100%		
SP-12	Molybdenum, as Mo Total	< 0.05	1	0	1	100%		
SP-12	Zinc, as Zn Total	< 0.02	1	0	1	100%		
SP-13	Field pH	7.2	1	1	0	0%	7.2	7.2
SP-13	Field Temp	2	1	1	0	0%	2	2
SP-13	Lab pH	7.1	1	1	0	0%	7.1	7.1
SP-13	Lab SC	138	1	1	0	0%	138	138
SP-13	TDS	91	1	1	0	0%	91	91
SP-13	Alkalinity, Bicarbonate as HCO3	83	1	1	0	0%	83	83
SP-13	Alkalinity, Total as CaCO3	68	1	1	0	0%	68	68
SP-13	Calcium, as Ca Total	18	1	1	0	0%	18	18
SP-13	Chloride, as Cl	< 1	1	0	1	100%		
SP-13	Fluoride, as F	< 0.05	1	0	1	100%		
SP-13	Hardness, as CaCO3	66	1	1	0	0%	66	66
SP-13	Magnesium, as Mg Total	5	1	1	0	0%	5	5
SP-13	Potassium, as K Total	< 1	1	0	1	100%		
SP-13	Sodium, as Na Total	< 1	1	0	1	100%		
SP-13	Sulfate, as SO4	2	1	1	0	0%	2	2
SP-13	Nitrate + Nitrite, as N	< 0.05	1	0	1	100%		
SP-13	Aluminum, as Al Total	< 0.1	1	0	1	100%		
SP-13	Arsenic, as As Total	< 0.005	1	0	1	100%		
SP-13	Chromium, as Cr Total	< 0.02	1	0	1	100%		
SP-13	Iron, as Fe Total	< 0.05	1	0	1	100%		
SP-13	Manganese, as Mn Total	< 0.02	1	0	1	100%		
SP-13	Molybdenum, as Mo Total	< 0.05	1	0	1	100%		
SP-13	Zinc, as Zn Total	< 0.02	1	0	1	100%		
SP-14	Field Temp	2	1	1	0	0%	2	2
SP-14	Lab pH	6.7	1	1	0	0%	6.7	6.7
SP-14	Lab SC	226	1	1	0	0%	226	226
SP-14	TDS	154	1	1	0	0%	154	154
SP-14	Alkalinity, Bicarbonate as HCO3	140	1	1	0	0%	140	140
SP-14	Alkalinity, Total as CaCO3	115	1	1	0	0%	115	115
SP-14	Calcium, as Ca Total	30	1	1	0	0%	30	30
SP-14	Chloride, as Cl	1	1	1	0	0%	1	1
SP-14	Fluoride, as F	0.08	1	1	0	0%	0.08	0.08
SP-14	Hardness, as CaCO3	108	1	1	0	0%	108	108
SP-14	Magnesium, as Mg Total	8	1	1	0	0%	8	8
SP-14	Potassium, as K Total	< 1	1	0	1	100%		
SP-14	Sodium, as Na Total	6	1	1	0	0%	6	6
SP-14	Sulfate, as SO4	< 1	1	0	1	100%		
SP-14	Nitrate + Nitrite, as N	< 0.01	1	0	1	100%		
SP-14	Aluminum, as Al Total	< 0.1	1	0	1	100%		
SP-14	Arsenic, as As Total	< 0.005	1	0	1	100%		
SP-14	Chromium, as Cr Total	< 0.02	1	0	1	100%		
SP-14	Iron, as Fe Total	0.67	1	1	0	0%	0.67	0.67
SP-14	Manganese, as Mn Total	0.71	1	1	0	0%	0.71	0.71
SP-14	Molybdenum, as Mo Total	< 0.05	1	0	1	100%		
SP-14	Zinc, as Zn Total	< 0.02	1	0	1	100%		
SP-15	Field Conductivity	18	1	1	0	0%	18	18
SP-15	Field pH	7.1	1	1	0	0%	7.1	7.1
SP-15	Field Temp	5	1	1	0	0%	5	5
SP-15	TDS	< 20	1	0	1	100%		
SP-15	Alkalinity, Bicarbonate as HCO3	9	1	1	0	0%	9	9
SP-15	Alkalinity, Total as CaCO3	7	1	1	0	0%	7	7
SP-15	Calcium, as Ca Total	1	1	1	0	0%	1	1
SP-15	Chloride, as Cl	< 1	1	0	1	100%		
SP-15	Hardness, as CaCO3	< 7	1	0	1	100%		
SP-15	Magnesium, as Mg Total	< 1	1	0	1	100%		
SP-15	Potassium, as K Total	< 1	1	0	1	100%		
SP-15	Sodium, as Na Total	< 1	1	0	1	100%		
SP-15	Sulfate, as SO4	< 1	1	0	1	100%		
SP-15	Nitrate + Nitrite, as N	< 0.07	1	0	1	100%		
SP-15	Arsenic, as As Total	< 0.005	1	0	1	100%		
SP-15	Cadmium, as Cd Total	< 0.0005	1	0	1	100%		
SP-15	Chromium, as Cr Total	< 0.02	1	0	1	100%		
SP-15	Copper, as Cu Total	< 0.01	1	0	1	100%		

Appendix K-2. Statistical summary of spring data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
SP-15	Iron, as Fe Total	< 0.05	1	0	1	100%		
SP-15	Lead, as Pb Total	< 0.01	1	0	1	100%		
SP-15	Manganese, as Mn Total	< 0.02	1	0	1	100%		
SP-15	Mercury, as Hg Total	< 0.0002	1	0	1	100%		
SP-15	Silver, as Ag Total	< 0.001	1	0	1	100%		
SP-15	Zinc, as Zn Total	< 0.02	1	0	1	100%		
SP-16	Field pH	7.1	1	1	0	0%	7.1	7.1
SP-16	Field Temp	4.5	1	1	0	0%	4.5	4.5
SP-16	Lab pH	6.2	1	1	0	0%	6.2	6.2
SP-16	Lab SC	18	1	1	0	0%	18	18
SP-16	TDS	< 20	1	0	1	100%		
SP-16	Alkalinity, Bicarbonate as HCO3	9	1	1	0	0%	9	9
SP-16	Alkalinity, Total as CaCO3	7	1	1	0	0%	7	7
SP-16	Calcium, as Ca Total	1	1	1	0	0%	1	1
SP-16	Chloride, as Cl	< 1	1	0	1	100%		
SP-16	Fluoride, as F	< 0.05	1	0	1	100%		
SP-16	Hardness, as CaCO3	< 7	1	0	1	100%		
SP-16	Magnesium, as Mg Total	< 1	1	0	1	100%		
SP-16	Potassium, as K Total	< 1	1	0	1	100%		
SP-16	Sodium, as Na Total	< 1	1	0	1	100%		
SP-16	Sulfate, as SO4	< 1	1	0	1	100%		
SP-16	Nitrate + Nitrite, as N	< 0.07	1	0	1	100%		
SP-16	Aluminum, as Al Total	< 0.1	1	0	1	100%		
SP-16	Arsenic, as As Total	< 0.005	1	0	1	100%		
SP-16	Chromium, as Cr Total	< 0.02	1	0	1	100%		
SP-16	Iron, as Fe Total	< 0.05	1	0	1	100%		
SP-16	Manganese, as Mn Total	< 0.02	1	0	1	100%		
SP-16	Molybdenum, as Mo Total	0.05	1	1	0	0%	0.05	0.05
SP-16	Zinc, as Zn Total	< 0.02	1	0	1	100%		
SP-21	Field Conductivity	88	1	1	0	0%	88	88
SP-21	Field pH	6.4	1	1	0	0%	6.4	6.4
SP-21	Field Temp	25	1	1	0	0%	25	25
SP-21	Flow	1	1	1	0	0%	1	1
SP-21	TDS	84	1	1	0	0%	84	84
SP-21	TSS	48	1	1	0	0%	48	48
SP-21	Alkalinity, Bicarbonate as HCO3	< 1	1	0	1	100%		
SP-21	Alkalinity, Total as CaCO3	13	1	1	0	0%	13	13
SP-21	Calcium, as Ca Total	6.4	1	1	0	0%	6.4	6.4
SP-21	Chloride, as Cl	1	1	1	0	0%	1	1
SP-21	Hardness, as CaCO3	26	1	1	0	0%	26	26
SP-21	Magnesium, as Mg Total	2.5	1	1	0	0%	2.5	2.5
SP-21	Potassium, as K Total	0.84	1	1	0	0%	0.84	0.84
SP-21	Sodium, as Na Total	7.3	1	1	0	0%	7.3	7.3
SP-21	Sulfate, as SO4	< 5	1	0	1	100%		
SP-21	Ammonia	0.45	1	1	0	0%	0.45	0.45
SP-21	Nitrate + Nitrite, as N	0.22	1	1	0	0%	0.22	0.22
SP-21	OrthoPhosphorus	< 0.001	1	0	1	100%		
SP-21	Total Phosphorus	< 0.001	1	0	1	100%		
SP-21	Arsenic, as As Total	< 0.003	1	0	1	100%		
SP-21	Cadmium, as Cd Total	0.0001	1	1	0	0%	0.0001	0.0001
SP-21	Chromium, as Cr Total	< 0.001	1	0	1	100%		
SP-21	Copper, as Cu Total	0.005	1	1	0	0%	0.005	0.005
SP-21	Iron, as Fe Total	16	1	1	0	0%	16	16
SP-21	Lead, as Pb Total	0.012	1	1	0	0%	0.012	0.012
SP-21	Manganese, as Mn Total	1.2	1	1	0	0%	1.2	1.2
SP-21	Mercury, as Hg Total	< 0.0002	1	0	1	100%		
SP-21	Silver, as Ag Total	< 0.0005	1	0	1	100%		
SP-21	Zinc, as Zn Total	< 0.01	1	0	1	100%		
SP-25	Field Conductivity	38	1	1	0	0%	38	38
SP-25	Field pH	6.9	1	1	0	0%	6.9	6.9
SP-25	Field Temp	13	1	1	0	0%	13	13
SP-25	Flow	5	1	1	0	0%	5	5
SP-25	TDS	< 10	1	0	1	100%		
SP-25	TSS	< 1	1	0	1	100%		
SP-25	Alkalinity, Bicarbonate as HCO3	< 1	1	0	1	100%		
SP-25	Alkalinity, Total as CaCO3	8	1	1	0	0%	8	8
SP-25	Calcium, as Ca Total	1.3	1	1	0	0%	1.3	1.3
SP-25	Chloride, as Cl	1.6	1	1	0	0%	1.6	1.6
SP-25	Hardness, as CaCO3	4	1	1	0	0%	4	4
SP-25	Magnesium, as Mg Total	0.26	1	1	0	0%	0.26	0.26
SP-25	Potassium, as K Total	0.4	1	1	0	0%	0.4	0.4
SP-25	Sodium, as Na Total	1.7	1	1	0	0%	1.7	1.7
SP-25	Sulfate, as SO4	< 5	1	0	1	100%		

Appendix K-2. Statistical summary of spring data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
SP-25	Ammonia	< 0.05	1	0	1	100%		
SP-25	Nitrate + Nitrite, as N	0.7	1	1	0	0%	0.7	0.7
SP-25	OrthoPhosphorus	< 0.001	1	0	1	100%		
SP-25	Total Phosphorus	< 0.001	1	0	1	100%		
SP-25	Arsenic, as As Total	< 0.003	1	0	1	100%		
SP-25	Cadmium, as Cd Total	< 0.00008	1	0	1	100%		
SP-25	Chromium, as Cr Total	< 0.001	1	0	1	100%		
SP-25	Copper, as Cu Total	< 0.001	1	0	1	100%		
SP-25	Iron, as Fe Total	< 0.01	1	0	1	100%		
SP-25	Lead, as Pb Total	< 0.0005	1	0	1	100%		
SP-25	Manganese, as Mn Total	< 0.005	1	0	1	100%		
SP-25	Mercury, as Hg Total	< 0.0002	1	0	1	100%		
SP-25	Silver, as Ag Total	< 0.0005	1	0	1	100%		
SP-25	Zinc, as Zn Total	< 0.01	1	0	1	100%		
SP-26	Field Conductivity	219	1	1	0	0%	219	219
SP-26	Field pH	7.7	1	1	0	0%	7.7	7.7
SP-26	Field Temp	14	1	1	0	0%	14	14
SP-26	Flow	0.5	1	1	0	0%	0.5	0.5
SP-26	TDS	< 10	1	0	1	100%		
SP-26	TSS	80	1	1	0	0%	80	80
SP-26	Alkalinity, Bicarbonate as HCO3	< 1	1	0	1	100%		
SP-26	Alkalinity, Total as CaCO3	110	1	1	0	0%	110	110
SP-26	Calcium, as Ca Total	30	1	1	0	0%	30	30
SP-26	Chloride, as Cl	1.4	1	1	0	0%	1.4	1.4
SP-26	Hardness, as CaCO3	114	1	1	0	0%	114	114
SP-26	Magnesium, as Mg Total	9.9	1	1	0	0%	9.9	9.9
SP-26	Potassium, as K Total	0.74	1	1	0	0%	0.74	0.74
SP-26	Sodium, as Na Total	3.2	1	1	0	0%	3.2	3.2
SP-26	Sulfate, as SO4	< 5	1	0	1	100%		
SP-26	Ammonia	< 0.05	1	0	1	100%		
SP-26	Nitrate + Nitrite, as N	0.82	1	1	0	0%	0.82	0.82
SP-26	OrthoPhosphorus	< 0.001	1	0	1	100%		
SP-26	Total Phosphorus	< 0.001	1	0	1	100%		
SP-26	Arsenic, as As Total	< 0.003	1	0	1	100%		
SP-26	Cadmium, as Cd Total	0.0001	1	1	0	0%	0.0001	0.0001
SP-26	Chromium, as Cr Total	< 0.001	1	0	1	100%		
SP-26	Copper, as Cu Total	0.005	1	1	0	0%	0.005	0.005
SP-26	Iron, as Fe Total	0.79	1	1	0	0%	0.79	0.79
SP-26	Lead, as Pb Total	0.005	1	1	0	0%	0.005	0.005
SP-26	Manganese, as Mn Total	0.22	1	1	0	0%	0.22	0.22
SP-26	Mercury, as Hg Total	< 0.0002	1	0	1	100%		
SP-26	Silver, as Ag Total	< 0.0005	1	0	1	100%		
SP-26	Zinc, as Zn Total	< 0.01	1	0	1	100%		
SP-27	Field Conductivity	15	1	1	0	0%	15	15
SP-27	Field pH	7	1	1	0	0%	7	7
SP-27	Field Temp	12	1	1	0	0%	12	12
SP-27	Flow	2	1	1	0	0%	2	2
SP-27	TDS	49	1	1	0	0%	49	49
SP-27	TSS	< 1	1	0	1	100%		
SP-27	Alkalinity, Bicarbonate as HCO3	< 1	1	0	1	100%		
SP-27	Alkalinity, Total as CaCO3	7	1	1	0	0%	7	7
SP-27	Calcium, as Ca Total	1	1	1	0	0%	1	1
SP-27	Chloride, as Cl	1	1	1	0	0%	1	1
SP-27	Hardness, as CaCO3	4.6	1	1	0	0%	4.6	4.6
SP-27	Magnesium, as Mg Total	0.3	1	1	0	0%	0.3	0.3
SP-27	Potassium, as K Total	0.6	1	1	0	0%	0.6	0.6
SP-27	Sodium, as Na Total	1	1	1	0	0%	1	1
SP-27	Sulfate, as SO4	< 5	1	0	1	100%		
SP-27	Ammonia	0.34	1	1	0	0%	0.34	0.34
SP-27	Nitrate + Nitrite, as N	0.23	1	1	0	0%	0.23	0.23
SP-27	OrthoPhosphorus	< 0.001	1	0	1	100%		
SP-27	Total Phosphorus	< 0.001	1	0	1	100%		
SP-27	Arsenic, as As Total	< 0.003	1	0	1	100%		
SP-27	Cadmium, as Cd Total	< 0.00008	1	0	1	100%		
SP-27	Chromium, as Cr Total	< 0.001	1	0	1	100%		
SP-27	Copper, as Cu Total	0.001	1	1	0	0%	0.001	0.001
SP-27	Iron, as Fe Total	0.017	1	1	0	0%	0.017	0.017
SP-27	Lead, as Pb Total	0.003	1	1	0	0%	0.003	0.003
SP-27	Manganese, as Mn Total	< 0.005	1	0	1	100%		
SP-27	Mercury, as Hg Total	< 0.0002	1	0	1	100%		
SP-27	Silver, as Ag Total	< 0.0005	1	0	1	100%		
SP-27	Zinc, as Zn Total	< 0.01	1	0	1	100%		
SP-28	Field Conductivity	334	1	1	0	0%	334	334

Appendix K-2. Statistical summary of spring data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
SP-28	Field pH	8.3	1	1	0	0%	8.3	8.3
SP-28	Field Temp	15	1	1	0	0%	15	15
SP-28	Flow	4	1	1	0	0%	4	4
SP-28	TDS	< 10	1	0	1	100%		
SP-28	TSS	< 1	1	0	1	100%		
SP-28	Alkalinity, Bicarbonate as HCO3	< 1	1	0	1	100%		
SP-28	Alkalinity, Total as CaCO3	169	1	1	0	0%	169	169
SP-28	Calcium, as Ca Total	51	1	1	0	0%	51	51
SP-28	Chloride, as Cl	1	1	1	0	0%	1	1
SP-28	Hardness, as CaCO3	181	1	1	0	0%	181	181
SP-28	Magnesium, as Mg Total	13	1	1	0	0%	13	13
SP-28	Potassium, as K Total	0.9	1	1	0	0%	0.9	0.9
SP-28	Sodium, as Na Total	2.5	1	1	0	0%	2.5	2.5
SP-28	Sulfate, as SO4	< 5	1	0	1	100%		
SP-28	Ammonia	< 0.05	1	0	1	100%		
SP-28	Nitrate + Nitrite, as N	< 1	1	0	1	100%		
SP-28	OrthoPhosphorus	< 0.001	1	0	1	100%		
SP-28	Total Phosphorus	< 0.001	1	0	1	100%		
SP-28	Arsenic, as As Total	< 0.003	1	0	1	100%		
SP-28	Cadmium, as Cd Total	0.0001	1	1	0	0%	0.0001	0.0001
SP-28	Chromium, as Cr Total	< 0.001	1	0	1	100%		
SP-28	Copper, as Cu Total	< 0.001	1	0	1	100%		
SP-28	Iron, as Fe Total	< 0.01	1	0	1	100%		
SP-28	Lead, as Pb Total	< 0.0005	1	0	1	100%		
SP-28	Manganese, as Mn Total	< 0.005	1	0	1	100%		
SP-28	Mercury, as Hg Total	< 0.0002	1	0	1	100%		
SP-28	Silver, as Ag Total	< 0.0005	1	0	1	100%		
SP-28	Zinc, as Zn Total	< 0.01	1	0	1	100%		
SP-30	Field Conductivity	315	1	1	0	0%	315	315
SP-30	Field pH	8.3	1	1	0	0%	8.3	8.3
SP-30	Field Temp	24	1	1	0	0%	24	24
SP-30	Flow	5	1	1	0	0%	5	5
SP-30	TDS	173	1	1	0	0%	173	173
SP-30	TSS	< 1	1	0	1	100%		
SP-30	Alkalinity, Bicarbonate as HCO3	< 1	1	0	1	100%		
SP-30	Alkalinity, Total as CaCO3	160	1	1	0	0%	160	160
SP-30	Calcium, as Ca Total	42	1	1	0	0%	42	42
SP-30	Chloride, as Cl	< 1	1	0	1	100%		
SP-30	Hardness, as CaCO3	161	1	1	0	0%	161	161
SP-30	Magnesium, as Mg Total	14	1	1	0	0%	14	14
SP-30	Potassium, as K Total	0.6	1	1	0	0%	0.6	0.6
SP-30	Sodium, as Na Total	2.6	1	1	0	0%	2.6	2.6
SP-30	Sulfate, as SO4	< 5	1	0	1	100%		
SP-30	Ammonia	0.35	1	1	0	0%	0.35	0.35
SP-30	Nitrate + Nitrite, as N	< 1	1	0	1	100%		
SP-30	OrthoPhosphorus	< 0.001	1	0	1	100%		
SP-30	Total Phosphorus	< 0.001	1	0	1	100%		
SP-30	Arsenic, as As Total	< 0.003	1	0	1	100%		
SP-30	Cadmium, as Cd Total	< 0.00008	1	0	1	100%		
SP-30	Chromium, as Cr Total	< 0.001	1	0	1	100%		
SP-30	Copper, as Cu Total	< 0.001	1	0	1	100%		
SP-30	Iron, as Fe Total	0.086	1	1	0	0%	0.086	0.086
SP-30	Lead, as Pb Total	0.005	1	1	0	0%	0.005	0.005
SP-30	Manganese, as Mn Total	0.014	1	1	0	0%	0.014	0.014
SP-30	Mercury, as Hg Total	< 0.0002	1	0	1	100%		
SP-30	Silver, as Ag Total	< 0.0005	1	0	1	100%		
SP-30	Zinc, as Zn Total	< 0.01	1	0	1	100%		
SP-32	Field Conductivity	87	1	1	0	0%	87	87
SP-32	Field pH	7.7	1	1	0	0%	7.7	7.7
SP-32	Copper, as Cu Total	< 0.001	1	0	1	100%		
SP-32	Lead, as Pb Total	< 0.01	1	0	1	100%		
SP-32	Zinc, as Zn Total	< 0.01	1	0	1	100%		

Units are mg/L, except pH in standard units, temperature in degrees celsius, conductivity and SC (specific conductivity) in µmhos/cm, and flow in gpm.
One result per location per analyte per day evaluated
Detection limit used in calculating the representative concentration
Representative concentration is the median if the percentage of non-detects is 0 or greater than 70
Representative concentration is the Kaplan Meier mean if the percentage of non-detects is greater than 0 but less than or equal to 70
< = one or more nondetect values were included in the representative concentration determination
Statistics updated with data collected through 2012

Appendix K-3. Statistical summary of lake data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Detects	Number of Non-Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
Lower Libby Lake	Field Conductivity	3.4	13	13	0	0%	2.1	13
Lower Libby Lake	Field pH	6.1	13	13	0	0%	5.8	6.3
Lower Libby Lake	Calcium, as Ca Total	0.2	13	13	0	0%	0.096	0.26
Lower Libby Lake	Chloride, as Cl	0.11	13	13	0	0%	0.024	0.4
Lower Libby Lake	Magnesium, as Mg Total	0.057	13	13	0	0%	0.019	0.095
Lower Libby Lake	Potassium, as K Total	< 0.097	13	12	1	8%	0.041	0.22
Lower Libby Lake	Sodium, as Na Total	0.23	13	13	0	0%	0.12	0.53
Lower Libby Lake	Sulfate, as SO4	0.22	13	13	0	0%	0.16	0.44
Lower Libby Lake	Ammonia	< 0.029	13	10	3	23%	0.011	0.15
Lower Libby Lake	Nitrate	< 0.033	13	6	7	54%	0.024	0.09
Upper Libby Lake	Field Conductivity	2.6	14	14	0	0%	0.19	4
Upper Libby Lake	Field pH	5.6	14	14	0	0%	5.4	6
Upper Libby Lake	Calcium, as Ca Total	0.087	14	14	0	0%	0.029	0.16
Upper Libby Lake	Chloride, as Cl	0.08	14	14	0	0%	0.02	0.23
Upper Libby Lake	Magnesium, as Mg Total	< 0.017	14	13	1	7%	0.006	0.032
Upper Libby Lake	Potassium, as K Total	< 0.065	14	13	1	7%	0.038	0.15
Upper Libby Lake	Sodium, as Na Total	0.12	14	14	0	0%	0.069	0.23
Upper Libby Lake	Sulfate, as SO4	0.19	14	14	0	0%	0.11	13
Upper Libby Lake	Ammonia	< 0.02	14	12	2	14%	0.002	0.078
Upper Libby Lake	Nitrate	< 0.087	14	6	8	57%	0.055	0.31
Rock Lake Intflow	Field Conductivity	7.6	8	8	0	0%	4.3	13
Rock Lake Intflow	Field pH	6.5	7	7	0	0%	6.3	7.3
Rock Lake Intflow	Field Temp	7	9	9	0	0%	2.5	9.5
Rock Lake Intflow	Flow	2.6	6	6	0	0%	0.22	14
Rock Lake Intflow	TDS	4.3	7	7	0	0%	2.5	7.5
Rock Lake Intflow	Alkalinity, Bicarbonate as HCO3	4	7	7	0	0%	4	8
Rock Lake Intflow	Alkalinity, Total as CaCO3	52	7	7	0	0%	4	122
Rock Lake Intflow	Calcium, as Ca Total	0.82	8	8	0	0%	0.51	2
Rock Lake Intflow	Chloride, as Cl	< 0.41	8	6	2	25%	0.026	0.091
Rock Lake Intflow	Magnesium, as Mg Total	< 0.35	8	7	1	13%	0.12	0.51
Rock Lake Intflow	Potassium, as K Total	< 0.2	8	7	1	13%	0.055	0.13
Rock Lake Intflow	Sodium, as Na Total	< 0.26	8	7	1	13%	0.064	0.26
Rock Lake Intflow	Sulfate, as SO4	< 0.99	7	6	1	14%	0.22	0.43
Rock Lake Intflow	Ammonia	< 0.034	6	3	3	50%	0.004	0.029
Rock Lake Intflow	Nitrate + Nitrite, as N	0.15	7	7	0	0%	0.022	0.48
Rock Lake Intflow	OrthoPhosphorus	< 0.001	1	0	1	100%		
Rock Lake Intflow	TKN	< 0.2	1	0	1	100%		
Rock Lake Intflow	Total Phosphorus	0.025	1	1	0	0%	0.025	0.025
Rock Lake Intflow	Barium, as Ba Total	< 0.014	4	3	1	25%	0.004	0.043
Rock Lake Intflow	Bromide	< 0.049	5	2	3	60%	0.018	0.026
Rock Lake Outflow	Field Conductivity	6	8	8	0	0%	4.4	8
Rock Lake Outflow	Field pH	6.5	7	7	0	0%	6.2	7.6
Rock Lake Outflow	Field Temp	9.1	9	9	0	0%	3	15
Rock Lake Outflow	Flow	4	8	8	0	0%	0.76	35
Rock Lake Outflow	TDS	3.6	7	7	0	0%	2.9	4.7
Rock Lake Outflow	Alkalinity, Bicarbonate as HCO3	4	7	7	0	0%	4	6
Rock Lake Outflow	Alkalinity, Total as CaCO3	53	5	5	0	0%	3	64
Rock Lake Outflow	Calcium, as Ca Total	0.79	8	8	0	0%	0.55	1
Rock Lake Outflow	Chloride, as Cl	< 0.42	8	6	2	25%	0.03	0.086
Rock Lake Outflow	Magnesium, as Mg Total	< 0.31	8	7	1	13%	0.15	0.3
Rock Lake Outflow	Potassium, as K Total	< 0.23	8	7	1	13%	0.098	0.2
Rock Lake Outflow	Sodium, as Na Total	< 0.28	8	7	1	13%	0.12	0.37
Rock Lake Outflow	Sulfate, as SO4	< 0.96	7	6	1	14%	0.24	0.39
Rock Lake Outflow	Ammonia	0.035	5	5	0	0%	0.002	0.09
Rock Lake Outflow	Nitrate + Nitrite, as N	0.15	5	5	0	0%	0.039	0.45
Rock Lake Outflow	OrthoPhosphorus	< 0.001	1	0	1	100%		
Rock Lake Outflow	TKN	< 0.2	1	0	1	100%		
Rock Lake Outflow	Total Phosphorus	0.036	1	1	0	0%	0.036	0.036
Rock Lake Outflow	Barium, as Ba Total	< 0.0038	4	3	1	25%	0.002	0.004
Rock Lake Outflow	Bromide	< 0.01	5	0	5	100%		
St. Paul Lake	Field Conductivity	18	1	1	0	0%	18	18
St. Paul Lake	Field pH	6.7	1	1	0	0%	6.7	6.7
St. Paul Lake	Calcium, as Ca Total	2.4	1	1	0	0%	2.4	2.4
St. Paul Lake	Chloride, as Cl	0.072	1	1	0	0%	0.072	0.072
St. Paul Lake	Hardness, as CaCO3	8.5	1	1	0	0%	8.5	8.5
St. Paul Lake	Magnesium, as Mg Total	0.62	1	1	0	0%	0.62	0.62
St. Paul Lake	Potassium, as K Total	0.19	1	1	0	0%	0.19	0.19
St. Paul Lake	Sodium, as Na Total	0.31	1	1	0	0%	0.31	0.31
St. Paul Lake	Sulfate, as SO4	0.45	1	1	0	0%	0.45	0.45
St. Paul Lake	Ammonia	< 0.01	1	0	1	100%		
St. Paul Lake	Nitrate	< 0.01	1	0	1	100%		
St. Paul Lake	OrthoPhosphorus	< 0.01	1	0	1	100%		

Units are mg/L, except pH in standard units, temperature in degrees celsius, and conductivity in μmhos/cm
One result per location per analyte per day evaluated
Detection limit used in calculating the representative concentration
Representative concentration is the median if the percentage of non-detects is 0 or greater than 70
Representative concentration is the Kaplan Meier mean if the percentage of non-detects is greater than 0 but less than or equal to 70
< = one or more nondetect values were included in the representative concentration determination

Table K-4a. Groundwater data summary.

Parameter	Libby Adit Area Wells (MW07-01 and MW07-02)			LAD Area Well (WDS-1V)			Impoundment Area Well (LCTM-8V)		
	Representative Concentation	No. Samples	No. BDL	Representative Concentation	No. Samples	No. BDL	Representative Concentation	No. Samples	No. BDL
Field Conductivity (µmhos/cm)	51	116	0	66	14	0	62	13	0
Field pH (su)	6.4	118	0	6.6	14	0	6	14	0
TDS	< 40	120	8	63	15	0	60	16	0
Alkalinity, Bicarbonate as HCO3	< 15	117	7	42	16	0	37	16	0
Alkalinity, Total as CaCO3	< 15	120	1	35	16	0	32	16	0
Calcium, as Ca Dissolved	< 5.8	118	1	6	16	0	4.1	16	0
Chloride, as Cl	< 0.83	122	47	< 0.81	16	8	< 1.3	16	7
Hardness, as CaCO3	18	110	0	23	16	0	18	16	0
Magnesium, as Mg Dissolved	< 1.2	116	6	2	16	0	2	16	0
Potassium, as K Dissolved	< 0.40	108	21	< 1	16	13	< 0.78	16	9
Sodium, as Na Dissolved	< 2.8	118	4	5	16	0	6	16	0
Sulfate, as SO4	< 9.6	122	14	< 2	16	10	< 4.5	16	8
Ammonia as N	< 0.040	120	94	< 0.033	16	11	< 0.042	16	10
Nitrate as N	< 0.16	120	18	0.060	16	0	< 0.10	16	1
Nitrate + Nitrite, as N	< 0.17	101	2	0.060	13	0	0.070	13	0
Nitrite as N	< 0.010	122	109	< 0.013	16	12	< 0.026	16	13
Total Kjeldahl Nitrogen	< 0.11	118	64	< 0.14	7	5	< 0.60	7	4
Total Inorganic Nitrogen	< 0.17	108	1	< 0.11	6	1	0.085	6	0
OrthoPhosphorus	< 0.0044	112	30	0.024	16	0	< 0.0082	16	3
Total Phosphorus	< 0.0089	112	13	0.099	15	0	0.074	16	0
Aluminum, as Al Dissolved	< 0.0079	111	56	< 0.050	16	12	< 0.050	16	13
Antimony, as Sb Dissolved	< 0.0010	122	108	< 0.0030	16	16	< 0.0030	16	16
Arsenic, as As Dissolved	< 0.00037	122	75	< 0.0030	16	13	< 0.0030	16	16
Barium, as Ba Dissolved	< 0.010	122	38	< 0.0067	16	4	< 0.040	16	3
Cadmium, as Cd Dissolved	< 0.000080	104	93	< 0.00010	16	13	< 0.00010	16	13
Chromium, as Cr Dissolved	< 0.00045	122	82	< 0.0010	16	12	< 0.00074	16	11
Copper, as Cu Dissolved	< 0.00046	121	85	< 0.0010	16	14	< 0.0012	16	11
Iron, as Fe Dissolved	< 0.050	121	92	< 0.052	16	8	< 0.010	16	14
Lead, as Pb Dissolved	< 0.000092	114	65	< 0.00034	16	14	< 0.00028	16	14
Manganese, as Mn Dissolved	< 0.0014	122	71	< 0.081	16	1	< 0.077	16	4
Mercury, as Hg Dissolved	< 0.000031	60	34	< 0.000020	16	14	< 0.000030	16	13
Nickel, as Ni Dissolved	< 0.0080	122	99	< 0.0100	16	13	< 0.010	16	13
Selenium, as Se Dissolved	< 0.0010	122	116	< 0.0010	16	16	< 0.0010	16	13
Silver, as Ag Dissolved	< 0.00025	64	53	< 0.00050	16	16	< 0.00050	16	16
Zinc, as Zn Dissolved	< 0.0037	122	83	< 0.010	16	12	< 0.0064	16	8

Units are mg/L except where noted
One result per location per analyte per day evaluated
Detection limit used in calculating the representative concentration
Representative concentration is the median if the percentage of non-detects is 0 or greater than 70
Representative concentration is the Kaplan Meier mean if the percentage of non-detects is greater than 0 but less than or equal to 70
< = one or more nondetect values were included in the representative concentration determination
Statistics updated with data collected through 2012

Appendix K-4b. Statistical summary of groundwater data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
MW07-01 and MW07-02	Dissolved Oxygen	10	103	103	0%	3.49	12.8
MW07-01 and MW07-02	Field Conductivity	51	116	116	0%	9.09	125.4
MW07-01 and MW07-02	Field pH	6.4	118	118	0%	5.94	8.1
MW07-01 and MW07-02	Field Temp	6.2	118	118	0%	3.9	10.2
MW07-01 and MW07-02	Lab pH	6.5	118	118	0%	5.5	7.2
MW07-01 and MW07-02	Lab SC	55	122	122	0%	10.8	143
MW07-01 and MW07-02	TDS	< 40	120	112	7%	5.0	222
MW07-01 and MW07-02	TSS	< 3.0	120	48	60%	0.085	57
MW07-01 and MW07-02	Turbidity	< 1.2	120	112	7%	0.050	21.5
MW07-01 and MW07-02	Alkalinity, Bicarbonate as HCO3	< 15	117	110	6%	4.89	44.7
MW07-01 and MW07-02	Alkalinity, Total as CaCO3	< 15	120	119	1%	4.89	44.7
MW07-01 and MW07-02	Calcium, as Ca Dissolved	< 5.8	118	117	1%	0.86	15.3
MW07-01 and MW07-02	Calcium, as Ca Total	3.5	12	12	0%	0.934	9.1
MW07-01 and MW07-02	Chloride, as Cl	< 0.8	122	75	39%	0.092	1.9
MW07-01 and MW07-02	Fluoride, as F	< 0.1	10	0	100%		
MW07-01 and MW07-02	Hardness, as CaCO3	18	110	110	0%	2.9	50.8
MW07-01 and MW07-02	Magnesium, as Mg Dissolved	< 1.2	116	110	5%	0.18	3.2
MW07-01 and MW07-02	Magnesium, as Mg Total	< 0.85	12	6	50%	0.587	1.4
MW07-01 and MW07-02	Potassium, as K Dissolved	< 0.40	108	87	19%	0.17	0.78
MW07-01 and MW07-02	Potassium, as K Total	< 1.0	12	3	75%	0.428	0.591
MW07-01 and MW07-02	Sodium, as Na Dissolved	< 2.8	118	114	3%	0.56	8.2
MW07-01 and MW07-02	Sodium, as Na Total	< 1.3	12	9	25%	1.08	1.81
MW07-01 and MW07-02	Sulfate, as SO4	< 9.6	122	108	11%	0.568	31.6
MW07-01 and MW07-02	Ammonia	< 0.040	120	26	78%	0.010	0.549
MW07-01 and MW07-02	Nitrate	< 0.16	120	102	15%	0.020	1.6
MW07-01 and MW07-02	Nitrate + Nitrite, as N	< 0.17	101	99	2%	0.020	1.6
MW07-01 and MW07-02	Nitrite	< 0.010	122	13	89%	0.00050	0.444
MW07-01 and MW07-02	OrthoPhosphorus	< 0.0044	112	82	27%	0.00080	0.025
MW07-01 and MW07-02	TKN	< 0.11	118	54	54%	0.035	1.3
MW07-01 and MW07-02	Total Inorganic Nitrogen	< 0.17	108	107	1%	0.040	1.6
MW07-01 and MW07-02	Total Phosphorus	< 0.0089	112	99	12%	0.0024	0.053
MW07-01 and MW07-02	Aluminum, as Al Dissolved	< 0.0079	111	55	50%	0.0022	0.10
MW07-01 and MW07-02	Aluminum, as Al Total	< 0.074	14	12	14%	0.015	0.45
MW07-01 and MW07-02	Antimony, as Sb Dissolved	< 0.0010	122	14	89%	0.000053	0.00062
MW07-01 and MW07-02	Antimony, as Sb Total	< 0.0030	14	0	100%		
MW07-01 and MW07-02	Arsenic, as As Dissolved	< 0.00037	122	47	61%	0.00019	0.00081
MW07-01 and MW07-02	Arsenic, as As Total	< 0.0030	14	0	100%		
MW07-01 and MW07-02	Barium, as Ba Dissolved	< 0.010	122	84	31%	0.0011	0.62
MW07-01 and MW07-02	Barium, as Ba Total	< 0.0047	14	6	57%	0.0016	0.011
MW07-01 and MW07-02	Beryllium, as Be Dissolved	< 0.00080	122	1	99%	0.00027	0.00027
MW07-01 and MW07-02	Beryllium, as Be Total	< 0.0010	14	0	100%		
MW07-01 and MW07-02	Cadmium, as Cd Dissolved	< 0.000080	104	11	89%	0.000013	0.00019
MW07-01 and MW07-02	Cadmium, as Cd Total	< 0.000080	14	1	93%	0.000080	0.000080
MW07-01 and MW07-02	Chromium, as Cr Dissolved	< 0.00045	122	40	67%	0.00018	0.0025
MW07-01 and MW07-02	Chromium, as Cr Total	< 0.0010	14	0	100%		
MW07-01 and MW07-02	Copper, as Cu Dissolved	< 0.00046	121	36	70%	0.00021	0.0054
MW07-01 and MW07-02	Copper, as Cu Total	< 0.0010	14	1	93%	0.0010	0.0010
MW07-01 and MW07-02	Iron, as Fe Dissolved	< 0.050	121	29	76%	0.00099	0.23
MW07-01 and MW07-02	Iron, as Fe Total	< 0.078	14	12	14%	0.012	0.32
MW07-01 and MW07-02	Lead, as Pb Dissolved	< 0.000092	114	49	57%	0.000020	0.0024
MW07-01 and MW07-02	Lead, as Pb Total	< 0.00050	13	1	92%	0.0025	0.0025
MW07-01 and MW07-02	Manganese, as Mn Dissolved	< 0.0014	122	51	58%	0.00020	0.017
MW07-01 and MW07-02	Manganese, as Mn Total	< 0.0050	14	3	79%	0.0060	0.0080
MW07-01 and MW07-02	Mercury, as Hg Dissolved	< 0.000031	60	26	57%	0.000017	0.00013
MW07-01 and MW07-02	Mercury, as Hg Total	0.000041	2	2	0%	0.000040	0.000041
MW07-01 and MW07-02	Nickel, as Ni Dissolved	< 0.0080	122	23	81%	0.00019	0.0031
MW07-01 and MW07-02	Nickel, as Ni Total	< 0.010	14	0	100%		
MW07-01 and MW07-02	Selenium, as Se Dissolved	< 0.0010	122	6	95%	0.00013	0.00041
MW07-01 and MW07-02	Selenium, as Se Total	< 0.0010	14	1	93%	0.0010	0.0010
MW07-01 and MW07-02	Silver, as Ag Dissolved	< 0.00025	64	11	83%	0.00010	0.0010
MW07-01 and MW07-02	Silver, as Ag Total	0.0020	1	1	0%	0.0020	0.0020

Appendix K-4b. Statistical summary of groundwater data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
MW07-01 and MW07-02	Thallium, as Tl Dissolved	< 0.00010	94	0	100%		
MW07-01 and MW07-02	Thallium, as Tl Total	< 0.00020	14	0	100%		
MW07-01 and MW07-02	Zinc, as Zn Dissolved	< 0.0037	122	39	68%	0.0010	0.11
MW07-01 and MW07-02	Zinc, as Zn Total	< 0.010	12	0	100%		
WDS-1V	Dissolved Oxygen	5.7	12	12	0%	4.3	9.5
WDS-1V	Field Conductivity	66	14	14	0%	24.6	83.9
WDS-1V	Field pH	6.6	14	14	0%	6.33	7.1
WDS-1V	Field Temp	7.4	14	14	0%	5.4	11.6
WDS-1V	Lab pH	6.7	16	16	0%	6.2	6.8
WDS-1V	Lab SC	72	16	16	0%	60	81
WDS-1V	TDS	63	15	15	0%	39	78
WDS-1V	TSS	60	15	15	0%	8.0	830
WDS-1V	Turbidity	28	6	6	0%	15.4	167
WDS-1V	Alkalinity, Bicarbonate as HCO3	42	16	16	0%	27.1	51
WDS-1V	Alkalinity, Total as CaCO3	35	16	16	0%	27.1	42
WDS-1V	Calcium, as Ca Dissolved	6.0	16	16	0%	5.5	8.0
WDS-1V	Chloride, as Cl	< 0.81	16	8	50%	0.51	2.0
WDS-1V	Hardness, as CaCO3	23	16	16	0%	21.1	32
WDS-1V	Magnesium, as Mg Dissolved	2.0	16	16	0%	1.8	3.0
WDS-1V	Potassium, as K Dissolved	< 1.0	16	3	81%	0.36	0.42
WDS-1V	Sodium, as Na Dissolved	5.0	16	16	0%	4.0	5.0
WDS-1V	Sulfate, as SO4	< 2.0	16	6	63%	1.5	5.0
WDS-1V	Ammonia	< 0.033	16	5	69%	0.010	0.13
WDS-1V	Nitrate	0.060	16	16	0%	0.020	0.33
WDS-1V	Nitrate + Nitrite, as N	0.060	13	13	0%	0.040	0.29
WDS-1V	Nitrite	< 0.060	16	4	75%	0.010	0.03
WDS-1V	OrthoPhosphorus	0.024	16	16	0%	0.010	0.04
WDS-1V	TKN	< 0.14	7	2	71%	0.14	0.49
WDS-1V	Total Inorganic Nitrogen	< 0.11	6	5	17%	0.050	0.34
WDS-1V	Total Phosphorus	0.099	15	15	0%	0.024	0.42
WDS-1V	Aluminum, as Al Dissolved	< 0.050	16	4	75%	0.0025	0.04
WDS-1V	Antimony, as Sb Dissolved	< 0.0030	16	0	100%		
WDS-1V	Arsenic, as As Dissolved	< 0.0030	16	3	81%	0.00035	0.001
WDS-1V	Barium, as Ba Dissolved	< 0.0067	16	12	25%	0.0050	0.010
WDS-1V	Beryllium, as Be Dissolved	< 0.0010	16	1	94%	0.000025	0.000025
WDS-1V	Cadmium, as Cd Dissolved	< 0.00010	16	3	81%	0.000018	0.00020
WDS-1V	Chromium, as Cr Dissolved	< 0.0010	16	4	75%	0.00025	0.0020
WDS-1V	Copper, as Cu Dissolved	< 0.0010	16	2	88%	0.0010	0.0040
WDS-1V	Iron, as Fe Dissolved	< 0.052	16	8	50%	0.0027	0.25
WDS-1V	Lead, as Pb Dissolved	< 0.00034	16	2	88%	0.00013	0.00018
WDS-1V	Manganese, as Mn Dissolved	< 0.081	16	15	6%	0.015	0.33
WDS-1V	Mercury, as Hg Dissolved	< 0.000020	16	2	88%	0.000020	0.000057
WDS-1V	Nickel, as Ni Dissolved	< 0.010	16	3	81%	0.00028	0.00041
WDS-1V	Selenium, as Se Dissolved	< 0.0010	16	0	100%		
WDS-1V	Silver, as Ag Dissolved	< 0.00050	16	0	100%		
WDS-1V	Thallium, as Tl Dissolved	< 0.00025	13	0	100%		
WDS-1V	Zinc, as Zn Dissolved	< 0.010	16	4	75%	0.0013	0.020
LCTM-8V	Dissolved Oxygen	6.7	12	12	0%	5.02	10.4
LCTM-8V	Field Conductivity	62	13	13	0%	34	119.7
LCTM-8V	Field pH	6.0	14	14	0%	5.7	6.7
LCTM-8V	Field Temp	6.9	14	14	0%	5.6	11
LCTM-8V	Lab pH	6.2	16	16	0%	5.7	6.5
LCTM-8V	Lab SC	74	16	16	0%	49	96
LCTM-8V	TDS	60	16	16	0%	24	82
LCTM-8V	TSS	509	16	16	0%	5.0	19800
LCTM-8V	Turbidity	179	5	5	0%	7.6	498
LCTM-8V	Alkalinity, Bicarbonate as HCO3	37	16	16	0%	23.5	48
LCTM-8V	Alkalinity, Total as CaCO3	32	16	16	0%	23.5	44.9
LCTM-8V	Calcium, as Ca Dissolved	4.1	16	16	0%	2.7	7.0
LCTM-8V	Chloride, as Cl	< 1.3	16	9	44%	0.25	5.0
LCTM-8V	Hardness, as CaCO3	18	16	16	0%	12.3	27

Appendix K-4b. Statistical summary of groundwater data.

Location ID	Parameter	Representative Concentration	Number of Observations	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
LCTM-8V	Magnesium, as Mg Dissolved	2.0	16	16	0%	1.4	3
LCTM-8V	Potassium, as K Dissolved	< 0.78	16	7	56%	0.53	2
LCTM-8V	Sodium, as Na Dissolved	6.0	16	16	0%	4.0	9
LCTM-8V	Sulfate, as SO4	< 4.5	16	8	50%	3.0	9
LCTM-8V	Ammonia	< 0.042	16	6	63%	0.010	0.22
LCTM-8V	Nitrate	< 0.10	16	15	6%	0.030	0.27
LCTM-8V	Nitrate + Nitrite, as N	0.070	13	13	0%	0.050	0.27
LCTM-8V	Nitrite	< 0.010	16	3	81%	0.020	0.080
LCTM-8V	OrthoPhosphorus	< 0.0082	16	13	19%	0.0010	0.030
LCTM-8V	TKN	< 0.60	7	3	57%	0	3.6
LCTM-8V	Total Inorganic Nitrogen	0.085	6	6	0%	0.060	0.15
LCTM-8V	Total Phosphorus	0.074	16	16	0%	0.0050	2.85
LCTM-8V	Aluminum, as Al Dissolved	< 0.050	16	3	81%	0.0030	0.015
LCTM-8V	Antimony, as Sb Dissolved	< 0.0030	16	0	100%		
LCTM-8V	Arsenic, as As Dissolved	< 0.0030	16	0	100%		
LCTM-8V	Barium, as Ba Dissolved	< 0.040	16	13	19%	0.026	0.053
LCTM-8V	Beryllium, as Be Dissolved	< 0.0010	16	1	94%	0.000040	0.000040
LCTM-8V	Cadmium, as Cd Dissolved	< 0.00010	16	3	81%	0.000024	0.00020
LCTM-8V	Chromium, as Cr Dissolved	< 0.00074	16	5	69%	0.00032	0.0030
LCTM-8V	Copper, as Cu Dissolved	< 0.0012	16	5	69%	0.0010	0.0030
LCTM-8V	Iron, as Fe Dissolved	< 0.010	16	2	88%	0.0015	0.0093
LCTM-8V	Lead, as Pb Dissolved	< 0.00028	16	2	88%	0.000050	0.000065
LCTM-8V	Manganese, as Mn Dissolved	< 0.077	16	12	25%	0.0018	0.29
LCTM-8V	Mercury, as Hg Dissolved	< 0.000030	16	3	81%	0.000020	0.000045
LCTM-8V	Nickel, as Ni Dissolved	< 0.010	16	3	81%	0.00039	0.00077
LCTM-8V	Selenium, as Se Dissolved	< 0.0010	16	3	81%	0.00017	0.00045
LCTM-8V	Silver, as Ag Dissolved	< 0.00050	16	0	100%		
LCTM-8V	Thallium, as Tl Dissolved	< 0.00025	13	0	100%		
LCTM-8V	Zinc, as Zn Dissolved	< 0.0064	16	8	50%	0.0020	0.020

Units are mg/L, except pH in standard units, temperature in degrees celsius, and conductivity and SC (specific conductivity) in µmhos/cm.

One result per location per analyte per day evaluated

Detection limit used in calculating the representative concentration

Representative concentration is the median if the percentage of non-detects is 0 or greater than 70

Representative concentration is the Kaplan Meier mean if the percentage of non-detects is greater than 0 but less than or equal to 70

< = one or more nondetect values were included in the representative concentration determination

Appendix K-5. Statistical summary of construction adit water.

Parameter	Representative Concentration	Number of Observations	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
Dissolved Oxygen	7.4	4	4	0%	7.0	11.4
Field Conductivity	205	35	35	0%	15	5820
Field pH	8.0	102	102	0%	6.6	9.48
Field Temp	14	96	96	0%	1.1	19
Flow	13	9	9	0%	3.0	24
Lab pH	7.9	107	107	0%	7.3	9.5
Lab SC	203	106	106	0%	101	1970
TDS	122	92	92	0%	14	1480
TSS	< 10	102	57	44%	0.60	254
Turbidity	2.7	83	83	0%	0.24	277
Alkalinity, Bicarbonate as HCO3	71	104	104	0%	15.8	150
Alkalinity, Total as CaCO3	69	98	98	0%	33.6	150
Calcium, as Ca Dissolved	20	101	101	0%	4.6	194
Calcium, as Ca Total	16	16	16	0%	9.95	132
Chloride, as Cl	< 2.7	93	71	24%	0.43	38.6
Fluoride, as F	0.16	1	1	0%	0.16	0.16
Hardness, as CaCO3	72	84	84	0%	15.6	620
Magnesium, as Mg Dissolved	< 6.3	101	99	2%	0.094	33
Magnesium, as Mg Total	< 4.6	16	13	19%	2.0	21.7
Potassium, as K Dissolved	< 2.7	80	76	5%	0.56	24
Potassium, as K Total	< 3.6	9	4	56%	1.0	23
Sodium, as Na Dissolved	< 11	87	86	1%	0.30	112
Sodium, as Na Total	16	10	10	0%	10	95.1
Sulfate, as SO4	21	118	118	0%	2.0	487
Ammonia	< 0.65	144	57	60%	0.010	21.9
Nitrate	< 37	114	96	16%	0.0096	687
Nitrate + Nitrite, as N	< 17	125	112	10%	0.010	419
Nitrite	< 1.2	105	38	64%	0.00080	40
OrthoPhosphorus	< 0.010	87	68	22%	0.00050	0.14
TKN	< 1.1	105	61	42%	0.035	17.5
Total Inorganic Nitrogen	< 3.6	92	87	5%	0.010	221
Total Phosphorus	< 0.026	87	79	9%	0.0011	0.20
Aluminum, as Al Dissolved	< 0.014	83	43	48%	0.0052	0.062
Aluminum, as Al Total	< 0.13	82	63	23%	0.017	2.1
Antimony, as Sb Dissolved	< 0.00069	87	39	55%	0.00016	0.0090
Antimony, as Sb Total	< 0.00073	84	49	42%	0.00019	0.0090
Arsenic, as As Dissolved	< 0.0057	84	80	5%	0.00060	0.058
Arsenic, as As Total	< 0.0064	82	80	2%	0.00092	0.058
Barium, as Ba Dissolved	0.014	86	86	0%	0.0024	0.25
Barium, as Ba Total	0.014	83	83	0%	0.011	0.28
Beryllium, as Be Dissolved	< 0.00080	86	3	97%	0.000030	0.031
Beryllium, as Be Total	< 0.00020	83	5	94%	0.000021	0.031
Cadmium, as Cd Dissolved	< 0.000080	90	19	79%	0.0000050	0.00029
Cadmium, as Cd Total	< 0.000080	92	23	75%	0.0000050	0.00058
Chromium, as Cr Dissolved	< 0.00047	101	34	66%	0.00018	0.0024
Chromium, as Cr Total	< 0.00065	99	35	65%	0.00023	0.0040
Copper, as Cu Dissolved	< 0.0012	100	49	51%	0.00021	0.0075
Copper, as Cu Total	< 0.0017	99	60	39%	0.00024	0.0097
Iron, as Fe Dissolved	< 0.017	100	45	55%	0.0043	0.088
Iron, as Fe Total	< 0.25	99	88	11%	0.020	3.5
Lead, as Pb Dissolved	< 0.00010	93	49	47%	0.000010	0.00042
Lead, as Pb Total	< 0.00076	98	87	11%	0.000053	0.0080
Manganese, as Mn Dissolved	< 0.0050	100	50	50%	0.00022	0.043
Manganese, as Mn Total	< 0.016	99	60	39%	0.00065	0.25
Mercury, as Hg Dissolved	< 0.000022	52	24	54%	0.00000015	0.00010
Mercury, as Hg Total	< 0.000019	46	20	57%	0.00000015	0.000094

Appendix K-5. Statistical summary of construction adit water.

Parameter	Representative Concentration	Number of Observations	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
Nickel, as Ni Dissolved	< 0.00075	83	34	59%	0.00023	0.0023
Nickel, as Ni Total	< 0.00095	83	53	36%	0.00022	0.0037
Selenium, as Se Dissolved	< 0.0010	85	11	87%	0.00011	0.0012
Selenium, as Se Total	< 0.0010	82	15	82%	0.00010	0.00034
Silver, as Ag Dissolved	< 0.00020	43	2	95%	0.00035	0.00043
Silver, as Ag Total	< 0.00025	42	4	90%	0.00025	0.014
Thallium, as Tl Dissolved	< 0.00010	64	1	98%	0.000055	0.000055
Thallium, as Tl Total	< 0.00010	64	4	94%	0.000063	0.00040
Zinc, as Zn Dissolved	< 0.010	101	73	28%	0.0015	0.032
Zinc, as Zn Total	< 0.014	98	82	16%	0.0019	0.041

Notes:

Units are mg/L, except pH in standard units, temperature in degrees celsius, turbidity in NTUs, conductivity and SC (specific conductivity) in μmhos/cm, and flow in cfs

One result per location per analyte per day evaluated

Detection limit used in calculating the representative concentration

Representative concentration is the median if the percentage of non-detects is 0 or greater than 70

Representative concentration is the Kaplan Meier mean if the percentage of non-detects is greater than 0 but less than or equal to 70

< = one or more nondetect values were included in the representative concentration determination

Data summarized from samples A-1, A-2, AD-1, OUTFALL 1-2, OUTFALL-001, RAW, RAW-1, WRS, WRS-1

Statistics updated with data collected through 2012

Appendix K-6. Statistical summary of post-construction adit water.

Parameter	Representative Concentration	Number of Observations	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
Field Conductivity	192	26	26	0%	15	254
Field pH	8.0	70	70	0%	6.58	8.7
Field Temp	14	68	68	0%	2.0	16.5
Flow	13	9	9	0%	3.0	24.3
Lab pH	7.9	69	69	0%	7.3	8.7
Lab SC	197	68	68	0%	163	341
TSS	< 2.1	63	21	67%	1	24
Turbidity	1.6	47	47	0%	0.51	27.1
Alkalinity, Bicarbonate as HCO3	74	66	66	0%	62	98.5
Alkalinity, Total as CaCO3	73	60	60	0%	61	98.5
Calcium, as Ca Dissolved	19	62	62	0%	10	22.4
Calcium, as Ca Total	16	14	14	0%	15	19.7
Chloride, as Cl	< 3.0	55	52	5%	0.60	29.3
Hardness, as CaCO3	70	46	46	0%	41.2	78.5
Magnesium, as Mg Dissolved	< 4.6	62	60	3%	0.094	5.7
Magnesium, as Mg Total	< 3.5	15	12	20%	2.0	4.3
Potassium, as K Dissolved	< 0.93	46	43	7%	0.71	2.9
Potassium, as K Total	< 1.3	8	3	63%	1.0	2.0
Sodium, as Na Dissolved	12	49	49	0%	7.2	15.1
Sodium, as Na Total	15	9	9	0%	10	22
Sulfate, as SO4	20	77	77	0%	13	142
TDS	114	53	53	0%	89	306
Ammonia	< 0.050	69	17	75%	0.010	0.57
Nitrate	< 0.12	58	50	14%	0.015	2.73
Nitrate + Nitrite, as N	0.045	60	60	0%	0.017	2.73
Nitrite	< 0.010	57	14	75%	0.00080	1.6
OrthoPhosphorus	< 0.0057	50	33	34%	0.00050	0.070
TKN	< 0.086	64	23	64%	0.035	0.78
Total Inorganic Nitrogen	< 0.14	54	52	4%	0.02	2.43
Total Phosphorus	< 0.0073	50	42	16%	0.0011	0.028
Aluminum, as Al Dissolved	< 0.011	48	24	50%	0.0058	0.026
Aluminum, as Al Total	< 0.050	48	29	40%	0.021	0.46
Antimony, as Sb Dissolved	< 0.00032	50	19	62%	0.00016	0.00086
Antimony, as Sb Total	< 0.00031	49	19	61%	0.00019	0.00069
Arsenic, as As Dissolved	< 0.0011	47	44	6%	0.00060	0.0015
Arsenic, as As Total	< 0.0014	47	45	4%	0.0010	0.0020
Barium, as Ba Dissolved	0.012	48	48	0%	0.011	0.020
Barium, as Ba Total	0.013	48	48	0%	0.011	0.022
Beryllium, as Be Dissolved	< 0.00080	49	3	94%	0.000030	0.031
Beryllium, as Be Total	< 0.00080	48	3	94%	0.000021	0.031
Cadmium, as Cd Dissolved	< 0.000080	57	6	89%	0.0000050	0.000022
Cadmium, as Cd Total	< 0.000080	57	3	95%	0.0000050	0.00010
Chromium, as Cr Dissolved	< 0.00054	64	19	70%	0.00018	0.0074
Chromium, as Cr Total	< 0.0010	63	17	73%	0.00024	0.0040
Copper, as Cu Dissolved	< 0.0010	62	15	76%	0.00021	0.0016
Copper, as Cu Total	< 0.00063	63	24	62%	0.00024	0.0078
Iron, as Fe Dissolved	< 0.017	63	28	56%	0.0076	0.091
Iron, as Fe Total	< 0.18	63	57	10%	0.020	1.3
Lead, as Pb Dissolved	< 0.00017	59	29	51%	0.000010	0.0050
Lead, as Pb Total	< 0.00058	62	51	18%	0.000090	0.0070
Manganese, as Mn Dissolved	< 0.0050	63	26	59%	0.0017	0.046
Manganese, as Mn Total	< 0.0057	63	27	57%	0.0029	0.030
Mercury, as Hg Dissolved	< 0.000017	31	14	55%	0.00000015	0.00010
Mercury, as Hg Total	< 0.000013	28	11	61%	0.00000015	0.000074
Nickel, as Ni Dissolved	< 0.00055	48	19	60%	0.00029	0.0011

Appendix K-6. Statistical summary of post-construction adit water.

Parameter	Representative Concentration	Number of Observations	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
Nickel, as Ni Total	< 0.00049	48	22	54%	0.00022	0.0016
Selenium, as Se Dissolved	< 0.0010	49	2	96%	0.0011	0.0012
Selenium, as Se Total	< 0.0010	48	3	94%	0.00010	0.00016
Silver, as Ag Dissolved	< 0.00025	23	2	91%	0.00035	0.00043
Silver, as Ag Total	< 0.00025	23	1	96%	0.0020	0.0020
Thallium, as Tl Dissolved	< 0.00010	37	1	97%	0.000055	0.000055
Thallium, as Tl Total	< 0.00010	37	2	95%	0.000063	0.00012
Zinc, as Zn Dissolved	< 0.012	63	47	25%	0.0017	0.032
Zinc, as Zn Total	< 0.015	62	50	19%	0.0030	0.028

Units are mg/L, except pH in standard units, temperature in degrees celsius, turbidity in NTUs, conductivity and
SC (specific conductivity) in µmhos/cm, and flow in cfs
One result per location per analyte per day evaluated
Detection limit used in calculating the representative concentration
Noranda-era data for nitrate, nitrate plus nitrite and ammonia not evaluated
Representative concentration is the median if the percentage of non-detects is 0 or greater than 70
Representative concentration is the Kaplan Meier mean if the percentage of non-detects is greater than 0 but less than or equal to 70
< = one or more nondetect values were included in the representative concentration determination
Data summarized from samples A-1, A-2, AD-1, OUTFALL 1-2, OUTFALL-001, RAW, RAW-1
Statistics updated with data collected through 2012

Appendix K-7. Statistical summary of operations mine water.

Parameter	Representative Concentration	Number of Observations	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
Field pH	7.5	14	14	0%	6.9	8.0
Lab SC	215	14	14	0%	164	323
Total Dissolved Solids	121	16	16	0%	82	201
Total Suspended Solids	< 457	16	12	25%	10	1590
Alkalinity Bicarbonate	92	16	16	0%	49	112
Alkalinity Total	76	16	16	0%	40	92
Calcium, as Ca Total	28	16	16	0%	16	35
Chloride, as Cl	< 1.0	16	0	100%		
Fluoride, as F	< 0.10	2	0	100%		
Hardness	99	16	16	0%	53	127
Magnesium, as Mg Total	7.0	16	16	0%	3.0	10
Potassium, as K Total	< 1.4	16	12	25%	1.0	4.0
Sodium, as Na Total	< 2.9	16	15	6%	1.0	8.0
Sulfate, as SO4	23	16	16	0%	17	37
Ammonia	< 1.6	16	14	13%	0.070	10.7
Nitrate + Nitrite, as N	3.1	16	16	0%	0.70	20
Total Phosphorus	0.096	15	15	0%	0.0040	0.36
Aluminum, as Al Dissolved	0.075	2	2	0%	0.060	0.090
Antimony, as Sb Dissolved	< 0.0088	6	5	17%	0.0060	0.015
Antimony, as Sb Total Recoverable	0.011	13	13	0%	0.0070	0.089
Arsenic, as As Dissolved	< 0.018	7	4	43%	0.0010	0.11
Arsenic, as As Total Recoverable	< 0.026	13	7	46%	0.0070	0.080
Barium, as Ba Dissolved	0.068	2	2	0%	0.065	0.070
Beryllium, as Be Dissolved	< 0.0010	2	0	100%		
Cadmium, as Cd Dissolved	0.0015	2	2	0%	0.00087	0.0022
Chromium, as Cr Dissolved	< 0.0010	2	0	100%		
Copper, as Cu Dissolved	0.042	5	5	0%	0.041	0.084
Copper, as Cu Total	0.13	4	4	0%	0.076	0.15
Iron, as Fe Dissolved	< 0.15	6	3	50%	0.010	0.81
Iron, as Fe Total Recoverable	4.4	13	13	0%	0.020	14.3
Lead, as Pb Dissolved	0.0080	3	3	0%	0.0021	0.047
Lead, as Pb Total Recoverable	0.19	12	12	0%	0.0070	1.08
Manganese, as Mn Dissolved	0.21	6	6	0%	0.025	0.31
Manganese, as Mn Total Recoverable	0.66	12	12	0%	0.026	3.5
Mercury, as Hg Dissolved	< 0.0000050	2	1	50%	0.0000050	0.0000050
Nickel, as Ni Dissolved	< 0.010	2	0	100%		
Selenium, as Se Dissolved	0.0020	2	2	0%	0.0010	0.0030
Silver, as Ag Total Recoverable	0.075	7	7	0%	0.0060	0.17
Thallium, as Tl Dissolved	< 0.00020	2	0	100%		
Zinc, as Zn Dissolved	< 0.012	6	2	67%	0.010	0.020
Zinc, as Zn Total Recoverable	< 0.043	14	8	43%	0.010	0.14

Units are mg/L, except pH in standard units

One result per location per analyte per day evaluated

Detection limit used in calculating the representative concentration

Representative concentration is the median if the percentage of non-detects is 0 or greater than 70

Representative concentration is the Kaplan Meier mean if the percentage of non-detects is greater than 0 but less than or equal to 70

< = one or more nondetect values were included in the representative concentration determination

Data summarized from Troy Mine samples Service Adit P and Service Adit D

Data limited to after restart of mining (post December 2004)

Appendix K-8. Statistical summary of post-operations mine water.

Parameter	Representative Concentration	Number of Observations	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
Field pH	7.4	54	54	0%	6.5	8.2
Lab SC	153	49	49	0%	106	274
Total Dissolved Solids	108	58	58	0%	64	181
Total Suspended Solids	< 9.4	45	20	56%	1.3	244.8
Alkalinity Bicarbonate	48	41	41	0%	20	113
Alkalinity Total	45	43	43	0%	20	93
Calcium, as Ca Total	22	55	55	0%	13	36
Chloride, as Cl	< 1.0	30	5	83%	1.0	1.4
Fluoride, as F	< 0.052	26	8	69%	0.05	0.064
Hardness	76	61	61	0%	43	133
Magnesium, as Mg Total	5.0	57	57	0%	2.59	11
Potassium, as K Total	< 2.0	49	11	78%	1.0	3.4
Sodium, as Na Total	< 1.3	13	11	15%	1.0	1.7
Sulfate, as SO4	< 24	62	60	3%	11.7	46
Ammonia	< 0.16	53	30	43%	0.010	1.8
Nitrate + Nitrite, as N	0.76	60	60	0%	0.083	6.8
Total Phosphorus	< 0.10	26	0	100%		
Aluminum, as Al Total	< 0.050	26	4	85%	0.060	0.30
Antimony, as Sb Dissolved	< 0.0094	7	4	43%	0.0070	0.016
Antimony, as Sb Total	< 0.0082	26	17	35%	0.0030	0.021
Arsenic, as As Dissolved	< 0.0031	7	3	57%	0.0030	0.0040
Arsenic, as As Total	< 0.0030	29	7	76%	0.0010	0.0090
Barium, as Ba Total	0.043	26	26	0%	0.031	0.38
Beryllium, as Be Total	< 0.0010	26	0	100%		
Cadmium, as Cd Total	0.00040	9	9	0%	0.00030	0.0030
Chromium, as Cr Total	< 0.0010	26	5	81%	0.0010	0.0020
Copper, as Cu Dissolved	0.065	15	15	0%	0.033	0.17
Copper, as Cu Total	0.13	45	45	0%	0.059	0.89
Iron, as Fe Dissolved	< 0.020	6	0	100%		
Iron, as Fe Total	< 0.21	47	38	19%	0.013	1.77
Lead, as Pb Total	0.0060	38	38	0%	0.0020	0.16
Manganese, as Mn Dissolved	0.067	15	15	0%	0.011	0.22
Manganese, as Mn Total	0.17	47	47	0%	0.026	0.47
Mercury, as Hg Total	0.00059	2	2	0%	0.00046	0.00072
Nickel, as Ni Total	< 0.010	22	0	100%		
Selenium, as Se Total	< 0.0010	26	0	100%		
Silver, as Ag Total	0.0040	4	4	0%	0.0030	0.0070
Zinc, as Zn Dissolved	< 0.013	9	8	11%	0.011	0.015
Zinc, as Zn Total	< 0.015	47	38	19%	0.0070	0.043

Units are mg/L, except pH in standard units
One result per location per analyte per day evaluated
Detection limit used in calculating the representative concentration
Representative concentration is the median if the percentage of non-detects is 0 or greater than 70
Representative concentration is the Kaplan Meier mean if the percentage of non-detects is greater than 0 but less than or equal to 70
< = one or more nondetect values were included in the representative concentration determination
Data summarized from Troy Mine samples Service Adit P and Service Adit D
Data limited to period of no mining (May '93 to November '04)

Appendix K-9. Statistical summary of tailings water.

Parameter	Representative Concentration	Number of Observations	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
Field pH	7.3	18	18	0%	6.92	7.98
Lab SC umhos/cm	399	16	16	0%	305	502
Total Dissolved Solids	266	18	18	0%	185	382
TSS	88	13	13	0%	17	257
Bicarbonate	96	16	16	0%	79	103
Calcium	22	17	17	0%	16	34
Chloride	< 3.1	18	17	6%	2	5
Flouride	0.20	4	4	0%	0.16	0.2
Hardness	77	16	16	0%	54	109
Magnesium	5.0	17	17	0%	4	6
Potassium	20	17	17	0%	15	31
Sodium	25	17	17	0%	15	35
Sulfate	36	17	17	0%	20	52
Total Organic Carbon	1.2	3	3	0%	0.9	1.6
Total Alkalinity	79	16	16	0%	65	84
Ammonia	4.4	18	18	0%	0.39	10.4
Nitrate + Nitrite as N	13	17	17	0%	5.71	37.5
Orthophosphorus	0.057	4	4	0%	0.01	0.169
Total Phosphorus	0.086	15	15	0%	0.014	0.37
Aluminum Dissolved	< 0.13	6	2	67%	0.12	0.18
Aluminum Total	8.9	2	2	0%	0.70	17
Antimony Dissolved	0.023	8	8	0%	0.0080	0.062
Antimony Total	0.016	14	14	0%	0.0070	0.034
Arsenic Dissolved	< 0.0017	8	4	50%	0.0013	0.0020
Arsenic Total	< 0.0062	15	12	20%	0.0030	0.018
Barium Dissolved	< 0.11	6	4	33%	0.099	0.156
Barium Total	0.60	3	3	0%	0.352	2.7
Beryllium Dissolved	< 0.0010	4	0	100%		
Beryllium Total	< 0.0010	1	0	100%		
Cadmium Dissolved	0.00097	3	3	0%	0.00091	0.0013
Cadmium Total	0.00020	1	1	0%	0.00020	0.00020
Chromium Dissolved	< 0.0010	4	0	100%		
Chromium Total	0.0040	1	1	0%	0.0040	0.0040
Copper Dissolved	0.026	8	8	0%	0.0060	0.043
Copper Total	0.30	14	14	0%	0.044	2.46
Iron Dissolved	0.050	8	8	0%	0.010	0.38
Iron Total	1.4	14	14	0%	0.55	4.43
Lead Dissolved	< 0.0044	3	2	33%	0.0026	0.010
Lead Total	0.025	13	13	0%	0.0080	0.14
Manganese Dissolved	0.51	8	8	0%	0.101	0.791
Manganese Total	0.65	14	14	0%	0.233	2.22
Mercury Dissolved	< 0.0000050	3	0	100%		
Nickel Dissolved	< 0.010	5	0	100%		
Nickel Total	< 0.0075	2	0	100%		
Selenium Dissolved	< 0.0013	5	3	40%	0.0010	0.0020
Selenium Total	< 0.0030	2	0	100%		
Silver Total	0.0017	6	6	0%	0.00080	0.0090
Thallium Dissolved	< 0.00020	3	0	100%		
Zinc Dissolved	< 0.010	8	2	75%	0.0060	0.020
Zinc Total	< 0.024	14	6	57%	0.010	0.12

All concentrations in units of mg/L except pH in standard units

One result per location per analyte per day evaluated

Detection limit used in calculating the representative concentration

Representative concentration is the median if the percentage of non-detects is 0 or greater than 70

Representative concentration is the Kaplan Meier mean if the percentage of non-detects is greater than 0 but less than or equal to 70

< = one or more nondetect values were included in the representative concentration determination

Data summarized from Troy Mine sample Decant Pond

Data limited to after restart of tailing pond use after restart of mining activities (post November 2005)

Statistics updated with data collected through 2012

Appendix K-10. Statistical summary of Libby Adit Waste Rock Sump.

Parameter	Representative Concentration	Number of Observations	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
Dissolved Oxygen	7.6	3	3	0%	7.04	11.4
Field Conductivity	3690	9	9	0%	903	5820
Field pH	8.2	32	32	0%	7.1	9.48
Field Temp	8.2	28	28	0%	1.1	19
Lab pH	8.0	38	38	0%	7.4	9.5
Lab SC	310	38	38	0%	101	1970
TDS	200	37	37	0%	44.7	1480
TSS	< 11	37	34	8%	1.0	62
Turbidity	4.2	36	36	0%	0.24	277
Alkalinity, Bicarbonate as HCO3	57	38	38	0%	15.8	150
Alkalinity, Total as CaCO3	57	38	38	0%	33.6	150
Calcium, as Ca Dissolved	43	39	39	0%	4.6	194
Calcium, as Ca Total	132	1	1	0%	132	132
Chloride, as Cl	< 2.3	38	19	50%	0.43	38.6
Hardness, as CaCO3	134	38	38	0%	15.6	620
Magnesium, as Mg Dissolved	7.0	39	39	0%	1.0	33
Magnesium, as Mg Total	22	1	1	0%	21.7	21.7
Potassium, as K Dissolved	< 5.0	34	33	3%	0.56	24
Potassium, as K Total	23	1	1	0%	22.6	22.6
Sodium, as Na Dissolved	< 8.9	38	37	3%	0.30	112
Sodium, as Na Total	95	1	1	0%	95.1	95.1
Sulfate, as SO4	77	39	39	0%	2.0	487
Ammonia	< 1.8	50	32	36%	0.010	22
Nitrate	< 87	48	39	19%	0.0096	687
Nitrate + Nitrite, as N	< 54	40	39	3%	0.010	419
Nitrite	< 2.5	48	24	50%	0.0026	40
OrthoPhosphorus	< 0.017	37	35	5%	0.0019	0.14
TKN	< 2.6	41	38	7%	0.11	18
Total Inorganic Nitrogen	< 8.6	38	35	8%	0.010	221
Total Phosphorus	0.037	37	37	0%	0.0097	0.20
Aluminum, as Al Dissolved	< 0.017	35	19	46%	0.0052	0.062
Aluminum, as Al Total	0.070	34	34	0%	0.017	2.1
Antimony, as Sb Dissolved	< 0.0012	37	20	46%	0.00037	0.0090
Antimony, as Sb Total	< 0.0012	35	30	14%	0.00051	0.0090
Arsenic, as As Dissolved	< 0.012	37	36	3%	0.0012	0.058
Arsenic, as As Total	0.0082	35	35	0%	0.00092	0.058
Barium, as Ba Dissolved	0.064	37	37	0%	0.0024	0.25
Barium, as Ba Total	0.072	35	35	0%	0.014	0.28
Beryllium, as Be Dissolved	< 0.00080	37	0	100%		
Beryllium, as Be Total	< 0.00020	35	2	94%	0.000042	0.000086
Cadmium, as Cd Dissolved	< 0.000043	33	13	61%	0.000016	0.00029
Cadmium, as Cd Total	< 0.000087	35	20	43%	0.000019	0.00058
Chromium, as Cr Dissolved	< 0.00053	38	16	58%	0.00023	0.0024
Chromium, as Cr Total	< 0.00077	36	18	50%	0.00023	0.0037
Copper, as Cu Dissolved	< 0.0024	37	33	11%	0.00042	0.0075
Copper, as Cu Total	0.0035	36	36	0%	0.00085	0.0097
Iron, as Fe Dissolved	< 0.020	38	18	53%	0.0043	0.088
Iron, as Fe Total	< 0.38	36	31	14%	0.046	3.50
Lead, as Pb Dissolved	< 0.00035	36	22	39%	0.000031	0.0080
Lead, as Pb Total	0.00044	36	36	0%	0.000053	0.0080
Manganese, as Mn Dissolved	< 0.0066	38	25	34%	0.00022	0.043
Manganese, as Mn Total	< 0.035	36	33	8%	0.00065	0.25
Mercury, as Hg Dissolved	< 0.000046	21	10	52%	0.000037	0.000095
Mercury, as Hg Total	< 0.000034	18	9	50%	0.000014	0.000094
Nickel, as Ni Dissolved	< 0.0011	36	16	56%	0.00023	0.0024
Nickel, as Ni Total	< 0.0013	35	31	11%	0.00033	0.0037

Appendix K-10. Statistical summary of Libby Adit Waste Rock Sump.

Parameter	Representative Concentration	Number of Observations	Number of Detects	Percentage of Non-Detects	Minimum Detected Value	Maximum Detected Value
Selenium, as Se Dissolved	< 0.0010	36	9	75%	0.00011	0.00023
Selenium, as Se Total	< 0.00017	34	12	65%	0.00010	0.00034
Silver, as Ag Dissolved	< 0.00020	20	0	100%		
Silver, as Ag Total	< 0.00025	19	3	84%	0.00025	0.014
Thallium, as Tl Dissolved	< 0.00010	27	0	100%		
Thallium, as Tl Total	< 0.00010	27	2	93%	0.000098	0.00040
Zinc, as Zn Dissolved	< 0.0077	38	26	32%	0.0015	0.025
Zinc, as Zn Total	< 0.012	36	32	11%	0.0019	0.041

Notes:

Units are mg/L, except pH in standard units, temperature in degrees celsius, turbidity in NTUs, conductivity and SC (specific conductivity) in μmhos/cm

One result per location per analyte per day evaluated

Detection limit used in calculating the representative concentration

Representative concentration is the median if the percentage of non-detects is 0 or greater than 70

Representative concentration is the Kaplan Meier mean if the percentage of non-detects is greater than 0 but less than or equal to 70

< = one or more nondetect values were included in the representative concentration determination

Data summarized from samples WRS and WRS-1

Statistics updated with data collected through 2012

Appendix K-11. Data outliers

Sample ID	Parameter	Data Outlier(s)	Remarks
BC-500	Aluminum, as Al Dissolved	0.063, 0.059	Dissolved significantly greater than total
BC-500	Calcium, as Ca Total	0.2	More than an order of magnitude lower than next result
BC-500	Chromium, as Cr Dissolved	0.0005	Dissolved significantly greater than total
BC-500	Copper, as Cu Dissolved	0.0053	Dissolved significantly greater than total
BC-500	Iron, as Fe Dissolved	0.18	Dissolved significantly greater than total
BC-500	Lead, as Pb Dissolved	0.00046, 0.00016	Dissolved significantly greater than total
BC-500	Manganese, as Mn Dissolved	0.002	Dissolved significantly greater than total
BC-500	Mercury, as Hg Dissolved	0.000075, 0.000045	Dissolved significantly greater than total
BC-500	Nickel, as Ni Dissolved	0.00054	Dissolved significantly greater than total
BC-500	TSS	34	Significantly higher than corresponding turbidity result
BC-500	Zinc, as Zn Dissolved	0.009	Dissolved significantly greater than total
Decant Pond	Arsenic Dissolved	0.005	Failed Dixon Test
Decant Pond	Bicarbonate	43, 99	Passed Dixon Test after suspect outlier removal
Decant Pond	Field pH	6.0	One order of magnitude lower than other results
Decant Pond	Iron TRC	0.08, 9.57, 93.8	Failed Dixon Test
Decant Pond	Sulfate	104	Passed Dixon Test after suspect outlier removal
Decant Pond	TOC	10	Less than five detects
Decant Pond	Total Alk	43, 99	Passed Dixon Test after suspect outlier removal
EFRC-100	Zinc, as Zn Dissolved	0.0044	Dissolved significantly greater than total
EFRC-200	Zinc, as Zn Dissolved	0.0044	Dissolved significantly greater than total
LB-1000	Chromium, as Cr Dissolved	0.00046	Dissolved significantly greater than total
LB-1000	Iron, as Fe Dissolved	0.085	Dissolved significantly greater than total
LB-200	Barium, as Ba Dissolved	0.086, 0.048	Dissolved significantly greater than total
LB-200	Chloride, as Cl	15	Failed Rosner Test
LB-200	Chromium, as Cr Dissolved	0.0038, 0.0032, 0.0026	Dissolved significantly greater than total
LB-200	Copper, as Cu Dissolved	0.012, 0.0041	Dissolved significantly greater than total
LB-200	Dissolved Oxygen	92.2, 85.7, 3.08, 6.4	High values reported as % saturation not mg/L; Low values failed dixon test and are toc low for mountain stream
LB-200	Iron, as Fe Dissolved	0.41	Failed Dixon Test
LB-200	Lead, as Pb Dissolved	0.099, 0.0082	Dissolved significantly greater than total
LB-200	Manganese, as Mn Dissolved	0.086, 0.0039, 0.0038,	Dissolved significantly greater than total
LB-200	Nickel, as Ni Dissolved	0.0029, 0.0015	Dissolved significantly greater than total
LB-200	Sodium, as Na Dissolved	13.2	More than one order of magnitude higher than other results
LB-200	Sodium, as Na Total	13.2	Failed Rosner Test
LB-300	Aluminum, as Al Dissolved	0.3	Dissolved significantly greater than total
LB-300	Barium, as Ba Dissolved	0.029, 0.017, 0.015	Dissolved significantly greater than total
LB-300	Cadmium, as Cd Dissolved	0.000081, 0.000034	Dissolved significantly greater than total
LB-300	Chromium, as Cr Dissolved	0.007, 0.0064, 0.0042, 0.003, 0.0022, 0.001, 0.00079, 0.00058, 0.00057, 0.00044	Dissolved significantly greater than total
LB-300	Dissolved Oxygen	91.6, 86, 0.1	Wrong units and too low for mountain stream
LB-300	Iron, as Fe Dissolved	6.9, 1.8, 0.13	Dissolved significantly greater than total
LB-300	Manganese, as Mn Dissolved	0.033	Dissolved significantly greater than total
LB-300	Mercury, as Hg Dissolved	7.10E-05	Dissolved significantly greater than total
LB-300	Nitrate + Nitrite, as N	124	Not consistent with upstream and downstream results
LB-300	Zinc, as Zn Dissolved	0.038, 0.0084	Failed Rosner Test; Dissolved significantly greater than total
LB-3000	Chromium, as Cr Dissolved	0.0012, 0.0011	Dissolved significantly greater than total
LB-3000	Lead, as Pb Dissolved	0.00063	Dissolved significantly greater than total
LB-3000	Mercury, as Hg Dissolved	0.000051	Dissolved significantly greater than total
LB-3000	Nickel, as Ni Dissolved	0.00081, 0.0006	Dissolved significantly greater than total
LB-3000	Zinc, as Zn Dissolved	0.0046	Dissolved significantly greater than total
LB-500	Antimony, as Sb Dissolved	0.001, 0.0002	Dissolved significantly greater than total
LB-500	Lead, as Pb Total	1.58	Orders of magnitude higher than other results and not seen upgradient or downgradient
LB-500	Arsenic, as As Dissolved	0.0049	Dissolved significantly greater than total
LB-500	Barium, as Ba Dissolved	0.022, 0.009, 0.0077	Dissolved significantly greater than total
LB-500	Cadmium, as Cd Dissolved	0.000081	Dissolved significantly greater than total
LB-500	Calcium, as Ca Dissolved	11	Order of magnitude greater than other results
LB-500	Chromium, as Cr Dissolved	0.0016, 0.00074, 0.00058, 0.00056	Dissolved significantly greater than total
LB-500	Copper, as Cu Dissolved	0.0017, 0.00085, 0.00075, 0.0007	Dissolved significantly greater than total
LB-500	Dissolved Oxygen	93.2, 34.5	Assumed wrong units
LB-500	Field Conductivity	103.8	Lab SC result one order of magnitude lower
LB-500	Iron, as Fe Dissolved	0.066, 0.036	Dissolved significantly greater than total
LB-500	Manganese, as Mn Dissolved	0.0055, 0.0046, 0.0035	Dissolved significantly greater than total
LB-500	Nickel, as Ni Dissolved	0.0023, 0.0018, 0.00098, 0.00082	Dissolved significantly greater than total
LB-500	Selenium, as Se Dissolved	0.00025	Dissolved significantly greater than total

Appendix K-11. Data outliers

Sample ID	Parameter	Data Outlier(s)	Remarks
LB-500	Silver, as Ag Dissolved	0.00016, 0.00011	Dissolved significantly greater than total
LB-500	Total Phosphorus	0.46	Failed Dixon Test; One order of magnitude higher
LB-500	Zinc, as Zn Dissolved	0.0061, 0.0058, 0.0051, 0.0043, 0.0037	Dissolved significantly greater than total
LC-800	Antimony, as Sb Dissolved	0.000096	Dissolved significantly greater than total
LC-800	Beryllium, as Be Dissolved	0.017, 0.000037	Dissolved significantly greater than total
LC-800	Cadmium, as Cd Dissolved	0.000034, 0.000029	Dissolved significantly greater than total
LC-800	Copper, as Cu Dissolved	0.0011, 0.0064	Dissolved significantly greater than total
LC-800	Dissolved Oxygen	0.8, 3.09	Too low for mountain stream
LC-800	Lead, as Pb Dissolved	0.0011, 0.00012	Dissolved significantly greater than total
LC-800	Manganese, as Mn Dissolved	0.0072, 0.0071	Dissolved significantly greater than total
LC-800	Mercury, as Hg Dissolved	0.000059, 0.00003, 0.000032	Dissolved significantly greater than total
LC-800	Nickel, as Ni Dissolved	0.001, 0.00057, 0.00042	Dissolved significantly greater than total
LC-800	Silver, as Ag Dissolved	0.016	Dissolved significantly greater than total
LC-800	Total Phosphorus	15	Three orders of magnitude greater than other results
MW07-01	Dissolved Oxygen	29.9	Unrealistic, assumed wrong units
MW07-02	Dissolved Oxygen	33.2, 28, 26.3, 15.02	Unrealistic, assumed wrong units
MW07-02	Iron, as Fe Dissolved	2.3	2-3 orders of magnitude greater than MW07-01 result
PM-1000	Aluminum, as Al Dissolved	0.036, 0.015	Dissolved significantly greater than total
PM-1000	Arsenic, as As Dissolved	0.00037	Dissolved significantly greater than total
PM-1000	Chromium, as Cr Dissolved	0.0007, 0.00037	Dissolved significantly greater than total
PM-1000	Copper, as Cu Dissolved	0.0064, 0.0004	Dissolved significantly greater than total
PM-1000	Dissolved Oxygen	2.5	Too low for mountain stream
PM-1000	Lead, as Pb Dissolved	0.0011, 0.003	Dissolved significantly greater than total
PM-1000	Manganese, as Mn Dissolved	0.0071, 0.0008	Dissolved significantly greater than total
PM-1000	Mercury, as Hg Dissolved	0.000058, 0.000051, 0.000039, 0.000038	Dissolved significantly greater than total
RA-200	Field Temp	25	Failed Dixon Test; high compared to other sites and other summer dates
RAW-1	Aluminum, as Al Dissolved	0.29	Dissolved significantly greater than total
RAW-1	Arsenic, as As Dissolved	0.034	Dissolved significantly greater than total
RAW-1	Barium, as Ba Dissolved	0.03	Dissolved significantly greater than total
RAW-1	Calcium, as Ca Total	9.95	Failed Dixon Test
RAW-1	Copper, as Cu Dissolved	0.0027, 0.043	Dissolved significantly greater than total
RAW-1	Flow	260	Failed Dixon Test; wrong units
RAW-1	Iron, as Fe Dissolved	0.98	Dissolved significantly greater than total
RAW-1	Lead, as Pb Dissolved	0.0035	Dissolved significantly greater than total
RAW-1	Nickel, as Ni Dissolved	0.0072	Dissolved significantly greater than total
RAW-1	Sodium, as Na Dissolved	1510	Failed Rosner Test; assumed decimal place not entered; Dissolved significantly greater than total
RAW-1	TSS	246, 254	Order of magnitude greater than third highest result (assumed decimal place not entered)
Service Adit-D	Copper, as Cu Dissolved	0.986	Order of magnitude higher than dissolved results and total results
Service Adit-D	Copper, as Cu Total	9	Order of magnitude higher and qualified as elevated RL yet listed as a detect
Service Adit-P	Field pH	8.9	Failed Rosner test and one unit greater than corresponding lab pH result
Service Adit-D	Zinc, as Zn Dissolved	0.35	Dissolved significantly greater than total
WRS-1	Aluminum, as Al Dissolved	0.269	Failed Dixon Test; Two orders of magnitude higher than remaining results
WRS-1	Cadmium, as Cd Dissolved	0.00052, 0.00018	Dissolved significantly greater than total
WRS-1	Copper, as Cu Dissolved	0.0055	Dissolved significantly greater than total
WRS-1	Field pH	10.55	One unit higher than lab pH result
WRS-1	Lead, as Pb Dissolved	0.015	Dissolved significantly greater than total
WRS-1	Nickel, as Ni Dissolved	0.0076	One order of magnitude higher than total results
WRS-1	Selenium, as Se Dissolved	0.021	Two orders of magnitude higher than remaining results
WRS-1	Selenium, as Se Total	0.022	Two orders of magnitude higher than remaining results
WRS-1	TSS	1280	Suspected missing decimal place

Outlier identification is based on detections only.

If outlier(s) are suspected based on graphical plots (Box Plots and Q-Q Plots), Dixon test or Rosner test is run after testing the null hypothesis that remaining data follow normal distribution. If data do not follow either normal or lognormal distribution after removing suspected outlier(s), outlier determination based on professional judgment.

Dataset with fewer than 5 detections do not have sufficient data for meaningful plots or statistical tests.

In addition to data outliers removed, data reduction methods consisted of the following: 1) data removed so that one result per day per sample location was evaluated, 2) Noranda-era (Pre-2004) total metals data removed due to high detection limits, 3) below detection limit data with a detection limit greater than the lowest applicable water quality standard were removed, and 4) ammonia, calcium, conductivity, hardness, nitrate, nitrite, sodium, sulfate, total dissolved solids, and total kjeldahl nitrogen measured from 1990 through 1998 from locations LB-300 through LB-3000 removed due to the period of direct adit discharge to Libby Creek. See ERO 2011c for further discussion.

Appendix K-12. Consolidated Sampe Identifications

Database Sample ID	Consolidated ID	Sample Type
BC-500 EK	BC-500	Surface Water
PLCR-1	EFBR-300	Surface Water
EFBL-1	EFBR-500	Surface Water
EF-200	EFRC-200	Surface Water
EF-300	EFRC-300	Surface Water
EF-400	EFRC-400	Surface Water
EF-800	EFRC-800	Surface Water
LB-1000 EK	LB-1000	Surface Water
LB-200 EK	LB-200	Surface Water
LB-205	LB-200	Surface Water
LB-2000 EK	LB-2000	Surface Water
LB-300 EK	LB-300	Surface Water
LB-300V	LB-300	Surface Water
LB-305	LB-300	Surface Water
LB-3000 EK	LB-3000	Surface Water
LB-505	LB-500	Surface Water
LC-800V	LC-800	Surface Water
LSMW07-01	MW07-01	Groundwater
LSMW02	MW07-02	Groundwater
LSMW07-02	MW07-02	Groundwater
PM-1000 EK	PM-1000	Surface Water
PM-1000V	PM-1000	Surface Water
RA-500	RA-600	Surface Water
RA-550	RA-600	Surface Water
RA-550V	RA-600	Surface Water
RA-600A	RA-600	Surface Water
A-1	RAW-1	Adit
A-2	RAW-1	Adit
AD-1	RAW-1	Adit
OUTFALL 1-2	RAW-1	Adit
OUTFALL-001	RAW-1	Adit
RAW	RAW-1	Adit
WRS	WRS-1	Waste Rock

Only consolidated sample identifications are shown

Appendix L— Final Lead Agencies 404(b)(1) Analysis

Final Lead Agencies
404(b)(1) Analysis
Montanore Project

Prepared for—

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404(B)(1) ANALYSIS
MONTANORE PROJECT

Introduction and Purpose

Montanore Minerals Corp. (MMC) proposes to construct a copper and silver underground mine and associated facilities, including a new transmission line, near Libby, Montana. The proposed project is called the Montanore Project. MMC has requested approval of a Plan of Operations for the Montanore Project by the U.S. Department of Agriculture (USDA), Kootenai National Forest (KNF). The KNF and the Montana Department of Environmental Quality (DEQ) are the lead agencies for the preparation of an environmental impact statement (EIS) in compliance with the National Environmental Policy Act (NEPA) and the Montana Environmental Policy Act (MEPA).

From the DEQ's perspective, the MMC's proposed mining operation is covered by a DEQ Operating Permit first issued by the Montana Department of State Lands (DSL) to Noranda Minerals Corp. (NMC). MMC has applied to the DEQ for a modification of the existing permit to incorporate aspects of any Plan of Operations approved by the KNF that are different from the DEQ Operating Permit. MMC has also applied to the DEQ for a certificate of compliance to allow for construction of the transmission line. MMC has applied for other permits, such as a section 404 permit for discharge of dredged or fill material from the U.S. Army Corps of Engineers (Corps) and renewal of an existing Montana Pollutant Discharge Elimination System (MPDES) permit from the DEQ.

The lead agencies prepared this 404(b)(1) analysis and provided it to the Corps so that the Corps may conduct a 404(b)(1) compliance determination on MMC's 404 permit application for the Montanore Project. This analysis is not intended to represent the Corps' conclusions or their final 404(b)(1) determination. The analysis should be read in conjunction with a companion report, *Tailings Disposal Alternatives Analysis*, which describes the lead agencies' alternatives analysis for tailings disposal (ERO Resources Corp. 2011). This analysis addresses the lead agencies' preferred alternatives, mine Alternative 3, Agency Mitigated Poorman Impoundment Alternative and transmission line Alternative D-R, and Miller Creek Alternative, in accordance with informal guidance provided by the Corps and the Environmental Protection Agency (EPA) during the development of the analysis.

The description of the potential impacts described in Subparts C through F of this analysis, actions to minimize adverse effects (Subpart H), and proposed compensatory mitigation (Subpart J) are consistent with the Montanore Project Final EIS. Because it is MMC's responsibility to demonstrate compliance with the 404(b)(1) Guidelines, MMC may revise this analysis during the 404 permitting process to be consistent other decision documents, such as the KNF's Record of Decision, the DEQ's transmission line certificate, and the United States Fish and Wildlife Service (USFWS) Biological Opinions. For example, the USFWS issued its Biological Opinion in 2014 on the effects of the KNF's proposed action on the grizzly bear. The BO's Incidental Take Statement includes two terms and conditions that implement the BO's reasonable and prudent measures. The KNF must comply with the terms and conditions as they are nondiscretionary. The BO's Term and Condition 2b stated "the Forest Service will require MMC to change the primary access and haul route from the Bear Creek road (Forest Road 278) to the Libby Creek road (Forest Road 231). This change reduces the likelihood that traffic levels on Forest Road 278 would create a fracture zone disrupting grizzly bear movements from den areas west of the road toward spring habitat to the east." The KNF will discuss compliance with the USFWS' terms and conditions in its Record of Decision. The Corps will consider the access road change in its decision document on the 404 permit.

404(b)(1) Guidelines and Corps' NEPA Regulations

The Corps and the EPA use regulations, informally called the "404(b)(l) Guidelines" or "Guidelines," to evaluate impacts from dredged or fill disposal activities on waters of the U.S. and to determine compliance with Section 404 (40 CFR 230 *et seq.*). The Guidelines require identification and evaluation of special characteristics of a disposal site and the surrounding area that may be affected by its use. These special characteristics include biological characteristics, special aquatic sites, and human use characteristics. Wetlands and riffle and pool complexes are considered special aquatic sites; both types of sites exist within the scope of the Corps' analysis.

The Guidelines require analysis of "practicable" alternatives that would not require disposal of dredged or fill material in waters of the U.S., or that would result in less environmental damage. Under the Guidelines, the term practicable connotes "available or capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes" (40 CFR 230.10(a)(2)). It is the Corps' responsibility to determine if a specific alternative is practicable. For projects that are not water dependent, the Guidelines presume that practicable alternatives that do not involve special aquatic sites, such as wetlands, are available, unless clearly demonstrated otherwise. In addition, Guidelines also assume that "all practicable alternatives to the proposed discharge which do not involve a discharge into a special aquatic site are presumed to have less adverse impact on the aquatic ecosystem, unless clearly demonstrated otherwise" (Section 230.10(a)(3)). It is the applicant's (MMC's) responsibility to rebut these presumptions. The reasonable alternatives developed for an EIS will, in most cases, provide the information for the evaluation of alternatives under the Guidelines (40 CFR 230.10(a)(4)).

The Guidelines include a section (40 CFR 230.12) that requires findings of compliance or noncompliance with the restrictions on discharge. The Corps will make these findings when it makes a 404(b)(1) compliance determination on MMC's 404 permit application for the project. This analysis does not discuss section 40 CFR 230.12 in accordance with informal guidance provided by the Corps during the development of the analysis.

The Corps has established regulations regarding procedures it uses in implementing NEPA (33 CFR 325, Appendix B). Under these regulations, the Corps considers only reasonable alternatives in detail. The regulations further state reasonable alternatives must be those that are feasible and such feasibility must focus on the accomplishment of the underlying purpose and need that would be satisfied by permit issuance. The "no action" alternative is one that results in no construction requiring a Corps permit. It may be brought by the applicant electing to modify the proposal to eliminate work under the jurisdiction of the Corps, or by denial of the permit. The EIS should also discuss geographic alternatives, such as changes in location, and functional alternatives, such as project substitutes and design modifications. The EIS should also indicate any cost considerations that are likely to be relevant to a decision.

Project Purpose

Basic Project Purpose

The Corps is required to consider and express the activity's underlying purpose and need from the applicant's and public's perspectives (33 CFR 325). From the Corps' perspective, the basic project purpose is to provide copper and silver to meet a portion of current and future public demands. Under the Guidelines, the Corps uses the basic project purpose to determine if a project is "water dependent." A project is water dependent if it must be located in, or in close proximity to, a water of the U.S. to fulfill its basic purpose. Providing copper and silver is not a water-dependent activity. For projects that are not water dependent, practicable alternatives that do not involve special aquatic sites, such as wetlands, are presumed to be available.

Overall Project Purpose

The overall project purpose is more specific to the applicant's proposed project than the basic project purpose. The overall project purpose is used for evaluating practicable alternatives under the 404(b)(1) Guidelines. The overall project purpose must be specific enough to define the applicant's needs, but not so restrictive as to preclude discussion of a range of alternatives. Defining the overall project purpose is the Corps' responsibility; the applicant's needs, however, are considered in the context of the desired geographic area of the development and the type of project being proposed. From the Corps' perspective, the overall project purpose is to extract copper and silver from ore in northwestern Montana in order to meet demand.

PROJECT DESCRIPTION

General Description

The Montanore Project is a proposed copper and silver underground mine and associated transmission line located about 18 miles south of Libby near the Cabinet Mountains of northwestern Montana (Figure 1). The ore body is beneath the Cabinet Mountains Wilderness (CMW). All access and surface facilities would be located outside of the CMW boundary. MMC, a wholly owned subsidiary of Mines Management, Inc. (MMI), would be the project operator. As proposed, the project would consist of eight primary components: the use of an existing evaluation adit, an underground mine, a mill, three additional adits and portals, a tailings impoundment, access roads, a transmission line, and a rail loadout (Figure 2).

The mineralized resource associated with the Montanore subdeposit is about 135 million tons. MMC anticipates mining up to 120 million tons. Ore would be crushed underground and conveyed to the Libby Plant Site. Copper and silver minerals would be removed from the ore by a flotation process. Silver/ copper concentrate from the plant would be transported by truck to a rail siding in Libby, Montana. The concentrate would then be shipped by rail to an out-of-state smelting facility.

Impacts on wetlands and streams were determined by calculating the number of acres that would be disturbed. For analysis purposes, the lead agencies used a disturbance area to assess effects on surface resources. The disturbance area surrounding the impoundment area encompassed most of the wetlands and streams downstream of the impoundment areas. Within the disturbance area are facility boundaries that include the footprint of the impoundment, dam, Seepage Collection Pond, diversion channel, borrow area, soil stockpiles, and roads. Wetlands within the facility boundary would be filled by project activities while some wetlands and other waters in the disturbance boundary that are not within the facility boundary may be avoided during final design. The effects within the disturbance boundary are presented as the total potential effects for this analysis.

Tailings from the milling process would be separated at the mill and tailings impoundment into coarse-textured sand (sand tailings) and fine-textured clay (fine tailings) fractions. Tailings from the milling process would be transported through a pipeline to a tailings impoundment site between the Little Cherry Creek and Poorman Creek, 4 miles from the Libby Plant Site. The design developed for the Poorman Tailings Impoundment Site is conceptual only, and is based on limited geotechnical investigations. It is unclear as to the need for a Rock Toe Berm or other specific design features. The tailings facility design would be based on additional site information obtained during the design process, which likely would include a preliminary design phase and a final design phase. Site information would be collected during field exploration programs for each of the two design phases. The tailings dam would consist of three sections, the Starter Dam along the upstream toe of the Main Dam section, a Rock Toe Berm to buttress/support the sand dam along the Main Dam section, and a Main Dam section consisting of the sand fraction cycloned from the tailings (Figure 3).

The dam would have a final crest length of 10,300 feet at an elevation of 3,664 feet. The dam would have a vertical height of 230 feet above the Rock Toe Berm and 360 feet including the Rock Toe Berm. A Saddle Dam of construction similar to the Starter Dam would be required in the north perimeter of the impoundment area. A system of trunk drains and smaller lateral drains over the impoundment floor and beneath the tailings dam would convey seepage to the toe of the dam. Smaller lateral drains would convey water to the main trunk drains, which would then convey water to the Seepage Collection Pond. Seepage collection drains through and under the dam footprint would be designed as integral parts of the dam foundation and compatible with each of the overlying dam sections. MMC would install pumpback recovery wells to collect tailings seepage not intercepted by the Seepage Collection System. The pumpback recovery wells would be located beyond the dam toe, and would be designed to collect seepage not collected by the drain system (Figure 3).

The thickener facility would remove water, or dewater, the tailings to a target slurry density of 70 percent solids and deposited to achieve an average in-place tailings density of 85 pcf or greater. Water removed from the tailings would be sent to the water storage pond on the north end of the Poorman Tailings Impoundment (Figure 3). Slurry density can vary between deposition methods depending on the physical and geotechnical characteristics of site-specific tailings. Deposition of tailings slurries at thicker densities can offer several advantages over tailings slurries at 55 percent or less, including increasing water recovery; reducing requirements for make-up water and water storage; providing greater impoundment stability; and under certain conditions, potentially depositing tailings higher than the level surface of the tailings.

The Main Dam would be raised using up to 30 million tons of cyclone underflow (sand tailings) hydraulically placed and compacted in cells. The cyclone overflow (fine tailings) would be discharged in the impoundment to form a tailings beach on the dam face, forcing water away from the dam. If necessary, mine waste rock would be used in dam construction to supplement the volume of cycloned sands.

MMC designed measures to prevent or mitigate ruptures in the tailings pipelines. MMC would construct a second sand fraction tailings line to use when the first line was in need of repair or replacement. The pipelines would be double-walled and fitted with air release/vacuum valves to ensure consistent flow. An automated leakage sensing system would continuously monitor line operation, and the sensing system would include the installation of magnetic flowmeters on the tailings line at the mill and at the tailings pond. If a flow differential signal were received at the control room, an alarm would sound, and the mill would be systematically shut down, starting with the feed conveyors to the grinding mills. Valves on the tailings line at the mill would be closed. The final tailings pump would bypass the cyclones and pump directly to the tailings thickener. Sensors would also be installed along each pipeline to monitor the space between the inner and outer pipes. If a leak were detected, the signal would be sent to the control room, and the shutdown procedures would be initiated. The surface pipelines between the mill and the tailings impoundment would be visually inspected each shift. An additional inspection would take place during scheduled maintenance shutdowns. The pipelines would be routed in a 24-foot-wide flat bottom ditch to contain any leakage from the pipelines. An unlined 6-foot-wide ditch paralleling the entire length of the road and pipelines would intercept any released tailings. Containment and surface water runoff ditches would be constructed with an earthen berm between them. This berm would ensure that in the event of a rupture of the double-walled pipe, all tailings would remain in the ditch and would not come in contact with surface waters. A lined flume and trestle would be constructed where the pipelines would cross Ramsey and Poorman creeks.

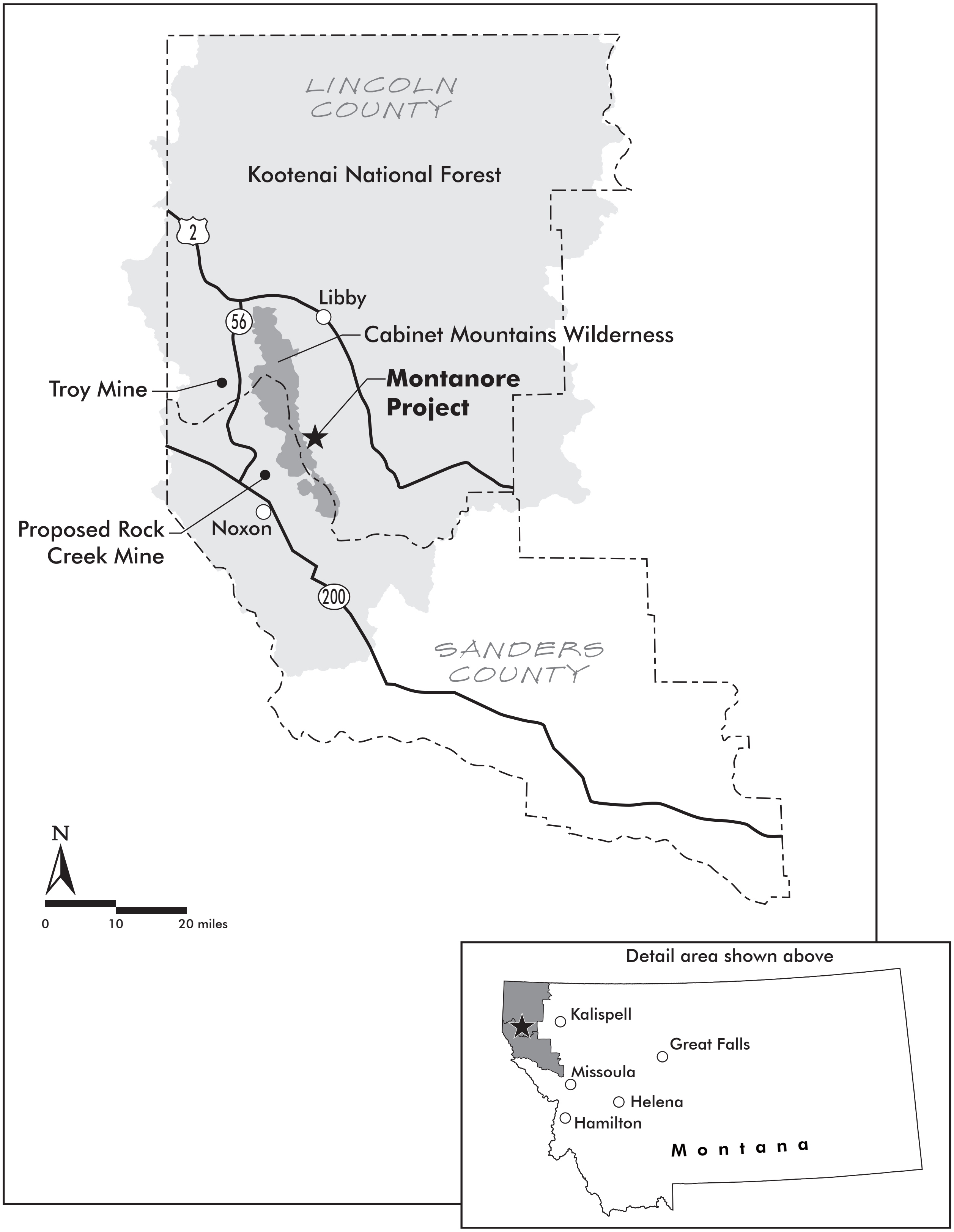

Figure 1. Location Map, Montanore Project, Kootenai National Forest.

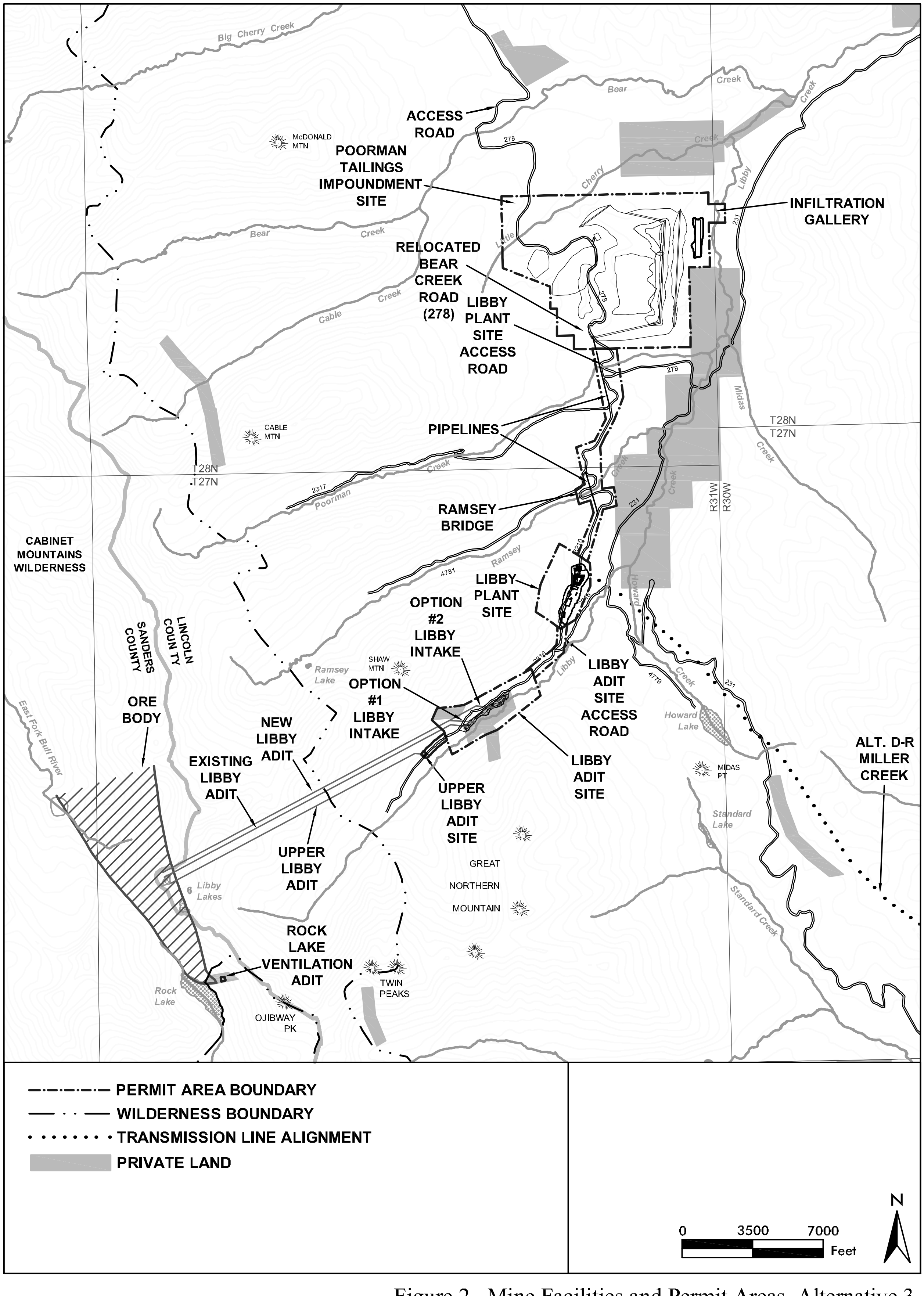

Figure 2. Mine Facilities and Permit Areas, Alternative 3

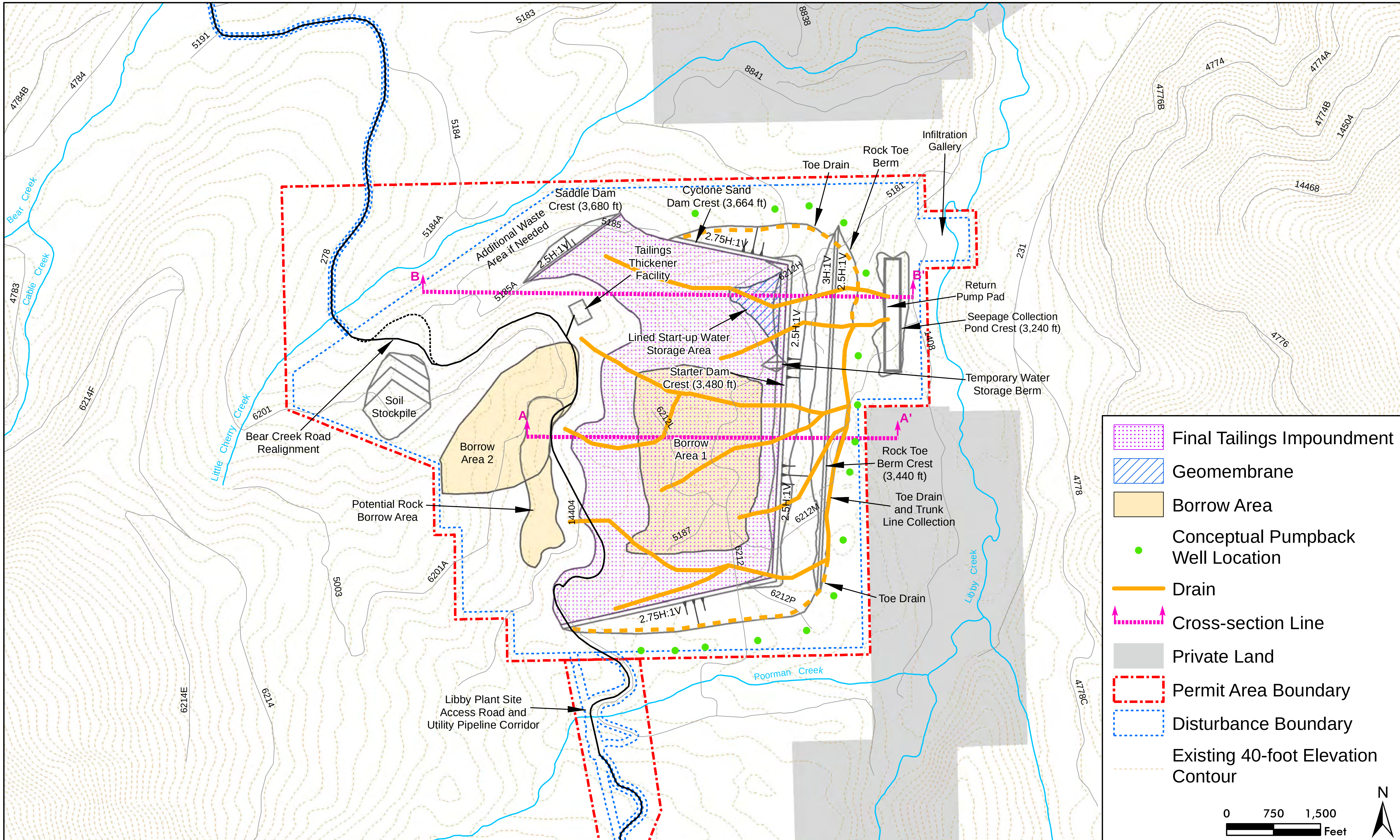

Figure 3. Poorman Tailings Impoundment
Site, Alternative 3

Access to the mine and all surface facilities would be via U.S. 2 and the existing National Forest System road #278, the Bear Creek Road. About 13 miles of the Bear Creek Road (NFS road #278), from U.S. 2 to the Poorman Tailings Impoundment Site, would be upgraded and paved to a roadway width of 26 feet. Additional widening would be necessary on curves. The disturbed area, including ditches and cut-and-fill slopes, is expected to be up to 100 feet wide. The existing Bear Creek bridge, which currently is 14 feet wide, also would be replaced and widened to a width compatible with a 26-foot-wide Bear Creek Road. During upgrading of the Bear Creek Road, MMC would use the Libby Creek Road. South of Little Cherry Creek, MMC would build 1.6 miles of new road west of and parallel to the Bear Creek Road that would connect Bear Creek Road with Ramsey Creek Road (NFS road #4781). MMC would construct a new bridge crossing of Poorman Creek just upstream and adjacent to the existing crossing. The road would have a chip-seal surface and would be constructed to a width to accommodate haul traffic.

Mining operations would continue for an estimated 16 years once facility development was completed and actual mining operations started. Three additional years may be needed to mine 120 million tons. The mill would operate on a three-shifts-per-day, seven-days-per-week, year-long schedule. At full production, an estimated 7 million tons of ore would be produced annually during a 350-day production year. Employment numbers are estimated to be 450 people at full production. An annual payroll of $12 million is projected for full production periods.

Permits and Authorizations Held by MMC

The DEQ is responsible for enforcing compliance with water quality laws on all lands in Montana, excluding Tribal lands. The Forest Service has a Memorandum of Understanding with the state that allows the Forest Service and the DEQ to work collaboratively to address water quality issues on National Forest System lands. The 1987 Kootenai Forest Plan (KFP) established management areas within the forest with different goals and objectives based on the capabilities of lands within this area (USDA Forest Service 1987).

Board of Health and Environmental Sciences Order No. 93-001-WQB

NMC submitted a “Petition for Change in Quality of Ambient Waters” in 1989 to the Board of Health and Environmental Sciences (BHES) requesting an increase in the allowable concentration of select constituents in surface water and groundwater above ambient water quality, as required by Montana’s 1971 nondegradation statute. NMC submitted supplemental information to support the petition in 1992. In response to NMC’s petition, the BHES issued an order in 1992, authorizing degradation and establishing limits in surface water and groundwater adjacent to the Montanore Project for discharges from the project. The Order established numeric limits for total dissolved solids, chromium, copper, iron, manganese, and zinc in both surface water and groundwater, nitrate+nitrite in groundwater only, and total inorganic nitrogen (nitrate+nitrite+ammonia) in surface water only. For these parameters, the limits contained in the authorization to degrade apply. For the parameters not covered by the authorization to degrade, the applicable nonsignificance criteria established by the 1994 nondegradation rules apply, unless MMC obtains an authorization to degrade under current statute. Although the Order established a limit for copper of 0.003 mg/L, the chronic aquatic life standard of 0.00285 mg/L would be the limiting concentration. The Order remains in effect for the operational life of the project and for as long as necessary thereafter (BHES 1992).

MPDES Permit No. MT-0030279

The DEQ issued a MPDES to NMC in 1997 for Libby Adit discharge to the local groundwater or Libby Creek. Three outfalls are included in the permit: outfall 001 – percolation pond; outfall 002 – infiltration system of buried pipes; and outfall 003 – pipeline outlet to Libby Creek. Only outfall 001 has been used since permit issuance. The DEQ renewed the permit in 2006. A minor modification of the MPDES permit in 2008 reflected an owner/operator name change from NMC to MMC. In 2010, MMC applied to the

DEQ to renew the existing MPDES permit and requested the inclusion of five new stormwater outfalls under the permit. In 2011, the DEQ determined the renewal application was complete and administratively extended the permit (ARM 17.30.1313(1)) until MMC receives the renewed permit. The DEQ issued a draft renewal MPDES permit in July 2015 and held a public hearing on the draft renewal permit in August 2015. The DEQ will issue a final MPDES permit with its ROD. MMC also held MPDES permit MTR104874 for stormwater discharges from the Libby Adit Site. These discharges were incorporated into the draft renewal MPDES permit.

Nature of Proposed Discharges of Fill

MMC would discharge several types of materials that would be considered fill under Section 404. The Corps defines fill as material placed in waters of the U.S. where the material has the effect of replacing any portion of a water of the U.S. with dry land, or changing the bottom elevation of any portion of a water of the U.S. (33 CFR 323.2(e)). Proposed discharges would be:

- General fill and waste rock during tailings impoundment site construction
- General fill, aggregate, incidental fill, and corrugated metal pipe during road construction or improvements
- General fill, aggregate, woody debris or large wood aggregates for grizzly bear and fisheries mitigation
- Fill or woody debris in Little Cherry Creek and its tributary during tailings impoundment closure
- Concrete or similar materials for streamflow or lake level measurements

Fill Associated with Tailings Impoundment Site Construction and Disposal

Within the facility boundary of the Impoundment and Seepage Collection Pond, all wetlands and the beds of streams would be excavated during initial site preparation to construct drains for the Seepage Collection System. Sand and gravel alluvial material available from the Impoundment Site would be used for the drains. Following excavation, all drains would be placed in a geomembrane-lined trench and consist of a core of highly pervious 1- to 4-inch rock wrapped in geotextile and surrounded by sand and gravel filter material. The drains would be covered with fill to prevent the fine tailings from piping into the drain materials during Operations.

The Rock Toe Berm, if needed, would be constructed with waste rock available from initial mine development and early mine operations and borrow material excavated from surface and near surface glacial deposits within or adjacent to the impoundment. Any waste rock used at the Impoundment Site would meet criteria specified in a waste rock management plan. The Starter Dam and Saddle Dam would be constructed with borrow material excavated from surface and near surface glacial deposits within or adjacent to the impoundment. During operations, MMC would discharge fill for road construction and other facilities within the impoundment site into streams not excavated during initial site preparation. No tailings would be deposited directly into streams because other fill materials would first be placed in these areas before depositing the tailings

Fill Associated with Road Construction or Improvements

MMC would discharge fill during road construction or improvements. The fill would consist of coarse soil fill with gravel, riprap of varying sizes to protect culvert outfalls, coarse sand for culvert bedding, and corrugated metal pipe as culverts.

Grizzly Bear and Fisheries Mitigation

Grizzly bear mitigation (USDA Forest Service 2013b) would include road closures, trail conversions, and land acquisition. These three requirements could include removal of some culverts from roads and trails. Some of the land that would be acquired is addressed in the wetlands and stream mitigation plan and includes numerous planned culvert removals. Some additional culvert removals may occur on the remainder of the acquired land that will not be addressed in the wetlands and stream mitigation plan, and on the other roads and trails addressed the grizzly bear mitigation plan.

Culvert removal would require excavation within or addition of fill to a stream and adjacent wetlands. Stream reaches would be restored after culvert removal, which would require excavation of fill material that was added to bury the culvert and complete the crossing. Excavation would occur to restore the stream channel and riparian corridor to be similar to that which occurs upstream and downstream. Small amounts of fill could be needed to provide stream bottom substrate that is appropriate for the channel type and hydrologic regime. The quantity of excavated material or fill material would be minor given that the crossings would likely be on narrow roads and narrow streams.

Four bull trout mitigation projects (USDA Forest Service 2013a) could require excavation within or addition of fill to a stream and adjacent wetlands. The mitigation plan identifies time frames during which the proposed mitigation measures would be assessed for feasibility, planning and coordination would be performed, and implementation would be accomplished. The aggraded lower reach of Copper Gulch could be restored to provide habitat and alleviate seasonal drying. The mitigation could require instream mechanical modification, and possibly addition of stream substrate, including boulders and large woody debris. If habitat in West Fork Rock Creek is identified as a limiting factor, mitigation could require the same modifications and additions as described for Copper Gulch. A mitigation project on Flower Creek could include construction of a fish ladder to allow selective upstream passage of bull trout at a low-head water diversion dam. Dredging of the stream might be required to provide for a preferred pathway for fish to get around the lower dam. Filling might also be required for portions of the ladder that may extend into the main stream channel. Fill could include other material such as boulders and woody debris. Large wood aggregates may be installed on 1,180 feet of upper Libby Creek to restore riparian function, improve spawning and rearing habitat for bull trout, and retain sediment retention.

Fill and Woody Debris in Little Cherry Creek and its Tributary

As part of the final impoundment closure plan, MMC would complete a hydraulic and hydrologic (H&H) analysis of the proposed diversion channel based on the final mine plan, and submit it to the lead agencies and the Corps for approval. The H&H analysis would include a channel stability analysis and a sediment transport assessment. Based on the analysis, modifications to the final channel design would be made and minor modifications to the upper reaches of the tributary of Little Cherry Creek may be needed to minimize effects on channel stability in the tributary of Little Cherry Creek and to avoid allowing water to pond on the surface of the reclaimed tailings. Discharges may include structures of natural materials, such as boulders or rock/log weirs or vanes to protect stream banks where needed and coarse woody debris along the channel banks to increase surface roughness to reduce flow velocities. Other drainage alternatives for the surface of the reclaimed tailings impoundment that protect against erosion but also provide aquatic habitat may be developed with agency approval.

Concrete or Similar Materials for Streamflow and Lake Level Measurements

MMC would install continuous streamflow recorders in area streams and water level recorders in area lakes. Fill associated with these water measurement devices would consist of concrete, wood, or similar materials.

Other Discharges

In this analysis, these discharges are referred to as "proposed discharges" or "proposed 404-permitted discharges." In addition, MMC may have discharges regulated under Section 402 of the Clean Water Act. Currently, MMC is permitted under MPDES Permit MT0030279 to discharge water from three outfalls at the Libby Adit and has applied for additional stormwater outfalls. When discharges regulated under Section 402 are discussed in this analysis, they are referred to as "proposed 402-permitted discharges."

SUBPART B – COMPLIANCE WITH THE GUIDELINES

Section 230.10 – Restrictions on the Discharge

Section 230.10(a) – Practicable Alternatives Analysis

The agencies' analysis of activities within the scope of the Corps' analysis as well as the overall project is described in detail in a separate *Tailings Disposal Alternatives Analysis* (ERO Resources Corp 2011). The following sections summarize the KNF's and the DEQ's alternatives analysis supporting Alternative 3 (Agency Mitigated Poorman Impoundment Alternative) and Alternative D-R (North Miller Creek Alternative) as the preferred alternatives.

Development of Alternatives

The alternatives development process was designed to identify a reasonable range of practicable alternatives for detailed analysis in the EIS. The agencies developed alternatives in accordance with the requirements of NEPA, MEPA, the Montana Major Facility Siting Act, and Section 404 of the Clean Water Act. To develop a reasonable range of alternatives, the lead agencies separated the proposed project into components. *Components* are discrete activities or facilities (*e.g.*, plant site or tailings impoundment) that, when combined with other components, form an alternative. The agencies identified options for each component. An *option* is an alternative way of completing an activity, or an alternative geographic location for a facility (component), such as alternative geographic locations for a tailings impoundment or transmission line, or an alternative method of tailings disposal, such as paste tailings. Options generate the differences among alternatives. An alternative is a complete project that has all the components necessary to fulfill the project purpose and need. The lead agencies considered options for the following project components:

- Underground mine
- Tailings disposal, including backfilling and surface disposal
- Plant site and adits
- LAD areas
- Access road
- Transmission line

Underground Mine Location

The agencies evaluated alternative copper-silver resources in northwest Montana, consistent with the Corps' purpose and need to determine if an alternative mine location was reasonable. A U.S. Geological Survey (USGS) review of copper-silver deposits in western Montana and eastern Idaho provided the primary basis for the agencies' analysis (Boleneus et al. 2005). World-class deposits are those that exceed the 90th percentile of discovered metal, and contain more than 2.2 million tons of copper. World-class deposits are significant because production from any of them would affect the world's supply-demand relation for the metal. Only three world-class stratabound copper-silver deposits are found in North

America: the Rock Creek and Montanore deposit (Montana), the Kona deposit (Michigan), and the White Pine deposit (Michigan). Individually, the Rock Creek and Montanore deposits are also considered world-class silver deposits. Such deposits represent a “supergiant” silver deposit, defined as the largest 1 percent of the world’s silver deposits. The right to mine the Rock Creek deposit is owned by another mining company, and may not be reasonably obtained, used, or managed by MMC. Consequently, the lead agencies did not identify any alternative mineralized resources in northwest Montana that MMC may reasonably obtain, use, or manage.

Combined Mining Operations (Rock Creek Project and Montanore Project)

In the 1992 Final EIS for the Montanore Project, the lead agencies evaluated the potential alternative of combining ASARCO’s (now RC Resources’) Rock Creek Project with the Montanore Project. A similar analysis was conducted and disclosed in the Rock Creek Project Final EIS. In the Rock Creek Project Final EIS, the agencies determined that the potential advantages of a joint operation were outweighed by the disadvantages. The alternative was dismissed for environmental, engineering, and legal reasons. In the Montanore Project analysis of joint operation, the agencies concluded they had no regulatory authority to require a combined operation, and joint operation is not a practicable alternative. If the companies were to develop an operational agreement and propose a joint operation, the agencies would initiate a NEPA/MEPA review as appropriate to disclose the effects of such a proposal.

Tailings Backfill Options

Backfilling was considered primarily because of the potential reduction of the surface tailings disposal area. The proposed production rate would be 12,500 tons per day (tpd) initially, and increased to 20,000 tpd in Year 11. For analysis purposes, the agencies used backfill system capacity of about 6,000 tpd of tailings solids, which represents 48 percent of the tailings at a production rate of 12,500 tpd and 30 percent of the tailings at a production rate of 20,000 tpd. A placement rate of 6,000 tpd approaches current maximum capacity of backfill production plants. Mines with higher production rates typically do not use room-and-pillar mining methods. The placement of backfill underground would, at a placement rate of 6,000 tpd, reduce the volume of tailings requiring surface disposal by 33 to 40 percent.

Mine development is a staged process; a Preliminary Economic Assessment (PEA) was completed for the Montanore Project (Mine and Quarry Engineering Services 2011). A PEA is an economic analysis of the potential viability of a mineral resource undertaken prior to having sufficient exploration data to support a prefeasibility study. The intent of the PEA is to provide an objective presentation of known geologic data, and preliminary cost projections and financial analysis based on these data. The PEA was prepared by an independent third-party consultant retained by MMI to conform to the then applicable Canadian Securities Administrators’ National Instrument 43-101 regarding disclosure of scientific and technical information about mineral properties. Since the Montanore Project PEA was issued, the 2005 Canadian Securities Administrators’ National Instrument 43-101 was repealed and replaced with an amended National Instrument 43-101 (Canadian Securities Administrators 2011). The lead agencies take no position regarding the compliance of MMC’s 2011 PEA with the current National Instrument 43-101. The accuracy of the costs in the PEA is ±35 percent (Mine and Quarry Engineering Services 2011).

MMC retained Beacon Hill Consultants, Ltd. to review four backfilling methods that could be considered applicable to the Montanore Project (Beacon Hill Consultants 2011). Two methods were identified as applicable: tailings dewatered to 6 to 8 percent water and partially dewater tailings using an additive to assist in pumping dewatered tailings over long distances. The report identified a number of concerns with backfilling including the increased complexity of the operating and decreased overall efficiency that ranged from 10 to 30 percent. The report concluded that the Montanore Project is not conducive to backfilling operations and that high capital and operating costs are more than likely to make the project non-viable (Beacon Hill Consultants 2011).

The lead agencies completed an independent assessment of backfill methods. Backfill methods considered in the agencies' analysis were dry placement, pneumatic placement, hydraulic placement, and thick slurry or paste placement. These backfill placement methods and their requirements are described in the *Tailings Disposal Alternatives Analysis* (ERO Resources Corp. 2011). Room-and-pillar mining with delayed paste backfill is the only technically feasible method of underground tailings disposal. An aboveground paste plant, outside the CMW, is the only feasible backfill plant location.

If the volume of surface tailings could be reduced by 33 to 40 percent, effects on wetlands and streams would be reduced. Screening criteria for tailings impoundment locations are discussed in the next section. Less than 9 acres of wetlands would be affected at the Impoundment Site if thickened tailings were deposited on the surface. Backfilling 40 percent of the tailings along with paste tailings would reduce impacts to wetlands by an estimated 1.6 acres.

The lead agencies retained RCM Analytics, LLC to conduct an independent economic analysis that examined the effects on the internal rate of return of including a backfilling component in the mining sequence (RCM Analytics 2011). In order to fully evaluate the cost implications of backfilling a portion of the tailings, RCM Analytics compared operating costs and capital costs for an option using 100 percent surface disposal of tailings, and an option that incorporated a backfill operation in the mining sequence. Using data in the PEA, mine capital costs without backfilling are estimated at $392.7 million, and estimated plant, tailings impoundment, and ancillary facilities capital costs are $360.1 million for an initial capital investment of $752.8 million. Because all of the tailings could not be placed underground, a surface impoundment would be necessary to accommodate the unbackfilled tailings, placing tailings underground would require infrastructure for both a backfill operation and a surface disposal operation. The estimated capital cost of a backfill system would add an additional $29.8 million, raising the initial capital requirements from $752.8 million to $782.6 million. RCM Analytics estimated Montanore's operating cost for mining, processing and refining to be $28.85/ton without backfilling and $35.87/ton with backfilling.

Using these cost data and the projected revenue of the Montanore Project, RCM Analytics also calculated an internal rate of return (IRR) for both scenarios. An IRR is a commonly-used industry measure of project viability that incorporates both the cost and revenue components of an operation, and can provide insight into how a change in cost affects a project's return on investment. Companies frequently use IRR to determine whether a project is appropriate for investment: if a project's IRR does not meet a threshold rate of return set by the company, the project is not of interest. The required threshold rate of return is specific to a company so not all companies use the same rate. Based on RCM's preliminary assessment level economic analysis, which may vary by ±35 percent, partial backfilling at Montanore would reduce the IRR from 15.7 percent to 10.4 percent. RCM Analytic indicated that the 404(b)(l) Guidelines do not provide numerical criteria for determining what constitutes substantially greater costs for a particular type of project. RCM Analytic reported "a reduction in the rate of return from 15.7 percent down to 10.4 percent strongly suggests that requiring the backfilling of tailings would result in significantly greater capital and operating costs than would normally be associated with room-and-pillar mining projects." Based on RCM Analytic's analysis, the agencies eliminated backfilling from detailed analysis (ERO Resources Corp. 2011).

Tailings Impoundment Location

The agencies analyzed 22 sites for surface tailings disposal using three successive levels of screening to narrow the range of tailings impoundment options analyzed in detail in the EIS (ERO Resources Corp. 2011). The criteria included logistical and environmental considerations. Sites were eliminated because they were unavailable, did not provide adequate capacity, or had more adverse environmental effects. The agencies retained two sites for detailed analysis in the EIS: the Little Cherry Creek and the Poorman impoundment sites, both of which result in wetland impacts (Table 1). During final design, MMC would avoid and minimize effects on wetlands and streams to the extent practical.

Plant Site

The agencies analyzed plant sites on the west side of the Cabinet Mountains in the Rock Creek drainage, and concluded that either they were not available, or they did not offer any environmental advantages over sites on the east side of the Cabinet Mountains. The lead agencies initially considered three plant sites along Libby Creek upstream of the confluence of Libby and Howard creeks: 1) on private land at the existing Libby Adit Site; 2) farther up Libby Creek on National Forest System land, but outside of the CMW (the upstream site); and 3) farther down Libby Creek on National Forest System land just west of the Libby Creek Recreational Gold Panning Area, a popular recreation site (the downstream site). After the initial analysis, the lead agencies completed additional analysis of three other options: 1) a site on private land on the south side of Libby Creek at the Libby Adit Site; 2) a site immediately adjacent to the Libby Adit Site upstream on Libby Creek; and 3) a site slightly west of the downstream Libby Creek site evaluated initially. Criteria included logistical and environmental considerations. The agencies identified the lower Libby Creek site as the option for a plant site with the least environmental impact because it would accommodate all necessary facilities, and would not affect wetlands, Riparian Habitat Conservation Areas, or an Inventoried Roadless Area.

Access Road

The agencies analyzed four possible roads to provide access: NFS road #278 south from U.S. 2 about 10 miles along Big Cherry Creek; NFS road #231 (Libby Creek Road) west from U.S. 2 about 12 miles along West Fisher Creek; NFS road #231 along Libby Creek; and NFS roads #385, #4724, #4780, and #231 up Miller Creek and then into the Libby Creek drainage. Criteria included logistical and environmental considerations. The agencies identified NFS road #278 south from US 2 as the option for the access road with the least environmental impact.

Transmission Line and Substation

The Sedlak Park Substation design was modified to avoid wetlands and streams. Discharges to wetlands and streams are expected to be avoided by placement of transmission structures outside of wetlands and streams. Any unavoidable wetland effects would be determined during final design. Minor discharges to wetlands and streams may occur from road construction activities.

Comparison of Alternatives

The four alternatives that were retained for detailed analysis are: Alternative 1—No Action Alternative, Alternative 2—Little Cherry Creek Impoundment, Alternative 3—Poorman Impoundment, and Alternative 4—Modified Little Cherry Creek Impoundment. The criteria to determine if an alternative is practicable (cost, logistics, and existing technology) (40 CFR 230.3(q)) and effects on aquatic resources for each alternative are summarized in Table 1. The agencies identified Alternative 3 Poorman Impoundment as its preferred alternative and as the least environmentally damaging alternative because it would have the least impacts on wetlands and streams, and would not have other significant adverse environmental consequences (40 CFR 230.10(a)). The impacts analysis in the remaining sections of this document is for Alternative 3 only.

For analysis purposes, the lead agencies used a disturbance area to assess effects on surface resources. For maximum flexibility, MMC would bond to cover the full disturbance area even if no activities were currently proposed. This would allow MMC to construct temporary and seasonal roads and other facilities within these disturbance area boundaries as needed. MMC did not apply for a 404 permit to fill all jurisdictional wetlands within the disturbance boundary. If jurisdictional wetlands within the disturbance boundary could not be avoided during final design, MMC would have to modify its 404 permit, if issued for the project.

Table 1. Comparison of the Four Mine Alternatives.

Characteristic	Alternative 1 No Action – (No Mine)†	Alternative 2 Little Cherry Creek Impoundment – (MMC's Proposed Mine)	Alternative 3 Poorman Impoundment – (Preferred Alternative)	Alternative 4 Modified Little Cherry Creek Impoundment
Practicable Criteria 40 CFR 230.10(a)(2)				
Cost	Not applicable	Alternative cost reasonable in terms of overall scope of cost of a similar project	Higher operating and capital costs for tailings disposal would be partially offset by decreased cost of avoiding Little Cherry Creek diversion; higher mitigation and monitoring costs. Alternative cost reasonable in terms of overall scope of cost of a similar project.	Higher mitigation and monitoring costs than Alternative 2. Alternative cost reasonable in terms of overall scope of cost of a similar project.
Logistics	Not applicable	Alternative logistically feasible	Same as Alternative 2	Same as Alternative 2
Existing Technology	Not applicable	All operations use existing technology	Same as Alternative 2	Same as Alternative 2
Environmental Considerations				
Operating Permit Area (acres)	219	3,628	2,157	2,979
Disturbance Area (acres)	18	2,582	1,565	1,924
Direct and Secondary Effects on Jurisdictional Wetlands (acres) §‡	0	38.6	9.4	38.9
Direct and Secondary Effects on Streams. (linear feet)§	0	33,753	19,058	34,063

†The DEQ's Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002 would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands.
§The jurisdictional status of the wetlands and streams is preliminary and impacts may change during the 404 permitting process.
‡MMC did not apply for a 404 permit to fill all jurisdictional wetlands within the disturbance boundary. If jurisdictional wetlands within the disturbance boundary could not be avoided during final design, MMC would have to modify its 404 permit, if issued for the project.

Section 230.10(b) – Discharge Compliance with Guidelines

The 404(b)(1) Guidelines Section 230.10(b) require that no discharge shall be authorized if it:

- Causes or contributes to any violation of water quality standards
- Violates any applicable toxic effluent standard or prohibition under Section 307 of the Act

- Jeopardizes the continued existence of species listed as threatened or endangered under the Endangered Species Act (ESA), or results in the likelihood of destruction or adverse modification of designated critical habitat under the ESA
- Violates any requirement imposed by the Secretary of Commerce to protect any marine sanctuary

State Water Quality Standards

None of the proposed discharges requiring a 404 permit, a 402 permit, or authorization from the DEQ under the Metal Mine Reclamation Act would cause or contribute to a violation of a water quality standard. Montana Ground Water Pollution Control System permits are required for discharges of wastes to state groundwaters. Discharges to groundwater from mining operations subject to operating permits under the Metal Mine Reclamation Act are not subject to groundwater permit requirements (75-5-401(5), MCA).

The tailings impoundment is designed with an underdrain system to collect seepage from the tailings and divert intercepted water to a Seepage Collection Pond downgradient of the impoundment. Some of the percolating water would seep into the underlying aquifer. Seepage from the tailings not collected by the underdrain system is estimated to decrease from 25 gpm during operations to 5 gpm over the long term. The seepage would mix with the underlying groundwater and be intercepted by the pumpback well system. During operations, tailings seepage and groundwater intercepted by the pumpback well system would be used in the mill for ore processing.

During operations, antimony concentrations greater than Montana water quality standards are predicted in groundwater beneath and downgradient of the tailings impoundment to the pumpback wells. Based on an analysis of the Troy Mine decant pond disposal system by Land and Water Consulting (2004), Hydrometrics (2010) Camp, Dresser and McKee (2010) and Schafer (2014), the agencies anticipate natural attenuation and removal of metals in the tailings water infiltrated at the tailings impoundment. Assuming that geochemical conditions would be similar at Montanore as at the Troy Mine, groundwater metals concentrations beneath the impoundment area are expected to be less than those predicted by the mass balance calculations.

MMC requested a groundwater mixing zone beneath the tailings impoundment from the DEQ under the Metal Mine Reclamation Act (NewFields 2015). Requested boundaries of the groundwater mixing zone beneath and downgradient of the Poorman Impoundment are 5,000 feet in length (east-west) downgradient of the west upper edge of the tailings impoundment; and 7,000 feet in width extending north-south. A mixing zone a limited area of a surface water body or a portion of an aquifer, where initial dilution of a discharge takes place and where water quality changes may occur and where certain water quality standards may be exceeded (ARM 17.30.502(6)). During the permitting process, the DEQ would determine if a mixing zone beneath and downgradient of the tailings impoundment would be granted in accordance with ARM 17.30.518 and, if so, would determine its size, configuration, and location. If DEQ granted a mixing zone, water quality changes might occur, but BHES Order limits could not be exceeded outside the mixing zone, and for other water quality parameters, nonsignificance criteria could not occur outside the mixing zone unless granted by DEQ. The DEQ also would determine where compliance with applicable standards would be measured.

At closure, tailings seepage and groundwater intercepted by the pumpback well system would be treated at a Water Treatment Plant and discharged at a 402-permitted outfall, or recycled to the tailings impoundment. All discharges from the Water Treatment Plant would be subject to MPDES-permitted effluent limits designed to maintain beneficial uses in all receiving waters. Post-Closure, MMC would operate the seepage collection and the pumpback well systems until nonsignificance criteria or BHES Order limits were met without additional treatment.

Other proposed discharges, such as those associated with fish habitat structures or water measurement devices, would increase turbidity at the discharge site. Turbidity would increase above ambient conditions. The increase would be temporary and would be permitted under a DEQ 318 permit. None of the 404-permitted discharges would cause or contribute to a violation of a surface water quality standard.

Toxic Effluent Standard or Prohibition

For industrial sources, national effluent limitation guidelines (ELGs) have been developed for specific categories of industrial facilities and represent technology-based effluent limits. The project is in an industrial category that is specifically identified and included in the ELGs at 40 CFR 440, Ore Mining and Dressing Point Source Category, Subpart J – Copper, Lead, Zinc, Gold, Silver, and Molybdenum Ores Subcategory.

The federal ELGs apply to mine drainage and process wastewater that discharge to surface water. Mine drainage is "any water pumped, drained, or siphoned from a mine" (40 CFR 440.132). Process wastewater is "any water which, during manufacturing or processing, comes into direct contact with or results from the production or use of any raw material, intermediate produce, finished product, by-product, or waste product" (40 CFR 401.11). In terms of the ELG requirements for copper mines that use froth flotation for milling, tailings water is considered process wastewater. Process wastewater from copper mines that use froth flotation for milling is not allowed to be discharged to state surface waters except in areas of net precipitation (where precipitation and surface runoff within the impoundment area exceeds evaporation). Because precipitation and surface runoff within the impoundment area would not consistently exceed evaporation, the impoundment would be designed as a zero-discharge facility and all tailings seepage and runoff would be intercepted by the Seepage Collection System or pumpback wells.

Threatened or Endangered Species

Section 230.30 – Threatened and Endangered Species of this analysis provides detailed discussion on the anticipated effects on threatened or endangered species of the KNF's proposed action (implementing Mine Alternative 3 and Transmission Line Alternative D-R). The effect of discharges within the scope of the Corps' analysis was not determined independently of the entire project. In summary, the KNF determined (USDA Forest Service 2013a, 2013b) that:

- May affect, and is likely to adversely affect, the grizzly bear
- May affect, and is not likely to adversely affect, the Canada lynx
- Would have no effect on Canada lynx critical habitat
- May affect, and is likely to adversely affect, the bull trout and designated bull trout critical habitat
- Would have no effect on the white sturgeon

The KNF submitted two Biological Assessments to the U.S. Fish and Wildlife Service (USFWS) that describes the potential effect on threatened and endangered species that may be present in the area (USDA Forest Service 2013a, 2013b). After review of the Biological Assessments and consultation with the KNF, the USFWS issued Biological Opinions (BOs) for the proposed project. In 2014, the USFWS (USFWS 2014a, USFWS 2014c) determined the KNF's proposed action (implementing Mine Alternative 3 and Transmission Line Alternative D-R):

- Is not likely to jeopardize the continued existence of the grizzly bear
- Is not likely to jeopardize the continued existence of the lynx
- Is not likely to result in the adverse modification of designated lynx critical habitat
- Is not likely to jeopardize the continued existence of the bull trout

- Is not likely to result in the adverse modification of designated bull trout critical habitat

The USFWS does not review or provide concurrence on no effect determinations but acknowledged the Forest Service's analysis that the project would have no effect on the Kootenai River white sturgeon (USFWS 2014b).

Requirements to Project Marine Sanctuaries

The discharges within the scope of the Corps' analysis and the overall project would have no effect on any marine sanctuary.

Section 230.10(c) – Degradation of Waters of the U.S.

Under the Guidelines, effects contributing to significant degradation considered individually or collectively, include:

- Significantly adverse effects of the discharge of pollutants on human health or welfare including, but not limited to, effects on municipal water supplies, plankton, fish, shellfish, wildlife, and special aquatic sites
- Significantly adverse effects of the discharge of pollutants on life stages of aquatic life and other wildlife dependent on aquatic ecosystems, including the transfer, concentration, and spread of pollutants or their byproducts outside of the disposal site through biological, physical, and chemical processes
- Significantly adverse effects of the discharge of pollutants on aquatic ecosystem diversity, productivity, and stability. Such effects may include, but are not limited to, loss of fish and wildlife habitat or loss of the capacity of a wetland to assimilate nutrients, purify water, or reduce wave energy
- Significantly adverse effects of discharge of pollutants on recreational, aesthetic, and economic values

Human Health or Welfare

The proposed discharges within the scope of the Corps' analysis and the overall project would not significantly adversely affect human health or welfare. All discharges would comply with the human health surface water quality standards. No municipal or private water supplies would be affected by the proposed discharges. Section 230.31 – Fish, Crustaceans, Mollusks, and Other Aquatic Organisms discusses effects on aquatic life. Section 230.30 – Threatened and Endangered Species and Section 230.32 – Other Wildlife discuss the effects on wildlife. Effects on special aquatic sites are discussed in detail in Subpart E – Potential Impacts on Special Aquatic Sites. Discharges would unavoidably directly and secondarily affect 9.4 acres of jurisdictional wetlands and 19,058 linear feet of streams. Any work in a water of the U.S. along an access road would be completed in compliance with Inland Native Fish Strategy (INFS) standards and guidelines. Streams within the Impoundment Site are not fish-bearing streams, and riffle and pool complexes are not expected to be affected at the Impoundment Site. Negligible areas of riffle and pool complexes may be affected at road crossings. The proposed mitigation plan for wetlands and streams is described in Section 230.93 – General Compensatory Mitigation Requirements. The final mitigation plan would adequately compensate for unavoidable direct effects on fish, other aquatic life, and wetlands, and mitigated effects would not be significantly adverse.

Life Stages of Aquatic Life and Other Wildlife Dependent on Aquatic Ecosystems

The proposed discharges within the scope of the Corps' analysis and the overall project would not significantly adversely affect life stages of aquatic life and other wildlife dependent on aquatic ecosystems. The four drainages in the tailings impoundment site do not provide habitat for fish. Some segments of the drainages are perennial and provide year-round habitat for amphibians. The wetlands in the impoundment area are seasonally saturated and do not provide year-round aquatic habitat. Wetlands that dry up in the impoundment area provide seasonal habitat for amphibians, and year-round habitat for terrestrial wildlife. The terrestrial wildlife found within the project area do not depend on the aquatic ecosystem. Discharges of fill would eliminate habitat for amphibians and other aquatic species in 19,058 linear feet of streams and 9.4 acres of jurisdictional wetlands. Because surface flow from these drainages into Libby Creek is low, the reduced flow into Libby Creek would be a negligible effect on the total flow and aquatic habitat downstream on Libby Creek.

The proposed mitigation plan for jurisdictional wetlands would consist of:

- Fifteen acres of wetland rehabilitation at the Swamp Creek site
- Three acres of upland vegetated buffer preservation at the Swamp Creek site

MMC would implement the following stream mitigation:

- Reconstruct three existing channels at the Swamp Creek site to add meanders and to raise the channel bottom, adding 6,500 linear feet of stream.
- Replace a culvert on Little Cherry Creek with a bottomless, arched culvert
- Replace a culvert on Poorman Creek with a bottomless arched culvert
- Remove a bridge across Poorman Creek and re-establish floodplain
- Stabilize 400 feet of eroding area on NFS road #6212
- Remove 21 culverts and restore riparian habitat on land acquired for grizzly bear mitigation
- Implement BMPs such as installing, replacing, or upgrading culverts on Libby Creek to bring the proposed access roads (NFS roads #231 and #2316) up to INFS standards and guidelines.

The proposed mitigation plan is discussed in more detail in Subpart J – Compensatory Mitigation for Losses of Aquatic Resources. Compensation for lost functions and values of wetlands will be presented in the final mitigation plan for the Montanore Project. The final amount of mitigation for each of the sites would depend on the final mitigation requirements of the Corps. The final mitigation would replace lost functions and services of the affected wetlands. MMC would submit more detailed plans for the selected compensatory mitigation sites for final approval by the Corps. Mitigated effects would not be significantly adverse. Other proposed discharges, such as fill for road construction or improvements, would have a negligible effect on the life stages of aquatic life and other wildlife dependent on aquatic ecosystems because the amount of fill would be small and BMPs would be implemented.

Aquatic Ecosystem Diversity, Productivity, and Stability

The proposed discharges within the scope of the Corps' analysis and the overall project would not significantly adversely affect aquatic ecosystem diversity, productivity, and stability. The streams in the tailings impoundment site do not provide habitat for fish. The wetlands in the impoundment area are seasonally saturated and provide year-round amphibian habitat. The functions and services provided by 9.4 acres of jurisdictional wetlands in the impoundment area would be unavoidably lost. Effects on wetlands are discussed in detail in Subpart E – Potential Impacts on Special Aquatic Sites. The final mitigation plan would adequately compensate for unavoidable direct effects on fish, other aquatic life, and wetlands, and mitigated effects would not be significantly adverse. Other proposed discharges, such as fill for road construction or improvements or water measurements, would have an insignificant effect on aquatic ecosystem diversity, productivity, and stability.

The surface waters of the Libby Creek drainage have low concentrations for most dissolved nutrients. Increased nutrient (nitrate and ammonia) concentrations as a result of 402-permitted discharges during all phases would occur in the Libby Creek drainage. For 402-permitted discharges, the total inorganic nitrogen (TIN) concentrations in streams may increase up to 1 mg/L under the BHES Order. Whether total nitrogen concentrations greater than the standard or TIN concentrations greater than the BHES Order limit would actually increase algal growth to the extent that it would be considered “nuisance” algae is unknown based on the other factors that influence such growth. Libby Creek from the US 2 bridge to the Kootenai River is on Montana’s list of impaired streams for sedimentation/siltation, a factor that could increase total phosphorus availability in the stream channel. Although projected TIN concentrations would be greater than existing conditions, the ammonia component of TIN would remain well below the applicable ammonia aquatic life standard, indicating no potential toxicity from increased ammonia concentrations in analysis area streams.

If an algal overgrowth occurred from elevated total nitrogen and total phosphorus concentrations, significant seasonal dissolved oxygen decreases along a stream could result, which would be harmful to fish (Suplee and Suplee 2011) and invertebrates. Adverse changes in the composition of macroinvertebrate assemblages to favor those taxa that are tolerant of nutrients or low dissolved oxygen, or those that feed directly on periphyton such as grazers, could also occur. Increased algal growth associated with total nitrogen concentrations greater than 0.275 mg/L and total phosphorus concentrations greater than 0.025 mg/L could stimulate productivity rates for aquatic insects and, consequently, stimulate populations of trout and other fish populations.

The BHES Order discussed protection of beneficial uses. On page 5, the Order states “surface water and groundwater monitoring, including biological monitoring, as determined necessary by the Department [DEQ], will be required to ensure that the allowed levels are not exceeded and that beneficial uses are not impaired.” Further on page 7, the Order indicates that the limit of 1 mg/L for TIN “should adequately protect existing beneficial uses. However, biological monitoring is necessary to insure protection of beneficial uses and to assure compliance with …applicable standards.” The applicable standards include the existing narrative standard prohibiting undesirable aquatic life, or nuisance algal growth. According to the reopener provisions of MPDES permits described in ARM 17.30.1361(2)(b), “permits may be modified during their terms if…the department [DEQ] has received new information …indicating that cumulative effects on the environment are unacceptable, or (c) the standards or requirements on which the permit was based have been changed by amendment or judicial decision after the permit was issued.” Consequently, the TIN limit for ambient surface waters set in the BHES Order could be modified in the MPDES permit issued by DEQ at any time if nuisance algal growth caused by MMC’s discharge was observed. To address the uncertainty regarding the response of area streams to increased TIN concentrations, MMC would implement the water quality and aquatic biology monitoring described in FEIS Appendix C. This includes monitoring for periphyton and chlorophyll-a monthly between July and September.

Recreational, Aesthetic, and Economic Values

The proposed discharges within the scope of the Corps’ analysis and the overall project would not significantly adversely affect recreational, aesthetic, and economic values. The effects of the discharges as well as the overall project on recreational, aesthetic, and economic values are discussed in the following sections.

Recreational Values. The proposed discharges at the tailings impoundment area would reduce public recreational access. Public access would be eliminated on the Little Cherry Loop Road (NFS road #6212) during the construction, operation, and closure phases and used exclusively for mine traffic. The road within the impoundment area would ultimately be buried by tailings. The bridge on NFS road #6212 across Poorman Creek would be removed during construction and the road south of Poorman Creek to the intersection of NFS road #278 would be decommissioned. A gate on the road would be installed near the tailings impoundment permit area boundary on the north end. The use of the following closed National Forest System roads within the impoundment area, which may provide some hunter access, would be eliminated: #1408 to the private land in the NW¼, Section 25, Township 28N, Range 31 West, #5181, #5181A, #5185, #5185A, #5187, #6212H, #6212L, #6212M, and #6212P. The tailings impoundment would not affect any designated trails. Recreational activities, such as camping and picnicking, forest product gathering, and winter activities, would be permanently displaced by the tailings impoundment beginning in the construction phase.

During mine operations, the level of mine facility development would change the recreational opportunity from less developed to more developed recreation settings for some portions of the area within the scope of the Corps' analysis. These changes would likely displace some recreationists seeking a more remote and dispersed recreational experiences.

Other recreational effects of the project include road closures that would be implemented to mitigate for the effects on the grizzly bear. Access would change seasonally on six roads totaling 14.5 miles and permanently on 26 roads totaling 48.1 miles. The overall character of the trail user experience would be reduced in the Libby Creek drainage due to noise, traffic, and visual effects associated with the proposed facilities. These effects, combined with increased knowledge of, and access to, the general area, would likely displace some dispersed recreation (hunting, hiking, and camping) to other areas of the forest. Individuals who are currently accustomed to these areas may use other areas of the forest with fewer visitors and developed facilities. The overall effect on recreation use and opportunity in the KNF would be negligible.

The improvements to the Libby Creek Road (NFS road #231) would improve recreational access to the area. Because the Libby Creek Road would be plowed in the winter, it would improve winter recreation access to the analysis area. Similarly, the Bear Creek Road would be plowed for 2 to 3 years during construction, improving winter recreation access to areas off of the road. Snowmobile and cross-country skiing use of the Libby Creek Road and parts of Upper Libby Creek Road during construction, and of the Libby Creek Road during mine life would be eliminated. Overall recreation effects would be mitigated through paying the reimbursement funding for a volunteer campground host from Memorial Day through Labor Day at Howard Lake campground using a Volunteer Services Agreement for Natural Resources Agencies (Optional Form 301a) throughout the life of the project.

Streams affected by the Impoundment Site are not fish-bearing and do not provide recreational fishing access. The project would not affect recreational fishing opportunities. Construction of habitat structures in Libby Creek and other fisheries mitigation would improve fish habitat and may increase recreational fishing opportunities in area streams. The project would comply with all applicable criteria for recreation in the KFP.

Aesthetic Values. The discharges at the tailings impoundment area would alter scenic integrity from key observation points and portions of the CMW. The impoundment's relatively large size would create noticeable contrasts in landscape character and substantial alterations in scenic integrity. Scenic integrity and landscape character from the private land parcel due east of the impoundment dam, about 350 feet between the dam and nearest property line, would be permanently and substantially altered. Scenic integrity would be reduced in westerly views from the north end of the private parcel due to a mostly unobstructed view of the 270-foot-high impoundment dam face. Scenic integrity would be moderately reduced in northwesterly views from the southern portion of this parcel due to the increasing screening effects of the forest with increasing distance from the impoundment. Following the mine closure in the future, revegetation of the tailings impoundment would partially reduce color and texture contrasts between the tailings impoundment and surrounding landscape. Other proposed discharges, such as fill for road construction or improvements or water measurements, would have a negligible effect on aesthetic values. Other project components outside the scope of the Corps' analysis, such as the Plant Site, adits, and the transmission line would be visible from some key observations points and the CMW. The project would comply with all applicable criteria for visual quality in the KFP (see Section 3.17.4, *Scenery*, in the Final EIS.

Economic Values. Streams affected by the Impoundment Site are not fish-bearing and do not provide economic benefits of recreational fishing access. The Impoundment Site would comprise a very small part of big game hunting districts. Any hunting or trapping activity would be permanently displaced by the tailings impoundment. Other recreational activities that generate some economic benefits, such as scenic driving on NFS road #6212, camping and picnicking, forest product gathering, and winter activities, would be permanently displaced by the tailings impoundment. The economic effect of the displacing recreational activities due to discharges within the scope of the Corps' analysis would be negligible.

The overall project would beneficially affect economic values. Estimated total employment during the construction phase would be 581 jobs at Year 3. About 21 percent of the direct employment would be construction related and the remainder attributable to operations. Employment during the Operations Phase would vary with the production rate. For production Years 4 through 8, total employment would vary from about 500 jobs in Year 4 to about 400 jobs in Years 5 through 8. Secondary employment would account for about 190 jobs in Year 4 and would drop to about 150 jobs during Years 5 through 8. In Year 9, the production rate is expected to increase from 12,500 tpd to 17,000 tpd. Direct mine employment would increase from 246 jobs to 450 jobs during this production increase. Secondary employment also would increase from about 150 jobs to 260 jobs. When production increases from 17,000 tpd to 20,000 tpd, direct employment would remain at 450 jobs and secondary employment would increase slightly.

At Year 3 of the proposed project, direct labor income would be about $42.7 million (2010 $) and total income would be about $50.3 million. About 21 percent of the direct labor income would be construction related and the remainder would be attributable to operations. The 23-person crew required for construction of the 230-kV transmission line would account for about 35 percent or $3.1 million of the direct labor income for construction in each of the Years 3 and 4. Estimated total labor income would range from a low of $39.3 million in project Years 5 through 8 to a peak of $63.5 million in Years 14 through 19 during the Operations Phase. The increased labor income would correspond to the expansion in mine production. In general, with the exception of Years 5 through 8, estimated total labor income would exceed $39 million. On a per-job basis, direct annual labor income for construction and operations employment would average about $137,000 and $113,000, respectively. Annual labor income for secondary employment would be about $36,000 per job.

Net impacts to local governments would start with a $180,242 deficit in Year 1, followed by net surpluses starting in Year 2 with a net surplus of about $4.8 million in Year 5. MMC's proposed mitigation of $180,000 would mitigate for the Year 1 fiscal deficit. While not directly affected by the project, Sanders County would receive $208,000 in gross proceeds tax in Year 4 and $546,000 in Year 5.

Section 230.10(d) – Appropriate and Practical Steps to Minimize Potential Adverse Impacts

This analysis is based on preliminary designs that include a variety of appropriate and practical measures to minimize potential adverse impacts. These measures are discussed in Subpart H – Actions to Minimize Adverse Effects. During final design, MMC would implement all appropriate and practical measures to avoid and minimize discharges into streams. Before construction, MMC would submit final design plans to the agencies for approval.

Section 230.11 – Factual Determinations

The factual determinations of the potential short-term or long-term, direct and secondary effects of the proposed discharges on the physical, chemical, and biological components of the aquatic environment are described in Subpart C – Potential Impacts on the Physical and Chemical Characteristics of the Aquatic

Ecosystem through Subpart F – Potential Effect on Human Use Characteristics. These sections address Sections 230.11(a) through 230.11(e) and Section 230.11(h).

The Final EIS discusses the indirect effects on the physical, chemical, and biological characteristics of aquatic ecosystems, on special aquatic sites, and human use characteristics. NEPA regulations define indirect effects as "... effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable." (40 CFR 1508.8). The discussion of indirect effects in the Final EIS is consistent with the NEPA definition. Under the 404(b)(1) Guidelines (40 CFR 230.11(h)(1)), "secondary effects are effects on an aquatic ecosystem that are associated with a discharge of dredged or fill materials, but do not result from the actual placement of the dredged or fill material. Information about secondary effects on aquatic ecosystems shall be considered prior to the time final section 404 action is taken by permitting authorities." The Corps indicated to the KNF that mine dewatering and operation of a pumpback well system are not within its scope of analysis and the effects of these activities will not be considered in its 404 permit decision. Consequently, the effects of mine dewatering and operation of a pumpback well system are not discussed in this analysis.

Section 230.11(f) – Proposed Disposal Site Determinations

MMC requested a groundwater mixing zone beneath the tailings impoundment from the DEQ under the Metal Mine Reclamation Act (NewFields 2015). Requested boundaries of the groundwater mixing zone beneath and downgradient of the Poorman Impoundment are 5,000 feet in length (east-west) downgradient of the west upper edge of the tailings impoundment; and 7,000 feet in width extending north-south. A mixing zone a limited area of a surface water body or a portion of an aquifer, where initial dilution of a discharge takes place and where water quality changes may occur and where certain water quality standards may be exceeded (ARM 17.30.502(6)). During the permitting process, the DEQ would determine if a mixing zone beneath and downgradient of the tailings impoundment would be granted in accordance with ARM 17.30.518 and, if so, would determine its size, configuration, and location. If DEQ granted a mixing zone, water quality changes might occur, but BHES Order limits could not be exceeded outside the mixing zone, and for other water quality parameters, nonsignificance criteria could not occur outside the mixing zone unless granted by DEQ. The DEQ also would determine where compliance with applicable standards would be measured. The DEQ ROD will contain the water quality assessment required before the DEQ could authorize a mixing zone.

Section 230.11(g) – Determination of Cumulative Impacts to the Aquatic Ecosystem

The Final EIS discusses the cumulative effects on aquatic ecosystems. NEPA regulations define cumulative impact as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." (40 CFR 1508.7). The discussion of cumulative effects in the Final EIS is consistent with the NEPA definition. Under the 404(b)(1) Guidelines (40 CFR 230.11(g)(1)), "cumulative impacts are the changes in an aquatic ecosystem that are attributable to the collective effect of a number of individual discharges of dredged or fill material. The Guidelines also state "cumulative effects attributable to the discharge of dredged or fill material in waters of the United States should be predicted to the extent reasonable and practical."

No past 404 permitted discharges are known in the analysis area. The Montana Department of Transportation was authorized to discharge fill for reconstruction of US 2, east and outside of the Montanore Project analysis area. No 404 permitted discharges are known in the analysis area. The cumulative effect of individual discharges of dredged or fill material, when combined with the proposed project, would be negligible.

SUBPART C – POTENTIAL IMPACTS ON THE PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE AQUATIC ECOSYSTEM

Section 230.20 – Physical Substrate Determinations

The substrate of the aquatic ecosystem underlies open streams and constitutes the surface of wetlands. It consists of organic and inorganic solid materials and includes water and other liquids or gases that fill the spaces between solid particles (40 CFR 230.20(a)).

Four drainages in the Impoundment Site (Drainages 3, 5, 10, and 14) flow east toward Libby Creek (Figure 4). The four drainages comprise a small, 1,025-acre watershed of Libby Creek, and Libby Creek is a third-order stream where the four drainages flow toward Libby Creek. The watershed of Libby Creek, upstream of and including the watershed of the four unnamed drainages, is 23,245 acres. Major drainages of Libby Creek upstream of the Impoundment Site are Poorman Creek, Ramsey Creek, Howard Creek, and Midas Creek.

Based on the Corps' 2013 preliminary jurisdictional determination, portions of the four drainages are subject to the Corps' jurisdiction (Corps 2013). The Corps determined that some reaches of the four drainages in the Poorman Impoundment Site lack an ordinary high water mark or a defined channel and are non-jurisdictional. The jurisdictional status of the wetlands and streams, including the four drainages, may change if the Corps completes an approved jurisdictional determination. All four drainages originate at springs in the impoundment area and consist of mostly perennial reaches on the upper portion of the watershed and intermittent reaches closer to Libby Creek. Some of the drainages may not have a surface flow connection through a channel with an ordinary high water mark or defined bed and bank to Libby Creek. The jurisdictional status of the drainages may change during the 404 permitting process.

Some reaches of the four drainages have wetlands along the channel. Other potentially jurisdictional wetlands occur within the project area. Impoundment construction would directly or secondarily affect 19,058 linear feet of streams and up to 9.4 acres of seasonally saturated and semi-permanent aquatic habitat (Table 2). Discharge of waste rock and fill at the Impoundment Site would unavoidably fill 9.0 acres of wetlands and 13,272 linear feet of streams. Road construction and reconstruction would unavoidably fill 0.2 acre of wetlands. The substrate elevation would be altered, and substrate functions would be eliminated. During final design, MMC would avoid wetlands to the extent practicable. Wetland effects within the facility boundary would be 8.6 acres of jurisdictional wetlands and 9,787 linear feet of streams. Proposed construction of new access roads and improvements of existing roads would require the discharge of fill and man-made materials, such as corrugated metal pipe and fill. Possible effects of loss of substrate are discussed under *Water Quality* and *Water Quantity* in Section 230.31 – Fish, Crustaceans, Mollusks, and Other Aquatic Organisms.

The effect on substrate from other proposed discharges, such as materials for sediment control structures or water measurement devices, would be minimal.

Section 230.21 – Suspended Particulates/Turbidity

Suspended particulates in the aquatic ecosystem consist of fine-grained mineral particles (usually smaller than silt) and organic particles. Suspended particulates may enter water bodies as a result of land runoff, flooding, vegetative and planktonic breakdown, re-suspension of bottom sediments, and human activities including dredging and filling. Particulates may remain suspended in the water column for variable lengths of time from factors such as agitation of the water mass, particulate specific gravity, particle shape, and physical and chemical properties of particle surfaces (40 CFR 230.21(a)).

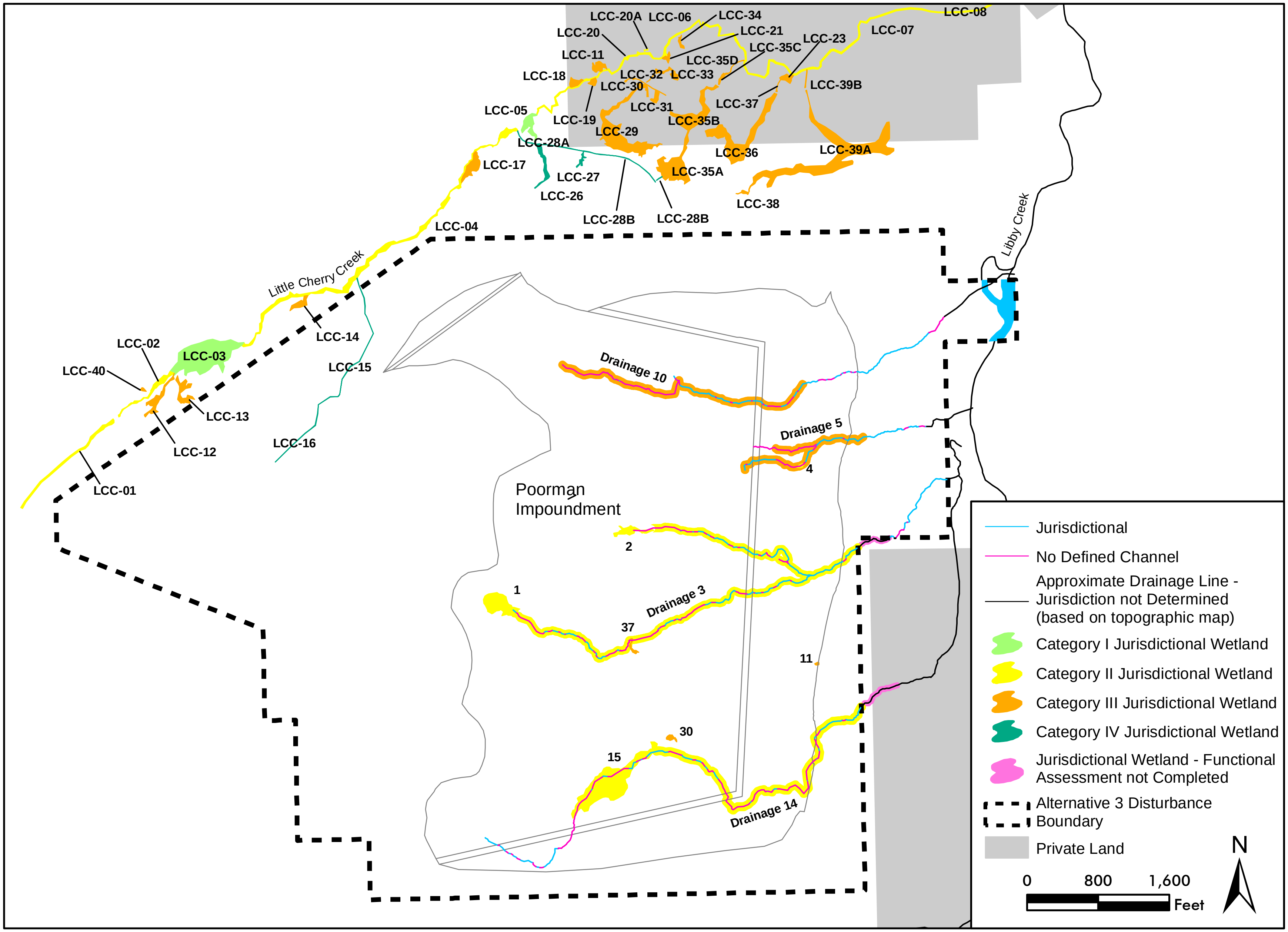

Figure 4. Wetlands and Other Waters of the U.S. in Poorman Impoundment Site

Table 2. Area of Jurisdictional Wetlands and Streams within Preferred Alternative Disturbance Areas and Facility Boundary.

Facility†	Jurisdictional Wetlands (acres)§			Streams (linear feet)		
	Disturbance Boundary	Outside Disturbance Boundary	Facility Boundary	Disturbance Boundary	Outside Disturbance Boundary	Facility Boundary
Impoundment Site*						
Direct effect	9.0	0.0	8.6	13,272	0	9,787
Secondary effect	0.0	0.2	0.0	0	4,727	0
Plant Site	0.0	0.0	0.0	0	0	0
Roads	0.2	0.0	0.2	1,059	0	0
Libby Adit Site	0.0	0.0	0.0	0	0	0
Total	9.2	0.2	8.8	14,331	4,727	9,787

Units for areas are rounded to the nearest 0.1 acre; units for stream length are rounded to the nearest whole number; subtotals may vary by 0.1 acre due to rounding.

†The adits would not affect any wetlands or streams in any alternative; although bridges would be constructed for road crossings on Ramsey, Poorman, and Bear creeks and would likely not affect wetlands or streams. Effects are included under the disturbance boundary effects.

§Area of streams has been subtracted from the area of wetlands.

*Impoundment site includes the impoundment footprint, dam, seepage collection pond, diversion channel, borrow area, soil stockpiles, and some roads.

Source: GIS analysis by ERO Resources Corp. using wetland data in Westech 2005e, Geomatrix 2009b, Kline Environmental Research 2012.

Discharges

In 2010, MMC applied to the DEQ to renew the MPDES permit and requested the inclusion under the permit of five new stormwater outfalls needed for Alternative 3 for the next 5 years. MMC submitted supplemental information in support of the renewal application in 2011 (Geomatrix 2011b). In 2011, the DEQ determined the renewal application was complete and administratively extended the permit (ARM 17.30.1313(1)) until MMC receives the renewed permit. The DEQ will issue a final MPDES permit with its ROD. MMC also held MPDES permit MTR104874 for stormwater discharges from the Libby Adit Site. These discharges were incorporated into the draft renewal MPDES permit. This section discusses stormwater control and discharges during the Construction Phase; discharges of water during the Operations Phase are discussed under the Operations Phase. The five outfalls in the draft renewal permit are:

- Outfall 004—stormwater-only outfall for runoff from the Upper Libby Adit pad and access road discharging into Libby Creek
- Outfall 005—stormwater-only runoff from a 3.8-acre road segment between the Libby Adit Pad and the Libby Plant Site discharging into Libby Creek
- Outfall 006—stormwater-only runoff from a 6.2-acre road segment north of the Libby Plant Site discharging into Ramsey Creek
- Outfall 007—stormwater-only runoff from a 2.8-acre road segment south of the Poorman Tailings Impoundment Site discharging into Poorman Creek; this outfall is unlikely to be used because the access road alignment changed after MMC submitted its MPDES renewal permit application

- Outfall 008—stormwater-only runoff from a 2.9-acre road segment south of the Poorman Tailings Impoundment Site discharging into Poorman Creek

The draft renewal MPDES permit contains the following requirements or restrictions regarding stormwater discharges from outfalls 004 through 008:

- The Upper Libby Adit pad and portal will be constructed such that any waste rock produced and/or any mine drainage encountered will be directed to the existing Libby Adit for removal and treatment. The discharge of any process wastewater or any water resulting from mine dewatering activities at Outfall 004 is prohibited.
- Outfalls 005-008 are stormwater only outfalls for runoff from access roads and haul roads which are not part of the active mine area. The discharge of any process wastewater or any water resulting from mine dewatering activities at Outfalls 005-008 is prohibited.
- Oil and grease cannot exceed 10 mg/L daily and pH must be within the range of 6.5 and 8.5 at all times.
- All stormwater ditches and sediment ponds associated with Outfalls 004 through 008 will be sized to contain the 10-year/24-hour storm event. Discharges will occur only during storms larger than the 10-year/24-hour storm event.
- MMC will implement an approved SWPPP.
- MMC will install and maintain site-specific BMPs that are an effective method for controlling the discharge of stormwater and that will minimize or eliminate any potential short-term stormwater impacts associated with the discharge of stormwater.
- MMC will conduct stormwater discharge monitoring summarized in Appendix C and described in detail in the draft renewal permit, including the requirement to collect grab samples within 30 minutes of discharge and flow-weighted samples over the course of the discharge.
- Effluent limits for metals and whole effluent toxicity testing on the discharge from Outfalls 004 through 008 is not required due to the expected nature and constituents (runoff driven sediment) of any discharges from these outfalls.

MMC has not applied for and is not authorized to discharge stormwater from any areas other than those described for Outfalls 001 through 008. Before the KNF and DEQ would allow MMC to start construction, MMC would have to obtain a permit to discharge stormwater from other disturbances associated with the project. MMC could either amend its MPDES permit or obtain coverage under Montana's General Permit for Storm Water Discharges Associated with Construction Activity if the project was eligible for coverage under the General Permit. The disturbances from which the agencies anticipate MMC would require authorization to discharge stormwater may include, but not necessarily be limited to:

- Libby Plant Site during construction
- Poorman Impoundment Site during construction
- Soil stockpiles during construction and operations
- Access roads, such as NFS road #278, and all other access roads used for the mine or transmission line
- Libby Loadout during construction if loadout construction was considered construction activity

In addition to the disturbances described above from which the agencies anticipate MMC would require authorization to discharge stormwater, MMC may need to obtain authorization to discharge stormwater that came in contact with waste rock. Waste rock excavated extending the Upper Libby Adit and the new Libby Adit would be hauled to a temporary waste rock stockpile within the Poorman Tailings Impoundment footprint, the location of which would be determined during final design. Before the KNF or the DEQ would allow MMC to create a temporary waste rock stockpile within the Poorman Tailings Impoundment footprint, MMC would submit data regarding the concentrations of potential pollutants in runoff and seepage from waste rock to the DEQ. The DEQ would use a reasonable potential analysis to determine whether a discharge, alone or in combination with other sources of pollutants to a water body, could lead to an excursion above an applicable water quality standard. The DEQ would establish effluent limits during the MPDES permitting process if runoff from the waste rock stockpile was not sent to the Water Treatment Plant (Outfalls 001 through 003) for treatment.

The tailings impoundment would be constructed between Little Cherry and Poorman creeks, and above Libby Creek. MMC would request an amendment to its MPDES permit for stormwater discharges during the Construction Phase at the Poorman Impoundment Site. During construction, ditches and sediment ponds containing stormwater runoff from the area would be sized to either the 100-year/24-hour or the 10-year/24-hour storm (see below). Infrequent discharges from the sediment ponds would flow and be monitored at one or more MPDES permitted outfalls, and would be required to meet applicable effluent limits.

Stormwater from undisturbed lands above the tailings facility would be diverted around the impoundment site toward the Poorman Creek and Little Cherry Creek drainages during mine operations, unless water was needed for mill operations. The small amount of water diverted around the Poorman Tailings Impoundment Site from the small watershed above the impoundment would not measurably affect the water quality of Little Cherry or Poorman creeks. The quality of the water is expected to be similar to the receiving water quality.

All runoff from the tailings impoundment dam and disturbed areas within the tailings impoundment permit area boundary would be directed to the Seepage Collection Pond or to lined containment ponds. Stormwater from the impoundment site probably would not be discharged because MMC would not use mine and adit water in the mill and would have a greater need for make-up water from the impoundment site. Ditches and sediment ponds containing process water or mine drainage would be designed for the 100-year/24-hour storm to minimize potential overflow to nearby streams. Water from the ponds would be returned to the Seepage Collection Pond or impoundment and then the mill for reuse. Alternative water management techniques may be identified during final design and the MPDES permitting process. Stormwater discharges from the tailings impoundment would not occur during operations and sediment in Libby, Poorman and Little Cherry creeks would not be affected.

Depending on final design, a stormwater outfall may be needed for stormwater from the soil stockpile upgradient of the tailings impoundment. Ditches and the sediment pond containing stormwater would be designed for the 10-year/24-hour storm. Infrequent discharges from the sediment pond would flow and be monitored at a MPDES permitted outfall at a Little Cherry Creek tributary, and would be required to meet applicable effluent limits.

It is anticipated that the levels of sediment generated through Alternative 2 would be small in volume and duration based on implementation of the BMPs and design features of the mine facilities. Any introduction of limited amounts of additional small gravels and fine sediment from construction or operation of the mine would likely have few if any effects on macroinvertebrate and fish populations, and annual snowmelt runoff would likely flush any accumulation of fine sediments downstream each spring. MMC's point source and non-point source discharges would be a small contribution to the estimated existing sediment load and the estimated future sediment load in the upper Libby Creek and Big Cherry Creek watersheds. These factors make it unlikely that effects from the project would result in detectable adverse changes in existing levels of sediment, quality of fish habitat, or sustainability of aquatic populations over the long-term.

Best Management Practices

Sediment and runoff from all disturbed areas would be minimized through the use of BMPs developed in accordance with the Forest Service's *National Best Management Practices for Water Quality Management on National Forest System Lands* (USDA Forest Service 2012) and the BMP requirements in the MPDES permit. All BMPs would be monitored throughout the project (see FEIS Appendix C) and remain in place until the DEQ approved MMC's Notice of Termination. MMC could submit a Notice of Termination when the disturbance associated with the construction activity had achieved final stabilization. Final stabilization means the time at which all soil-disturbing activities at a site have been completed and a vegetative cover has been established with a density of at least 70 percent of the pre-disturbance levels, or equivalent permanent, physical erosion reduction methods have been employed. Final stabilization using vegetation must be accomplished using seeding mixtures or forbs, grasses, and shrubs that are adapted to the conditions of the site. Establishment of a vegetative cover capable of providing erosion control equivalent to pre-existing conditions at the site would be considered final stabilization.

The KNF completed an analysis of BMPs that would be required for the Bear Creek Road that would be used for mine access during all phases except the Evaluation Phase and the first year of Construction. The analysis focused on the segment of the Bear Creek Road from US 2 to Little Cherry Creek because most stormwater discharges within the mine permit area boundary south of Little Cherry Creek are covered by Outfalls 005 through 008 in the draft renewal MPDES permit. The analysis considered stream crossings along the Bear Creek Road as well as some of the open roads that would be closed for grizzly bear mitigation. The analysis also evaluated stream crossings on the Libby Creek Road that would be used for mine access during the Evaluation Phase and the first year of Construction.

The agencies used the Forest Service interface for the Water Erosion Prediction Project computer model (WEPP) to quantitatively evaluate erosion and sediment delivery from forest roads that would be used for the mine alternatives (ERO Resources Corp. 2015). The modeling assumed the Bear Creek Road would be entirely paved and widened to 26 feet. On the Libby Creek Road, the agencies would require that the road length contributing sediment would be no longer than 150 feet. During final design, BMPs other than paving at stream crossings on the Bear Creek Road where WEPP predicted paving would increase sediment would be evaluated. Appropriate BMPs would be determined on a site-specific basis and would be monitored to determine their effectiveness. Appropriate BMPs may include:

- Locating outlets for road drain dips, surface water deflectors and open top box culverts in non-erosive buffer areas
- Stabilizing disturbed areas with vegetative cover
- Erosion control treatment on fillslopes and cutslopes such as erosion control mats, rocks, hydromulching, and sodding
- Placement of filter windrows (such as logging slash) on or just below fillslopes
- Capture of road runoff in settling ponds
- Prevention of ruts in roadways that channel runoff
- Regular road maintenance
- Addition of at least 6 inches of good aggregate to roads (if not paving)
- Dust control on roads
- Prevention of erosion from roadside ditches using riprap, mats or paving
- Aligning culverts with the natural course and gradient of a stream

- Controlling scouring at culvert outlets
- Replacing buried or damaged culverts
- Replacing culverts or bridges with larger structure to prevent road flooding and channel and bank scouring
- Monitoring and maintaining culverts to prevent clogging and flooding of roads

The proposed stream mitigation includes instream activity in Swamp Creek near US 2, Little Cherry Creek, Poorman Creek and at 21 stream crossings on land acquired for grizzly bear mitigation. Appropriate BMPs would be determined on a site-specific basis and would be monitored to determine their effectiveness. Placing straw bales in the stream below the construction area would significantly reduce sediment concentrations in the stream below the bales. An effective way to prevent brief turbidity and sediment concentration increases, if practicable, would be to route stream water around the construction area until completion.

All point source discharges containing sediment from the Montanore Project via stormwater outfalls or the Water Treatment Plant would be monitored and sediment concentrations reported to DEQ, and Outfall 003 would be subject to daily and monthly sediment limits. The DEQ and EPA established as a TMDL an average annual sediment load of 4,234 tons for Libby Creek from the US 2 bridge to the confluence with the Kootenai River (DEQ and EPA 2014). A TMDL is the maximum amount of a pollutant a waterbody can receive and still meet water quality standards. As part of this TMDL, the Montanore facility was assigned a sediment wasteload allocation of 24 tons/year. MMC's point source and nonpoint source discharges would be small in comparison to the estimated existing sediment load of 1,621 tons/year and the estimated future sediment load of 1,102 tons/year in the upper Libby Creek watershed. Beginning on the effective date of the MPDES permit, MMC would monitor all discharges to surface water for sediment, and report sediment concentrations to DEQ annually (see Appendix C). Any failures of the sediment BMPs would require MMC to implement corrective measures in accordance with the MPDES permit.

Monitoring

MMC would maintain the BMPs so they remained effective. Drainage and conveyance systems would be inspected periodically for blockages and erosion. Fueling areas would be inspected to prevent problems before they occurred. MMC would conduct a facility inspection once every 14 days and within 24 hours of a significant precipitation event of 0.5 inches or greater. At a minimum, the documentation of each routine facility inspection would include: the inspection date and time; the name(s) and signature(s) of the inspector(s); weather information; a description of any discharges occurring at the time of the inspection; any previously unidentified discharges of pollutants from the site; any observations of obvious indicators of stormwater pollution; any control measures needing maintenance or repairs; any failed control measures that need replacement; any incidents of noncompliance observed; and any additional control measures needed to comply with MPDES permit requirements. An inspection for a significant storm event may also be used and credited toward one of the monthly inspections. If an inspection or other observation identified stormwater pollution or control measures needing repair or replacement, then MMC would document these conditions within 24 hours of making such discovery. Subsequently, within 14 days of such discovery, MMC would document any corrective action(s) taken or needed, any further investigation of the deficiency, or the basis for determining that no further action is needed. If it was determined that changes were necessary following the review, MMC would make any modifications to the control measures before the next storm event if possible, or as soon as practicable following that storm event. The final MPDES permit will contain final stormwater monitoring and BMP inspection requirements.

Disturbed areas such as access and haul roads, sedimentation ponds and other BMPs would be recontoured and revegetation would be performed to stabilize soils and prevent erosion. Inspection and monitoring of stormwater BMPs would continue until disturbed areas achieved final stabilization. Final stabilization is defined as when a vegetation cover has been established with a density of at least 70 percent of the pre-disturbance levels, or equivalent permanent, physical erosion control reduction methods have been employed. Final stabilization using vegetation would be accomplished using the seed mixture approved by the agencies. The agencies expect that final stabilization would occur within 2 years of the completed activities.

Section 230.22 – Water

Water is the part of the aquatic ecosystem in which organic and inorganic constituents are dissolved or suspended. Water constitutes part of the liquid phase and is contained by the substrate. Water forms part of a dynamic aquatic life-supporting system. Water clarity, nutrients and chemical content, physical and biological content, dissolved gas levels, pH, and temperature contribute to its life-sustaining capabilities (40 CFR 230.22(a)).

Effects of Discharges within the Scope of the Corps' Analysis

Factors other than Temperature

Due to their seasonal or lack of connection to Libby Creek, the channels directly or secondarily impacted by the tailings impoundment have a low capacity to convey water to Libby Creek. Libby Creek flow is 10 cfs near the impoundment site during low flow conditions, and is 300 to 400 cfs during high flows. During high flow conditions, the combined surface flow of the four drainages to Libby Creek is about 0.7 cfs; during low flows, the combined surface flow to Libby Creek from the four streams is zero. The ecological functions of the tributaries—moderate streamflow; sequester, degrade, or volatilize pollutants that may occur in the drainages; and retain sediment—would be substantially reduced until the Seepage Collection Pond was reclaimed, which may be decades or more. In addition, any nutrient recycling that occurs within the streams also would be reduced. These effects on Libby Creek would minor during high flow conditions and negligible or nonexistent for the majority of the year (Kline Environmental Research and NewFields Companies 2014).

Other discharges such as culverts, measurement devices, and woody debris may affect some characteristics of water, such as water clarity, chemical content, dissolved gas concentrations, and pH. The discharges may change the chemical and physical characteristics of the waterbody by introducing suspended or dissolved chemical compounds or sediments into the water.

Temperature

Temperature data collected during the 2005 through 2007 in the Libby Creek watershed ranged from 32°F to 70°F, with maximum 7-day average maximum temperatures at each site ranging from 50°F at a site on Libby Creek upstream of the Howard Creek confluence to 68°F at a site on Libby Creek downstream of the Crazyman Creek confluence over this time period. Temperatures were often warmer at the more downstream sites, and ranged from 43°F to 50°F. The KNF concluded in the Biological Assessment (KNF 2013a) that Libby Creek was currently functioning at an unacceptable risk for the habitat parameter of temperature. The most relevant factor is the common occurrence of widened and braided reaches, which may create low-flow barriers and contributes to thermal barriers.

The primary long-term source of water in the perennial reaches of the four tributaries in the Impoundment Site is one or more springs located within the footprint of the tailings impoundment. After the springs were filled, flow in the perennial reaches down-gradient of the impoundment would be reduced, at least during baseflow conditions. Perennial flow would change to intermittent or ephemeral flows in some segments. The current locations and periods of intermittent and ephemeral flow are expected to be similar after construction of the impoundment, but the magnitude of flow would be reduced due to significant reductions in drainage area from the tailings impoundment. The reduction of groundwater discharge to the tributaries may increase the temperature of the flow that would remain in the tributaries. The loss of a minor contribution of water to Libby Creek from the four drainages would not measurably alter Libby Creek temperatures.

Other discharges would not affect stream temperatures.

Other Effects of the Overall Project

Factors other than Temperature

Generally, nutrient and most metal concentrations in analysis area streams are low. Nitrate/nitrite concentrations in Libby Creek downstream of the Libby Adit were elevated from 1990 through 1995 due to discharge from the adit. The Libby Creek reach from 1 mile upstream of the Howard Creek confluence to the US 2 bridge is included on Montana's list for water quality impaired streams. In 2014, the DEQ and the EPA issued total maximum daily loads and water quality improvement plan for the Kootenai River-Fisher River Project Area, which included Libby Creek. The DEQ performed updated assessments on Libby Creek for metals impairment and did not identify metals impairment conditions in Libby Creek in the reassessment (DEQ and Environmental Protection Agency 2014).

The BHES Order set a limit of 1 mg/L for TIN in Libby, Ramsey and Poorman creeks. The DEQ has developed seasonal numeric standards between July 1 to September 30 in wadeable streams of 0.025 mg/L for total phosphorus and 0.275 mg/L for total nitrogen. A narrative nutrient standard applies during October 1 to June 30. In 2015, MMC requested that the general variance for both total nitrogen and total phosphorus be incorporated into the MPDES permit and indicated that the facility design flow is less than 1.0 million gallons per day (mgd). In the draft renewal MPDES permit (DEQ 2015), the DEQ preliminarily granted a variance for total nitrogen of 15 mg/L, and determined that a variance for total phosphorus was not necessary because the facility did not show reasonable potential to violate this nutrient standard. The DEQ would require the completion of an optimization study/nutrient reduction analysis to optimize nutrient reduction with existing infrastructure and analyze other cost-effective methods of nutrient load reductions. The total nitrogen variance would be reviewed every 3 years by DEQ and the variance concentration reduced if new, low cost nutrient removal technologies have become widely available (DEQ 2014). The general variance for total nitrogen may not be in place more than 20 years, and the standard of 0.275 mg/L for total nitrogen must be reached at the end of the mixing zone when it is technologically and economically feasible to do so.

MMC would treat excess water at the existing Water Treatment Plant prior to discharge at one of three MPDES-permitted outfalls. The treatment plant would be modified to treat nutrients, and if necessary, dissolved metals. Water discharged from the Water Treatment Plant would not cause an exceedance in BHES Order limits or water quality standards for any parameter downstream of the mixing zone. Increased nutrient (nitrate and ammonia) concentrations as a result of 402-permitted discharges during all phases would occur in the Libby Creek drainage. Increases would be below water quality standards and BHES Order limits. Possible effects of increased nutrients are discussed under *Water Quality* in Section 230.31 – Fish, Crustaceans, Mollusks, and Other Aquatic Organisms. Water clarity is discussed in Section 230.21 – Suspended Particulates/Turbidity.

The pH of the discharge of mine and adit water is expected to be about 8, slightly greater than in-stream pH values of between 6.5 and 7.5 in Libby Creek. Although three outfalls to surface water are in the existing MPDES permit, MMC has only discharged from the Water Treatment Plant at the Libby Adit Site to the outfall to groundwater beneath the percolation pond. Water discharged from the Water Treatment Plant, if discharged to the percolation pond next to Libby Creek, would mix with groundwater with a pH of about 6.5. In the draft renewal MPDES permit, the DEQ preliminarily determined the size, configuration, and location of the mixing zones in Libby Creek for Outfalls 001, 002, and 003. The chronic groundwater mixing zone for Outfalls 001 and 002 authorized in the 1997-issued MPDES permit and continued in the 2006-issued MPDES permit was retained in the draft renewal MPDES permit. The mixing zone for Outfalls 001 and 002 extends from their point of discharge to Libby Creek downgradient to monitoring station LB-300 for these parameters: nitrate + nitrite, total inorganic nitrogen, chromium, copper, iron, lead, manganese, and zinc. For Outfalls 001, 002, and 003, the DEQ preliminarily authorized a chronic mixing zone, at 25 percent of the $7Q_{10}$, from the point of discharge two stream widths for the following parameters: nitrate + nitrite, total inorganic nitrogen, chromium, copper, iron, lead, manganese, and zinc. For Outfalls 001, 002, and 003, the DEQ also preliminarily authorized a nutrient mixing zone, at 100 percent of the 14-day, 5-year low flow ($14Q_5$), from the point of discharge two stream widths for the following parameters: total nitrogen, and total phosphorus. MMC did not requested a mixing zone for any discharges from Outfalls 004 through 008; any applicable effluent limitations must be met at the end-of-pipe discharge. The DEQ did not authorize a mixing zone for any parameters discharged from Outfalls 004 through 008 in the draft renewal permit. The draft renewal permit (DEQ 2015b) contains the water quality assessment required before the DEQ could authorize a mixing zone. The final MPDES permit will contain DEQ's final determination regarding mixing zones. Field and lab pH would be monitored in all receiving surface waters downstream of the Water Treatment Plant discharge outfalls during water resources and aquatic biology monitoring.

Reductions in groundwater discharge due to mine inflows may reduce nutrient concentrations in waters in the East Fork Bull River and East Fork Rock Creek drainages, particularly during the low flow period of the year during the Operations, Closure, and Post-Closure Phases. The magnitude of the reduction in nutrient concentrations is not known and may not be detectable. Decreases in nutrient concentrations would not be directly deleterious to fish and macroinvertebrates, but primary productivity could decrease and adversely affect fish and invertebrate assemblages if an insufficient amount of nutrients were available to support these assemblages. If mine void water flowed to the East Fork Bull River or East Fork Rock Creek after mine closure, it is not likely that changes in nutrient concentrations in the river would be detectable.

Temperature

The fish assemblages within the analysis area streams are dominated by salmonid species that are adapted to cold water temperatures. Bull trout are found in the coldest waters and among the most limited range of temperatures, and generally require water temperatures ranging from 36°F to 59°F, with temperatures at the low end of this range required for successful incubation. Constant temperatures greater than 61°F have been shown to be intolerable to bull trout. Based on limited data, the temperatures in many stream reaches appear to be within this range for most of the year, but some exceedances occur in the summer. Cutthroat trout, rainbow trout, brook trout, and sculpin also require cold water temperatures. These fish could also be affected by any increasing stream temperatures.

Stream temperature is an important criterion for aquatic life and Montana has surface water aquatic life standards for temperature changes. The project may affect stream temperatures by discharge of treated water from the Water Treatment Plant, vegetation clearing, decreased streamflow due to direct diversions, and changes in groundwater discharge to area streams. Water discharged from the Water Treatment Plant, if discharged to the percolation pond next to Libby Creek, would cool as it flowed from the percolation pond via the subsurface to the creek. Heat is not added as part of the facility's wastewater treatment process. Discharges to groundwater (Outfalls 001 and 002) are expected to attenuate any thermal effects. Synoptic temperature data collected in 2014 and 2015 generally indicate less than 1 degree change between monitoring locations LB-200 and LB-300. Conditions where a direct discharge to Libby Creek would be necessary are expected to be limited in duration and frequency during the project; a direct discharge to Libby Creek has not occurred since the MPDES permit was first issued in 1997. Temperatures upstream and downstream of the Water Treatment Plant outfalls would be monitored during water resources and aquatic biology monitoring (see FEIS Appendix C). Clearing would increase direct solar radiation to streams and may increase stream temperature slightly at and for a short distance below the stream crossings along new roads on warm to hot days. The pumpback wells and any other diversions (such as make-up wells) would reduce streamflow. For example, at PM-1200 in Poorman Creek, the estimated $7Q_{10}$ flow is predicted to be reduced by up to 12 percent. It is possible that this might increase the stream temperature during low flows, but forest shading and flow in the gravel streambed substrate, as well as groundwater supply to the stream, may prevent or minimize such a temperature change.

The reduction in bedrock groundwater inflows to analysis area streams due to mine inflows may increase stream temperatures where and when bedrock groundwater is the major component of baseflow, such as in the upper streams in the mine area where alluvial and colluvial deposits are thin or absent. Bedrock groundwater flow to streams is fracture controlled and does not occur uniformly along any stream reach. It is difficult to predict how, when and where reduced bedrock inflows may affect stream temperatures, or if such changes would be measureable.

Due to the numerous factors affecting stream temperatures and the constantly changing stream temperature regime that occurs, it is difficult to predict how activities other than water treatment plant discharges may indirectly affect stream temperature, or to what extent stream temperatures may change. It may not be possible to separate indirect effects of the mine alternatives on stream temperature from other natural effects. The agencies' water resources and aquatic biology monitoring includes temperature monitoring (FEIS Appendix C).

Water clarity is discussed in Section 230.21 – Suspended Particulates/Turbidity. The proposed discharges would not affect dissolved gas levels or pH.

Section 230.23 – Current Patterns and Water Circulation

Current patterns and water circulation are the physical movements of water in the aquatic ecosystem. Currents and circulation respond to natural forces as modified by basin shape and cover, physical and chemical characteristics of water strata and masses, and energy-dissipating factors (40 CFR 230.23(a)).

This section describes the direct effects of 404-permitted discharges, 402-permitted discharges, and the secondary effects of the project on current patterns and water circulation.

Effects of Discharges within the Scope of the Corps' Analysis

Watershed Modifications

Tributary Drainages. The proposed impoundment would require placement of fill and other material in four 1st order streams (Drainages 3, 5, 10, and 14). These four drainages tributary to Libby Creek comprise a small 1,025-acre (1.6 square miles) watershed. The Tailings Impoundment and Seepage Collection Pond would comprise about 62 percent (635 acres) of the 1,025-acre watershed. The undisturbed drainage area upgradient of the impoundment would be 270 acres, and 120 acres of undisturbed drainage area would remain downgradient of the impoundment and Seepage Collection Pond (NewFields 2014 in MMC 2014). The lower reaches of the four tributary channels typically are dry by mid-summer (July-August) with no flow connection to Libby Creek at that time. Some of the lower tributary stream reaches have not been surveyed in the field. Flow conditions in these reaches are assumed based on upstream observations. Highest flow rates measured in the tributary streams range from a few hundred gpm during the spring runoff period (May-June), to 5 gpm or less in the summer-fall period. Some stream reaches throughout each of the four tributaries become dry during portions of the year. During the winter, these drainages are typically covered with several feet of snow.

A total of 8,212 linear feet of defined channel downstream of the tailings impoundment would be secondarily affected by the construction of the impoundment (Table 3). After the tailings impoundment and Seepage Collection Pond were constructed, the natural drainage area of the four tributaries would be reduced and all springs identified in the four tributary drainages site would be filled. These modifications would reduce a primary source of year-round flow to the perennial reaches of tributary streams. Such reduction would primarily affect baseflow conditions in the tributary drainages downstream of the tailings impoundment and seepage pond. Baseflow rates in these streams are less than 25 gpm, with the ephemeral stream reaches having no baseflow. Thirteen known springs are within the Poorman impoundment disturbance area. It is possible that the increase in hydraulic head over the springs by placement of saturated tailings would prevent future flow from the springs. Alternately, the springs could discharge to the underdrain system beneath the impoundment and be collected by the Seepage Collection System. Of the 8,212 linear feet of defined channel downstream of the impoundment not filled and secondarily affected, all flow in an estimated 2,236 linear feet would be used to convey tailings seepage to the Seepage Collection Pond throughout all mining phases after the Evaluation Phase. The estimate of 2,236 linear feet is based on the channel lengths between the impoundment and the Seepage Collection Pond shown in Table 3, plus an estimated 100 feet of Drainage 14. The length of time 2,236 linear feet of channel would be used to convey tailings seepage may be decades or more. Another 1,059 linear feet of stream in the tailings impoundment disturbance area not shown in Table 3 would be potentially filled.

After the impoundment was reclaimed and tailings seepage met nonsignificance criteria or BHES Order limits without additional treatment, the Seepage Collection Pond would be removed. Flow in all tributaries would be permanently reduced due to watershed modifications. Surface water runoff from dam face and steady-state impoundment seepage of infiltrated precipitation and groundwater discharge of 50 to 100 gpm would flow into the drainages and increase flow over mining phases.

Little Cherry Creek and Poorman Creek. Discharges of materials at the Impoundment Site would require diversion of runoff from watersheds above the impoundment to either Poorman Creek or Little Cherry Creek during the Construction, Operations, and Closure phases. Surface water runoff from above the Impoundment Site and Plant Access Road would be diverted either to Poorman Creek or Little Cherry Creek, increasing the watershed of both creeks by about 3 percent. Average annual flow in both creeks would increase by about 3 percent. The changes in watersheds of Poorman Creek or Little Cherry Creek would remain until the impoundment was reclaimed. After the impoundment was reclaimed, surface water runoff that was diverted to Poorman Creek prior to closure would flow toward the reclaimed impoundment. The watershed and average annual flow in Poorman Creek would return to pre-mine conditions.

Post-Closure, the watershed area of Little Cherry Creek would increase by 644 acres, an increase of 44 percent (ERO Resources Corp. 2010). The Hortness method overestimates low flows in watersheds containing a reclaimed impoundment. The reclaimed impoundment would be in a watershed adjacent to the original watershed, and some of the precipitation that would infiltrate into the reclaimed impoundment would be intercepted by the impoundment's underdrain system and routed toward the original watershed. Both $7Q_2$ and $7Q_{10}$ flow likely occur during late summer or early fall during periods of little or no precipitation. The amount of baseflow that would flow during these periods toward Little Cherry Creek would be negligible. The agencies anticipate little or no increase in $7Q_2$ and $7Q_{10}$ flow in Little Cherry Creek. Any increased flow would be partially offset by flow reduction due to the pumpback well system as long as it operated. As part of the final closure plan, MMC would complete a hydraulic and hydrologic analysis of the impoundment channel during final design, and submit it to the lead agencies and the Corps for approval. The analysis would include a channel stability analysis and a sediment transport assessment. Based on the analysis, modifications to the final channel design would be made and minor modifications to the upper reaches of the tributary of Little Cherry Creek may be needed to minimize effects on channel stability in the tributary of Little Cherry Creek.

Table 3. Potential Indirect Effects of Tailings Impoundment on Tributary Streamflow Below Impoundment Dam.

Length of Defined Channel† (linear feet)	Segment Location	Existing Streamflow Condition	General Flow Category	Predicted Secondary Effect Downstream of Tailings Impoundment: During Construction, Operations, Closure, and Post-Closure Periods	Predicted Secondary Effect Downstream of Tailings Impoundment: Permanent Effect
Drainage 3					
1,164	Between impoundment and Seepage Collection Pond	Mostly defined channel; measured flow of <10-70 gpm in May-Sept. 2011 at upstream end of reach; flow was observed in May throughout reach, but intermittent in Sept. 2011.	Intermittent	All flow would be intercepted by Seepage Collection Pond after the pond was constructed and until it was reclaimed, which may be decades or more. Flow would remain intermittent, but flow rates, flow duration, and flowing lengths would be reduced because of 65 percent reduction in drainage area and elimination of two upstream springs; low base-flow rates (<10 gpm) in segments with baseflow would be reduced.	Similar to mining phases with reduced intermittent flow. Surface water runoff from dam face and steady-state impoundment seepage of infiltrated precipitation and groundwater discharge of 50 to 100 gpm would flow into drainage and increase flow over mining phases.
442	Between Seepage Collection Pond and disturbance boundary	Defined channel; flow was observed in May, but intermittent in Sept. 2011.	Intermittent	Flow not intercepted by Seepage Collection Pond; other effects similar to above.	Same as above.
720	Between disturbance boundary and Libby Creek	Unsurveyed	Intermittent and/or Ephemeral	Similar to above; low base-flow rates (<5 gpm) in segments with baseflow would be reduced.	Same as above.
Drainage 5					
559	Between impoundment and Seepage Collection Pond; no channel downgradient of pond	Defined channel; at end of defined channel at downgradient side of the Seepage Collection Pond, channel was flowing April-October 2011; at location near impoundment boundary, channel was mostly flowing April-Sept. 2011 (18 gpm in May; some segments of partial subsurface flow in Sept.), and dry October 2011.	Intermittent	Similar to Drainage 3; 86 percent reduction in drainage area and elimination of three upstream springs; low base-flow rates (<15 gpm) would be reduced, but only to Seepage Collection Pond because no channel is from this location to Libby Creek.	Same as above.
Drainage 10					
413	Between impoundment and Seepage Collection Pond	Defined channel; within impoundment footprint, channel was flowing Apr-October 2011; measured flow at NFS road 6212H culvert of 20-125 gpm in May-Sept. 2011.	Perennial	Similar to Drainage 3; 72 percent reduction in drainage area and elimination of four upstream springs; low base-flow rates (<25 gpm) in segments with baseflow would be reduced.	Same as above.

Length of Defined Channel[†] (linear feet)	Segment Location	Existing Streamflow Condition	General Flow Category	Predicted Secondary Effect Downstream of Tailings Impoundment	
				During Construction, Operations, Closure, and Post-Closure Periods	Permanent Effect
716	Between Seepage Collection Pond and disturbance boundary	5 feet of defined channel at downgradi-ent side of Seepage Collection Pond, then undefined channel extending a few hundred feet, then 711 feet of unsurveyed channel (assumed defined) farther down to disturbance boundary; channel was flowing near Seepage Collection Pond Apr-July 2011 and dry Aug- Oct 2011; at FS Road 1408 near upstream end of unsurveyed reach, channel was flowing only in Apr2011 (15 gpm) and dry May-Oct 2011.	Ephemeral	Flow not intercepted by Seepage Collection Pond; other effects similar to above; no base-flow changes.	Same as above.
235	Between disturbance boundary and Libby Creek	Unsurveyed; assumed defined channel only flows in the spring similar to upstream observations at NFS Road 1408.	Ephemeral	Same as above.	Same as above.
Drainage 14					
633	Between impoundment and disturbance boundary	Mostly defined channel; spring SP-26 is located at upper end of wetland WET-15; at downstream end of reach, channel was flowing Apr-July 2011 (108 gpm in May) and dry Aug-Oct 2011.	Intermittent	Except for an estimated 100 feet downstream of impoundment, flow not intercepted by Seepage Collection Pond; other effects similar to Drainage 3; 48 percent reduction in drainage area and elimination of four upstream springs; low base-flow rates (<10 gpm) in segments with baseflow would be reduced.	Same as above.
3,330	Between disturbance boundary and Drainage 3 confluence	Unsurveyed; assumed channel is defined and generally flows only in the spring and early-summer due to channel mostly located on relatively flat alluvial floodplain of Libby Creek.	Intermittent and/or Ephemeral	Similar to above.	Same as above.

Source: Modified by lead agencies based on NewFields (2014) in MMC (2014)
[†]Drainage segments without a defined channel are not included in the linear footage calculations presented in this table for secondary impacts.
See NewFields (2014) for general flow category definitions.

As part of the final impoundment closure plan, MMC would complete a hydraulic and hydrologic (H&H) analysis of the proposed diversion channel based on the final mine plan, and submit it to the lead agencies and the Corps for approval. The H&H analysis would include a channel stability analysis and a sediment transport assessment. Based on the analysis, modifications to the final channel design would be made and minor modifications to the upper reaches of the tributary of Little Cherry Creek may be needed to minimize effects on channel stability in the tributary of Little Cherry Creek and to avoid allowing water to pond on the surface of the reclaimed tailings. Discharges may include structures of natural materials, such as boulders or rock/log weirs or vanes to protect stream banks where needed and coarse woody debris along the channel banks to increase surface roughness to reduce flow velocities. Other drainage alternatives for the surface of the reclaimed tailings impoundment that protect against erosion but also provide aquatic habitat may be developed with agency approval.

Other Discharges of Fill

Discharges of fill for road improvement and new road construction, fish habitat structures, and water measurement devices would have a minor effect on current patterns and water circulation. Most new roads would be associated with the transmission line and would involve short crossings of intermittent or ephemeral streams. Road improvements along Libby Creek Road (NFS road #231) or Bear Creek Road (NFS road #278) and for transmission line access would require replacement of existing culverts or installation of new culverts. Current patterns and water circulation would be altered for short distances at each crossing.

Discharges fill and woody debris in Little Cherry Creek and its tributary at closure would be completed after MMC completed H&H analysis of the proposed diversion channel based on the final mine plan, and submitted it to the lead agencies and the Corps for approval. Water measurement devices would be installed in Libby Creek and in alpine lakes, such as Wanless Lake. The fill for water measurement devices in area streams would have a minor effect on current patterns and water circulation. Discharge of fill for streamflow or lake level measurements would be constructed to withstand expected high flows and would not restrict or impede the passage of normal or high flows. Discharge of fill in alpine lakes would have no effect on current patterns and water circulation.

Other Effects of the Overall Project

Due to Water Treatment Plant discharges, flow in Libby Creek at and below the Libby Adit would increase. During operations, peak flow would increase slightly (less than 1 percent) and average annual flow by about 5 percent at LB-300, with a smaller percent increase down to LB-2000. Peak flow and average annual flow at and downstream of LB-2000 during the Operations Phase would be less than during the Construction Phase due to all of MMC's appropriations, primarily of up to 2.5 cfs during April through July. Total stream discharge with the addition of Water Treatment Plant discharge would be within the natural range of Libby Creek discharge below the outfalls. Processes that naturally occur would continue to occur, but at a slightly elevated rate. Average streamflow would increase by 1 percent due to project discharges during May and June, when the majority of bedload transport occurs and when streamflow is commonly in contact with the streambanks. Total annual bedload transport would increase by 7 percent. Streambanks are not exposed to streamflow in most reaches except when discharge approaches low-bankfull conditions (toe of bank slope), mainly during May and June. Total days when streamflow is at or above low bankfull conditions would increase by 1 to 2 days per year.

Section 230.24 – Normal Water Fluctuations

Normal water fluctuations in a natural aquatic system consist of daily, seasonal, and annual tidal and flood fluctuations in water level. Biological and physical components of such a system are either attuned to or characterized by these periodic water fluctuations (40 CFR 230.24(a)).

Effects of Discharges within the Scope of the Corps' Analysis

The loss of a minor contribution of water to Libby Creek from the four drainages would not measurably alter Libby Creek normal water fluctuations or channel morphology. Other discharges within the scope of the Corps' analysis also would have a negligible effect on normal water fluctuations or channel morphology. All culverts placed in streams would comply with INFS standards and guidelines, such as fish passage or conveyance of adequate flows. Discharges for bull trout mitigation would have no effect on normal water fluctuations and be designed to enhance bull trout habitat.

Other Effects of the Overall Project

The project would indirectly alter streamflow in Libby Creek and their tributaries. These changes are expected to be minor and would have no notable effect on normal water fluctuations or channel morphology.

Section 230.25 – Salinity Gradients

Salinity gradients form where salt water from the ocean meets and mixes with fresh water from land (40 CFR 230.25(a)). The project would not be in or near an ocean and salinity gradients would not be affected by proposed discharges.

SUBPART D – POTENTIAL IMPACTS ON BIOLOGICAL CHARACTERISTICS OF THE AQUATIC ECOSYSTEM

Section 230.30 – Threatened and Endangered Species

An endangered species is a plant or animal in danger of extinction throughout all or a significant portion of its range. A threatened species is one in danger of becoming an endangered species in the foreseeable future throughout all or a significant portion of its range. Listings of threatened and endangered species as well as critical habitats are maintained by some individual states and by the FWS (40 CFR 230.30(a)). The threatened or endangered species potentially affected within the scope of the Corps' analysis are the bull trout, grizzly bear, and Canada lynx. No federally threatened or endangered listed plant species are found within the scope of the Corps' analysis.

In its 2014 Biological Opinion on the grizzly bear, the USFWS indicated that it was the USFWS' biological opinion that the Montanore Project as proposed in the KNF's preferred Mine Alternative 3 and the agencies' preferred Transmission Line Alternative D-R is not likely to jeopardize the continued existence of the grizzly bear (USFWS 2014a). No critical habitat has been designated for this species, and therefore none would be affected. The USFWS concurred with the KNF's determination that the project may affect, but is not likely to adversely affect the Canada lynx (USFWS 2014b). The USFWS does not review or provide concurrence on no effect determinations but acknowledged the KNF's analysis that the project would have no effect on lynx critical habitat (USFWS 2014b). The USFWS issued a final rule for the designation of critical habitat for the contiguous United States Distinct Population Segment of the Canada lynx and revised Distinct Population Segment boundary (USFWS 2014d). None of the proposed activities associated with the project would occur with the designated critical habitat for the contiguous United States Distinct Population Segment of the Canada lynx.

In its 2014 Biological Opinion on the bull trout, the USFWS indicated that it was the USFWS' biological opinion that the project as proposed in the KNF's preferred Mine Alternative 3 and the agencies' preferred Transmission Line Alternative D-R is not likely to jeopardize the bull trout, and is not likely to destroy or adversely modify bull trout critical habitat (USFWS 2014c). The USFWS also indicated in the Biological Opinion that "The Service's opinion is based on the conclusions that implementation of the Montanore Project is not likely to appreciably reduce the reproduction, numbers, or distribution of bull trout at the scale of either the Lower Clark Fork River or Kootenai River core areas, and by extension not at the Clark Fork River Management Unit or Kootenai River Management Unit levels and larger scale of the Columbia River Interim Recovery Unit. Therefore, the Service concludes that the proposed Montanore Project will not jeopardize the bull trout at the scale of the coterminous U.S. population of bull trout." The Service does not review or provide concurrence on no effect determinations but acknowledged the KNF's analysis that the project would have no effect on the Kootenai River white sturgeon (USFWS 2014b).

Both Biological Opinions concluded that the project would result in "take" as defined under the ESA and included reasonable and prudent measures to reduce the likelihood of incidental take and minimize adverse effects to both bull trout and designated critical habitat. Both Biological Opinions contained terms and conditions that implement the reasonable and prudent measures. The take of one grizzly bear deemed attributable to the mine would trigger re-evaluation of the situation by the FWS to determine whether additional measures are needed to reduce the potential for future mortality (USFWS 2014a). The USFWS determined that the actual amount or extent of the anticipated incidental take of bull trout due to changes in habitat conditions in the affected streams is unquantifiable (USFWS 2014c). The USFWS determined its revised bull trout mitigation plan (USFWS 2014c) will minimize the impact of incidental take to bull trout and minimize adverse effects to primary constituent elements associated with bull trout critical habitat.

Section 230.31 – Fish, Crustaceans, Mollusks, and Other Aquatic Organisms

Aquatic organisms in the food web include, but are not limited to, finfish, crustaceans, mollusks, insects, annelids, planktonic organisms, and the plants and animals on which they feed and depend upon for their needs. All forms and life stages of an organism, throughout its geographic range, are included in this category (40 CFR 230.31(a)).

Effects of Discharges within the Scope of the Corps' Analysis

Water Quantity

The four drainages perform the function of providing aquatic habitat at a low level because aquatic habitat diversity is lacking relative to more dynamic streams. The habitat is dominated by swales with no defined channel, long riffles, and partially subsurface channels (tunnels). Because of the lack of diverse aquatic habitat in the streams, they have a low capacity to support aquatic biota. Vascular plants that were observed within the stream channels appeared to be mainly terrestrial species, such as ferns and grasses, that had spread to unsubmerged substrate within the bankfull width. Identified macroinvertebrates were mainly indicative of impaired streams. Columbia spotted frogs were the only confirmed semi-aquatic species in stream channels. No crayfish or fish were observed. Fish occurrence would be unlikely due to a lack of depth and connectivity, poor habitat, and a sparse invertebrate prey base (Kline Environmental Research and NewFields Companies 2014). Wetlands and streams support terrestrial biota, such as moose, elk, deer, and black bear. No threatened or endangered amphibian or reptile species were found in the streams or wetlands

Fill material would directly or secondarily affect 19,058 linear feet of streams and up to 9.4 acres of seasonally saturated and semi-permanent aquatic habitat (see Section 230.41 – Wetlands). Discharge of fill into wetlands and streams would eliminate local populations of aquatic organisms within the Impoundment Site. These discharges would adversely affect bottom-dwelling organisms at the site by smothering immobile forms or forcing mobile forms to migrate. Benthic forms present prior to a discharge are unlikely to recolonize on the discharged material. Tailings seepage would adversely affect habitat in 2,236 feet of channel used to convey tailings seepage to the Seepage Collection Pond. Flow reduction is described in Section 230.23 – Current Patterns and Water Circulation and Section 230.21 – Suspended Particulates/Turbidity. Flow reduction in 5,976 linear feet of channel downstream of the

Tailings Impoundment not used to convey tailings seepage to the Seepage Collection Pond also would reduce available habitat. At access roads, the effects would be on a smaller scale and may only affect a small percentage of aquatic organism populations. If some organisms complete an early life stage within the Impoundment Site and migrate to other areas, the fill would disrupt the advancement of life stages and would have an secondary effect on aquatic life in other areas. The effect on aquatic organisms would be minor. Implementation of BMPs and Environmental Specifications for the transmission line would minimize adverse effects.

Section 230.30 – Threatened and Endangered Species discussed the effect of the project on the threatened bear and bull trout.

Water Quality

Discharges at the tailings impoundment site would not affect the quality of flow in the four drainages below the tailings impoundment that would not be used to convey tailings seepage. The federal ELGs apply to mine drainage and process wastewater that discharge to surface water. The EPA considers runoff from tailings dams when constructed of tailings to be mine drainage, or, if process water if process fluids are present. Process wastewater from copper mines that use froth flotation for milling is not allowed to be discharged to state surface waters except in areas of net precipitation (where precipitation and surface runoff within the impoundment area exceeds evaporation). Because precipitation and surface runoff within the impoundment area would not consistently exceed evaporation, the impoundment would be designed as a zero-discharge facility. All runoff from impoundment dam constructed of tailings or waste rock would be routed to Seepage Collection Pond or other containment pond and then returned to the mill for reuse. MMC would design all ditches and sediment ponds that would contain process water or mine drainage for a 100-year/24-hour storm.

Other Effects of the Overall Project

Water Quantity

During all phases, 402-permitted discharges in upper Libby Creek below the Libby Adit would increase streamflow in Libby Creek. These increases would benefit the bull trout and other fish species within this section of Libby Creek, including the redband trout population. Higher flows resulting from the Water Treatment Plant discharges would increase the depth of the pool habitat and provide more thermal refuge areas for salmonids and other fish during the times of year when flows are lowest. Macroinvertebrate populations may also be beneficially affected, as the increased flow would result in greater wetted area and thus potential habitat within the affected reaches of Libby Creek.

Water Quality

During all mine phases, 402-permitted discharges would be treated at the Water Treatment Plant and discharged to an outfall at the Libby Adit Site. An additional outfall may be needed in Ramsey Creek to avoid injury to senior water rights. Water treated at the Water Treatment Plant would be below BHES Order limits and nonsignificance criteria in surface water and groundwater after mixing. Groundwater and surface water quality would not be adversely affected.

For 402-permitted discharges, the total inorganic nitrogen (TIN) concentrations in streams may increase up to 1 mg/L under the BHES Order. The surface waters of the Libby Creek drainage have low concentrations for most dissolved nutrients. Increased nutrient (nitrate and ammonia) concentrations as a result of 402-permitted discharges during all phases would occur in the Libby Creek drainage. For 402-permitted discharges, the total inorganic nitrogen (TIN) concentrations in streams may increase up to 1 mg/L under the BHES Order. Whether total nitrogen concentrations greater than the standard or TIN concentrations greater than the BHES Order limit would actually increase algal growth to the extent that it would be considered “nuisance” algae is unknown based on the other factors that influence such growth.

Libby Creek from the US 2 bridge to the Kootenai River is on Montana's list of impaired streams for sedimentation/siltation, a factor that could increase total phosphorus availability in the stream channel. Although projected TIN concentrations would be greater than existing conditions, the ammonia component of TIN would remain well below the applicable ammonia aquatic life standard, indicating no potential toxicity from increased ammonia concentrations in analysis area streams.

If an algal overgrowth occurred from elevated total nitrogen and total phosphorus concentrations, significant seasonal dissolved oxygen decreases along a stream could result, particularly during early fall low flow periods. Increased algal growth may also result in higher daily pH values, but it is difficult to determine if the pH standard would be exceeded due to instream factors such as chemical buffering and re-aeration rates. Such increases in algal growth may not occur in response to an increased total nitrogen concentration because phosphorus concentrations may limit algal growth when nitrogen is already present in surplus supply. Co-limitation is also common in flowing waters, with additions of both total nitrogen and total phosphorus resulting in increases in algal growth of a larger magnitude than either nutrient separately. Other factors such as light, temperature, and length of the growing season can be important factors determining algal growth

Adverse changes in the composition of macroinvertebrate assemblages to favor those taxa that are tolerant of nutrients or low dissolved oxygen, or those that feed directly on periphyton such as grazers, could also occur. Increased algal growth associated with total nitrogen concentrations greater than 0.275 mg/L and total phosphorus concentrations greater than 0.025 mg/L could stimulate productivity rates for aquatic insects and, consequently, stimulate populations of trout and other fish populations. Increased algal growth could also reduce habitat availability for macroinvertebrates.

The BHES Order discussed protection of beneficial uses. On page 5, the Order states "surface and groundwater monitoring, including biological monitoring, as determined necessary by the Department [DEQ], will be required to ensure that the allowed levels are not exceeded and that beneficial uses are not impaired." Further on page 7, the Order indicates that the limit of 1 mg/L for TIN "should adequately protect existing beneficial uses. However, biological monitoring is necessary to insure protection of beneficial uses and to assure compliance with …applicable standards." The applicable standards include the existing narrative standard prohibiting nuisance algal growth. According to the reopener provisions of MPDES permits described in ARM 17.30.1361(2)(b), "permits may be modified during their terms if…the department [DEQ] has received new information …indicating that cumulative effects on the environment are unacceptable, or (c) the standards or requirements on which the permit was based have been changed by amendment or judicial decision after the permit was issued." Consequently, the TIN limit for ambient surface waters set in the BHES Order could be modified in the MPDES permit issued by DEQ at any time if nuisance algal growth caused by MMC's discharge is observed. To address the uncertainty regarding the response of area streams to increased TIN concentrations, MMC would implement the water quality and aquatic biology monitoring, including monitoring for periphyton and chlorophyll-a, monthly between July and September.

The low concentrations of dissolved minerals in surface waters of the Libby Creek drainage cause these waters to tend toward acidic pH levels, and to have extreme sensitivities to fluctuations in acidity. For most heavy metals, the percentage of the metal occurring in the dissolved form increases with increasing acidity. Generally, dissolved metals are the most bioavailable fraction and have the greatest potential toxicities and effects on fish and other aquatic organisms. Any increase in metal concentrations could increase the potential risk for future impacts to fish and other aquatic life in some reaches. Metal concentrations near the aquatic life could result in physiological stress, such as respiratory and ion-regulatory stress, and mortality.

The BHES Order would allow total copper concentrations up to 0.003 mg/L in all surface waters affected by the project (BHES 1992). The total copper concentration outside of a mixing zone resulting from project discharges could not exceed the chronic aquatic life standard of 0.00285 mg/L. Potential effects to aquatic life from an increase in copper concentrations are difficult to determine given recent uncertainties regarding the protectiveness of the hardness-modified copper standard and existing instream copper concentrations. Typical groundwater and snowmelt-fed mountain streams would be expected to have low dissolved organic carbon concentrations that make dissolved copper bioavailable and potentially toxic. Predicted increased nitrogen concentrations may increase primary productivity and likely increase dissolved organic carbon concentrations, which may offset potential toxic responses due to increased copper concentrations. Furthermore, measured instream copper concentrations are either at or near minimum laboratory detection limits, creating some uncertainty with any change in concentration from existing conditions.

MMC would implement BMPs and road closure mitigation, some of which would be completed before the Evaluation Phase and some before the Construction Phase. Other roads would be closed at the end of operations. Reduction in sediment delivery from roads would be about 225 tons. Road removal would have direct and long lasting beneficial effects on water quality. The BMPs to minimize sediment delivery from affected forest roads are predicted to be between 88 and 99 percent effective.

Such reductions would result in long-term benefits to aquatic habitat and populations. Sediment reduction would be substantial in most of the analysis area streams in the Libby Creek watershed, including Bear Creek, which is an important bull trout spawning area in the Kootenai River Core Area and supports the highest reported average density of these trout within the Libby Creek watershed. Sediment delivery to East Fork Rock Creek from NFS road #150A would also decrease by almost 87 percent with the project and BMPs.

Fish Barriers

All bridges proposed for construction or upgrades would comply with INFS standards and guidelines and would not impact fish passage. Additionally, culverts along a 1.4-mile segment of Libby Creek Road would be replaced as necessary to allow for fish passage. Culvert removal associated with access changes would improve fish passage in affected drainages. The mitigation plan includes replacement of one culvert on Little Cherry Creek, one culvert on Poorman Creek, and bridge removal on Poorman Creek, all of which would improve fish passage.

Section 230.32 – Other Wildlife

Wildlife associated with aquatic ecosystems are resident and transient mammals, birds, reptiles, and amphibians (40 CFR 230.32(a)).

The project would disturb habitat of various resident and transient mammals, birds, reptiles, and amphibians. Larger wildlife, such as elk or moose, would be displaced by surface disturbance and human activity. Temporary displacement could result in increased mortality from vehicle collisions and increased resource competition. Populations of smaller wildlife would be affected by displacement and mortality. Section 3.25 of the EIS describes effects on other wildlife.

SUBPART E – POTENTIAL IMPACTS ON SPECIAL AQUATIC SITES

Section 230.40 – Sanctuaries and Refuges

Sanctuaries and refuges consist of areas designated under state and federal laws or local ordinances to be managed principally for the preservation and use of fish and wildlife resources (40 CFR 230.40(a)). No sanctuaries or refuges are within the scope of the Corps' analysis.

Section 230.41 – Wetlands

Wetlands consist of areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (40 CFR 230.41a)).

Wetlands within the scope of the Corps' analysis are a mix of palustrine emergent, scrub-shrub, and forested types. Within the Impoundment Site, wetlands occur along drainages to Libby Creek and as isolated wetlands. Wetlands occur at road crossings on Ramsey and Poorman creeks.

Based on evaluating functions and services using the 2008 MDT Montana Wetland Assessment Method (Berglund and McEldowney 2008), wetlands within the scope of the Corps' analysis are classified as Category I, II, III, or IV. Category I wetlands are exceptionally high quality wetlands and are generally rare to uncommon. Category II wetlands are more common than Category I wetlands, and provide habitat for sensitive plants and animals. Category III wetlands are more common than Category II or I wetlands, generally less diverse, and are often smaller than Category II or I wetlands. Category IV wetlands are generally small, isolated, and lack vegetative diversity. These wetlands provide minor wildlife habitat. Category II and III wetlands would be filled at the Poorman Impoundment Site. Category II wetlands had high functional ratings for structural diversity, general wildlife habitat, known or potential habitat for special-status wildlife species, and sediment/toxicant removal. Category III wetlands are most common and are present in areas that previously have been logged, and usually are seasonally flooded due to spring snow melt and precipitation.

Direct Effects

Discharges of materials at the Impoundment Site would unavoidably fill 9.0 acres of jurisdictional wetlands and 13,383 linear feet of other streams. Roads not associated with the impoundment would affect 0.2 acre of jurisdictional wetlands and 1,059 linear feet of other streams (Table 2). Stream crossings on Ramsey, Poorman, and Libby creeks would be bridged and would not affect wetlands or streams.

Functional Category II and III wetland types were found in the Impoundment Site. Of the 9.0 acres of jurisdictional wetlands in the Impoundment Site, 7.7 acres are Category II wetlands and 1.3 acres are Category III wetlands. The location and functional category of each wetland in the Impoundment Site is shown on Figure 4.

Secondary Effects

Some wetlands would not be filled by tailings impoundment construction, but are within the disturbance area and likely would be filled by access roads or other project facilities. During final design, MMC would avoid and minimize effects on wetlands and streams to the extent practical. Outside of the disturbance area, 0.2 acres of jurisdictional wetlands and 4,724 linear feet of streams would be affected by reduced or eliminated flow. Mitigation for jurisdictional wetlands and streams is described in Section 230.93 – General Compensatory Mitigation Requirements.

Section 230.42 – Mudflats

Mudflats are broad flat areas along the sea coast and in coastal rivers to the head of tidal influence and in inland lakes, ponds, and riverine systems (40 CFR 230.42(a)). No mudflats are within the scope of the Corps' analysis.

Section 230.43 – Vegetated Shallows

Vegetated shallows are permanently inundated areas that under normal circumstances support communities of rooted aquatic vegetation, such as turtle grass and eelgrass in estuarine or marine systems as well as a number of freshwater species in rivers and lakes (40 CFR 230.43(a)). Most wetlands in the

Impoundment Site have persistent emergent vegetation. Because of the seasonal water regime with the Impoundment Site, areas with rooted aquatic vegetation are less likely to occur and no vegetated shallows would be affected.

Section 230.44 – Coral Reefs

Coral reefs consist of the skeletal deposit, usually of calcareous or silicaceous materials, produced by the vital activities of anthozoan polyps or other invertebrate organisms present in growing portions of the reef (40 CFR 230.43(a)). No coral reefs are within the scope of the Corps' analysis.

Section 230.45 – Riffle and Pool Complexes

Steep gradient sections of streams are sometimes characterized by riffle and pool complexes. Such stream sections are recognizable by their hydraulic characteristics. The rapid movement of water over a coarse substrate in riffles results in a rough flow, a turbulent surface, and high dissolved oxygen levels in the water. Pools are deeper areas associated with riffles. Pools are characterized by a slower stream velocity, a steaming flow, a smooth surface, and a finer substrate. Riffle and pool complexes are particularly valuable habitat for fish and wildlife (40 CFR 230.45(a)). Streams within the Impoundment Site are not fish-bearing, and riffle and pool complexes are not expected to be affected at the Impoundment Site. Negligible areas of riffle and pool complexes may be affected at road crossings.

SUBPART F – POTENTIAL EFFECT ON HUMAN USE CHARACTERISTICS

Section 230.50 – Municipal and Private Water Supplies

Municipal and private water supplies consist of surface water or groundwater that is directed to the intake of a municipal or private water supply system (40 CFR 230.50)). No municipal or private water supplies are within the scope of the Corps' analysis or would be affected by the proposed discharges.

Section 230.51 – Recreational and Commercial Fisheries

Recreational and commercial fisheries consist of harvestable fish, crustaceans, shellfish, and other aquatic organisms used by man (40 CFR 230.51(a)). The area within the scope of the Corps' analysis does not support a commercial fishery. Fishing is a relatively minor activity in Libby Creek, Poorman Creek, Howard Creek and West Fisher Creek. Most fishing in the analysis area occurs on the Fisher River and Howard Lake. For example, total angler days between 2003 and 2009 averaged 3,685 days on Fisher River, 990 days on Howard Lake, and 385 days on Libby Creek (FWP 2012). The proportion of angler days on the Fisher River and Libby Creek that occurs in the analysis are is unknown.

Drainages affected by the Impoundment Site are not fish-bearing and do not provide recreational fishing access. Section 230.22 – Water discusses the effects on Libby Creek, which would minor during high flow conditions and negligible or nonexistent for the majority of the year (Kline Environmental Research and NewFields Companies 2014). The anticipated effects on Libby Creek would have negligible effects on recreational fishing in Libby Creek.

Changes in water quality or streamflow from 402-permitted discharges would not affect recreational fishing opportunities. The Compensatory Mitigation Plan and Wildlife Mitigation Plan would substantially reduce sediment reaching area streams, improve fish habitat, and may increase recreational fishing opportunities.

Section 230.52 – Water-Related Recreation

Water-related recreation encompasses activities undertaken for amusement and relaxation. Activities encompass two broad categories of use: consumptive, *e.g.*, harvesting resources by hunting and fishing;

and nonconsumptive, *e.g.*, canoeing and sightseeing (40 CFR 230.52(a)). Effects on recreational fishing are discussed in Section 230.51 – Recreational and Commercial Fisheries. Noise during construction of the Libby Plant Site and transmission line and views of the transmission line may adversely affect recreational use and enjoyment of the Libby Creek Recreational Gold Panning Area. The Little Cherry Loop Road (NFS road #6212) closure and other road closures within the scope of the Corps' analysis would restrict both motorized and non-motorized recreation access. The improvements to the Libby Creek Road (NFS road #231) would improve recreational access to the area.

Section 230.53 – Aesthetics

Aesthetics associated with the aquatic ecosystem consist of the perception of beauty by one or a combination of the senses of sight, hearing, touch, and smell. Aesthetics of aquatic ecosystems apply to the quality of life enjoyed by the public and property owners (40 CFR 230.53(a)).

The Impoundment Site would alter scenic integrity over the short term from key observation points and portions of the CMW. Although the visual absorption capability of the tailings impoundment location is moderate, its relatively large size in all views would create noticeable contrasts in landscape character and substantial alterations in scenic integrity. Scenic integrity and landscape character from the private land parcel due east of the impoundment dam, about 0.06 mile (350 feet) between dam and nearest property line, would be permanently and substantially altered. Scenic integrity would be substantially reduced in westerly views from the north end of the private parcel due to a mostly unobstructed view of the 270-foot-high impoundment dam face. Scenic integrity would be moderately reduced in northwesterly views from the southern portion of this parcel due to the increasing screening effects of the forest with increasing distance from the impoundment. The size of the impoundment would diminish with increasing viewing distance. Following the mine closure, revegetation of the tailings impoundment would partially reduce color and texture contrasts between the tailings impoundment and surrounding landscape. Other proposed discharges, such as fill for road construction or improvements or water measurements, would have a negligible effect on aesthetic values.

Section 230.54 – Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves

These preserves consist of areas designated under federal and state laws or local ordinances to be managed for their aesthetic, educational, historical, recreational, or scientific value (40 CFR 230.54(a)). No parks, national and historical monuments, national seashores, research sites, or similar preserves would be affected by the proposed discharge of dredged or fill material. The CMW would not be directly affected by any discharge of dredged or fill material.

Direct effects outside the scope of the Corps' analysis on wildlife and habitat resources outside of CMW may have indirect effects on ecological processes within the CMW, due to long-term impacts to populations of wide-ranging species such as grizzly bear and wolverine. The extent to which the direct effect on wildlife and habitat outside of wilderness affects ecological processes within the CMW is uncertain; while some species may adapt to mine disturbance, others may avoid areas of mine activity and spend more time in the CMW.

The visitor experience within the CMW would be indirectly affected by mining-related activities. Some of the mining facilities including the Impoundment Site would be visible from viewpoints within the CMW. Night lighting of the mine facilities and areas cleared of timber would also be visible from portions of the CMW. The visual effects of mining operations would be noticeable during construction and operations and would diminish following facility reclamation and closure. During construction, operation, and reclamation, noise from generators, fans, equipment, traffic, and plant operations would extend westward into the CMW and interfere with the peaceful experience of wilderness users. Following mine closure and reclamation, noise levels in the CMW would return to pre-mine levels. Elevated noise levels would occur periodically from traffic and monitoring activities following reclamation. Noise levels would return to pre-mine levels over the long term.

Because the wilderness experience is highly personal and individual, the perceived effect would differ among individuals. It is likely that the visual and noise effects of the project would reduce the natural quality of the wilderness experience for some individuals in portions of the wilderness. Visitation in the portions of the CMW exposed to sound and visual effects may decrease. Other qualities such as untrammeled, undeveloped, and outstanding opportunities for solitude or a primitive and unconfined type of recreation may also be diminished at some locations within the CMW for visitors during operation. These effects would occur throughout the duration of project operations and diminish following operations and reclamation.

SUBPART G – EVALUATION AND TESTING

Section 230.60 – General Evaluation of Dredged or Fill Material

Fill material used in road construction and improvements, impoundment construction, and fish structures would be comprised primarily of sand, gravel, or other naturally occurring inert material found on National Forest System lands. The sites from which the dredged or fill material would be extracted have been examined and they are sufficiently removed from sources of pollution to provide reasonable assurance that the proposed discharge material would not be a carrier of contaminants. The chemical and biological testing sequence in Section 230.61 would not be required and Section 230.61 is not discussed further.

SUBPART H – ACTIONS TO MINIMIZE ADVERSE EFFECTS

Section 230.70 – Actions Concerning the Location of the Discharge

An extensive alternatives analysis was conducted, consisting of three levels of successive screening of 22 possible impoundment sites and 9 plant and adit sites. Following the initial analysis, three alternatives underwent a more thorough environmental analysis to determine the least environmentally damaging practicable alternative. During final design, MMC would minimize and avoid, to the extent practicable, filling wetlands and other streams.

Section 230.71 through 230.74 – Actions Concerning the Material to be Discharged, the Material after Discharge, and the Method of Dispersion and Related Technology

No material that contains hazardous materials would be discharged into streams. BMPs would be used to control the material after discharge. Temporary and permanent erosion-control devices would be used during construction of all project facilities to control discharges and methods of discharges into streams. All runoff from the tailings impoundment would be intercepted by diversion ditches, routed to the Seepage Collection Pond, and pumped back to the tailings impoundment. During operations, water from the impoundment would be pumped to the mill for ore processing. During the Closure and Post-Closure phases, intercepted runoff would be treated and discharged at the Water Treatment Plant until the tailings impoundment was reclaimed and no longer subject to the effluent limit guidelines. MMC would implement a construction stormwater management plan.

In accordance with the draft renewal MPDES permit, MMC would submit a final Stormwater Pollution Prevention Plan (SWPPP) for the agencies’ approval no later than the 28th of the following month 60 days after the effective date of the MPDES permit. The SWPPP would describe the facility, BMPs, control measures, and monitoring procedures that will ensure compliance with the terms and conditions of their MPDES permit. The plan would addresses stormwater runoff from mine-related facilities including topsoil stockpiles, access/haul roads, adit pads, and parking lots. The plan also would address stormwater runoff from transmission-related facilities. The plan would incorporate special conditions or requirements for the SWPPP identified by the DEQ as a part of the MPDES permit. The final SWPPP would be approved by the KNF and the DEQ.

Section 230.75 – Actions Affecting Plant and Animal Populations

Stream Mitigation

Mitigation for streams would consist of:

- property
- Planting a 10-foot wide riparian zone on each side of the channels totaling about 3 acres
- Removing cattle from the Swamp Creek property
- Replacing or removing two culverts and removing one bridge in the project area
- Stabilizing 400 feet of eroding area on NFS road #6212
- Removing 21 culverts and restoring riparian habitat on land acquired for grizzly bear mitigation

Proposed mitigation would have direct benefits to the functions and services of the stream reaches on the Swamp Creek mitigation site, with many benefits that would extend downstream in Swamp Creek and into Libby Creek. Benefits would include improved water quality and transport of organic material and biota to downstream waters. While stream flow data are not available downstream of the Swamp Creek property to ascertain the percentage contribution of Swamp Creek discharge to Libby Creek, low flow discharge of Libby Creek near the tailings impoundment is 10 cfs, compared to a measured low flow of about 2 cfs in Swamp Creek on the mitigation property. Swamp Creek probably has a significant influence on the functions and services of Libby Creek.

For the mainstem of Swamp Creek and the Spring #2 and Spring #3 channels, mitigation would raise the functions from low and medium ratings to mostly high ratings. For the Spring #1 channel that has mostly low function ratings, mitigation would result in medium and high ratings. All services at the Swamp Creek site currently have a low rating, but would be increased to mostly high ratings due to the planned future allowance of public access to the site. The mitigation site is also well placed with regard to stream services related to use by the public due to its location near US 2 and its proximity to the town of Libby (MMC 2014).

Bull Trout Mitigation

The agencies' mitigation for bull trout is described in the Final EIS and the Biological Assessment for aquatic species. Conceptual mitigation action for Copper Gulch, West Fork Rock Creek, Rock Creek, Libby Creek and Flower Creek that would be included in Bull Trout Core Area Mitigation Guidance Plans include:

- Creating or securing genetic reserves through bull trout transplanting to protect existing bull trout populations (Libby Creek and Bear Creek) from catastrophic events;
- Rectifying unnatural blockages to bull trout passage that are prohibiting access to spawning and rearing habitat;
- Rectifying other factors that are limiting the potential of streams to support increased production of bull trout;

- Eradicating or suppressing non-native fish species, especially brook trout that are a hybridization threat to bull trout.

MMC would prepare Core Area Bull Trout Mitigation Guidance Plans (Kootenai River and Lower Clark Fork River Core Areas) that would identify and quantitatively evaluate potential bull trout population effects, potential habitat effects, and overall bull trout conservation effects of specific mitigation concepts. These potential beneficial effects of proposed mitigation actions would be compared to predicted adverse effects to bull trout populations identified in the KNF Biological Assessment (2013a) and the USFWS' BO (USFWS 2014c). The Core Area Bull Trout Mitigation Guidance Plans would identify success criteria and monitoring effort needed to verify that objectives of the subject mitigation proposals have been met.

The KNF concluded in its Biological Assessment that the project would maintain or increase bull trout populations in Libby Creek, and increase bull trout populations in Flower Creek, West Fork Rock Creek, and Copper Gulch through proposed mitigation. The project might decrease local populations in Rock Creek, East Fork Rock Creek, and East Fork Bull River. With benefits to other streams in the project area and successful proposed mitigation, the project would increase bull trout populations in the Rock Creek drainage, the Libby Creek drainage, Flower Creek, the Lower Clark Fork Core Area and Kootenai Core Area and offset projected impacts to designated critical habitat in the two Core Areas (USDA Forest Service 2013a).

The Biological Opinion provided KNF with reasonable and prudent measures and terms and conditions that will minimize the impact of incidental take to bull trout and minimize adverse effects to primary constituent elements (PCEs) associated with bull trout critical habitat (USFWS 2013c).

Sediment Reduction

Evaluation, Construction, and Operations Phases

The following sections disclose the potential effect on sediment in analysis area streams from activities during the Evaluation, Construction, and Operations Phases. Each mine facility is discussed following a discussion of initially planning and implementation. Potential effects of proposed mitigation on sediment in analysis area streams also are described.

Stormwater Control Planning and Implementation

MMC would submit a final Stormwater Pollution Prevention Plan (SWPPP) for the agencies' approval no later than the 28th of the following month 60 days after the effective date of the MPDES permit. The SWPPP would describe the facility, BMPs, control measures, and monitoring procedures that would ensure compliance with the terms and conditions of their MPDES permit. The SWPPP would address stormwater runoff from mine-related facilities including topsoil stockpiles, access/haul roads, adit pads not constructed of waste rock, and parking lots. The plan also would address stormwater runoff from transmission-related facilities. Sediment and runoff from all disturbed areas would be minimized through the use of BMPs developed in accordance with the Forest Service's *National Best Management Practices for Water Quality Management on National Forest System Lands* (USDA Forest Service 2012) and the BMP requirements in the MPDES permit. After the activities were completed, and the roads became stabilized, sediment delivery to area streams would decrease below existing levels. In the event that a large runoff-producing storm occurred during the initial reclamation period, soil losses along roads and road cuts may be locally moderate to severe. MMC may request and the DEQ may authorize a short-term exemption from surface water quality standards for total suspended sediments and turbidity for construction of the transmission line, access roads, the tailings impoundment, and other stream crossings.

All discharges of sediment from the Montanore Project via stormwater or the Water Treatment Plant would be subject to an annual limit. The DEQ and EPA established a sediment TMDL of 4,234 tons/year average annual load for Libby Creek from the US 2 bridge to the confluence with the Kootenai River. A TMDL is the maximum amount of a pollutant a waterbody can receive and still meet water quality standards. As part of this TMDL, the Montanore facility was assigned a sediment wasteload allocation of 24 tons/year. This wasteload allocation, applied as a wasteload allocation for total suspended solids applicable to all permitted outfalls at the facility, including any future permitted outfalls, will be implemented in the final MPDES permit. Beginning on the effective date of the MPDES permit, MMC would monitor all discharges to surface water for sediment, and report sediment concentrations to DEQ monthly (see Appendix C). Any failures of the sediment BMPs would require MMC to implement corrective measures in accordance with the MPDES permit.

Plant Site

The Libby Plant Site would be constructed between Libby and Ramsey creeks. The plant would be more than 500 feet from Libby Creek, minimizing the potential for non-channelized overland flow to reach Libby Creek (Belt *et al.* 1992). During the Construction Phase, surface water runoff from the Plant Site area would be directed along ditches to lined sediment ponds sized for the 10-year/24-hour storm. MMC would request amendment to its MPDES permit to include stormwater runoff from the plant site during construction for Outfalls 005 and 006. Based on preliminary design, the Libby Plant Site would not be built with waste rock. MMC would request amendment to its MPDES permit to include stormwater runoff from the plant site during construction for Outfalls 005 and 006.

During the Operations Phase, surface water runoff from the Plant Site area would be directed along ditches to lined sediment ponds sized for the 10-year/24-hour storm. Water from the ponds would be pumped to the plant for makeup needs. An ore stockpile at the Plant Site would be covered so that precipitation water would not contact this material. No waste rock would be placed at the Plant Site. Stormwater discharges from the Libby Plant Site would not occur during operations and sediment in Libby and Ramsey creeks would not be affected.

Tailings Impoundment

The tailings impoundment would be constructed between Little Cherry and Poorman creeks, and above Libby Creek. MMC would request an amendment to its MPDES permit for stormwater discharges during the Construction Phase at the Poorman Impoundment Site. During construction, ditches and sediment ponds containing stormwater runoff from the area would be sized to either the 100-year/24-hour or the 10-year/24-hour storm (see below). Infrequent discharges from the sediment ponds would flow and be monitored at one or more MPDES permitted outfalls, and would be required to meet effluent limits.

Waste rock excavated extending the Upper Libby Adit and the new Libby Adit would be hauled to a temporary waste rock stockpile within the Poorman Tailings Impoundment footprint, the location of which would be determined during final design. Before the KNF or the DEQ would allow MMC to create a temporary waste rock stockpile within the Poorman Tailings Impoundment footprint, MMC would submit data regarding the concentrations of potential pollutants in runoff and seepage from waste rock to the DEQ. The DEQ would use a reasonable potential analysis to determine whether a discharge, alone or in combination with other sources of pollutants to a water body, could lead to an excursion above an applicable water quality standard. The DEQ would establish effluent limits during the MPDES permitting process if runoff from the waste rock stockpile was not sent to the Water Treatment Plant (Outfalls 001 through 003) for treatment.

Stormwater from undisturbed lands above the tailings facility would be diverted around the impoundment site toward the Poorman Creek and Little Cherry Creek drainages during mine operations, unless water was needed for mill operations. The small amount of water diverted around the Poorman Tailings Impoundment Site from the small watershed above the impoundment would not measurably affect the water quality of Little Cherry or Poorman creeks. The quality of the water is expected to be similar to the receiving water quality.

All runoff from the tailings impoundment dam and disturbed areas within the tailings impoundment permit area boundary would be directed to the Seepage Collection Pond or to lined containment ponds. Stormwater from the impoundment site would be less likely discharged in Alternative 3 than Alternative 2 because MMC would not use mine and adit water in the mill and would have a greater need for make-up water from the impoundment site. Ditches and sediment ponds containing process water or mine drainage would be designed for the 100-year/24-hour storm to minimize potential overflow to nearby streams. Water from the ponds would be returned to the Seepage Collection Pond or impoundment and then the mill for reuse. Alternative water management techniques may be identified during final design and the MPDES permitting process. Stormwater discharges from the tailings impoundment would not occur during operations and sediment in Libby, Poorman and Little Cherry creeks would not be affected.

Depending on final design, a stormwater outfall may be needed for stormwater from the soil stockpile upgradient of the tailings impoundment. Ditches and the sediment pond containing stormwater would be designed for the 10-year/24-hour storm. Infrequent discharges from the sediment pond would flow and be monitored at a MPDES permitted outfall at a Little Cherry Creek tributary, and would be required to meet applicable effluent limits.

Adit Sites

The Libby Adit Site is already constructed and slopes adjacent to Libby Creek revegetated. A lined stormwater holding pond also was constructed near the Libby Adit to collect runoff from the portal area. Two new lined waste rock piles also would be located on the main portal pad site. Storm water from these rock piles would collect in lined ditches and sumps located downgradient of each waste rock pile. This water would be pumped to the Water Treatment Plant, treated, and discharged to outfalls 001, 002, or 003. Precipitation and runoff from other locations at the Libby Adit pad area would be collected and directed to outfall 001.

The Upper Libby Adit would be constructed from underground, and waste rock hauled out of the Libby Adit Site, and not the Upper Libby Adit site. The adit portal pad would be constructed of on-site soil and rock materials with no waste rock used. Ditches and a sediment pond designed for the 100-year/24-hour storm also would be constructed at this site, with excess stormwater from the pad surface being discharged to outfall 004 at Libby Creek.

Libby Loadout

The Libby Loadout would be constructed near Libby Creek. The loadout would be more than 250 feet from all the creek, minimizing the potential for non-channelized overland flow to reach the creek (Belt *et al.* 1992). During Construction, if the Libby Loadout construction was considered a construction activity, surface water runoff from the area would be discharged to Libby Creek from an MPDES-permitted outfall. During operations, all transfer operations and storage areas at the Libby Loadout would be completely enclosed, so no runoff from the loadout would occur. The potential accumulation of concentrate along the haul truck turn-around, at the concentrate storage area, and along the railroad tracks would be limited, and would be managed by regular clean-up with sweepers, so runoff from any concentrate at these locations would be minimal.

Access Road Use and Improvements

Within the mine permit area boundary, all stormwater runoff from roads would be captured by ditches and sediment ponds sized to contain the 10-year/24 hour storm. Andy discharges from the ponds would be routed toward MPDES permitted outfalls 004, 005, 006, 007, or 008. Discharges from the outfalls to Libby, Ramsey, and Poorman creeks would be monitored, and would be required to meet applicable effluent limits.

The Libby Creek Road (NFS road #231) would not be widened or paved, but the road length contributing to the nearest RHCA would be reduced to 150 feet by adding drain dips, surface water deflectors or open top box culverts that would route the water off the road away from drainages or wetlands. Reducing the contributing road length to 150 feet on the Libby Creek Road would reduce the average annual sediment leaving the road buffer and entering RHCAs by about one-third. Reducing the contributing road length to less than 150 feet would reduce sediment delivery further; the WEPP model indicates a linear relationship between contributing road length and the amount of sediment leaving a road and buffer.

The WEPP model predicted that paving and widening all of the Bear Creek Road would increase the amount of sediment leaving the buffer. Most of the sediment increase (40 pounds per year) is predicted to occur at one crossing of an unnamed tributary of Big Cherry Creek. The crossing would be 600 feet from Big Cherry Creek. Forty pounds of sediment is 0.24 cubic feet; this small volume may not reach Big Cherry Creek, but remain in the channel of the unnamed tributary. Other crossings at which WEPP sediment increases were predicted, including a bridge at Bear Creek and a culvert at Little Cherry Creek, had increases of less than 10 pounds per year. BMPs in addition to paving at these crossings would be evaluated during final design. The model assumes that paving a road increases runoff from the road, which can cause increased erosion on fillslopes (assumed to be erodible in the model) and flow paths leading from the road into drainages. It has been the experience of other modelers that WEPP inaccurately models the effect of road paving because it over-predicts erosion from paved roads (Breibart *et al.* 2007). Research indicates that paved roads generate the least sediment and typically have the shortest distance of sediment transport away from a road bed compared to gravel or unimproved roads (Riedel *et al.* 2007).

The movement of sediment from roads to RHCAs would be minimized through the use of BMPs. Some of these BMPs cannot be modeled using the WEPP model, but they would further reduce sediment leaving the roads and buffers. Various studies have shown that BMPs implemented to reduce sediment movement from roads, cutslopes and fillslopes to drainages are effective in reducing sediment by 70 to 100 percent (Burroughs and King 1989, Gucinski *et al.* 2001, Kennedy 1997, Riedel *et al.* 2007). Appropriate BMPs would be determined on a site-specific basis and would be monitored to determine their effectiveness. Appropriate BMPs may include:

- Locating outlets for road drain dips, surface water deflectors and open top box culverts in non-erosive buffer areas
- Stabilizing disturbed areas with vegetative cover
- Erosion control treatment on fillslopes and cutslopes such as erosion control mats, rocks, hydromulching, and sodding
- Placement of filter windrows (such as logging slash) on or just below fillslopes
- Capture of road runoff in settling ponds
- Prevention of ruts in roadways that channel runoff
- Regular road maintenance
- Addition of at least 6 inches of good aggregate to roads (if not paving)
- Dust control on roads
- Prevention of erosion from roadside ditches using riprap, mats or paving
- Aligning culverts with the natural course and gradient of a stream
- Controlling scouring at culvert outlets
- Replacing buried or damaged culverts
- Replacing culverts or bridges with larger structure to prevent road flooding and channel and bank scouring
- Monitoring and maintaining culverts to prevent clogging and flooding of roads

Changes in Road Access, Stream Crossings, and Other Sediment Reduction Mitigation

MMC would implement or fund yearlong access changes on 26 roads totaling 48 miles, some of which would be completed before the Evaluation Phase and some before the Construction Phase. Other roads would be closed at the end of operations. The roads with access changes would be covered by a Road Management Plan. The plan would describe requirements for pre-, during-, and post-storm inspections and maintenance; implementation and effectiveness monitoring plans for road stability, drainage, and erosion control; and mitigation plans for road failures.

Six roads totaling 14.9 miles with access changes may be decommissioned and converted to trails. Decommissioned roads would be monitored for stability, drainage, and erosion control. To minimize sediment movement from decommissioned roads to RHCAs, MMC may decompact the road surface, move any unstable road fill to a more stable location, re-establish natural surface drainage patterns (such as by removing culverts and reshaping stream banks), recontour and revegetate the former road area. An analysis of decommissioning treatments on forest roads in northern Montana and Idaho showed a reduction in fine sediment delivery to streams of 97 percent (Cissel *et al.* 2011).

Intermittent stored service roads (some grizzly bear mitigation roads and transmission line roads) would be closed to motorized traffic and would be treated and maintained to minimize sediment movement to nearby streams. The treatment would include:

- Removing culverts determined by the KNF to be high risk for blockage or failure and laying back stream banks to allow flows to pass without scouring or ponding so that revegetation would have a strong chance of success
- Installing drain dips, surface water deflectors or open top box culverts that would route the water off the road away from drainages or wetlands
- Removing and placing unstable materials to a stable location where stored materials would not present a risk to drainages or wetlands
- Replacing salvaged soil and revegetate with grasses in disturbed areas and unstable road segments to reduce erosion potential

The proposed stream mitigation would include instream activity in Swamp Creek near US 2, Little Cherry Creek, Poorman Creek and at 21 stream crossings on land acquired for grizzly bear mitigation. Brief effects (2 days or less) of these mitigations would be increased turbidity and sediment concentrations downstream of the culvert removals, bridge removal, and channel reconstruction and stabilization during construction. Placing straw bales in the stream below the construction area would significantly reduce sediment concentrations in the stream below the bales (Foltz *et al*. 2008). The most effective way to prevent brief turbidity and sediment concentration increases would be to route stream water around the construction area until completion (Wegner 1999). Longer-term effects to the streams would be beneficial. Fine sediment in streams below mitigation sites has been shown to decrease, spawning areas increased, and monitoring of instream aquatic macroinvertebrate communities for several years after culvert removals showed increases in their populations and number of species (Wegner 1999).

Proposed instream activities would be subject to three permitting processes: a 310 permit, a 318 authorization, and a 404 permit. Installation of culverts, bridges, or other structures at perennial stream crossings would be specified in accordance with a 310 permit following on-site inspections with DEQ, Forest Service, FWP, landowners, and the local conservation district. Installation or removal of culverts or other structures in a water of the State would be in accordance with DEQ 318 permit conditions. All installation or removal of culverts or other structures in a water of the United States if they resulted in a discharge of fill would be in accordance with the Corps' 404 permit conditions.

The DEQ may authorize short-term surface water quality standards for total suspended sediments and turbidity for construction. Any exemption would include conditions that minimize, to the extent practicable, the magnitude of any change in water quality and the length of time during which any change may occur. The authorization also would include site-specific conditions that ensure that the activity is not harmful, detrimental, or injurious to public health and the uses of state waters and that ensure that existing and designated beneficial uses of state water are protected and maintained upon completion of the activity.

Instream Fisheries Mitigation

Fisheries mitigation may include the instream activity in Copper Gulch, Libby Creek, and Flower Creek. Before implementation, MMC would complete and an interagency committee would review feasibility assessments on each project. Possible instream mitigation would include installing large wood structures in the floodplain and riparian zone of a short segment Libby Creek upstream of Libby Creek Falls and constructing a selective withdrawal mechanism in the Flower Creek dam or a stream water by-pass system through the reservoir. Mitigation implemented in Flower Creek would be a contingency to failed mitigation in Upper Libby Creek. Brief effects (2 days or less) of these mitigations would be increased turbidity and sediment concentrations downstream of the activity during construction. Appropriate BMPs would be identified during final design and implemented with each project. Longer-term effects to stream water quality would be beneficial because of improved channel stability and decreased downstream sediment concentrations.

Other Mitigation

To control dust on mine access roads, MMC would use either a chemical stabilization, groundwater, or segregated mine or adit water with nitrate concentrations of 1 mg/L or less and with concentrations of all other parameters below the mine drainage ELG. This mitigation would reduce the potential for adversely affecting water quality.

Closure and Post-Closure Phases

When the impoundment was no longer needed to store water from the seepage collection and pumpback well systems during the Closure or Post-Closure Phase, a channel would be excavated through the tailings and Saddle Dam abutment at the Poorman Impoundment to route runoff from the site toward a tributary of Little Cherry Creek. The runoff channel would be routed at no greater than 1 percent slope and along an alignment requiring the shallowest depth of tailings to be excavated down to the channel grade. The side slopes would be designed to a stable slope and covered with coarse rock to prevent erosion. As part of the final closure plan, MMC would complete a hydraulic and hydrologic (H&H) analysis of the proposed runoff channel during final design, and submit it to the lead agencies and the Army Corps of Engineers for approval. The H&H analysis would include a channel stability analysis and a sediment transport assessment. Based on the analysis, modifications to the final channel design would be made and minor modifications to the upper reaches of the tributary of Little Cherry Creek may be needed to minimize effects on channel stability in the tributary of Little Cherry Creek. These measures would minimize erosion and sedimentation of Little Cherry Creek.

Terrestrial Wildlife

MMC would implement a variety of measures designed to avoid, minimize, or mitigate effects on terrestrial wildlife. MMC would:

- Implement measures to reduce grizzly bear mortality risks, increase grizzly bear core habitat, improve movement corridors, improve habitat conditions in the BORZ, and ensure mitigation plan management.
- Implement a wildlife awareness program.
- Fund habitat enhancement on lynx stem exclusion habitat to mitigate for the physical loss of suitable lynx habitat.

- If a wolf den or rendezvous site was located in or near the project facilities by FWP wolf monitoring personnel, provide funding for FWP personnel to implement adverse conditioning techniques before wolves concentrate their activity around the den site (in early to mid-March) to discourage use of the den.
- Avoid removal of old growth habitat (effective or replacement) between April 1 and July 15 to avoid direct mortality to active nest sites for bird species using old growth habitat.
- Leave snags within the disturbance area unless required to be removed for safety or operational reasons.
- Fund surveys to monitor mountain goats.
- Avoid blasting at the entrance to any adit portals during May 15 to June 15 to avoid disturbance to the potential goat kidding area on Shaw Mountain.
- Do not remove vegetation in the nesting season to avoid direct mortality at active nest sites or complete surveys to locate active nests in appropriate habitat. If an active nest were found, an area surrounding the nest would be delineated and not disturbed until after the young fledged.
- Fund or conduct monitoring of landbird populations annually on two standard Region One monitoring transects within the Crazy and Silverfish Planning Subunits.

Vegetation

MMC would implement a variety of measures designed to avoid, minimize, or mitigate effects on plant populations. MMC would:

- Implement a Vegetation Removal and Disposition Plan to minimize vegetation clearing.
- Complete a survey for threatened, endangered, and Forest Service- and state-sensitive plant species on National Forest System lands for any areas where such surveys have not been completed and that would be disturbed by the alternative. If adverse effects could not be avoided, develop appropriate mitigation plans for the agencies' approval and implement the mitigation before any ground-disturbing activities.
- To the extent possible, survey all proposed ground disturbance areas for noxious weeds prior to initiating disturbance. Where noxious weeds were found, treat infestation the season before the activity was planned.
- Implement all weed BMPs identified in Appendix A of the KNF Invasive Plant Management Final EIS for all weed-control measures.
- Use reclamation success criteria to evaluate revegetation success before bond release.
- Modify all seed mixes to use of local native seed from the Forest Service Coeur d'Alene Nursery or the Kootenai Seed Mix (defined in Savage 2014)..
- Plant sufficient trees and shrubs to achieve 400 trees and 200 shrubs per acre 15 years after planting.
- Amend the top 0 to 4 inches of soil before seeding with an agencies-approved wood-based organic amendment to raise the organic matter level in the soil to a minimum of 1 percent by volume.
- Develop and implement a final Road Management Plan that would describe all new and reconstructed roads criteria that govern road operation, maintenance, and management; requirements of pre-, during-, and post-storm inspection and maintenance; regulation of traffic during wet periods to minimize erosion and sediment delivery and accomplish other objectives; implementation and effectiveness monitoring plans for road stability, drainage, and erosion control; and mitigation plans for road failures.

Section 230.76 – Actions Affecting Human Use

Dust Control

MMC would use BMPs during Construction, Operation, and Closure phases to control wind and water erosion. All appropriate precautions would be taken to minimize fugitive dust from all construction and operation activities related to the project, including concentrate transfer and loading activities at the Libby Loadout. These measures would include watering or applying dust-suppression agents on unpaved roads and work areas on an as-needed basis.

Dust emissions from ore crushing, conveying, and other handling activities would be controlled with water sprays, wet Venturi scrubbers, and enclosures. Such control devices would be included on the primary crusher located underground, the conveyor belt, and the ore stockpile adjacent to the mill facilities.

The tailings from the mill would be slurried through a pipeline to a tailings impoundment site. Excess water would be returned to the mill for reuse. Spigots distributing wet tailings material and water would cover about one-half of the total tailings at any time. The spigots would be moved regularly and would cause wetting of all non-submerged portions of the tailings impoundment to occur each day. This wetting would be supplemented by sprinklers as necessary when weather conditions could exist to cause fugitive dust. Water used by the sprinklers would be obtained from the water reclaim system, which returns water to the mill from the tailings impoundment. Although the tailings would be wetted with a sprinkler system, some drying may occur in the summer months.

The decision to operate sprinklers at the tailings impoundment would be made based on regular inspection of the tailings impoundment during the day and on weather criteria to be established as part of the fugitive dust-control plan. The presence of visible emissions, observed through shift inspection of the tailings impoundment on a regular basis during the day by environmental personnel trained in visual opacity monitoring and by shift operators staffing the tailings impoundment, would prompt sprinkler operation. In addition, specific thresholds for weather conditions such as wind speed, precipitation, and humidity would be developed as part of the fugitive dust-control plan to indicate the potential for fugitive dust emissions to occur, prompting sprinkler operation.

MMC would develop a general operating plan for the tailings impoundment site including a final fugitive dust control plan to control wind erosion from the tailings impoundment site. Before commencing operations, MMC would submit to the agencies for approval a general operation plan for the tailings impoundment site including the fugitive dust control plan. The plan would include, at a minimum, the embankment and cell (if any) configurations, a general sprinkler arrangement, and a narrative description of the operation, including tonnage rates, initial area, and timing of future enlargement. Should these measures not be adequate to control wind erosion from the impoundment, MMC would submit a revised plan to the agencies for approval, incorporating alternative measures, such as a temporary vegetative cover. At closure, MMC would maintain wind erosion control during the interim period after the end of active tailings deposition and before final reclamation of the site. Any revisions to these requirements in the final air quality permit would be implemented.

Tailings Pipeline Monitoring

MMC designed measures to prevent or mitigate ruptures in the tailings pipelines. MMC would construct a second sand fraction tailings line to use when the first line was in need of repair or replacement. The pipelines would be double-walled and fitted with air release/vacuum valves to ensure consistent flow. An automated leakage sensing system would continuously monitor line operation, and the sensing system would include the installation of magnetic flowmeters on the tailings line at the mill and at the tailings pond. If a flow differential signal were received at the control room, an alarm would sound, and the mill would be systematically shut down, starting with the feed conveyors to the grinding mills. Valves on the tailings line at the mill would be closed. The final tailings pump would bypass the cyclones and pump directly to the tailings thickener. Sensors would also be installed along each pipeline to monitor the space between the inner and outer pipes. If a leak were detected, the signal would be sent to the control room, and the shutdown procedures would be initiated. The surface pipelines between the mill and the tailings impoundment would be visually inspected each shift. An additional inspection would take place during scheduled maintenance shutdowns. The pipelines would be routed in a 24-foot-wide flat-bottom ditch to contain any leakage from the pipelines. An unlined 6-foot-wide ditch paralleling the entire length of the road and pipelines would intercept any released tailings. Containment and surface water runoff ditches would be constructed with an earthen berm between them. This berm would ensure that in the event of a rupture of the double-walled pipe, all tailings would remain in the ditch and not come in contact with surface waters. A lined flume and trestle would be constructed where the pipelines would cross Poorman Creek.

Impoundment Reclamation

At closure, the tailings impoundment would be reclaimed. Soils in the impoundment area would be replaced based on soil erodibility and slope steepness. For example, the least erodible colluvial/glacial soils having the greatest rock fragment content for both first lift and second lift soils, would be used on the impoundment face to minimize erosion potential. The soils with the greatest erodibility, primarily glaciolacustrine soils, would be used on slopes less than 8 percent, such as the relatively flat tailings impoundment surface. Soil salvage and redistribution would occur throughout the life of the mine operation. Soils should be handled and worked at the minimal moisture content to reduce the risk of compaction and tire rutting.

MMC would survey tailings settlement at closure on a 100-foot by 100-foot grid to document settlement. The area would be surveyed after borrow material used for fill was placed to create final reclamation gradients, and again after soil placement to ensure runoff gradients were achieved and soil thicknesses were met. Rocky borrow and geotextile would be needed for construction equipment to work on the tailings surface. MMC would use rocky borrow from within the disturbance area to provide erosion protection. Borrow material volumes would be determined during final design.

MMC would operate the seepage collection and the pumpback well systems until nonsignificance criteria or BHES Order limits were met without additional treatment. Long-term treatment may be required if water quality standards were not met. The length of time these closure activities would occur is not known, but may be decades or more. Following removal of the Seepage Collection Dam, the disturbed area would be graded to blend with the original slope. After nonsignificance criteria or BHES Order limits were met, seepage from the underdrains and seepage not intercepted by the underdrains would flow to Libby Creek.

MMC would develop a design to recontour faces of the tailings impoundment dams to closely blend with the surrounding landscape. Sand deposition would be varied during final cycloning and placement of sand on the dams. This design would incorporate additional rocky borrow at selected locations on the dam face and use benches in some locations. Islands of trees and shrubs would be planted in the rocky areas. The seed mixture on the dam face would vary to reduce uniformity of the revegetated dam.

Recreational Use

Current human use in the project area is primarily recreation. Effects on recreational experiences would be minimized by continuing to allow access to most areas within the analysis area. Recreational access to the area would be improved with improvements to Libby Creek Road (NFS road #231). Winter recreation access, with the exception of snowmobilers, would be improved because Libby Creek Road would be plowed.

To minimize noise effects, sound levels of all surface and mill equipment would not exceed 55 decibels (dBA), measured 250 feet from the mill for continuous periods exceeding an hour. Intake and exhaust ventilation fans in the Libby Adits would be adjusted to generate sounds less than 82 dBA measured 50 feet downwind of the portal. If necessary, specially designed low-noise fan blades or active noise-suppression equipment would be used.

MMC would design and construct a scenic overlook with information and interpretive signs on NFS road #231 (Libby Creek Road) downstream of the Midas Creek crossing with views of the tailings impoundment. MMC would develop two interpretative signs, one on the mining operation and another one on the mineral resource and geology of the Cabinet Mountains. Parking would be developed in cooperation with the KNF. MMC would pay the reimbursement funding for a volunteer campground host from Memorial Day through Labor Day at Howard Lake campground using a Volunteer Services Agreement for Natural Resources Agencies (Optional Form 301a) throughout the life of the project. MMC would shield or baffle night lighting at all facilities.

Section 230.77 – Other Actions

Controlling Runoff from Impoundment

Until the tailings impoundment was reclaimed, runoff from all fill material associated with impoundment construction, such as waste rock or tailings, would be subject to the Effluent Limit Guidelines (40 CFR 440.100). Diversion ditches at the toe of the impoundment dam would intercept all surface water runoff and route it to a Seepage Collection Pond. MMC would design all ditches and sediment ponds that would contain process water or mine drainage for a 100-year/24-hour storm; stormwater ditches that would contain stormwater would be sized to accommodate a 10-year/24-hour storm event.

Deposition of the tailings at closure would produce a final surface that would drain toward an unnamed tributary of Little Cherry Creek. Once all water from the tailings surface in the northern area of the impoundment had been removed (evaporated, or treated, if necessary, and discharged), and the near surface tailings had stabilized for equipment access, a channel would be excavated through the tailings and Saddle Dam abutment to route runoff from the site toward a tributary of Little Cherry Creek. The channel would be routed at no greater than 1 percent slope and along an alignment requiring the shallowest depth of tailings to be excavated down to the channel grade. The side slopes would be designed to a stable slope and covered with coarse rock to prevent erosion. The channel section through the abutment would be backfilled with a porous dam section designed to retain the PMF and dissipate the flood water at a flow rate of 2 cfs or within a 60-day period, whichever flow rate is the greater. As part of the final closure plan, MMC would complete a H&H analysis of the proposed diversion channel during final design, and submit it to the lead agencies and the Corps for approval. The H&H analysis would include a channel stability analysis and a sediment transport assessment. Based on the analysis, modifications to the final channel design would be made and minor modifications to the upper reaches of the tributary of Little Cherry Creek may be needed to minimize effects on channel stability in the tributary of Little Cherry Creek and to avoid allowing water to pond on the surface of the reclaimed tailings. Discharges may include structures of natural materials, such as boulders or rock/log weirs or vanes to protect stream banks where needed and coarse woody debris along the channel banks to increase surface roughness to reduce flow velocities. Other drainage alternatives for the surface of the reclaimed tailings impoundment that protect against erosion but also provide aquatic habitat may be developed with agency approval.

Water Releases

The dam associated with the Impoundment Site is designed primarily to retain tailings. Water would retained behind the dam with the tailings during construction and operations as part of an overall water management plan. No water would be released from the impoundment dam. All surface water runoff from the impoundment would be intercepted by diversion ditches and routed to a Seepage Collection Pond and pumped to the mill for reuse during operations. Seepage not captured by the seepage collection system at the tailings impoundment would be intercepted by the pumpback well system and pumped to the mill for reuse during operations. At closure, seepage intercepted by the pumpback well system would be sent to the Water Treatment Plant, or pumped back to the impoundment. MMC would continue to operate the seepage collection and pumpback well systems, and the Water Treatment Plant until nonsignificance criteria and BHES Order limits were met without treatment.

Maintaining Desired Water Quality

The project is not a dredging project funded by any federal agency. The existing Water Treatment Plant would be used solely to treat any waters prior to discharge at the existing MPDES-permitted outfalls. Water would not be discharged at the LAD Areas. MMC would maintain the current MPDES permit MT0030279 with three outfalls at the Libby Adit Site and the five stormwater outfalls described in the draft renewal permit, and request an amendment to the MPDES permit for additional stormwater outfalls. In the draft renewal MPDES permit, the DEQ preliminarily determined the size, configuration, and location of the mixing zones in Libby Creek for Outfalls 001, 002, and 003. The chronic groundwater mixing zone for Outfalls 001 and 002 authorized in the 1997-issued MPDES permit and continued in the 2006-issued MPDES permit was retained in the draft renewal MPDES permit. The mixing zone for Outfalls 001 and 002 extends from their point of discharge to Libby Creek downgradient to monitoring station LB-300 for these parameters: nitrate + nitrite, total inorganic nitrogen, chromium, copper, iron, lead, manganese, and zinc. For Outfalls 001, 002, and 003, the DEQ preliminarily authorized a chronic mixing zone, at 25 percent of the $7Q_{10}$, from the point of discharge two stream widths for the following parameters: nitrate + nitrite, total inorganic nitrogen, chromium, copper, iron, lead, manganese, and zinc. For Outfalls 001, 002, and 003, the DEQ also preliminarily authorized a nutrient mixing zone, at 100 percent of the 14-day, 5-year low flow ($14Q_5$), from the point of discharge two stream widths for the following parameters: total nitrogen, and total phosphorus. MMC did not requested a mixing zone for any discharges from Outfalls 004 through 008; any applicable effluent limitations must be met at the end-of-pipe discharge. The DEQ did not authorize a mixing zone for any parameters discharged from Outfalls 004 through 008 in the draft renewal permit. The draft renewal permit (DEQ 2015) contains the water quality assessment required before the DEQ could authorize a mixing zone. The final MPDES permit will contain DEQ's final determination regarding mixing zones and effluent limits.

All discharges of sediment from the Montanore Project via stormwater or the Water Treatment Plant would be subject to an annual limit. The DEQ and EPA established a sediment TMDL of 4,234 tons/year average annual load for Libby Creek from the US 2 bridge to the confluence with the Kootenai River. The DEQ and EPA (2014) determined that achieving a sediment Total Maximum Daily Load for lower Libby Creek, of which the Montanore Project's sediment wasteload allocation of 24 tons/year is a part, will allow lower Libby Creek to support and maintain their state-designated beneficial uses. A TMDL is the maximum amount of a pollutant a waterbody can receive and still meet water quality standards. As part of this TMDL, the Montanore facility was assigned a sediment wasteload allocation of 24 tons/year. This wasteload allocation, applied as a wasteload allocation for total suspended solids applicable to all permitted outfalls at the facility, including any future permitted outfalls, will be implemented in the final MPDES permit. Beginning on the effective date of the MPDES permit, MMC would monitor all discharges to surface water for sediment, and report sediment concentrations to DEQ annually (see Appendix C). Any failures of the sediment BMPs would require MMC to implement corrective measures in accordance with the MPDES permit.

SUBPART I – PLANNING TO SHORTEN PERMIT PROCESSING TIME

Section 230.80 – Advanced Identification of Disposal Areas

No advanced identification of possible future disposal sites or areas generally unsuitable for disposal site specification has been conducted beyond the sites described in this document and the EIS. The EIS includes an analysis of alternative locations for the tailings impoundment, Plant Site, adit sites, and transmission line alignments.

SUBPART J – COMPENSATORY MITIGATION FOR LOSSES OF AQUATIC RESOURCES

Section 230.93 – General Compensatory Mitigation Requirements

Compensatory mitigation is required for up to 9.4acres of jurisdictional wetlands and up to 19,058 linear feet of other waters. MMC's mitigation plan developed for Alternative 3 is described below. The Corps would be responsible for developing final mitigation requirements for jurisdictional wetlands and streams.

Wetland Mitigation

The proposed Swamp Creek off-site wetland mitigation area is about 4 miles east of the project area and encompasses 67 acres along US 2. The meadows cover an area of about 30 acres. In the early 1950s, a new channel of Swamp Creek was excavated across the property, enhancing surface water drainage and lowering the shallow groundwater surface. Other side ditches were excavated to channel water from several natural springs on the property. As a result of the ditching effort, productive hayfields were developed on the property.

MMC completed a wetland delineation in 2011 and the site has 20 acres of degraded wetland. MDT holds an easement on the property for a stabilization berm for reconstruction of US 2. The total area rehabilitated would be 18 acres, with 15 acres attributed to wetland mitigation and 3 acres attributed to stream restoration. Wetland rehabilitation is the manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions of degraded wetland. Rehabilitation results in a gain in wetland function but does not result in a gain in wetland acres (33 CFR 332.2, 40 CFR 230.92). Most of this degraded wetland area would be rehabilitated from the current condition of hayfields to a viable ecological habitat by planting wetland vegetation throughout the site, increasing water availability to the rooting zones of plants, and preventing cattle grazing on the property.

The Swamp Creek wetland mitigation project would be accomplished by completing the following specific activities: (1) prolong valley bottom flooding and near-surface groundwater levels by constructing meanders and raising the channel bottom of Swamp Creek and two spring-fed channels; (2) terminate hay production in the valley bottom; burn the grass (one or more times), followed by plowing the soil and seeding the area with wetland vegetation; 3 acres of this area would be used for riparian corridor planting along the stream channels; (3) plant willow/alder shrubs in separate "pods" throughout the 15-acre mitigation area in the valley bottom and around the springs to increase wetland diversity and habitat; (4) prohibit cattle grazing on the 18-acre meadow area and the Spring #1 area of the Swamp Creek property and (5) implement a weed control program to prevent invasion of undesirable species into the wetland mitigation areas.

A minimum 50-foot-wide vegetated upland vegetated buffer (3 acres) would be maintained around the wetland rehabilitation area. The east and west sides of the Swamp Creek property are bordered by National Forest System lands; the buffer zone around the wetland mitigation area would help provide some connectivity for the two sides of public land. Construction of the wetland mitigation area on the Swamp Creek property is expected to be conducted over a 2-year period prior to filling of wetlands at the

Poorman Impoundment Site. Once wetland rehabilitation and vegetation planting were completed, the residential house and other buildings on the site would be removed, which would improve overall habitat conditions on the entire 67-acre Swamp Creek property.

In Montana, reed canary grass is an “exotic” species that is not native to Montana. Reed canary grass is not considered a noxious weed but it is also not a desired species for wetland rehabilitation. Based on three sites evaluated, reed canary grass is makes up 25 to 80 percent of the cover of the Swamp Creek mitigation site. Reed canarygrass is difficult to control because it has vigorous, rapidly spreading rhizomes and forms a large seed bank. Control of reed canarygrass is most effective when it includes an integrated approach implemented in a sequential and timely order (Waggy 2010). MMC would complete a vegetation survey of the entire mitigation site to define distribution of the grass and presence of more desirable species. MMC’s initially would burn areas where reed canary grass is found during late spring. In areas where reed canary grass is dominant and/or pervasive, herbicides would be applied. Application of herbicide would be limited to areas where reed canary grass is the dominant species and where the vegetative survey did not identify sufficient quantities of desirable wetland species. Burning would be completed for the first 3 years to ensure long-term treatment. Vegetative surveys would be completed to assess the success of burning to reduce reed canary grass presence. Where mowing of the hayfield would reduce the presence of reed canary grass, it would be completed in conjunction with burning to reduce the ability of reed canary grass to produce seed heads. Vegetation monitoring would be conducted to ensure mowing is occurring effectively when combined with burning.

The water right associated with this Swamp Creek allows for flood irrigation of 26 acres of hay meadow. Rehabilitation of the site to improve its functions as a wetland would not require a water right. MMC would file for a change of use for this water right to an instream flow right. Any water right used for the Swamp Creek wetland and stream mitigation site would be conveyed to the Forest Service.

MMC would convey the title or a perpetual conservation easement of the Swamp Creek mitigation site to the Forest Service after the Corps has determined the sites’ performance standards have been met. The requirements for conveyance are described in the agencies’ grizzly bear mitigation plan. If a perpetual conservation easement was conveyed, the easement would allow for public access to the property. Known Native American Traditional Use Areas are on the uplands adjacent to the proposed Swamp Creek wetlands mitigation site and within the private land boundary. The upland areas at the Swamp Creek site protected by a conservation easement or conveyed to the Forest Service would be managed to protect and provide for future traditional cultural uses. Developed recreational use would not be encouraged.

The capacity of wetlands in the upper Libby Creek watershed to perform functions and services after mitigation and impacts would be 1.5 times greater, on average, than current conditions. The magnitude of overall change would vary for each function and service. The greatest gains in the capacity of wetlands in the upper Libby Creek watershed to perform functions and services would be water quality maintenance, flood attenuation, and improvement/creation of aquatic habitat. These functions would be improved greatly at the mitigations sites, with benefits that would extend to first and second order streams, and to Libby Creek (MMC 2014).

Stream Mitigation

Swamp Creek Site. The Swamp Creek stream mitigation would consist of constructing about 6,500 linear feet of new meandering channels, planting a 10-foot wide riparian zone on each side of the channels totaling about 3 acres, and removal of cattle on the property to prevent grazing along the channels. Three primary drainage channels located on the Swamp Creek site would be subject to channel restoration: main Swamp Creek channel and two tributary channels from Spring #2 and Spring #3. The Swamp Creek channel flows through the center of the valley bottom on this property. The two spring-fed drainages of Swamp Creek flow year-round, with Spring #2 having the highest flows (1.0 to 1.5 cfs baseflow).

The three Swamp Creek channels would be subject to reconstruction to natural meandering conditions that would be accomplished by completing the following: (1) reconstruct the channels to a meandering configuration, raise the channel bottom of Swamp Creek and two spring-fed channels, and incorporate small woody debris structures along some stream bank reaches; (2) plant riparian vegetation, including willow/alder shrubs, in a buffer zone along the new meandering channels to create a riparian corridor; and (3) protect the valley bottom area by prohibiting cattle grazing along Swamp Creek and tributary channels. Construction of the stream mitigation project on the Swamp Creek property is expected to be conducted over a 2-year period prior to filling wetlands at the impoundment site or along the access road.

In some reaches of the new channels, specific areas of hedge-brush layering, willow fascines, and/or salvaged wetland sod mats would be constructed on the channel banks as protection from erosion and to improve establishment of riparian vegetation. These features typically would be limited to selected locations along the outside bank of meanders. The abandoned segments of the original straight channels would be filled with soil from the excavated new channels, and planted with wetland vegetation. These fill areas would remain as slight topographic depressions to provide some small areas of open-water near the new stream channels during periods of high groundwater. A riparian buffer zone 10 feet wide (3 acres) would be developed along each side of the reconstructed channels. Riparian vegetation would be planted in these stream corridors where there is sufficient soil and sod to allow the successful plantings. Shrubs and herbaceous wetland vegetation would be planted in the riparian zone.

Little Cherry Creek Site

Stream mitigation at the Little Cherry Creek sites would consist of replacing the culvert at NFS road #6212 with a bridge, bottomless arch pipe, or a new culvert that would comply with USFS stream stimulation techniques. The culvert would be replaced before the project affected streams in the impoundment site.

Poorman Creek Sites

Stream mitigation at the Poorman Creek sites would consist of replacing one culvert across the creek at NFS road #278, removing one bridge on a decommissioned NFS road #6212, and stabilizing 400 feet of eroding cut slope adjacent to NFS road #6212. The bridge on NFS road #6212 across Poorman Creek would be removed during construction. MMC would dispose of the bridge structure in accordance with Forest Service policy on solid waste management. Concrete footers and reinforcement structures would be demolished and removed. Fill material that was placed to provide the proper elevation for the bridge structure and adjacent topography would be excavated and removed. Material removed from the bridge area would be relocated to the Poorman Impoundment to be used in construction of the impoundment or placed behind the impoundment. The culvert removal would follow procedures described for the Little Cherry Creek site.

Stream Improvements on Lands Acquired for Grizzly Bear Mitigation

MMC would convey the title to or a perpetual conservation easement on 5,466 acres of land to the Forest Service or private conservation organization independent of MMC for grizzly bear mitigation. All lands would be acquired before the start of the Construction Phase. The Forest Service would ensure that the specified acres of mitigation properties were managed for grizzly bear habitat in perpetuity. The grizzly bear mitigation plan also requires MMC to implement access management improvements, such as road decommissioning and culvert removal, on mitigation lands. MMC would conduct a survey to assess all mitigation lands for opportunities to improve aquatic resources. Some of the types of activities that would be conducted to mitigate streams include: remove culverts and restore the floodplain, restore disturbed riparian buffer areas by removing roads and revegetating, add woody debris to the floodplain, remove riprap and bridge abutments below the ordinary high water mark, remove berms and other impervious fill material, and install instream habitat features to increase the value to aquatic life. MMC would use the Corps' Montana Stream Mitigation Procedure and the Corps' compensatory mitigation regulations (33 CFR 332) in assessing mitigation opportunities. For the purposes of assessing stream mitigation credits, MMC identified 21 culverts that would be removed and adjacent riparian habitat would be restored on 908 linear feet of stream (MMC 2014).

Section 230.94 – Planning and Documentation

As part of the planning and documentation requirements for mitigation, MMC has been coordinating with the Corps Montana's Regulatory office. Several site meetings with the Corps were held between 2009 and 2013 to discuss potential mitigation sites and to incorporate Corps' input into the mitigation plan. MMC submitted a Section 404 permit application to the Corps for the agencies' preferred alternatives (Mine Alternative 3 and Transmission Line Alternative D-R) in 2011 (MMC 2011). The application described the amount and types of wetlands and other streams that would be affected by proposed facilities. The permit application also included a draft conceptual mitigation plan to mitigate impacts to wetlands and streams. The Corps and the DEQ jointly issued a 60-day public notice on the permit application in 2011. Because MMC had not submitted an application for 401 certification to the DEQ, the 2011 public notice is no longer valid for the 401 certification process.

Section 230.95 – Ecological Performance Standards

Swamp Creek Wetland Mitigation Site

The performance standards for the Swamp Creek wetland mitigation site proposed by MMC for Alternative 3 (MMC 2014) could be modified by the Corps in accordance with any 404 permit issued for the project. MMC would request that monitoring cease and the site be transferred to the KNF when the follow performance standards were met for two consecutive years a minimum of 2 years after active management ceased:

Wetlands

- Water saturation levels are within 12 inches of the surface, and/or standing water
- Water is present for at least 12.5 percent of the growing season (20 consecutive days) at the far edges of the hayfield where conditions currently were dewatered for agricultural use
- Aerial cover of facultative or wetter species cover meets or exceeds 60 percent of combined cover
- State listed noxious weeds do not exceed 10 percent after 5 years and for at least 2 consecutive years without maintenance to demonstrate sustainability of the site
- More than three wetland species are present, one species does not exceed 30 percent of the total cover, and reed canarygrass was not a dominant species for the vegetative community
- Planted and volunteer native woody species (alder, willow and other wetland species) are at least 174 stems per acre in the planted areas

Upland Buffer

- Maintain a predominance of native vegetative communities (including trees and shrubs) in the upland buffer areas. Native vegetation is at least 80 percent of the plant communities compared to surrounding upland areas
- MT state listed noxious weeds do not exceed 10 percent after five years and for at least two consecutive years without maintenance to demonstrate sustainability of the site
- Buffers remain undisturbed to the maximum extent practicable allowing for sound management practices

Swamp Creek Stream Mitigation Site

The performance standards for the Swamp Creek stream mitigation site proposed by MMC for Alternative 3 (MMC 2014) could be modified by the Corps in accordance with any 404 permit issued for the project. The Montana NRCS Riparian Assessment Method (MT RAM) would be used to evaluate performance of stream and riparian buffer areas. The MT RAM incorporates geomorphological features and processes (pattern, dimension, profile, incisement, and bank stability) with ecological features (riparian vegetation composition and condition) to quantitatively establish the system as Unsustainable, At Risk, or Sustainable. The stream bank and riparian buffer would meet the following performance standards before release of all credits:

1) Attain a cumulative rating score on the MT RAM of “Sustainable” for two consecutive years, including the final year of monitoring. Since component criteria in Questions 1 – 3 and Question 10 can be somewhat qualitative, the following would be used as a refinement:
   - One cross-section per 1,000 feet of assessed reach, beginning at the edge of the designated floodplain, and extending perpendicular across the stream to the opposite floodplain edge. Evidence of active headcuts or low vertical edge (scarp) at the toe of the stream bank, particularly on the inside of a meander, as determined by this cross-section would affect scoring negatively.
   - The project must experience at least one observed bank-full event during the monitoring period to successfully complete this rating; should the project not experience a bank-full event during the initial five-year monitoring period, the USACE may require additional monitoring until a bank-full event occurs. In the situation where a bank-full event has not occurred but all other performance standards have been met, a partial bond release would occur. Regarding scoring the scrub-shrub component of the riparian buffer where this is a component of the climax community, a calculation must be made to determine eventual coverage class of the buffer at maturity.
   - Using the Cowardin et al. classification for scrub-shrub areas of 30 percent cover at maturity, the standard would be 174 stems per acre of native shrub species (alder and willow). Should other species be proposed for the community, a separate calculation would be required for this performance standard based on the estimated canopy cover at maturity of the proposed species assemblage.
2) Less than 10 percent cover of exotic/noxious species as listed by the Montana Department of Agriculture, state noxious weeds list; and
3) Buffers remain undisturbed to the maximum extent practicable allowing for sound management practices.

Culvert Removal and Replacement and Bridge Removal

Monitoring and performance standards described for the Swamp Creek wetland and stream mitigation site would be used for culvert removal and replacement and bridge removal sites.

Section 230.96 – Monitoring

The Corps would use wetlands monitoring to determine if the compensatory mitigation was meeting the performance standards established in any 404 permit issued for the project. The monitoring described in this section may be modified in the 404 permit. Monitoring would follow the Corps’ Regulatory Guidance Letter (RGL 06-3) that addresses monitoring requirements for compensatory mitigation projects.

Wetland Mitigation Sites

Maintenance would consist of inspecting the site on an at least monthly schedule to identify any maintenance control problems, such as erosion, sedimentation, instability, weeds, wetland vegetation degradation, and structure/fence damage. If any such problems were identified, corrective action would be initiated promptly. Inspection results would be described in the annual monitoring report. A weed monitoring and control program would be implemented to minimize invasive species. The following tasks would be performed and photo-documented during the non-winter period (May-October) for the wetland mitigation site:

- ***Vegetation:*** Determine boundaries of dominant, species-based vegetation communities once per year during the last half of the growing season. Characterize plant type and density in quadrats established along one or more transects (depending on wetland size) through the center of representative new wetlands in each of the three mitigation areas. Locations and types of noxious weeds would be identified and noted on a site map.
- ***Hydrology:*** Monitor groundwater levels monthly during the growing season in piezometers installed within the mitigation areas and in nearby wetland and upland areas. Delineate presence or evidence of moving and/or standing surface water within the wetland areas. This information would be compared to the existing dewatered state to assure water is present for an extended period of time to support rehabilitation of the degraded wetlands.
- ***Soil:*** Characterize shallow soil conditions at representative locations in the new wetland area using soil cores/samples obtained from a hand-auger or sharpshooter shovel.
- ***Wildlife:*** Record direct and indirect observations of site use by mammals, reptiles, amphibians, and bird species. Indirect use indicators include tracks, scat, burrow, eggshells, skins, and bones.
- ***Functional Assessment:*** Evaluate functions and services once per year during the last half of the growing season using established lists of site-specific functions and services to be achieved at the new wetland site.

Photo-points would be established at each wetland mitigation site to document site-specific conditions and changes from year to year. Field information obtained for each of the above-listed six monitoring categories would be recorded on monitoring forms. The monitoring period would be sufficient to demonstrate that the mitigation met the performance standards, but not less than 5 years. Some aspects of compensatory mitigation may require inspections or monitoring more frequently than annually during the early stages of development to identify and address problems that may develop. Annually, the Corps would review all monitoring results to determine if changes to the monitoring program were warranted, and whether other mitigation measures were necessary. The Corps would also determine when monitoring could be terminated after successful self-sustaining mitigation sites were established.

Swamp Creek Stream Mitigation Site

Maintenance would consist of inspecting the site on an at least monthly schedule to identify any maintenance control problems, such as erosion, sedimentation, instability, weeds, wetland vegetation degradation, and structure/fence damage. If any such problems were identified, corrective action would be initiated promptly. Inspection results would be described in the annual monitoring report. A weed monitoring and control program would be implemented to minimize invasive species. The following monitoring would be performed and photo-documented during the non-winter period (May-October) for the stream mitigation project sites:

- ***Riparian Corridor:*** Characterize plant type and density, including locations and types of noxious weeds.

- ***Stream Channels:*** Assess stream cross-sections to monitor channel form and function, natural channel migration, vertical stability (down-cutting), sediment deposition, and stream bank vegetation development.
- ***Aquatic Life and Habitat:*** Characterize aquatic life and fisheries, where applicable, following accepted protocols.
- ***Functional Assessment:*** Evaluate functions and services based on site-specific goals.

Section 230.97 – Management

MMC would convey the title or a perpetual conservation easement of the Swamp Creek mitigation site to the Forest Service after the Corps has determined the sites' performance standards have been met. The requirements for conveyance are described in the grizzly bear mitigation plan. Any water right obtained for the wetland mitigation sites would be conveyed to the Forest Service. The final mitigation plan would include a description of management needs, cost estimates, and the funding mechanism that would be used to meet those needs.

Adaptive management is a strategy to address unforeseen changes in site conditions or other components of the compensatory mitigation project. If the compensatory mitigation project cannot be constructed in accordance with the approved final mitigation plan, or if performance standards were not being met as anticipated, MMC would notify the Corps, with approval required for any significant modification of the mitigation plan. Performance standards may be revised in accordance with adaptive management to account for measures taken to address deficiencies in the mitigation.

Adaptive management may include the following measures: 1) plant additional wetland vegetation species in areas where new growth is inadequate; 2) adjust site conditions to improve hydrologic conditions (e.g., promote more surface water retention at the site); 3) improve/enhance erosion control measures; 4) irrigate areas to improve vegetation growth; and/or 5) provide for additional access restrictions if human disturbance is occurring.

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