DEQ EXHIBIT A
APPENDIX OF LEGAL AUTHORITIES

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BEFORE THE BOARD OF ENVIRONMENTAL REVIEW
OF THE STATE OF MONTANA

IN THE MATTER OF:	)	**CASE NO. BER 2013-07 SM**
THE NOTICE OF APPEAL AND	)	
REQUEST FOR HEARING BY	)	
MONTANA ENVIRONMENTAL	)	
INFORMATION CENTER	)	
REGARDING DEQ 'S APPROVAL OF	)	
COAL MINE PERMIT NO. C1993 017	)	
ISSUED TO SIGNAL PEAK ENERGY	)	
LLC FOR BULL MOUNTAIN MINE NO.	)	
1 IN ROUNDUP, MT.	)	
	)	

APPENDIX OF LEGAL AUTHORITY FOR DEPARTMENT OF ENVIRONMENTAL QUALITY RESPONSE BRIEF

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A. Excerpts from MAPA—Montana Administrative Procedures Act

2-4-601. Notice. (1) In a contested case, all parties must be afforded an opportunity for hearing after reasonable notice.

(2) The notice must include:

(a) a statement of the time, place, and nature of the hearing;

(b) a statement of the legal authority and jurisdiction under which the hearing is to be held;

(c) a reference to the particular sections of the statutes and rules involved;

(d) a short and plain statement of the matters asserted. If the agency or other party is unable to state the matters in detail at the time the notice is served, the initial notice may be limited to a statement of the issues involved. Thereafter, upon application, a more definite and detailed statement must be furnished.

(e) a statement that a formal proceeding may be waived pursuant to 2-4-603.

2-4-603. Informal disposition and hearings -- waiver of administrative proceedings -- recording and use of settlement proceeds. (1) (a) Unless precluded by law, informal disposition may be made of any contested case by stipulation, agreed settlement, consent order, or default. A stipulation, agreed settlement, consent order, or default that disposes of a contested case must be in writing.

(b) Unless otherwise provided by law, if a stipulation, agreed settlement, consent order, or default results in a monetary settlement involving an agency or the state, settlement proceeds must be deposited in the account or fund in which the penalty, fine, or other payment would be deposited if the contested case had proceeded to final decision. If there is no account or fund designated for the fine, penalty, or payment in the type of action, then the settlement must be deposited in the general fund.

(c) If a stipulation, agreed settlement, consent order, or default results in a nonmonetary settlement involving an agency or the state, settlement proceeds, whether received by the state or a third party, must be recorded in a nonstate, nonfederal state special revenue account established pursuant to 17-2-102(1)(b)(i) for the purpose of recording nonmonetary settlements.

(2) Except as otherwise provided, parties to a contested case may jointly waive in writing a formal proceeding under this part. The parties may then use informal proceedings under 2-4-604. Parties to contested case proceedings held under Title 37 or under any other provision relating to licensure to pursue a profession or occupation may not waive formal proceedings.

(3) If a contested case does not involve a disputed issue of material fact, parties may jointly stipulate in writing to waive contested case proceedings and may directly petition the district court for judicial review pursuant to 2-4-702. The petition must contain an agreed statement of facts and a statement of the legal issues or contentions of the parties upon which the court, together with the additions it may consider necessary to fully present the issues, may make its decision.

2-4-623. Final orders -- notification -- availability. (1) (a) A final decision or order adverse to a party in a contested case must be in writing. A final decision must include findings of fact and conclusions of law, separately stated. Findings of fact, if set forth in statutory language, must be accompanied by a concise and explicit statement of the underlying facts supporting the findings. Except as provided in 75-2-213 and 75-20-223, a final decision must be issued within 90 days after a contested case is considered to be submitted for a final decision unless, for good cause shown, the period is extended for an additional time not to exceed 30 days.

(b) If an agency intends to issue a final written decision in a contested case that grants or denies relief and the relief that is granted or denied differs materially from a final agency decision that was orally announced on the record, the agency may not issue the final written decision without first providing notice to the parties and an opportunity to be heard before the agency.

(2) Findings of fact must be based exclusively on the evidence and on matters officially noticed.

(3) Each conclusion of law must be supported by authority or by a reasoned opinion.

(4) If, in accordance with agency rules, a party submitted proposed findings of fact, the decision must include a ruling upon each proposed finding.

(5) Parties must be notified by mail of any decision or order. Upon request, a copy of the decision or order must be delivered or mailed in a timely manner to each party and to each party's attorney of record.

(6) Each agency shall index and make available for public inspection all final decisions and orders, including declaratory rulings under 2-4-501. An agency decision or order is not valid or effective against any person or party, and it may not be invoked by the agency for any purpose until it has been made available for public inspection as required in this section. This provision is not applicable in favor of any person or party who has actual knowledge of the decision or order or when a state statute or federal statute or regulation prohibits public disclosure of the contents of a decision or order.

B. Excerpts from MSUMRA—Montana Code Annotated

The preamble attached to Ch. 361, L. 2003, (2003 Mont. Laws 1219-1220) amending MSUMRA provides:

"WHEREAS, Article II, section 3, of the Montana Constitution enumerates certain inalienable individual rights, including the right to a clean and healthful environment, the right of pursuing life's basic necessities, the right of enjoying and defending an individual's life and liberty, the right of acquiring, possessing, and protecting property, and the right of seeking individual safety, health, and happiness in all lawful ways; and

WHEREAS, the constitutionally enumerated rights are by their very nature bound to result in competing interests in specific fact situations; and

WHEREAS, Article IX, section 1, of the Montana Constitution provides that the state and each person shall maintain and improve a clean and healthful environment in Montana for present and future generations and directs the Legislature to provide for the administration and enforcement of this duty and also directs the Legislature to provide adequate remedies for the protection of the environmental life support system from degradation and to provide adequate remedies to prevent unreasonable depletion and degradation of natural resources; and

WHEREAS, the Legislature has reviewed the intent of the framers of the 1972 Montana Constitution as evidenced in the verbatim transcripts of the constitutional convention; and

WHEREAS, there is no indication that one enumerated inalienable right is intended to supersede other inalienable rights, including the right to use property in all lawful means; and

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WHEREAS, the Legislature, mindful of its constitutional obligation to provide for the administration and enforcement of the constitution, has enacted a comprehensive set of laws to accomplish the goals of the constitution, including the Montana Clean Indoor Air Act of 1979, Title 50, chapter 40, part 1, MCA; the Montana Environmental Policy Act, Title 75, chapter 1, parts 1 through 3, MCA; the Clean Air Act of Montana, Title 75, chapter 2, parts 1 through 4, MCA; water quality laws, Title 75, chapter 5, MCA; The Natural Streambed and Land Preservation Act of 1975, Title 75, chapter 7, part 1, MCA; The Montana Solid Waste Management Act, Title 75, chapter 10, part 2, MCA; The Montana Hazardous Waste Act, Title 75, chapter 10, part 4, MCA; the Comprehensive Environmental Cleanup and Responsibility Act, Title 75, chapter 10, part 7, MCA; the Montana Megalandfill Siting Act, sections 75-10-901 through 75-10-945, MCA; the Montana Underground Storage Tank Installer and Inspector Licensing and Permitting Act, Title 75, chapter 11, part 2, MCA; the Montana Underground Storage Tank Act, Title 75, chapter 11, part 5, MCA; the Montana Major Facility Siting Act, Title 75, chapter 20, MCA; the Open-Space Land and Voluntary Conservation Easement Act, Title 76, chapter 6, MCA; the Environmental Control Easement Act, Title 76, chapter 7, MCA; The Strip and Underground Mine Siting Act, Title 82, chapter 4, part 1, MCA; The Montana Strip and Underground Mine Reclamation Act, Title 82, chapter 4, part 2, MCA; The Opencut Mining Act, Title 82, chapter 4, part 4, MCA; and The Nongame and Endangered Species Conservation Act, Title 87, chapter 5, part 1, MCA.

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82-4-203. Definitions

(2) "Adjacent area" means the area outside the permit area where a resource or resources, determined in the context in which the term is used, are or could reasonably be expected to be adversely affected by proposed mining operations, including probable impacts from underground workings.

. . .

(5) "Aquifer" means any geologic formation or natural zone beneath the earth's surface that contains or stores water and transmits it from one point to another in quantities that permit or have the potential to permit economic development as a water source.

. . .

(25) "Hydrologic balance" means the relationship between the quality and quantity of water inflow to, water outflow from, and water storage in a hydrologic unit, such as a drainage basin, aquifer, soil zone, lake, or reservoir, and encompasses the dynamic relationships among precipitation, runoff, evaporation, and changes in ground water and surface water storage.

. . .

(32) "Material damage" means, with respect to protection of the hydrologic balance, degradation or reduction by coal mining and reclamation operations of the quality or quantity of water outside of the permit area in a manner or to an extent that land uses or beneficial uses of water are adversely affected, water quality standards are violated, or water rights are impacted. Violation of a water quality standard, whether or not an existing water use is affected, is material damage.

. . .

82-4-206. Procedure for contested case hearings. (1) An applicant, permittee, or person with an interest that is or may be adversely affected may request a hearing before the board on any of the following decisions of the department by submitting a written request stating the reason for the request within 30 days after the department's decision:

(a) approval or denial of an application for a permit pursuant to 82-4-231;

(b) approval or denial of an application for a prospecting permit pursuant to 82-4-226;

(c) approval or denial of an application to increase or reduce a permit area pursuant to 82-4-225;

(d) approval or denial of an application to renew or revise a permit pursuant to 82-4-221; or

(e) approval or denial of an application to transfer a permit pursuant to 82-4-238 or 82-4-250.

(2) The contested case provisions of the Montana Administrative Procedure Act, Title 2, chapter 4, part 6, apply to a hearing before the board under subsection (1).

82-4-222. Permit application -- application revisions. (1) An operator desiring a permit shall file an application that must contain a complete and detailed plan for the mining, reclamation, revegetation, and rehabilitation of the land and water to be affected by the operation. The plan must reflect thorough advance investigation and study by the operator, include all known or readily discoverable past and present uses of the land and water to be affected and the approximate periods of use, and provide:

. . .

(m) a determination of the probable hydrologic consequences of coal mining and reclamation operations, both on and off the mine site, with respect to the hydrologic regime and quantity and quality of water in surface water and ground water systems, including the dissolved and suspended solids under seasonal flow conditions and the collection of sufficient data for the mine site and surrounding areas, so that cumulative impacts of all anticipated mining in the area upon the hydrology of the area and particularly upon water availability can be made. However, this determination is not required until hydrologic information on the general area prior to mining is made available from an appropriate federal or state agency. The permit may not be approved until the information is available and is incorporated into the application. The determination of probable hydrologic consequences must include findings on:

(i) whether adverse impacts may occur to the hydrologic balance;

(ii) whether acid-forming or toxic-forming materials are present that could result in the contamination of ground water or surface water supplies;

(iii) whether the proposed operation may proximately result in contamination, diminution, or interruption of an underground or surface source of water within the proposed permit or adjacent areas that is used for domestic, agricultural, industrial, or other beneficial use; and

(iv) what impact the operation will have on:

(A) sediment yields from the disturbed area;

(B) acidity, total suspended and dissolved solids, and other important water quality parameters of local impact;

(C) flooding or streamflow alteration;

(D) ground water and surface water availability; and

(E) other characteristics required by the department that potentially affect beneficial uses of water in and adjacent to the permit area;

. . .

82-4-227. Refusal of permit -- applicant violator system. (1) An application for a prospecting, strip-mining, or underground-mining permit or major revision may not be approved by the department unless, on the basis of the information set forth in the application, in an onsite inspection, and in an evaluation of the operation by the department, the applicant has affirmatively demonstrated that the requirements of this part and rules will be observed and that the proposed method of operation, backfilling, grading, subsidence stabilization, water control, highwall reduction, topsoiling, revegetation, or reclamation of the affected area can be carried out consistently with the purpose of this part. The applicant for a permit or major revision has the burden of establishing that the application is in compliance with this part and the rules adopted under it.

. . .

(3) The department may not approve an application for a strip- or underground-coal-mining permit or major revision unless the application affirmatively demonstrates that:

(a) the assessment of the probable cumulative impact of all anticipated mining in the area on the hydrologic balance has been made by the department and the proposed operation of the mining operation has been designed to prevent material damage to the hydrologic balance outside the permit area; and

(b) the proposed strip- or underground-coal-mining operation would not:

(i) interrupt, discontinue, or preclude farming on alluvial valley floors that are irrigated or naturally subirrigated, excluding undeveloped rangelands that are not significant to farming on alluvial valley floors and excluding land about which the department finds that if any farming will be interrupted, discontinued, or precluded, it is of such small acreage as to be of negligible impact on the farm's agricultural production; or

(ii) materially damage the quantity or quality of water in surface water or underground water systems that supply the valley floors described in subsection (3)(b)(i).

82-4-231. Submission of and action on reclamation plan. (1) As rapidly, completely, and effectively as the most modern technology and the most advanced state of the art will allow, each operator granted a permit under this part shall reclaim and revegetate the land affected by the operation, except that underground tunnels, shafts, or other subsurface excavations need not be revegetated. Under the provisions of this part and rules adopted by the board, an operator shall prepare and carry out a method of operation, a plan of grading, backfilling, highwall reduction, subsidence stabilization, water control, and topsoiling and a reclamation plan for the area of land affected by the operation. In developing a method of operation and plans of grading, backfilling, highwall reduction, subsidence stabilization, water control, topsoiling, and reclamation, all measures must be taken to eliminate damages to landowners and members of the public, their real and personal property, public roads, streams, and all other public property from soil erosion, subsidence, landslides, water pollution, and hazards dangerous to life and property.

(2) The reclamation plan must set forth in detail the manner in which the applicant intends to comply with 82-4-232 through 82-4-234 and this section and the steps to be taken to comply with applicable air and water quality laws and rules and any applicable health and safety standards.

(3) The application for a permit or major revision of a permit, which must contain the reclamation plan, must be submitted to the department.

. . .

(10) In addition to the method of operation, grading, backfilling, highwall reduction, subsidence stabilization, water control, topsoiling, and reclamation requirements of this part and rules adopted under this part, the operator, consistent with the directives of subsection (1), shall:

. . .

(k) minimize the disturbances to the prevailing hydrologic balance at the mine site and in adjacent areas and to the quality and quantity of water in surface water and ground water systems both during and after strip- or underground-coal-mining operations and during reclamation by:

(i) avoiding acid or other toxic mine drainage by measures including but not limited to:

(A) preventing or removing water from contact with toxic-producing deposits;

(B) treating drainage to reduce toxic content that adversely affects downstream water upon being released to watercourses;

(C) casing, sealing, or otherwise managing boreholes, shafts, and wells and keeping acid or other toxic drainage from entering ground and surface waters;

(ii) (A) conducting strip- or underground-mining operations so as to prevent, to the extent possible using the best technology currently available, additional contributions of suspended solids to streamflow or runoff outside the permit area, but the contributions may not be in excess of requirements set by applicable state or federal law;

(B) constructing any siltation structures pursuant to subsection (10)(k)(ii)(A) prior to commencement of strip- or underground-mining operations, with the structures to be certified by a qualified registered engineer and to be constructed as designed and as approved in the reclamation plan;

(iii) cleaning out and removing temporary or large settling ponds or other siltation structures from drainways after disturbed areas are revegetated and stabilized and depositing the silt and debris at a site and in a manner approved by the department;

(iv) restoring recharge capacity of the mined area to approximate premining conditions;

(v) avoiding channel deepening or enlargement in operations that requires the discharge of water from mines;

(vi) preserving throughout the mining and reclamation process the essential hydrologic functions of alluvial valley floors in the arid and semiarid areas of the country;

(vii) designing and constructing reclaimed channels of intermittent streams and perennial streams to ensure long-term stability; and

(viii) any other actions that the department may prescribe;

. . .

C. Excerpts from MSUMRA—Administrative Code of Montana

17.24.301 DEFINITIONS The following definitions apply to all terms used in the Strip and Underground Mine Reclamation Act and subchapters 3 through 13 of this chapter:

. . .

(12) "Amendment" means any change in the mine or reclamation plan that results in expansion or decrease of the operation's permitted boundaries, excluding incidental boundary changes. See also "major revision," "minor revision," and "incidental boundary change." (31) "Cumulative hydrologic impacts" means the expected total qualitative and quantitative, direct and indirect effects of mining and reclamation operations on the hydrologic balance.

. . .

(32) "Cumulative hydrologic impact area" means the area, including, but not limited to, the permit and mine plan area within which impacts to the hydrologic balance resulting from the

proposed operation may interact with the impacts of all previous, existing and anticipated mining on surface and ground water systems. "Anticipated mining" includes, at a minimum, the entire projected lives through bond release of all operations with pending applications and all operations required to meet diligent development requirements for leased federal coal for which there is actual mine-development information available.

. . .

(66) "Major revision" means any change in the mining or reclamation plan that:
(a) results in a significant change in the postmining drainage plan;
(b) results in a change in the postmining land use;
(c) results in a significant change in the bonding level within the permitted area; or
(d) results in a change that may affect the reclaimability of the area or the hydrologic balance on or off of the permitted area.

. . .

(93) "Probable hydrologic consequences" means the projected results of proposed strip or underground mining operations that may reasonably be expected to alter, interrupt, or otherwise affect the hydrologic balance. The consequences may include, but are not limited to, effects on stream channel conditions and the aquatic habitat on the permit area and adjacent areas.

17.24.304 BASELINE INFORMATION: ENVIRONMENTAL RESOURCES
(1) The following environmental resources information must also be included as part of an application for a strip or underground mining permit:

. . .

(e) all hydrologic and geologic data necessary to evaluate baseline conditions, to evaluate the probable hydrologic consequences and cumulative hydrologic impacts of mining, pursuant to ARM 17.24.314(3) and (5) and 82-4-222, MCA, and to develop a plan to monitor water quality and quantity to address the requirements of ARM 17.24.314;
(f) hydrologic and geologic descriptions pursuant to (1)(e) including:
(i) a narrative and graphic account of ground water hydrology including, but not limited to:
(A) the lithology, thickness, structural controls, hydraulic conductivity, transmissivity, recharge, storage and discharge characteristics, extent of aquifer, production data, water quality analyses and other relevant aquifer characteristics for each aquifer within the mine plan area and adjacent areas;
(B) the results of a minimum of one year of quarterly monitoring of ground water for total dissolved solids, specific conductance corrected to 25^{o}C, pH, major dissolved cations (Ca, Mg, Na, K), major dissolved anions (SO_4, HCO_3, CO_3, Cl, NO_3), concentrations of dissolved metals as prescribed by the department, and water levels. These data must be generated in accordance with the standards contained in ARM 17.24.645(2), (3), and (6); and
(C) a listing of all known or readily discoverable wells and springs and their uses located within three miles downgradient from the proposed permit area and within one mile in all other directions unless hydrologic conditions justify different distances;
(ii) a narrative and graphic account of surface water hydrology within the mine plan area and adjacent areas including, but not limited to:

(A) the name, location, use, and description of all surface water bodies such as streams, lakes, ponds, springs, and impoundments; and

(B) descriptions of surface drainage systems sufficient to identify, in detail, the seasonal variations in water quantity and quality including, but not limited to:

(I) minimum, maximum, and average discharge conditions which identify critical low flow and peak discharge rates of streams and springs; and

(II) water quality data to identify the characteristics of surface waters discharging into or receiving flows from the proposed mine plan area, including total suspended solids, total dissolved solids, specific conductance corrected to 25$_{o}$C, pH, major dissolved cations (Ca, Mg, Na, K), major dissolved anions (SO_4, CO_3, HCO_3, NO_3, Cl), and concentrations of metals as prescribed by the department. Such data must be generated in accordance with the standards contained in ARM 17.24.646(1), (1)(a), (3), (5), and (6);

(iii) a description of alternative water supplies, not to be disturbed by mining, that could be developed to replace water supplies diminished or otherwise adversely impacted in quality or quantity by mining activities so as not to be suitable for the approved postmining land uses; and

(iv) such other information that the department determines is relevant;

. . .

(3) The application must also include a determination pursuant to (1) and (2) of the probable hydrologic consequences of the proposed mining operation, on the proposed mine plan area and adjacent areas, with respect to the hydrologic balance. This determination must:

(a) be based on appropriate information on environmental resources addressed in ARM 17.24.304 and other relevant information;

(b) list and summarize all probable hydrologic consequences of the proposed mining operation including:

(i) whether adverse impacts may occur to the hydrologic balance;

(ii) whether acid-forming or toxic-forming materials that could result in the contamination of surface or ground water supplies are present;

(iii) whether the proposed operation may proximately result in contamination, diminution or interruption of an underground or surface source of water within the proposed permit or adjacent areas which is used for domestic, agricultural, industrial or other legitimate purpose; and

(iv) what impact the proposed operation will have on:

(A) sediment yields from the disturbed area;

(B) acidity, total suspended and dissolved solids, and other important water quality parameters of local impact;

(C) flooding or streamflow alteration;

(D) ground water and surface water availability; and

(E) other characteristics as required by the department; and

(c) explain to what extent each hydrologic consequence can be mitigated by measures taken pursuant to (1) and (2).

(4) Whenever this determination in (3) indicates that adverse impacts to the hydrologic balance on or off the permit area may occur, the department shall require submission of supplemental information to evaluate such impacts and to evaluate plans for remedial and long-term reclamation activities.

(5) The department shall provide an assessment of the cumulative hydrologic impacts of the proposed operation and all anticipated mining upon surface and ground water systems in the

cumulative impact area. The cumulative hydrologic impact assessment must be sufficient to determine, for purposes of a permit decision, whether the proposed operation has been designed to prevent material damage to the hydrologic balance outside the permit area. The department may allow the applicant to submit data and analyses relevant to the cumulative hydrologic impact assessment with the permit application.

17.24.314 PLAN FOR PROTECTION OF THE HYDROLOGIC BALANCE (1) Each permit application must contain a detailed description, supported by appropriate maps, data, and other graphics, of the measures to be taken during and after the proposed mining activities to minimize disturbance of the hydrologic balance on and off the mine plan area and to prevent material damage to the hydrologic balance outside the permit area in accordance with subchapters 4 through 9. The measures must minimize disturbance of the hydrologic balance sufficiently to sustain the approved postmining land use and the performance standards of subchapters 5 through 12 and must provide protection of:

(a) the quality of surface and ground water systems, within both the proposed mine plan and adjacent areas, from the adverse effects of the proposed strip or underground mine operations;

(b) the rights of present users of surface and ground water; and

(c) the quantity of surface and ground water within both the proposed mine plan area and adjacent areas from adverse effects of the proposed mining activities, or to provide alternative sources of water in accordance with ARM 17.24.304 (1)(e) and (f) and 17.24.648, where the protection of quantity cannot be ensured.

(2) The description must include:

(a) a plan for the control, in accordance with ARM 17.24.631 through 17.24.652, of surface and ground water drainage into, through and out of the proposed mine plan area;

(b) a plan for the treatment, where required, of surface and ground water drainage from the area to be disturbed by the proposed operations, and proposed quantitative limits on pollutants in discharges subject to ARM 17.24.633 or other applicable state or federal laws. The plan must include design specifications, drawings, method of operation and control, and quality of discharge of the treatment facilities;

(c) a plan for the restoration of the approximate recharge capacity of the mine plan area in accordance with ARM 17.24.644; and

(d) plans for monitoring and semi-annual reporting of ground and surface water quality and quantity data collected and analyzed in accordance with ARM 17.24.304(1)(e) and (f), 17.24.645, and 17.24.646.

(3) The application must also include a determination pursuant to (1) and (2) of the probable hydrologic consequences of the proposed mining operation, on the proposed mine plan area and adjacent areas, with respect to the hydrologic balance. This determination must:

(a) be based on appropriate information on environmental resources addressed in ARM 17.24.304 and other relevant information;

(b) list and summarize all probable hydrologic consequences of the proposed mining operation including:

(i) whether adverse impacts may occur to the hydrologic balance;

(ii) whether acid-forming or toxic-forming materials that could result in the contamination of surface or ground water supplies are present;

(iii) whether the proposed operation may proximately result in contamination, diminution or interruption of an underground or surface source of water within the proposed permit or adjacent areas which is used for domestic, agricultural, industrial or other legitimate purpose; and

(iv) what impact the proposed operation will have on:

(A) sediment yields from the disturbed area;

(B) acidity, total suspended and dissolved solids, and other important water quality parameters of local impact;

(C) flooding or streamflow alteration;

(D) ground water and surface water availability; and

(E) other characteristics as required by the department; and

(c) explain to what extent each hydrologic consequence can be mitigated by measures taken pursuant to (1) and (2).

(4) Whenever this determination in (3) indicates that adverse impacts to the hydrologic balance on or off the permit area may occur, the department shall require submission of supplemental information to evaluate such impacts and to evaluate plans for remedial and long-term reclamation activities.

(5) The department shall provide an assessment of the cumulative hydrologic impacts of the proposed operation and all anticipated mining upon surface and ground water systems in the cumulative impact area. The cumulative hydrologic impact assessment must be sufficient to determine, for purposes of a permit decision, whether the proposed operation has been designed to prevent material damage to the hydrologic balance outside the permit area. The department may allow the applicant to submit data and analyses relevant to the cumulative hydrologic impact assessment with the permit application.

17.24.405 FINDINGS AND NOTICE OF DECISION (1) The department shall prepare written findings approving or denying an application . . ..

. . .

(6) The department may not approve an application submitted pursuant to ARM 17.24.401(1) unless the application affirmatively demonstrates and the department's written findings confirm, on the basis of information set forth in the application or information otherwise available that is compiled by the department, that:

. . .

(c) the hydrologic consequences and cumulative hydrologic impacts will not result in material damage to the hydrologic balance outside the permit area;

17.24.631 GENERAL HYDROLOGY REQUIREMENTS (1) The permittee shall plan and conduct mining and reclamation operations to minimize disturbance to the prevailing hydrologic balance and to prevent material damage to the prevailing hydrologic balance outside the permit area.

(2) Changes in water quality and quantity, in the depth to ground water, and in the location of surface water drainage channels must be minimized so that the postmining land use of the disturbed land is not adversely affected and applicable federal and state statutes and regulations are not violated.

(3)(a) The permittee shall conduct operations so as to minimize water pollution and shall, where necessary, use treatment methods to control water pollution. The permittee shall emphasize mining and reclamation practices that will prevent or minimize water pollution. Diversions of drainages must be used in preference to the use of water treatment facilities.

(b) Practices to control and minimize pollution include, but are not limited to, stabilizing disturbed areas through land shaping, diverting runoff, achieving quickly germinating and growing stands of temporary vegetation, regulating channel velocity of water, lining drainage channels with rock or vegetation, mulching, selectively placing and sealing acid-forming and toxic-forming materials, and selectively placing waste materials in backfill areas.

(4) If pollution can be controlled only by treatment, the permittee shall operate and maintain the necessary water treatment facilities for as long as treatment is required. The department may specify which practices, used to minimize water pollution, may be used on a permanent basis.

17.24.645 GROUND WATER MONITORING

. . .

(4) Whenever an applicant demonstrates by the use of the probable hydrologic consequences determination (see ARM 17.24.314) and other available information that a particular water bearing stratum in the proposed permit or adjacent areas does not have a significant role in maintaining the hydrologic balance within the cumulative impact area, the department may waive monitoring of that stratum.

. . .

D. Excerpts from the Montana Regulations on Groundwater Quality

17.30.602 DEFINITIONS In this subchapter the following terms have the meanings indicated below and are supplemental to the definitions given in 75-5-103, MCA:

. . .

(7) "Electrical conductivity (EC)" means the ability of water to conduct an electrical current at 25ºC. The electrical conductivity of water represents the amount of total dissolved solids in the water and is expressed as microSiemens/centimeter (µS/cm) or micromhos/centimeter (µmhos/cm) or equivalent units and is corrected to 25ºC.

17.30.1001 DEFINITIONS The following definitions, in addition to those in 75-5-103, MCA, apply throughout this subchapter:

. . .

(8) "Montana ground water quality standards" means the standards for ground water quality set forth in ARM 17.30.1006.

. . .

17.30.705 NONDEGRADATION POLICY--APPLICABILITY AND LEVEL OF PROTECTION
(1) The provisions of this subchapter apply to any activity of man resulting in a new or increased source which may cause degradation.
(2) Department review of proposals for new or increased sources will determine the level of protection required for the impacted water as follows:
(a) For all state waters, existing and anticipated uses and the water quality necessary to protect those uses must be maintained and protected.
(b) For high quality waters, degradation may be allowed only according to the procedures in ARM 17.30.708. These rules apply to any activity that may cause degradation of high quality waters, for any parameter, unless the changes in existing water quality resulting from the activity are determined to be nonsignificant under ARM 17.30.670, 17.30.715, or 17.30.716. If degradation of high quality waters is allowed, the department will assure that within the United States Geological Survey hydrologic unit upstream of the proposed activity, there shall be achieved the highest statutory and regulatory requirements for all point and nonpoint sources. This assurance will be achieved through ongoing administration by the department of mandatory programs for control of point and nonpoint discharges.

(c) For outstanding resource waters, no degradation is allowed and no permanent change in the quality of outstanding resource waters resulting from a new or increased point source discharge is allowed.
(3) The department will comply with the provisions of the Montana Environmental Policy Act in the implementation of this subchapter. (History: 75-5-301, 75-5-303, MCA; IMP, 75-5-303, MCA; NEW, 1994 MAR p. 2136, Eff. 8/12/94; TRANS, from DHES, 1996 MAR p. 1499; AMD, 2000 MAR p. 843, Eff. 3/31/00; AMD, 2006 MAR p. 528, Eff. 2/24/06.)

17.30.1006 CLASSIFICATIONS, BENEFICIAL USES, AND SPECIFIC STANDARDS FOR GROUND WATERS (1) Class I ground waters are those ground waters with a natural specific conductance less than or equal to 1,000 microSiemens/cm at 25ºC.

(a) The quality of Class I ground water must be maintained so that these waters are suitable for the following beneficial uses with little or no treatment:

(i) public and private water supplies;

(ii) culinary and food processing purposes;

(iii) irrigation;

(iv) drinking water for livestock and wildlife; and

(v) commercial and industrial purposes.

(b) Except as provided in ARM 17.30.1005(2), a person may not cause a violation of the following specific water quality standards in Class I ground water:

(i) the human health standards for ground water listed in DEQ-7;

(ii) for concentrations of parameters for which human health standards are not listed in DEQ-7, no increase of a parameter to a level that renders the waters harmful, detrimental, or injurious to the beneficial uses listed for Class I water. The department may use any pertinent credible information to determine these levels; and

(iii) no increase of a parameter that causes a violation of the nondegradation provisions of 75-5-303, MCA.

(2) Class II ground waters are those ground waters with a natural specific conductance that is greater than 1,000 and less than or equal to 2,500 microSiemens/cm at 25ºC.

(a) The quality of Class II ground water must be maintained so that these waters are at least marginally suitable for the following beneficial uses:

(i) public and private water supplies;

(ii) culinary and food processing purposes;

(iii) irrigation of some agricultural crops;

(iv) drinking water for livestock and wildlife; and

(v) most commercial and industrial purposes.

(b) Except as provided in ARM 17.30.1005(2), a person may not cause a violation of the following specific water quality standards for Class II ground water:

(i) the human health standards for ground water listed in DEQ-7;

(ii) for concentrations of parameters for which human health standards are not listed in DEQ-7, no increase of a parameter to a level that renders the waters harmful, detrimental, or injurious to the beneficial uses listed for Class II water. The department may use any pertinent credible information to determine these levels; and

(iii) no increase of a parameter that causes a violation of the nondegradation provisions of 75-5-303, MCA.

(3) Class III ground waters are those ground waters with a natural specific conductance that is greater than 2,500 and less than or equal to 15,000 microSiemens/cm at 25ºC.

(a) The quality of Class III ground water must be maintained so that these waters are at least marginally suitable for the following beneficial uses:

(i) irrigation of some salt tolerant crops;
(ii) some commercial and industrial purposes;
(iii) drinking water for some livestock and wildlife; and
(iv) drinking, culinary, and food processing purposes where the specific conductance is less than 7,000 microSiemens/cm at 25ºC.

(b) Except as provided in ARM 17.30.1005(2), a person may not cause a violation of the following specific water quality standards for Class III ground water:

(i) the human health standards listed in DEQ-7, except that the nitrate nitrogen and nitrate plus nitrite nitrogen standards listed in DEQ-7 do not apply to ground waters with a specific conductance equal to or greater than 7,000 microSiemens/cm at 25ºC. The nitrate nitrogen and nitrate plus nitrite nitrogen standards for these waters are each 50 mg/l; and

(ii) for concentrations of parameters for which human health standards for ground water are not listed in DEQ-7, no increase of a parameter to a level that renders the waters harmful, detrimental, or injurious to the beneficial uses listed for Class III water. The department may use any pertinent credible information to determine these levels.

(c) The nondegradation provisions of 75-5-303, MCA, do not apply to Class III ground water.

(4) Class IV ground waters are those ground waters with a natural specific conductance greater than 15,000 microSiemens/cm at 25_oC.

(a) The quality of Class IV ground waters must be maintained so that they are suitable for some industrial and commercial uses.

(b) Except as provided in (5) and ARM 17.30.1005(2), a person may not cause a violation of the following specific water quality standards for Class IV ground water:

(i) the human health standards for parameters categorized as carcinogens in DEQ-7;

(ii) for concentrations of parameters in DEQ-7 which are not listed as carcinogens, no increase of a parameter to a level that would adversely affect existing beneficial uses. The nitrate nitrogen and nitrate plus nitrite nitrogen standards are each 50 mg/l;

(iii) for concentrations of parameters for which human health standards are not listed in DEQ-7, no increase of a parameter to a level that would adversely affect existing beneficial uses. The department may use any pertinent credible information to determine these levels.

(c) The nondegradation provisions of 75-5-303, MCA, do not apply to Class IV ground water.

(5) For Class III or IV waters, where it can be demonstrated to the satisfaction of the department that the field hydraulic conductivity is less than 0.1 feet per day in an affected or potentially affected ground water zone, the nitrate nitrogen and nitrate plus nitrite nitrogen standards in (3)(b)(i) and (4)(b)(ii) do not apply, provided that all existing and anticipated uses of the ground waters are protected.

<u>17.30.715 CRITERIA FOR DETERMINING NONSIGNIFICANT CHANGES IN WATER QUALITY</u> (1) The following criteria will be used to determine whether certain activities or classes of activities will result in nonsignificant changes in existing water quality due to their low potential to affect human health or the environment. These criteria consider the quantity and strength of the pollutant, the length of time the changes will occur, and the character of the pollutant. Except as provided in (2), changes in existing surface or ground water quality resulting from the activities that meet all the criteria listed below are nonsignificant, and are not required to undergo review under 75-5-303, MCA:

. . .

(g) changes in the quality of water for any parameter for which there are only narrative water quality standards if the changes will not have a measurable effect on any existing or anticipated use or cause measurable changes in aquatic life or ecological integrity.

. . .

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DEQ DIRECTORS OFFICE

November 18, 2013

Board of Environmental Review
Department of Environmental Quality
Metcalf Building
1520 East Sixth Avenue
PO Box 200901
Helena, Montana 59620-0901

RE: Bull Mountain Mine No. 1, Permit ID: C1993017

NOTICE OF APPEAL AND REQUEST FOR HEARING

The Montana Environmental Information Center (MEIC), pursuant to Montana Code Annotated § 82-4-206(1)-(2), and Montana Administrative Code 17.24.425(1), hereby files its notice of appeal and request for hearing regarding Montana Department of Environmental Quality (DEQ) approval of Bull Mountain Mine No. 1 Permit ID C1993017, on October 18, 2013. MEIC further requests that the Board of Environmental Review or its appointed hearing examiner hold a hearing on this appeal.

MEIC states that the grounds for this appeal include but are not limited to the following:

1. DEQ's determination that the proposed mine expansion was designed to prevent material damage to the hydrologic balance outside the permit area was arbitrary and capricious and not in accordance with the law because the assessment employed the incorrect legal standard.
2. DEQ's determination that the proposed mine expansion was designed to prevent material damage to the hydrologic balance outside the permit area was arbitrary and capricious and not in accordance with the law because the permit application did not affirmatively demonstrate and DEQ could not, therefore, rationally conclude that the proposed mine expansion was designed to prevent material damage to the hydrologic balance.

Respectfully submitted this 18th day of November, 2013,

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Counsel for Montana Environmental Information Center

Appendix I

Bull Mountains Mine No. 1

Cumulative Hydrologic Impact Assessment

Amendment 3

TABLE OF CONTENTS

Acronyms used within this document.	
Acronym	**Definition**
ARM	Administrative Rules of Montana
CDFA	Cumulative Departure From Average
CHIA	Cumulative Hydrologic Impact Assessment
CIA	Cumulative Hydrologic Impact Area
DEQ	Department of Environmental Quality
DNRC	Department of Natural Resources and Conservation
EPA	Environmental Protection Agency
GWIC	Groundwater Information Center
LOM	Life of Mine
MBMG	Montana Bureau of Mines and Geology
MCA	Montana Code Annotated
MCL	Maximum Contaminant Levels
MPDES	Montana Pollutant Discharge Elimination System
MSUMRA	Montana Strip and Underground Mine Reclamation Act
NRWQC	National Recommended Water Quality Criteria
NSDWR	National Secondary Drinking Water Regulations
OSMRE	Office of Surface Mining Reclamation and Enforcement
PHC	Probable Hydrologic Consequences
PMT	Post Mine Topography
SMCRA	Surface Mining Reclamation and Control Act
SPE	Signal Peak Energy LLC
SWL	Static Water Elevation
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
USGS	United States Geological Survey

1.0 INTRODUCTION

The Montana Department of Environmental Quality (DEQ) is the regulatory authority for coal mining operations in the state of Montana and implements the Montana Strip and Underground Mine Reclamation Act (MSUMRA) and the administrative rules pursuant to the Act. The Federal Office of Surface Mining Reclamation and Enforcement (OSMRE) implements the Surface Mining Reclamation and Control Act of 1977 (SMCRA), and has granted primacy to DEQ as the regulatory agency for coal mining in Montana. As such, DEQ is responsible for the review and decisions on all permit applications to conduct surface coal mining operations within the state with oversight from OSMRE.

This assessment of cumulative hydrologic impacts is prepared by DEQ as part of the permit review process for Amendment 3, submitted by Signal Peak Energy, LLC (SPE) for the Bull Mountains Mine No. 1 (SMP C1993017). It includes an analysis of anticipated hydrologic impacts associated with mining in and adjacent to the proposed permit area.

2.0 REGULATORY ENVIRONMENT

Administrative Rule of Montana (ARM) 17.24.314(1) requires that DEQ determine that a given proposed mining and reclamation operation has been designed to minimize disturbance to the hydrologic balance on and off the mine plan area, and prevent material damage[1] to the hydrologic balance[2] outside the permit area. In order to evaluate whether the proposed mining and reclamation plan has been designed to prevent material damage, a Cumulative Hydrologic Impact Assessment (CHIA) is prepared by DEQ. Prior to making a permitting decision, DEQ makes an assessment of cumulative hydrologic impacts of all existing and anticipated mining operations. The CHIA analysis must be sufficient to determine whether mining impacts to the hydrologic balance on and off the permit area have been minimized and material damage outside the permit area has been prevented [ARM 17.24.314(5)].

2.1 MATERIAL DAMAGE CRITERIA

Following the definition of material damage in 82-4-203(31), Montana Code Annotated (MCA), material damage criteria are established for the evaluation of both groundwater and surface water quality and quantity, and are used to determine whether water quality standards and beneficial uses of water, including water rights, outside the permit boundary have been or are expected to be impacted by mining activities. The interruption or diminution of a surface water or groundwater supply to the extent that an existing use is precluded is considered to be material damage. When material damage occurs mitigation is required; mitigation would include dependable, long-term replacement of a resource acceptable for the designated use [ARM 17.24.314(1)(c) and 17.24.648] or treatment to return water quality to state standards.

Material damage criteria include applicable numeric and narrative water quality standards, and criteria established to protect existing beneficial uses of water. Baseline water quantity and quality is compared against changes or anticipated changes in quantity and quality associated with mine activity to determine if uses have been impacted or water quality standards exceeded outside the permit boundary. Threshold criteria are used by DEQ to identify potential problems in water quality and quantity before these problems escalate to material damage (**Table 2-1**).

The Montana Water Quality Act (MWQA) is the primary basis for water quality protection in the state of Montana. Rules promulgated under the authority of MWQA establish surface water and groundwater standards [ARM 17.30.subchapter 6 and 17.30.subchapter 7] to protect the designated beneficial uses of state waters. Numeric standards published in Circular DEQ-7, Montana Numeric Water Quality Standards, were developed using guidance from the Environmental Protection Agency (EPA) which includes:

[1] "Material damage" means, with respect to the protection of the hydrologic balance, degradation or reduction by coal mining and reclamation operations of the quality or quantity of water outside of the permit area in a manner or to an extent that land uses or beneficial uses of water are adversely affected, water quality standards are violated, or water rights are impacted. Violation of a water quality standard, whether or not an existing water use is affected, is material damage. [82-4-203(31), MCA]

[2] "Hydrologic balance" means the relationship between the quality and quantity of water inflow to, water outflow from, and water storage in a hydrologic unit, such as a drainage basin, aquifer, soil zone, lake, or reservoir, and encompasses the dynamic relationships among precipitation, runoff, evaporation, and changes in ground water and surface water storage. [82-4-203(24), MCA]

- National Recommended Water Quality Criteria (NRWQC) developed under Section 304(a) of the Clean Water Act
- Drinking Water Lifetime Health Advisory (HA) and Maximum Contaminant Levels (MCL) developed under the Safe Drinking Water Act

Montana's surface water and groundwater rules also contain narrative standards [ARM 17.30.620 through 17.30.670 and 17.30.1001 through 17.30.1045]. The narrative standards are designed to address water quality for which sufficient information does not yet exist to develop parameter-specific numeric standards. These narrative standards are established to protect beneficial uses from adverse effects, supplementing the existing numeric standards.

2.1.1 Surface Water Material Damage Criteria

Material damage to surface water occurs when, as a result of mining, any of the following are met:

- Surface water quality standards outside of the permit area are violated
- Land uses or beneficial uses of water outside of the permit area are adversely affected to the extent that an existing use is precluded
- A surface water right is adversely impacted

Material damage criteria for surface waters[3] include the numeric water quality standards established in Circular DEQ-7 (where applicable) and water use criteria established for parameters where specific numeric standards have not been developed. Surface water quality standards contained in ARM 17.30.620 through 17.30.670 vary according to stream classification. Numeric standards for parameters including *Escherichia coli* bacteria, color, turbidity, pH, and temperature, change with stream classification. Surface waters in the Bull Mountains Mine area are classified as C3 surface waters [ARM 17.30.611]. Beneficial uses of surface waters are established according to the streams' water use classification. Specific water quality standards (along with general provisions) protect the established beneficial uses for each classification [ARM 17.30.620].

Beneficial uses of C3 waters are given in ARM 17.30.629:

> *"Waters classified C-3 are to be maintained suitable for bathing, swimming, and recreation, and growth and propagation of non-salmonid fishes and associated aquatic life, waterfowl, and furbearers. The quality of these waters is naturally marginal for drinking, culinary, and food processing purposes, agriculture, and industrial water supply. Degradation which will impact established beneficial uses will not be allowed."*

With the exception of some spring-fed stream reaches and stockwater ponds, surface waters in the vicinity of the Bull Mountains Mine are typically ephemeral[4], flowing only in response to precipitation

[3] "Surface waters" means any waters on the earth's surface including, but not limited to, streams, lakes, ponds, and reservoirs; and irrigation and drainage systems discharging directly into a stream, lake, pond, reservoir, or other surface water. Water bodies used solely for treating, transporting, or impounding pollutants shall not be considered surface water. [ARM 17.30.602(33)]

[4] "Ephemeral stream" means a stream or part of a stream which flows only in direct response to precipitation in the immediate watershed or in response to the melting of a cover of snow and ice and whose channel bottom is always above the local water table. [ARM 17.30.602(12)]

events or for short reaches below the issue point of springs or seeps. As stated in ARM 17.30.637(6), "*Ephemeral streams are subject to ARM 17.30.635 through 17.30.637, 17.30.640, 17.30.641, 17.30.645, and 17.30.646 but not to the specific water quality standards of ARM 17.30.620 through 17.30.629*" (including Circular DEQ-7, Montana Numeric Water Quality Standards).

Applicable water quality standards for ephemeral surface waters are therefore predominantly narrative and primarily include the General Treatment Standards [ARM 17.30.635], General Operational Standards [ARM 17.30.636], General Prohibitions [ARM 17.30.637], and other descriptive portions of the surface water quality standards.

Numeric surface water standards for perennial and intermittent streams are in **Table 2-2**. This list is not exhaustive, and only includes selected parameters known to be potentially associated with coal mining impacts that are monitored by Montana coal mines. These numeric water quality standards apply to perennial/intermittent streams only and not to ephemeral streams.

The predominant beneficial use of surface water in the area is drinking water for livestock and wildlife. Water quality guidelines established for livestock use (**Table 2-3**) are based on limits for livestock consumption found in documents published by the Montana Extension Service (Sigler and Bauder, 2012, Hutcheson, 2001). These are not enforceable standards but are used by DEQ for guidance in evaluating suitability of pre- and postmine water quality for livestock use. It is not uncommon for water quality in the area to naturally exceed these livestock water quality guidelines.

Surface water availability is variable in the Bull Mountains area. Surface water quantity is generally governed by the seasonal runoff from storms and snow melt. Runoff models submitted with as-built pond designs model the water and sediment retention of sediment control ponds. These models are also used to assess water quantity impacts to downstream users and uses from the capture and/or attenuation of storm runoff. Runoff from areas disturbed by mining operations is required to be managed in a manner that prevents surface water pollution (e.g. increased suspended solids, changes in pH, increases in metals of concern, etc.) outside the permit area to the extent possible with the best technology currently available [ARM 17.24.633].

Impacts to surface water supply and water rights are evaluated with respect to regional and local impacts to surface water resources and natural variations in seasonal and yearly runoff. Mitigation for the loss of a beneficial use of surface water or a water right requires provision of a dependable, long-term replacement water resource of acceptable quality for the designated use and adequate quantity to support the existing and/or planned future use [ARM 17.24.314(1)(c) and 17.24.648].

Material damage criteria are therefore a combination of applicable narrative standards, numeric standards, and livestock beneficial use criteria. Impacts to surface water rights are evaluated on a case-by-case basis, and include an analysis of climatic conditions and the natural availability of surface water.

2.1.2 Groundwater Material Damage Criteria

Groundwater material damage occurs when, as a result of mining, any of the following circumstances occur:

- Groundwater quality standards outside of the permit area are violated

- Land uses or beneficial uses of groundwater outside of the permit area are adversely affected to the extent that an existing use is precluded
- A groundwater right is adversely impacted

Protection of groundwater quality for beneficial uses is based on narrative standards established by ARM 17.30.1006 (**Table 2-4**) and numeric standards for individual parameters in Circular DEQ-7 (**Table 2-2**). Water quality guidelines established for livestock use are shown in **Table 2-3**. Groundwater quality in the area may naturally exceed these livestock water quality guidelines. Groundwater released from the mine is not required to be purer than natural, background conditions [75-5-306, MCA and ARM 17.30.629(2)(k)].

Beneficial uses of groundwater outside the permit boundary include livestock and domestic use. Wells completed in the alluvium, overburden, and underburden supply livestock water. Wells for domestic use typically have reported completion depths that suggest utilization of groundwater from the underburden. The location of private wells and water rights are discussed in Section 6.0, Water Resource Uses.

Water levels and water quality are monitored inside and outside the permit boundary to establish baseline conditions and measure subsequent changes so that impacts during and after mining can be anticipated and evaluated. Analytical results of water quality parameters most likely to be affected by mining are compared to standards to determine suitability of the water for current and anticipated uses. The amount of change to water quality or quantity that can be tolerated before material damage results will depend upon the baseline water level and water quality at a given location. Baseline water levels or water quality that is marginally supportive of a given use are more vulnerable to changes that would cause material damage than water levels or water quality more supportive of an established use.

A transient groundwater flow model was developed to predict drawdown impacts to water levels in aquifers affected by operations at the Bull Mountains Mine. Impacts to wells and springs located within the modeled drawdown area can be anticipated and mitigated to avoid material damage. Mitigation for the loss of a beneficial use of groundwater or a water right requires providing a dependable, long-term replacement water resource of acceptable quality for the designated use and adequate quantity to support the existing and/or planned future use [ARM 314.24.314(1)(c) and 17.24.648].

2.2 CUMULATIVE HYDROLOGIC IMPACT ASSESSMENT

The Cumulative Hydrologic Impact Assessment (CHIA) includes an assessment of the Probable Hydrologic Consequences (PHC) of the proposed operation (Nicklin, 2013[1]). The PHC determination is prepared by the applicant [ARM 17.24.314(3)] and approved by the regulatory authority (DEQ). Prior to making a permitting decision, DEQ makes an assessment of all hydrologic impacts of the proposed operation, existing, previous, or anticipated mining that collectively impact surface and groundwater systems in a cumulative impact area. The CHIA analysis must determine whether mining impacts to the hydrologic balance on and off the permit area have been minimized and material damage outside the permit area has been prevented [ARM 17.24.314(5)]. The hydrologic balance is defined as "the relationship between the quality and quantity of water inflow to, outflow from, and storage in a hydrologic unit such as a drainage basin, aquifer, soil zone, lake, or reservoir, and encompasses the dynamic relationships among precipitation, runoff, evaporation, and changes in ground and surface water storage as they relate to uses of land and water within the area affected by mining and the adjacent area" [ARM 17.24.301(54)].

CHIA development involves the analysis of critical aspects of the hydrologic system within a defined cumulative impact area to predict the type and magnitude of impacts to the hydrologic system from proposed and existing mining. The CHIA process includes the following: 1) define the area to the studied, 2) describe the hydrologic system, the baseline values, and subsequent changes, 3) identify hydrologic resources likely to be affected, 4) develop criteria for evaluating the impacts, 5) estimate the impacts of mining on hydrologic resources, and 6) make a material damage determination and prepare a statement of findings.

3.0 PROPOSED PERMITTING ACTION

Signal Peak Energy, LLC (SPE) submitted Permit Amendment Application No. 3 that would increase the mine permit area of their underground coal mine (Bull Mountain Mine No. 1) by adding 7,161 acres and expanding the mine from five longwall panels (approved under Amendment 00187) to fourteen longwall panels (**Figure 3-1**). This area is included in 18 sections within Township 6 North, Range 27 East.

SPE is the operator of Montana's only active underground coal mine. The proposed plan includes room and pillar mining to develop nine additional panels for longwall mining. If approved, Amendment No. 3 would extend the permit boundary toward the northeast and increase the permit area by 7,161 acres for a total area of 14,896 acres. Total acreage of the underground mine plan would be 10,569 acres. Approval of this amendment would increase the potential of the ground surface (directly above the panels and within the angle of draw) to be adversely affected by subsidence caused by mining.

Approximately 20 acres of additional surface disturbance is expected as a result of this amendment. This amount of additional disturbance is necessary to construct temporary surface facilities that support underground mining. Temporary surface support facilities include boreholes, associated pads, power lines, and roads. No significant changes to the reclamation plan are proposed since Amendment No. 3 only addresses expansion of the permit area to allow continuation of underground mining. Plans for the mitigation of impacts to springs, seeps and drainages are included in SMP C1993017. Site-specific plans for the repair or mitigation of impacts related to subsidence or other mining impacts will be developed as they are identified, in consultation with DEQ and affected landowners.

If approved, Amendment No. 3 would add approximately 176 million tons of in-place coal reserves or 110 million tons of mineable coal. Of this, approximately 83 percent would be recoverable (91 million tons of coal.

3.1 BACKGROUND & MINING HISTORY

Bull Mountain Mine No. 1 (**Figure 4-1**) is approximately 15 miles southeast of Roundup, MT in Musselshell and Yellowstone counties. Mining Permit C1993017 was originally issued to Meridian Minerals on October 15, 1993, transferred to Glacier Park Company on September 25, 1995, transferred to Mountain Inc., on November 20, 1995, and to BMP Investments, Inc. (BMPII) on July 2, 2002. BMPII was renamed Bull Mountain Coal Mining (BMCM), Inc. on December 13, 2006 and the permit was transferred to SPE on September 15, 2008.

Coal fields in the area extend from the Bull Mountains to just north of Roundup and the Musselshell River (Perry, 1962). Mining in the greater region began in the early 1880's, and commercial mining was underway by about 1906. Coal was shipped to smelters and used as a source of fuel for the railroads (Slagle and others, 1986). All of the mines near the town of Roundup were abandoned by 1956. By the mid-1980's, the last few mines operating in the coal field were located south of Roundup in the Bull Mountains and included the P.M. Mine, the Divide mine, and the Storm King Mine (Slagle and others, 1986) (**Figure 3-2**). These mines mined the Mammoth Coal seam underlying the Bull Mountains that is approximately 10 feet to 15 feet in thickness.

The largest mines were the Divide (or Carlson) mine and the adjacent Gildroy mine, each with about 70 to 80 acres of underground room and pillar mining. These mines are approximately 1.5 miles south of the Bull Mountains Mine No.1 portals area and extracted Mammoth Coal. Two mines, the P.M. Mine and Meridian Test Pit (**Figure 3-2**), are the predecessors of Bull Mountains Mine No.1. The P.M. Mine included 51 acres of room and pillar mining. The Meridian test pit included 90 acres of strip mining that were reclaimed upon completion of mining. The P.M. Mine was operated as an underground coal mine in the 1930's that was converted to a surface mine in 1972 by the Maged Family. In 1989 Meridian Minerals Company (Meridian) opened the Meridian Test Pit surface mine to the southeast. P.M. Coal Company then reopened the underground mine in 1991. The Meridian Test Pit surface mine and the underground mine combined were termed the Bull Mountains Mine. The remaining mines in the area were all much smaller underground operations that used room and pillar or other simple mining techniques and have been abandoned. The majority of mines are located where the Mammoth Coal crops out at the surface, and it is the coal seam that was most likely mined.

3.2 CURRENT MINING OPERATIONS

Coal at Bull Mountains Mine No. 1 is recovered using continuous mining and longwall mining methods. Continuous mining includes cutting parallel entries (main entries) approximately 8 to 10 feet high by about 20 feet wide intersected by regularly spaced tunnels or crosscuts. Pillars or unmined areas between the entries and crosscuts are the primary supports of the mine. This method of mining is known as "room-and-pillar mining" and is used primarily for developing entries necessary for transportation, ventilation, utilities, and providing access to longwall panels.

Longwall mining requires a significant amount of up-front preparation, or "development" using continuous mining methods. In order to supply power, water, air, and safe transportation corridors to the longwall panels, a set of parallel entries must be established. These main entries, or "mains," are designed to remain intact for the life of mine, and allow access to the longwall panels via "gate roads". Gate roads are driven roughly perpendicular to the mains, and consist of three parallel entries. Besides providing worker access to the longwall panels, gate roads are vital for the installation of longwall equipment, ventilation of the working area, and transportation. Once gate roads have been developed around a panel, the longwall equipment can be installed.

Longwall mining is a method that removes all coal from each longwall panel, effectively achieving 100 percent coal extraction, and causes surface subsidence. Longwall mining uses a series of hydraulic supports, or shields, set up along the longwall face that function as temporary supports to protect workers and equipment. A cutting machine or shearer moves back and forth along the coal face and line of shields, cutting the coal in a series of passes. After the shearer completes a pass the entire system (shields, shearer, and face conveyor) advances (perpendicular to the shearer) and unsupported overburden is allowed to collapse into the void formally occupied by coal.

At full production SPE is capable of mining longwall panels at a rate of 11,000,000 tons of raw coal per year. This is equivalent to the longwall face advancing approximately 55 feet per day. However, actual production rates are expected to be less. Each gate road is designed to stay open for the first panel, but yield as the adjacent panel is mined-out, mining out of sequence would limit access to some panels and limit coal conservation. Panels must be mined in sequential order to achieve maximum coal recovery.

4.0 REGIONAL OVERVIEW

The permit and proposed amendment area of Bull Mountains Mine No.1 is located in the Bull Mountains in central Montana, within the Northern Great Plains physiographic province (**Figure 4-1**). The Bull Mountains lie within the drainage basins of the Yellowstone River and the Musselshell River. The lands to the north of the Bull Mountains drain to the Musselshell River while the lands to the south drain to the Yellowstone River. The majority of the proposed permit amendment area is located within the Rehder Creek and Fattig Creek drainages, which are tributaries of the Musselshell River.

Differential erosion of rocks of varying hardness and resistance is the main process active in forming the present landscape. The underlying rocks are composed of interbedded shales, claystones, siltstones, coals, and sandstones; however, the high mesas and ridges are capped by "clinker". Clinker is a term used to describe the baked sedimentary rocks resulting from burning of underlying coal beds. The shales and claystones tend to be easily eroded, while the sandstone and clinker are more resistant to erosion. Sheet and rill erosion are active geomorphic processes in the upper drainage basins, and mass wasting occurs locally along the steep-walled ridges. Ephemeral streams occur throughout the area; intermittent flow, which may occur on lower reaches of Rehder and Fattig creeks during wet years, has been observed along portions of the streams supported by springs or seeps associated with groundwater base flow.

Vegetation in the Bull Mountains Mine No. 1 study area includes silver sagebrush-mixed grasslands, mixed grasslands, ponderosa pine-mixed grassland, burned ponderosa pine-mixed grassland, and relatively small areas of improved pasture and wetlands. In 1984 an intense fire burned much of the forest leaving many scattered charred logs and dead trees. Currently the burned area is dominated by grasses.

4.1 CLIMATE

The climate of south central Montana is classified as semiarid continental. Precipitation and temperature measurements have been collected at the mine and also at the nearby climate stations at Roundup, MT (National Weather Service Cooperative Observer ID 247214) and Billings, MT (National Weather Service Cooperative Observer ID 240807). Climate data are available from the Western Regional Climate Center (WRCC, 2013) with temperature and precipitation records for Roundup and Billings going back to 1914 and 1948, respectively.

Figure 4-2 shows average precipitation data from the past 30 years at Roundup and Billings, MT. The average annual precipitation (1983-2012) at Roundup (elevation 3,230 ft) is 13.58 inches and Billings (elevation 3,570 ft) is 13.36 inches. The average peak precipitation month is June at Roundup (2.53 inches) and May at Billings (2.21 inches), while the average minimum monthly precipitation occurs in January at Roundup (0.37 inches) and December at Billings (0.46 inches).

4.2 TOPOGRAPHY

The topography in the mine area consists of gently sloping valleys bounded by moderately steep to very steep ridges capped by isolated sandstone and clinker mesas. Elevations range from approximately 3,700 to 4,700 feet above mean sea level. Surface slopes vary from zero to 15 percent in the vicinity of the proposed surface facilities and up to 50 percent or more in the higher elevations of the Bull Mountains.

4.3 Geology

Alluvial deposits (gravel, sand, and silt) are generally unconsolidated and typically occur in ephemeral drainages or areas of lower elevation in the stream and valley bottom areas. Alluvial deposits are generally less than 40 feet in thickness.

The Bull Mountain coal region and vicinity is underlain by a sequence of sedimentary rocks that comprise the Bull Mountain Basin. This sequence of rocks is comprised of an alternating sequence of sandstones, siltstones, shales, carbonates, clinker, and coal approximately 12,000 feet in thickness that range from early Paleozoic to Tertiary in age. The basin is underlain by Precambrian metamorphic basement rocks (Wheaton, 1992). The sedimentary sequence was deposited or formed in a single depositional center of the Powder River Basin but is now isolated or separated from the main basin due to post-depositional tectonics and erosion.

Tertiary age continental rocks of the Tongue River Member of the Fort Union Formation are the principal rock units disturbed by longwall mining at the Bull Mountains Mine No. 1. Rocks of the Tongue River Member consist of interbedded siltstones, sandstones, shales and coals and form the bedrock under the mine area where they extend to depths in the range of about 1100 feet below the base of the Mammoth Coal. **Figure 4-3** illustrates the general geologic relationships in the region. **Figure 4-4** shows a detailed lithologic column for the Bull Mountains (Meridian, 1990). It represents about 1250 feet of the uppermost portion of the Tongue River Member occurring at Bull Mountains. Rocks of the Tongue River Member are situated in a broad (approximately 10 miles) and relatively long (axial trace of approximately 15 miles) north-northwest plunging syncline (less than one degree) that includes the Mammoth Coal. This area includes approximately 150 square miles.

A general description of the shallow stratigraphy of the Tongue River Member includes:

- Overburden rocks include interbedded siltstones, sandstones, shales, clinker, and coal above the Mammoth Coal. These rocks thicken toward the north-northwest or along the plunge of the syncline and range from approximately 200 feet to over 800 feet in thickness. Clinker, a reddish-brown, commonly brecciated pyro-metamorphic rock formed by prehistoric coal fires, occurs throughout the study area and commonly caps ridges or areas of higher elevation.
- Rocks of the Mammoth Coal occur immediately below overburden rocks. This coal seam is the principal economic seam in the area and varies in thickness from eight to ten feet within the permit boundary.
- Underburden rocks are similar to rocks of the overburden and are divided into the upper (immediately below the base of the Mammoth Coal) and deeper overburden.

5.0 CUMULATIVE IMPACT AREA

A cumulative hydrologic impact area (CIA) is defined by ARM 17.24.301(31): ‘"Cumulative hydrologic impact area" means the area, including, but not limited to, the permit and mine plan area within which impacts to the hydrologic balance resulting from the proposed operation may interact with the impacts of all previous, existing and anticipated mining on surface and ground water systems’. "Anticipated mining" includes the entire projected life through bond release of all permitted operations and all operations required to meet diligent development requirements for leased federal coal for which there is actual mine-development information available. The size and location of a given CIA will depend on the surface water and groundwater system characteristics, the hydrologic resources of concern, and projected impacts from the operations included in the assessment. For this CHIA, a surface water CIA and a groundwater CIA are delineated to assess impacts associated within these distinct hydrologic resource areas.

5.1 SURFACE WATER CUMULATIVE IMPACT AREA

The surface water CIA includes all areas that may see a measurable change in water quantity or water quality due to mining activities at the Bull Mountains Mine. The surface water CIA is presented in **Figure 5-1**.The CIA extends beyond the proposed Amendment No. 3 boundary and includes Rehder Creek to its confluence with Halfbreed Creek, and Fattig Creek to stream monitoring station 52996, both of which flow north to the Musselshell River. The CIA extends southward to include a number of named and unnamed ephemeral watercourses that flow south from the Bull Mountains to the Yellowstone River. CIA boundaries were established to allow evaluation of any potential impacts to streams, springs, and ponds that could reasonably be affected by present and future mining operations on and off the permit area. The CIA boundaries are established downgradient from potentially affected streams and springs, and include all surface water monitoring stations to allow assessment of impacts to stream water quality and quantity. Likewise, the CIA extends southward to include springs and ephemeral stream channels that could potentially be affected by subsidence-related changes in hydrology as Dunn Mountain and the southern portions of the permit area are undermined.

5.2 GROUNDWATER CUMULATIVE IMPACT AREA

The groundwater CIA boundary is based on the anticipated or potential extent of impacts to groundwater affected by mining based on the hydrology of the mine area. Potential impacts to groundwater include changes to water level or water quality such that the resource is no longer available or suitable for established uses.

The groundwater CIA is presented in **Figure 5-2**. This area is drawn to include mining-induced groundwater impacts from drawdown of the Mammoth Coal and underburden aquifers, as well as impacts upon shallow aquifers (alluvium and shallow fractured bedrock) from operations (ponds, conveyors, storage areas including fueling and laydown areas) within the facilities area, and impacts from the Waste Disposal Area (WDA). Water storage areas or ponds, pipelines, conveyors, fuel and other storage areas including the WDA have the potential to affect the shallow groundwater system of Rehder Creek and its tributaries such as PM Draw. Also, any mining-induced water quality impacts are expected to be contained within the CIA.

Results of the new transient flow model (Nicklin, 2013[2]) indicate that drawdown in the upper underburden and Mammoth Coal aquifers immediately after the cessation of mining would extend approximately three miles down gradient of the permit boundary to the northwest and generally extend to the outcrop of the Mammoth Coal in the cross and up gradient directions (**Figure 5-2**).

The groundwater CIA includes a buffer area around the modeled upper underburden five-foot drawdown contour and is also extended around the facilities area. The modeled drawdown for the upper underburden is used to define the CIA instead of the drawdown for the Mammoth Coal because drawdown in the upper underburden has a greater areal extent.

6.0 WATER RESOURCE USES

Historic and current surface and groundwater uses in and adjacent to the mine area include domestic, livestock, wildlife, and industrial uses. Wells located within and immediately adjacent to the CIA were identified from the Montana Bureau of Mines and Geology, Groundwater Information Center (GWIC). Registered surface water and groundwater rights were identified from records at the Montana Department of Natural Resources and Conservation (DNRC). Groundwater users (wells and groundwater rights) are shown in **Table 6-1** and **Figure 6-1**, and surface water users (surface water rights) are shown in **Table 6-2** and **Figure 6-2.**

6.1 DOMESTIC

Domestic use is indicated in GWIC or DNRC records for 33 wells within the groundwater cumulative impact area. Domestic or private wells in the area generally produce water under confined conditions from relatively deep underburden sandstones that are hydrologically separated from the upper underburden aquifer and Mammoth Coal, although a few domestic wells are completed in the upper underburden. Office Supply Well No. 1 (OSW), which supplies water to the mine office facilities, also produces from the deep (355 to 405 feet) and relatively thick (50 feet) underburden sandstones.

6.2 INDUSTRIAL

Three industrial supply wells, currently used for mining operations are completed in carbonate rocks of the Madison Group, at depths greater than 8,700 feet. These wells produce hot (approximately 165°F) and highly mineralized water that is isolated from the shallow aquifers of the Fort Union Formation by thousands of feet of confining rock units. The water contains concentrations of fluoride and radionuclides in excess of drinking water standards for groundwater that make the deep Madison well water unsuitable as potable water. Shallow aquifers disturbed by mining (i.e., overburden, Mammoth Coal and upper underburden) are not expected to have an effect on aquifers of the Madison Group.

Groundwater extraction from the Madison aquifer is expected to be approximately 600 acre-feet per year and will not have a significant drawdown effect on the aquifer. The nearest Madison well off site is approximately 20 miles from the mine and calculations indicate that the radius of influence of the Madison Group wells in use at the mine is limited to several miles (DNRC, 2012).

Industrial water from the Madison wells is stored in Madison Pond No. 1, a lined pond used by the mine for coal processing in the preparation plant, and to control road dust and dust generated during mining. Wastewater generated from the preparation plant and underground dust control is filtered and re-used in a closed-loop system.

6.3 AGRICULTURE

Livestock watering is the dominant water use in the CIA, and surface water, springs, and groundwater wells in the CIA area are used for livestock watering. Water quality in surface water, springs, and shallow wells is variable and may change seasonally with the availability and use of the water source. Deeper wells provide a more consistent and reliable water source.

60 wells that lie within the groundwater CIA are identified for stockwater use in the GWIC and DNRC databases. The completion depths listed for stockwater wells indicate that groundwater resources used for supply include alluvium, overburden, coal, and upper and deep underburden aquifers. There are also 46 groundwater rights listed for stockwater use at springs in the groundwater CIA. These springs are primarily sourced from overburden aquifers with a few sourced by the Mammoth Coal.

Livestock are listed as the use at 30 of the 34 surface water rights within the surface water CIA in the DNRC database. Livestock use of surface water is typically directly from the source or at a stock pond. The remaining four surface water rights are listed for irrigation use. Nearly half of the surface water rights in the surface water CIA are owned by SPE.

6.4 Aquatic and Wildlife Habitat

Aquatic plants, macroinvertebrates, and vertebrates are associated with springs and ponds in the permit area. Fish have not been found in any of the ponds or stream reaches, and no threatened or endangered aquatic species or habitat has been identified in the area. Aquatic species are associated predominantly with stock ponds and rely on spring-water inputs for the maintenance of habitats.

7.0 MONITORING PROGRAM

Surface water and groundwater monitoring programs have been implemented at the Bull Mountains Mine No. 1 and are the basis for assessment of mining impacts on water resources. Monitoring has been designed to collect water quantity and quality information pertinent to the evaluation of impacts. The monitoring plan identifies parameters, sampling frequency, geologic units monitored, and site locations. All current monitoring sites are shown on **Figure 7-1** and **Figure 7-2**. A list of currently required analytical parameters is shown in **Table 2-2**. Quality assurance is an essential part of analytical requirements.

In addition to monitoring requirements issued under Mine Permit C1993017, the Bull Mountains Mine No. 1 also monitors MPDES-regulated discharges from the facilities and waste disposal areas, as directed under MPDES Permit No. MT0028983. The Bull Mountains Mine has eight outfalls under the MPDES Permit, of which six discharge to PM Draw and two discharge to Rehder Creek.

As mining proceeds or potential impacts are anticipated, the monitoring plan is revised to accommodate changes, including replacement of monitoring sites or development of new sites. Monitoring is required to continue through the final phase of bond release.

7.1 SURFACE WATER

Surface water monitoring began in 1989 with the original permit applicant, Meridian. Baseline surface water quality and quantity data were collected by Meridian from 1989-1991 as required by ARM 17.24.304. Monitoring resumed in 2003 when BMPII, assumed the surface mining permit from Meridian. Currently Signal Peak Energy operates the mine and collects surface water monitoring data associated with streams, springs, and ponds in accordance with ARM Section 17.24.314 (Permit C1993017, Vol. 3, Section 314, Protection of the Hydrologic Balance).

Streamflow is typically ephemeral in nature, with local spring inputs forming wet areas or short reaches of streamflow before infiltration into the alluvium. Flow from most springs is dependent upon precipitation and recharge of shallow perched aquifers that feed area springs and seeps. Continuous flow is therefore infrequent to rare.

Stream monitoring consists of the collection of water quality parameters and flow measurements at 12 established surface water monitoring stations within and outside of the permit area. Streams are sampled for a variety of field parameters, analytical constituents, peak flows, and instantaneous flows (**Table 7-1**). The stream monitoring network is shown in **Figure 7-1**.

Spring (spring and seep) monitoring consists of collection of water quality parameters and flow measurements at 81 established monitoring stations on and off the permit area. Springs are sampled for a variety of field parameters, analytical constituents, peak flows, and instantaneous flows (**Table 7-1**). The spring monitoring network is shown in **Figure 7-1**.

Pond monitoring consists of collection of field parameters at 16 established stock pond monitoring stations. Measurements are scheduled monthly at 13 ponds and semi-annually at 3 ponds. Parameters associated with pond sampling are field parameters only, as included in **Table 7-1**. The pond monitoring network is shown in **Figure 7-1**.

7.2 GROUNDWATER

Meridian installed the majority of the wells in the original monitoring network at Bull Mountains Mine No. 1 between 1989 through 1991. A number of wells installed by the Montana Bureau of Mines and Geology (MBMG) as early as 1981 were incorporated into the monitoring network that included 110 monitoring wells by 1995. With the exception of MBMG wells and a few wells that were transferred to landowners, the Meridian monitoring wells were abandoned and reclaimed after the Bull Mountains Mine No. 1 closed in 1998.

In 2002 and 2003, BMPII constructed a new monitoring network for the Bull Mountains Mine No. 1. The new monitoring wells were designed and completed to monitor the same stratigraphic interval in the same general location as the former monitoring wells. In some cases, new well construction differed from construction of the former well due to different drilling conditions and other limitations or purposes. BMCM reinstated the frequency and type of groundwater monitoring specified in the Meridian permit document including water level measurements, water chemistry field parameters, and groundwater quality sampling and laboratory analyses. While data from the original set of wells can generally be compared with data from the new wells, differences in well construction or monitoring methods and techniques create problems that prevent comparison of water level and water quality data between the old and new monitoring networks.

The monitoring plan was revised and updated in 2012. Currently, there are 105 groundwater wells which are monitored: 42 alluvial, 28 overburden, 15 Mammoth Coal, and 20 underburden (**Figure 7-2**). The existing groundwater monitoring wells and schedule are shown in **Table 7-2**. As overburden collapses into the void where Mammoth Coal has been removed, future groundwater monitoring wells will be installed in the gob to monitor the quality and quantity of water as the depleted aquifer is recharged.

8.0 BASELINE HYDROLOGIC CONDITIONS

The goals in establishment of baseline hydrologic conditions are to characterize the local hydrology, understand the regional hydrologic balance, and identify any water resource or water use that could be affected by the mining operation.

The hydrologic and geologic data required to evaluate baseline hydrologic conditions, probable hydrologic consequences, and cumulative hydrologic impacts of mining was collected by the original permit applicant, Meridian, from 1989-1991 and submitted with the initial permit application, and are discussed in detail in Sections 17.24.304(1)(e) and (f), respectively, of Mine Permit C1993017.

Baseline hydrologic and geologic data of the permit area and adjacent area of potential hydrologic impact were collected from a number of sources including literature review, hydrogeologic field reconnaissance, static water level measurements, aquifer tests, groundwater and surface water sampling and well and spring inventories. Monitoring data were collected by Meridian, the Louisiana Land and Exploration Company (LL&E), Yellowstone Coal Company, the P.M. Mine, Consolidation Coal Company, the United States Geological Survey (USGS), MBMG, and the Mine Safety and Health Administration (MSHA).

Baseline monitoring in the area was begun by LL&E as early as 1980. MBMG began monitoring the area in 1981 with the installation of eight monitoring wells. During baseline monitoring between 1989 and 1991 by Meridian and MBMG, a total of 3509 flow and water level measurements were taken, 614 water quality samples were collected, 59 aquifer tests were performed, and continuous flow data from three surface water sites and one spring were collected. In addition, narrative descriptions of surface drainage and channel characteristics were included in baseline water quality and quantity assessments.

Although the mining permit was originally issued to Meridian in the fall of 1993, substantial mining and disturbance at the mine site did not occur until mining by SPE began in 2008. Data collected by BMPII. and SPE from 2003 to 2008 may be considered baseline data for the purposes of impact assessment, and in some cases data collected from 2008 to present may also be considered baseline data where it was collected outside the area of mining influence (i.e. Fattig Creek drainage).

8.1 SURFACE WATER BASELINE

Surface water baseline conditions were derived from a network of surface water monitoring stations (springs/seeps, streams, ponds) established during initial permit development and include data predominantly from 1989 through 1991. Data collection resumed in 2003 with the onset of mining activities and continues presently.

8.1.1 Surface Water Regime

The region is drained by tributaries of the Musselshell and Yellowstone Rivers north and south of the permit area, respectively. Tributaries within and in the vicinity of the permit area that drain north to the Musselshell River include Fattig Creek, Rehder Creek, East Parrot Creek and Halfbreed Creek. Tributaries that drain south to the Yellowstone River include Pompey's Pillar Creek, Railroad Creek, and Razor Creek. There are no perennial streams within the surface water cumulative impact area. The nearest perennial stream of consequence is lower Halfbreed Creek which flows into the Musselshell River approximately 18 miles to the north. Tributary streams in the area are generally ephemeral and have deeply cut valleys that often flood after heavy rains (Woolsey and others, 1917). Some drainages within the project study area contain intermittent reaches, which vary from year to year depending upon precipitation received in the contributing drainages and the amount of spring output contributing to baseflow.

8.1.2 Surface Water Quantity

Baseline water quantity data consists primarily of data collected from 1989 through 1991, and includes flow and/or water level data for streams, springs/seeps, and ponds. Streamflow in the study area are typically ephemeral, with short reaches supporting intermittent streamflow during wet years or periods of prolonged or above average precipitation. Typically streams flow only in response to seasonal snowmelt, precipitation events, or directly below spring inputs from local perched aquifers. The shallow alluvium or colluvium and bedrock outcrops in the study area are generally conducive to natural spring discharges. These springs are an expression of groundwater as geologic units crop out. At these outcrops, surface flow is initiated. The length of the surface expression is dependent on a number of variables, including amount of flow, width, and depth of alluvium/colluvium, and landowner manipulation of the drainage for livestock use.

Landowner manipulation of spring inputs has a dominant effect on surface flow as indicated at the major springs in the permit area including numbers 14325 (Busse Water), 17415 (Litsky), and 16655 (Cold Water). At these locations, embankments have been constructed across the drainages to form ponds which impound water for livestock. These ponds control downstream drainage and in some cases the ponds are large enough to eliminate downstream flow. Ponds are typically located directly below spring issuances or directly atop the spring input and are a reflection of spring water inputs from shallow groundwater movement.

In the absence of immediate precipitation events or spring snowmelt, stream and pond water quantity is generally governed by spring inputs from shallow perched aquifers that respond to seasonal precipitation. In most years, streambeds are dry, except below spring issue points. Sustained streamflows were observed, however, in 1991 when 19.1 inches of precipitation was recorded in Roundup, an amount nearly six inches above the 30-year (1982-2011) annual average of 13.4 inches. Sustained streamflows on Rehder Creek and Fattig Creek were again observed from 2011 through 2013 as a result of well-above average precipitation during the spring of 2011 and 2013. Conditions observed during the baseline periods should therefore be viewed within the context of regional precipitation trends, and at times, represent conditions during a period of above-normal precipitation.

As mining progresses and coal is removed through the longwall mining process, subsidence of overburden has the potential to affect spring flows and, consequently, associated stream flows. Due to ephemeral conditions in potentially affected drainages, the limited streamflow data set precludes detailed analysis and establishment of typical numeric baseline streamflow conditions. Rather, potential impacts from mining activity are more readily evaluated through changes in groundwater discharge from springs and the location of issue points that feed established ponds and stream reaches.

Flowing or ponded baseline conditions were reported for 36 individual springs from 1989 through 1991. **Table 8-1** presents an estimated average flow rate for 30 springs with flows greater than 1.0 gpm during the baseline monitoring period, and represents baseline flow conditions for springs for the climatic conditions observed during the 1989-1991 baseline monitoring timeframe.

8.1.3 Surface Water Quality

Baseline surface water quality data consists primarily of data collected from 1989-1991, and includes field parameters and analytical water quality samples from streams, springs/seeps, and ponds. Precipitation at Roundup, MT during this period was 15.2, 11.6, and 19.1 inches, respectively. The 30-year average annual rainfall at Roundup is 13.4 in.

Baseline (1989-1991) stream water quality data consists of water quality samples (n=10) from eight stream-sampling locations. All samples were collected during runoff events and represent water quality associated with ephemeral stormwater flows; seven of the 10 samples were collected during a single major storm event in June 1991. **Table 8-2** presents summary water quality statistics for analytical water quality samples collected during this time frame. A low number of observations (n=10) and high variability among data results reflects the ephemeral event-driven nature of surface flows in the area. Ephemeral flows are typically high in suspended solids as they occur in response to storm-driven events, resulting in detects of several metals (iron, manganese, aluminum, zinc) associated with suspended sediment. Other, less common metals (cadmium, chromium, mercury, nickel, silver) were detected at very low levels, or were not detected at all in baseline samples. As sampling events were from stormwater events on ephemeral streams, numeric standards in Circular DEQ-7 do not apply (see Section 2.2.1).

Baseline pond water quality data (1991) consists of water quality samples (n=20) from 16 pond-sampling locations. **Table 8-3** presents summary water quality statistics for analytical water quality samples collected during the sampling time frame (05/91-08/91). Baseline pond water quality data was collected from May through July of 1991 during a period of unusually high precipitation and may not reflect typical conditions in the region, which typically are much dryer.

Baseline spring water quality data (1989-1991) consists of water quality samples (n=231) from 16 spring-sampling locations. Spring water quality data is comparable to overburden water quality; sulfate and total dissolved solids (TDS) ranged from 11 mg/L to 3,020 mg/L and 226 mg/L to 6,030 mg/L and averaged 466 mg/L and 1,118 mg/L, respectively. **Table 8-4** presents summary water quality statistics for analytical water quality samples collected during this time frame.

In addition to baseline spring water quality data collected by Bull Mountains Mine No 1, Wheaton and Donato (1991) reported concentrations of sulfate and TDS collected in 1978 from six seepage sites along Halfbreed Creek just west of the permit area. Respective sulfate and TDS concentrations ranged from 370 mg/L to 640 mg/L and 947 mg/L to 1,460 mg/L and averaged 508 mg/L and 1,182 mg/L. Similarly, Wheaton and Donato (1991) reported concentrations of sulfate and TDS from eleven springs in the vicinity of the permit area. Respective sulfate and TDS concentrations ranged from 11 mg/L to 2,400 mg/L and 420 mg/L to 4,170 mg/L and averaged 615 mg/L and 1,592 mg/L.

8.2 GROUNDWATER

Baseline water level and water quality were measured in the alluvium, overburden, Mammoth Coal, and underburden during the baseline period 1989 - 1991. Monitoring continued during ownership by subsequent operators, but most of the monitoring wells used to determine baseline conditions were abandoned when the mine closed in 1998. A new network of 121 monitoring wells was completed in 2002 and 2003 by BMPII and continued to monitor baseline conditions as substantial mining disturbance had not yet occurred.

8.2.1 Groundwater Regime

Groundwater in the mine area occurs in the alluvial, overburden, Mammoth Coal, and underburden aquifers. Groundwater flow is generally toward the north-northwest except in the often dry alluvial aquifer system. Contiguous rock units including the sandstone above the Rock Mesa Coal (lower overburden aquifer), the Mammoth Coal, and the underburden are saturated across much of the study area.

Aquifer tests were performed by the MBMG and Meridian from 1982 through 1991. Aquifer tests results are summarized in **Table 8-5**. These results show a wide range of hydraulic conductivity (geometric mean between 28 and 0.013 feet per day) that decreases with depth. For example, unconsolidated alluvium has a hydraulic conductivity that is four orders of magnitude greater than that of the underburden. Storage coefficients were determined by 11 aquifer pumping tests in bedrock aquifers. These results indicate a wide range of storage coefficients in the overburden and the Mammoth Coal ranging from 1×10^{-3} to 6×10^{-6}. The underburden values were even wider in range, from 1×10^{-1} to 4×10^{-6}. In general, this indicates that groundwater typically occurs under confined conditions in bedrock aquifers.

8.2.2 Alluvial Baseline

Alluvial sediments locally are up to 20 feet in saturated thickness but are generally dry in the permit area except following periods of significant precipitation. Alluvial baseline water quantity was determined by a network of 25 relatively shallow monitoring wells completed in alluvium that occurs in the valley bottoms of the larger ephemeral stream channels. Alluvial material is not a major aquifer in the region due to its limited saturation and areal distribution.

Measurements from baseline alluvial wells indicated that the alluvial aquifer is generally dry in the permit area and becomes partly saturated in Rehder Creek near the northern border of the permit boundary. Alluvial groundwater flow in Rehder Creek is toward the west-northwest (downstream). The alluvium of ephemeral tributaries from the permit area into Rehder Creek is generally dry and becomes partly saturated along short reaches due to spring discharge and during significant seasonal precipitation events.

Alluvial baseline water quality was determined by monitoring 11 wells (**Table 8-6**). Data from these wells indicate that alluvial groundwater in the permit area and vicinity is generally of a magnesium-sulfate or magnesium-bicarbonate composition. Specific Conductance (SC) ranged between 759 μS/cm and 2,360 μS/cm with a mean of 1,625 μS/cm, and sulfate concentrations ranged from 143 mg/L to 1,000 mg/L with a mean of 535 mg/L. Alluvial groundwater ranged between Class I and Class II water (**Table 2-4**). However, most alluvial groundwater quality falls into Class II. Water quality of most alluvial groundwater is suitable for livestock.

8.2.3 Overburden Baseline

Overburden rocks are commonly over 200 feet in thickness and range to over 800 feet in thickness within the permit boundary. Shallow overburden groundwater is typically unconfined, perched, and often moves laterally along sedimentary layers before discharging as springs, seeps, or into alluvium (**Figure 4-3**). Water levels in the perched aquifers and spring flow issuing from them are strongly influenced by seasonal and periodic fluctuations in precipitation. Deeper overburden groundwater occurs in sandstones stratigraphically above the Rock Mesa and the Mammoth Coal seams (**Figure 4-4**).

These sandstones are up to 80 feet in thickness. Flow in these sandstones is generally toward the north-northwest, nearly coincident with the synclinal structural axis.

Overburden baseline groundwater quantity was determined by a network of 26 groundwater wells. Where saturated, overburden groundwater occurs under both confined and unconfined conditions depending upon the proximity to the outcrop. Baseline data indicate that overburden groundwater is associated with alternating perched aquifers and rock units of low permeability and unsaturated rocks that extend to approximately 100 feet in depth. However, deeper overburden rocks are saturated and in hydrologic connection with the underlying strata. 12 of the 26 baseline overburden monitoring wells were completed in sandstones within the lower overburden above the Rock Mesa and the Mammoth Coal seams.

16 wells were used to determine the baseline water quality of the overburden aquifer (**Table 8-7**). Water in the overburden wells is generally of sodium-bicarbonate or sodium-sulfate composition, and is relatively poor in quality due to high sulfate and SC. Overburden baseline SC ranged from 464 μS/cm to 3,330 μS/cm, with an average of 1,644 μS/cm, and sulfate concentrations ranged between 12 mg/L and 1,410 mg/L, with an average of 1,143 mg/L and 457 mg/L. Water sampled from overburden wells ranged from Class I through Class III groundwater, but most wells produce Class II water. Only wells 30-2 and 62721-10W, located east and upgradient of mining, had water classified as Class I groundwater. Locally, baseline water quality within the deeper overburden wells is suitable for livestock.

8.2.4 Mammoth Coal Baseline

The west margin of the Mammoth Coal crops out at the mine portal. Near the western margin, the coal is dry but becomes saturated and eventually becomes confined toward the synclinal axis. Groundwater flow in this unit is toward the north-northwest, following the direction of synclinal plunge. Recharge reaches the Mammoth Coal via exposed outcrops, subcrops, and from infiltration through the overburden.

The geometric mean hydraulic conductivity of the Mammoth Coal is 0.16 ft/day (**Table 8-5**). Although the hydraulic conductivities for the Mammoth Coal are relatively higher than the overburden, they are typically inadequate to provide a reliable source of well water and few production wells are completed in the coal. **Figure 8-1** illustrates the potentiometric surfaces in the Mammoth Coal and in overburden sandstones above the Rock Mesa Coal. Water levels indicate that the Mammoth Coal aquifer is isolated from overlying overburden aquifers.

Mammoth Coal baseline groundwater quantity was determined by a network of 14 groundwater wells. Water levels in most Mammoth Coal wells showed little natural fluctuation and did not vary more than two feet over the period of baseline monitoring, except in one well near the Mammoth coal outcrop which showed larger fluctuations apparently in response to precipitation.

Baseline water quality of the Mammoth Coal aquifer was determined from samples from 10 wells (**Table 8-8**). Generally, sodium and sulfate are the dominant ions in groundwater collected from most Mammoth Coal monitoring wells. SC and sulfate baseline concentrations in the Mammoth Coal tend to be greater than in the overburden. SC ranged from 1,400 μS/cm to 3730 μS/cm with an average of 2,272 μS/cm. Sulfate concentrations ranged from 251 mg/L to 1,690 mg/L, with an average of 798 mg/L.

Mammoth baseline groundwater samples fall into Class I through Class III groundwater. However, water from most Mammoth Coal wells is Class II groundwater. Mammoth Coal groundwater is generally suitable for watering livestock.

8.2.5 Underburden Baseline

In the context of the mine permit, the term underburden refers to rocks below the base of the Mammoth Coal. Generally, the underburden aquifer can be divided into two distinct aquifers: 1) the upper underburden aquifer immediately below the base of the Mammoth Coal that is hydraulically connected to the Mammoth Coal, and 2) the deep underburden sandstones hydraulically isolated from the upper underburden aquifer that typically occur hundreds of feet below the base of the Mammoth Coal.

The upper underburden has very low conductivities with a geometric mean of 0.013 ft/day and does not supply substantive amounts of groundwater to wells. The deep underburden is characterized by a 50-foot thick massive fluvial sandstone at a depth of approximately 350 feet below the Mammoth Coal. The deep underburden provides much of the domestic and livestock well water in the vicinity of the mine, including the office supply well used by the mine. A pump test of the office well completed in these deep sandstones indicated a hydraulic conductivity of 3.8 feet per day, which is two orders of magnitude higher than the conductivities of the upper underburden and the Mammoth Coal (**Table 8-5**).

Underburden baseline quantity was determined from a network of 19 wells. Groundwater in the upper underburden generally occurs under confined conditions and flows north-northwest like the overlying aquifers.

Baseline water quality of the upper underburden was determined by 12 monitoring wells (**Table 8-9**). The baseline water quality of the upper underburden is similar to that of the Mammoth Coal. Sulfate was the dominant anion and sodium tended to be the dominant cation. Underburden groundwater generally fell into Class II and III. Respective SC and sulfate concentrations of the upper underburden aquifer ranged from 1,440 μS/cm to 4,280 μS/cm and 216 mg/L to 2,680 mg/L. Average SC and sulfate concentrations were 2,721 μS/cm and 1,121 mg/L. Upper underburden wells are typically suitable for livestock use, and some are marginally suitable for domestic use. Water quality analysis of a sample from the office well completed in the deeper underburden indicated Class I groundwater, and is suitable for the mine public water supply. Most deeper underburden wells are suitable for domestic and livestock use.

9.0 Hydrologic Impact Assessment

As required by ARM 17.24.314(5), DEQ must provide an assessment of the cumulative hydrologic impacts of the proposed operation and all anticipated mining upon surface and groundwater systems in the cumulative impact area. The assessment must be sufficient to determine if the Bull Mountains Mine No. 1 operation has been designed to prevent material damage to the hydrologic balance outside the permit area. This process takes into account the measures to be taken during and after mining to minimize impacts to the hydrologic balance, and evaluates hydrologic monitoring data with respect to these measures to determine whether impacts to the hydrologic balance have been minimized and material damage prevented. Material damage criteria include Montana water quality standards and water quality criteria to support the approved post-mine land use.

To prevent material damage outside the permit area, action thresholds have also been established for surface water and groundwater inside the permit area in order that potential water quantity or quality impacts are anticipated and mitigated prior to reaching levels that exceed standards or impinge on designated uses (**Table 2-1**).

9.1 Minimization of Impacts

Montana's Strip and Underground Mine Reclamation Act requires permit holders to employ measures to minimize disturbance to the hydrologic balance. Per ARM 17.24.314(1), the proposed measures must minimize disturbance of the hydrologic balance sufficiently to sustain the approved postmining land use and the performance standards of subchapters 5 through 12 and must provide protection of:

a) the quality of surface and ground water systems, within both the proposed mine plan and adjacent areas, from the adverse effects of the proposed strip or underground mine operations;
b) the rights of present users of surface and ground water; and
c) the quantity of surface and ground water within both the proposed mine plan area and adjacent areas from adverse effects of the proposed mining activities, or to provide alternative sources of water in accordance with ARM 17.24.304(1)(e) and (f) and 17.24.648, where the protection of quantity cannot be ensured.

Among these measures are requirements and performance standards given for a variety of processes and activities. These include requirements and standards for drainage control, pond design and maintenance, sediment control, road design and maintenance, reclamation, permitted discharges to surface waters, and protection of undisturbed drainages. In addition, adherence to Best Technology Currently Available (BTCA) and Best Management Practices (BMPs) in the design and implementation of equipment, devices, systems, methods, and techniques is required for the minimization of hydrologic disturbance. These requirements and performance standards established in ARM 17.24 subchapter 5 through subchapter 12 are incorporated into operation and reclamation plans included throughout the Bull Mountains Mine No. 1 surface mining permit (SMP C1993017), and have been reviewed and approved by DEQ.

9.2 Historic, Pre-law Mining

Past coal mining in the area include the P.M. Mine and some historic, small-scale operations along the Mammoth Coal outcrop that utilized room and pillar methods, which resulted in some limited residual subsidence (USDI, 2011). Existing residual impacts from historic coal mining in the area near the Bull Mountains Mine No.1 are unknown, as water quality data for these historic mining areas is unavailable.

Water quality data from underground coal mines to the north of the CIA (near Roundup, MT), however, is available. Water quality data reported by Reiten and Wheaton (1988) indicate that the average groundwater concentrations of TDS and sulfate at underground coal mines in the Roundup area, sampled between 1910 and 1986, were 1,324 mg/L and 659 mg/L, respectively. Later, Wheaton (1992) again reported concentrations of TDS and sulfate in the groundwater of coal mined areas near Roundup collected between 1986 and 1991. Average TDS and sulfate concentrations were 2,647 mg/L and 1,445 mg/L, respectively.

These data do not represent water quality at the Bull Mountains Mine No. 1, but are presented to illustrate that residual water quality from abandoned mines in the area near Bull Mountains have the potential to influence water quality where historic workings are in close proximity to existing monitoring wells. At this time, it is unknown whether historic workings have influenced water quality in the Bull Mountains area, however no residual impacts from historic mining have been identified.

9.3 Alluvial Valley Floors

As defined in 82-4-203(3)(a) and (b), MCA, "'Alluvial valley floor' means the unconsolidated stream-laid deposits holding streams where water availability is sufficient for subirrigation or flood irrigation agricultural activities. The term does not include upland areas that are generally overlain by a thin veneer of colluvial deposits composed chiefly of debris from sheet erosion and deposits by unconcentrated runoff or slope wash, together with talus, other mass movement accumulation, and windblown deposits".

The presence of an alluvial valley floor is determined by the presence of geologic, hydrologic, and biologic properties necessary to support agriculture. Alluvial deposits are found in both the Rehder and Fattig Creek valleys, however the alluvial deposits are generally dry and do not provide a source of subirrigation. Historic and current farming also does not depend on surface irrigation. Therefore, no alluvial valley floor has been identified in the area.

9.4 Surface Facilities and Waste Disposal Area Impacts

The facilities and waste disposal area (WDA) of the Bull Mountains Mine No. 1 are located to the northwest of the longwall panels (**Figure 9-1**). The main facilities area lies within PM Draw and an unnamed ephemeral tributary to Rehder Creek, and includes coal processing, storage and loading facilities, the WDA, unpaved roads, the rail loop, equipment fueling and storage areas, shops, the mine portal, and the mine offices. Additional peripheral facilities such as unpaved roads, crib pads, boreholes, power lines, and other improvements are located throughout the permit area and serve to support mine operations.

Within the disturbed area, Bull Mountains Mine No. 1 uses a network of ditches and detention ponds to convey and treat mine water and stormwater runoff. Mine water and stormwater from disturbed areas are detained within ponds, allowing suspended solids to settle out before discharge to ephemeral drainages, Rehder Creek and PM Draw, in accordance with MPDES Permit MT0028983. Solids retained in the ponds are removed to maintain sediment volume in the pond below 60% of the as-built storage volume. Sediments removed from settling ponds are disposed of in the WDA along with coal processing wastes and mine development wastes. Coal processing wastes are comprised of shales, sandstones, mudstones, and unrecovered coal fines that are removed from mined coal to make it marketable. Coal processing wastes make up more than 90% of the material disposed of in the WDA. Mine development wastes consist of shales, sandstones, mudstones, and poor quality coal that are removed to access economic-quality, or to maintain safety and access to underground workings. Mine development wastes are hauled directly to the WDA from underground without further processing. Mine development wastes makes up less than 10% of the materials in the WDA. Both coal processing waste and underground mine wastes use water from the deep underburden Madison wells (see Section 6.2) for cleaning and processing.

Each MPDES-permitted outfall at the facility is associated with a sediment pond designed to contain the runoff from a 10-year, 24-hour rainfall event. **Table 9-1** provides a description of the discharge point for each outfall. Influent flow to sediment ponds consists mainly of stormwater runoff from the disturbed zones within the facilities area. Sediment ponds are discharged periodically by pumping to retain pond storage capacity once adequate time for settling has occurred so that the discharge will comply with applicable MPDES requirements. Precipitation events in excess of the design capacity of a pond may cause discharges from ponds as flows overtop low lying spillways. Outfalls 001 and 008 are the primary outfalls controlling release of mine-produced water to Rehder Creek and PM Draw.

In addition to stormwater runoff, Outfall 006 is associated with a sediment pond (Pond F) that also receives groundwater discharged from underground mine workings (**Figure 9-1**). Water in this pond is either used for dust control or pumped into a second, lined storage pond for re-use underground. Ponds at outfalls 001, 002, 004, 005, and 008 may occasionally receive underground mine discharge water if water must be pumped from Pond F to other sediment ponds.

9.4.1 Impacts to Surface Water: Surface Facilities and WDA

No permanent effects to the quantity and quality of surface water are anticipated from the facilities and WDA. Flow through disturbed areas is ephemeral, occurring only in response to precipitation, and is managed through sedimentation ponds and regulated under DEQ's MPDES permitting section.

Due to the low precipitation in the area, pond discharges are infrequent. Recent discharges in 2011 and 2013 were the first since 1991. Extended wet spring conditions were widespread across much of Montana in the spring and early summer of 2011 and 2013, and wet-weather discharges were reported at the Bull Mountain Mine No. 1 in both circumstances. During discharges which occurred in 2011 (**Table 9-2**), total recoverable iron, pH, total suspended solids (TSS), and oil and grease were within allowable limits. Settleable solids and pH effluent limitations were exceeded during a July 2011 discharge at Outfall 008, however violations were not issued due to widespread flooding throughout the region, and a 'state of emergency' issued by Montana Governor Schweitzer, in response to the extreme hydrologic conditions.

Discharges at several outfalls occurred again in 2013 (**Table 9-3**). Discharges were the result of a precipitation event in excess of the 10-yr/24-hour event flow, and effluent limitations for iron and TSS are therefore not applicable per ARM 17.24.633(5). SPE did receive a violation, however, due to settleable solids results being in excess of permit effluent limitations at Outfall 008, which controls discharge from the WDA. DEQ conducted a follow-up assessment in response to this discharge by sampling channel sediments at three locations downstream from Outfall 008. At each location, sediments were sampled for a variety of constituents including arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Toxicity characteristic leaching procedure (TCLP) analyses were conducted, and results compared against EPA solid waste criteria established under the Resource Conservation and Recovery Act (RCRA). Results showed non-detects for all TCLP parameters in all samples at levels well below criteria established by RCRA, indicating that's settleable solids released during these events posed no toxic threat to the environment.

In addition to analytical parameters for which limits are established (**Table 9-3**), several additional water quality parameters (nutrients, metals) are collected, in accordance with MPDES permit requirements, to assist in characterizing effluent quality from disturbed lands within the facilities area. This additional information collected on effluent water quality is used to inform analysis for future MPDES permitting actions.

Due to the use of deep Madison well water for coal processing, the potential for the accumulation of Madison water constituents in coal processing waste emplaced in the WDA exists, however they are not anticipated to approach levels of concern for groundwater or surface waters. Groundwater flow through the WDA is controlled to prevent groundwater flow from the WDA to underlying aquifers, thereby limiting their potential for contamination due to WDA materials. Likewise, surface water runoff is controlled through MPDES-permitted outfalls. As stated earlier, runoff from the WDA is rare and only occurs during significant precipitation events, which would provide significant dilution of any constituent concentrations that may be present in WDA runoff water. Therefore, it is not anticipated that constituents in coal processing wastes will contribute significantly to groundwater or surface water quality conditions.

During the life of the mining operation, ditches and culverts are employed to handle surface runoff within and around the mine facilities area. All ditches and culverts are routinely inspected to ensure that accelerated erosion is not occurring at the outfalls. No long term or permanent water quality impacts are anticipated due to the emplacement of these structures. Ponds are used to retain stormwater runoff from events equivalent to or less than the 10-year 24-hour precipitation event. Ponds are anticipated to alter the duration, volume, timing, and frequency of stormwater runoff through PM Draw downstream of the mine area. This attenuation of runoff has limited potential to affect downstream surface water quantity and, as no surface water rights are held on PM Draw or Rehder Creek downstream of the facilities area (**Figure 6-2**), diminution or withholding of streamflows from ephemeral flow events is not expected to significantly impact downstream surface water users. The nearest downstream water rights are located on perennial reaches of Halfbreed Creek.

Outside the main facilities area, land disturbance from peripheral support facilities has the potential for hydrologic impacts, and may include geomorphic alteration of channels, increases in sediment loading to drainages, and alteration of stream hydrographs. Surface water impacts to ephemeral streams resulting from surface disturbance are assessed through adherence to established and approved design criteria for the installation and maintenance of roads, culverts, and other surface structures, and through the proper placement and usage of BMPs designed to minimize surface impacts to watercourses. Surface water control and treatment plans have been designed to protect the hydrologic balance within the permit area and adjacent areas in accordance with ARM 17.24.314(2)(a) and (b) and 17.24.631 through 17.24.652. A detailed discussion of practices employed to comply with these requirements is provided in Permit C1993017, Vol. 3, Section 314, 3.0 Surface Water and Groundwater Control and Treatment Plan.

Adherence to the surface water control plan is evaluated through monthly inspections by DEQ staff. Where impacts or the potential for impacts is observed, DEQ conducts an assessment of the issue and directs the operator to comply with permit conditions as stated in the approved control and treatment plan. Currently, there is no compelling evidence that surface disturbance has impacted surface water resources off the permit area.

9.4.2 Impacts to Groundwater: Surface Facilities and WDA

The alluvial aquifer with the greatest potential to be affected by operational impacts is in PM Draw since this drainage goes through the principal areas of operations**. Figure 9-2** presents hydrographs for alluvial monitoring wells BMP-26 and BMP-40 in PM Draw and show that the alluvium has been unsaturated except after the significant precipitation in 2011.

The WDA where coal waste is stored is in the drainage of an unnamed tributary just south of Rehder Creek. Potential impacts to the Rehder Creek alluvial aquifer and shallow bedrock may occur due to precipitation, runoff, and infiltration from the WDA. However, impacts are limited by compaction to engineering standards of materials placed in the WDA. **Figure 9-3** presents hydrographs of static water level (SWL) and selected water quality data for Rehder Creek alluvial monitoring well BMP-33 and overburden monitoring well BMP-52 located near the northern boundary of the WDA. Water levels in both wells show a response to the high precipitation event of 2011. Recent water quality data for both of these wells have shown increases in conductivity and TDS, with an increase in sulfate also evident in alluvial well BMP-33. These increases do not appear to be related to the WDA because similar increases also occurred in up gradient Rehder Creek alluvial well BMP-1 (**Figure 9-8**). The abnormally high water levels in the alluvial aquifer due to the significant precipitation in 2011 may be responsible for mobilizing additional ions in shallow groundwater and producing the observed increases in water quality parameters.

After the WDA fill has reached it final elevation and is graded, it will be covered with a minimum of 4 feet of the best available non-toxic and non-combustible material, including subsoil and topsoil as described in the Reclamation Plan. No subdrainage systems will be installed. Toxic, acid-forming and other deleterious materials will be handled and covered in accordance with the Rules 17.24.505(2) and 17.24.204(2). The WDA will be revegetated in accordance with the Reclamation Plan.

9.5 Underground Mine Impacts

9.5.1 Impacts Due to Subsidence

Subsidence impacts include those hydrologic impacts introduced as a result of surface subsidence cracks or deformation of overlying strata as the coal is mined. Each longwall panel at the Bull Mountains Mine No. 1 consists of a large block of coal, approximately 1,250 feet in width by 15,000 to 23,300 feet in length. Surface depressions or subsidence troughs are expected to form as the overburden is undermined and coal is extracted. Overburden rocks are allowed to flex downward, fracture (creating a Fractured Zone) and collapse or cave into the void (forming a Caved Zone) causing immediate and progressive surface subsidence as the longwall system advances along the length of the panel. Generally, the amount of surface subsidence is less than the thickness of the coal seam and has been predicted to be about 70 percent of the extraction height in the Bull Mountains (Agapito, 1990).

The Mammoth Coal ranges in thickness from 8 to 12 feet in the permit area, so approximately seven to eight feet of surface subsidence is expected. This was confirmed in August 2011 when Panel 2 undermined the communication tower on Dunn Mountain and seven feet of subsidence was recorded. No damage to the towers was recorded; tension on the guy-wires was constantly adjusted as Panel 2 approached and undermined the tower. Linear surface fractures, minor rockslides, and small sink-like depressions (approximately 5 feet in depth) have occurred in some areas of higher overburden. This amount of subsidence including surface fracturing was anticipated as discussed in the protection/mitigation plan that was submitted and approved prior to initiation of longwall mining.

Continued mining as proposed under Amendment No. 3, would create surface subsidence features similar to those experienced to date. Where subsidence features occur within established ephemeral watercourses, the profiles of these drainages may be modified by small ridges held up over barriers, pillars, mains, and by depressions over the longwall panels. Minor damage to roads and fences is anticipated, and minor cracks have been observed in the fall of 2013 along some roads above Panel 3.

State regulations require mine operators to promptly repair damage to private property, and landowners must be provided with a mining schedule at least six months before their property is undermined. The schedule must contain enough information to enable landowners to move cattle to safe areas, and to avoid hazardous areas while mining is taking place.

The main hydrologic issue regarding subsidence at the Bull Mountains Mine No. 1 is the potential for loss or diminution of the quantity and quality of groundwater and surface water, and impacts to wells, springs, ponds, and stream reaches as a result of subsidence-related fracturing of overburden shales and sandstones. The potential exists for the alteration of surface and shallow groundwater flow paths as a result of subsidence-related fracturing.

Near vertical subsidence fractures are expected to be controlled or buffered by thick and relatively soft shales. Subsidence fractures in areas of shallow overburden cover may cause diversion of the shallow groundwater, and some increased lateral drainage from higher overburden units to lower springs also may occur as a result of flow along subsidence fractures. Settling and compression after mining are expected to heal or close most subsidence fractures, thereby returning the shallow groundwater flow directions, including flow to springs, to approximately the premining orientation. Some spring impacts are expected as not all pre-existing hydrologic flow-paths may be reestablished to pre-mine conditions. If flow to the springs is impacted, the permittee is committed to replacing the water resource following methods discussed in Permit C1993017, Vol. 3, Section 314, 5.0, Mitigation Plans.

Portal discharge is possible after reclamation, and would be controlled initially by seals and a piping system as the rubble zone saturates and water levels rise. However, even without a piping system, the temporary effectiveness of the portal seals would probably not allow water levels to raise much beyond the elevation of the portal. Chemical and physical deterioration of the portal seals is expected to limit the operational life of the seals to a relatively short period. Seepage through the fractured shallow bedrock around the portal seals and deterioration of the seals should prevent filling of the mine pool much above the elevation of the portal. Any water flowing through the portal opening will be discharged into PM Draw at an approved MPDES discharge location, and be subject to MPDES regulatory requirements.

To date, only the first three panels of the proposed total of 14 longwall panels have been mined under the current permit. A network of springs and surface water stations are monitored regularly to evaluate the potential for impacts or material damage during or post mining. As longwall mining approaches monitored springs, the frequency of flow monitoring increases from monthly or quarterly to weekly so that any discernible impacts may be evaluated and mitigated in a timely manner and in accordance with the approved mitigation plan. Thus far, several springs above panels 2 and 3 have been under mined.

Litsky Spring (Station No. 17415), the first known spring to be affected, was undermined in late-March/early-April of 2012. Recent site visits and monitoring data confirm that the pond at Litsky Spring maintains water for livestock and wildlife use, suggesting that flow from the spring has not been impacted as to affect water supply at the site.

Adjacent monitoring wells BMP-60 and BMP-90 (**Figure 9-4**), however, recorded the drop in overburden water levels as the area under Litsky Spring was mined, followed by recharge of monitoring wells as subsidence fractures healed and water levels rebounded. The drop in water level in well BMP60 was more pronounced as it was located over the middle of panel 2, while BMP 90 is located closer to an underground gate road which limits the short-term subsidence observed at this well location. Presently, the water level in well BMP 60 is about 5 feet below historically low levels, while BMP 90 remains about 3 feet above historically low levels. The drop in water level in BMP 60 reflects both loss of water due to undermining and subsidence (estimated elevation loss due to subsidence is estimated at 3 feet). Recent recharge from abnormally high precipitation in 2011 and 2013 confounds comparison of existing well levels to historical (2003 to present). As subsurface strata continues to deform and heal, it is anticipated that water levels will be reestablished at a stratigraphic level equivalent to pre-undermining. Continued monitoring of water levels will inform understanding of short and long-term response of underlying strata and consequent flow paths to undermining and subsequent recovery.

More recent undermining of springs occurred in 2013 when several springs (17115, 17145, 17165, 17185, & 17315) were undermined as the longwall miner advanced through panel 3 (**Figure 7-1**). Springs 17115, 17165 and 17315 are typically dry, precluding any evaluation of impacts from undermining.   Spring 17145 was dry in the months prior to undermining; after undermining in March 2013, flow was reported at @ 0.5 gpm (**Figure 9-5a**). Spring 17185 exhibited a brief interruption of flow immediately after undermining in May of 2013, and flow resumed within two weeks and has shown no discernible interruption in flow since recovery (**Figure 9-5b**). In both cases flows were higher after undermining than before undermining; however undermining occurred in the spring during a period of abnormally high precipitation. As present flows are within the range of historic flows recorded at these sits (**Figure 9-5c**), it is unclear whether the flows observed after undermining are a result of increased precipitation and recharge of overburden aquifers, of increased transmissivity due to deformation and fracturing of overburden strata or a combination of factors.   In either case, spring flows were not adversely affected in the short term. Continued monitoring of wells and springs will allow additional evaluation of potential impacts as longwall mining advances and additional springs are undermined.

Mitigation of impacts from subsidence generally involves replacement of water supplies lost or diverted by subsidence-related processes with the purpose of maintaining premine land uses. Mitigation plans in the permit include restoring springs, stream reaches, and ponds by opportunistic development of springs where they appear, guzzler emplacements, horizontal wells, vertical wells, pipeline systems, deepening or rehabilitating existing wells, reclamation of stream reaches and function, water treatment where appropriate or necessary, and restoring premine land uses (MDSL, 1993). Detailed monitoring and mitigation plans are provided in Permit C1993017, Vol. 2, Section 313, Appendix 313-2 Spring/Seep Mitigation Plan.

Likewise, the rights of present and future groundwater and surface water owners or users will be protected in accordance with ARM 17.24.314(1)(b) and 17.24.648. ARM 17.24.648 states that "the permittee will replace the water supply of any owner of interest in real property who obtains all or part of his supply of water for domestic, agricultural, industrial or other legitimate use from a surface or underground source if such supply has been affected by contamination, diminution, or interruption proximately resulting from strip or underground mining operation by the permittee". To protect uses replacement water must be of a quality and quantity sufficient to satisfy premining consumption requirements.

9.5.2 Impacts Due to Dewatering

Groundwater monitoring data, maps and graphs and the groundwater flow model included in the PHC were the chief tools used to assess groundwater impacts to the hydrologic balance within the CIA. Groundwater levels and quality data reported in annual hydrology reports submitted to DEQ each year by SPE were also used in this analysis. This data was used to evaluate water quantity and water quality in the potentially affected aquifers in the groundwater CIA.

9.5.2.1 Groundwater Model

The Amendment No. 3 application included a transient flow model to evaluate the potential effects of mining on groundwater in the area surrounding the mine (Nicklin, 2013[2]). **Figure 9-6** shows the model domain and layering. The groundwater model simulates flow in all aquifers of concern but is focused on the Mammoth Coal and upper underburden, as these aquifers are expected to experience the greatest effects from mining. The groundwater model is calibrated by comparing model results to measured water levels from monitoring wells and adjusting model parameters to achieve the best simulation of groundwater conditions. After calibration the model was run forward in time to predict water levels at the end of mining. In this predictive simulation, the mine tunnels are added to the model according to the proposed mine plan schedule as drains which simulate the dewatering associated with mine development. As mining progresses the material properties of the Mammoth Coal and overburden layers are also modified to simulate the collapse of material into the void left behind by longwall mining, and the subsidence and fracturing that occurs above the mined out areas. The results of this simulation are shown in **Figure 9-7**, which displays the predicted drawdown in the Mammoth Coal and upper underburden at the end of mining. In the Mammoth Coal, the area of the mine workings is completely dewatered, and an area of drawdown extends primarily to the north of the mine. A drawdown cone of depression is formed in the upper underburden, centered on the northern part of the mine workings and extending throughout the life of mine area and to the north. Drawdown to the south, east, and west in both the Mammoth Coal and the upper underburden is limited by the outcrops of the aquifers in those directions.

9.5.2.2 Alluvium

46 alluvial monitoring wells monitor the alluvial aquifer system in the Bull Mountain area (**Figure 9-8**). Historic monitoring data indicates that the alluvium within and near the permit boundary is often dry. Generally, alluvial water levels have increased over time (since 2003) and are responsive to seasonal precipitation events, especially during events in May of 2011.

Rehder Creek drains much of the proposed permit area. **Figure 9-9** shows Rehder Creek alluvial responses in upgradient well BMP-17 and down gradient wells BMP-19 and BMP-1, indicating that all wells responded to increased precipitation in 2007 and 2011. Also notable in **Figure 9-9** is how the degree and duration of saturation increases moving downstream. At upstream well BMP-17 alluvial water is present only after major precipitation events, moving downstream at well BMP-19 a small amount of water is usually present except during long dry periods, further downstream at well BMP-1 alluvial groundwater is always present.

Portions of the proposed permit area are also drained by Fattig Creek and Railroad Creek, and alluvial wells from these drainages are shown in **Figure 9-10**. Well BMP-77 is completed in the Fattig Creek alluvium and shows a similar increasing trend with response to precipitation events as seen in the Rehder Creek alluvium. Alluvial groundwater quality in Fattig Creek also shows a response to the significant precipitation event of 2011, with increases in SC, TDS, and sulfate. Well BMP-80 is located in the Railroad Creek drainage, and shows the presence of alluvial groundwater only in response to major precipitation events.

Tributaries of Rehder Creek known as the 16 and 17 drainages drain the majority of the current permit area. Water levels and quality in alluvial wells in these drainages are shown in **Figure 9-11**. Alluvial well BMP-62 shows an example of alluvial groundwater influenced by inflow from the shallow overburden aquifer. Alluvial groundwater is present most of the time, with seasonal variations in water level due to snowmelt and increase spring precipitation evident. Water quality at BMP-62 is also much better than at other alluvial wells. The 17 drainage is the only drainage which has been undermined to date. Alluvial monitoring wells BMP-32 in the 16 drainage and BMP-45 in the 17 drainage show that alluvial water quantity and quality are similar in both drainages, indicating that undermining has not affected alluvial water quality or quantity in the 17 drainage.

The alluvial hydrographs discussed above indicate that there is no evidence that mining and associated dewatering of the Mammoth Coal have affected water levels of the alluvial aquifer system. Because the alluvial aquifer is typically a perched aquifer supplied by recent precipitation or snow melt, additional mining is not expected to affect water levels in the alluvial aquifer.

Water quality of the alluvial groundwater generally declined recently, however, based on the alluvial water quality graphs discussed above this appears to be due to significant precipitation in 2011 and the resultant higher alluvial water levels. Currently, there is no evidence that alluvial water quality has been impacted by mining. No exceedances of water quality standards were observed for any of the alluvial monitoring wells. The additional proposed mining is not expected to have any effects on alluvial water quality.

9.5.2.3 Overburden

Overburden water levels are monitored by 33 monitoring wells within the permit boundary and vicinity (**Figure 9-12**). Generally, water levels in shallow overburden (BMP-47, total depth (TD)=40 feet) and relatively deep overburden wells (BMP-4, TD=200 feet) have increased over time (**Figure 9-13**). Shallow well BMP-47 in the Rehder Creek drainage shows an abrupt water level increase of approximately 15 feet due to seasonal precipitation in June 2011. By contrast, deeper well BMP-4 shows a slow but steady increase in water level in the deeper overburden aquifer in an area remote from mining.

Figure 9-13 shows that the water-level response of shallow overburden well BMP-47 is similar to that of nearby Rehder Creek alluvial well BMP-1 (**Figure 9-9**), indicating that both the shallow overburden and alluvium rapidly respond to seasonal precipitation events. Respective well logs show alluvium directly overlying overburden bedrock in Rehder Creek drainage indicating a likely hydraulic connection.

Currently, there is little evidence that longwall mining has had a significant impact upon overburden water levels except in areas affected by subsidence. Water levels in monitoring wells BMP-60 and BMP-

90 in the vicinity of longwall panel 2 have shown declines of approximately nine feet and 18 feet, respectively (**Figure 9-4**). Inspection of the hydrographs for the two wells indicates that water levels in these relatively shallow overburden wells (BMP-60, TD=50 feet; BMP-90, TD=30 feet) were slowly declining from the precipitation of 2011 and then declined abruptly between February 2012 and April 2012 when BMP-60 went dry. **Figure 9-4** indicates that after this period water levels in both wells began to recover and subsequently have had a slow decline, likely due to dry conditions.

The abrupt decline of water levels suggests that the relatively shallow overburden and perched aquifer system in the vicinity of these wells was partially drained via subsidence fractures that healed over the period between February and April 2012 leading to the water level rebound as seen in **Figure 9-4**. Well log data indicates that relatively impermeable gray shale occurs below the respective screened intervals. These rocks may have become fractured, allowing perched groundwater to drain into the mine workings, and then healed due to compression and settling. This data may illustrate that the various perched aquifers within the upper overburden may have become temporarily dewatered by subsidence fractures in the vicinity of BMP-60 and BMP-90 due to mining. Monitoring data will continue to be collected to evaluate the affect upon local overburden dewatered due to subsidence fractures.

Similar temporary overburden dewatering may occur over all longwall mining areas as subsidence occurs, but these effects are expected limited in spatial and temporal extent. No long term effects on overburden water quantity are expected as a result of mining.

Comparison of current and baseline water quality concentrations of TDS, sulfate, bicarbonate, and specific conductance show no significant differences, indicating that mining has not impacted water quality of the overburden aquifer. The water quality of shallow overburden (BMP-43, **Figure 9-13**) and Rehder Creek alluvium (BMP-1, **Figure 9-9**) located just down gradient of mining remains relatively consistent, but shows a decline in water quality during the rise of water levels associated with the 2011 high precipitation event. Deeper overburden water quality at well BMP-4 (**Figure 9-13**) has remained consistent over time.

Elevated arsenic concentrations were reported in 2006 from monitoring well BMP-10, located over longwall panel 4 and up gradient of mining at that time. The initial arsenic concentration (0.051 mg/L) recorded in 2006 was approximately five times the DEQ-7 human health limit of 0.01 mg/L. Arsenic concentrations in this well have rapidly declined (**Figure 9-14**) and are currently below laboratory detection limits. The source of the elevated arsenic concentrations in the overburden aquifer is unknown but its location up gradient indicates that it is not related to mining. A similar pattern of declining concentrations was recorded in this well for iron, which was associated with a less pronounced decline of specific conductance, TDS, sulfate, and bicarbonate (**Figure 9-14**).

Because overburden groundwater does not flow through the mine workings, or come into contact with the mine gob, mining is not expected to affect overburden groundwater quality.

9.5.2.4 Mammoth Coal

17 groundwater monitoring wells monitor water levels of the Mammoth Coal aquifer in and outside of the permit boundary (**Figure 9-15**). Water level data associated with a number of wells, especially those within the permit boundary, indicate that longwall mining and the development of gate roads has lowered water levels and created a cone-of-depression in the Mammoth Coal that radiates outward from panels 3 and 4 as mining continues. **Figure 9-16** indicates that drawdown or the radius of influence

is greater east of mining because of confined conditions within the coal; unconfined conditions prevail west and south of mining where the radius of influence is limited.

Hydrographs show that the respective water levels in BMP-37, BMP-11, and BMP-8 have been lowered approximately 30, 25, and 18 feet respectively (**Figure 9-17**). Mammoth Coal drawdown is not observed three miles east of BMP-8 toward BMP-14 and BMP-21 (**Figure 9-18**), where water levels have remained stable or increased slightly during the same general period (2004-2011). Similarly, drawdown rapidly decreases west of BMP-37 as water levels in BMP-30 have shown a general increasing trend since 2003 as seen in the hydrograph of BMP-30 (**Figure 9-18**). Mammoth Coal wells to the south of BMP-11 are typically dry.

Water levels in the Mammoth Coal north of the permit boundary in wells BMP-3 and BMP-5 generally declined from 2003-2010, which is likely attributable to mining related drawdown (**Figure 9-19**). Water levels in both of these wells increased following the high precipitation of 2011, with BMP-3 water levels rising 15 feet due to the hydraulic connection of the Mammoth Coal and alluvium near this location. Since 2011 water levels in BMP-3 have declined to approximately the same level as 2012 and BMP-5 water levels have declined approximately two feet below 2010 levels. The high precipitation of 2011 may have acted to temporarily interrupt mining related drawdown at BMP-3 and BMP-5, but does not appear to have altered the long term trend of drawdown north of the mine.

The water level observations in Mammoth Coal monitoring wells are generally consistent with the expected pattern of decreasing drawdown radiating outward in all directions from the dewatered mine area. Current Mammoth drawdown illustrated in **Figure 9-16** (calculated drawdown 2004-2011) lies within the predicted drawdown of the groundwater flow model described in the PHC. Hydrologic impacts of longwall mining activity upon the Mammoth Coal are limited by the extent of the coal to the south and west. The amount and extent of drawdown in the Mammoth Coal is expected to increase as mining progresses, particularly to the north of the active mine area. Following the completion of mining, water levels will begin to recover, and are expected to reach a post-mine equilibrium within 50 years.

Currently, there is no evidence that mining has affected the water quality of the Mammoth Coal aquifer. Comparison of SC, TDS, sulfate, and bicarbonate concentrations in Mammoth Coal wells over time indicate that there are no persistent trends associated with mining. **Figure 9-17**, **Figure 9-18, and Figure 9-19** indicate that water quality data have generally been consistent over time regardless of changes in water level. Water quality of BMP-37, BMP-11, and BMP-8 are generally unchanged through time despite being in the immediate vicinity of active longwall mining. The average specific conductivity of water produced by Mammoth Coal wells is higher relative to the alluvial and overburden aquifers due to relatively greater concentrations of sulfate and sodium. Approximately one-half of the Mammoth Coal wells produce Class II water and one-half produce Class III water. This data is consistent with Mammoth Coal baseline water quality (Class II to Class III). No exceedances of DEQ-7 standards were observed in any of the Mammoth Coal wells.

Because mine dewatering produces groundwater flow towards the mine working during mining, no water quality affects are expected during mining. After mining is completed, some of the mine gob will become saturated. Groundwater quality in the mine gob is expected to be degraded relative to natural water quality, however, due to the small quantity of gob influenced water and the slow water movement in the Mammoth Coal this poor quality water is not expected to migrate outside the permit boundaries within 50 years after mining.

9.5.2.5 Underburden

The underburden aquifer in the area is monitored by 25 monitoring wells (**Figure 9-20**). The drawdown map (**Figure 9-21**) of the upper underburden aquifer within the permit area show water level declines similar to and development of a cone-of-depression nearly coincident with the drawdown observed in the overlying Mammoth Coal aquifer. This indicates the upper underburden aquifer has also been affected by mining and that a hydraulic connection exists in some areas between the Mammoth Coal and upper underburden aquifers where the potentiometric heads are similar.

Comparing the hydrographs for upper underburden wells BMP-12, and BMP-9 in **Figure 9-22** to the hydrographs for co-located Mammoth Coal wells BMP-11, and BMP-8 (respectively) in **Figure 9-17** shows that while drawdown has occurred at both locations in both aquifers, the timing and magnitude of drawdown can vary. This is likely due to the variable geology of the underburden, where the water bearing units tend to be discontinuous and separated by lower permeability rocks. Although no underburden well is co-located with Mammoth Coal well BMP-37 (**Figure 9-17)**, underburden well BMP-44 (**Figure 9-22**), located approximately one mile north shows a similar water level response to mining. **Figure 9-23** shows underburden wells located to the east (BMP-83 and BMP-15) and west (BMP-31) of the mine area which have not been affected by mine drawdown. The two wells east of the mine are in similar locations as Mammoth Coal wells BMP-21 and BMP-14 (**Figure 9-18**) and show similar water level trends. Underburden well BMP-31 is co-located with Mammoth Coal well BMP-30, but the underburden well shows water level fluctuations not observed in the Mammoth Coal well indicating a hydraulic separation between the hydrologic units at this location. The water level fluctuations in the underburden well do not appear to be related to mining and recent water levels have been similar to those first observed in 2003.

Underburden wells north of the mine show different water level responses depending on local geologic factors (**Figure 9-24**). Underburden well BMP-38 shows no effects of mining related drawdown, and the well mimics the water level response of the alluvial aquifer observed in co-located well BMP-33 (**Figure 9-3**) indicating that the underburden is hydraulically connected to the alluvium near this location. As illustrated in **Figure 9-24** water levels in underburden well BMP-6 show a general decreasing trend since 2007, but recovered in response to the high precipitation in 2011. The decrease in water level in BMP-6 is similar to the response seen in Mammoth Coal well BMP-5 (**Figure 9-19**) and is likely related to mine drawdown.

Due to the hydraulic connections between the Mammoth Coal and the upper underburden, the effects of mining on upper underburden water quantity are expected to be similar to those described for the Mammoth Coal.

By contrast, the relatively deep sandstones of the lower underburden aquifer are hydraulically isolated from the Mammoth Coal and upper underburden aquifers. Aquifer test data (Hydrometrics, 2009) associated with the Office Supply Well (OSW) confirm that confined conditions exist in these relatively deep sandstones (355-405 feet) and that the nearest domestic well, a distance of approximately 4,200 feet from the OSW, will not be adversely impacted by continuously pumping the OSW at approximately 6 gpm. During a pump test, observation well 62614-100-UB (BMP-121), located 3,346 feet from OSW, recorded 1.4 feet of drawdown. Projected drawdown shows 3.3 feet of drawdown in monitoring well BMP-121 and three feet of drawdown in the nearest private well after 20 years of continuous pumping. These relatively deep sandstones are the source of domestic use and are isolated from the effects of mining.

Baseline water quality of the upper underburden aquifer is similar to water quality observed between 2003 and 2011. Currently there is no evidence that mining has affected the water quality of the upper underburden aquifer. Water quality graphs show no persistent trends or changes in the water quality of the underburden aquifer even in areas where the potentiometric surface of the upper underburden has been affected by mining (**Figure 9-22**). Consistent water quality has been recorded in a number of other underburden wells indicating they have remained unaffected by mining. BMP-15 (**Figure 9-23**), located down gradient just outside the eastern Amendment 3 boundary; BMP-31 (**Figure 9-23**), located down gradient along the western permit boundary; and BMP-6 (**Figure 9-24**), located immediately down gradient just north of the Amendment boundary show consistent water quality from 2003 to the present.

Approximately one-half of the underburden wells exhibit Class II water and the rest have Class III water consistent with baseline SC and water quality. Based upon monitoring well information, there is no evidence of any mining related impacts to upper underburden or to the relatively deep upper underburden water quality in the vicinity of the Bull Mountains Mine No. 1 and no exceedances of DEQ-7 water quality standards have been reported in the wells.

Similar to the Mammoth Coal, water quality in the upper underburden aquifer may be locally affected by poor quality water from the mine gob after mining is completed and water levels in the mine area recover. No water quality effects on the deeper underburden aquifer are expected due to the hydraulic separation between this aquifer and the mine.

10.0 MATERIAL DAMAGE

As defined by Montana statue, "material damage means, with respect to protection of the hydrologic balance, degradation or reduction by coal mining and reclamation operations of the quality or quantity of water outside the permit area in a manner or to an extent that land uses or beneficial uses of water are adversely affected, water quality standards are violated, or water rights are impacted. Violation of a water quality standard, whether or not an existing water use is affected, is 'material damage'" (82-4-203, MCA). Observation of changes to the hydrologic balance observed with current mining provides a framework within which continued and future impacts can be anticipated. It is possible to make quantitative and qualitative projections regarding the severity and extent of impacts expected with proposed mining and to evaluate the likelihood that impacts will extend outside the permit area **(Table 2-1**).

10.1 CUMULATIVE IMPACT OF HISTORIC AND CURRENT MINING

Currently there is no evidence that the quantity and quality of surface waters has been impacted by mining activities. Surface streamflow in the area is ephemeral and driven by storm events and extended periods of wet weather that act to recharge perched aquifers. Perched aquifers, in turn, supply spring flow and dry up during extended periods of below normal precipitation. Spring-flow may be impacted through subsidence processes related to undermining of the overburden aquifers, potentially interrupting, and/or altering subsurface flow-paths. Potential impacts to identified surface water users in the surface water CIA are shown in **Table 6-2**.

Springs and seeps are monitored regularly in order to assess impacts from mining. Where flows from springs and seeps are impacted, water quantity and water rights have the potential to be impacted. Impacts to water rights are assessed and evaluated with respect to regional and local impacts to spring systems that feed surface water resources. To date, several springs under panels 2 and 3 have been undermined. While some springs (17145, 17185) have shown a temporary alteration or interruption of flows or adjacent well-water levels as anticipated, weekly monitoring of spring flows prior to and after undermining have shown no adverse long-term effects.

As stated in Section 9.0, surface water runoff is controlled through a series of ponds and diversion structures in the facilities and WDA, and regulated through DEQ's MPDES program. Discharges to surface waters are very infrequent with the first discharges in 20 years occurring during extreme wet periods in 2011 and 2013. Water management controls on peripheral facilities areas (permit lands not including the main facilities and WDA) include structures to control runoff from mine roads, pads, and other land surface disturbances, and are managed through the implementation of BMPs. BMPs typically include a variety of design considerations (culvert sizing, berming, placement of structures, etc.) and are described in detail in Permit C1993017, Vol. 3, Section 314, 3.0, Surface Water and Groundwater Control and Treatment Plan. Evaluation of impacts relating to surface water runoff and management are therefore evaluated with respect to adherence to approved design plans and permit conditions in controlling and managing surface runoff. No significant impacts to surface water resources have been observed to date regarding implementation and management of surface water controls, including MPDES-permitted discharges and surface BMPs.

Current monitoring indicates mining has affected groundwater quantity by producing an area of drawdown around the dewatered mine workings. This area of drawdown is expected to increase and expand as mining progresses and then recover after mining is completed. Potential impacts to identified groundwater users in the groundwater CIA are shown in **Table 6-1**.

The most significant drawdown and the greatest radius of influence have been recorded in the Mammoth Coal (drawdown of approximately 30 feet in BMP-37) consistent with the predictions made in the PHC. Significant drawdown (approximately 20 feet in BMP-44) has also been recorded in the upper underburden that generally mimics the drawdown pattern or radius of influence of the overlying coal indicating that the upper underburden and coal aquifers are hydraulically connected.

The flow model prediction in the PHC indicates groundwater associated with the Mammoth Coal and upper underburden aquifers will recover to near pre-mining levels approximately 50 years after the cessation of mining. After the conclusion of mining, the gate roads may remain intact or may collapse, thus each of these scenarios was tested using the groundwater model. If the gate roads collapse, groundwater levels in the northern part of the mine area and north of the permit area will return to near pre-mine levels. If the gate roads remain intact, a mine pool will form in the northern part of the mine workings resulting in post-mine water levels higher than pre-mine near the north permit boundary. In either scenario, some residual drawdown will persist in the southern part of the mine area indefinitely due to the change in aquifer properties from coal to gob.

By contrast, very little drawdown has been recorded in the overburden aquifer except directly over panel 2 (BMP-60 and BMP-90) during active mining. Extensive overburden drawdown is expected over the mined area as mining advances consistent with predictions in the PHC as overburden subsidence fractures provide a series of transmissive conduits into the mineralized gob of the Caved Zone. Drawdown in the overburden is not expected outside of the subsidence area due to the generally perched and discontinuous nature of the overburden aquifers. Drawdown of the alluvial aquifer system is not expected as these sediments are often dry and become partially saturated due to significant precipitation events.

Currently, there is no evidence that local and off permit groundwater quality of any of the hydrologic units has been degraded or impacted by mining. Groundwater quality of shallow and deep aquifers (alluvium, overburden, coal, and underburden) is monitored regularly by a network of 105 monitoring wells to alert DEQ about the potential for material damage during or post mining.

A decline of groundwater quality is expected as longwall mining and subsidence continue to produce additional panels of collapsed and mineralized rubble in the Caved Zone (gob). Vertically transmissive and mineralized fractures may intercept and direct shallow groundwater into the Caved Zone affecting local overburden groundwater levels, spring discharge, and surface drainage that may ultimately increase mine discharge. This prediction is consistent with the PHC: "A general increase in total dissolved solids, sodium, and sulfate concentration is anticipated in the groundwater that flows through the gob and potentially in the highly fractured zones immediately above the mined out area" (Page 314-5-47). As described in Section 6.2.3 of the PHC, Madison well water used in the underground mine workings is expected to constitute less than 0.1 percent of the total water in the mine gob voids. Because of this, the use of Madison well water in the underground mine workings is not expected to have any measurable impact on the quality of mine gob water. The eventual groundwater quality within the mined-out area or Caved Zone may become similar to the groundwater quality within abandoned coal mines near Roundup, MT where the average TDS, sulfate, and specific conductance concentrations are 2,042 mg/L, 1,106 mg/L and 3,038 μS/cm, respectively. However, the groundwater quality within the

Caved Zone may exceed these concentrations since the groundwater in the abandoned mines near Roundup does not come into contact with mineralized gob.

10.2 Material Damage Assessment

10.2.1 Surface Water

Evaluation of material damage to surface waters includes an assessment of potential impacts to surface waters and the monitored response of surface water systems to potential impacts. Material damage criteria established in Section 2.0 include water quality standards, beneficial use criteria for the support of livestock, and impact to water rights.

Thus far, impacts to surface waters have been minimal; potential impacts include impacts to surface waters from water management and control within the facilities area and WDA, the effects of surface infrastructure (roads, culverts, pads) on surface waters outside the facilities and WD, and the effects of undermining and subsidence on springs and seeps.

Impacts from surface water runoff both within the facilities area and WDA are evaluated through compliance with narrative water quality standards (for ephemeral streams) and MPDES permit requirements. Adherence with general operational provisions of the narrative surface water quality standards (ARM 17.30.635 through 17.30.637) constitutes compliance with water quality standards for ephemeral streams. On-site management of surface water is detailed in the Permit C1993017, Vol. 3, Section 314, 3.0, Surface Water and Groundwater Control and Treatment Plan, and includes a variety of surface water controls that meet the requirements of the narrative surface water quality standards contained in ARM 17.30.645 through 647. Adherence and compliance with the Surface Water and Groundwater Control and Treatment Plan is assessed during monthly mine inspections by department personnel, and through departmental management and oversight of permitted activity. No significant issues regarding compliance with this plan have been noted to date, and no material damage has been observed in regards to surface water runoff from disturbed areas within the permit area. With the exception of a wet-weather exceedance for settleable solids and pH during 2011 and 2013 (see Section 9.4.1), MPDES discharges to date have been very infrequent and have not violated MPDES permit conditions.

As underground mining thus far has progressed only through Panel 3, potential impacts to surface waters have been confined to springs within panels 2 and 3 and to the capture of stormwater runoff within the mine permit area. As described in Section 9.5.1, impacts due to subsidence have been limited, buffered by recent recharge of overburden aquifers, and have had no impact on the quality and quantity of surface water resources (springs) in the permit area. Accordingly, because the current mining methods are proposed to extend throughout the expanded permit area, significant, irremediable impacts to the quality and quantity of surface water resources are not expected from continued underground mining.

Due to the fact that only the first three longwall panels have been undermined, surface water impacts are limited in their potential extent. To date, no material damage to surface waters is evident. Narrative standards for surface waters have not been violated or exceeded, and the quantity of surface waters (springs and ephemeral runoff) has not been impacted due to mining activity, and surface water rights have not been impacted. Accordingly, because current mining activities are proposed throughout the expanded permit area, disturbance of the hydrologic balance on and off the permit area and material damage to surface waters outside the permit area are not expected from continued underground mining.

10.2.2 Groundwater

Currently, there is no evidence of material damage and no material damage is predicted with mining proposed in Amendment 3. There is no evidence from monitoring data to suggest a change in predictions made in the PHC with regard to potential impacts to water quality and levels. Comparison of baseline and recent groundwater quality data show no significant changes. No water quality standards, numeric or narrative, have been exceeded and beneficial uses (domestic and livestock) have not been impacted.

Mining is not expected to affect the alluvial aquifer beyond the permit boundary. The alluvial section within the boundary is generally dry. Groundwater levels in the overburden, Mammoth Coal and upper underburden near the western permit boundary have been lowered as a result of mining and drawdown in these aquifers will continue as mining advances. Mining proposed in Amendment 3 will result in continued drawdown to the east, south and north of the mine but is expected to remain largely within the mine permit boundary and drawdown will not affect most groundwater users. Mining related drawdown in these aquifers may affect a few domestic wells completed in the upper underburden north of the permit area. Since most domestic and stock wells produce from relatively deep sandstones (deep underburden aquifer) that are hydraulically isolated from mining by a relatively thick section of alternating shales and siltstones, no impact to these deeper wells is expected. SPE is committed to replacing any water supplies affected by mine related drawdown with a comparable permanent supply.

Post mining groundwater quality within the mined-out area (Caved Zone) is expected to degrade after coming into contact with fresh rock surfaces exposed in subsidence fractures and mineralized rubble or gob. Oxidizing conditions are anticipated until after mining is complete and resaturation of the collapsed material has occurred. These conditions may result in increased sulfide oxidation, cation exchange, leaching, and weathering, which together may cause an increase in the concentrations of calcium, magnesium, sulfate and sodium ions. Due to the buffering capacity of the alkaline mineralogy of the overburden and shallow underburden, development of acidic conditions in water present in the gob is extremely unlikely. As explained above at 9.5.2, any degradation of groundwater quality is not expected to render groundwaters unsuitable for current or anticipated use. Accordingly, because current mining methods are proposed throughout the expanded permit area, material damage to the quality or quantity of groundwater resources outside the proposed permit area is not expected from continued underground mining. Although presently there is no evidence of a general increase in any water quality parameters that can be attributed to mining, continued monitoring will provide additional insights of the potential effects on groundwater quality predicted to accrue over time as mining progresses.

10.3 CONCLUSION

SPE's Bull Mountains Mine No. 1 has supplied sufficient information for the completion of this CHIA and finding. Although DEQ analysis identified some surface water users and water rights holders outside the permit area that may experience a temporary impact to their water resources, the Bull Mountains Mine permit commits to replacing water supplies that have been affected by mining with water of similar quality and quantity.

At this time, DEQ finds that the operational and reclamation plans for the Bull Mountains Mine No. 1 have been designed to minimize impacts to the hydrologic balance within the permit area and to prevent material damage outside of the permit area.

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EXHIBIT D-DEQ RESPONSE BRIEF

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**BEFORE THE BOARD OF ENVIRONMENTAL REVIEW
OF THE STATE OF MONTANA**

IN THE MATTER OF: THE NOTICE OF APPEAL AND REQUEST FOR HEARING BY MONTANA ENVIRONMENTAL INFORMATION CENTER REGARDING DEQ 'S APPROVAL OF COAL MINE PERMIT NO. C1993 017 ISSUED TO SIGNAL PEAK ENERGY LLC FOR BULL MOUNTAIN MINE NO. 1 IN ROUNDUP, MT.	**CASE NO. BER 2013-07 SM** **AFFIDAVIT OF MARTIN VAN OORT**

STATE OF MONTANA)
) ss.
County of Lewis and Clark)

I, Martin Van Oort, being duly sworn, state as follows:

1. I am over 18 years of age.

2. I reside in Lewis and Clark County.

3. I am employed by the Montana Department of Environmental Quality ("the Department") as a Hydrologist for Department's Coal and Uranium Section.

4. I received a B.S. in geology, magna cum laude, from Hope College in Holland, MI, in May 2001. In August 2005 I received a M.S. in geology, summa cum laude, from The Ohio State University in Columbus, OH. My specialization for my Master's degree was in hydrogeology

and my thesis project was a groundwater model of dewatering due to mining at a limestone quarry.

5. From October 2005 to September 2008, I worked as a project hydrogeologist for an environmental consulting company, GeoTrans, Inc., in Sterling, Virginia. My duties with GeoTrans included field work and report preparation for environmental studies, and groundwater flow and transport modeling. From September 2008 to May 2013, I worked as a hydrogeologist for the Department's Solid Waste Section, in Helena, Montana. For the Solid Waste Section I reviewed hydrogeologic information in license applications for solid waste facilities, compliance monitoring data submitted by licensed facilities, and corrective action plans and progress reports for facilities in corrective action.

6. In my capacity as a hydrologist for the Department's Coal and Uranium Section, I review hydrologic information and among other things, advise the Section about the sufficiency of hydrologic information including the Probable Hydrologic Consequences ("the PHC") report included in an application for a permit or an amendment to a permit for a coal mine operation. In addition, I assist with analysis of hydrologic information, formulation of the material damage determination, and preparation of the Cumulative Hydrologic Impact Assessment ("CHIA") that is required before the Department can approve an application for a surface mine operating permit or an amended permit.

7. I was part of the team that reviewed Signal Peak Energy's (SPE) Application for Amendment No. 3 to their coal mine operating permit and prepared the CHIA as a part of the Department's review of the SPE Amendment No. 3 Application.

8. In the course of my work on the CHIA for the Amendment No. 3 Application, I reviewed hydrologic information included in the application, including the PHC, other hydrologic information contained in annual hydrology reports submitted by SPE under MSUMRA, and

information available in the public record such as groundwater information maintained the Montana Groundwater Information Center and the Department of Natural Resources and Conservation.

9. In our review of the PHC submitted by SPE we concluded that the Groundwater Model included in the PHC was based on generally accepted methodologies and that it provides a reasonable prediction of groundwater flow in the confined aquifers, such as the Mammoth Coal, at Bull Mountain Coal Mine #1. We also concluded that the particle tracking conducted using the results from the Groundwater Model provides a conservative prediction of the rate that gob water may migrate through the undisturbed Mammoth Coal.

10. Coal Section hydrologists are not aware of a generally accepted groundwater model or modeling methodology capable of predicting, with a reasonable probability of certainty, the concentration of inorganic constituents at any time in a hydrologic unit subject to migration of groundwater from an area mined by underground methods that permit caving of overburden.

11. Based on my review of the PHC and the hydrologic information gathered for review of the SPE Application, no groundwater wells identified in the CHIA and located within the cumulative impact area produce water solely from the Mammoth Coal.

12. Based on my review of the PHC and the hydrologic information gathered for review of the SPE Application, a groundwater well located in the cumulative impact area and completed solely within the Mammoth Coal would likely only produce quantities of water sufficient for marginal livestock watering or marginal (requiring use of a cistern) domestic use.

13. "Natural specific conductance," the measure of total dissolved solids used to classify groundwaters in ARM 17.30.1006, is equivalent to "electrical conductivity" ("EC") as defined in ARM 17.30.602(7) because both measure the conductivity of water at 25° C.

14. The CHIA and the ARM 17.24.1006 respectively refer to measurements of total dissolved solids by specific conductivity ("SC") or electrical conductivity ("EC") which are interchangeable measures for the purpose of the CHIA.

15. This completes my affidavit.

AFFIANT

Martin Van Oort

Subscribed and sworn to before me by Martin Van Oort, this 27th day of May, 2014.

Signature of Notary

State of Montana
County of Lewis & Clark

Subscribed and sworn to (or affirmed) before me this 27th day of May 2014, ~~20~~___, by Martin Van Oort.

K. BREWER
NOTARY PUBLIC for the
State of Montana
Residing at Helena, Montana
My Commission Expires
October 19, 2016

K. BREWER NOTARIAL SEAL STATE OF MONTANA

________ (sign)
Notary Public ~~for~~ the State of Montana
K Brewer (print)
Residing at: Helena, Montana
My Commission expires: 10/19/16

BULL MOUNTAINS MINE NO. 1
PERMIT NO. C1993017

VOLUME 3

SECTION	**TITLE**
314	**PROTECTION OF THE HYDROLOGIC BALANCE**

MUSSELSHELL & YELLOWSTONE COUNTIES
MONTANA

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17.24.314 PLAN FOR PROTECTION OF THE HYDROLOGIC BALANCE

1.0 INTRODUCTION

To minimize the disturbance from mining on the hydrologic balance within and adjacent to the Bull Mountains Mine No. 1 permit area and to prevent material damage to the hydrologic balance in the area outside to the permit area:

(1) mining, reclamation, and monitoring plans, and data reporting schedules, which emphasize protection of the hydrologic balance, have been developed and will be implemented; and

(2) potentially affected water rights and alternative sources of water have been identified.
The following discussion will address mining and above ground activities as they relate to:

- groundwater and surface water protection;
- alternative sources of water;
- operational and postmining groundwater and surface water monitoring plans; and
- the probable hydrologic consequences of mining.

The plan for protection of the hydrologic balance is comprised of sections containing these discussions, associated addenda, and tables, figures, maps and appendices referenced therein.

2.0 GROUNDWATER AND SURFACE WATER PROTECTION

The permittee considers the protection of surface and groundwater resources, including existing and potential future water rights, of primary importance in the implementation of the mine plan. The following outlines how groundwater and surface water protection will be accomplished.

2.1 *Groundwater and Surface Water Quality*

In accordance with Rule 17.24.314(1)(a), the permittee will implement measures to ensure that the quality of both the groundwater and surface water systems are protected within the permit, mine plan, and adjacent areas. These measures and the predicted quality of groundwater during the operational and postmining phases are discussed in the following sections.

2.1.1 *Groundwater Quality*

Due to the nature of mining, the groundwater quality in the vicinity of the mine will be affected. The groundwater flowing through the mined out area and gob is most likely to be impacted. This is primarily due to the long term exposure of unweathered rock faces to geochemical processes, which, in turn, contributes to an increase in the mineralization of the groundwater. Details of these processes and a prediction of postmining groundwater quality are presented in Appendix 314-5. Postmining groundwater quality is predicted to be suitable for its proposed uses.

To protect the groundwater from other adverse effects not directly related to the coal extraction process, any existing borings or wells that are no longer needed and which have not been converted into water supply wells will be abandoned according to procedures described in Rules 17.24.313, 17.24.632, and 17.24.1005. Other exposed underground openings will be properly sealed and the associated surface sites reclaimed according to the procedures described in the rules listed above. Proper sealing and reclamation will prevent mixing of waters from other sources with that of the groundwater system.

As discussed in 17.24.901, coal refuse (toxic, acidic, or otherwise) will not be placed in the underground workings. Excess mine water will be collected in underground sumps, and if necessary, pumped to the surface and discharged into P.M. Draw at an approved Montana Pollutant Discharge Elimination System (MPDES) discharge point. Surface water runoff at the mine portal area and surface facilities area will be prevented from entering the underground workings by grading these areas and by routing surface flow to a sedimentation pond. A perimeter embankment and diversion ditches will be used to direct flow away from the portal.

2.1.2 *Surface Water Quality*

The descriptions, designs, and plans for sediment ponds, roads, railroad loops, and ditches to be built and utilized during mining operations at the Bull Mountains Mine No. 1 are given below in 17.24.314 - Section 3.1 *Surface Water Control and Treatment Plan*. These facilities have been designed to ensure protection of the surface water hydrologic system, including water quality.

The following method and procedures will be used to maintain surface water quality:

1. Diversion of runoff originating from undisturbed areas around disturbed areas (refer to the detailed discussion in 17.24.314 - Section 3.0 SURFACE WATER AND GROUNDWATER CONTROL AND TREATMENT PLAN).

2. Minimization of disturbance areas.

3. Prudent design of roads, ditches, and culverts.

4. Proper surfacing of roads, parking lots, open storage, and work areas.

5. Use of riprap and revegetation as soon as practical after disturbance.

6. Creation of ditches to collect runoff originating from disturbed areas and routing flow to sedimentation ponds (refer to the detailed discussion in 17.24.314 - Section 3.0 SURFACE WATER AND GROUNDWATER CONTROL AND TREATMENT PLAN).

7. Collection of groundwater in sedimentation sumps before discharge to approved MPDES discharge points.

8. Use of sedimentation ponds designed to contain the 10-year/24-hour precipitation event prior to discharge in compliance with MPDES requirements.

9. Routine cleaning and maintenance of ponds, culverts, and ditches.

10. Construction of sediment catch basins and berms around stockpiles.

11. Routine in-house inspection and maintenance for all surface water control facilities.

Seven sedimentation ponds are planned for use during the life-of-mining operations (Map 308-2). All are temporary impoundments that will be removed at the cessation of mining and reclamation activities. All are designed in accordance with appropriate regulations, and any discharges will be monitored in accordance with MPDES permit terms.

2.2 *Protection of Water Rights*
The rights of present and future groundwater and surface water owners or users will be protected in accordance with Rules 17.24.314(1)(b) and 17.24.648. Existing groundwater and surface water rights within the Bull Mountains Mine No. 1 study area are listed in Addendum 1, Table 304(5)-10 and in Addendum 5, Table 304(6)-46.
The permittee will replace the water supply of any owner of real property who obtains all or part of his supply of water for domestic, agricultural, industrial or other legitimate use from a surface or underground source if such supply has been affected by contamination, diminishment, or interruption proximately resulting from the underground mining operation of the permittee. Such replacement water shall be of a quality and quantity sufficient to satisfy premining consumptive requirements. Several possible sources of replacement water are being considered, including overburden and underburden wells, horizontal drains, surface water impoundments, precipitation collection devices, and the opportunistic development of existing unaffected or relocated springs.

After mining activities cease, the permittee may allow the surface property owner to convert a monitoring well into a water supply well for private use. If this does occur, then the surface owner and the permittee will obtain written approval for the transfer from Montana Department of Environmental Quality (MDEQ) and the Board of Water Well Contractors (BWWC). The permittee will provide evidence that the well has been completed in compliance with standards established by the BWWC. The permittee will remain responsible for proper management of the well until bond release at which time the surface owner will accept management responsibilities.

2.3 *Groundwater and Surface Water Quantity*
In accordance with Rule 17.24.314(1)(c), the permittee will implement measures to ensure that the quantity of groundwater and surface water are protected within the permit, mine plan, and adjacent areas. The following sections discuss these measures.

2.3.1 *Groundwater Quantity*
Due to mine dewatering, subsidence, and groundwater withdrawal, some losses and diversions of available groundwater at the Bull Mountains Mine No. 1 are anticipated.

2.3.1.1 Mine Dewatering
During the first 20 years of mining, groundwater flow into the mine from drainage of the fragmented roof, and flow from the floor will be collected in sumps and used for the mining operation. Thereafter, excess water will be allowed to flood the lower workings. The volume of water contained in underground sumps will be maintained at less than ten acre feet (ac.ft.) at any given time for approximately the first 20 years of mining, over which period inflow was estimated by modeling to rise and then taper off (refer to Appendix 314-6, Section 3.2.3

2.3.1.2 Postmining Subsidence
Postmining subsidence will affect the overburden and the Mammoth coal. These effects are discussed in detail in 17.24.314 - Section 5.1.1 *Impact Due to Mining and Subsidence*. There is, however, some uncertainty involved in predicting the quantitative impact to the groundwater in the shallow fractured mantle system from which most springs emanate. The probability of impacts occurring to this system and to the springs is dependent upon numerous factors discussed in Appendix 314-5, Section 6.3.1. A plan has been developed to protect the recharge capacity of the groundwater system (17.24.314 Section 3.2.6 *Protection and Restoration of Recharge Capacity*). A hydro-geologic mitigation plan is presented in 26.4.314 - Section 6.0 MITIGATION PLANS.

2.3.1.3 Groundwater Withdrawal

An underburden well will be used as a source of water for the office and bathhouse. This underburden well is labeled Office Well and the location is shown on Map 308-2A. Groundwater withdrawals to supply the office and bathhouse from the underburden well is expected to have virtually no impact on the aquifer. Please refer to Section 17.24.308 (Service Facilities) for the current and anticipated usage in gallons per minute (gpm) required from this well. Also, refer to Atttachment E of Appendix 314-5 for current usage information and the relative response of a nearby observation well designated as BMP121.

The Madison Group will be used as a source of water for the mine. The impact to this aquifer from groundwater withdrawals for the surface and underground mining facilities is expected to be minimal. Approximately 500 gpm will be required for the coal wash plant, dust suppression, and other purposes. To assess the impact of this withdrawal, basic assumptions were made on the hydrologic character of the aquifers that comprise the Madison Group. These assumptions are as follows:

- Aquifer thickness (1068 feet), available head (5843 feet), and hydraulic conductivity (2.26 feet/day) of the Madison are similar to that found in this aquifer at United States Geological Survey (USGS) Test Well 3 (USGS,1729) some 25 miles south of the site.
- The storativity of this unit is 2×10^{-6}, conservatively estimated by the USGS (1979).
- The aquifer meets the criteria outlined by Theis (1935) for nonsteady, radial flow without vertical flow.

Since no groundwater is extracted from the Madison Group for other purposes in the direct vicinity the mine, groundwater withdrawal to supply the mine is considered to have virtually no impact on the system.

2.3.2 *Surface Water Quantity*

No adverse impact to surface water quantity is anticipated as a result of mining activities because surface water flow in the permit and mine plan areas is ephemeral and occurs only in direct response to precipitation events. Short reaches of some of these ephemeral streams are fed by spring discharge. Water in these reaches travels a short distance along the surface before it infiltrates back into the alluvium or the underlying bedrock. Mining may have both temporary and permanent impacts on springs contributing to surface water flow in such instances. These impacts will be the result of subsidence and, potentially from mine dewatering. The nature of these potential impacts to springs is discussed further in Appendix 314-5, 6.3.1.

The postmining landscape is designed to protect the hydrologic balance. During the life of the mine, surface disturbances in the surface facilities areas and in the longwall subsidence areas will be kept to a minimum. Proper grading, sediment control and reclamation practices will adequately control runoff into, through, and out of the disturbed areas. Reclamation designs are discussed in detail in 17.24.313 of this document.

3.0 SURFACE WATER AND GROUNDWATER CONTROL AND TREATMENT PLAN

Surface water and groundwater control and treatment plans have been designed to protect the hydrologic balance within the permit area and adjacent areas in accordance with Rules 17.24.314(2)(a) and (b) and 17.24.631 through 17.24.652. A discussion of these plans follows:

3.1 *Surface Water Control and Treatment Plan*

No major drainage relocations are planned at the Bull Mountains Mine No. 1. No perennial or intermittent stream, or any stream reach with a biologic community of two or more species of fish, amphibian, arthropod, or mollusk that are dependent upon flowing water, exists within 100 feet of any land that will be disturbed in the surface facilities areas. Only ephemeral flow of water has been observed in the drainages in the vicinity of the surface facilities since monitoring began in March 1989. The only natural drainages to be altered by surface disturbance activities will be at the Waste Disposal Area (WDA) and along P.M. Draw.

3.1.1 *Subsidence*

Rehder Creek and several of its tributaries may be affected by the surface expression of mine subsidence. In addition, upper portions of Fattig Creek, Railroad Creek, and Pompeys Pillar Creek drainages may be affected by surface expressions as well. The profiles of these drainages may be modified by small ridges held up over barriers, pillars, and mains, and by depressions over the longwall panels. The occurrence of these modifications will be dependent upon the orientation of the drainages with respect to the mine layout.

Generally, the mine will only pass under a given drainage approximately one time in a year, so the progression of the effects can be monitored and enduring detrimental effects can be mitigated. These drainages are ephemeral and flow in response to storm events. If surface water flow is being diverted downward into the mine workings, then culverts, piping, or some other appropriate method, subject to Department approval, will be used to carry flow over extraction areas.

If ponding occurs in the depressions, the permittee will mitigate adverse impacts of newly created marshy areas by redirecting surface water flow around or over the area using pipes, culverts, or troughs.

3.1.2 *Design Criteria*

For initial design, site specific input data were obtained from the following informational sources:

1. NOAA Precipitation Frequency Atlas
   10-year/24-hour precipitation event - 2.2 inches
   25-year/24-hour precipitation event - 2.7 inches
   100-year/24-hour precipitation event - 3.4 inches

2. SCS Engineering Field Manual

3. Soil Surveys

4. Urban Hydrology for Small Watersheds, SCS Technical Release No. 55

The Curve Number (CN) was determined by first determining an SCS Hydrologic Soil Group for the mine area. This was done by identifying the type of soil in the area as indicated in the soil survey described in Addendum 15, Section 304(1)(K). The predominant soils are identified as Cabbart and Delpoint, which are classified as Hydrologic Group C.

A Curve Number (CN) of 80 is obtained by using Antecedent Moisture Condition II, Soil Group C, and appropriate land use for the undisturbed soils in this area. This value is used in all hydrologic computations. Appendix 314-1 summarizes surface water control plan calculations.

No other treatment facilities are planned, other than those shown and listed in the surface water control plan. If additional facilities are added (with Department approval), they will be designed to treat a 10-year/24-hour precipitation event.

The permittee currently has a MPDES permit for all discharge points as required by law. All terms and agreements specified in the approved permit will be adhered to during the mining operation.

Sedimentation ponds and ditches will be the only water treatment methods used. . All discharges from permitted outfalls will be in compliance with the MPDES permit.

3.1.3 *Design Specifications*

Tables 314-6a through 314-8a summarize the surface water control plan specifications. Maps 314-1 and 314-2, illustrate the locations of diversions ditches, drainage ditches, culverts, and sediment ponds for the mine facilities area, and unit train loadout area, respectively. WDA surface water control is illustrated on Map 901-1 and described in Section 17.24.920. Table 314-6a summarizes design parameters for all proposed sediment ponds. Sedimentation Ponds WDA No. 1 and WDA No.2 are sized to accommodate WDA fill to the drainage divide. (see Maps 901-1 & 901-2). Sedimentation pond E-1 (MPDES MT-0028983) already exists at the mine site to control runoff from previous mining activities, and is designated as pond E in Table 314-6a. Specifications for various areas are detailed in the "Tables section" of Section 17.24.314.

3.2.1 *Coal Processing Waste*

At the WDA, an ephemeral side drainage to Rehder Creek will eventually be filled with coal processing waste. The natural drainage will be rerouted around the WDA site to prevent mixing of disturbed area and undisturbed area runoff.

3.2.2 *Mine Facilities*

Mine facilities will extend part way into P.M. Draw throughout the life of mine activities. The facilities will be protected from the ephemeral surface water flow down the draw by perimeter embankments and ditches. The embankment will be designed to withstand the 100-year/24-hour event without flow into the facilities. Sediment ponds will be used to prevent an increase in sediment from entering natural drainages. After mining ceases, the area will be re-graded and revegetated to premining conditions.

3.2.2.1 Diversion Ditches

The proposed diversion ditches will not increase the potential for landslides. There is an inactive underground mine north of the facilities area; however, no diversion will be made which would allow the entry of diverted water into the underground mine.

Diversion ditches are shown on surface water control plans (Maps 314-1 &314-2) and generally divert flow from ephemeral drainages around disturbed areas and back into the same drainages already fed by the flow. Diversion Ditches are designed to convey the 10-year/24-hour runoff event. Diversions will be constructed with slopes generally ranging from 0.5 to 1.0 percent to minimize flow velocities where possible. In those areas where velocities will be excessive, riprap or other appropriate BMP will be placed to minimize erosion.

To the extent possible using the best technology currently available, diversions will be designed, constructed and maintained to prevent additional contributions of suspended solids to streamflow and to runoff outside the permit area.

If needed, straw bale dikes will be placed and /or sandbags at 200-foot intervals along main diversion channels. The dikes will be staked in place and will remain in place until the ditches are stabilized with vegetative cover. The interim revegetation mixture listed in Table 313-7 will be broadcast seeded.

The channel bottoms are designed to be 2 to 10 feet wide. Straw bales (each approximately 3 feet long) or sandbags will be staked in place from first the left side of each channel, and then alternately on the right side of each channel, on 200-foot centers or other appropriate spacing. This will force the water to meander and reduce the erosion of the channel bottom. In addition, an energy dissipater will be installed at the outlet of each diversion channel. The energy dissipater will be constructed with riprap or straw bales staggered and staked across the entire channel bottom. If erosion appears to be a problem, the permittee will consider additional sediment control measures (e.g. closer spacing of bales) to prevent erosion.

Topsoil will be handled in compliance with Rules 17.24.701 through 17.24.703 or placed into windrows on the form slopes.

Diversion ditch designs will incorporate the following design criteria for overland flow, through flow, shallow groundwater flow, and flow from drainage basins of less than one square mile:

1. All diversions are temporary and have been designed to convey the 10-year/24-hour precipitation event.

2. Channel linings will be designed using standard engineering practices to safely pass design velocities. If riprap is found to be appropriate as a channel lining in any of the project control or impoundment structures, it will be designed, installed and maintained in consultation with the Department using the best available control practices;

3. Unless otherwise specified by the Department, the minimum freeboard will be 0.3 feet. Protection will be provided for areas of transition in nonuniform flow and for critical areas such as curves and swales;

4. The permittee has permanently diverted the PM Draw ephemeral drainage around Pond A. Design and flow characteristics of this diversion are included in Section 17.24.317, "PM Coal Fines Diversion".

The surface water control plans (Maps 314-1, 314-2) are designed to meet the requirements of Rule 17.24.638.

3.2.2.2 Sediment Ponds

Sediment ponds, listed on Table 314-6a, will be constructed prior to any disturbance of the area that will drain into the pond. There are no perennial stream courses in the mine area. Ponds will be located as near as possible to the disturbed area. Pond designs provide for 0.035 acre-feet of sediment storage per disturbed acre in the watershed. Sediment levels will be maintained at less than or equal to 60 percent of this volume.

All sedimentation ponds are designed to contain runoff from the 10-year/24-hour event without discharge through the principle or emergency spillway. Regular inspections and maintenance will be performed on the principal spillways, until the vegetation requirements of Rules 17.24.711 through 17.24.735 have been met, and the bond release criteria in Rule 17.24.639(21) are also met. At that time, the ponds will be removed and revegetated according to the plan presented in 17.24.313.

The Thickener pond is designed to contain the water discharged from the Thickener Tank. The Thickener Tank will be drained every one to two years. Once discharged into the Thickener Pond, coal sediment will settle and the water will be pumped back to the Thickener Tank. The coal sediment will be removed from the Thickener Pond and hauled or conveyed to the WDA.

The temporary waste coal storage area will not be retained as a part of the approved postmining land use.

The combination of the principal and emergency spillways will be designed to carry maximum discharge from a 25-year/24-hour event. The elevation of the crest of the emergency spillway will be at least 1 foot above the crest of the principal spillway. Emergency spillways will be constructed with appropriately designed riprap or other channel linings if grades and resulting velocities indicate that excess erosion could occur.

3.2.3 *Undisturbed Areas*

Diversion Ditches are listed on Table 314-7, and illustrated on Maps 314-1 and 314-2. No permanent diversions are planned for the surface facilities area. The WDA is designed to pass all water in the drainage through sediment ponds. No permanent diversions are planned in the WDA. See Map 901-1.

Ancillary facilities outside of the surface facilities area but still within the Permit Area are often required to support the underground mining operation. These ancillary facilities generally have a small disturbance footprint and are designed to divert run-on and to contain all run-off of surface waters. Minor berms, minor diversion ditches, and minor collection ditches, grading and BMP's such as straw wattle, silt fence and temporary seeding are typically utilized at these ancillary facilities. Sediment traps design are included on Table 314-6B. Borehole pad designs or other ancillary facilties designs are included in Volume 1, Section 308. Road designs are included in Volume 4, Section 321.

3.2.4 *Roads and Railroad Loop*

The Administrative Rules of Montana state that roads and railroad loops must be constructed to: "not cause additional contributions of suspended solids to streamflow or to runoff outside the permit area or otherwise degrade the quantity or quality of surface or groundwater." For most roads, railroads, conveyor corridors and other linear structures, it is impractical to direct runoff from these areas to sedimentation ponds because the actual disturbed area is relatively small and construction of ponds would result in a disproportionate amount of additional disturbance. Therefore, sediment control will be achieved for these structures through implementation of the following design and construction procedures:

1. Runoff over these disturbed areas will be minimized through proper sizing of side ditches and culverts to pass the 10-year, 24-hour precipitation event; i.e., runoff from undisturbed areas will not be allowed to flow over the disturbed areas.

2. Cuts, fills and other disturbed areas will be revegetated as soon as possible after construction to stabilize embankments and minimize erosion.

3. Sand bags, straw bales or rock check dams will be placed in roadside ditches and other drainages to reduce flow velocities and minimize erosion

4. Road surfaces will be maintained to properly drain (minimize pooling and muddy areas) and with a hard surface to minimize sheet erosion.

5. Ditches and culverts will be cleaned and maintained so that they continue to function properly

6. Ditches and other disturbed areas will be closely monitored so that eroding areas can be identified early in their development and proper mitigation can be implemented.

Runoff from these linear structures will be commingled with runoff from undisturbed areas. It will generally not be directed through sedimentation ponds but will be carefully managed to avoid additional contributions of suspended solids or degradation of quantity or quality of streamflow or runoff outside the permit area.

3.2.5 *Groundwater Inflow Control and Treatment Plan*

Groundwater inflow into the mine workings will be routed to underground sumps with pumps and piping, and used for the underground mining operation. Projections of mine inflow are provided in Appendix 314-6, Section 3.2.3.

No discharge of water will be allowed into the mine in accordance with rule 17.24.649. No treatment of groundwater inflow is anticipated, other than settling in underground sumps.

3.2.6 *Protection and Restoration of Recharge Capacity*

In accordance with Rules 17.24.314(2)(c) and 17.24.649, the approximate recharge capacity of the permit and mine plan areas will be protected and restored. The postmining recharge capacity at the Bull Mountains Mine No. 1 will approximate the premining recharge capacity. Recharge of local aquifers in the mine plan area is limited to precipitation, since no major surface water flows, or subsurface water flows in or above the Mammoth coal, enter the study area. The climate is semi-arid with precipitation averaging less than 14 inches per year. Recharge will remain dependent upon precipitation both during for operational and postmining activities. This source will not be altered. The total recharge in this area is estimated to range from one to five percent of the total annual precipitation. Refer to Appendix 314-5 for discussion on aspects of recharge and the hydrologic balance.

4.0 OPERATIONAL MONITORING AND REPORTING PROGRAM

The network of hydrologic sites to be monitored is shown in Map 314-4.1. Operational monitoring will continue until the end of mining and beyond, subject to periodic review by DEQ and the permittee. A detailed outline of operational monitoring program including monitoring types and frequencies is described in Appendix 314-4 Monitoring frequencies for spring sites are scheduled to increase near to the expected time of impact from mining.

As mining progresses, the operational monitoring program will be modified to increase or decrease monitoring within and near past and future affected areas and associated monitoring sites. Monitoring will be initiated or increase at sites where advancing mining is expected to impact the water resource. Monitoring will be suspended or decrease at sites outside the range of mining effects or where monitoring has reached conclusions regarding the effects of mining and DEQ and the permitting agree suspension or reduction in monitoring is warranted. The schedule for review will coincide with the scheduled 5 year permit renewal beginning in 2018 or sooner as prompted by modifications to mining schedules or the findings of monitoring.

Wells completed in the Mammoth coal or underburden within the coal extraction area will be removed by mining, but will be used to monitor the effects of mining prior to their removal. Following or immediately prior to removal, the permittee will abandon these wells in accordance with ARM 17.24.313, 17.24.632, and 17.24.1005. Some of the underburden wells will be replaced after being mined through. Some of the Mammoth coal wells will be replaced with wells into the Mammoth “gob” after being mined through. Locations of replacement wells will be in consultation with the Department as mining progresses. All other wells will be used to monitor the effects of subsidence on the groundwater system overlying and adjacent to the mined out area.

The number of springs and wells included in the operational monitoring program may be changed as the permit is renewed and mining progresses into the mine plan area. As mined areas are allowed to flood, wells also will be installed into the mine pool to monitor groundwater quality and quantity; to monitor recovery of the deeper groundwater system; and to evaluate the use of the mine pool as a source of replacement water.

Interruption of groundwater flow and inflow into the mined out area will be determined by monitoring water level and flow rate fluctuations in the alluvium, overburden, Mammoth coal, underburden, and springs. Water level fluctuations in all monitoring wells will be evaluated to determine whether there is drawdown due to mine inflow and subsidence and the extent of any water level declines.

Mine inflow of groundwater will be monitored as part of the operational monitoring program using a number of techniques. The volume of water held in underground sumps will be estimated periodically, and areas of inflow will be mapped qualitatively in main entries; however, direct mapping or monitoring of inflow into the areas of extracted coal is not possible in a longwall mine. Mapping will include point inflows that are sufficiently large to be measured or at least estimated. The method of measurement or estimation, and an assessment of the responsible controls will be noted.

A one time detailed inventory and field verification of private wells within the study area will also be conducted as part of the operational monitoring program. This will include, contacting land owners regarding well locations; volume and pattern of water use; well construction details; and pump capacity. These additional details will be added to Table 304(5)-10 upon completion. SPE will complete this updated inventory and field verification of private wells on or before the end of 2013.

As required by rule 26.4.314 (2)(d), hydrologic monitoring data will be submitted to the Department semiannually, and all monitoring data will be maintained for inspection at the mine office. Beginning in October 2012, the annual hydrologic monitoring reports will cover the period from October 1 to September 30, with semiannual and annual reports due for submittal to DEQ by May 31 and December 31, respectively. The reporting format and content will comply with the DEQ's most current (finalized) Hydrology Guidelines.

An interpretive analysis will be prepared as part of the annual report. This interpretative analysis will include a comparison of new data with previous data including baseline information to determine whether the data are consistent with the information used in development of the surface and groundwater mass balance and mine pool models. If inconsistencies occur, the models will be modified to maintain consistency with the new information. Probable hydrologic consequence evaluations described in the following section will be revised as necessary.

5.0 PROBABLE HYDROLOGIC CONSEQUENCESIn addition to the discussion below, thehe probable hydrologic consequences are provided in Appendix 314-5.

5.1 Impacts to Springs

Approximately 144 springs and seeps have been identified within and adjacent to the study area (Addendum 1, Table 304(5)-4 and Map 314-4.1). Most of these springs have been monitored as part of the baseline and operational program. The monitoring and sampling programs for the springs are discussed in 17.24.314 - Section 4.0 *Operational Monitoring and Reporting Program*.

There are 70 springs within the Permit Area, of which 61 lie within the subsidence angle of draw (Table 314-12). Note: two springs lie outside the subsidence angle of draw, but over underground workings. All of the other springs occur outside the areas that will be affected by mining.

The nature of subsidence due to longwall mining and its potential impact to groundwater quantity and discharge are discussed in detail in Appendix 314-5, *COMPREHENSIVE HYDROLOGIC EVALUATION AND ANALYSIS OF PROBABLE HYDROLOGIC CONSEQUENCES.* The probability of individual springs being affected earliest by mining is discussed below. This evaluation has been made on the basis of:

- depth to mining from the ground surface;
- the lithology of the rocks between the spring and the Mammoth coal (i.e. percent of shales, percent coals, etc.), if a spring lies within the subsidence areas;
- percentage of watershed in the mining and subsidence areas; and
- the percent slope of the spring site (i.e. the steeper the slope, the more likely the spring will be impacted).

To evaluate these factors a matrix was designed to evaluate each spring in terms of the probability of impact. As presented in Tables 314-13 and 314-14, qualitative descriptors were used to define in relative terms the potential for impact to springs. Relative scores for each category, based on literature and our understanding of the hydrogeologic system, are defined as follows:

- Mining. The vertical distance between the spring and the Mammoth coal; the relationship of the spring to the mine layout; and the direction of mining relative to topography as the mine moves under the spring all were determined for each spring (Table 314-13). Each of these three categories was evaluated as a factor contributing to the probability of spring impact.

There are no published criteria for developing the Mining Scores. Professional judgment and the literature indicate that the springs most likely to be impacted are close to the mining level, located near or on a pillar, and/or positioned on a slope that would be undermined in an uphill direction. It is also known that fracturing at the surface is most likely to occur in areas of shallow cover (<200 ft); therefore, the springs located less than 200 feet above the mining operation would have a disproportional higher probability of being impacted. The total or the raw scores for each of the three categories outlined above is the Mining Score used in Table 314-15.

- Hydrology. The conceptual groundwater model, supported by field data, shows that most of the water discharged at a spring originates from recharge to the watershed in which it is located. This water moves downhill by gravity through a thin system of alluvium and shallow fractured bedrock. Therefore, the percentage of the contributing watershed overlying the subsidence areas was calculated for each spring. As described in Table 314-14, springs with greater proportions of their contributing watersheds overlying the active mining area were given higher scores. For example, a spring with 50% to 100% of its contributing watershed overlying the active mine was given a score of 5, while a spring with less than 20% was given a score of 1.

- Geology. Geophysical logs from boreholes close to each spring were used to determine the percentages of shale, sandstone/siltstone, coal, and unconsolidated surficial material between the spring and the Mammoth coal. It is assumed that a relatively high percentage of shale will reduce the impacts of subsidence on a spring. As shown in Table 314-14, springs underlain by less than 20% shale were given a score of 5-, while springs underlain\ by more than 40% shale were given a score of 1 and springs beyond the subsidence areas were given a score of 0.

- Topography. Topography, especially high topographic relief, will effect the size and location of tension cracks and horizontal ground movement. The percent slope map generated by the Office of Surface Mining and USGS topographic maps for the area were used in this analysis. Topography scores on Table 314-14 ranged from 5 to zero. Springs with slopes greater than 50% were give a score of 5, while springs with slopes less than 5% were given a score of one. Springs beyond the subsidence areas were given a score of 0.

The scores for each of these factors for the 25 springs potentially affected earliest by mining are presented in Table 314-15. All potential impact to these springs during the life of mine were considered in this evaluation. An evaluation also has been made for the additional springs that may eventually be impacted. The results of this analysis are presented in Appendix 314-2. The scores were added and ranked according to the following probability criteria:

Score	Impact Potential
0 - 2	None
3 - 5	Negligible
6 - 10	Low
11 - 14	Moderate
15 - 21	High

to arrive at a total Probability of-Impact Score (Table 314-15).

This analysis indicates that for the 25 springs potentially affected the soonest, ten springs have a low potential for being impacted by mining, 12 have a moderate potential, and three have a high potential. Further discussion of the logic used to develop the Probability of Impact Scores for the fifteen springs is presented in Appendix 314-2.

Impact scores are considered relative. An impact to a spring could be a change in location, flow quantity, or water quality. For instance, a spring such as 16145 (refer to Appendix 314-2), which lies in the upper portion of Basin 16 has a moderate Impact Potential score. In evaluating this spring, a mining Score of 1 (relatively low) was assigned primarily because of the depth to mining. Whereas, a Topography Score of 4 was assigned because of the steepness of terrain. Due to the depth to mining, it is not anticipated that these springs will lose flow. However, there is a chance that the spring could be relocated due to changes to the topography.

For topographically low springs such as 14535 the opposite holds true. This spring has a high Mining Score (5) yet a relatively low Topography Score (1). In this case, there is a chance that a change in flow quantity may occur due to the shallow depth to mining, yet, the change in topography will have little impact on the spring. Geology Scores are based on percent of shale above the coal at spring locations. If the percentage of shale is high the impacts are expected to be lessened.

This analysis presented above is considered to be the "expected case" scenario. However, modifications of the various criteria could produce varying results. Of the criteria used in the analysis, depth to mining was considered the most critical. sensitivity analysis was conducted for this criterion by varying the predicted range in height above mining (of the effects of subsidence fracturing) by adding (for the "less than 100 feet case") and subtracting (for the "plus 100 feet case") 100 feet to/from the "expected case" range.

For the "less than 100 feet case" scenario depth to mining scores were modified as follows:

DEPTH TO MINING (ft)	SCORE
<300	10
300 - 400	4
400 - 500	3
500 - 600	2
600 - 700	1
>700 OR OUTSIDE OF MINING	0

For the "plus 100 feet case" scenario depth to mining scores were modified as follows:

DEPTH TO MINING (ft)	SCORE
<100	10
100 - 200	4

200 - 300	3
300 - 400	2
400 - 500	1
>500 OR OUTSIDE OF MINING	0

In comparing the results using the "less than 100 feet case" scenario to the "expected case", within the first few years of mining, an additional three springs (16655, 16855, and 17415, for a total of six) would have a high potential for impact. For the mine plan area, an additional eight springs (for a total of 16) would have a high potential for impact, and four springs would be reclassified from a low to a moderate potential of being impacted.

Using this "plus 100 feet case" scenario, there would be no springs with a high impact potential during the first few years of mining. In the mine plan area, three springs would be reclassified from a low to a negligible probability of being impacted.

These cases present a range of possible impacts. It is still unknown as to what impacts actually will occur to the springs and the actual impacts maybe different from those predicted by this analysis. Nonetheless, the permittee is committed to mitigate impacts to springs (17.24.314 **Section 6.0 MITIGATION PLANS**, Appendix 313-2 SPRING MITIGATION PLANS, Appendix 314-3 SPRING IMPACT MITIGATION PLANS), and to mitigate impacts to the associated perennial and intermittent stream reaches (Appendix 313-3 STREAM FUNCTION, IMPACT, AND RECLAMATION PLAN).

Although caution must be exercised in applying conclusions drawn from hydrogeologic studies from one mine to another, the results of a study by Pennington et. al. (1984) on the effects of longwall mining on overlying aquifers gives additional insight into the possible consequences of mining under springs in the Bull Mountains. As part of that study the effects of longwall mining on a shallow sourced spring were evaluated. The spring was located between 500 and 600 feet above the a longwall panel, a situation similar to that which will occur in the Bull Mountains. The study showed that during premining, active mining, and postmining conditions spring flow was maintained and was consistently related to precipitation in the study area. It is believed that this also will be the case in the Bull Mountains area where the majority of springs emanate from the shallow fractured bedrock and are recharged locally by precipitation.

6.0 MITIGATION PLANS

The permittee is committed to mitigating hydrologic impacts caused by mining by the measures approved in the permit, or, should these approved measures fall short, by alternative measures to be developed in consultation with the Department. To implement these measures, the permittee has developed a strategy for mitigation of any long-term hydrologic and wetlands impacts that occur due to mine development and operation. The goals of the permittee mitigation strategy are:

- No net loss of wetlands (no decrease in total wetland area due to mining); and

- Long-term maintenance by the permittee (until bond release) of adequate water supply in regards to quantity, quality and location for existing levels of wildlife and livestock.

- After bond release, maintenance of the water replacement facilities is expected to be provided for by a trust fund established by Permittee and administered by its Department appointed trustees. -

This strategy uses a phased approach that begins with planning, followed by implementation of the plan, and includes monitoring to ensure success. Successful mitigation is defined as the achievement through replacement or enhancement of resource which provides the potential for postmining land use equal to premine conditions. Success will be measured through appropriate testing and statistical comparison of data collected during baseline and postmining periods (see discussions of resources within the 17.24.313 RECLAMATION PLAN).

The mitigation plan will follow a multi-step process which will be initiated in separate phases during the progression of the mining operation. These steps include:

- Premining

  1. Determine water use patterns and demands to be maintained.

  2. Estimate the time required for hydrologic impacts to appear after mining begins.

  3. Estimate probable impacts during existing permit term.

  4. Determine mitigation alternatives for impacted sites.

  5. Evaluate alternative materials to be used for pond and stream liners, and surface fracture repair.

- Operational/Mining (liability period)

  1. Monitoring to determine if impacts have occurred.

  2. Inspection to define extent, cause and permanence of changes/impacts.

  3. Emergency response and temporary mitigation to satisfy current water uses.

  4. Develop and Implement Permanent Mitigation Plans (and associated mitigation targets) for all Permanent Impacts.

The plan for detecting spring impacts and determining mitigation requirements is presented in Appendix 314-3. Plans for mitigating springs and streams in the permit area are presented in Appendix 313-2 and 313-3, respectively.

APPENDIX 313-2
BULL MOUNTAINS MINE NO. 1
SPRING MITIGATION PLAN

1.0 INTRODUCTION

Springs located within both the permit and mine plan areas are valuable components of premining land use, providing forage and water for livestock and wildlife habitat. Additionally, these areas provide important hydrologic functions including water recharge and, when developed, sediment retention, flood control and attenuation. Successful mitigation of impacts to springs depends on reestablishing water in quantity and quality similar to that which occurred prior to mining.

For existing springs located in the permit and adjacent areas, specific impacts can only be projected. As a result, specific mitigation plans for each site cannot be completed until impacts have been documented. **Appendix 314-3, Table 314-3.1** identifies springs that have substantial and reliable flow/discharge or consistent/reliable pond levels and may be impacted by mining. In order to detect potential impacts to springs, weekly monitoring of flow/discharge and pond levels(where applicable) will be will be conducted for all springs identified in **Appendix 314-3, Table 314-3.1**. This weekly monitoring will commence two months prior to longwall mining beneath each identified spring and continue for twelve months after longwall undermining the same spring. This weekly monitoring will also be conducted for springs that are within 150 feet of the edge of a panel being mined. This weekly monitoring in addition to the monitoring conducted in accordance with **Appendix 314-4** and associated data analysis will detect potential mining impacts. If impacted, these springs will require mitigation according to one of the options described herein or other mitigation as approved by the Department.

This appendix details a number of techniques available for mitigation of potential impacts that may occur as a result of mining. These include interim (temporary) mitigation of water used by livestock and permanent mitigation including enhancement of existing natural springs, seeps and water holes, and the construction of water developments such as wells, reservoirs, small ponds, tanks, and guzzlers. The means of determining mitigation success and reclaiming wetlands disturbed in association with mitigation activities are also described herein.

2.0 IMPACT DETECTION AND TIMING OF MITIGATION

Mitigation is proposed for all springs listed in **Table 314-3.1** that are determined to be impacted by mining operations. Assessments of impact will be determined through review of post-mining conditions to:

a) The premining descriptions of all of the springs within the proposed Bull Mountains Mine No. 1 baseline study area are presented in 26.4.304(5) and 26.4.304(6); and,

b) The condition that existed during mining period prior to detecting mine-related impacts as determined through monitoring specified in permit section 314-4 (MQAP) and summarized in the Annual Hydrology Report(s).

The Permittee is committed to mitigating mining-caused adverse impacts to all springs that have a history of beneficial use or are necessary to support postmine land uses, not just those listed in Table 314-3.1.

Interim Mitigation

The Permittee recognizes that livestock owners conducting operations seasonally rely on water discharged by the springs identified in **Table 314-3.1** and addressed by this mitigation plan. Weekly monitoring will be conducted during periods of anticipated potential impact (2 months before and 12 months after undermining)..

When spring impacts (including Potential, Temporary and Permanent Impacts described in **Appendix 314-3**) are detected <u>during a period of livestock use</u>, the immediate response action will be implementation of the following Interim Mitigation measures, or other measures as approved by the Department:

a. Provide a temporary source of water by:
    i. Hauling water to livestock tanks at a location proximal to the impacted spring; or
    ii. Pumping from nearby wells to replace the spring water for use by livestock. During summer months, this option may include overland (i.e., not buried) conveyance through use of a temporary pipeline; and
b. Within three weeks of impact detection, plans and drawings (if applicable) for the temporary haulage plan or piping system all/either to be referred to as the "Interim Mitigation Plan" will be submitted to MDEQ for approval.
c. Permittee shall implement/construct all interim mitigation measures according to the "Interim Mitigation Plan" , within two months of MDEQ approval.

Water provided by these interim mitigation measures will have quality suitable for livestock consumption and will be provided in daily quantities not less than the typical seasonal spring discharge volumes. Interim mitigation measures will continue during periods of livestock use until one of the following conditions exist:

- A potential impact is found to not be related to mining (i.e., no mitigation required);
- A temporary impact ceases to occur after the premining conditions recover;
- New nearby spring issuance effectively replaces the impacted spring; or
- Permanent mitigation plans are approved by the Department and implemented by the Permittee.

Permanent Mitigation

If Permanent impacts to listed springs occur, then site-specific Permanent mitigation plans and reclamation targets for water quantity and quality will be developed in consultation with the Department. Reclamation targets will be determined by identifying the amount of water required to support livestock and wildlife utilizing the spring (including seasonal variation) and comparing this to the amount of water flow originally present at the spring prior to Permanent Impact. The minimum permanent mitigation reclamation target will be the lesser of (a) the quantity and quality required to support uses or (b) the seasonal quantities of suitable water lost due to diminished flow rates or quality. If for some reason the initial attempts at permanent mitigation fall short of reclamation standards, then alternative techniques will be used to achieve successful mitigation. In the event permanent mitigation measures are unsuccessful, interim mitigation measures will continue during periods of livestock use.

At this time, the Permittee has identified the following sources of replacement water:

- Underburden Aquifer
- Mine Pool
- Overburden Aquifers (including re-development of naturally occurring springs)
- Rainfall and snowmelt (for ponds, reservoirs, and guzzlers)

Where practicable, permanent mitigation reliant on surface water and overburden aquifers will be designed to impound volumes or yield flow rates in excess of that required to sustain consumptive uses. Any "excess" water may result in semi-permanent water bodies and/or discharge to enhance wetlands or create stream reaches as described in **Appendix 313-3**. Permanent mitigation reliant on underburden aquifers will be developed in a manner that conserves water, preserves the long-term use of the aquifer for existing users, and minimizes impacts outside of the permit area. The potential use of the mine pool or other water sources is not known at this time, but will be investigated during mitigation planning. The most likely alternatives (options) for permanent mitigation to be employed by the Permittee are presented in the following section.

3.0 PERMANENT MITIGATION ALTERNATIVES

Alternative mitigation strategies identified by the Permittee include:

- Drilling vertical wells and constructing water distribution systems to replace spring discharge points. Discharge points may include tanks, small reservoirs, ponds and "guzzlers" for wildlife use.
- Repair of springs to re-establish natural issuance of groundwater;
- Repair of ponds to minimize leakance that may occur as a result of subsidence fractures;
- Enhancement of natural springs and water holes existing in the area following mining;
- Construct new ponds, reservoirs, or guzzlers reliant on surface water catchment; and,
- Drilling horizontal wells to intercept overburden aquifers.

The selection of appropriate enhancement/development techniques depends on many site specific factors including, but not limited to:

- Degree of mining impacts to water quantity and/or quality;
- Degree of mining impacts to existing spring developments;
- Availability of water in aquifers post-mining;
- Availability of water rights for mitigation alternatives;
- Recent function and management of existing water resources;
- Existing level of development at spring sites;
- Seasonal water availability and flow;
- Potential for increasing existing spring flow;
- Location relative to spring Permanently Impacted by mining;
- Topographic characteristics at spring sites; and
- Habitat enhancement goals and objectives.

Given the uncertainty regarding the effects of subsidence on hydrologic systems in the overburden and mammoth coal seam, the underburden aquifer is the most reliable (dependable) source of water at this time. In consideration of this, drilling wells and constructing water distribution systems (as previously noted) is proposed as the "default" mitigation measure for springs impacted by mining. However, there is a finite amount of water that may be withdrawn from the underburden aquifer without infringing upon existing water rights or otherwise affecting adjacent users. Therefore, to the extent that spring development (or redevelopment) or new surface water catchment systems can provide water of the quantity and quality desired, these methods will be investigated.

Prior to construction, new wells and other water developments proposed as mitigation measures will be designed and permitted in accordance with applicable regulations. Design details will be prepared for each development and approved by the appropriate regulatory agency. It is not feasible to provide complete design details for all water developments throughout the life of the mine at this time. In no case will any facility be constructed which has not been thoroughly evaluated and designed in accordance with applicable minimum criteria.

The Permittee is committed to restoring springs and ponds to achieve postmining land use. The Permittee will attempt to reestablish these water resources in their original locations. However, if for some reason this is not practicable, then alternative locations will be chosen in consultation with the Department.

Spring Development

As a result of mining, some of the springs overlying mine workings may be relocated, redirected, or lost, while new springs may appear in other areas. The relocated, redirected, and new springs may be developed to replace impacted water resources. Before a spring would be developed, the reliability and quantity of its flow would be monitored. In addition, it will be determined if the impacted springs could be repaired using methods illustrated in **Figures 313-2-1 and 313-2-2.** Development might include, but not be limited to, protective boxes, excavation of collection basins or ponds, large capacity storage tanks, troughs, and piping.

Trough systems can also be implemented at spring sites to provide a water source for wildlife and livestock. **Figure 313-2-3** provides a schematic drawing of a multi-purpose spring development system using troughs. These systems generally include a collection box to catch and store water. The water is conducted to a collection basin and then piped to a trough or series of troughs. A natural depression, as shown in **Figure 313-2-3**, or an excavated impoundment can be used for wetlands and wildlife habitat. Optimally, the water source and reservoir should be fenced from human or livestock use (Yoakum, 1980). Similar multipurpose systems can be implemented by using stock tanks in conjunction with a small reservoir to provide both livestock and wildlife use.

Ranchers in the Bull Mountains use several different methods for developing springs. Three of these are discussed below, with a specific example of each provided:

- Dug Out Pond: Find a wet area in the bottom of a drainage. The water in places like these usually is perched on a shale. Using a backhoe, the issue point(s) are exposed and a depression large enough to hold water is dug to the top of or into the underlying shale. The excavated material is used to construct the dam. Spring 17685 is an example of this kind of development.

- 180˚ Perforated Culvert: Spring 71465 was redeveloped in 1982. The old wooden homestead box was removed and a 5' x 5' x 3' deep hole was dug into the hillside using a backhoe. Water was observed discharging from a 2" x 4" "sandstone break". Heavy plastic sheeting was placed in the bottom of the hole. Half (180°) of a 3' x 5' culvert was perforated. The culvert was placed in the hole so the perforations faced, and were even with or lower than the issue point. A 2" PVC pipe was attached to the unperforated side of the culvert and laid in a small trench running downhill to a stock tank. The hole around the perforations was filled with 3/4" washed gravel. Plastic sheeting was placed on top of the gravel and then the rest of the hole and the trench were filled with dirt. Overflow from the stock tank discharges into Railroad Creek.

- Trench & Pre-fabricated Drainage System: Spring 17185 was developed early in 1985. Prior to this development the area was a wet, boggy stream bottom approximately 150 feet long with a small (10' x 12') pond. Using a backhoe, a 20' long x 5.5' deep trench was dug across the drainage. Sandstone was exposed on the east side of the trench, which was wet and seeping water. The trench was extended downstream along this sandstone for approximately 30 feet. This created an approximately 50' long x 5' deep, "L" shaped trench. A prefabricated drainage system was placed in this trench instead of gravel. Then the trench was backfilled with the excavated material A 4" solid drain pipe was spliced into the collector pipe and used to convey the discharge downstream approximately 30' to a partially buried storage culvert. Buried, 3" PVC pipe conveys water from the storage culvert approximately 125 feet farther downstream to a large stock tank. Overflow from the stock tank flows down the stream channel to a pond.

Reservoirs & Ponds

The terms reservoir and pond refer to water impounded behind a dam. They may be formed by building a dam directly across a drainage or by enclosing a depression to one side of a drainage and constructing a diversion ditch into the resulting basin. Reservoirs would be designed to provide maximum storage with minimal surface area to reduce evaporation loss. Placement of a reservoir in an area with a north or east facing exposure can also reduce evaporation loss. The following are some general guidelines to be considered when designing replacement ponds or developing techniques for pond construction or repair.

Embankment ponds are relatively versatile water sources which promote maximum utilization by a broad variety of wildlife species. These ponds provide optimum benefits to wildlife when designed for year-round utilization. A number of small, irregularly shaped ponds are preferable to one large, uniformly shaped pond, particularly if they are dispersed; this maximizes habitat availability.

Where surface runoff and snowmelt are the primary water sources, ponds will be sited so the supporting watershed is of adequate area to provide sufficient water to replenish the reservoir annually. However, runoff should not be so large that peak flows damage the dam or spillway. A watershed area of approximately 20.2 to 24.3 hectares (50 to 60 acres) per acre-foot of pond storage is generally required in eastern Montana (Proctor et al., 1983). Pond size will vary with runoff accumulation. However, ponds should optimally have a minimum size of 0.25 surface acres.

Ideally, water depths in about one-third of the pond should be at least 10 to 12 feet to ensure the presence of year-round surface water. If seepage exceeds three inches per month, deeper portions or pond sealing measures may be required (Proctor et al., 1983). The deep pool will provide the last remnant of water when the remainder of the pond has dried up. In wetter months, the pool should overflow and provide shallow water habitat. Where possible, no more than 20 percent of the pond surface shall have a depth less than two feet.

A soil survey will be conducted to determine the distribution and thickness of various soil horizons. Hydric and organic soils will be salvaged and segregated from upland soils following the guidelines presented in this appendix. Visual inspection of the existing ponds indicates that in most, if not all, cases the impermeable layer in the pond bottom is a naturally occurring shale or clay.

In some cases, subsidence fractures may result in leakage, thereby draining the pond or further limiting the supply of seasonably available water. If spring-fed ponds are impacted by subsidences fractures in this manner, pond repair may be required as part of the mitigation plan.

Naturally occurring materials will be used whenever possible to line or repair ponds, as necessary. If naturally occuring materials are too permeable or unsuitable for some other reason, then sealer such as bentonite will be mixed into the soil with a disc. The sealer will be placed below zones of biotic influence and potential erosional surfaces as determined by the soil survey. Where possible, the deep portion of the pond will be excavated immediately upstream of the dam and the excavated material used in dam construction.

Areas disturbed during pond construction will be promptly revegetated to prevent excessive sediment loading. Fencing of all or a portion of the ponds to exclude livestock will be considered where existing land uses and landowners permit. This would greatly enhance wildlife habitat where practicable. Water would be piped to tanks for livestock use outside the fenced area. Pond and dam specifications will follow SCS guidelines.

Waterholes / Catchments

Water holes are open water storage basins, either natural or artificial. The water holding capacity of natural water holes and depressions can be improved by deepening the catchment or by trenching to direct surface runoff waters into the basin. Water catchments, some of which are known as guzzlers, are permanent, self-filling water devices that catch and store water in a manner similar to a cistern. Installation of a guzzler consists of a watertight tank set in the ground. Precipitation is collected on a collecting apron and then drains into a tank where it is stored. The size of the needed interception is relatively small because nearly 100 percent of the rainfall is collected. Guzzlers have been used successfully in other parts of the western United States that receive similar amounts of rainfall as the Bull Mountains.

Guzzlers are water devices used to establish self-filling, low maintenance water sources for small game, big game, and dual purposes. They serve as a cost effective alternative to wind-mills, and have been constructed in numerous designs, sizes, and shapes. Guzzlers will be designed and sited in locations where springs are relatively small (<1 gpm) and it is not more feasible to employ alternative mitigation measures.

Mourning doves and many other passerines will not enter under-ground entrances (i.e., tank openings) to obtain water. To accommodate their water needs, the water source will be placed in the open, with relatively bare surroundings and good visibility in all directions. However, feeding and escape covers should be available nearby. Where exposed to the sun, the water source will be kept small to reduce stagnation and algae growth. The guzzler area will be fenced and water may be piped to tanks for livestock and larger wildlife use.

Water in guzzlers will usually freeze in winter and be unavailable to wildlife. However, where guzzler entrances face south, the entrance can be painted black to absorb the sun's rays to partially thaw the ice. A piece of shiny metal can also be positioned and curved to reflect the sun's winter rays onto the water to promote thawing.

A variety of designs and materials have been used to construct guzzlers. **Figure 313-2-4** illustrates a practical design for multi-purpose watering. The basic prerequisite for this design is a gentle slope or hillside with deep soil to permit burial of the storage tank and float-and-foot-valve device. This guzzler uses a collecting apron made of corrugated fiberglass or galvanized steel, elevated about one foot above ground on a wooden framework. The rainwater drains from the sheeting into a collecting trough and is then piped into a large buried fiberglass storage tank. Water is piped by gravity flow from the tank a short distance down slope to a float and foot-valve installed in a small water container. This, in turn, is connected to and is level with, a down slope small drinking pan which is placed at ground surface where it can be used by wildlife (Rutherford and Snyder, 1983).

Both the storage tank and the float and foot-valve should be buried at least four feet below ground surface to prevent freeze up. A covered entrance to both is needed for occasional maintenance. Fifty to 100 gallons of water storage will suffice for small game only, whereas storage of up to several thousand gallons is necessary where big game will utilize the water. The drinking pan should be placed in a concrete support or be surrounded by rocks to prevent trampling.

Figure 313-2-5 illustrates another guzzler design emphasizing use by big game. However, upland game birds, small mammals, and songbirds are also known to use this particular design (Yoakum, 1980).

Wells & Horizontal Drains

Both horizontal drains and vertical wells can be drilled to provide water to replace impacted water resources. Wells can be equipped with stock tanks or excavations can be designed to supply the needs of wildlife, especially small game. Larger game, livestock, and some bird species can drink directly from the stock tanks. Overflow areas can be fenced in order to preserve their availability for small game. Rocks, brush, or other natural barrier materials can be used opportunistically to discourage disturbance of the fenced areas by larger animals. Fence line location can be chosen for wells to provide water to either or both pastures at those locations.

Vertical wells are likely to be the most viable source of replacement water. Drilling vertical wells and installing submersible pumps pose no problems; however, the pumps and any associated pipelines will require long-term maintenance, and electricity will be required. Windmills may be used on shallower wells.

Alternative, horizontal drains may be drilled, although this method will likely be less effective in most circumstances. A number of types of drilling rigs are designed to drill boreholes at any angle. Aardvark drill rigs are specially designed to drill and install casing where hole stability may be a problem. Using this rig, casing can be placed in the hole through the drill stem, which is then extracted. Other rigs use more conventional drilling methods. Once the casing is set, the drain will allow water to flow via gravity and will require little, if any, maintenance.

Figure 313-2-6 depicts a possible configuration for a system to regulate discharge from a replacement water well. A system such as this could be used on either deep or shallow wells, could be programmed to mimic seasonal flow fluctuations of a spring, and could be remotely monitored and controlled, if desired.

4.0 HYDROLOGIC MONITORING FOR MITIGATION SUCCESS

The Permittee is committed to monitoring the quantity and quality of water provided by all implemented permanent mitigation measures. Each permanent mitigation plan proposal will summarize historical and recent monitoring data to determine the seasonal quality and quantity of water to be replaced/reclaimed (i.e. targets) as discussed in Section 2.0 of this appendix. Monitoring plans (i.e., methods, parameters, and frequency) will be incorporated into **Appendix 314-4** (MQAP) in conjunction with mitigation plan development.

Mitigation (i.e., reclamation) will be determined successful if at the time the liability period has expired, the Permittee has demonstrated mitigation measures can provide water for consumptive use by livestock and wildlife of seasonal quality (i.e., laboratory parameters) and quantity (e.g., daily available volume) identified in the Permanent Mitigation plan. However, diminished quantity and quality may be approved by the Department in the event that natural regional conditions (e.g., drought) have resulted in below-average (i.e., depressed) flow rates or diminished water quality coincident with the mining term, as evidenced by monitoring at similar spring sites (i.e., control sites) beyond the influence of mining.

5.0 WETLAND DISTURBANCE AND RECLAMATION

Construction of ponds and spring development may result in disturbance of wetlands within the Permit Area. This section describes procedures for disturbance, soil handling and reclamation specific to hydric soils and wetlands; information regarding general (upland/non-hydric/non-wetland) grading and soil handling techniques is provided in the Reclamation Plan (see Section 313 text).

Construction in association with mitigation measures described herein will only be conducted in non-jurisdictional (i.e., isolated) wetlands, not subject to permitting under Section 404 of the Clean Water Act. In the event that construction within jurisdictional waters is proposed, the Department will be consulted, the appropriate permit(s) will be obtained (e.g., permit from the US Army Corps of Engineers), and the mine permit will be revised to specifically address the associated construction activity.

Soil Salvage and Storage

Prior to construction in wetlands, hydric soils and organic soils associated with wet sites will be salvaged and segregated from upland soil. Soil salvaged from these sites may be stockpiled for up to 30 calendar days following removal. Organic soils must maintain adequate moisture to avoid oxidation and structural changes. Watering stockpiles may, however cause premature germination and subsequent reduction of native seed banks. Depending on field conditions and duration of soil storage, application of a soil stabilizer or establishment of temporary vegetative cover to limit wind and water erosion may be required.

If sufficient native hydric soils are not available, wetlands may be reclaimed using a relatively fertile topsoil blended with manure. Good plant survival and seed germination rates can be obtained by mixing 30 percent (by volume) livestock manure in with topsoil to act as a source of organic matter and nitrogen.

It may also be possible to utilize sandy loam or clay loam soils, if available. Sandy loam and clay loam soils usually have adequate nutrients, provide good gas circulation and have moderate texture to support new plants and permit root or rhizome penetration.

Soil Redistribution

Salvaged (or constructed) soil will be redistributed at all spring development projects, on reservoir and pond perimeters (not on pond bottoms) and at water holes.

Seedbed Preparation

Seedbed preparation will be conducted immediately after grading and soiling. The surface will be scarified to a depth of approximately six inches using disking or harrowing. Scarification will loosen soil material to establish a friable seedbed, and aid in weed control.

Species Selection

The majority of hydrophytic species selected for revegetation of these areas are not available commercially. The Permittee will rely as necessary on propagation of plant material from sources in the vicinity of the project area. Seed collection and propagation are discussed in a following section.

Selection of plant species for revegetation of water developments is based on existing species occurrence, expected post-operation hydrological conditions, substrate properties, establishment potential and post-operation land use objectives. Species commonly occurring in and adjacent to springs in the area are listed in **Table 313-2-1**.

TABLE 313-2-1
SPECIES COMMONLY OCCURING IN AND ADJACENT TO SPRINGS IN THE BULL MOUNTAINS MINE NO. 1 EXTENSIVE STUDY AREA.

Binomial	Common Name
NATIVE PERENNIAL GRAMINOIDS (Cool Season)	
XAgrohordeum macounii	Macoun wildrye
Carex hystricina	Porcupine sedge
Carex lanuginosa*	Woolly sedge
Carex nebraskensis*	Nebraska sedge
Carex praegracilis*	Clustered field sedge
Carex vulpinoidea	Fox sedge
Eleocharis palustris*	Common spikesedge
Elymus canadensis	Canada wildrye
Elymus cinereus	Basin wildrye
Glyceria striata*	Fowl mannagrass
Hordeum brachyantherum	Meadow barley
Hordeum jubatum*	Foxtail barley
Juncus balticus*	Baltic rush
Juncus ensifolius	Dagger-leaf rush
Juncus longistylis*	Longstyle rush
Juncus nodosus	Jointed rush
Juncus tenuis var. dudleyi	Slender rush
Juncus torreyi*	Torrey's rush
Phalaris arundinacea*	Reed canarygrass
Poa arida	Plains bluegrass
Puccinellia nuttalliana*	Nuttall's alkaligrass
Scirpus americanus*	American bulrush
Scirpus pallidus	Pale bulrush
Scirpus validus*	Softstem bulrush
NATIVE PERENNIAL GRAMINOIDS (Warm Season)	
Catabrosa aquatica*	Brookgrass
Distichlis stricta	Alkali saltgrass
Muhlenbergia asperifolia	Alkali muhly
Muhlenbergia richardsonis*	Mat muhly
Spartina gracilis*	Alkali cordgrass
Spartina pectinata*	Prairie cordgrass
Sphenopholis obtusata	Prairie wedgegrass

Binomial	Common Name
INTRODUCED PERENNIAL GRAMINOIDS	
Agropyron repens	Quackgrass
Agrostis stolonifera*	Redtop
Alopecurus pratensis	Meadow foxtail
Festuca arundinacea	Reed fescue
Phleum pratense	Common timothy
Poa palustris	Fowl bluegrass
Poa pratensis*	Kentucky bluegrass
NATIVE ANNUAL GRAMINOIDS	
Juncus bufonius	Toad rush
INTRODUCED ANNUAL GRAMINOIDS	
Polypogon monspeliensis	Rabbitfoot polypogon
NATIVE PERENNIAL FORBS	
Alisma gramineum	Narrowleaf waterplantain
Artemisia ludoviciana*	Cudweed sagewort
Asclepias speciosa	Showy milkweed
Aster campestris*	Meadow aster
Aster falcatus*	Creeping white prairie aster
Aster pansus*	Heath-leaved aster
Cirsium flodmanii*	Flodman's thistle
Epilobium ciliatum*	Common willow-herb
Glycyrrhiza lepidota	American licorice
Helianthus maximilianii	Maximilian's sunflower
Mentha arvensis*	Field mint
Monarda fistulosa	Horsemint
Prunella vulgaris	Self-heal
Psoralea argophylla*	Silverleaf scurfpea
Ranunculus cymbalaria*	Rocky Mountain buttercup
Ranunculus macounii	Macoun's buttercup
Ratibida columnifera	Prairie coneflower
Solidago canadensis	Canada goldenrod
Typha latifolia*	Common cattail
Urtica dioica	Stinging nettle
Veronica americana*	American speedwell
Zannichellia palustris	Horned pondweed

Binomial	Common Name
INTRODUCED PERENNIAL FORBS	
Cirsium arvense*	Canada thistle
Plantago major	Common plantain
Rumex crispus*	Curl dock
Taraxacum officinale	Common dandelion
FERNS AND ALLIES	
Equisetum arvense	Common horsetail
Equisetum laevigatum*	Smooth horsetail
SHRUBS	
Rosa woodsii*	Wood's rose
Symphoricarpos occidentalis*	Western snowberry
TREES**	
Fraxinus pennsylvanica	Green ash
Populus deltoides	Plains cottonwood

*Species which dominate springs quantitatively sampled in 1991.
**Very limited
Nomenclature follows USDA Forest Service (1987).

Revegetation Communities

The Permittee proposes to reclaim wetland/mesic communities at the site of all disturbed wetlands, including those disturbed by surface water development and spring development. This will be achieved using methodologies outlined in this Appendix; however, post-operational hydrology will ultimately drive community structure and the distribution of hydrophytic species.

General wetland and mesic revegetation mixtures based on composition of existing plant communities (Addendum 304(9)-7) are presented in **Tables 313-2-2 and 313-2-3**. The mesic revegetation mixture will be seeded on all sites immediately after seedbed preparation. This mixture will provide permanent stabilization to mesic portions of water developments and interim stabilization for wetter portions of these sites. Interseeding/planting of the wetland mixture will occur when an adequate and dependable source of water is available to support these species and where such species are not naturally regenerate from plant propagules in the reclaimed wetland soil.

TABLE 313-2-2
WETLAND REVEGETATION MIXTURE

Species	Percent Composition
GRASSES AND GRASS-LIKES:	
Carex lanuginosa, nebraskensis or.praegracilis	30
Catabrosa aquatica	5
Eleocharis palustris	5
Juncus balticus, longistylis or torreyi	5
Muhlenbergia richardsonis	5
Phalaris arundinacea	10
Scirpus americanus or validus	15
Spartina gracilis or pectinata	10
FORBS[2]:	15
Aster pansus	
Mentha arvensis	
Ranunculus cymbalaria	
Typha latifolia	
Veronica americana	

1 Actual seeding. rates and planting densities will depend on availability of species and propagation and planting techniques.
2 Includes a combination of any or all species listed.

TABLE 313-2-3
MESIC REVEGETATION MIXTURE

Species	Variety	Seeding Rate[1] Pounds/PLS	PLS/sq.ft.
GRASSES:			
Agropyron smithii	Rosanna	4.00	10
Agropyron trachycaulum	Revenue	1.00	4
Agrostis stolonifera	-	0.05	6
Elymus canadensis	-	3.00	8
Elymus cinereus	Magnar	3.00	9
Phalaris arundinacea	-	0.75	9
Poa ampla	Sherman	0.50	10
FORBS:			
Artemisia ludoviciana		0.05	5
Monarda fistulosa		0.10	3
Psoralea argophylla		0.10	3
Ratibida columnifera		0.10	3
SHRUBS:			
Artemisia cana		0.25	5
Prunus virginiana		2.00	<1
Ribes aureum or setosum		0.25	2
Rosa woodsii		0.25	2
Symphoricarpos occidentalis		1.00	2
	TOTAL	16.4	82

[1] Approximate. Based on availability and a drill rate of approximately 80 pure live seeds (PLS); rates will be doubled for broadcast seeding.

Sources of Plant Materials

Sources of plant materials include seed, containerized stock, bareroot stock, transplants, sod plugs and sprigs. Plant materials (seed and nursery stock) may be purchased commercially from seed dealers/nurseries or collected in the wild. Quality of stock, availability and costs related to acquisition and planting will be considerations in the selection of appropriate materials. Seed and plant materials will be purchased commercially when available.

Commercially available plant materials may be supplemented by onsite plant material collections. Plant populations of selected species will be identified for harvest based on onsite evaluations. Sources for collection may, include 1) sites expected to be impacted by mining, 2) onsite areas with extensive hydrophytic zones (where a loss of some plants would be insignificant, and 3) other lands owned or leased by the Permittee outside the mine area: the Permittee will schedule plant material collection activities to coincide, if possible; with planting activities. Plant materials will be acquired only with permission and so as not to impact collection sites. Collection of undesirable species within the seed bank will be avoided.

Seed may be collected on and adjacent to the permit area to produce seedlings and provide additional seed to revegetate areas impacted by mining. Seed collection will be conducted prior to disturbance and throughout operations and will be based on phenological considerations. Seed normally matures in late summer or fall, and should be collected prior to dispersal. Production of mature and viable seed may be variable between years and among species within a given year. Considerable information on collecting, processing and germinating seeds of native species is available in Young and Young (1986). Seed will be collected by hand or with the use of specially adapted harvesting equipment; it will be cleaned and stored under optimal conditions.

Wild collections of seed and plant materials (including transplants, sod plugs and sprigs) are acclimated to local soils, typical hydrologic regimes and regional weather patterns. These plant materials contain a considerable amount of seed and other propagules in the attached soil that will enhance establishment of a diverse, complex community of plants in the new system.

Colonization by volunteer hydrophytic species is not uncommon in wetlands restoration, and is expected to occur at the Bull Mountains Mine No. 1. Colonization will occur from upstream sources and from wildlife and livestock movement between existing hydrophytic stands in the area.

Seeding Methods

The mesic revegetation mixture will be drill seeded or broadcast seeded. The seeding rate totals approximately 80 pure live seeds (PLS) per square foot for drill seeding and double this rate for broadcast seeding. This somewhat lower than conventional rate will provide initial stabilization and promote species diversity for a range of mesic to hydric conditions but avoid excessive 'herbaceous competition for eventual plantings, interseeding, or colonization by hydrophytic species.

Drill seeding will be conducted wherever conventional farm equipment can operate; care will be taken to place seeds at appropriate depths to promote germination. Broadcast seeding will be employed on steeper slopes and smaller disturbances, using cyclone-type spreaders, mechanical-seedblowers or hydroseeder. Where possible, broadcast seeded areas will be chained, harrowed or hand-raked to cover seed. Seeding will be coordinated with other reclamation activities to occur as soon after seedbed preparation as possible.

Seeding of hydrophytic species will be conducted at the time a dependable water supply has been indicated. Seed from hydrophytic species that has been collected locally or obtained from commercial sources will be interseeded (when water is not present) on all sites that are frequently or intermittently inundated. The decision to drill or broadcast seed will be made based on existing vegetative cover, soil moisture considerations and other site conditions. If used, drill seeding will generally traverse the narrow axis of ponds and drainages to prevent water from flowing down rows and losing the filtering action of. the vegetation.

Planting Methods

Planting will be conducted on frequently and intermittently inundated portions of water developments when it has been determined that an adequate and dependable water supply has been established to support hydrophytic species. The creation of suitable conditions for establishment (and natural invasion) consists of holding the water level at or immediately below the surface or by periodic shallow flooding and dewatering. The objective is to eliminate upland species by flooding but avoid stressing the hydrophytic species from deep flooding. Planting methods include planting of containerized and bareroot nursery stock and transplants, sod transplanting and sprigging.

Containerized stock, bareroot stock and transplants will be planted in a slit made in the ground with a tree planting bar or tile spade; once the propagule is inserted, the slit is sealed. Transplants will be placed so that the previous soil line (discoloration line or stalk) is level with the new soil line, but not deep enough to prevent floating out when the area is flooded. Power augers may be used to create holes for core plantings in dry soil; spades will be used if the planting is under water or in wet soil. Mechanical devices such as a trencher may be used to expedite the planting process. Planting densities will vary on a site by site basis, and will depend on existing vegetative cover and hydrologic conditions. Many wetlands restoration projects utilize a spacing of 1.0 - 1.5 m for herbaceous vegetation.

Sod plugs (transplants) will initially be used on a limited basis as a means of propagating hydrophytic species. The use of sod plugs is potentially attractive for the following reasons: 1) plant dormancy at time of transplanting reduces physiological damage; 2) well-developed root systems and root crown portions are not as susceptible to desiccation or frost heave as young seedlings; 3) transplants are usually capable of seed production after only one growing season; and 4) seeds, roots, tubers and rhizomes present in the substrate can contribute to community complexity and diversity.

Sprigging involves the harvest of above-ground and below-ground hydrophytic plant parts and incorporation of said parts into the receiving soil surface. This technique will also initially be used on a limited basis.

Planting herbaceous species is usually most successful in early spring, although the planting period extends from the onset of dormancy in the fall to midsummer. Sod plug transplants and sprigs are best planted in the fall following dormancy (Hammer 1992).

Mulching and Erosion Control

Surface mulches may be used to retard evaporation, ameliorate high surface temperatures, trap wind-blown seeds and soil, prevent frost action, control erosion, reduce surface crusting, increase infiltration and improve seedling emergence.

Where employed, the type of mulch and application rate will be based on slope steepness, slope length, soil texture and season of seeding. Mulching is described in more detail in the Reclamation Plan.

Plant anchoring devices such as blankets, netting, geo-textiles, etc. may be utilized if it is evident that erosion will disturb seedling establishment. Erosion control products protect substrates, hold plantings in place and trap sediments to help stabilize reclaimed sites. Necessity for use and type of product will be assessed during revegetation activities.

Schedule

Revegetation activities will occur as soon after seedbed preparation as possible. The mesic revegetation mixture will initially be seeded on all sites immediately after seedbed preparation to provide permanent stabilization to mesic portions of water developments and interim stabilization for wetter portions of these sites. The wetland revegetation mixture will be seeded/planted when an adequate and dependable source of water is available.

Protection & Management

Wetlands and to a lesser degree, mesic areas are dependent upon disturbance for initial formation and continued existence.

According to Hammer (1992):

> *"Stability is neither common nor desirable in wetland systems. Unlike upland habitats, wetlands are dynamic, transitional and dependent on natural perturbations. The most visible and significant perturbation is periodic inundation and drying. Changing water depths, either daily, seasonal, or annual, strongly influence plant species composition, structure and distribution. Other influences, such as complex zones of water regimes, salt and temperature gradients, and tide and wave action, produce wetland vegetation that is generally stratified, much like forests. These factors combine to create a diversity and wealth of niches that make wetlands important wildlife habitat.*
> *Wetlands are ephemeral components of the landscape formed by drainage interruptions and maintained by geological, hydrological and biological factors that arrest or retard the impacts of other biological factors that tend to transform the wetlands into a copy of its neighboring ecosystems - upland or deep water habitats. In contrast to the latter, unique, complex and productive wetlands thrive on disturbance and change and soon cease to exist under long-term conditions of stability."*

The Permittee will implement a strategy that will limit impacts to wetland systems and mesic areas. This strategy will include the replenishment of water supplies, erosion control, revegetation, noxious weed control, and the management of wildlife and livestock grazing. Specifically:

- Damage to the reclaimed surface from erosion will be repaired on a site by site basis by regrading, reestablishing vegetation and utilizing erosion control products as necessary.
- Results of revegetation will be assessed to determine the need for corrective measures such as supplemental seeding or planting, reseeding, or fertilization.
- Weed populations will be evaluated in wetland areas to assess the need for control efforts in accordance with the approved Noxious Weed Control Plan.

- Livestock grazing will be manipulated to discourage concentration in reclaimed wetlands. This will be accomplished using wildlife friendly exclusion fencing, supplemental watering devices, distribution of salt away from wetlands and creative grazing systems designed to prevent concentration in wetlands.
- Wildlife will be allowed to utilize wetlands unless it is determined that unacceptable damage is occurring.

Revegetation Monitoring

Following construction and during the liability period, interim monitoring will be conducted to evaluate reestablishment of wetland/mesic communities. Final monitoring will be conducted prior to bond release. Monitoring will be conducted in accordance with the methods described in Section 313 or the Departments most current revegetation monitoring guidelines consistent with the requirements of ARM 17.24.723.

6.0 REFERENCES

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APPENDIX 314-3
SPRING IMPACT DETECTION & MITIGATION
BULL MOUNTAINS MINE NO. 1

The permittee reviewed monitoring records from 1989-1994 (historical data) and 2003-2012 (recent data) and identified springs that meet the following criteria:

- Substantial and reliable flow/discharge or consistent/reliable pond levels;
- Suitable quality for consumption by livestock and wildlife; and
- One of the following:
    - Located within the permit area or within 500ft of the Permit Area; or,
    - Located anywhere in the baseline study area (Section 304) if baseline studies indicate water likely originates from the Mammoth Coal aquifer.

The springs satisfying the above criteria are listed in **Table 314-3-1**. Notable characteristics determined from baseline inventories and monitoring data are also presented. As mining progresses, the Permittee will develop tentative mitigation plans for each of the springs that may be impacted by mining, as listed in **Table 314-3-1**, and the monitoring frequencies specified in **Appendix 314-4** (MQAP) will be reviewed annually and necessary revisions will be proposed in conjunction with the Annual Hydrology Report. As the effects of mining approach more distant springs, (e.g., those in the eastern portions of the Permit Area and beyond), monitoring frequencies will be modified as necessary to ensure prompt detection of impacts and address monitoring of springs historically impacted and associated replacement water sources.

The Permittee expects that should an impact to spring flow or quality occur, it would be identified as sudden changes in hydrologic conditions or unexpected seasonal conditions, combined with changes at adjacent monitoring wells and/or observable and proximal physical indicators (e.g., subsidence fractures). If an impact is observed, potential changes in the point of spring issuance will be investigated by visual inspections of the adjacent drainages and hill slopes.

For purposes of evaluation, changes in spring conditions not attributed to seasonal variability natural local conditions (e.g., atypical wet or dry weather) will be classified as follows:

- Potential Impact - an impact to a spring has occurred; it may or may not be due to mining.
- Temporary Impact - mining related impact has occurred, premining conditions recover after subsidence is complete (usually within months, but possibly after mining the adjacent panel).
- Permanent Impact - a mining related impact has occurred, premining conditions do not recover.

If impacts to the listed springs are detected, mitigation will be implemented as specified in **Appendix 313-2**. Interim Mitigation measures will be employed as specified therein for all Potential and Temporary Impacts. Permanent Mitigation measures will be employed to compensate for Permanent Impacts resulting in decreases in water quality or adverse impacts to water quality that preclude consumptive livestock and wildlife use in the manner possible prior to mining impacts. Upon detection of Potential Impacts, data review and site investigations will commence, continuing until the Permittee and Department concur regarding the cause and permanence of the impact. All identified impacts to springs listed in **Table 314-3-1** will be reported in the Annual Hydrology Report.

95th Congress, 1st Session - - - - - - - - House Report No. 95-218

SURFACE MINING CONTROL AND RECLAMATION ACT OF 1977

REPORT

OF THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS HOUSE OF REPRESENTATIVES

together with

ADDITIONAL, CONCURRING, SEPARATE AND DISSENTING VIEWS

TO ACCOMPANY

H.R. 2

(INCLUDING THE CONGRESSIONAL BUDGET OFFICE COST ESTIMATE)

APRIL 22, 1977.—Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

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U.S. GOVERNMENT PRINTING OFFICE

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serted to require that the reclamation plan include an indication of land productivity prior to mining.

Section 508(a). Deletion of reclamation planning requirement regarding air and water quality laws

The committee eliminated section (a)(6) that would have required that applicant to indicate the "steps to be taken" to comply with other environmental laws.

Section 509(a). Amount of bond

H.R. 2 and the committee amendment both set forth procedures for determining the amount of a performance bond to cover the costs of reclamation. H.R. 2 required that the level of coverage be based upon two independent estimates. The committee eliminated this requirement and substituted various factors to be considered in setting the amount of bond.

Section 510(a). Modification of permits

The committee amendment to H.R. 2 provides that in addition to the authority to grant or deny an application, the regulatory authority may "require modification" of the application. This allows the regulatory authority to require that the applicant make changes in the plan during review of the application. Such a process more fairly represents what actually happens and provides more flexibility.

Section 510(a). Burden on renewal

Consistent with a number of modifications to section 505 designed to assure security of tenure of permit, the committee amendment deletes the words "or renewal" in subsection (a) to make it clear that the applicant does not have the burden of demonstrating compliance upon renewal of a permit for the same area already under permit. Rather, consistent with other provisions of the act, the permit carries with it the right of renewal for the same area if the operation is in compliance with the law.

Section 510(b)(3). Hydrologic impacts

Under H.R. 2, prior to approval of a permit application, the regulatory authority is to make an assessment of the cumulative hydrologic impact of all mining in the area of concern. The committee amendment clarifies the test to be applied to this review. The words "significant irreparable offsite" damage have been deleted in favor of language that specifies that the mine is to be designed to prevent damage to the hydrologic balance outside the permit area.

Section 510(b)(5). Alluvial valley floor modification

H.R. 2 and the committee amendment contain a prohibition on mining of alluvial valley floors—areas of agricultural significance in the Western United States—in certain circumstances. In addition to adding clarifying language in subsection (A), the committee amendment incorporates the test that operations off alluvial valley floors but affect water systems that supply such valley floors should "not materially damage" the supply systems. The phrase "not adversely affect" was deleted in order to avoid a possible interpretation that any operation off an alluvial valley floor may have some adverse effect on the water system that supplies an alluvial valley floor.

The committee recognizes, however, that within arid and semiarid regions the length of time necessary to reestablish vegetation on mining spoil varies considerably. The time estimates for revegetation set forth in the academy report for the wettest of the potential mining areas (given the natural vegetation characteristics of the area) in the arid and semiarid areas of the country ranges from 10 years upward. Thus a 10-year standard of the bill represents a minimum time under the most favorable circumstances. Regulatory authorities may establish longer periods of responsibility suitable to subregional climatic and vegetative zones.

The time limit set for revegetation responsibility in the more humid areas (over 26 inches of precipitation) was set at 5 years. This provides sufficient time for the revegetation to prove establishment and regeneration. For instance, "on the average, 4 years elapsed—after mining—before mine sites are adequately and totally reclaimed in accordance with (Kentucky) regulations (Mathematica, page I-54).

The committee recognizes that in some areas and under some conditions, intensive commercial agricultural activity such as row crop cultivation are suitable, postmining land uses. In those instance where long-term intensive agricultural activities are approved as a postmining land use, the period of vegetation responsibility begins at the date of initial planting of the intensive agricultural crop and the period covers the agricultural activity for the respective time period. It should be noted that pasture, grassland, and similar agricultural land uses are not considered as intensive uses by the committee. Such agricultural activities can be conducted on reclaimed mine slopes without requiring variances from the approximate original contour and spoil placement standards. It is also noted that to date little mined land has been returned to row crop or other intensive agricultural use, with those instances being an exception rather than a frequent reclamation land use. It seems reasonable that the greatest likelihood of returning lands to intensive uses is in those instances where the land supported such activities prior to mining. This would also imply that the mining and reclamation cycle would result in the segregation of sufficient top and subsoil material (or other suitable spoil) so as to provide the capability of recreating the upper soil layers in sufficient depth to assure appropriate chemical and physical qualities suitable to such agricultural uses.

Some concern has been expressed that where lands are reclaimed for extensive agricultural use such as grazing or pasture, such uses might be prohibited during the period of reclamation responsibility. This is not the committee's intention. Grazing use of such lands during the period of operator responsibility is allowable, but presumably the type and extent of use would be such that it would not endanger the survival coverage and productivity of the revegetation.

MINING IMPACTS ON HYDROLOGIC BALANCE

Surface coal mining operations can have a significant impact on the hydrologic balance of the mined area and also its environs. The hydrologic balance is the equilibrium established between the ground and surface waters of an area between the recharge and discharge of water to and from that system. Some of the measurable indicators or

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such an equilibrium are: Flow patterns of ground water within aquifers; the quantity of surface water as measured by the volume rate and duration of flow in streams; the erosion, transport, and deposition of sediment by surface runoff and stream flow; the quality of both ground and surface water including both suspended and dissolved materials; and the interrelationship between ground and surface waters. The hydrologic balance of an area is a complex relationship maintained by a number of factors. The impacts of mining on any one of these factors can trigger changes throughout the system.

The total prevention of adverse hydrologic effects from mining is impossible and thus the bill sets attainable standards to protect the hydrologic balance of impacted areas within the limits of feasibility. For most critical areas uncertain fragile hydrologic settings, the bill sets standards that are imperative to begin to assure that adverse impacts to the hydrologic balance are not irreparable. It is not intended by such minimum standards that these measures will be considered wholly sufficient to meet the objectives of "minimizing disturbance to the prevailing hydrologic balance." It is anticipated that the State regulatory authorities will strengthen such provisions and require whatever additional measures are necessary to meet local conditions.

Concern has been expressed that the bill's hydrology provisions somehow require that the hydrologic characteristics of the site prior to mining must be maintained in the actual working mine excavation. Such an interpretation is not justified. Of course, the actual operating area of the mine is necessarily dewatered. The committee is concerned about how extensive the secondary effects could be—such as a drawdown of ground water in surrounding areas. The bill requires that the operator will take such measures as are necessary to minimize the disturbance to the hydrologic balance in the surrounding areas. In addition, the operator is to conduct reclamation activities on a continuing basis that assure the impacts are minimized after mining has been completed.

The impact of coal mining on water resources has been well documented. A number of studies provide insight into potential water resource impacts of mining in arid and semiarid areas and of effects of mining in humid areas.

Five publications cited and the abbreviations used in this text are listed here:

Beaver Creek: *Influences of Strip Mining on the Hydrologic Environment of Parts of Beaver Creek Basin, Kentucky, 1955–66*, U.S. Geological Survey Professional Paper 427–C, Washington, 1970.

Tradewater: *Effects of Coal Mining on the Water Resources of the Tradewater River Basin, Kentucky*, Geological Survey Water Supply Paper 1940, Washington, 1972.

Cheyenne: *Hydrology of the Upper Cheyenne River Basin*, Sediment Sources and Drainage-Basin Characteristics, Geological Survey Water Supply Paper 1531, Washington, 1961.

NAS: *Rehabilitation Potential of Western Coal Lands*, National Academy of Sciences, A Study for the Energy Policy Project, Washington, 1974.

Decker: *Hydrology of the Decker Coal Mine and Vicinity, Southeastern Montana*, Preliminary Report, Montana, Bureau of Mines and Geology, 1974.

EPA: *Alluvial Valley Floors in East-Central Montana and Their Relation to Strippable Coal;* Jack Schmidt; Environmental Protection Agency; Denver, Colo., January 1977.

Past mining operations have a mixed impact on stream flow regimes. In the Appalachian mountain mining areas, conventional contour mining has resulted in greater peak flows, more rapid changes in discharge, reduction in base flows and increased flooding of streams (Beaver Creek, page C–1).

Reclaimed spoil areas resulting from area mining in more gently rolling terrain under humid conditions act as deposits which can store and slowly release groundwater. Under such conditions, it has been found that "stream flow is sustained during extended periods of no precipitation . . . owing to drainage from mined areas while streams in nonmined sub-basins cease flowing." (Tradewater, page 60).

In arid and semiarid settings, mining alters drainage patterns which can "result in a decrease in storm runoff volume and loss of recharge to alluvial aquifers in downstream valleys" (NAS, page 68). The unconsolidated materials resulting from strip mining can have similar hydrologic properties to the aggredational features of Western streams, which can result in a loss of water to both the surrounding lands and downstream areas (Cheyenne, page 168).

Water quality impacts are readily noticeable and have an extended geographic influence. Mining increases the mineralization of waters and is a function of the type or chemistry of the strata disturbed, the amount of water available, and the duration of contact with the disturbed material.

In Appalachian mountain mining areas, the dissolved solid content of streams has been measured and found to be 12 times greater than that in nonmined areas (for instance a yield of 1,370 tons per square mile compared to 111 tons per square mile). However, flow directly from mines sites has been measured containing dissolved solid concentrations equivalent to a yield of 1,400 tons per square mile—a pollution load increase of 126 times that of unmined areas (Beaver Creek, page C–2).

Area mines in humid settings can have similar impacts, with stream flows containing 17 times the amount of dissolved solids and flows from nonmined areas. However, particular constituents had increased concentrations of up to 300 times that of nonmined areas (Tradewater, page 54).

These increases in chemicals in surface waters provided significant water problems for all types of uses as well as precluding the realization of the full potential of the streams for recreational and wildlife purposes.

In some arid and semiarid areas, one of the possible impacts of surface mining on water quality is an increase in salinity (sodium, bicarbonate, sulfate). For example, in one instance where water quality is monitored at an active Western mine, sufficiently high concentration of sodium, up to sixteen times that of the normal concentration in surface flow, indicates a high to very high alkalinity hazard for irrigation and thus for revegetation purposes at the mine site. In this case, downstream water uses are not affected because the volume of flow from the mine at this time is quite small (0.5 cfs) compared to the receiving stream (more than 20 cfs 99% of the time) and there is adequate capacity for dilution (Decker, page 12).

Sediment yields from strip mines can be exceedingly high and can persist at high levels for long periods after mining unless adequate revegetation and soil stabilization work is done to replace the appropriate surface drainage at the site.

In the Appalachian mountain mining areas, sediment concentrations in streams commonly exceed 30,000 parts per million (ppm) during storms whereas streams in non-mined areas yield 600 ppm under the same hydrologic circumstances. On an annual basis, such yields from watersheds containing strip mines are equivalent to 1900 tons per square mile compared to 25 tons sq. mi. on non-mined areas. Moreover spoil banks yielded a considerably greater amount of sediment, 27,000 tons per sq. mi., which is more than 1,000 times greater than yields from nonmined areas. Yields from inadequately reclaimed mine sites continue at a high level of 5,600 ppm (250 tons per sq. mi.) for long periods after mining has ceased (Beaver Creek, pages C-38-41).

Sedimentation from coal mining has resulted in shortening the useful life of major public works facilities—flood control reservoirs and navigation channels—as well as clogging streams and increasing flood flows.

While the processes of sedimentation in the arid and semiarid areas of the country are the same as those in humid regions, the potential for large area impacts adjacent to streams is greater in the arid and semiarid coal areas since the erosional balance of stream valleys is more fragile.

Substantial surface mining in the arid and semiarid areas of the West has not existed long enough to allow full analysis of the hydrologic consequences of such activities. Insight into the potential problem of sedimentation in such areas, however, can be gained through studies of the cumulative effect of past experiences with the destruction of vegetation over large areas (for example, overgrazing, deforestation and construction). One such case is the experience of sedimentation on the Rio Puerco, a tributary of the Rio Grande River. Briefly stated the pattern presented in that situation entailed the destruction of vegetation in part of the valley triggered substantial erosion and head cutting and deepening of the stream channel. This lowered the groundwater levels on adjacent alluvial valley floors which resulted in further destruction of vegetation since roots could not reach the lowered water table. Erosion increased and the cycle worsened. Over a period of years, the head cut moved up the valley. Eventually the entire alluvial floor was affected by reducing the amount of and changing the nature of the vegetation which was essential to the local economy as well as to the long-term productivity and stabilization of the land.

While the above example is an extreme case in which little was done to manage lands to control erosion, a pattern similar to the history of the Rio Puerco could result from expanded surface coal mining in similar areas of the West without regard for hydrologic consequences (NAS, page 68-69).

The purpose of the hydrologic balance provisions of H.R. 2 is to assure the maintenance of that balance on and off the mining site during and after the mining operation. Looking back at the Rio Puerco situation, the amount of disruption during any one year to the surface area of the basin could have been considered minimal. However, taken together and accumulating over a period of time, the disturbances resulted in a major alteration of the tributary valley.

Similarly, individual disturbances caused by mining might be considered minimal and of small geographic consequence. On the other hand, there are indications that their cumulative impact could be of long duration and of large geographic extent.

Provisions in the Act directed toward maintenance of the hydrologic balance include: (1) certain mining permit application requirements, (2) permit approval or denial criteria check off, (3) specific environmental standards, (4) monitoring requirements, and (5) compensation requirements for decrease in water availability to users.

APPLICATION FOR MINING

H.R. 2 requires that the operator make a determination of the probable hydrologic consequences of the proposed mining and reclamation operations. It is intended that the data assembled with this assessment be included in the application so that the regulatory authority, utilizing this and other information available, can assess the probable cumulative impacts of all anticipated mining in the area upon the hydrology and adjust its actions and recommendations accordingly.

Meeting such requirements will necessitate more planning and engineering on the part of the mining operator than is now generally the case. It will also involve the necessity to use trained professional persons in a number of fields: mining and civil engineering; geology; hydrology; and plant and soil sciences. Current experience, however, clearly shows that where operators have carried out adequate planning and engineering, they have been able to identify ways of limiting environmental impacts to the mine site and have been able to conduct operations in such critical water and environmental areas as the Hanaford Creek basin in Washington.

PERMIT APPROVAL AND DENIAL

One of the written findings the regulatory authority makes in the approval or denial of an application for a mining permit addresses the impacts of mining on the hydrologic balance of the area. This finding also includes the authority's assessment of the probable cumulative impact of existing and anticipated mining on the hydrologic balance of the area affected. These specific standards are emphasized at the permit approval stage due to the critical and long-term impacts mining can have on the water resources of the area affected.

In addition to the Environmental Performance Standards of section 515(b), (see discussion later in this report) the bill addresses the alluvial valley floor issue in the permit approval and denial section. In response to criticism of this provision in H.R. 25, the Committee amended the section to clear up any possible ambiguity. It is

Section 6. Section 37-69-307, MCA, is amended to read:

"**37-69-307. Examination fee and annual renewal fee.** (1) No applicant for a master plumber's license may submit to the examinations prescribed by the board until he has deposited with the department an examination fee *prescribed by the board*, and no applicant for a journeyman plumber's license may submit to the examination prescribed by the board until he has deposited with the department an examination fee *as prescribed by the board.*

(2) A license when issued expires 1 year from the date of issuance. A license issued to a master plumber or a journeyman plumber may be renewed annually without examination, at any time prior to its expiration, by a written request for its renewal directed to the department and the payment of *a fee* as set by the board for renewal of a master plumber's license *or a fee* as set by the board for *renewal of* a journeyman plumber's license. Renewal is for the period of 1 year.

(3) Fees prescribed by the board pursuant to this section must be reasonably related to the costs incurred by the board in carrying out its respective functions."

Section 7. **Effective date.** Sections 1 and 2 are effective on passage and approval.

Approved April 12, 1979.

CHAPTER NO. 550

AN ACT TO MAKE ONLY THOSE AMENDMENTS NECESSARY TO BRING THE MONTANA STRIP AND UNDERGROUND MINE RECLAMATION ACT INTO COMPLIANCE WITH PUBLIC LAW 95-87, THE SURFACE MINING CONTROL AND RECLAMATION ACT OF 1977; TO REPEAL THE STRIP-MINED COAL CONSERVATION ACT; AMENDING SECTIONS 70-30-102, 82-4-202 THROUGH 82-4-205, 82-4-221 THROUGH 82-4-223, 82-4-225, 82-4-227, 82-4-228, 82-4-231, 82-4-232, 82-4-235, 82-4-239, 82-4-251, 82-4-252, AND 82-4-254; AND REPEALING SECTIONS 82-3-101 THROUGH 82-3-110, MCA.

Be it enacted by the Legislature of the State of Montana:

Section 1. Section 82-4-202, MCA, is amended to read:

"**82-4-202. Policy — findings.** (1) It is the declared policy of this state and its people to:

(a) maintain and improve the state's clean and healthful environment for present and future generations;

(b) protect its environmental life-support system from degradation;

(c) prevent unreasonable degradation of its natural resources;

(d) restore, enhance, and preserve its scenic, historic, archeologic, scientific, cultural, and recreational sites;

(e) demand effective reclamation of all lands disturbed by the taking of natural resources and *maintain state administration of the reclamation program;*

(f) require the legislature to provide for proper administration and enforcement, create adequate remedies, and set effective requirements and standards (especially as to reclamation of disturbed lands) in order to achieve the aforementioned objectives*; and*

(g) provide for the orderly development of coal resources through strip or underground mining to assure the wise use of these resources and prevent the failure to conserve coal.

(2) The legislature hereby finds and declares that:

(a) in order to achieve the aforementioned policy objectives, promote the health and welfare of the people, control erosion and pollution, protect domestic stock and wildlife, preserve agricultural and recreational productivity, save cultural, historic, and aesthetic values, and assure a long-range dependable tax base, it is reasonably necessary to require, after March 16, 1973, that all strip-mining and underground-mining operations be limited to those for which *5-year* permits are granted, that no permit be issued until the operator presents a comprehensive plan for reclamation and restoration *and a coal conservation plan*, together with an adequate performance bond, and the plan is approved, that certain other things must be done, that certain remedies are available, that certain lands because of their unique or unusual characteristics may not be strip-mined or underground-mined under any circumstances, all as more particularly appears in the remaining provisions of this part*, and that the department be given authority to administer and enforce a reclamation program that complies with Public Law 95-87, the Surface Mining Control and Reclamation Act of 1977, as amended*;

(b) this part be deemed to be an exercise of the authority granted in the Montana constitution, as adopted June 6, 1972, and, in particular, a response to the mandate expressed in Article IX thereof and also be deemed to be an exercise of the general police power to provide for the health and welfare of the people."

Section 2. Section 82-4-203, MCA, is amended to read:

"**82-4-203. Definitions.** Unless the context requires otherwise, in this part the following definitions apply:

(1) "Abandoned" means an operation where no mineral is being produced and where the department determines that the operation will not continue or resume.

(2) "Alluvial valley floor" means the unconsolidated stream-laid deposits holding streams where water availability is sufficient for subirrigation or flood irrigation agricultural activities; but the term does not include upland areas which are generally overlain by a thin veneer

boundary revisions. If the department approves a reduction in the acreage covered by the original or supplemental permit, it shall release the bond for each acre reduced, but in no case shall the bond be reduced below *$10,000*, except as provided in 82-4-223."

Section 9. Section 82-4-227, MCA, is amended to read:

"**82-4-227. Refusal of permit.** (1) An application for a prospecting, strip-mining, or underground-mining permit *or major revision* shall not be approved by the department *unless*, on the basis of the information set forth in the application, an on-site inspection, and an evaluation of the operation by the department, *the applicant has affirmatively demonstrated* that the requirements of *this* part *and* rules will be observed *and* that the proposed method of operation, backfilling, grading, subsidence stabilization, water control, highwall reduction, topsoiling, revegetation, or reclamation of the affected area *can* be carried out consistently with the purpose of this part. *The applicant for a permit or major revision has the burden of establishing that his application is in compliance with this part and the rules adopted under it.*

(2) The department shall not approve the application for a prospecting, strip-mining, or underground-mining permit where the area of land described in the application includes land having special, exceptional, critical, or unique characteristics or that mining or prospecting on that area would adversely affect the use, enjoyment, or fundamental character of neighboring land having special, exceptional, critical, or unique characteristics. For the purposes of this part, land is defined as having such characteristics if it possesses special, exceptional, critical, or unique:

(a) biological productivity, the loss of which would jeopardize certain species of wildlife or domestic stock;

(b) ecological fragility, in the sense that the land, once adversely affected, could not return to its former ecological role in the reasonable foreseeable future;

(c) ecological importance, in the sense that the particular land has such a strong influence on the total ecosystem of which it is a part that even temporary effects felt by it could precipitate a system-wide reaction of unpredictable scope or dimensions; or

(d) scenic, historic, archeologic, topographic, geologic, ethnologic, scientific, cultural, or recreational significance. (In applying this subsection, particular attention should be paid to the inadequate preservation previously accorded Plains Indian history and culture.)

(3) The department may not approve an application for a strip- or underground-coal-mining permit or major revision unless the application affirmatively demonstrates that:

(a) the assessment of the probable cumulative impact of all anticipated mining in the area on the hydrologic balance has been made by the department and the proposed operation thereof has been designed to prevent material damage to the hydrologic balance outside the permit area; and

(b) the proposed strip- or underground-coal-mining operation would not:

(i) interrupt, discontinue, or preclude farming on alluvial valley floors that are irrigated or naturally subirrigated, excluding undeveloped rangelands that are not significant to farming on alluvial valley floors and those lands as to which the regulatory authority finds that if the farming that will be interrupted, discontinued, or precluded is of such small acreage as to be of negligible impact on the farm's agricultural production; or

(ii) materially damage the quantity or quality of water in surface-water or underground-water systems that supply these valley floors in subsection (3)(b)(i).

(4) Subsection (3)(b) does not affect those strip- or underground-coal-mining operations that in the year preceding the enactment of Public Law 95-87 produced coal in commercial quantities and were located within or adjacent to alluvial valley floors or had obtained specific permit approval by the department to conduct strip- or underground-coal-mining operations within alluvial valley floors. If coal deposits are precluded from being mined under this subsection, the commissioner shall certify to the secretary of interior that the mineral owner or lessee may be eligible for participation in coal exchange programs pursuant to section 510(5) of Public Law 95-87.

(5) If the area proposed to be mined contains prime farmland, the department may not grant a permit to mine coal on the prime farmland unless it finds in writing that the applicant has the technological capability to restore the mined area, within a reasonable time, to equivalent or higher levels of yield as nonmined prime farmland in the surrounding area under equivalent levels of management and can meet the soil reconstruction standards of 82-4-232(3). Nothing in this subsection applies to any permit issued prior to August 3, 1977, or to any revisions or renewals thereof, or to any existing strip- or underground-mining operations for which a permit was issued prior to August 3, 1977.

(6) If the department finds that the overburden on any part of the area of land described in the application for a prospecting, strip-mining, or underground-mining permit is such that experience in the state with a similar type of operation upon land with similar overburden shows that substantial deposition of sediment in streambeds, subsidence, landslides, or water pollution cannot feasibly be prevented, the department shall delete that part of the land described in the application upon which the overburden exists. *The burden is on the applicant to demonstrate that any area should not be deleted under this subsection.*

(7) If the department finds that the operation will constitute a hazard to a dwelling house, public building, school, church, cemetery, commercial or institutional building, public road, stream, lake, or other public property, the department shall delete those areas from the prospecting, strip-mining, or underground-mining permit application before it can be approved. *In no case may strip- or underground-coal-mining be allowed within 300 feet of any occupied dwelling, unless waived by the owner, nor*

(iv) affect natural hazard lands in which these operations could substantially endanger life and property, these lands to include areas subject to frequent flooding and areas of unstable geology.

(3) Prior to designating any land areas as unsuitable for strip- or underground-coal-mining operations, the department shall prepare a detailed statement on:

(a) the potential coal resources of the area;

(b) the demand for coal resources; and

(c) the impact of this designation on the environment, economy, and supply of coal.

(4) A designation does not prevent mineral exploration pursuant to this act of any area so designated.

(5) The requirements of this section do not apply to lands on which strip- or underground-coal-mining operations are being conducted pursuant to a permit issued under this part or where substantial legal and financial commitments in these operations were in existence prior to January 4, 1977.

Section 11. Section 82-4-231, MCA, is amended to read:

"**82-4-231. Submission of and action on reclamation plan.** (1) As rapidly, completely, and effectively as the most modern technology and the most advanced state of the art will allow, each operator granted a permit under this part shall reclaim and revegetate the land affected by his operation, except that underground tunnels, shafts, or other subsurface excavations need not be revegetated. Under the provisions of this part and rules adopted by the board, an operator shall prepare and carry out a method of operation, plan of grading, backfilling, highwall reduction, subsidence stabilization, water control, topsoiling, and a reclamation plan for the area of land affected by his operation. In developing a method of operation and plans of backfilling, subsidence stabilization, water control, grading, highwall reduction, topsoiling, and reclamation, all measures shall be taken to eliminate damages to landowners and members of the public, their real and personal property, public roads, streams, and all other public property from soil erosion, subsidence, landslides, water pollution, and hazards dangerous to life and property.

(2) The reclamation plan shall set forth in detail the manner in which the applicant intends to comply with this section and 82-4-232 through 82-4-234, as amended, *and the steps to be taken to comply with applicable air and water quality laws and rules and any applicable health and safety standards*. The application for permit *or major revision of a permit, which shall contain the reclamation plan,* shall be submitted to the department. *The department shall notify various local governmental bodies, planning agencies, sewage and water treatment authorities, and water companies in the locality in which the proposed mining will take place of the application and provide a reasonable time for them to submit written comments. Any person having an interest which is or may be adversely affected or the officer or head of any federal, state, or local*

governmental agency or authority shall have the right to file written objections to the proposed initial or revised application for permit or major revision within 30 days of the applicant's published notice. If written objections are filed and an objector requests an informal conference, the department shall hold an informal conference in the locality of the proposed operation after adequate public notice. The department may arrange with the applicant upon request by any party to the administrative proceeding for access to the proposed mining area for the purpose of gathering information relevant to the proceeding. The department shall notify the applicant by certified or registered mail within 120 days after receipt of the complete application if it is or is not acceptable. The department may extend the 120 days an additional 120 days upon notification of the operator in writing. *The department shall make written findings granting or denying the permit or revision application in whole or in part.* If the *application* is not acceptable, the department shall set forth the reasons why *it* is not acceptable, and it may propose modifications, delete areas, or reject the entire *application.* A landowner, operator, or any person *with an interest that is or may be adversely affected* may by written notice request a hearing by the board. *The hearing shall be held within 30 days of the request. No person who presided at the informal conference may either preside at the hearing or participate in the decision thereon. For purposes of the hearing, the board may order site inspections of the area pertinent to the application.* The board shall notify the person by certified or registered mail *and all other persons by regular mail* within 20 days after the hearing of its decision. Every reclamation plan shall be subject to annual review and modification.

(3) In addition to the method of operation, grading, backfilling, subsidence stabilization, water control, highwall reduction, topsoiling, and reclamation requirements of this part and rules adopted under this part, the operator, consistent with the directives of subsection (1) of this section, shall:

(a) bury under adequate fill all toxic materials, shale, mineral, or any other material determined by the department to be acid producing, toxic, undesirable, or creating a hazard;

(b) as directed by rules seal off tunnels, shafts, or other openings or any breakthrough of water creating a hazard;

(c) impound, drain, or treat all runoff or underground mine waters so as to reduce soil erosion, damage to grazing and agricultural lands, and pollution of surface and subsurface waters;

(d) remove or bury all metal, lumber, and other refuse resulting from the operation;

(e) use explosives in connection with the operation only in accordance with department regulations designed to minimize noise, damage to adjacent lands, and water pollution and ensure public safety and for other purposes;

(f) adopt measures to prevent land subsidence unless the board approves a plan for inducing subsidence into an abandoned operation in a predictable and controlled manner with measures for grading, topsoiling, and revegetating the subsided land surface. In order for a controlled subsidence plan to be approved, the applicant must show that subsidence will not cause a direct or indirect hazard to any public or private buildings, roads, facilities, or use areas, constitute a hazard to human life or health, or constitute a hazard to domestic livestock or to a viable agricultural operation, or violate any other restrictions the board may consider necessary.

(g) stockpile and protect from erosion all mining and processing wastes until these wastes can be disposed of according to the provisions of this part;

(h) deposit as much stockpiled waste material as possible back into the mine voids upon abandonment in such manner as to prevent or minimize land subsidence. The remaining waste material shall be disposed of as provided by this part and the rules of the board.

(i) seal all portals, entryways, drifts, shafts, or other openings between the surface and underground mine workings *when no longer needed;*

(j) to the extent possible using the best technology currently available, minimize disturbances and adverse impacts of the operation on fish, wildlife, and related environmental values and achieve enhancement of such resources where practicable;

(k) minimize the disturbances to the prevailing hydrologic balance at the mine site and in associated offsite areas and to the quality and quantity of water in surface-water and ground-water systems both during and after strip- or underground-coal-mining operations and during reclamation by:

(i) avoiding acid or other toxic mine drainage by such measures as, but not limited to:

(A) preventing or removing water from contact with toxic-producing deposits;

(B) treating drainage to reduce toxic content which adversely affects downstream water upon being released to water courses;

(C) casing, sealing, or otherwise managing boreholes, shafts, and wells and keeping acid or other toxic drainage from entering ground and surface waters;

(ii) (A) conducting strip- or underground-mining operations so as to prevent, to the extent possible using the best technology currently available, additional contributions of suspended solids to streamflow or runoff outside the permit area but in no event shall contributions be in excess of requirements set by applicable state or federal law;

(B) constructing any siltation structures pursuant to (ii)(A) of this subsection prior to commencement of strip- or underground-mining operations, such structures to be certified by a qualified registered engineer to be constructed as designed and as approved in the reclamation plan;

(6) The provisions of Title 18, chapter 1, part 2, and Title 18, chapter 2, parts 2 and 3, do not apply to procurements under this chapter."

Approved April 1, 2003

CHAPTER NO. 204

[HB 373]

AN ACT REVISING THE MONTANA STRIP AND UNDERGROUND MINE RECLAMATION LAWS; CLARIFYING THE POLICY AND FINDINGS; CLARIFYING CERTAIN DEFINITIONS AND DEFINING CERTAIN TERMS; REDUCING THE TIME REQUIRED FOR THE DEPARTMENT OF ENVIRONMENTAL QUALITY TO APPROVE OR DISAPPROVE MINOR REVISIONS; MODIFYING PERMIT APPLICATION REQUIREMENTS; CLARIFYING HYDROLOGIC BALANCE RECLAMATION REQUIREMENTS; MODIFYING AREA MINING REQUIREMENTS; MODIFYING THE REQUIREMENTS FOR PLANTING VEGETATION FOLLOWING GRADING OF A DISTURBED AREA; PROVIDING STANDARDS FOR SUCCESSFUL REVEGETATION; CLARIFYING THAT VEGETATION THAT IS PLACED OR SEEDED BECOMES THE PROPERTY OF THE LANDOWNER AFTER THE BOND IS RELEASED; ALLOWING REVISION OF PERMIT AND RECLAMATION PLAN APPLICATIONS IN ORDER TO INCORPORATE THE PROVISIONS OF THIS ACT; AMENDING SECTIONS 82-4-202, 82-4-203, 82-4-221, 82-4-222, 82-4-231, 82-4-232, 82-4-233, 82-4-234, 82-4-235, AND 82-4-236, MCA; AND PROVIDING A DELAYED EFFECTIVE DATE.

Be it enacted by the Legislature of the State of Montana:

Section 1. Section 82-4-202, MCA, is amended to read:

"**82-4-202. Policy — findings.** (1) It is the declared policy of this state and its people to:

(a) maintain and improve the state's clean and healthful environment for present and future generations;

(b) protect its environmental life-support system from degradation;

(c) prevent unreasonable degradation of its natural resources;

(d) restore, enhance, and preserve its scenic, historic, archaeologic, scientific, cultural, and recreational sites;

(e) demand effective reclamation of all lands disturbed by the taking of natural resources and maintain state administration of the reclamation program;

(f) require the legislature to provide for proper administration and enforcement, create adequate remedies, and set effective requirements and standards ~~(~~, especially as to reclamation of disturbed lands~~)~~, in order to achieve ~~the aforementioned~~ *those* objectives; and

(g) provide for the orderly development of coal resources through strip or underground mining to ~~assure~~ *ensure* the wise use of these resources and prevent the failure to conserve coal.

(2) The legislature ~~hereby~~ finds and declares that:

(a) in order to achieve the ~~aforementioned~~ policy objectives *enumerated in subsection (1)*, promote the health and welfare of the people, control erosion and pollution, protect domestic stock and wildlife, preserve agricultural and recreational productivity, save cultural, historic, and aesthetic values, and ~~assure~~ *ensure* a long-range dependable tax base, it is reasonably necessary to require~~, after March 16, 1973,~~ that all strip-mining and underground-mining operations be limited to those for which 5-year permits are granted, that ~~no~~ *a* permit *may not* be issued until the operator presents a comprehensive plan for reclamation and restoration and a coal conservation plan, together with an adequate performance bond, and the plan is approved, that certain other things must be done, that certain remedies are available, that certain lands because of their unique or unusual characteristics may not be strip-mined or underground-mined under any circumstances, all as more particularly appears in the remaining provisions of this part, and that the department be given authority to administer and enforce a reclamation program that complies with Public Law 95-87, the Surface Mining Control and Reclamation Act of 1977, as amended;

(b) this part ~~be deemed to be~~ *is* an exercise of the authority granted in the Montana constitution~~, as adopted June 6, 1972,~~ and, in particular, a response to the mandate expressed in Article IX ~~thereof~~ *of the constitution* and ~~also be deemed to be~~ *that this part is also* an exercise of the general police power to provide for the health and welfare of the people~~.~~*;*

(c) coal mining alters the character of soils and overburden materials and that duplication of premining topography, soils, and vegetation composition is not practicable;

(d) the standard for successful reclamation of lands mined for coal is the reestablishment of sustainable land use comparable to premining conditions or to higher or better uses; and

(e) standards for successful reclamation must be well-defined, consistent, and attainable so that mine operators can reclaim lands disturbed by mining with confidence that the release of performance bonds can be achieved."

Section 2. Section 82-4-203, MCA, is amended to read:

"**82-4-203. Definitions.** Unless the context requires otherwise, in this part, the following definitions apply:

(1) "Abandoned" means an operation in which a mineral is not being produced and that the department determines will not continue or resume operation.

(2) "Adjacent area" means the area outside the permit area where a resource or resources, determined in the context in which the term is used, are or could reasonably be expected to be adversely affected by proposed mining operations, including probable impacts from underground workings.

~~(2)~~*(3)* (a) "Alluvial valley floor" means the unconsolidated stream-laid deposits holding streams where water availability is sufficient for subirrigation or flood irrigation agricultural activities.

(b) The term does not include upland areas that are generally overlain by a thin veneer of colluvial deposits composed chiefly of debris from sheet erosion~~;~~ *and* deposits by unconcentrated runoff or slope wash, together with talus, other mass movement accumulation, and windblown deposits.

(4) "Approximate original contour" means that surface configuration achieved by backfilling and grading of the mined area so that the reclaimed area,

(23) "Higher or better uses" means postmining land uses that have a higher economic value or noneconomic benefit to the landowner or the community than the premining land uses.

(24) "Hydrologic balance" means the relationship between the quality and quantity of water inflow to, water outflow from, and water storage in a hydrologic unit, such as a drainage basin, aquifer, soil zone, lake, or reservoir, and encompasses the dynamic relationships among precipitation, runoff, evaporation, and changes in ground water and surface water storage as they relate to uses of land and water within the area affected by mining and the adjacent area.

~~(15)~~*(25)* "Imminent danger to the health and safety of the public" means the existence of any condition or practice or any violation of a permit or other requirement of this part in a strip- or underground-coal-mining and reclamation operation that could reasonably be expected to cause substantial physical harm to persons outside the permit area before the condition, practice, or violation can be abated. A reasonable expectation of death or serious injury before abatement exists if a rational person, subjected to the same conditions or practices giving rise to the peril, would not willingly be exposed to the danger during the time necessary for abatement.

(26) "Industrial or commercial" means land used for:

(a) extraction or transformation of materials for fabrication of products, wholesaling of products, or long-term storage of products. This includes all heavy and light manufacturing facilities.

(b) retail or trade of goods or services, including hotels, motels, stores, restaurants, and other commercial establishments.

(27) "Intermittent stream" means a stream or reach of a stream that is below the water table for at least some part of the year and that obtains its flow from both ground water discharge and surface runoff.

(28) "Land use" means specific uses or management-related activities, rather than the vegetative cover of the land. Land uses may be identified in combination when joint or seasonal uses occur and may include land used for support facilities that are an integral part of the land use. Land use categories include cropland, developed water resources, fish and wildlife habitat, forestry, grazing land, industrial or commercial, pastureland, land occasionally cut for hay, recreation, or residential.

~~(16)~~*(29)* "Marketable coal" means a minable coal that is economically feasible to mine and is fit for sale in the usual course of trade.

(30) "Material damage" means, with respect to protection of the hydrologic balance, degradation or reduction by coal mining and reclamation operations of the quality or quantity of water outside of the permit area in a manner or to an extent that land uses or beneficial uses of water are adversely affected, water quality standards are violated, or water rights are impacted. Violation of a water quality standard, whether or not an existing water use is affected, is material damage.

~~(17)~~*(31)* "Method of operation" means the method or manner by which the cut, open pit, shaft, or excavation is made, the overburden is placed or handled, water is controlled, and other acts are performed by the operator in the process of uncovering and removing the minerals that affect the reclamation of the area of land affected.

(b) replacement of the vehicle with an identical vehicle or a comparable vehicle acceptable to the consumer;

(c) refund as provided in 61-4-503(2);

(d) any other remedies available under the applicable warranties or 15 U.S.C. 2301 through 2312, as in effect on October 1, 1983; or

(e) reimbursement of expenses and costs to the prevailing party.

(3) The decision must specify a date for performance and completion of all awarded remedies. The department of administration shall contact the prevailing party within 10 working days after the date for performance to determine whether performance has occurred. The parties shall act in good faith in abiding by any decision. In addition, if the decision is not accepted, the parties shall follow the provisions of Title 27, chapter 5. If it is determined by the court that the appellant has acted without good cause in bringing an appeal of an award, the court, in its discretion, may grant to the respondent costs and reasonable attorney fees."

Approved April 17, 2003

CHAPTER NO. 361

[HB 437]

AN ACT GENERALLY REVISING LAWS GOVERNING THE ENVIRONMENT; PROVIDING THAT THE ENACTMENT OF CERTAIN LEGISLATION IS THE LEGISLATIVE IMPLEMENTATION OF ARTICLE II, SECTION 3, AND ARTICLE IX OF THE MONTANA CONSTITUTION AND PROVIDING THAT COMPLIANCE WITH THE REQUIREMENTS OF THE LEGISLATIVE IMPLEMENTATION CONSTITUTES ADEQUATE REMEDIES AS REQUIRED BY THE CONSTITUTION; REQUIRING THAT A CHALLENGE TO A PERMIT ISSUED PURSUANT TO THE AIR QUALITY LAWS OR OPENCUT MINING RECLAMATION LAWS, A CHALLENGE TO A LICENSE OR PERMIT ISSUED PURSUANT TO THE METAL MINE RECLAMATION LAWS, A CHALLENGE TO A CERTIFICATE ISSUED PURSUANT TO THE MONTANA MAJOR FACILITY SITING ACT, OR AN AMENDMENT ISSUED PURSUANT TO THE OPENCUT MINING RECLAMATION LAWS MUST PROVIDE FOR COSTS AND ATTORNEY FEES IF THE CHALLENGE WAS FOR AN IMPROPER PURPOSE; PROVIDING THAT AN ACTION CHALLENGING THE ISSUANCE OF A PERMIT UNDER THE AIR QUALITY LAWS, THE ISSUANCE OF AN AMENDMENT UNDER THE OPENCUT MINING RECLAMATION LAWS, THE ISSUANCE OF A LICENSE OR PERMIT UNDER THE METAL MINE RECLAMATION LAWS, A PETITION FOR REVIEW CHALLENGING A LICENSING OR PERMITTING DECISION UNDER THE MONTANA ADMINISTRATIVE PROCEDURE ACT, AN ARBITRATION ACTION UNDER THE NATURAL STREAMBED AND LAND PRESERVATION ACT OF 1975, ANY ACTION UNDER THE HAZARDOUS WASTE FACILITIES LAWS OR THE MONTANA ENVIRONMENTAL POLICY ACT, ENTRY AND INSPECTION UNDER THE COAL AND URANIUM MINE RECLAMATION LAWS, OR A CERTIFICATE ISSUED UNDER THE MAJOR FACILITY SITING LAWS MUST BE BROUGHT IN THE COUNTY IN WHICH THE ACTIVITY SUBJECT TO THE PERMIT, PETITION FOR REVIEW, AMENDMENT, LICENSE, ARBITRATION, ACTION, CERTIFICATE, OR

INSPECTION WILL OCCUR; PROVIDING THAT FOR AN ACTIVITY THAT WILL OCCUR IN MORE THAN ONE COUNTY, ANY COUNTY IN WHICH THE ACTIVITY WILL OCCUR IS A PROPER VENUE; PROVIDING THAT CERTAIN PERSONS MAY NOT CONDUCT REMEDIAL ACTIONS CONCERNING CLEANUP ACTIVITIES AT ANY FACILITY THAT IS SUBJECT TO AN ADMINISTRATIVE OR JUDICIAL ORDER; AMENDING SECTIONS 2-4-702, 2-4-704, 50-40-102, 75-1-102, 75-1-103, 75-2-102, 75-2-104, 75-5-101, 75-5-102, 75-7-102, 75-7-121, 75-10-202, 75-10-402, 75-10-420, 75-10-706, 75-10-902, 75-11-202, 75-11-301, 75-11-502, 75-20-102, 75-20-201, 75-20-401, 75-20-406, 76-6-102, 76-7-102, 82-4-102, 82-4-202, 82-4-239, 82-4-252, 82-4-301, 82-4-349, 82-4-402, 82-4-427, 82-4-436, AND 87-5-103, MCA; AND PROVIDING AN IMMEDIATE EFFECTIVE DATE AND A RETROACTIVE APPLICABILITY DATE.

WHEREAS, Article II, section 3, of the Montana Constitution enumerates certain inalienable individual rights, including the right to a clean and healthful environment, the right of pursuing life's basic necessities, the right of enjoying and defending an individual's life and liberty, the right of acquiring, possessing, and protecting property, and the right of seeking individual safety, health, and happiness in all lawful ways; and

WHEREAS, the constitutionally enumerated rights are by their very nature bound to result in competing interests in specific fact situations; and

WHEREAS, Article IX, section 1, of the Montana Constitution provides that the state and each person shall maintain and improve a clean and healthful environment in Montana for present and future generations and directs the Legislature to provide for the administration and enforcement of this duty and also directs the Legislature to provide adequate remedies for the protection of the environmental life support system from degradation and to provide adequate remedies to prevent unreasonable depletion and degradation of natural resources; and

WHEREAS, the Legislature has reviewed the intent of the framers of the 1972 Montana Constitution as evidenced in the verbatim transcripts of the constitutional convention; and

WHEREAS, there is no indication that one enumerated inalienable right is intended to supersede other inalienable rights, including the right to use property in all lawful means; and

WHEREAS, the Legislature, mindful of its constitutional obligation to provide for the administration and enforcement of the constitution, has enacted a comprehensive set of laws to accomplish the goals of the constitution, including the Montana Clean Indoor Air Act of 1979, Title 50, chapter 40, part 1, MCA; the Montana Environmental Policy Act, Title 75, chapter 1, parts 1 through 3, MCA; the Clean Air Act of Montana, Title 75, chapter 2, parts 1 through 4, MCA; water quality laws, Title 75, chapter 5, MCA; The Natural Streambed and Land Preservation Act of 1975, Title 75, chapter 7, part 1, MCA; The Montana Solid Waste Management Act, Title 75, chapter 10, part 2, MCA; The Montana Hazardous Waste Act, Title 75, chapter 10, part 4, MCA; the Comprehensive Environmental Cleanup and Responsibility Act, Title 75, chapter 10, part 7, MCA; the Montana Megalandfill Siting Act, sections 75-10-901 through 75-10-945, MCA; the Montana Underground Storage Tank Installer and Inspector Licensing and Permitting Act, Title 75, chapter 11, part 2, MCA; the Montana Underground Storage Tank Act, Title 75, chapter 11, part 5, MCA; the Montana Major Facility Siting Act, Title 75, chapter 20, MCA; the

Open-Space Land and Voluntary Conservation Easement Act, Title 76, chapter 6, MCA; the Environmental Control Easement Act, Title 76, chapter 7, MCA; The Strip and Underground Mine Siting Act, Title 82, chapter 4, part 1, MCA; The Montana Strip and Underground Mine Reclamation Act, Title 82, chapter 4, part 2, MCA; The Opencut Mining Act, Title 82, chapter 4, part 4, MCA; and The Nongame and Endangered Species Conservation Act, Title 87, chapter 5, part 1, MCA.

Be it enacted by the Legislature of the State of Montana:

Section 1. Section 2-4-702, MCA, is amended to read:

"**2-4-702. Initiating judicial review of contested cases.** (1) (a) A person who has exhausted all administrative remedies available within the agency and who is aggrieved by a final decision in a contested case is entitled to judicial review under this chapter. This section does not limit utilization of or the scope of judicial review available under other means of review, redress, relief, or trial de novo provided by statute.

(b) A party who proceeds before an agency under the terms of a particular statute may not be precluded from questioning the validity of that statute on judicial review, but the party may not raise any other question not raised before the agency unless it is shown to the satisfaction of the court that there was good cause for failure to raise the question before the agency.

(2) (a) Except as provided in subsection (2)(c), proceedings for review must be instituted by filing a petition in district court within 30 days after service of the final decision of the agency or, if a rehearing is requested, within 30 days after the decision is rendered. Except as otherwise provided by statute *or subsection (2)(d)*, the petition must be filed in the district court for the county where the petitioner resides or has the petitioner's principal place of business or where the agency maintains its principal office. Copies of the petition must be promptly served upon the agency and all parties of record.

(b) The petition must include a concise statement of the facts upon which jurisdiction and venue are based, a statement of the manner in which the petitioner is aggrieved, and the ground or grounds specified in 2-4-704(2) upon which the petitioner contends ~~he is~~ *to be* entitled to relief. The petition must demand the relief to which the petitioner believes the petitioner is entitled, and the demand for relief may be in the alternative.

(c) If a petition for review is filed pursuant to 33-16-1012(2)(c), the workers' compensation court, rather than the district court, has jurisdiction and the provisions of this part apply to the workers' compensation court in the same manner as the provisions of this part apply to the district court.

(d) If a petition for review is filed challenging a licensing or permitting decision made pursuant to Title 75 or Title 82, the petition for review must be filed in the county where the facility is located or proposed to be located or where the action is proposed to occur.

(3) Unless otherwise provided by statute, the filing of the petition may not stay enforcement of the agency's decision. The agency may grant or the reviewing court may order a stay upon terms that it considers proper, following notice to the affected parties and an opportunity for hearing. A stay may be issued without notice only if the provisions of 27-19-315, 27-19-316, and 27-19-317 are met.

(4) Within 30 days after the service of the petition or within further time allowed by the court, the agency shall transmit to the reviewing court the

of this part provide adequate remedies for the protection of the environmental life support system from degradation and provide adequate remedies to prevent unreasonable depletion and degradation of natural resources.

~~(1)~~*(2)* It is the policy of this state to provide adequate remedies for the protection of the environmental life support system from degradation and provide adequate remedies to prevent unreasonable depletion and degradation of natural resources.

~~(2)~~*(3)* It is the purpose of this part:

(a) to vest in the department the authority to review new strip-mine and new underground-mine site locations and reclamation plans and either approve or disapprove ~~such~~ *those* locations and plans and to exercise general administration and enforcement of this part;

(b) to vest in the board the authority to adopt rules;

(c) to satisfy the requirement of Article IX, section 2, of the constitution of this state~~,~~ that all lands disturbed by the taking of natural resources be reclaimed; and

(d) to ~~insure~~ *ensure* that adequate information is available on areas proposed for strip mining or underground mining so that mining and reclamation plans may be properly formulated to accommodate areas that are suitable for strip mining or underground mining.

~~(3)~~*(4)* This part is ~~deemed to be~~ an exercise of the general police power to provide for the health and welfare of the people."

Section 28. Section 82-4-202, MCA, is amended to read:

"**82-4-202.** ~~**Policy**~~ ***Intent — policy —* findings.** *(1) The legislature, mindful of its constitutional obligations under Article II, section 3, and Article IX of the Montana constitution, has enacted The Montana Strip and Underground Mine Reclamation Act. It is the legislature's intent that the requirements of this part provide adequate remedies for the protection of the environmental life support system from degradation and provide adequate remedies to prevent unreasonable depletion and degradation of natural resources.*

~~(1)~~*(2)* It is the declared policy of this state and its people to:

(a) maintain and improve the state's clean and healthful environment for present and future generations;

(b) protect its environmental life-support system from degradation;

(c) prevent unreasonable degradation of its natural resources;

(d) restore, enhance, and preserve its scenic, historic, archaeologic, scientific, cultural, and recreational sites;

(e) demand effective reclamation of all lands disturbed by the taking of natural resources and maintain state administration of the reclamation program;

(f) require the legislature to provide for proper administration and enforcement, create adequate remedies, and set effective requirements and standards ~~(~~, especially as to reclamation of disturbed lands~~)~~, in order to achieve the ~~aforementioned~~ objectives *enumerated in this subsection (2)*; and

(g) provide for the orderly development of coal resources through strip or underground mining to ~~assure~~ *ensure* the wise use of these resources and prevent the failure to conserve coal.

~~(2)~~*(3)* The legislature hereby finds and declares that:

(a) in order to achieve the ~~aforementioned~~ policy objectives *enumerated in subsection (2)*, promote the health and welfare of the people, control erosion and pollution, protect domestic stock and wildlife, preserve agricultural and recreational productivity, save cultural, historic, and aesthetic values, and ~~assure~~ *ensure* a long-range dependable tax base, it is reasonably necessary to require, after March 16, 1973, that*:*

(i) all strip-mining and underground-mining operations be limited to those for which 5-year permits are granted~~,~~*;*

(ii) ~~that no~~ *a* permit *not* be issued until the operator presents a comprehensive plan for reclamation and restoration and a coal conservation plan, together with an adequate performance bond, and the plan is approved~~,~~*;*

(iii) ~~that~~ certain other things must be done, ~~that~~ certain remedies ~~are~~ *must be* available, ~~that~~ *and* certain lands because of their unique or unusual characteristics may not be strip-mined or underground-mined under any circumstances~~, all as more particularly appears in the remaining provisions of this part,~~*;* and

(iv) ~~that~~ the department be given authority to administer and enforce a reclamation program that complies with Public Law 95-87, the Surface Mining Control and Reclamation Act of 1977, as amended;

(b) this part be ~~deemed~~ *considered* to be an exercise of the authority granted in the Montana constitution~~, as adopted June 6, 1972,~~ and, in particular, a response to the mandate expressed in Article IX ~~thereof~~ and also be ~~deemed~~ *considered* to be an exercise of the general police power to provide for the health and welfare of the people."

Section 29. Section 82-4-239, MCA, is amended to read:

"**82-4-239. Reclamation.** (1) The department may have reclamation work done by its employees, by employees of other governmental agencies, by soil conservation districts, or through contracts with qualified persons. The board may construct, operate, and maintain plants for the control and treatment of water pollution resulting from mine drainage.

(2) Any funds or any public works programs available to the department must be used and expended to reclaim and rehabilitate lands that have been subjected to strip mining or underground mining and that have not been reclaimed and rehabilitated in accordance with the standards of this part. The department shall cooperate with federal, state, and private agencies to engage in cooperative projects under this section.

(3) Agents, employees, or contractors of the department may enter upon any land for the purpose of conducting studies or exploratory work to determine whether the land has been strip- or underground-mined and not reclaimed and rehabilitated in accordance with the requirements of this part and to determine the feasibility of restoration, reclamation, abatement, control, or prevention of any adverse effects of past coal-mining practices. Upon request of the director of the department, the attorney general shall bring an injunctive action to restrain any interference with the exercise of the right to enter and inspect granted in

this subsection. *The action must be brought in the county in which the mine is located.*

(4) (a) The department shall take the actions described in subsection (4)(b) when it makes a finding of fact that:

(i) land or water resources have been adversely affected by past coal-mining practices;

(ii) the adverse effects are at a stage at which, in the public interest, action to restore, reclaim, abate, control, or prevent should be taken; and

(iii) the owners of the land or water resources where entry must be made to restore, reclaim, abate, control, or prevent the adverse effects of past coal-mining practices are not known or readily available or the owners will not give permission for the department or its agents, employees, or contractors to enter upon the property to restore, reclaim, abate, control, or prevent the adverse effects of past coal-mining practices.

(b) After giving notice by mail to the owner, if known, and any purchaser under contract for deed, if known, or, if neither is known, by posting notice on the premises and advertising in a newspaper of general circulation in the county in which the land lies, the agents, employees, or contractors of the department may enter on the property adversely affected by past coal-mining practices and on any other property necessary for access to the mineral property to do all things necessary or expedient to restore, reclaim, abate, control, or prevent the adverse effects of past coal-mining practices.

(c) Action taken under subsection (4)(b) is not an act of condemnation of property or of trespass, but rather is an exercise of the power granted by ~~sections 1 and 2,~~ Article IX, *sections 1 and 2,* of the Montana constitution.

(5) (a) Within 6 months after the completion of projects to restore, reclaim, abate, control, or prevent adverse effects of past coal-mining practices on privately owned land, the department shall itemize the money expended and may file a statement of those expenses in the office of the clerk and recorder of the county in which the land lies, together with a notarized appraisal by an independent appraiser of the value of the land before the restoration, reclamation, abatement, control, or prevention of adverse effects of past coal-mining practices if the money expended resulted in a significant increase in property value. The statement constitutes a lien upon the land. The lien may not exceed the amount determined by the appraisal to be the increase in the market value of the land as a result of the restoration, reclamation, abatement, control, or prevention of the adverse effects of past coal-mining practices. A lien under this subsection *(5)(a)* may not be filed against the property of a person who owned the surface prior to May 2, 1977, and who did not consent to, participate in, or exercise control over the mining operation that necessitated the reclamation performed under this part.

(b) The landowner may petition within 60 days of the filing of the lien to determine the increase in the market value of the land as a result of the restoration, reclamation, abatement, control, or prevention of the adverse effects of past coal-mining practices. The amount reported to be the increase in value of the premises constitutes the amount of the lien and must be recorded with the statement provided for in this section. Any party aggrieved by the decision may appeal as provided by law.

(c) The lien provided in this section must be recorded at the office of the county clerk and recorder. The statement constitutes a lien upon the land as of

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January 12, 2006

583-1

Robert Ochsner
Mine Superintendent
B.M.P. Investments, Inc.
127 PM Coal Road
Roundup, MT 59072

Re: **Bull Mountains Mine, Prediction of Subsidence**

Dear Mr. Ochsner,

Per your request,[1] this letter presents our comments on the effect of the 2006 mine plan changes to subsidence predictions made in our report[2] (AAI 1990) prepared for Meridian Minerals Company. We have reviewed your 2006 mine plan projections map which was based on the 1990 mine plan used in our report.

The revisions made to the original mine plan reflect the progress attained by longwall mining during the last 16 years in the use of wider and longer panels which significantly increased mine productivity. B.M.P. Investments, Inc. (BMP) is considering increasing the panel lengths from about 10,000 ft up to 25, 000 ft and the panel widths from about 700-800 ft to 1250-1500 ft. In proposing these changes to the 1990 plan, BMP is potentially developing a very efficient mine plan. Both the mine reserve and panel orientation remain the same with no critical surface areas excluded from the planned subsidence.

We find that there are no significant changes to the 1990 subsidence predictions. In fact, the elimination of the fire barriers and increase in panel width should produce a smoother, more favorable, subsidence basin.

Yours sincerely,

J.F.T. Agapito

J.F.T. Agapito
Principal
joe2700bannatyne@agapito.com

JFTA:klg

[1] B.M.P. Investments, Inc. (2006), "Bull Mountains Mine, Prediction of Subsidence," Robert Ochsner, Mine Superintendent, letter to Mike Hardy, AAI, January 11.

[2] Agapito, J. F. T. and H. N. Maleki (1990), "Prediction of Subsidence for Bull Mountains, Meridian Minerals," Agapito Associates, Inc. report to Meridian Minerals Company, January, 30 pp.

PREDICTION OF SUBSIDENCE FOR BULL MOUNTAINS

MERIDIAN MINERALS

By
J. F. T. Agapito
Hamid N. Maleki

January, 1990

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PREDICTION OF SUBSIDENCE FOR BULL MOUNTAINS

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INTRODUCTION

This report was prepared at the request of Meridian Minerals Company for an evaluation of the surface subsidence mechanics and determination of typical deformations expected at the Bull Mountains project in Montana.

Specific objectives were as follows:

- description of the expected type of subsidence and associated mechanisms;
- calculation of subsidence profiles over longwall panels at two locations, respectively, at shallow and deep overburden; and
- general recommendations for a surface subsidence monitoring program.

The coal reserves from the Bull Mountains are planned to be mined by the longwall method. The project is located approximately 40 miles northeast of Billings, Montana. Longwall mining is generally the most environmentally attractive method to mine coal. This is because it minimizes damage to the surface by gradually subsiding the overburden strata over the mined-out areas while, at the same time, allowing high resource utilization.

Mining is currently planned for the Mammoth Seam at a depth of 200 to 800 feet. The two subsidence profiles for which vertical movements and strains were calculated were chosen at average depths of 330 and 780 ft, respectively.

CONCLUSIONS AND RECOMMENDATIONS

A trough-type of subsidence is predicted over the full extraction areas in the Bull Mountains project. Trough subsidence is associated with longwall mining and is much less damaging than other types of subsidence. Sink-type subsidence is not expected over the mains because of the presence of massive sandstones in the mine roof.

The mechanism of subsidence at the surface is characterized by the formation of tension (expansion) and compression zones. Tension occurs as the surface begins to subside, and compression as the surface begins to settle. Tension tends to open up existing fractures and create new ones. Compression tends to close-up and heal the surface fractures. After subsiding, the ground settles and returns to approximately its original state of strain.

In the overburden above the coal seam, there are usually three zones of movement. First, there is a fragmented zone of broken up strata immediately above the coal seam that can be as much as 10 times thicker than the mining height. Second, there is a fractured zone that deforms and fractures, but maintains its continuity. This may be as much as 50 times thicker than the coal seam. And third, there is a deformation zone to the surface where the strata deforms without significant formation of fractures. The fractures that occur at the surface, due to tension, are normally quite shallow and not more than 50 ft deep.

The overburden in the planned Bull Mountains mining area contains a high percentage of shale/clay rocks which are advantageous in minimizing subsidence effects including that of water inflow from perched aquifers. Two thick sandstone beds are also present which may fracture and bulk, thereby, reducing subsidence.

Subsidence is defined by the subsidence factor and angle of draw. The subsidence factor is the ratio of maximum vertical surface movement to the seam mining height. It is often expressed as a percentage of the mining height. The angle of draw identifies the limits of surface movement beyond the mining boundaries underground. From a review of subsidence in western U. S. coal mines, a subsidence factor of 70 percent and an angle of draw of 22.5 degrees were chosen for the calculation of the subsidence profiles at the Bull Mountains.

Predicted subsidence is 5.95 ft at a depth of 330 ft (seam height of 8.5 ft) and 9.45 ft at a depth of 780 ft (seam height of 13.5 ft). Predicted tensile strains reach levels that may cause surface fractures. These are more likely to occur over panel boundaries and gate roads. Many of the fractures should heal due to compression and settlement of the surface, but some of the fractures will remain open.

Expected surface movement beyond the underground mining boundaries is approximately 140 ft for a depth of 330 ft and 230 ft for a depth of 780 feet.

Ground movements should be relatively uniform and subsidence gradual because of the massive sandstone beds. These should concentrate the overburden loads on the gate pillars between the longwall panels causing them to crush and lower the surface uniformly. Changes in surface slopes are moderate (approximately 5 percent).

Subsidence monitoring consisting of both precise level and tape extensometer measurements, should be conducted to verify the subsidence predicted in this report. These measurements should be done along surveying monument lines located over the first panel at 50 ft intervals, and all subsequent panels at 1000 to 2000 ft intervals (refer to Figure 12).

SUBSIDENCE MECHANISM

Surface subsidence occurs as a result of downward strata movement caused by the caving and closure of underground openings. The type of subsidence mechanism predicted for the Bull Mountains project is the trough-type subsidence which is associated with longwall mining. It is characterized by the formation of a relatively smooth basin and is much less damaging than other types of subsidence such as plug, chimney and sinkhole. These types of subsidence normally occur as a result of rapid failure caused by large geologic discontinuities (faults), localized weak rock and sudden pillar failure. Sinkholes are not expected over the mains, because the mains pillars are designed to remain stable over the life of the mine and because of the presence of massive sandstone beds in the mine roof.

As longwall operations are initiated, the roof span behind the longwall face increases until it caves. This roof span may vary in most cases between 45 to 450 ft, depending on the strength of the immediate roof. An arch-like stress distribution develops in the overburden above the cave as illustrated in Figure 1. High abutment pressures occur in the vicinity and along the edges of the caved area, while lower overburden stresses occur in the caved area itself. The magnitude of the peak abutment pressure may vary from 1.5 to 7 times the overburden stress.

As the width of the cave increases and exceeds a critical width, the arching mechanism in the overburden collapses and ground movements occur to the surface causing subsidence. The critical width is often approximately one-third of the cover depth, but it can vary depending on the strength of the strata, particularly the immediate roof above the coal seam and the stress field. For example, a thick, massive sandstone immediately above the coal may have a

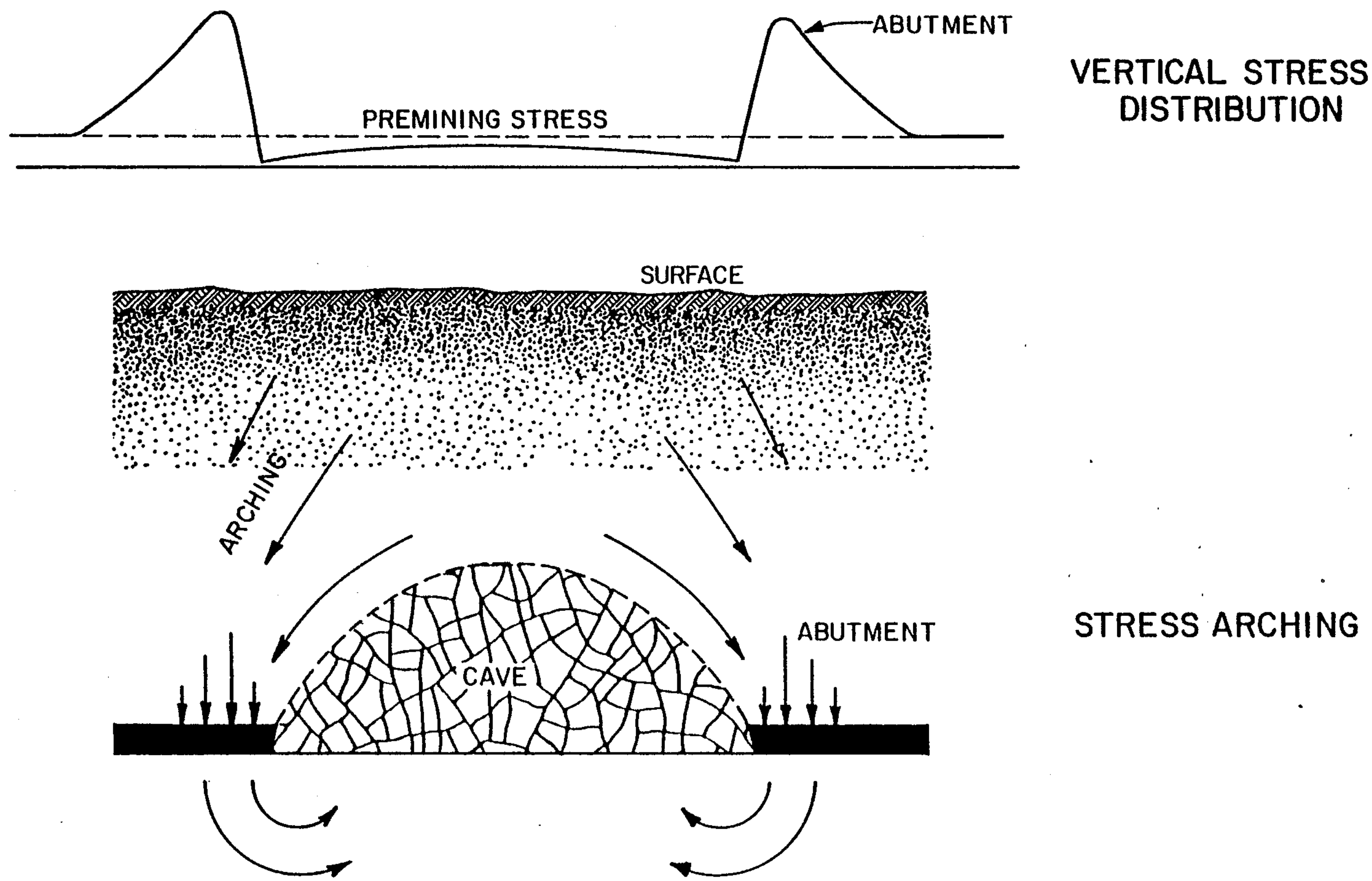


Figure 1 Schematic Illustration of Caving and Arching Mechanism

wider critical width than highly-jointed shale. High horizontal stresses may also induce wider critical widths than lower horizontal stresses by providing lateral confinement to the arch.

Generally, there are three zones of movement in the overburden strata associated with subsidence. This is illustrated in Figure 2 as follows:

Zone 1 -- Fragmented zone for the immediate roof with a height approximately equal to 2 to 10 times the seam thickness.

Zone 2 -- Fractured zone that can be as high as 30 to 50 times the seam thickness. The strata deforms and fractures but maintains its continuity.

Zone 3 -- Deformation zone from the top of the fractured zone to the surface. The strata deforms without significant fracturing, forming compression zones at the surface near to the center of the panel and tension zones at the edge of the excavation.

The angle of draw defines the boundaries between the underground openings and the limit of surface subsidence.

Caving is greatly affected by the rock type of the immediate roof and by the presence of joints. For example, a pronounced, high-density joint system parallel to the face can induce good caving conditions. But if joints are absent or few, and are perpendicular to the face, then a lagging cave can develop, which can greatly hinder the operations. Caving induces bending and shear forces that fracture the strata in the second zone. In the third zone, fracturing is minimal as the strata deflects to form a surface subsidence basin or trough. Open cracks may form at the surface, but usually are believed to be less than 50 ft deep. Since the cave is rectangular and the coal seam horizontal, the subsidence basin is usually approximately elliptical in plan view.

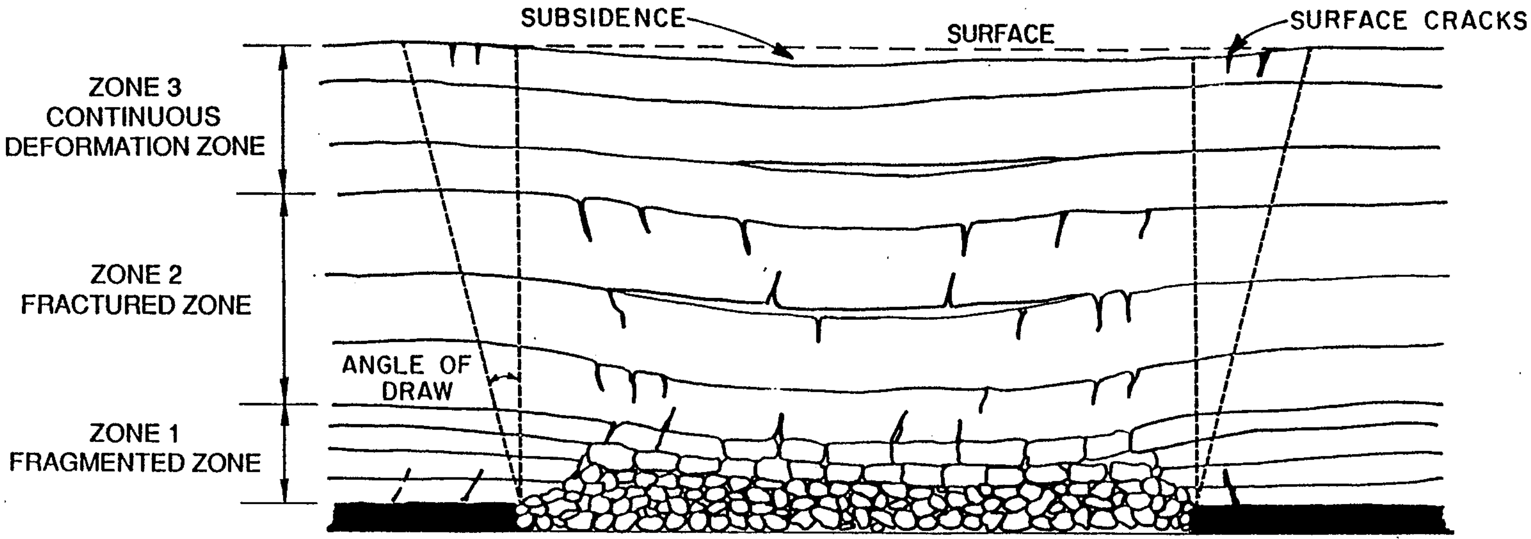


Figure 2 Zones of Strata Deformation

There are three subsidence phases as shown in Figure 3.

- The subcritical phase occurs immediately at the beginning when the movement is located in a small area at the center of the basin.
- The critical phase occurs as the basin area expands when the maximum value of the downward movement is reached at the center.
- The supercritical phase occurs as the basin develops a flat bottom. In this phase, the basin area continues to increase with the cave area, but the subsidence will remain at the maximum value attained in the critical phase.

Thus, the surface response of longwall mining activity shown in Figure 3, begins with the subcritical phase, then progresses to the critical phase and, finally, to the supercritical phase. The subsidence process first shows effects on the surface as the upper strata bend, including tension (expansion) which causes an opening-up of near surface fractures and the creation of new ones. As the subsidence process continues, Figure 3 shows how the middle portion of the excavation expands, going through a cycle of tension first and then compression which heals the tension cracks. The tighter and more uniform the cave, the better the fracture and healing process. Final subsidence shows an excavation with the middle portions lowered in elevation but back to a near original state. Areas on the edge of the excavation basin are subjected to tensile strains with compression following much more slowly.

The longwalls at the Bull Mountains will reach the supercritical phase with tensile strains forming over the sides of the panel and compressive strains over and inside the panel. Strains over the center of the panel will vanish as the ground returns to approximately its original state of strain.

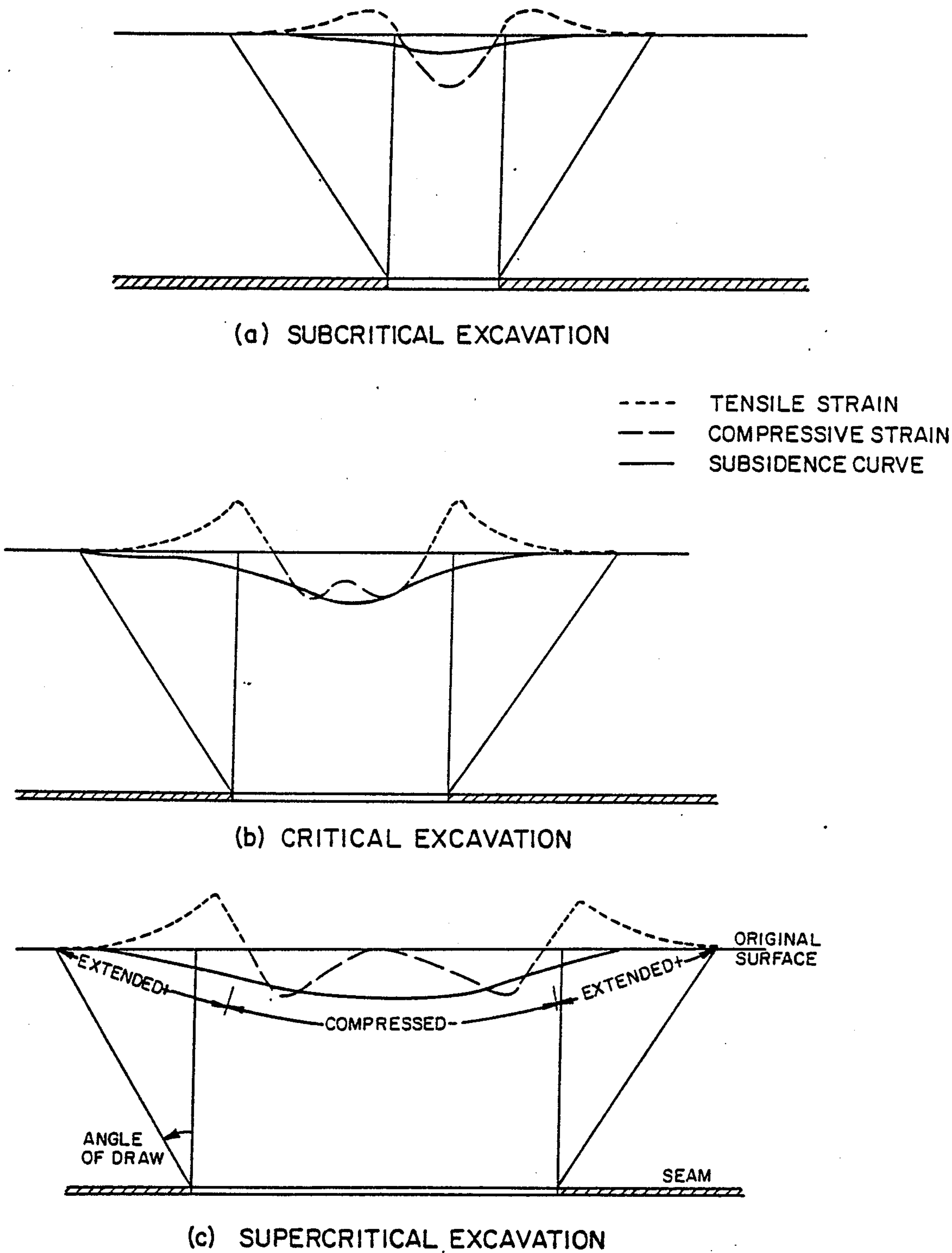


Figure 3 Subsidence Phases

Various geologic and mining factors impact the extent and magnitude of subsidence.

- *Overburden Physical Properties* -- Stronger strata inhibit subsidence because of more self-supporting characteristics than weaker and softer strata. Generally less and more delayed subsidence is obtained in stronger overburden.

- *Seam Depth* -- Although there is some controversy regarding this factor, it is generally recognized that the deeper the excavation, the less the surface effects.

- *Seam Dip* -- The higher the dip, the more asymmetric the trough profile. The angle of draw on the lower dip side is greater than that on the upper side.

- *Geologic Discontinuities* -- Planes of major geologic discontinuities can greatly increase the extent and amount of rock mass movements and cause significant surface fractures.

The effects of mining factors are as follows:

- *Mining Height* -- The higher the mining height, the higher the subsidence. The magnitude of subsidence is always less than the mining height because of bulking of the overburden strata.

- *Panel Width and Length* -- Maximum subsidence occurs when the panel width reaches a critical value. The maximum subsidence occurs approximately when the longwall panel width is 1.0 to 1.4 of the overburden depth, provided the panel length is at least 1.4 of the depth.

- *Mining Rate* -- Experience indicates that smoother subsidence profiles with less differential movements occur when the face is extracted at an even rate. Halting or slowing the mining rate usually results in cave hang-ups and uneven subsidence.

- *Multiple-Seam Mining* -- Greater vertical displacements are obtained by multiple-seam mining.

In addition to the above geologic and mining factors, topographic effects also should be considered. Experience has shown that abrupt variations in topography can lead to sliding and toppling failures. Also, subsidence in the valleys can be less than on the top of the ridges.

SUBSIDENCE CHARACTERISTICS IN WESTERN U. S. COAL MINES

A review of subsidence in western U. S. coal mines was made to develop the subsidence characteristics for Bull Mountains. Generally, the overburden lithology in the Bull Mountain area is similar to that of the other western coal mines.

Table 1 summarizes the subsidence characteristics in five western coal mines. A trough-type of subsidence occurred in all mines which were at a wide range of cave depth (240 to 2000 ft). This data indicated a higher potential for the formation of surface cracks in mines under shallow cover.

The Kaiser Coal experience in the York Canyon Mine, New Mexico, is particularly relevant because of similarities in the depth of cover with Bull Mountains. At York Canyon, a number of surface cracks were formed both parallel to the face, over the gate pillars, and perpendicular to the face, at the final panel boundaries. Most of the cracks parallel to the face, however, healed as the longwall face passed under the cracks. This was because of the previously discussed change from tension to compression strains at the surface.

Surface subsidence is usually defined by two parameters: the subsidence factor and the angle of draw. In this data, the subsidence factor is the ratio of maximum subsidence to the seam mining height and is often expressed as a percentage. For example, a subsidence of 5 ft is obtained for a subsidence factor of 50 percent and a mining height of 10 feet. The angle of draw identifies the limits of movement beyond the excavation boundaries and is shown in Figures 2 and 3.

Table 1 Summary of Subsidence Characteristics of Some Western U. S. Longwall Coal Mines

Mine	Depth (ft)	Width of Total Excavation (ft)	Number of Seams Mined	Open Fractures	Type of Subsidence	Reference
Price River Coal	800-1500	1038	one	at one location	trough	Fejes, 1986
Deer Creek Mine	1500	2400	one	none	trough	Fejes, 1986
PMC-longwalls	1500	1140	one	none	trough	Jones, 1985
Bookcliff Mine	2000	550	one	none	trough	Allgaier, 1982
Kaiser Coal	240-675	1630	one	many	trough	King, 1980

Figures 4 and 5 summarize subsidence factors and angles of draw as a function of depth for some of the western U. S. coal mines. In this data, the subsidence factor seems independent of depth. It averages 70 percent based on measurements in supercritical panels. The angle of draw is quite variable, even for a particular site. For example, at York Canyon, values from 8 to 35 degrees were obtained, with the depth seemingly not influencing the angle of draw. An average angle of draw of 22.5 degrees was obtained for the western U. S. coal mines reviewed in this study.

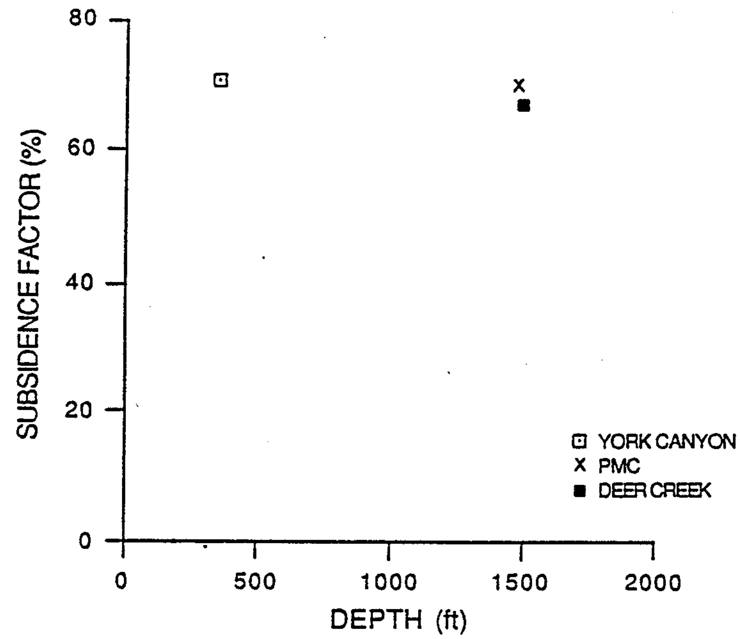


Figure 4 Subsidence Factor vs. Depth of Cover for Supercritical Panels

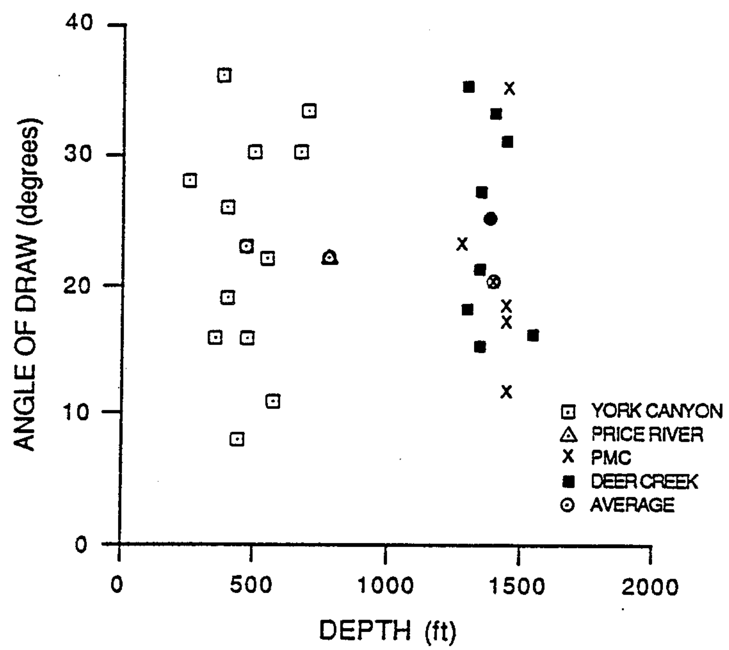


Figure 5 Angle of Draw vs. Depth of Cover for Western U.S. Mines

GEOLOGIC SETTING

The Bull Mountains were formed from a broad, gently dipping synclinal basin with a northwest trending axis. The strata are nearly horizontal to the south, dipping 4 degrees to the center of the basin, and up to 30 degrees outside the mining boundary to the north.

No major faults have been found within the synclinal basin. A few minor faults with displacements between 4 to 8 ft have been mapped (Dahl and Silkwood, 1976).

Strata containing the coal deposits consist of Tertiary aged sedimentary rocks of the Tongue River Member of the Fort Union Formation. Twenty six coal beds, ranging in thickness from approximately one ft to 15 ft have been identified and mapped in the Bull Mountains. The coal of primary interest for the Bull Mountains Mine No. 1 is the Mammoth Coal. In the western portion of the study area, the Mammoth Coal is overlain by a massive sandstone. Above this sandstone is a thinner coal known as the Rehder Coal. In the central portion of the study area, the interburden thins and the two beds merge. Both beds will be mined where the beds have merged. The combined Mammoth and Rehder Coal bed is simply referred to as the Mammoth Coal. Thickness of the Mammoth Coal varies from 8 to 15 feet. Figure 6 shows the general stratigraphy and the location of the Mammoth Seam.

The overburden consists of interbedded sandstones, siltstones, shales, claystones, and coals. The sandstones exhibit a range of bed geometries. Two massive units, located immediately above and 100 ft above the Mammoth Coal, are up to 80 ft thick and can be traced in the subsurface over a large distance. Most of the sandstones occur in thinner beds that vary from lenticular and discontinuous to laterally continuous. Sandstones comprise up to 50 percent of the overburden. Shales and claystones comprise 23 to 39 percent of the

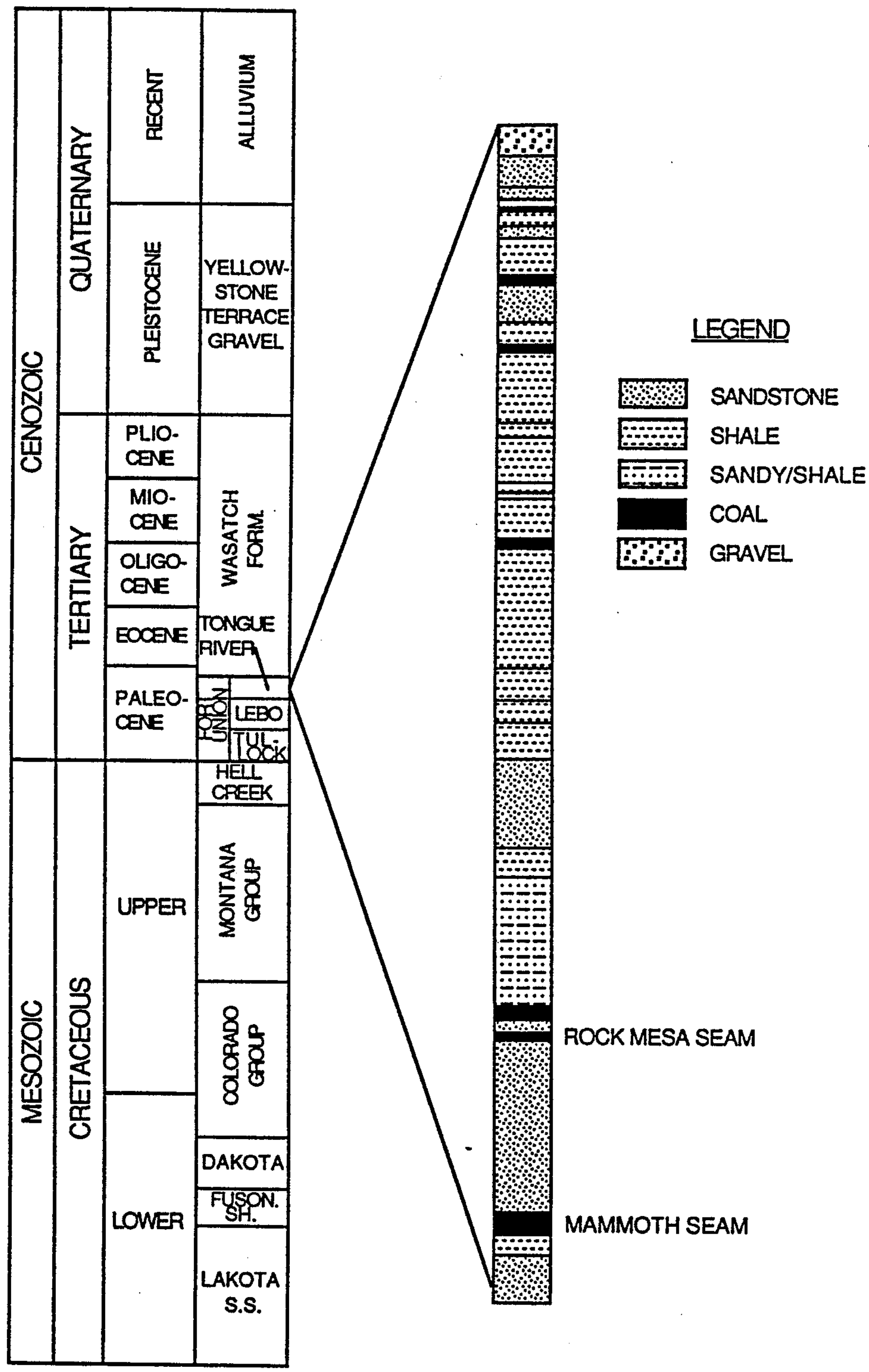


Figure 6 General Stratigraphy of Bull Mountains

overburden. These units vary in thickness and extent, however, they can be laterally quite continuous. There also are a number of thin coal beds in the overburden. Eight of these are laterally continuous and are present throughout the study area except where they have been removed by erosion.

Lithology of Subsidence Profile Areas

Two areas were chosen within the planned longwall mining area for the calculation of subsidence profiles. Figure 7 shows their location in the property: Section A-A′ to an average depth of 330 ft and Section B-B′ to an average depth of 780 feet. These sections were chosen because they represent extreme values of cover depth in the property and should produce results covering the expected range of movements.

Figures 8 and 9 show in more detail the overburden and seam thickness in the location of Sections A-A′ and B-B′. The variation in the position and thickness of overburden and coal seam is a result of the fluvial depositional environment.

The relative position, distribution and thickness of shale/clay beds in the overburden is important in minimizing water flow into the mine. This is because the shales can take large strains without fracturing, while clays can seal fractures in underlying sandstones. Table 2 summarizes the distribution of shale/clay beds in the holes in the vicinity of Sections A-A′ and B-B′. The shale/clay beds form in average 23 to 39 percent of overburden. The apparent wide variability in the range of data relates to inconsistent core logging procedures adopted by different geologists and drillers. The minimum shale content takes into account all overburden rocks, identified as shale. The average shale content (Table 2) includes shale and sandstone interbed thicknesses in the calculations. This relatively high percentage of shale/clay is good for minimizing subsidence effects, including the impact of water inflow from perched aquifers.

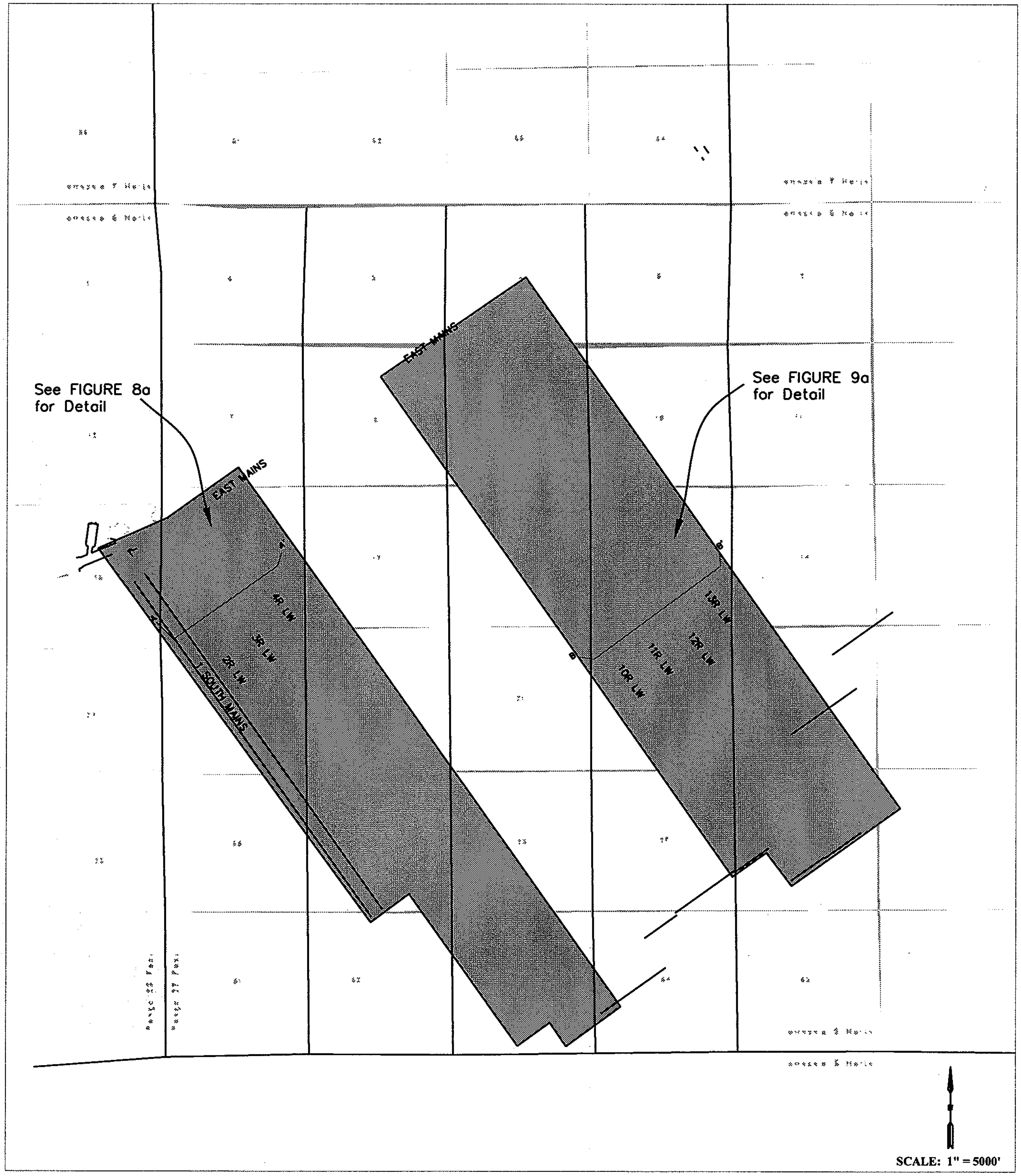


Figure 7a Longwall Layout and Location of Subsidence Profiles

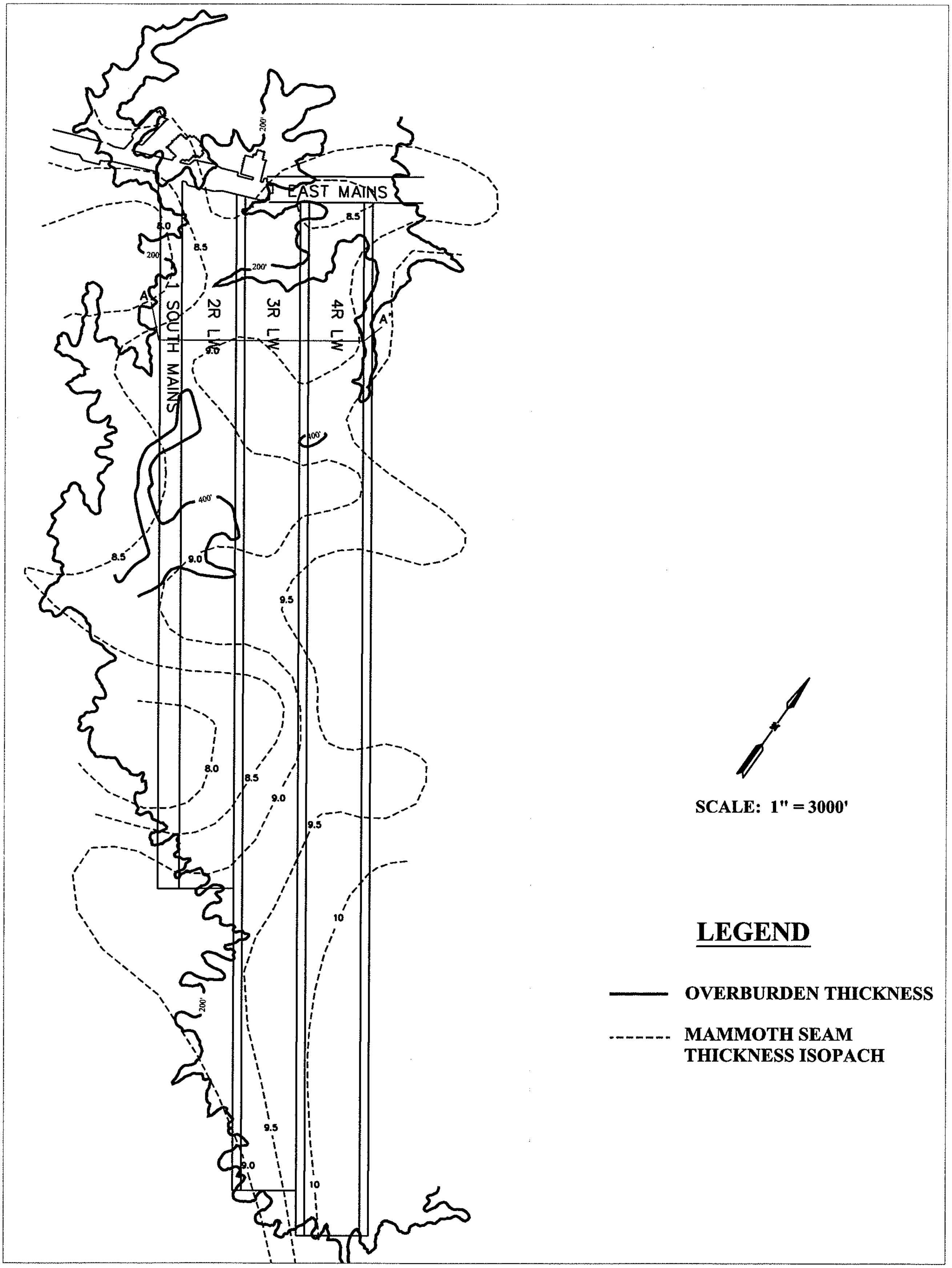


Figure 8a Longwall Layout, Overburden Thickness and Seam Thickness Isopach for Location A-A', Figure 7a

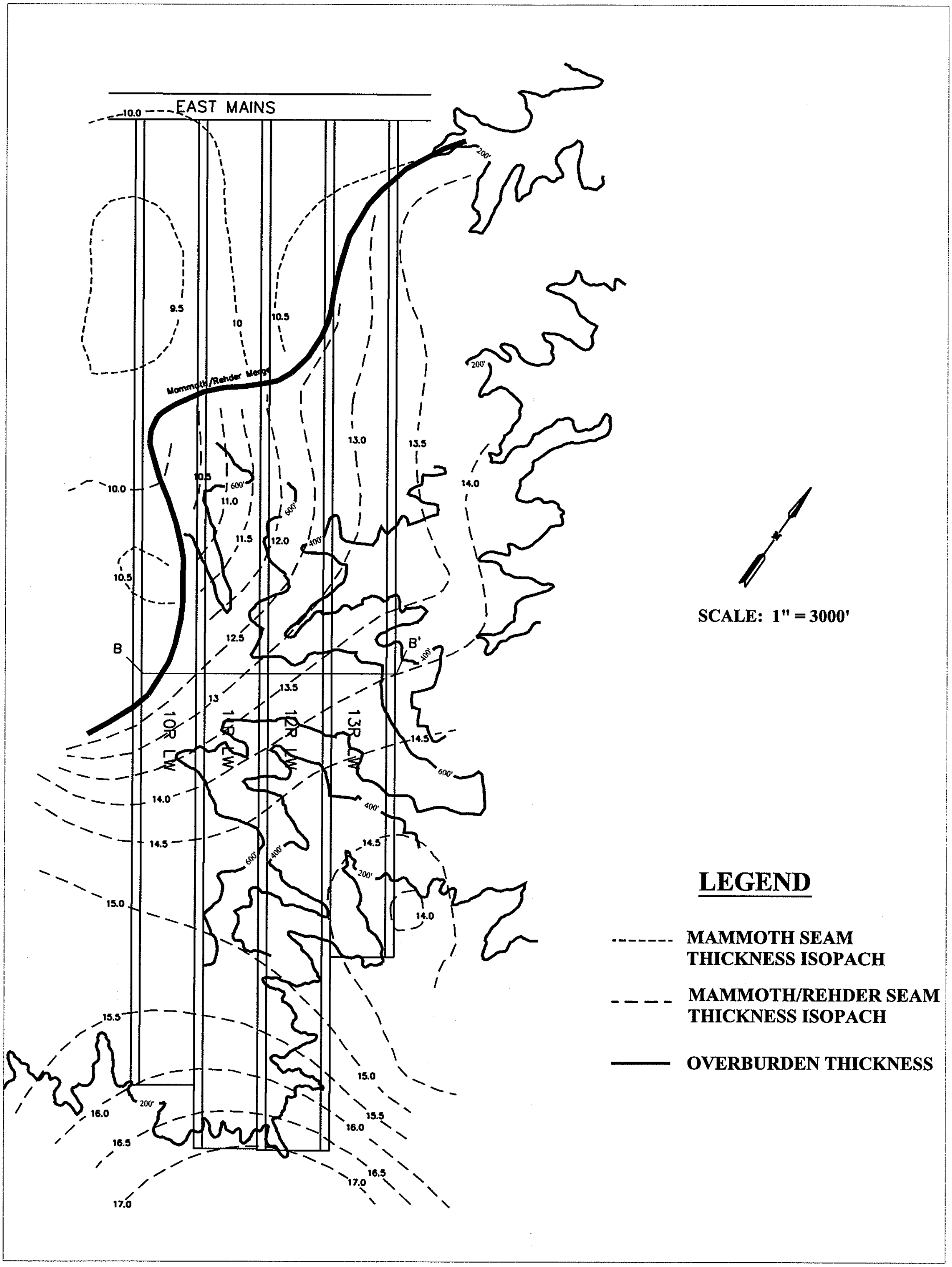


Figure 9a Longwall Layout, Overburden Thickness and Seam Thickness Isopach for Location B-B', Figure 7a

Table 2 Distribution of Shale/Clay Beds from Holes in the Vicinity of Sections A-A′ and B-B′

Core Hole	Minimum Shale Percentage	Average Shale Percentage
Section A-A′		
62719-4 (L19-4′79)	44	48
62719-6 (L19-6′79)	0	28
62719-7 (L19-7C′79)	17	35
62719-8 (L19-8C′79)	30	41
Section B-B′		
62715-2 (L15-2′79)	6	30
62715-3 (L15-3′79)	44	57
62715-4 (L15-4C′79)	20	33
Total Average	**23**	**39**

PREDICTED SUBSIDENCE

Two subsidence profiles were calculated for two typical longwall mining areas: one under shallow overburden depth (330 ft) and the other under deeper overburden (780 ft). The method of calculation used was that developed by the British National Coal Board (Subsidence Engineers' Handbook, 1975), but modified for the stronger strata of the western U. S. coal mines (Maleki, 1987). The NCB method offers one of the most comprehensive techniques for calculating subsidence and surface strains. It was based on hundreds of observations and measurements in the British coal mines.

From a review of subsidence in western U. S. coal mines, a subsidence factor of 70 percent and an angle of draw of 22.5 degrees were chosen as the subsidence parameters for Bull Mountains. This is based on a conservative judgement. Agapito & Associates believes that the angle of draw for Bull Mountains may be lower than the average values chosen from the subsidence review of western U. S. coal mines. This is because of the two massive sandstone units in the overburden strata at the Bull Mountains immediately above and approximately 100 ft above the Mammoth Seam. These sandstones have bulking characteristics which may reduce subsidence.

The predicted subsidence values are summarized in Table 3. A maximum subsidence of 5.95 ft is projected for Section A-A′ (70 percent of 8.5 ft mining height) and 9.45 ft for Section B-B′ (70 percent of 13.5 ft mining height) since the panel widths will reach the supercritical subsidence phase, Figure 3(c). Three-entry gate road systems with 30 ft and 50 ft wide pillars for Section A-A′ and 40 ft and 60 ft wide pillars for Section B-B′were used in the subsidence calculations. The pillar sizes were based on a previous design study (Maleki, 1989) and subsequent discussions with Mr. Robert Ochsner, Meridian's Project Engineer. A lower limit for surface strains was calculated based on the NCB

Table 3A Predicted Subsidence Values

Mined Panel(s)	Panel Width (ft)	Average Depth (ft)	Mining Height (ft)	Subsidence Factor (%)	Angle of Draw (degree)	Maximum Subsidence (ft)	Peak Tensil Strain		Peak Compressive Strain	
							Lower Limit (%)	Upper Limit (%)	Lower Limit (%)	Upper Limit (%)
Section A-A'										
2RTLW	1250	331	8.5	70	22.5	5.95	1.17	2.34	0.92	1.84
3RTLW	1250	331	8.5	70	22.5	5.95	1.17	2.34	0.92	1.84
2RTLW and 3RTLW	2500	331	8.5	70	22.5	5.95	1.27	2.54	0.92	1.84
Section B-B'										
26RTLW or 27RTLW	1250	782	13.5	70	22.5	9.45	0.79	1.58	0.62	1.24
26RTLW and 27RTLW	2500	782	13.5	70	22.5	9.45	1.26	2.52	0.62	1.24

and an upper limit based on available measurements in the United States. U. S. measurements have indicated that surface strains may be twice higher than that suggested by NCB.

The subsidence profiles and the lower limit for surface strains for Sections A-A′ and B-B′ are shown in Figures 10 and 11, respectively. In Section A-A′, subsidence movements cease approximately 140 ft beyond the full extraction limits, and in Section B-B′, 230 ft beyond the full extraction limits. The amount of strain at the surface is higher for the shallower A-A′ Section. In both cases, the tensile strain exceeds the strain criterion recommended by Singh and Bhattacharya (1984) and surface cracking is likely at the panel boundaries and over the gate roads. However, subsequent movement over the gate roads, caused by long-term pillar failure, may reduce the strains and heal some of the cracks at these locations. This phenomenon is more likely to occur in Section B-B′ because of a combination of higher depth and more extensive pillar failure. The dashed lines in both subsidence profiles over the central gate road indicate the subsidence resulting from single panels and the full line represents the subsequent subsidence.

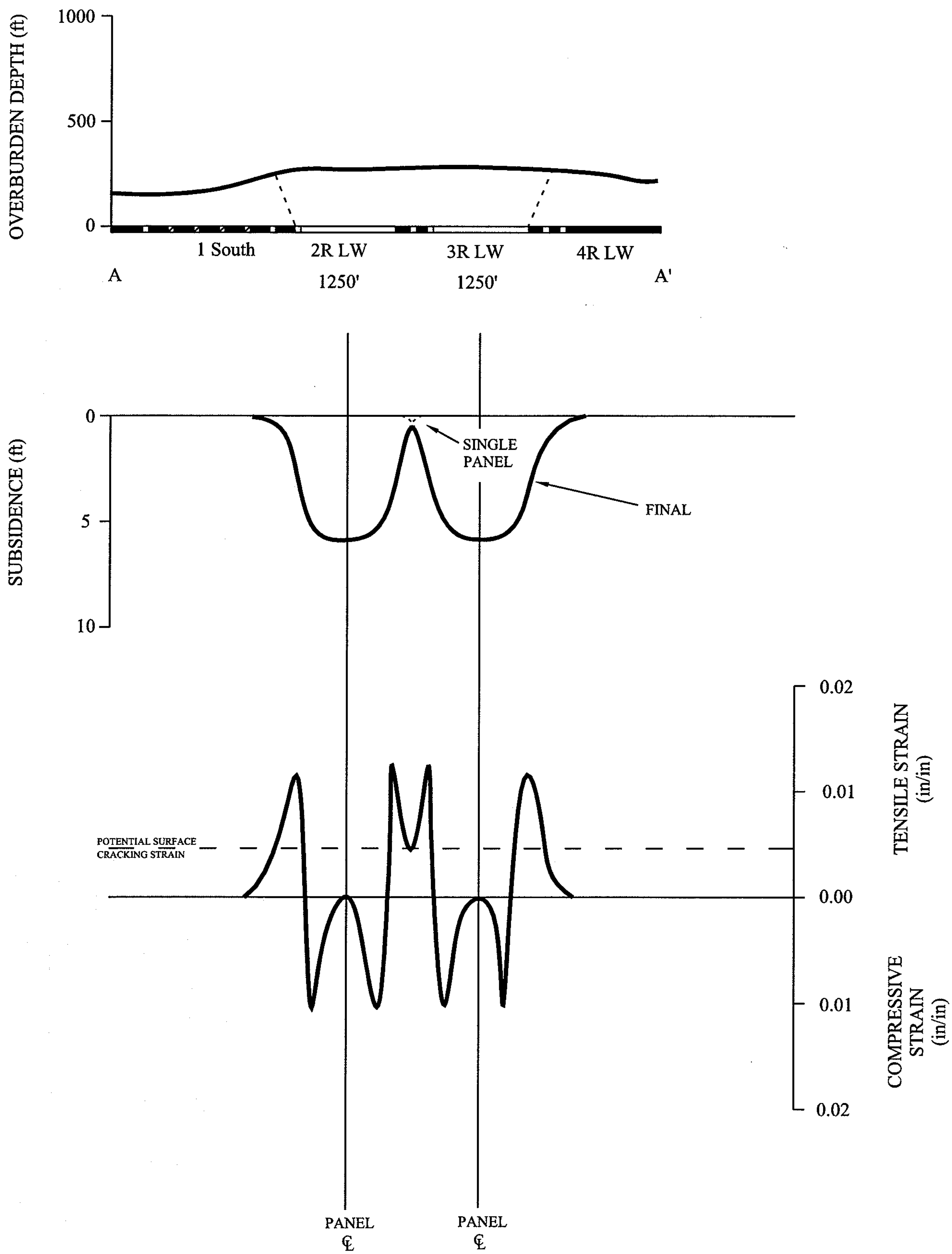


Figure 10a Subisdence and Strain Profiles for Section A-A'

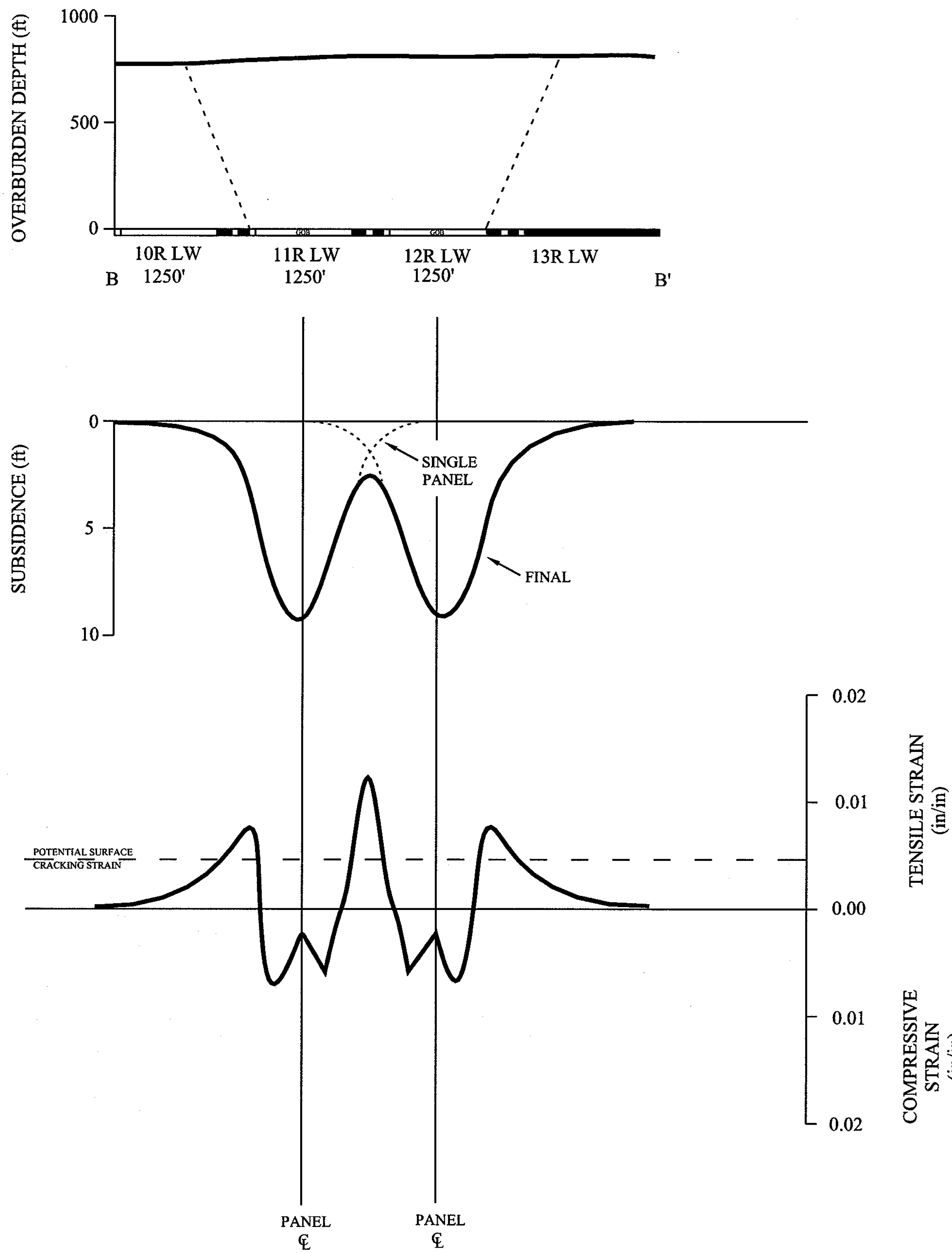


Figure 11a Subisdence and Strain Profiles for Section B-B'

SUBSIDENCE MONITORING

A subsidence monitoring program should be implemented to verify the subsidence predicted in this study and to record any mining-induced damage to surface resources.

Subsidence movements are monitored by surveying monument lines located over the panels and extending over the solid coal block. The proposed subsidence monitoring grid is shown in Figure 12 and consists of three lines of monuments at 50 ft spacing. Additional monuments located at the center of the panel should be spaced at 1,000 to 2,000 feet. From such monitoring, site specific angle of draw, subsidence factor and tensile strains can be calculated. This will result in predictive subsidence techniques for the Bull Mountains. However, the arrangement and location of these survey lines can vary according to site-specific needs caused by topography, streams, roads, etc. Monuments must be well constructed so as to be unaffected by movements unrelated to subsidence, such as soil heave due to freezing.

In order to verify the subsidence mechanism and to evaluate the cave growth towards the surface, recommendations are to install a monitoring system consisting of time Domain Reflectometry (TDR) or multiple position extensometers, or any other suitable device. Since the strata movement is a function of panel width and depth of cover, it is recommended to conduct such measurements at approximately 400 and 600 ft of cover. Measurements at shallow depth of cover may not reveal any differential strata movements.

Instrumentation should include both a precision level to measure vertical settlement, and a steel tape extensometer to measure horizontal strain. Automatic data recording equipment is available for a continuous record of strain and tilt.

SUBSIDENCE MONITORING PROGRAM

An updated subsidence monitoring program has been included in this Appendix as required by the Department pursuant to A.R.M. 17.24.901(1)(c)(iii)(A)(III) and A.R.M. 17.24.901(1)(c)(iii)(D) for approval of Application 00178.

This updated subsidence monitoring program is a more thorough approach than what is found in the 1990 Subsidence Study by J.F.T. Agapito & Associates[reference Map 901-4 (Subsidence Monument Locations) for monument locations]. Survey control will be located well outside the area of projected subsidence and these controls will be tied to known control points (USGS benchmark, section corner).

Subsidence for the first 2 longwall panels plus longwall panel 3(until longwall face passes through cross-section C – C', *see Figure 12a)* will be surveyed and results submitted to the Department. Pending sufficient subsidence parameters to predict subsidence of subsequent longwall mining, no further monitoring is required except for special features, or as required by the Department. See Table 4 (Potential Features Affected by Subsidence) for a listing of features included for subsidence monitoring.

Subsidence monitoring is tied to longwall mining operations. A baseline survey of installed monuments will be conducted prior to longwall mining. Upon commencement of longwall mining, subsidence survey measurements will be conducted according to the frequency polygons shown on Figure 12a. The following directives all refer to Figure 12a (Monitoring Frequency):

- When the longwall face transitions from a polygon of greater monitoring frequency to a polygon of lesser monitoring frequency, the greater monitoring frequency will be observed for timing of the next survey date.

- When the longwall face transitions from a polygon of lesser monitoring frequency to a polygon of greater monitoring frequency, the greater monitoring frequency will be observed for timing of the next survey date.

- The polygon correlated frequency will only be observed if the longwall face has advanced a minimum of 500 feet from previous survey. Until such time as the longwall face advances 500 feet from previous survey, the survey frequency defaults to 6 months from previous survey.

- Excluding baseline survey of installed monuments, only monuments: a.) mined under by longwall, or b.) within 500 feet of longwall face advance will be measured according to the frequency detailed in Figure 12a.

Full subsidence is expected to be delayed, therefore, monitoring will continue until full subsidence is determined (this may be carried out for as long as 24 months after mining under particular monuments). Each subsidence survey will include the location of the longwall face and will be tied to known control points. Surveying during winter months will be conducted according to the schedule as long as weather permits. Heavy snow may preclude acquisition of data; however, survey data will be collected as soon as weather allows.

Table 4
Potential Features Affected By Subsidence

POTENTIAL FEATURES			
1 SOUTH MAINS	**LONGWALL PANEL 1**	**LW PANEL 2**	**LW PANEL 3**
NO KNOWN FEATURES	TRIANGULAR CONFIGURATION (SOUTH END)	CROSS-SECTION A - A' (CONT)	B - B' (CONTINUED)
	1000' LONGITUDINAL AXIS	1000' LONGITUDINAL AXIS	S-17115
	CROSS-SECTION A - A'	CROSS-SECTION B - B'	S-17145
	50' MONUMENT SPACING (BARRIER)	COMMUNICATION TOWERS	P-17147
		50' MONUMENT SPACING (SOUTH END)	S-17165
		100' MONUMENT SPACING (BARRIER)	S-17185
		P-17417	S-17255
		S-17415	S-17275
		S-17535	P-17317
			S-17315
			S-17415
			P-17417
			S-17525
			S-17515
			P-17517
			P-17817
			P-17917
			S-17535

S = SPRING
P = POND

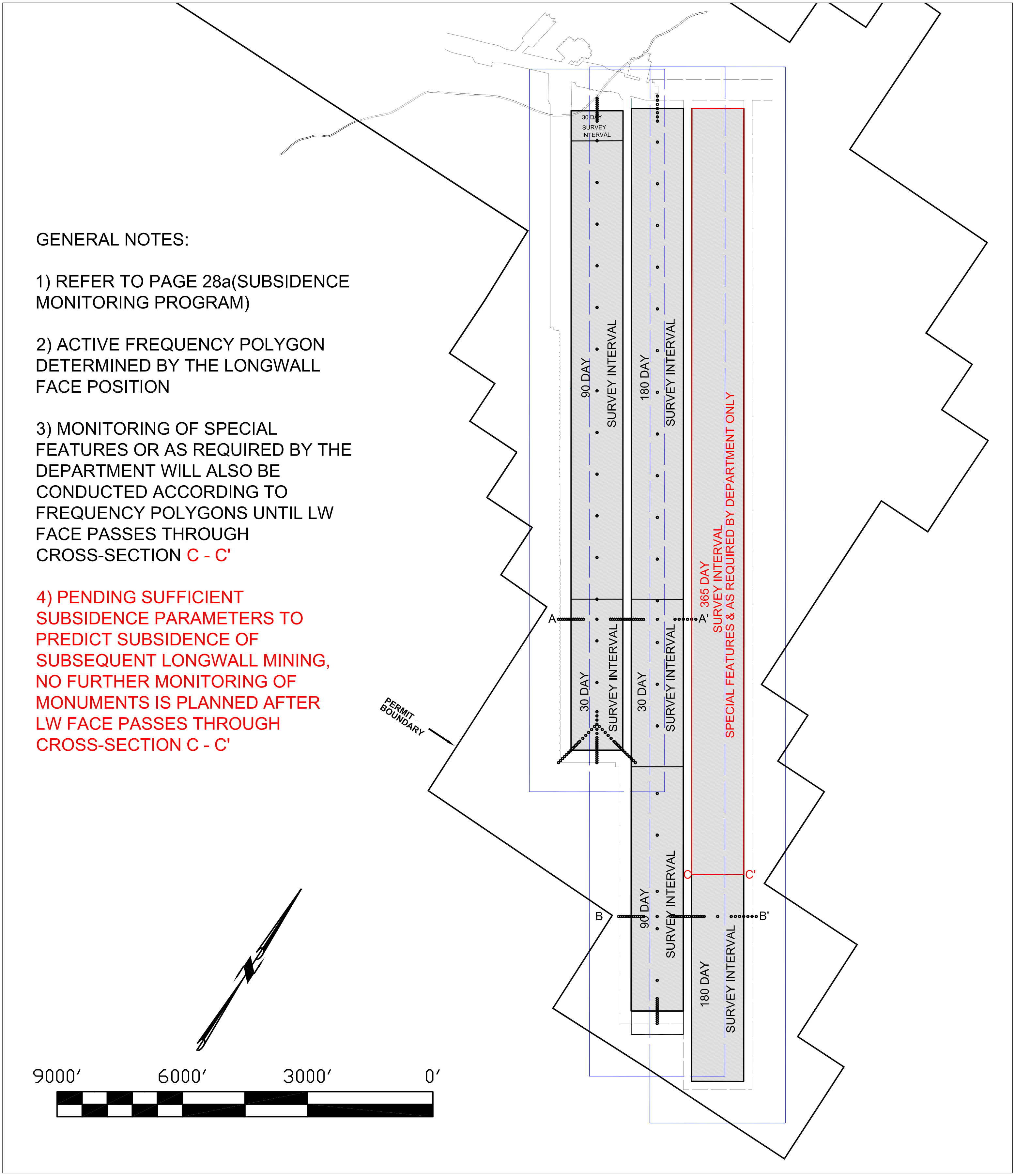
GENERAL NOTES:

1) REFER TO PAGE 28a(SUBSIDENCE MONITORING PROGRAM)

2) ACTIVE FREQUENCY POLYGON DETERMINED BY THE LONGWALL FACE POSITION

3) MONITORING OF SPECIAL FEATURES OR AS REQUIRED BY THE DEPARTMENT WILL ALSO BE CONDUCTED ACCORDING TO FREQUENCY POLYGONS UNTIL LW FACE PASSES THROUGH CROSS-SECTION C - C'

4) PENDING SUFFICIENT SUBSIDENCE PARAMETERS TO PREDICT SUBSIDENCE OF SUBSEQUENT LONGWALL MINING, NO FURTHER MONITORING OF MONUMENTS IS PLANNED AFTER LW FACE PASSES THROUGH CROSS-SECTION C - C'



MONUMENT LOCATION

1000' FT BUFFER

LONGWALL EXTRACTION PERIMETER

SIGNAL PEAK ENERGY LLC

BULL MOUNTAINS MINE NO. 1

MUSSELSHELL COUNTY, MONTANA
YELLOWSTONE COUNTY, MONTANA

MAY 20, 2009

FIGURE 12a
MONITORING FREQUENCY

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