

FINAL CR Kendall Mine Closure Environmental Impact Statement



Prepared for:

State of Montana
Department of Environmental Quality

April 2016





April 15, 2016

Dear Interested Party:

The Department of Environmental Quality (DEQ) has completed the Final Environmental Impact Statement (Final EIS) for an amendment to Operating Permit No. 00122 proposed by CR Kendall Corporation (CR Kendall). An electronic copy of the Final EIS can be found on DEQ's website: <http://deq.mt.gov/public/eis>.

DEQ issued Operating Permit No. 00122 to CR Kendall on September 14, 1984, under the Montana Metal Mine Reclamation Act (Sections 82-4-301, *et seq.*, MCA). CR Kendall conducted mining operations at the CR Kendall Mine under Operating Permit No. 00122. The CR Kendall Mine was an open pit mine located on the eastern flanks of the North Moccasin Mountains in Fergus County, Montana. The CR Kendall Mine is currently in closure status.

On July 25, 2012, CR Kendall submitted to DEQ an application to amend Operating Permit No. 00122 (permit amendment application). The permit amendment application proposed 1) an amended closure plan for the final design of water management and treatment, 2) final capping and reseeded of the former process pads, and 3) long-term reclamation monitoring and maintenance. On March 9, 2015, pursuant to Section 82-4-337, MCA; DEQ determined that the CR Kendall's permit amendment application was complete and compliant and issued a draft permit amendment.

DEQ issued a Draft EIS on September 10, 2015, in regard to the proposed permit amendment. The Draft EIS analyzed the potential impacts of the No Action Alternative, the Proposed Action, the Process Pad Drainage Pretreatment Alternative, and the Process Pad Barrier Cover Alternative. Issues that were identified and analyzed during the scoping process include, but are not limited to:

1. The effects of mine closure on surface water and groundwater quantity and quality; and
2. The effects of mine closure on soils and reclamation.

The Final EIS addresses issues and concerns raised during the Draft EIS public meeting and during the public comment period. All new information and analysis supplied during the comment period and developed in response to comments received were used to prepare the Final EIS.

DEQ has identified the Process Pad Drainage Pretreatment Alternative as its preferred alternative in the Final EIS. DEQ will set forth its final decision and rationale in its Record of Decision (ROD). The ROD is a public notice identifying what the decision is, the reasons for the decision, and any special conditions surrounding the decision or its implementation. Pursuant to ARM 17.4.620, DEQ may issue its ROD no less than 15 days from the transmittal of the Final EIS to the public, the Environmental Quality Council, and the office of the Governor.

DEQ appreciates the public's participation in the CR Kendall EIS Project. For additional copies of the Final EIS please contact Jen Lane, at 406-444-4956 or jlane2@mt.gov, or on DEQ's website: <http://deq.mt.gov/public/eis>. A copy of the ROD will be sent to everyone who receives the Final EIS.

Sincerely,

A handwritten signature in black ink that reads "Tom Livers". The signature is written in a cursive, slightly slanted style.

Tom Livers
File Code: DIR-16101
Encl: Final EIS

FINAL

CR Kendall Mine Closure Environmental Impact Statement

Prepared for:



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Summary

S.1 Introduction

This final environmental impact statement (EIS) was prepared for the proposed closure of the CR Kendall Mine on the eastern flanks of the North Moccasin Mountains in Fergus County, Montana (**Figure 1-1**). On July 25, 2012, the Department of Environmental Quality (DEQ) received an application to amend Operating Permit No. 00122 (Amendment 007) from CR Kendall that contained an amended closure plan for final design of water management and treatment, final capping and reseeded of the former process pads, and long-term reclamation monitoring and maintenance (Hydrometrics & CR Kendall Corp. 2012, CR Kendall 2012). DEQ provided a deficiency letter to CR Kendall on September 21, 2012. CR Kendall responded to the deficiency review and DEQ issued a favorable compliance determination and a Draft Amendment 007 on March 9, 2015. The CR Kendall Mine closure activities described in the Amendment 007 Application comprise the Proposed Action.

DEQ is the lead agency and prepared this final EIS to present the analysis of possible environmental consequences of four closure alternatives: the No Action Alternative, the Proposed Action, the Process Pad Drainage Pretreatment Alternative, and the Process Pad Barrier Cover Alternative. The two process pad alternatives include additional mitigation measures developed by DEQ.

The final EIS includes the analysis of the alternatives and responses to comments received on the draft EIS (Chapter 9). The responses to the comments resulted in modifications or additions to the analysis.

S.2 Purpose and Need

CR Kendall conducted mining activity under Operating Permit 00122, which was originally issued to Triad Investments on September 14, 1984 and allowed mine development within a 119 acre permit area. The permit was subsequently amended several times, was acquired by Canyon Resources following a bankruptcy, and currently covers about 1,040 acres. The mine was permitted under the Montana Metal Mine Reclamation Act ([MMRA]; 82-4-301, *et seq.*, Montana Code Annotated [MCA]). Amendment 007 is a closure plan for the CR Kendall Mine and primarily focuses on water management and treatment. The amendment also addresses final capping of the former process pads, and long-term reclamation monitoring and maintenance.

The Montana Environmental Policy Act (MEPA) requires an environmental review of actions taken by the State of Montana that may significantly affect the quality of the human environment. This EIS was prepared to fulfill the MEPA requirements. The Director of DEQ will decide which alternative should be approved in a Record of Decision (ROD) based on the analysis in the final EIS. The final EIS includes comments received on the draft EIS and the agency's responses to those comments.

Summary

S.3 Issues of Concern

From public involvement, two relevant issues were identified that should be addressed through the alternatives analysis for the closure EIS— (1) the effects of the mine closure actions on surface water and groundwater quantity and quality; and (2) the effects of the mine closure actions on soils and reclamation. These issues will be evaluated in detail to address impacts to resources and to help determine reasonable alternatives for mine closure, including the Proposed Action. The specific components of the two relevant issues are:

Issue 1: Effects on quantity and quality of surface water and groundwater resources:

- Discharges from the mine to surface water and groundwater may exceed water quality standards for certain contaminants: arsenic, antimony, selenium, thallium, cyanide, and nitrate.
- Pumpback of contaminated groundwater and capture of surface water have reduced downgradient water quantity in four watersheds. Water management at the mine may continue to reduce downgradient water quantity.
- Pumping clean groundwater from water wells WW-6 and WW-7 may have reduced water quantity in downgradient wells.
- The mine facilities have intercepted natural drainages that channeled stormwater and snowmelt that no longer reach drainages below the mine.
- Water quantity in each drainage could need augmented by rerouting drainage channels and developing springs and other groundwater sources.
- Water and sediment from the mine may contribute arsenic to the Boy Scout pond downgradient of the permit boundary in South Fork Last Chance Creek.
- The underdrain in the process valley could be receiving impacted water.

Issue 2: Effects on soils and reclamation

- Reclamation efforts may have resulted in inadequate vegetation in some areas, erosion on steeper slopes, and excessive infiltration through the cover systems.
- Application of reverse osmosis (RO) brine on the leach pads may have caused elevated levels of salts and other potential contaminants possibly affecting the reclamation cover system and future revegetation.
- Insufficient and unsuitable onsite reclamation materials may limit reclamation cover system alternatives.

Summary

S.4 Alternatives Analyzed in Detail

Four alternatives are described and evaluated in detail in this final EIS: the No Action Alternative; the Proposed Action (Application for Amendment 007); the Process Pad Drainage Pretreatment Alternative; and the Process Pad Barrier Cover Alternative. Brief summaries of the four alternatives are presented below. Detailed descriptions of the alternatives are provided in Chapter 2.

S.4.1 No Action Alternative

For this EIS, the 1989 Plan of Operations and 1995 Soils and Revegetation Plan along with the pumpback and water treatment plans and monitoring are considered to be the No Action Alternative. The No Action Alternative reflects the current CR Kendall Mine operations under Operating Permit 00122, including six Amendments and 23 minor revisions up through Minor Revision 11-001. Most reclamation activities under the permit have been completed. Major disturbed areas have been reclaimed, including the Horseshoe Pit and Horseshoe Waste Rock Dump; Muleshoe Waste Rock Dump; Barnes-King Pit; Kendall Waste Rock Dump, and most of the Kendall and Muleshoe Pits. Minor Revision 11-001 was approved in 2011 and allowed CR Kendall to place a 17-inch layer of growth media directly over the basal layer on process pads 3 and 4 as an interim reclamation measure.

Under this alternative, CR Kendall would address the remaining reclamation items at the mine, including pond reclamation, spreading the remaining stockpiled soil, completing some additional revegetation work, and providing long-term reclamation monitoring and maintenance.

Other mine facilities will be retained until water treatment is no longer needed, including pumps and piping; ponds 2B, 3B, 7, and 8; stormwater controls; water treatment and maintenance facilities; roads; power lines; and land application disposal (LAD) facilities.

S.4.2 Proposed Action

The Proposed Action is the proposed Closure Water Management Plan CR Kendall submitted in their Application for Amendment 007 to Operating Permit No. 00122. The Proposed Action primarily addresses the long-term water treatment of the process pad drainage and captured groundwater. The alternative would retain the installed vegetated soil cover authorized under Minor Revision 11-001 and address reclamation monitoring and maintenance activities. The main items different from the No Action Alternative are:

- The process pad drainage and all captured groundwater would be combined for treatment by filtering to remove particulate, treating with zeolite adsorption to remove thallium, and discharged to groundwater through the Kendall Pit. The option for LAD is retained as a contingency.

Summary

- No additional growth media (soil) would be placed on the regraded areas of the Kendall Pit with slopes less than 2:1 or the lower slopes in the Muleshoe Pit with poor vegetation establishment. No additional reseeding is planned.
- Most buildings would remain for private use after closure.

S.4.3 Process Pad Drainage Pretreatment Alternative

A separate piping system would collect the drainage water from process pads 3 and 4 for pretreatment prior to blending the drainage water with other mine waters. Arsenic is one of the contaminants in the process pad drainage water, and is projected to exceed groundwater standards even after the drainage water and captured groundwater are combined. The pretreatment system could remove arsenic and other contaminants, if necessary to comply with discharge criteria.

The likely pretreatment system would involve the oxidation and adsorption of arsenic onto an adsorbent compound (ferric chloride, iron filings, or other). The pretreatment process would most likely be developed specifically for the CR Kendall process pad drainage water to effectively remove arsenic. After pretreatment, the water would be combined with the other captured groundwater for thallium removal through the current method of zeolite adsorption. Treated water would be discharged to groundwater through the Kendall Pit.

New water treatment equipment would be required to pretreat the process pad drainage water. The annual average flow rate after installing the current process pads caps (2009 to 2014) ranged from 11.3 gallons per minute (gpm) to 20.5 gpm, with an average rate of 13.7 gpm. Estimated costs for a generalized adsorptive media pretreatment system for flow rates of 14 gpm and 30 gpm were provided in a Technical Memo to DEQ (Appendix B; Tetra Tech 2015).

The specific pretreatment technology chosen by CR Kendall to remove arsenic could generate contaminated treatment media, or byproduct, that requires proper disposal. Because the specific technology has not been chosen or designed, the possible disposal options for the contaminated media could include: (1) shipping it back to the manufacturer when exhausted; (2) shipping it offsite for disposal; or (3) burying it onsite if confirmed as non-hazardous.

Similar to the Proposed Action, no additional growth media (soil) would be placed on the regraded areas of the Kendall or Muleshoe Pits where there has been poor vegetation establishment. However, there would be some reseeding of areas with limited growth on the lower slopes with modified seed mix and amending after seeding with an agency-approved organic amendment, if equipment can safely be mobilized into the pit bottoms. The remaining stockpiled soil would be used for pond reclamation.

Summary

S.4.4 Process Pad Barrier Cover Alternative

The Process Pad Barrier Cover Alternative was developed to minimize the process pad drainage flows that require treatment. Adding a barrier liner to the process pads could effectively reduce drainage water flows. CR Kendall would select the effective cover materials to use; however, DEQ would have final review and approval. DEQ would require the barrier liner be of HDPE or a similar product rather than a geosynthetic clay liner (GCL). The current 17 inches of soil would be temporarily removed and a geomembrane liner installed. The geomembrane liner would consist of a textured HDPE liner overlaid with a geocomposite drainage net. The salvaged soil would be replaced over the geomembrane liner and the process pads reseeded.

As with the Proposed Action, the process pad drainage and all captured groundwater would be combined for treatment by filtering to remove particulate, treating with zeolite adsorption to remove thallium, and discharged to groundwater through the Kendall Pit. The option for LAD is retained as a contingency.

Similar to the No Action Alternative, the remaining stockpiled soil in excess of the quantity required to complete reclamation of facilities required for long term water treatment, would be used for reclamation.

S.5 Summary of Impacts

Table S-1 summarizes and compares the impacts of the four alternatives considered and evaluated in detail.

S.6 Preferred Alternative

DEQ has identified the Process Pad Drainage Pretreatment Alternative as the preferred alternative for the reasons discussed below

The Process Pad Drainage Pretreatment Alternative (as modified in the final EIS) is the only alternative that ensures compliance with all groundwater standards for water to be treated and discharged. This would be achieved through the development of an additional water treatment system to specifically remove arsenic from the process pad drainage. The system would be modified as necessary to include treatment for other elements, such as selenium, which may require treatment in the future to comply with groundwater discharge standards.

Mixing models developed for the Proposed Action predict the combined drainage water and captured groundwater would not meet groundwater standards for thallium and arsenic, but only treatment for thallium was proposed. CR Kendall assumed (1) either the natural background arsenic concentration in the Madison Limestone aquifer is also above the standard, or (2) dilution provided by mixing of the effluent from the treatment plant with groundwater moving through the aquifer would result in

Summary

compliance with groundwater quality standards after mixing. CR Kendall has not collected data from the local Madison Limestone aquifer to document the validity of either assumption, which might allow for effluent limits higher than groundwater standards.

The Process Pad Barrier Cover Alternative is intended to reduce the rate of infiltration into, and drainage from, the process pads. Reduced flows from the process pads and combining this water with other captured groundwater may result in sufficient dilution of constituents, other than thallium, so that no other water treatment would be required to achieve standards. However, reclamation of process pads using barrier covers may not reduce seepage to levels where treatment is no longer required. It is also possible the total amounts of contaminants in the residual seepage may not decrease in proportion to the reduced flows. Therefore, the Process Pads Barrier Cover Alternative does not provide assurance that it would eliminate the need for additional water treatment steps in order to achieve compliance with groundwater discharge standards.

The existing 17 inch process pad soil cover overlies 6 inches of subsoil amended with bentonite and 12 inches of unamended subsoil. Plant roots are able to penetrate the entire soil profile, and thus should be more tolerant of drought. Plant roots may extend into the underlying spent ore. In contrast, the Process Pad Barrier Cover Alternative would restrict plant roots to the upper 17 inches of soil, resulting in the vegetation being more susceptible to drought. There would also be an increased potential for soil slumping along a saturated zone on top of the liner and increased potential for exposure and damage to the barrier cover from toppling of shallow-rooted trees. Additional impacts to soils and vegetation would be expected due to salvage, stockpiling, and replacement of the soil materials on the process pad barrier cover.

Purpose of and Need for Action

1.1 Introduction

This final environmental impact statement (EIS) was prepared for the proposed closure of the CR Kendall Mine on the eastern flanks of the North Moccasin Mountains in Fergus County, Montana (**Figure 1-1**). On July 25, 2012, the Department of Environmental Quality (DEQ) received an application to amend Operating Permit No. 00122 (Amendment 007) from CR Kendall Corp. (CR Kendall) that contained an amended closure plan for final design of water management and treatment, final capping and reseeding of the former process pads, and long-term reclamation monitoring and maintenance (Hydrometrics & CR Kendall Corp. 2012, CR Kendall 2012). DEQ provided a deficiency letter to CR Kendall on September 21, 2012. CR Kendall responded to the deficiency review and DEQ issued a favorable compliance determination and a Draft Amendment 007 on March 9, 2015.

The CR Kendall Mine closure activities described in the Amendment 007 Application comprise the Proposed Action. DEQ prepared a draft EIS to present the analysis of possible environmental consequences of four closure alternatives: the No Action Alternative, the Proposed Action, the Process Pad Drainage Pretreatment Alternative, and the Process Pad Barrier Cover Alternative. The two process pad alternatives include additional mitigation measures developed by DEQ. All four alternatives are described in detail in Chapter 2.

The final EIS includes the analysis of the alternatives and responses to comments received on the draft EIS (Chapter 9). The responses to the comments resulted in modifications or additions to the analysis. The Director of DEQ will decide which alternative should be approved in a Record of Decision (ROD) based on the analysis in the final EIS.

1.2 Purpose and Need

CR Kendall conducted mining activity under Operating Permit 00122, which was originally issued to Triad Investments on September 14, 1984 and allowed mine development within a 119 acre permit area. The permit was subsequently amended several times, was acquired by Canyon Resources following a bankruptcy, and currently covers about 1,040 acres. The mine was permitted under the Montana Metal Mine Reclamation Act ([MMRA]; 82-4-301, *et seq.*, Montana Code Annotated [MCA]). Amendment 007 is a closure plan for the CR Kendall Mine and primarily focuses on water management and treatment. The amendment also addresses final capping of the former process pads, and long-term reclamation monitoring and maintenance.

The Montana Environmental Policy Act (MEPA) requires an environmental review of actions taken by the State of Montana that may significantly affect the quality of the

human environment. This EIS was prepared to fulfill the MEPA requirements. The final EIS includes comments received on the draft EIS and the agency's responses to those comments.

1.3 Project Location and History

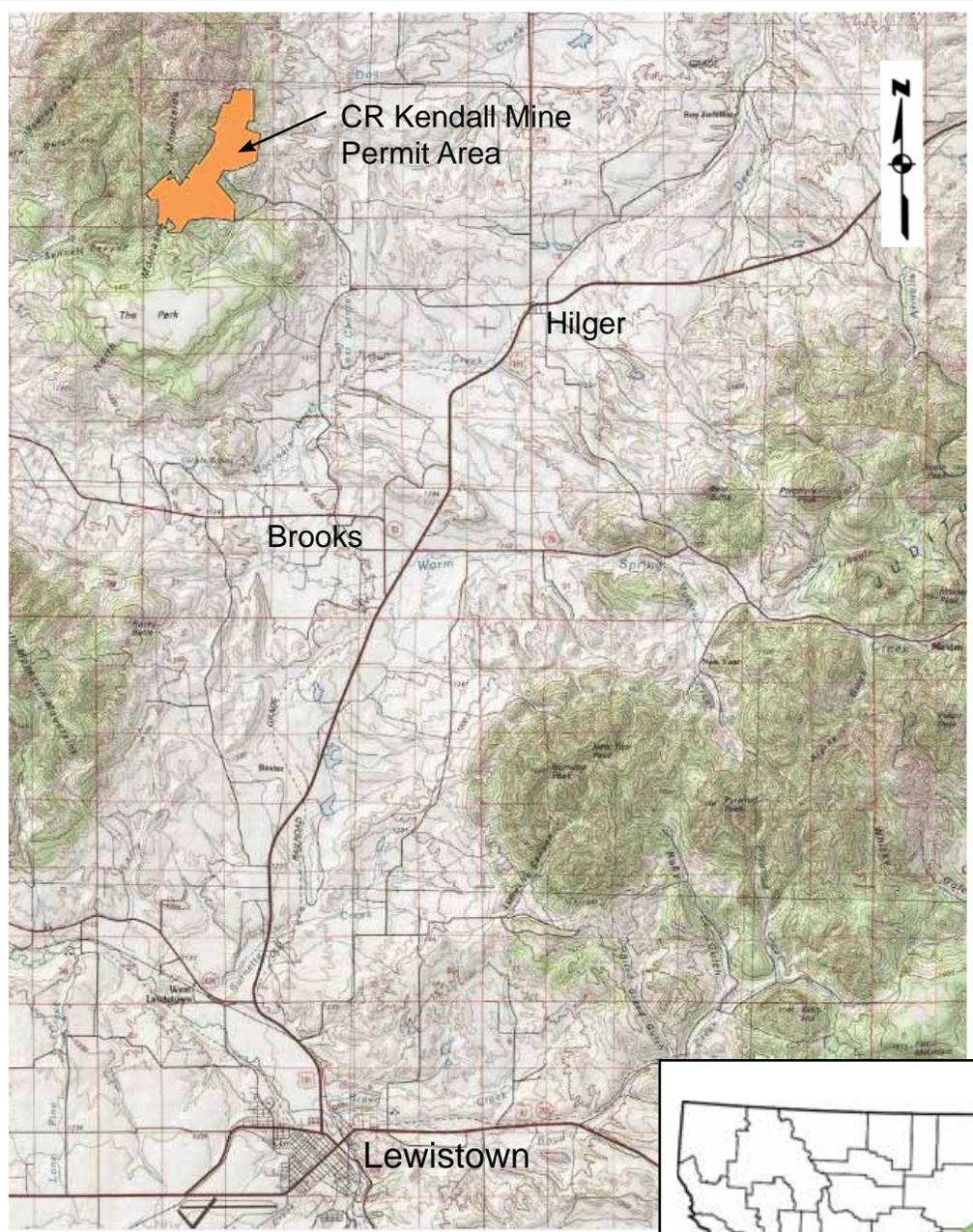
The CR Kendall Mine is in Fergus County, approximately 8 miles west of Hilger and 25 miles north of Lewistown, Montana (**Figure 1-1**).

1.3.1 Previously Completed Mining and Reclamation

Mining began in the area around the CR Kendall Mine in about 1880 and continued until 1942. Historical tailings from ore milling operations were deposited in Mason Canyon, Barnes-King Gulch, and Little Dog Creek, prior to CR Kendall's modern mining activities. The historical Kendall Mill discharged tailings into Mason Canyon. The Barnes-King Mill discharged tailings into Barnes-King Gulch and some tailings were transported as far as 2 miles downstream. The North Moccasin Syndicate Mill deposited tailings in the North Fork of Little Dog Creek.

The Horseshoe waste rock dump was constructed on top of North Moccasin Syndicate tailings after some tailings were removed and used for the process pad underliner material (CR Kendall 1992). The majority of the North Moccasin Syndicate mill tailings are below and east of the CR Kendall Mine property boundary and behind a series of three earthen dams in Little Dog Creek.

Modern mining processes were initiated by Triad Investments, Inc. in 1981 under a Small Miner Exclusion for disturbance of less than 5 acres. In 1984 the company was issued Operating Permit #00122 with a permit area of 119 acres. The permit was later transferred to Greyhall Resources, who continued mining operations through 1986. Canyon Resources (CR) Corporation voluntarily took over the management of the site to prevent uncontrolled discharges of cyanide process solution during the bankruptcy of Greyhall Resources in 1987. CR Corporation took over sole management of the property in 1990 under the name of CR Kendall Corporation. Mining ceased in February 1995, and gold recovery continued through the fall of 1997. The gold recovery process involved cyanide heap leaching, gold precipitation on zinc filings, carbon recovery, and smelting.



LOCATION MAP

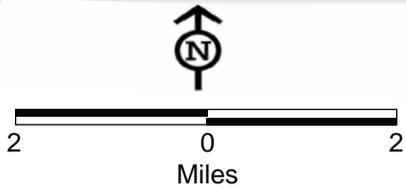


Figure 1-1
Project Location Map

The CR Kendall Mine operations disturbed approximately 448 acres of the 1,040 acre permit area (CR Kendall 2014 Annual Report). Through December 31, 2014, approximately 395 acres have been reclaimed leaving approximately 53 acres unvegetated. The currently unvegetated acres include the mine office and shops, water treatment plant (WTP), main road and access roads, and approximately 8 acres in the Kendall and Muleshoe Pits where soil has not been replaced. The proposed Amendment 007 Water Management Closure Plan would continue to use approximately 45 acres for the WTP and associated facilities and for the access roads. A summary of the acres disturbed and reclaimed is in **Table 1-1**.

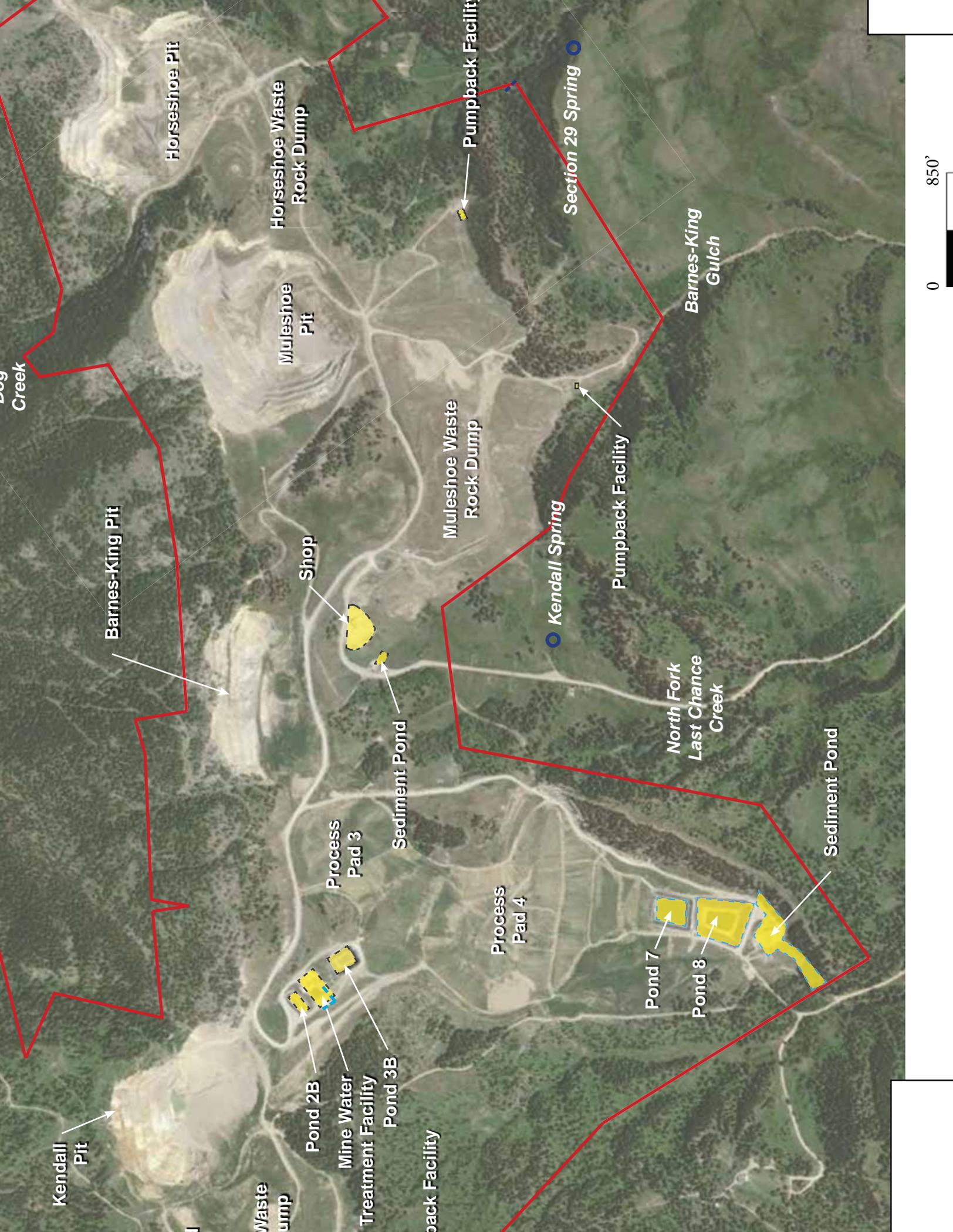
The major features at CR Kendall Mine include four mine pits (Horseshoe, Muleshoe, Barnes-King, and Kendall), three waste rock dumps (Horseshoe, Muleshoe, and Kendall), two process pads (3 and 4), various ore processing and/or water management facilities including process water ponds 2B, 3B, 7, and 8, and other disturbances. These mine features are shown on **Figure 1-2**. All of the waste rock dumps and three of the four mine pits have been reclaimed in compliance with the approved reclamation plan. Approximately 8 acres of the Kendall Pit have regraded slopes but have not had soil replaced or been reseeded.

| TABLE 1-1 DISTURBED AND RECLAIMED ACRES¹ FOR CR KENDALL MINE (DECEMBER 2014) | | |
|--|------------------------|------------------------|
| Disturbance Type | Acres Disturbed | Acres Reclaimed |
| Mine Pits, Waste Rock Dumps, Soil Stockpiles, Associated Areas | 353 | 345 |
| Process Pads | 50 | 50 |
| WTP and Facilities | 15 | 0 |
| Main Roads (30-foot average width) | 12 | 0 |
| Access Roads (20-foot average width) | 18 | 0 |
| Totals | 448 | 395 |

Note:

¹ Acreages are approximate.

In 2004, CR Kendall graded the process pads to their final reclamation slopes and, in 2006 and 2008, placed an 18-inch thick basal layer composed of crushed and screened Kootenai Formation rock obtained from an onsite quarry south of process pad 4. The 18 inch layer consisted of 12 inches of minus-6-inch material capped by 6 inches of minus-1.25-inch material amended with sodium bentonite at 5 to 8 percent by volume. This grading and placement of the basal layers was approved by DEQ recognizing that these layers would be a component of any closure plan approved for the process pads.



0 850'

1.3.2 Permit Amendment Submittals, Reviews, and Compliance

While an EIS on the CR Kendall closure plan was initiated and scoped in 2003, an EIS was never published. Work on the EIS was suspended in 2005 following a meeting between CR Kendall and DEQ during which CR Kendall proposed to submit a long-term water treatment plan in the near future, and to fund the completion of the EIS once the water treatment plan had been accepted. That plan was submitted by CR Kendall in July of 2012. A public scoping document was published in 2003 and comments were used in the development of the draft and final EIS.

In July 2011, CR Kendall submitted a request for a revision to its operating permit regarding final capping of process pads 3 and 4. CR Kendall sought authorization to place 17 inches of growth media directly over the basal layer as the final capping of the process pads. CR Kendall expressed a concern that if a soil cap was not placed on the process pads, the bentonite-amended basal layer could significantly erode due to continued exposure to precipitation events. DEQ could only approve placement of the 17 inches of growth media on the basal layer as an interim measure because DEQ had not completed an environmental review for the final cap design. DEQ and CR Kendall agreed that the growth media might have to be removed if the final reclamation plan requires the capping of the process pads to be modified (such as the inclusion of a barrier cover). DEQ determined that CR Kendall would have to submit a reclamation bond covering the cost of removing the soil if required by the final reclamation plan. DEQ approved the minor revision (Minor Revision 11-001) contingent on receipt of the additional reclamation bond which was subsequently posted.

On July 25, 2012, CR Kendall submitted an application to amend their operating permit. In accordance with Section 82-4-337, MCA, DEQ reviewed the application for completeness and compliance.

On September 21, 2012, DEQ sent the First Deficiency Review, which stated: "Page 1-5, Section 1.4: It is noted that water treatment will cease once water quality standards and/or background levels are met. CR Kendall should clarify whether this refers to the background study conducted by Water Management Consultants in 2003 (and if so, background levels should be specified), or whether a future background analysis is anticipated." As CR Kendall did not respond with any proposed elevated natural background levels for arsenic, DEQ assumed that CR Kendall intended to comply with the established water quality standards.

DEQ requested clarification on whether the plan was referring to previously estimated background conditions or whether a future background analysis is anticipated in part because DEQ assumed that CR Kendall intended to comply with the established water quality standard.

When DEQ determined the application was complete and compliant as required under Section 82-4-337(1)(d), MCA, DEQ detailed, in writing the substantive requirements of the MMRA and how the application complies with those requirements. DEQ determined that CR Kendall had committed to meet all standards. DEQ accepted CR Kendall's statement on page 1-7 of the Request for Permit Amendment (Section 1.4.3 Process Pad Drainage, paragraph 2, lines 6 through 8) as a commitment by CR Kendall to comply with the criteria by stating that "[t]reated water will meet all groundwater quality standards and will be discharged to groundwater via the Kendall Pit." Table 4-1 of the Closure Plan describes predicted water treatment plant *influent* concentrations and indicates that concentrations of arsenic in blended water prior to treatment may at times reach levels as high as 0.022 mg/L. Nothing in Table 4-1 nor the rest of the Closure Plan indicate that the *effluent* from the water treatment plant would exceed the groundwater quality standard of 0.01 mg/L.

Furthermore, on July 17, 2015, CR Kendall submitted a letter to DEQ in response to the question "*Discuss the fate and quality of groundwater affected by long term disposal from the Kendall Pit.*" CR Kendall responded; "[n]o water quality impacts are expected from the release of treated water to the Kendall Pit because water will be treated to meet Montana Groundwater Quality Standards prior to release." DEQ assumed it was CR Kendall's intent to comply with all groundwater quality standards, including those for arsenic. DEQ's reliance on these representations is reflected in its completeness and compliance determination. DEQ's inclusion in its completeness and compliance determination that the mixed water will meet background groundwater concentrations in the area of the Kendall Pit, with the exception of thallium, was in error.

1.4 Scope of the Document

Four alternatives are described and evaluated in detail in this EIS. Chapter 2 describes the No Action Alternative, the Proposed Action, the Process Pad Drainage Pretreatment Alternative, and the Process Pad Barrier Cover Alternative. Chapter 3 describes the existing environment and environmental consequences to the resource areas from implementation of the alternatives. Resource areas discussed in detail include: geology and minerals; soil, vegetation, and reclamation; surface and groundwater; and wildlife. Chapter 4 describes the cumulative, unavoidable, irreversible, irretrievable, and secondary impacts that may occur under the alternatives. Chapter 5 provides a comparison of alternatives and Chapter 6 lists the preparers. Chapter 7 contains the glossary and acronym list and Chapter 8 has the references.

Brief summaries of the four alternatives are presented below with detailed descriptions in Chapter 2.

1.4.1 No Action Alternative

The No Action Alternative reflects the current CR Kendall Mine operations under Operating Permit 00122, including six Amendments (**Table 1-2**) and 23 minor revisions up through Minor Revision #11-001. The main mine components consist of four mine pits (Horseshoe, Muleshoe, Barnes-King, and Kendall), three waste rock dumps (Horseshoe, Muleshoe, and Kendall), two process pads (3 and 4), various WTP facilities including ponds 2B, 3B, 7, and 8, and other disturbances. The mine would continue to collect the process pad drainage water in Pond 7 and be land applied during growing season. The use of land application as a means of water management has had temporary inhibitory effects on plant growth from the salt content in the discharged water. The captured alluvial groundwater would continue to be pumped to the WTP and treated by a media filtration step (sand filtration) and zeolite adsorption to remove thallium and discharged to groundwater through the Kendall Pit.

Concentrations of thallium, arsenic, cyanide, nitrate, and other parameters in the process pad drainage have been decreasing over the last 20 years. Under the No Action Alternative, CR Kendall has not estimated how long water treatment would need to be continued. CR Kendall's time estimate for continued water treatment under the Proposed Action (Section 1.4.2) is between 10 and 40 years (Hydrometrics and CR Kendall 2012). The alluvial groundwater capture system may need to continue operating after groundwater standards are met to achieve surface water standards. Under this alternative, CR Kendall would address the remaining reclamation items at the mine, including spreading the remaining stockpiled soil, completing some additional revegetation work, and providing long-term reclamation monitoring and maintenance.

As indicated in Section 1.3, DEQ approved Minor Revision 11-001 allowing CR Kendall to place 17 inches of growth media over the already placed 18-inch basal layer containing 6 inches of bentonite amended soil, as an interim reclamation measure. The minor revision was approved based on the parties' understanding that the growth media would have to be removed if the final reclamation plan required a liner under the growth media or otherwise required the capping material to be modified. Under the No Action Alternative, the capping completed by CR Kendall under Minor Revision 11-001 would remain.

| Permit, Amendment, or Minor Revision No. | Effective Date | Brief Description |
|--|-------------------|---|
| Operating Permit 00122 | Sept. 14, 1984 | Compliance with the MMRA to permit 119 acres and a mill. |
| Amendment 001 | April 22, 1987 | Water treatment and land application disposal (LAD). Addition of 6.8 acres for LAD area. Permit increased to 125.8 acres (submitted January 1, 1987). |
| Amendment 002 | August 19, 1988 | Addition of 61.3 acres for disturbance and facilities. Permit area increased to 187.1 acres (submitted May 27, 1989). |
| Second Amendment 002 | July 12, 1989 | Increased capacity of process pad 3 by adding 3.8 acres. Permit increased to 190.9 acres (submitted May 30, 1989). |
| Amendment 004 | November 1, 1989 | Addition of 994.1 acres for "Life of Mine" expansion of disturbance and facilities. Permit increased to 1,185 acres. |
| Amendment 005 | June 16, 1992 | Relocation of part of the area for LAD (area 3). |
| Amendment 006 | March 17, 1993 | Change location of the Horseshoe waste rock dump from north of the Horseshoe Pit to south of and adjacent to the pit (submitted December 18, 1992). |
| Revision 93001 | April 6, 1993 | Modification of approved plan to dispose of spent ore from process pad 1 (placement beneath liner during construction of process pad 4 Phase IV expansion). |
| Revision 93002 | June 1, 1993 | Removal of undisturbed lands (162 acres) from Permit Boundary |
| Revision 93003 | June 8, 1993 | Modification to plan of off-loading spent ore from process pad 1 (placement of coarse rock into borrow area) |
| Minor Revision 94-001 | March 14, 1994 | Modified Water Resources Monitoring Program (including addition of four new monitoring wells) |
| Minor Revision 94-002 | March 14, 1994 | Modification to Processing Facility: Addition of a building to house a Carbon Adsorption plant for gold recovery, to replace the Merrill-Crowe system. |
| Minor Revision 94-003 | July 28, 1994 | Soils and Revegetation Plan |
| Minor Revision 94-004 | December 19, 1994 | Drainage and Sediment Control Plan (withdrawn) |
| Minor Revision 95-001 | July 29, 1995 | Construction of new sediment retention pond between Kendall waste rock dump and South Fork Last Chance Creek |
| Minor Revision 95-002 | March 25, 1995 | Drainage and Sediment Control Plan |
| Minor Revision 96-001 | July 3, 1996 | Proposal to construct seepage capture systems and to use the water for irrigation of reclaimed areas (withdrawn) |
| Minor Revision 97-002 | April 14, 1997 | Revision to water monitoring program |
| Minor Revision 97-001 | May 1997 | Change in pond freeboard requirement from storage of 6.3 inches of precipitation to 4.2 inches |
| Minor Revision 97-003 | August 18, 1997 | Treatment of process water with Reverse Osmosis, followed by zeolite polishing, followed by discharge to groundwater via the Kendall Pit |

| Permit, Amendment, or Minor Revision No. | Effective Date | Brief Description |
|---|---------------------------------------|--|
| Water Management Plan | Submitted May 28, 1997; Not approved | Water Management Plan (replaces Minor Revision 96-001) (Tentatively, Amendment 007); withdrawn in 1999. |
| Minor Revision 99-001 | Rejected by DEQ April 2, 1999 | Final Closure Plan; rejected by DEQ as incomplete and not a minor revision |
| Minor Revision 99-002 | July 1, 1999 | Expansion of LAD areas |
| Minor Revision 00-001 | December 11, 2000 | Request to reclaim 7 acres |
| Amended Closure Plan | Submitted March 6, 2001; Not approved | DEQ determined that an EIS would be required. The EIS was not completed at that time because CR Kendall requested time to develop a final water management plan. That plan was included as part of the revised amended closure plan submitted in 2012. |
| Minor Revision 01-001 | April 18, 2001 (Partial Approval) | Request to decommission several water monitoring sites |
| Minor Revision 02-001 | Not Approved | Request for additional irrigation areas |
| Minor Revision 04-001 | October 8, 2004 | Approved 4 items; (1) partial regrade Kendall Pit, (2) regrade area on Kendall waste rock dump, (3) relocate excess limestone, and (4) extend Muleshoe pumpback system. |
| Minor Revision 05-001 | May 4, 2006 | Approved changes to replace the 12 inch Reduced Permeability Layer (RPL) basal layer with 18 inches of soil amended with sodium bentonite. |
| Minor Revision 05-002 | October 21, 2005 | Construction of a pilot-scale treatment facility in Process Valley for demonstration of passive treatment technology |
| Minor Revision 05-003 | September 29, 2005 (Partial Approval) | Request to modify water monitoring schedule |
| Minor Revision 06-001 | January 25, 2006 | Request to complete regrading of Kendall Pit and Kendall waste rock dump |
| Minor Revision 07-001 | July 13, 2007 | Approved construction of a pilot-scale treatment facility and access road. |
| Minor Revision 11-001 | October 27, 2011 | Approved placement of 17 inches of growth media over existing basal layer on process pads 3 and 4. |
| Amendment 007 | Draft approved March 16, 2015 | Proposed Closure Water Management Plan that includes water treatment, discussion of facilities to be retained, and discussion of long-term maintenance and monitoring (submitted July 25, 2012). |

1.4.2 Proposed Action

Under the Proposed Action, CR Kendall would complete the tasks developed and described in the Amended Closure Water Management Plan (Amendment 007) prepared by Hydrometrics, Inc. and CR Kendall Corp. (2012). The Proposed Action would provide for long-term water management (estimated up to 40 years) and monitoring, accept the interim capping of the former process pads as the final reclamation plan for those facilities, specify the final water treatment design as described below, and outline the long-term reclamation monitoring and maintenance activities. The long-term water management tasks would include:

1. Capturing and temporarily storing process pad drainage and alluvial groundwater;
2. Long-term treating of process pad drainage and captured alluvial groundwater with zeolite adsorption to remove thallium;
3. Disposing of spent zeolites in Pond 7;
4. Discharging treated water to groundwater through the Kendall Pit;
5. Maintaining the ponds, buildings, pipelines and other infrastructure needed to support the water management and treatment system;
6. Monitoring and mitigation plans for water management facilities; and
7. Augmenting stream flows to offset stream flow reductions resulting from continued operation of the pumpback systems and to supply downgradient water users.
8. Soil stockpiled in TS-13a would remain in place.
9. Reclamation of ponds and creating a channel after water capture and treatment is no longer necessary.

The 17 inches of growth media that CR Kendall Mine placed on the process pads as an interim reclamation measure under Minor Revision 11-001 would become the final reclamation cover for the process pads. Long-term reclamation monitoring and maintenance under the Proposed Action are detailed in Section 2.3.

1.4.3 Process Pad Drainage Pretreatment Alternative

The Process Pad Drainage Pretreatment Alternative is similar to the Proposed Action. The main difference for this alternative would be the separate collection and pretreatment of the process pad drainage for removal of arsenic and possibly other constituents if necessary to comply with groundwater discharge criteria. The average arsenic concentration in the process pad drainage (2010 to 2011) was 0.148 milligrams per liter (mg/L) which exceeds the groundwater quality standard of 0.01 mg/L (DEQ

2012). This alternative would include pretreatment for the process pad drainage and not the captured groundwater.

CR Kendall is responsible for identifying the treatment method that would be used to meet effluent limits established by DEQ. DEQ assumes CR Kendall would construct a separate piping system to collect the drainage water from process pads 3 and 4 that have a combined average flow of 13.7 gallons per minute (gpm). For the purpose of the effects analysis, DEQ assumes adsorptive media would be the preferred pretreatment option compared to ferric coagulant addition. Adsorptive media would generate spent media that could be contained within vessels for easier handling, compared to the need to deal with ferric hydroxide sludge from ferric coagulant addition, which is more labor-intensive and less desirable at the predicted flowrate. Furthermore, DEQ assumes an iron-based ferric oxide adsorption media would have lower operational costs compared to other arsenic-removal adsorptive media such as titanium-oxide or alumina-based media, and that the spent ferric oxide adsorption media would likely pass TCLP testing for arsenic. If the spent media passes TCLP testing and is classified as non-hazardous waste, it could be disposed of either onsite or offsite.

After pretreatment, the drainage water would be combined with the captured groundwater and further treated with zeolite adsorption to remove thallium. All treated water would be discharged to groundwater at the Kendall Pit. The land application system would still be available for use, but only if necessary to prevent direct discharges to surface water in response to extreme precipitation events. A new or expanded WTP and associated facilities would be needed for the process pad drainage pretreatment. CR Kendall may submit treatment system designs other than the assumed pretreatment system described above, which DEQ would evaluate for consistency with the impacts disclosed in this EIS. If the treatment system design submitted by CR Kendall may result in materially different impacts as that disclosed in this EIS, DEQ will conduct further MEPA review.

Like the Proposed Action, the 17 inches of growth media placed on the process pads under Minor Revision 11-001 would become the final reclamation cover. This alternative differs from the Proposed Action in that areas with limited growth on the lower slopes of the Kendall and Muleshoe Pits would be reseeded with modified seed mix and the areas amended after seeding with an agency-approved organic amendment, if equipment can safely be mobilized into the pit bottoms.

1.4.4 Process Pad Barrier Cover Alternative

The Process Pad Barrier Cover Alternative is similar to the Proposed Action with the addition of barrier covers on process pads 3 and 4 to reduce the volume of drainage water requiring treatment. Under this Alternative, CR Kendall would remove the upper 17 inches of growth media from process pads 3 and 4, install a barrier cover cap, replace the 17 inches of growth media, and seed the process pads.

The barrier cap would consist of a geomembrane liner, drainage net, and filter fabric. The geomembrane would consist of a textured polyvinyl chloride (PVC) or high-density polyethylene (HDPE) material to reduce slipping and movement of the soil on the barrier cap. The barrier would be installed on top of the existing 6 inches of subsoil basal layer material that was amended with 5 to 8 percent sodium bentonite and placed over 12 inches of subsoil basal layer material. The growth media would be returned and placed on the barrier cap and all disturbed areas reseeded with an approved reclamation seed mixture.

This alternative would include reseeded areas with limited growth on the lower slopes of the Kendall and Muleshoe Pits with a modified seed mix and the areas amended after seeding with an agency-approved organic amendment, if equipment can safely be mobilized into the pit bottoms.

1.5 Agency Roles and Responsibilities

DEQ is responsible for administering the MMRA and the rules and regulations governing the MMRA. Approval and enforcement of Operating Permit 00122 and all subsequent amendments and minor revisions has been the responsibility of DEQ. Since the Operating Permit was approved in 1984, there have been six amendments and 23 minor revisions approved and attached to the Operating Permit. The amendments and minor revisions are listed in **Table 1-2**.

1.6 Public Participation

The following scoping activities were completed in 2003 as part of the scoping process for the EIS initiated in 2003:

1. Private interviews of interested members of the public were conducted in Lewistown, Montana. The interviews were widely advertised to ensure that all interested parties would have an opportunity to participate. Twenty-five people were interviewed.
2. An open house was held at the Yogo Inn in Lewistown. Technical representatives were present to discuss five individual topic areas with members of the public. Notes of the discussions were recorded to summarize the event.
3. A public meeting was held at the Yogo Inn to obtain comments from the public on the proposed permit amendment.
4. There was a series of working meetings with technical specialists and stakeholders. Those who were interviewed or attended the open house and public meeting were asked if they were interested in participating in the technical meetings. Recipients of the scoping document were advised that

they could participate in the technical meetings. Twenty people expressed interest. Issues raised during the technical meeting were added to the list of issues gathered from other scoping activities.

DEQ held an open house in Lewistown on March 31, 2015, to kick off the environmental review process for the proposed amendment to CR Kendall's operating permit.

Members of the public submitted comments on the draft EIS during a comment period, September 10 through November 10, 2015. DEQ reviewed the comments received and responded to comments in Chapter 9. Some responses required changes in the final EIS. Modifications are indicated in the comment response.

1.7 Issues of Concern

From the public involvement, two relevant issues were identified that should be addressed through the alternatives analysis process for the closure EIS - (1) the effects of the mine closure actions on surface water and groundwater quantity and quality; and (2) the effects of the mine closure actions on soils and reclamation. These issues will be evaluated in detail to address impacts to resources and to help determine reasonable alternatives for mine closure, including the Proposed Action. The specific components of the two relevant issues are:

Issue 1: Effects on quantity and quality of surface water and groundwater resources:

- Discharges from the mine to surface water and groundwater may exceed water quality standards for certain contaminants: arsenic, antimony, selenium, thallium, cyanide, and nitrate.
- Pumpback of contaminated groundwater and capture of surface water have reduced downgradient water quantity in four watersheds. Water management at the mine may continue to reduce downgradient water quantity.
- Pumping clean groundwater from water wells WW-6 and WW-7 may have reduced water quantity in downgradient wells.
- The mine facilities have intercepted natural drainages that channeled stormwater and snowmelt that no longer reach drainages below the mine.
- Water quantity in each drainage could be augmented by rerouting surface water and developing springs and other groundwater sources.
- Water and sediment from the mine may contribute arsenic to the Boy Scout pond downgradient of the permit boundary in South Fork Last Chance Creek.
- The underdrain in the process valley could be receiving impacted water.

Issue 2: Effects on soils and reclamation

- Reclamation efforts may have resulted in inadequate vegetation in some areas, erosion on steeper slopes, and excessive infiltration through the cover systems.
- Application of reverse osmosis (RO) brine on the leach pads may have caused elevated levels of salts and other potential contaminants possibly affecting the reclamation cover system and future revegetation.
- Insufficient and unsuitable onsite reclamation materials may limit reclamation cover system alternatives.

1.8 Issues Considered But Not Studied in Detail

An Interdisciplinary Team (IDT) review determined that because a number of resource areas and associated issues would not be affected or would be minimally affected by the closure plan alternatives, they would not be studied in detail through the EIS alternatives analysis process. The description of resource areas and rationale for eliminating these issues are:

- The cost of the selected alternative may exceed the reclamation bond. If CR Kendall cannot fund the entire cost of the reclamation and long-term water treatment, the public would have to pay. *Alternatives are developed to address environmental concerns. MEPA requires the evaluation of reasonable alternatives to the Proposed Action that will achieve the purpose and need for action, comply with water quality standards, and would be economically feasible for similar projects having similar conditions. If the cost of implementing the selected alternative exceeds the amount of the reclamation bond currently held by DEQ, CR Kendall will be required to submit additional bond. This issue will not be carried forward and is addressed by law and regulation. It should be noted that, as discussed previously, CR Kendall has already submitted a bond covering the cost of removing the growth media on the process pads if DEQ selects an alternative that requires removal or modification.*
- Since DEQ previously approved a reclamation plan, an EIS is not necessary. *An EIS is required when there is state action that may significantly affect the human environment. Previous approval and issuance of the operating permit and the current proposed Amendment 007 to the operating permit are both state actions that require preparation of an environmental review. DEQ concluded in its 2001 Environmental Assessment on CR Kendall's Amended Closure Plan (CR Kendall 2001a) there might be significant impacts from approval of the final closure plan for the CR Kendall Mine, so preparation of an EIS is required under MEPA.*
- DEQ will develop the EIS with a predetermined preferred alternative for reclamation and water treatment. *DEQ did not have a predetermined alternative regarding the final closure plan for the CR Kendall Mine. However, MEPA authorizes*

DEQ to identify a preferred alternative in the draft EIS if it has one. This issue will not be carried forward.

- **DEQ and CR Kendall have shown a lack of interest in involving the public on mine-related issues.** *Since 2003, DEQ has involved the public in the CR Kendall Mine closure process with multiple activities, including 1 public meeting, 2 open houses, 4 technical meetings, 25 public interviews, and a published scoping document (CDM 2004). The public will have an opportunity to submit comments on the draft EIS. DEQ is required to consider and address these comments in the final EIS. This issue will not be carried forward.*
- **DEQ should ensure the reclamation is effectively implemented and meets legal requirements.** *CR Kendall has reclaimed much of the mining-related disturbed areas and DEQ completes field inspections annually, or more frequently. DEQ would monitor implementation of the selected mine closure alternative and pursue enforcement actions if reclamation does not achieve legal requirements. This issue will not be carried forward.*
- **The overall effect of the Kendall Mine on the local economy should be evaluated.** *The EIS addresses the alternatives for mine closure primarily for reclamation monitoring and long-term water treatment. Mitigating the economic impacts of mine closure are beyond the scope of this EIS.*
- **The Bureau of Land Management (BLM) should be a co-lead agency in preparing the EIS.** *In 1995 BLM and CR Kendall completed a land exchange making all lands within the permit boundary privately owned. BLM has no land management responsibilities. BLM's permitting involvement in the past is outside the scope of this EIS. DEQ has no authority to require BLM to participate, but BLM will be given an opportunity to comment on the draft EIS. This issue is outside the scope of this EIS and will not be carried forward.*
- **The land within the permit boundary is privately owned. The current boundary includes hundreds of acres that were never disturbed or do not need further reclamation. The permit boundary should be redrawn to encompass only those areas where reclamation is not complete and areas actively used for reclamation.** *A request to remove areas from the permit boundary must be made by CR Kendall and would require a minor revision to the permit. If such a request is received, DEQ would review the submission and determine if those areas could be removed. Areas that contain disturbed land that has been reclaimed would first require a public notice and comment period for bond release before land could be removed from the permit boundary.*
- **Hazardous wastes should receive special treatment.** *Waste rock, spent ore, and historical tailings do not qualify as hazardous waste under the Code of Federal Regulations (CFR) (40 CFR 261.4(17), etc.) because they are exempt (Bevill Amendment). Spent zeolite from water treatment columns is buried in the process pads and is not considered hazardous waste based on toxicity characteristic leaching procedure (TCLP) analyses (CR Kendall 2015d). Reverse osmosis (RO) brine was recirculated to the*

process pads, mixed with process water, and eventually land applied. All mining wastes either pass TCLP or are Bevill Amendment excluded. Since 1996, water and seepage from all facilities has been intercepted and captured by the pumpback systems and either land applied or treated by zeolite adsorption and discharged to groundwater through the Kendall Pit. Hazardous materials from the assay lab were disposed offsite. No further hazardous materials are on site (CR Kendall 2015d). Therefore, this concern will not be carried forward as a separate issue.

- *The slopes of the heap leach pad should be terraced to catch surface water until vegetation can use it. The regrading on the process pads was approved after an environmental assessment and was completed per the approved reclamation plan. The proposed Amendment 007 does not seek to modify the permit requirements for regrading of the process pads. Therefore, this concern will not be carried forward as a separate issue.*
- *The buffering capacity of the waste rock should be enough to prevent acid mine drainage. Waste rock dumps and the process pads contain materials dominated by limestone. The pH of all seepage from waste rock dumps and process pad is above 7. DEQ does not expect the buffering capacity to be depleted over time. The long-term problem at the Kendall Mine is not acid mine drainage, but near-neutral metal mobility, especially metalloids including thallium, arsenic, and selenium, that are most soluble in non-acidic conditions. Near-neutral mobilization of metalloids is addressed in the water quality section. The only natural acidic seep in the area is associated with a coal seam outside the disturbed areas of the mine. The issue is not relevant to this site.*
- *Disposal of mine wastes into pits could result in contaminated seepage into the Madison limestone and could affect the Lewistown water supply and Petroleum County. Reclamation of the open pits was approved after an environmental assessment and was completed per the approved reclamation plan. The proposed Amendment 007 does not seek to modify the permit requirements for reclamation of the open pits at the CR Kendall Mine, with the single exception that it is proposing not to place soil on regraded areas at the Kendall Pit. Therefore, this concern will not be carried forward as a separate issue.*
- *The pit floors should be lined with impermeable materials before backfilling. The proposed Amendment 007 does not seek to modify the permit requirements for reclamation of the open pits at the CR Kendall Mine, with the single exception that it is proposing not to place soil on regraded areas at the Kendall Pit. The reclamation of the open pits was approved after an environmental assessment and was completed per the approved reclamation plan. Therefore, this concern will not be carried forward as a separate issue.*
- *Highwall stability should be evaluated. The proposed Amendment 007 does not seek to modify the permit requirements for reclamation of the open pits at the CR Kendall Mine, with the single exception that it is proposing not to place soil on regraded areas at the Kendall Pit. The reclamation of the open pits was approved after an environmental*

assessment and was completed per the approved reclamation plan. Therefore, this concern will not be carried forward as a separate issue.

- *Ditches should be constructed on native grounds rather than on disturbed materials. All major drainage channels have been constructed. Minor drainage modifications might be required as roads and other facilities are reclaimed under the proposed closure alternatives. This concern will not be carried forward as a separate issue. Where possible, drainage channels have been constructed on native ground.*
- *Surface water quality monitoring may not adequately identify all exceedances. In its Amendment 007 application, CR Kendall has not requested authorization to discharge to surface water. Neither of the Agency modified alternatives include discharges to surface water, so surface water quality monitoring beyond the scope of current monitoring plans will not be carried forward as a separate issue.*
- *Piping water from Little Dog Creek around the mine instead of letting it go underground may unfairly allocate water to a specific landowner. Addressing the fairness of where this water goes is outside the scope of this EIS. The pumpback system diverts water from lower Little Dog Creek drainage. CR Kendall proposed this means of augmentation as a way to replace water to the drainage.*
- *DEQ shows favoritism to CR Kendall and/or specific landowners. DEQ is a neutral regulator and administers the Metal Mine Reclamation Act without favoring CR Kendall, specific landowners, or any other interested persons who may be affected by DEQ's decision on Amendment 007 proposed by CR Kendall.*
- *The compensation to local ranchers by CR Kendall for alleged water losses may be an admission of guilt. Water quantity issues are covered under Issue 1 and water quality and quantity in Chapter 3. This issue is outside the scope of this EIS.*
- *Existing water rights may be compromised by mining or reclamation activities. Effects on water quantity are predicted by estimating changes in water availability as a result of mining and reclamation and water treatment activities. Impacts to individual water rights are beyond the scope of the EIS.*
- *A water reservoir should be retained for firefighting. Retaining an existing pond or constructing a new reservoir for firefighting purposes was raised during the scoping process.*
- *Noxious weeds from the mine may have spread to exploration roads and neighboring properties. Noxious weed control has been conducted during mine life, but Canada thistle and houndstongue continue to expand on the site. These weeds are common throughout the region and it would be difficult to determine the seed source. Seeds are spread by wind or carried by animals. Noxious weed control will be addressed as part of the revegetation and long-term monitoring for each alternative but will not be carried forward as a separate issue.*

- Historical tailings in the streambeds below the permit area should be removed to prevent recontamination of treated water discharge. *DEQ cannot legally require CR Kendall to remove the historical tailings outside the permit area. Neither the Proposed Action nor the agency alternatives include plans to discharge treated water directly into drainages, where there is potential for the treated water to be recontaminated.*
- Reclamation should protect people and property from long-term effects from the mine. Reclamation should meet laws and regulations relative to non-degradation, property rights, trespass, etc. *Reclamation of the mine site must comply with all requirements of the Metal Mine Reclamation Act and the Montana Water Quality Act. This issue is addressed by existing laws and regulations.*
- Sediment from the mine site has contaminated the Boy Scout Pond. *Water sampling indicates that arsenic levels are sometimes above water quality standards (MDEQ-7). Skin exposure to arsenic is regarded as safe at much higher concentrations than for drinking water. CR Kendall is required to monitor the pond under its permit and will be required to continue monitoring until DEQ determines it is no longer necessary.*
- Several resource areas will not be affected by the No Action, Proposed Action, Process Pad Drainage Pretreatment, or Process Pad Barrier Cover Alternatives and are not evaluated in detail in the EIS. Summaries of why these resources are not considered issues are:
 - Cultural resources: No cultural resource issues have been raised during the life of the mine. *Alternatives being considered would disturb no new acreage. A cultural resources evaluation report was completed for the permit area in 1989 (GCM Services Inc. 1989). Cultural issues were addressed in previous environmental assessments. Cultural resources do not need to be carried forward in the EIS.*
 - Fisheries and aquatics: Fisheries and aquatics were not raised as issues during scoping. *The only fisheries issue identified during mine life concerned a fish kill at the Boy Scout Pond in South Fork Last Chance Creek in May 1989. Montana Fish Wildlife and Parks (FWP) investigated the incident and concluded the fish kill was due to oxygen depletion and that the fish had died before the ice left the pond. Reasons for oxygen depletion were a combination of very low water levels due to previous drought years, and long-lasting ice on the pond. (FWP 1989). No changes in discharge to surface water resources are proposed in Amendment 007. Impacts to fisheries and aquatics will not be carried forward in the analysis.*
 - Threatened and endangered species: No threatened and endangered species have been observed during the baseline surveys or the life of the mine. *CR Kendall attempted to introduce peregrine falcons in the mid-1990s, but the falcons have since left the site. No new disturbances would occur under the*

Proposed Action or either of the Agency-Modified alternatives. No impact to threatened or endangered species habitat would result from implementation of alternatives in this EIS. Impacts to fisheries and aquatics will not be carried forward in the analysis.

- Air quality: No air quality issues were raised during mine operations, or expected to be raised from mine closure. *Dust control would continue as needed throughout the remaining mine closure efforts. Reclamation of the remaining areas and roads would further reduce potential sources of dust. Equipment emissions would be similar to operational levels during reclamation activities, but would cease when reclamation was completed. Impacts to air quality will not be carried forward in the analysis.*

Socioeconomics: Socioeconomics was not raised as an issue during scoping. Socioeconomic impacts were evaluated when the mine was permitted and in the Environmental Analysis of Revised Bond Calculations (DEQ 2000). No new socioeconomic impacts would result from the actions of Amendment 007. Impacts to socioeconomics will not be carried forward in the analysis.

Aesthetics: Aesthetic issues were addressed when the mine was permitted. No new disturbances would occur under Amendment 007. Impacts to aesthetics will not be carried forward in the analysis.

Description of Alternatives

2.1 Introduction

The No Action Alternative reflects the current, approved plan and is a benchmark against which the Proposed Action and other alternatives can be evaluated. For this analysis, the No Action Alternative is CR Kendall's Operating Permit 00122 and the previously approved amendments (through Amendment 006) and minor revisions, including Minor Revision #05-001 and Minor Revision #11-001.

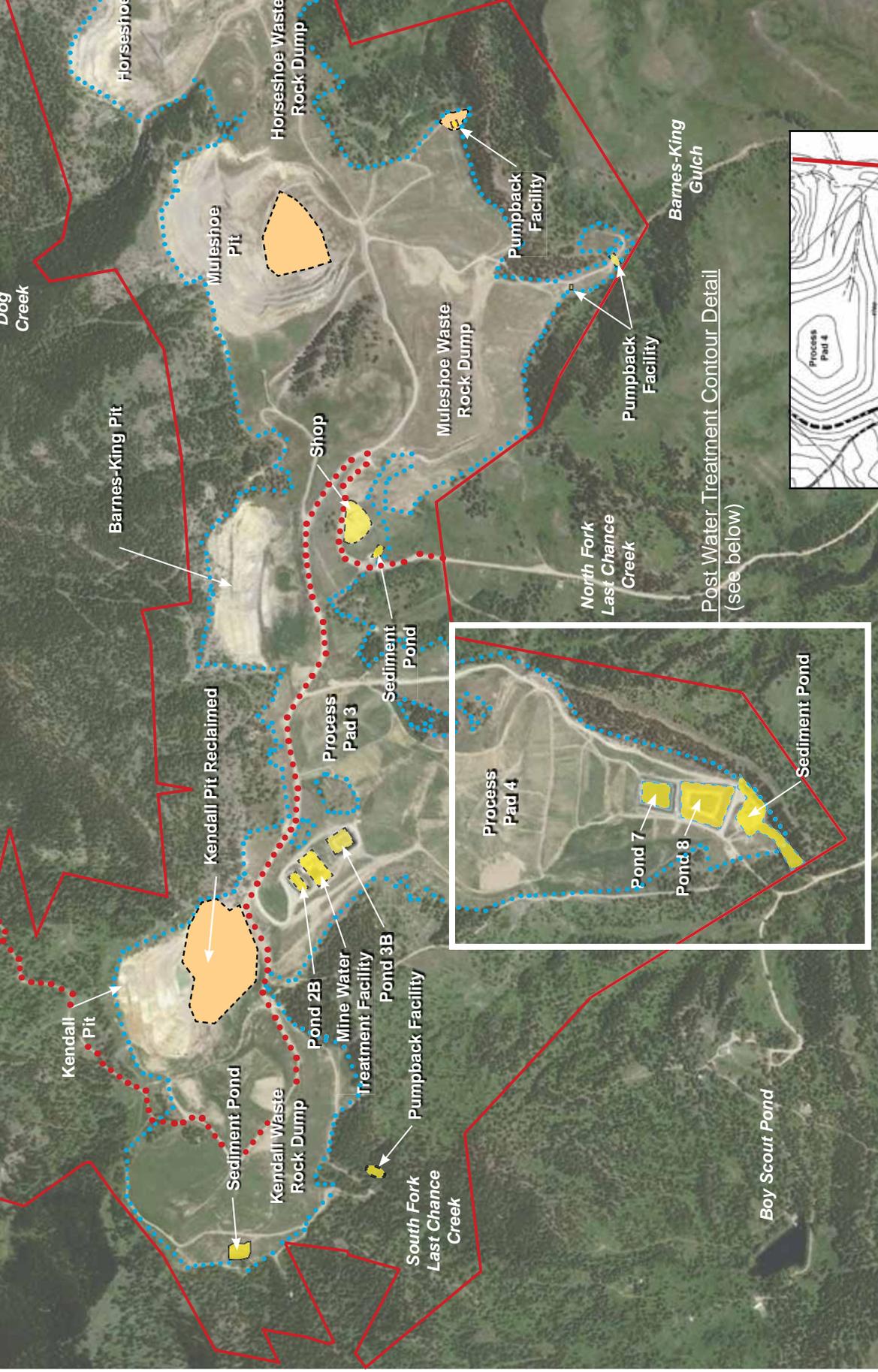
The Proposed Action is the proposed Closure Water Management Plan CR Kendall submitted in their Application for Amendment 007 to Operating Permit No. 00122 (Hydrometrics, Inc. and CR Kendall Corp. 2012). MEPA requires the evaluation of reasonable alternatives to the Proposed Action. Reasonable MEPA alternatives are those that are achievable under current technology (Section 75-1-201(1)(b)(iv)(C)(I), MCA) and are economically feasible as determined solely by the economic viability for similar projects having similar conditions and physical locations and determined without regard to the economic strength of the specific project sponsor (Section 75-1-201(b)(iv)(C)(I), MCA). Two Agency-Modified alternatives were developed that include measures to mitigate specific environmental impacts from the Proposed Action. **Table 2-1** has a detailed comparison of the components and activities for the No Action Alternative, Proposed Action, and the two Agency-Modified alternatives.

Additional alternatives were considered, but were determined to be not reasonable and were eliminated from further study. These alternatives and the rationale for dismissing them are discussed in Section 2.5.

Because the mine is in closure and the proposed Operating Permit Amendment 007 is primarily limited to water treatment, consideration of the need for Agency-Modified alternatives was based on how well the components met the Purpose and Need outlined in Chapter 1 (Section 1.2).

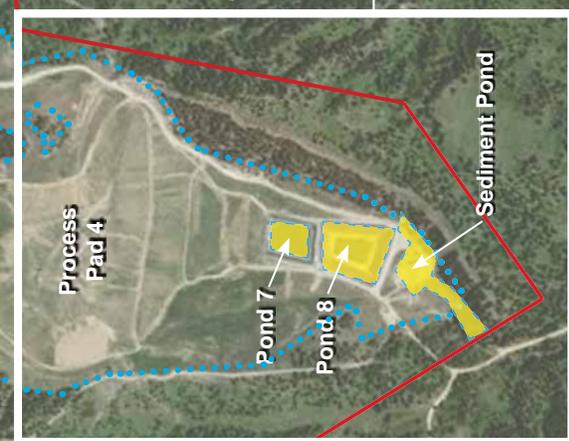
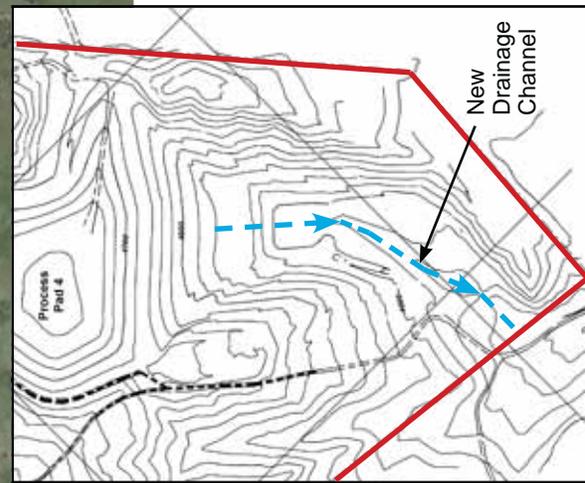
2.2 No Action Alternative

For this EIS, the 1989 Plan of Operations (Kendall Venture and Hydrometrics 1989, Revised 1995), Soils and Revegetation Plan (Shafer and Associates 1995), and the pumpback and water treatment plans and monitoring are considered to be the No Action Alternative. The main features of the No Action Alternative are shown on **Figure 2-1** and the pumpback and water treatment components are shown on **Figure 2-2**.



LEGEND

- Permit Boundary
- ⋯ Permitted Disturbance Boundary
- ⋯ BLM Road to Remain - All Other Roads To Be Ripped, Regraded & Reclaimed (see Figure 2-3)
- Additional Revegetation Needed
- All Facilities To Be Removed & Reclaimed (includes: buildings, ponds, process pads,



ge water is not actively
ted in Pond 7 and land
ing season. Annual
ter installing caps (2009
m 11.3 gpm to 20.5 gpm,
13.7 gpm.

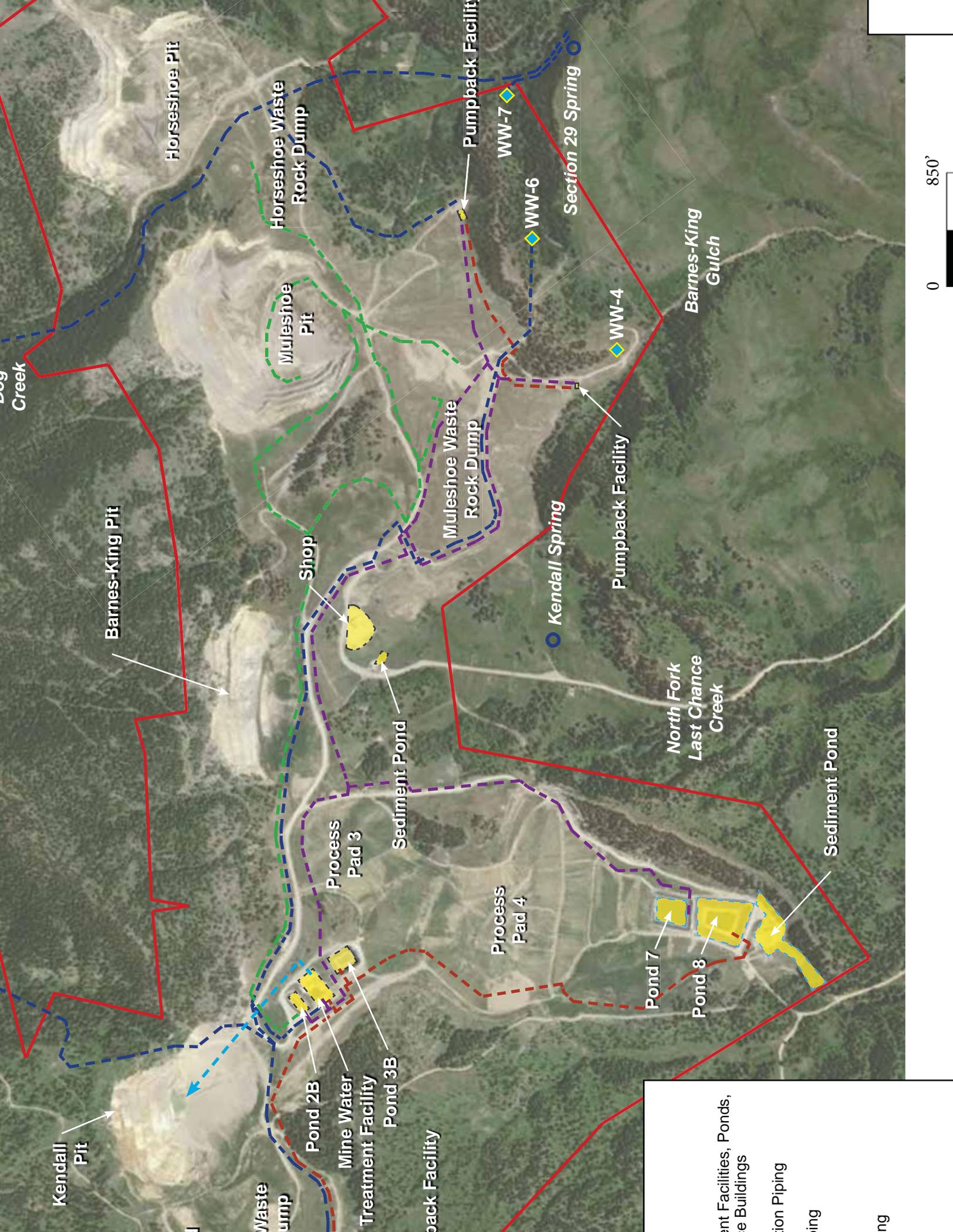
oes not meet water
umped back from
ance Creek (KVPB-5)
lley Underdrain (TMW-
alley Ponds 2B and 3B,
olite adsorption before
groundwater through
underwater pumped back
KVPB-2) and Little
3) is land applied in the
herwise, groundwater is
mpback and discharge
assumed to continue for

ads until capped in 2012.
n site and stored in the

regraded to 3:1 slopes
s every 100 feet in 2004
ations). A modified water-
installed in 2008 and
17 inches of growth media
soil basal layer material
3 percent bentonite, over
basal layer material
001). Process pads were
perforated by drilling to
eliminate water ponding
ations).

he Kendall Pit were
Minor Revision 06-001).
to 10 inches of soil on
less than 2:1 slopes and
een completed. The lower
hoe Pit were backfilled
n soil. Revegetation has
up to 20 years), but is
y in the Muleshoe Pit.

ing the WTP) will be
when reclamation is
an of Operations). All
lled or graded to drain
red with soil and reseeded
is no longer required.



Kendall Pit

Barnes-King Pit

Horseshoe Pit

Waste Dump

Pond 2B

Mine Water Treatment Facility

Pond 3B

Pumpback Facility

Process Pad 3

Sediment Pond

Process Pad 4

Pond 7

Pond 8

Sediment Pond

Muleshoe Pit

Horseshoe Waste Rock Dump

Muleshoe Waste Rock Dump

Shop

Kendall Spring

Pumpback Facility

WW-4

WW-7

WW-6

Section 29 Spring

North Fork Last Chance Creek

Barnes-King Gulch

ent Facilities, Ponds,
e Buildings
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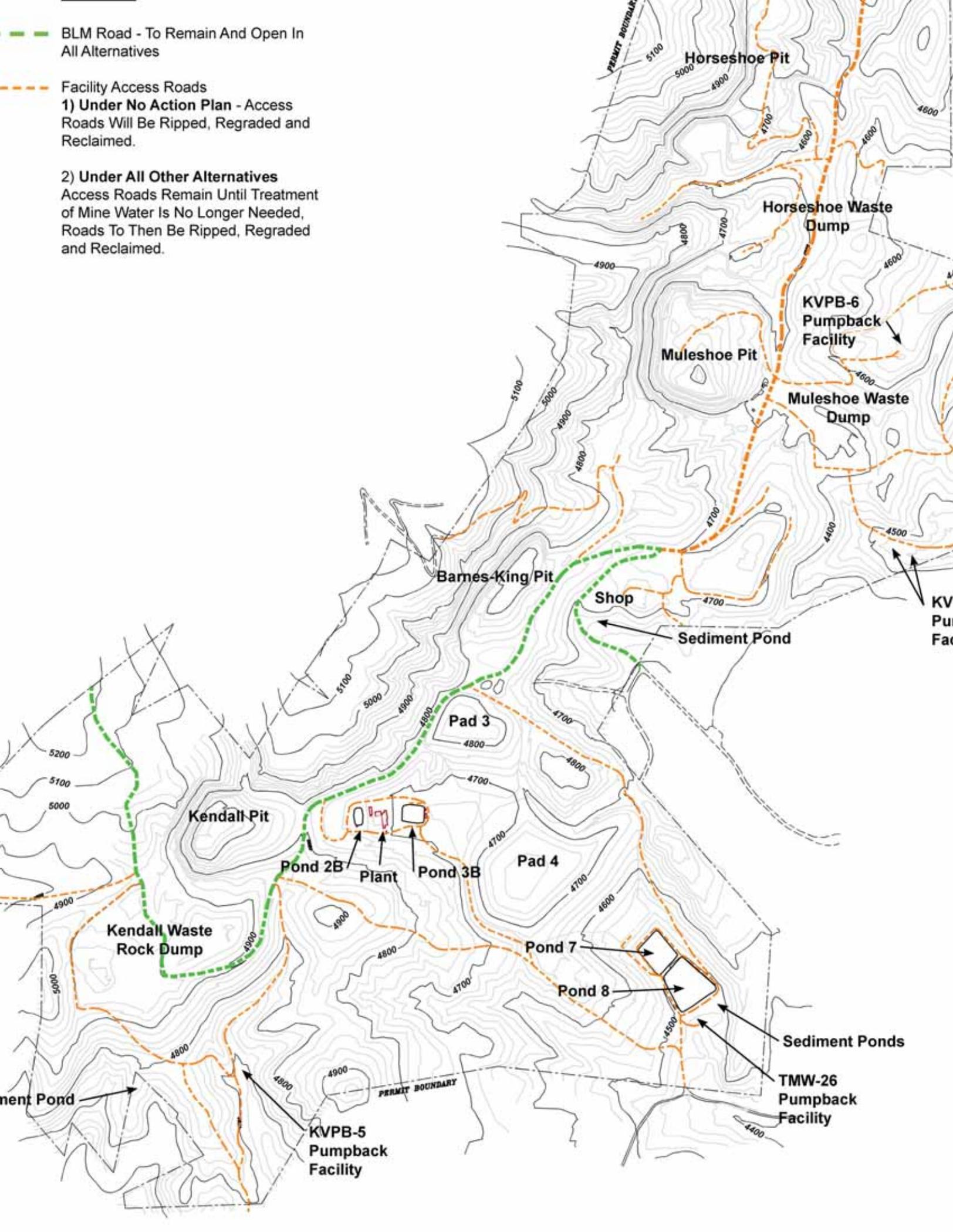
0 850'

The No Action Alternative reflects the current CR Kendall Mine operations under Operating Permit 00122, including six Amendments (**Table 1-2**) and 23 minor revisions up through Minor Revision 11-001. Most reclamation activities under the permit have been completed. Major disturbed areas have been reclaimed, including the Horseshoe Pit and Horseshoe Waste Rock Dump; Muleshoe Waste Rock Dump; Barnes-King Pit; Kendall Waste Rock Dump, and most of the Kendall and Muleshoe Pits. Minor Revision 11-001 was approved in 2011 and allowed CR Kendall to place a 17-inch layer of growth media directly over the basal layer on process pads 3 and 4 as an interim reclamation measure. As a condition for the approval of Minor Revision 11-001, CR Kendall was required to submit additional reclamation bond to DEQ to cover the costs of removing the growth media if this capping of the process pads was not approved in the final reclamation closure plan or was otherwise modified.

CR Kendall previously submitted an MPDES permit application to DEQ which would have resulted in authorization to discharge to surface water. A public hearing was held in Lewistown in 1998 concerning the draft MPDES permit and many people testified that they were opposed to DEQ issuing an authorization to discharge to CR Kendall. Subsequently, the issue of stream dewatering associated with pumpback of mine water was addressed through other means of augmenting stream flow. DEQ issued Administrative Order WQ-98-06 in September 1998 which directed CR Kendall to augment stream flows to replace water intercepted by the pumpback systems. Water was pumped from water supply wells for which CR Kendall held water rights. Later, when CR Kendall obtained the appropriate water rights and easements, water from springs upgradient of the mine was piped to locations downgradient of the mine. Water from the intercepted springs would normally infiltrate into the Madison Limestone above the mine site, so this water would not have contributed to stream flow or supply shallow aquifers below the mine site, which was a potential concern if CR Kendall had continued prior practices of augmenting streamflow via pumping from water supply wells.

WQ-98-06 also required CR Kendall to submit a compliance plan and propose interim water quality standards. The Department can authorize interim water quality standards under an administrative order. The interim standards were approved by the Department in a July 19, 1999 letter. CR Kendall applied for an MPDES permit, but a permit was never issued as the discharges to surface water were eliminated by the pumpback systems.

Other mine facilities will be retained until water treatment is no longer needed, including pumps and piping; ponds 2B, 3B, 7, and 8; stormwater controls; water treatment and maintenance facilities; roads; power lines; and land application disposal (LAD) facilities. The BLM road and mine facility roads are shown on **Figure 2-3**. The remaining and ongoing reclamation components addressed under this amendment include:



Process pads drainage water capture and LAD – The drainage from process pads 3 and 4 is currently captured but not actively treated. It is collected in Pond 7 and land applied during the growing season. The combined average flow rate is 13.7 gpm.

Captured groundwater pumpback treatment – CR Kendall initiated pumpback of contaminated water from 4 locations in June of 1996. Captured groundwater not meeting groundwater standards is land applied or pumped back to the central WTP, filtered to remove particulate, and treated with zeolite adsorption to remove thallium and then discharged to groundwater through the Kendall Pit. The combined flow rate from the four pumpback systems has ranged from 33 gpm to 125 gpm over the last 18 years (1997 to 2014). The groundwater captured from Barnes-King Gulch and Little Dog Creek is directly land applied during the growing season, or pumped and stored in Ponds 7 and 8 for LAD during the growing season. Spent zeolites are retained on site and stored in the truck shop.

Process pad underliner – The underliners would be perforated by drilling to the underdrain to eliminate water ponding.

Soil placement on slopes in Kendall and Muleshoe Pits – 8 to 10 inches of soil would be placed on regraded slopes in the Kendall Pit and poorly vegetated areas in the Muleshoe Pit and the areas reseeded.

Building removal – All buildings (including water treatment) would be removed at closure when reclamation is completed.

Soil stockpile use – All soil stockpiles would be used for reclamation.

Pond Reclamation – All ponds would be maintained for pumpback storage until groundwater quality standards are met and the need for treatment has been eliminated. After completing water treatment, the ponds would be reclaimed. On a case by case basis, reclamation plans for lined ponds will depend on whether the pond contains solids with the potential to leach thallium, arsenic, or other pollutants. Liners would be cut, folded into the pond bottoms, and buried with clean fill. Additional liner would be placed over the top to preclude infiltration into the material. The pond sites would then be regraded, soil placed on surfaces, and reseeded unless DEQ approves retaining the pond per landowner request (as long as a post-mining land use is identified and water quality is protected).

2.3 Proposed Action

The Proposed Action consists of the Amended Closure Water Management Plan in CR Kendall's application to amend its operating permit (Hydrometrics & CR Kendall Corp. 2012). It primarily addresses the long-term water treatment of the process pad drainage and captured groundwater. The alternative would retain the installed vegetated soil cover authorized under Minor Revision 11-001 and outlines reclamation monitoring

and maintenance activities. The main features of the Proposed Action are shown on **Figure 2-4**. The specific items different from the No Action Alternative are:

Process Pad Drainage Treatment– Drainage water would be captured, combined with other waters, filtered to remove particulate, treated with zeolite adsorption to remove thallium, and discharged to groundwater through the Kendall Pit. The option for LAD during the growing season is retained as a contingency. The volume of spent zeolites generated annually is estimated to be 0.1% of the storage capacity in pond 7.

Groundwater Capture Pumpback Systems – All captured water would be combined with process pad drainage water in ponds 7 and 8, filtered to remove particulate, treated to remove thallium, and discharged to groundwater through the Kendall Pit or the Muleshoe Pit. LAD during the growing season would be retained as a contingency.

Process Pad Underliner – The integrity of the liner would be maintained to route drainage water to ponds 7 and 8 for water treatment for as long as needed. Liners would be replaced as necessary. After the cessation of mine water treatment, the drainage water would either be discharged to the Kendall Pit without treatment or discharged as Mason Canyon surface water after treatment.

Soil Placement on slopes in Kendall and Muleshoe Pits – No additional growth media (soil) would be placed on the regraded areas of the Kendall Pit with slopes less than 2:1 or the lower slopes in the Muleshoe Pit with poor vegetation establishment.

Building Removal – Most buildings would remain for private use after closure.

Pond Reclamation – All ponds would be maintained for pumpback storage until groundwater quality standards are met and the need for treatment has been eliminated. After completing water treatment, the ponds would be reclaimed. On a case by case basis, reclamation plans for lined ponds will depend on whether the pond contains solids with the potential to leach thallium, arsenic, or other pollutants. Liners in Pond 7 would be folded over the zeolite and a free-flowing drainage established that would discharge to surface water in Mason Canyon. Liners in all other ponds would be cut, folded into the pond bottoms, and buried with clean fill. The pond sites would then be regraded, soil placed on surfaces, and reseeded unless DEQ approves retaining the pond per landowner request (as long as a post-mining land use is identified and water quality is protected). Additional liner would be placed over the top to preclude infiltration into the material.



LEGEND

- Permit Boundary
- ⋯ Permitted Disturbance Boundary
- ⋯ Main BLM Road to Remain - All Other Mine Facility Roads To Remain and Maintained Until Water Treatment Is No Longer Required (see Figure 2-3)
- Facilities To Remain Intact After Closure Until Water Treatment Is No Longer Required
- Buildings To Remain For Private Use

...ge water would be ...d with other mine waters, ... particulate, treated by ... and discharged to the ... could be retained as ... al during the growing

...water would be combined ... drainage water in Ponds ... remove particulate, ... olite adsorption before ... o groundwater through ... D would be retained as ... al during the growing ... and discharge to the ... med to continue for 100

... If zeolite generation is ... ated, could transport off- ... a Class II or III landfill, or ... built, on-site repository. ... ds would comply with ... e regulations.

... integrity for drainage ... Ponds 7 and 8.

... mpleted in 2006) in ... additional soil placed on ... Muleshoe Pits. Reseed ... growth on the lower slopes ... mix and amend the areas ... an agency-approved ... it, if equipment can safely ... e pit bottoms.

... remain after closure ... or water treatment is no ... ponds will be backfilled or ... t the areas covered with

... until no longer needed ... r treatment. After water ... rger needed, all roads ... LM right of way.

Reclamation Seeding – Seed mixes and seeding methods would be modified based on actual techniques and successful revegetation practices used to date.

Soil Stockpile Use – Some of the soil stockpiles would be used for maintenance of reclaimed areas and for final reclamation of ponds, buildings, and maintenance roads.

2.4 Agency-Modified Alternatives

DEQ developed two Agency-Modified alternatives (Process Pad Drainage Pretreatment Alternative and Process Pad Barrier Cover Alternative) to address issues associated with:

1. Arsenic and possibly other contaminants that may be above groundwater quality standards in the drainage water after treatment through zeolite adsorption alone, and
2. Reducing the volume of process pad drainage water that contains contaminants that require treatment (arsenic and thallium).

CR Kendall is responsible for identifying treatment methods that would meet effluent limits established by DEQ. For the purposes of the effects analysis, DEQ assumes that CR Kendall would use an adsorptive media treatment option specifically for the CR Kendall process pad drainage water to effectively remove arsenic.

To address the elevated arsenic levels and possible other constituents above groundwater quality standards in the drainage water, DEQ developed the Process Water Pretreatment Alternative that would include an additional treatment process. The Process Pad Barrier Cover Alternative was developed to minimize the volume of process pad drainage that would require long term treatment. The addition of a barrier liner would involve removing the current growth media cover, installing a textured barrier liner on the process pads, and replacing the salvaged soil. Pretreatment for arsenic is achievable under current technology, and is economically feasible as demonstrated by other mining operations that currently treat for arsenic.

The placement of soil from stockpile TS-13a (**Figure 2-1**) onto the Kendall and Muleshoe Pit slopes and reseeded the areas was a component included in both Agency-Modified alternatives. The two Agency-Modified alternatives are described in more detail below.

Removal of water treatment facilities in the buildings and the LAD system would be required when water treatment is no longer needed.

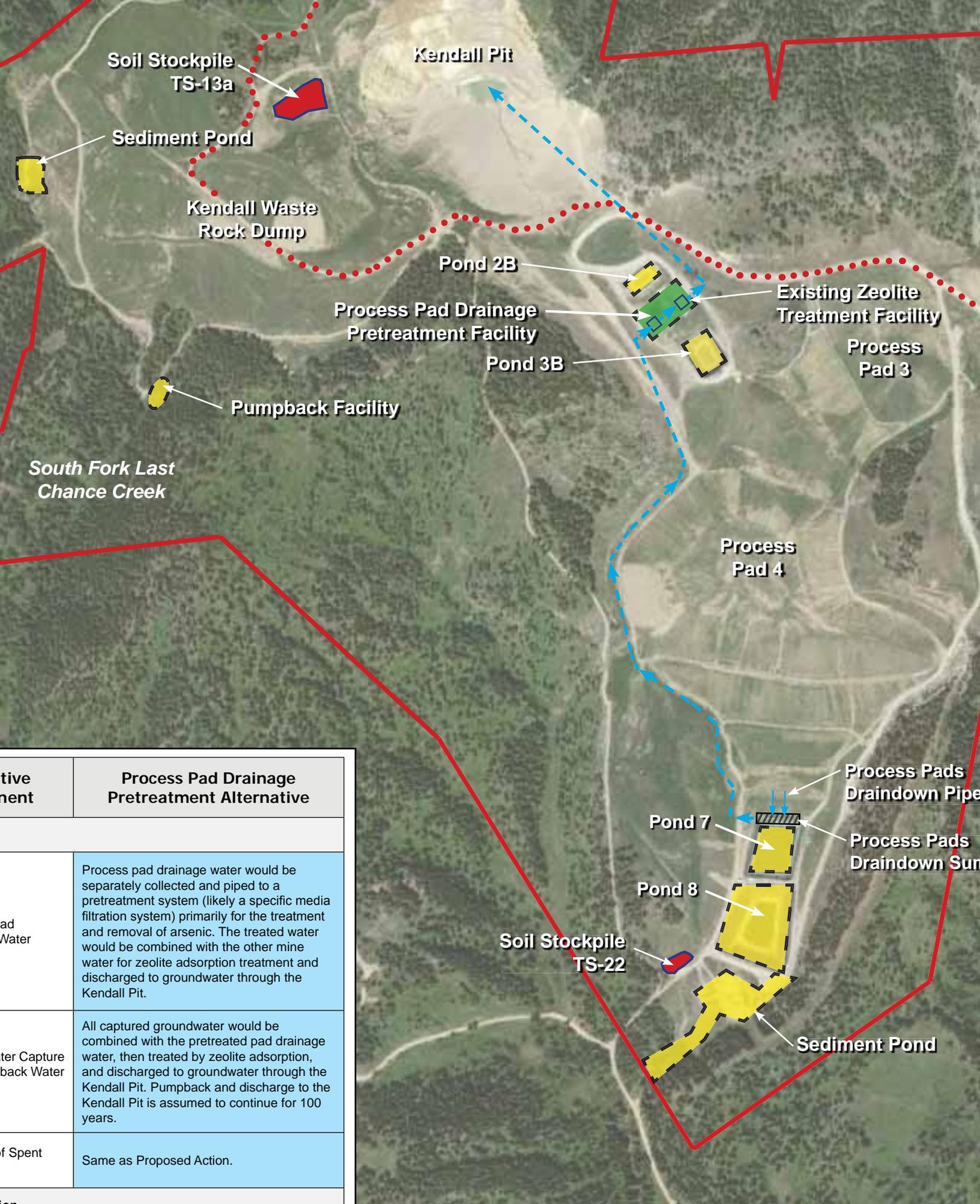
2.4.1 Process Pad Drainage Pretreatment Alternative

This alternative was modified between the draft and final EIS based on comments from CR Kendall. Originally, soil remaining in TS-13a was to be placed on regraded slopes in the Kendall Pit and on the lower slopes of the Muleshoe Pit, then reseeded. Review of the stockpile volumes that exist on the site and the acres needing reclamation at closure indicate the majority of TS-13a would be needed to reclaim more important disturbed areas. However, some areas with limited growth on the lower slopes of the Kendall and Muleshoe Pits would be reseeded with modified seed mix and the areas amended after seeding with an agency-approved organic amendment, if equipment can safely be mobilized into the pit bottoms.

Process Pad Drainage Pretreatment – A separate piping system would collect the drainage water from process pads 3 and 4 for pretreatment prior to blending the drainage water with other mine waters. Arsenic is one of the contaminants in the process pad drainage water, and is projected to exceed groundwater standards even after waters are combined. The pretreatment system could remove other contaminant constituents, if necessary to comply with discharge criteria. The pretreatment system would likely be developed specifically for the CR Kendall process pad drainage water to effectively remove arsenic. A conceptual diagram and flow chart of a possible pretreatment method for the process pad drainage water is on **Figure 2-5**.

The likely pretreatment system for arsenic would use an adsorptive media option compared to a ferric coagulant addition. Adsorptive media would generate a spent media that is contained in vessels and would likely pass TCLP testing for arsenic. If an iron-based ferric oxide adsorption media were used, it would have lower operational costs compared to other arsenic-removal adsorptive media such as titanium-oxide or alumina-based media. A technical memo was prepared with estimated costs for a generalized adsorptive media pretreatment system for flow rates of 14 gpm and 30 gpm (Appendix B; Tetra Tech 2015). The spent adsorptive media, if classified as non-hazardous waste, could be disposed of onsite, but CR Kendall may choose offsite disposal. CR Kendall may submit treatment system designs other than the adsorptive media pretreatment system described above, which DEQ would evaluate for consistency with the impacts disclosed in the EIS or conduct further MEPA review.

After pretreatment, the water would be combined with the other captured groundwater for thallium removal through the current method of zeolite adsorption. The spent zeolites would be disposed of in Pond 7, where additional adsorption of thallium and other contaminants may occur (same as Proposed Action). Treated water would be discharged to groundwater through the Kendall Pit. The land application system would still be available for use, but only if necessary to prevent direct discharges to surface water in response to extreme precipitation events. The infrequent use of LAD during such times is not anticipated to cause additional impacts to soils and vegetation.



| Alternative | Process Pad Drainage Pretreatment Alternative |
|------------------------------|---|
| | |
| Pad Water | Process pad drainage water would be separately collected and piped to a pretreatment system (likely a specific media filtration system) primarily for the treatment and removal of arsenic. The treated water would be combined with the other mine water for zeolite adsorption treatment and discharged to groundwater through the Kendall Pit. |
| Water Capture Pumpback Water | All captured groundwater would be combined with the pretreated pad drainage water, then treated by zeolite adsorption, and discharged to groundwater through the Kendall Pit. Pumpback and discharge to the Kendall Pit is assumed to continue for 100 years. |
| Cost Spent | Same as Proposed Action. |
| Other Information | |
| Roads Construction Design | Same as No Action. |

LEGEND

— Permit Boundary

CR Kendall may submit a treatment system design other than the treatment system described above, which DEQ would evaluate for consistency with the impacts disclosed in the EIS. If the treatment system design submitted by CR Kendall may result in materially different impacts than disclosed in this EIS, DEQ will conduct further MEPA review.

New water treatment equipment would be required to pretreat the process pad drainage water. The annual average flow rate after installing the current process pads caps (2009 to 2014) ranged from 11.3 gpm to 20.5 gpm, with an average rate of 13.7 gpm.

The specific process water pretreatment technology chosen by CR Kendall to remove arsenic could generate a contaminated treatment media, or byproduct, that requires proper disposal. Because the specific technology has not been chosen or designed, this alternative assumes proper disposal options for the contaminated treatment media would be to: (1) ship it back to the manufacturer when exhausted; (2) ship it offsite for disposal; or (3) bury it onsite if confirmed as non-hazardous. Potential environmental impacts from these disposal options would range from some additional fuel consumption and air quality impacts for options 1 and 2, to temporary impacts to vegetation and soils for onsite disposal. For impact assessment purposes, the volume of spent granular ferric oxide adsorption treatment media generated from pretreating 15 gpm of process pad drainage water was estimated at 40 to 50 cubic feet per year.

Groundwater Capture Pumpback System – This system would operate the same as the Proposed Action.

Process Pad Reclamation Design – No major changes from the No Action Alternative or Proposed Action would be needed; some minor regrading and reclamation would be associated with the installation of the new process pad drainage water piping.

Reseeding and Required Seed Mix Modifications – CR Kendall would be required to reseed the lower slopes of the Kendall and Muleshoe pits where there has been limited vegetation growth. Based on past reclamation monitoring and inspections, observations of species naturally reestablishing in these areas, and the recommendations from the June 18, 2008 inspection report (Montana DEQ 2008), the following seed mixes would be required.

Phacelia hastata (Silkyleaf phacelia)
Artemisia ludoviciana (Louisiana sagewort)
Thermopsis rhombifolia (Mountain pea)
Artemisia frigida (Fringed sagewort)
Petalostemon candidum (White prairieclover)
Agropyron spicatum (Bluebunch wheatgrass)
Elymus cinereus (Basin wildrye)

Seed Mix for Rocky Areas:

Silkyleaf phacelia
Louisiana sagewort
Medicago lupulina (Black medic)
Rosa woodsii (Wild rose)
Pinus ponderosa (Ponderosa pine)
Potentilla fruticosa (Shrubby cinquefoil)

Seed Mix for Wet Salty Areas (where land application with reverse osmosis brine has been used):

Atriplex canescens (Fourwing saltbush)
Sporobolus airoides (Alkali sacaton)
Basin wildrye
Agropyron smithii (Western wheatgrass)
Elymus canadensis (Canada wildrye)

CR Kendall will also be required to add an agency-approved organic amendment (such as BIOSOL) to the lower slopes of the Kendall and Muleshoe pits after seeding if the equipment can safely be mobilized into the pit bottoms.

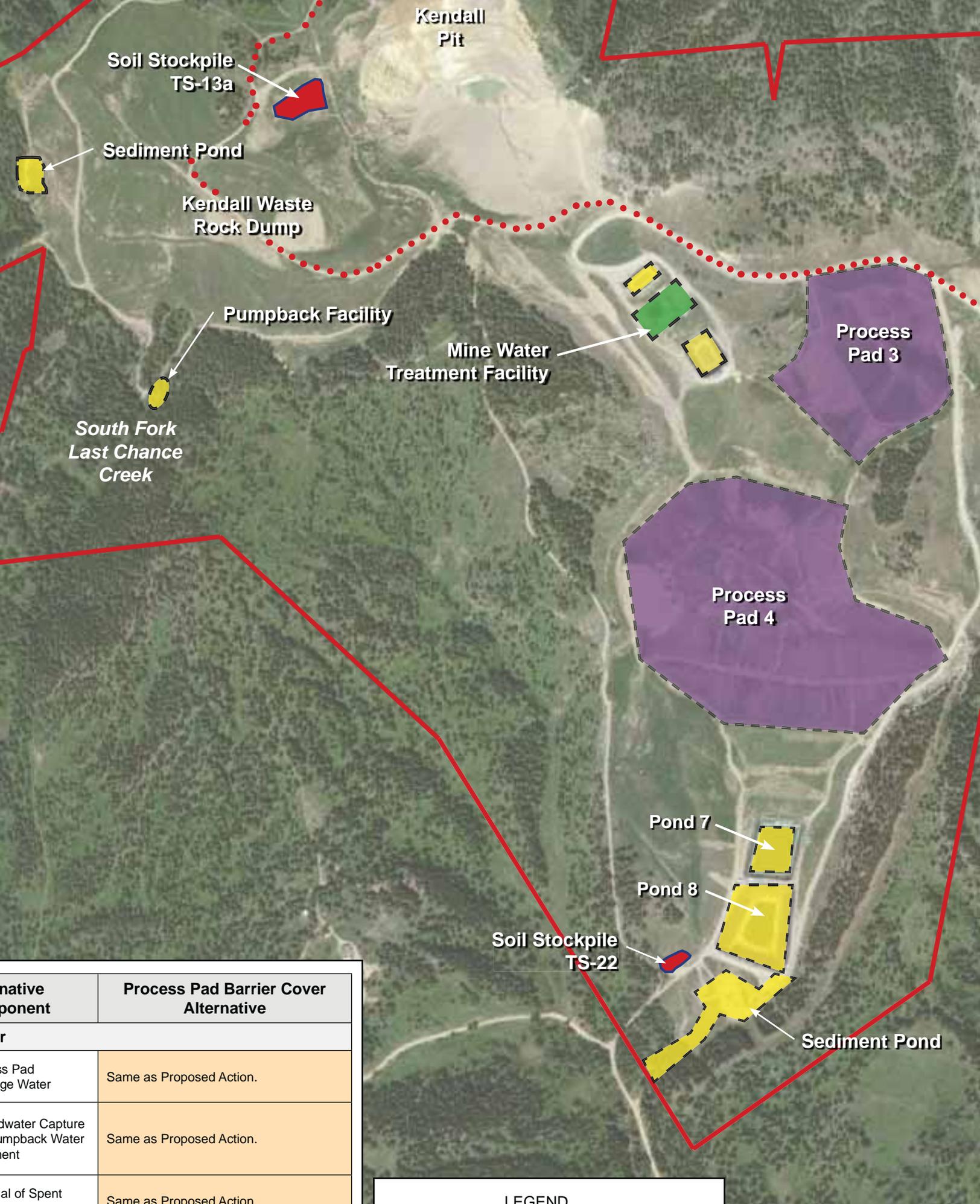
Water Treatment Facilities Removal– The buildings would remain. The LAD system would be removed. Ponds, pipelines, and vessels required for water treatment would be removed from the site when no longer needed.

The other components of this alternative would be the same as the No Action Alternative.

2.4.2 Process Pad Barrier Cover Alternative

The Process Pad Barrier Cover Alternative was developed to minimize the process pad drainage flows that require treatment. Adding a barrier liner to the process pads could effectively reduce drainage water flows. CR Kendall would select the effective cover materials to use, however DEQ would have final review and approval. DEQ would require the barrier liner be of HDPE or a similar product rather than a geosynthetic clay liner (GCL). The current 17 inches of soil would be temporarily removed and a geomembrane liner installed. The geomembrane liner would consist of a textured HDPE liner overlaid with a geocomposite drainage net. The salvaged soil would be replaced over the geomembrane liner and the process pads reseeded. A conceptual diagram showing the main components of this alternative is on **Figure 2-6**. A cross-sectional diagram showing the vertical components of the process pads barrier cover is on **Figure 2-7**. Specific aspects of this alternative are:

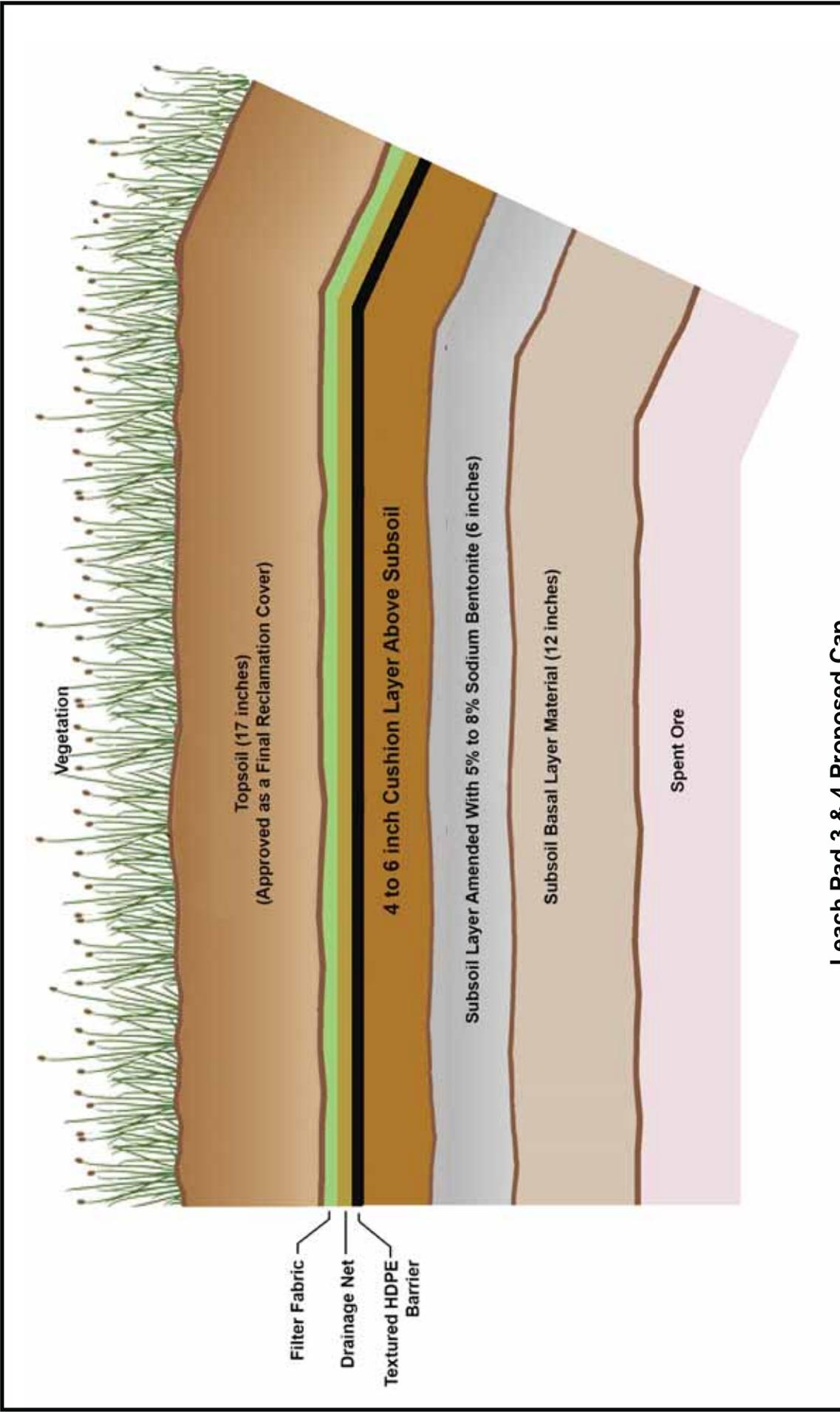
Process Pad Drainage Pretreatment – These components would be the same as the Proposed Action, with the process pad drainage combined with the captured



| Alternative Component | Process Pad Barrier Cover Alternative |
|--|---------------------------------------|
| Process Pad Edge Water | Same as Proposed Action. |
| Groundwater Capture Pumpback Water Treatment | Same as Proposed Action. |
| Material of Spent Solids | Same as Proposed Action. |
| Information | |

LEGEND

- Permit Boundary
- Main BLM Road to Remain - All Other



Leach Pad 3 & 4 Proposed Cap

Not To Scale

Figure 2-7
CR Kendall Mine
Process Pad Barrier Cover Alternative
Cross-Sectional Diagram Of Single
Barrier Liner

NOTE:
HDPE = High Density Polyethylene

groundwater system water at a central WTP, filtered to remove particulate, treated by zeolite adsorption, and discharged to groundwater through the Kendall Pit.

Groundwater Capture Pumpback Systems – These components would be the same as the Proposed Action.

Process Pad Reclamation Design – CR Kendall would remove the upper 17 inches of growth media (soil) and vegetation from process pads 3 and 4. A barrier cover cap, consisting of a textured HDPE liner and geocomposite drainage net, would be installed on top of the existing 6 inches of subsoil basal layer material amended with 5 to 8 percent sodium bentonite, over 12 inches of subsoil basal layer material. The approximate 17 inches of growth media would then be replaced on the geomembrane liner and the area reseeded with an approved reclamation grass mixture. A textured PVC or HDPE material would be needed to reduce slipping and movement of the soil on the barrier cover cap.

Reseeding and Required Seed Mix Modifications – This component would be the same as the Process Pad Drainage Pretreatment where CR Kendall would be required to reseed the lower slopes of the Kendall and Muleshoe pits where there has been limited vegetation growth. CR Kendall may also be asked to add an agency-approved organic amendment (such as BIOSOL) to the lower slopes of the Kendall and Muleshoe pits after seeding if the equipment can safely be mobilized into the pit bottoms.

Water Treatment Facilities Removal – The same action as for the Process Pad Drainage Pretreatment Alternative.

The other components of this alternative would be the same as the No Action Alternative.

2.5 Alternatives Considered But Dismissed

Additional alternatives were considered and evaluated. Those dismissed from detailed consideration are explained below.

2.5.1 Process Pad Removal

Scoping comments suggested that spent ore from the process pads should be removed. Removed spent ore would need to be placed somewhere. The most logical sites would be to backfill into the mine pits, including the Kendall, Barnes-King, and portions of Muleshoe pits.

This alternative was not considered further because moving the spent ore containing remnant cyanide solution and elevated concentrations of leachable metalloids, into the pits would require the pits to be lined and a seepage collection system installed (much like the process pads). Installing a liner would require 3:1 slopes to maintain stability of

the liners, which would be achieved through placement of waste rock and a cushion layer of finer material of subsoil or historical tailings. Appropriately-sized subsoil with low leaching potential is limited onsite and using it for the cushion material or to achieve desired slopes beneath the lower liner would be an inefficient use of resources.

The relocation of spent ore does not solve any specific problem. The spent ore would still have to be isolated to minimize infiltration of meteoric water and subsequent groundwater contamination. The concerns associated with the spent ore would simply be moved from one site to another.

Inspection reports in 2004 documented the liner under the process pads was in good condition and that all the spent ore was on the liner (Womack and Associates 2004). Stakeholders concurred there would be no beneficial reason to move the spent ore from the pads (CDM 2004b).

2.5.2 Waste Isolation in Mine Pits

A suggestion was made to isolate the waste rock in mine pits with liners and covers.

This alternative was not considered in detail because the pits could not hold all of the waste rock. Liners and a soil cover would be needed to eliminate water infiltrating into the waste rock. The capping systems on the waste rock dumps, currently well vegetated, would have to be removed and used to cap the new pit disposal sites. There is not enough suitable soil available to cover waste rock dump areas and the new pit disposal sites. There would be at least a temporary increase in erosion until the vegetation was reestablished. This disturbance would cause additional and renewed flushing of metalloids in addition to the flushing of metalloids from the remaining excess waste rock that could not be placed in pits.

The pits are currently providing raptor and bat habitat, which would be eliminated in this alternative. CR Kendall is currently meeting groundwater standards so there is no benefit from disturbing the waste rock dumps again. This measure would not eliminate the current pumpback systems.

2.5.3 GCL Cover on Process Pads

GCLs contain a thin layer of sodium-saturated bentonite clay, create a layer with a low hydraulic conductivity, and can be self-healing if there is a puncture. The performance of a GCL cover is dependent on proper installation in an appropriate environment (EPA 2001). A GCL-type cover system could be used as a barrier cover for the process pads and would require:

- Removing the existing 17 inches of plant growth media from the surface of the process pads,

- Regrading the top 6 inches of subsoil basal layer material amended with 5 to 8 percent sodium bentonite to provide a lower cushion layer,
- Installing a drainage net with non-woven fiber on both sides,
- Installing the GCL,
- Spreading a 6-inch upper cushion layer of soil or borrow material with low thallium levels screened to less than ½-inch particle size to protect the GCL,
- Reapplying the approximately 17 inches of the salvaged growth media to the top of the process pads, and
- Reseeding the disturbed areas.

The presence of calcium in infiltration water can reduce the expansive properties of the clay and lead to higher hydraulic conductivities because the sodium in the bentonite will be replaced by calcium. CR Kendall Mine soils are naturally high in calcium because much of the soils developed from limestone parent materials. Thus, limiting contact of calcium-rich water with the GCL at this mine would not be possible.

GCLs are often not as effective in cold climates where freezing and thawing cycles can desiccate and cause cracks in the GCL causing higher hydraulic conductivities (EPA 2001).

2.5.4 Other Water Treatment and Water Discharge Alternatives

2.5.4.1 Biological Treatment – Active or Passive

Use of active or passive biological treatment methods was dismissed because past systems failed to work effectively to remove contaminants (Golder Associates 2006). Three different, small passive systems were tested and failed to work satisfactorily for removing thallium and other metals from the Barnes-King captured groundwater (KVSW-2). Biological treatment systems would not be reliable during colder temperatures. Unless a groundwater collection and pumping system is included, each drainage would need to have its own gravity-fed treatment system, requiring higher maintenance. Space below the waste rock dumps is limited in most drainages.

2.5.4.2 Reverse Osmosis (RO) Treatment

RO with Brine Disposal Onsite. RO is a frequently used water treatment system. This method was tried at the CR Kendall Mine site for 2 years but the resulting water quality did not meet the standard for thallium, consequently zeolite treatment would still be required. Additionally, RO systems have high energy requirements. Onsite RO brine storage and disposal would require constructing a new lined repository for permanent storage. Brine would need to be evaporated onsite to reduce the volume required for

storage. The use of an evaporator or crystallizer would require additional time and more energy.

RO with Brine Disposal Offsite. Offsite disposal of RO brine would increase impacts from truck traffic and use more fuel, as the nearest licensed disposal facility for brine is in Idaho. Liquid waste cannot be disposed of in a solid waste landfill, so evaporation or crystallization would also be necessary.

2.5.4.3 Sulfide Precipitation through Chemical Addition

It has been suggested that thallium could be precipitated out of the water with the addition of chemicals. Bench-scale tests were done before 1996; (1) using a pH adjustment and addition of sodium sulfide, (2) addition of trimercaptan product TMT-15, and 3) treatment with permanganate.

This alternative was not considered further because none of the bench-scale tests showed that thallium would be removed to a level that would meet water quality standards (Hydrometrics, Inc. 1996). Thallium levels were reduced, but it is likely that additional treatment would be necessary to remove hydrogen sulfide that would be created in the process. This alternative would require high chemical usage and sludge disposal.

2.6 Related Future Actions

Related future actions are those related to the Proposed Action by location or type. For future actions, an agency need only evaluate those actions under concurrent consideration by any state agency, specifically state agency actions through pre-impact statement studies, separate impact statement evaluation, or permit process procedures.

Because of the limited extent of the project effects, the CR Kendall Mine DEQ permit area is used as the effects analysis area for all resources evaluations. Based on the MEPA model rules definition, there are no related future actions in the CR Kendall Mine DEQ permit area.

Affected Environment and Environmental Consequences

Information in this chapter describes the relevant resource components of the existing environment. Only resources that could be affected by the alternatives are described. They are: geology and minerals; surface and groundwater; soils, vegetation, and reclamation; and wildlife. After the environment of each resource is described, the impacts of the No Action Alternative, Proposed Action, Process Pad Drainage Pretreatment Alternative, and Process Pad Barrier Cover Alternative are discussed.

3.1 Location Description and Study Area

The project location and associated study area for the mine include all lands and resources in the mine permit area, plus those additional areas identified by technical disciplines as "resource analysis areas" that are beyond the mine permit area. Resource analysis areas are identified for each technical discipline. Additional information on analysis areas is in Chapter 4. By definition, the resource analysis areas that extend beyond the mine permit boundary are included in the "study area" for this EIS.

3.2 Geology and Minerals

A discussion of the geology and mineralization in the mining district is in this section. The stability of the regraded waste rock and process pad slopes is also discussed.

3.2.1 Analysis Area and Methods

The analysis area for geology and minerals is the North Moccasin Mining District including the Horseshoe, Muleshoe, Barnes King, and Kendall pits.

The analysis methods for geology and minerals included reviewing publications of the U.S. Geological Survey and other sources along with their associated geology maps and drawings. Historical mining in the area was summarized by CDM in 2004 and was included in the analysis.

3.2.2 Affected Environment

The geology and mineral deposits of the North and South Moccasin Mountains were evaluated by Lindsey (1982) who describes the area as dominated by Tertiary laccolith intrusions of syenite and quartz monzonite porphyry mantled by older Paleozoic and Mesozoic sedimentary rocks. The Paleozoic and Mesozoic formations are steeply dipping on the flanks of the intrusions with dip angles decreasing away from the mountains. Mineralization at the CR Kendall Mine on the eastern flank of the North Moccasin Mountains was initially exploited in the late 1800s. The primary ore zone was an oxidized and silicified limestone breccia at the top of the Madison Limestone Group emplaced along a north-south trending normal fault (hanging wall on the east). The

Chapter 3 Affected Environment and Environmental Consequences

regional geology map with the boundary of the CR Kendall Mine is provided in **Figure 3-1**.

Gold mineralization in the North Moccasin Mining District is directly related to the intrusion of igneous rocks and associated hydrothermal activity. During and after the emplacement of the syenite porphyry, hydrothermal groundwater flow was directed along existing zones of structural weakness near the top of the Madison Limestone. The Madison Limestone is a complex interbedded group of sedimentary rock formations identified as the Lodgepole Limestone, Mission Canyon Limestone, and Charles Formation members (USGS 1984). The gold ore in the North Moccasin Mining District is in the upper unit of the Madison Limestone (Charles Formation) within interbedded carbonate rock and shale zones and in irregularly distributed dikes. The major historical gold mining activities along the eastern slope of the North Moccasin Mountains involved underground and open-pit mining and cyanide processing. Fergus County was the leading gold producing county in Montana in 1903 and 1904 (Koschmann and Bergendahl 1968).

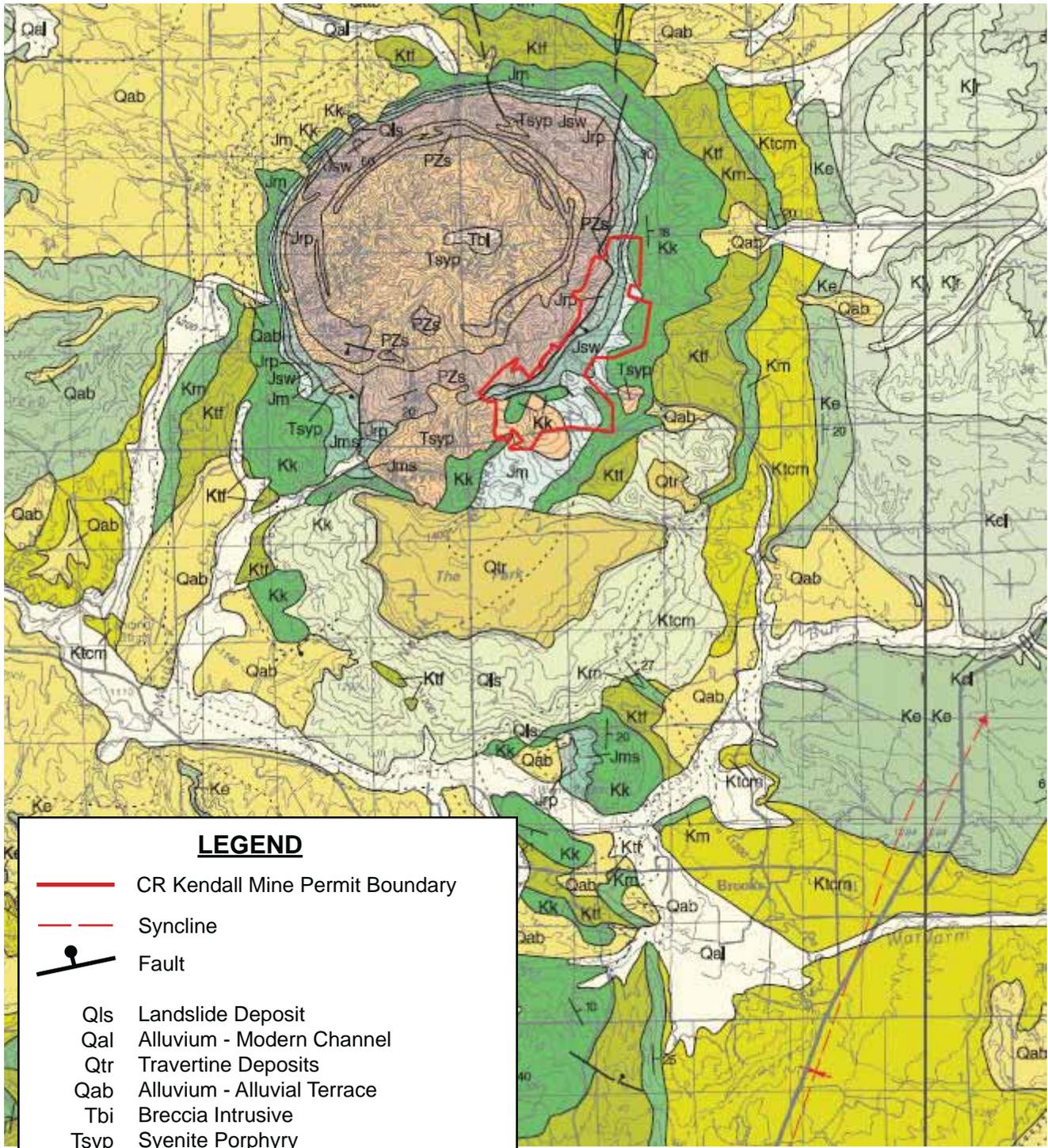
3.2.3 Environmental Consequences

3.2.3.1 No Action Alternative

Active mining ceased in February 1995, with gold recovery continuing through the fall of 1997. The No Action Alternative reflects the current CR Kendall Mine operations and reclamation under Operating Permit 00122, including six Amendments (**Table 1-2**) and minor revisions up through Minor Revision 11-001. The current and proposed activities under the approved reclamation plan are the capture and treatment of process pad drainage water, capture and treatment of alluvial groundwater that does not meet water quality standards, disposal of spent zeolites, augmenting flows in South Fork Last Chance Creek and Little Dog Creek, removing all buildings and reclaiming the disturbances, removing all ponds and reclaiming the sites, reclaiming all mine roads except for the one public access road, and using all stockpiled soil for reclamation.

Additional geotechnical oversight was completed during 2004 for placement of the pad liner extension between process pads 3 and 4 (Womack and Associates 2005b). The work was completed as part of reclamation associated with the CR Kendall Mine closure. The pad extension construction was in accordance with plans and specifications under the direction of the DEQ. The installation met or exceeded the engineering requirements.

Impacts to geology and minerals at the CR Kendall Mine site occurred during active mining. No additional specific impacts to these resources would be expected from the No Action Alternative mine closure activities. Some areas of the CR Kendall Mine site (e.g., portions of regraded slopes in the Kendall and Muleshoe Pits) have yet to receive soil or to be reseeded as required by the currently approved reclamation plan.



LEGEND

- CR Kendall Mine Permit Boundary
- - - Syncline
-  Fault

- Qls Landslide Deposit
- Qal Alluvium - Modern Channel
- Qtr Travertine Deposits
- Qab Alluvium - Alluvial Terrace
- Tbi Breccia Intrusive
- Tsyp Syenite Porphyry
- Kjr Judith River Formation
- Kcl Claggett Shale Formation
- Ke Eagle Formation
- Ktcm Telegraph Creek & Marias River Form.
- Ktcb Telegraph Creek & Belle Fourche Form.
- Km Mowry Shale Formation
- Ktf Thermopolis & Fall River Formation
- Kk Kootenai Formation
- Jm Morrison Formation
- Jms Morrison & Swift Formation
- Jsw Swift Formation
- Jrp Rierdon & Piper Formation
- PZs Paleozoic Sedimentary Rock

0 2 miles

SCALE: 1" = 2 miles
 Geologic Map of Lewistown - 1999
 Karen W. Porter and Edith M. Wilde

FIGURE 3-1
 CR Kendall Mine
 Regional Geology Map

Chapter 3 Affected Environment and Environmental Consequences

3.2.3.2 Proposed Action

There would be no additional adverse impacts to the geology and minerals from implementing the Proposed Action compared to the No Action Alternative. Soil would be placed on current roads, footprints of buildings, and parking areas after water treatment ceases. Soil would also be used for maintenance of rills, slumps, and other erosion features. No soil would be placed on the areas of the Kendall Pit with less than 2:1 slopes; or unvegetated areas of the Muleshoe Pit.

3.2.3.3 Process Pad Drainage Pretreatment Alternative

This alternative would be similar to the No Action Alternative and Proposed Action with no additional adverse impacts to the geology and minerals. The main difference between this alternative and the No Action Alternative and Proposed Action would be the pretreatment of the process pad drainage prior to combining it with the captured alluvial groundwater. The combined waters would then be treated at the central WTP with media filtration and zeolite adsorption and discharged to groundwater in the Kendall Pit.

3.2.3.4 Process Pad Barrier Cover Alternative

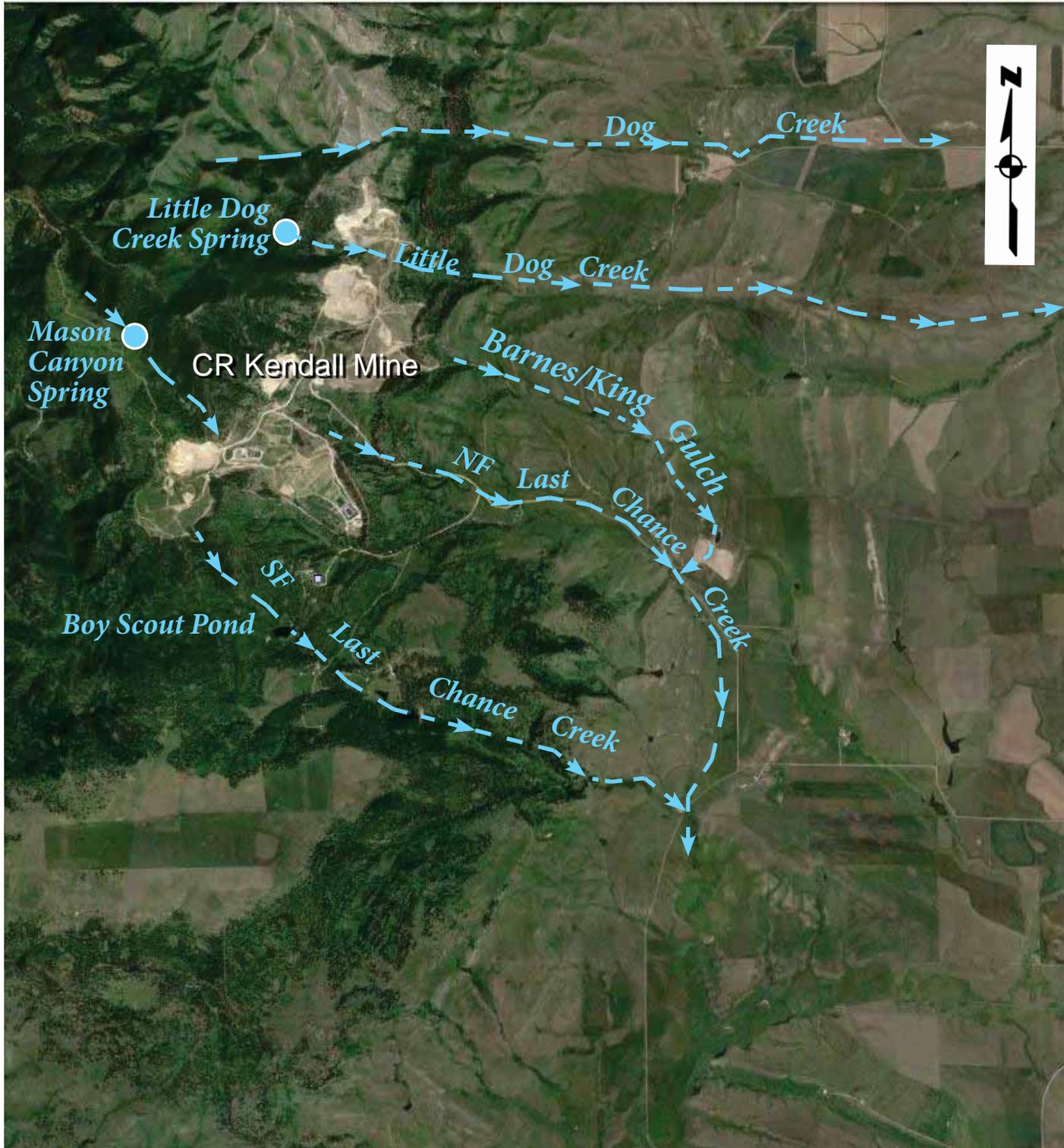
The Process Pad Barrier Cover Alternative would involve removing the upper 17 inches of soil/growth media and vegetation from process pads 3 and 4 and installing a barrier cap system. After the geomembrane liner is installed, soil would be replaced on the process pads. Most of the process pads area consists of 3:1 slopes (estimated to be 71 percent). Placing soil on a barrier material on 3:1 slopes (even for textured geomembrane liners) would increase geotechnical instability for the reclamation cover soil by creating a potential slippage plane. All other specific impacts to the geology and mineralization would be similar to those for the No Action Alternative and Proposed Action.

3.3 Surface and Groundwater

3.3.1 Analysis Area and Methods

The analysis area for all surface water and groundwater resources and water treatment is the eastern side of the North Moccasin Mountains, including all upgradient and downgradient drainages that flow across or near the CR Kendall Mine permitted mine boundary. **Figure 3-2** shows these major drainages in relationship to the mine.

The water resources for the CR Kendall Mine area were analyzed by reviewing documents and publications by various consultants and specialists that worked for CR Kendall; other technical reports prepared by the mine for DEQ; inspection reports and memoranda from DEQ; technical reports and publications with specific information on water quality and water treatment; and associated maps and drawings.



0 4000'

SCALE: 1" = 4,000 feet

Source of Base: Google Earth Pro
Image Date: 7/1/2014

FIGURE 3-2
CR Kendall Mine
Regional Water Features Map

Chapter 3 Affected Environment and Environmental Consequences

3.3.2 Affected Environment

3.3.2.1 Climate

Climatic conditions play a major role in the availability of surface water and the evapotranspiration and recharge of groundwater at the CR Kendall Mine. Rainfall has been monitored at the mine site since 1992. Regional precipitation data for nearby monitoring stations through 2014 are summarized in **Table 3-1**. The mine receives an average of approximately 25.8 inches of precipitation per year while the surrounding areas receive approximately 13 to 16 inches. This difference is likely due to the higher elevation at the CR Kendall Mine and orographic effects from the mountains surrounding the mine.

| Station Name | Annual Precipitation 1993-2014 | | |
|-----------------|--------------------------------|------------------|------------------|
| | Mean (inches) | Maximum (inches) | Minimum (inches) |
| Winifred | 16.0 | 23.8 | 12.1 |
| Moccasin | 14.8 | 23.4 | 10.9 |
| Roy | 13.2 | 19.6 | 10.2 |
| Grass Range | 16.0 | 23.1 | 12.8 |
| Denton | 15.6 | 24.6 | 11.1 |
| CR Kendall Mine | 25.8 | 36.4 | 16.3 |

Precipitation data from the CR Kendall Mine reported by CR Kendall from 1992 to 2014 show that about 60 percent of the annual precipitation occurs from April through July, and 14 percent during December through February. The average annual temperature at Lewistown is 43 degrees Fahrenheit (°F) with the average monthly low temperature of 20 °F occurring in January and the average maximum temperature of 65 °F in July. (Lewistown Weather Data 2015).

3.3.2.2 Water Quantity

Surface Water Quantity

The North Moccasin Mountains reach an elevation slightly over 5,600 feet, and are on a surface water drainage divide between the Judith and Missouri River Basins. Surface water in the CR Kendall Mine area is primarily composed of runoff from snowmelt and storm water in ephemeral drainages. Some of the drainages receive supplemental flow from groundwater discharged as springs and seeps. The majority of surface flow from the upper portions of the North Moccasin Mountain watersheds is intercepted by porous and possibly karstic Madison Limestone. Little or no surface water flows reach the CR Kendall Mine.

Chapter 3 Affected Environment and Environmental Consequences

There are six surface drainage systems in the mine permit area that generally trend east to southeast (**Figures 3-2 and 3-3**). These drainages, from south to north, are:

- South Fork of Last Chance Creek
- Mason Canyon
- North Fork of Last Chance Creek
- Barnes-King Gulch
- Little Dog Creek
- Dog Creek

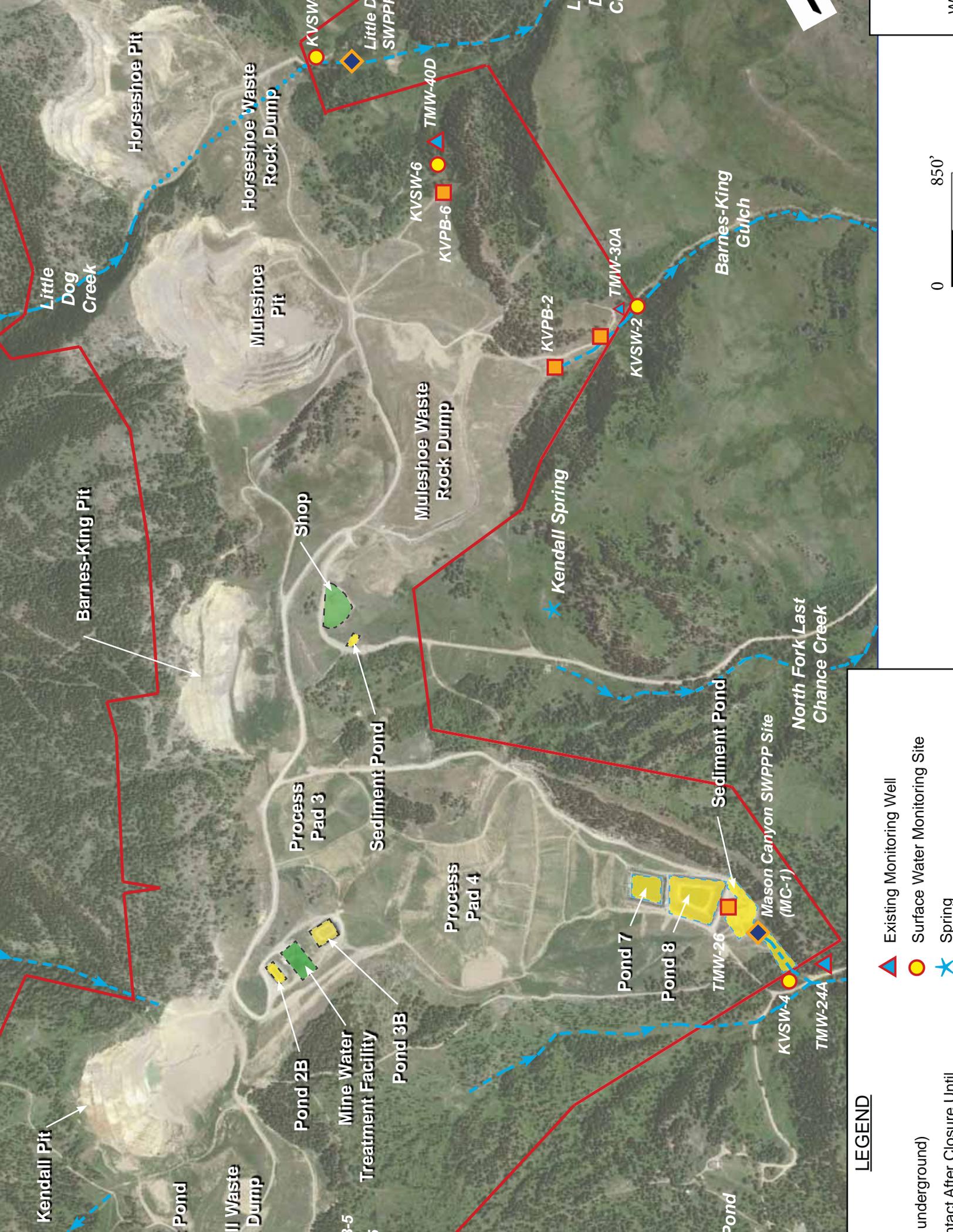
The majority of the headwater areas for the South and North Forks of Last Chance Creek and Barnes-King Gulch are in the mine permit area. The headwater areas of Mason Canyon, Little Dog Creek, and Dog Creek are at higher elevations above the mine permit area. The Little Dog and Dog Creek drainages flow toward the Missouri River and the remaining drainages flow toward the Judith River.

Surface water monitoring began in 1990-91 at four stations in the mine permit area (KVSU-1 through KVSU-4) (**Figure 3-3**). Three additional sites (KVSU-5 through KVSU-7) were added in 1994. Instantaneous flow measurements collected between 1990 and 2014 are summarized in **Table 3-2** (CR Kendall 2015b). In general, the maximum flow occurred in the wetter spring months, followed by declining flows over the summer. Little or no flow was observed during fall months. All stations exhibited periods of no flow.

Water quality at surface water site KVSU-4 is likely affected by residual historic tailings in the area.

| Station Number | Drainage | Number of Events | Number of Events with Flow | Average Flow (gpm) | Maximum Flow (gpm) | Minimum Flow (gpm) |
|----------------|------------------------------|------------------|----------------------------|--------------------|--------------------|--------------------|
| KVSU-1 | North Fork Little Dog Creek | 92 | 2 | 54 | 5,000 | 0 |
| KVSU-2 | Barnes-King Gulch | 161 | 31 | 1.5 | 80 | 0 |
| KVSU-3 | North Fork Last Chance Creek | 51 | 13 | 2.2 | 35.0 | 0 |
| KVSU-4 | Mason Canyon | 170 | 104 | 12.4 | 1,200.0 | 0 |
| KVSU-5 | South Fork Last Chance Creek | 158 | 131 | 16.5 | 375 | 0 |
| KVSU-6 | South Fork Little Dog Creek | 65 | 2 | 0.4 | 25.1 | 0 |
| KVSU-7 | Mason Canyon LAD Area | 93 | 78 | 7.3 | 50.0 | 0 |

Notes: gpm = gallons per minute



LEGEND

- ▲ Existing Monitoring Well
- Surface Water Monitoring Site
- ★ Spring

Map Labels:

- Kendall Pit
- Pond
- III Waste Dump
- Pond 2B
- Mine Water Treatment Facility
- Pond 3B
- Process Pad 3
- Sediment Pond
- Shop
- Barnes-King Pit
- Muleshoe Waste Rock Dump
- Muleshoe Pit
- Horseshoe Waste Rock Dump
- Horseshoe Pit
- Kendall Spring
- Process Pad 4
- Pond 7
- Pond 8
- Mason Canyon SWPPP Site (MC-1)
- Sediment Pond
- North Fork Last Chance Creek
- Barnes-King Gulch
- Little Dog Creek
- Little D SWPPP
- KVSW-6
- KVPB-6
- TMW-40D
- KVPB-2
- TMW-30A
- KVSW-2
- TMW-26
- KVSW-4
- TMW-24A

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Continuous flow measurements over several months are only available in the southern drainages. Analysis of one storm in September 1996 showed little groundwater recharge in the drainages from the event (Water Management Consultants [WMC] 1996). WMC (1999) reported that surface water in the drainages above the mine was either ephemeral or intermittent and that surface flows above the mine are lost as recharge into the Madison Limestone. DEQ has routinely observed the loss of all surface flow in Little Dog Creek, downstream of Little Dog Spring, at the contact of the Madison Limestone and the syenite porphyry (DEQ 2003).

The average annual precipitation reported for the CR Kendall Mine site for 1993 to 2014 was 25.8 inches. Gallagher (2002) documented drought conditions that persisted in the area between 1990 and 2001. Hydrologic drought is defined as declining groundwater levels due to decreased recharge and increased water loss through evaporation and plant uptake. Hydrologic drought was a major contributing factor in decreased flows in springs and ephemeral and intermittent stream flows reported in the drainages originating on or crossing the mine site (Gallagher 2002). Surface water flows at several monitoring sites have increased since the drought ended in 2001.

Groundwater Quantity

All mine pits are dry indicating modern mining did not intercept groundwater in the Madison Limestone and no groundwater was historically reported in the underground workings. The Kendall shaft was excavated down to approximately 650 feet, putting it approximately 100 to 200 feet below the floor of the current Kendall Pit. Historical mining operations and the town of Kendall obtained water supply from Little Dog Spring above the mine.

There are springs and seeps above and below the CR Kendall Mine site that are derived from shallow flow systems. Springs above the mine, such as Little Dog Spring, originate from the Tertiary syenite and are recharged from precipitation higher in the North Moccasin Mountains. A portion of upper Little Dog Spring is currently diverted for augmentation in lower Little Dog Creek. The portion of upper Little Dog Spring discharge that is not diverted does not reach the mine and is lost as recharge to the Madison Limestone. Similarly, the Mason Canyon Spring flows are lost as recharge to the Madison Limestone. One time in the last 25 years, the flow from the Mason Canyon Spring reached the Kendall Pit during an extreme precipitation event (Volberding 2015c).

Springs in the drainages east and downgradient of the mine site appear to be related to low permeability units in the Morrison and Kootenai formation bedrock aquifers, in combination with groundwater movement in the alluvial aquifer sediments. WMC (1999) reported that most of the water in the seeps and springs is derived from local recharge sources. These springs are highly susceptible to small fluctuations in water table elevation resulting in variable seasonal discharge. Fluctuations in water table

Chapter 3 Affected Environment and Environmental Consequences

elevation may be caused by one or more factors including increased groundwater withdrawal, seasonal recharge variations, decreasing recharge from precipitation from drought, and variations in agricultural practices.

Mine Pumpback, Monitoring, and Water Supply Wells

CR Kendall Mine installed four groundwater pumpback systems to capture contaminated seepage below waste rock dumps and the process pads (**Table 3-3**). The pumpback volumes varied from a low of 17,517,103 gallons in 2001 to 65,256,850 gallons in 2011 (CR Kendall 2015b).

| Year | South Fork Last Chance Creek | Mason Canyon | Barnes-King Gulch | South Fork Little Dog Creek | Total |
|------|------------------------------------|-----------------|----------------------|-----------------------------------|------------|
| 1997 | 6,432,390 | 6,152,471 | 3,367,715 | 8,030,050 | 23,982,626 |
| 1998 | 5,678,400 | 6,886,823 | 2,613,020 | 8,152,220 | 23,330,463 |
| 1999 | 4,367,690 | 7,226,157 | 3,149,815 | 8,253,945 | 22,997,607 |
| 2000 | 4,194,260 | 7,559,250 | 3,409,090 | 8,536,600 | 23,699,200 |
| 2001 | 3,358,183 | 5,494,520 | 2,651,320 | 6,013,080 | 17,517,103 |
| 2002 | 4,739,810 | 8,473,350 | 5,491,790 | 11,309,340 | 30,014,290 |
| 2003 | 6,348,430 | 10,427,810 | 7,741,060 | 14,774,970 | 39,292,270 |
| 2004 | 6,669,470 | 11,868,690 | 8,435,590 | 12,666,700 | 39,640,450 |
| 2005 | 5,800,870 | 7,884,930 | 6,827,790 | 10,488,730 | 31,002,320 |
| 2006 | 10,137,300 | 12,885,000 | 10,783,000 | 15,652,380 | 49,457,680 |
| 2007 | 9,042,120 | 9,139,000 | 8,937,000 | 11,784,240 | 38,902,360 |
| 2008 | 7,504,890 | 7,584,000 | 7,545,000 | 9,613,350 | 32,247,240 |
| 2009 | 9,104,610 | 9,382,000 | 7,030,000 | 8,777,590 | 34,294,200 |
| 2010 | 10,983,180 | 13,511,000 | 13,130,000 | 17,109,520 | 54,733,700 |
| 2011 | 5,953,220 | 17,698,000 | 19,795,000 | 21,810,630 | 65,256,850 |
| 2012 | 8,075,980 | 11,621,900 | 6,816,800 | 12,783,030 | 39,297,710 |
| 2013 | 5,226,050 | 5,463,700 | 10,294,700 | 8,068,130 | 29,052,580 |
| 2014 | 7,130,340 | 6,060,400 | 7,745,200 | 7,999,660 | 28,935,600 |

The company installed numerous monitoring wells and water supply wells that date back to 1985. Most monitoring wells are associated with a pumpback system or in the process valley to monitor the former process pads for leaks. All monitoring wells are less than 100 feet deep and are screened in the shallow alluvium or in the first bedrock formation encountered. Water levels in several monitoring wells have increased since the drought ended in 2002 (CR Kendall 2006).

Chapter 3 Affected Environment and Environmental Consequences

Eight water supply wells were drilled on the mine site. Two, WW-6 and WW-7, have historically been used to augment surface flows in the South Fork of Last Chance Creek and Little Dog Creek. However, more recently, springs above the mine have been diverted to provide augmentation water and have replaced the wells as an augmentation water source. Historical augmentation volumes are in **Table 3-4**. The static water level in WW-7 has been near or above the ground surface since mid-2002. At this level, artesian flow from WW-7 flows into Little Dog Creek.

| Year | South Fork Last Chance Creek | Little Dog Creek |
|------|---------------------------------|------------------|
| 1998 | NA | 4,755,350 |
| 1999 | NA | 8,348,980 |
| 2000 | 4,494,530 | 9,498,610 |
| 2001 | 5,675,580 | 9,447,278 |
| 2002 | 5,053,700 | 7,976,073 |
| 2003 | 6,928,300 | 16,423,317 |
| 2004 | 6,509,000 | 15,959,410 |
| 2005 | 6,719,000 | 15,370,380 |
| 2006 | 6,075,640 | 32,992,590 |
| 2007 | 10,905,900 | 29,390,680 |
| 2008 | 10,316,140 | 21,092,560 |
| 2009 | 9,526,940 | 20,898,360 |
| 2010 | 15,075,260 | 28,136,370 |
| 2011 | 14,190,910 | 31,162,400 |
| 2012 | 11,518,910 | 27,974,220 |
| 2013 | 10,988,850 | 20,543,060 |
| 2014 | 9,513,880 | 29,608,110 |

3.3.2.3 Water Chemistry

Metals, metalloids, and other contaminant concentrations can be elevated at mine sites from disturbances to the natural mineralogy that allow previously immobile metals or metalloids to become mobile, or from the addition of the contaminants during mining or ore processing. Described below are the properties of the main contaminants found in the geologic materials, reclamation resources, and water at the CR Kendall Mine. The probable sources, forms, and fate and transport are described for each contaminant. Elevated arsenic, selenium, and thallium concentrations are often encountered with carbonate-replacement gold deposits, which are termed Carlin-like deposits when associated with alkaline igneous intrusions (Berger and Bagby 1991). There is no documentation of the arsenic concentration in the receiving groundwater (Madison

Chapter 3 Affected Environment and Environmental Consequences

aquifer) or that the natural background level of arsenic exceeds the projected arsenic concentration in the blended, untreated mine waters.

Arsenic

Arsenic is present in the ore body mined by CR Kendall and in the surrounding rocks and soils that have been influenced by the emplacement of the ore body. Elevated background levels of arsenic around some gold-bearing ore bodies are common due to the geochemical association of arsenic-containing minerals with gold in many areas (Nekrasov 1996). Arsenic can occur in many oxidation states, which is a value indicating the degree of oxidation (or loss of electrons) of a particular atom, and is hypothetically equal to the net charge of that atom. The oxidation state of arsenic can range from the 3- reduced state to its most oxidized state, 5+. Naturally occurring arsenic typically exists in a reduced state, such as arsenic (1-) in arsenopyrite. In such reduced states, arsenic is not soluble or mobile in water, but on exposure to air, reduced arsenic can be oxidized to form arsenic (3+) (arsenite) or arsenic (5+) (arsenate) ions that are soluble and mobile in water. Arsenate is sorbed more strongly on soils and sediments compared to arsenite, and adsorbs more strongly to iron hydroxide or oxide minerals.

In addition to the oxidation state of arsenic, the pH of the water affects arsenic mobility through sediment. At high pH, arsenic does not adsorb onto soil and sediment surfaces as well as it does at lower pH levels, especially for soils and sediment with relatively high levels of iron or aluminum. Because the cyanide leaching process requires raising the pH of process solutions to greater than 10, the high pH in the process solution and the oxidative conditions encouraged arsenic mobilization. The increased mobility of arsenic in the process pad combined with the high concentrations in the ore resulted in high arsenic levels (approximately 0.2 mg/L or higher) in process pad drainage effluent from 1994 to 2002, with a decreasing trend to approximately 0.12 mg/L arsenic in August, 2014.

Selenium

Selenium occurs in local geologic materials associated with carbonate-replacement deposits (Berger and Bagby 1991). The selenium is released into solution by oxidation of the sulfide minerals in the process pads or waste rock dumps. As with arsenic, the two most oxidized states of selenium, selenium (4+) (selenite) and selenium (6+) (selenate), are the most water-soluble and mobile forms. Selenium distribution varies across the site. Little Dog Creek has higher selenium concentrations in water than other mine-site drainages, and selenium was occasionally detected in water samples from Little Dog Creek prior to the start of modern mining in the drainage.

Because the oxidized forms of selenium (selenite and selenate) are similar to the oxidized forms of arsenic in that they are oxyanions, they exhibit similar geochemical properties. Selenium adsorbs better onto soils and sediments at lower pH compared to

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higher pH. As opposed to arsenic, where the most oxidized form (arsenate) is adsorbed more strongly to iron oxides or hydroxides, the most oxidized form of selenium (selenate), adsorbs less strongly to iron oxides or hydroxides compared to selenite.

Selenium concentrations and average weekly pumpback flows are different between the pumpback systems located in different drainages. Considering a range of flow and selenium-loading scenarios, when these sources are combined at the central water treatment plant, the resulting selenium concentration in the influent water would be below the Montana groundwater quality standard (Closure Plan Mixing Model, Table 4-1).

Thallium

Thallium was deposited at the same time as the gold in the mineralized rock. Thallium is known to occur with Carlin-like carbonate-replacement gold deposits (Berger and Bagby 1991, Percival and Radtke 1993). Weathering of these minerals can release thallium into mine drainage and stormwater from the site.

Thallium occurs in two oxidation states in natural water: thallium (1+) and thallium (3+). Thallium (1+) behaves similarly to the alkali metal ions (sodium, potassium, etc.), and is extremely soluble and mobile in water. Thallium (3+) has chemical similarities to aluminum and precipitates as a thallium (3+) hydroxide or co-precipitates with iron oxyhydroxides in higher pH waters.

Nitrogen

The most important forms of nitrogen in natural waters are ammonia (NH_3), nitrite (NO_2^-), nitrate (NO_3^-), and various nitrogen-bearing organic compounds. The most important forms of nitrogen at the site are nitrite and nitrate, which are usually reported by analytical laboratories as the sum of the two species due to holding time constraints. Nitrates in this discussion will include nitrate and nitrite.

Nitrates at the CR Kendall Mine are derived from a number of sources including degradation of cyanide used in the leaching process, nitrate-containing explosives, and oxidation of nitrogenous organic matter. During operations, residues from blasting were the primary source of nitrates. Since operations ceased, degradation of residual cyanide has been the major source of nitrates in the process valley and LAD areas.

Nitrates can be reduced and converted to nitrogen gas by bacteria under low oxygen (anoxic) conditions if a source of organic carbon is present, such as in wetland areas. Under oxidizing conditions, nitrates tend to persist and are relatively mobile in the environment because of the high solubility of nitrate and the fact that nitrate does not adsorb strongly to sediments and soils. Growing plants require nitrogen as a nutrient and can remove nitrates from water by uptake through roots.

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Cyanide

Cyanide (CN⁻) was used by CR Kendall to solubilize gold from the crushed ore in the process pads in Mason Canyon. The gold-bearing solution was collected and conveyed to the processing plant where the gold was separated from the cyanide and the cyanide solution was recycled back to the process pads. Cyanide was used by the historical mills in Little Dog Creek, Barnes-King Gulch, and Mason Canyon as discussed in Chapter 1.

Dissolved cyanide can occur as free cyanide (either as HCN or CN⁻, depending on the pH), weak acid dissociable (WAD) cyanide, or strong cyanide complexes, such as iron cyanide complexes. Free cyanide, the most toxic form, generally does not persist in the environment due to loss by volatilization as HCN gas, biodegradation, uptake by plants, or reaction with metals to form WAD cyanide complexes, or strong cyanide complexes. Strong cyanide complexes tend to persist, but are considerably less toxic than free or WAD cyanide compounds. Water quality analyses can measure total cyanide that includes all forms of cyanide, WAD cyanide, or free cyanide. Montana water quality standards conservatively use total cyanide analytical results as a guideline.

3.3.2.4 Water Quality

The overall quality of onsite waters is expressed in terms of concentration ranges and the percentage of time that substances of concern have exceeded water quality standards. This is a summary of data found elsewhere (WMC 1999 and 2003, Gallagher 2002, CDM 2004b, Golder 2006). Concentrations of arsenic, selenium, and thallium in the CR Kendall Mine groundwater and the process pad drainage over the last 20 years are provided in **Figures A-1 through A-9** in **Appendix A**. Surface water quality standards for metals are based on total recoverable concentrations that include dissolved and suspended components. Since 1994, CR Kendall Mine has obtained both dissolved and total recoverable analyses for surface water samples. Groundwater quality standards for metals are based solely on dissolved concentrations.

Process Pad Water Chemistry

Several lined process ponds containing the process pad drainage and captured alluvial groundwater are located in the Mason Canyon process valley. Pond 7 contains primarily water draining from the process pads. **Table 3-5** shows the quality of Pond 7 water and the concentrations of arsenic, selenium, and thallium over the last 20 years is provided in **Figure A-1 (Appendix A)**. The process pad drainage water is disposed by LAD, so the applicable groundwater standard is shown for comparison in **Table 3-5**. Groundwater standards would only apply to the process pad drainage if it were discharged to groundwater.

**TABLE 3-5
ANALYSES FOR POND 7 WATER (1990-2014)**

| Parameter ¹ | DEQ-7 Criteria ² | Range of Data ³ | % of Samples Exceeding Standards | Average Concentration (Number of Samples) | Recent (2014) |
|------------------------------|-----------------------------|----------------------------|----------------------------------|---|-----------------|
| Specific Conductance (µS/cm) | --- | 1770-5870 | --- | 3240 (62) | 1930 |
| Sulfate | --- | 702-2690-2510 | --- | 1500 (52) | 871 |
| Cyanide as total | 0.2 | 0.005-302 | 44 | 7.54 (62) ⁶ | 0.019 |
| Nitrate/nitrite as N | 10 | 0.01-199 | 87 | 61.0 (62) | 10.2 |
| Arsenic | 0.010 | 0.003-0.129 | 96 | 0.052 (27) ⁵ | 0.042 |
| Iron | --- | 0.01-0.9 | -- | 0.121 (10) | NA ⁴ |
| Selenium | 0.05 | 0.018-0.202 | 37 | 0.058 (27) | 0.030 |
| Thallium | 0.002 | 0.249-9.03 | 100 | 5.75 (26) | 5.7 |
| Zinc | 2.0 | 0.13-14.6 | 13 | 2.06 (8) | NA |

Notes: Bold values indicate the groundwater criteria are exceeded.

¹ Units are mg/L unless otherwise noted (metals are dissolved and total recoverable concentrations combined).

² Values listed are the groundwater criteria

³ Data from February 1990 to August 2014.

⁴ NA = not analyzed, removed from the monitoring plan.

⁵ One anomalous data point (84.1 mg/L) from August of 2001 was omitted for purposes of computing average and number of exceedances.

⁶ Average shown may be skewed by high values during 2002 and 2003

Surface Water Quality

The default surface water classification for streams in Montana is B-1, which means it is assumed to be suitable for drinking water and the growth and propagation of salmonid fishes and associated aquatic life. Consequently, the lowest value between the human health drinking water standards and chronic aquatic life criteria applies to streams classified as B-1. The six drainages leaving the CR Kendall permit area are classified as B-1 even though they are ephemeral or intermittent. Sampling locations have been modified due to expansion of and changes to mine facilities. Data from sampling locations are sporadic due to freezing or lack of the surface water at the designated sampling stations. A summary of the surface water sampling locations and the dates they were sampled is in **Table 3-6**.

| TABLE 3-6 SURFACE WATER SAMPLING LOCATIONS AND YEARS SAMPLED, BY DRAINAGE | | |
|--|--|---|
| Drainage | Stream Water Locations | Pond Water Locations |
| South Fork Last Chance Creek | KVSW-5 (1994-2014), KVSW-5E (1996), KVSW-5W (1996), S Fork Boundary (1997-2005), S Fork Fence (1996-97), S Fork Inlet (1999) | Boy Scout Pond (1990, 1996, 1998-2014) |
| Mason Canyon | TSW-1 (1984-85), KVSW-4 (1990-2014), KVSW-7 (1994-2005) | TPO-1 (1984-86) |
| North Fork Last Chance Creek | TSW-2 (1982-85), KVSW-3 (1990-2005) | TPO-2 (1984-86), Peters Pond #1 (2001) |
| Barnes-King Creek | TSW-3 (1984-85), KVSW-2 (1990-2014), BKS-1 (2001) | |
| Little Dog Creek | TSW-4 (1984-85), KVSW-1 (1981, 1991-2014), KVSW-6 (1984-85, 1994-2001), #1 (1998), #14 (1998), #15 (1998), Section 29 Spring (1984-2014) | #12 (1998), TPO-3 (1984-86), Tailings Pond (2002) |
| Dog Creek | #3 (1998), #6 (1998), #10 (1998) | #2 (1998), #4 (1998), #5 (1998), #7 (1998) |

The locations of current sampling points are shown on **Figure 3-3**. The surface water quality in each of the six drainages is described in the following sections. The tables for each sampling station compare the concentrations of each parameter of concern to the human health or chronic aquatic life water quality standards, whichever is more stringent.

South Fork Last Chance Creek

The water quality results for surface water station KVSW-5 in the South Fork Last Chance Creek are in **Table 3-7**. Average thallium concentrations have decreased in recent years to levels at or near 0.002 mg/L with a few exceptions.

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**TABLE 3-7
ANALYSES FOR SURFACE WATER STATION KVSW-5 IN SOUTH FORK
LAST CHANCE CREEK 1994-2014**

| Parameter ¹ | DEQ-7 Criteria ² | Range of Data | % of Samples Exceeding Standards | Average Concentration (Number of Samples) | Recent (2014) |
|---|-----------------------------|----------------------------------|----------------------------------|---|-----------------|
| SC ($\mu\text{S}/\text{cm}$) ³ | --- | 686-2250 | --- | 1519 (175) | 956 |
| Sulfate ³ | --- | 204-1240 | --- | 675 (175) | 310 |
| Nitrate/nitrite as N ³ | 10 (1.3 in summer) | 0-6.05 | 28 | 2.7 (174) | 0.62 |
| Cyanide as total | 0.0052 | <0.005- 3.36 ⁵ | 0 | 0.005 | NA ⁶ |
| Arsenic ⁴ | 0.010 | <0.003- 0.02 | 4 | 0.003 (174) | <0.003 |
| Iron ⁴ | 1.0 | <0.01- 2.92 | 18 | 0.43 (41) | NA ⁶ |
| Selenium ⁴ | 0.005 | <0.001- 0.012 | 1.7 | 0.002 (174) | 0.001 |
| Thallium ⁴ | 0.00024 | 0.002-0.10 | 100 ⁷ | 0.005 (174) | 0.002 |
| Zinc ⁴ | 0.388 @ >400 mg/L hardness | 0.01-0.19 | 0 | 0.033 (25) | NA ⁶ |

Note: Bold values indicate the human health or chronic aquatic life criteria are exceeded.

¹Units are mg/L unless otherwise noted (metals are total recoverable).

²The lowest value between the surface water human health and chronic aquatic life criteria.

³Data from May 1994 to November 2014.

⁴Total recoverable metals data from May 1994 to November 2014.

⁵Sample error with very first sample, as cyanide has never been detected since. The results from the first sample have been omitted from calculations for the average and number of samples exceeding standards.

⁶NA = not analyzed, removed from the monitoring plan.

⁷Analytical detection limit (0.002) exceeds the standard, leading to this apparent high percentage of samples which exceed the standard.

The analytical results for the Boy Scout pond water are in **Table 3-8**. Arsenic is the only parameter that frequently exceeds the human health standard.

The source of the arsenic in the pond is believed to be from sediments transported down the South Fork Last Chance Creek during storms, or from naturally occurring arsenic in the sediment beneath the pond. Sources of this sediment may include mine waste rock or tailings or natural sources of sediment eroding from the mineralized zone. South Fork Last Chance Creek sediment sample results, collected by DEQ in April 1998, are in **Table 3-9**.

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**TABLE 3-8
WATER ANALYSES – BOY SCOUT POND 1990-2014**

| Parameter ¹ | DEQ-7 Criteria ² | Range of Data | % of Samples Exceeding Standards | Average Concentration (Number of Samples) | Recent (2014) |
|---|-----------------------------|---------------------------------|----------------------------------|---|-----------------|
| SC ($\mu\text{S}/\text{cm}$) ³ | --- | 174-1420 | --- | 777 (82) | 521 |
| Sulfate ³ | --- | 36-601 | --- | 272 (82) | 176 |
| Nitrate/nitrite as N ³ | 10 (1.3 in summer) | <0.01-1.86 | 0 | 0.07 (81) | <0.01 |
| Cyanide as total | 0.2 | <0.005- 0.6 ⁵ | 33 | | NA ⁶ |
| Arsenic ⁴ | 0.010 | <0.003- 0.05 | 66 | 0.016 (82) | 0.014 |
| Iron ⁴ | 1.0 | <0.01- 1.78 | 16.7 | 0.28 (6) | NA ⁶ |
| Selenium ⁴ | 0.005 | <0.001-0.005 | 0 | 0.001 (82) | <0.001 |
| Thallium ⁴ | 0.00024 | <0.002- 0.006 | 100 ⁷ | 0.002 (82) | <0.002 |
| Zinc ⁴ | 0.388 @ >400 mg/L hardness | 0.01-0.02 | 0 | 0.015 (6) | NA ⁶ |

Note: Bold values indicate the human health or chronic aquatic life criteria are exceeded.

¹Units are mg/L unless otherwise noted (metals are total recoverable).

²The lowest value between the surface water human health and chronic aquatic life criteria.

³Data from May 1990 to November 2014.

⁴Total recoverable metals data from May 1990 to November 2014

⁵Believed to be sample error with very first sample, as cyanide has not been detected since.

⁶NA = not analyzed, removed from the monitoring plan.

⁷Analytical detection limit (0.002) exceeds the standard leading to this apparent high percentage of samples which exceed the standard.

**TABLE 3-9
ARSENIC IN SEDIMENT FROM SAMPLES COLLECTED BY DEQ IN APRIL 1998 (CR KENDALL MINE 1998)**

| Sample ID | Location | Arsenic Concentration (mg/kg) |
|-----------|---|-------------------------------|
| CRK-1 | In the Boy Scout Pond | 98 |
| CRK-2 | Areas adjacent to the pond and SFLCC ¹ | 8.4 |
| CRK-3 | Sediment in SFLCC | 128 |
| CRK-4 | Areas adjacent to the pond and SFLCC | 26 |
| CRK-5 | Areas adjacent to the pond and SFLCC | 8.0 |
| CRK-6 | Sediment in SFLCC | 138 |
| CRK-7 | Sediment in SFLCC | 132 |

¹SFLCC means South Fork Last Chance Creek

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The results show that the sediments in the South Fork Last Chance Creek channel (CRK-3, CRK-6, and CRK-7) have 5 to 16 times higher arsenic concentrations than areas adjacent to the Boy Scout Pond and South Fork Last Chance Creek (CRK-2, CRK-4, and CRK-5). The presence of dissolved arsenic above the human health standard in the Boy Scout Pond, but not in the surface waters of South Fork Last Chance Creek, as measured at KVSW-5, suggests that arsenic is being mobilized from sediment in the bottom of the pond under seasonal reducing conditions. Because reducing conditions are not present in the surface waters at KVSW-5, arsenic is not mobilized in the drainage to the same extent as at the bottom of the pond.

The Harrell and Jack Ruckman ponds below the Boy Scout Pond were sampled in July 2003 and were within water quality standards for all substances (CDM 2003). The ponds are on the main fork and side tributaries of South Fork Last Chance Creek.

Mason Canyon

The water quality results in **Table 3-10** for surface water station KVSW-4 in Mason Canyon include data beginning in 1990, several years before pumpback of TMW-26 was initiated. Based on long term data from this station, the pumpback system has improved surface water quality at KVSW-4, except when the creek is turbid from stormwater runoff. Station KVSW-4 is downstream of the process valley below TMW-26 and the stormwater settling pond (**Figure 3-3**). Thallium concentrations generally exceed the human health standard, but there has been a noticeable reduction in average concentration since about 2006. This may also be related to historical tailings removal between the process pads and KVSW-4. Elevated cyanide concentrations (0.1 mg/l and higher) were observed between 1991 and 1993. These are believed to be related to spills in the process valley during operations. Cyanide concentrations have been non-detectable (<0.005 mg/L) since 2003. Total arsenic concentrations at KVSW-4 sometimes exceed the human health standard. These exceedances are believed to be related to the occurrence of turbidity at the time of the sample as the corresponding dissolved concentration of arsenic generally does not exceed the human health standard. Selenium sometimes exceeded the chronic aquatic life standards at this station when the creek was turbid, but has not exceeded standards since 2000. Iron occasionally exceeded standards at this station when the creek was turbid, and samples have not been analyzed for iron since 2001.

The water quality results for surface water station KVSW-7 in a tributary of Mason Canyon are in **Table 3-11**. KVSW-7 was established in 1994 downgradient of the LAD site used for disposal of treated process water in 1993. The LAD site was also used for disposal of waste rock dump seepage during 1997 through 1998. Trends in data since 1994 show a decrease in concentrations in most substances since the cessation of LAD, except when the creek is turbid from stormwater runoff. No data have been collected at this site since 2005.

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**TABLE 3-10
ANALYSES FOR SURFACE WATER STATION KVSW-4 IN MASON CANYON
(PROCESS VALLEY) 1990-2014**

| Parameter ¹ | DEQ-7 Criteria ² | Range of Data | % of Samples Exceeding Standards | Average Concentration (Number of Samples) | Recent (2014) |
|---|-----------------------------|---------------------|----------------------------------|---|-----------------|
| SC ($\mu\text{S}/\text{cm}$) ³ | --- | 139-1320 | --- | 792 (131) | 905 |
| Sulfate ³ | --- | 15-323 | --- | 132 (121) | 191 |
| Nitrate/nitrite as N ³ | 10 (1.3 in summer) | <0.01- 10.8 | 8 | 0.953 (132) | 0.01 |
| Cyanide as total | 0.0052 | <0.005- 1.26 | 28 | 0.023 (121) | <0.005 |
| Chloride | --- | 1-60 | --- | 17.4 (23) | NA ⁵ |
| Arsenic ⁴ | 0.010 | <0.03- 0.398 | 28 | 0.016 (120) | 0.011 |
| Iron ⁴ | 1.0 | <0.03- 57.8 | 14 | 2.945 (43) | NA ⁶ |
| Selenium ⁴ | 0.005 | 0.001- 0.017 | 8 | 0.002 (119) | <0.001 |
| Thallium ⁴ | 0.00024 | 0.002-0.149 | 100 | 0.019 (115) | 0.006 |
| Zinc ⁴ | 0.388 @ >400 mg/L hardness | 0.01-0.33 | 0 | 0.040 (28) | NA |

Note: Bold values indicate the human health or chronic aquatic life criteria are exceeded.

¹Units are mg/L unless otherwise noted (metals are total recoverable).

²The lowest value between the surface water human health and chronic aquatic life criteria.

³Data from May 1990 to November 2014; data from 1984-86 were collected from TSW-1 located further upstream.

⁴Total recoverable metals data from May 1990 to November 2014.

⁵Most recent sample for chloride was collected on 5/24/1999; chloride has been removed from the monitoring plan.

⁶NA = not analyzed, removed from the monitoring plan.

| Parameter ¹ | DEQ-7 Criteria ² | Range of Data | % of Samples Exceeding Standards | Average Concentration (Number of Samples) | Recent (2005) |
|-----------------------------------|-----------------------------|----------------------|----------------------------------|---|-----------------|
| SC (µS/cm) ³ | --- | 633-1300 | --- | 883 (85) | 814 |
| Sulfate ³ | --- | 52-154 | --- | 86 (85) | 65 |
| Nitrate/nitrite as N ³ | 10 (1.3 in summer) | 0.17-3.23 | 5.9 | 0.91 (85) | 0.32 |
| Cyanide as total | 0.0052 | <0.005- 0.093 | 33.6 | 0.008 (80) | 0.005 |
| Chloride ⁵ | --- | 48-164 | --- | 98 (18) | NA |
| Arsenic ⁴ | 0.010 | <0.003- 0.287 | 31.3 | 0.004 (85) | 0.003 |
| Iron ⁴ | 1.0 | 0.06- 69.9 | 54.2 | 8.67 (24) | NA ⁶ |
| Selenium ⁴ | 0.005 | <0.001- 0.015 | 6.25 | 0.002 (85) | 0.001 |
| Thallium ⁴ | 0.00024 | <0.002- 0.032 | 100.0 | 0.003 (80) | 0.002 |
| Zinc ⁴ | 0.388 @ >400 mg/L hardness | 0.01-0.180 | 0 | 0.03 (19) | NA |

Note: Bold values indicate the human health or chronic aquatic life criteria are exceeded.
¹Units are mg/L unless otherwise noted (metals are total recoverable).
²The lowest value between the surface water human health and chronic aquatic life criteria.
³Data from May 1994 to September 2005.
⁴Total recoverable metals data from May 1994 to September 2005.
⁵Most recent sample for chloride was collected on 11/18/1998, chloride has been removed from the monitoring plan.
⁶NA = not analyzed, removed from the monitoring plan.

North Fork Last Chance Creek

The CR Kendall mine does not have facilities within the North Fork drainage. The drainage may have been influenced by historic mining. The water quality results for surface water station KVSW-3 in the North Fork Last Chance Creek are in **Table 3-12**. CR Kendall has not disturbed lands in this drainage. Greyhall Resources constructed two small waste rock dumps at the head of this drainage adjacent to the Barnes-King Pit that were reclaimed in the late 1980s. There is no pumpback in the North Fork Last Chance Creek drainage. Concentrations of selenium have exceeded the chronic aquatic life standard by up to twice the standard. Thallium concentrations exceeded the human health standard by up to four times the standard. Elevated levels of arsenic and iron occurred when the stream was turbid from stormwater runoff. These levels may represent background conditions. No samples have been collected from this site since 2005.

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**TABLE 3-12
ANALYSES FOR SURFACE WATER STATION KVSU-3 IN NORTH FORK LAST
CHANCE CREEK 1990-2005**

| Parameter ¹ | DEQ-7 Criteria ² | Range of Data | % of Samples Exceeding Standards | Average Concentration (Number of Samples) | Recent (2005) |
|---|-----------------------------|---------------------|----------------------------------|---|---------------|
| SC ($\mu\text{S}/\text{cm}$) ³ | --- | 598-1070 | --- | 818 (21) | 853 |
| Sulfate ³ | --- | 94-289 | --- | 170 (16) | 226 |
| Nitrate/nitrite as N ³ | 10 (1.3 in summer) | <0.01-1.85 | 0 | 0.80 (20) | 0.01 |
| Cyanide as total ⁵ | 0.0052 | <0.005- 0.01 | 8.3 | 0.005 (15) | NA |
| Chloride ⁵ | --- | 2-48 | --- | 16 (10) | NA |
| Arsenic ⁴ | 0.010 | 0.005- 0.19 | 46.7 | 0.025 (15) | 0.006 |
| Iron ⁴ | 1.0 | 0.11- 75.2 | 27.3 | 7.10 (12) | NA |
| Selenium ⁴ | 0.005 | 0.002- 0.01 | 33.3 | 0.006 (15) | 0.004 |
| Thallium ⁴ | 0.00024 | <0.003- 0.01 | 100.0 | 0.005 (11) | 0.005 |
| Zinc ⁴ | 0.388 @ >400 mg/L hardness | <0.01-0.120 | 0 | 0.05 (12) | NA |

Note: Bold values indicate the human health or chronic aquatic life criteria are exceeded.

¹Units are mg/L unless otherwise noted (metals are total recoverable).

²The lowest value between the surface water human health and chronic aquatic life criteria.

³Data from May 1990 to May 2005.

⁴Total recoverable metals data from May 1990 to May 2005.

⁵Most recent samples for cyanide and chloride were collected on 5/14/1996; both substances have been removed from the monitoring plan for this station.

⁶NA = not analyzed, removed from monitoring plan.

Barnes-King Gulch

The water quality results for surface water station KVSU-2 in Barnes-King Gulch are in **Table 3-13**. The station is below the South Muleshoe Waste Rock Dump that was constructed over historical tailings from the Barnes-King mill. Historical tailings between the toe of the waste rock dump and permit boundary were removed in 1997. The data collected since pumpback system KVPB-2 was put into service have been sparse due to a lack of water at the sampling location. Thallium consistently exceeds the human health standard at this site. Average concentrations of all other substances have improved since removal of the historical tailings in 1997 and initiation of pumpback above KVSU-2. Historical tailings that remain within Barnes-King Gulch from the permit boundary down to its confluence with the North Fork Last Chance Creek resulted in increased concentrations of arsenic and thallium in surface waters between KVSU-2 and the mouth of the gulch. Surface water is also infrequently monitored further downstream near its confluence with the North Fork Last Chance Creek (site BKSU-1). Site BKSU-1 typically has dissolved arsenic concentrations near 0.03 mg/L

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and dissolved thallium concentrations near 0.06 mg/L which are likely caused by the historic mill tailings within the drainage.

**TABLE 3-13
ANALYSES FOR SURFACE WATER STATION KVSW-2 IN BARNES-KING GULCH
1990-2014**

| Parameter ¹ | DEQ-7 Criteria ² | Range of Data | % of Samples Exceeding Standards | Average Concentration (Number of Samples) | Recent (2014) |
|-----------------------------------|-----------------------------|---------------------|----------------------------------|---|-----------------|
| SC (µS/cm) ³ | --- | 358-2170 | --- | 1,150 (39) | 549 |
| Sulfate ³ | --- | 54-1230 | --- | 433 (35) | 84 |
| Nitrate/nitrite as N ³ | 10 (1.3 in summer) | <0.01-5.56 | 8.1 | 1.1(39) | 0.1 |
| Cyanide as total | 0.0052 | <0.005- 0.01 | 8.3 | 0.007 (14) | NA ⁶ |
| Chloride | --- | 5-13 | --- | 7.7(10) | NA ⁶ |
| Arsenic ⁴ | 0.010 | 0.004- 0.167 | 21.2 | 0.038 (33) | 0.069 |
| Iron ⁴ | 1.0 | 0.03- 2.62 | 27.3 | 1.30(12) | NA ⁵ |
| Selenium ⁴ | 0.005 | 0.001- 0.045 | 33.3 | 0.008 (33) | 0.002 |
| Thallium ⁴ | 0.00024 | 0.005-0.549 | 100 | 0.108 (30) | 0.033 |
| Zinc ⁴ | 0.388 @ >400 mg/L hardness | 0.04-0.33 | 0 | 0.197 (9) | NA ⁵ |

Note: Bold values indicate the human health or chronic aquatic life criteria are exceeded.
¹Units are mg/L unless otherwise noted (metals are total recoverable).
²The lowest value between the surface water human health and chronic aquatic life criteria.
³Data from May 1990 to November 2014
⁴Total recoverable metals data from May 1990 to November 2014.
⁵NA = not analyzed, removed from the monitoring plan for this station.
⁶Most recent samples for cyanide and chloride were collected on 5/14/1996; both substances have been removed from the monitoring plan for this station.

Little Dog Creek

Two surface water monitoring stations and one spring (Section 29 Spring) are monitored in Little Dog Creek, but few water quality data are available for the surface water sites due to the ephemeral nature of this drainage. Additional data have been collected from Upper Little Dog Spring.

The data from surface water stations KVSW-1 and KVSW-6 are in **Table 3-14**. KVSW-1 is downgradient of the Horseshoe Waste Rock Dump in the North Fork Little Dog Creek. KVSW-6 is downgradient of the North Muleshoe Waste Rock Dump in the South Fork Little Dog Creek. Flows at KVSW-1 have been observed and sampled twice – once in 1991 and once in 2011. Flow at KVSW-6 has been observed and sampled once in 1995. The samples exceeded water quality standards for some substances as shown in **Table**

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3-14. The operation of the pumpback system since 1996 has intercepted flows above KVSW-6.

| Parameter ¹ | DEQ-7 Criteria ² | KVSW-1 1991/2011 | KVSW-6 1995 |
|---|-------------------------------|--------------------------------|----------------|
| SC (µS/cm) | --- | 2490/199 | 2240 |
| Sulfate | --- | 1500/5 | 1220 |
| Nitrate/nitrite as N | 10 (1.3 in summer) | 7.76/0.01 | 25.4 |
| Cyanide as total | 0.0052 | 0.007 /-- | <0.005 |
| Chloride | --- | 8/-- | 20 |
| Arsenic | 0.010 | 0.037 /0.003 | 0.006 |
| Iron | 1.0 | 0.38/-- | <0.03 |
| Selenium | 0.005 | 0.053 /0.001 | 0.036 |
| Thallium | 0.00024 | NA ³ / 0.002 | 0.28 |
| Zinc | 0.388 @ >400 mg/L hardness | 0.06/-- | 0.05 |
| <p>Note: Bold values indicate the human health or chronic aquatic life criteria are exceeded.</p> <p>¹ Units are mg/L unless otherwise noted (metals are total recoverable).</p> <p>² The lowest value between the surface water human health and chronic aquatic life criteria.</p> <p>³ NA = not analyzed.</p> | | | |

Table 3-15 presents data from the Section 29 Spring collected between 1990 and 2014, including data collected before the pumpback system was installed to intercept mine-influenced waters upgradient of the spring in 1996. The Section 29 Spring is below the confluence of the North and South forks of Little Dog Creek and below the historical tailings pond in the North Fork Little Dog Creek (**Figure 3-3**). Nitrates, sulfate, and selenium concentrations increased after the North Muleshoe Waste Rock Dump was developed. Nitrate concentration rose from an average background concentration of approximately 1 mg/L to a high of 14 mg/L before the pumpback system in this drainage was installed and operated. Nitrate slowly diminished to about 1 mg/L or less in 2014. The average concentrations of most substances remained relatively constant at this site, while selenium frequently slightly exceeds chronic aquatic life criteria prior to mixing with augmentation water at the stock tank.

This spring represents the beginning of intermittent surface flows downgradient of the mine. This spring has been developed and discharges to a stock tank. Installation of pumpback system KVPB-6 temporarily reduced flow of this spring, so CR Kendall Mine augmented flow to this spring from WW-7 and Upper Little Dog Spring. The flow augmentation discharged to Little Dog Creek occurs below the Section 29 Spring sampling point to avoid influencing water quality monitoring results for the spring.

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**TABLE 3-15
ANALYSES FOR SECTION 29 SPRING IN LITTLE DOG CREEK 1990-2014**

| Parameter ¹ | DEQ-7 Criteria ² | Range of Data | % of Samples Exceeding Standards | Average Concentration (Number of Samples) | Recent (2014) |
|-----------------------------------|-----------------------------------|----------------------|----------------------------------|---|-----------------|
| SC (µS/cm) ³ | --- | 710-1900 | --- | 1335 (173) | 1260 |
| Sulfate ³ | --- | 61-768 | --- | 482(173) | 381 |
| Nitrate/nitrite as N ³ | 10 (1.3 in summer) ⁽⁶⁾ | 0.37- 14.1 | 3.4% ⁽⁷⁾ | 3.42 (175) | 0.61 |
| Cyanide as total | 0.0052 | <0.005 | 0 | 0.005 (8) | NA |
| Arsenic ⁴ | 0.010 | <0.003-0.005 | 0 | 0.003 (153) | <0.003 |
| Iron ⁴ | 1.0 | <0.01-0.22 | 0 | 0.024 (21) | NA ⁵ |
| Selenium ⁴ | 0.005 | <0.001- 0.013 | 76.5 ⁽⁹⁾ | 0.007 (153) | 0.007 |
| Thallium ⁴ | 0.00024 | <0.002- 0.029 | 2.9 ⁽⁸⁾ | 0.002 (171) | <0.002 |
| Zinc ⁴ | 0.388 @ >400 mg/L hardness | <0.01-0.03 | 0 | 0.013 (9) | NA |

Note: Bold values indicate the human health or chronic aquatic life criteria are exceeded.

¹Units are mg/L unless otherwise noted (metals are total recoverable).

²The lowest value between the surface water human health and chronic aquatic life criteria.

³Data from May 1990 to November 2014.

⁴Total recoverable metals data from May 1990 to November 2014.

⁵NA = not analyzed, removed from monitoring plan.

⁶ Prior to 2014, DEQ-7 criteria were for 10 mg/L year-round.

⁷ Percent exceedances shown are based on the historic criteria of 10mg/L year round.

⁸ The detection limit for Thallium has historically been 0.002 mg/L. Tests reporting less than that detection limit (<0.002 mg/L) are treated as a non-exceedance.

⁹ Augmentation water from upgradient springs is added to spring flow prior to release from the stock tank, resulting in few if any exceedances downstream in Little Dog Creek.

In 2014, a revised nitrate surface water quality standard of 1.3 mg/L was adopted for summer months only (see note 6). Prior to 2014, nitrate exceeded the 10 mg/L numeric standard at the Section 29 Spring six times, which was prior to the installation of a pumpback system. Nitrate has not exceeded 1.3 mg/L in summer months since the adoption of the standard in 2014.

Few detections of thallium have occurred at the Section 29 Spring. Until recently, laboratory analyses for thallium could not detect levels at the current surface water quality standard. For these past analyses, the detection limit used by the laboratory was reported, indicating the sample exceeded the established thallium standard, even if that was not actually the case.

Selenium in the Section 29 Spring often exceeds the chronic aquatic life criterion (averaging 0.007 mg/L), but never the acute aquatic life criterion or the human health standard. Because augmentation water is added to the same stock tank the spring is piped into (see note 9), it is unlikely the chronic aquatic life criterion is ever exceeded

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once the mixed water leaves the stock tank. Selenium concentrations of 0.01 mg/L (April 1985) and 0.009 mg/L (December 1985) were reported for the Section 29 Spring (not included in **Table 3-15**) long before any mining under the Operating Permit occurred within the Little Dog Creek watershed upgradient of the spring.

Dog Creek

The Dog Creek drainage is north of the CR Kendall Mine site. No water monitoring stations were established in this watershed. Several sites in this watershed were sampled by DEQ in 1998 for estimating background water quality. The majority of the sampling locations were not downgradient of the Kendall mine site and are indicative of the quality of local surface water sources not potentially influenced by the mine. The results of the stream and stock pond water sampling are in **Tables 3-16** and **3-17**. Most of the surface water samples from the Dog Creek watershed were within human health and chronic aquatic life standards with the exceptions that iron slightly exceeded chronic aquatic life standards in surface water site #10 and stock pond #7, and arsenic, which was detected in most of the stock ponds and stream sampling sites, exceeded the current drinking water standard in one of the stock ponds.

| Parameter | DEQ-7 Criteria ² | Concentration (mg/L unless noted otherwise) | | |
|-----------------------|-----------------------------|---|--------|-------------|
| | | #3 | #6 | #10 |
| SC (µS/cm) | --- | 855 | 737 | 507 |
| Sulfate | --- | 74.8 | 44.5 | 11.7 |
| Nitrate/nitrite as N | 10 (1.3 in summer) | N/A | N/A | N/A |
| Arsenic ³ | 0.010 | 0.002 | <0.001 | 0.006 |
| Iron ³ | 1.0 | 0.46 | 0.16 | 1.11 |
| Selenium ³ | 0.005 | 0.002 | <0.001 | <0.001 |
| Thallium ³ | 0.00024 | <0.001 | <0.001 | <0.001 |

¹ Data collected by DEQ June 30, 1998.
² The lowest value between the surface water human health and chronic aquatic life criteria.
³Total recoverable metals.

**TABLE 3-17
ANALYSES FOR STOCK PONDS IN DOG CREEK¹**

| Parameter | DEQ-7 Criteria ² | Concentration (mg/L unless noted otherwise) | | | |
|-----------------------|-----------------------------|---|--------|--------------|-------------|
| | | #2 | #4 | #5 | #7 |
| SC (µS/cm) | --- | 517 | 518 | 343 | 754 |
| Sulfate | --- | 98.7 | 83.8 | 22.1 | 9.8 |
| Arsenic ³ | 0.010 | 0.006 | 0.008 | 0.015 | <0.001 |
| Iron ³ | 1.0 | 0.54 | 0.35 | 0.26 | 1.07 |
| Selenium ³ | 0.005 | <0.001 | <0.001 | <0.001 | <0.001 |
| Thallium ³ | 0.00024 | <0.001 | <0.001 | <0.001 | <0.001 |

¹ Data collected by DEQ June 30, 1998.
² The lowest value between the surface water human health and chronic aquatic life criteria.
³Total recoverable metals.

Groundwater Quality

The groundwater quality beneath the CR Kendall Mine site has been monitored at 45 groundwater monitoring wells starting in 1981, of which 4 continue to be sampled regularly. Groundwater has also been sampled at three water supply wells, four pumpback systems, and several local springs and seeps. The pumpback systems have a wide capture zone and represent a larger volume of groundwater than a monitoring well or a seep. The remaining monitoring wells and the pumpback systems are in the South Fork Last Chance Creek (TMW-42 and KVPB-5), Mason Canyon (process valley) (TMW-24A and TMW-26), Barnes-King Gulch (TMW-30A and KVPB-2), and South Fork Little Dog Creek (TMW-40D and KVPB-6) watersheds (**Figure 3-3**). Trends in the concentrations of arsenic, selenium, and thallium in CR Kendall Mine groundwater and the process pad drainage over the last 20 years are provided in **Figures A-1 through A-9** in **Appendix A**. These wells are below the pumpback systems to monitor the effectiveness of the systems. The water from the pumpback systems is routed, treated, and disposed of as described in Section 2.2.

The groundwater in the monitoring wells and pumpback water has exceeded the DEQ-7 groundwater quality standard for thallium in most samples since monitoring began. Some exceedances of nitrate or arsenic standards have also occurred.

South Fork Last Chance Creek

Groundwater monitoring in South Fork Last Chance Creek began in December 1989 at well TMW-31. In 1996, pumpback system KVPB-5 was constructed downgradient of this well and TMW-31 was abandoned. TMW-42 was installed downgradient of the pumpback system in 1998. The only parameter that exceeded standards in TMW-42 water has been thallium (**Table 3-18**). Trends in the concentrations of arsenic, selenium, and thallium in South Fork Last Chance Creek groundwater over the last 20 years are

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shown for KVPB-5 (Figure A-2; Appendix A) and for TMW-42 (Figure A-3; Appendix A).

| Parameter ¹ | DEQ-7 Criteria | Range of Data | % of Samples Exceeding Standards | Average Concentration (Number of Samples) | Recent (2014) |
|------------------------|----------------|-----------------|----------------------------------|---|------------------|
| SC (µS/cm) | --- | 610-1750 | --- | 1288 (128) | 885 |
| Sulfate | --- | 76-863 | --- | 494 (128) | 270 |
| Nitrate/nitrite as N | 10 | 0.03-4.26 | 0 | 1.36 (128) | 0.52 |
| Arsenic | 0.010 | <0.003 | 0 | <0.003 (128) | <0.003 |
| Selenium | 0.050 | <0.001-0.005 | 0 | 0.002 (128) | <0.001 |
| Thallium | 0.002 | <0.002-0.009 | 73 | 0.003 (128) | <0.002 |
| Zinc | 2.0 | 0.01-0.02 | 0 | 0.01 (5) | NA ³ |

Note: Bold indicates value at or above the groundwater human health standards.
¹ Units are mg/L unless otherwise noted.
² Data from February 1998 to November 2014
³NA = not analyzed, removed from monitoring plan in 1998.

Water chemistry data for pumpback system KVPB-5 are in **Table 3-19** and shown graphically in **Figure A-3 (Appendix A)**. The only substances that exceeded human health standards were nitrate, arsenic, and thallium.

| Parameter ¹ | DEQ-7 Criteria | Range of Data | % of Samples Exceeding Standards | Average Concentration (Number of Samples) | Recent (2014) |
|------------------------|----------------|----------------------|----------------------------------|---|-----------------|
| SC (µS/cm) | --- | 1750-3370 | --- | 2650 (112) | 2520 |
| Sulfate | --- | 673-2210 | --- | 1624 (112) | 1470 |
| Nitrate/nitrite as N | 10 | 1.81- 12.6 | 12.5 | 6.46 (112) | 2.74 |
| Arsenic | 0.010 | <0.003- 0.018 | 0.9 | 0.004 (112) | 0.003 |
| Selenium | 0.050 | <0.001-0.028 | 0 | 0.012 (112) | 0.017 |
| Thallium | 0.002 | 0.008-0.156 | 100 | 0.028 (112) | 0.023 |
| Zinc | 2.0 | 0.020-0.070 | 0 | 0.039 (7) | NA ³ |

Note: Bold indicates value at or above the groundwater human health standards.
¹ Units are mg/L unless otherwise noted.
² Data from November 1996 to November 2014
³NA = not analyzed, removed from monitoring plan in 1998.

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Mason Canyon

Groundwater monitoring in Mason Canyon began in 1985. Since then, there have been 15 monitoring wells installed in the drainage. Most of these wells were installed to monitor for leaks from process ponds and were removed due to expansion of mine facilities. TMW-24A was installed near the permit boundary in 1994 and continues to be monitored. The substances that exceeded standards were thallium and arsenic (**Table 3-20**). Concentration trends for arsenic, selenium, and thallium have been decreasing over the past 8 years for TMW-24A, as shown in **Figure A-4 (Appendix A)**. Arsenic does not appear to be derived from the CR Kendall mine site. Shallow groundwater within the Process Valley drains through the underdrain into collection sump TMW-26, and this water has remained within water quality standards for arsenic. The arsenic detected in TMW-24A is likely related to the historic tailings that were encountered during construction of the leach pads and were removed from the Process Valley but still remain downgradient of the CR Kendall mine site. Similar arsenic concentrations have been observed for many years in lower Barnes-King Gulch, where surface water flows through historic tailings.

| Parameter ¹ | DEQ-7 Criteria | Range of Data | % of Samples Exceeding Standards | Average Concentration (Number of Samples) | Recent (2014) |
|------------------------|----------------|----------------------|----------------------------------|---|------------------|
| SC (µS/cm) | --- | 974-1770 | --- | 1150 (231) | 1320 |
| Sulfate | --- | 23-483 | --- | 295 (231) | 394 |
| Nitrate/nitrite as N | 10 | 0.01-0.14 | 0 | 0.02 (230) | 0.01 |
| Arsenic | 0.010 | 0.003- 0.039 | 79.2 | 0.019 (231) | 0.020 |
| Selenium | 0.050 | <0.001-0.005 | 0 | 0.001 (231) | <0.001 |
| Thallium | 0.002 | <0.002- 0.004 | 0.43 | 0.002 (231) | <0.002 |
| Zinc | 2.0 | 0.01-0.08 | 0 | 0.03 (34) | NA ³ |

Note: Bold indicates value at or above the groundwater human health standards.
¹ Units are mg/L unless otherwise noted.
² Data from May 1994 to November 2014
³NA = not analyzed, removed from monitoring plan in 1998.

Process pad 4 and its underdrain system were constructed in 1989 (Section 2.2.1.1), and water flowing through the underdrain system reports to a sump, TMW-26. Water chemistry data for TMW-26 are in **Table 3-21** and shown graphically in **Figure A-5 (Appendix A)**. Until 1996, the sump discharged into Mason Canyon except when it was pumped back in response to cyanide spills. Since 1996, the sump has been continuously pumped back. Nitrate, thallium, and cyanide have exceeded groundwater human

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health standards in the past. Since process pad operations ceased, only thallium continues to exceed its standard.

| Parameter ¹ | DEQ-7 Criteria | Range of Data | % of Samples Exceeding Standards | Average Concentration (Number of Samples) | Recent (2014) |
|------------------------|----------------|-----------------|----------------------------------|---|-----------------|
| SC (µS/cm) | --- | 467-3100 | --- | 1369 (188) | 2370 |
| Sulfate | --- | 23-1650 | --- | 392 (175) | 428 |
| Nitrate/nitrite as N | 10 | 0.88-13.0 | 2 | 4.42 (192) | 1.47 |
| Arsenic | 0.010 | <0.003-0.009 | 0 | 0.004 (176) | 0.008 |
| Selenium | 0.050 | <0.001-0.024 | 0 | 0.012 (176) | 0.008 |
| Thallium | 0.002 | 0.002-0.074 | 100 | 0.032 (172) | 0.035 |
| Zinc | 2.0 | 0.040-0.180 | 0 | 0.08 (18) | NA ³ |

Note: Bold indicates value at or above the groundwater human health standards.
¹ Units are mg/L unless otherwise noted.
² Data from August 1990 to November 2014
³NA = not analyzed, removed from monitoring plan in 1998.

Barnes-King Gulch

Groundwater monitoring in Barnes-King Gulch began in 1990 at TMW-30. This well was replaced by TMW-30A due to concerns about well construction. TMW-30A was installed near the permit boundary in 1994 (before the pumpback system was installed in 1996) and continues to be monitored (**Figure 3-3**). Thallium, arsenic, and selenium have all exceeded standards in the past, but only thallium continues to exceed its standard (**Table 3-22**). Trends in the concentrations of arsenic, selenium, and thallium from TMW-304A for the last 20 years are shown in **Figure A-6 (Appendix A)**. Water quality in the area of well TMW-30A may be influenced by residual historic tailings within the gulch.

| Parameter ¹ | DEQ-7 Criteria | Range of Data | % of Samples Exceeding Standards | Average Concentration (Number of Samples) | Recent (2014) |
|------------------------|-------------------|------------------|---|--|-----------------|
| SC (µS/cm) | --- | 398-1400 | --- | 1087 (45) | 935 |
| Sulfate | --- | 60-594 | --- | 400 (45) | 281 |
| Nitrate/nitrite as N | 10 | 0.01-3.93 | 0 | 0.73 (44) | 0.12 |
| Arsenic | 0.010 | 0.002-0.120 | 13 | 0.011 (45) | <0.003 |
| Selenium | 0.050 | <0.001-0.050 | 2 | 0.009 (45) | 0.005 |
| Thallium | 0.002 | <0.002-0.100 | 36 | 0.007 (45) | 0.003 |
| Zinc | 2.0 | 0.01-0.13 | 0 | 0.04 (18) | NA ³ |

Note: Bold indicates value at or above the groundwater human health standards.
¹ Units are mg/L unless otherwise noted.
² Data from May 1994 to August 2014
³NA = not analyzed, removed from monitoring plan in 1998.

Pumpback system KVPB-2 was installed in 1996 in Barnes-King Gulch downgradient of the South Muleshoe Waste Rock Dump (**Figure 3-3**). Water chemistry data for pumpback system KVPB-2 are in **Table 3-23** and shown graphically in **Figure A-7 (Appendix A)**. Nitrate, arsenic, and thallium have all exceeded standards in the past, but only thallium continues to exceed its standard. **Figure A-7** shows that arsenic concentrations have generally declined throughout the period of record at that location, with the exception of a spike during 2008 that was associated with testing a passive treatment system upgradient of the capture system. The other graphs on **Figure A-7** show that selenium concentrations in pumpback KVPB-2 have remained fairly constant (with a minor increase in 2010-2012) and well below the human health standard, while thallium concentrations increased steadily through 2005 but have been decreasing since then.

**TABLE 3-23
WATER ANALYSES FOR PUMPBACK SYSTEM KVPB-2, BARNES-KING GULCH
(1996-2014)²**

| Parameter ¹ | DEQ-7 Criteria | Range of Data | % of Samples Exceeding Standards | Average Concentration (Number of Samples) | Recent (2014) |
|------------------------|----------------|----------------------|----------------------------------|---|-----------------|
| SC (µS/cm) | --- | 662-3560 | --- | 2486 (120) | 1450 |
| Sulfate | --- | 572-1700 | --- | 1353 (120) | 1240 |
| Nitrate/nitrite as N | 10 | 0.23- 14.7 | 8.3 | 3.76 (120) | 0.57 |
| Arsenic | 0.010 | <0.003- 0.051 | 58 | 0.013 (120) | 0.003 |
| Selenium | 0.050 | 0.006-0.030 | 0 | 0.014 (120) | 0.012 |
| Thallium | 0.002 | 0.033-1.80 | 100 | 1.102 (120) | 0.033 |
| Zinc | 2.0 | 0.170-0.350 | 0 | 0.24 (8) | NA ³ |

Note: Bold indicates value at or above the groundwater human health standards.
¹ Units are mg/L unless otherwise noted.
² Data from November 1996 to November 2014
³NA = not analyzed, removed from monitoring plan in 1998.

Little Dog Creek

South Fork Little Dog Creek. Groundwater monitoring in South Fork Little Dog Creek began in 1994 at TMW-36. This well was replaced by TMW-40D in 1998 because TMW-36 was too close to the pumpback system (**Figure 3-3**). The only substances that exceeded human health standards in TMW-40D were nitrate and thallium (**Table 3-24**). Trends in the concentrations of arsenic, selenium, and thallium from TMW-40D for the last 20 years are shown in **Figure A-8 (Appendix A)**. **Figure A-8** shows arsenic concentrations have remained below the detection limit throughout the period of record. Selenium concentrations have declined somewhat and have consistently remained below the human health standard. Data from the well show a few exceedances of the human health standard for thallium early during the monitoring period, but none in the past 10 years. Thallium has been consistently below the detection limit since then.

Pumpback system KVPB-6 was installed in 1996 in South Fork Little Dog Creek downgradient of the North Muleshoe Waste Rock Dump (**Figure 3-3**). Water chemistry data for pumpback system KVPB-6 are in **Table 3-25** and shown graphically in **Figure A-9 (Appendix A)**. This pumpback system consists of two interception trenches and three pumpback wells. The substances that exceeded human health standards in the past were nitrate, arsenic, selenium, and thallium, while selenium and thallium continue to exceed standards. **Figure A-9** shows a slight decrease in average arsenic concentrations over the period of record and a more substantial decrease in thallium concentrations. The concentration of selenium has increased at this location, from an average of about 0.025 mg/L in 1996 to a current average of about 0.06 mg/L. The graph also indicates that the selenium concentration at this seepage collection system

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does not appear to have increased since approximately 2007. Nitrate and sulfate concentrations at KVPB-6 have also shown strongly decreasing trends.

| Parameter ¹ | DEQ-7 Criteria | Range of Data | % of Samples Exceeding Standards | Average Concentration (Number of Samples) | Recent (2014) |
|--------------------------------|----------------|----------------------|----------------------------------|---|-----------------|
| SC ($\mu\text{S}/\text{cm}$) | --- | 1200-2650 | --- | 1939 (142) | 1640 |
| Sulfate | --- | 361-1440 | --- | 918 (142) | 606 |
| Nitrate/nitrite as N | 10 | 1.52- 18.8 | 37 | 8.34 (142) | 1.91 |
| Arsenic | 0.010 | <0.003-0.003 | 0 | <0.003 (142) | <0.003 |
| Selenium | 0.050 | 0.007-0.038 | 0 | 0.018 (142) | 0.018 |
| Thallium | 0.002 | <0.002- 0.006 | 7 | <0.002 (142) | <0.002 |
| Zinc | 2.0 | 0.01-0.04 | 0 | 0.01 (7) | NA ³ |

Note: Bold indicates value at or above the groundwater human health standards.
¹ Units are mg/L unless otherwise noted.
² Data from February 1998 to November 2014
³NA = not analyzed, removed from monitoring plan in 1998.

| Parameter ¹ | DEQ-7 Criteria | Range of Data | % of Samples Exceeding Standards | Average Concentration (Number of Samples) | Recent (2014) |
|--------------------------------|----------------|----------------------|----------------------------------|---|-----------------|
| SC ($\mu\text{S}/\text{cm}$) | --- | 760-2950 | --- | 2324 (111) | 2090 |
| Sulfate | --- | 649-1870 | --- | 1346 (111) | 1120 |
| Nitrate/nitrite as N | 10 | 1.73- 39.8 | 62 | 11.79 (111) | 1.95 |
| Arsenic | 0.010 | <0.003- 0.018 | 50 | 0.010 (111) | 0.008 |
| Selenium | 0.050 | 0.008- 0.070 | 23 | 0.038 (111) | 0.052 |
| Thallium | 0.002 | 0.020-0.820 | 100 | 0.360 (111) | 0.219 |
| Zinc | 2.0 | 0.030-0.120 | 0 | 0.05 (8) | NA ³ |

Note: Bold indicates value at or above the groundwater human health standards.
¹ Units are mg/L unless otherwise noted.
² Data from November 1996 to November 2014
³NA = not analyzed, removed from monitoring plan in 1998.

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North Fork Little Dog Creek. Groundwater monitoring in North Fork Little Dog Creek began in 1989 at TMW-15. This well was replaced by TMW-15B in 1993 due to construction of the Horseshoe Waste Rock Dump (**Figure 3-3**). Both wells are typically dry or contain too little water to sample; therefore, no groundwater analyses could be completed.

3.3.3 Environmental Consequences

3.3.3.1 No Action Alternative

Surface Water

The existing water capture systems are intercepting shallow groundwater that contains some contaminants at concentrations above surface water standards (DEQ 2012). The captured water could influence and degrade the quality of surface waters in these drainages if not captured and treated. The No Action Alternative would continue the operations of the current water capture systems and would result in minimal additional impacts to surface water. Current surface water drainage patterns and runoff volumes and rates would likely remain as they are now. Water augmentation from Mason Canyon Spring to South Fork Last Chance Creek and from Little Dog Spring to Little Dog Creek would continue. WW-6 would be maintained as a contingency for augmentation as necessary. WW-7 would continue to flow seasonally to Little Dog Creek. Over the long-term, and as vegetation on reclaimed surfaces becomes more dense, ephemeral surface water runoff rates would likely decrease.

Groundwater

Currently, groundwater that does not meet human health groundwater quality standards is pumped from South Fork Last Chance Creek and the Process Valley Underdrain to Process valley ponds 2B and 3B where it is treated with particulate filtration and zeolite adsorption before being discharged to the Kendall Pit. Treated groundwater discharge is also permitted to the Muleshoe Pit, but this location has not been used. Groundwater with occasional exceedances of standards for arsenic, selenium, and/or nitrates could also be land applied during the growing season.

Zeolites have been effective in removing thallium from water through bench- and pilot-scale testing, and through operating a 100 GPM, full-scale treatment system at the Kendall Mine for over 10 years. Optimization studies conducted in 2010 and 2011 are documented in the Closure Plan (Appendices E and F) and similar water quality results were achieved using two different types of zeolite.

The treatment system utilizes a series of zeolite-filled columns, which sequentially lower the thallium concentration in the mine water through adsorptive action. Examples from the 2010 and 2011 studies show thallium concentrations being reduced from 0.379 - 0.6 mg/L in the influent to 0.0002 mg/L in effluent from the last column.

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The zeolite treatment system is effective and generates a non-hazardous waste product (spent zeolites), as determined by TCLP leach testing. Leach testing indicates that the thallium is effectively adsorbed on the zeolites, with < 1% of the thallium being mobilized.

Under the No Action Alternative, CR Kendall Mine would continue with its current treatment configuration. Treated water that is discharged to groundwater is expected to infiltrate to the Madison aquifer. There are no monitoring wells at the site deep enough to collect samples from the Madison aquifer, so the local water chemistry in this aquifer is unknown.

Process Pad Drainage

During treatment optimization studies in 2010 and 2011, leachability tests (SPLP and TCLP) were conducted on the spent zeolites, and results indicated the leachable concentrations of the “RCRA 8” metals (As, Ba, Cd, Cr, Pb, Hg, Se, and Ag) were below detection limits. The adsorbed thallium was found to be essentially non-leachable, with < 1% of the thallium being liberated from the zeolites.

Water draining from process pads is currently collected in pond 7 and is land applied during the growing season. Selenium concentrations have been increasing in the process pad drainage water since 2011, which may be related to decreased dilution since the process pads were reclaimed.

3.3.3.2 Proposed Action

Surface Water

If the Proposed Action is selected, no additional impacts to surface water beyond those described in section 3.3.2.2 would occur. Current surface water drainage patterns and runoff volumes and rates would likely remain as they are now. Water augmentation from Mason Canyon Spring to South Fork Last Chance Creek and from Little Dog Spring to Little Dog Creek would continue. Well WW-6 would be maintained as a contingency for augmentation as necessary, and artesian well WW-7 would continue to flow seasonally to Little Dog Creek. Over time, as vegetation on reclaimed surfaces becomes more dense, ephemeral surface water runoff rates would likely decrease.

Groundwater

Under the Proposed Action all captured waters including the process pad drainage and water captured from KVPB-5, TMW-26, KVPB-2, and KVPB-6, would be routed to Pond 7 for storage before being pumped to the centrally located WTP for particulate filtration and zeolite adsorption, and then discharged to groundwater through the Kendall Pit.

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There are several benefits of routing all impacted waters to a central WTP for removal of thallium before discharging to groundwater through the Kendall Pit. First, it would not be cost effective to build and operate multiple WTPs at the groundwater capture sources. Another reason is that drainage from the process pads has not met, and does not currently meet DEQ-7 groundwater standards for total cyanide, nitrate/nitrite-N, antimony, arsenic, selenium, and thallium. By blending the process pad drainage with water from the pumpback systems, the combined water is projected to meet DEQ-7 groundwater standards for total cyanide, nitrate/nitrite-N, antimony, and selenium. A third reason is that while KVPB-6 groundwater does not meet the DEQ-7 groundwater standard for selenium, the other pumpback waters, KVPB-2, TMW-26, and KVPB-5, all have low selenium concentrations. Fourth, by implementing a centralized water treatment system and combining all waters, CR Kendall projects that treatment for selenium would not be necessary to achieve groundwater discharge standards. All captured mine water sources exceed the DEQ-7 groundwater standard for thallium and would require treatment prior to discharge to groundwater.

The water quality mixing model by Hydrometrics (2015) titled "*Updated Mixing Model Predictions of Combined Water Quality*," indicates that the blended and treated water would exceed groundwater human health standards for arsenic, and that the effluent arsenic concentration would be projected to range between 0.012 mg/L and 0.022 mg/L. CR Kendall's closure plan assumed that these arsenic concentrations would be acceptable for discharge to groundwater based upon the "Evaluation of Background Hydrochemistry" studies conducted by WMC in 1999 and 2003 which indicated that natural background concentrations of arsenic are elevated in the CR Kendall Mine area. However, those studies only addressed surface water and shallow alluvial groundwater. No data were collected that documented elevated arsenic concentrations within the Madison limestone aquifer to which the treated water is proposed to be discharged.

It is possible that this deep aquifer beneath the mine site either contains naturally elevated arsenic concentrations (thus allowing for water of similar quality to be added to it) or that a sufficient volume of groundwater flows through the Madison aquifer to rapidly dilute any discharge from the mine to within groundwater standards. However, no monitoring wells have been drilled into the Madison aquifer within the region of the CR Kendall Mine and thus no conclusive data are available that would support the discharge of water containing elevated levels of arsenic into the deep groundwater system. The depth to groundwater within the Madison limestone in the area of the Kendall mine is unknown, but is greater than the 650 foot depth below ground surface that was reached by the historic underground mines in the area. The general direction of groundwater flow within the regional Madison aquifer is from south (Big Snowy Mountains) to north (Feltis 1973). Downgradient of the Kendall mine, groundwater from the Madison aquifer is not used as a drinking water supply and does not discharge to the surface as springs within the immediate area. The nearest spring which may be derived from the Madison aquifer is Warm Spring located to the south of the

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North Moccasin Mountains, approximately 4 miles from the mine and presumably upgradient based upon the regional flow direction. The nearest discharge points for the regional flow within the Madison aquifer to the north of the North Moccasin Mountains are a series of warm springs which surround the Little Rocky Mountains about 60 miles to the northeast.

Process Pad Drainage

Selenium concentrations in the process pad drainage have been increasing since approximately 2010, which is also a concern because the Proposed Action water treatment process primarily removes thallium. If selenium from the process pad drainage continues to increase, selenium concentrations in the blended water may exceed the DEQ-7 groundwater human health standard in the future.

The projected impacts to groundwater would be from the inability of the proposed water treatment processes to meet human health groundwater standards for arsenic, and for selenium if concentrations in the process pad drainage continue to increase.

3.3.3.3 Process Pad Drainage Pretreatment Alternative

Surface Water

Similar to the No Action and Proposed Action alternatives, there would be minimal future impacts to surface water under the Process Water Pretreatment Alternative. Current surface water drainage patterns and runoff volumes and rates would likely remain as they are now. Water augmentation from Mason Canyon Spring to South Fork Last Chance Creek and from Little Dog Spring to Little Dog Creek would continue. Well WW-6 would still be maintained as a contingency for augmentation as necessary, and artesian well WW-7 would continue to flow seasonally to Little Dog Creek. Over the long-term, as vegetation on reclaimed surfaces becomes more dense, stormwater runoff rates would likely decrease.

Groundwater

Under the Process Pad Drainage Pretreatment Alternative, drainage from the process pads would be pretreated for the removal of arsenic before being combined at the central WTP with waters from the groundwater capture pumpback systems in the South Fork Last Chance Creek, Mason Canyon, Barnes King Gulch, and South Fork Little Dog Creek drainages. The combined water would be treated with particulate filtration and zeolite adsorption, and discharged to groundwater through the Kendall Pit. The pretreatment for arsenic under this alternative would achieve the DEQ-7 groundwater human health standard for arsenic.

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CR Kendall Mine WTP data (Volberding, 2015c) shows the WTP effluent consistently meeting all DEQ-7 groundwater standards. CR Kendall Mine currently disposes of all captured water that does not meet the DEQ-7 groundwater standards via LAD on the mine site.

Exceedances for arsenic are almost exclusively due to high concentrations in the process pad drainage. An exception is for KVPB-6 water that occasionally exceeded 0.010 mg/L arsenic. The combined groundwater pumpback waters would not have arsenic concentrations that exceed 0.010 mg/L. It would be more effective to pretreat only the process pad drainage to remove arsenic rather than treat the combined mine waters. Arsenic speciation analyses show the arsenic in the process pad drainage exists primarily as arsenic (5+), or arsenate, which is more amenable to removal through adsorptive treatment.

While antimony levels in the combined waters have not exceeded DEQ-7 standards, the process pad drainage has had some exceedances for antimony. As a side-benefit, some arsenic removal processes also remove or lower antimony concentrations. The potential lowering of antimony in the process pad drainage waters would be an added benefit for pretreating the process pad drainage prior to treatment at the WTP.

Pretreating drainage from the process pads for arsenic would be important for several reasons. First, the process pad drainage is the primary source of arsenic and the cause of most potential exceedances in the blended water. Second, unlike cyanide or nitrate/nitrite that should continue to decrease over time, the trend and timeframe for decreasing arsenic concentrations to reach steady-state are less predictable. Cyanide and nitrate/nitrite were added to the process pads during the gold mining and heap leach operations, so it is reasonable to expect total cyanide and nitrate/nitrite concentrations to continue declining and ultimately to meet DEQ-7 standards (0.2 mg/L total cyanide; 10 mg/L nitrate/nitrite as N). There are no natural sources of cyanide in the area and few natural sources of nitrate/nitrite, but thallium and arsenic are naturally occurring elements. Even though elevated thallium and arsenic concentrations in the process pad drainage are likely influenced by human activities, the quantities of these elements in the process pad and their rates of dissolution over the long term are uncertain. It is unknown how quickly, or to what level, the concentrations of thallium and arsenic will decrease in the process pad drainage.

The uncertainties with projecting future concentrations for thallium and arsenic also apply for selenium concentrations in drainage from the process pads. Selenium concentrations appear to have a long-term decline from 1994 through 2010, but have recently leveled off and may have increased (**Figure A-1; Appendix A**). The short period (between 2010 and 2013) of increasing selenium concentrations makes it difficult to establish a trend. If selenium levels in the process pad drainage continue to increase, there could be a point where the blended water and the current water treatment process would no longer meet the DEQ-7 selenium groundwater standard of 0.050 mg/L.

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Additional pre-treatment or a larger volume of low-selenium water would be needed to meet the selenium groundwater standard. This would also be true if selenium concentrations continue to increase in KVPB-6 water (**Figure A-9; Appendix A**). Because selenium pre-treatment of drainage from the process pads may become necessary, it may be appropriate to select a pretreatment technology that will effectively remove both arsenate and selenate, or that can easily be modified at a later date to treat for selenate as well as arsenate.

The recent water quality mixing model (Hydrometrics 2015) showed maximum selenium concentration estimates above 0.04 mg/L for two pond storage sizes (7.2 million gallons and 20.5 million gallons) and three flow conditions (low flow, average flow, and maximum flow). Although there are no selenium speciation data for these two waters, it is reasonable to assume most of the selenium will be selenium (6+) or selenate because the arsenic speciation showed primarily oxidized arsenic (5+) or arsenate, which suggests the water has been exposed to air and is relatively oxidizing.

There would be fewer adverse impacts to groundwater under this alternative, compared to the No Action or Proposed Action alternatives because the addition of pretreatment for arsenic would produce water treatment effluent that meets all human health groundwater standards prior to discharge.

Process Pad Drainage

DEQ does not stipulate the arsenic-removal pretreatment process that should be used. If an adsorptive media treatment system is chosen by CR Kendall to pretreat the pad drainage, it would generate a spent media that could be contained within vessels. The spent media would likely pass TCLP testing for arsenic and be classified as non-hazardous waste for disposal purposes. The spent media would likely be: (1) shipped back to the manufacturer when exhausted; (2) shipped offsite for disposal; or (3) buried onsite if confirmed as non-hazardous. Minor environmental impacts from spent media disposal would result from some additional fuel consumption and air quality impacts for shipping offsite. Potential environmental impacts from these disposal options would range from some additional fuel consumption and air quality impacts for options 1 and 2, to temporary impacts to vegetation and soils for onsite disposal. For impact assessment purposes, the volume of spent granular ferric oxide adsorption treatment media generated from pretreating 15 gpm of process pad drainage water was estimated at 40 to 50 cubic feet per year.

Other water treatment technologies (e.g., biological treatment, reverse osmosis) were evaluated and considered, but dismissed from detailed evaluations. The complete list of the water treatment and disposal options considered but dismissed are in Section 2.5.4.

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3.3.3.4 Process Pad Barrier Cover Alternative

Surface Water

Similar to all of the other actions, under the Process Pad Barrier Cover Alternative there would be minimal future impacts to surface water if the Proposed Action is selected. Current surface water drainage patterns and runoff volumes and rates would likely remain as they are now. Water augmentation from Mason Canyon Spring to South Fork Last Chance Creek and from Little Dog Spring to Little Dog Creek would continue. Well WW-6 would still be maintained as a contingency for augmentation as necessary, and artesian well WW-7 would continue to flow seasonally to Little Dog Creek. Over the long-term as vegetation on reclaimed surfaces becomes more dense, stormwater runoff rates would likely decrease.

Groundwater

Under the Process Pad Barrier Cover Alternative all captured mine waters, including process pad drainage, and water captured from KVPB-6, KVPB-2, TMW-26, and KVPB-5, would be routed to Pond 7 before being pumped to the central WTP for particulate filtration and zeolite adsorption, and then discharged to groundwater through the Kendall Pit.

Instead of pretreating the process pad drainage for arsenic to achieve the groundwater human health standards, the Process Pad Barrier Cover Alternative would consist of a liner cover installation on process pads 3 and 4. Drainage water from these process pads would be routed to Pond 7 and combined with the captured alluvial groundwater from KVPB-6, KVPB-2, TMW-26, and KVPB-5. The blended waters would be pumped to the central WTP for particulate filtration and zeolite adsorption, and discharged to groundwater at the Kendall Pit.

Hydrologic Evaluation of Landfill Performance (HELP) modeling has shown that a geomembrane liner would greatly decrease the amount of rainfall infiltrating into and draining from the process pads (Tetra Tech 2004, Hydrometrics 2012). The reduced process pad drainage volume could reduce the total arsenic load discharging from the process pads. With the reduction in the amount of arsenic, the proposed water treatment system may be able to achieve concentrations of arsenic below human health standards. However, until a liner is installed and any increases or decreases in arsenic and selenium concentrations and loading are determined, the ability of the proposed treatment system to meet groundwater discharge standards remains unknown. Although a barrier cover is almost certain to reduce the volume of water infiltrating into the process pads, it is not known whether the concentrations of arsenic and selenium in the residual drainage would remain the same or increase, in response to changing oxidative conditions in the process pads. Therefore, it is not certain that groundwater standards would be met after blending of this water with water from the pumpback systems and treatment for thallium removal.

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Hydrologic Evaluation of Landfill Performance (HELP) modeling has shown that a geomembrane liner would greatly decrease the amount of rainfall infiltrating into and draining from the process pads (Tetra Tech 2004, Hydrometrics 2012). The reduced process pad drainage volume could reduce the total arsenic load discharging from the process pads. With the reduction in the amount of arsenic, the proposed water treatment system may be able to achieve concentrations of arsenic below human health standards. However, until a liner is installed and any increases or decreases in arsenic and selenium concentrations and loading are determined, the ability of the proposed treatment system to meet groundwater discharge standards remains unknown. Although a barrier cover is almost certain to reduce the volume of water infiltrating into the process pads, it is not known whether the concentrations of arsenic and selenium in the residual drainage would remain the same or increase, in response to changing oxidative conditions in the process pads. Therefore, it is not certain that groundwater standards would be met after blending of this water with water from the pumpback systems and treatment for thallium removal.

By decreasing the rate at which contaminants are flushed from the process pads, it is possible that placing a barrier cover over the pads may significantly increase the length of time that treatment of the residual process pad draindown is required.

The impacts of concern to groundwater are the potential inability of the Process Pad Barrier Cover Alternative to meet human health groundwater standards for arsenic, increasing selenium concentrations in the process pad drain-down water, and the potential degradation of groundwater quality in the Madison aquifer from the infiltration of the water with untreated arsenic.

3.4 Soils, Vegetation, and Reclamation

Reclamation status for the CR Kendall Mine is discussed in the description of the No Action Alternative in Chapter 2. The most current summary and reporting on the soils, vegetation, and reclamation are found in the Annual Progress Report for each year (CR Kendall 2014). This section discusses the soil, vegetation, and reclamation resources at the CR Kendall Mine. The quality of revegetation on reclaimed areas has improved in the past 20 years.

3.4.1 Analysis Area and Methods

The analysis for the soils, vegetation, and reclamation includes the area within the CR Kendall Mine disturbance boundary of 447.5 acres. The mine area, topography, disturbance boundary, and undisturbed areas within the disturbance boundary are shown on **Figure 1-2**.

For soils, the amount (depth) used for final reclamation and its ability to support the post-mine reclamation goals were analyzed. For vegetation, the level of success achieved through reclamation efforts to date and its ability to meet the post-mine land

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use were analyzed. For reclamation, the potential success of current reclamation methods and their ability to stabilize the disturbed areas and reestablish vegetation that supports the post-mining land use were evaluated.

3.4.2 Affected Environment

3.4.2.1 Soil Resources

The current disposition of the soils in the analysis area is: process pads 3 and 4 received a 17 inch soil cover in addition to an 18 inch basal layer (6 inches of 5 to 8 percent sodium bentonite amended subsoil and 12 inches of subsoil basal layer), and other disturbance areas received 8 to 10 inches of soil. The flat waste rock dump tops received the originally permitted reduced permeability layer cover that consists of (top down): 10-14 inch topsoil layer, 18 inch subsoil layer, 12 inch of coarse drainage layer (limestone) and 12 inches of onsite clayey materials placed over the waste rock (CR Kendall 2012). Currently, 38,300 cubic yards of soil material remain in stockpiles; 35,800 cubic yards in TS-13a and 2,500 cubic yards in other stockpiles. The stockpiled soil is classified as A and B soil types (CR Kendall 2015a), except stockpile TS-13a that contains subsoil that could include tailings (Volberding 2015a). Soil type A has moderate to high organic matter with low to moderate coarse fragment content. Soil type B has low to moderate organic matter with moderate to high coarse fragment content.

The final grading, soil covering and seeding for the CR Kendall Mine is mostly complete following the approved reclamation plan. Including facilities that would be retained post mine for water treatment, there are 51 acres unvegetated (**Table 1-1**). The current estimate of soil needed to finish reclamation under the Agency Modified Alternatives is 15,043 cubic yards; the main BLM access road and other facility access roads would remain unvegetated. The Proposed Action would require 6,984 cubic yards of soil resources for final reclamation, with portions of the Kendall and Muleshoe Pits, the main BLM access road, and other facility access roads remaining unvegetated. CR Kendall has 38,300 cubic yards of soil resources stockpiled as of the 2014 annual report.

Past LAD practices may have temporarily affected plant growth by causing inhibitory properties in the soils within the LAD area; however, vegetation in these areas now appears to be robust.

3.4.2.2 Vegetation Resources

The CR Kendall Mine site is on east-facing slopes surrounded by relatively dry forests dominated by ponderosa pine and Douglas-fir with deciduous shrubs and quaking aspen occupying the moist, headwater drainages of Dog Creek, Little Dog Creek, the South Fork of Last Chance Creek, and Barnes-King Gulch. Native grasslands dominated by bluebunch wheatgrass, arrowleaf balsamroot, and other grasses and forbs are

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interspersed in forest habitats on warmer and drier slopes with bedrock close to the surface. The conifer forests on and adjacent to the mine site include mature stands of ponderosa pine on the drier slope with denser stands of Douglas-fir at higher elevations and on moister, cooler sites. Patches of quaking aspen of multiple age classes are present on moist sites interspersed with conifers and riparian areas (Elliott 2010).

The vegetation on the reclaimed areas is in various stages of development based on the different treatments and years of growth (Bighorn Environmental Sciences 2003). A self-sustaining cover of agronomic grasses, with few trees and shrubs or other native plant species, dominates most of the reclaimed areas. Although these areas have low species diversity, they produce large amounts of forage for grazing species such as livestock, elk, and small mammals, and provide nesting cover for some grassland birds (vesper sparrow). Controlled livestock grazing is currently occurring on reclaimed areas with vegetation cover capable of sustaining livestock use. The partially backfilled Horseshoe Pit was not seeded with agronomic species as part of the reclamation program, but has been colonized by native species from the surrounding landscape including ponderosa pine, Douglas-fir, common juniper, and numerous forbs and grasses (Elliott 2010).

Vegetation on the LAD areas has improved over the years. The quality of the vegetation on the LAD areas indicates a lessening of salt impacts on these sites. Infrequent use of LAD as specified in **Table 2-1** is not anticipated to cause additional impacts on vegetation. The DEQ inspection report from September 8, 2014 describes the vegetation growth on the waste dumps as “robust” (DEQ 2014). Field inspections have noted the vegetative growth on the process pads, reclaimed in 2012, has established successfully in most areas (**Figure 3-4**). Small populations of planted and naturally-regenerated conifers are growing on some of the reclaimed waste dumps. CR Kendall Mine performs annual weed control.

3.4.2.3 Reclamation Resources

Post-mining land use objectives include: (1) protection of public health and safety, (2) establishment of wildlife habitat and livestock grazing through revegetation, (3) protection of water quality by establishment of a stable landform, (4) enhancement of aesthetics by reforestation of waste rock dump faces and pit benches (where pit walls are visible to the public) (CR Kendall 1995). Current analysis of the vegetation and soils indicate some areas may need increased soil or seeding to reach reclamation goals (DEQ 2014, Bighorn Environmental Sciences 2003). The area received 9 inches of rain in 24 hours in late August 2014 (CR Kendall 2015a). This caused minor slumping in areas directly northwest of Pond 7 and west of Pond 8. That event provided a significant amount of rain, considering the 10-year, 24-hour event for this area is 2.6 inches (CR Kendall 1995). The stability of the reclaimed process pads and waste rock dumps was not affected by this event.

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FIGURE 3-4 REVEGETATED PLANT COMMUNITIES AT THE CR KENDALL MINE



July 7, 2014 photograph of vegetation on Process Pad 4 (foreground)



July 7, 2015 photograph of top of Process Pad 4 (foreground) and Process Pad 3 (background) with vegetation on slopes and tops.

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The possibility that some of the remaining stockpiled soil is contaminated with tailings is a concern for final reclamation; however, if that soil is used for reclamation in the permit area and the areas are promptly reseeded, it is less of a concern for offsite impacts due to erosion.

To evaluate the leachability of metals in the reclamation resource stockpiles, samples were collected in July 2003, and analyzed using the Synthetic Precipitation and Leaching Procedure (EPA Method 1312). Results indicated that antimony, arsenic, and thallium are leachable at levels above water quality criteria from all six of the 2003 samples (Womack and Associates 2005). Selenium was detected in five of the six samples, but at levels well below the human health water quality criteria level of 0.050 mg/L.

In 2004, the CR Kendall Mine began recontouring the process pads and constructing ditches in natural geologic materials adjacent to the pads. CR Kendall Mine sampled the natural geologic materials to determine their suitability for reclamation (Womack & Associates, Inc., 2005). Results indicated the natural geologic materials have lower concentrations of leachable metals than the stockpiled soils sampled in 2003. Exceptions were that two natural geologic material samples contained antimony at levels above water quality criteria.

DEQ field checked CR Kendall Mine's proposed reclamation resource material and found some natural geologic layers contain abundant black shale and were acid producing. A seep originating nearby the undisturbed black shales was acidic indicating natural acid rock drainage. These materials were not used for reclamation.

3.4.3 Environmental Consequences

3.4.3.1 No Action Alternative

The current CR Kendall Mine operating permit calls for the final reclamation of all disturbed areas. The current 17 inch soil and 18 inch cover system for the process pads would remain in place as the final cover for the pads. The approved reclamation cover was modified by Minor Revision 05-001 to include 5 to 8 percent sodium bentonite incorporated into the upper 6 inches of the lower 18 inch subsoil basal material layer.

Other disturbance areas would be covered with 8 to 10 inches of soil, and would be subject to the currently approved reclamation goals for the site as defined by the reclamation plan. As identified by site inspections and records (DEQ September 9, 2014), several areas of the mine have not achieved the reclamation goals that include the establishment of wildlife habitat and livestock grazing through revegetation. Some portions of the Kendall Pit and Muleshoe Pit have poor vegetation establishment, or have not yet been covered with soil and reclaimed, and do not currently meet the reclamation goals. The poor vegetation establishment in some areas is primarily due to lack of soil cover.

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The total current disturbance of 447.5 acres and the 1,040.4 acre permit area would not change. No new soil would be stripped or stockpiled. The stockpiled soil would be used to reclaim up to approximately 15 acres of facilities, ponds, roads and other areas (CR Kendall 2015a). All soil stockpiles would ultimately be used for reclamation. The facilities would not be retained post mine.

These soil, vegetation, and reclamation components and actions would be part of the No Action Alternative:

- **Process pads regrading** – Process pads 3 and 4 were regraded to 3:1 slopes with 10 foot benches every 100 feet in 2004 (Minor Revision 04-001).
- **Process pads cover design** – A modified water balance cover of 17 inches of soil, over a 6 inch subsoil basal layer amended with 5 to 8 percent sodium bentonite, over 12 inches of subsoil basal layer material was approved and completed by CR Kendall Mine (Minor Revision 11-001). This functioning cover would remain in place as part of this alternative.
- **Process pads drainage ditches** – A final cover of subsoil/sodium bentonite amended subsoil basal layer with geomembrane liner was approved and has been completed (Minor Revision 11-001).
- **Process pads underliners** – The underliners for process pads 3 and 4 would be perforated by drilling after water discharge standards have been met, to eliminate water ponding (1989 Plan of Operations).
- **Kendall Pit** – Regrading of pit walls and spreading of stockpiled materials in the pit was completed in 2006 as a beneficial step toward final reclamation (Minor Revision 04-001). Eight to 10 inches of soil would be placed on the regraded pit slopes that are less than 2:1 and those regraded areas would be reseeded.
- **Kendall Waste Rock Dump** – Slopes have been regraded to a combination of 2:1 and 3:1 slopes and covered in 8 to 10 inches of soil (1989 Plan of Operations). In 1995, an RPL was used on some flatter portions of the regraded dump (Shafer and Associates 1995).
- **Barnes-King Pit** – Reclamation work included completing a partial pit wall reduction in 2004 under Minor Revision 04-001. The regraded areas of less than 2:1 were covered with 8 to 10 inches of soil.
- **Muleshoe Pit** – Reclamation included partially backfilling the pit with waste rock, regrading, replacing soil over most areas, and seeding in 1993-1995. Not all of the regraded pit backfill received soil placement and vegetation establishment has not been successful where no soil was placed. Eight to 10

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inches of soil would be placed on the areas where no soil was placed and seeded.

- **Muleshoe Waste Rock Dump** – The southeast face was graded to 2:1 in 1991 (CR Kendall 1989), and grading was completed to 3:1 in 1995 (Shafer and Associates 1995). Slopes were covered with 8 to 10 inches of soil and seeded. In 1995, an RPL was used on some flat portions of the dump.
- **Horseshoe Pit** – The Horseshoe pit was partially backfilled and was covered with soil and seeded in 1993-1994.
- **Facilities** – All buildings, including the WTP and associated ponds would be removed at mine closure when reclamation is completed (Plan of Operations 1989).
- **Ponds** – All ponds would be drained and liners folded in and covered with 8 to 10 inches of soil. For ponds 7 and 8, the lower pond berms would be breached to allow free draining surface water (Plan of Operations 1989).
- **Roads** – One public access road through the mine site would be left at mine closure in a location approved by the BLM. All other mine roads would be ripped, graded, covered with soil, and seeded (Plan of Operations 1989).
- **Seed Mixes** – Five seed mixes were approved for different forest or grassland areas, and for moderate or harsh site conditions (Shafer and Associates 1995). Currently, three seed mixtures are approved by DEQ for different slope conditions.
- **Soil Stockpiles** – All soil stockpiles would be used for reclamation.

The impacts of the No Action Alternative on the soil, vegetation, and reclamation resources are: (1) all 447.5 acres of disturbance would be reclaimed per the approved and revised reclamation plan. The approved reclamation plan allows the single BLM access road through the mine to be retained for post-mine land use. All soil stockpiles would be used for reclamation. Additional impacts to soils and vegetation could result from the continued use of LAD for disposal of the process pad drainage during the growing season. All current mine facilities would be removed at mine closure and the areas reclaimed.

The revegetated cover currently in place on process pads 3 and 4 appears stable and is growing vegetation (**Figure 3-4**). Recent DEQ inspections have stated that the vegetation growth is robust and that vegetation has established successfully on these pads. The process pad covers have shown no sign of erosion or slumping. The large rain event in 2014 produced very little erosion or slumping on the process pads. It is reasonable to conclude that the process pad covers would continue to function under this alternative.

3.4.3.2 Proposed Action

The Proposed Action was developed from the Closure Water Management Plan (Hydrometrics & CR Kendall Corp. 2012) and was designed primarily for long-term water treatment of the process pad drainage and captured groundwater. The Proposed Action would reference and document actions for approval of the final capping and reseeding of process pads 3 and 4 and would outline some long-term reclamation monitoring and maintenance activities. The components and actions are part of the Proposed Action and would differ from those for the No Action Alternative. They are:

- **Process pads underliners** – The underliners would not be perforated and their integrity would be maintained to provide capture and treatment of process pad drainage water into ponds 7 and 8.
- **Kendall and Muleshoe Pits** – There would be no additional soil replacement for any areas of these pits.
- **Facilities** – All buildings would remain after closure for private use (Volberding 2015b).
- **Ponds** – All ponds would be maintained for pumpback storage and fire control until water quality standards are met and treatment is no longer needed. When water treatment is not needed, ponds would be reclaimed per the approved reclamation plan.
- **Roads** – Similar to the No Action alternative, one public access road would be left at closure. The other roads currently used for accessing water treatment facilities would be left until water treatment is no longer needed.
- **Soil Stockpiles** – Soil stockpile would remain for use to repair erosion rills and other features requiring vegetation maintenance during the closure period.

The impacts of the Proposed Action on the soil, vegetation and reclamation resources of the analysis area would be similar to the No Action Alternative. It would differ in that: facility buildings would be left for beneficial post-mine uses, roads used to access the facilities would remain open for additional years, and soil stockpiles would be used for erosion maintenance rather than for growth media in the Kendall or Muleshoe Pits. No new disturbance is proposed and no new soil stripping or stockpiling would occur.

The revegetated cover currently in place on process pads 3 and 4 appears stable and is growing vegetation (**Figure 3-4**). Recent DEQ inspections have stated that the vegetation growth is robust and that vegetation has established successfully on these pads. The process pad covers have shown no sign of erosion or slumping. The large rain event in 2014 produced very little erosion or slumping on the process pads. It is reasonable to conclude that the process pad covers would continue to function under this alternative.

3.4.3.3 Process Pad Drainage Pretreatment Alternative

DEQ developed this alternative to include a water pretreatment action to address issues associated with arsenic concentrations exceeding groundwater quality standards in the process pads drainage. This alternative would not have any major impacts to soils, vegetation, and reclamation. No additional soil would be placed on the regraded areas in Kendall Pit or in the Muleshoe Pit. Some existing reclaimed areas with limited vegetation growth would be reseeded with a modified seed mix and amended after seeding with an agency-approved organic amendment, if equipment can safely be mobilized into the areas.

Pretreatment Byproducts Storage Facility – This alternative would not stipulate the exact pretreatment process or methods CR Kendall Mine would use to remove arsenic and other contaminants from the process pad drainage. Any water pretreatment process would likely have some byproducts or spent media (e.g., sludge, precipitates, iron filings) from the treatment that would require proper handling and disposal. The treatment byproducts or spent media could be disposed of onsite with DEQ approval in a constructed landfill that would require soil salvage and a final closure plan, or placed in an existing lined pond.

The impacts of the Process Pad Drainage Pretreatment Alternative on the soil, vegetation and reclamation resources would be similar to the No Action and Proposed Action. The soil in stockpile TS-13a would be used to reclaim Ponds 7 and 8 after they are no longer needed for water treatment. The pond liners would be cut and folded into the pond bottoms and buried with clean fill and regraded. An additional liner would be placed over the regraded fill to preclude infiltration, soil placed over the lined surface, and the areas reseeded. DEQ could approve the retention of a pond, per landowner request, as long as a post-mining land use is identified and water quality is protected.

Similar to the Proposed Action, final reclamation would retain facilities and access roads for beneficial post mine use. The need to construct a landfill onsite to store the byproducts from the pretreatment of process pad drainage would cause impacts to the soil and vegetation while the landfill is operating. After the process pad drainage pretreatment ceases, the landfill would be properly closed and reclaimed.

The revegetated cover currently in place on process pads 3 and 4 appears stable and is growing vegetation (**Figure 3-4**). Recent DEQ inspections have stated that the vegetation growth is robust and that vegetation has established successfully on these pads. The process pad covers have shown no sign of erosion or slumping. The large rain event in 2014 produced very little erosion or slumping on the process pads. It is reasonable to conclude that the process pad covers would continue to function under this alternative.

3.4.3.4 Process Pad Barrier Cover Alternative

The Process Pad Barrier Cover Alternative was developed to help minimize the volume of precipitation infiltrating into the process pads, where drainage contains levels of arsenic, selenium, and other contaminants exceeding groundwater discharge standards. Water treatment at a central WTP would still occur under this alternative. The installation of a barrier liner would involve temporarily removing 17 inches of soil covering the pads, installing a textured barrier liner over the pad areas, and replacing the salvaged soil. This alternative would result in impacts to soils, vegetation and reclamation and differs from the No Action and Proposed Action alternatives in these ways:

Process Pads – The upper 17 inches of growth media and vegetation would be removed from process pads 3 and 4 and a barrier cap (textured liner with drainage net) installed over the areas. After the barrier cap is installed, the salvaged growth media would be replaced on top of the liner and the disturbed areas reseeded.

Soil Stockpiles – The soil in stockpile TS-13a would be used to reclaim Ponds 7 and 8 after they are no longer needed for water treatment. All other stockpiled soil resources would be used for reclamation of road closures at final mine closure.

The impact of this alternative on the soil, vegetation, and reclamation resources at the CR Kendall Mine would be different from the No Action and Proposed Action alternatives. The removal of 17 inches of growth media (soil) and vegetation from process pads 3 and 4 and installation of a barrier cover cap would cause additional impacts to the soil, vegetation, and reclamation resources during this operation. The mine wastes in the process pads would probably not be encountered or disturbed because the barrier cover cap would be installed on top of the existing 6 inches of subsoil basal layer material amended with 5 to 8 percent sodium bentonite, over 12 inches of subsoil basal layer material. The activities associated with stripping and replacing the approximate 17 inches of growth media (104,925 cubic yards of soil) would cause some mechanical and physical impacts to the soil (dis-aggregation, soil compaction, lost soil). The replaced growth media would be reseeded with an approved grass seed mixture, but some soil erosion and soil slumping could occur until the pads have sufficient vegetation established.

The disturbance of the existing process pads vegetated cover would set back the established vegetation (see Section 3.4.2.2) and would increase the potential for erosion until the new vegetation becomes established. Some soil loss and increased soil compaction would likely occur from the extra soil handling activities.

Installing a barrier cover on the process pads and covering with approximately 17 inches of soil would increase the potential for soil slumping, particularly on the slope faces. Soil slumping could occur from the formation of a saturated slippage plane on

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top of the impermeable geomembrane liner. Mass soil slumping would disturb the vegetation, increase soil erosion, and expose the geomembrane liner to damage.

Tree growth on the process pads would be a concern if a geomembrane barrier cover is placed on the process pads. Trees would likely naturally grow on the reclaimed areas. The trees would be shallow rooted (only 17 inches of growth media) and would be susceptible to blowdown. The uprooted trees would potentially expose and puncture the liner when toppled, resulting in disturbance to the vegetation, increased soil erosion, and punctures that would increase pad drainage flows.

Similar to the Proposed Action, final reclamation would retain facilities and access roads for beneficial post mine use. Ponds currently used for water treatment would be reclaimed at closure by draining the water, cutting and folding the liners, covering the areas with soil, and seeding. Soil in stockpile TS-13a would be used to reclaim the ponds. An estimated 38,300 cubic yards of stockpiled topsoil remained on the CR Kendall Mine at the end of 2014 (CR Kendall 2015a).

3.5 Wildlife

The CR Kendall Mine is on forested lands along the eastern flanks of the North Moccasin Mountains. The site and surrounding area provide good quality habitat for deer, turkeys, and other wildlife and are used for hunting. The primary post-mining reclamation land use is to provide habitat for wildlife and grazing for livestock. A biological resources technical report was done in 2010 in support of Amendment 007 (Elliott 2010). The report included visual observations of wildlife, pedestrian surveys, a bat survey, use of mist nets and photographs, and evaluated the current and potential use of the mine for wildlife habitat.

3.5.1 Analysis Area and Methods

The analysis area for wildlife includes the 1,040 acre CR Kendall Mine permit area and the adjacent lands in the North Moccasin Mountains in Fergus County. The mine permit area and forested areas immediately adjacent to the mine area are shown on **Figure 1-2**.

The impacts analysis considered CR Kendall Mine wildlife notes, applicable websites pertaining to the presence of wildlife, and the 2010 Biological Resources Report (Elliott 2010). Professional judgement based on the changed disturbance or timing of activities was used to evaluate impacts.

3.5.2 Affected Environment

The habitats on the mine site include diverse areas of ponderosa pine and Douglas-fir forest, aspen in moist sites, riparian, native and disturbed grasslands, water, and pit highwalls. Some surrounding lands are agricultural. Activities at the mine site

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(including pits, stockpiles, roads, ponds, process pads, and buildings) have modified the wildlife habitat from natural conditions for more than 100 years.

All of the mined land (447 acres) has been or is in the process of being reclaimed. Approximately 55 acres of pit highwall have been reclaimed (Elliott 2010). Reclaimed and undisturbed areas provide trees, shrubs, and grass used as forage by elk, mule deer, white-tailed deer, wild turkey, and small mammals, and hiding and nesting cover for birds. Raptors, including golden eagles, hunt there. Natural cavities and mined areas, including pit highwalls, provide breeding and roosting habitat for bats, birds, and small mammals.

The 2010 report noted that beaver had constructed dams and created wetlands and riparian habitat supporting birds and amphibians in Dog Creek, Little Dog Creek, South Fork of Last Chance Creek, and Barnes-King Gulch down slope from the mine (Elliott 2010). A pond where water is pumped for LAD near the top of Barnes-King Gulch created a wetland providing breeding habitat for frogs and foraging habitat for bats.

No threatened or endangered species are known to exist near the permit area. Biological surveys of the area in 1984 and 1988 did not identify any federally threatened or endangered species. The US Fish and Wildlife Service (USFWS) indicated elk, mule deer, white-tail deer, wild turkey, and small mammals would be reasonably expected to occur in and around the mine (Fergus County) (USFWS 2015a). Other wildlife noted near the project include antelope, mountain lion, sharp-tailed grouse, pheasant, and gray partridge. Greater sage-grouse and Sprague's pipit may occur in or around the mine area, but their habitat is primarily grassland and agricultural areas. There is no habitat near the mine for the pallid sturgeon, black-footed ferret, or Canada lynx.

3.5.3 Environmental Consequences

3.5.3.1 No Action Alternative

The impacts of the No Action Alternative on wildlife would be minimal and would be associated with the ongoing water treatment activities for the process pad drainage and groundwater capture. The major reclamation activities are completed and the mine traffic limited to the operations and maintenance of piping and water treatment processes. Wildlife species recorded on and adjacent to the mine site are typical species in central Montana that occupy mountain ranges and habitats (Elliott 2010).

Completing reclamation of other areas by placing 8 to 10 inches of soil and seeding should provide beneficial results for wildlife and help achieve the reclamation goal of establishing wildlife habitat. The actual reclamation activities may create minor, short-term impacts to wildlife. As the reclaimed areas develop sustainable vegetation, impacts should be beneficial with the revegetated areas providing additional habitat. Spreading the remaining soil in stockpile TS-13a on poorly vegetated areas in the

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Kendall and Muleshoe Pits or for reclamation of Ponds 7 and 8 after the ponds are no longer needed for water treatment should improve reclamation and revegetation for those areas.

3.5.3.2 Proposed Action

Under the Proposed Action, there would be no additional adverse impacts to wildlife resources from implementing the mine closure activities, compared to the No Action Alternative. The soil from TS-13a would not be placed on the Kendall or Muleshoe pit slopes and there would be no minor, short-term, adverse impact to wildlife from those reclamation activities. Because there would be no additional soil placement or vegetation in the Kendall and Muleshoe Pits under the Proposed Action, no additional habitat or forage would be established. The delay for reclaiming several mine access roads, and the use by mining staff during water treatment, would cause some minor adverse impacts to wildlife compared to the No Action Alternative.

3.5.3.3 Process Water Pretreatment Alternative

DEQ developed this alternative for the pretreatment of the process water to remove arsenic to below the groundwater discharge standard. This reduction in arsenic would have minor benefits for wildlife in overall improved water quality, compared to the No Action and Proposed Action alternatives.

The Process Water Pretreatment Alternative would have the same long-term effects on wildlife resources as the Proposed Action because no additional habitat or forage would be established in the Kendall and Muleshoe Pits.

3.5.3.4 Process Pad Barrier Cover Alternative

This Alternative would remove the existing 17 inches of soil (including established vegetation that provides some wildlife habitat), install a textured barrier liner, replace the salvaged soil, and reestablish the vegetation. This removal of soil and vegetation would result in short-term loss of foraging for wildlife.

The impacts of the Process Pad Barrier Cover Alternative on wildlife resources would be adverse in the short-term compared to all other alternatives. Wildlife resources would benefit in the long-term due to the additional topsoil and revegetation on regraded slopes for reclamation of the Kendall and Muleshoe Pits.

Cumulative, Unavoidable, Irreversible and Irretrievable, and Secondary Impacts

4.1 Cumulative Adverse Impacts

DEQ is required to conduct a cumulative impact analysis to ensure that DEQ's decisions consider the full range of effects of its action on the human environment.

Cumulative impacts are the collective impacts on the human environment when considered in conjunction with other past, present, and future actions by location and generic type. Cumulative impact analysis under the MEPA Model Rules requires an agency to consider all past and present state and non-state actions. Related future actions must also be considered when these actions are under concurrent consideration by any state agency through pre-impact statement studies, separate impact statement evaluation, or permit process procedures. Analysis of cumulative environmental impacts includes other actions that are related to all action alternatives by location or generic type, recognizing that impacts on water resources, wildlife resources, and other resources might be manifested beyond the actual mine site.

The geographical extent of the study area was selected for each resource based on the location, timing, and duration of anticipated effects from the alternatives evaluated. Resource specific study areas for direct and indirect impacts are limited to the areas where activities (such as topsoil placement) or water discharge would occur. The cumulative impacts region of influence includes all areas in which planned or expected actions might affect one or more resources. The DEQ permit area is used as the cumulative impacts analysis area for all resources (**Figure 1-2**), because the minimal direct and indirect impacts on any of the resources will not be distinguishable from existing conditions by the time they reach the DEQ permit area.

Based on the MEPA model rules definition, since there are no future actions in the CR Kendall Mine DEQ permit area, the cumulative impacts consider the present and past actions that may continue to have impacts or may affect future management. These activities include reclamation of roads and facilities, grazing, hunting, general recreation, weed management, fire and fuel mitigation, and road maintenance.

4.1.1 Surface and Groundwater

CR Kendall Mine completed two previous studies to determine background concentrations for arsenic, selenium, thallium, and other water quality parameters in the surface water of five main drainages that traverse the mine (WMC 1999 and 2003). DEQ scientists reviewed both reports and provided technical memoranda with their comments and overall assessments (DEQ 2001 and 2004). Concentrations of contaminants in Dog Creek, South Fork of Last Chance Creek, and North Fork of Last Chance Creek were all fairly low. The Mason Canyon and Barnes-King Gulch drainages

had elevated concentrations of arsenic, selenium, and thallium. These two drainages have had the most historical mining and could also be assumed to have the most naturally occurring mineralization. However, DEQ's interpretations for background water quality are that background levels of arsenic, selenium, and thallium in Mason Canyon and Barnes-King drainages are similar and not very different from those in the unimpacted drainages.

The current conditions and activities of the Proposed Action are a direct result of past mining and previously completed reclamation. Past mining activities created the need for water treatment of the contaminated groundwater and process pads drainage water. The past mining actions will continue to have effects on water quality, as demonstrated by the elevated concentrations of thallium, arsenic, and other contaminants requiring treatment to be below groundwater discharge standards. Consequently, the impacts described in Chapter 3 on water resources include the cumulative effects of past and present actions.

4.1.2 Soils, Vegetation, and Reclamation

All alternatives involve long-term water treatment (up to 40 years). Mine facilities dedicated to water treatment include the WTP building, storage ponds, discharge system to the Kendall Pit, and roads that must be maintained. The cumulative impacts on soil, vegetation, and reclamation for all alternatives are from the delayed reestablishment of vegetative cover due to the retention of the water treatment facilities. The impacts would be minor, but could include the reduction of favorable soil properties in the long-term stockpiled soil and loss of grazing for the areas until finally reclaimed.

4.2 Unavoidable Adverse Effects

4.2.1 Geology and Minerals

Under the No Action, Process Pad Drainage Pretreatment, and Process Pad Barrier Cover alternatives, soil from stockpile TS-13a would likely be used for reclaiming some facility roads and Ponds 7 and 8 when they are no longer needed for water treatment. .

4.2.2 Surface and Groundwater Resources

All alternatives involve long-term water treatment to improve water quality and close and reclaim the CR Kendall Mine. Water treatment would cease once the process pads drainage and groundwater capture system water quality standards are met, which could be up to 40 years.

Under the Proposed Action, CR Kendall Mine would not directly dispose of water with concentrations above groundwater standards, but would continue to use LAD as the contingency disposal method for water with concentrations above standards. This

would be an unavoidable adverse impact if contaminants cause contamination of groundwater beyond the mine site. The Process Pad Drainage Pretreatment and Process Pad Barrier Cover alternatives include additional water treatment for arsenic or a barrier on the process pads to reduce future drainage rates.

4.2.3 Soil, Vegetation, Reclamation

Soil compaction and erosion from respreading the soil in TS-13a onto the regraded pond areas and reclaimed roads are minor, unavoidable impacts. Short-term impacts of soil compaction, soil erosion from the newly reclaimed areas, reduction of favorable physical and chemical properties, and changes in nutrient levels would likely occur. After the soil is spread and the vegetation communities established, the soil properties would return to a level that reestablishes nutrient cycling, supports the vegetation, and has reduced erosion.

4.3 Irreversible and Irretrievable Commitment of Resources

Irreversible resource commitments are generally related to the use of nonrenewable resources, such as minerals, soils, or cultural resources, and the impacts this use could have on future use options. Irreversible commitments are usually permanent, or at least persist for a long time. Irretrievable resource commitments involve a temporary loss of the resource or loss in its value.

No irreversible or irretrievable commitments of resources have been identified for any of the alternatives. Nothing in the Proposed Action would obligate any resources that are irretrievable (i.e., capping of mineralized rock would not render it irretrievable; it could still be mined at a later date). There were no irreversible or irretrievable commitments of the other resource areas (geology and minerals; soil, vegetation, reclamation; or wildlife) identified in this EIS.

4.4 Regulatory Restrictions

MEPA requires state agencies to evaluate any regulatory restrictions proposed to be imposed on the proponent's use of private property (Section 75-1-201(1)(b)(iv)(D), MCA). Government entities generally have the authority and responsibility to protect the public health, safety, and welfare. Under this "police power," government entities may limit the use of real property through land use planning, zoning ordinances set back requirements, and environmental regulations. Normally, a government entity's exercise of its police powers does not involve a taking of private property. Nevertheless, at some point government regulations may go too far and constitute a taking of property.

DEQ's selection of the Process Pad Drainage Pretreatment Alternative for arsenic alters CR Kendall's proposed closure plan. However, the Process Pad Drainage Pretreatment Alternative is needed to achieve compliance with the regulatory requirements of the Metal Mine Reclamation Act and the Montana Water Quality Act. The Process Pad Drainage Pretreatment Alternative does not result in a physical occupation of private property, does not deprive CR Kendall of all economically viable uses of its property, does not deny CR Kendall a fundamental attribute of property ownership, does not require CR Kendall to dedicate a portion of its property or grant an easement, does not have a severe impact on the value of CR Kendall's property, or cause physical disturbance with respect to CR Kendall's property in excess of that sustained by the public generally. Therefore, there are no takings implications.

4.5 Secondary Impacts

Based on the MEPA model rules definition, secondary impacts are further impacts to the human environment that may be stimulated or induced by, or otherwise result from a direct impact of the action. The direct impacts to most resources areas evaluated in this EIS (geology and minerals; soils, vegetation, and reclamation; and wildlife) occurred during active mining and no secondary impacts to these resources would be expected from any of the mine closure alternatives. For surface and groundwater resources, the secondary impacts would be to groundwater if the Proposed Action water treatment approach fails to treat water to meet human health groundwater standards for arsenic (and selenium if the increasing trend continues), and the potential degradation of groundwater quality in the Madison aquifer from the discharge of treated water containing these elements. DEQ developed the Process Pad Drainage Pretreatment and Process Pad Barrier Cover alternatives to address these potential secondary impacts.

Comparison of Alternatives

5.1 Comparison of Alternatives

Table 2-1 summarizes important components of the four alternatives and the effects of implementing each alternative. Information in **Table 2-1** quantitatively or qualitatively lists effects among the No Action Alternative, Proposed Action (Amendment 007), the Process Pad Drainage Pretreatment Alternative, and the Process Pad Barrier Cover Alternative.

The alternatives compared are described in detail in Chapter 2 and summarized below.

5.1.1 No Action Alternative

For this EIS, the 1989 Plan of Operations and 1995 Soils and Revegetation Plan along with the pumpback and water treatment plans are considered to be the No Action Alternative. The No Action Alternative reflects the current CR Kendall Mine operations under Operating Permit 00122, including six Amendments and 23 minor revisions up through Minor Revision 11-001. Most reclamation activities under the permit have been completed. Major disturbed areas have been reclaimed, including the Horseshoe Pit and Horseshoe Waste Rock Dump; Muleshoe Waste Rock Dump; Barnes-King Pit; Kendall Waste Rock Dump, and most of the Kendall and Muleshoe Pits. Minor Revision 11-001 was approved in 2011 and allowed CR Kendall to place a 17-inch layer of growth media directly over the basal layer on process pads 3 and 4 as an interim reclamation measure.

Under this alternative, CR Kendall would address the remaining reclamation items at the mine, including spreading the remaining stockpiled soil, completing some additional revegetation work, and providing long-term reclamation monitoring and maintenance.

Other mine facilities will be retained until water treatment is no longer needed, including pumps and piping; ponds 2B, 3B, 7, and 8; stormwater controls; water treatment and maintenance facilities; roads; power lines; and LAD facilities.

5.1.2 Proposed Action

The Proposed Action is the proposed Closure Water Management Plan CR Kendall submitted in their Application for Amendment 007 to Operating Permit No. 00122. The Proposed Action primarily addresses the long-term water treatment of the process pad drainage and captured groundwater. The alternative would retain the installed vegetated soil cover authorized under Minor Revision 11-001 and outlines reclamation monitoring and maintenance activities. The main items different from the No Action Alternative are:

- The process pad drainage and all captured groundwater would be combined for treatment by filtering to remove particulate, treating with zeolite adsorption to remove thallium, and discharged to groundwater through the Kendall Pit. The option for LAD is retained as a contingency.
- No additional growth media (soil) would be placed on the regraded areas of the Kendall Pit with slopes less than 2:1 or the lower slopes in the Muleshoe Pit with poor vegetation establishment. No additional reseeding is planned.
- Most buildings would remain for private use after closure.

5.1.3 Process Pad Drainage Pretreatment Alternative

A separate piping system would collect the drainage water from process pads 3 and 4 for pretreatment prior to blending the drainage water with other mine waters. Arsenic is one of the contaminants in the process pad drainage water, and is projected to exceed groundwater standards even after the drainage water and captured groundwater are combined. The pretreatment system could remove other contaminant constituents, if necessary to comply with discharge criteria.

The likely pretreatment system would involve the oxidation and adsorption of arsenic onto an adsorbent compound (ferric chloride, iron filings, or other). The pretreatment process would most likely be developed specifically for the CR Kendall process pad drainage water to effectively remove arsenic. After pretreatment, the water would be combined with the other captured groundwater for thallium removal through the current method of zeolite adsorption. Treated water would be discharged to groundwater through the Kendall Pit.

New water treatment equipment would be required to pretreat the process pad drainage water. The annual average flow rate after installing the current process pads caps (2009 to 2014) ranged from 11.3 gallons per minute (gpm) to 20.5 gpm, with an average rate of 13.7 gpm.

The specific pretreatment technology chosen by CR Kendall to remove arsenic could generate a contaminated treatment media, or byproduct, that requires proper disposal. Because the specific technology has not been chosen or designed, the possible disposal options for the contaminated media could include: (1) shipping it back to the manufacturer when exhausted; (2) shipping it offsite for disposal; or (3) burying it onsite if confirmed as non-hazardous.

5.1.4 Process Pad Barrier Cover Alternative

The Process Pad Barrier Cover Alternative was developed to minimize the process pad drainage flows that require treatment. Adding a barrier liner to the process pads could effectively reduce drainage water flows. CR Kendall would select the effective cover materials to use, however, DEQ would have final review and approval. DEQ would

require the barrier liner be of HDPE or a similar product rather than a geosynthetic clay liner (GCL). The current 17 inches of soil would be temporarily removed and a geomembrane liner installed. The geomembrane liner would consist of a textured HDPE liner overlaid with a geocomposite drainage net. The salvaged soil would be replaced over the geomembrane liner and the process pads reseeded.

As with the Proposed Action, the process pad drainage and all captured groundwater would be combined for treatment by filtering to remove particulate, treating with zeolite adsorption to remove thallium, and discharged to groundwater through the Kendall Pit. The option for LAD is retained as a contingency.

Similar to the other Alternatives, the soil remaining in TS-13a would be used to reclaim the pond area and facility roads and the areas reseeded.

5.2 Preferred Alternative

The rules and regulations implementing MEPA (ARM 17.4.617) require agencies to indicate a preferred alternative in the draft EIS, if one has been identified.

DEQ identified the Process Pad Drainage Pretreatment Alternative as the preferred alternative for several reasons discussed below.

5.2.1 Rationale for the Preferred Alternative

The MMRA requires a reclamation plan to provide sufficient measures to ensure public safety and to prevent the pollution of air or water and the degradation of adjacent lands.

The Process Pad Drainage Pretreatment Alternative (as modified) is the only alternative that ensures compliance with all groundwater standards for all water to be treated and discharged. This would be achieved through the development of an additional water treatment system to specifically remove arsenic from the process pad drainage. The system would be modified as necessary to include treatment for other elements, such as selenium, which may require treatment in the future to comply with groundwater discharge standards.

Mixing models developed for the Proposed Action predict the combined drainage water and captured groundwater would not meet groundwater standards for thallium and arsenic, but only treatment for thallium was proposed. CR Kendall assumed (1) either the natural background arsenic concentration in the Madison Limestone aquifer is also above the standard, or (2) dilution provided by mixing of the effluent from the treatment plant with groundwater moving through the aquifer would result in compliance with groundwater quality standards after mixing. CR Kendall has not collected data from the local Madison Limestone aquifer to document the validity of

either assumption or if effluent limits higher than groundwater standards would be allowed.

The Process Pad Barrier Cover Alternative is intended to reduce the rate of infiltration into, and drainage from, the process pads. Reduced flows from the process pads and combining this water with other captured groundwater may result in sufficient dilution of constituents, other than thallium, so that no other water treatment would be required to achieve standards. However, reclamation of process pads using barrier covers at other mine sites has not reduced seepage to levels where treatment is no longer required. In some cases, higher concentrations of contaminants in the residual seepage has resulted. Therefore, the Process Pads Barrier Cover Alternative does not provide assurance that it would eliminate the need for additional water treatment steps in order to achieve compliance with groundwater discharge standards.

The existing 17 inch process pad soil cover overlies 6 inches of subsoil amended with bentonite and 12 inches of unamended subsoil. Plant roots are able to penetrate the entire soil profile, and thus should be more tolerant of drought. Plant roots may extend into the underlying spent ore. In contrast, the Process Pad Barrier Cover Alternative would restrict plant roots to the upper 17 inches of soil, resulting in the vegetation being more susceptible to drought. There would also be an increased potential for soil slumping along a saturated zone on top of the liner and increased potential for exposure and damage to the barrier cover from toppling of shallow-rooted trees. Additional impacts to soils and vegetation would be expected due to salvage, stockpiling, and replacement of the soil materials on the process pad barrier cover.

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Glossary and Acronym List

Bond - Financial assurance posted by an applicant/permittee to guarantee that funds are available for state and/or federal agencies to complete the reclamation plan associated with an operating permit or license, including water treatment if needed, in the event the permittee is unable or unwilling to do so. DEQ will not release bond held for revegetation of these lands until the conditions in 82-4-336 MCA are met.

Buffer Area - An undisturbed area left around the area permitted for disturbance within the operating permit boundary.

Cyanide Leach Process - Recovery of gold and other metals by soaking an ore in a cyanide solution.

Deficiency Letter - In this case, DEQ's response to an operating permit amendment application identifying additional items needing clarification so an application can be called complete and compliant with the MMRA.

DEQ-7 Water Quality Standards - Numeric water quality standards for Montana's surface water and groundwater developed to protect the designated beneficial uses of state waters, such as growth and propagation of fishes and associated wildlife, waterfowl and furbearers, drinking water, culinary and food processing, recreation, and agriculture.

Draft Operating Permit/Operating Permit Amendment - Permit or permit amendment issued on completion of the completeness and compliance review, prior to the completion of the required MEPA review.

Groundwater Capture System - System used to capture alluvial groundwater and control seepage from the waste rock piles, process pads, and historic tailings since 1998 with capture wells in South Fork Last Chance Creek, Mason Canyon (Process Valley), Barnes-King Gulch, and Little Dog Creek drainages.

Heap Leaching - The mining process used by CR Kendall to extract gold and other precious metals from ore by applying cyanide solution to ore to react, dissolve, and leach metals with later separation of the metals from the solution.

Highwall - The face of overburden and ore in an open pit mine.

Highwall Stability - The potential for a highwall to maintain structural integrity.

Interdisciplinary Team - A group of technical experts conducting an impact analysis.

Particulate Filtration – For CR Kendall, the first water treatment step used to remove suspended solids in the mine impacted water by passing the water through a multi-media filter.

Mitigation - A measure used to reduce impacts by (1) avoiding an impact altogether by not taking a certain action or parts of an action; (2) minimizing impacts by limiting the degree or magnitude of an action and its implementation; (3) rectifying an impact by repairing, rehabilitating, or restoring the affected environment; (4) reducing or eliminating the impact over time by preservation and maintenance operations during the life of an action; or (5) compensating for an impact by replacing or providing substitute resources or environments.

Montana Environmental Policy Act – Title 71, Chapter 1 of the Montana Code Annotated.

Open Pit Mining – A surface mining method where rock is ripped or drilled and blasted, then removed as overburden or removed as ore for further processing.

Operating Permit – Permit issued by DEQ to mine, process ore, construct or operate a hard-rock mill or disturb land in anticipation of those activities.

Ore – A mineral or an aggregate of minerals from which a commodity can be profitably mined or extracted.

Permitted Disturbance Boundary – The area in an operating permit that is designated to be disturbed.

Permit Area or Boundary - The disturbed land as defined in 82-4-303 , MCA, and a minimal area delineated around a disturbance area for the purposes of providing a buffer adjacent to all disturbances.

Process Pads Drainage – Water with residual contaminants that continues to drain from the former process pads 3 and 4.

Reclamation – Returning a surface disturbance to support desired post-mining uses, including recontouring and plant growth, and minimizing hazardous conditions, ensuring stability, and protecting against wind or water erosion.

Scoping – Determining the scope of the analysis, i.e., the range of reasonable alternatives, mitigation, issues, and potential impacts to be considered in an environmental assessment or an environmental impact statement.

Soil Salvage - Soil or other growth media removed and saved for use during reclamation.

Spent Zeolites - Zeolites that have been used for treating water and have adsorbed and trapped other molecules (particularly cations) inside their crystal lattice to become part of the zeolite crystal.

Waste Rock - Rock that is removed for access, but does not contain enough mineral to be mined and processed at a profit.

Waste Rock Dump - Engineered location where waste rock is stored.

Zeolites - A group of microporous, hydrated, aluminosilicate minerals with a relatively open, three-dimensional crystal structure made from interlinked tetrahedra of AlO_4 and SiO_4 . Zeolites are commonly used as commercial adsorbents.

Zeolite Adsorption - For CR Kendall, the water treatment process used primarily to remove thallium by passing the mine impacted water through tanks filled with zeolites.

| | |
|------------------------------|---|
| < | Less than |
| > | Greater than |
| % | Percent |
| μS/cm | Microsiemens per centimeter |
| BLM | Bureau of Land Management |
| CDM | Camp, Dresser and McKee |
| CFR | Code of Federal Regulations |
| DEQ | Montana Department of Environmental Quality |
| EIS | Environmental Impact Statement |
| °F | Degree Fahrenheit |
| GCL | Geosynthetic clay liner |
| gpm | Gallons per minute |
| HDPE | High-density polyethylene |
| HELP | Hydrologic Evaluation of Landfill Performance |
| IDT | Interdisciplinary team |
| LAD | Land application disposal |
| MCA | Montana Code Annotated |
| MEPA | Montana Environmental Policy Act |
| mg/L | Milligrams per liter |
| MMRA | Metal Mine Reclamation Act |
| NH ₃ | Ammonia |
| NO ₂ ⁻ | Nitrite |
| NO ₃ ⁻ | Nitrate |
| PVC | Polyvinyl chloride |
| RO | Reverse osmosis |
| ROD | Record of Decision |
| RPL | Reduced permeability layer |
| SC | Specific conductance |
| TCLP | Toxicity Characteristic Leaching Procedure |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | U.S. Geological Survey |
| WAD | Weak acid dissociable |
| WMC | Water Management Consultants |
| WTP | Water treatment plant |

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Response to Comments

9.1 DEIS Comment Period

The 60-day comment period on the draft EIS started September 10, 2015 and ended November 10, 2015. During that period, DEQ received comments at the public meeting, by regular mail, and by electronic mail. This chapter presents a compilation of all comments received as described below.

A summary of the public meeting held by DEQ to discuss the draft EIS is provided in **Appendix A**. The public meeting was held on Wednesday, September 30, 2015 from 6:00 to 8:00 p.m. at the Yogo Inn in Lewistown, Montana. Information about the meeting format and a complete copy of the court reporter's transcript of the public comments is also provided in Appendix A.

9.2 Comment Responses

Written responses to comments with specific questions or concerns related to the content of the draft EIS are shown below. Many resulted in modifications to the EIS as reflected in the final EIS. When a modification was made to the EIS, the section in which the modification was made is indicated. Comments with written responses and the page each comment begins on in this chapter are shown below.

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1. CR Kendall Corporation, James Volberding



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November 3, 2015

Jen Lane
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 Montana Department of Environmental Quality
 P.O. Box 200900
 Helena, MT 59620-0901

Sent via Certified Mail
 Return Receipt Number:
 7015 0640 0036 5721 4006

Re: Draft EIS for CR Kendall Mine Closure Plan

Dear Ms. Lane:

CR Kendall Corp. ("CR Kendall") appreciates the opportunity to provide the following comments on the draft Environmental Impact Statement ("DEIS") published by the Department of Environmental Quality ("DEQ") on September 10, 2015, regarding its approval of Amendment 007 to Operating Permit No. 00122, which contains an amended Closure Plan for the final design of water management and treatment, final capping and reseedling of the former process ponds, and long-term reclamation monitoring and maintenance for the CR Kendall Mine. CR Kendall appreciates DEQ's efforts in preparing this DEIS—these comments are intended to aid DEQ in its analysis and ensure that a final EIS and decision on approval of Amendment 007 is adequately supported by relevant information and is legally compliant with the requirements of both the Montana Environmental Quality Act ("MEQA"), MCA § 75 1-101 et seq., and the Montana Metal Mining and Reclamation Act ("MMRA"), MCA § 82-4-301 et seq.

Comment 1

DEQ's selection of the pre-treatment alternative for arsenic does not violate MEPA or the MMRA. MEPA is a procedural law and does not govern DEQ's substantive determination under the MMRA. Procedurally, MEPA requires the consideration of alternatives to a proposed action. Thus, DEQ's consideration of the pre-treatment alternative for arsenic was consistent with MEPA.

Comment 2

Additional rationale has been added to Section 5.2.1 to incorporate the requirements of the MMRA, which requires a reclamation plan to provide sufficient measures to ensure public safety and to prevent the pollution of air or water and the degradation of adjacent lands. As discussed in further detail below, the reclamation plan must include pre-treatment of mine water for arsenic in order to prevent the pollution of groundwater. Thus, selection of the pre-treatment alternative does not violate the MMRA. See also Response 3.

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Comment 3

compliance determination stated that the Proposed Plan satisfied the requirement of MCA § 82-4-336(10), which requires that a reclamation plan "provide sufficient measures to ensure public safety and to prevent the pollution of air or water..." Compl. Det., at 5. The Proposed Alternative provides for the combination of process pad drainage water and other collected water from the mine site to be combined in on-site ponds, and treated for thallium prior to being discharged to groundwater in the Kendall Pit. DEIS, at 2-7. DEQ determined that the Proposed Alternative satisfied Montana law, including the requirement to prevent water pollution, because the "mixed water will meet water quality standards, or background groundwater concentration in the areas of the Kendall Pit, with the exception of thallium." *Id.* Thus, DEQ determined that, with appropriate treatment for thallium, the discharges proposed to the Kendall Pit complied with Montana law. *Id.*

Comment 4

Despite this determination, the DEIS asserts that the process pad drainage water must be pre-treated for arsenic, because the mixed water proposed for discharge to groundwater in the Kendall Pit may slightly exceed the state-wide water quality standard for arsenic of 0.010 mg/L. DEIS, at 5-3. In selecting the pre-treatment alternative, DEQ abandons its prior determination that the mixed water discharge would meet groundwater standards or background, instead, it asserts that discharges must meet the statewide standard. The DEIS concludes that the Closure Plan improperly relies on a determination that the concentrations of arsenic in the discharge water are below background. *Id.*

The DEIS offers no analysis of groundwater to support this determination. Rather, the DEIS simply states that "no data were collected that documented elevated arsenic concentrations within the Madison limestone aquifer to which the treated water is proposed to be discharged." DEIS, at 3-34. In short, DEQ determined that the Closure Plan was deficient because it did not contain adequate information to support a determination that the concentrations of arsenic in the discharges, which were slightly above the statewide water quality standard, were allowed because they do not exceed background.

Comment 5

This determination is inappropriate in a DEIS. Under the MMRA, DEQ was required to identify any deficiency with the Closure Plan in an initial notice of deficiencies, issued within 90 days of its receipt of CR Kendall's application. MCA § 82-4-337(1)(e) ("The initial notice must note all deficiency issues, and [DEQ] may not in a later notice raise an issue pertaining to the initial application that was not raised in the initial notice."). Yet that is exactly what DEQ has done here. The Closure Plan clearly indicated that the proposed discharges in the Kendall Pit contained concentrations of arsenic above the statewide water quality standard, and that the discharges were still appropriate because they were below background. DEQ did not identify any issue with the discharges or the determinations regarding background in the Closure Plan. Indeed, DEQ declared that the Closure Plan, including the determination that the concentration of arsenic in the discharge was below background, was compliant with Montana law. *See Compl. Det.* The MMRA does not allow DEQ to raise deficiencies with the Closure Plan that were not previously identified, at this stage.

Moreover, DEQ's determination that the Closure Plan was deficient in documenting that the concentration of arsenic in the discharges were below background is in error. Indeed, DEQ's own assessment of background arsenic concentrations in surface and shallow alluvial

Response 3:

More detail has been added to Section 1.3. A subsection (1.3.2) has been added discussing the permit amendment submittals, DEQ's interpretation of the permit application, CR Kendall's responses, and DEQ's interpretation of the responses.

See Issue 1, Section 1.7 in the draft EIS. DEQ identified the potential for water quality standards to not be met as an issue of concern, to be addressed through the analysis and determining reasonable alternatives.

In its initial deficiency review, DEQ addressed whether it would be appropriate to use potentially elevated background criteria, rather than water quality standards, as effluent limits. The 4th paragraph of the September 21, 2012 First Deficiency Review states, in part: "Page 1-5, Section 1.4: It is noted that water treatment will cease once water quality standards and/or background levels are met. CR Kendall should clarify whether this refers to the background study conducted by Water Management Consultants in 2003 (and if so, background levels should be specified), or whether a future background analysis is anticipated." CR Kendall did not respond to the deficiency questions with any proposed elevated natural background levels for arsenic. Therefore, DEQ assumed in its review of CR Kendall's permit amendment application that CR Kendall intended to comply with the established water quality standards. DEQ's inclusion in its completeness and compliance determination that the mixed water will meet background groundwater concentrations in the area of the Kendall Pit, with the exception of thallium, was in error.

Moreover, in preparing the completeness and compliance determination, DEQ accepted CR Kendall's commitment in the permit amendment application that the treated water would meet all groundwater quality standards. Table 4-1 of the Closure Plan describes predicted water treatment plant influent concentrations. It indicates that concentrations of arsenic in blended water prior to treatment may at times reach levels as high as 0.022 mg/L. Nothing in Table 4-1, or elsewhere in the Closure Plan, however, states that the effluent from the water treatment plant would exceed the groundwater quality standard

of 0.01 mg/L. To the contrary, CR Kendall states elsewhere in the Closure Plan that “treated water will meet all groundwater quality standards.”

Furthermore, CR Kendall submitted a letter to DEQ dated July 17, 2015, in response to questions raised by DEQ. In response to the question “Discuss the fate and quality of groundwater affected by long term disposal from the Kendall Pit,” CR Kendall responded: “No water quality impacts are expected from the release of treated water to the Kendall Pit because water will be treated to meet Montana Groundwater Quality Standards prior to release.” DEQ’s reliance on these representations is reflected in its completeness and compliance determination.

While preparing the DEIS analysis, DEQ determined that the proposed treatment plan was not likely to achieve Montana groundwater quality standards for arsenic and that no elevated background concentration for arsenic in the local Madison Aquifer had been established. Therefore, an alternative was developed that would provide certainty that the standard could be achieved.

Response 4:

DEQ’s inclusion of additional alternatives in the DEIS does not indicate that the closure plan is deficient.

Response 5:

Section 82-4-337(1)(a), MCA, requires DEQ to review all applications for completeness and compliance within 90 days of receipt of the initial application and within 30 days of receipt of responses to notices of deficiencies. DEQ is required to note all deficiency issues in the initial notice and may not in a later notice raise an issue pertaining to the initial application that was not raised in the initial notice. CR Kendall has not asserted, and DEQ did not raise, an issue in a later notice of deficiency that was not raised in the initial notice.

In its initial deficiency review, DEQ addressed the question of whether it would be appropriate to use potentially elevated background criteria, rather than water quality standards, as effluent limits. As previously indicated, DEQ noted in its first deficiency review that,

“[W]ater treatment will cease once water quality standards and/or background levels are met. CR Kendall should clarify whether this refers to the background study conducted by Water Management Consultants in 2003 (and if so, background levels should be specified), or whether a future background analysis is anticipated.” CR Kendall did not respond to the deficiency questions with any proposed elevated natural background levels for arsenic. Therefore, DEQ assumed that it was CR Kendall’s intention to comply with the established water quality standard.

CR Kendall states that “the Closure Plan clearly indicated that the proposed discharges in the Kendall Pit contained concentrations of arsenic above the statewide water quality standard, and that the discharges were still appropriate because they were below background.” DEQ disagrees with this statement. The only location in the Closure Plan that implies that arsenic concentrations in the proposed discharge may exceed Montana’s groundwater quality standard is on page 2 of Table 4-1 which describes the “Predicted Water Treatment Plant Influent Concentrations.” While that table does indicate that concentrations of arsenic in blended water prior to treatment may at times reach levels as high as 0.022 mg/L, nothing in Table 4-1, or elsewhere in the Closure Plan, states that effluent from the water treatment plant would exceed the groundwater quality standard of 0.01 mg/L. To the contrary, CR Kendall states elsewhere in the Closure Plan that “treated water will meet all groundwater quality standards.”

Furthermore, CR Kendall’s letter to DEQ dated July 17, 2015, titled “Responses to MEPA questions, CR Kendall Mine” states in response to the question “Discuss the fate and quality of groundwater affected by long term disposal from the Kendall Pit”: “No water quality impacts are expected from the release of treated water to the Kendall Pit because water will be treated to meet Montana Groundwater Quality Standards prior to release.” Therefore, DEQ was justified in assuming CR Kendall’s proposal was intended to comply with all groundwater quality standards, including those for arsenic.

Finally, while Section 82-4-337(1)(a), MCA, precludes DEQ from raising issues in later deficiency reviews that were not raised in DEQ's initial deficiency review, it does not preclude additional issues from being raised in the MEPA review of the permit amendment application. As indicated in Response 1, DEQ's completeness and compliance determination is made prior to initiation of its review of the permit amendment application under MEPA. During the MEPA review, additional issues may be identified. If identification of these issues results in the inclusion of stipulations in the final permit that were not included in the draft permit, DEQ is required to provide the applicant in writing the reason for the stipulation, a citation to the statute or rule that gives DEQ the authority to impose the stipulation, and the reason that the stipulation was not contained in the draft permit.

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groundwater arrives at a value of 0.025 mg/l, well above what Kendall is proposing to discharge to groundwater. See Jim Castro to Wayne Jepson, Interoffice Memorandum, "CR Kendall Background Assessment", March 25, 2004. As stated in the DEIS, Kendall is an example of a Carlin-style gold deposit. DEIS at 3-12. One of the outstanding characteristics of this style of gold mineralization is elevated arsenic, selenium, and thallium concentrations which in turn is reflected in the elevated background concentrations of these elements in groundwater spatially associated with these deposits. See "Sediment-Hosted Au Deposits" by Hofstra, et al, in "Preliminary Compilation of Descriptive Geoenvironmental Mineral Deposit Models" du Buis, Edward A., editor. USGS OF-95-831, Chap. 23. At Kendall, Carlin-style mineralization occurs from the surface to over 1400 feet beneath the surface, the latter well below the potentiometric surface of groundwater in the Madison Limestone in the vicinity of the Kendall Mine. See "Geohydrology of the Madison and Associated Aquifers in Parts of Montana, North Dakota, South Dakota, and Wyoming" Downey, Joe S., USGS Professional Paper 1273-G. It is inconceivable that groundwater within the Madison Limestone impacted by the presence of Carlin-style mineralization would not have elevated arsenic, selenium, and thallium concentrations as is so clearly reflected in surface and shallow alluvial groundwater. Castro, 2004. Therefore, it is logical to conclude that the arsenic concentrations in the proposed discharge from Kendall's water treatment facility would not exceed established background levels.

Comment 6

Comment 7

Because the concentrations of arsenic contained in the discharges are below background, the selection of the preferred alternative in the DEIS violates MEPA by placing an additional stipulation or requirement on CR Kendall that is not required by a substantive requirement of the MMRA, or any other enforceable requirement of Montana law. MCA §§ 82-4-337(2)(b) and 75-1-201(4)(a). Accordingly, the DEQ's March compliance determination was correct, and the discharge to groundwater, without pretreatment, described in the Proposed Alternative satisfies the substantive requirements of Montana law for the protection of groundwater. See ARM 17.30.1005(3).

Comment 8

Additionally, the analysis of the Preferred Alternative in the DEIS fails to satisfy other requirement of MEPA:

- The DEIS does not identify a treatment process for the removal of arsenic, rather the DEIS states that a "pretreatment process would most likely be developed specifically for the CR Kendall Mine." DEIS, at 2-11. Without identifying a pretreatment process, the DEIS cannot satisfy MEPA's requirement.

First, without identifying a pretreatment process the DEIS cannot analyze the environmental impacts of the preferred alternative. MCA § 75-1-201(1)(b)(iv). Rather, the DEIS repeatedly makes unsubstantiated assumptions regarding the environmental impacts of the Preferred Alternative. See DEIS, at 2-11 ("[b]ecause the specific technology has not been chosen or designed, this alternative assumes proper disposal option for the contaminated media [likely to be generated by the pretreatment]").

Second, the analysis of the Preferred Alternative cannot satisfy MEPA's requirement that "[a]ny alternative proposed must be reasonable, in that the alternative must be achievable

Response 6:

CR Kendall's statement that DEQ's own assessment of background arsenic concentrations in surface water and shallow alluvial groundwater arrived at a value of 0.025 mg/L is incorrect. CR Kendall references Jim Castro's March 2004 memo reviewing the 2003 Water Management Consultants report "Evaluation of Recent Monitoring Data and Updated Assessment of Background Chemistry." That report presented background values for arsenic, selenium, and thallium for each drainage in the Kendall mine area that were "considered to be reasonable." For most locations, the report identified arsenic concentrations of 0.05 mg/L as reasonable background levels. Mr. Castro's memo did not accept these levels as reasonable background, but also did not identify any specific concentrations of arsenic as an accepted background level. Rather, the memo merely stated "I have not seen any persuasive evidence that would justify natural background concentrations higher than 0.025 mg/L for arsenic..."

DEQ disagrees with CR Kendall's statement that "it is inconceivable that groundwater within the Madison Limestone... would not have elevated arsenic... concentrations..." While the interaction of groundwater with Carlin-style mineralization in the bedrock may result in some mobilization of arsenic and other elements, there is no evidence that this dissolution or desorption is occurring at rates that would result in the exceedance of water quality standards. The comparison with surface water and shallow alluvial groundwater quality is not appropriate because near-surface materials are likely to be subject to more intense weathering, erosion, wetting, drying, and freezing cycles, and fluctuations in oxidizing / reducing conditions than the bedrock deep in the aquifer. As stated in the DEIS, no water chemistry data from the deep Madison aquifer near the Kendall site are available.

The referenced memo did not accept levels for arsenic, selenium, and thallium identified in the WMC 2003 report as reasonable background, nor did it identify specific concentrations of arsenic as an accepted background level. Page 3-34 of the DEIS explains DEQ's interpretation

of background concentrations in groundwater, consistent with the conclusions of the 2004 memo. See also Response 3.

While the interaction of groundwater with Carlin-style mineralization may result in some mobilization of arsenic and other elements, DEQ has no evidence that this dissolution or desorption is occurring at rates that would result in the exceedance of water quality standards. Comparing surface water and shallow alluvial groundwater quality is not appropriate because near-surface materials are likely to be subject to more intense weathering, erosion, wetting, drying, and freezing cycles, and fluctuations in oxidizing / reducing conditions than the bedrock deep in the aquifer. As stated in the DEIS on page 3-34, no water chemistry data from the deep Madison aquifer near the Kendall site are available.

Response 7:

See Responses 3 and 5.

Section 1.1 has been expanded to disclose the regulatory responsibility of DEQ to authorize discharges to groundwater under the Montana Water Quality Act and Administrative Rules.

As noted in previous responses, CR Kendall has not provided any documentation that the arsenic concentration in the proposed receiving water (the Madison Limestone aquifer) has a higher natural background level than the projected arsenic concentration in the blended, untreated mine waters. Although Table 4-1 in CR Kendall's Amended Closure Plan provides estimates of arsenic in water treatment plant influent ranging between 0.012 mg/L and 0.022 mg/L, no estimated values are stated in the Amended Closure Plan for water treatment plant effluent. The plan does not state whether or not the proposed zeolite adsorption treatment process would result in any arsenic removal; however, the plan did state on page 1-7 "Treated water will meet all groundwater quality standards and will be discharged to groundwater via the Kendall Pit."

CR Kendall states that the preferred alternative in the EIS violates MEPA by placing an additional stipulation or requirement on CR Kendall that is not required by "any other enforceable requirement of

Montana law. However, it is the responsibility of DEQ to authorize discharges to groundwater in accordance with the Montana Water Quality Act. DEQ refers CR Kendall to 75-5-401 MCA, and Administrative Rules 17.30.1005 and 17.30.1006.

The discharge of treated water into the Kendall pit was originally authorized via MR 97-003 on August 18, 1997. Compliance with all groundwater standards at the point of discharge was required at that time. This requirement has not been modified since that time and is still in effect.

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Comment 8
(cont.)

under current technology” because it does not actually identify a pretreatment process. MCA § 75-1-201(C)(1)(b)(iv)(C)(I). The entire analysis in the Preferred Alternative is premised on an assumption that an effective pretreatment process *will* be developed. See DEIS at 2-11. Such an assumption does not satisfy MEPA. The DEIS must demonstrate that Preferred Alternative is “reasonable,” and DEQ cannot satisfy this requirement by simply assuming that a reasonable pretreatment process can be developed.

Third, without identifying a pretreatment process the DEIS cannot satisfy MEPA’s requirement that the “alternative must be economically feasible.” MCA § 75-1-201(C)(1)(b)(iv)(C)(I). The DEIS contains no analysis of the economic feasibility of designing and implementing a pretreatment process that will reduce arsenic levels below the state-wide standards. The assumption that the DEIS cannot satisfy MEPA by assuming that the preferred alternative is technologically and economically feasible.

Comment 9

The DEIS fails to document that the consultation with the project sponsor regarding the Preferred Alternative required by MEPA occurred. MCA § 75-1-201(C)(1)(b)(iv)(C)(II). At no time in preparing the DEIS and selecting the Preferred Alternative did DEQ consult with CR Kendall regarding the Preferred Alternative. To the contrary, Kendall was explicitly instructed *not* to comment on any portions of available drafts other than the Proposed Action. See email from Craig Jones, DEQ, to Jan Volberding, July 31, 2015.

Comment 10

As demonstrated above, the analysis and selection of the Preferred Alternative in the DEIS does not comply with MEPA or the MMKA. The DEIS lacks necessary information regarding the Preferred Alternative to conduct the environmental analysis required by MEPA. The DEIS also is not an appropriate place for DEQ to raise a concern that was never before raised regarding the sufficiency of the Closure Plan. The discharges proposed in the Closure Plan are fully compliant with Montana law and DEQ should revise the DEIS to reflect this fact.

Sincerely,


James E. Volberding
CR Kendall Corporation

Response 8:

Section 2.1 of the EIS explained how DEQ determines an alternative considered in an EIS to be reasonable. Pursuant to Section 75-1-201(1)(b)(iv)(C)(I), MCA, any alternative included in an environmental impact statement must be reasonable, in that the alternative must be achievable under current technology. In addition, Section 75-1-201(b)(iv)(C)(I), MCA, requires any alternative included in an environmental impact statement to be economically feasible. Economic feasibility is to be determined solely by the economic viability for similar projects having similar conditions and physical locations and determined without regard to the economic strength of the specific project sponsor.

DEQ does not select specific treatment methods that an applicant must implement. DEQ determines what water quality effluent limits are required for compliance with the Water Quality Act. It is the responsibility of the applicant to develop a water treatment system that achieves compliance with those limits. Estimated costs for a generalized adsorptive media pretreatment system for flow rates of 14 gpm and 30 gpm were provided in a Technical Memo to DEQ (Appendix B; Tetra Tech 2015). The EIS clarifies the roll of the applicant in Sections 1.4.3 and 2.4.

To facilitate the analysis of effects and to determine that effective treatments are available, the DEIS made certain assumptions which were described in Section 1.4.3 of the EIS. Analysis of the impacts of waste generated has been added to the Surface Water discussion in Section 3.3.3.3. Information was added to Section 1.4.3 and 2.4.1 to specify that CR Kendall may submit treatment system designs other than the treatment system described above, which DEQ would evaluate for consistency with the impacts disclosed in the EIS. If the treatment system design submitted by CR Kendall could result in materially different impacts as that disclosed in the EIS, DEQ will conduct further MEPA review.

Response 9:

Section 1.1 of the EIS has been updated to reflect the roll of the applicant in the MEPA process.

Section 75-1-201(1)(b)(iv)(C)(III), MCA, requires DEQ to consult with the project sponsor regarding any proposed alternative and give due weight and consideration to the project sponsor's comments regarding the proposed alternative. DEQ consulted with CR Kendall regarding the proposed alternatives in a number of conference calls involving DEQ, DEQ's third-party contractor, and CR Kendall in the Spring of 2015 (April 17, April 23, May 8, 2015). During the conference calls, the participants held technical discussions on the CR Kendall mine closure water treatment alternatives that would be analyzed in the EIS, including pre-treatment of mine water primarily for the removal of arsenic. Section 75-1-201(1)(b)(iv)(C)(III), MCA, does not require DEQ to consult with a project sponsor in regard to DEQ's identification of a preferred alternative. Nor does that statute provide that a project sponsor participate in the actual preparation of a draft environmental impact statement.

Response 10:

Comment Noted. Also see Responses 2 through 8 above.

2. CR Kendall Corporation, Glen Pegg



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October 29, 2015

Jen Lane
 MEPA Project Coordinator
 Montana Department of Environmental Quality
 P.O. Box 200901
 Helena, MT 59620-0901

Kendall Mine Draft EIS comments

This response is directed toward the reclamation of disturbed lands and the alternatives for additional reclamation. The draft EIS states that reclamation has been completed over most of the site and that vegetation on the reclaimed areas is in various stages of development based on the different treatments and years of growth. It goes on to state that the DEQ describes vegetation growth as "robust" on the waste dumps and has established successfully in most areas over the leach pads.

Comment 11

Response 11:
 Comment noted.

This document then suggests that some portions of the Kendall and Muleshoe pits have poor vegetation establishment, or have not yet been covered with soil and reclaimed, and do not currently meet the reclamation goals. It states the poor vegetation establishment in some areas is primarily due to lack of soil cover.

Comment 12

Response 12:

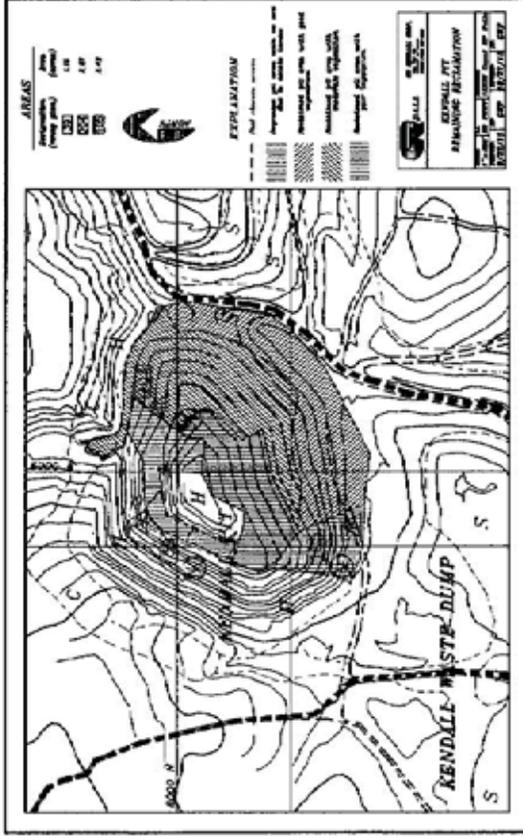
The agency-preferred alternative states that: "The soil in stockpile TS-13a would be used for reclamation of the interior slopes of the Kendall and Muleshoe Pits, where surface water runoff internally collects"; and that: "Soil in stockpile TS-13a would be used to reclaim the Kendall and Muleshoe Pit slopes". The agency was concerned with the overall revegetation success in these areas especially on the lower slopes of the backfilled pits and wanted to use the soil that existed on the site. Review of the stockpile volumes that exist on the site and the number of acres needing reclamation at closure indicate that the majority of TS-13a would be needed to reclaim more important disturbed areas including ponds, etc.

The agency appreciates CRK's concern with redistributing the area around TS-13a and the need to disturb a much larger area because of a need to reestablish drainage. After surveying the area in question only the amount of soil needed to reclaim disturbances would be removed. A new channel would not need to be created.

Comment 12
(cont.)

highwall, falling debris was a safety concern and will likely cover any soil placed there. Area 105 totals 2.42 acres comprising slopes of less than 2:1 which cannot be reduced due to composition of the highwall. Area 204 totals 2.09 acres and cannot be completed because any further slope reduction will compromise the Mason Canyon drainage. Unlike the Muleshoe pit, The Kendall pit was not re-graded prior to publishing the Soils and Revegetation Plan and as such, Schafer could not accurately determine the total of what could be completed.

Soil placed in the Kendall pit was generally considered the poorest remaining on site. Those soils originated from stockpiles TS-4 and TS-21. TS-4 originated, in part, from stockpile TS-13a, the same source as proposed to be used in any future soil placement. This soil was separated from TS-13a during the grading of the upper Kendall waste dump runoff bench after it was determined that drainage ran through TS-13a. If this resource is not performing as it should in the pit now, will placing more above be of any beneficial use?



Completed areas within the Kendall Pit.

Based on CRK's comments and DEQ's review of available stockpiled soil and the need to reclaim more important disturbances at closure, DEQ would not recommend re-soiling these small areas in the pits. The areas in the pits are not causing any major problems, any erosion, etc.

DEQ has watched the reclamation and revegetation success in the pits over the years. It is true the revegetation has been slow to start but eventually revegetation has been successful. The Horseshoe Pit revegetation is the best example of the success of revegetation in the pits over time.

DEQ addressed the Kendall and Muleshoe pit concerns in 2008 in a June 18th inspection report sent to CRK: "Areas with limited growth should be 1) re-soiled, amended with an agency approved organic amendment, reseeded, and/or planted with Ponderosa pine (Pinus ponderosa); or 2) amended with an agency approved organic amendment, reseeded, and/or planted with Ponderosa pine (Pinus ponderosa)."

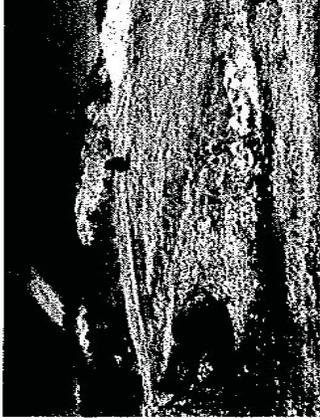
In addition, the agency suggested alterations to the seed mix in the inspection report:

- "Additions to Seed Mix
 Phacelia hastata (Silkyleaf phacelia)
 Artemisia ludoviciana (Louisiana sagewort)
 Thermopsis rhombifolia (Mountain pea)
 Artemisia frigida (Fringed sagewort)
 Petalostemon candidum (White prairieclover)
 Agropyron spicatum (Bluebunch wheatgrass)
 Elymus cinereus (Basin wildrye)

- Rocky Area Seed and Planting Mix
 Silkyleaf phacelia
 Louisiana sagewort
 Black medic

Comment 12 (cont.)

a limited amount of topsoil can be removed from TS-13a without leaving a depression or needing to establish a daylighted drainage. The total area of re-disturbance required to establish that drainage is approximately 2.75 acres.



The Horseshoe waste dump was described as a "model native vegetation" area by DEQ personnel.



The Kendall pit shows vegetation similar to that of the Horseshoe at the same stage of reclamation.

It is important to note that soil placed in areas of the Horseshoe pit and waste dump in 1995 and 1996 performed poorly and was never re-soiled or re-seeded. Only over the last several years have native weeds been displaced by vegetation that is now considered robust. The native vegetation included Silver Leaf Phacelia, pepperweed and flax. The resulting vegetation as it exists today has essentially taken 20 years to establish. Much of the Kendall pit contains the same plant species as that of the Horseshoe area

Rosa woodsii (Wild rose)
Pinus ponderosa (Ponderosa pine)

Shrubby cinquefoil
Seed Mix for Wet Salty Areas
Atriplex canescens (Fourwing saltbush)
Sporobolus airoides (Alkali sacaton)
Basin wildrye
Agropyron smithii (Western wheatgrass)
Elymus canadensis (Canada wildrye)"

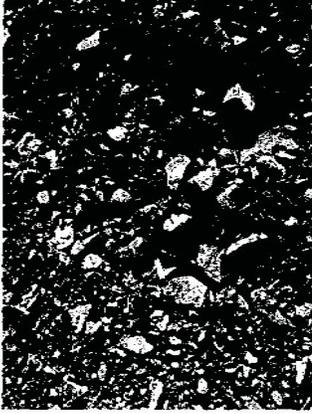
In 2008, DEQ suggested re-soiling or just amending with an organic amendment. CRK and the Stillwater Mining Company have used an organic amendment called BIOSOL in the past and an organic amendment like BIOSOL would provide acceptable results.

The 2008 seed mix recommendations were simple additions to the mix based on species volunteering on the site in reclaimed areas. The 2008 rocky area seed and planting mix recommendations were suggested based on observations of species observed volunteering on the rocky areas in the pits. The 2008 seed and planting mix for wet salty areas was recommended based on observations in the pits especially in the areas where LAD with RO brine had been used.

Section 2.4.1 (Process Pad Drainage Pretreatment Alternative) has been revised to eliminate the additional soil placement in the Kendall and Muleshoe pits.

Sections 2.4.1 and 2.4.2 have been revised to require that CR Kendall modify the seed mix based on the 2008 recommendations and reseed the lower slopes of the pits. DEQ will stipulate that CR Kendall propose amending the lower slopes of the Kendall and Muleshoe pits after seeding with an agency-approved organic amendment if equipment can safely be mobilized into the pit bottoms. DEQ will not require planting ponderosa pine as it volunteers regularly on the mine site without seeding or planting.

after it was seeded. If the poorer soils require in excess of 15 years to become fertile enough to show moderate vegetation, would it be wise to cover soil placed 9 years ago with even more poor soil?

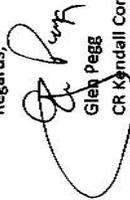


Even marginal vegetation in the Kendall pit show signs of early growth typical to that seen in areas of the Muleshoe and Kendall dumps and the process valley prior to grasses taking over.

Comment 13

In conclusion, we believe that the Muleshoe and Kendall pits have been successfully reclaimed according to the DEQ's approved plans. Further, soil contained in TS-13a should remain in its current, stable location and be used for contingency purposes rather than be wasted in the Muleshoe and Kendall pits.

Response 13:
See Response 12.

Regards,

Glen Pegg
CR Kyndall Corp.

3. Montana Environmental Information Center



Nov. 9, 2015

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Re: Draft EIS comments on CR Kendall Mine Closure

Thank you for the opportunity to comment on the Draft EIS for the CR Kendall Mine Closure Plan. These comments are submitted on behalf of Earthworks, a non-profit conservation organization dedicated to protecting communities and the environment against the adverse impacts of mining, and the Montana Environmental Information Center, a state-wide environmental organization with nearly 5,000 members. These two organizations have been involved in this issue for many years, and have members who live and ranch downstream of the mine.

Comment 14

Response 14:
 Comment noted.

We are relieved to see the Department require Kendall to complete a closure plan to address management of long-term quality problems at the mine, which the DEIS predicts could continue for another 100 years. Given that the mine ceased operations in 1997, this plan is long overdue.

At this point, four administrations, starting with Governor Racicot, have promised that this would occur.

Comment 15

Response 15:
 Comment noted.

"On September 23, 1998, the Department issued a notice of violation and administrative order under the Water Quality Act. The order requires Kendall to propose by November 1, 1998 a plan to permanently correct the problem and to achieve compliance with water quality standards in all discharges to state waters by August 1, 2001. Upon receipt of a complete application for amendment and the compliance plan, we will conduct an environmental review under MEPA."

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Comment 15
(cont.)

-Governor Mark Racicot, October 1998.¹

"The process of addressing pollution concerns at the Kendall mine site has regrettably been slow, but the time involved reflects the complexity of the situation."

-Governor Marc Racicot, January 12, 1999.²

"Water quantity and quality issues at the site are complex and unresolved. We have determined that approval of the proposed modifications would be a major action of state government that significantly affects the quality of the environment. An environmental impact statement will therefore be necessary."

- DEQ Director Jan Sensibaugh, January 11, 2002.³

"I've made a commitment that Kendall is going to be our top priority to resolve."

- DEQ Director Jan Sensibaugh, January 2002.⁴

"DEQ is committed to completing the EIS process."

- DEQ Director Richard Oppert, June 2005.⁵

"Please understand that I share your frustration over the years that have passed. I have instructed the Environmental Management Bureau (EMB) to restart the process and bring it to a successful conclusion as soon as possible."

- DEQ Director Tracy Stone-Manning, September 22, 2014.⁶

Now that the EIS for final closure of this mine is underway again, we urge the Department to complete the EIS process and require a comprehensive closure plan that ensures that Montana's water quality standards will be met with valid water treatment facilities. We urge DEQ to take immediate steps to require the company to increase its financial assurance to cover the cost of long-term water treatment for the anticipated 100 years, including the cost of additional treatment that may be necessary for selenium, thallium and arsenic.

Comment 16

Response 16:

This subject was discussed Section 1.8 of the EIS, Issues Considered But Not Studied in Detail.

¹ Governor Marc Racicot, Letter to Jim Jensen, Montana Environmental Information Center, October 13, 1998.

² Governor Marc Racicot, Letter to Stephanie Shaumel, January 12, 1999.

³ Montana DEQ, Letter to CR Kendall, January 11, 2002.

⁴ Mike Demussen, Great Falls Tribune "State Orders Kendall EIS," January 2002.

⁵ Meeting with Richard Oppert, June 2005.

⁶ DEQ Director Tracy Stone Manning, Letter to Bonnie Gestring, September 22, 2014.

Comment 17

This company has been allowed to delay water treatment for the highly contaminated process
paid water long enough. We urge DEQ to develop a plan that requires the company to treat and
return the water to the appropriate stream drainages, and secure an adequate reclamation bond to
protect Montana taxpayers against the cost of long-term water treatment and downstream
landowners from impacts.

Our more detailed comments are below.

Sincerely,

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Response 17:

CR Kendall initiated water capture and treatment of contaminated water from 4 locations in June 1996. DEQ issued Administrative Order WQ-98-06 in September of 1998 directing CR Kendall to augment stream flows to replace water intercepted by the pumpback systems. This was initially accomplished via pumping from water supply wells for which CR Kendall held water rights. Later, CR Kendall obtained water rights and easements allowing for interception of springs upgradient of the mine site and piping of this water to locations downgradient of the mine to compensate for intercepted water. Because the water from the intercepted springs would normally infiltrate into the Madison Limestone, this water would not otherwise have contributed to stream flow downgradient of the mine site, nor does diversion of these springs diminish availability of groundwater in shallow aquifers in the region as continued pumping from water supply wells might. Management of contaminated water is discussed in further detail in Section 2.2.

Because the diversion of springs replaces surface water intercepted by the pumpback systems and is conducted pursuant to valid water rights, DEQ does not have the authority to require that water treated by CR Kendall also be returned to these stream drainages. See also Response 26 for a discussion of historic tailings that occur in some drainages, which would negate the benefits of water treatment if treated effluent was discharged to those drainages.

An updated reclamation bond will be calculated at the completion of environmental review, based upon the details of the chosen alternative.

1. The Purpose and Need section of the DEIS should incorporate the full scope of activities as they relate to the NEPA process.

Comment 18

It's important to note that the NEPA process has been highly irregular. The NEPA process for the closure plan started with DEQ Director Jan Sensibaugh in 2003 – fully 12 years ago.⁷ Many local landowners and organizations spent considerable time on it. I participated in a scoping meeting in Lewistown on April 29, 2003⁸ and technical team meetings with Montana DEQ and Canyon Resources in Lewistown on May 29, 2003 and June 3, 2003 and in Helena on June 26, 2003.

In April 2005, a preliminary draft of the Kendall Mine Reclamation Plan EIS was completed. On June 15, 2005, I met with the new DEQ Director Oppen, who insisted the EIS would be completed. Yet, with no public notice or explanation, the Department discontinued the EIS process.

Now that the EIS process has been reinitiated, the DEIS should make the NEPA history clear in the document, including the scoping period and other agency decisions leading to this point.

The scoping document released by DEQ in 2003, states that “The EIS will address the major issues identified in DEQ’s 2001 environmental analysis.”⁹ As such, it will include:

- Reevaluation of the reclamation plan, including all existing reclaimed acres on the site, and addressing a range of alternatives for reclamation.
- Review of all potential impacts to water quantity and quality in the drainages.
- Review of water rights issues, and
- Review of water treatment alternatives.

2. The preferred alternative does not demonstrate that water quality standards will be met.

We support the proposed pretreatment component of the preferred alternative, but we remain concerned that the DEIS does not demonstrate that water quality standards will be met.

Comment 19

As demonstrated by selenium concentrations in KVPB-6 and the process pad discharge, the trend analysis for some sites is highly uncertain (p. 3-36 DEIS). In these areas, there isn't a clear indication that water quality concentrations are improving.

Response 18:

Information on the past history of the MEPA process has been added to Section 1.3.2, explaining when it was originally initiated and why it was suspended. Information on the scoping was included in the DEIS Section 1.6.

The current EIS does address the items listed in this comment in Chapters 2 and 3.

The commenter is correct that considerable efforts were made between February and June 2003 in the scoping of possible reclamation at the Kendall Mine. A Scoping Report dated June 2004 resulted from those efforts.

The Scoping Report indicates that the stakeholders agreed that no proposed alternative existed for the Kendall mine closure, because DEQ had denied CR Kendall's earlier proposed amendment to their closure plan. The stakeholders compiled a list of “preliminary reclamation alternative components” that addressed water quality, water quantity and improved revegetation and land use.

The stakeholders also identified actions that would be common to any of the alternatives the might be chosen. The stakeholders believed that early identification of the common actions may enable DEQ and CR Kendall to initiate reclamation efforts at the mine site before the EIS was complete. The actions common to all alternatives included reclamation of Leach Pads 3 and 4. It was agreed that the leach pads would remain in place, would be regraded, and that an appropriate cap would be evaluated and chosen in the EIS process. The stakeholders believed that the leach pads were the main priority for remediation at the site. The other common action pertained to increasing flows downstream of the mine site.

By April of 2005, DEQ had prepared a preliminary draft EIS. In the preliminary draft, many of the preliminary reclamation components identified during scoping were considered but not retained for detailed analysis. The reclamation components not retained for detailed analysis included removal of the waste rock dumps into the pits, complete pit backfill with liners and leachate collection, leach pad removal, composite covers for leach pads and waste rock dumps,

⁷ Great Falls Tribune, “State Orders Kendall EIS,” DEQ head says mine cleanup, help for neighbors top priority, January 12, 2012.

⁸ CR Kendall, Environmental Impact Statement, Scoping Document, 2003.

⁹ deq.mt.gov/eis/hardrock/CRKendall/Scoping.pdf

¹⁰ Id.

geocomposite clay liner-type covers, combination covers for leach pads and waste rock dumps, complete historic tailings removal, reverse osmosis water treatment, ion exchange water treatment, water treatment by chemical precipitation, passive biological treatment, centralized water treatment, blending water for use by livestock, water supply wells to supplement water quantity, and dismantling of process facilities and structures. See preliminary draft EIS, pp. 2-1, et seq.

DEQ subsequently suspended work on the EIS later in 2005 when CR Kendall indicated that it would submit a long-term water treatment plan in the near future and would fund the completion of the EIS. That plan was submitted by CR Kendall in July of 2012.

During the 2005-2012 period, CR Kendall requested several minor revisions and conducted reclamation work consistent with all alternatives that were being evaluated in the EIS. These include:

- Recontouring of the leach pads to final grade and construction of perimeter storm water diversion ditches
- Recontouring of backfill in the Kendal and Barnes-King pits and regrading of portions of the Kendall waste rock dump
- Placement of additional topsoil on portions of the pit backfill areas and waste rock dumps
- Placement of a 18" layer of bentonite-amended subsoil (the "basal layer") over the recontoured leach pads, and interim seeding of that surface
- Construction of a pilot-scale passive treatment facility in the Process Valley to test the effectiveness of a treatment technology
- Construction of a pilot-scale passive biological treatment cell in Barnes-King Gulch to test another potential treatment technology
- Placement of 17" of topsoil over the leach pads and revegetation of the surface
- Construction of collection systems at springs upgradient of the mine and installation of pipelines to divert these springs through the mine site to compensate for impacts to water rights due to operation of mine

drainage interceptions systems in Little Dog Creek and South Fork Last Chance Creek

Finally, CR Kendall has continued:

- Operation and maintenance of water collection and treatment facilities
- Maintenance of reclaimed areas, including erosion control and repair, weed spraying, and placement of additional topsoil and seed in areas where vegetation was performing poorly
- Maintenance of storm water ditches and settling ponds
- Water quality and quantity monitoring

Response 19:

See Response 8.

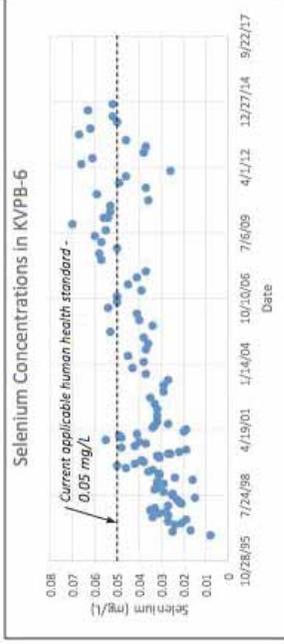
Additional information was added in Sections 1.4.3 and 2.4.

As noted, it is uncertain whether concentrations of some parameters in untreated mine-influenced waters, particularly selenium, will continue to decline. Selenium concentrations and average weekly pumpback flows are different between the pumpback systems located in different drainages. Even when considering a range of flow and selenium-loading scenarios, when these sources are combined at the central water treatment plant, the resulting selenium concentration in the influent water is below the Montana groundwater quality standard (Closure Plan Mixing Model, Table 4-1). CR Kendall will be obligated to comply with appropriate effluent limits in the discharge from their water treatment plant, subject to penalties if effluent limits are violated. It is the responsibility of CR Kendall to comply with water quality criteria, and to modify their water treatment system as necessary to maintain compliance. Additional information has been added to Section 1.3 and Section 3.3.2.3 regarding the findings in the Closure Plan.

To facilitate the analysis of effects and to determine that effective treatments are available, the DEIS made certain assumptions described in Section 1.4.3. Information was added to Section 1.4.3 to specify that

CR Kendall may submit treatment system designs other than the treatment system described above, which DEQ would evaluate for consistency with the impacts disclosed in the EIS or conduct further MEPA review.

Comment 19
(cont.)



The EIS should specify the additional water treatment requirements that will be required if arsenic and selenium concentrations do not improve as anticipated, and incorporate the cost of that treatment into the final closure plan and the associated reclamation bond.

Although the DEIS includes a vague reference for additional water treatment if needed, it does not provide enough detail on how and when this would be implemented, and the cost of additional treatment must be included in the bond calculation to ensure that funds are collected now to cover those costs.

Furthermore, the DEIS preferred alternative calls for the pretreatment of process pad drainage, but it fails to specify how that treatment would occur. It proposes an adsorption process to remove constituents not susceptible to zeolite treatment, but defers to CR Kendall to determine what type of treatment technology it will use. Given the ongoing delay of appropriate treatment technology at Kendall, the EIS should specify how and when this new technology must be identified and implemented.

3. The EIS must clearly identify a range of reasonable alternatives.

MEPA requires state agencies to consider a range of reasonable alternatives, and state law requires that the agencies meet certain reclamation requirements outlined in the Metal Mine Reclamation Act, MCA 82-4-336 (9-12):

- (9)(a) With regard to disturbed land other than open pits and rock faces, the reclamation plan must provide for the reclamation of all disturbed land to comparable utility and stability as that of adjacent areas.
- (10) The reclamation plan must provide sufficient measures to ensure public safety and to prevent the pollution of air or water and the degradation of adjacent lands.
- (12) The reclamation plan must provide for permanent land-capping and contouring to minimize the amount of precipitation that infiltrates into disturbed areas that are to be graded, covered, or vegetated, including but not limited to tailings impoundments and waste rock dumps. The plan must also provide measures to prevent objectionable post-mining ground water discharges.

1612 K ST. N.W., SUITE 808 / WASHINGTON, DC 20006 / P 202.887.1872 / F 202.887.1875 / WWW.MINEARTHWORКСACTION.ORG

Response 20:

The EIS evaluates the Closure Plan (see Section 1.1) and a reasonable range of alternatives, including various methods of water management and treatment, as well as source controls in Sections 2.2 through 2.5.

The environmental impact statement analyzes potential impacts resulting from state action on the permit amendment application submitted by CR Kendall in April of 2012. The permit amendment application contains a proposed revised final reclamation plan addressing the remaining reclamation issues at the site. These issues include the final capping of the former process ponds, final design and installation of water treatment facilities and long term reclamation monitoring and maintenance. The environmental impact statement contains a reasonable range of alternatives for the reclamation activities proposed in the revised final reclamation plan.

All major disturbed areas at the CR Kendall Mine other than the former process pads have been reclaimed pursuant to the approved reclamation plan.

The language is very clear. This must be the starting point from which this reclamation plan is developed. As such, the DEIS must include additional reasonable alternatives.

a) An alternative that includes the treatment of mine discharges to water quality standards and release to the applicable drainages.

Comment 21

According to the DEIS, the various alternatives will require that "all captured groundwater would be combined with process pad drainage water in ponds 7 and 8, filtered to remove particulate, and treated with zeolite adsorption before being discharged to groundwater through the Kendall Pit. Pumpback and discharge to the Kendall Pit is assumed to continue for 100 years." (P. 2-2, DEIS)

The hydrological effects of diverting groundwater from four drainages, and discharging that water into the Kendall Pit for 100 years must be evaluated in the DEIS, along with the effects of diverting water from springs to augment water downstream from the mine.

The public and downstream landowners have repeatedly urged DEQ to require the company to treat their discharges and return it to the appropriate drainages, rather than discharging to the pit.

In fact, DEQ has also said this is the right course, "Mixing of pumpback water and process water should be avoided whenever possible because this reduces the treatment and disposal options available. Provided appropriate standards can be met, it would be preferable to return this water to the streams. The agencies will encourage the return of suitable water to the creeks."¹⁰ This alternative should be evaluated in the EIS.

b) An alternative that includes additional source controls.

Comment 22

The mine uses a pumpback system to capture groundwater that has been adversely affected by the rock piles in various stream drainages. For example, the proposed Kendall Mine Closure Plan states that, "Shallow groundwater in the area is captured by the KVPB-6 pumpback system, located at the toe of the Muleshoe repository."¹¹

The pumpback data for KVPB-6, which captures alluvial groundwater from the Muleshoe waste rock pile, clearly shows concentrations of selenium in the pump back system in the South Fork of Little Dog Creek drainage above standards (Figure A-9, DEIS). The water quality exceeds human health standards for arsenic 50% of the time; thallium 100% of the time; selenium 23% of the time, and nitrates 62% of the time (Table 3-25). Thallium concentrations in KVPB-6 in 2014 were still 100 times the standard. Furthermore, it isn't certain whether water quality is improving in KVPB-6.

The DEIS should include an alternative that considers additional source control measures for waste rock piles to prevent objectionable groundwater discharges and reduce the need for water treatment.

¹⁰ Maire Simionich, Montana DEQ and Brad Clinch DNRC, Letter to Alan Shammel, August 9, 1999.
¹¹ CR Kendall, Amended Closure Plan Water Management, July 2012.

Response 21:

See Response 17. Additional information about water management has been added to Section 2.2.

While public comment has been concerned with the stream flows, solutions have not necessarily been to return treated discharges to surface water. CR Kendall previously submitted an MPDES permit application to DEQ which would have resulted in authorization to discharge to surface water. A public hearing was held in Lewistown in 1998 concerning the draft MPDES permit, and many of the public who testified at the hearing stated that they were opposed to DEQ issuing an authorization to discharge to CR Kendall. Subsequently, the issue of stream dewatering associated with pumpback of mine water was addressed through other means of augmenting stream flow.

The current pumpback and stream flow augmentation plans were approved more than a decade ago and are not being revised by the closure plan under review in this EIS. The referenced letter written by DEQ and DNRC in August of 1999 did not commit to returning treated water to streams, and was very preliminary in that it predated both the development of the current treatment system for thallium removal, and also the investigations into the availability of upgradient springs for diversion to augment stream flows.

See Response 26 for a discussion of historic tailings that occur in some drainages, which would negate the benefits of water treatment if treated effluent was discharged to those drainages.

Response 22:

This comment cites frequent exceedances of water quality standards in the water that is captured at pumpback station KVPB-6, which documents the necessity to continue to operate this pumpback system. Alternatives addressing source controls were in Sections 2.5.1 and 2.5.2 of the DEIS.

4. The proposed action does not meet the Montana constitution's requirement that all lands disturbed by mining be reclaimed.

It appears that the proposed action would leave portions of the Kendall and Muleshoe pits unreclaimed. (Table 2-1, DEIS) This does not meet the requirements of the Montana Constitution, which states that all lands disturbed by the taking of natural resources shall be reclaimed.

Comment 23

Section 2. Reclamation. (1) All lands disturbed by the taking of natural resources shall be reclaimed.

5. The DEIS does not provide for adequate reclamation of storage ponds.

The DEIS states that the treatment ponds will be reclaimed by folding the liners over the zeolite and establishing a free-flowing drainage that would discharge to surface water in Mason Canyon. It further states that liners in all other ponds will be cut, folded into the pond bottoms and buried with clean fill. (P.2-7, DEIS) The pond sites would be regraded, 8-10 inches of clean soil placed on surfaces and reseeded. (P. 3-46, DEIS)

Comment 24

This is inadequate to ensure that the storage ponds that contain spent zeolites, and possibly arsenic, won't leach pollutants into groundwater. These ponds should be reclaimed with a protective barrier to prevent infiltration. Liners have limited life expectancy, and re-using the existing liners as some type of cover system 50-100 years down the road is entirely inappropriate.

The scoping document released by DEQ in 2003, states that "The EIS will address the major issues identified in DEQ's 2001 environmental analysis." ¹² As such, it will include:

- Reevaluation of the reclamation plan, including all existing reclaimed acres on the site, and addressing a range of alternatives for reclamation.
- Review of all potential impacts to water quantity and quality in the drainages.

Comment 25

Reclamation and closure of the storage ponds is a critical element of this EIS.

6. The no action alternative fails to identify the impact of the no action alternative.

There is no data to support the assertion in the EIS that minimum additional impacts to surface water would occur under the No Action Alternative. The current system is operating under interim effluent limits that were approved by the DEQ in 1999. According to DEQ, those effluent limits would be temporary while the company applied for an MPEDES permit to meet water quality standards. Yet, the Department has allowed these interim standards to continue, without any public review process or appropriate scientific analysis and without any regulatory basis for allowing discharges to continue for the last fifteen years. Furthermore, impacts from Land Application Disposal have been documented in the past, and the on-going use of LAD

Comment 26

¹² Id.

Response 23:

See Response 12. DEQ would not release bond held for revegetation of these lands until the conditions in 82-4-336 MCA are met.

Response 24:

Specific details of reclamation of the lined ponds will be dependent upon their condition at the time of closure. If the ponds are retained for as long as 100 years, it is very unlikely that the existing liners would still be in use at that time. They would be replaced as necessary. On a case by case basis, reclamation plans for lined ponds will depend on whether the pond contains solids with the potential to leach thallium, arsenic, or other pollutants. Additional information has been included in Section 2.3 relating to the maintenance of liners, reclamation plans for lined ponds, need for a liner on the top, and storage capacity for spent zeolites.

The volume of spent zeolites generated annually is estimated to be 0.1 % of the storage capacity in Pond 7. During treatment optimization studies in 2010 and 2011, leachability tests (SPLP and TCLP) were conducted on the spent zeolites, and results indicated that the leachable concentrations of the "RCRA 8" metals (As, Ba, Cd, Cr, Pb, Hg, Se, Ag) were below detection limits. The adsorbed thallium was found to be essentially non-leachable, with < 1% of the thallium being liberated from the zeolites. Additional information on the leachability of thallium from the zeolite has been included in Section 3.3.3.1.

Response 25:

Subsequent to DEQ's 2001 environmental analysis, additional reclamation has occurred at the CR Kendall mine site and the quality of revegetation on reclaimed areas has improved substantially in the past 14 years. New water management and treatment plans have been proposed, approved, and implemented that were not under consideration at the time of the 2001 environmental analysis. Therefore, fewer major issues remain. These issues were addressed in the DEIS in Section 1.8.

would be expected to exacerbate problems at the site. The continued release of these contaminants would reasonably be expected to result in cumulative effects.

Comment 26
(cont.)

The monitoring wells demonstrate that water continues to exceed standards in surface water and groundwater monitoring wells, including Mason Canyon groundwater at TMW-24A (Figure A-4); and Mason Canyon surface water KVSW - 4 (Table 3-10, P. 3-20), surface water in Barnes King Gulch (KVSW-3) (Table 3-12, p. 3-22), groundwater in Barnes King Gulch (TMW-30A)(Table 3-22, p. 3-30), and the Section 29 spring (Table 3-15, p. 3-25).

7. Cumulative impacts fail to account for the change in hydrology related to the long-term loss and diversion of the alluvial aquifer and associated stream flow.

The DEIS should disclose the cumulative effects to surface and groundwater resources from the capture and diversion of contaminated surface and groundwater from the various drainages as a result of the pumpback system. Page 2-6 points out that the combined flow rate from the four pumpback systems has ranged from 33 gpm to 125 gpm over the last 18 years (1997 to 2014). At 33 gpm the loss of water to the drainages is over 17 million gallons per year. At 125 gpm the loss to the drainages is over 65 million gallons per year or an average of 41,522,400 gallons per year with a total loss over 20 years of 830,448,000. This is a significant loss of water to the four drainages, especially when this may continue for 100 years as stated on Table 2-1 for all the alternatives.

Comment 27

8. Land application disposal (LAD) impacts to soils, vegetation, water and other resources should be disclosed and LAD should not be authorized in the final closure plan.

On February 5, 2002, DEQ released the Final EA and Decision Notice on Kendall amended Closure Plan. DEQ concluded that issues were raised by the public "that cannot be dealt with using the changes added to the Agency Modified Plan in the Draft EA. According to the Final EA and Decision Notice, "the process valley water, which has been disposed of on the reclaimed acres, contains a relatively large amount of salts. DEQ is concerned that continued LAD of process solutions could impact reclaimed area soils and lead to limited revegetation success." "If the process solutions have impacted or could impact future reclamation areas, then revegetation success would be limited, erosion would increase, and more potential problems to water quality and quantity could result." Furthermore, "the leach pad ore may have become contaminated because of the disposal of process valley water and the reverse osmosis brine on the leach pads. The salt load in the process valley water may limit the ability of the ore to provide a subsoil resource as originally thought by DEQ. Therefore, the agency has decided that a comprehensive EIS is needed. On May 14, 2002, DEQ submitted a letter to Canyon informing Canyon that the department was denying its application for an amendment (March 8, 2001 plan). The letter states "Department inspectors have recently observed that portions of the vegetation that has been irrigated using water from the process valley are distressed. The process valley waters contain elevated levels of salts and metals.

Comment 28

In March 2003, DEQ initiated scoping under the Montana Environmental Policy Act (MEPA). According to the March 2003 Scoping Document, DEQ stated that "an EIS was needed to address the soil, vegetation and water resources efforts on Canyon's proposed amended water

Comment 29

Response 26:

Information has been added to the description of the No Action Alternative (Section 2.2) explaining DEQ's ability to authorize interim water quality standards.

This closure plan does not rely on the interim standards. The Preferred Alternative in this EIS involves discharge of treated water to groundwater, in compliance with Montana groundwater quality standards.

The Affected Environment for Soils and Vegetation (Section 3.4.2.1 and 3.4.2.3) has been updated to include the impacts from past LAD. The analysis in Section 3.4.3.1 has been revised to address additional impacts on soils and vegetation if process pad waters continue to be land applied over the long term. Any action alternative from this EIS would greatly restrict any future use of LAD (see Table 2-1).

Exceedances of water quality standards were discussed in Section 3.3.2 in the DEIS. Additional details interpreting the data have been added.

Site KVSW-3 is located along the North Fork of Last Chance Creek as stated on page 3-21 of the DEIS, not Barnes-King Gulch.

Table 3-15 has been modified and additional text added to correct the column of the table labeled "% of Samples Exceeding Standards".

The September 23, 1998 Notice of Violation and Administrative Compliance and Penalty Order, Docket No. WQ-98-06, required CR Kendall to submit a compliance plan and propose interim water quality standards. The Department can authorize interim water quality standards under an administrative order. The interim standards were approved by the Department in a July 19, 1999 letter. CR Kendall applied for an MPDES permit, but a permit was never issued as the discharges to surface water were eliminated by the pumpback systems.

Seepage from the CR Kendall mine facilities has been intercepted since 1996 to prevent water quality impacts to surface water.

This closure plan does not rely on the interim standards. The Preferred Alternative in this EIS involves discharge of treated water to

groundwater, in compliance with Montana groundwater quality standards.

Although there may be impacts to soils within the mine permit area due to land application, vegetation in irrigated areas still appears to be robust. Selection of any action alternative from this EIS would greatly restrict any future use of land application disposal. While selection of the No Action Alternative is not being considered, the discussion in the FEIS will clarify that additional impacts to soils and vegetation are expected if process pad waters continue to be land applied over the long term.

The comment also references continued exceedances of water quality standards. The specific sites are discussed below:

Well TMW-24A (Figure A-4) in lower Mason Canyon has shown elevated arsenic concentrations since the late 1990s, with a trend of improving quality over the past 8 years. This arsenic does not appear to be derived from the CR Kendall mine site, as all shallow groundwater within the Process Valley drains through the underdrain into collection sump TMW-26, and this water has consistently remained within water quality standards for arsenic. During construction of the leach pads, historic tailings were removed from the process valley; however, deposits of tailings remain present downgradient of the CR Kendall mine site, and the arsenic detected in TMW-24A is suspected to be related to the presence of these tailings. Similar arsenic concentrations have been observed over many years in lower Barnes-King Gulch, where surface water flows through historic tailings.

Mason Canyon (KVSW-4): As with well TMW-24A, water quality at surface water site KVSW-4 is likely impacted by residual historic tailings in the area. Table 3-10 (page 3-20) in the DEIS is not the best reference for assessing water quality trends at KVSW-4 because it includes data since 1990, several years before pumpback of TMW-26 was initiated.

Well TMW-30A (Barnes-King Gulch): As with site KVSW-4 (discussed above), the data presented in DEIS Table 3-20 (page 3-30) includes data collected since 1994, prior to the initiation of pumpback. Water quality in the area of well TMW-30A may be influenced by residual historic tailings within the gulch.

Barnes-King Gulch (KVSW-3): Note that the comment refers to DEIS Table 3-12, Page 3-22, KVSW-3. Site KVSW-3 is actually located along the North Fork of Last Chance Creek, not Barnes-King Gulch. The CR Kendall mine does not

have facilities within the North Fork drainage, but the drainage may have been influenced by historic mining. Surface water in Barnes-King Gulch is monitored at site KVSW-2, and infrequently further downstream near its confluence with the North Fork Last Chance Creek (site BKSU-1). Site BKSU-1 typically has dissolved arsenic concentrations near 0.03 mg/L and dissolved thallium concentrations near 0.06 mg/L due to the presence of historic mill tailings within the drainage.

Section 29 Spring (Little Dog Creek): The data in Table 3-15 on Page 3-25 of the DEIS include water quality analyses of the Section 29 Spring since 1990, and therefore are not representative of water quality conditions at the spring since the initiation of pumpback of mine-influenced waters upgradient of the spring during 1996. The column of the table labeled “% of Samples Exceeding Standards” is not reliable for the following reasons:

The nitrate standard is listed as 10 mg/L, except that the newly adopted (as of 2014) surface water quality standard for nitrate during summer months is 1.3 m/L. Nitrate only exceeded 10 mg/L at the Section 29 Spring once, prior to the installation of a pumpback system in 1996. Nitrate in the spring has not exceeded 1.3 mg/L in summer months since the adoption of that standard, so the actual % exceedances should be less than 1% rather than the 33.9% stated in the table.

Very few detections of thallium have occurred at the Section 29 Spring, but until recent times laboratory analyses for thallium could not achieve the current surface water quality standard. In cases (the majority of samples) where thallium was not detected but the detection limit used by the laboratory was higher than the standard, Table 3-15 reports that the standard was exceeded.

Selenium in the Section 29 Spring often exceeds the chronic aquatic life criterion (averaging 0.007 mg/L), but never the acute aquatic life criterion or the human health standard. Because augmentation water is added to the same stock tank that the spring is piped into, it is unlikely that the chronic aquatic life criterion is ever exceeded once the mixed water leaves the stock tank. It should be noted that water

quality samples collected from the Section 29 Spring during April and December of 1985, long before any modern mining activity within the Little Dog Creek watershed upgradient of the spring, reported selenium concentrations of 0.01 mg/L and 0.009 mg/L, respectively.

In general, the tables in Section 3.3.2 of the DEIS that were cited in this comment are not very relevant for citing continued exceedances of water quality standards because they include data from the early 1990s prior to the initiation of pumpback of mine-influenced waters.

Response 27:

This comment does not take into account the augmentation flow provided to the drainages via diversion of upgradient spring water which would not otherwise reach the stream channels below the mine site. For example, during 2014, the four pumpback systems collected seepage at an annual average rate of 55.39 gallons per minute, which is a total annual volume of 29,111,370 gallons. During 2014, the diversions from the Mason Canyon spring and the Upper Little Dog Creek spring returned a total of 39,121,990 gallons of water to these drainages. The augmentation flow is 134% of the pumpback volume, not enough to affect the hydrology and not a significant loss of water. See Table 3-3 compared to Table 3-4.

Response 28:

Impacts from land application of brine have not been a concern since 2002, when brine production ceased (because the reverse osmosis treatment system was replaced with a zeolite absorption system). Since that time, continued observation of vegetation in areas where brine was applied has indicated that vegetative cover is healthy and improving.

This comment describes conditions at the Kendall mine prior to 2002 which are no longer applicable. CR Kendall began pumpback of mine-influenced seepage below waste rock dumps during 1996, and managed the intercepted water via land application. Leach pad process water was also land applied when freeboard in process water storage ponds approached minimum allowed capacity. In June of 1997, impacts to surface water downgradient of the LAD area (site KVSW-7) were detected, and land application was discontinued. CR Kendall then acquired a Reverse Osmosis treatment plant. Testing indicated that the RO system could not achieve water quality standards for thallium, so CR Kendall also tested a zeolite adsorption polishing step and determined that

this process could remove residual thallium in the RO – treated water. In August 1997 CR Kendall received approval to use this new water treatment process in lieu of land application to dispose of process water. Water was discharged to the Kendall mine pit, where it would infiltrate into the Madison limestone aquifer. DEQ required that all water discharged in this way meet Montana groundwater quality standards.

The Reverse Osmosis treatment process produced a substantial quantity of waste brine, and CR Kendall attempted to manage this volume of waste water via evaporation. CR Kendall purchased snow making equipment which they operated during the summer, spraying water mist over the leach pads with the intention of maximizing evaporation while collecting the residual brine within the leach pad system. After a few years of operation of this system, CR Kendall concluded that it could not achieve long term water balance management goals. The process water storage ponds were again reaching capacity, but were now storing brine (concentrated process water). There was a risk that pond capacity could be exceeded as a result of storm events, and to avoid an uncontrolled discharge, CR Kendall developed new land application areas on waste rock dumps and other revegetated disturbed areas upgradient of their seepage capture systems and began to blend the stored brine with captured seepage and to irrigate these areas to manage the excess water. CR Kendall discontinued the use of reverse osmosis to avoid the creation of more brine.

Impacts from land application of brine at the CR Kendall site were a concern in 2002, but the cessation of brine production since that time in conjunction with continued land application of waters having lower salt concentrations and continued observation of the health of vegetation in areas where brine was applied have reduced the concerns associated with land application.

Under the proposed Amended Closure Plan, routine land application as a means of water management would be discontinued and all water would be treated and discharged to the Kendall mine pit. The land application system would still be available for use if necessary to prevent direct discharges to surface water in response to extreme

Comment 29
(cont.)

resources management plan. It further states that the EIS will "address the major issues identified in DEQ's 2001 EA: 1. re-evaluation of the reclamation plan, including all existing reclaimed acres on the site, and addressing a range of alternatives for reclamation, 2. A review of all potential impacts to water quantity and quality in the drainages and, 3. A review of water rights issues; and Review of water treatment alternatives."

Comment 30

The Kendall mine has continued to use the LAD system to discharge process pad water, because it hasn't installed the water treatment technology necessary to meet standards. Yet, the DEIS fails to describe the conditions associated with the long-term land application disposal (LAD) on soils, vegetation and water, and it still proposes to allow LAD to continue.

Comment 31

The EIS must provide information on contaminant levels in the soils and vegetation throughout the mine site LAD areas, and whether long-term land application has resulted in adverse impacts to those resources. It should also provide data on whether the long-term application of metals-contaminated leachate may have contributed to elevated concentrations of these metals in groundwater in the applicable drainages, including the Section 29 spring. Land application is not suitable for long-term treatment of metals such as thallium and selenium, and it certainly isn't suitable as the primary treatment mechanism.

9. The EIS must disclose how the Administrative Order on Consent (AOC) and discharge permits will be addressed in conjunction with the final closure plan.

Comment 32

The Kendall mine has caused extensive water quality and quantity problems over the years. In 1998, the State of Montana ordered Canyon to pay a penalty for polluting downstream surface and groundwater with cyanide, selenium, arsenic, nitrites and thallium.

At the same time, the State issued an Administrative Order requiring the company to obtain (NPDES) discharge permits for its various discharges. It also authorized interim effluent limits that were set at levels substantially weaker than state water quality standards. These interim effluent limits were described as a temporary measure intended to give the company time to show progress with reclamation activities and obtain the required discharge permits.

According to the administrative order, Canyon Resources was required to submit a draft compliance plan that "explains how the discharges from the mine will be brought into compliance with the Water Quality Act" and "how applicable water quality standards will be achieved for all discharges to state waters at the site by August 1, 2001." There was no scientific or public review of the interim limits as would occur in the MPDES process. The company was never required to obtain a discharge permit, and the "interim" effluent limits remain in place today.

The monitoring wells demonstrate that contaminated water continues past the pumpback system in some cases, including Mason Canyon groundwater at TMW-21A (Figure A-4), and Mason Canyon surface water KV-SW - 4 (Table 3-10, P. 3-20), surface water in Barnes King Gulch (KVSW-3) (Table 3-12) and groundwater in Barnes King Gulch (TMW-30A)(Table 3-22) (p. 3-30).

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precipitation events, but infrequent use of LAD during such times is not anticipated to cause additional impacts to soils and vegetation.

Response 29:

See Response 18.

Response 30:

See Response 28. Both CR Kendall's proposed action and DEQ's preferred alternative involve the elimination of routine land application for water management in favor of water treatment, with the allowance for rare use of irrigation for water management during times when the treatment system cannot keep up with the volume of water requiring treatment. Only the No Action Alternative involves continued reliance on LAD for routine water management.

Response 31:

See Response 26.

Water quality of land applied water has improved over the years. Continued LAD with this cleaner water has flushed salts out the rooting zone. The rainfall at the mine site including precipitation events up to 9 inches in one storm in 2014 have also flushed salts from the LAD area soils. Vegetation on the LAD areas has improved over the years especially since grazing has helped reduce the litter accumulation in the LAD areas and LAD with cleaner water has continued. The quality of the vegetation on the LAD areas documents the lack of salt impacts on these sites.

The Proposed Action and Agency Modified Alternatives eliminate the use of LAD except for emergency purposes at the mine site (see Table 2-1).

Response 32:

See Response 21 and Response 26.

The Administrative Order issued September 23, 1998 required CR Kendal to submit a request to DEQ to modify its existing MPDES permit application to include discharges from Barnes King Gulch, Mason Canyon, and the unnamed tributary to Last Chance Creek. The

Comment 32
(cont.)

The DEIS should describe how DEQ will terminate the ACC¹⁹ and explain how these discharges will be required to meet water quality standards and meet the requirements of the MMRRA, which states that the reclamation plan must provide sufficient measures to ensure public safety and to prevent the pollution of air or water and the degradation of adjacent lands. MCA 82-4-336 (10)

Once again, CR Kendall should have an MPDES permit for these discharges and be required to meet water quality standards. The DEIS should specify how this will occur. If not, the Department should specify why these discharges are exempt. It is entirely inappropriate to continue to authorize effluent limits of 0.1 milligrams per liter of thallium in surface water and groundwater (as authorized in the 1999 NOV).

Comment 33

10. The EIS should provide data on the maximum storm event, and analyze whether the storage ponds are of sufficient volume to prevent releases.

The DEIS should identify the maximum storm event, and determine whether the ponds are sufficient in volume to prevent a release. DEQ has made it clear that designing for a 24-hour, 100-year storm event isn't adequate to deal with the large storm events that are now more frequent with climate change.¹⁹ It should not rely on land application for backup, when the soils are likely to be saturated during a maximum storage event and unable to function as needed.

Comment 34

11. The EIS should describe the long term monitoring requirements that will be required post-closure.

The DEIS does not include any discussion of long-term water monitoring requirements, particularly for the process valley, to ensure that liners and cover systems are working appropriately.

Comment 35

12. The EIS should specify dates by which the water treatment system must be identified and operational.

For too long, Kendall has been allowed to delay the implementation of a closure plan by proposing a myriad of inadequate water treatment technologies. The EIS should specify the dates by which a water treatment system is identified, implemented and operational.

Comment 36

13. DEQ is correct in precluding any use of "estimated" background levels to determine applicable discharge limits.

According to the DEIS, "CR Kendall assumed (1) either the natural background arsenic concentration in the Madison Limestone aquifer is also above the standard, or (2) dilution provided by mixing of the effluent from the treatment plant with groundwater moving through the aquifer would result in compliance with groundwater quality standards after mixing. CR Kendall has not collected data from the local Madison Limestone aquifer to document the validity of either assumption, which might allow for effluent limits higher than groundwater standards."

¹⁹ http://www.mtscb.edu/mwtp/conf/enc/2012_gov/entire/04/Water/04%20MacCallough.pdf

Administrative Order also required CR Kendall to submit proposed interim water quality standards. Interim standards for surface and ground water in specific drainages were reviewed by DEQ experts and approved July 19, 1999. The interim water quality standards are not permit effluent limits. CR Kendall did not require an MPDES permit because discharges to surface water were eliminated by pumpback systems. Also, mining operations with a Metal Mine Reclamation Act operating permit are exempt from a Montana Ground Water Pollution Control System permit. (See Section 75-5-401(5)(j), MCA). CR Kendall submitted the compliance plan required by the Administrative Order on October 30, 1998, which was approved by DEQ on May 30, 2000. The Water Quality Act does require public review of administrative enforcement actions.

Additional information has been added to Section 2.2.

With regard to the referenced water quality exceedances below the pumpback systems, see response to comment #26. In many cases, water becomes contaminated downgradient of the capture systems where the water interacts with historic mill tailings for which CR Kendall has no liability.

Response 33:

Many factors need to be considered in determining the appropriate sizing of retention ponds, including the degree of contamination of the water to be contained, the quality of downgradient waters, the likelihood of dilution during major storm events, and the impacts to landscape and habitat that would result from the construction of very large lined ponds that would likely remain empty for decades at a time. In some cases, it is appropriate to design for a 10 year 24 hour storm event, while in other cases design for a 100 year 24 hour storm event is not sufficient.

The collection/ pump back systems at CR Kendall are not intended to collect all runoff from a storm event, therefore the question of maximum storm events is not appropriate. The pump back systems collect groundwater downgradient of waste rock dumps, or in the case of the Ponds #7 and #8, seepage that gets through the soil cover on the leach pads and collects on the liner. The rate of seepage through a

vegetated soil cover depends on a great number of factors: antecedent soil moisture conditions, season, rate of precipitation, etc. Storm water runoff is diverted around the ponds and seepage collection systems.

Response 34:

Section 1.4.2 Proposed Action identified monitoring and mitigation as one of the tasks included in CR Kendall's July 2012 application for an Amended Closure Plan, which states (page 7-3, Section 7.6) that "routine monitoring will continue under the approved water monitoring plan." No changes to the monitoring program currently in effect have been proposed.

Response 35:

Over the past 20 years, CR Kendall has tested several water treatment systems primarily intended to remove thallium from the water, as thallium is the most significant contaminant at the site. These methods could not be determined inadequate until they had been tested. During this process, CR Kendall developed the zeolite adsorption treatment method which adequately addresses thallium contamination. This treatment system has been implemented but is currently only used for treatment of water intercepted by capture systems and not for water that collects within the process pads and ponds. The Record of Decision will address the timeframe for adapting the treatment system to manage all contaminated water from the site, and for implementation of any modifications that may be necessary to treat for contaminants other than thallium.

Comment 36
(cont.)

As stated, there is not data to demonstrate the validity of these assumptions, and they should not be used.

Similarly, the DEIS states that

"CR Kendall Mine completed two previous studies to determine background concentrations for arsenic, selenium, thallium, and other water quality parameters in the surface water of five main drainages that traverse the mine (WMC, 1999 and 2003). DEQ scientists reviewed both reports and provided technical memoranda with their comments and overall assessments (DEQ, 2001 and 2004). Concentrations of contaminants in Dog Creek, South Fork of Last Chance Creek, and North Fork of Last Chance Creek were all fairly low. The Mason Canyon and Barnes-King Gulch drainages had elevated concentrations of arsenic, selenium, and thallium. These two drainages have had the most historical mining and could also be assumed to have the most naturally occurring mineralization. However, DEQ's interpretations for background water quality are that background levels of arsenic, selenium, and thallium in Mason Canyon and Barnes-King drainages are similar and not very different from those in the unimpacted drainages.

The current conditions and activities of the Proposed Action are a direct result of past mining and previously completed reclamation. Past mining activities created the need for water treatment of the contaminated groundwater and process ponds drainage water. The past mining actions will continue to have effects on water quality, as demonstrated by the elevated concentrations of thallium, arsenic, and other contaminants requiring treatment to be below groundwater discharge standards. Consequently, the impacts described in Chapter 3 on water resources include the cumulative effects of past and present actions." (P. 4-1 & 4-2, DEIS)

We agree that CR Kendall should not be authorized to discharge to "estimated" background concentrations. Adequate baseline data was not collected to quantify background levels.

14. Stormwater runoff should be addressed in the EIS, particularly impacts to adjacent landowners.

Downstream landowners, Stephanie and Alan Shammel, are concerned about the adequacy of stormwater controls on the mine site, and impacts to their adjacent property from directed stormwater runoff from the mine (see photo below). The Metal Mine Reclamation Act requires that the reclamation plan provide sufficient measures to ensure public safety and to prevent the pollution of air or water and the degradation of adjacent lands. (MCA 82-4-336(10)) See photo below.

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Response 36: Comment noted.

Response 37:

The photo is an erosional gully that developed on the Shammel property from a May 2011 precipitation event that affected all of eastern and central Montana and in many locations was judged to be in excess of a 500 year storm event. Erosional features of this size, and in many cases much more severe, developed throughout the region in response to this storm event. It is incorrect to describe the gully formation as in response to "directed stormwater runoff from the mine." The majority of the runoff was derived not from the mine site, but from the large watershed of Little Dog Creek which exists upgradient of the mine site. During 1993 to 1995, CR Kendall placed waste rock over historic mill tailings in Little Dog Creek, then constructed an armored channel through this material to convey streamflow across the mine site. This channel only conveys water in



response to extreme precipitation events. The channel contains energy dissipation structures designed using coarse rock to reduce flow velocity in the steeper portion of the channel, and terminates in an energy dissipation basin immediately above the Shammel property. DEQ inspected the mine site shortly after the storm event and concluded that there was no evidence that sediment had been eroded from the mine site and transported toward the Shammel property. Any minor erosion in the upper Little Dog Creek watershed would have involved only topsoil and not mine waste.

The erosion on the Shammel property was not the result of any actions, inadequate stormwater controls, or negligence on the part of CR Kendall, but rather was the result of a natural storm event and the resultant volume of water flowing down Little Dog Creek. Had CR Kendall not placed waste rock over the historic tailings in Little Dog Creek and then constructed the armored channel, it is likely that this storm event would have remobilized this historic tailings and redeposited significant quantities of this material on the Shammel ranch. Therefore, the actions of CR Kendall, permitted under the Metal Mine Reclamation Act, likely reduced impacts to adjacent lands compared with the probable impacts of the storm event on those lands had CR Kendall not stabilized the historic tailings on the site.

4. Montana Department of Transportation

MDT Montana Department of Transportation
 2701 Prospect Avenue
 PO Box 201001
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Michael T. Dooley, Director
 Steve Bullock, Governor

October 6, 2015

Jen Lane
 Department of Environmental Quality
 PO Box 200901
 Helena MT 59601

Subject: CR Kendall Mine Closure – Draft EIS
 Montana Department of Transportation Comments

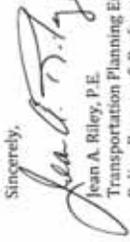
Dear Ms. Lane,

The Montana Department of Transportation (MDT) staff has reviewed the draft Environmental Impact Statement (EIS) for the CR Kendall Mine Closure. The anticipated work outlined in the draft EIS should not impact MDT facilities.

If the nature or scope of the work changes from what is outlined in the draft EIS, MDT would appreciate the opportunity to review the changes to determine if there would be impacts to MDT facilities.

Thank you for the opportunity to comment on the draft EIS. If you have any questions concerning this letter, please contact me at (406)444-9456 or email at jlrcy@mt.gov.

Sincerely,



Jean A. Riley, P.E.
 Transportation Planning Engineer
 Policy, Program & Performance Analysis Bureau

Copies: Stefan Streeter, P.E. – Billings District Administrator
 Doug Lutke – Lewistown Maintenance Chief
 Mike Tierney – Policy, Program & Performance Analysis Bureau
 File

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And, send draft Planning Bulletin
 to: mtplanning@mt.gov
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 Web Page: www.mdt.mt.gov

Comment 38

Response 38: Comment noted.

5. Boyd Creek

BOYD CREEK PROPERTIES, LLC

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October 6, 2015

State of Montana
Department of Environmental Quality

Subject: Public Comment on the CR Kendall Mine Closure Environmental Impact Statement

To Whom it May Concern:

The undersigned are the owners of Boyd Creek Property, LLC. Over the past five years we have purchased approximately 500 acres of the Kendall mine site from Canyon Resources. We have spent considerable time on the mine site. On average we spend over 100 hours per month on the property. We are very familiar with the reclamation efforts. We have watched the reclamation progress and we frequently talk to mine personnel to ensure that we understand how the reclamation efforts are moving forward.

In many ways, we have more at stake than any other party. We have invested our resources in this tract of land. We hope to pass this land to our children and we hope to utilize this land for many decades for agricultural and recreational purposes.

Kindly accept the following comments:

- 1) **General Reclamation Progress:** We are very pleased with reclamation progress. The land is healthy and the re-vegetation efforts have been very successful. Native grasses have taken root. Likewise, Aspen and Pine groves are healthy and expanding. Berry bushes are plentiful. Cattle are grazing well on the property. Likewise, Whistail deer, Mule deer, elk, turkeys, birds of prey, woodchucks, and multiple species of smaller birds and mammals are thriving. Frogs are loud and present in the marshy areas.
- 2) **Roads:** The EIS recommends removal of the existing roads. As the surface owners of much of the property, we strongly object to removal of the existing roads. The existing roads are critical for a successful cattle operation on the premises. If the DEQ requires road removal, we will need to put in new roads to access cattle, stock tanks and mineral tubs. Likewise, the roads will be critical if a fire ever starts on the property or on nearby property. Without the existing roads, we would not be able to access the burning area to fight the fire. Please leave the roads in place.
- 3) **Soil Stockpiles:** The EIS recommends removing soil stockpiles. As the surface owner of the property, we strongly object to removal of the soil stockpiles. In particular, the EIS appears to suggest that the soil stock pile located west of the Kendall pit be moved into the Kendall Pit. We strongly object. We own that stockpile. If the stockpile is placed on the sides of the pit, it will merely wash to the bottom. That would be a waste of soil. Moreover, the stockpile has re-vegetated and is not a detractor from the landscape. Please leave the stockpiles in place.

Comment 39

Comment 40

Comment 41

Response 39:
Comment noted.

Response 40:
The No Action Alternative is the only alternative considered that would involve the removal of existing roads. CR Kendall's Proposed Action, as well as the Agency Preferred Alternative, would retain existing roads (see Table 2-1).

Response 41:
See Response 12.

All soil stockpiles at the mine site were established for the purpose of reclaiming disturbed lands following the completion of mining. CR Kendall previously committed to placing 8 to 10 inches of soil over all portions of mine pits that have suitable slopes (2h:1v or less steep) such that the soil would not erode from them in substantial quantities. This includes the backfilled portions of the Kendall and Muleshoe pits, but not the pit highwalls. The fact that the soil stockpile currently supports adequate vegetation is further evidence that this soil, if spread across areas of pit backfill, would support vegetation within these areas and provide several additional vegetated acres that would support grazing.

Comm

4) **Pond Removal:** The EIS recommends removal or filling of the ponds. Likewise, the EIS appears to require the removal or puncture of the pond liners. As the surface owner of the property, we strongly object to removal of the ponds or puncturing the pond liners. The ponds are a first line of defense for fire fighting. In the event of a fire, the ponds provide a ready source of water for fire trucks. Likewise, with minor modification, the ponds will enhance wildlife habitat and will provide stock water. We plan to apply for water rights, so as to utilize the pond water for agricultural purposes and for wildlife habitat enhancement. Please do not require removal of the ponds.

Comm

5) **Permit Boundary:** Currently, the permit boundary covers hundreds of acres that were never disturbed or do not need further reclamation. We request that the permit boundary be redrawn to encompass only those areas where reclamation is not complete and areas actively utilized for reclamation. We request that the boundary be re-drawn as indicated on the enclosed map (Exhibit A). Re-drawing the boundary will facilitate more productive cattle production and wildlife habitat enhancement. If the permit boundary is re-drawn, old fences can be removed and grass will be more readily accessible.

Thank you in advance for considering our comments. You can contact us at the address or phone number set forth above.

Sincerely,

BOYD CREEK PROPERTIES, LLC

Bret Birdwell
Bret Birdwell, Member

Kris A. Birdwell
Kris A. Birdwell, Member

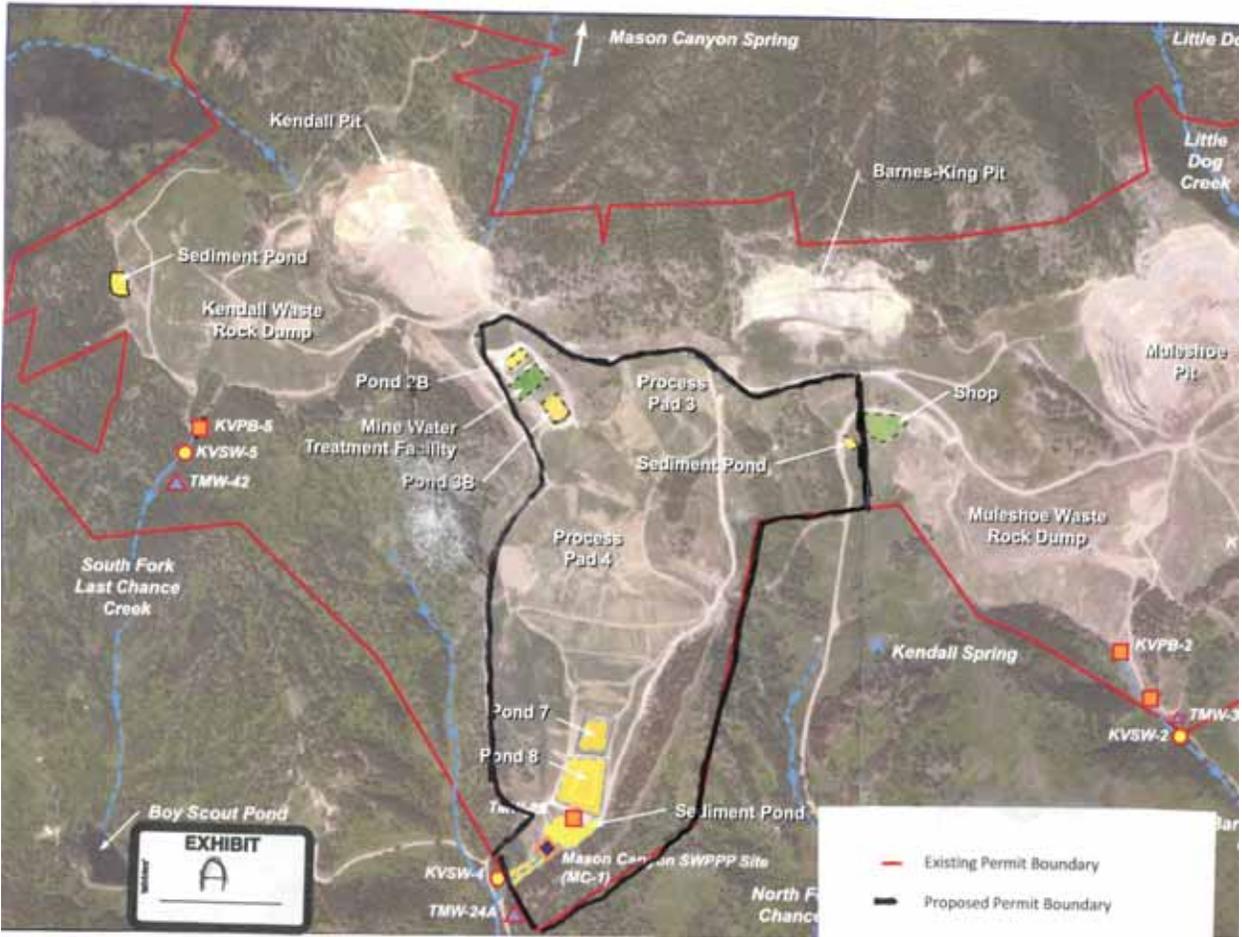
Response 42:

The ponds would remain in place for as long as they are required for storage and treatment of water in order to comply with the Montana Water Quality Act and Metal Mine Reclamation Act. Their ultimate removal and reclamation has been a component of the mine plan since the ponds were originally permitted and constructed during the 1980s. When they are no longer required, DEQ would consider requests by the property owner to modify the closure plans if there is a legitimate post-mining land use for the ponds that is also protective of water quality.

Sections 2.2 and 2.3 has been modified to incorporate consideration of requests by the property owner to modify the closure plans if there is a legitimate post-mining land use for the ponds that is also protective of water quality.

Response 43:

This issue has been added to Section 1.8. A request to remove areas from the permit boundary must be made by CR Kendall. This would require a minor revision to the permit. If such a request is received the DEQ would review the submission and determine if those areas could be removed. Areas that contain disturbed land that has been reclaimed would first require a public notice and comment period for bond release before land could be removed from the permit boundary.



6. Alan and Stephanie Shammel

Response 44:

Shallow groundwater quality and the continued operation of the pumpback systems are addressed in Response to Comment 17, 22, and 26. The augmentation of stream flows, using up-gradient springs and not groundwater, is discussed in Response to Comment 27.

A centralized water treatment plant is a major component of the proposed Closure Plan and the alternatives discussed in the DEIS, and its sole purpose at the site is "cleaning up the polluted water." See Response to Comment 8 and 19 for discussion of the water treatment plant.

Response 45:

See Response 8.

Response 46:

See Responses 17, 26, and 27.

The average annual volume of water pumped back from the four interception systems during the period 1997 through 2014 is 34,811,669 gallons per year (CR Kendall Annual Progress Report for 2014, page 7). During the 18 year period, 201,784,165 gallons of water were removed from the Little Dog Creek watershed via pumpback system KVPB-6, and 329,577,748 gallons of water were returned to the watershed via the augmentation system (CR Kendall monthly pumpback reports, 1998 – present). During the same period, 120,767,193 gallons of water were removed from the South Fork Last Chance Creek watershed via pumpback system KVPB-5, and 133,492,540 gallons of water were returned to the watershed via the augmentation system.

Response 47:

Runoff from the reclaimed leach pads enters constructed storm water channels and is returned to tributaries of North Fork Last Chance Creek downgradient of the mine. The seepage from the leach pads has previously been collected in a storage pond and land-applied during the growing season, but the Proposed Action and other action alternatives in the DEIS would require that seepage water to be

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DEQ DIRECTORS
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Montana Department of Environmental Quality
Attn: Jen Lane
PO BOX 200901
Helena, Montana 59601

October 1, 2015

We are glad to see that after over 30 years DEQ and CR Kendall are attempting to get a Closure Plan on the CR Kendall Mine permit #00122. After attending the public hearing in Lewistown, Montana we would like to reiterate our concerns in this letter.

As stated the Draft Closure Plan (September 2015) on page 1-12 does identify many of the water problems we have repeatedly pointed out in past letters, meetings, etc. The problem is the document does not really identify any solutions to the continued dewatering (pumpback) of the drainages, cleaning up the polluted water or further restoration of the intercepted water, and water treatment. Mr. Volberding stated in his comments that the document was lacking in a water treatment system.

The water in the pumpback systems needs to be treated and returned to the proper drainage. Page 2-6 points out "combined flow rate from the four pumpback systems has ranged from 33 gpm to 125 gpm over the last 18 years (1997 to 2014). At 33 gpm the loss of water to the drainages is 17,344,800 gallons per year. At 125 gpm the loss to the drainages is 65,700,000 gallons per year or an average of 41,522,400 gallons per year with a total loss over 20 years of 830,448,000. We consider this a significant loss of water to the 4 drainages and especially when you intend to continue this for 100 years as stated on Table 2-1 for all the alternatives.

Even the runoff from the leach pad at 13.7 gpm amounts to 7,200,720 gallons per year which is supposed to be treated and dumped into the Kendall Pit not treated and returned to it's proper drainage.

As I have pointed out many times before, the Lewistown DNRC in February 1999 calculated that at 20" of precipitation on the 217 acres directly above the Mule Shoe Pit at only 10% run-off 11.76 million gallons would be diverted directly into the pit. This is a conservative figure as figure (3.3.2.1) states the Kendall Mine gets 25.8 inches of precipitation annually.

CR Kendall has repeatedly maintained that the water does not flow across the Madison Limestone but Glenn Pegg testified that pre-mine as a kid he was able to go motorcycling on the old tailings and they would develop a pretty good track only to come back and find out it had been washed away in a rain event. I know I can produce pictures of these pre- modern mining events.

We were told that water quality on the site has been improving the charts provided in this document do not indicate that this is the trend. The charts on the last pages

Comment 44

Comment 45

Comment 46

Comment 47

Comment 48

Comment 49

Comment 50

combined with other sources, undergo treatment at the centralized treatment plant, and disposed of in the Kendall Pit.

Response 48: The assumption of 10% runoff from the area above the Mule Shoe Pit is not valid. The Mule Shoe Pit is excavated into the Madison Limestone. As observed in upper Little Dog Creek and upper Mason Canyon, all stream flow enters the Madison Limestone where the stream channels cross it and none reaches downstream locations except during extreme precipitation events. The ephemeral channel that was removed by excavation of the Mule Shoe Pit likely also lost all flow to the Madison Limestone. Assuming 10% runoff from the area above the Mule Shoe Pit is an overestimation.

Response 49: There is a difference between localized erosion occurring on the surface of the historic tailings and erosion occurring in response to flowing water within the channel. Neither CR Kendall nor DEQ dispute that stream flow crosses the Madison Limestone during rare, extreme precipitation events.

Response 50:

Please note that many of the charts do show trends of improving water quality. With regard to the cited charts A-7, A-8, and A-9, many of the plots on these graphs also show trends of improving water quality, as discussed below:

Chart A-7 presents water chemistry at pumpback station KVPB-2 in Barnes-King Gulch, and shows that arsenic concentrations have generally been declining throughout the period of record at that location, with the exception of a spike during 2008 that was associated with testing of a passive treatment system upgradient of the capture system. The other graphs on Figure A-7 show that selenium concentrations in pumpback KVPB-2 have remained fairly constant (with a minor increase during the 2010-2012 period) and well below the human health standard, while thallium concentrations increased steadily through 2005 but have been decreasing since that time.

Figure A-8 presents water chemistry from monitoring well TMW-40D in Little Dog Creek downgradient of pumpback system KVPB-6. Arsenic concentrations at this location have remained below the detection limit throughout the period of record. Selenium concentrations have declined somewhat and have consistently remained below the human health standard. Data from the well show a few exceedances of the human health standard for

thallium early during the monitoring period, but none in the past 10 years. Thallium has consistently been below the detection limit since that time.

Figure A-9 presents water chemistry from pumpback system KVPB-6, located below the North Muleshoe waste rock dump in Little Dog Creek. The data from this location shows a slight decrease in average arsenic concentrations over the period of record and a more substantial decrease in thallium concentrations. The concentration of selenium has increased at this location, from an average of about 0.025 mg/L in 1996 to an average of about 0.06 mg/L at present. The graph also indicates that the selenium concentration at this seepage collection system does not appear to have increased since approximately 2007.

See page 3-9 in the EIS. Water diverted from upper Little Dog Spring is for augmenting the flow in lower Little Dog Creek, not to dilute contaminated water.

Comment 51

especially A-7, A-8, and A-9 indicate that the pollution levels are as bad as in 1995 or with the Selenium actually significantly worse. We have observed that if it is drier the contaminate levels are higher due to more concentration. We assume this is why you are allowing CR Kendall to take Spring Water which was designated by Water Rights for augmentation to the Little Dog Drainage and divert a part of it to the KVPB-6 as indicated on the Figure 2-2 piping chart. We are assuming the meter for water being sent down the pipe is at the Little Dog Creek Spring so water being diverted into the pumpback is being shown as being returned to the drainage. I can imagine no reason to divert clean spring water into the system other than to try to dilute contaminated water. We believe part of the problem with the KVPB 6 is the use of the LAD system, which has continually for over 20 years deposited more contaminants on the dump thus creating a vicious cycle. These pollutants will probably only continue to get worse as the LAD is allowed to continue for the next 100 years. Wayne Jepsen told us in March that this was an emergency LAD but if that is so what was the emergency last week.

Comment 52

We showed numerous pictures last night. Especially upsetting is the lack of response from DEQ regarding the erosion on the Shammels property due to the high flow events coming off the mine site. After a visit to the DEQ Director in Helena, Wayne Jepsen and Betsy Hovda made an inspection of our property on November 27, 2012. We received a copy of the inspection but no action was taken on how to resolve the continuing erosion. Last night Wayne Jepsen even told the Shammels it was our fault that we were now experiencing erosion caused by the constructing of this rock drain. As Glen Pegg pointed out these flash events do occur with regularity. This document Table 3-2 notes 2 events with flow rates in excess of 5,000 gpm. We feel this Draft document should take some action to slow the velocity of this flow out of the rock drain. We visited with Ed Surburgg after the meeting and he had some ideas to fix this problem.

Comment 53

We also showed pictures from May 13, 2015 of the Shammels hauling water to cattle directly behind the Shammels house. The well would not support the use of 2,000 gallons per day for cattle. This is very upsetting when on the same day pictures were taken of "emergency LAD" on the mine site.

Comment 54

Jerry Hanley spoke of giving mine tours and how impressed the people are by the reclamation. We had an AG Tour come to our property in September when the LAD was in operation and totally visible from our buildings. The people were shocked at the waste of water. These are Ag people who know the value of clean water. You can't grow dehydrated cows and crops.

Comment 55

We would also like to see figures on the effectiveness of the Zeolite Columns in removing contaminants. This information is never presented in any document. CR Kendall ran an RO system but we were told the water was "too thick" and the system had to be dismantled. Further investigation into water treatment is imperative.

Comment 56

Response 51:

See Responses 19, 28, and 48.

The comment that CR Kendall is diverting spring water intended for augmentation into KVPB-6 for dilution purposes is incorrect, and indicates a mis-interpretation of Figure 2-2. The pipeline from the spring in upper Little Dog Creek is not connected with KVPB-6 and does not direct water into the pumpback system. As required by CR Kendall's water right for the augmentation system, the water is returned to the "South Fork" of Little Dog Creek immediately downstream of the point of extraction at KVPB-6. Additional water from the augmentation pipeline is directed into the stock tank at the Section 29 Spring further downstream. All metered flow within the augmentation system is routed to the Little Dog Creek drainage.

Response 52:

Improving water quality trends for most parameters at KVPB-6 do not indicate deteriorating water quality seeping from the dump. As noted in previous responses (e.g. #50), thallium concentrations have been declining in water intercepted by KVPB-6 for the past decade. Nitrate and sulfate concentrations at this location have also shown strongly decreasing trends during that timeframe. These trends do not support your interpretation that land application of water onto the reclaimed waste rock dump is making the quality of water seeping from the dump worse over time. Also please note that your statement that LAD would continue for the next 100 years appears to be a mis-interpretation of the EIS alternatives. Both CR Kendall's proposed action and DEQ's preferred alternative involve the elimination of routine land application for water management in favor of water treatment, with the allowance for rare use of irrigation for water management during times when the treatment system cannot keep up with the volume of water requiring treatment. Only the No Action Alternative involves continued reliance on LAD for routine water management. During the meeting in March, DEQ staff attempted to

explain that under the proposed action, LAD would only continue to be used during “emergency” situations. The closure plans contemplated under this EIS have not been implemented as yet; therefore, any land application observed “last week” would have been part of routine current water management.

Response 53:

See Response 37.

DEQ responded to the complaint of erosion occurring on the Shammell property by conducting the cited inspection, which concluded that the erosion was not caused by the CR Kendall mine.

As indicated in the 11/27/2012 inspection report, the erosion was a natural response to an extreme precipitation event. During the same storm event, similar or more severe erosion occurred in numerous locations in the region, including Maiden Canyon in the Judith Mountains and Rock Creek (Crystal Lake Road) in the Big Snowy Mountains.

Excerpt from 11/27/2012 inspection report:

“... the gully was not caused by the steepness of the armored channel that descends the Horseshoe Waste Rock dump, nor due to inadequacy of the size of the energy dissipation basin at the base of the dump. While it is difficult to estimate what the velocity of water leaving the basin was, it is likely that the rate of discharge from the basin was very similar to the rate of inflow, and that this flow rate was dictated by the rate and duration of precipitation in the natural watershed upstream of the mine site. Once the water left the basin, it would have spread out across the Little Dog Creek “floodplain” below it, and likely slowed down to a velocity determined by the gradient of the valley. It should be noted that this is not a natural floodplain, but rather a deposit of storm water–transported tailings derived from historic milling upstream of this location, on which vegetation has slowly become re-established over the years.

The lack of deposits of sediment on the floodplain through which the gully developed suggests that little if any material from the mine site was transported beyond the energy dissipation basin by the flood waters. Thus, the sediment deposited at the downstream end of the gully was all eroded from lands downstream of the basin.

The gully appeared to have developed as a classic “head-cut”. Erosion of this type begins at the downstream end where water is flowing over material which is

susceptible to erosion. In this case, the fine grained soils, dominated by mill tailings, were not stable given the velocity and volume of water flowing over them. This would result in down-cutting of the stream through the fine grained material, beginning just above the old tailings pond. The water would cut down through the sediment, seeking to establish a less steep stream gradient that would be stable given the fine grained substrate in the channel. As material is eroded out of the bottom of the channel and displaced downstream, this allows material further upstream to also be eroded, resulting in the gully “head-cutting” upstream over time. It is noteworthy that this form of erosion begins at the downstream end of the unstable sediments and progresses upstream, because it is therefore not related to the velocity of water leaving the basin at the upstream end, but rather due to the velocity of water at the downstream end and the fact that the velocity exceeds the cohesive strength of the sediment over which the water is flowing at the downstream end.”

Response 54:

Comment noted.

As noted in Response 46, CR Kendall’s water augmentation system returns substantially more water to the Little Dog Creek drainage, including the Shammels’ stock tank at the Section 29 Spring, than is extracted from the watershed by the pumpback system.

Response 55:

Please see Responses 28, 46, and 54.

Response 56:

CR Kendall has submitted “Water Treatment and Disposal Reports” to DEQ monthly since discharge to the Kendall pit was originally approved in 1997. These reports are on file at the DEQ office in Helena. These reports show that the zeolite treatment system consistently removes thallium from the water to levels lower than the detection limit of 0.002 mg/L, which is also the groundwater standard.

Zeolites have been effective in removing thallium from water through bench- and pilot-scale testing, and through operating a 100 GPM, full-scale treatment system at the Kendall Mine for over 10 years. Optimization studies that were conducted in 2010 and 2011 are

documented in the Closure Plan (Appendices E and F) and similar water quality results were achieved using two different types of zeolite.

The treatment system utilizes a series of zeolite-filled columns, which sequentially lower the thallium concentration in the mine water through adsorptive action. Examples from the 2010 and 2011 studies show thallium concentrations being reduced from 0.379 - 0.6 mg/L in the influent, down to 0.0002 mg/L in effluent from the last column.

As discussed in Section 2.5.4.2 of the DEIS, reverse osmosis (RO) was utilized at the Kendall Mine for 2 years, but the resulting water quality still did not meet the standard for thallium, so additional treatment would be required. Additionally, RO systems have high energy requirements and require separate storage and disposal of the resulting brine.

The zeolite treatment system is effective and generates a non-hazardous waste product (spent zeolites), as determined by TCLP leach testing. Leach testing indicates that the thallium is effectively adsorbed on the zeolites, with < 1% of the thallium being mobilized.

Additional information on the effectiveness of the zeolite treatment has been included in Section 3.3.3.1, the environmental consequences of the No Action Alternative.

Comment 57

It was our understanding that the Draft EIS was made in an attempt to protect adjacent lands not just be a cheap solution to a 5 year mine. With 100 years of water contamination projected we need a fair solution. The adjacent landowners have been very patient in not having a closure plan in 30 years.

Thank you for your time;

Alan and Stephanie Shammel



524 Salt Creek Rd
Hilger, Montana 59451

Response 57:

The purpose of the Amended Closure Plan is to protect water quality and adjacent lands. It should be noted that there has always been an approved closure plan for the CR Kendall mine since the time of issuance of the Operating Permit and subsequent amendments. This amendment is merely a revision to the previous closure plan and is intended to address previously unanticipated long term water quality impacts.

With regard to the mining history, it should be clarified that this was not a "5 year mine". Several mines operated within the project area currently managed by CR Kendall during the period from 1900 through 1942. These mines processed substantial quantities of ore and left unreclaimed pits, waste rock, and tailings on the landscape. The tailings washed downstream and continue to cause impacts to water quality beyond the limits of the CR Kendall permit boundary.

Open pit mining and cyanide heap leaching resumed in 1981 as a small-scale operation conducted by Triad Resources. Following receipt of an Operating Permit in 1984, the mining operation expanded and was later acquired by Canyon Resources in 1987. Mining continued through 1995 and ore leaching through 1997. Therefore the modern mining operation lasted for a period in excess of 15 years, in addition to a historic mining era lasting for about 43 years.

7. William Gardner

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Following are my comments regarding the Draft EIS for a proposed amendment to Operating Permit 00122 issued to CR Kendall Corp. for the Kendall Mine.

I have an interest in the North Moccasin Mountains area because I hunt the foothills and fish in nearby Warm Springs Creek. Also, my son and several other scouts from our Lewistown Boy Scout troop have camped several times and hiked near the mine at the K-M Boy Scout Camp. I hope that the reclamation continues and is completed to a point where we don't have to worry about pollution from the past mining. The draft EIS reports that thallium, arsenic and to a lesser amount selenium degrade water quality that seeps from the process pads. I support the continued ongoing wastewater treatment plus adding a new treatment system to remove arsenic from the process pads seeps.

Comment 58

Response 58:
Comment noted.

The mining site is still fairly disturbed looking, so anything that would continue to reveg the area should be done. Therefore, the stockpiled soil should be utilized to accomplish this (as was intended). Also, all unnecessary roads in the mining site should be reclaimed and only key ones retained. This should help reduce sediment erosion. BLM right of way should be maintained to insure public access to the mountain top.

Comment 59

Response 59:
See Responses 12 and 41.

I support the Process Pad Pretreatment Alternative.
Thank you for this opportunity comment. Sincerely,



William M Gardner
624 NE Washington
Lewistown, MT 59457

P.S. Tried to send this thru email but your site was too difficult to allow

8. Glenn Pegg

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NOV 04 2015
DEQ DIRECTORS
OFFICE

GLEN W. PEGG

422 Pegg Lane
Lewistown, MT 59457

Home: 406/350-2099
Work: 406/538-2355

I am the site supervisor at the Kendall mine now; however, my history with the area goes way back. In the late 60's we visited the ski hill just south of the current plant location. When I worked as a busboy at a local restaurant, I would listen hours of stories about the "wooden sidewalk days" from Colonel Joe and Amel, several Kendall old timers.

When I turned 16 I had a driver's license, a Jeep, a motorcycle, and a nose for adventure. If I wasn't out backpacking I was tearing up the turf in Kendall. If I was on a packing adventure, I took only memories and left only footprints. When we went to Kendall we did so because you could not ruin the land. Little vegetation grew above the townsite, just some arrow root and juniper bushes. Large rocks and dozer divots, dislodged from generations of mining, provided obstacles for our playground. We would fly past old debris and equipment and over stacks of nails and broken glass. Dozer trails, roads and acre upon acre of tailings were put there for us to uproot. Adventure in all those workings, shafts and glory holes left open and unprotected.

In 1981 I got a job working in that same playground I grew up in. This time I could combine my other passion, geology, with some expert teachers. They taught me about the geology, the process it took nature to concentrate the precious metals, and the presence of other minerals associated with an ore body. They also taught me the process it took to extract the gold and what was left after that process. I began to realize the extent of damage the area had seen, and through their visions, how remediation of the land would work.

In 1988 I was once again put to work here, this time as a draftsman and part of the survey crew. I began to enhance the engineer's blocky waste rock dumps to be more visually appealing and soon I was doing much of the design work. I liked the idea of being able to blend some more natural slopes to the area. I took over the responsibility of reclamation in 1996, thus being able to place soils to the proper depths and having the ability to enhance habitat and diversify the plant communities. My work in the treatment plant has led to better efficiency and lower costs.

We continue to enhance the area by improving vegetation thus reducing the amount of naturally occurring contaminants. I have planted hundreds of saplings and we are testing various ways of soil improvement. I am proud of my accomplishments here and look forward to continuing to improve the site.

Of the alternatives provided in the draft EIS, I believe the proposed action alternative is best suited for the benefit of the land and landowners. I base this on the fact that it appears we have no need for further refinements to the water treatment process. There is no need to treat the water to below background levels only to release the water back into altered rock or to surface conditions that will degrade it to pre-treated conditions. By law, we are required to treat the water to set standards. If it turns out that additional treatment for any constituent in the water is needed, we will have to do that. Anything above and beyond that is unneeded, adds additional unneeded costs and adds to possible problems because there is simply more to go wrong. Additionally those costs would be transferred to subsequent land owners or even the public in the event of a default.

The cost of running more experiments goes well beyond just the money needed to design, build and monitor such a project, but also in terms of the land itself. We have literally sunk hundreds of thousands of dollars of infrastructure into many acres of pristine land to test the latest and greatest and have always returned to what works. We should utilize that money instead to continue to improve the landscape and wildlife habitat.



Glen Peigg

Comment 60

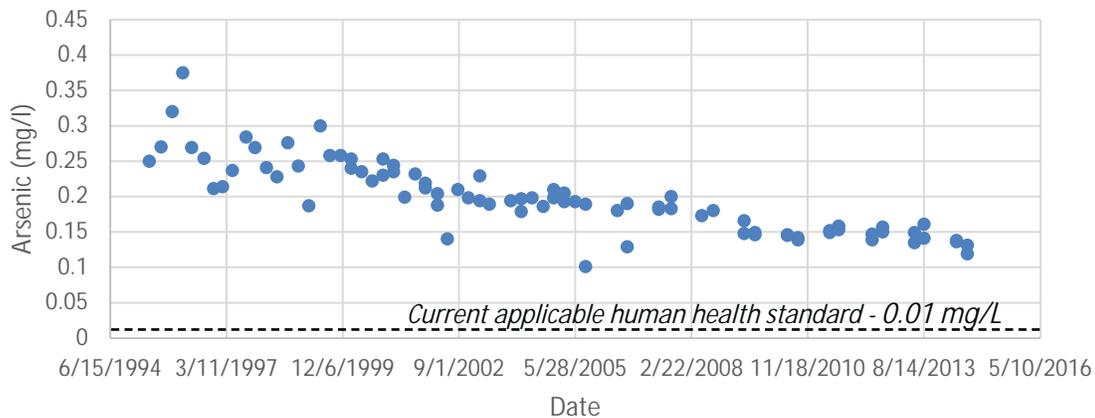
Response 60:
Comment noted.

Appendix A

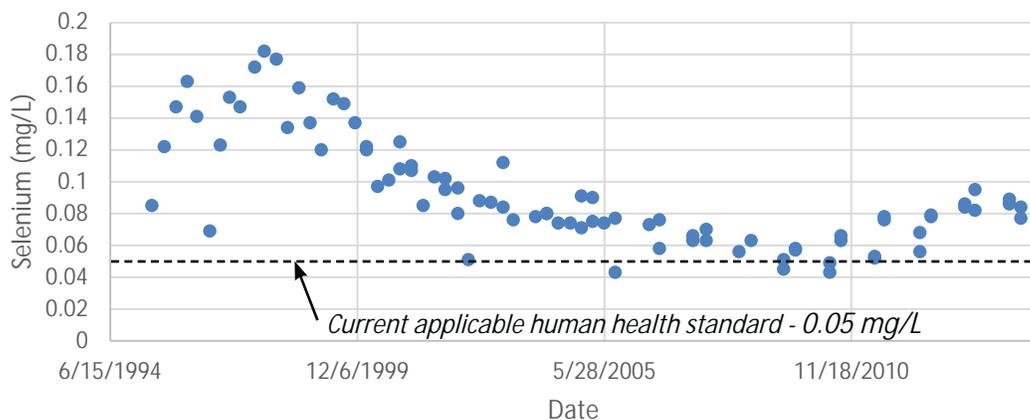
Arsenic, Selenium, and Thallium Concentrations in Monitoring and Pumpback Wells

Note: The detection limits of specific analytes can vary depending on the specific sample matrix, even on the same analytical instrument at the same analytical laboratory. However, for the data shown in the following figures, the detection limits are generally 0.003 mg/L for arsenic, 0.001 mg/L for selenium, and 0.002 mg/L for thallium. Therefore, most flat lines or clusters of data at those concentrations represent non-detect samples for that particular analyte.

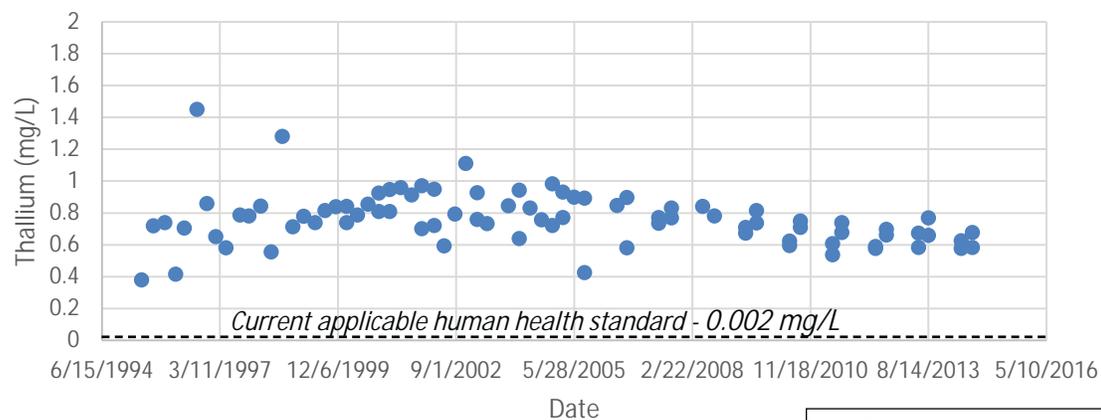
Arsenic Concentrations in Process Pad Drainage



Selenium Concentrations in Process Pad Drainage



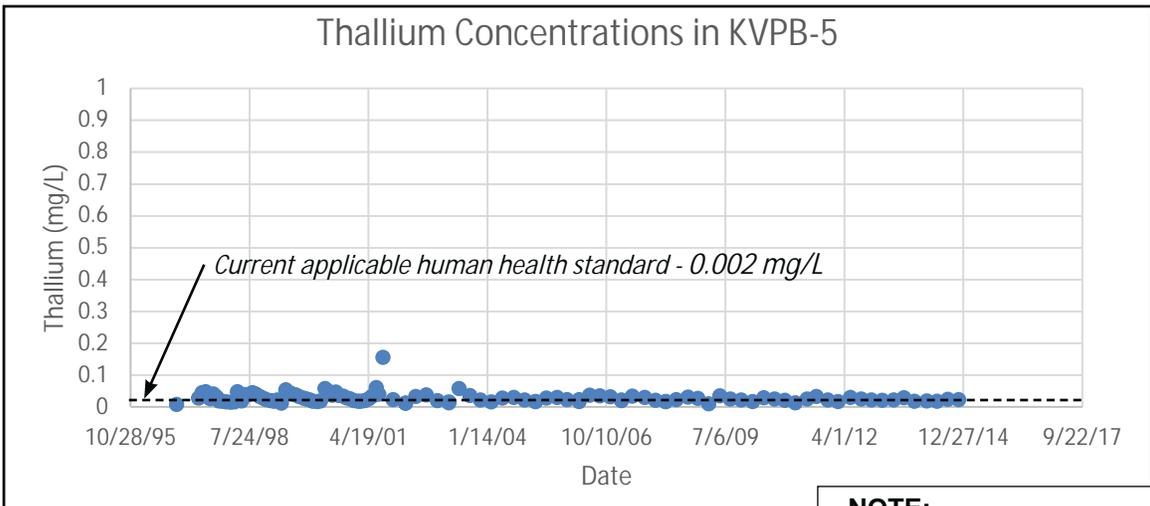
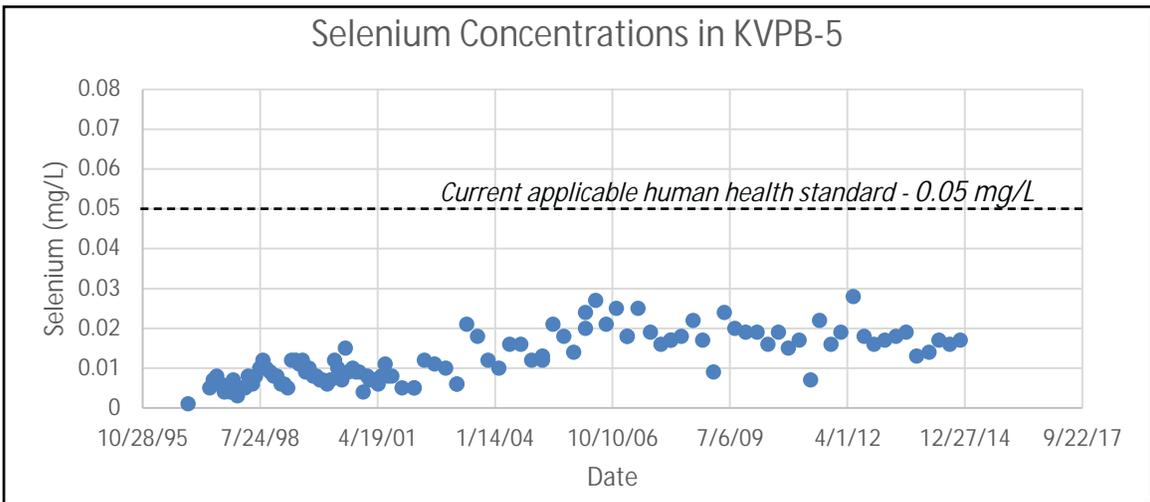
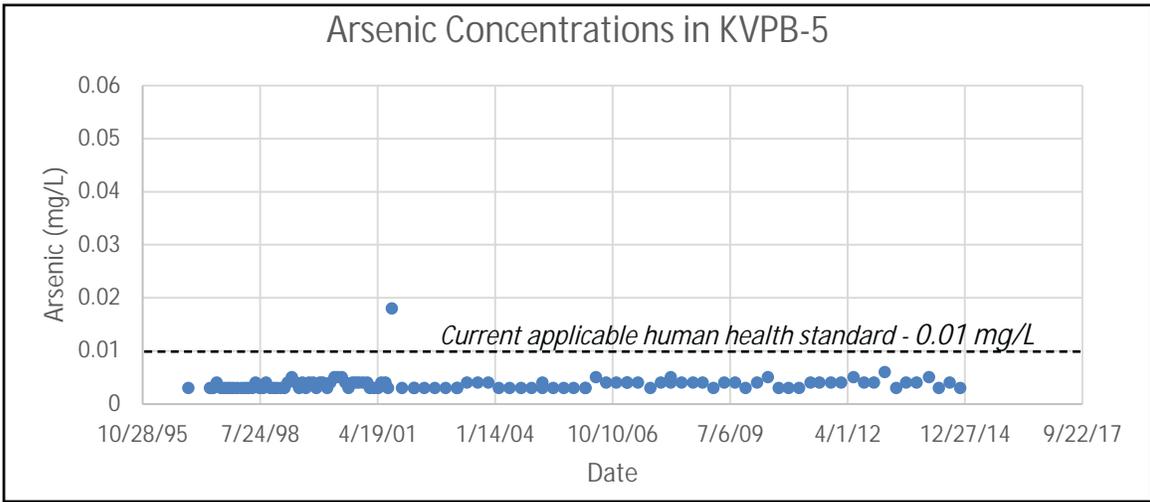
Thallium Concentrations in Process Pad Drainage



NOTE:
mg/L = Milligrams per Liter



FIGURE A-1
CR Kendall Mine
Arsenic, Selenium, and Thallium Levels in
Process Pad Drainage

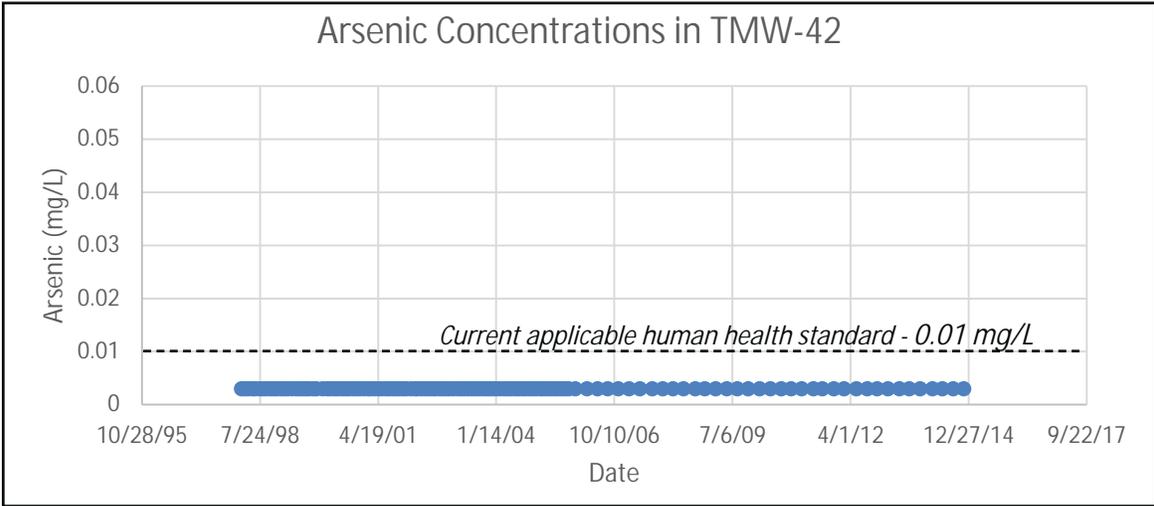


NOTE:
mg/L = Milligrams per Liter

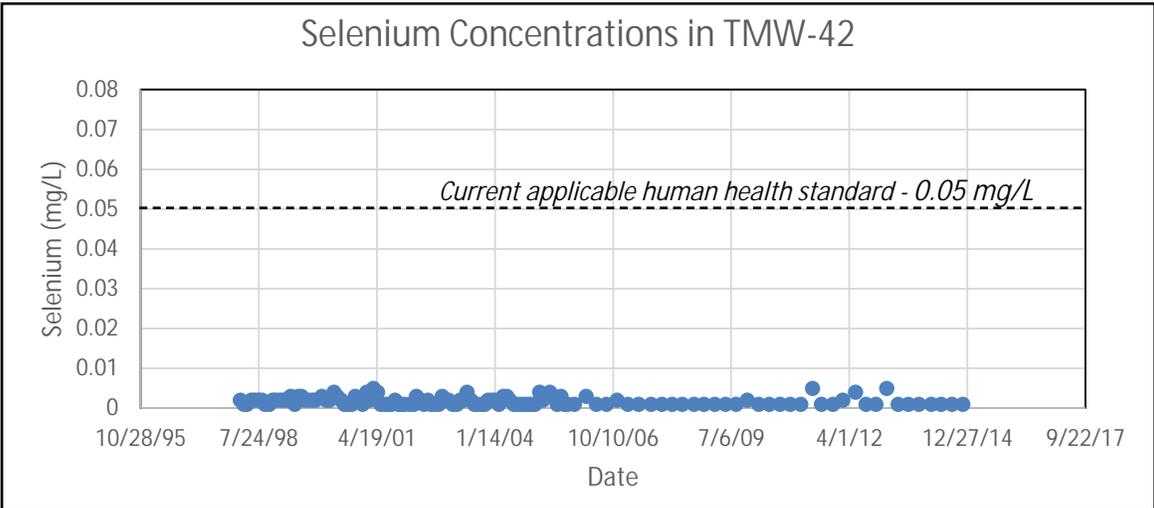


FIGURE A-2
CR Kendall Mine
Arsenic, Selenium, and Thallium Levels in
South Fork Last Chance Creek Pumpback
Water (KVPB-5)

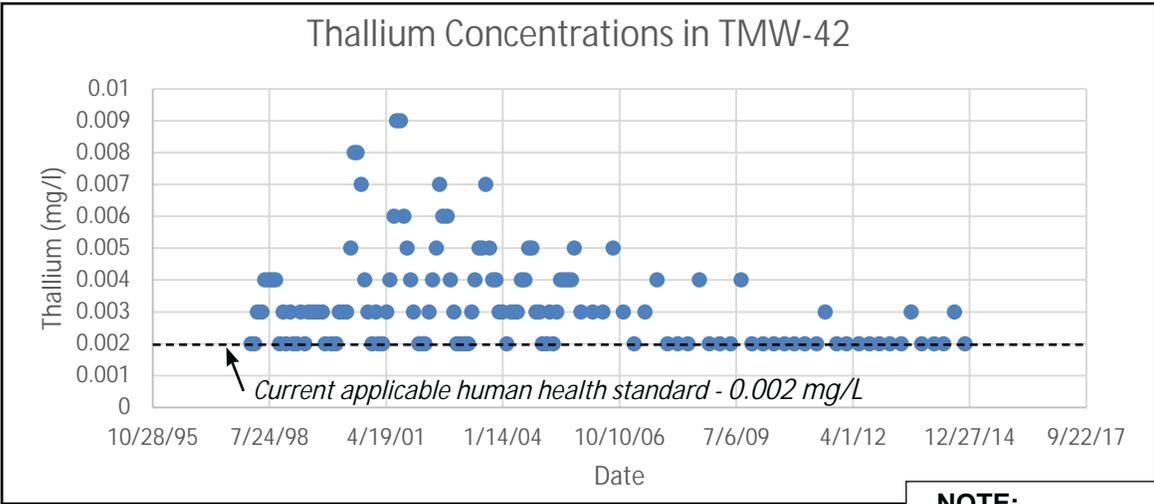
Arsenic Concentrations in TMW-42



Selenium Concentrations in TMW-42



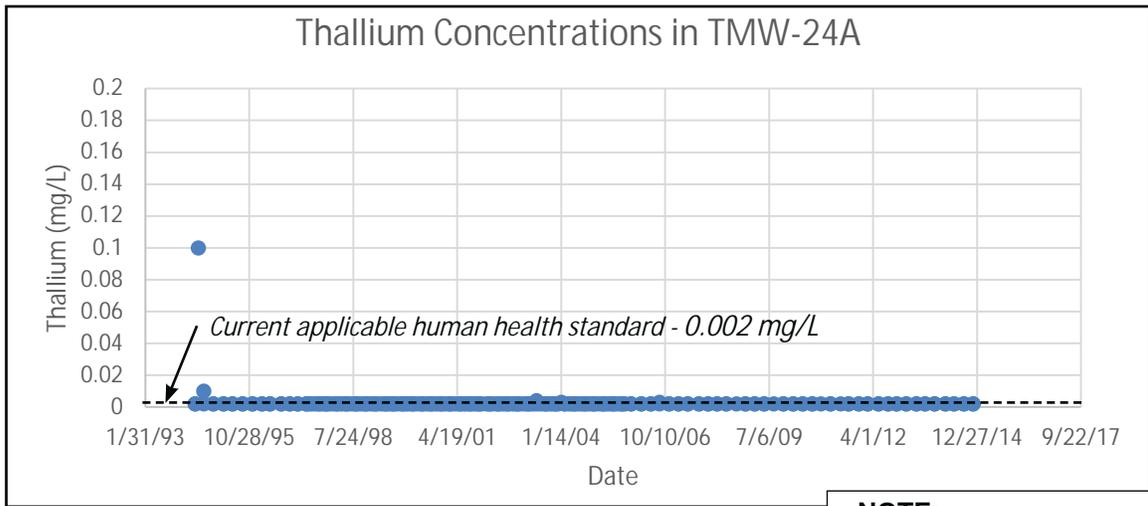
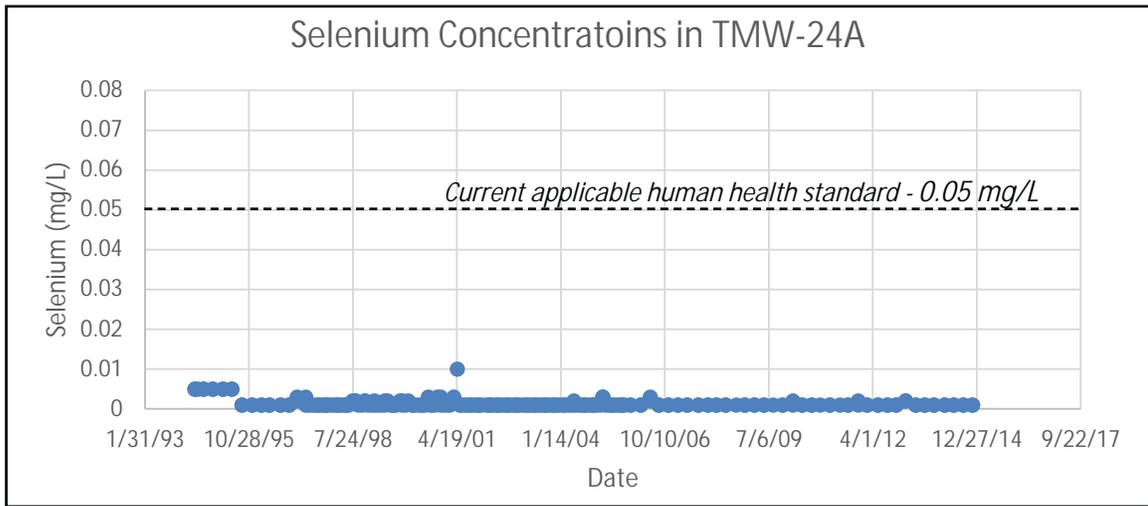
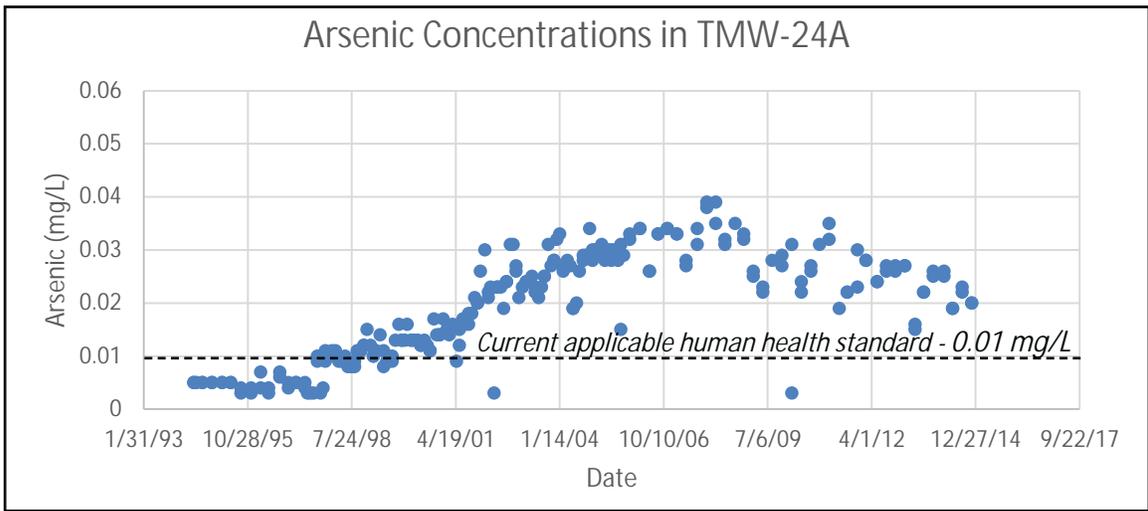
Thallium Concentrations in TMW-42



NOTE:
mg/L = Milligrams per Liter



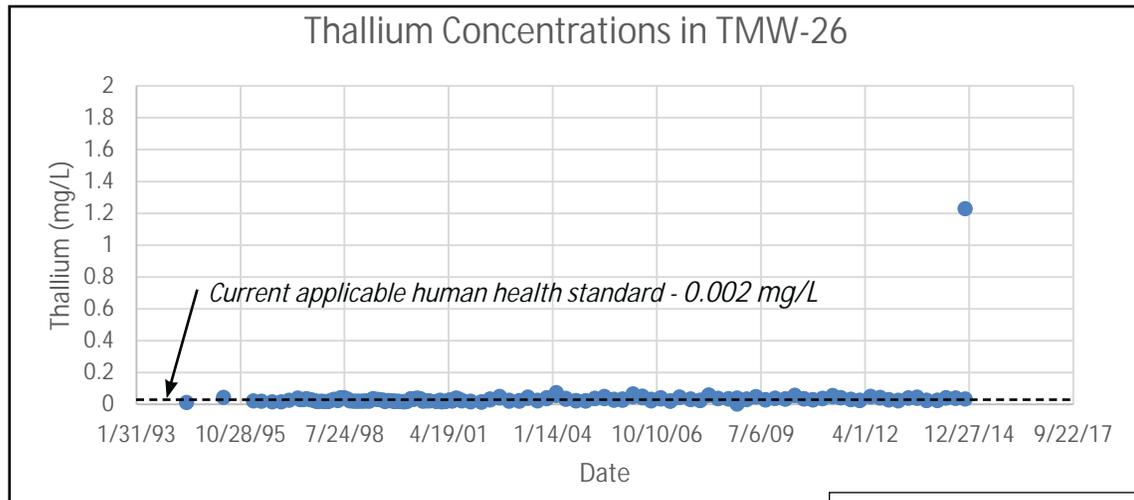
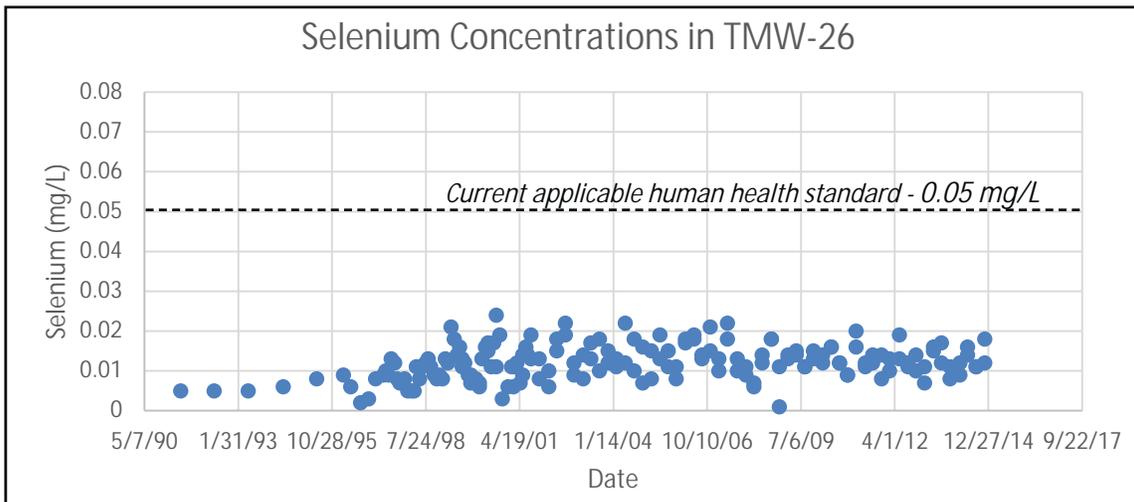
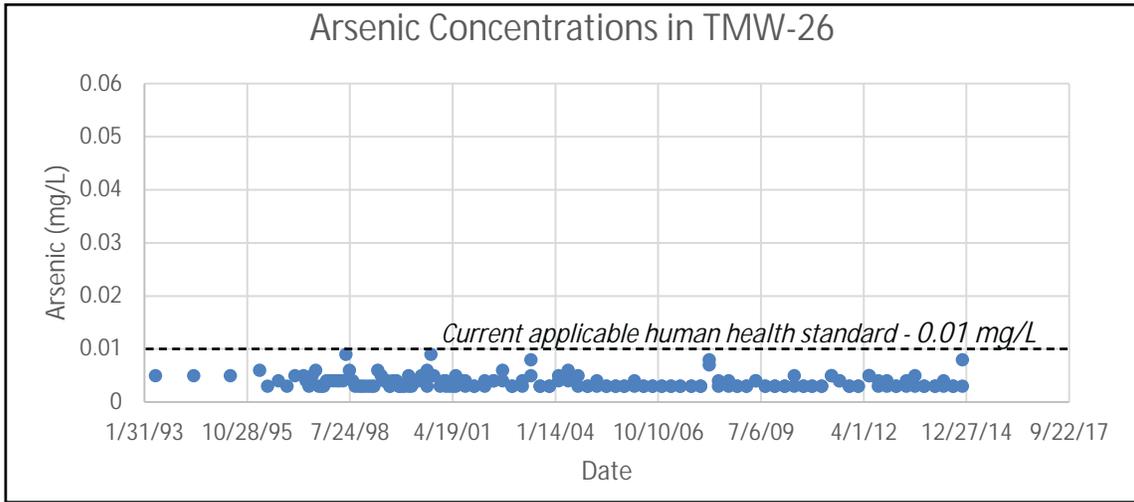
FIGURE A-3
CR Kendall Mine
Arsenic, Selenium, and Thallium
Levels in South Fork Last Chance Creek
Groundwater
(TMW-42)



NOTE:
mg/L = Milligrams per Liter



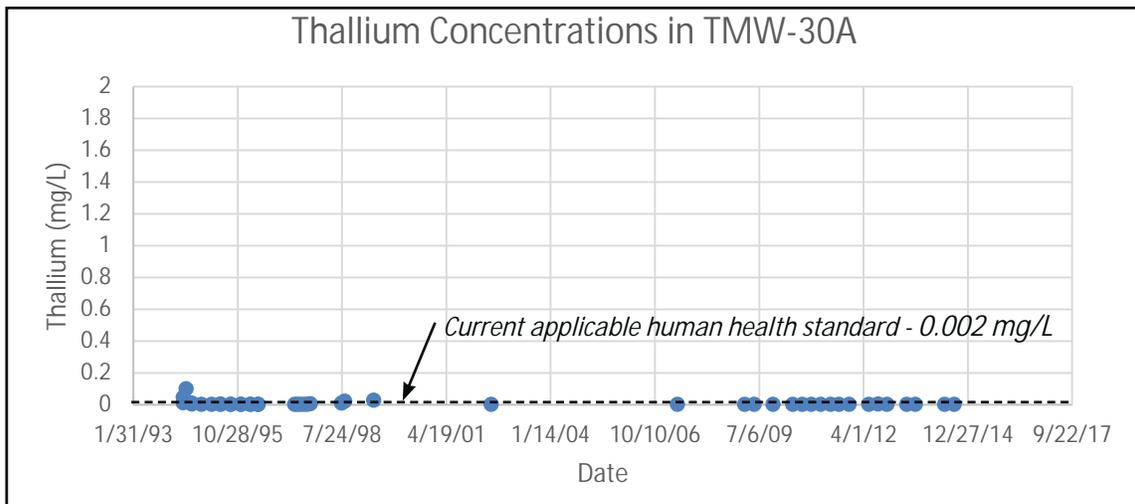
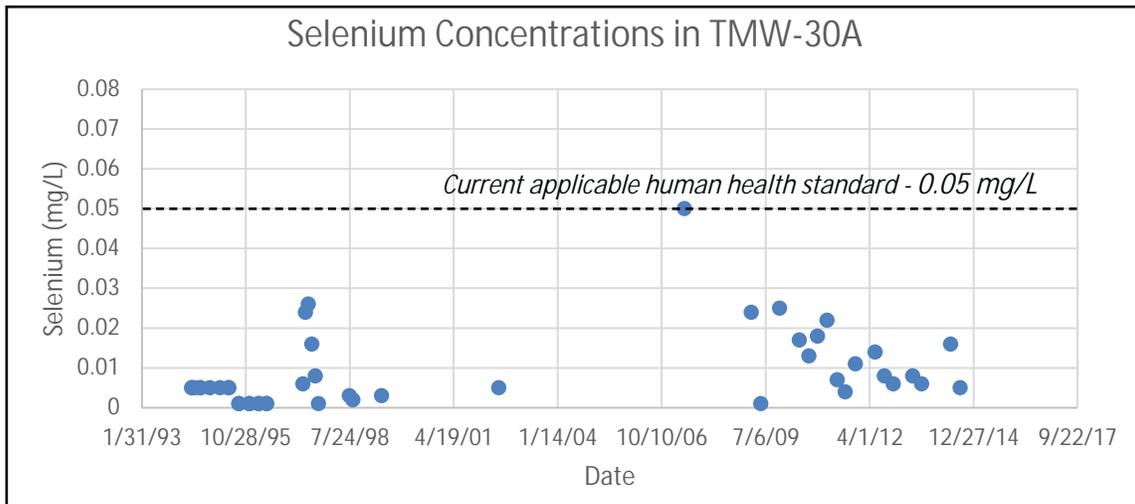
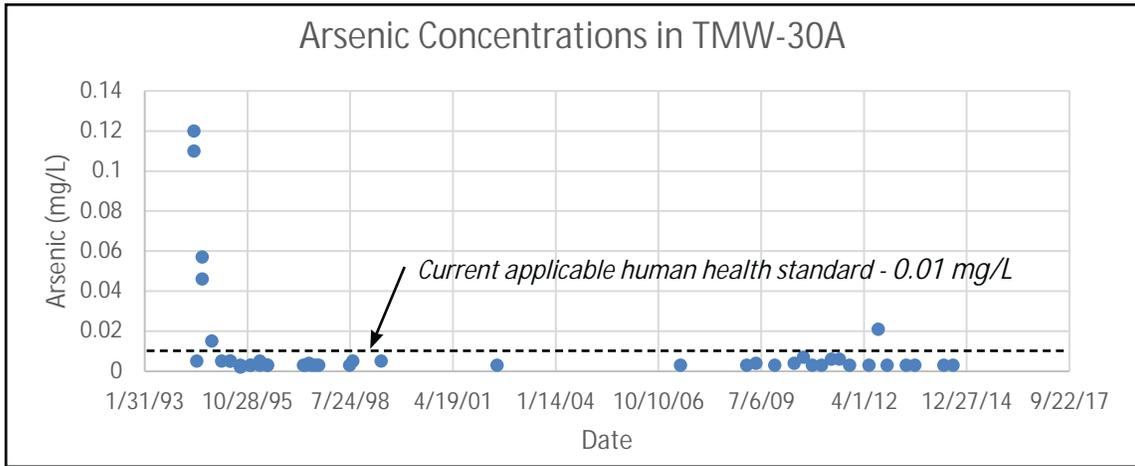
FIGURE A-4
CR Kendall Mine
Arsenic, Selenium, and Thallium Levels in
Mason Canyon Groundwater
(TMW-24A)



NOTE:
mg/L = Milligrams per Liter



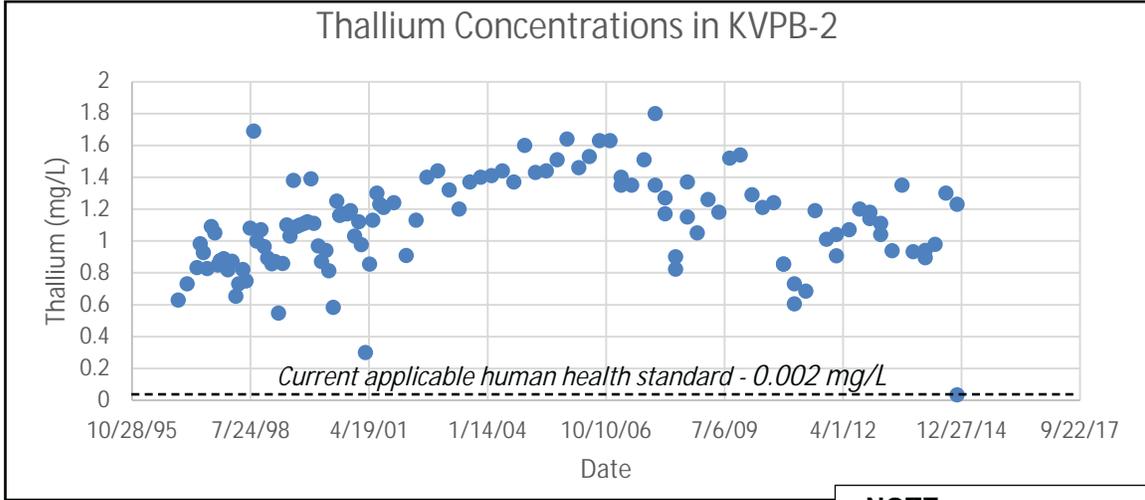
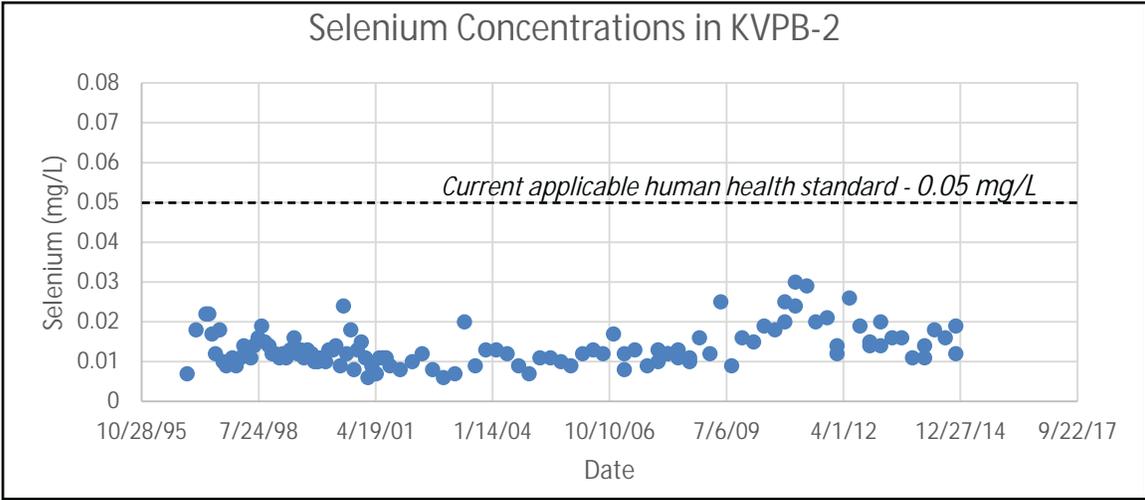
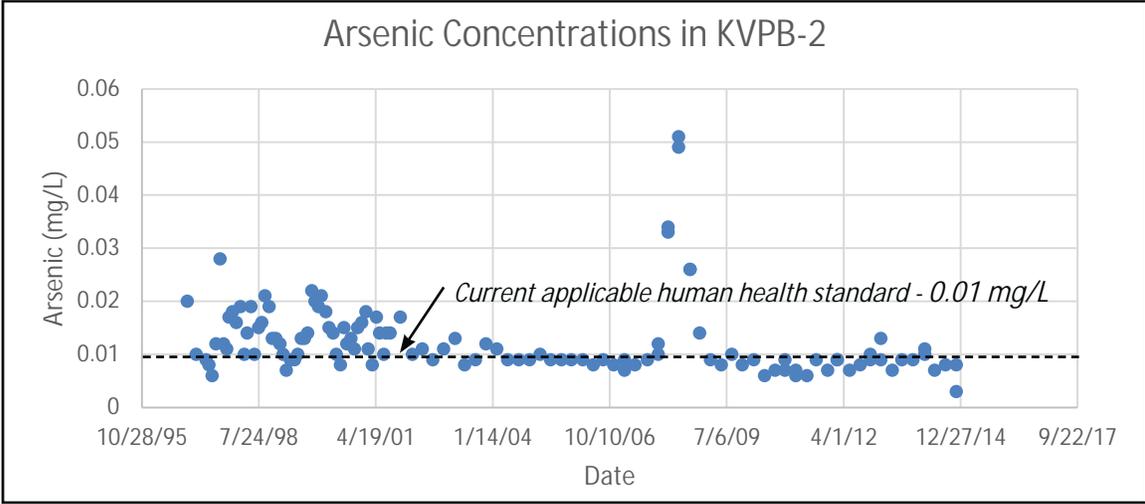
FIGURE A-5
CR Kendall Mine
Arsenic, Selenium, and Thallium Levels in
Mason Canyon Sediment Pond Pumpback
(TMW-26)



NOTE:
mg/L = Milligrams per Liter



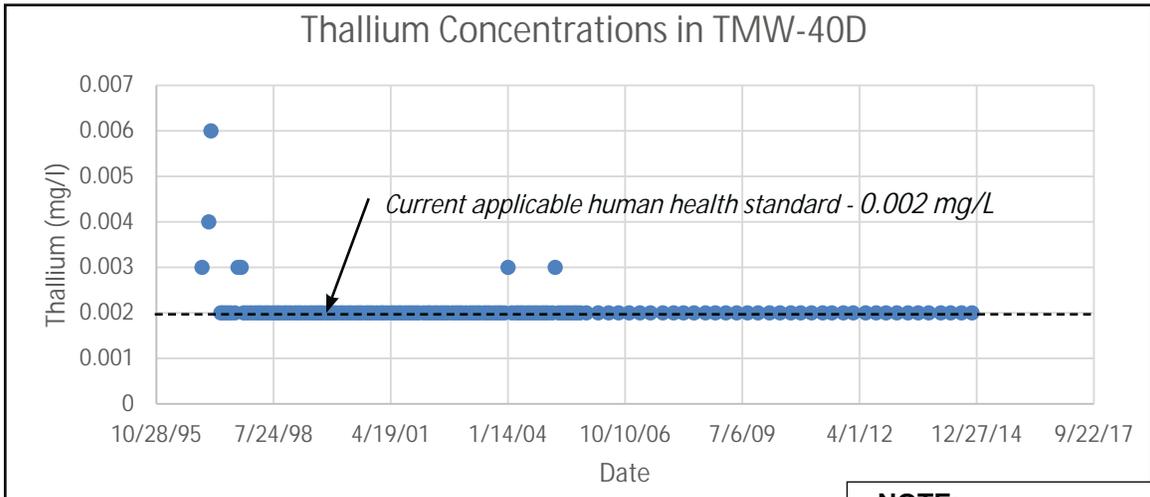
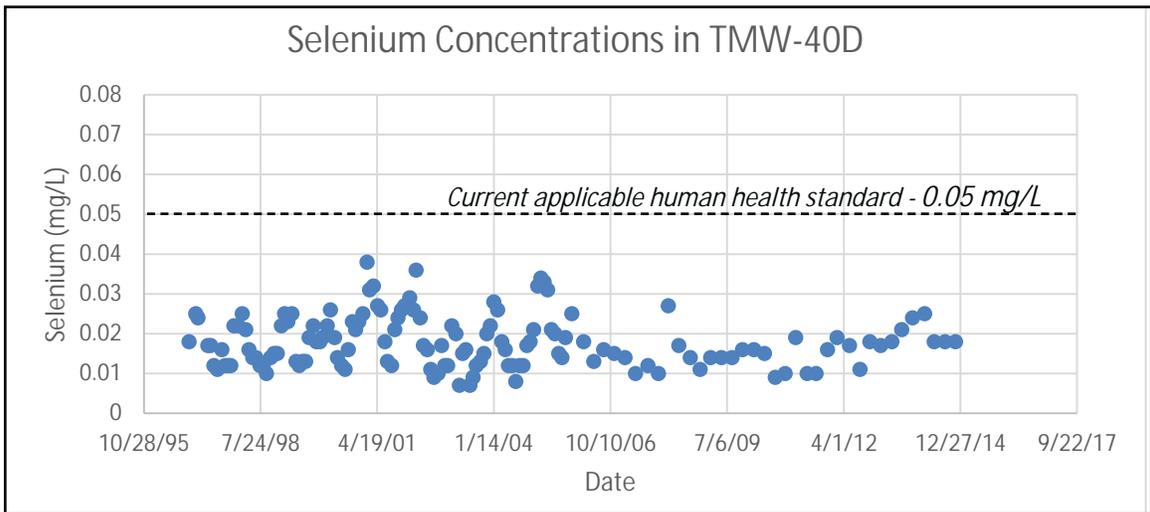
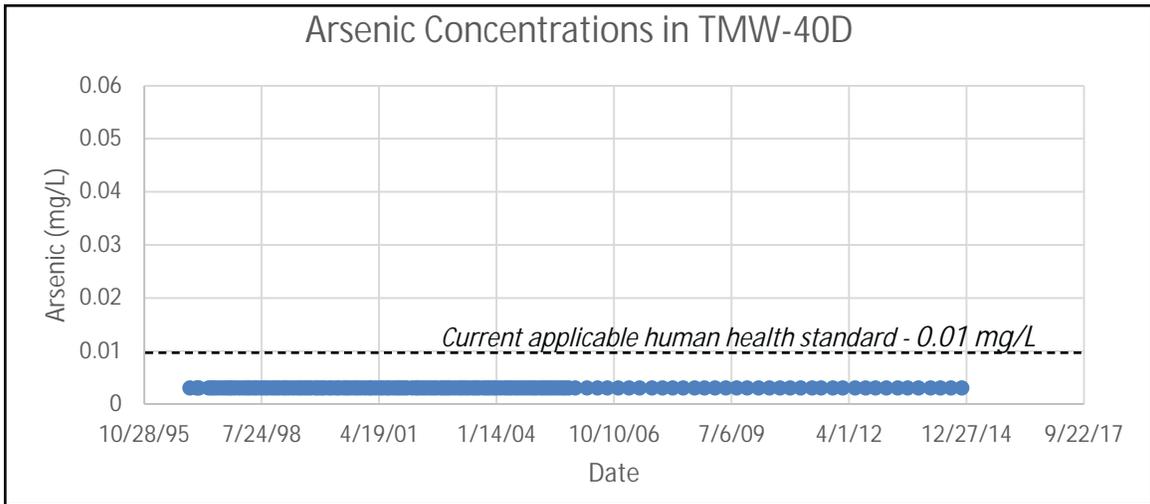
FIGURE A-6
CR Kendall Mine
Arsenic, Selenium, and Thallium Levels in
Barnes-King Gulch Groundwater
(TMW-30A)



NOTE:
mg/L = Milligrams per Liter



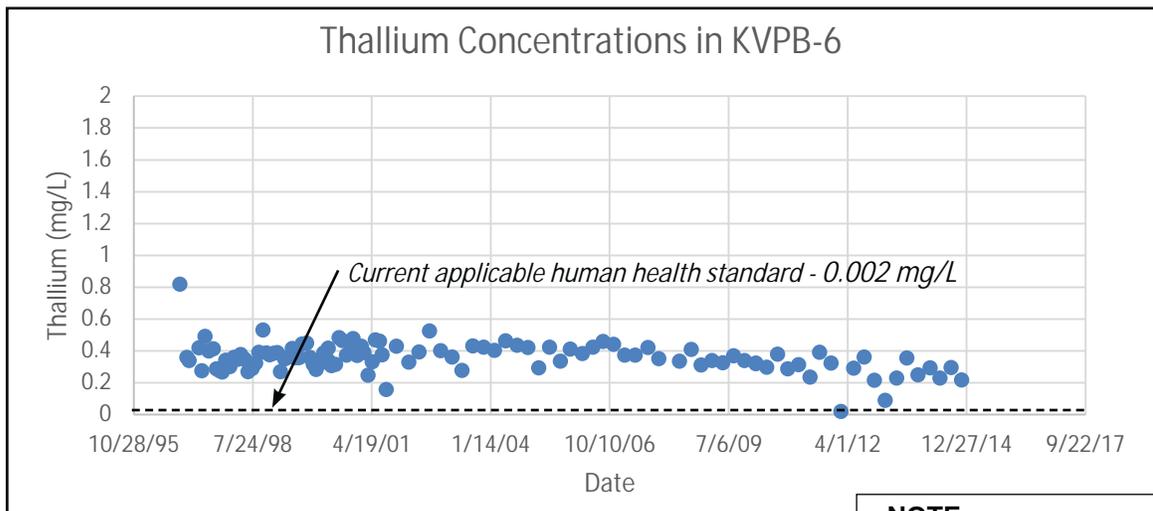
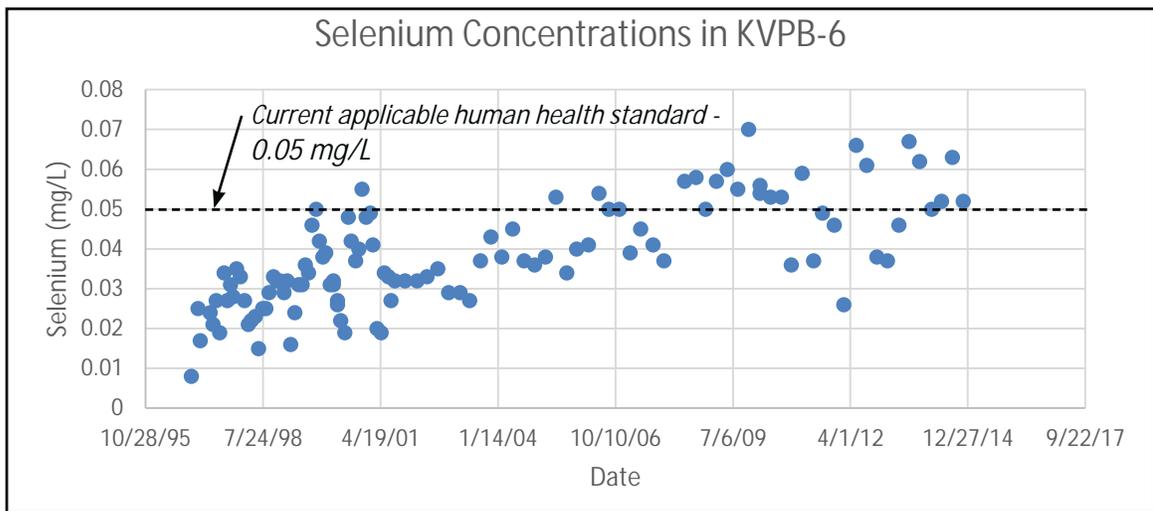
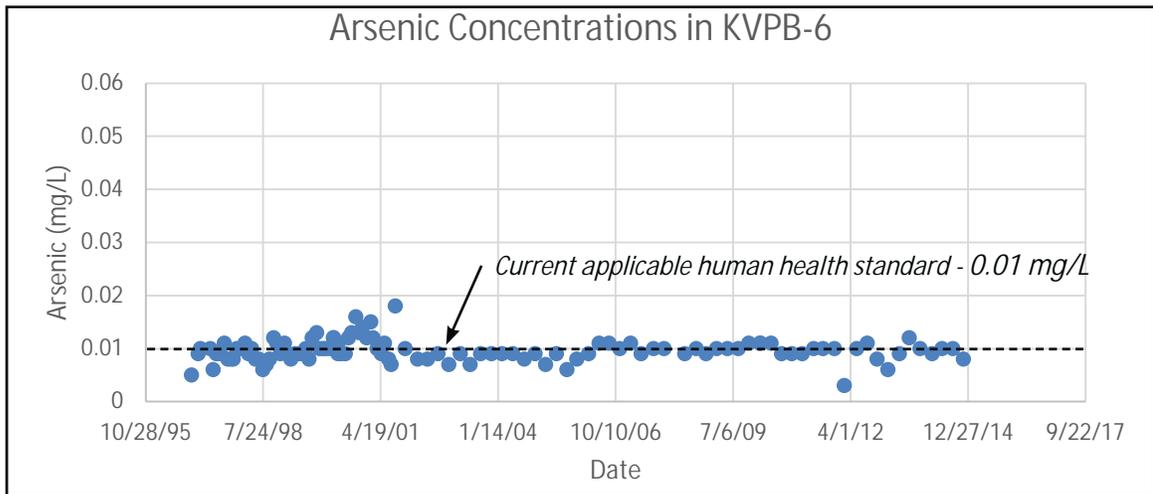
FIGURE A-7
CR Kendall Mine
Arsenic, Selenium, and Thallium Levels in
Barnes-King Gulch Pumpback
(KVPB-2)



NOTE:
mg/L = Milligrams per Liter



FIGURE A-8
CR Kendall Mine
Arsenic, Selenium, and Thallium Levels in
South Fork Little Dog Creek Groundwater
(TMW-40D)



NOTE:
mg/L = Milligrams per Liter



FIGURE A-9
CR Kendall Mine
Arsenic, Selenium, and Thallium Levels
in South Fork Little Dog Creek Pumpback
Water (KVPB-6)

Appendix B

CR Kendall Process Pad Drainage Arsenic Removal Pre-Treatment Cost Estimates

Technical Memo, December 10, 2015

TECHNICAL MEMO

To: Charles Freshman

Cc: Garrett Smith, Wayne Jepson, Jen Lane

From: H.C. Liang

Date: December 10, 2015

Project Name: CR Kendall Process Pad Drainage Arsenic Removal Pre-Treatment Cost Estimates

Background

The Montana Department of Environmental Quality (DEQ) needs to estimate capital and operating and maintenance (O&M) costs to pre-treat process pad drainage at the CR Kendall Mine to remove arsenic should it become necessary in the future. Although the DEQ does not stipulate which specific arsenic-removal treatment process should be implemented, in order to generate cost estimates, it has been assumed that an adsorptive media would be the preferred treatment option compared to ferric coagulant addition to remove arsenic because using an adsorptive media would generate a spent media that is contained within vessels for easier handling compared to the need to deal with ferric hydroxide sludge from ferric coagulant addition, which is more labor-intensive and less desirable at lower flowrates. Furthermore, in order to generate more specific cost estimates, it was also assumed that an iron-based ferric oxide adsorption media would be used due to its cheaper costs compared to other arsenic-removal adsorptive media such as titanium-oxide or alumina-based media.

Two different sets of cost estimates have been generated based on differing assumptions about arsenic-removal system design flowrates. For the first set of cost estimates, it was assumed that a system that is designed to operate optimally at 14 gallons per minute (gpm) based on the anticipated average flowrate data from the CR Kendall Mine process pad drainage (CR Kendall Mine Amended Closure Plan Water Management, Hydrometrics, 2012) would be able to provide adequate arsenic removal even at peak flowrates of approximately 30 gpm. To provide more conservatism in the cost estimates, however, a second set of cost estimates was generated which assumed a design flowrate of 30 gpm to cover the peak flow events.

Methodology

The cost estimates generated in the memo are calculated based on costs from actual arsenic-removal facilities reported in a September 2011 EPA report, "Costs of Arsenic Removal Technologies for Small Water Systems: U.S. EPA Arsenic Removal Technology Demonstration Program." The cost estimates for the 14 gpm design flowrate was derived from reported costs from a 10 gpm system using a ferric oxide media called E33 from AdEdge. The 10 gpm flowrate was the closest flowrate to 14 gpm using a ferric oxide arsenic removal media in the report. A linear correlation in costs was assumed to be within the desired accuracy for this level of cost estimate when extrapolating between 10 and 14 gpm design flowrates. The O&M cost estimates were also derived from reported O&M figures from the 10 gpm system. All cost estimates were escalated assuming a 3% cost increase per year from 2011 to 2015.

A similar approach was used to estimate the capital and O&M costs for a 30 gpm arsenic-removal pre-treatment system. The capital cost estimate was derived from the same 2011 EPA document's reported costs for a 40 gpm system using the same ferric oxide media, E33 from AdEdge, which was the closest flowrate to 30 gpm using the same removal media. A linear correlation in costs was again assumed to be within the desired accuracy when extrapolating between 40 and 30 gpm design flowrates. Because no O&M cost estimates were reported for the 40 gpm system, O&M cost estimates of the 10 gpm system were used again. And because O&M costs are based on the same average flowrate of 14 gpm, the O&M cost estimates are the same for the 14 gpm and 30 gpm design flowrate systems. It is important to note that O&M costs, especially for media replacement, depend greatly on specific water quality. Therefore, the actual O&M costs for the CR Kendall site could vary significantly from the estimates stated in this memo. For more accurate O&M cost estimates, laboratory testing using actual process pad drainage water on the adsorption media should be performed to better estimate the anticipated frequency of media replacements.

Cost Estimates for 14 gpm Design Flowrate

For a 14 gpm system using AdEdge's E33 ferric oxide media, the capital cost estimate for the equipment is \$35,300, and the total capital cost is estimated at \$53,900. The total capital cost includes equipment, site engineering, and installation and startup costs.

The annual O&M cost estimate is \$27,100, which includes the annual media replacement cost estimate of \$23,300 and cost estimates for spent media disposal and labor. Spent media is expected to pass Toxicity characteristic leaching procedure (TCLP) for arsenic and is not expected to be considered hazardous waste.

Cost Estimates for 30 gpm Design Flowrate

For a 30 gpm system using AdEdge's ferric oxide media, the capital cost estimate for the equipment is \$79,900, and the total capital cost is estimated at \$117,000. The total capital cost includes equipment, site engineering, and installation and startup costs.

The annual O&M cost estimate is \$27,100, which includes the annual media replacement cost estimate of \$23,300 and cost estimates for spent media disposal and labor. Spent media is expected to pass Toxicity characteristic leaching procedure (TCLP) for iron and will not be considered hazardous waste.

Summary

As stated above, the cost estimates were calculated based on reported costs in 2011 for similar arsenic-removal systems in the U.S. Tetra Tech has requested equipment cost quotes on similar iron-based arsenic-removal treatment systems from AdEdge and from Evoqua for both 14 gpm and 30 gpm design flowrates and will forward the equipment cost estimates to DEQ as soon as they are received from the vendors. The cost estimates above do not account for a filtration system to treat and remove total suspended solids (TSS) upstream of the arsenic-removal media. In addition to providing cost estimates for the arsenic-removal system, Evoqua will also provide equipment cost estimates for the TSS-removal filter. Tetra Tech has also contacted Culligan to request an estimate for a TSS-removal filter and will also forward the TSS-removal equipment cost estimates to DEQ as soon as they are received. Tetra Tech believes, however, that the TSS-removal equipment will cost significantly less than the arsenic-removal media equipment and that contingencies in arsenic-removal cost estimates for this level of cost estimation will likely cover the additional costs of such filter equipment.



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