3.13 Aquatic Biological Resources

The aquatic biological resources study area for direct and indirect impacts and the cumulative effects study area (CESA) encompasses the Little Antelope Creek and Antelope Creek drainages located within the Rock Creek Valley Hydrographic Basin (62) (**Figure 3.13-1**). Both the study area for direct and indirect impacts and the CESA include the lower portion of Antelope Creek downstream to the confluence with Rock Creek. The rationale for the study area boundary is based on drainages that potentially could be directly or indirectly affected by project construction and operation. Past, present, and reasonably foreseeable future actions (RFFAs) are described in Section 3.2. The types of information used to characterize aquatic biological resources consist of aquatic habitat and distribution/occurrence information for fish, amphibian, and invertebrate species or groups. Special status aquatic species also are discussed in this section.

3.13.1 Affected Environment

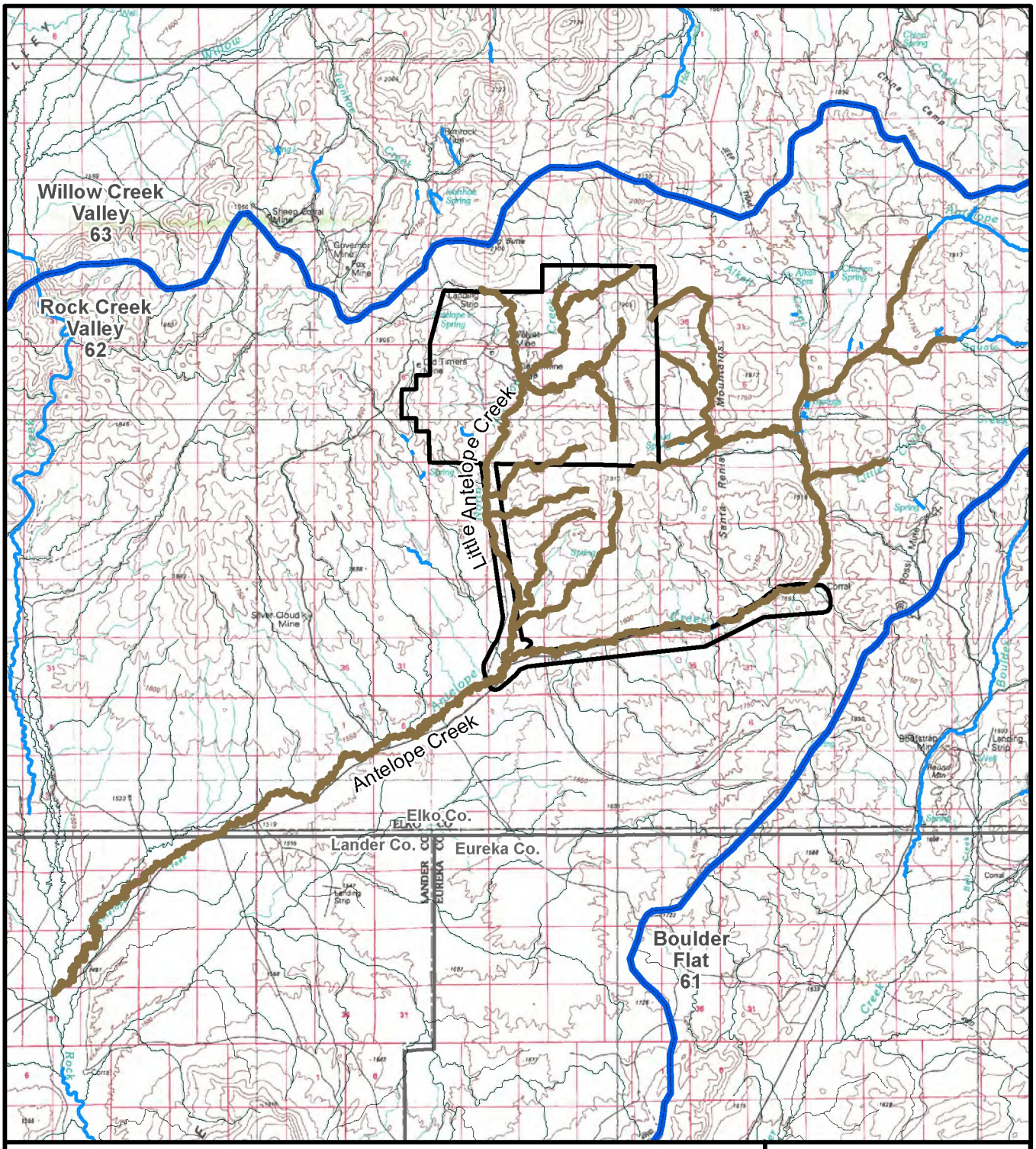
3.13.1.1 Habitat

Aquatic habitat in the project area includes streams, wetlands, and springs located within the Little Antelope Creek drainage (**Figure 3.13-2**). Most of the habitat consists of intermittent and ephemeral creeks and springs that provide water only during spring run-off and seasonal storm events (Bureau of Land Management [BLM] 2004a). Little Antelope Creek is considered an intermittent creek with numerous unnamed ephemeral tributaries. The mainstem portion of Little Antelope Creek is characterized as a broad, poorly defined channel with gravel, cobble, and boulder substrates (BLM 2004a; Brown and Caldwell 2011b). The average channel width in the vicinity of the Hollister Site is 5 feet. Little Antelope Creek flows into Antelope Creek approximately 5 miles south of the Hollister Site. Antelope Creek flows in a southwesterly direction and enters Rock Creek approximately 6 miles from the Little Antelope and Antelope creek confluence.

Based on wetland surveys conducted within the project area by JBR Environmental Consultants, Inc. (JBR) (2003a), several small areas of perennial flow were identified along Little Antelope Creek (**Figure 3.9 1**). The areas are considered wetlands that are located within or immediately adjacent to the stream. These wetlands ranged in size from <0.1 to 0.3 acre (JBR 2003a) (**Figure 3.9-1**). Riparian vegetation along the wet portions of the stream included Baltic rush (*Juncus balticus*), willows (*Salix exigua* and *S. lutea*), and creeping spikerush (*Eleocharis macrostachya*). Fire closure monitoring of riparian vegetation in 2006 indicated proper functioning conditioning at two sites along Little Antelope Creek within and below the BLM enclosure area (Evans 2008). As discussed in Section 3.9, Riparian and Wetland Areas, riparian vegetation is present in most of Antelope Creek within the study area.

General aquatic habitat observations also were made in Antelope Creek, as part of wildlife and amphibian surveys conducted by AECOM in May and June 2010 (AECOM 2010d). Flow was noted in an approximate 6-mile section of Antelope Creek upstream of its confluence with Little Antelope Creek. Stream widths ranged from approximately 4 to 20 feet, while depths varied from less than 0.5 to 4 feet. Habitat consisted of a mixture of pools, riffles, and runs. After spring runoff is completed, the creek is considered to have intermittent flow in late summer through the winter months.

Springs represent the other type of aquatic habitat in the overall region. Spring habitat within the project area is limited to several unnamed and named intermittent springs (e.g., Antelope Springs), which are wet after snowmelt and precipitation events. Mud Springs, which is located 1,400 feet east of the project area boundary, is estimated to be 0.7 acre in size and it contains a small perennial reach below the pond outflow. This area supports wetland vegetation including cattails (Evans 2010). Adjacent riparian areas also exist near springs within the Antelope Creek spring complexes (BLM 2011b).



Legend

- Project Area Boundary
- Cumulative Effects Study Area (Including associated seeps and springs)
- Stream (Intermittent or Ephemeral)
- Perennial Stream Reach
- Hydrologic Basin Boundary

N

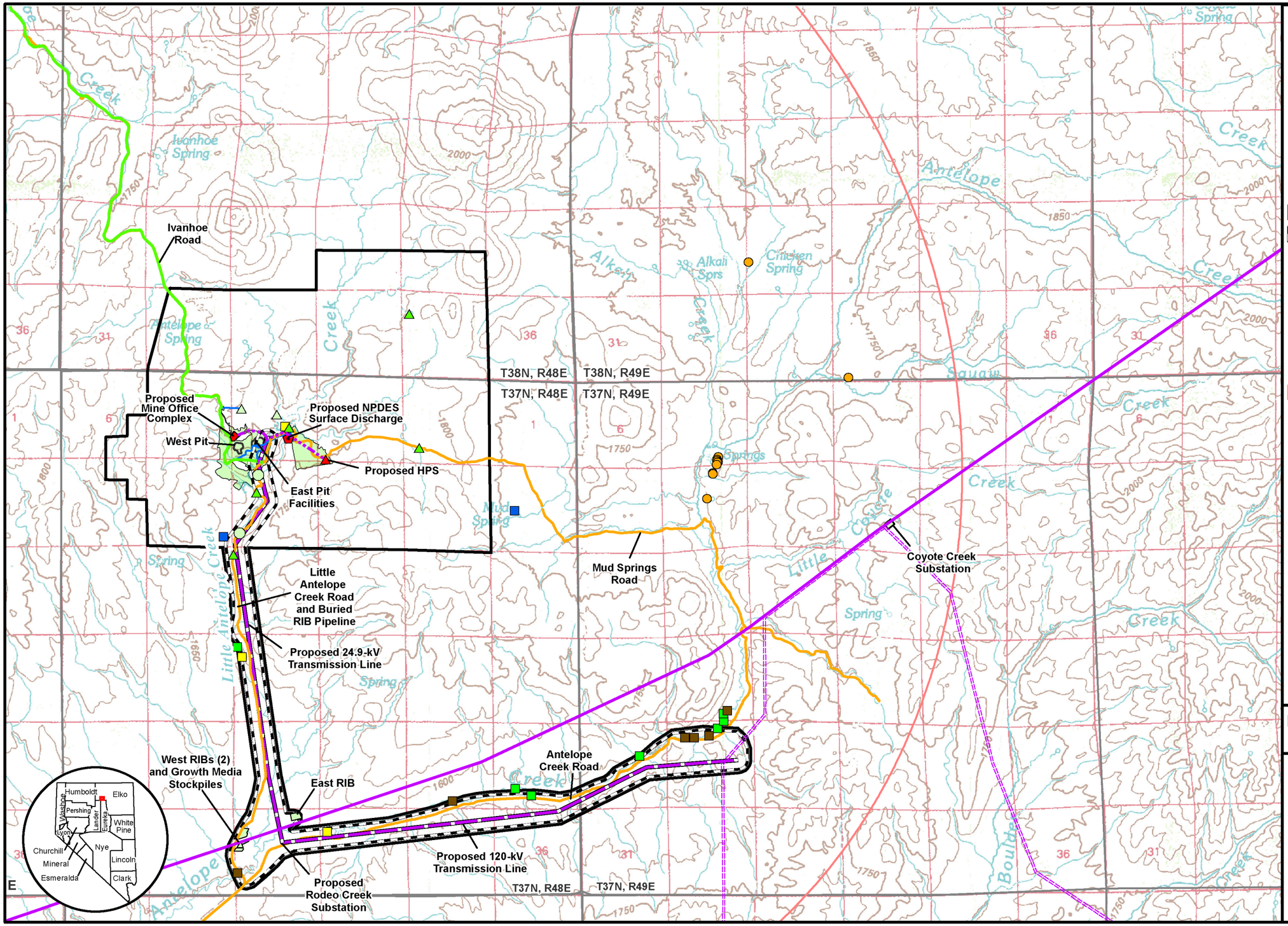
0 1 2 Miles

Source: BLM 2009b; Sada 2007.

Hollister Underground Mine Project EIS

Figure 3.13-1

Aquatic Resources Direct, Indirect, and Cumulative Effects Study Area



Legend

Existing/Authorized Disturbance or Facilities

- Mining Disturbance
- Rapid Infiltration Basin (RIB)
- Water Well
- Escapeway Raise
- Road
- Ivanhoe Road
- 345-kV Transmission Line
- 120-kV Transmission Line

Proposed Disturbance or Facilities

- Project Area Boundary
- Transmission Line Analysis Corridor
- Mine Office Complex
- NPDES Surface Discharge
- Proposed HPS
- 24.9-kV Transmission Line
- 120-kV Transmission Line
- Buried Pipeline
- Maximum Extent of the 10-foot Groundwater Drawdown Contour

Aquatic Occurrence Locations

- Benthic Macroinvertebrate Sampling (Tetra Tech 2010)
- Springsnails

Pacific Chorus Frog

- NDOW Surveys
- AECOM Survey (Adults)
- AECOM Survey (Tadpoles)
- AECOM Survey (Habitat)

Sources: AECOM 2010d; Brown and Caldwell 2010a; Evans 2010; NDOW 2010a; Sada 2007.

N

0 0.45 0.9 Miles

Hollister Underground Mine Project EIS

Figure 3.13-2

Aquatic Biological Resources Occurrence Information

3/20/2012

3.13.1.2 Aquatic Communities

Fish

Due to the limited amount of perennial surface water in Little Antelope and Antelope creeks, potential fish habitat is restricted to a few wetland areas or stream sections that provide surface water on a consistent annual basis. A previous survey in 1990 in the upper portion of Antelope Creek collected Lahontan speckled dace (*Rhinichthys osculus robustus*) and Lahontan mountain sucker (*Catostomus platyhynchus*) (JBR 1994). Lahontan speckled dace, redside shiner, and suckers (species not mentioned) also were observed in isolated pools in Antelope Creek by McGuire (1995). Fish (likely speckled dace) also were observed in Antelope Creek upstream of the confluence with Little Antelope Creek during the 2010 AECOM amphibian survey (AECOM 2010d). Suckers, redside shiners, and Lahontan speckled dace were observed to be abundant in perennial sections of Antelope Creek during July 2011 (BLM 2011b). These species could occur in other areas with perennial flow in the project area. In addition, fish occurrence could be expanded temporarily from these perennial water sources during storm events or high water years.

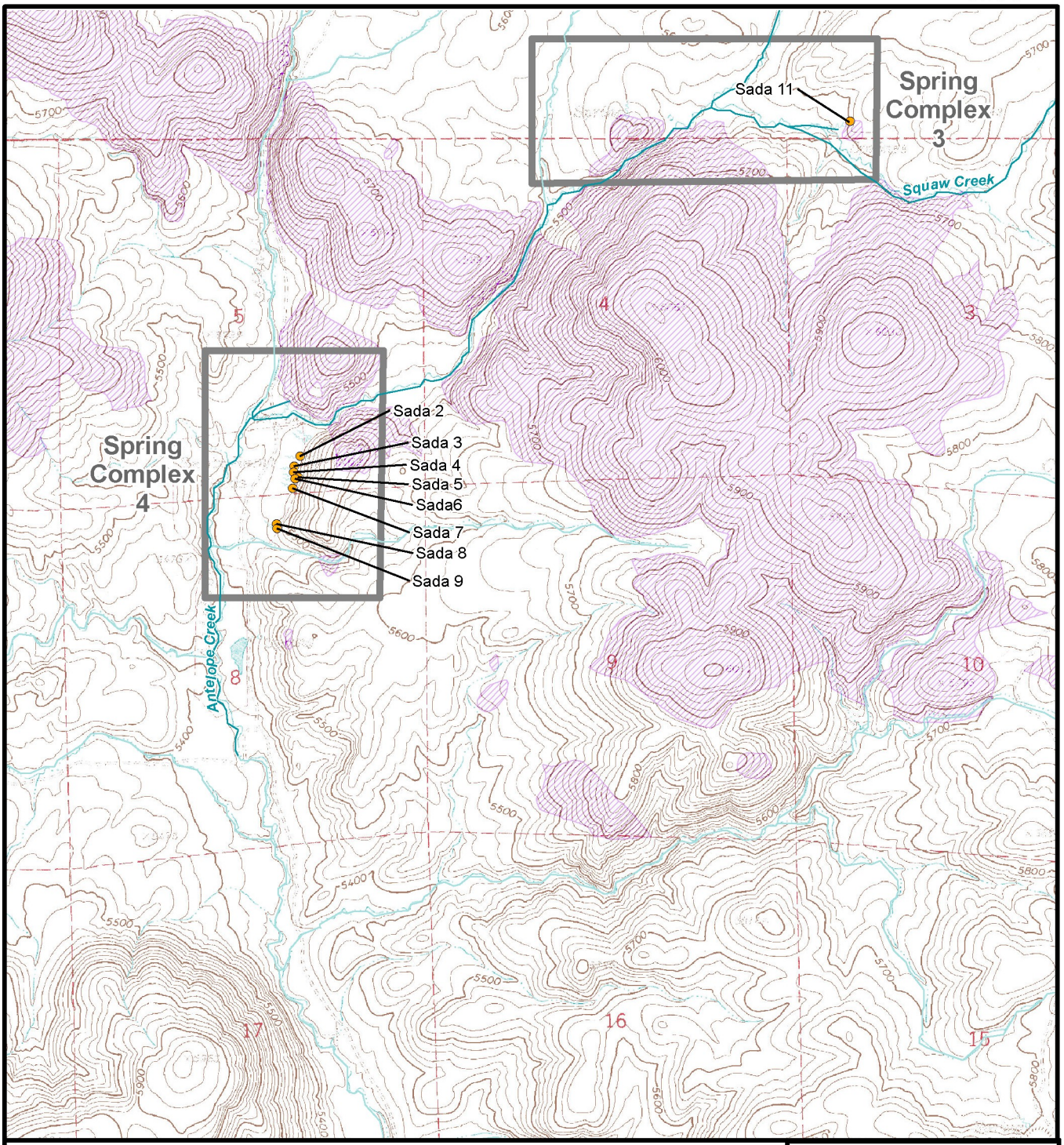
Amphibians

Potential habitat for amphibians includes perennial and intermittent reaches, wetlands, springs, and ephemeral ponds. Amphibian "visual encounter surveys" were conducted by AECOM from June 14 to 18, 2010, in Little Antelope and Antelope creeks. The survey protocol followed methods described by the Nevada Department of Wildlife (NDOW) (Hatch and Simandle, No Date). In Little Antelope Creek, Pacific chorus frogs (*Pseudacris regilla*) were observed at two locations, one with adult and tadpole life stages and the other with tadpoles. In Antelope Creek, adult or tadpole Pacific chorus frogs were observed at six locations (**Figure 3.13-2**). Potential amphibian habitat also was noted at six locations in this stream. Pacific chorus frog also was documented in Little Antelope Creek and Mud Springs in a previous NDOW survey (Evans 2010; NDOW 2010a) (**Figure 3.13-2**). This species also was observed near Antelope Creek in 2001 by JBR (2001) as cited in JBR (2008). This amphibian species uses perennial and ephemeral ponds and wetlands for breeding and early life stage development. Breeding typically occurs in late winter or spring. After the breeding season is completed, this species disperses back into upland habitat surrounding the waterbodies. Adults return to the same waterbody in subsequent years for breeding (Bernard 2010). Approximately 10 to 20 percent of the adults can survive more than one breeding season.

Invertebrates

In June 2009, Tetra Tech (2010) conducted an invertebrate survey at three stream locations along Little Antelope (**Figure 3.13-2**). In total, 11 taxonomic groups were collected at the stream locations, with the most abundant groups consisting of water beetles (Coleoptera), damselflies/gragonflies (Odonata), water mites (Hydracarina), caddisflies (Trichoptera), and worms (Oligochaeta).

Invertebrate communities in spring habitats depend on the type of water source (permanent or temporary), water chemistry, outflow discharge, substrate, and other habitat features (Erman 2002). Five major invertebrate groups typically are present in all types of springs including nematodes, aquatic worms (Oligochaeta), water mites (Acari), caddisflies (Trichoptera), and chironomid midges. Several groups such as flatworms and stoneflies are present only in springs with permanent water sources. Erman's studies also showed that the highest number of species were associated with stable springs that maintained water levels throughout the 20-year period of study. Invertebrate composition in Mud Springs and an unnamed spring near Little Antelope Creek included eight orders, with the most abundant groups consisting of Hirudinea (leeches), Coleoptera, Hydracarina, and Odonata (Tetra Tech 2010). Five invertebrate groups were present in each spring. Nine springs in the Antelope Creek drainage and one spring near Squaw Creek contain the springsnail, *Pyrgulopsis gibba* (McGuire 1996, 1995; Sada 2007) (**Figure 3.13-3**). *P. gibba* occurs in northern Nevada, eastern California, and southern Oregon, including 13 populations near the Carlin Trend (Sada 2007).



Legend

Spring Complex

Springs (Sada 2007)

Springsnail

Vinini Formation

1:24k Geologic Maps (NBMG)

N

0 1,300 2,600 Feet

Source: Sada 2007.

Hollister Underground Mine Project EIS

Figure 3.13-3

Springsnail Springs Potentially Affected by Groundwater Pumping

1/18/2012

Springsnails are indicators of springs with water being present on a persistent basis and good water quality. Additional discussion of springsnails is provided in Section 3.14, Special Status Species.

3.13.2 Environmental Consequences

The primary issues related to aquatic resources include the following potential direct and indirect effects:

- Habitat alteration and sedimentation on aquatic species due to surface disturbance activities;
- Potential adverse water quality effects on aquatic species from water discharge;
- Potential flow changes on aquatic habitat due to water discharge and groundwater pumping; and
- Potential spills from vehicle traffic, equipment, and storage of diesel and gasoline products near waterbodies containing aquatic biological resources.

3.13.2.1 Proposed Action

Surface Disturbance Activities

Construction activities associated with the National Pollutant Discharge Elimination System (NPDES) surface discharge point, new electric power transmission lines (transmission lines), and road maintenance grading on the existing Little Antelope Creek Road would disturb soils near Little Antelope and Antelope creeks. This disturbance could result in potential sediment input to these drainages. The extent of sedimentation on downstream areas would depend on riparian vegetation. Sediment would be minimized in the portion of Little Antelope Creek inside the exclosures that support well vegetated and stabilized streambanks. This filtering effect on sediment would not occur in sections of the stream without riparian vegetation. As part of the construction activities, applicant-committed erosion control measures outlined in the project's Storm Water Pollution Prevention and Reclamation Plan would be implemented to reduce erosion and sediment transport in these streams. In addition, engineered storm water diversions would be designed and constructed to divert runoff away from the mine facilities. Storm water would be directed back to the natural drainage features associated with Little Antelope Creek. As a result, project-related effects of sediment on aquatic habitat are considered to be minor.

Construction of the 120-kilovolt (kV) and 24.9-kV transmission lines would result in temporary alteration of aquatic habitat in Little Antelope and Antelope creeks. For example, the 24.9-kV transmission line would cross Little Antelope Creek at three locations and three unnamed intermittent tributaries. The 120-kV transmission line would cross nine unnamed intermittent tributaries to Antelope Creek. Transmission line construction would involve vehicle traffic through these creeks. Instream construction for the transmission line structures are not anticipated at the intermittent creek crossings. The temporary disturbance to these creeks could result in mortalities to aquatic macroinvertebrates at locations with water flow. Fish are not expected to occur in the waters associated with construction areas due to an absence of persistent flow. After construction is completed, bottom substrates would return to pre-construction conditions. Macroinvertebrate species, if present, would be expected to recover within 6 months as the areas are recolonized, assuming flow or water is present on a periodic basis (Waters 1995).

Water Management Activities

The current mine water management facilities and operations would continue to be used as part of the mine water management system. Groundwater within the underground workings would be pumped at a rate of approximately 400 to 1,100 gallons per minute (gpm) over a 20-year life-of-mine period. Based on studies by Brown and Caldwell (2010a, 2003), groundwater pumping within the Vinini Formation is not expected to affect flows in Little Antelope Creek for the following reasons:

- Source of stream flows is snowmelt and precipitation runoff;
- Groundwater in the project area does not recharge Little Antelope and Antelope creeks; and
- Presence of clay-hydraulic boundary that restricts groundwater exchange between the Vinini Formation and overlying Tertiary volcanic units.

Based on groundwater modeling using the maximum extent of the 10-foot groundwater drawdown contour, groundwater pumping in the Vinini Formation could reduce flows and water levels in four spring complexes and potentially affected segments in Antelope, Alkali, and Squaw creeks in the CESA. As shown in **Figure 3.13-3**, eight springs associated with springsnails are located as a series in spring complex 4 in a wetland area adjacent to Antelope Creek. Seven of these Antelope Creek springs are considered low potential impact for groundwater pumping. The northern most spring (Sada 2) is considered a high potential impact. One additional spring (Sada 11) associated with springsnails, in spring complex 3 (high potential impact) is located in the Squaw Creek drainage. Although these nine springs associated with springsnails are located just outside of the Vinini Formation, they are within the maximum extent of the 10-foot groundwater drawdown contour, and groundwater could contribute flow to these springs. As a result, there is a risk that groundwater pumping could adversely affect spring habitat and species. Effects on habitat could include no change, slight to moderate reductions in spring water levels, or a total loss of wetted area depending on the volume of flow reduction. The effects of reduced flow would be more pronounced in small springs where changes in habitat conditions could represent a substantial portion of the habitat. Invertebrates are known to inhabit spring habitats (Erman 2002). Flow changes could shift the occurrence of invertebrates along the spring brook segment (i.e., inflow or outflow channel from spring). For example, spring invertebrates often move along a spring outflow gradient in response to changes in their thermal environment, located food sources, and find more suitable larval development sites. In addition, flow-related water quality changes could contribute to changes in community composition and taxonomic richness due to increased temperature and sedimentation and altered algae assemblages. Potential effects on springsnails, which occur in nine springs, are discussed in Section 3.14, Special Status Species.

Groundwater pumping also could reduce flow in the wetland areas in Antelope and Squaw creeks, referenced above for the nine springs. These areas could represent potential habitat for amphibian species, based on surveys conducted by McGuire (1996) and Sada (2007). If present, amphibian breeding, rearing, and adult habitat could be adversely affected by flow and water level reductions.

Groundwater pumping also could reduce flows in Antelope Creek and its tributaries, as a result of decreased spring flow input from the eight springs located adjacent to Antelope Creek. Flows could be reduced in approximately 10.4 miles of Antelope Creek upstream of the confluence with Little Antelope Creek. Fish and invertebrate densities could be reduced in this 10.4-mile segment of Antelope Creek due to a decrease in habitat or wetted area.

After treatment, the inflow water would be discharged to Little Antelope Creek at a rate of up to 1,100 gpm. The effects of the discharge on Little Antelope Creek flows are discussed in Section 3.6, Surface Water Resources and Watersheds, and evaluated in an analysis by Brown and Caldwell (2011b). Utilization of the NPDES outfall would result in increased flow in Little Antelope Creek, which would create additional aquatic habitat. The additional aquatic habitat during discharge would be temporary. After the discharge ceases, aquatic habitat would be reduced to pre-discharge conditions. Stream reaches with increased flow would provide habitat for aquatic macroinvertebrates and possibly nongame native fish species that have been observed in nearby drainages (e.g., speckled dace and Lahontan mountain sucker) and amphibians. Due to a predominance of losing reaches in Little Antelope and Antelope creeks (i.e., stream water infiltrates into a subsurface aquifer through the streambed, causing a net loss of surface water), increased flow may not persist throughout the downstream portions of these creeks below the NPDES discharge point.

As a result of increased discharge into Little Antelope Creek, water depths would increase at the three stream crossings by Little Antelope Creek Road. Currently, vehicles drive through the channel at relatively low water levels. Culverts could be required at these road crossings due to the increased water depths and flow conditions. Culvert construction would result in short-term disturbance to stream substrates and cause macroinvertebrate mortalities. Fish would likely move away from the construction area. Macroinvertebrates would recolonize the disturbed area within several months.

As discussed in Section 3.6, Surface Water Resources and Watersheds, comparisons of existing water quality conditions to stream standards indicates exceedences for dissolved oxygen, total dissolved solids, and sulfates in Little Antelope Creek. Mine discharge into Little Antelope Creek would require that stream water quality standards be met under the NPDES permit. Water quality monitoring would be required to confirm that these standards are met. By adhering to the NPDES permit requirements, no adverse effects of water quality on aquatic species would occur in Little Antelope Creek.

Spill Risks

Vehicle and equipment use in areas near creeks and springs would pose a risk to aquatic species from fuel spills or leaks reaching these waterbodies. In addition, the transport and storage of diesel and gasoline near waterbodies also would represent a risk if products enter the aquatic environment. If a spill occurred, the magnitude of the impact would depend upon the volume spilled and the extent of dispersal within the waterbody. Spilled fuel products could result in mortalities to aquatic species or sublethal effects on physiological functions or degradation of habitat due to effects on water quality. Rodeo Creek Gold Inc (RCG) would implement a Spill Prevention, Control, and Countermeasures (SPCC) Plan (RCG 2008a) to prevent and contain potential spills that could affect aquatic species and their habitat. The SPCC Plan would reduce the spill risks to a low level.

The Proposed Action also would involve ore transport by truck to the Esmeralda Mill in Mineral County or the Midas Mill in Elko County or other suitable processing facility. The estimated number of truck trips per day is 18 to 25, with frequency up to 7 days per week (described in Section 2.4.4.4, Ore Transport). Existing roads would be used for the ore transport, with no road upgrades or other surface disturbance activities. Truck transport poses a fuel spill risk along the route. In terms of potential fuel risks, the shorter transportation route to the Midas Mill would cross fewer perennial streams than the Esmeralda route. Aquatic species and their habitat could be affected if a fuel spill entered a perennial stream at a road crossing. Examples of streams crossed by the transport route include Willow Creek and Rock Creek. As previously discussed, the SPCC Plan (RCG 2008a) would be applied to ore transport activities, which would reduce the spill risk to a low level.

Exploration

Exploration activities would continue under the Proposed Action and involve additional surface disturbance of approximately 25 acres and 600 to 800 new drill holes over the 20-year life of the project within the project study area. No drilling would be allowed within 400 feet of springs, based on the Elko Resource Management Plan (BLM 1986a). No amphibians were observed in the small wetlands within the proposed exploration areas. Applicant-committed environmental protection measures involving sediment-control measures would be implemented to minimize sediment input to waterbodies. In addition, drill holes would be properly plugged and abandoned to avoid water quality effects to the environment.

3.13.2.2 Mud Springs Road Transmission Line Alternative

Construction of this alternative would result in temporary disturbance within the proposed right-of-way from vehicle traffic and installation of structures. This alternative would cross nine intermittent creeks (two in Little Antelope Creek, one at the Mud Springs outflow, four in Alkali Creek, and two in Coyote Creek). Habitat would be disturbed if vehicles crossed the creeks. If water is present during the time of

construction, sediment also could enter the drainage. As previously discussed, applicant-committed erosion control measures would be implemented to minimize sediment input to these creeks. By implementing these measures, sediment-related impacts would be considered minor. Based on the intermittent nature of these creeks, impacts to aquatic species would likely be limited to macroinvertebrates, which can develop in creek reaches with seasonal water availability. In comparison to the transmission line associated with the Proposed Action, this alternative would cross nine intermittent creeks compared to 15 intermittent creeks for the Proposed Action. Therefore, temporary disturbance to intermittent creeks and aquatic habitat (if water is present) would be less in comparison to the Proposed Action.

3.13.2.3 Mud Springs Waste Rock Storage Facility Alternative

Under this alternative, the Mud Springs Waste Rock Storage Facility (WRSF) would be constructed instead of backfilling the West Pit with waste rock. Impacts to aquatic resources from the Mud Springs WRSF Alternative would be similar to the Proposed Action. Construction and operation of this alternative would overlap and disturb three small intermittent unnamed streams. No springs would be affected by this alternative. Aquatic habitat in these intermittent streams would be limited to spring runoff and periods after precipitation events. Water would be absent during most of the summer, fall, and winter months. Aquatic species inhabiting these streams would include invertebrates and algae that are suited for temporary habitat conditions. Construction of the Mud Springs Road diversion would not disturb any aquatic habitat. As discussed for other alternatives, applicant-committed erosion control measures would be implemented to minimize sediment input to these streams located along the perimeter of the WRSF. Impacts to aquatic habitat and associated species in the intermittent streams would be considered minor.

3.13.2.4 Backfill Alternative

This alternative would have the same impacts to aquatic resources as discussed for the Proposed Action. Waste rock removal and backfill activities would be conducted by implementing applicant-committed erosion control measures that would avoid sediment input to intermittent or spring habitats. The additional vehicle trips associated with this alternative would not cross aquatic habitats.

3.13.2.5 No Action Alternative

Under the No Action Alternative, the proposed project would not be approved. Proposed surface disturbance activities, increased ore transport, and water discharge to Little Antelope Creek for the proposed project would not occur. Currently approved exploration activities would continue under this alternative. None of these activities currently result in surface disturbance or habitat alteration near Little Antelope or Antelope creeks or springs in the project area.

3.13.3 Cumulative Impacts

The CESA for aquatic resources includes Little Antelope Creek, Mud Springs, and Antelope Creek drainages downstream to the confluence with Rock Creek located within the Rock Creek Valley Hydrographic Basin (62) (**Figure 3.13-1**). The RFFAs are described in Section 3.2. Livestock grazing, mining operations, industrial development, presence of invasive noxious weeds and non-native invasive plant species, and agricultural activities in the CESA would act cumulatively in affecting aquatic biological resources. Potential cumulative adverse effects on aquatic habitat would include surface disturbance and loss of riparian vegetation from livestock grazing, conversion of native riparian vegetation to noxious weeds and non-native invasive plant species, wildfire, and disturbance and groundwater pumping from mining. The Proposed Action would result in minor adverse effects on aquatic biological resources in the Little Antelope and Antelope creek drainages as a result of surface disturbance activities and low risk from potential fuel spills.

Flow changes could occur in portions of the CESA due to groundwater pumping. Flow reductions could adversely affect habitat for fish and invertebrates due to potential groundwater pumping effects on springs along Antelope Creek. This adverse effect would exist upstream of the confluence with Little Antelope Creek. Beneficial effects on aquatic habitat could occur in Little Antelope Creek from mine water discharges as additional wetted areas could be added to Little Antelope and Antelope creeks. Some creek reaches may be able to contain water on a more consistent basis throughout the year. Additional habitat would be provided for macroinvertebrates and possibly fish and amphibians. These impacts would combine with other past, present, and future actions in the Little Antelope and Antelope creek drainages. Actions that have resulted in past disturbance within these drainages include the previous surface mining conducted at the Ivanhoe Mine and surface exploration at the Hollister Development Block Project. Past and current grazing also has occurred in the northern portion of Antelope Creek, which has affected riparian vegetation, sedimentation, and substrate alteration in creek channels. Other past and current mining operations in the region such as the Betze Project required dewatering that could affect some of the nearby drainages such as Boulder Creek. Monitoring has been implemented for the Betze Project EIS to detect potential groundwater pumping effects. It includes existing monitoring in the Boulder Creek Subbasin and Antelope Creek. Springs in Upper Boulder Creek, Antelope Creek, and upper Bell Creek also are being monitored to detect potential changes in water levels, outflows, and water quality (BLM 2008b). Post-mining monitoring has indicated that mine dewatering appears to have impacted flows of springs at two sites along Boulder Creek located downstream of the Bootstrap Mine (AATA International 2010). No dewatering effects were evident at the other four monitoring sites in the Boulder Creek catchment. In addition, there is no evidence that flows and water quality in the Antelope Creek, Little Antelope Creek, and Rock Creek catchment basins have been affected by the Betze/Post Mine.

Groundwater pumping from the Hollister Mine could reduce flow in nine springs associated with springsnails, which are fed by the Vinini Formation. These springs are located along Antelope Creek and Squaw Creek. Flow could decrease in these springs and result in flow reductions in Antelope Creek. Water level and flow reductions would result in adverse effects on springsnails in springs and fish and invertebrates in Antelope Creek.

Ore transport to the Midas Mill as an option under the Proposed Action would result in lower spill risks to streams crossed by the truck route due to the shorter transport distance compared with ore transport to the Esmeralda Mill. The SPCC Plan (RCG 2008a) would be implemented to prevent or contain any potential fuel spills. The Proposed Action would contribute minor impacts in the CESA.

Construction of the Mud Springs Road Transmission Line Alternative would result in short-term impacts to nine intermittent creeks. Due to the intermittent nature of these creeks, impacts would be limited to macroinvertebrates, if water was present during the time of construction. Applicant-committed erosion-control measures would be implemented to reduce sediment effects on water quality and macroinvertebrate communities. As a result, this alternative would contribute minor effects on aquatic habitat and biota within the CESA. Other past mining projects, along with past and present grazing, has resulted in sediment effects on intermittent streams to Antelope and Little Antelope creeks.

Cumulative impacts to aquatic resources under the Mud Springs WRSF and Backfill alternatives would be the same as discussed for the Proposed Action.

3.13.4 Potential Monitoring and Mitigation Measures

AR-1

Issue: Springsnail populations may be at risk from groundwater pumping because this pumping could potentially affect springs and wetlands.

Monitoring/Mitigation Measure: A cooperative monitoring plan would be developed for the monitoring of springs containing springsnails that may be affected by groundwater drawdown. Access to springs on private land would require permission from the land owner(s). RCG would fund the monitoring efforts.

Effectiveness: This measure would be effective in determining changes in springsnail population numbers and habitat conditions that are an important part of population maintenance. However, the measure would not be effective in preventing the loss of a population if water levels are reduced to a level that adversely affects the species.

In addition to AR-1, mitigation measure RW-1 described in Section 3.9, Riparian and Wetland Areas, would be implemented to try to reduce potential groundwater pumping impacts on springsnail springs.

3.13.5 Residual Impacts

Residual beneficial effects on aquatic habitat and species could result from the Proposed Action as a result of the NPDES discharge into Little Antelope Creek, for the life of the mine. The magnitude of the beneficial effect would depend on the discharge volume and the ability of the stream reaches to maintain flow. Residual adverse effects of groundwater pumping could occur if water levels are reduced in springs containing aquatic species. There is a potential for a loss of springsnail populations further discussed in Section 3.14, Special Status Species.