3.7 Aquatic Biological Resources

3.7.1 Affected Environment

3.7.1.1 Overview

Aquatic biological resources within the study area include fish, invertebrates, amphibians, and their habitat. Species or groups that are emphasized in the baseline characterization are game fish species and special status fish, invertebrates, and amphibians. Other nongame native fish species also are included if they exhibit limited distribution or are considered in fish management actions. Information consists of game fish occurrence, macroinvertebrate composition, and special status species occurrence. An overview of aquatic resources within the study area is provided in this section. Detailed discussions of aquatic biological resources are included for specific portions of the study area in relation to ROW and groundwater development areas and the natural resources region of study as a broader geographical area (**Figure 3.7-1**). The natural resources region of study for aquatic biological resources includes 33 hydrologic basins that encompass portions of Nevada and Utah. The natural resources region of study is different than the water resources region of study in that four basins (Long, Jakes, Garden, and Coal) were excluded on the eastern boundary due to a lack of aquatic habitat. The natural resources region of study also included four basins (Pine, Wah Wah, Tule, and Deep Creek) that were not part of the model analysis. The decision to include these basins was made by the Natural Resources Group because they contained aquatic habitats and sensitive species.

QUICK REFERENCE

afy – Acre-feet per year
BMP – Best Management Practice
cfs – Cubic-feet per second
DDC – Dry Lake, Delamar, and Cave Valleys
ESA – Endangered Species Act
GBNP – GBNP
GWD – Groundwater Development
MOA – Memorandum of Agreement
NDOW – Nevada Department of Wildlife
NPDES – National Pollutant Discharge Elimination System
NWR – National Wildlife Refuge
POD – Plan of Development
RMP – Resource Management Plan
TSS – Total Suspended Solids
UDWR – Utah Division of Wildlife Resources
WMA – Wildlife Management Area

The study area is mainly in two ecoregions: the Mojave Desert and the Great Basin Desert. Both of these ecoregions are arid environments that receive relatively little precipitation, so aquatic environments generally are limited in number and often are isolated from one another. Aquatic habitat consisting of intermittent and ephemeral washes is common throughout the project study area, but this type of habitat is limited due to the lack of water on a consistent basis. Perennial springs and streams and reservoirs provide aquatic habitat throughout the year. Spring systems are scattered throughout the study area and represent the majority of the reliable water sources in the region (BIO-WEST 2007). As a result, the springs provide habitat for a variety of fish, invertebrate, and amphibian species. Permanent waterbodies in the form of perennial streams and lakes/reservoirs also are present in portions of the study area; the greatest number occur in the northern basins such as Snake, Spring (#184), Steptoe, Deep Creek, and White River. These habitats support the majority of the game fish populations within the study area.

Figure 3.7-1 Natural Resources Region of Study

Perennial – Waterbody with water present continuously during a normal year.

Intermittent – Waterbody that flows or exists sporadically or periodically.

Ephemeral – Waterbody with water presence that is short-lived or transitory.

The types of aquatic habitat within the ROW and groundwater development areas and the natural resources region of study were identified using USGS Hydrography Dataset (USGS 2008). Descriptions of these three levels of the project study area are provided in Chapter 3.0, Affected Environment and Environmental Consequences, Introduction. Habitat was defined in terms of perennial streams and lakes, springs, reservoirs, and ponds. Spring habitat also included map files that were produced by Sada (2007a) and BIO-WEST (2009, 2007).

A variety of data sources were used to identify occurrences for aquatic species. Information on game fish occurrences was obtained mainly from the NDOW and the UDWR. Occurrence information for special status aquatic species was based on the Nevada and Utah Natural Heritage databases, the NDOW, and the UDWR. Additional surveys also were conducted in the natural resources region of study by BIO-WEST (2009, 2007), which identified the occurrence of fish, amphibians, and invertebrates in spring habitats. Additional data on springsnail occurrences in the natural resources region of study were provided by Hershler (1998) and Sada (2007a,b). Sources of occurrence information for amphibians (especially northern leopard frog) include BIO-WEST (2009, 2007), SNWA (2009, 2008), a geodatabase created by the SNWA (2007a) from Hitchcock (2001), and the Nevada and Utah Natural Heritage databases. Information on aquatic communities in the GBNP was provided by GBNP (2007), Baker (2009), and unpublished spring data. Numerous other published literature sources, such as recovery plans, conservation plans, and journal articles, were used for sensitive aquatic species occurrences. These references are cited in discussions for various species. As previously mentioned in the overview for vegetation and wildlife resources (Sections 3.5.1, Affected Environment and 3.6.1, Affected Environment), the Natural Resources Group also provided input and evaluation on species occurrences (ENSR/AECOM 2008).

In Nevada and Utah public waters, fish species are managed by the state agencies (NDOW and the UDWR) with coordination and cooperation with federal agencies (BLM, NPS, USFS, and USFWS). One exception to species management is the NPS authority in parks such as Great Basin (GBNP). The NPS direction is to protect and manage resources in the park including fish and wildlife resources. Fishing regulations in the GBNP are under the jurisdiction of U.S. and State of Nevada laws. Aquatic habitat is managed by the agency who owns the land (i.e., BLM, NPS, USFS Humboldt-Toiyabe National Forest, and USFWS refuges). On lands with federally listed species, their management is under the jurisdiction of the USFWS. The USFWS coordinates with the state agencies to develop and implement recovery and other plans for threatened and endangered species. Collectively, the state and federal agencies develop and implement management plans and strategies for both game and nongame fish species and determine management practices that involve fishing regulations and habitat protection. Management direction and guidance are provided through the implementation of management plans, agreements, and their wildlife plans (e.g., Wildlife Action Plan [2006] and the Utah Comprehensive Wildlife Conservation Strategy [Sutter et al. 2005].

The discussions of special status aquatic species in the ROW, groundwater development areas, and the natural resources region of study include fish, amphibians, and invertebrates that are listed or proposed for listing under the ESA, and/or considered sensitive by the BLM or the USFS. Additional discussion on how the USFWS, BLM, and USFS define and manage these special status species is provided in Section 3.6.1.1, Terrestrial Wildlife Overview.

3.7.1.2 Right-of-way Areas

Habitats and General Aquatic Species

Streams

The pipeline ROWs would cross one perennial stream in the Snake Valley basin in Nevada (**Figure 3.7-2**). The pipeline ROWs also would cross intermittent streams (Lexington, Chokecherry, and Big Wash) and numerous ephemeral washes, such as Pahranagat. In addition, the power line ROWs would cross two perennial streams, Steptoe Creek in Steptoe Valley and Snake Creek in Snake Valley in Nevada. There are no ROWs in Utah. The Snake Creek crossing is the same for both the pipeline and power line ROW (**Figure 3.7-2**).

Figure 3.7-2 Proposed Pipeline/Power Line Crossings for Snake Creek and Big Wash

Snake Creek supports a coldwater fishery with species including brook, brown, and rainbow trout. Brown trout occur throughout the stream on a year-round basis (Crookshanks 2010). Spawning and rearing habitat for brown trout exists in the area to be crossed by the pipeline ROW. Rainbow trout in this section of the stream are likely escapees from the NDOW Spring Creek Rearing Station, which is located approximately 2 miles upstream of the proposed pipeline crossing in Snake Creek. Brown and rainbow trout numbers in Snake Creek are maintained by natural reproduction. The NPS is considering stream eradication in 2012 to allow expansion of Bonneville cutthroat trout downstream to the hatchery, but the schedule has not been defined. The upper portion of the stream (upstream of the proposed pipeline and power line crossing) also contains Bonneville cutthroat trout. Rainbow trout and Bonneville cutthroat trout are spring spawners, while brook and brown trout spawn in the fall months. Snake Creek also supports native nongame species including mottled sculpin, speckled dace, and redside shiner that have been reintroduced in recent years.

One additional stream (Big Wash) to be crossed by the pipeline and power line is intermittent at the proposed crossing (**Figure 3.7-2**). No fish spawning or rearing habitat exists at this proposed crossing. The stream contains Bonneville cutthroat trout and three reintroduced native fish species (mottled sculpin, redside shiner, and speckled dace) in the perennial reach upstream of the proposed crossing (Crookshanks 2010). Some Bonneville cutthroat trout can be washed downstream during high flow periods (e.g., spring of 2005).

Steptoe Creek is the only additional perennial stream to be crossed by the power line ROW. This stream contains a coldwater game fishery consisting of brook, brown, and rainbow trout. The NDOW annually stocks rainbow trout in Steptoe Creek. Populations for the other two trout species are maintained by natural reproduction. The proposed crossing is considered spawning and rearing habitat for brown trout. Perennial streams also provide habitat for macroinvertebrate species. Macroinvertebrates serve important roles in the aquatic environment through their food-web dynamics and are indicators of water-quality conditions (Barbour et al. 1999). Macroinvertebrate communities in Snake Creek were surveyed by the GBNP (2007) between 1997 and 2002. These sampling efforts revealed a total of 93 taxa, with trueflies (Diptera) representing the most abundant group by comprising approximately 29 percent of the total numbers. Beetles and mayflies were the next most abundant groups, which collectively comprised approximately 51 percent of the total numbers. Diversity indices and presence of mayflies, stoneflies, and caddisflies indicated nearly pristine water quality and habitat conditions. The mean abundance for five samples was approximately 1,882 invertebrates/meter^2, which is considered a moderate abundance value.

Springs

No springs are located within the pipeline or power line ROWs.

Special Status Aquatic Species

Waterbodies that would be crossed by the ROWs contain habitat for one special status fish species: Bonneville cutthroat trout. This species occurs in Big Wash and Snake Creek in White Pine County. As previously discussed, this species occurs in headwater areas located upstream of the proposed ROW crossings. No federally listed aquatic species or other special status species occur in waterbodies that would be crossed by the ROWs. The Bonneville cutthroat trout is a BLM Sensitive Species and USFS Sensitive Species and is managed under conservation agreements in Nevada and Utah (NDOW 2006; Lentsch et al. 2000). Cutthroat trout spawn in the spring and early summer months.

Based on a letter from the Confederated Tribes of the Goshute Reservation to the BLM (Steele 2010), streams crossed by the ROWs also contain “culturally significant plants and animals.” In particular, Snake Creek is located within the aboriginal territory of the Confederated Tribes of the Goshute Reservation and supports “various species of fish that are culturally significant.” In addition, the power line crossing of Steptoe Creek is located within the aboriginal territory of the Western Shoshone Tribe. This stream contains fish that may be culturally significant for this tribe. Fish in these streams include trout, minnow, and sculpin species.

Alignment Options 1 through 4

Aquatic habitat within three of the four alignment options (1, 3, and 4) is limited to intermittent streams or washes. No perennial streams are located within the ROWs of these alignment options. Aquatic communities in these intermittent streams consist of macroinvertebrates that have adapted to seasonal water availability. One perennial stream, Geyser Creek in Lake Valley, would be crossed by the pipeline and power line ROWs for Option 2 (North Lake Valley Pipeline Alignment). This stream contains rainbow and brook trout. Spring habitats are present near one of the alignment options: North Lake Valley Pipeline and Power Line Alignment (Option 2). Two special status aquatic species, northern leopard frog and Lake Valley springsnail (pyrg), occur in the Wambolt Spring Complex, which is located approximately 0.1 mile from the ROW for the North Lake Valley alignment (Option 2).

3.7.1.3 Groundwater Development Areas

Aquatic habitat within the groundwater development areas includes numerous intermittent washes, perennial streams, several small playas, and springs. Ephemeral streams and springs are the most abundant type of surface water features. There are no perennial streams in Delamar Valley, Dry Lake Valley, and Cave Valley groundwater development areas. Perennial streams occur within the groundwater development areas in Spring and Snake valleys. The following information describes aquatic resources in these areas.

Habitats and General Aquatic Species

Streams

In total, the groundwater development areas in Spring and Snake valleys contain 13 and 4 perennial streams, respectively, that support coldwater game fish populations (**Table 3.7-1**) (**Figure 3.7-3**). The game species consist of four salmonid species (brook, Bonneville cutthroat, rainbow, and brown trout) and hybrids. In general, many of the stream reaches within the groundwater development areas have modified channels such as irrigation canals. The reaches support trout, but habitat quality has been reduced due to channel alterations.

Table 3.7-1 Perennial Streams[1] with Fish Species Occurrence Within the Groundwater Development Areas

Basin/Stream	Map Code (Figure 3.7-3)	Game Fish Species	Nongame Species
Spring Valley (Basin #184)			
Bassett Creek	SP-1	Rainbow trout	None
Bastian Creek and tributary	SP-2	Brown trout, rainbow trout	None
Cleve Creek and tributaries	SP-3	Brown trout, rainbow trout	None
Indian Creek	SP-4	Rainbow trout	None
Kalamazoo Creek	SP-5	Brown trout, rainbow trout	None
McCoy Creek	SP-6	Brown trout, rainbow trout, rainbow/cutthroat hybrid	None
Meadow Creek	SP-7	Brown trout	None
Muncy Creek	SP-8	Brook trout, brown trout, rainbow trout, rainbow/cutthroat hybrid	None
Negro Creek	SP-9	Brown trout, rainbow trout, trout hybrids	None
Odgers Creek	SP-10	Rainbow trout	None
Piermont Creek	SP-11	Brown trout	None
Shingle Creek	SP-12	Rainbow trout, rainbow/cutthroat hybrid	None
Vipont Creek	SP-13	Rainbow trout	None
Snake Valley			
Big Springs Creek	SN-1	None	Mottled sculpin, redside shiner, speckled dace, Utah chub, Utah sucker
Big Wash	SN-2	Bonneville cutthroat trout	None
Lake Creek	SN-3	None	Mottled sculpin, redside shiner, speckled dace, Utah chub, Utah sucker
Lehman Creek	SN-4	Brook trout, brown trout, rainbow trout, rainbow/cutthroat hybrid	None

[1] Many of the stream reaches contain modified channels such as irrigation canals.

Figure 3.7-3 Perennial Streams with Aquatic Biological Resources in the GWD Areas

In general, other native and nonnative fish species do not occur in most of the perennial streams in the groundwater development areas. However, there are exceptions in four Snake Valley streams. Big Springs Creek/Lake Creek in Snake Valley contain native species such as redside shiner, speckled dace, mottled sculpin, Utah sucker, and Utah chub (NDOW 2007). In addition, mottled sculpin, redside shiner, and speckled dace occur in Upper Snake and Strawberry creeks. Big Springs Creek is the only stream in Nevada that supports this assemblage of Bonneville basin species. As a result of their limited distribution in Nevada, the NDOW considers this fish community to be unique.

The perennial streams in the groundwater development areas also support macroinvertebrate communities. Based on surveys conducted in Lehman Creek in 1997 and 1998 by the GBNP (2007), the macroinvertebrate communities were considered diverse (total of 58 taxa) and moderately abundant (mean of 6,600 invertebrates/meter^2). Taxonomic composition was dominated by mayflies, which comprised approximately 66 percent of the total numbers. Other abundant taxonomic groups that comprised at least 10 percent of the total numbers included chironomid midges and beetles. Diversity indices and presence of mayflies, stoneflies, and caddisflies indicated nearly pristine water quality and habitat conditions.

Springs

Springs with aquatic biological resources within and in the region of groundwater development areas are shown in **Figures 3.7-4** and **3.7-5**. Springs are located in all five basins associated with the groundwater development areas (**Figures 3.3.1-4** through **3.3.1-7**, in Water Resources, Section 3.3). The highest number of springs is within the Spring and Snake groundwater development areas (**Figures 3.3-4** and **3.3-5**). Previous aquatic biological surveys in springs within the groundwater development areas indicated that there was limited fish habitat (BIO-WEST 2007). No fish habitat was identified in the few springs located in the Cave and Dry Lake groundwater development areas due to shallow depths. Based on fish surveys conducted in springs within the Delamar, Snake, and Spring valley groundwater development areas, no fish are present (**Table 3.7-2**).

Nongame native fish species occur in Big Springs, which is located approximately 300 feet from the boundary of the Snake Valley groundwater development area. Species include mottled sculpin, redside shiner, Utah chub, and speckled dace (BIO-WEST 2007). Utah sucker has been collected in this spring in earlier surveys.

Based on surveys conducted in six of the springs in the Spring Valley groundwater development areas (Blind, Layton, North Millick, South Millick, South Bastian, and unnamed east of Cleve Creek), these waterbodies support fairly diverse and abundant macroinvertebrate communities (BIO-WEST 2009, 2007). Chironomid midges, oligochaete worms, amphipod crustaceans, dragonfly larvae, and ostracod crustaceans were the most abundant taxonomic groups. Mollusks also were present in most springs. The total number of taxa ranged from approximately 6 to 40. Macroinvertebrate abundances ranged from approximately 2,000 to 17,000 organisms per composite D-frame sampler. Springsnails, such as the Toquerville pyrg, also were present in two springs, an unnamed spring south of Caine Spring in Snake Valley and an unnamed spring east of Cleve Spring in Spring Valley.

Two additional springs, West Spring Complex #1 in Spring Valley and Caine Spring in Snake Valley, are located just outside the groundwater development area boundaries. The approximate distances from the development area boundaries are 20 feet and 170 feet, respectively. No fish were collected in either of these springs. Macroinvertebrate communities in these two springs were moderately diverse and abundant (17 taxa and mean density of 12,480 invertebrates/sample in Caine Spring and 29 taxa and mean density of 5,574 invertebrates/sample in West Valley Complex #1) (BIO-WEST 2007). The most abundant taxonomic groups included amphipod crustaceans and ostracods. Springsnails (Toquerville pyrg) were present in both springs.

Of the springs located within the groundwater development areas (**Figures 3.7-4** and **3.7-5**), amphibians (i.e., northern leopard frog) were observed in three springs (Blind, North Millick, and South Millick) in Spring Valley (BIO-WEST 2009, 2007). Potential suitable habitat may exist for other amphibian species in springs with perennial flow, as well as ephemeral (seasonal) waterbodies within the groundwater development areas. Examples of springs with perennial flow include Four Wheel Drive, Layton, North Millick, South Millick, and South Bastian. Regarding the two springs located just outside of the groundwater development areas (Caine Spring in Snake Valley and West Valley Complex #1 in Spring Valley), the northern leopard frog was collected in the West Valley Complex #1 (BIO-WEST 2007).

Figure 3.7-4 Springs with Aquatic Biological Resources (North)

Figure 3.7-5 Springs with Aquatic Biological Resources (South)

Table 3.7-2 Biological Surveys Conducted in Springs Within the Groundwater Development Areas

Basin/Spring	Fish Present?	Northern Leopard Frog Present?	Springsnails Present?
Delamar			
Grassy Spring	No	No	No
Snake			
North Little Spring	No	No	No
Unnamed spring #2 north of Big Springs	No	No	No
Unnamed spring south of Caine Spring	No	No	Yes
Spring			
Blind	No	Yes	No
Four Wheel Drive	No	No	No
Layton Spring	No	No	No
North Millick Spring	No	Yes	No
South Bastian Spring	No	No	No
South Millick Spring	No	Yes	No
The Seep	No	No	No
Unnamed spring east of Cleve Creek	No	No	Yes

Source: BIO-WEST 2009, 2007; SNWA 2009, 2008

Ephemeral Pools and Playas

A number of ephemeral pools and playas are located in the groundwater development areas. Since the majority of these habitats hold water only briefly (i.e., they are rainfall dependent), they typically contain fewer taxa. However, when they hold water, ephemeral pools support an abundance of aquatic invertebrates, which are an important food source for migratory birds (Wildlife Action Plan Team 2006). They also play a crucial role in maintaining populations of aquatic invertebrates, such as brine, fairy, and tadpole shrimp, in desert systems, as well as providing breeding habitat for amphibians such as the Great Basin spadefoot (Wildlife Action Plan Team 2006).

Special Status Aquatic Species

Based on a review of occurrence data (Baker 2008; BIO-WEST 2009, 2007; NNHP 2006; Hershler and Sada 2002; Sada 2007a,b; Sada and Vinyard 2002; UNHP 2005), the potential occurrence of special status aquatic species was identified for the groundwater development areas. Species occurrence, by basin area, is provided in **Appendix F**, **Table F3.7-1**. **Figures F3.6-1** and **F3.6-2** (**Appendix F**) show the occurrence of federally listed species in the study area. Scientific names of aquatic species also are provided in **Appendix F**, **Table F3.7-1**.

Streams

Within the five groundwater development areas, one stream (Big Wash in Snake Valley) contains Bonneville cutthroat trout, a BLM sensitive species. One perennial stream, Big Springs Creek in Snake Valley, contains native species such as redside shiner, speckled dace, mottled sculpin, Utah sucker, and Utah chub. Although these fish species have no special status designation, they are considered unique because of their limited occurrence in Nevada.

Springs

No special status fish species have been collected in springs within the groundwater development areas, based on surveys conducted by BIO-WEST (2009, 2007).

Three springs within the Spring Valley groundwater development area (Blind, North Millick, and South Millick) contain known populations or suitable habitat for the special status amphibian species, northern leopard frog (**Figure 3.7-4**). This species has been petitioned for federal listing and is currently under a status review. The springs provide habitat for breeding and early life-stage development. In addition, northern leopard frog is present in the West Valley Complex #1, which is located just outside of the groundwater development in Spring Valley.

One group of aquatic species (springsnails) has been documented in the groundwater development areas in two basins: Snake and Spring (BIO-WEST 2009, 2007). The petitioned springsnails (bifid duct and longitudinal gland prygs) have been collected in Big Springs and an unnamed spring north of Big Springs, which are located approximately 300 feet from the groundwater development boundary in Snake Valley.

Springsnails are considered a special status group of mollusks because of their restricted distribution and native origin. Many species of springsnails are endemic to one or two spring complexes and are considered BLM sensitive and species of concern in Utah and Nevada. Additional information on springsnails, including those petitioned for listing under the ESA, is provided in Section 3.7.1.4, Region of Study, Special Status Aquatic Species.

3.7.1.4 Region of Study

Habitats and General Aquatic Species

Streams

Fourteen game fish species, including trout hybrids, occur within the natural resources region of study, which represents a broader geographical area (**Appendix F**, **Table F3.7-2**). The species represent both coldwater (trout) and warmwater (bullhead, sunfishes, crappies, largemouth bass, and Sacramento perch) species. In total, 16 valleys or basins within the overall region of study contain one or more game fish populations. Steptoe, Spring, and Snake valleys contain the highest number of waterbodies with game fisheries. Stream and lake/reservoir habitats contain the most productive and diverse game fisheries. Trout species can utilize both stream and lake/reservoir habitats, but they require streams for spawning. Species that prefer ponds and lakes include northern pike, white crappie, bullhead (black and brown), and largemouth bass. As previously mentioned, the trout species are spring (rainbow and cutthroat) and fall (brook and brown) spawners. The warmwater species spawn in late spring or summer. Habitat and spawning periods for all game fish species are provided in **Appendix F**, **Table F3.7-3**.

A mixture of Bonneville Basin native nongame fish inhabits Big Springs Creek in the Nevada portion of Snake Valley and Lake Creek in the Utah portion of Snake Valley. The Big Springs system is considered unique because it is one of only two waters in Nevada that contain this suite of Bonneville Basin species. A survey in 2005 documented the presence of Utah chub, speckled dace, redside shiner, mottled sculpin, and Utah sucker in various reaches between the spring source and the Nevada-Utah stateline (Tallerico and Crookshanks 2005).

Big Springs Creek in Nevada is renamed Lake Creek when it enters Utah. Lake Creek flows in a northeasterly direction and provides water to Pruess Lake. Surveys conducted in Lake Creek in 2008 by BIO-WEST (2009) collected mottled sculpin, redside shiner, speckled dace, Utah sucker, and Utah chub. The most abundant species included speckled dace and mottled sculpin, which collectively comprised 59 percent of the total catch. The percent composition for the other species was 28 percent for Utah chub, 11 percent for redside shiner, and 2 percent for Utah sucker.

Stream systems in Sunnyside Creek (White River Valley) and Meadow Valley Wash (Dry and Panaca valleys) also provide habitat for native fish species. Sunnyside Creek contains populations of White River spinedace, speckled dace, and desert suckers. The upper portion of Meadow Valley Wash in Panaca and Dry valleys supports populations of Big Springs spinedace (federally threatened), speckled dace, and desert suckers, while the lower portion of Meadow Valley Wash contains dace and sucker species. Two of these species, Big Springs spinedace and White River spinedace (federally endangered), are discussed separately in the Federally Listed Species section. These stream systems provide the most extensive habitats for speckled dace and desert sucker subspecies within the larger region of study.

Based on fish surveys conducted in the GBNP, game fish composition and abundance is available for Lehman, Baker, and Snake creeks (GBNP 2007). The number of game fish species in the surveyed reaches ranged from one to two species in Snake Creek (brown and brook trout) to three species in Lehman and Baker creeks (brook, brown, and rainbow trout). Trout abundance varied depending on the stream and location of the survey reach. When considering surveys conducted since 2000, the following ranges in abundances were reported for these streams: lower reaches of Baker Creek (300 to 600 fish/mile), lower reaches of Lehman Creek (2,100 to 3,000 fish/mile), and Snake Creek (2,500 to 3,200 fish/mile).

Three streams within the GBNP, South Fork Big Wash, Strawberry, and Snake creeks, also contain native nongame fish species such as mottled sculpin, speckled dace, and redside shiner. Native fish species are considered species of management concern due to their native origin and limited distribution within the GBNP and the general region.

A key source of information for characterizing stream macroinvertebrate communities within the region of study is the GBNP (2007). Macroinvertebrate communities in Lehman and Snake creeks were previously discussed in the ROW and groundwater development sections. In addition, macroinvertebrate surveys were conducted in Baker Creek in 1997 and 1998. Mayflies were the most abundant major taxonomic group in Baker Creek. Based on these surveys, macroinvertebrate communities are considered moderately abundant and diverse, as indicated by a mean density of 4,123 invertebrates/meter^2 and a total of 68 taxa.

Macroinvertebrates also are present in six caves within the GBNP that contain flowing water. These include Model, Ice, Wheeler's Deep, and System's Key caves in the Baker Creek watershed; Squirrel Spring Cave in the Snake watershed; and the Water Trough Cave in the Can Young watershed (Baker 2009, 2007). Taxonomic groups that have been collected in surface water habitat include mollusks, mayflies, caddisflies, stoneflies, trueflies, springtails, copepods, ostracods, oligochaete worms, and flatworms. Unique cave-dwelling species in close contact with water were collected in Model Cave, where a Nevada state record earthworm (*Haplotaxis gordiodes*) was found along with possible new species of an ostracod and an amphipod (S. Taylor, personal communication, as cited in Baker 2009).

Springs

Spring habitats, which include wetlands and riparian areas, are scattered throughout Clark, Lincoln, Nye, and White Pine counties in Nevada and Beaver, Millard, Juab, and Tooele counties in Utah (**Figures 3.7-4** and **3.7-5**). Spring habitat includes riparian and wetland habitats (Nevada Natural Resources Department 2008). In arid areas such as the Great Basin, springs provide a reliable source of water that represents important habitat for aquatic species. As a result of their consistency as water sources, spring systems are considered "biodiversity hotspots" that are critical to the survival and persistence of numerous plant and animal species (Sada and Vinyard 2002). In addition, the Great Basin's hydrologic history has resulted in many of these spring systems being fragmented and isolated from adjacent springs. This situation has contributed to the presence of unique and endemic aquatic species.

Springs and associated wetlands do not support diverse game fish populations. Springs are often small and shallow and do not typically support trout species or other large predatory fish. Smaller game fish, such as green sunfish and bluegill, are present in some spring habitats. The only known occurrences of trout species in spring habitats within the region of study were noted in Swallow Spring in Spring Valley and Rowland Spring and an unnamed spring near Strawberry Creek in Snake Valley, where rainbow or brook trout have been reported (BIO-WEST 2009; Dickinson 2010).

Within the region of study, information on fish occurrence in spring habitats is provided in reports by BIO-WEST (2009, 2007) and occurrence data in the Natural Resources Baseline Summary Report (ENSR/AECOM 2008). Fish communities are known to occur in springs within the following region of study basins: Fish Springs, Spring (#184), Snake, Steptoe, Muddy River Area, White River, Pahranagat, and Panaca (**Appendix F**, **Table F3.7-4**). White River Valley contains the largest number of springs with fish populations. In general, the number of species ranges from one to four. Native species in these springs are represented by Utah chub, least chub, relict dace, speckled dace and subspecies, mottled sculpin and subspecies, desert sucker subspecies, springfishes, and Pahrump poolfish. Many of the native fish species occurring in theses springs are special status species, which are discussed in Special Status Aquatic Species. The occurrence of federally listed species in spring habitats (e.g., White River spinedace within the Flag Spring complex in White River Valley) is discussed in the *Federally Listed Species* section.

Nonnative fish species, such as western mosquitofish, guppy, shortfin molly, convict cichlid, and common carp, have been introduced into waters within the study area (BIO-WEST 2007). These nonnative species have caused population declines in numerous waterbodies that are inhabited by rare endemic species. Many native species, including northern leopard frog and White River springfish, are threatened by nonnative species (Wildlife Action Plan Team 2006).

Macroinvertebrate and springsnail surveys were conducted in springs within the following region of study basins by BIO-WEST (2009, 2007): Tule, Fish Springs, Snake, Pleasant, Spring (#184), Lake, White River, Dry Lake, Delamar, Pahranagat, and Panaca. Macroinvertebrate diversity varied in the springs from approximately 4 to 44 taxa. The most abundant taxa typically included amphipods, ostracods (seed shrimp), and chironomid midges. Other taxonomic groups that were present in most springs included damselfly larvae, mayfly, stonefly, caddisfly larvae, oligochaete worms, and beetles. Springsnail occurrence in these springs is discussed in Special Status Aquatic Species, Aquatic Invertebrates.

A variety of nonnative invertebrate species have become established in aquatic habitats within the study area. These include red swamp crayfish and red-rimmed melania snail. Crayfish adversely affect warmwater fauna by feeding on early life stages of fish and amphibians, and also on adult life stages of small-bodied fish (most of the federally listed fish in Nevada) (Wildlife Action Plan Team 2006).

Springs also provide habitat for amphibians. Springs are numerous and widely distributed throughout the study area, although they are more abundant north of Clark County, Nevada. They vary greatly in size and quality of habitat. Many have been damaged by livestock, had their water diverted for human use, or were otherwise altered. Introduced aquatic species are present at many springs and have impacted native amphibian populations. Toads use the moist and vegetated areas for feeding, breeding, and shelter. Frogs, including introduced bullfrogs, may be found in springs year-round and may overwinter under water in colder areas. The following species occur within the region of study area springs: Arizona toad, bullfrog, Great Basin spadefoot, red-spotted toad, Woodhouse’s toad, Pacific chorus frog, northern leopard frog, relict leopard frog, and Columbia spotted frog (SNWA 2008; NatureServe 2007).

At least two nonnative amphibian species have been documented within the region of study: tiger salamanders and bullfrogs. These are considered to be exotic species in Nevada (BIO-WEST 2007; NatureServe 2007). Aside from springs, both species potentially occur in all aquatic habitat types within the study area (NatureServe 2007). As mentioned for crayfish, bullfrogs also prey on other amphibians and small-size fish. Bullfrogs inhabit permanent waterbodies throughout the year.

Shoshone Ponds

The region of study also includes a series of man-made ponds located in Spring Valley, White Pine County, Nevada, referred to as the Shoshone Ponds Native Fish Refugium. The refugium was established in the 1970s as a cooperative effort between the NDOW and the BLM Ely Field Office to help conserve and recover native fishes. Aquatic habitat consists of three small ponds that are fed by an artesian well within a fenced enclosure (**Figure 3.7-6**). A larger earthen pond (referred to as Stock Pond) is located outside of the enclosure and is maintained by a separate artesian well. Three of the ponds are inhabited by the federally listed Pahrump poolfish. Other special status species in the Shoshone Ponds area include relict dace (South Pond) and northern leopard frog.

Lakes/Reservoirs

Aquatic habitat also is provided by numerous lakes, reservoirs, and ponds within the region of study (**Appendix F**, **Table F3.7-5**). In total, one or more named lakes or reservoirs occur in the following basins: Deep Creek, Wah Wah, Pine, Spring (#201), Snake, Steptoe, Clover, Dry Lake, Patterson, Lake, Lower Moapa, White River, Pahranagat, and Las Vegas. The highest number of named lakes and reservoirs is located in the Snake and Steptoe hydrologic basins. Habitat for game fish occurs in Las Vegas, Pahranagat, White River, Lower Moapa, Spring (#201), Dry, Steptoe, Panaca, Rose, and Snake (**Appendix F**, **Tables F3.7-2** and **F3.7-5**). These waterbodies also provide occupied habitat for native and introduced fish species, invertebrates, and amphibians. The margins and nearshore areas of these waterbodies often provide feeding areas, cover, and breeding areas for fish and amphibians. Occurrence of other sensitive aquatic species in lakes or reservoirs includes Lahontan cutthroat trout in Baker Lake and California floater in Pruess Lake. Further discussion of sensitive aquatic species is provided in the subsequent section.

Figure 3.7-6 Shoshone Ponds Area, Spring Valley, Nevada

Special Status Aquatic Species

The occurrence of special status aquatic species within the natural resources region of study is listed by basin in **Appendix F**, **Table F3.7-1**. The list includes over 50 species of fish, amphibian, and invertebrate species with federal, state, or BLM special status. The study area contains habitat for seven federally listed species. The occurrence of the federally listed fish species within the region of study is shown in **Appendix F**, **Figures F3.6-1** and **F3.6-2**. Two of these species (White River springfish and Hiko White River springfish) occur in spring habitats. Pahrump poolfish inhabit a man-made refugium (Shoshone Ponds) that is fed by artesian wells. The other four species (Pahranagat roundtail chub, Big Springs spinedace, White River spinedace, and Moapa dace) use springs or stream habitats. Critical habitat has been designated for four of the fish species (White River springfish, Hiko White River springfish, White River spinedace, and Big Springs spinedace). A summary of the occurrence information for the federally listed species is provided below. Additional habitat and life-history information is provided in **Appendix F**, **Table F3.7-6**. Management guidance for special status fish and amphibian species is described in recovery plans, habitat-management plans, and conservation agreements (**Table 3.7-3**). This section is followed by a summary of the BLM Sensitive Species or groups, with more detailed discussions for those species with conservation agreements or public scoping interest.

Table 3.7-3 Management Guidance for Special Status Fish and Amphibian Species

Species	Status	Plan/Citation
Pahrump poolfish	FE, NVP	Recovery Plan Pahrump Killifish (USFWS 1980)
Big Springs spinedace	FT, NVP	Big Springs Spinedace Recovery Plan (USFWS 1993a); Big Springs Spinedace Monitoring and Nonnative Species Control Plan (NDOW 1999a); Big Springs Spinedace Recovery Implementation Plan (Draft) (NDOW 1999b); Condor Canyon Habitat Management Plan (Guerrero et al. 1989); Determination of Threatened Status and Critical Habitat for Big Springs Spinedace (USFWS 1985a)
Hiko White River springfish White River springfish Pahranagat roundtail chub White River speckled dace White River desert sucker	FE, NVP FE, NVP FE, NVP BLM, NVP BLM, NVP	Recovery Plan for the Aquatic and Riparian Species of Pahranagat Valley (USFWS 1998); White River Valley Native Fishes Management Plan (NDOW 2000), Pahranagat Valley Native Fishes Management Plan (NDOW 1999c); Final Rule to Determine Endangered Status and Critical Habitat for White River Springfish and Hiko White River Springfish (USFWS 1985b)
Moapa dace	FE, NVP	Recovery Plan for Rare Aquatic Species of the Muddy River Ecosystem (USFWS 1995)
White River spinedace Virgin River chub Moapa White River springfish Moapa Speckled dace	FE, NVP NVP NVP NVP	White River Spinedace Recovery Plan (USFWS 1994a); Determination of Endangered Status and Determination of Critical Habitat for White River Spinedace (USFWS 1985c); White River Valley Native Fishes Management Plan (NDOW 2000)
Bonneville cutthroat trout	BLM, USFS, NVP, UTSC, CA, GF	Conservation Agreement and Conservation Strategy for Bonneville Cutthroat Trout in the State of Nevada (NDOW 2006); Range-Wide Conservation Agreement for Bonneville Cutthroat (Utah) (Lentsch et al. 2000)
Least chub	C, UTSC, CA	Conservation Agreement and Strategy for the Least Chub in the State of Utah (Bailey et al. 2007)
Northern leopard frog	P, BLM, NVP	Northern Leopard Frog: A Technical Conservation Assessment (Smith and Keinath 2007)
Relict leopard frog	C, NVP, CA	Conservation Agreement and Rangewide Conservation Assessment and Strategy for the Relict Leopard Frog (Relict Leopard Frog Conservation Team 2005)
Columbia spotted frog	NVP, UTSC, CA	Conservation Agreement and Strategy for the Columbia Spotted Frog (*Rana lutreventris*) in the State of Utah (Bailey et al. 2005)

Status: FE = Federally endangered; FT = Federally threatened; C = candidate; P = petitioned for federal listing; BLM = BLM sensitive species; NVP = Nevada Protected; NLD = No special status but species has limited distribution in Nevada; UTSC = Utah Special Concern; CA = Conservation agreement species; USFS = Forest Service sensitive species; and GF = game fish species.

Federally Listed Species

Pahrump Poolfish (Federally Endangered) (Spring Valley). This species was originally called the Pahrump killifish, but it was assigned the common name *poolfish* in 1991. Historically, separate populations occurred in three springs in Pahrump Valley in Nye County. Two of these populations are extinct (Pahrump Ranch and Raycraft Ranch). The Manse Ranch Spring population was extirpated in 1975, but it was transplanted to other sites to provide refugia populations. Presently, introduced populations exist in an irrigation reservoir fed by Sandstone Spring (Spring Mountain Ranch State Park, Clark County), a refuge tank facility at Corn Creek (Clark County), and man-made ponds maintained by artesian wells in Shoshone Ponds (White Pine County). Pahrump poolfish are present in three of the four ponds (North Shoshone, Middle Shoshone, and Stock Ponds) within the Shoshone Ponds Native Fish Refugium (**Figure 3.7-6**). No critical habitat has been designated for Pahrump poolfish, but a recovery plan was prepared in 1980 (USFWS 1980). Population numbers in North and Middle Shoshone Ponds during 2008 and 2009 ranged from approximately 200 to 250 fish. Numbers were higher in the Stock Pond (approximately 2,200 in 2008 and 3,800 fish in 2009 (Hobbs 2009).

Hiko White River Springfish (Federally Endangered) (Pahranagat Valley). This species occupies pools in Hiko and Crystal springs in the Pahranagat Valley, Lincoln County (USFWS 1998). This species was extirpated from Hiko Spring in 1967 but reintroduced in 1984. These springs and their associated open outflows were designated as critical habitat for this species in 1985.

Pahranagat Roundtail Chub (Federally Endangered) (Pahranagat Valley). Historically, Pahranagat roundtail chub occurred in Crystal Spring, Hiko Spring, Ash Spring, and the Pahranagat River in Lincoln County, Nevada (Stein et al. 2001). The present distribution of this species is limited to a small section of Pahranagat Creek on private land. A population also is maintained at the Dexter National Fish Hatchery and Technology Center in Dexter, New Mexico. A new refugium was established for this species in 2004, at the Key Pittman WMA near Hiko, Nevada. A total of 2,400 individuals were stocked in the former irrigation reservoir, which was lined and filled with well water. No critical habitat has been designated for this species, although the species was included in a recovery plan for aquatic and riparian species in the Pahranagat Valley (USFWS 1998).

White River Springfish (Federally Endangered) (Pahranagat Valley). Historic and present distributions of White River springfish are restricted to Ash Spring and its outflow in Pahranagat Valley, Lincoln County, Nevada. The majority of the population is found in the pool; however, fish occasionally occur in the outflow stream (Tuttle et al. 1990). Designated critical habitat includes Ash Spring (Lincoln County, Nevada), its outflow, and the surrounding land for a distance of 50 feet (USFWS 1998).

White River Spinedace (Federally Endangered) (White River Valley). Historically, the White River spinedace occurred in the White River, near the confluence with Ellison Creek in White Pine County and below Adams-McGill Reservoir in Nye County (USFWS 1994a). Historic distribution also included springs in White Pine County (Preston Big, Cold, Nicholas, and Arnoldson) and Nye County (Flag). The present distribution for this species is limited to Flag Springs and the upper portion of Sunnyside Creek, which includes a series of three springs and a stream segment in the Kirch WMA (USFWS 1994a). This species has been introduced into Indian Ranch Spring. Critical habitat was designated for three springs and their outflows, plus the surrounding land areas at a distance of 48 feet (Preston Big Springs and Lund Spring in White Pine County and Flag Springs in Nye County).

Moapa Dace (Federally Endangered) (Muddy River Springs Area). The Moapa dace is endemic to the upper Muddy River and tributary thermal spring systems within the Warm Springs area (USFWS 1995). The Moapa Valley Refuge was established in 1979 to secure habitat for Moapa dace. Historically, this species inhabited approximately 25 individual springs and 10 miles of stream habitat. The present population consists of approximately 6 miles of stream channel, supported by flow from 6 thermal springs (Nevada State Parks 2007; USFWS 1995). The types of habitat used by this species in the Warm Springs area include spring pools, spring outflows, and the mainstem portion of the Muddy River (USFWS 1995). Habitat restoration has been implemented to improve the cover and the configuration of pools, riffles, and runs (Nevada State Parks 2007). A recent MOA regarding the groundwater withdrawal of 16,100 afy from the regional aquifer in Coyote Spring and California Wash basins established minimum instream flow levels that trigger conservation actions for the Moapa dace (USFWS 2006). The flow levels will be measured at the Warm Springs West Flume in the Moapa Valley NWR. Under the MOA, SNWA, the Moapa Valley Water District, and Coyote Springs Investments would restrict groundwater pumping from the Coyote Basin, if flow levels at the Warm Springs West Flume decline below 3 cfs. Details of the conservation measures that the SNWA is to implement as part of the MOA (USFWS 2006) are described in the Coyote Spring Well and Moapa Transmission System Project Final Environmental Assessment (SNWA 2007b).

Virgin River Chub (Nevada Protected) (Muddy River Springs Area, Lower Moapa, and California Wash Valleys). The Virgin River chub occurs within the Muddy River in Nevada and the mainstem portion of the Virgin River from Pah Tempe Hot Springs, Utah, downstream to the confluence with Lake Mead in Nevada (USFWS 1994b). The recovery needs of the Moapa population are covered in a separate plan (USFWS 1995). The Muddy River population is not considered to be part of the federal listing at this time. However, a proposed rule change regarding federal listing is under review by the USFWS. The present distribution of this species in the Muddy River extends from the Warm Springs area downstream to the Wells Siding Diversion (approximately 8 miles below the Meadow Valley Wash confluence). This species is usually associated with deep runs or pool habitats that have slow to moderate velocities and an abundance of cover provided by boulders, undercut banks or woody debris (USFWS 1995; USFWS 1994b). Spawning is suspected to occur in April through June (USFWS 1995).

Big Springs Spinedace (Federally Threatened) (Panaca and Dry Valleys). The present distribution of this species is restricted to a 4-mile section of Upper Meadow Valley Wash called the Condor Canyon reach, which is northeast of Panaca, Nevada. The boundaries of the occupied habitat area are defined by perennial flow. A barrier that consists of a falls at the north end of the canyon restricts movement. A second falls exists near private property, which also is a barrier to fish movement. Previous surveys in Upper Meadow Valley Wash showed that the species occurred throughout most of the canyon. Currently, the largest numbers of Big Springs spinedace exist below the barrier falls, near the Delmue property. Critical habitat also was designated for the species in a 4-mile section of Meadow Valley Wash (above and within Condor Canyon) in Lincoln County near Panaca, Nevada (USFWS 1985a).

Bureau of Land Management Sensitive Species Fish

In total, 14 additional BLM sensitive or state-protected fish species occur within the overall region of study. The state-protected and the BLM sensitive fish species lists are generally the same (**Appendix F**, **Table F3.7-1**). All of these fish species are native to Nevada or Utah. The Bonneville cutthroat trout is associated with stream habitat. The other sensitive fish species are associated with spring environments (springfishes) or use both stream and spring habitats (dace and sucker species). Occurrence and habitat information is summarized below for the Bonneville cutthroat trout and least chub, two BLM sensitive species with conservation agreements. Habitat and life history information for the other special status species is provided in **Appendix F**, **Table F3.7-6**. The occurrence of special status fish species within the region of study springs is listed in **Appendix F**, **Table F3.7-7**.

Bonneville Cutthroat Trout. The Bonneville cutthroat trout was petitioned for listing under the ESA, but the 12-month finding determined that the species was not warranted for listing under the ESA. This species was associated with Lake Bonneville, which covered parts of southern Idaho, eastern Nevada, southwestern Wyoming, and western Utah during the late Pleistocene era. Remaining populations became isolated in remaining headwaters and streams within the Bonneville drainage basin; an estimated 90 percent of these rivers and streams in the basin once had populations of Bonneville cutthroat trout. Within the region of study, Bonneville cutthroat trout occurs in perennial streams within Steptoe, Snake, Spring (#184), and Deep Creek valleys (**Appendix F**, **Table F3.7-1**). This species is only native to drainages in Snake and Deep Creek valleys. Populations in the other two valleys are introduced and outside of their historic range. In Nevada, Snake and Silver creeks and their associated tributaries have been proposed as reintroduction streams.

Least Chub. The least chub was petitioned for listing under the ESA in 2007. The USFWS conducted a 12-month status review and released their finding in June 2010 (USFWS 2010). The USFWS determined that the status of the least chub was “warranted but precluded” and it was identified as a candidate species. This species is endemic to the Bonneville Basin of Utah where it was once widely distributed and occupied a variety of habitats including rivers, streams, springs, ponds, marshes, and swamps (Sigler and Sigler 1983). Currently, there are five known wild, extant populations of least chub; three are in Snake Valley in Utah’s West Desert (Leland Harris Spring Complex/Miller Spring, Gandy Salt Marsh Complex, and Bishop Springs Complex). Least chub also were transplanted into Walter’s and Deadman springs in the Fish Springs NWR in 1995 and 1996 (Bailey et al. 2007) and Ibis and Pintail ponds in 2006 and 2007. Least chub introduced to Walter and Deadman springs (Fish Springs Flat) were replaced by mosquitofish. The USFWS considers these sites to be extirpated and unsuccessful. Since the transplantation and the completion of the initial Least Chub Conservation Agreement Strategy in 1998, the UDWR has had an ongoing monitoring program for least chub populations in Utah. This species has not been found in Deadman Spring since 1999 and the last observation at Walter's Spring occurred in 2001 (BIO-WEST 2007). Ibis and Pintail ponds have been monitored since their introduction. Although least chub has not been collected during monitoring, it could be present due to the large habitat area. The Snake Valley waterbodies also are used by other native fish species such as Utah sucker, Utah chub, speckled dace, redside shiner, and mottled sculpin (BIO-WEST 2007).

Amphibians. Five special status amphibian species were evaluated in terms of potential occurrence within or near the region of study: Columbia spotted frog, northern leopard frog, relict leopard frog, Arizona toad, and western toad. Western toad was eliminated from further consideration, since it does not occur in the natural resources region of study. A summary of their occurrence within the overall region of study is described below with spring locations shown in **Figures 3.7-4** and **3.7-5** and listed in **Appendix F**, **Table F3.7-1**.

- Columbia Spotted Frog – This species was placed on a candidate list in 1993 (USFWS 1993b). After the Candidate Notice of Review was completed in 1999, the West Desert population was taken off the candidate list (USFWS 1999). Based on surveys or distribution accounts by BIO-WEST (2007) and Bailey et al. (2005), the Columbia spotted frog occurs in springs or wetlands within Tule Valley (Coyote, South Tule, Tule, and Willow), Snake Valley (Leland Harris, Twin, Beck Springs North, Gandy Salt Marsh, and Miller), and Deep Creek Valley (unnamed wetlands in the valley floor). The population in this geographical area is considered part of the West Desert population, which is not a federal candidate.
- Northern Leopard Frog – This species has been petitioned for listing under the ESA. A 90-day finding was issued and a 12-month status review is being conducted to determine if listing the species in the western part of its range is warranted (USFWS 2009). Records for the northern leopard frog include springs in Fish Springs Flat Valley (Crater, House, Lost, and South), Snake (Gandy Marsh and Bishop Springs complexes and private land in the community of Gandy), Spring Valley (Blind, Cleveland Ranch, Keegan Ranch Complex, Shoshone Ponds area, McCoy Creek Ranch, North Millick, South Millick, Minerva Complex, West Spring Complex, and unnamed #5), Lake Valley (Wambolt Complex and Geyser Spring), and Pahranagat Valley (L and Maynard) (BIO-WEST 2009, 2007; SNWA 2009). This species also occurs in wet meadows within the Shoshone Ponds area. Water in the wet meadows is maintained by free-flowing artesian wells. Maynard Spring in Pahranagat Valley currently is being evaluated as a translocation site for this species.
- Relict Leopard Frog – This amphibian is a federal candidate species. Records for relict leopard frog include springs and wetlands in the Black Mountains Area (Blue Point, Gnatcatcher, and Rogers).
- Arizona Toad – This species, also commonly referred to as the southwestern toad, is found in scattered localities throughout southeastern Utah and southern Nevada. Within the region of study, it is primarily limited to Clark and Lincoln counties (NatureServe 2007). It has been collected in standing water with marsh or riparian vegetation within Meadow Valley Wash (BIO-WEST 2005).

Habitat for special status amphibians includes rivers, streams, lakes, reservoirs, springs, and wetlands during at least a portion of their development. Most amphibian species found within the study area use springs, and all special status amphibians may use springs in some capacity. All special status amphibian species found within the study area use riverine or stream environments to varying extents. Riverine habitats are used for feeding and cover. Undercut stream banks are used by Columbia spotted frogs as overwintering sites (Wildlife Action Plan Team 2006). The northern leopard frog uses underwater areas as over winter habitat. Arizona toads prefer streams for breeding.

Aquatic Invertebrates

Nine BLM sensitive aquatic invertebrates are present within the natural resources region of study (**Appendix F**, **Table F3.7-1**). The BLM sensitive species include California floater, the Pahranagat naucorid bug, the Moapa Warm Springs riffle beetle, and six snails or springsnails (**Appendix F**, **Table F3.7-1**). The California floater (Utah portion of Snake Valley) is the only invertebrate that occurs in larger rivers, streams, or lakes such as Pruess Lake in Snake Valley. This mollusk also has been reported from Redden Spring (north of Callao) in the Utah portion of Snake Valley. The Pahranagat naucorid bug lives among aquatic vegetation in spring and stream reaches in the White River drainage (USFWS 1998). The Moapa Warm Springs riffle beetle is restricted to the Warm Springs area within the Muddy River Valley (USFWS 1995).

Springsnails (or pyrgs), including the genera *Pyrgulopsis*, *Stenelmis*, and *Tryonia*, occur within the region of study and constitute the rarest and most unique macroinvertebrate fauna in the area. Springsnails are a group of mollusks found in perennial springs and seeps and usually are confined to the spring source and immediately downstream in the stream brook. Presence of species in this group is considered an important indicator of spring health. While springsnails as a whole can exist in a range of habitats, individual populations have been isolated by the distances between springs and seeps, and have become highly specialized to their habitats. Snails and springsnails have been reported from 17 of the basins within the overall region of study (**Appendix F**, **Table F3.7-1**). Springsnail occurrence within the region of study is listed in **Appendix F**, **Table F3.7-7**. The list of springsnail species includes those considered to be BLM sensitive or special status in Nevada or Utah. Other springsnail species are included in the list because they have limited distribution in Nevada or Utah.

Six of the BLM sensitive springsnails and an additional 20 springsnail species have been petitioned for federal listing (**Appendix F**, **Table F3.7-1**). The current status of the petitioned species is that the USFWS negotiated a stipulated agreement with Wild Earth Guardians that postpones a 12-month decision until the end of FY 2012 or early FY 2013 for four of the petitioned species that occur in the region of study (bifid duct pyrg, longitudinal gland pyrg, Hamlin Valley pyrg, and sub-globose Snake pyrg). The other petitioned species were included in a separate petition from the Center for Biological Diversity (2009). A 90-day finding on these species has not yet been published in the Federal Register.

The distribution of the petitioned springsnail (pyrg) species within the region of study is summarized by three categories, as listed below. Specific occurrence by springs is included in the impact analysis in Section 3.7.2, Environmental Consequences.

- Occurrence limited to one spring in one basin – Butterfield pyrg, Camp Valley pyrg, Emigrant pyrg, flat-topped Steptoe pyrg, Hamlin Valley pyrg, Lake Valley pyrg, Landyes pyrg, neretiform Steptoe pyrg, and sub-globose Snake pyrg.
- Occurrence in multiple springs in one basin – Corn Creek pyrg, Hubbs pyrg, longitudinal gland pyrg, Moapa pebblesnail, Moapa Valley pyrg, northern Steptoe pyrg, southeast Nevada pyrg, Spring Mountains pyrg, and White River Valley pyrg.
- Occurrence in multiple springs in multiple basins – Bifid duct pyrg, Flag pyrg, grated tyronia, Hardy pyrg, and Pahranagat pebblesnail.

Culturally Significant Fish

As indicated by the Confederate Tribes of the Goshute Reservation (Steele 2010), the region of study contains streams with various species of fish that are considered culturally significant in terms of food resources, spiritual resources, and traditional values. The occurrence of culturally significant fish species also would apply to other aboriginal territories used by the Western Shoshone, Chemehuevi, Southern Paiute, Hualapai, and Mojave Tribes. It is assumed that the fish would include native and non-native species.

3.7.2 Environmental Consequences

3.7.2.1 Rights-of-way

Issues

The following issues for aquatic biological resources are discussed as part of the impact analysis for ROW construction and facility maintenance.

The number and type of waterbodies that are crossed or are located within project ROWs are an important impact parameter.

- Potential loss of individuals or habitat from short-term disturbance of stream channels by construction equipment.
- Potential loss of individuals or habitat from sediment delivery.
- Potential effects on fish spawning from habitat alteration.
- Effects of water use for hydrostatic testing and dust control on aquatic biota and their habitat.
- Potential damage to aquatic habitat and biota from fuel spills reaching a waterbody directly or leaching through soils.
- Potential direct mortalities to amphibians from vehicle traffic.
- Compliance with management objectives defined in recovery plans, conservation agreements, and state wildlife action plans for special status aquatic species.
- Potential effects on fish species traditionally used as food by regional Tribes.
- Short-term disturbance to aquatic habitat and species during pipeline and transmission line facility maintenance activities.

Assumptions

The following assumptions were used in the impact analysis for aquatic biological resources:

- Identification of aquatic habitat potentially affected by project actions focused on waterbodies that support aquatic species on a persistent basis throughout the year (perennial streams, springs, lakes, and reservoirs).
- Temporary (seasonal) waterbodies were considered in the ROW construction analysis, since they are used for amphibian breeding and early life stage development.
- Temporary access roads and permanent roads would be located within the ROWs except for two 14-mile segments. No new road disturbance outside the ROWs would occur as a result of roads. The two 14-mile road segments do not cross perennial streams, springs, or wetlands.

Methodology for Analysis

Construction surface disturbance impacts were evaluated for each alternative using the following methods:

- The pipeline and transmission line ROWs were mapped along with access roads and other surface facilities. The location of these project facilities were related to perennial streams, ponds, lakes, and springs that are located within the corridors and footprint of the project facilities.
- For those waterbodies located within the ROWs, the affected environment section was used to identify the presence of game fish, native fish, and special status aquatic species.
- Literature information and the applicant's POD were used to describe the types of impacts that would result from pipeline and transmission line construction activities.
- As part of the impact analysis, impact parameters were used in combination with effects information for the purpose of quantifying impacts and as impact indicators. The impact parameters also allow comparison among alternatives or groups of alternatives. Examples of impact parameters for aquatic resources included the number of waterbodies with game fisheries or special status aquatic species that are located within the pipeline and power line ROWs.

3.7.2.2 Proposed Action, Alternatives A through C

Construction and Facility Maintenance

Pipeline construction would cross one perennial stream (Snake Creek in Snake Valley) that contains game fisheries and special status aquatic species (**Figure 3.7-2**). One other waterbody, Big Wash, would be crossed by the pipeline ROW in a section that is classified as an ephemeral stream. Water would be present in Big Wash during a high water year. Open-cut trenching or jack and bore techniques would be used at the Snake Creek and Big Wash crossings in the Nevada portion of Snake Valley. Details on the construction procedures for stream crossings are provided in the POD. Open-cut trenching could result in impacts to aquatic biota, as discussed below for the habitat alteration, fish spawning, and water quality impact issues.

No springs would be crossed by the pipeline ROW. However, four springs are located within 500 feet and downgradient of the pipeline corridor. Three of these springs are unnamed and have not been inventoried for aquatic biological resources. The other spring (Big Springs in Snake Valley) is located 320 feet downgradient of the corridor. This spring contains fish (mottled sculpin, redside shiner, Utah sucker, Utah chub, and speckled dace) and springsnails (bifid duct pyrg and longitudinal gland pyrg) petitioned for federal listing.

Two perennial streams with game fisheries, Steptoe Creek in Steptoe Valley and Snake Creek in Snake Valley, would be crossed by a power line ROW. The Snake Creek crossing is the same corridor for the power line and pipeline ROW. Impact issues would include potential sedimentation and fuel spills and possible removal of riparian vegetation, as discussed below. No instream disturbance would result from power line construction.

A construction support area is proposed for a location adjacent to the upper portion of Lower Meadow Wash near Caliente. However, the boundary for this area is located outside of the Meadow Valley Wash floodplain. This portion of Meadow Valley Wash contains potential habitat for rainbow trout and special status fish species (Meadow Valley Wash desert sucker and speckled dace). Since facilities for this construction support area would be located outside of the Meadow Valley Wash floodplain, impacts to aquatic species and their habitat are not expected.

In general, access roads would be located within the proposed pipeline and power line ROWs. There would be no additional surface disturbance outside the ROWs for access roads with two exceptions. These include a 14-mile road (south pipeline road) in northern Delamar Valley and southern Dry Lake Valley and a 14-mile road from the Gonder Substation. Improvements involving leveling along a 20-foot ROW would be required. Both of these road segments do not cross perennial streams or springs. Therefore, no surface disturbance or water quality changes involving sedimentation would affect perennial aquatic habitat or species.

The following information discusses potential impacts of ROW construction on aquatic biological resources in terms of impact issues.

Habitat Alteration and Loss of Individuals

Trenching and backfilling within the trenchline at the Snake Creek crossing would result in the physical alteration of channel morphology including streambanks and bottom substrates. Assuming a ROW width of 200 feet and a stream width of 16 feet, the estimated instream disturbance would be approximately 3,200 square feet. Disturbance to the stream bottom could alter substrates or other types of structure that are used by fish as cover, feeding areas, or spawning. Trenching also could result in possible mortalities to macroinvertebrates and small-size fish. Large-size fish are expected to move away from the construction area to avoid instream activities and noise. Based on previous studies, macroinvertebrate communities typically recolonize disturbed areas from pipeline construction within several months (Waters 1995). The BLM BMPs would be followed regarding erosion control, limiting access roads across streams, and restoration of riparian vegetation (see management direction for Vegetation [VEG-23] and Appendix A of the FEIS for the Ely District [BLM 2008]).

Two construction techniques have been proposed for stream crossings: 1) jack-and-bore beneath the water, or 2) open-cut trenching with temporary water diversion. If the jack-and-bore technique is used, instream disturbance would not occur within the channel. A work area would be required on both sides of the stream. The open-cut trenching with temporary water diversion method would maintain flow and associated aquatic habitat in a portion of the construction area and the entire stream wetted area downstream of the Snake Creek crossing, as defined in ACM A.5.77 (**Appendix E**). There would be a temporary reduction in wetted area or aquatic habitat in the trenched area of Snake Creek. This measure also would be used at the Big Wash crossing, if water was present during construction. The presence of water at the Big Wash crossing also would result in the addition of aquatic habitat at a 2 to 1 ratio (i.e., 2 acres of comparable aquatic habitat to every 1 acre affected by construction) (ACM A.5.78). The following ;information describes these measures:

- During pipeline construction, BMPs will be implemented to minimize effects to fish from the temporary rerouting of perennial flow in Snake Creek, and in Big Wash if water is present. Practices will comply with NDOW and CWA permitting requirements (ACM A.5.77).
- Two acres of comparable habitat for every acre of lost habitat will be improved if construction across Big Wash occurs in a high water year and water is present (ACM A.5.78).

Power line construction could result in soil disturbance near Steptoe and Snake creeks, as well as possible instream habitat alteration because of any equipment crossing the stream. Impacts would be temporary and limited to the proximity of construction areas adjacent to or within the stream. The extent of bottom disturbance would be considerably less than described for pipeline trenching.

Vegetative cover along streambanks of a waterbody provides cover for fish, shading, bank stability, and increased food and nutrient supply because of the deposition of insects and vegetative matter into the watercourse. Disturbance to the streambank areas at the Snake Creek crossing may reduce cover and shading in a relatively small area (up to 100-foot wide) on each bank. Given the relatively small width of the disturbance area associated with the pipeline crossing, impacts would be considered minor relative to the entire stream system. These stream bank areas would be restored to preconstruction contours and stabilized slopes. Impacts to riparian vegetation would be reduced by implementing a 10-foot buffer strip adjacent to the pipeline ROW at the perennial stream crossing (ACM A.1.61). The details of this measure include:

- At a minimum, a 10-foot-long vegetation buffer strip or other erosion control measure such as straw bales will be maintained between the cleared ROW and an adjacent drainage high-water mark of jurisdictional drainages if the time between clearing/grading is expected to exceed 10 days or a precipitation event is forecast.

Snake Creek supports one special status species, Bonneville cutthroat trout. Perennial sections of Big Wash also contain Bonneville cutthroat trout. Construction would not affect Bonneville cutthroat trout in these streams because occupied habitat is located upstream of the proposed pipeline crossings.

The perennial stream bank disturbance area is relatively small (less than 200 foot width), minimizing the impacts from reduced cover and shading.

The power line ROW also would cross one perennial stream, Steptoe Creek, in Steptoe Valley. However, construction near this stream would not affect special status aquatic species, since none are present in this stream.

A construction support area is proposed for an area located adjacent to the upper portion of Lower Meadow Wash near Caliente. Although this section of Lower Valley Meadow Wash contains special status aquatic species (Meadow Valley Wash desert sucker, Meadow Valley Wash speckled dace, and southwestern Arizona toad [BIO-WEST 2005]), they would not be affected because surface disturbance would occur outside of the floodplain.

Conclusion. Aquatic habitat would be altered on a short-term duration by the pipeline construction in one perennial stream (Snake Creek) in Snake Valley. Ephemeral and intermittent streams such as Big Wash, Lexington Creek, and Chokecherry Creek in Snake Valley also would be crossed by the pipeline ROW. No springs would be crossed by the pipeline ROW. The BLM BMPs would reduce impacts by limiting road access across streams and restoration of riparian vegetation associated with construction and maintenance activities for this project. Loss of riparian vegetation from construction at the Snake Creek and other intermittent stream crossings would be a long-term impact. ACMs would be used to minimize habitat alteration by maintaining flow at the Snake Creek and Big Wash (if water is present) crossings, replacing affected habitat in Big Wash at a 2 to 1 ratio, and establishing a 10-foot buffer at the Snake Creek crossing. Power line construction could result in short-term disturbance (soil and instream alteration) to two perennial streams (Steptoe and Snake creeks).

Proposed mitigation measures:

ROW-AB-1: Habitat Restoration. The SNWA shall restore substrate composition to preconstruction conditions at the Snake Creek pipeline crossing using procedures approved by the BLM and the NDOW. The results shall be included in the detailed Restoration Plan to be prepared for the project. Effectiveness: This measure would be highly effective because it would restore substrate composition to preconstruction conditions. Effects on other resources: Implementation of this measure would extend the construction disturbance for a short-term period and result in temporary sedimentation.

ROW-AB-2: Avoidance of Instream Disturbance. Construction of the power line at the Steptoe Creek crossing shall avoid instream disturbance from equipment and vehicles. Effectiveness: This measure would be highly effective, since it would avoid disturbance to Steptoe Creek. Effects on other resources: There would be no effects of implementing this measure on environmental resources.

Residual impacts involving habitat alteration include:

- Short-term temporary disturbance to aquatic habitat and associated species representing fish, macrophytes, periphyton, and macrophyte communities in perennial (Snake Creek) and intermittent streams (including Big Wash).
- Long-term loss of riparian vegetation in a 100-foot section on either side of Snake Creek C and intermittent stream crossings.

Fish Spawning

The construction schedule has not yet been determined at this time. If construction occurred during the fall months, direct impacts could affect brown trout spawning activity, cause mortalities to eggs or young fish, or alter spawning habitat. The other trout species in Snake Creek (brook trout) would not be affected by construction because it occupies headwater areas located upstream of the proposed crossing. The spawning periods generally range from October 1 through December 1 for brown trout. The effects of construction-related sediment on fish spawning are discussed in the water quality effects section. Mitigation measure ROW-AB-3 would be implemented to restrict construction during the brown trout spawning period. Measure ROW-AB-1 would restore channel substrate to preconstruction conditions.

Conclusion. If construction occurs in the fall months, instream disturbance at the Snake Creek Crossing in Snake Valley could disturb spawning activity and alter spawning habitat for brown trout. No RMP management, direction BMPs, or ACMs are available to reduce impacts on trout spawning in Snake Creek.

Proposed mitigation measures:

ROW-AB-1: Habitat Restoration. The SNWA shall consult with the BLM and the NDOW to determine procedures to restore substrate composition to preconstruction conditions at the Snake Creek pipeline crossing. The results shall be included in the detailed Restoration Plan to be prepared for the project. Effectiveness: This measure would be highly effective because it would restore substrate composition to preconstruction conditions. Effects on other resources: Implementation of this measure would extend the construction disturbance for a short-term period and result in temporary sedimentation.

ROW-AB-3: Spawning Restrictions. Timing restrictions between October 1 and December 1 shall be required during pipeline construction at the Snake Creek crossing. If construction during this period is necessary, SNWA shall prepare a site-specific plan that adopts mitigation measures recommended by the NDOW to minimize impacts to brown trout. Effectiveness: This measure would be highly effective because it would eliminate effects on brown trout spawning. Effects on other resources: There would be no effects of implementing this measure on environmental resources.

Residual impacts involving fish spawning effects would include:

- Potential short-term temporary disturbance to trout spawning habitat in Snake Creek.

Water Quality Effects

Instream construction activities would result in short-term increases in total suspended solids (TSS) levels or turbidity in a section of the stream within or immediately downstream of the crossing. Other surface disturbance activities associated with work areas or access roads near streams also could contribute to short-term sedimentation. The extent of the area affected would depend on the type of soil composition and flow conditions. Streams with firm substrates such as sand, gravel, or cobble would exhibit lower levels of sedimentation compared to soft substrates such as silt. The extent of downstream movement of suspended sediment also would depend on flow and channel configuration. By constructing during a low flow period, movement of suspended sediment would be limited in downstream extent. The generation of a downstream turbidity plume is usually limited to the duration of instream construction (Reid and Anderson 1999). Typically, the peak in TSS is associated with trench excavation.

Surface disturbance activities within the pipeline ROW also could contribute sediment to downgradient areas immediately outside of the corridor, if a precipitation event occurred after construction. As previously mentioned, Big Springs is located downgradient and just outside of the pipeline ROW.

Increases in sediments entering the stream can adversely affect resident trout by covering spawning and rearing areas, thereby reducing the survival of fish embryos and juvenile fish (Waters 1995). Excessive sedimentation also can fill in pool habitats and blanket structural cover for fish. Pool habitats provide important depth cover and overwintering habitat. The BLM BMPs would be followed regarding erosion control.

Vehicle and equipment use within and adjacent to waterbodies also could pose a risk to aquatic biota from fuel or lubricant spills. If fuel reached a waterbody, aquatic species could be exposed to toxic conditions. Impacts could include direct mortalities or reduced health of aquatic organisms. Impacts from fuel spills would be avoided by not allowing refueling to occur within 100 feet of waterbodies (BLM BMP) (Appendix A, Water Resources in BLM 2008) and ACMs would be implemented to reduce sediment and spill-related effects on water quality and aquatic biota. These measures are described in **Appendix E** as part of construction and storm water and erosion control activities. Reference numbers for these ACMs include A.1.40 through A.1.46, A.1.51, A.1.52, A.1.54 through A.1.59, and A.1.61 through A.1.68. Additional detail on sediment control is provided in Water Resources, Section 3.3. By implementing erosion control techniques as part of the Reclamation Plan, suspended sediment would be localized and expected to return to preconstruction levels within several days.

<u>Conclusion</u>. Construction activities at streams with standing or flowing water would result in short-term erosion and sedimentation. One perennial stream (Snake Creek in Snake Valley) would be crossed by the pipeline ROW. Soil disturbance within the ROW also could affect three unnamed springs and one named spring (Big Springs) in Snake Valley due to their location within 500 feet of the ROW boundary. Vehicle and equipment use within the ROWs also pose a short-term risk of fuel spills to aquatic habitat and species. These activities could alter water quality and cause physiological stress or mortalities. BMP management direction restricts vehicle fueling within 100 feet of waterbodies. BMPs and numerous ACMs would be implemented to reduce erosion effects on waterbodies. These measures would result in low level impacts to aquatic habitat and species.

Proposed mitigation measures:

None.

Residual effects of construction involving water quality would include:

- Short-term sedimentation effects on one perennial stream (Snake Creek in Snake Valley) and intermittent streams (if water is present at the time of construction).

Construction Water Use

The SNWA is proposing to use groundwater or temporary construction wells for hydrostatic testing, dust control, and fire suppression (if needed). It is estimated that between 5.5 and 8.7 million gallons of construction water would be needed for every pipeline mile (or one water supply well for each 10 miles of pipeline). Groundwater withdrawal for construction water use could result in localized drawdown effects. There could be potential short-term effects on surface water quantity and aquatic habitat depending on the hydraulic connection to groundwater and the surface water location. No diversion or modification of surface water flows would occur for temporary construction water use. Any change in water use involving surface water sources would need to meet Nevada permit requirements, as well as a review by the BLM. If surface water use was approved, BLM Ely BMP requirements involving the use of screening with a mesh size of 3/16 inch on intake hoses would be used to prevent fish from being entrained.

The discharge of hydrostatic test water would follow NPDES requirements, which would eliminate potential effects on water quality. Erosion effects would be minimized by implementing ACMs to reduce discharge velocities (ACM A.1.64 and A.1.65, as described in **Appendix E**). Additional details on hydrostatic test water discharge are provided in Section 3.4.2.5, Alternative D.

Conclusion. Construction water use could adversely affect aquatic habitat and species, if surface water is located within the drawdown area and connected to groundwater sources.

Proposed mitigation measures:

As discussed in Section 3.3.2.2, Water Resources, mitigation measure ROW-WR-3 (Construction Water Supply Plan) would be required to determine the effects of construction water use on surface water and groundwater. Additional mitigation may be required, if surface water and aquatic habitats are adversely affected.

Residual effects from construction water use could occur if groundwater withdrawal reduces surface water quantity and aquatic habitat. Residual impacts will be quantified during subsequent BLM review of the Construction Water Supply Plan.

Vehicle Traffic/Equipment Effects on Amphibians

Vehicle traffic could cause toad and frog mortalities during movement periods.

Construction activity in areas near streams and temporary waterbodies (if present at the time of construction) would cross potential habitat for amphibian species. Stream habitat crossed by the pipeline and power line ROWs includes Snake Creek in Snake Valley and Steptoe Creek in Steptoe Valley. No springs or wetlands are located within these ROWs. Vehicle traffic within the ROW could potentially cause mortalities to toads and frogs during breeding movement to waterbodies in the spring or summer and post-breeding movement to upland areas in late summer or fall (Andrews et al. 2008). Construction activities within waterbodies could alter habitat used for eggs and rearing of young, as well as possibly causing direct mortalities. Vehicle traffic also could cause increased sedimentation in the disturbance area near waterbodies as discussed in Section 3.3, Water Resources. In total, vehicle traffic would occur within approximately 431 miles of access roads. A small portion of this ROW distance could be near temporary waterbodies (i.e., small ponded areas that can develop after substantial rainfall events), which could be used as breeding habitat by amphibians.

Conclusion. Vehicle traffic within 431 miles of access roads could result in alteration of amphibian habitats (Snake Creek, Steptoe creek, and temporary waterbodies) and potential mortalities during breeding movements to waterbodies in the spring or summer and movement to upland areas in late summer and fall. Risk of mortalities would be highest near waterbodies.

Proposed mitigation measures:

None.

Residual impacts of vehicle traffic on amphibians would include:

- Potential short-term alteration of amphibian habitat if vehicles or equipment cause disturbance to waterbodies used by amphibians for breeding.
- Long-term effects on amphibians could occur if vehicles cause mortalities. The magnitude of potential mortalities would depend on the number affected, as well as population numbers for the species on a basin-wide distribution. Numbers could be reduced at particular waterbodies for one breeding year.

Compliance with Management Objectives

One special status species with a conservation agreement, Bonneville cutthroat trout, occurs near the ROW. Management objectives for the Bonneville cutthroat trout in Nevada are defined in the conservation agreement for this species (NDOW 2006). **Appendix F**, **Table F3.7-8** provides a list of the management objectives. Construction activities would not result in effects on habitat for Bonneville cutthroat trout in Snake Creek or Big Wash, since habitat is located upstream of the proposed pipeline crossings. Therefore, construction activities would not limit the achievement of management objectives for Bonneville cutthroat trout.

Conclusion. Compliance with conservation agreements were evaluated for one special status species, Bonneville cutthroat trout. Since occupied habitat for the Bonneville cutthroat trout occurs in sections located upstream of proposed pipeline crossings of Snake Creek and Big Wash, construction activities would not conflict with conservation objectives for this species.

Proposed mitigation measures:

None.

No residual impacts of ROW construction on management objectives would affect Bonneville cutthroat trout.

Tribal Species

Snake Creek and Big Wash (pipeline and power line crossings) support one special status species, Bonneville cutthroat trout, and other native and non-native fish. These streams and their associated fish species also are located within the Confederated Tribes of the Goshute Reservation and are considered culturally significant species. Construction would not affect Bonneville cutthroat trout in these streams, because occupied habitat is located upstream of the proposed pipeline crossings. Short-term disturbance to other fish species would occur as a result of construction. Implementation of ACMs (previously discussed in the habitat alteration and fish spawning sections) and mitigation measures ROW-AB-1, ROW-AB-3, and ROW-WR-1 would reduce impacts to habitat and fish species.

An impact issue for project maintenance could involve potential localized sediment and habitat disturbance.

Steptoe Creek (power line crossing) in Steptoe Valley supports game fish species. Fish in Steptoe Creek are located within the Western Shoshone Tribe's aboriginal territory and may be considered culturally significant species. Implementation of mitigation measure ROW-AB-3 (no instream disturbance from vehicles and equipment) would avoid impacts to fish in Steptoe Creek.

Conclusion. Pipeline ROW construction would result in short-term impacts to Snake Creek and Big Wash, which contain fish traditionally used by the Confederated Tribes of the Goshute Reservation.

Proposed mitigation measures:

None.

Residual impacts involving fish with traditional value for Tribes would include:

- Short-term temporary disturbance to fish habitat and associated species in Snake Creek and possibly Big Wash in Snake Valley.

Facility Maintenance

Routine maintenance of the pipeline and transmission line ROWs could consist of removing vegetation within the ROWs. Removal of riparian vegetation could affect overhanging cover in a small section of a stream. Surface disturbance also could disturb soil and contribute localized sediment to a waterbody if it is located immediately adjacent to the maintenance area. Pipeline repair within the waterbody would directly disturb aquatic habitat. However, the pipeline system is considered to be quite durable and therefore, repair activities are expected to be unlikely. Potential fuel spills from equipment near waterbodies also could be a risk to aquatic biota. However, impacts from fuel spills would be avoided by not allowing refueling to occur within 100 feet of waterbodies (BLM Ely BMP). Vehicle traffic near waterbodies could cause mortalities to amphibians during movement periods especially during the spring and summer breeding periods.

An impact issue for facility maintenance could involve potential localized sediment and habitat disturbance.

Proposed mitigation measures:

None.

Conclusion**.** Facility maintenance activities within ROWs could result in short-term effects on water quality, if surface disturbance occurred near Snake Creek or intermittent streams when water is present. Other potential effects would be the same as described for construction. The same BMPs and ACMs and mitigation measures would be applied to facility maintenance activities.

Residual impacts would be the same as construction, except that the magnitude would be lower due to the smaller amount of vehicle traffic and equipment use.

3.7.2.3 Alternative D

Construction and Facility Maintenance

Since no perennial streams or springs and associated biota are crossed by Alternative D ROWs, several of the impact areas discussed in the previous section are not applicable. The following information discusses the remaining potential impacts.

Habitat Alteration and Water Quality Effects

Construction and facility maintenance in Snake Valley and White Pine County would be eliminated under Alternative D. As a result, construction of the remaining ROWs and project facilities in Lincoln and Clark counties and the Lincoln County portion of Spring Valley would result in effects on intermittent streams. If water is present at the time of construction, aquatic habitat and aquatic communities such as macroinvertebrates and attached algae or macrophytes could be affected as a result of habitat alteration and water quality (i.e., sedimentation and potential fuel spills). Fish species are unlikely to be present in the intermittent streams due to a lack of water on a consistent basis throughout the year. No special status aquatic species are known to occur in these intermittent streams. The same BMPs and ACMs would be applied to construction and facility maintenance activities to reduce water quality effects on aquatic habitat and species.

Conclusion. Construction and facility maintenance activities could result in short-term water quality effects, fuel spill risks, and habitat alteration in intermittent streams in Clark and Lincoln counties, if water is present during these activities. These effects would be considered minor due to the lack of water being present throughout the year. No game fish or special status aquatic species are present in these intermittent streams. Riparian vegetation could be removed on a long-term basis as a result of stream crossing construction. BMPs and ACMs would be applied to construction and facility maintenance activities to reduce effects related to these impact topics. No additional mitigation would be required for effects on intermittent stream habitat and their associated species.

Proposed mitigation measures:

None.

Residual impacts involving water quality and habitat alteration would include:

- Short-term temporary disturbance to aquatic habitat in intermittent streams and macroinvertebrate, periphyton, and macrophyte communities.
- Streamside vegetation could be affected on a long-term basis at intermittent stream crossings.

Amphibian Habitat Alteration and Mortalities

Vehicle movements within the 315 miles of access roads potentially could cause amphibian mortalities as they move to and from temporary waterbodies. Effects could range from habitat alteration to amphibian mortalities. The types of habitat that could be affected are temporary waterbodies, which would depend on whether water is present during construction or facility maintenance activities.

Conclusion. Vehicle traffic and movement along the ROWs could result in short-term effects on amphibians, as they move to and from permanent and temporary waterbodies. Vehicles could disturb habitat in short-term alteration of habitat in temporary waterbodies. Effects could range from habitat alteration to amphibian mortalities. Construction would occur along 315 miles of access roads, with the mortality risk being highest near waterbodies.

Proposed mitigation measures:

None.

Residual impacts of vehicle traffic on amphibian habitat alteration and mortalities would include:

- Potential alteration of amphibian habitat near permanent and temporary waterbodies and mortalities due to vehicle traffic within 315 miles of access roads.

3.7.2.4 Alternative E

Construction and Facility Maintenance

Since no perennial streams or springs and associated biota are crossed by Alternative E, Several of the impact areas discussed in the previous section are not applicable. The following information discusses the remaining potential impacts.

Habitat Alteration and Water Quality Effects

Construction and facility maintenance in Snake Valley would be eliminated under Alternative E. If water is present at the time of construction, aquatic habitat and aquatic communities such as macroinvertebrates and attached algae or macrophytes could be affected in intermittent streams as a result of habitat alteration and water quality (i.e., sedimentation and potential fuel spills). Alternative E would cross additional intermittent streams in the White Pine County portion of Spring Valley (several small washes and Bastian Creek). These Spring Valley intermittent streams would not be crossed by Alternative E. Fish species are unlikely to be present in the intermittent streams due to a lack of water on a consistent basis throughout the year. No special status aquatic species are known to occur in these intermittent streams. The same BMPs and ACMs would be applied to construction and facility maintenance activities to reduce water quality effects on aquatic habitat and species.

Conclusion. Construction and maintenance activities could result in short-term water quality effects, fuel spill risks, and habitat alteration in intermittent streams in basins crossed by ROWs. These effects would be considered minor due to the lack of water being present throughout the year. No game fish or special status aquatic species are present in these intermittent streams. Riparian vegetation could be removed on a long-term basis as a result of stream crossing construction. BMPs and ACMs would be applied to construction and maintenance activities to reduce effects related to these impact topics.

Proposed mitigation measures:

None.

Residual impacts involving water quality and habitat alteration would include:

- Short-term temporary disturbance to aquatic habitat in intermittent streams and macroinvertebrates, periphyton, and macrophyte communities.
- Streamside vegetation could be affected on a long-term basis at intermittent stream crossings.

Amphibian Habitat Alteration and Mortalities

Vehicle movements within the 388 miles of access roads could potentially cause amphibian mortalities as they move to and from permanent and temporary waterbodies. Effects could range from habitat alteration to amphibian mortalities. The types of habitat that could be affected are temporary waterbodies, which would depend on whether water is present during construction or facility maintenance activities.

Conclusion. Vehicle traffic and movement along the ROWs could result in short-term effects on amphibians, as they move to and from temporary waterbodies. Vehicles could disturb habitat in short-term alteration of habitat in temporary waterbodies. Effects could range from habitat alteration to amphibian mortalities. Construction would occur along 388 miles of access roads, with the mortality risk being highest near waterbodies.

Proposed mitigation measures:

None.

Residual impacts of vehicle traffic on amphibian habitat alteration and mortalities would include:

- Potential alteration of amphibian habitat near permanent and temporary waterbodies and mortalities due to vehicle traffic within 388 miles of access roads.

3.7.2.5 Alignment Options 1 through 4

Impacts for the alignment options (1 through 4) are identified in relation to the relevant segment of the Proposed Action (**Table 3.7-4**).

Table 3.7-4 Aquatic Biology Impact Summary for Alignment Options 1 through 4

Alignment Option	Analysis
Alignment Option 1 (Humboldt-Toiybe Power Line Alignment) **Option Description**: Change the locations of a portion of the 230-kV power line from Gonder Substation near Ely to Spring Valley. **Applicable To**: Proposed Action and Alternatives A through C and E.	• Impacts associated with Alignment Option 1 would be the same as the comparable Proposed Action segment (intermittent stream crossings but no perennial stream or spring crossings).

Table 3.7-4 Aquatic Biology Impact Summary for Alignment Options 1 through 4 (Continued)

Alignment Option	Analysis
Alignment Option 2 (North Lake Valley Pipeline Alignment) **Option Description**: Change the locations of portions of the mainline pipeline and electrical transmission line in North Lake Valley. **Applicable To**: Proposed Action and Alternatives A through C and E.	• Impacts associated with Alignment Option 2 would result in more impacts (one spring, Wambolt, within pipeline ROW) than the comparable Proposed Action segment. This spring contains northern leopard frog and Lake Valley pyrg. In addition, one perennial stream (Geyser Creek) would be crossed by the pipeline and spanned by the power line ROWs. This stream contains rainbow and brook trout. Impacts would include habitat alteration and short-term water quality changes due to sedimentation. Trenching could result in mortalities to macroinvertebrates and small-size fish. Mitigation measures ROW-AB-1 (Habitat Restoration) and ROW-AB-3 (Spawning Restrictions) would be implemented to reduce impacts on habitat and trout spawning. Direct disturbance to Wambolt Spring would be avoided.
Alignment Option 3 (Muleshoe Substation and Power Line Alignment) **Option Description**: Eliminate the Gonder to Spring Valley transmission line, and constructing a substation with an interconnection with an interstate, high voltage power line in Muleshole Valley. **Applicable To**: Proposed Action and Alternatives A through C and E.	• Impacts for Alignment Option 3 would be less than the comparable Proposed Action segment because of the elimination of the Steptoe Creek crossing associated with the Humboldt-Toiyabe Power Line ROW.
Alignment Option 4 (North Delamar Valley Pipeline and Power Line Alignment) **Option Description**: Change the location of a short section of mainline pipeline in Delamar Valley to follow an existing transmission line. **Applicable To**: All alternatives.	• Impacts for Alignment Option 4 would be the same as the comparable Proposed Action segment (i.e., no stream or spring crossings).

3.7.2.6 No Action

Under the No Action Alternative, the proposed project would not be constructed or maintained. No project-related surface disturbance would occur. Impacts to aquatic species and their habitat would continue at present levels as a result of natural conditions and existing and other proposed development within the project area. Habitat for aquatic species would continue to be influenced by natural events such as drought and fire and land use activities such as grazing, and existing water diversions. Management activities on public lands will be directed by the Ely and Las Vegas RMPs, which involve measures to maintain or improve aquatic habitat parameters such as riparian vegetation. Management guidance for other public lands in the project study area would be provided by the GBNP General Management and the Forest Plan for the Humbolt-Toiyabe National Forest.

3.7.2.7 Comparison of Alternatives

Table 3.7-5 provides a comparison of impacts for construction and facility maintenance of the action alternatives.

Table 3.7-5 Alternative Comparison of Aquatic Biological Resource Impacts for Construction and Facility Maintenance

Parameter	Proposed Action, Alternatives A through C	Alternative D	Alternative E
Number of Perennial Streams with Game Fish Species Crossed by ROWs	1	0	0
Number of Springs with Aquatic Species Located within 500 feet of ROWs	4	0	0
Miles of Access Roads for Potential Amphibian Mortalities	431	315	388

3.7.2.8 Groundwater Development and Groundwater Pumping

Issues

The following issues for aquatic biological resources are discussed as part of the impact analysis for ROW groundwater development and pumping.

Groundwater Development Construction and Facility Maintenance

- Potential loss of individuals or habitat from short-term disturbance of stream channels by construction equipment;
- Potential loss of individuals or habitat from sediment delivery;
- Potential effects on fish spawning from habitat alteration;
- Effects of water use on aquatic biota and their habitat;
- Potential damage to aquatic habitat and biota from fuel spills reaching a waterbody directly or leaching through soils;
- Potential direct mortalities to amphibians from vehicle traffic;
- Compliance with management objectives defined in recovery plans, conservation agreements, and state wildlife action plans for special status aquatic species;
- Potential effects on fish species traditionally used by regional Tribes; and
- Short-term disturbance to aquatic habitat and species during facility maintenance activities.

Groundwater Pumping

- Potential effects on aquatic habitats and species, special status aquatic species and their habitats, and sensitive ecological areas because of reductions in surface water availability and quality caused by groundwater development.
- Compliance with management objectives defined in recovery plans, conservation agreements, and state wildlife action plans for special status aquatic species.
- Potential effects on fish traditionally used by regional Tribes.
- Potential effects of climate change on aquatic biological resources. Refer to Air Resources, Section 3.1.3.2 for a discussion of how climate change could contribute to groundwater development pumping effects on aquatic biological resources and other environmental resources.

Assumptions

Groundwater Development Construction and Facility Maintenance

- Identification of aquatic habitat potentially affected by project actions focused on waterbodies that support aquatic species on a persistent basis throughout the year (perennial streams, springs, lakes, and reservoirs).
- Identification of aquatic habitat potentially affected by construction activities for groundwater development associated with the Proposed Action and Alternatives A through E included all waterbodies located within the groundwater development boundaries.
- Identification of aquatic habitat potentially affected by construction activities for groundwater development associated with Alternative B included all waterbodies located within approximately 1-mile of proposed diversion points.
- Compliance with management objectives included those defined in recovery plans, conservation agreements, and state wildlife action plans for special status aquatic species.
- Fish species traditionally used by Tribes included native and non-native species.

Groundwater Pumping

- Aquatic habitat potentially affected by groundwater drawdown included perennial streams, springs, permanent wetlands and mesic meadows, lakes, and reservoirs that were located within the 10-foot drawdown area as determined by groundwater modeling.
- Model-simulated flow changes for selected springs and streams also were used in determining pumping effects on aquatic habitat. Additional detail on assumptions used in the analysis is provided in Section 3.3.2.2, Proposed Action and Alternatives A through C.
- Risk to special status species populations is discussed if drawdown is predicted to affect a waterbody that supports a population with limited distribution (e.g., springsnail population in one spring and one basin).
- The magnitude of residual effects cannot be determined at this time because of the uncertainty regarding the magnitude of impacts and the level of impact reduction by ACMs and additional mitigation. Residual effects of pumping on environmental resources will be determined in subsequent NEPA analyses.
- Fish species traditionally used by Tribes included native and non-native species.

Methodology for Analysis

Groundwater Development Construction and Facility Maintenance

- Known aquatic biology resources (game fish and special status species) were identified for groundwater development areas in the basins for each alternative.
- Surface disturbance activities were described in general terms, since locations are not known at this time.
- As part of the impact analysis, impact parameters were used in combination with effects information for the purpose of quantifying impacts and as an impact indicator. The impact parameters also allow comparison amongst alternatives or groups of alternatives. Examples of impact parameters for aquatic resources included the number of waterbodies with game fisheries or special status aquatic species that could be affected by pumping.

Groundwater Pumping

- The pumping effects analysis for aquatic biology focused on aquatic habitat (perennial springs and streams) located within the 10-foot drawdown contour. If groundwater and surface water connectivity were determined, these waterbodies were considered as potentially affected by groundwater pumping in terms of water level or flow reductions. Further discussion of this connectivity determination is provided in Section 3.3, Water Resources, **Table 3.3.2-3**.
- Springs in valley floor settings where there is a shallow depth to groundwater (i.e. <100 feet) were assumed to be controlled by discharge from the regional groundwater flow system. The impact analysis assumed a high risk to valley floor springs located within the drawdown area where there is a shallow depth to groundwater.
- Springs and stream reaches fed by springs located within valley margin settings may be controlled by discharge from local, intermediate, or in some cases, the regional groundwater flow system. Considering the uncertainty associated with the source of groundwater discharge to these springs, the impact analysis generally assumed a moderate risk to valley margin springs and stream reaches fed by springs located within the drawdown area.
- Springs and stream reaches fed by springs in upland areas (i.e., high elevation regions or mountain block settings) were assumed to be controlled by discharge from local or perched groundwater systems that are unlikely to be connected to the regional groundwater flow system. The impact analysis assumed a low risk to springs and stream reaches located in upland settings even if they were situated in the drawdown area.
- The types of impacts resulting from flow or water level reductions on aquatic biota were discussed in general terms using available literature. As part of the hydrologic modeling, the percent change in flow was estimated for individual springs or spring systems. In total, approximately 30 springs were analyzed with focus on the larger springs or stream segments within the hydrologic model study area. This step provided a quantitative estimate of flow changes for larger springs or streams in the study area. Section 3.3.2.2, Proposed Action and Alternatives A through C in Water Resources provides a detailed discussion of the methodology used in the evaluation of pumping effects on perennial streams and springs.

- Pumping effects to spring flow were assumed if the spring is thought to be hydraulically connected to the regional groundwater flow system, and either occurs within the groundwater drawdown area or is simulated to have a greater than five percent flow reduction.
- Biological importance was based on the presence of fish and special status aquatic species.
- Assumptions about the potential changes in aquatic habitats (habitat area and flows) from groundwater pumping do not incorporate additional assumptions about the effects of climate change because specific long term effects of climate change are not presently known, and the incremental contribution of climate change effects to project effects cannot be reasonably estimated. A general discussion of climate change effects is provided in Section 3.1.3.2, Climate Change Effects to All Other Resources.

3.7.2.9 Proposed Action

Groundwater Development Area

Game Fish and Other Aquatic Communities

Since the location of well development facilities are not known at this stage of the project, impact discussions are considered general in terms of applicability to aquatic biological resources within the pumping basins. Subsequent NEPA analyses will be required to describe impacts of construction at specific facility locations.

The impacts of constructing wells, roads, feeder lines, and other support facilities in Snake, Spring, Cave, Dry Lake, and Delamar basins potentially could include the same issues discussed for the pipeline and power line ROWs (Section 3.7.2.2). Surface disturbance and vehicle traffic could 1) directly disturb aquatic habitats located within the footprint of construction areas; 2) contribute sediment to drainages that contain aquatic habitat; 3) cause water quality risks to aquatic biota from accidental fuel spills; and 4) potentially result in amphibian mortalities from vehicle traffic during movement periods. These impacts would occur only if well development occurs within, adjacent to, or immediately upstream/upslope of waterbodies that contain habitat for aquatic biota. Removal of riparian vegetation would be of long-term duration, while the other impacts would be considered short-term. Sedimentation and spill-related impacts would be minimized by ACMs previously discussed for Proposed Action ROW areas.

Well development also would require the use of drilling muds and small quantities of water. Drilling mud handling and disposal could result in sedimentation if the activity occurred in drainages or near waterbodies. Water for well development would be trucked in by the drilling contractors. The source of water is assumed to be from groundwater. Since well development water is not expected to be obtained from local water sources, reductions in aquatic habitat are not expected.

Construction-related impacts in the groundwater development areas potentially could affect aquatic biological resources in all five basins (Snake, Spring, Cave, Dry Lake, and Delamar). In total, 17 perennial streams (Snake and Spring valleys) (**Table 3.7-1**) and over 40 springs (all five basins) are located within the boundaries of the groundwater development area. All of these waterbodies likely contain aquatic macroinvertebrates. When focusing on game fish and special status aquatic species, two of the basins contain stream and spring habitat with these species. Groundwater development areas in Spring and Snake valleys overlap with 13 and 4 streams, respectively, that support game fish species (**Table 3.7-1**). However, many of the stream reaches within the Snake and Spring valleys groundwater development areas have channel modifications such as irrigation canals. The occurrence of special status aquatic species is discussed below.

Game fish or special status species habitat is present in two basins. Construction-related impacts could occur.

Special Status Aquatic Species

One special status fish species, Bonneville cutthroat trout (BLM sensitive and a conservation agreement species), occurs in Big Wash in Snake Valley. This stream is located within the Snake Valley groundwater development area. One additional perennial stream in Snake Valley, Big Springs Creek, also contains native fish species considered to be unique because of their limited distribution in Nevada.

Three springs located within the groundwater development areas (Blind, North Millick, and South Millick in Spring Valley) contain potential habitat for the special status amphibian species, northern leopard frog. Vehicle traffic near these springs could result in mortalities as frogs move to waterbodies particularly during the breeding season. Surface disturbance activities near these springs could directly alter habitat or affect water quality from sedimentation or fuel spill risks.

Springsnail species (Toquerville pyrg) also are present in spring habitats within two of the groundwater development areas: Spring Valley (unnamed spring near Cleve Creek drainage) and Snake Valley (unnamed spring southwest of Caine Spring). This springsnail species is not a special status species due to its more widespread distribution. Surface disturbance activities near these springs could directly alter habitat or affect water quality from sedimentation or fuel spill risks.

Compliance with Management Objectives

If direct disturbance occurred in spring habitat, achievement of the conservation objective involving protection of known or potential breeding sites could be affected for northern leopard frog (Smith and Keinath 2007) (**Appendix F**, **Table F3.7-8**). Vehicle traffic near springs and seasonal waterbodies also could affect the objectives involving protection of dispersal pathways and reducing road-related mortality. Groundwater development in spring areas also could affect management objectives for protecting spring and springbrook habitats, as described by the Nevada Wildlife Action Plan Team (2006) (**Appendix F**, **Table F3.7-10**).

Habitat alteration or other surface disturbance effects on Big Wash could affect management objectives for Bonneville cutthroat trout involving maintenance of natural hydrologic characteristics and enhancing connectiveness and opportunities for migration.

Maintenance activities for groundwater development could affect aquatic biota and their habitat, if vehicles or equipment crossed waterbodies. The types of impacts would be the same effects discussed for ROW areas. The location of facility maintenance activities has not been defined at this time. Implementation of ACMs would be used to avoid or minimize effects on aquatic habitat. These measures would control sediment input to waterbodies and reduce fuel spill risks. Removal of riparian vegetation near waterbodies could affect shade and cover for aquatic species on a long-term basis.

ACMs and the BLM RMPs described for ROWs (**Appendix E**) also would be incorporated for the groundwater development areas, as applicable. The BLM RMPs for development near springs also would be followed, which specifies that surface water sources and associated riparian areas be maintained. Additional project-specific measures would be determined as part of subsequent NEPA analysis for specific project locations. As part of the programmatic level of analysis for this EIS, additional ACMs could include the following design features to reduce impacts to aquatic biological resources. Other measures may be added during subsequent NEPA analyses.

- Location of production wells, collector lines, power lines, and secondary substations will consider the presence of special status species and their habitat (ACMs B.1.1 and B.1.3); and
- Construction practices to meet permit requirements will be implemented on well drilling, abandonment, drilling, and water discharge (ACMs B.2.1 through B.2.3).

<u>Conclusion</u>. Construction of well pads, gathering pipelines, and electrical service lines could disturb up to 17 perennial streams and approximately 40 springs in the five groundwater basins. All of these waterbodies likely support macroinvertebrates. Game fish species occur in perennial streams in the Snake and Spring valleys' groundwater development areas. Special status species within the groundwater development areas include Bonneville cutthroat trout (one stream in Snake Valley) and northern leopard frog (three springs in Spring Valley). Potential effects on Bonneville cutthroat trout and northern leopard frog could conflict with management objectives in their conservation plans. BMPs and ACMs would be implemented to reduce water quality and potential fuel spill effects. Direct effects on habitat would be reduced by ACMs that would consider the presence of special status species when siting facilities.

Mitigation Recommendations:

GW-AB-1: Avoid Disturbance to Springs. Avoid direct disturbance to springs in Spring and Snake valleys with known special status aquatic species by establishing a 0.5-mile buffer around these areas. Effectiveness: This measure would be highly effective, since it would eliminate impacts to species in spring habitats. Effects on other resources: There would be no effects of implementing this measure on environmental resources.

GW-AB-2: Avoid Disturbance to Streams. Avoid locating wells, new roads or other linear facilities within 0.5 mile of or parallel to perennial streams and riparian areas. Effectiveness: This measure would be highly effective, since it would eliminate impacts to aquatic habitat in perennial streams. Effects on other resources: There would be no effects of implementing this measure on environmental resources.

Residual impacts of groundwater development disturbance to aquatic habitat and species would include:

- Potential amphibian mortalities from vehicle traffic near temporary or permanent waterbodies.

Groundwater Pumping

Pumping Effects Literature Review for Aquatic Habitat and Species (Background Information Applicable to All Alternatives)

Streams

The importance of a stream's flow regime for sustaining the biodiversity and ecological integrity of the aquatic environment is well established (Poff and Zimmerman 2010). Flow regime is considered the primary determinant regarding the structure and function of aquatic and riparian ecosystems for streams and rivers (Poff et al. 2010). Nearly all streams need to have some contribution from groundwater in order to provide reliable habitat for aquatic organisms (Winter 2007). The effects of stream flow changes on aquatic biota and their habitat have received considerable attention in the published literature. Of 165 papers reviewed by Poff and Zimmerman (2010), 152 (92 percent) reported negative ecological effects in relation to flow alterations. It should be noted that the majority of these studies evaluated changes related to relatively large flow alterations ranging from 50 to 100 percent compared to base flow conditions. This review indicated that there is a paucity of data in the low to middle range of flow alteration (0-50 percent). The overall conclusion of the literature review is that larger changes in flow alteration are associated with greater risk of ecological effects on aquatic communities. The effects of flow reductions on aquatic communities in streams are summarized below for habitat and aquatic biological groups (i.e., fish, invertebrates, and algae).

Habitat and Water Chemistry. The effects of flow reductions on stream habitat and water quality include decreases in water velocity, water depth, and wetted channel width (Dewson et al. 2007). The magnitude of change in aquatic habitat and water quality conditions depends on the quantity of flow reduction. Although flow reductions result in decreased wetted habitat for aquatic species, the quantity of change is not a 1:1 relationship. Riffles and other shallow areas (e.g., backwaters, shoreline areas associated all habitats) are affected by reduced flows more dramatically than pool habitats.

Flow reductions can affect water quality characteristics in streams in terms of increased sedimentation, thermal regimes, and the potential concentration of other water constituents. In terms of water chemistry, sedimentation is often a consequence of reduced flow because lower velocities enable more sediment to settle out of the water column (Dewson et al. 2007). Water temperature usually increases with reductions in discharge in the summer, with the magnitude of change dependent on the volume of reduction compared to the stream volume, stream velocity, and the time of year. Sufficient information is not available in the model analysis used in this EIS to predict quantitative effects on habitat or water chemistry.

Fish. Based on the literature review by Poff and Zimmerman (2010), fish was the only aquatic biological group to consistently respond negatively to changes in flow magnitude. Under reduced flow conditions, fish responses were negative in all 10 studies, with 8 of the changes exceeding 50 percent compared to base flow conditions. Fish diversity showed a consistently large decline, especially where reduced flow exceeded 50 percent. Reductions in abundance and demographic parameters also were shown for fish in these studies. Fish species that spend most of their time in riffle habitats (e.g., dace and suckers) are more likely affected by reduced flow and depth (Bradford and Heinonen 2008). Based on literature reviews by Bradford and Heinonen (2008), Bunn and Arthington (2002), Lake (2003), and Poff and

Zimmerman (2010), the following direct effects of flow reductions on fish habitat have been reported. Minimum or threshold flows have not been identified in relation to these habitat effects.

- Reduced water velocity, water depth, and wetted channel areas;
- Reduced depths and velocities over spawning and rearing areas;
- Reduced depths in overwintering pools;
- Potential restrictions in fish movement or migration due to reduced stream depths;
- Potential shift in habitat use from riffles and runs to pools for some species;
- Changes in quantity and types of cover (e.g., undercut banks, woody debris, substrate, turbulence) as depths are reduced; and
- Potential loss of riparian vegetation and overhanging cover for fish.

These literature reviews also have reported indirect effects of flow reductions on fish species. Critical life events such as spawning, early life development, growth, physiological functions, and competition are linked to flow regime in combination with other ecological factors (Bunn and Arthington 2002). The following indirect effects could occur as a result of flow changes:

- Adverse effects on fish growth as a result of changes in food sources consisting of macroinvertebrates;
- Adverse effects on physiological and ecological requirements as a result of water quality changes involving temperature and increased sedimentation;
- Potential increase in parasite infestation; and
- Potential shift to habitat conditions that favor exotic species such as carp and mosquitofish.

Macroinvertebrates. The response of macroinvertebrate communities to reduced flow has been the subject of recent literature reviews by Poff and Zimmerman (2010) and Dewson et al. (2007). Based on a review of studies involving relatively large flow reductions (approximately 60 to 100 percent compared to base flow conditions), results showed that macroinvertebrate abundance and diversity declined in most cases. As discussed for fish, the lack of data points throughout the entire range of flow changes makes it difficult to identify any threshold levels that result in macroinvertebrate responses. Studies reviewed by Dewson et al. (2007) indicated varying changes in macroinvertebrate abundance in relation to reduced flow. It was suggested that density decreased as a result of reduced habitat diversity and food sources and changes in competition and predation. In situations with increased abundance after flow reduction, it was suggested that the reduction in wetted area resulted in a concentration of invertebrates in a smaller area. Flow reductions also usually result in compositional changes, as indicated by the number of taxa and their relative abundance. Compositional changes typically result from the effect of flow reduction on habitat suitability. Low flows would favor taxa that prefer slower velocities. Flow reductions also result in decreased macroinvertebrate taxonomic richness (i.e., number of taxa). Changes in water quality conditions due to increased temperature and sedimentation and altered attached algae assemblages also can contribute to changes in community composition and taxonomic richness.

As a result of low flow conditions, invertebrates can move from the surface of the stream bottom into the deeper substrate zone referred to as the hyporheic zones (saturated sediment area that exchanges water, nutrients, and fauna with flowing surface waters). Hyporheic water can be used as a thermal refuge for invertebrates because this deeper zone is often cooler than the surface water (Dewson et al. 2007).

Additional information on macroinvertebrate responses to flow reductions is provided in a study by McKay and King (2006). The study diverted between 28 and 97 percent of the total stream discharge in experimental reaches for the purpose of identifying macroinvertebrate responses. The diversions consistently reduced the mean density of total macroinvertebrates, mean density of sensitive mayfly/caddisfly/stonefly taxa, macroinvertebrate family richness (i.e., number of taxa), and density of a number of dominant taxa in the diversion reaches compared to control reaches. In terms of flow reduction effects on habitat, the entire range of diversions resulted in a decline in the wetted area or useable habitat for macroinvertebrates.

Field studies have demonstrated that mobile macroinvertebrate species, such as beetles and adult caddis and stoneflies, would disperse as flows decline (Boulton 2003). Those invertebrates that are unable to escape the aquatic environment may drift downstream or move upstream to more consistent water sources (Dewson et al. 2007). Time of the year, rapidity of the desiccation (drying), the duration, and the magnitude of the decreased flow all affect the severity of changes in the invertebrate community (Boulton 2003). As stream desiccation begins to occur, invertebrates with limited mobility experience mortality due to elevated temperatures and declining water quantity and quality (Dewson et al. 2007).

If flows are restored, recolonization is variable (Boulton 2003). Often mobile species will be the first to recolonize a restored stream, along with species with drought-resistant life stages. Less mobile and sensitive species will frequently lag in recolonization of an area. The ability and time frame of the aquatic invertebrate community to recover are dependent upon the proximity of a functional aquatic ecosystem that can recolonize the area.

Algae and Macrophytes. Flow regime is an important component of attached algae (periphyton) and macrophytes. Water velocity can affect the colonization, production, and composition of periphyton communities. Investigators have reported varying density changes in relation to reduced flows (Dewson et al. 2007). These contrasting results are probably caused by the different growth forms and physiological requirements of algae in stream environments. The periphyton community typically changes from a low-biomass diatom assemblage to a high-biomass filamentous green algal mat during low or reduced flows. This change occurs in response to increased temperatures, higher nutrient concentrations, and reduced current velocity. Responses of periphyton to reduced flow conditions also depend on the nutrient concentrations in the stream. In general, reduced flow or low flow increases the establishment and growth of macrophytes. Other factors involving nutrient concentrations and substrate play a role in macrophyte development.

Springs

Spring flow or discharge is an important component of spring habitat. Springs are points of concentrated discharge from groundwater flow systems (van der Kamp 1995). The stability and quantity of the flow mostly depends upon the extent and storage capacity of the contributing flow system. The size and configuration of the spring are dictated by flow quantity and topography in the area. Most large springs and some smaller spring systems generally support spring brook outflow habitat, hyporheic zones, downstream wetland and marsh habitats, and may contribute significant flow to associated tributary and first order stream and river systems such as the White and Muddy rivers (Wildlife Action Plan Team 2006). The following information summarizes the effects of flow or water level reductions on spring habitat and their associated aquatic biota. Available literature did not identify minimum flow or threshold water levels needed to maintain habitat and aquatic species populations in springs.

Habitat and Water Quality. The effects of flow reductions from groundwater pumping on spring habitat in southern Nevada were evaluated by Sada and Deacon (1994). Reductions in groundwater input to springs would result in decreased water depths and wetted area. The reduction in hyporheic zones and wetlands would decrease the areal extent or size of the spring. Water velocities and depth also would decrease in the spring inflow and outflow areas due to reduced groundwater input.

The magnitude and time frame of these habitat changes would depend on the quantity of decreased flow and the relative size of the spring. Small-size springs would be more susceptible to decreased spring discharges. Small springs could dry up if the water source is eliminated. If flow input is maintained to the spring, flow reductions would modify habitat in terms of depth and velocity changes, especially in riffle areas of spring brooks. Pool habitat would be affected by decreased depths and size.

Reduced groundwater input also can affect water quality in springs due to increased sedimentation, altered thermal regimes, and potential changes in the concentration of other water constituents. Flow reductions in riffle areas could result in sedimentation of gravel and cobble substrates. Lower flow also could modify the thermal dynamics of the spring system, which could have adverse effects on species adapted to particular temperature conditions in the spring.

Fish. Based on information provided in Sada and Deacon (1994) and literature summarized above for stream habitats, reduced groundwater input to springs would result in decreased fish abundance and diversity. These changes would result from direct and indirect effects on fish habitat and their ecological or physiological requirements. Habitat effects are related to the ecology of fish species. For example, the springfishes, spinedaces, and Pahrump poolfish utilize pool habitats for feeding, spawning, and other life processes. In contrast, sucker and dace species are associated with riffle areas for their ecological requirements (feeding, spawning, and other physiological requirements). The following direct effects of flow reductions on fish species in spring habitats have been identified.

- Reduced water velocity, water depth, and wetted areas in pool and riffle habitats;
- Reduced depths and velocities over spawning and rearing areas;
- Potential shift in habitat use from riffles to pools for some species; and
- Changes in quantity and types of cover (e.g., substrate, aquatic vegetation) as depths are reduced.

The following indirect effects on spring biota could occur as a result of flow changes:

- Adverse effects on fish growth as a result of changes in food sources consisting of macroinvertebrates;
- Adverse effects on physiological and ecological requirements as a result of water quality changes involving temperature and increased sedimentation; and
- Potential shift to habitat conditions that favor non-native species.

Invertebrates. Erman (2002) reported that the most diverse invertebrate assemblages were evident in the most stable springs, which showed the least change in water discharge and temperature during a 20-year period. Based on a long-term study of springs during varying drought conditions (Erman 2002), reduced flow or water levels resulted in decreased abundance and diversity of invertebrates, as well as compositional changes. The effects of reduced flows would likely be more pronounced in small springs where changes in habitat conditions would be more substantial. Literature pertaining to effects of flow reductions on stream invertebrates is considered to be applicable to the spring brook or outflow areas of springs. Flow changes could shift the occurrence of invertebrates along the spring brook segment. For example, spring invertebrates often move along a spring outflow gradient to change their thermal environment, locate better 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 attached algae assemblages.

Reduced flow in springs also could affect springsnail populations. These mollusk species are restricted to spring sources and a limited distance of the spring brook (usually less than 600 feet) (Sada and Deacon 1994). Habitat typically consists of aquatic macrophyte areas, moderate velocities of approximately 10 centimeters/second, sand and/or gravel substrates, and thermal or cold temperatures.

Algae and Macrophytes. The effects of flow reductions on attached algae in spring brook areas of springs would be similar to responses discussed for stream habitats. Flow reductions in pool areas of springs would decrease depths and wetted areas. These changes could alter existing macrophyte areas by affecting depth and substrate combinations that are preferred by plant species.

Pumping Effects Analysis

Based on evaluations of the model-predicted 10-foot groundwater drawdown contour for Proposed Action pumping and geology and groundwater characteristics, aquatic biological resources could be affected in portions of six basins during the full build out plus 75 years and full build out plus 200 years time frames (White River, Pahranagat, Lower Meadow Valley Wash, Spring [#184], Snake, and Lake) (**Appendix F**, **Tables F3.7-11** and **F3.7-12**). The analysis indicated that Proposed Action pumping could reduce flows or water levels in 27 to 30 standing water bodies (springs, ponds, or lakes) and 27 to 33 perennial streams that contain game fish or special status aquatic species at the full build out plus 75 years and full build out plus 200 years time frames. Three springs/ponds/lakes were predicted to be affected at full build out. The predicted 10-foot drawdown contour for Proposed Action pumping is shown for streams in **Figure 3.7-7** and springs in **Figure 3.7-8**. It should be clarified that there are uncertainties associated with the model analysis, as described in 3.3 Water Resources, Section 3.3, Methodology, Assumptions, and Limitations, Model Uncertainty. This would apply to all impact discussions for individual alternatives, as well as cumulative impacts associated with each alternative.

Figure 3.7-7 Proposed Action Drawdown and Streams/Waterbodies with Aquatic Biological Resources

Figure 3.7-8 Proposed Action Drawdown and Springs with Aquatic Biological Resources

As part of the model simulation, percent change in flow was predicted for six springs located within the groundwater drawdown areas. The predicted percent flow reduction for these springs included the following ranges using the three model time frames: Butterfield Spring (-1 to -18) and Flag Springs (-1 to -17) in White River Valley; Keegan Spring (-58 to -100), North Millick Spring (-31 to -75), and South Millick Spring (-55 to -99) in Spring Valley; and Big Springs (-2 to -100) in Snake Valley. The model simulation results indicate that Keegan, North Millick, South Millick, and Big Springs could potentially experience substantial flow reductions or eventually cease flowing. Pumping impacts are discussed below for fish, amphibian, and invertebrate species.

Small springs (<100 gallons/minute flow rate) also could experience substantial flow reductions or dry up as a result of pumping. The number of small springs with biological resources that could be affected was 0 (full build out), 13 (full build out plus 75 years), and 15 (full build out plus 200 years) for the three model time frames. The small springs included Wambolt in Lake Valley; Blind, Cleveland Ranch, Osborne, Stonehouse, Willow, unnamed near Cleve Creek, and unnamed # 5 in Spring Valley; and Caine, Clay, Kious, Outhouse, unnamed near Caine Springs, and two unnamed springs near Big Springs in Snake Valley. These springs could potentially dry up and result in a loss of all aquatic species (full build out plus 200 years).

Fish

Game Fish

Based on the groundwater drawdown analysis, game fish species could be affected in 4 to 25 streams for the three model time frames (full build out, full build out plus 75 years, and full build out plus 200 years). The analysis was based on the stream's topography and relationship to the 10-foot groundwater drawdown contour. If a valley floor or valley margin perennial stream overlapped with the 10-foot groundwater drawdown contour, potential stream flow reductions could result from Proposed Action pumping. During the full build out model time frame, flow reductions were predicted in four streams (Bastian, Meadow, Negro, and, Shingle creeks). The analysis indicated that a total of 6 miles was located within the 10-foot drawdown contour. The full build out plus 75 years and full build out plus 200 years time frames indicated that 22 and 25 streams, respectively, could exhibit reduced flows. A list of these streams and their game fish species is provided in **Appendix F**, **Table F3.7-12**. Some of these stream reaches also contain non-native fish species. The analysis indicated that a total of 60 and 75 stream miles, respectively, were located within the 10-foot drawdown contours for these two model time frames. Stream flows could be affected within these stream lengths as well as downstream reaches. Game fish streams with the highest predicted affected lengths included Big Wash, Lehman, Silver, and Snake creeks in Snake Valley and Bastian, McCoy, Meadow, Negro, Shingle, and Siegel creeks in Spring Valley (**Appendix F**, **Table F3.7-12**). Water levels also could be reduced in two reservoirs that contain game fish (Pruess Lake and Silver Creek Reservoir in Snake Valley (**Appendix F**, **Table F3.7-11**).

Proposed Action pumping also could reduce water levels in two springs (Swallow Spring in Spring Valley and Rowland Spring in Snake Valley) that support rainbow trout populations. Based on overlap with the 10-foot groundwater drawdown contour, water levels in Swallow Spring could be reduced at full build out plus 75 years and full build out plus 200 years. No data are available to predict the percent flow change for these springs. In Rowland Spring, flow reductions were predicted only at full build out plus 200 years. Spring Creek Spring in Snake Valley, which provides water for the Spring Creek Rearing Station (**Figure 3.7-2**), could be affected by groundwater pumping at the full build out plus 75 years and full build out plus 200 years time frames.

Federally Listed Aquatic Species

Seven federally listed fish species were evaluated as part of the pumping effects analysis. Based on a comparison of the 10-foot groundwater drawdown contours and model-predicted flows, Proposed Action pumping could affect two species, Pahrump poolfish and White River spinedace. Results of the impact analysis are discussed below:

- **Pahrump Poolfish**: Proposed Action pumping could potentially reduce flows or water levels in Shoshone Ponds in Spring Valley inhabited by Pahrump poolfish for two model time frames (full build out plus 75 years and continuing through full build out plus 200 years). No flow reductions were predicted for the full build out time frame. Data are not available to predict the percent change in flow resulting from Proposed Action pumping.
- **White River Spinedace**: Although the Flag Spring complex in White River Valley occupied by this species is not located within the 10-foot groundwater drawdown contour, model-simulated flow reduction was 17 percent for the full build out plus 200 years time frame. Flow reductions in the Flag Spring complex for the full build out and full

build out plus 75 years are <1 and 7 percent, respectively, for these model time frames. Critical habitat for White River spinedace is designated in Flag Spring. Proposed Action pumping would not affect White River spinedace habitat at other locations (Preston Big Springs and Lund Spring in White Pine County, which are considered critical habitat but not occupied for the species).

- **Other Federally Listed Species**: Since the 10-foot groundwater drawdown contour did not overlap with habitat for the other five federally listed species (Hiko White River springfish, Pahranagat roundtail chub, Big Springs spinedace, Moapa dace, and White River springfish), Proposed Action pumping would not affect these species. The predicted flow changes in waterbodies inhabited by these species ranged from 0 to -2 percent (Preston Big Springs in White River Valley; Ash, Crystal, and Hiko springs in Pahranagat Valley; and Muddy River in Muddy River Springs Area). Specific analyses for these species are provided in **Appendix F**, **Table F3.7-13A**. As discussed in Section 3.3.2.8 on model uncertainty and limitations, a simulated change in flow of less than 5 percent is inferred to indicate that measurable impacts are unlikely to occur for the species.

Other Special Status Fish Species: Based on the model analysis, nine additional fish species or subspecies (White River sculpin, White River desert sucker, White River speckled dace, relict dace, Utah chub, Utah sucker, redside shiner, speckled dace, and mottled sculpin) potentially could be affected by Proposed Action pumping. Spring species are listed in **Appendix F**, **Table F3.7-11**, while stream species are provided in **Appendix F**, **Table F3.7-12**. Impacts are discussed separately for these two habitats. Impact analyses organized by species are provided in **Appendix F**, **Table F3.7-13A**.

Bonneville cutthroat trout could be adversely affected by Proposed Action pumping in six streams at the full build out plus 75 years and full build out plus 200 years time frames. No streams containing this species would be affected at full build out. The estimated stream lengths with potential flow reductions for these two longer term time frames include:

- Spring Valley – Pine Creek (0.1 to 0.4 mile) and Ridge Creek (0.6 to 1.1 miles); and
- Snake Creek – Big Wash (4.8 miles), Hendry's Creek (0.2 to 0.4 mile), Strawberry Creek (0.8 mile), and Snake Creek (0.1 mile).

Other Bonneville cutthroat trout streams in Spring (#184), Snake, Steptoe, and Deep Creek valleys (**Appendix F**, **Table F3.7-2**) would not be affected by Proposed Action pumping because the occupied habitat is located outside of the 10-foot drawdown contour or it is considered low risk due to their occurrence in mountain block areas. Two additional streams (Silver and Snake creeks in Snake Valley), which have been targeted as future reintroduction sites, could have reduced flows as a result of pumping at the full build out plus 75 years and full build out plus 200 years time frames.

Seven streams (Big Springs, Lake, Snake, Strawberry, Spring Valley, Pahranagat, and Lower Meadow Valley Wash) that support native non-game fish species could be affected by Proposed Action pumping. Big Springs and Lake creeks support mottled sculpin, redside shiner, speckled dace, Utah chub, and Utah sucker. Strawberry Creek contains mottled sculpin, redside shiner, and speckled dace. The estimated miles located within the 10-foot drawdown contour is 27 miles at full build out plus 75 years and 34 miles at full build out plus 200 years. These stream reaches could have reduced flow due to Proposed Action pumping.

Special status fish species also occur in eight spring or pond locations including Butterfield and Flag Spring complex in White River Valley; Keegan, Minerva, Stonehouse Spring complex, and Shoshone Ponds in Spring Valley; and Stateline and Big Springs in Snake Valley. Based on overlap with the 10-foot groundwater drawdown contour with occupied habitat for these species, potential flow reductions were predicted for Keegan Spring, Minerva Spring, Shoshone Ponds, Stonehouse Spring complex, and Stateline Springs. The estimated flow reductions for springs with available data included 2 to100 percent for Big Springs, 58 to 100 percent for Keegan Spring, and 1 to 18 percent for Butterfield and Flag springs. The highest flow changes were predicted for the full build out plus 200 years time frame.

Tribal Species

Native and non-native fish species potentially affected in Snake, Spring, Lake, and Lower Meadow Valley Wash basin streams (**Appendix F**, **Table F3.7-12**) are considered traditional values to regional Tribes. Streams and species affected are the same as discussed for game fish and special status species. The majority of the affected streams are located in Spring and Snake valleys.

Amphibians

Based on the modeling analysis, Proposed Action pumping potentially could affect habitat for one special status amphibian species, northern leopard frog. Impact analyses organized by species are provided in **Appendix F**, **Table F3.7-13B**. Northern leopard frog populations could be affected by pumping in 9 waterbodies in the full build out plus 75 years time frame and 10 waterbodies at the full build out plus 200 years time frame. These include Blind, Cleveland Ranch, Keegan, Minerva, North Millick, South Millick, and unnamed #5 springs and Shoshone Ponds (artesian well water sources) and O'Neal/Frog Pond in Spring Valley; and Wambolt Spring in Lake Valley. Model flow simulation results were available for three of the springs inhabited by this amphibian species. Model-simulated flow reductions ranged from 58 to 100 percent in Keegan Spring, 31 to 75 percent in North Millick Spring, and 55 to 99 percent in South Millick Spring. Flow changes in the springs would occur in one or both of the full build out plus 75 years and full build out plus 200 years time frames (**Appendix F**, **Table F3.7-11**). As discussed for fish species, flow reductions could result in substantial loss of wetted areas in these springs or ponds. Data are not available to predict percent flow changes in the other springs. The effects of Proposed Action pumping on northern leopard frog would include reductions in habitat used for breeding and early development and adult life stages.

As discussed in the Utah pumping effects analysis section below, there is a slight risk from pumping in Wah Wah, Tule, and Fish Springs Flat valleys. Columbia spotted frog occurs in four springs in Tule Valley and five springs in Snake Valley. Pumping would not affect relict leopard frog habitat in the Black Mountains area.

Invertebrates

Proposed Action pumping could adversely affect habitat for special status springsnails in 7 springs (**Appendix F**, **Table F3.7-11**) and one perennial stream, Big Springs Creek (**Appendix F**, **Table F3.7-12**). Based on the model results, flow reductions could occur in 7 and 8 waterbodies, respectively, at the full build out plus 75 years and full build out plus 200 years time frames. Impact analyses organized by species are provided in **Appendix F**, **Table F3.7-13C**. Six petitioned species (Butterfield pyrg, Hardy pyrg, Flag pyrg, bifid duct pyrg, longitudinal gland pyrg, and Lake Valley pyrg) could be affected by pumping, as discussed below:

- Bifid Duct Pyrg – Flows could be reduced in one spring (Big Springs in Snake Valley). The simulated flow reduction in this spring ranged from 2 to 100 percent for the three time frames. The 100 percent reduction at the two long-term time frames indicates that there could be a total loss of habitat for the species, which would eliminate the population at this location.

- Longitudinal Gland Pyrg – Flows could be reduced in four springs inhabited by this species in Snake Valley (Big Springs, unnamed spring north of Big Springs, Clay, and Stateline). Flow reductions could eliminate or reduce habitat for this species in Nevada. Population effects could range from decreased numbers to a total loss of the population at a particular spring depending on the magnitude of flow reduction.

- Butterfield Pyrg – Flows could be reduced in Butterfield Spring in White River Valley, as indicated by simulated flow reductions of 1 to 18 percent. Habitat loss could reduce the population numbers for the only population in Nevada.

- Flag Pyrg – Flow reductions could adversely affect habitat and population numbers at one spring (Flag) in White River Valley. The simulated flow reduction was predicted to be 1 to 17 percent for the three model time frames. Habitat loss could reduce the population numbers for the only population in Nevada.

- Hardy Pyrg – Pumping could decrease flows in Butterfield Spring in White River Valley, as indicated by the simulated flow reductions of 1 to 18 percent. Flow reductions would decrease habitat, which could result in decreased population numbers for this species. Hardy pyrg is known to occur at seven springs in Cave and White River valleys.

- Lake Valley Pyrg – Flow reductions could decrease habitat for this species in one spring in Lake Valley, Wambolt Spring. The model analysis indicated potential flow reduction at full build out plus 200 years. The effect of habitat reduction could decrease population numbers in the only spring inhabited by this species.

Pumping also could reduce flows in 10 additional springs inhabited by non-petitioned springsnail species (designated as springsnails or Toquerville pyrg). Water levels also could be reduced in Pruess Lake, which contains California floater. It is important to note that that water levels in Preuss Lake are controlled by upstream irrigators and therefore, water levels can vary extensively depending on irrigation activity.

Great Basin National Park Pumping Effects

Based on the groundwater drawdown analysis, Proposed Action pumping could reduce flows in two springs and two streams within the GBNP that contain game fish or nongame native fish species. The water resources analysis indicates that Rowland Spring (rainbow trout) occurs within an area of moderate risk of effects at full build out plus 200 years time frame. Outhouse Spring (Toquerville pyrg and glossy valvata snail) could have reduced flow and habitat at the full build out plus 75 years and full build out plus 200 years. Of the 2.2 mile-section of Lehman Creek that is located within the GBNP and model analysis area, approximately 0.5 mile could exhibit reduced flows at the full build out plus 200 years time frame. Of the 1.8-mile-section of Snake Creek in the GBNP and model analysis area, the entire 1.8 miles could have reduced flows at the full build out plus 75 years time frame and 1.9 miles at the full build out plus 200 years time frame. As discussed in Section 3.3, Water Resources, a study by Elliott et al. (2006) indicated that other streams at risk include Shingle and Williams Canyon creeks in Spring Valley and Baker and Strawberry creeks in Snake Valley.

Utah Pumping Effects

In Utah, Proposed Action pumping could potentially affect two springs (Clay Spring and Stateline Springs) and two perennial streams (Lake Creek and Snake Creek) in Snake Valley. The analysis predicted that these waterbodies could be affected at full build out plus 75 years and full build out plus 200 years time frames. The following stream lengths in Utah were estimated to be affected by Proposed Action pumping for these model time frames: Snake Creek (1.2 miles) and Lake Creek (10.6 miles). Game fish and special status aquatic species associated with these waterbodies are listed in **Appendix F**, **Tables F3.7-11** and **F3.7-12**. As discussed in Section 3.3, Water Resources, there is a slight risk to aquatic habitats in Pine, Tule, Wah Wah, and Fish Springs Flat due to possible reductions in groundwater flow to those basins (i.e., approximate reduction of 4 to 10 percent at full build out plus 75 years and full build out plus 200 years time frames). Flow reductions into two of these basins could adversely affect habitat for least chub (Ibis and Pintail ponds in Fish Springs) and Columbia spotted frog (Coyote, South Tule, and Willow springs in Tule Valley). It is important to clarify that there is considerable uncertainty regarding the amount of subsurface flow between Snake Valley and Pine, Wah Wah, Tule, and Fish Springs valleys.

Compliance with Management Objectives

Four species were analyzed in terms of effects of Proposed Action pumping on management objectives (**Appendix F**, **Tables F3.7-8** and **F3.7-9**) for federally listed or conservation agreement species. Results of the analysis are listed below:

- Pahrump Poolfish – As part of the Spring Valley Stipulated Agreement, alternative withdrawal points would be considered for Shoshone Ponds. In addition, mitigation measure GW-WR-4 (drilling a deeper well to provide reliable water for Shoshone ponds) would eliminate pumping effects on Shoshone Ponds and habitat for this species. Therefore, Proposed Action pumping would not affect achievement of recovery plan conservation management objectives for Pahrump poolfish.
- White River Spinedace – Model-simulated percent flow reductions for the Flag Springs complex ranged from 1 to 17 for the three model time frames. The 17 percent reduction would conflict with the recovery plan objective of maintaining and enhancing aquatic habitat for White River spinedace at one of its critical habitat locations.
- Bonneville Cutthroat Trout – Flow reductions were predicted for six Bonneville cutthroat trout streams (Pine and Ridge creeks in Spring Valley and Big Wash, Hendry's, Snake, and Strawberry creeks in Snake Valley). Proposed Action pumping also could reduce flows in reintroduction sites in Silver and Snake creeks. Since Big Wash is considered one of the 14 conservation populations in Nevada (**Figure 3.7-7**), Proposed Action pumping would conflict with conservation management objectives for this species.

- Northern Leopard Frog – Flow reductions in 10 springs inhabited by northern leopard frog would conflict with the conservation management objective of protecting known or potential breeding sites for this species.

Flow or water level reductions also would conflict with management objectives for springs and spring brooks, as defined in the Wildlife Action Plan Team (2006) (**Appendix F**, **Table F3.7-10**).

Applicant-committed Measures

As discussed in the Chapter 3, Affected Environment and Environmental Consequences, Introduction, ACMs would be implemented to reduce groundwater pumping impacts on environmental resources. The measures would involve monitoring, management, and mitigation measures required by existing agreements and adaptive management measures. The following items highlight those measures relative to aquatic biological resources. The ACM number from **Appendix E** is noted in parentheses.

Stipulated Agreements

The plans follow an adaptive management framework such that changes to the monitoring program can occur based on new information and improved understanding of the groundwater-influenced ecosystems. The biological monitoring plans that have been developed to date are strictly monitoring plans (i.e., they lack the mitigation and management component). Thresholds for management action/response have not been identified, but this task will be initiated through the technical work groups. It will be important to link monitoring to appropriate management responses and mitigation to avoid unreasonable adverse effects.

- Implement monitoring, management, and mitigation in Spring, Hamlin, and Snake valleys as required by the Spring Valley Stipulation (ACM C.1.1). Specifically, biological monitoring will be conducted in Spring Valley (Keegan, Minerva Complex, North Little, Shoshone Ponds, South Millick, Stonehouse Complex, Swallow, West Spring Valley Complex, Willard, Willow, 4WD Spring, unnamed spring #5) and Snake Valley (Big Springs Complex, Clay, and unnamed spring #1 north of Big Spring) (Biological Work Group (2009).

- Consider alternative withdrawal points from Shoshone Ponds as part of the Spring Valley Stipulated Agreement (ACM C.1.3).
- Ensure continued monitoring of Flag, Hot Spring, Moorman, Ash, Hiko, and Crystal springs as part of the DDC Stipulation (ACM C.1.38).
- Monitor the biology of valley floor and range-front springs where special status species occur (with approved access) as part of the DDC Stipulation (ACM C.1.42).
- Monitor selected sites for special status species and their habitat in Pahranagat Valley (Ash, Crystal, and Hiko springs) and White River Valley (Hot Creek, Flag, Moorman, and Hardy springs), as determined by the Biological Resource Team and Technical Review Panel (DDC Stipulation) (ACM C.1.42).
- Monitor and mitigate as defined in the Delamar, Dry Lake, and Cave Valley Hydrologic and Biological Monitoring and Mitigation Plans (in preparation).

Other Agreements

- The SNWA assists in the implementation of the Conservation Agreements for the least chub and Columbia spotted frog (ACMs C.1.48 and C.1.49).

Adaptive Management Measures

These measures to restore and enhance habitat for federally listed species would be implemented in cooperation with the Department of Interior agencies and the NDOW.

- Reduce or cease groundwater withdrawals. Reduction or cessation of pumping would be determined on a case-by-case basis for individual production wells or well fields using technical and consultation processes identified in the stipulated agreements.
- Conduct habitat enhancement for springsnails in Snake Valley by restoring natural fluvial morphology of spring flow systems (ACM C.2.6).
- Work with NDOW at the Flag Springs Complex in White River Valley to restore/enhance habitat for the White River spinedace, ensure long-term conservation for the species, and develop water management procedures that would optimize wetland conditions (ACM C.2.8).
- Work with the NDOW and private landowners in areas located at and downstream of Hiko, Crystal, and Ash springs to restore and remove non-native species to benefit Hiko White River springfish, White River springfish, and Pahranagat roundtail chub (ACM C.2.9).
- Assist the BLM with habitat enhancement projects in Rainbow Canyon of Lower Meadow Valley Wash to improve conditions for White River speckled dace, southwestern willow flycatchers, and yellow-billed cuckoo (ACM C.2.14).
- Purchase property or obtain conservation easements on private lands in Snake Valley to reduce grazing impacts on springsnail habitat (ACM C.2.16).
- Purchase property or water rights to preserve or enhance habitat for White River spinedace (ACM C.2.17).
- Reduce or change grazing in wet meadows to improve habitat for northern leopard frog (ACM C.2.18).
- Conduct facilitated recharge projects to offset local groundwater drawdown to benefit sensitive biological areas (ACM C.2.21).

Monitoring Recommendations

GW-MN-AB-1: Stream Flow and Aquatic Biology Monitoring. Monitor flows in game fish streams where potential pumping effects could occur (i.e., 1 stream in Lake Valley, 7 streams in Snake Valley, and 19 streams in Spring Valley [#184]) (**Appendix F**, **Table F3.7-12**). Monitoring measurements would include discharge and cross-sectional profiles. Cross-section data would be used to estimate flow changes on the wetted area of streams. Fish and macroinvertebrate surveys also would be conducted following methods approved by the Department of Interior agencies and the NDOW. <u>Effectiveness</u>: This measure would be highly effective in providing baseline and post-project stream flows prior to and during groundwater pumping. <u>Effects on other resources</u>: Implementation of this measure could involve surface disturbance and operational pumping effects on resources, if alternative diversion points are developed.

GW-MN-AB-2: Spring and Aquatic Biology Monitoring. If access can be obtained, monitoring would be conducted at the following springs where pumping effects are predicted (Butterfield and Flag in White River Valley; Blind, Cleveland Ranch, North Millick, and Osborne in Spring Valley; Caine in Snake Valley; and Wambolt in Lake Valley). These springs contain special status aquatic species and are not being monitored as part of the Spring Valley Stipulated Agreement. Cross-sectional profile measurements would be taken in the springs. Biology surveys (fish, macroinvertebrates, springsnails, and amphibians would follow methods described in the Spring Valley Stipulated Agreement. If monitoring indicates pumping effects, alternative diversion points would be considered. <u>Effectiveness</u>: This measure would be moderate to highly effective in reducing or possibly eliminating pumping effects on these springs. <u>Effects on other resources</u>: Implementation of this measure could involve surface disturbance and operational pumping effects on resources, if alternative diversion points are developed.

GW-MN-AB-3: Flow/habitat Determination. Flow- or water level-habitat relationships will be studied in selected streams and springs to determine minimum flow or water levels needed to support critical life stage of aquatic species in these habitats. The streams or springs will be selected from the list being monitored as part of the Stipulated Agreements or additional waterbodies recommended for Measures GWD-MN-AB-1 and GWD-MN-AB-2. Methods for determining minimum flows in stream habitats will be based on existing procedures involving flow-habitat measurements and flow preferences for fish species. It is anticipated that methods will need to be developed for spring habitats due to a general lack of studies. Effectiveness: This measure would be highly effective in determining flow-habitat relationships. Effects on other resources: This measure would not affect other resources.

GW-MN-AB-4: Monitoring Actions Resulting from the 3M Plan for Snake Valley. A comprehensive monitoring, mitigation, and management plan will be developed for Snake Valley by the BLM in conjunction with SNWA, other federal agencies, and the states of Utah and Nevada (**Appendix B**). Key concepts of the proposed 3M Plan are described in the monitoring and mitigation recommendations section in Water Resources (Section 3.3) as Measure GWD-WR-3; Vegetation Resources (Section 3.5) as Measure GW-VEG-3; and Terrestrial Wildlife (Section 3.6) as Measure GW-WL-8. The plan will include actions to manage or mitigate effects, such as geographic redistribution of groundwater withdrawals; reduction or cessation of groundwater withdrawals; acquisition of property or water rights for management of special status species; and augmentation of water supply or acquisition of exiting water rights. The establishment of technical working groups and baseline biological monitoring is also anticipated to be part of this plan. Biological monitoring could include population level studies for sensitive species or other surrogate species at representative locations. A Technical Work Group will be formed and they will determine through the Nature Conservancy's Conservation Action Planning process, if biological monitoring will be needed in Utah basins adjacent to Snake Valley. The effectiveness and environmental effects of this measure will be determined during subsequent NEPA analyses when specific details are defined.

Mitigation Recommendations

GW-AB-3: Flow Change Mitigation. Specific mitigation measures will be identified for those springs or streams with game fish or special status aquatic species where flow or water level changes are identified during modeling or monitoring. Mitigation ideas are identified as part of ACMs under adaptive management (**Appendix E**). Effectiveness: This measure could be moderately to highly effective in reducing pumping effects on aquatic habitat, if impacts are avoided or offset by mitigation. The effectiveness would depend upon the additional mitigation that would be defined as part of adaptive management. Without defining the actions to be implemented under this measure, it is not possible to describe effects of any actions on environmental resources.

As discussed in Section 3.3, Water Resources, mitigation measure GWD-WR-4 would involve drilling a deeper well that would provide a reliable water source for Shoshone Ponds. The well would be drilled to a depth that would not be affected by pumping. Implementation of this measure would require surface disturbance at the well site, which would require erosion control measures to reduce sediment input to the ponds.

GW-AB-4: Mitigation Actions Resulting from the 3M Plan for Snake Valley. Mitigation planning will be developed as part of the 3M Plan for Snake Valley (**Appendix B**). Management actions to be considered will include geographic redistribution of groundwater withdrawals; reduction or cessation of groundwater withdrawals; provision of consumptive water supply requirements using surface and/or groundwater sources; acquisition of property or water rights dedicated to management of special status species; and augmentation of water supply and/or acquisition of existing water rights. Effectiveness: The effectiveness and environmental effects of this measure will be determined during subsequent NEPA analyses when specific details are defined.

Residual Impacts

As discussed in Section 3.3, Water Resources, groundwater drawdown effects are predicted to extend for at least full build out plus 200 years. These potential effects on aquatic habitats including springs, ponds, lakes, and streams could occur during this time frame. Successful implementation of ACMs and monitoring and mitigation recommendations would likely reduce adverse effects on aquatic habitat and their associated species at some locations. However, it is not possible to determine the level of impact reduction at this time. Residual effects on some aquatic habitats and species could exist considering the potential long recovery period that could occur in some aquatic habitats. Therefore, unavoidable adverse impacts on aquatic habitat and species could occur at some locations.

A summary of impact information including ACMs and mitigation recommendations is provided for the Proposed Action in **Table 3.7-6**. This same tabular presentation is used in subsequent pumping effects analyses for Alternatives A through E and No Action.

Table 3.7-6 Summary of Aquatic Biological Resource Impacts, Applicant-committed Protection Measures, and Monitoring and Mitigation Recommendations for Proposed Action Pumping

Effects/Conclusions

- Flow reductions would modify habitat by decreasing depths, water velocities, and wetted area in spring/pond/lake and stream habitats. A total of 30 springs/ponds/lakes and 33 streams are at risk when considering the longest model time frame.
- Effects would be most pronounced in riffle habitats in streams and spring inflow and outflow areas. Effects on pool habitats would depend on the magnitude of the flow change and size of the pools. Reduced flows could adversely affect aquatic habitat by altering thermal regimes, increasing sedimentation, and reducing riparian cover. A complete loss of habitat could occur in small springs and larger springs such as Big Springs in Snake Valley.
- Flow reductions could adversely affect aquatic species by reducing abundance and diversity, altering composition, reducing food sources, limiting spawning and early life stage development, and decreasing individual health condition.
- Flow reductions in 9 springs in Spring Valley and 1 spring in Lake Valley could result in habitat reductions and adverse effects on the special status amphibian, northern leopard frog.
- Flow reductions in Big Springs Creek and Lake Creek in Snake Valley could result in substantial loss of habitat and aquatic species.
- Flow reductions in 4 springs in Snake Valley could result in loss of bifid duct and longitudinal gland pyrg populations at these locations.
- Substantial flow reductions in Butterfield, Flag, and Wambolt springs could result in the loss of Butterfield, Flag, and Lake Valley pyrg populations due to their limited occurrence (one spring/one basin).
- Conflicts with recovery or conservation management objectives could occur for four species: Pahrump poolfish (Shoshone Ponds), White River springfish (Flag Springs), Bonneville cutthroat trout (2 streams in Spring Valley and 4 streams in Snake Valley), and northern leopard frog (10 springs).
- Game fish species considered to be traditional values to regional Tribes could be affected in Snake, Spring, Lake, and Lower Meadow Valley Wash.

Impact Indicators[1] By Model Time Frame	Full Build Out	Full Build Out Plus 75 Years	Full Build Out Plus 200 Years
Number of Hydrologic Basins at Risk with Waterbodies Containing Game Fish or Special Status Species	1	3	6
Estimated Percent Flow Reductions			
Butterfield Spring (White River Valley)	1	7	18
Flag Springs (White River Valley)	1	7	17
Keegan Spring (Spring Valley)	58	100	100
North Millick Spring (Spring Valley)	31	62	75
South Millick Spring (Spring Valley)	55	94	99
Big Springs (Snake Valley)	2	100	100
Federally Listed Species at Risk			
Pahrump poolfish	No effect	Potential effect	Potential effect
White River spinedace	No effect	Potential effect	Potential effect
Number of Springs/Ponds/Lakes with Game Fish or Special Status Species at Risk	1	10	12
Number of Springs/Ponds/Lakes with Special Status Amphibian Species at Risk	3	9	10
Number of Springs/Ponds/Lakes with Special Status Invertebrate Species at Risk	0	7	8
Number of Small Springs (100 gpm) with Aquatic Species at Risk	0	13	15

Table 3.7-6 Summary of Aquatic Biological Resource Impacts, Applicant-committed Protection Measures, and Monitoring and Mitigation Recommendations for Proposed Action Pumping (Continued)

Number of Streams with Game Fish or Special Status Species at Risk	4	25	30
Miles of Streams at Risk with Game Fish or Special Status Species	6	60	75
GBNP Springs and Streams[2] with Game Fish or Special Status Species at Risk			
Outhouse Spring	No effect	Potential effect	Potential effect
Rowland Spring	No effect	No effect	Potential effect
Lehman Creek	No effect	No effect	0.5 mile
Snake Creek	No effect	1.8 miles	1.9 miles
Utah Springs and Streams with Game Fish or Special Status Species at Risk			
Caine Spring	No effect	Potential effect	Potential effect
Clay Spring	No effect	Potential effect	Potential effect
Stateline Spring	No effect	Potential effect	Potential effect
Lake Creek	No effect	10.6 miles	10.6 miles
Snake Creek	No effect	1.2 miles	1.2 miles

ACMs

- Existing agreements include the Spring Valley Stipulation, DDC Stipulation, Conservation Agreements (least chub and Columbia spotted frog), Utah and SNWA Snake Valley Environmental Monitoring and Management Agreement (not yet completed), and Candidate Conservation Agreement/Candidate Conservation Agreement (not yet completed).
- The Spring Valley and DDC Stipulated Agreements will involve monitoring in selected springs in Spring, Snake, Delamar, Dry Lake, and Cave valleys (see Measures C.1.1 and C.1.38 in **Appendix E**). The Spring Valley Stipulated Agreement also would consider alternative withdrawal points from Shoshone Ponds.
- ACMs would be implemented to restore and enhance habitat for federally listed or special status species and would be done in cooperation with the USFWS. These measures would restore or enhance habitat for springsnails (ACM C.2.6 and C.2.16), White River spinedace (ACM C.2.8 and C.2.17), White River springfish (ACM C.2.9), Hiko White River springfish (ACM C.2.9), Pahranagat roundtail chub (ACM C.2.9), White River speckled dace (ACM C.2.14), and northern leopard frog (ACMC.2.18).

Monitoring Recommendations

GW-MN-AB-1, **GW-MN-AB-2**, and **GW-MN-AB-4** would be applied to the Proposed Action. Springs and streams to be considered for monitoring are provided in **Appendix F3.7**, **Tables F3.7-11** and **F3.7-12**.

GW-MN-AB-3 will be conducted in selected springs and streams to be able to determine minimum flows or water levels for critical life stages of representative fish species.

Mitigation Recommendations

GW-MT-AB-3 and **GW-AB-4** would be applied to the Proposed Action.

GW-WR-4 would avoid a conflict with management objectives for Pahrump poolfish.

Residual Impacts

ACMs and monitoring and mitigation measures could be effective in reducing impacts to aquatic habitats and species. However, it is not possible to determine the level of impact reduction at this time. Residual effects on some aquatic habitats and species could exist considering the potential long recovery period that could occur in some aquatic habitats. Therefore, unavoidable adverse impacts on aquatic habitat and species could occur at some locations.

1 Parameters are based on streams or springs that are located within the 10-foot drawdown contour and characterized as having moderate or high risk of pumping effects.

2 A study by Elliott et al. (2006) indicated that other streams at risk include Shingle and Williams Canyon creeks in Spring Valley and Baker and Strawberry creeks in Snake Valley.

3.7.2.10 Alternative A

Groundwater Development Area

Surface disturbance would be dispersed throughout the five groundwater development basins (Snake, Spring, and DDC). The effects of constructing well pads, gathering pipelines, and electrical service lines would depend upon the location of the facilities in relation to aquatic biological resources. In total, 17 perennial streams and 5 springs with aquatic biological resources occur in the groundwater development areas. A more detailed account of the resource information includes:

- Game Fish – Species occur in 2 streams in Snake Valley and 13 streams in Spring Valley (**Table 3.7-1**; **Figure 3.7-3**).
- Special Status Fish – Bonneville cutthroat trout occurs in one stream (Big Wash in Snake Valley) (**Figure 3.7-3**).
- Special Status Amphibians – Northern leopard frog occurs in three springs (Blind, North Millick, and South Millick in Spring Valley) within the groundwater development areas (**Figure 3.7-4**).
- Springsnails – Toquerville pyrg (not a special status species) occurs in two springs within the groundwater development areas (unnamed spring southwest of Caine Spring in Snake Valley) and unnamed spring near Cleve Creek in Spring Valley) (**Figure 3.7-4**).
- Macroinvertebrates – Species are present in all 17 perennial streams and 5 springs and waterbodies with seasonal water presence in the groundwater development area.

The effects and conclusions of groundwater development on aquatic biological resources are provided in **Table 3.7-7** along with ACMs and proposed mitigation.

Table 3.7-7 Summary of Aquatic Biological Resource Impacts, ACMs, and Monitoring and Mitigation Recommendations for Alternative A Groundwater Development

Effects
• Construction could alter aquatic habitat on a short-term basis in 17 perennial streams and 5 springs with aquatic biological resources. Riparian vegetation near waterbodies could be affected on a long-term basis. Surface disturbance and vehicle/equipment could affect water quality from sediment input and risks from fuel spills on a short-term basis. • Instream activities in the spring or fall could affect trout spawning on a short-term basis. • Vehicle traffic near waterbodies could cause mortalities to amphibians during movement periods especially during the spring and summer breeding periods. • Special status Bonneville cutthroat trout could be affected in one stream within the groundwater development areas (Big Wash in Snake Valley). • Special status amphibian species could be affected in three springs within the groundwater development areas. • Springsnail species could be affected in spring habitats within two of the groundwater development areas (one unnamed spring in Spring Valley and one spring in Snake Valley). • Conflicts with conservation management objectives could occur for two species: Bonneville cutthroat trout (Big Wash) and northern leopard frog (three springs). • Game fish species considered to be traditional values to regional Tribes could be affected in Snake and Spring valleys.
BLM RMP Direction and ACMs
• BLM RMP direction for development near springs specifies that surface water resources and associated riparian areas be maintained. • ACM B.1.1 and ACM B.1.3 will consider the presence of special status species and their habitat in the location of production wells, collector lines, and secondary substations. • ACM B.2.1 through B.2.3 will implement permit requirements on well drilling, abandonment, drilling, and water discharge.
Proposed Mitigation
GW-AB-1 (avoidance of springs with special status aquatic species) and GW-AB-2 (establishing a 0.5-mile buffer near perennial streams with game fish and special status aquatic species), as described for the Proposed Action, would be applied to Alternative A.

Table 3.7-7 Summary of Aquatic Biological Resource Impacts, ACMs, and Monitoring and Mitigation Recommendations for Alternative A Groundwater Development (Continued)

Conclusions • By avoiding springs and streams with game fish or special status species, short-term disturbance would be limited to waterbodies with seasonal flow or limited water volumes. Macroinvertebrates likely would be present in these waterbodies. • Vehicle traffic could cause mortalities to amphibians during movement periods especially during the spring and summer breeding periods.
Residual Impacts • Potential amphibian mortalities from vehicle traffic near temporary and permanent waterbodies during construction.

Groundwater Pumping

Alternative A would consist of reduced quantity pumping (114,755 afy) at distributed locations in Snake, Spring, and DDC valleys. Alternative A pumping could result in reductions in aquatic habitat and affect aquatic species. Based on the model analysis, the predicted 10-foot drawdown contour for Alternative A pumping is shown for streams in **Figure 3.7-9** and springs in **Figure 3.7-10**. Flows could be reduced in the following number of habitats with aquatic biological resources for the three model time frames.

- Streams – 2 at full build out, 15 at full build out plus 75 years, and 20 at full build out plus 200 years; and
- Springs – 3 at full build out, 19 at full build out plus 75 years, and 28 at full build out plus 200 years.

Flow reductions could affect all types of aquatic communities including fish, amphibians, macroinvertebrates, macrophytes, and algae. For this EIS analysis, emphasis was placed on game fish and special status aquatic species. Alternative A could adversely affect the following game fish or special status species and their associated waterbody occurrences in at least one of the model time frames. Specific results for waterbodies and species at risk for each model time frame are provided in **Appendix F**, **Tables F3.7-14** and **F3.7-15**.

- Game Fish Streams – Geyser Creek in Lake Valley; Baker, Big Wash, Lehman, Silver, and Snake creeks in Snake Valley; Bastian, Indian, Meadow, Muncy, Piermont, Pine, Ridge, Shingle, Siegel, Willard, and Williams Canyon creeks in Spring Valley.
- Game Fish Springs/Ponds/Lakes – Swallow Spring in Spring Valley; Pruess Lake, Rowland Spring, and Silver Creek Reservoir in Snake Valley.
- Federally Listed Species – Flag Springs (White River spinedace) in White River Valley and Shoshone Ponds (Pahrump poolfish) in Spring Valley.
- Bonneville Cutthroat Trout – Stream miles at risk for flow reductions include: Pine (0.1 to 0.4 mile), Ridge (0.6 to 1.1 miles), Big Wash (4.8 miles), and Snake (<0.1 mile).
- Other Special Status Fish Streams – Baker, Big Wash, and Snake creeks in Snake Valley and Ridge Creek in Spring Valley.
- Other Special Status Fish Springs/Ponds/Lakes – Butterfield and Flag springs in White River Valley; Keegan and Minerva springs, and Shoshone Ponds in Spring Valley; and Big Springs and Stateline Springs in Snake Valley.
- Special Status Amphibian Species Springs/Ponds/Lakes – Blind, Keegan, Minerva, North Millick, South Millick, and unnamed #5 springs and Shoshone Ponds and O'Neal/Frog Pond in Spring Valley and Wambolt Spring in Lake Valley.
- Special Status Invertebrates Springs/Ponds/Lakes – Butterfield and Flag springs in White River Valley; Big Springs, Clay, Stateline Springs, one unnamed spring, and Pruess Lake in Snake Valley; and Wambolt Spring in Lake Valley.

Figure 3.7-9 Alternatives A Drawdown and Streams/Waterbodies with Aquatic Biological Resources

Figure 3.7-10 Alternative A Drawdown and Springs with Aquatic Biological Resources

The effects and conclusions of groundwater development on aquatic biological resources are provided in **Table 3.7-8** along with ACMs and proposed mitigation.

Table 3.7-8 Summary of Aquatic Biological Resource Impacts, ACMs, and Monitoring and Mitigation Recommendations for Alternative A Pumping

Effects/Conclusions

- Flow reductions would modify habitat by decreasing depths, water velocities, and wetted area in spring/pond/lake and stream habitats. A total of 28 springs/ponds/lakes and 20 streams are at risk when considering the longest model time frame.
- Effects would be most pronounced in riffle habitats in streams and spring inflow and outflow areas. Effects on pool habitats would depend on the magnitude of the flow change and size of the pools. Reduced flows could adversely affect aquatic habitat by altering thermal regimes, increasing sedimentation, and reducing riparian cover. A complete loss of habitat could occur in small springs and larger springs such as Big Springs in Snake Valley.
- Flow reductions could adversely affect aquatic species by reducing abundance and diversity, altering composition, reducing food sources, limiting spawning and early life stage development, and decreasing individual health condition.
- Flow reductions in 8 springs/ponds in Spring Valley and 1 spring in Lake Valley could result in habitat reductions and adverse effects on the special status amphibian, northern leopard frog.
- Flow reductions in Big Springs Creek and Lake Creek in Snake Valley could result in substantial loss of habitat and aquatic species.
- Flow reductions in 4 springs in Snake Valley could result in loss of bifid duct and longitudinal gland pyrg populations at these locations.
- Due to their limited occurrence (one spring/one basin), populations of Butterfield pyrg (Butterfield Spring), Flag pyrg (Flag Springs), and Lake Valley pyrg (Wambolt Spring) could be lost if their spring habitat is substantially reduced.
- Conflicts with recovery or conservation management objectives could occur for four species: Pahrump poolfish (Shoshone Ponds), White River springfish (Flag Springs), Bonneville cutthroat trout (2 streams in Spring Valley and 2 streams in Snake Valley), and northern leopard frog (9 springs/ponds).
- Game fish species considered to be traditional values to regional Tribes could be affected in Snake, Spring, Lake, and Lower Meadow Valley Wash.

Impact Indicators[1] By Model Time Frame	Full Build Out Plus 75 Years	Full Build Out Plus 200 Years	Full Build Out Plus 75 Years
Number of Hydrologic Basins at Risk with Waterbodies Containing Game Fish or Special Status Species	1	2	4
Estimated Percent Flow Reductions			
Butterfield Spring (White River Valley)	0	3	8
Flag Springs (White River Valley)	1	3	8
Keegan Spring (Spring Valley)	12	28	36
North Millick Spring (Spring Valley)	4	9	11
South Millick Spring (Spring Valley)	10	21	24
Big Springs (Snake Valley)	2	100	100
Federally Listed Species at Risk			
Pahrump poolfish	No effect	Potential effect	Potential effect
White River spinedace	No effect	No effect	Potential effect
Number of Springs/Ponds/Lakes with Game Fish or Special Status Species at Risk	2	8	11
Number of Springs/Ponds/Lakes with Special Status Amphibian Species at Risk	2	6	9
Number of Springs/Ponds/Lakes with Special Status Invertebrate Species at Risk	0	5	8
Number of Small Springs (100 gpm) with Aquatic Species at Risk	0	7	12

Table 3.7-8 Summary of Aquatic Biological Resource Impacts, ACMs, and Monitoring and Mitigation Recommendations for Alternative A Pumping (Continued)

Number of Streams with Game Fish or Special Status Species at Risk	2	14	19
Miles of Streams at Risk with Game Fish or Special Status Species	3	45	52
GBNP Springs and Streams[2] with Game Fish or Special Status Species at Risk			
Outhouse Spring	No effect	Potential effect	Potential effect
Rowland Spring	No effect	No effect	Potential effect
Lehman Creek	No effect	No effect	0.5 mile
Snake Creek	No effect	1.8 miles	1.9 miles
Utah Springs and Streams with Game Fish or Special Status Species at Risk			
Caine Spring	No effect	Potential effect	Potential effect
Clay Spring	No effect	Potential effect	Potential effect
Stateline Spring	No effect	Potential effect	Potential effect
Lake Creek	No effect	10.6 miles	10.6 miles
Snake Creek	No effect	1.2 miles	1.2 miles

ACMs

- Existing agreements include the Spring Valley Stipulation, DDC Stipulation, Conservation Agreements (least chub and Columbia spotted frog) Utah and SNWA Snake Valley Environmental Monitoring and Management Agreement (not yet completed), and Candidate Conservation Agreement/Candidate Conservation Agreement (not yet completed).
- The Spring Valley and DDC Stipulated Agreements will involve monitoring in selected springs in Spring, Snake, DDC valleys (see Measures C.1.1 and C.1.38 in **Appendix E**). The Spring Valley Stipulated Agreement also would consider alternative withdrawal points from Shoshone Ponds.
- ACMs would be implemented to restore and enhance habitat for federally listed or special status species and would be done in cooperation with the USFWS. These measures would restore or enhance habitat for springsnails (ACM C.2.6 and ACM C.2.16), White River spinedace (ACM C.2.8 and ACM C.2.17), White River springfish (ACM C.2.9), Hiko White River springfish (ACM C.2.9), Pahranagat roundtail chub (ACM C.2.9), White River speckled dace (ACM C.2.14), and northern leopard frog (ACMC.2.18).

Monitoring Recommendations

GW-MN-AB-1, **GW-MN-AB-2**, and **GW-MN-AB-4** described for the Proposed Action, would be applied to Alternative A. Springs and streams to be considered for monitoring are provided in **Appendix F3.7**, **Tables F3.7-14** and **F3.7-15**.

GW-MN-AB-3 will be conducted in selected springs and streams to be able to determine minimum flows or water levels for critical life stages of representative fish species.

Mitigation Recommendations

GW-AB-3 and **GW-AB-4**, described for the Proposed Action, also would be applied to Alternative A.

GW-WR-4 would avoid a conflict with management objectives for Pahrump poolfish.

Residual Impacts

ACMs and monitoring and mitigation measures could be effective in reducing impacts to aquatic habitats and species. However, it is not possible to determine the level of impact reduction at this time. Residual effects on some aquatic habitats and species could exist considering the potential long recovery period that could occur in some aquatic habitats. Therefore, unavoidable adverse impacts on aquatic habitat and species could occur at some locations.

[1] Parameters are based on streams or springs that are located within the 10-foot drawdown contour and characterized as having moderate or high risk of pumping effects.

[2] A study by Elliott et al. (2006) indicated that other streams at risk include Shingle and Williams Canyon creeks in Spring Valley and Baker and Strawberry creeks in Snake Valley.

3.7.2.11 Alternative B

Groundwater Development Area

Surface disturbance would be focused on an approximate 1-mile radius of diversion points in five basins (Snake, Spring, Cave, Dry Lake, and Delamar). The effects of constructing well pads, gathering pipelines, and electrical service lines would depend upon the location of the facilities in relation to aquatic biological resources. In total, one perennial stream (Big Springs Creek in Snake Valley) and one spring (Kious Spring in Snake Valley) with aquatic biological resources occur in the groundwater development areas. A more detailed account of the resource information includes:

- Game Fish – No species are present in Big Springs Creek or Kious Spring.
- Native Fish – Native species (mottled sculpin, redside shiner, speckled dace, and Utah chub) that have limited distribution in Nevada occur in Big Springs Creek.
- Special Status Amphibians – No species are present in Big Springs Creek or Kious Spring.
- Springsnails – Springsnails (species not identified) occur in Kious Spring.
- Macroinvertebrates – Species are present in Big Springs Creek, Kious Spring, and waterbodies with seasonal water presence in the groundwater development area.

The effects and conclusions of groundwater development on aquatic biological resources are provided in **Table 3.7-9** along with ACMs and proposed mitigation.

Table 3.7-9 Summary of Aquatic Biological Resource Impacts, ACMs, and Monitoring and Mitigation Recommendations for Alternative B Groundwater Development

Effects
• Construction could alter aquatic habitat on a short-term basis in one perennial stream (Big Springs Creek) and one spring (Kious) in Snake Valley. Riparian vegetation near waterbodies could be affected on a long-term basis. Surface disturbance and vehicle/equipment could affect water quality from sediment input and risks from fuel spills on a short-term basis. • Vehicle traffic near waterbodies could cause mortalities to amphibians during movement periods especially during the spring and summer breeding periods. • Springsnail species could be affected in Kious Spring in one of the groundwater development areas in Snake Valley. • There would be no conflicts with management objectives for special status species. • There would be no effects on fish species considered to be traditional values to regional Tribes.
BLM RMP Direction and ACMs
• The BLM RMP direction for development near springs specifies that surface water resources and associated riparian areas be maintained. • ACMs B.1.1 and B.1.3 will consider the presence of special status species and their habitat in the location of production wells, collector lines, and secondary substations. • ACMs B.2.1 through B.2.3 will implement permit requirements on well drilling, abandonment, drilling, and water discharge.
Proposed Mitigation
GW-AB-1 and **GW-AB-2**, as described for the Proposed Action, would be applied to Alternative B. **GW-AB-2**, as described for the Proposed Action, would be applied to Alternative B.
Conclusions • By avoiding springs and streams with game or native fish or special status species, short-term disturbance would be limited to waterbodies with seasonal flow or limited water volumes. Macroinvertebrates likely would be present in these waterbodies. • Vehicle traffic could cause mortalities to amphibians during movement periods especially during the spring and summer breeding periods.
Residual Impacts • Potential amphibian mortalities from vehicle traffic near temporary and permanent waterbodies during construction.

Groundwater Pumping

Alternative B would consist of full quantity pumping (176,655 afy) at or near Points of Diversions in Snake, Spring, and DDC valleys. Alternative B pumping could result in reductions in aquatic habitat and affect aquatic species. Based on the model analysis, the predicted 10-foot drawdown contour for Alternative B pumping is shown for streams in **Figure 3.7-11** and springs in **Figure 3.7-12**. Flows could be reduced in the following number of habitats with aquatic biological resources for the three model time frames.

- Streams – 3 at full build out, 18 at full build out plus 75 years, and 24 at full build out plus 200 years; and
- Springs – 8 at full build out, 26 at full build out plus 75 years, and 32 at full build out plus 200 years.

Flow reductions could affect all types of aquatic communities including fish, amphibians, macroinvertebrates, macrophytes, and algae. For this EIS analysis, emphasis was placed on game fish and special status aquatic species. Alternative B could adversely affect the following game fish or special status species and their associated waterbody occurrences in at least one of the model time frames. Specific results for waterbodies and species at risk for each model time frames are provided in **Appendix F**, **Tables F3.7-16** and **F3.7-17**.

- Game Fish Streams – Steptoe Creek in Steptoe Valley; Geyser Creek in Lake Valley; Baker, Big Wash, Lehman, Silver, Snake, and Strawberry creeks in Snake Valley; Bastian, Indian, Negro, Pine, Ridge, Shingle, Taft, South Taft, Vipont, Willard, and Williams Canyon creeks in Spring Valley; and Lower Meadow Valley Wash (stream and basin name).
- Game Fish Springs/Ponds/Lakes – Swallow Spring in Spring Valley; Pruess Lake, Rowland Spring, and Silver Creek Reservoir in Snake Valley; and Cave Lake in Steptoe Valley.
- Federally Listed Species – Flag Springs (White River spinedace) in White River Valley and Shoshone Ponds (Pahrump poolfish) in Spring Valley.
- Bonneville Cutthroat Trout – Stream miles at risk for flow reductions include: Pine (0.1 to 0.4 mile), Ridge (0.6 to 1.1 miles), Big Wash (4.8 miles), Strawberry (1.5 to 1.9 miles), and Snake (<0.1 mile).
- Other Special Status Fish Streams – Baker, Big Wash, Snake, and Strawberry creeks in Snake Valley; Pine and Ridge creeks in Spring Valley; and Meadow Valley Wash (same valley name).
- Other Special Status Fish Springs/Ponds/Lakes – Butterfield, Flag, Hot Creek and Moorman springs in White River Valley; Minerva Spring and Shoshone Ponds in Spring Valley; and Big Springs and Stateline Springs in Snake Valley.
- Special Status Amphibian Species Springs/Ponds/Lakes – Blind, Cleveland Ranch, Minerva, North Millick, South Millick, West Valley Complex, and unnamed # 5 springs and Shoshone Ponds in Spring Valley and Wambolt Spring in Lake Valley.
- Special Status Invertebrates Springs/Ponds/Lakes – Butterfield, Flag, Hot Creek, and Moorman springs in White River Valley; Big Springs, Clay, Stateline, and one unnamed spring and Pruess Lake in Snake Valley; and Wambolt Spring in Lake Valley.

The effects and conclusions of groundwater development on aquatic biological resources are provided in **Table 3.7-10** along with ACMs and proposed mitigation.

Figure 3.7-11 Alternative B Drawdown and Streams/Waterbodies with Aquatic Biological Resources

Figure 3.7-12 Alternative B Drawdown and Springs with Aquatic Biological Resources

Table 3.7-10 Summary of Aquatic Biological Resource Impacts, ACMs, and Monitoring and Mitigation Recommendations for Alternative B Pumping

Effects/Conclusions

- Flow reductions would modify habitat by decreasing depths, water velocities, and wetted area in spring/pond/lake and stream habitats. A total of 32 springs/ponds/lakes and 24 streams are at risk when considering the longest model time frame.
- Effects would be most pronounced in riffle habitats in streams and spring inflow and outflow areas. Effects on pool habitats would depend on the magnitude of the flow change and size of the pools. Reduced flows could adversely affect aquatic habitat by altering thermal regimes, increasing sedimentation, and reducing riparian cover. A complete loss of habitat could occur in small springs and larger springs such as Big Springs in Snake Valley.
- Flow reductions could adversely affect aquatic species by reducing abundance and diversity, altering composition, reducing food sources, limiting spawning and early life stage development, and decreasing individual health condition.
- Flow reductions in 8 springs/ponds in Spring Valley and 1 spring in Lake Valley could result in habitat reductions and adverse effects on the special status amphibian, northern leopard frog.
- Flow reductions in Big Springs Creek and Lake Creek in Snake Valley could result in substantial loss of habitat and aquatic species.
- Flow reductions in 4 springs in Snake Valley could result in loss of bifid duct and longitudinal gland pyrg populations at these locations.
- Due to their limited occurrence (one spring/one basin), populations of Butterfield pyrg (Butterfield Spring) Flag pyrg (Flag Springs), and Lake Valley pyrg (Wambolt Spring) could be lost if their spring habitat is substantially reduced.
- Conflicts with recovery or conservation management objectives could occur for four species: Pahrump poolfish (Shoshone Ponds), White River springfish (Flag Springs), Bonneville cutthroat trout (2 streams in Spring Valley and 3 streams in Snake Valley), and northern leopard frog (9 springs).
- Game fish species considered to be traditional values to regional Tribes could be affected in Snake, Spring, Lake, and Lower Meadow Valley Wash.

Impact Indicators[1] By Model Time Frame	Full Build Out	Full Build Out Plus 75 Years	Full Build Out Plus 200 Years
Number of Hydrologic Basins at Risk with Waterbodies Containing Game Fish or Special Status Species	3	4	7
Estimated Percent Flow Reductions			
Butterfield Spring (White River Valley)	20	34	45
Flag Springs (White River Valley)	19	29	37
Hot Creek Spring (White River Valley)	3	5	7
Moorman Spring (White River Valley)	2	4	6
Keegan Spring (Spring Valley)	0	3	5
North Millick Spring (Spring Valley)	2	18	42
South Millick Spring (Spring Valley)	8	47	99
Big Springs (Snake Valley)	7	100	100
Federally Listed Species at Risk			
Pahrump poolfish	No effect	Potential effect	Potential effect
White River spinedace	Potential effect	Potential effect	Potential effect
Number of Springs/Ponds/Lakes with Game Fish or Special Status Species at Risk	5	10	14
Number of Springs/Ponds/Lakes with Special Status Amphibian Species at Risk	3	8	9
Number of Springs/Ponds/Lakes with Special Status Invertebrate Species at Risk	3	7	10
Number of Small Springs (100 gpm) with Aquatic Species at Risk	2	9	13
Number of Streams with Game Fish or Aquatic Species at Risk	3	18	24

Table 3.7-10 Summary of Aquatic Biological Resource Impacts, ACMs, and Monitoring and Mitigation Recommendations for Alternative B Pumping (Continued)

Miles of Streams at Risk with Game Fish or Special Status Species	3	59	72
GBNP Springs and Streams[2] with Game Fish or Special Status Species at Risk			
Outhouse Spring	No effect	Potential effect	Potential effect
Rowland Spring	No effect	Potential effect	Potential effect
Baker Creek	No effect	1.2 miles	1.6 miles
Lehman Creek	No effect	2.0 miles	2.5 miles
Snake Creek	No effect	1.9 miles	1.9 miles
Utah Springs and Streams with Game Fish or Special Status Species at Risk			
Clay Spring	No effect	Potential effect	Potential effect
Stateline Spring	No effect	Potential effect	Potential effect
Lake Creek	No effect	10.6 miles	10.6 miles
Snake Creek	No effect	0.6 mile	0.6 mile

ACMs

- Existing agreements include the Spring Valley Stipulation, DDC Stipulation, Conservation Agreements (least chub and Columbia spotted frog) Utah and SNWA Snake Valley Environmental Monitoring and Management Agreement (not yet completed), and Candidate Conservation Agreement/Candidate Conservation Agreement (not yet completed).
- The Spring Valley and DDC Stipulated Agreements will involve monitoring in selected springs in Spring, Snake, and DDC valleys (see ACMs C.1.1 and C.1.38 in **Appendix E**). The Spring Valley Stipulated Agreement also would consider alternative withdrawal points from Shoshone Ponds.
- ACMs would be implemented to restore and enhance habitat for federally listed or special status species and would be done in cooperation with the USFWS. These measures would restore or enhance habitat for springsnails (ACMs C.2.6 and C.2.16), White River spinedace (ACMs C.2.8 and C.2.17), White River springfish (ACMs C.2.9), Hiko White River springfish (ACM C.2.9), Pahranagat roundtail chub (ACM C.2.9), White River speckled dace (ACM C.2.14), and northern leopard frog (ACM C.2.18).

Monitoring Recommendations

GW-MN-AB-1, **GW-MN-AB-2**, and **GW-MN-AB-4**, described for the Proposed Action, would be applied to Alternative B. Springs and streams to be considered for monitoring are provided in **Appendix F3.7**, **Tables F3.7-16** and **F3.7-17**.

GW-MN-AB-3 will be conducted in selected springs and streams to be able to determine minimum flows or water levels for critical life stages of representative fish species.

Mitigation Recommendations

GW-AB-3 and **GW-AB-4**, described for the Proposed Action, also would be applied to Alternative B.

GW-WR-4 would avoid a conflict with management objectives for Pahrump poolfish.

Residual Impacts

ACMs and monitoring and mitigation measures could be effective in reducing impacts to aquatic habitats and species. However, it is not possible to determine the level of impact reduction at this time. Residual effects on some aquatic habitats and species could exist considering the potential long recovery period that could occur in some aquatic habitats. Therefore, unavoidable adverse impacts on aquatic habitat and species could occur at some locations.

[1] Parameters are based on streams or springs that are located within the 10-foot drawdown contour and characterized as having moderate or high risk of pumping effects.

[2] A study by Elliott et al. (2006) indicated that other streams at risk include Shingle and Williams Canyon creeks in Spring Valley and Baker and Strawberry creeks in Snake Valley.

3.7.2.12 Alternative C

Groundwater Development Area

Surface disturbance would be dispersed throughout the five groundwater development basins (Snake, Spring, Cave, Dry Lake, and Delamar). The effects of constructing well pads, gathering pipelines, and electrical service lines would depend upon the location of the facilities in relation to aquatic biological resources. In total, 23 perennial streams and 5 springs with aquatic biological resources occur in the groundwater development areas. A more detailed account of the resource information includes:

- Game Fish – Species occur in 2 streams in Snake Valley and 13 streams in Spring Valley (**Table 3.7-1**; **Figure 3.7-3)**.
- Special Status Fish – Bonneville cutthroat trout occurs in one stream (Big Wash in Snake Valley) (**Figure 3.7-3)**.
- Special Status Amphibians – Northern leopard frog occurs in three springs (Blind, North Millick, and South Millick in Spring Valley) within the groundwater development areas (**Figure 3.7-4**).
- Springsnails – Toquerville pyrg (not a special status species) occurs in two springs within the groundwater development areas (unnamed spring southwest of Caine Spring in Snake Valley and unnamed spring near Cleve Creek in Spring Valley) (**Figure 3.7-4**).
- Macroinvertebrates – Species are present in all 17 perennial streams and 5 springs and waterbodies with seasonal water presence in the groundwater development area.

The effects and conclusions of groundwater development on aquatic biological resources are provided in **Table 3.7-11** along with ACMs and proposed mitigation.

Table 3.7-11 Summary of Aquatic Biological Resource Impacts, ACMs, and Monitoring and Mitigation Recommendations for Alternative C Groundwater Development

Effects
• Construction could alter aquatic habitat on a short-term basis in 17 perennial streams and five springs with aquatic biological resources. Riparian vegetation near waterbodies could be affected on a long-term basis. Surface disturbance and vehicle/equipment could affect water quality from sediment input and risks from fuel spills on a short-term basis. • Instream activities in the spring or fall could affect trout spawning on a short-term basis. • Vehicle traffic near waterbodies could cause mortalities to amphibians during movement periods especially during the spring and summer breeding periods. • Special status Bonneville cutthroat trout could be affected in one stream within the groundwater development areas (Big Wash in Snake Valley). • Special status amphibian species could be affected in three springs within the groundwater development areas. • Springsnail species could be affected in spring habitats within two of the groundwater development areas (one unnamed spring in Spring Valley and one spring in Snake Valley). • Conflicts with conservation management objectives could occur for two species: Bonneville cutthroat trout (Big Wash) and northern leopard frog (3 springs). • Game fish species considered to be traditional values to regional Tribes could be affected in Snake and Spring valleys.
BLM RMP Direction and ACMs
• BLM RMP direction for development near springs specifies that surface water resources and associated riparian areas be maintained. ACM B.1.1 and B.1.3 will consider the presence of special status species and their habitat in the location of production wells, collector lines, and secondary substations. • ACM B.2.1 through B.2.3 will implement permit requirements on well drilling, abandonment, drilling, and water discharge.
Proposed Mitigation
GW-AB-1 and **GW-AB-2**, as described for the Proposed Action, would be applied to Alternative C.

Table 3.7-11 Summary of Aquatic Biological Resource Impacts, ACMs, and Monitoring and Mitigation Recommendations for Alternative C Groundwater Development (Continued)

Conclusions
• By avoiding springs and streams with game fish or special status species, short-term disturbance would be limited to waterbodies with seasonal flow or limited water volumes. Macroinvertebrates likely would be present in these waterbodies. • Vehicle traffic could cause mortalities to amphibians during movement periods especially during the spring and summer breeding periods.
Residual Impacts
• Potential amphibian mortalities from vehicle traffic near temporary and permanent waterbodies during construction.

Groundwater Pumping

Alternative C would consist of intermittent pumping (between 12,000 to 114,755 afy) at distributed locations in Snake, Spring, Cave, Dry Lake, and Delamar valleys based on a conceptual drought scenario. Alternative C pumping could result in reductions in aquatic habitat and affect aquatic species. Based on the model analysis, the predicted 10-foot drawdown contour for Alternative C pumping is shown for streams in **Figure 3.7-13** and springs in **Figure 3.7-14**. Flows could be reduced in the following number of habitats with aquatic biological resources for the three model time frames.

- Streams – 1 at full build out, 12 at full build out plus 75 years, and 13 at full build out plus 200 years; and
- Springs – 2 at full build out, 12 at full build out plus 75 years, and 17 at full build out plus 200 years.

Flow reductions could affect all types of aquatic communities including fish, amphibians, macroinvertebrates, macrophytes, and algae. For this EIS analysis, emphasis was placed on game fish and special status aquatic species. Alternative C could adversely affect the following game fish or special status species and their associated waterbody occurrences in at least one of the model time frames. Specific results for waterbodies and species at risk for each model time frames are provided in **Appendix F**, **Tables F3.7-18** and **F3.7-19**.

- Game Fish Streams – Baker, Big Wash, Lehman, Silver, and Snake creeks in Snake Valley; Bastian, Pine, Ridge, Shingle, and Williams Canyon creeks in Spring Valley.
- Game Fish Springs/Ponds/Lakes – Swallow Spring in Spring Valley; Pruess Lake, Rowland Spring, and Silver Creek Reservoir in Snake Valley.
- Federally Listed Species –Shoshone Ponds (Pahrump poolfish) in Spring Valley.
- Bonneville Cutthroat Trout – Stream miles at risk for flow reductions include: Pine (0.1 mile), Ridge (0.6 mile), Big Wash (2.6 to 4.8 miles), and Snake (<0.1 mile).
- Other Special Status Fish Streams – Baker, Big Wash, and Snake creeks in Snake Valley; and Pine and Ridge creeks in Spring Valley.
- Other Special Status Fish Springs/Ponds/Lakes – Keegan and Minerva springs and Shoshone Ponds in Spring Valley; and Big Springs and Stateline Springs in Snake Valley.
- Special Status Amphibian Species Springs/Ponds/Lakes – Blind, Keegan, Minerva, South Millick, and Shoshone Ponds in Spring Valley.
- Special Status Invertebrates Springs/Ponds/Lakes – Big Springs, Clay, Stateline, and one unnamed spring, and Pruess Lake in Snake Valley.

Figure 3.7-13 Alternative C Drawdown and Streams/Waterbodies with Aquatic Biological Resources

Figure 3.7-14 Alternative C Drawdown and Springs with Aquatic Biological Resources

The effects and conclusions of groundwater development on aquatic biological resources are provided in **Table 3.7-12** along with ACMs and proposed mitigation.

Table 3.7-12 Summary of Aquatic Biological Resource Impacts, ACMs, and Monitoring and Mitigation Recommendations for Alternative C Pumping

Effects/Conclusions

- Flow reductions would modify habitat by decreasing depths, water velocities, and wetted area in spring/pond/lake and stream habitats. A total of 17 springs/ponds/lakes and 13 streams are at risk when considering the longest model time frame.
- Effects would be most pronounced in riffle habitats in streams and spring inflow and outflow areas. Effects on pool habitats would depend on the magnitude of the flow change and size of the pools. Reduced flows could adversely affect aquatic habitat by altering thermal regimes, increasing sedimentation, and reducing riparian cover. A complete loss of habitat could occur in small springs and larger springs such as Big Springs in Snake Valley.
- Flow reductions could adversely affect aquatic species by reducing abundance and diversity, altering composition, reducing food sources, limiting spawning and early life stage development, and decreasing individual health condition.
- Flow reductions in 5 springs/ponds in Spring Valley could result in habitat reductions and adverse effects on the special status amphibian, northern leopard frog.
- Flow reductions in Big Springs Creek and Lake Creek in Snake Valley could result in substantial loss of habitat and aquatic species.
- Flow reductions in 4 springs in Snake Valley could result in loss of bifid duct and longitudinal gland pyrg populations at these locations.
- Conflicts with management objectives could occur for three species: Pahrump poolfish (Shoshone Ponds), Bonneville cutthroat trout (2 streams each in Spring and Snake valleys), and northern leopard frog (5 springs/ponds).
- Game fish species considered to be traditional values to regional Tribes could be affected in Snake, Spring, Lake, and Lower Meadow Valley Wash.

Impact Indicators[1] By Model Time Frame	Full Build Out	Full Build Out Plus 75 Years	Full Build Out Plus 200 Years
Number of Hydrologic Basins at Risk with Waterbodies Containing Game Fish or Special Status Species	1	2	2
Estimated Percent Flow Reductions			
Butterfield Spring (White River Valley)	0	2	5
Flag Springs (White River Valley)	1	2	5
Keegan Spring (Spring Valley)	12	14	15
North Millick Spring (Spring Valley)	4	5	5
South Millick Spring (Spring Valley)	10	12	11
Big Springs (Snake Valley)	2	87	100
Federally Listed Species at Risk			
Pahrump poolfish	No effect	Potential effect	Potential effect
White River spinedace	No effect	No effect	Potential effect
Number of Springs/Ponds/Lakes with Game Fish or Special Status Species at Risk	1	8	8
Number of Springs/Ponds/Lakes with Special Status Amphibian Species at Risk	3	5	5
Number of Springs/Ponds/Lakes with Special Status Invertebrate Species at Risk	0	5	5
Number of Small Springs (100 gpm) with Aquatic Species at Risk	0	3	6

Table 3.7-12 Summary of Aquatic Biological Resource Impacts, ACMs, and Monitoring and Mitigation Recommendations for Alternative C Pumping (Continued)

Number of Streams with Game Fish or Special Status Species at Risk	1	12	13
Miles of Streams at Risk with Game Fish and Special Status Species	1	29	43
GBNP Springs and Streams[2] with Game Fish or Special Status Species at Risk			
Outhouse Spring	No effect	No effect	Potential effect
Rowland Spring	No effect	No effect	No effect
Lehman Creek	No effect	No effect	<0.1 mile
Snake Creek	No effect	No effect	1.9 miles
Utah Springs and Streams with Game Fish or Special Status Species at Risk			
Caine Spring	No effect	Potential effect	Potential effect
Clay Spring	No effect	Potential effect	Potential effect
Stateline Spring	No effect	Potential effect	Potential effect
Lake Creek	No effect	10.6 miles	10.6 miles
Snake Creek	No effect	1.2 miles	1.2 miles

ACMs

- Existing agreements include the Spring Valley Stipulation, DDC Stipulation, Conservation Agreements (least chub and Columbia spotted frog) Utah and SNWA Snake Valley Environmental Monitoring and Management Agreement (not yet completed), and Candidate Conservation Agreement/Candidate Conservation Agreement (not yet completed).
- The Spring Valley and DDC Stipulated Agreements will involve monitoring in selected springs in Spring, Snake, and DDC valleys (see ACMs C.1.1 and C.1.38 in **Appendix E**). The Spring Valley Stipulated Agreement also would consider alternative withdrawal points from Shoshone Ponds.
- ACMs would be implemented to restore and enhance habitat for federally listed or special status species and would be done in cooperation with the USFWS. These measures would restore or enhance habitat for springsnails (ACM C.2.6 and C.2.16), White River spinedace (ACMs C.2.8 and C.2.17), White River springfish (ACM C.2.9), Hiko White River springfish (ACM C.2.9), Pahranagat roundtail chub (ACM C.2.9), White River speckled dace (ACM C.2.14), and northern leopard frog (ACM C.2.18).

Monitoring Recommendations

GW-MN-AB-1, **GW-MN-AB-2**, and **GW-MT-AB-4**, described for the Proposed Action, would be applied to Alternative C. Springs and streams to be considered for monitoring are provided in **Appendix F3.7**, **Tables F3.7-18** and **F3.7-19**.

GW-MN-AB-3 will be conducted in selected springs and streams to be able to determine minimum flows or water levels for critical life stages of representative fish species.

Mitigation Recommendations

GW-AB-3 and **GW-AB-4**, described for the Proposed Action, also would be applied to Alternative C.

GW-WR-4 would avoid a conflict with management objectives for Pahrump poolfish.

Residual Impacts

ACMs and monitoring and mitigation measures could be effective in reducing impacts to aquatic habitats and species. However, it is not possible to determine the level of impact reduction at this time. Residual effects on some aquatic habitats and species could exist considering the potential long recovery period that could occur in some aquatic habitats. Therefore, unavoidable adverse impacts on aquatic habitat and species could occur at some locations.

[1] Parameters are based on streams or springs that are located within the 10-foot drawdown contour and characterized as having moderate or high risk of pumping effects.

[2] A study by Elliott et al. (2006) indicated that other streams at risk include Shingle and Williams Canyon creeks in Spring Valley and Baker and Strawberry creeks in Snake Valley.

3.7.2.13 Alternative D

Groundwater Development Area

Development in Snake Valley and the White County portion of Spring Valley would be eliminated. Surface disturbance could be dispersed throughout the remaining portions of Spring, Cave, Delamar, and Dry Lake basins. The effects of constructing well pads, gathering pipelines, and electrical service lines would depend upon the location of the facilities in relation to aquatic biological resources. No perennial streams or spring habitat with aquatic biological resources occur in the groundwater development areas. No game fish or special status species are present in intermittent streams or springs with the Alternative D development areas. Macroinvertebrates would likely occur in these waterbodies.

The effects and conclusions of groundwater development on aquatic biological resources are provided in **Table 3.7-13** along with ACMs and proposed mitigation.

Table 3.7-13 Summary of Aquatic Biological Resource Impacts, ACMs, and Monitoring and Mitigation Recommendations for Alternative D Groundwater Development

Effects
• Construction could alter aquatic habitat on a short-term basis in intermittent streams or springs that contain macroinvertebrates. Riparian vegetation near waterbodies could be affected on a long-term basis. Surface disturbance and vehicle/equipment could affect water quality from sediment input and risks from fuel spills on a short-term basis. • Vehicle traffic near waterbodies could cause mortalities to amphibians during movement periods especially during the spring and summer breeding periods. • There would be no conflicts with management objectives for special status species. • There would be no effects on fish species considered to be traditional values to regional Tribes.
BLM RMP Direction and ACMs
• BLM RMP direction for development near springs specifies that surface water resources and associated riparian areas be maintained. • ACM B.1.1 and B.1.3 will consider the presence of special status species and their habitat in the location of production wells, collector lines, and secondary substations. • ACM B.2.1 through B.2.3 will implement permit requirements on well drilling, abandonment, drilling, and water discharge.
Proposed Mitigation
No mitigation measures would be required for Alternative D because perennial and springs are not present within the groundwater development areas.
Conclusions • By avoiding springs and streams with game fish or special status species, short-term disturbance would be limited to waterbodies with seasonal flow or limited water volumes. Macroinvertebrates likely would be present in these waterbodies. • Vehicle traffic could cause mortalities to amphibians during movement periods especially during the spring and summer breeding periods.
Residual Impacts • Potential amphibian mortalities from vehicle traffic near temporary and permanent waterbodies during construction.

Groundwater Pumping

Alternative D would consist of reduced pumping (78,755 afy) at distributed locations in southern Spring, Cave, Dry Lake, and Delamar valleys. No pumping would occur in Snake Valley. Alternative D pumping could result in reductions in aquatic habitat and affect aquatic species. Based on the model analysis, the predicted 10-foot drawdown contour for Alternative D pumping is shown for streams in **Figure 3.7-15** and springs in **Figure 3.7-16**. Flows could be reduced in the following number of habitats with aquatic biological resources for the three model time frames.

- Streams – 0 at full build out, 2 at full build out plus 75 years, and 10 at full build out plus 200 years; and
- Springs – 1 at full build out, 4 at full build out plus 75 years, and 13 at full build out plus 200 years.

Figure 3.7-15 Alternative D Drawdown and Streams/Waterbodies with Aquatic Biological Resources

Figure 3.7-16 Alternative D Drawdown and Springs with Aquatic Biological Resources

Flow reductions could affect all types of aquatic communities including fish, amphibians, macroinvertebrates, macrophytes, and algae. For this EIS analysis, emphasis was placed on game fish and special status aquatic species. Alternative D could adversely affect the following game fish or special status species and their associated waterbody occurrences in at least one of the model time frames. Specific results for waterbodies and species at risk for each model time frames are provided in **Appendix F**, **Tables F3.7-20** and **F3.7-21**.

- Game Fish Streams – Geyser Creek in Lake Valley; Big Wash and Snake creeks in Snake Valley; Pine, Ridge, Shingle, and Williams Canyon creeks in Spring Valley.
- Game Fish Springs/Ponds/Lakes – Swallow Spring in Spring Valley.
- Federally Listed Species – Flag Springs (White River spinedace) in White River Valley and Shoshone Ponds (Pahrump poolfish) in Spring Valley.
- Bonneville Cutthroat Trout – Stream miles at risk for flow reductions include: Pine (0.1 mile), Ridge (0.6 mile), Big Wash (4.8 miles), and Snake (<0.1 mile).
- Other Special Status Fish Streams – Big Wash and Snake creeks in Snake Valley; and Pine and Ridge creeks in Spring Valley.
- Other Special Status Fish Springs/Ponds/Lakes – Butterfield and Flag springs in White River Valley; Minerva Spring and Shoshone Ponds in Spring Valley; and Big Springs and Stateline Springs in Snake Valley.
- Special Status Amphibian Species Springs/Ponds/Lakes – Blind and Minerva springs and Shoshone Ponds in Spring Valley; and Wambolt Spring in Lake Valley.
- Special Status Invertebrates Springs/Ponds/Lakes – Butterfield and Flag springs in White River Valley; Big Springs, and one unnamed spring, in Snake Valley; and Wambolt Spring in Lake Valley.

The effects and conclusions of groundwater development on aquatic biological resources are provided in **Table 3.7-14** along with ACMs and proposed mitigation.

Table 3.7-14 Summary of Aquatic Biological Resource Impacts, ACMs, and Monitoring and Mitigation Recommendations for Alternative D Pumping

Effects/Conclusions
• Flow reductions would modify habitat by decreasing depths, water velocities, and wetted area in spring/pond/lake and stream habitats. A total of 13 springs/ponds/lakes and 10 streams are at risk when considering the longest model time frame. • Effects would be most pronounced in riffle habitats in streams and spring inflow and outflow areas. Effects on pool habitats would depend on the magnitude of the flow change and size of the pools. Reduced flows could adversely affect aquatic habitat by altering thermal regimes, increasing sedimentation, and reducing riparian cover. A complete loss of habitat could occur in small springs and larger springs such as Big Springs in Snake Valley. • Flow reductions could adversely affect aquatic species by reducing abundance and diversity, altering composition, reducing food sources, limiting spawning and early life stage development, and decreasing individual health condition. • Flow reductions in 4 springs in Spring Valley could result in habitat reductions and adverse effects on the special status amphibian, northern leopard frog. • Flow reductions in Big Springs Creek and Lake Creek in Snake Valley could result in substantial loss of habitat and aquatic species. • Flow reductions in 2 springs in Snake Valley could result in loss of bifid duct and longitudinal gland pyrg populations at these locations. • Due to their limited occurrence (one spring/one basin), populations of Butterfield pyrg (Butterfield Spring), Flag pyrg (Flag Springs), and Lake Valley pyrg (Wambolt Spring) could be lost if their spring habitat is substantially reduced. • Conflicts with recovery and conservation management objectives could occur for four species: Pahrump poolfish (Shoshone Ponds), White River springfish (Flag Springs), Bonneville cutthroat trout (2 streams each in Spring and Snake valleys), and northern leopard frog (4 springs/ponds). • Game fish species considered to be traditional values to regional Tribes could be affected in Snake, Spring, Lake, and Lower Meadow Valley Wash.

Table 3.7-14 Summary of Aquatic Biological Resource Impacts, ACMs, and Monitoring and Mitigation Recommendations for Alternative D Pumping (Continued)

Impact Indicators[1] By Model Time Frame	Full Build Out	Full Build Out Plus 75 Years	Full Build Out Plus 200 Years
Number of Hydrologic Basins at Risk with Waterbodies Containing Game Fish or Special Status Species	1	2	45
Estimated Percent Flow Reductions			
Butterfield Spring (White River Valley)	1	3	9
Flag Springs (White River Valley)	1	3	9
Keegan Spring (Spring Valley)	0	0	0
North Millick Spring (Spring Valley)	0	0	0
South Millick Spring (Spring Valley)	0	0	0
Big Springs (Snake Valley)	19	100	100
Federally Listed Species at Risk			
Pahrump poolfish	No effect	Potential effect	Potential effect
White River spinedace	No effect	No effect	Potential effect
Number of Springs/Ponds/Lakes with Game Fish or Special Status Species at Risk	1	3	6
Number of Springs/Ponds/Lakes with Special Status Amphibian Species at Risk	0	2	4
Number of Springs/Ponds/Lakes with Special Status Invertebrate Species at Risk	1	1	5
Number of Small Springs (100 gpm) with Aquatic Species at Risk	0	1	5
Number of Streams with Game Fish or Special Status Species at Risk	0	2	10
Miles of Streams at Risk with Game Fish and Special Status Species	0	3	29
GBNP Springs and Streams[2] with Game Fish or Special Status Species at Risk			
Outhouse Spring	No effect	No effect	Potential effect
Rowland Spring	No effect	No effect	No effect
Snake Creek	No effect	No effect	1.9 miles
Utah Springs and Streams with Game Fish or Special Status Species at Risk			
Caine Spring	No effect	No effect	No effect
Clay Spring	No effect	No effect	No effect
Stateline Spring	No effect	No effect	No effect
Lake Creek	No effect	No effect	10.6 miles
Snake Creek	No effect	No effect	No effect

Table 3.7-14 Summary of Aquatic Biological Resource Impacts, ACMs, and Monitoring and Mitigation Recommendations for Alternative D Pumping (Continued)

ACMs
• Existing agreements include the Spring Valley Stipulation, Delamar, Dry Lake, and Cave Valley (DDC) Stipulation, Conservation Agreements (least chub and Columbia spotted frog) Utah and SNWA Snake Valley Environmental Monitoring and Management Agreement (not yet completed), and Candidate Conservation Agreement/Candidate Conservation Agreement (not yet completed). • The Spring Valley and DDC Stipulated Agreements will involve monitoring in selected springs in Spring, Snake, Delamar, Dry Lake, and Cave valleys (see Measures C.1.1 and C.1.38 in **Appendix E**). The Spring Valley Stipulated Agreement also would consider alternative withdrawal points from Shoshone Ponds. • ACMs would be implemented to restore and enhance habitat for federally listed or special status species and would be done in cooperation with the USFWS. These measures would restore or enhance habitat for springsnails (ACM C.2.6 and C.2.16), White River spinedace (ACM C.2.8 and C.2.17), White River springfish (ACM C.2.9), Hiko White River springfish (ACM C.2.9), Pahranagat roundtail chub (ACM C.2.9), White River speckled dace (ACM C.2.14), and northern leopard frog (ACMC.2.18).
Monitoring Recommendations
GW-MN-AB-1, **GW-MN-AB-2**, and **GW-MN-AB-4**, described for the Proposed Action, would be applied to Alternative D. Springs and streams to be considered for monitoring are provided in **Appendix F3.7**, **Tables F3.7-20** and **F3.7-21**. **GW-MN-AB-3** will be conducted in selected springs and streams to be able to determine minimum flows or water levels for critical life stages of representative fish species.
Mitigation Recommendations
GW-AB-3 and **GW-AB-4**, described for the Proposed Action, also would be applied to Alternative D. **GW-W-4** would avoid a conflict with management objectives for Pahrump poolfish.
Residual Impacts ACMs and monitoring and mitigation measures could be effective in reducing impacts to aquatic habitats and species. However, it is not possible to determine the level of impact reduction at this time. Residual effects on some aquatic habitats and species could exist considering the potential long recovery period that could occur in some aquatic habitats. Therefore, unavoidable adverse impacts on aquatic habitat and species could occur at some locations. The magnitude of effects would be less in Snake Valley and higher in Spring Valley compared to the Proposed Action.

[1] Parameters are based on streams or springs that are located within the 10-foot drawdown contour and characterized as having moderate or high risk of pumping effects.

[2] Other streams identified by Elliott et al. (2006) (Shingle and Williams Canyon creeks in Spring Valley and Baker and Strawberry creeks in Snake Valley) would not likely be affected.

3.7.2.14 Alternative E

Groundwater Development Area

Development in Snake Valley would be eliminated. Surface disturbance could be dispersed throughout the remaining portions of Spring, Cave, Delamar, and Dry Lake basins. The effects of constructing well pads, gathering pipelines, and electrical service lines would depend upon the location of the facilities in relation to aquatic biological resources. In total, 13 perennial streams and 4 springs with aquatic biological resources occur in the groundwater development areas. A more detailed account of the resource information includes:

- Game Fish – Species occur in 13 streams in Spring Valley (**Table 3.7-1**; **Figure 3.7-3**).
- Special Status Fish – No special status fish species occur in the groundwater development areas.
- Special Status Amphibians – Northern leopard frog occurs in three springs (Blind, North Millick, and South Millick in Spring Valley) within the groundwater development areas (**Figure 3.7-5**).
- Springsnails – Toquerville pyrg (not a special status species) occurs in one spring within the groundwater development areas (unnamed spring near Cleve Creek in Spring Valley) (**Figure 3.7-5**).
- Macroinvertebrates – Species are present in all 13 perennial streams and 4 springs and waterbodies with seasonal water presence in the groundwater development area.

The effects and conclusions of groundwater development on aquatic biological resources are provided in **Table 3.7-15** along with ACMs and proposed mitigation.

Table 3.7-15 Summary of Aquatic Biological Resource Impacts, ACMs, and Monitoring and Mitigation Recommendations for Alternative E Groundwater Development

Effects
• Construction could alter aquatic habitat on a short-term basis in 13 perennial streams and 4 springs with aquatic biological resources. Riparian vegetation near waterbodies could be affected on a long-term basis. Surface disturbance and vehicle/equipment could affect water quality from sediment input and risks from fuel spills on a short-term basis. • Instream activities in the spring or fall could affect trout spawning on a short-term basis. • Vehicle traffic near waterbodies could cause mortalities to amphibians during movement periods especially during the spring and summer breeding periods. • Special status Bonneville cutthroat trout could be affected in one stream within the groundwater development areas (Pine/Ridge Creek in Spring Valley). • Special status amphibian species could be affected in three springs within the groundwater development areas. • Springsnail species could be affected in spring habitats within one of the groundwater development areas (one unnamed spring in Spring Valley). • Conflicts with conservation management objectives could occur for one species: northern leopard frog (3 springs). • Game fish species considered to be traditional values to regional Tribes could be affected in Snake and Spring valleys.
BLM RMP Direction and ACMs
• BLM RMP direction for development near springs specifies that surface water resources and associated riparian areas be maintained. • ACM B.1.1 and B.1.3 will consider the presence of special status species and their habitat in the location of production wells, collector lines, and secondary substations. • ACM B.2.1 through B.2.3 will implement permit requirements on well drilling, abandonment, drilling, and water discharge.
Proposed Mitigation
GW-AB-1 and **GW-AB-2** as described for the Proposed Action, would be applied to Alternative E.
Conclusions
• By avoiding springs and streams with game fish or special status species, short-term disturbance would be limited to waterbodies with seasonal flow or limited water volumes. Macroinvertebrates likely would be present in these waterbodies. • Vehicle traffic could cause mortalities to amphibians during movement periods especially during the spring and summer breeding periods.
Residual Impacts
• Potential amphibian mortalities from vehicle traffic near temporary and permanent waterbodies during construction.

Groundwater Pumping

Alternative E would consist of reduced pumping (78,755 afy) at distributed locations in Spring, Cave, Dry Lake, and Lake valleys. No pumping would occur in Snake Valley. Alternative E pumping could result in reductions in aquatic habitat and affect aquatic species. Based on the model analysis, the predicted 10-foot drawdown contour for Alternative E pumping is shown for streams in **Figure 3.7-17** and springs in **Figure 3.7-18**. Flows could be reduced in the following number of habitats with aquatic biological resources for the three model time frames.

- Streams – 1 at full build out, 7 at full build out plus 75 years, and 15 at full build out plus 200 years; and
- Springs – 2 at full build out, 7 at full build out plus 75 years, and 15 at full build out plus 200 years.

Figure 3.7-17 Alternative E Drawdown and Streams/Waterbodies with Aquatic Biological Resources

Figure 3.7-18 Alternative E Drawdown and Springs with Aquatic Biological Resources

Flow reductions could affect all types of aquatic communities including fish, amphibians, macroinvertebrates, macrophytes, and algae. For this EIS analysis, emphasis was placed on game fish and special status aquatic species. Alternative D could adversely affect the following game fish or special status species and their associated waterbody occurrences in at least one of the model time frames. Specific results for waterbodies and species at risk for each model time frames are provided in **Appendix F**, **Tables F3.7-22** and **F3.7-23**.

- Game Fish Streams – Geyser Creek in Lake Valley; Big Wash and Snake Creek in Snake Valley; Bastian, Indian, Meadow, Muncy, Odgers, Pine, Ridge, Shingle, Siegel, Willard, and Williams Canyon creeks in Spring Valley.
- Game Fish Springs/Ponds/Lakes – Swallow Spring in Spring Valley.
- Federally Listed Species – Flag Springs (White River spinedace) in White River Valley and Shoshone Ponds (Pahrump poolfish) in Spring Valley.
- Bonneville Cutthroat Trout – Stream miles at risk for flow reductions include: Pine (0.1 to 0.4 mile), Ridge (0.6 to 1.1 miles), Big Wash (0.8 mile), and Snake (<0.1 mile).
- Other Special Status Fish Streams – Big Wash and Snake Creek in Snake Valley; and Pine and Ridge creeks in Spring Valley.
- Other Special Status Fish Springs/Ponds/Lakes – Butterfield and Flag springs in White River Valley; Minerva and Keegan springs and Shoshone Ponds in Spring Valley; and Big Springs and Stateline Springs in Snake Valley.
- Special Status Amphibian Species Springs/Ponds/Lakes – Blind, Keegan, Minerva, North Millick, South Millick, and two unnamed springs and Shoshone Ponds and O'Neal/Frog Pond in Spring Valley.
- Special Status Invertebrates Springs/Ponds/Lakes – Butterfield and Flag springs in White River Valley Big Springs in Snake Valley.

The effects and conclusions of groundwater development on aquatic biological resources are provided in **Table 3.7-16** along with ACMs and proposed mitigation.

Table 3.7-16 Summary of Aquatic Biological Resource Impacts, ACMs, and Monitoring and Mitigation Recommendations for Alternative E Pumping

Effects/Conclusions
• Flow reductions would modify habitat by decreasing depths, water velocities, and wetted area in spring/pond/lake and stream habitats. A total of 15 springs/ponds/lakes and 15 streams are at risk when considering the longest model time frame. • Effects would be most pronounced in riffle habitats in streams and spring inflow and outflow areas. Effects on pool habitats would depend on the magnitude of the flow change and size of the pools. Reduced flows could adversely affect aquatic habitat by altering thermal regimes, increasing sedimentation, and reducing riparian cover. A complete loss of habitat could occur in small springs and larger springs such as Big Springs in Snake Valley. • Flow reductions could adversely affect aquatic species by reducing abundance and diversity, altering composition, reducing food sources, limiting spawning and early life stage development, and decreasing individual health condition. • Flow reductions in 9 springs in Spring Valley could result in habitat reductions and adverse effects on the special status amphibian, northern leopard frog. • Flow reductions in Big Springs Creek and Lake Creek in Snake Valley could result in substantial loss of habitat and aquatic species. • Flow reductions in Big Springs in Snake Valley could result in loss of bifid duct and longitudinal gland pyrg populations at this location. • Due to limited occurrence (one spring/one basin), the populations of Butterfield pyrg (Butterfield Spring) and Flag pyrg (Flag Springs) could be lost if the spring habitat is substantially reduced. • Conflicts with recovery and conservation management objectives could occur for four species: Pahrump poolfish (Shoshone Ponds), White River springfish (Flag Springs), Bonneville cutthroat trout (2 streams each in Spring and Snake valleys), and northern leopard frog (9 springs/ponds). • Game fish species considered to be traditional values to regional Tribes could be affected in Snake, Spring, Lake, and Lower Meadow Valley Wash.

Table 3.7-16 Summary of Aquatic Biological Resource Impacts, ACMs, and Monitoring and Mitigation Recommendations for Alternative E Pumping (Continued)

Impact Indicators[1] By Model Time Frame	Full Build Out	Full Build Out Plus 75 Years	Full Build Out Plus 200 Years
Number of Hydrologic Basins at Risk with Waterbodies Containing Game Fish or Special Status Species	1	2	4
Estimated Percent Flow Reductions			
Butterfield Spring (White River Valley)	0	3	8
Flag Springs (White River Valley)	1	3	8
Keegan Spring (Spring Valley)	12	28	36
North Millick Spring (Spring Valley)	4	9	11
South Millick Spring (Spring Valley)	10	21	24
Big Springs (Snake Valley)	2	26	78
Federally Listed Species at Risk			
Pahrump poolfish	No effect	Potential effect	Potential effect
White River spinedace	No effect	No effect	Potential effect
Number of Springs/Ponds/Lakes with Game Fish or Special Status Species at Risk	1	5	7
Number of Springs/Ponds/Lakes with Special Status Amphibian Species at Risk	2	6	9
Number of Springs/Ponds/Lakes with Special Status Invertebrate Species at Risk	0	1	3
Number of Small Springs (100 gpm) with Aquatic Species at Risk	0	1	5
Number of Streams with Game Fish or Special Status Species at Risk	1	7	15
Miles of Game Fish Streams at Risk	1	5	13
GBNP Springs and Streams[2] with Game Fish or Special Status Species at Risk			
Outhouse Spring	No effect	No effect	No effect
Rowland Spring	No effect	No effect	No effect
Lehman Creek	No effect	No effect	No effect
Snake Creek	No effect	No effect	<0.1 mile
Utah Springs and Streams with Game Fish or Special Status Species at Risk			
Clay Spring	No effect	No effect	No effect
Stateline Spring	No effect	No effect	No effect
Lake Creek	No effect	No effect	10.6 miles
Snake Creek	No effect	No effect	No effect

Table 3.7-16 Summary of Aquatic Biological Resource Impacts, ACMs, and Monitoring and Mitigation Recommendations for Alternative E Pumping (Continued)

ACMs
• Existing agreements include the Spring Valley Stipulation, Delamar, Dry Lake, and Cave Valley (DDC) Stipulation, Conservation Agreements (least chub and Columbia spotted frog) Utah and SNWA Snake Valley Environmental Monitoring and Management Agreement (not yet completed), and Candidate Conservation Agreement/Candidate Conservation Agreement (not yet completed). • The Spring Valley and DDC Stipulated Agreements will involve monitoring in selected springs in Spring, Snake, Delamar, Dry Lake, and Cave valleys (see Measures C.1.1 and C.1.38 in **Appendix E**). The Spring Valley Stipulated Agreement also would consider alternative withdrawal points from Shoshone Ponds. • ACMs would be implemented to restore and enhance habitat for federally listed or special status species and would be done in cooperation with the USFWS. These measures would restore or enhance habitat for springsnails (ACM C.2.6 and C.2.16), White River spinedace (ACM C.2.8 and C.2.17), White River springfish (ACM C.2.9), Hiko White River springfish (ACM C.2.9), Pahranagat roundtail chub (ACM C.2.9), White River speckled dace (ACM C.2.14), and northern leopard frog (ACMC.2.18).
Monitoring Recommendations
GW-MN-AB-1, **GW-MN-AB-2**, and **GW-MN-AB-4**, described for the Proposed Action, would be applied to Alternative E. Springs and streams to be considered for monitoring are provided in **Appendix F3.7**, **Tables F3.7-22** and **F3.7-23**. **GW-MN-AB-3** will be conducted in selected springs and streams to be able to determine minimum flows or water levels for critical life stages of representative fish species.
Mitigation Recommendations
GW-AB-3 and **GW-AB-4**, described for the Proposed Action, also would be applied to Alternative E. **GW-W-4** would avoid a conflict with management objectives for Pahrump poolfish.
Residual Impacts ACMs and monitoring and mitigation measures could be effective in reducing impacts to aquatic habitats and species. However, it is not possible to determine the level of impact reduction at this time. Residual effects on some aquatic habitats and species could exist considering the potential long recovery period that could occur in some aquatic habitats. Therefore, unavoidable adverse impacts on aquatic habitat and species could occur at some locations. The magnitude of effects would be less in Spring and Snake valleys compared to the Proposed Action.

[1] Parameters are based on streams or springs that are located within the 10-foot drawdown contour and characterized as having moderate or high risk of pumping effects.

[2] Other streams identified by Elliott et al. (2006) (Shingle and Williams Canyon creeks in Spring Valley and Baker and Strawberry creeks in Snake Valley) would not likely be affected.

3.7.2.15 No Action

Groundwater Development Area

Under the No Action Alternative, no groundwater activities would occur in the five pumping basins. Therefore, aquatic biological resources would not be affected by surface disturbance or facility maintenance activities.

Groundwater Pumping

No Action pumping could result in reductions in aquatic habitat and affect aquatic species. Based on the model analysis, the predicted 10-foot drawdown contour for No Action pumping is shown for streams in **Figure 3.7-19** and springs in **Figure 3.7-20**. Flows could be reduced in the following number of habitats with aquatic biological resources for the three model time frames.

- Streams – 2 at full build out, 3 at full build out plus 75 years, and 7 at full build out plus 200 years; and
- Springs – 2 at full build out, 6 at full build out plus 75 years, and 9 at full build out plus 200 years.

Figure 3.7-19 No Action Drawdown and Streams/Waterbodies with Aquatic Biological Resources

Figure 3.7-20 No Action Drawdown and Springs with Aquatic Biological Resources

Flow reductions could affect all types of aquatic communities including fish, amphibians, macroinvertebrates, macrophytes, and algae. For this EIS analysis, emphasis was placed on game fish and special status aquatic species. No Action could adversely affect the following game fish or special status species and their associated waterbody occurrences in at least one of the model time frames. Specific results for waterbodies and species at risk for each model time frames are provided in **Appendix F**, **Tables F3.7-24** and **F3.7-25**.

- Game Fish Streams – Ridge and Williams Canyon creeks in Spring Valley (#184); Clover Creek in Clover Valley; Meadow Valley Wash (Lower Meadow Valley Wash); and Camp Valley Creek in Spring Valley (#201).
- Game Fish Springs/Ponds/Lakes – none.
- Federally Listed Species – Flag Springs (White River spinedace) in White River Valley, Shoshone Ponds (Pahrump poolfish) in Spring Valley, and Moapa dace in the Muddy River (Muddy River Springs Area).
- Other Special Status Fish Streams – Clover Creek in Clover Valley and Meadow Valley Wash (Lower Meadow Valley Wash and Panaca Valley).
- Other Special Status Fish Springs/Ponds/Lakes – Arnoldson, Indian Ranch, Nicolas, and Preston Big springs in White River Valley.
- Special Status Amphibian Species Springs/Ponds/Lakes –Wambolt Spring in Lake Valley.
- Special Status Invertebrates Springs/Ponds/Lakes – Arnoldson, Indian Ranch, Nicolas, and Preston Big springs in White River Valley; and Wambolt Spring in Lake Valley.

The effects and conclusions of groundwater development on aquatic biological resources are provided in **Table 3.7-17** along with ACMs and proposed mitigation.

Table 3.7-17 Summary of Aquatic Biological Resource Impacts, ACMs, and Monitoring and Mitigation Recommendations for No Action Pumping

Effects/Conclusions
• Flow reductions would modify habitat by decreasing depths, water velocities, and wetted area in spring/pond/lake and stream habitats. A total of 9 springs/ponds/lakes and 7 streams are at risk when considering the longest model time frame. • Effects would be most pronounced in riffle habitats in streams and spring inflow and outflow areas. Effects on pool habitats would depend on the magnitude of the flow change and size of the pools. Reduced flows could adversely affect aquatic habitat by altering thermal regimes, increasing sedimentation, and reducing riparian cover. A complete loss of habitat could occur in small springs. • Due to limited distribution (one spring/one basin), the population of Lake Valley pyrg (Wambolt Spring) could be lost if flow is substantially reduced. • Flow reductions could adversely affect aquatic species by reducing abundance and diversity, altering composition, reducing food sources, limiting spawning and early life stage development, and decreasing individual health condition. • Conflicts with recovery and conservation management objectives could occur for four species: Pahrump poolfish (Shoshone Ponds), White River springfish (Flag Springs), Bonneville cutthroat trout (Ridge Creek in Spring Valley), and northern leopard frog (1 spring). • Game fish species considered to be traditional values to regional Tribes could be affected in Snake, Spring (#184 and 201), Clover, Panaca, and Lower Meadow Valley Wash.

Table 3.7-17 Summary of Aquatic Biological Resource Impacts, ACMs, and Monitoring and Mitigation Recommendations for No Action Pumping (Continued)

Impact Indicators[1] By Model Time Frame	Full Build Out	Full Build Out Plus 75 Years	Full Build Out Plus 200 Years
Number of Hydrologic Basins at Risk with Waterbodies Containing Game Fish or Special Status Species	4	5	7
Estimated Percent Flow Reductions			
Arnoldson Spring (White River Valley)	4	6	8
Butterfield Spring (White River Valley)	0	1	3
Flag Springs (White River Valley)	0	1	3
Nicolas Spring (White River Valley)	5	7	9
Preston Big Springs (White River Valley)	2	5	7
Keegan Spring (Spring Valley)	2	2	2
North Millick Spring (Spring Valley)	0	0	0
South Millick Spring (Spring Valley)	1	1	1
Big Springs (Snake Valley)	9	13	16
Muddy River near Moapa (Muddy Springs Area)	4	6	9
Federally Listed Species at Risk			
Pahrump poolfish	No effect	No effect	No effect
White River spinedace	No effect	Potential effect	Potential effect
Moapa dace	No effect	Potential effect	Potential effect
Number of Springs/Ponds/Lakes with Game Fish or Special Status Species at Risk	1	4	5
Number of Springs/Ponds/Lakes with Special Status Amphibian Species at Risk	0	0	1
Number of Springs/Ponds/Lakes with Special Status Invertebrate Species at Risk	1	5	7
Number of Small Springs (100 gpm) with Aquatic Species at Risk	1	1	2
Number of Streams with Game Fish or Special Status Species at Risk	2	3	7
Miles of Game Fish Streams at Risk	5	6	26
GBNP Springs and Streams with Game Fish or Special Status Species at Risk	No Effect	No effect	No effect
Utah Springs and Streams with Game Fish or Special Status Species at Risk	No Effect	No effect	No effect

[1] Parameters are based on streams or springs that are located within the 10-foot drawdown contour and characterized as having moderate or high risk of pumping effects.

3.7.2.16 Alternatives Comparison

Impact parameter information for aquatic biological resources was tabulated for all action alternatives for the purpose of comparing pumping effects (**Table 3.7-18**). Impact parameters provide a quantitative indication of effects on aquatic habitat or species groups. A visual comparison of the impact parameter information also is shown in **Figure 3.7-21**. Information in **Figure 3.7-21** focuses on those parameters that show a noticeable difference amongst the alternatives.

Table 3.7-18 Summary of Aquatic Biology Impact Parameters for the Proposed Action, Alternatives A through E, and No Action Pumping[1]

Impact Information	Proposed Action	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	No Action
Impact Indicators							
Miles of Game Fish and Special Status Species Streams with Potential Flow Reductions (three model periods)	6, 60, and 75	3, 45, and 52	3, 59, and 72	1, 29, and 43	0, 3, and 29	1, 5, and 13	5, 6, and 26
Number of Streams with Game Fish or Special status species potentially affected (three model periods)	4, 25, and 30	2, 14, and 19	3, 18, and 24	1, 12, and 13	0, 2, and 10	1, 7, and 15	2, 3, and 7
Number of Springs/Ponds/Lakes Containing Game Fish and Special Status Species with Potential Water Level Reductions (three model periods)	1, 10, and 12	2, 8, and 11	5, 10, and 14	1, 8, and 8	1, 3, and 6	1, 5, and 7	1, 4, and 5
Number of Springs/Ponds/Lakes Containing Special Status Amphibian Species with Potential Water Level Reductions (three model periods)	3, 9, and 10	2, 6, and 9	3, 8, and 9	3, 5, and 5	0, 2, and 4	2, 6, and 9	0, 0, and 1
Number of Springs/Ponds/Lakes Containing Special Status Invertebrate Species with Potential Water Level Reductions (three model periods)	0, 7, and 8	0, 5, and 8	3, 7, and 10	0, 4, and 5	1, 1, and 5	0, 1, and 3	1, 5, and 7
Number of Small Springs (< 100 gpm) with Aquatic Species in Drawdown Area with Potential Flow Reductions (three model periods)	0, 13, and 15	0, 7, and 12	2, 9, and 13	0, 3, and 6	0, 1, and 5	0, 1, and 5	1, 1, and 2
Number of Springs with Aquatic Biological Importance Potentially Affected within GBNP (three model periods)	0, 1, and 2	0, 1, and 2	0, 2, and 2	0, 0, and 1	0, 0, and 1	0, 0, and 0	0, 0, and 0
Stream Miles in GBNP with Aquatic Biological Importance Potentially Affected (three model periods)	0, 2, and 2	0, 2, and 2	0, 5, and 6	0, 0, and 2	0, 0, and 2	0, 0, and <1	0, 0, and 0
Number of Springs with Aquatic Biological Importance Potentially Affected within Utah (three model periods)	0, 3, and 3	0, 3, and 3	0, 2, and 3	0, 3, and 3	0, 0, and 0	0, 0, and 0	0, 0, and 0
Stream Miles in Utah with Aquatic Biological Importance Potentially Affected (three model periods)	0, 12, and 12	0, 12, and 12	0, 12, and 12	0, 12, and 12	0, 0, and 0	0, 0, and 0	0, 0, and 0

[1] Numbers are presented in sequence for the three model time frames: full build out, full build out plus 75 years, and full build out plus 200 years.

Figure 3.7-21 Comparison of Aquatic Biological Resource Pumping Impact Parameters

3.7.3 Cumulative Impacts

3.7.3.1 Issues

Rights-of-way and Groundwater Development Area Construction and Maintenance

- Short-term, long-term, and permanent changes in aquatic habitat and species composition due to surface disturbance as a result of construction-related activities, and operational maintenance.
- Potential effects on fish spawning from habitat alteration.
- Loss of individuals, or populations of federal listed, candidate, or special status aquatic species due to surface disturbance.
- Compliance with management objectives defined in recovery plans, conservation agreements, and state wildlife action plans for special status aquatic species.
- Availability of fish species traditionally used for food by regional Tribes.
- Potential direct mortalities to amphibians from vehicle traffic.

Groundwater Pumping

- Short-term, long-term, and permanent changes in aquatic habitat and species, special status aquatic species and their habitats due to groundwater drawdown.
- Compliance with management objectives defined in recovery plans, conservation agreements, and state wildlife action plans for special status aquatic species.
- Changes in the availability of fish species traditionally used for food by regional Tribes in relation to groundwater drawdown.

3.7.3.2 Assumptions

Rights-of-way and Groundwater Development Area Construction and Maintenance

- Study Area. The study area is the proposed ROW project surface disturbance area (pipelines, power facilities, and roads) for each project alternative plus the total project surface disturbance estimate (well pads, roads, gathering pipelines, power lines) within groundwater development areas for each hydrographic basin. For ROWs, the focus was on perennial streams and springs with game fish or special status aquatic species that are crossed by ROWs, access roads, or other project facilities. For groundwater development areas, the presence of past, present, and reasonably foreseeable actions within the overall groundwater development area boundaries within each hydrographic basin was used as the basis for evaluating potential additive cumulative effects.
- Time frames. The effects analysis included time frames that ranged from several days to 2 years for a short-term effect and greater than 5 years for a long-term effect.
- The past and present action footprints are based on utility ROWs and other surface disturbance activities identified in the BLM and other data bases (Section 2.8, Past, Present, and Reasonably Foreseeable Future Actions).
- The reasonably foreseeable projects and activities are those outlined in **Table 2.8-1**, Section 2.8, Past, Present, and Reasonably Foreseeable Future Actions. No cumulative effects related to surface development activities are anticipated outside hydrographic basins occupied by project water development and conveyance facilities.

Groundwater Pumping

- Study area. The study area is the boundary for the groundwater model simulations.
- Time frames. The effects analysis included time frames from full build out of the entire project (approximately 2050) to full build out plus 200 years.

3.7.3.3 Methodology for Analysis

Rights-of-way and Groundwater Development Area Construction and Maintenance

- The cumulative surface disturbance effects to aquatic biological resources by hydrographic basin were estimated by overlaying the existing surface disturbances for (past and present actions), reasonably foreseeable projects (RFFAs), and the development areas for the project alternative being evaluated. The estimated cumulative surface disturbance was then compared with the overall area of the hydrographic basin affected.
- The cumulative surface disturbance effects to special status aquatic species were estimated from evaluating the cumulative aquatic biological resource surface disturbance footprint in relation to the habitat requirements of special status plants to provide a risk assessment for future effects on these species.
- The potential cumulative changes in the availability of plants traditionally used for food and fiber by regional tribe were estimated from evaluating the cumulative vegetation community surface disturbance footprint in relation to the habitat requirements of food and fiber plants.

Groundwater Pumping

- The cumulative analysis focuses on those basins and waterbodies with aquatic biological resources that were predicted to be affected by each alternative. This represents the incremental effect of the alternative on aquatic biological resources in combination with other cumulative pumping actions.
- Figures were used to show the effects of pumping on springs and perennial streams with game fish and special status species using a spring and stream impact parameter. For each alternative, impact parameter information was shown in chart format for cumulative pumping with No Action, project alternative, and cumulative with the project alternative.
- The groundwater flow model was used to predict the groundwater drawdown from pumping. The overlap of the 10-foot drawdown contour with perennial streams and springs with game fish and special status aquatic species was used as the first step and key assumption in identifying areas of potential risk.
- Springs and Streams with Risk to Pumping. The 10-foot drawdown index was applied to the springs and perennial stream reaches that were classified as being at risk from groundwater drawdown (Section 3.3, Water Resources). The springs included for analysis were those rated as presenting a “high” or “moderate” risk of effects. The number of springs and miles of perennial stream reaches potentially affected were enumerated for each alternative over time from the modeling results.

3.7.3.4 No Action

Groundwater Development Area

Under the No Action Alternative, the proposed project would not be constructed or maintained. No project-related surface disturbance would occur. Vegetation communities would continue to be influenced by natural events such as drought and fire and land use activities such as grazing, and existing water diversions. Management activities on public lands will continue to be directed by the Ely and Las Vegas RMPs, which involve measures to maintain natural vegetation communities. Management guidance for other public lands in the project study area would be provided by Great Basin Park General Management and the Forest Plan for the Humbolt-Toiyabe National Forest. Future actions would consist of four projects: Wilson Creek Wind (southern Spring and Lake valleys), Spring Valley Wind (Spring Valley), ON Transmission Line (Cave, Dry Lake, Delamar, Pahranagat, Coyote Spring, Hidden, and Garnett valleys), and Kane Springs Valley Ground Water Development (Kane Springs and Coyote Springs valleys). Surface disturbance activities associated with construction and maintenance activities could adversely affect aquatic habitat and species in Spring Valley. Project areas in the other basins have limited perennial stream and spring habitats.

Groundwater Pumping Effects

Cumulative pumping with No Action could reduce flows and adversely affect aquatic biological resources in springs and streams within 8 to 13 hydrologic basins for the three model periods. Groundwater basins affected at the full build out plus 200 years would include Steptoe, Spring [#184], Snake, White River, Pahranagat, Lake, Dry Lake, Dry, Panaca, Clover, Muddy Springs Area, Lower Meadow Valley Wash, and Lower Moapa (**Appendix F**, **Tables F3.7-38** and **F3.7-39**). The effects of reduced flows would modify aquatic habitat in terms of decreased depth, water velocity, wetted area, and water quality parameters such as sedimentation and temperature. The effects of these habitat changes on aquatic biota could include reductions in abundance and taxonomic diversity, composition changes, loss of food sources, altered spawning and rearing success, restricted movement, and potential adverse effects on health.

Cumulative pumping with No Action could reduce flows and adversely affect aquatic biota in 9 and 14 springs/ponds/lakes at the full build out plus 75 and full build out plus 200 years time frames, respectively. Five springs/ponds/lakes would be affected at full build out. Pumping could affect the following number of springs or lakes with game fish or special status species for the three model periods: game fish and special status fish (2 to 8), special status amphibians (1 to 3), and special status invertebrates (1 to 6). Five or six small springs could dry up for the full build out plus 75 years and full build out plus 200 years time frames, respectively, which could result in a total loss of habitat and associated species. Three small springs could be affected at full build out. Loss of fish species such as dace and suckers and macroinvertebrates associated with spring inflow and outflow in riffle habitat could occur as a result of reduced flows. Reductions in population numbers and health of pool species such as springfishes, spinedaces, and macroinvertebrates could result from decreased water levels in pools.

Cumulative pumping with No Action also could reduce flows in the following number of streams for the three model time frames: full build out (4), full build out plus 75 years (6), and full build out plus 200 years (11). The estimated stream miles with game fish or special status species were 22, 26, and 51 for the three model time frames. The game fish streams have traditional values to regional Tribes. Loss of riffle and run habitats could result in the loss of trout, dace, and sucker species and macroinvertebrates that utilize these habitats. If stream segments should dry up, there would be a total loss of species.

Cumulative pumping with No Action could affect habitat for three federally listed fish species: White River spinedace, Big Springs spinedace, and Moapa dace. Spring flow or water level reductions were determined at the following locations for these species:

- **White River Spinedace:** The 10-foot drawdown contour overlapped with one spring (Indian Ranch) occupied by this species at the full build out plus 75 years and full build out plus 200 years time frames. The model-simulated flow reduction also indicated a reduction of 7 percent at the full build out plus 200 years time frame in Preston Big Spring.
- **Big Springs Spinedace –** The 10-foot drawdown contour overlapped with 0.1 mile of occupied and critical habitat for this species in Meadow Valley Wash in Dry Valley during the full build out plus 200 years time frame. In total 3.1 miles of habitat exists in Meadow Valley Wash in this valley. Pumping would not affect flows in 2.1 miles of Big Springs spinedace habitat in Meadow Valley Wash in Panaca Valley.
- **Moapa Dace –** Model-predicted flow reductions were shown for all three model time frames in the Muddy River near Moapa, with percentages ranging from -37 to -61. This represents a substantial reduction in habitat for this species.
- **Pahrump Poolfish:** Since the 10-foot drawdown contour did not overlap Shoshone Ponds, No Action pumping would not affect Pahrump poolfish.
- **Other Federally Listed Species** – Cumulative pumping with No Action would not affect habitat for the following species: Hiko White River springfish (Hiko and Crystal springs), White River springfish (Ash Spring), and Pahranagat roundtail chub (Pahranagat Creek). Model-predicted flow reductions were less than 4 percent in Ash, Crystal, and Hiko springs for the three model periods.

Cumulative pumping with No Action would not affect flows or water levels in springs and streams in GBNP or Utah.

3.7.3.5 Proposed Action

Groundwater Development Area

Rights-of-way and Groundwater Development Area Construction and Maintenance

<u>Habitat Alteration and Direct/Indirect Effects on Aquatic Species</u>

Past and present actions consist primarily of existing roads, energy utility corridors, mining districts, and recent wildfires (**Figures 2.12-4** and **2.12-5**). Other activities that have influenced aquatic habitat and species include livestock grazing over nearly all public lands. The primary future actions consist of construction of the Wilson Creek

Wind Project in southern Spring Valley and northern Lake Valley, the Spring Valley Wind Project in Spring Valley, the ON Transmission Line Project (overlaps with the GWD Project in Cave, Dry Lake, Delamar, Pahranagat, Coyote Springs, Hidden, and Garnett valleys), and the Kane Springs Valley Groundwater Development Project in Kane Springs and Coyote Spring valleys. Of these four cumulative projects, one (Spring Valley Wind Project) potentially could affect aquatic habitat and species that are located within the Spring Valley groundwater development for the GWD Project. Aquatic species located in perennial streams and springs in the Spring Valley groundwater development area are listed in **Tables 3.7-1** and **3.7-2**. Surface disturbances on aquatic species and habitat in the Spring Creek groundwater development area could combine with potential effects from the Spring Valley Wind Farm. No future projects overlap with the three streams (Snake, Steptoe, and Big Wash) that are located with the GWD Project ROWs or one stream (Geyser Creek) crossed by the Option 2 alignment in Lake Valley.

Cumulative Effects. The areas where the GWD Project surface disturbance would potentially overlap with past and present actions, and reasonably foreseeable future actions (**Figures 2.12-4** and **2.12-5**) include existing road and highway crossings in all hydrographic basins; the LCCRDA utility corridor that extends from southern Dry Lake Valley to the vicinity of Apex (currently occupied by one electrical transmission line, but likely will contain one or more additional high voltage electrical transmission lines in the next 10 years), and intersection with the Spring Valley Wind Project in Spring Valley. The major additive cumulative effects would be the expansion in the width of adjacent utility ROWs, which could cross streams or be located adjacent to streams and springs in Spring Valley. Some new roads also could cross streams. It is not expected that cumulative development would substantially expand the surface disturbance to aquatic biological resources, based on only four perennial streams (Snake, Steptoe, Big Wash, and Geyser [Option 2 alignment] that would be affected by the GWD Project. By implementing BMPs, ACMs, and mitigation recommendations involving avoidance of streams and springs in the groundwater development areas in Spring and Snake valleys, the GWD Project would not contribute incremental effects to aquatic biological resources in combination with other cumulative actions.

Compliance with Management Objectives for Special Status Aquatic Species

Cumulative Effects. Two special status aquatic species (Bonneville cutthroat trout and northern leopard frog) were evaluated as part of ROW and groundwater development surface disturbance activities for the GWD Project. Within the ROW and groundwater development areas analyzed as part of the GWD Project, Bonneville cutthroat trout occurs in headwater areas in two streams in Spring Valley (Pine and Ridge creeks) and 23 streams in Snake Valley (**Appendix F**, **Table F3.7-2**). Northern leopard frog occurs in numerous springs in Spring and Snake valleys (**Appendix F**, **Table F3.7-7**). The GWD Project would likely intersect service roads for wind energy projects in Spring Valley. Management objectives for these species are listed in **Appendix F**, **Table F3.7-8**. The following conclusions are made regarding cumulative effects to these two species:

- Bonneville Cutthroat Trout – Construction and maintenance activities would not affect two streams (Snake Creek and Big Wash) crossed by ROWs because this species occurs in headwater areas located upstream of the proposed crossings. For the groundwater development areas, implementation of mitigation recommendations involving avoidance of streams and springs in the groundwater development areas in Spring and Snake valleys would avoid impacts to Bonneville cutthroat trout. The GWD Project would not contribute incremental effects to this species in combination with other cumulative actions. Therefore, cumulative effects involving conflicts with management objectives for Bonneville cutthroat trout are not expected.
- Northern Leopard Frog – Construction and maintenance activities within the ROWs and groundwater development areas for the GWD Project could cause mortalities to northern leopard frog from vehicle traffic. These unquantifiable effects would contribute to potential mortalities from vehicle traffic for other cumulative actions. No direct adverse effects are predicted for breeding habitat, since groundwater development ROWs do not cross springs and recommended mitigation for the groundwater development areas would avoid springs with special status aquatic species. When considering springs with known habitat for this species, cumulative effects could occur in Spring Valley. In conclusion, potential conflicts with management objectives (i.e., reduce road-related mortality) for northern leopard frog could result from cumulative actions.

Tribal Traditional Use of Fish

Cumulative Effects. Traditional use of native and non-native fish species occur in perennial streams in three hydrographic basins (Spring, Snake, and Steptoe) that have been affected by past and present actions, and would be affected by reasonably foreseeable actions, and the proposed GWD Project facilities. It is not expected that cumulative development would substantially expand the surface disturbance to aquatic biological resources, based on only three perennial streams (Snake, Steptoe, and Big Wash) that would be affected by the GWD Project ROWs. By implementing BMPs, ACMs, and mitigation recommendations involving avoidance of streams in the groundwater development areas in Spring and Snake valleys, the GWD Project would not contribute incremental effects to Traditional use fish species in combination with other cumulative actions.

Groundwater Pumping Effects

Past and present actions are represented by the No Action pumping operations described in Section 3.3, Water Resources. The reasonably foreseeable actions are described in **Table 2.8-4**. The following discussions are based on an interpretation of the groundwater model simulations that predict groundwater drawdown elevations and changes in flow in springs and perennial streams that contain game fish and special status fish, invertebrate, and amphibian species.

Detailed results of the cumulative pumping analysis with the Proposed Action are provided in **Appendix F**, **Tables F3.7-26** and **F3.7-27** for springs/ponds/lakes and streams, respectively. As discussed in water resources (Section 3.3.3, Cumulative Impacts), the cumulative analysis focused on the incremental pumping effects that could be contributed by the Proposed Action in combination with other cumulative pumping activities. In total, 6 to 13 basins with aquatic biological resources could be affected by this cumulative analysis for the three model time frames. However, only six of these basins could be affected by the Proposed Action: White River, Spring (#184), Snake, Lake, Pahranagat, and Lower Meadow Valley Wash.

Percent flow reduction and impact indicator information are summarized in **Appendix F**, **Table F3.7-40** and shown in **Figure 3.7-22**. The summary and figure include impact parameter information for cumulative with No Action, Proposed Action, and cumulative pumping with the Proposed Action as a way of identifying the incremental effects of the alternative. The following conclusions were made based on this summary:

- Spring Valley (#184) – The Proposed Action could contribute to flow reductions (30 to 100 percent) in springs and streams in Spring Valley. These adverse effects on aquatic habitat could occur in all three model periods. The spring and stream impact parameters indicate that the Proposed Action could contribute most of the incremental cumulative effects on spring and stream habitat and species in this basin. In total, the Proposed Action could affect 3 to 14 springs and 4 to 20 streams with game fish or special status aquatic species for the three model time frames. No Action cumulative pumping could contribute reduced flows to three of the streams with biological resources in this valley (or 15 percent of the streams affected by Proposed Action pumping). No Spring Valley springs with biological resources could be affected by No Action cumulative pumping.
- Snake Valley – The Proposed Action could contribute reduced flows in Snake Valley springs and streams. Spring and stream habitat could be affected at the full build out plus 75 years and full build out plus 200 years time frame. The impact parameter information indicates that the Proposed Action contributes almost all of the cumulative effects on aquatic habitat and species in this basin. In total, the Proposed Action could reduce flows in 0 to 13 springs and 0 to 8 streams with game fish or special status aquatic species for the three model time frames.
- White River Valley – The Proposed Action could contribute reduced flows (1 to 18 percent) in two springs (Butterfield and Flag) in White River. This alternative also could contribute very small flow reductions (1 to 3 percent) in five other springs (Arnoldson, Hot Creek, Moorman, Nicolas, and Preston Big). Most of the estimated flow reduction for Arnoldson, Nicolas, and Preston Big could result from No Action pumping. The spring and stream impact parameters indicate that the Proposed Action and No Action contribute cumulative effects on spring habitat and species in this basin. The impact parameter information shows that Proposed Action pumping could affect 0 to 2 springs. No Action also could reduce flows in 0 to 4 springs in this basin. Cumulative effects on spring habitat and species could result from No Action and Proposed Action pumping.
- Lake Valley – Proposed Action pumping could contribute to reduced flows in one spring and one stream at full buildout plus 200 years time frame. No Action also could reduce flows in 1 to 2 springs (all three model time frames) and 0 streams (full build out plus 200 years). The spring and stream impact parameters indicate that the Proposed Action and No Action contribute cumulative effects on spring habitat and species in this basin.

Figure 3.7-22 Cumulative Analysis with the Proposed Action and No Action Using Aquatic Biological Resource Impact Parameters

- Pahranagat Valley – Proposed Action pumping could reduce flows in 1 stream (Pahranagat Creek) with game fish or special status aquatic species at full build out plus 200 years time frame. No Action pumping also could contribute to reduced flows in this same stream during all three model time frames.
- Lower Meadow Valley Wash – The Proposed Action could contribute very small flow reductions to Lower Meadow Valley Wash and Muddy River Springs Area. Most of the cumulative effects on stream habitat could result from cumulative pumping with No Action.

Cumulative pumping with the Proposed Action could affect habitat for four federally listed fish species, White River spinedace, Pahrump poolfish, Big Springs spinedace, and Moapa dace. The Proposed Action only could contribute effects to two of these species, White River spinedace and Pahrump poolfish. Spring flow or water level reductions were determined at the following locations for these species:

- **White River Spinedace** – Although the 10-foot groundwater drawdown contours did not overlap with springs occupied by this species, the model simulation predicted cumulative flow reductions of 2, 9, and 19 percent for the three model time frames in the Flag Spring complex. The Proposed Action could contribute most of the flow reduction in Flag Spring (-1 to -17). The predicted cumulative flow reduction in Preston Big Springs ranged from 2 to 8 for the three model time frames. Proposed Action pumping could contribute a very small portion of the predicted flow reduction (0 to -1) in Preston Big Springs. These springs are considered critical habitat for White River spinedace. Flow reductions also could occur at the full build out plus 75 years and full build out plus 200 years time frame in Indian Ranch Spring, which is inhabited by this species.
- **Pahrump Poolfish –** Potential water level reductions were predicted for all three model time frames in Shoshone Ponds. No information is available to quantify the potential flow reduction in the ponds. The Proposed Action pumping could contribute all of the reduced flow risk predicted for Shoshone Ponds.
- **Big Springs Spinedace –** No Action and other cumulative pumping could result in potential flow reductions in Meadow Valley Wash in Dry and Panaca valleys. In total, approximately 0.5 mile of the 5.2 miles of occupied and critical habitat could be adversely affected at the full build out plus 200 years time frame. The Proposed Action would not contribute to these effects on habitat for this species. Habitat in Condor Canyon in Upper Meadow Valley Wash in Panaca Valley could be affected in approximately 0.4 mile at the full build out plus 200 years time frame. No effect was indicated in the analysis for the full build out and full build out plus 75 years time frame.
- **Moapa Dace** – Cumulative pumping with No Action could result in flow reductions in the Muddy River. Proposed Action could not contribute to these effects on habitat for this species. Model-predicted cumulative flow reductions were shown for all three model time frames, with percentages ranging from -37 to -62. Proposed Action pumping could contribute a very small portion of this flow reduction (0 to -1 percent).
- **Other Federally Listed Species** – Cumulative pumping with the Proposed Action would not affect habitat for the following species: Hiko White River springfish (Hiko and Crystal springs), White River springfish (Ash Spring), and Pahranagat roundtail chub (Pahranagat Creek). Model-simulated flow reductions were estimated to be 0 to 5 percent in Ash and Crystal springs for the three model periods.

Cumulative pumping with the Proposed Action could contribute risks for habitat reductions for other special status fish, amphibians (northern leopard frog), and invertebrates (springsnails and California floater) in these six basins. Specific waterbodies and their associated species at risk are provided in **Appendix F**, **Tables F3.7-26** and **F3.7-27**. In total, 7 to 29 springs/lakes with game fish or special status species could be affected by cumulative pumping in these six basins at the three model time frames. Cumulative effects on stream habitat for game fish or special status aquatic species would range from 29 to 127 miles for the three model time frames.

The Proposed Action could contribute to cumulative effects on two springs (Outhouse and Rowland) and two streams (Lehman and Snake) in Snake Valley with aquatic biological resources in GBNP. Data are not available to quantify the cumulative effect on habitat in these springs. Stream miles affected by this alternative included 1.8 miles for Snake Creek at the full build out plus 75 years and full build out plus 200 years time frame and 0.5 mile for Lehman Creek at the full build out plus 200 years time frame. Snake and Lehman creeks and Rowland Spring contain game fish species. Outhouse springs contain springsnails. Additional streams at risk include Shingle and Williams Canyon creeks in Spring Valley and Baker and Strawberry creeks in Snake Valley.

In Utah, cumulative pumping with the Proposed Action could reduce flows in two springs (Clay and Stateline) and two streams (Lake and Snake) in Snake Valley with aquatic biological resources. Data are not available to quantify the cumulative effect on habitat in these springs. Stream miles affected at the full build out plus 75 years and full build out plus 200 years time frame included 1.2 miles for Snake Creek and 10.6 miles for Lake Creek. Flow reductions in Lake Creek would result in reduced flow input to Pruess Lake in Utah. Snake Creek supports game fish species, while Lake Creek contains native fish species. Springsnails are present in Stateline and Clay Springs.

Cumulative pumping with the Proposed Action could conflict with conservation agreements for Bonneville cutthroat and northern leopard frog in Spring and Snake valleys and recovery plans for Pahrump poolfish and White River spinedace in Spring and White River valleys, respectively. Potential conflicts with the recovery plan for Big Springs spinedace would be caused by No Action and other cumulative action pumping.

The availability of fish species traditionally used for food by regional Tribes in relation to groundwater drawdown also could be affected in all six basins identified above with cumulative effects on native and non-native fish species.

3.7.3.6 Alternative A

Right-of-ways and Groundwater Development Area Construction and Maintenance

The effects of Alternative A surface disturbance resulting from ROWs and project facilities in combination with other cumulative actions on aquatic biological resources would result in the same types of impacts discussed for cumulative impacts with the Proposed Action.

Groundwater Pumping Effects

Detailed results of the cumulative pumping analysis with Alternative A are provided in **Appendix F**, **Tables F3.7-28** and **F3.7-29** for springs/ponds/lakes and streams, respectively. The cumulative analysis focused on the incremental pumping effects that could be contributed by Alternative A in combination with other cumulative pumping activities. In total, 6 to 13 basins with aquatic biological resources could be affected by this cumulative analysis for the three model time frames. However, only five of these basins could be affected by the Proposed Action: White River, Spring (#184), Snake, Lake, and Lower Meadow Valley Wash.

Percent flow reduction and impact indicator information are summarized in **Appendix F**, **Table F3.7-41** and shown in **Figure 3.7-23**. The summary and figure include impact parameter information for cumulative with No Action, Alternative A, and cumulative pumping with Alternative A as a way of identifying the incremental effects of the alternative. One notable difference for this cumulative pumping scenario would be that the magnitude of flow reduction would be smaller compared to cumulative pumping with the Proposed Action. Therefore, the magnitude of effects on reduced habitat would be lower in White River and Spring valleys. Based on the model-simulated flow predictions for Big Spring, the flow reduction would be the same for cumulative pumping with the Proposed Action and Alternative A.

Based on the overlap of the 10-foot drawdown to springs and streams with aquatic biological resources, the number of affected springs and streams would be generally similar for cumulative pumping with the Proposed Action and Alternative A. The only notable exception could be Spring Valley, where the list of affected springs and streams would be less than cumulative pumping with the Proposed Action. For example, stream miles (i.e., streams containing game fish or special status aquatic species) affected by pumping could range from 2 to 12 for Alternative A model time frames, with the range for cumulative pumping being 4 to 13 miles. In contrast, the stream mile range for Proposed Action would be 6 to 24 for the three model time frames and 7 to 25 miles for cumulative pumping. Pumping effects on spring habitat and species in this basin also would be less than cumulative pumping with the Proposed Action.

The relative contribution of Alternative A to cumulative effects on aquatic habitat is shown in **Figure 3.7-23**. The figure includes impact parameter information for cumulative with No Action, Alternative A, and cumulative pumping with Alternative A. The same general pattern of relative contribution to cumulative pumping effects is evident for Alternative A and the Proposed Action. Alternative A could contribute a substantial portion of reduced habitat in Spring and Snake valleys. There could be more equal contribution of incremental effects from No Action and Alternative A in White River and Lake valleys. No Action pumping contributes most of the effects on habitat in Lower Meadow Valley Wash and all of the pumping effects in Pahranagat Valley.

Figure 3.7-23 Cumulative Analysis with Alternative A and No Action Using Aquatic Biological Resource Impact Parameters

Cumulative pumping with Alternative A could affect habitat for four federally listed fish species, White River spinedace, Pahrump poolfish, Big Springs spinedace, and Moapa dace. Alternative A only would contribute effects to two of these species, White River spinedace and Pahrump poolfish. Spring flow or water level reductions were determined at the following locations for these species:

- **White River Spinedace:** Although the 10-foot groundwater drawdown contours overlap with springs occupied by this species, the model simulation predicted cumulative flow reductions of 1, 5, and 11 percent for the three model time frames in the Flag Spring complex. Most of this flow reduction could result from Alternative A pumping (-1 to -8 percent). Alternative A pumping could result in a very small percent flow reduction in Preston Big Springs (0 to -1 percent). Flow reductions also could occur at the full build out plus 75 years and full build out plus 200 years time frame in Indian Ranch Spring, which is inhabited by this species.
- **Pahrump Poolfish** – Potential water level reductions were predicted for all three model time frames in Shoshone Ponds. No information is available to quantify the potential flow reduction in the ponds. Alternative A pumping would contribute all of the incremental effects on habitat for Pahrump poolfish.
- **Big Springs Spinedace** – No Action and other cumulative pumping actions could affect flows in Meadow Valley Wash in Panaca Valley. Alternative A pumping is not expected to affect flows in this stream.
- **Moapa Dace –** Cumulative pumping with No Action would likely result in flow reductions in the Muddy River. Alternative A would not contribute to these effects on habitat for this species. Model-predicted cumulative flow reductions were shown for all three model time frames, with percentages ranging from -37 to -61. Alternative A could contribute a very small portion of flow reduction in the Muddy River (0 to -1 percent).

Other Federally Listed Species – Cumulative pumping pumping with Alternative A would not affect habitat for the following species: Hiko White River springfish (Hiko and Crystal springs), White River springfish (Ash Spring), and Pahranagat roundtail chub (Pahranagat Creek). Model-simulated flow reductions of 0 to 4 percent were predicted for Ash and Crystal springs for the three model periods.

Cumulative pumping with Alternative A would contribute risks for habitat reductions for other special status fish, amphibians (northern leopard frog), and invertebrates (springsnails and California floater) in these five basins. Specific waterbodies and their associated species at risk are provided in **Appendix F**, **Tables F3.7-28** and **F3.7-29**. In total, 4 to 27 springs with game fish or special status species could be affected by cumulative pumping in these five basins at the three model time frames. Cumulative effects on stream habitat for game fish or special status aquatic species would range from 25 to 109 miles for the three model time frames.

Alternative A would contribute to cumulative effects to the same springs and streams and associated aquatic species in GBNP and Utah, as discussed for cumulative pumping with the Proposed Action. Flow data are not available to predict the percent flow reduction for these aquatic habitats.

Cumulative pumping with Alternative A could conflict with conservation agreements for Bonneville cutthroat and northern leopard frog in Spring and Snake valleys and recovery plans for Pahrump poolfish and White River spinedace in Spring and White River valleys, respectively.

The availability of fish species traditionally used for food by regional Tribes in relation to groundwater drawdown also could be affected in all five basins identified above regarding cumulative effects on game fish or special status fish species.

3.7.3.7 Alternative B

Right-of-ways and Groundwater Development Area Construction and Maintenance

The effects of Alternative B surface disturbance resulting from ROWs and project facilities in combination with other cumulative actions on aquatic biological resources would be the same as discussed for cumulative impacts with the Proposed Action.

Groundwater Pumping Effects

Detailed results of the cumulative pumping analysis with Alternative B are provided in **Appendix F**, **Tables F3.7-30** and **F3.7-31** for springs/ponds/lakes and streams, respectively. The cumulative analysis focused on the incremental pumping effects that would be contributed by the Alternative B in combination with other cumulative pumping activities. In total, 6 to 14 basins with aquatic biological resources would be affected by this cumulative analysis for the three model time frames. However, only seven of these basins would be affected by Alternative B: White River, Steptoe, Spring (#184), Snake, Lake, Pahranagat, and Lower Meadow Valley Wash. The addition of Steptoe Valley is unique to Alternative B, since this basin was not affected by the Proposed Action or Alternative A.

Percent flow reduction and impact indicator information are summarized in **Appendix F**, **Table F3.7-42**. Using model-simulated flow information, the magnitude of effects on reduced habitat would be higher in White River Valley and lower in Spring Valley in comparison to the Proposed Action. Based on the model-simulated flow predictions for Big Spring, the flow reduction would be similar for cumulative pumping with the Proposed Action and Alternative B.

The relative contribution of Alternative B to cumulative effects on aquatic habitat is shown in **Figure 3.7-24**. The figure includes impact parameter information for cumulative with No Action, Alternative B, and cumulative pumping with Alternative B. The same general pattern of relative contribution to cumulative pumping effects is evident for Alternative B and the Proposed Action. Alternative B would contribute a substantial portion of reduced habitat in Spring and Snake valleys. There would be more equal contribution of incremental effects from No Action and Alternative B in White River and Lake valleys. No Action and Alternative B pumping contribute most of the effects on habitat in Lower Meadow Valley Wash. No Action and Alternative B pumping contribute effects to aquatic habitat in Pahranagat Valley. One notable difference under cumulative pumping with Alternative B is that a higher number of springs with aquatic biological resources are affected at the full build out model time frame compared to the Proposed Action.

Cumulative pumping with Alternative B could affect habitat for four federally listed fish species, White River spinedace, Pahrump poolfish, Big Springs spinedace, and Moapa dace. Alternative B only would contribute effects to two of these species, White River spinedace and Pahrump poolfish. Spring flow or water level reductions were determined at the following locations for these species:

- **White River Spinedace** – Although the 10-foot groundwater drawdown contours did not overlap with springs occupied by this species, the model simulation predicted cumulative flow reductions of 19, 30, and 39 percent for the three model time frames in the Flag Spring complex. Alternative B pumping would contribute most of the flow reductions, as indicated by predicted percentages of -19 to -37. Cumulative pumping with Alternative B could result in percent flow reductions in Preston Big Springs (-3 to -9 percent). Alternative B pumping would contribute a small portion of the reduction as indicated by percentages of 0 to -2. Flow reductions also could occur at the full build out plus 75 years and full build out plus 200 years time frame in Indian Ranch Spring, which is inhabited by this species.
- **Pahrump Poolfish –** Potential water level reductions were predicted for all three model time frames in Shoshone Ponds. No information is available to quantify the potential flow reduction in the ponds. Alternative B would contribute all of the potential reduction in Shoshone Ponds.
- **Big Springs Spinedace –** No Action and other cumulative pumping actions would affect flows in Meadow Valley Wash in Panaca Valley (0.4 mile) and Dry Valley (0.1 mile). Alternative B pumping would not contribute reduced flows in Meadow Valley Wash.
- **Moapa Dace** – Cumulative pumping with No Action would likely result in flow reductions in the Muddy River. Alternative B would not contribute to these effects on habitat for this species. Model-predicted cumulative flow reductions were shown for all three model time frames, with percentages ranging from -37 to -62. The percent reduction for Alternative B pumping was 0 to -1.
- **Other Federally Listed Species –** Cumulative pumping with Alternative B would not affect habitat for the following species: Hiko White River springfish (Hiko and Crystal springs), White River springfish (Ash Spring), and Pahranagat roundtail chub (Pahranagat Creek). Model-simulated flow reductions of 0 to 5 percent were predicted for Ash and Crystal springs for the three model periods.

Figure 3.7-24 Cumulative Analysis with Alternative B and No Action Using Aquatic Biological Resource Impact Parameters

Cumulative pumping with Alternative B would contribute risks in habitat reductions for other special status fish, amphibians (northern leopard frog), and invertebrates (springsnails and California floater) in these seven basins. Specific waterbodies and their associated species at risk are provided in **Appendix F**, **Tables F3.7-30** and **F3.7-31**. In total, 8 to 28 springs with game fish or special status species could be affected by cumulative pumping in these seven basins at the three model time frames. Cumulative effects on stream habitat for game fish or special status aquatic species would range from 26 to 122 miles for the three model time frames.

In GBNP, Alternative B could contribute to cumulative effects to three springs (Rowland, Outlet, and Outhouse) and four streams (Baker, Lehman, Snake, and Strawberry creeks) and associated aquatic species. In Utah, the same springs and streams could be affected, as discussed for cumulative pumping with the Proposed Action. Flow data are not available to predict the percent flow reduction for these aquatic habitats. Additional streams at risk include Shingle and Williams Canyon creeks in Spring Valley, based on the Elliott et al. (2006) study.

Cumulative pumping with Alternative B could conflict with conservation agreements for Bonneville cutthroat and northern leopard frog in Spring and Snake valleys and recovery plans for Pahrump poolfish and White River spinedace in Spring and White River valleys, respectively.

The availability of native and non-native fish species traditionally used for food by regional Tribes in relation to groundwater drawdown also could be affected in all seven basins identified above regarding cumulative effects on game fish or special status fish species.

3.7.3.8 Alternative C

Right-of-ways and Groundwater Development Area Construction and Maintenance

The effects of Alternative C surface disturbance resulting from ROWs and project facilities in combination with other cumulative actions on aquatic biological resources would be the same as discussed for cumulative impacts with the Proposed Action.

Groundwater Pumping Effects

Detailed results of the cumulative pumping analysis with Alternative C are provided in **Appendix F**, **Tables F3.7-32** and **F3.7-33** for springs/ponds/lakes and streams, respectively. The cumulative analysis focused on the incremental pumping effects that would be contributed by the Alternative C in combination with other cumulative pumping activities. In total, 6 to 13 basins with aquatic biological resources would be affected by this cumulative analysis for the three model time frames. However, only six of these basins would be affected by Alternative C: White River, Spring (#184), Snake, Lake, Dry Lake, and Lower Meadow Valley Wash.

Percent flow reduction and impact indicator information are summarized in **Appendix F**, **Table F3.7-43**. Using model-simulated flow information, the magnitude of effects on reduced habitat would be lower in White River and Spring valleys in comparison to the Proposed Action. Based on the model-simulated flow predictions for Big Spring, the flow reduction would be similar for cumulative pumping with the Proposed Action and Alternative C.

The relative contribution of Alternative C to cumulative effects on aquatic habitat is shown in **Figure 3.7-25**. The figure includes impact parameter information for cumulative with No Action, Alternative C, and cumulative pumping with Alternative C. Alternative C would contribute a substantial portion of reduced habitat in Spring and Snake valleys. There would be more equal contribution of incremental effects from No Action and Alternative C in White River Valley. No Action pumping contributes most of the effects on habitat in Pahranagat Valley, Lake Valley, and Lower Meadow Valley Wash. One notable difference under cumulative pumping with Alternative C is that a lower number of spring and stream habitats would be affected in Spring Valley compared to the Proposed Action. The number of spring and stream habitat is similar in the other five valleys when comparing cumulative pumping with Alternative C and the Proposed Action.

Figure 3.7-25 Cumulative Analysis with Alternative C and No Action Using Aquatic Biological Resource Impact Parameters

Cumulative pumping with Alternative C could affect habitat for four federally listed fish species, White River spinedace, Pahrump poolfish, Big Springs spinedace, and Moapa dace. Alternative C only would contribute effects to two of these species, White River spinedace and Pahrump poolfish. Spring flow or water level reductions were determined at the following locations for these species:

- **White River Spinedace –** Although the 10-foot groundwater drawdown contours did not overlap with springs occupied by this species, the model simulation predicted cumulative flow reductions of 1, 4, and 8 percent for the three model time frames in the Flag Spring complex. Alternative C pumping would contribute most of the percent flow reductions in this spring (-1 to -5). Cumulative pumping could result in percent flow reductions in Preston Big Springs of 2 to 7 percent. Alternative C would not contribute to the predicted flow reduction in Preston Big Springs. Flow reductions also could occur at the full build out plus 75 years and full build out plus 200 years time frame in Indian Ranch Spring, which is inhabited by this species.
- **Pahrump Poolfish –** Potential water level reductions were predicted for all three model time frames in Shoshone Ponds. No information is available to quantify the potential flow reduction in the ponds. Alternative C would contribute all of the potential reduction in Shoshone Ponds.
- **Big Springs Spinedace –** No Action and other cumulative pumping actions could reduce flows in Meadow Valley Wash in Panaca Valley (0.1 mile). Potential flow reductions and reduced habitat were predicted at the full build out plus 200 years time frame. Alternative C pumping would not contribute to pumping effects on Meadow Valley Wash.
- **Moapa Dace** – Cumulative pumping with No Action would likely result in flow reductions in the Muddy River. Alternative C would not contribute to these effects on habitat for this species. Model-predicted flow reductions were shown for all three model time frames, with percentages ranging from -37 to -65.
- **Other Federally Listed Species** – Cumulative pumping with Alternative C would not affect habitat for the following species: Hiko White River springfish (Hiko and Crystal springs), White River springfish (Ash Spring), and Pahranagat roundtail chub (Pahranagat Creek). Model-simulated flow reductions of 0 to 4 percent were predicted for Ash and Crystal springs for the three model periods.

Cumulative pumping with Alternative C would likely contribute risks for habitat reductions for other special status fish, amphibians (northern leopard frog), and invertebrates (springsnails and California floater) in these six basins. Specific waterbodies and their associated species at risk are provided in **Appendix F**, **Tables F3.7-32** and **F3.7-33**. In total, 6 to 25 springs with game fish or special status species could be affected by cumulative pumping in these six basins at the three model time frames. Cumulative effects on stream habitat for game fish or special status aquatic species would range from 25 to 102 miles for the three model time frames.

In GBNP, Alternative C could contribute to cumulative effects to three springs (Rowland and Outhouse) and two streams (Lehman and Snake creeks) and associated aquatic species. Additional streams at risk in GBNP include Shingle and Williams Canyon creeks in Spring Valley and Strawberry Creek in Snake Valley, based on the Elliott et al. (2006) study. In Utah, the same springs and streams would be affected, as discussed for cumulative pumping with the Proposed Action. Flow data are not available to predict the percent flow reduction for these aquatic habitats. Cumulative pumping with Alternative C could conflict with conservation agreements for Bonneville cutthroat and northern leopard frog in Spring and Snake valleys and recovery plans for Pahrump poolfish and White River spinedace in Spring and White River valleys, respectively.

The availability of fish species traditionally used for food by regional Tribes in relation to groundwater drawdown also could be affected in all six basins identified above regarding cumulative effects on game fish or special status fish species.

3.7.3.9 Alternative D

Right-of-ways and Groundwater Development Area Construction and Maintenance

Construction and facility maintenance in Snake Valley and White Pine County would be eliminated under Alternative D. As a result, construction of the remaining ROWs and project facilities in Lincoln and Clark County and the Lincoln County portion of Spring Valley would result in effects on intermittent streams. No perennial streams or springs would be crossed by this alternative. Therefore, Alternative D impacts would contribute low level impacts after ACMs and additional mitigation in combination with past effects from grazing. Other past and future cumulative actions involving linear ROWs, wind projects, and the Kane Springs Valley Groundwater Development have or will result in surface disturbance and sedimentation impacts to streams and springs located in other portions of the cumulative effects study area. Alternative D would contribute minor impacts to the overall cumulative effects area due to the fact that no perennial streams or springs are affected.

Groundwater Pumping Effects

Detailed results of the cumulative pumping analysis with Alternative D are provided in **Appendix F**, **Tables F3.7-34** and **F3.7-35** for springs/ponds/lakes and streams, respectively. The cumulative analysis focused on the incremental pumping effects that would be contributed by the Alternative D in combination with other cumulative pumping activities. In total, 5 to 13 basins with aquatic biological resources would be affected by this cumulative analysis for the three model time frames. However, only six of these basins would be affected by Alternative D: White River, Spring (#184), Snake, Lake, Pahranagat, and Lower Meadow Valley Wash.

Percent flow reduction and impact indicator information are summarized in **Appendix F**, **Table F3.7-44**. Using model-simulated flow information, the magnitude of effects on reduced habitat would be considerably lower in White River and Spring valleys in comparison to the Proposed Action. Based on the model-simulated flow predictions for Big Spring, the flow reduction would be similar for cumulative pumping with the Proposed Action and Alternative D.

The relative contribution of Alternative D to cumulative effects on aquatic habitat is shown in **Figure 3.7-26**. The figure includes impact parameter information for cumulative with No Action, Alternative D, and cumulative pumping with Alternative D. Alternative D would contribute a substantial portion of reduced habitat in Snake and Spring valleys. This pattern is most evident in Snake Valley at the full build out plus 200 years time frame. There would be more equal contribution of incremental effects from No Action and Alternative D in White River and Lake valleys. No Action pumping contributes all of the effects on habitat in Pahranagat Valley and most of the effects in Lower Meadow Valley Wash. One notable difference under cumulative pumping with Alternative D is that a lower number of spring and stream habitat would be affected in Spring and Snake valleys compared to the Proposed Action. The number of spring and stream habitat is similar in the other five valleys when comparing cumulative pumping with Alternative D and the Proposed Action.

Cumulative pumping with Alternative D could affect habitat for four federally listed fish species, White River spinedace, Pahrump poolfish, Big Springs spinedace, and Moapa dace. Alternative D only would contribute effects to two of these species, White River spinedace and Pahrump poolfish. Spring flow or water level reductions were determined at the following locations for these species:

- **White River Spinedace** – Although the 10-foot groundwater drawdown contours did not overlap with springs occupied by this species, the model simulation predicted cumulative flow reductions of 1, 5, and 11 percent for the three model time frames in the Flag Spring complex. Most of the flow reduction would result from Alterantive D, as indicated by a percent change of 0 to -9. Cumulative pumping could result in percent flow reductions in Preston Big Springs of 2 to 7 percent. None of this reduction would be caused by Alternative D pumping. Flow reductions also could occur at the full build out plus 75 years and full build out plus 200 years time frame in Indian Ranch Spring, which is inhabited by this species.
- **Pahrump Poolfish –** Potential water level reductions were predicted for the full build out plus 75 years and full build out plus 200 years time frame in Shoshone Ponds. No information is available to quantify the potential flow reduction in the ponds. Alternative D would contribute all of the potential reduction in Shoshone Ponds.
- **Big Springs Spinedace –** No Action and other cumulative pumping actions would likely affect flows in Meadow Valley Wash in Dry Valley (0.1 mile) at the full build out plus 200 years time frame. Alternative D pumping would not contribute to reduced flows in Meadow Valley Wash in Panaca Valley.
- **Moapa Dace –** Cumulative pumping with No Action would likely result in flow reductions in the Muddy River. Alternative D would not contribute to these effects on habitat for this species. Model-predicted cumulative flow reductions were shown for all three model time frames, with percentages ranging from -36 to -61. None of the predicted reduction would be caused by Alternative D.

Figure 3.7-26 Cumulative Analysis with Alternative D and No Action Using Aquatic Biological Resource Impact Parameters

- **Other Federally Listed Species** – Cumulative pumping with Alternative D would not affect habitat for the following species: Hiko White River springfish (Hiko and Crystal springs), White River springfish (Ash Spring), and Pahranagat roundtail chub (Pahranagat Creek). Model-simulated flow reductions of 0 to 4 percent were predicted for Ash and Crystal springs for the three model periods.

Cumulative pumping with Alternative D would likely contribute risks in habitat reductions for other special status fish, amphibians (northern leopard frog), and invertebrates (springsnails and California floater) in these six basins. Specific waterbodies and their associated species at risk are provided in **Appendix F**, **Tables 3.7-34** and **3.7-35**. In total, 2 to 17 springs with game fish or special status species could be affected by cumulative pumping in these six basins at the three model time frames. Cumulative effects on stream habitat for game fish or special status aquatic species would range from 20 to 74 miles for the three model time frames.

Alternative D could contribute to cumulative effects to one spring (Outhouse) and one stream (Snake Creek) and associated aquatic species in the GBNP. In Utah, one spring (Stateline) and one stream (Lake Creek) could be affected, as discussed for cumulative pumping with the Proposed Action. Flow data are not available to predict the percent flow reduction for these aquatic habitats.

Cumulative pumping with Alternative D could conflict with conservation agreements for Bonneville cutthroat and northern leopard frog in Spring and Snake valleys and recovery plans for Pahrump poolfish and White River spinedace in Spring and White River valleys, respectively.

The availability of fish species traditionally used for food by regional Tribes in relation to groundwater drawdown also could be affected in all six basins identified above regarding cumulative effects on game fish or special status fish species.

3.7.3.10 Alternative E

Right-of-ways and Groundwater Development Area Construction and Maintenance

Under Alternative E, surface disturbance impacts would be limited to intermittent streams crossed by ROWs that would exclude Snake Valley. These impacts would be considered low level due to the implementation of BMPs and ACMs to reduce water quality effects involving sedimentation and potential fuel spills. Other past and future cumulative actions involving linear ROWs, wind projects, and groundwater development have or will result in surface disturbance and sedimentation impacts to waterbodies located in other portions of the cumulative effects study area. Alternative E would contribute minor impacts to the overall cumulative effects area due to the fact that no perennial streams or springs are affected.

Groundwater Pumping Effects

Detailed results of the cumulative pumping analysis with Alternative E are provided in **Appendix F**, **Tables F3.7-36** and **F3.7-37** for springs/ponds/lakes and streams, respectively. The cumulative analysis focused on the incremental pumping effects that would be contributed by the Alternative E in combination with other cumulative pumping activities. In total, 5 to 13 basins with aquatic biological resources would be affected by this cumulative analysis for the three model time frames. However, only six of these basins would be affected by Alternative E: White River, Spring (#184), Snake, Lake, Pahranagat, and Lower Meadow Valley Wash.

Percent flow reduction and impact indicator information are summarized in **Appendix F**, **Table F3.7-45**. Using model-simulated flow information, the magnitude of effects on reduced habitat would be considerably lower in White River and Spring valleys in comparison to the Proposed Action. Based on the model-simulated flow predictions for Big Spring, the flow reduction would be similar for cumulative pumping with the Proposed Action and Alternative E.

The relative contribution of Alternative E to cumulative effects on aquatic habitat is shown in **Figure 3.7-27**. The figure includes impact parameter information for cumulative with No Action, Alternative E, and cumulative pumping with Alternative E. Alternative E would contribute a substantial portion of reduced habitat in Spring Valley. There would be more equal contribution of incremental effects from No Action and Alternative E in White River, Snake, and Lake valleys. No Action pumping would contribute all of the effects on habitat in Pahranagat Valley and most of the effects in Lower Meadow Valley Wash. One notable difference under cumulative pumping with Alternative E is that a lower number of spring and stream habitats would be affected in Snake Valley compared to the Proposed Action. The number of spring and stream habitat is similar in the other five valleys when comparing cumulative pumping with Alternative E and the Proposed Action.

Cumulative pumping with Alternative E could affect habitat for four federally listed fish species, White River spinedace, Pahrump poolfish, Big Springs spinedace, and Moapa dace. Alternative E only would contribute effects to two of these species, White River spinedace and Pahrump poolfish. Spring flow or water level reductions were determined at the following locations for these species:

- **White River Spinedace:** Although the 10-foot groundwater drawdown contours did not overlap with springs occupied by this species, the model simulation predicted cumulative flow reductions of 1, 5, and 11 percent for the three model time frames in the Flag Spring complex. Most of the predicted reduction would be caused by Alternative E pumping (-1 to -8 percent). Model simulations indicate that cumulative pumping would result percent flow reductions in Preston Big Springs of 2 to 8 percent. A very small portion of this reduction would be caused by Alternative E pumping (0 to -1 percent). Flow reductions also could occur at the full build out plus 75 years and full build out plus 200 years time frame in Indian Ranch Spring, which is inhabited by this species.
- **Pahrump Poolfish:** Potential water level reductions were predicted for the full build out plus 75 years and full build out plus 200 years time frame in Shoshone Ponds. No information is available to quantify the potential flow reduction in the ponds. Alternative E would contribute all of this potential reduction in Shoshone Ponds.
- **Big Springs Spinedace:** No Action and other cumulative pumping actions could reduce flows in Meadow Valley Wash in Dry Valley (0.1 mile) at the full build out plus 200 years time frame. Alternative E pumping would not contribute reduced flow to Meadow Valley Wash in Panaca Valley.
- **Moapa Dace** – Cumulative pumping with No Action would likely result in flow reductions in the Muddy River. Alternative E would not contribute to these effects on habitat for this species. Model-predicted cumulative flow reductions were shown for all three model time frames, with percentages ranging from -37 to -61. Alternative E pumping would not contribute to his reduction.
- **Other Federally Listed Species –** Cumulative pumping with Alternative E would not affect habitat for the following species: Hiko White River springfish (Hiko and Crystal springs), White River springfish (Ash Spring), and Pahranagat roundtail chub (Pahranagat Creek). Model-simulated flow reductions would be 0 to 4 percent in Ash and Crystal springs for the three model periods.

Cumulative pumping with Alternative E would contribute risks for habitat reductions for other special status fish, amphibians (northern leopard frog), and invertebrates (springsnails and California floater) in these six basins. Specific waterbodies and their associated species at risk are provided in **Appendix F**, **Tables 3.7-34** and **3.7-35**. In total, 6 to 21 springs with game fish or special status species could be affected by cumulative pumping in these six basins at the three model time frames. Cumulative effects on stream habitat for game fish or special status aquatic species would range from 26 to 75 miles for the three model time frames.

Alternative E could contribute to cumulative effects to one spring (Outhouse) and one stream (Snake Creek) and associated aquatic species in the GBNP. In Utah, no springs and one stream (Lake Creek) could be affected, as discussed for cumulative pumping with the Proposed Action. Flow data are not available to predict the percent flow reduction for these aquatic habitats.

Cumulative pumping with Alternative E could conflict with conservation agreements for Bonneville cutthroat and northern leopard frog in Spring and Snake valleys and recovery plans for Pahrump poolfish and White River spinedace in Spring and White River valleys, respectively.

The availability of fish species traditionally used for food by regional Tribes in relation to groundwater drawdown also could be affected in all six basins identified above regarding cumulative effects on game fish or special status fish species.

Figure 3.7-27 Cumulative Analysis with Alternative E and No Action Using Aquatic Biological Resource Impact Parameters