Environmental Evaluation of SNWA Groundwater Development in Spring, Cave, Dry Lake, and Delamar Valleys

PRESENTATION TO THE OFFICE OF THE NEVADA STATE ENGINEER

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Environmental Evaluation of SNWA Groundwater Development in Spring, Cave, Dry Lake, and Delamar Valleys

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Pertaining to:
Groundwater Applications 54003 through 54021 in
Spring Valley
and
Groundwater Applications 53987 through 53992 in
Cave, Dry Lake, and Delamar Valleys

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CONTENTS

CONTENTS (CONTINUED)

CONTENTS (CONTINUED)

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FIGURES

TABLES

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ACRONYMS

BA	Biological Assessment
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BO	Biological Opinion
BRT	Biological Resources Team
BWG	Biological Work Group
CAP	Conservation Action Planning
CCAA	Candidate Conservation Agreement with Assurances
CCRP	Central Carbonate-Rock Province
DDC	Delamar, Dry Lake and Cave Valleys
DMI	Digital Mapping Incorporated
DOI	U.S. Department of Interior
DRI	Desert Research Institute
EC	Executive Committee
EIS	Environmental Impact Statement
ENLC	Eastern Nevada Landscape Coalition
ESA	Endangered Species Act
ET	Evapotranspiration
FS	U.S. Forest Service
GBBO	Great Basin Bird Observatory
GBNP	Great Basin National Park
GIS	Geographic Information System
GPS	Global Positioning System
GWD	Groundwater Development
IBMA	Initial Biological Monitoring Area
LVWCC	Las Vegas Wash Coordination Committee
NPS	National Park Service
NAIP	National Agriculture Imagery Program
NDOW	Nevada Department of Wildlife
NEPA	National Environmental Policy Act
NSE	Nevada State Engineer
NNHP	Nevada Natural Heritage Program
NWR	National Wildlife Refuge
QA	Quality Assurance
QC	Quality Control
RIT(s)	Recovery Implementation Team(s)
ROW(s)	Right-of-Way(s)
SNWA	Southern Nevada Water Authority

ACRONYMS (CONTINUED)

SWReGAP	Southwest Regional Gap Analysis Project
TCWC	Tri-County Weed Coalition
TNC	The Nature Conservancy
TRP	Technical Review Panel
UDWR	Utah Division of Wildlife Resources
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WMA	Wildlife Management Area
ZOI	Zone of Influence

ABBREVIATIONS

afy	acre-feet per year
amsl	above mean sea level
bgs	below ground surface
ft	foot
in	inch
km	kilometer
m	meter
mi	mile
mi^2	square mile

1.0 INTRODUCTION

In context with an array of environmental compliance and monitoring and management processes, this report evaluates the interbasin transfer of Southern Nevada Water Authority (SNWA) applications 54003 through 54021, inclusive, in Spring Valley and applications 53987 through 53992, inclusive, in Delamar, Dry Lake, and Cave valleys (DDC) to meet the standards set by N.R.S. § 533.370(5), which requires the state engineer to determine whether the proposed use threatens to prove detrimental to the public interest, and N.R.S. § 533.370(6)(c), which requires the State Engineer to consider whether the proposed action is environmentally sound as it relates to the basin from which the water is exported.

In 2006 and 2008, SNWA entered into the Spring Valley and DDC Stipulated Agreements, respectively, with Department of Interior (DOI) Bureaus including U.S. Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM), Bureau of Indian Affairs (BIA) and National Park Service (NPS). These agreements established an Executive Committee (EC) and three technical committees (Technical Review Panel [TRP], Biological Work Group [BWG] and the Biological Resources Team [BRT]) to oversee implementation, and obligated SNWA to conduct hydrologic and biological monitoring, avoid unreasonable adverse effects to Federal Resources and Special Status Species, and avoid injury to Federal Water Rights. Also, the Spring Valley Stipulation requires avoidance of any effects to Federal Resources within the boundaries of Great Basin National Park (GBNP). Since the signing of these stipulations both hydrologic and biological monitoring plans have been developed by the technical teams and data collection is underway.

Intensive biological studies began in the Groundwater Development (GWD) Project area in 2000 and have continued to the present. Standardized protocols for data collection have been used whenever possible. When necessary, resource experts developed and used modified protocols. Many thousands of professional hours have contributed to this effort, which has significantly raised the level of knowledge regarding biological resources in the project area. This body of knowledge provides a foundation from which informed management decisions can be made now and into the future.

Federal environmental regulatory compliance for the GWD Project, including National Environmental Policy Act (NEPA) and Endangered Species Act (ESA) compliance, was initiated in 2004 and is ongoing. A Final Environmental Impact Statement, Record of Decision and Biological Opinion are expected in 2012, and supplemental NEPA and ESA compliance will continue as future facilities are sited. Collectively, these processes ensure a thorough evaluation of environmental effects, protection of federally listed species and their designated critical habitat, the implementation of monitoring and mitigation plans and public input.

Since 2006, SNWA has acquired approximately 23,500 acres of ranch and farm lands in the GWD Project area and a 1480 acre conservation easement in Cave Valley. Four of the ranches in Spring Valley are base properties for approximately 900,000 acres of grazing allotments on U.S. Forest

Service (FS) and BLM lands. These acquisitions provide SNWA the opportunity to offset the impacts of groundwater development by integrating the management of water, land, vital ecosystems, sensitive species and other related natural resources over an area exceeding 920,000 acres that include portions of Spring, Steptoe, Lake, Hamlin, Patterson, Dry Lake, Cave and White River valleys.

Hydrological analyses conducted by Watrus and Drici (2011) on Environmental Areas of Interest are considered in this report. Watrus and Drici used qualitative or quantitative methods to evaluate 51 sites in and around Spring, Cave, Dry Lake and Delamar valleys (Project Basins). Of the 51 sites evaluated, 17 were eliminated because the hydrogeological characteristics of the site indicated they will not likely be affected, and 34 were evaluated using the Central Carbonate-Rock Province (CCRP) Model. Three of the 34 that were evaluated with the CCRP Model were found to be in areas where depth to groundwater was simulated to potentially increase by more than 50 ft. Another three sites were found to be in areas where spring flow discharge was simulated to potentially decline by more than 15 percent. This is a site specific environmental analysis that considered CCRP Model runs as one part of the evaluation. The current CCRP Model is best suited to provide a relatively coarse analysis regarding regional impacts of Project effects. This tool is also helpful in verifying the appropriateness of previously determined monitoring locations, identifying areas potentially needing additional monitoring, and supporting scenario analysis as part of the adaptive management decision-making process.

The many efforts undertaken by SNWA, the DOI Bureaus (USFWS, BLM, NPS, and BIA) and the Nevada State Engineer's (NSE) office have amassed an immense set of knowledge, tools and resources that have and continue to be utilized in innovative processes, such as the Spring Valley and DDC Stipulations, to ensure the long-term sustainability of natural resources in the Project Basins and surrounding areas. These many efforts will ensure that SNWA's development of applications 53987 through 53992, inclusive, in Spring Valley and applications 54003 through 54021, inclusive, in Delamar, Dry Lake, and Cave valleys will be environmentally sound and in the best interest of the public. The following chapters provide a more in-depth evaluation for the NSE's consideration.

2.0 ENVIRONMENTAL SETTING

The discussion below provides the environmental setting of the project basins (Spring, Cave, Dry Lake, and Delamar Valleys) and adjacent basins. Areas of focus in the adjacent basins include southern Snake Valley (south of Preuss Reservoir, encompassing the Big Springs Creek / Lake Creek system), northern Hamlin Valley, northern Lake Valley, southern White River Valley (south of and including Shingle Pass), and Pahranagat Valley.

The primary focus of this section is groundwater-influenced habitats and associated Special Status Species. Special Status Species include federally threatened, endangered, proposed or candidate species under the ESA; Nevada BLM sensitive species; Nevada or Utah state protected species; and species ranked critically imperiled or imperiled across their entire range (G1 or G2 rank) by NatureServe. Emphasis is placed on areas below the mountain block, as local mountain-block springs and streams do not have reasonable potential to be affected by SNWA groundwater development (Watrus and Drici, 2011).

Fifty-one Environmental Areas of Interest were selected for the environmental evaluations (Section 7.0 and Section 8.0) by a team of technical experts, and are highlighted in the discussion below. These Environmental Areas of Interest represent sample areas in the project basins and adjacent basins, and were chosen using the following selection criteria:

- Located below the mountain block;
- Spring Valley or DDC Stipulation monitoring site [Stipulation, 2006 and 2008];
- aquatic Special Status Species present;
- sites of particular interest;
- representative sites for a particular area; and/or,
- on federally protected land.

Over half (28) of these sites are below the mountain block and support aquatic Special Status Species. Sites in the mountain block or without aquatic Special Status Species include sites of interest (12 sites) and representative sites of a particular area (5 sites). Thirty-nine sites are Spring Valley Stipulation or DDC Stipulation monitoring sites, and eight sites are located on federally protected land (GBNP: six sites, Pahranagat National Wildlife Refuge [Pahranagat NWR]: two sites).

2.1 Biogeographical Setting

The project basins and adjacent basins are located within the Basin and Range Geographic Province in the Great Basin and Mojave Deserts. Spring, Cave, the northern half of Dry Lake valleys, Snake, Hamlin, Lake, and White River valleys lie within the Great Basin Desert; the southern half of Dry Lake Valley, Delamar Valley, and the northeastern portion of Pahranagat Valley span a transitional area between the Great Basin and Mojave deserts; and most of Pahranagat Valley is within the Mojave Desert. All of the valleys have typical basin and range topography, with corresponding changes in soils and plant communities from the valley floors to the mountain tops. Differences in valley floor elevation, latitude, precipitation and depth to groundwater are driving factors in the distribution of plant and wildlife communities throughout these valleys.

2.2 Groundwater-influenced Habitat

A groundwater-influenced habitat is a habitat that is substantially affected by groundwater at least most of the year. Such habitats include springs, seeps, ponds, streams, and wetlands, as well as those meadows, shrublands, and woodlands where the vegetation utilizes substantial amounts of groundwater on an annual basis and where the composition, structure, or productivity is dependent on this groundwater utilization (Biological Monitoring Plan for the Spring Valley Stipulation, BWG, 2009). Groundwater-influenced habitats present in the project basins and adjacent basins include the following:

- **Spring:** Body of water fed by the emergence of groundwater to the surface.
- **Seep:** Area where groundwater slowly discharges to the surface.
- **Pond:** Small, confined water body.
- **Stream:** Small flowing-water systems. Streams can be perennial, ephemeral (seasonal) or intermittent.
- **Wetland:** Area with soils that are saturated to the surface most of the time.
- **Meadow:** Plant community dominated by grasses or grass-like plants that has saturated soil within the rooting zone in most or all months of the year.
- **Phreatophytic shrubland**[1]**:** Shrub-dominated plant community that uses groundwater.
- **Phreatophytic woodland:** Tree-dominated plant community that uses groundwater. Phreatophytic woodlands can also use other sources of water, including surface expressions of groundwater and water sources not connected to groundwater (e.g., precipitation, surface runoff from precipitation events, subsurface drainage, and irrigation water).
- **Riparian woodland:** Tree-dominated plant community typically occuring along standing/flowing water.

1. Obligate phreatophytes rely almost exclusively on groundwater or surface water, and cannot exist on only precipitation (e.g., Nebraska sedge [*Carex nebrascensis*]). Facultative phreatophytes use some groundwater or surface water, but can exist on only precipitation (e.g., many species of shrubs and perennial grasses in the project basins and adjacent basins). For more detailed discussion, see McLendon (2011).

Land cover data (SNWA, 2004) and fine-scale vegetation mapping data (BIO-WEST, 2007a; McLendon et al., 2011; SNWA et al., 2011) provide extensive information on valley floor phreatophytic vegetation in the GWD Project area. Calculations of acres of groundwater-influenced habitats within the project basins and adjacent basins, as discussed below, are based on these datasets. For more information on these data collection efforts, see Section 4.0.

2.3 Project Basins

2.3.1 Spring Valley

Spring Valley is located in White Pine and Lincoln Counties in the Great Basin Desert, bordered by the Schell Creek Range to the west and Snake Range to the east. The valley floor elevation ranges between 5,500 and 6,000 ft above mean sea level (ft-amsl), and the bordering mountain ranges exceed 11,000 ft-amsl. One of the longest valleys in the State of Nevada, Spring Valley is approximately 110 mi long and 15 mi wide. Surface water drainage in the north flows to and terminates in Yelland Dry Lake playa, and surface water drainage in the south flows to and terminates in Baking Powder Flat. Numerous perennial streams flow off the northern Schell Creek Range in the northwestern portion of the valley, and mostly ephemeral streams flow off the Snake Range on the east side of the valley. Wetlands, meadows and valley floor springs, with a few exceptions, exist primarily along the alluvial fan margins in the northwestern and southeastern portions of the valley.

Spring Valley's physical diversity supports a number of groundwater-influenced habitats that include springs, seeps, streams, ponds, wetlands, meadows, phreatophytic woodlands, and phreatophytic shrublands (BWG, 2009). All of these habitats have been affected by anthropogenic factors such as grazing, surface water and groundwater diversion, farming and non-native species introduction. As an example, many of the perennial streams in the northwest and southeast portion of Spring Valley are diverted at or near the mountain block and are taken across the alluvial fans to the valley floor where the water is used to irrigate crops and/or meadows. Valley floor springs have been modified in some cases to improve access to cattle, and most are at least seasonally affected by livestock and/or feral horses. In the case of Shoshone Ponds, in southeastern Spring Valley, artificial habitats were constructed and are currently used to maintain refugium populations of the endangered Pahrump poolfish (*Empetrichthys latos latos*) and the state protected relict dace (*Relictus solitarius*). These ponds are supplied with water from artesian wells, which overflow into a meadow and may be adversely affecting valley-floor Rocky Mountain junipers that surround the area.

The majority of the valley floor and valley floor / alluvial fan interface in Spring Valley is composed of shrubland habitats. According to the Southwest Regional Gap Analysis Project (SWReGAP), the valley floor and valley floor / alluvial fan interface is composed largely of Great Basin Xeric Mixed Sagebrush Shrubland, Inter-Mountain Basins Mixed Salt Desert Scrub, Inter-Mountain Basins Greasewood Flat, Inter-Mountain Basins Playa, and Agriculture (USGS, 2004).

Approximately 160,000 acres (approx. 15 percent of the basin) on the valley floor and valley floor / alluvial fan interface is characterized by groundwater-influenced vegetation (Figure 2-1; SNWA, 2004). The majority of this lowland vegetation (approx. 145,000 acres, or 14 percent of the project basin) is phreatophytic shrubland. Less than 1 percent of the basin (approx. 8,000 acres) is lowland

wetland habitat, and less than 1 percent of the basin (approx. 7,000 acres) is lowland meadow habitat; only a fraction of that area includes springs and springbrooks (McLendon et al., 2011; SNWA et al., 2011). Most of these wetlands and meadows exist due to spring outflow supplemented by irrigation (irrigation can supplement both surface flow and groundwater elevation). Valley-floor woodlands are infrequent in Spring Valley, making up approximately 0.1 percent of the basin (approx. 1,000 acres) (McLendon et al., 2011; SNWA et al., 2011).

Biota of Interest in Groundwater-influenced Habitats

Aquatic Special Status Species below the mountain block in Spring Valley include two fish species, the Pahrump poolfish and relict dace (Table 2-1). The occurrence of these fishes is the result of transplantation. Pahrump poolfish, a federally endangered species, is maintained at the Shoshone Ponds refuge (BWG, 2009). Relict dace currently occur at Shoshone Ponds, Keegan Spring Complex and Stonehouse Spring Complex (BWG, 2009). Pahrump poolfish and relict dace are currently monitored by the BWG, and all sites with Pahrump poolfish and relict dace are monitored by the BWG and TRP (Monitoring Plans: BWG, 2009 and SNWA, 2009a; Annual reports: SNWA, 2010a, 2010b, 2011a, and 2011b).

Another aquatic Special Status Species below the mountain block in Spring Valley is the northern leopard frog (*Lithobates* [=*Rana*] *pipiens*) (Table 2-1). Northern leopard frogs are native to Spring Valley, and occur within lowland springs and wetlands in the valley. Breeding has been documented in both natural spring pools and irrigation ponds, including areas used by cattle. Recent documented occurrences of northern leopard frogs include Keegan Spring Complex, McCoy Creek Ranch, O'Neal Frog Pond, Cleveland Ranch, North Millick Spring, South Millick Spring, West Spring Valley Complex, Shoshone Ponds, Unnamed 5 Spring, Minerva Spring Complex, and Blind Spring (BIO-WEST, 2009; SNWA, 2009b and 2011c). Northern leopard frog is currently monitored by the BWG, and seven sites with northern leopard frog are currently monitored by the BWG and TRP (Monitoring Plans: BWG, 2009, and SNWA, 2009a; Annual reports: SNWA, 2010a, 2010b, 2011a, and 2011b).

Aquatic Special Status Species in the mountain block in Spring Valley include Bonneville cutthroat trout (*Uncorhynchus clarki utah*) and the bifid duct pyrg (*Pyrgulopsis peculiaris*) (Table 2-1). Locations where the bifid duct pyrg occur include Turnley Spring (Sada, 2005; elevation 6,768 ft-amsl) and Rock Spring (BIO-WEST, 2009; elevation 6,364 ft-amsl). The aquatic Special Status Species Bonneville cutthroat trout occur in Pine and Ridge creeks at over 7,000 ft-amsl. These streams have a diversion and the fish are located above it. These sites are not being monitored by the BWG because of their location in the mountain block. Rock Spring is currently monitored by the TRP and Turnley Spring is monitored by SNWA (Monitoring Plan: SNWA, 2009a; Annual reports: SNWA, 2010b and 2011b).

Although not a Special Status Species, the aquatic Toquerville pyrg (*Pyrgulopsis kolobensis*) is of interest in Spring Valley because it occurs below the mountain block and relies exclusively on springs and springbrooks. Toquerville pyrg is widespread and common, and in Spring Valley it occurs in various springs (e.g., Stonehouse Spring Complex, Willow Spring, Unnamed springs east of Cleve Creek, and Minerva Spring Complex). Toquerville pyrg is currently monitored by the BWG as an indicator species, and five sites with Toquerville pyrg are currently monitored by the BWG and TRP

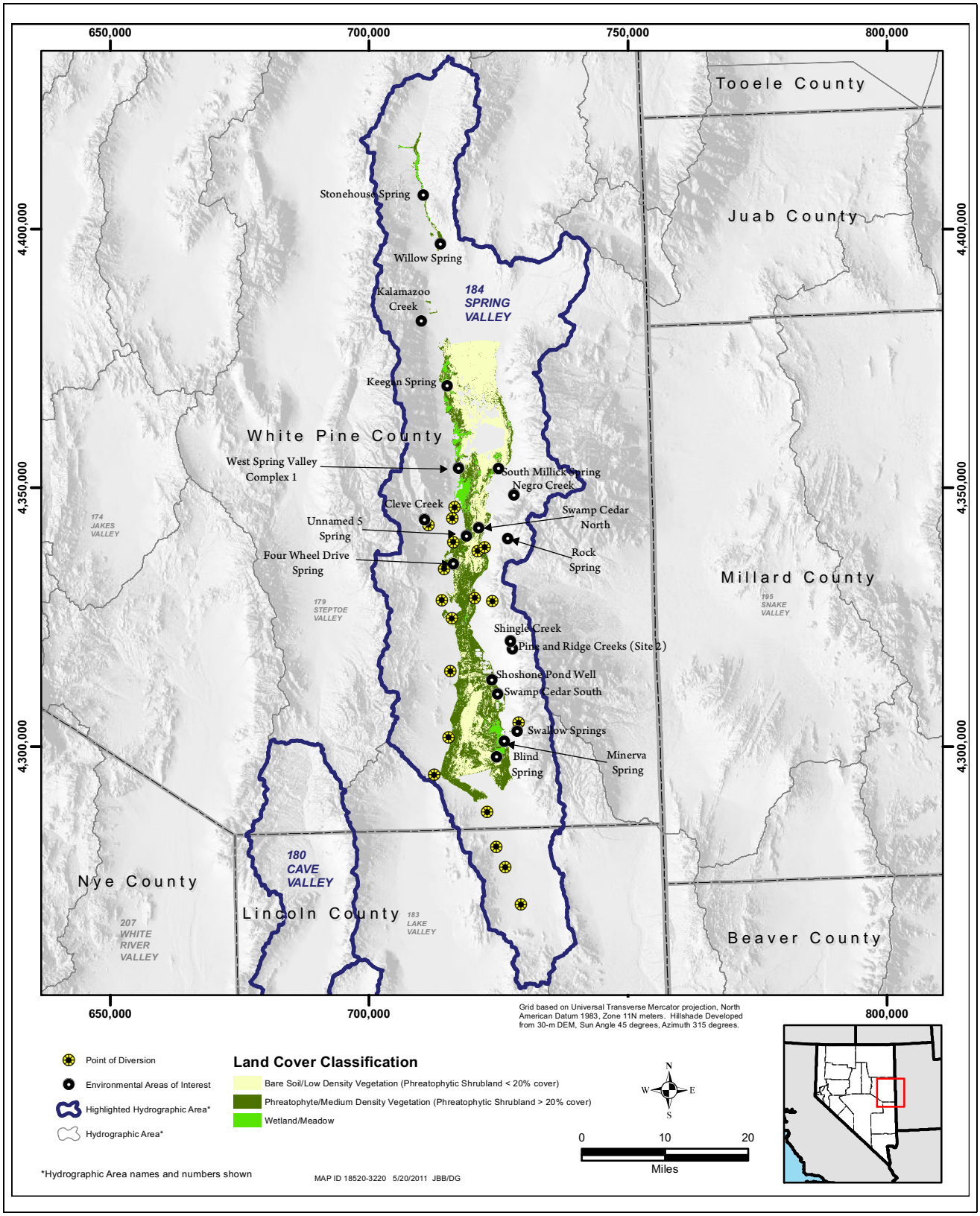

Figure 2-1
ET Land Cover Mapping, Environmental Areas of Interest and POD Locations in Spring Valley

Table 2-1 Aquatic Special Status Species in Environmental Areas of Interest in the Project Basins

Aquatic Species	Status[a]	Groundwater-Influenced Habitat
Spring Valley		
Fish		
Bonneville cutthroat trout	NVP, UTP, BLM	Mountain-block stream
Pahrump poolfish	NVP, FE	Artesian well-fed pond
Relict Dace	NVP, BLM	Alluvial fan / valley floor spring, Artesian well-fed pond
Amphibian		
Northern leopard frog	BLM	Valley floor & alluvial fan / valley floor springs
Invertebrate		
Bifid duct pyrg	NS	Mountain-block spring
Cave Valley		
Invertebrate		
Hardy pyrg	NS	Alluvial fan / valley floor spring
Dry Lake Valley		
Invertebrate		
Flag pyrg	NS	Mountain-block spring

[a] Highest ranks listed. FE = Federally Endangered. NVP = Nevada State Protected.
UTP = Utah State Protected. BLM = BLM Sensitive. NS = NatureServe global imperiled rank 1 or 2.

(Monitoring Plans: BWG, 2009 and SNWA, 2009a; Annual reports: SNWA, 2010a, 2010b, 2011a, and 2011b).

Terrestrial Special Status Species that occur below the mountain block and use groundwater-influenced habitats in Spring Valley include birds and bats. Greater Sage-Grouse (*Centrocercus urophasianus*), a federal candidate species, uses wet meadows, riparian areas and irrigated agricultural fields near sagebrush during the summer months (Connelly et al., 2000; Sage Grouse Conservation Team, 2004). In a two-year telemetry study conducted by SNWA, collared Greater Sage-Grouse on the valley floor of Spring Valley were documented mostly on ranch properties during the summer months (SNWA Northern Resources properties and other private lands; SNWA, 2009b and 2010c). In addition to Greater Sage-Grouse, various other Special Status Species birds occur below the mountain block and use groundwater-influenced habitats in Spring Valley for foraging and breeding (Floyd et al., 2007; GBBO, 2007a), and Special Status Species bats have been documented to forage above various springs and associated wetlands (O'Farrell Biological Consulting, 2006; SNWA, 2009b). As part of Great Basin Bird Observatory's (GBBO's) statewide habitat-based bird monitoring effort (GBBO, 2011), SNWA has contributed to annual bird monitoring

in Spring Valley since 2005, including funding and surveying routes near groundwater-influenced habitats. Selected groundwater-influenced habitats used by birds and bats in Spring Valley are currently monitored by the BWG and TRP (Monitoring Plans: BWG, 2009 and SNWA, 2009a; Annual reports: SNWA, 2010a, 2010b, 2011a, and 2011b).

Two Rocky Mountain juniper (*Juniperus scopulorum*) populations in Spring Valley, which do not have conservation status, are of interest to the BLM. Known as "swamp cedars," the Rocky Mountain junipers of interest occur on the valley floor, although the species typically occurs at higher elevations in the region. Both Rocky Mountain juniper populations in Spring Valley (Swamp Cedar North and Swamp Cedar South) are currently monitored by the BWG (Monitoring Plan: BWG, 2009; Annual reports: SNWA, 2010a and 2011a).

Elk (*Cervus canadensis*), mule deer (*Odocoileus hemionus*) and pronghorn (*Antilocapra americana*) (big game species) are of management interest in Spring Valley. Pronghorn habitat in Spring Valley mainly occurs across the valley floor and up onto the alluvial fans (NDOW, 2004). In northern Spring Valley, pronghorn migration corridors occur in the areas of Stonehouse Spring Complex and Willow Spring, as well as the eastern and western edges of the valley floor / alluvial fan interface (including Keegan Spring Complex, West Spring Valley Complex and Four Wheel Drive Spring). Mule deer and elk habitats occur mostly in the uplands and at higher elevations, but they also occur at the eastern and western edges of the valley floor / alluvial fan interface in southern Spring Valley (NDOW, 2004). The lowland areas of probable big game use occur, in part, in groundwater-influenced habitats (including Stonehouse Spring Complex, Shoshone Ponds, Swamp Cedar South, and Minerva Spring Complex); these do not, however, include crucial summer or crucial winter ranges (NDOW, 2004; SNWA, 2004; SNWA et al., 2011). Springs and wetlands are likely sources of water for all three of these species. Selected groundwater-influenced habitats used by big game in Spring Valley are currently monitored by the BWG and TRP (Monitoring Plans: BWG, 2009 and SNWA, 2009a; Annual reports: SNWA, 2010a, 2010b, 2011a, and 2011b).

Environmental Areas of Interest

The 19 Environmental Areas of Interest in Spring Valley that were selected for the environmental evaluation (Section 7.0 and Section 8.0) are highlighted in the below discussion and detailed in Table 2-2, Table 7-1, and Figure 2-1. Eight of the 19 sites are below the mountain block and support aquatic Special Status Species. Sites in the mountain block or without aquatic Special Status Species include sites of interest (five sites) and representative sites of the area (two sites). Two of the sites are located, in part, in the GBNP.

Fifteen of the 19 Environmental Areas of Interest in Spring Valley are Spring Valley Stipulation monitoring sites. For more summary information on the Biological Monitoring Plan (BWG, 2009) and Hydrologic Monitoring and Mitigation Plan (SNWA, 2009a), see Section 3.0.

Blind Spring, located on the valley floor in south Spring Valley, is a small seep consisting of a shallow, open pool with fringing wetland vegetation. The seep area was historically impounded for livestock use, and continues to be used by livestock as part of a BLM grazing allotment where SNWA holds a grazing permit. The aquatic Special Status Species northern leopard frog has been documented in Blind Spring, although the species has not been observed to reproduce there (SNWA,

Table 2-2 Spring Valley Environmental Areas of Interest: Groundwater-Influenced Habitats and Aquatic Biota of Interest

Site Name	Geographic Location	Groundwater Influenced Habitat	Aquatic Biota of Interest	Aquatic Special Status Species
Blind Spring	Valley Floor	Spring, Wetland	Amphibian	Northern leopard frog
Cleve Creek	Originates in Mtn Block	Stream	Game fish	Not present
Four Wheel Drive Spring	Alluvial Fan / Valley Floor	Spring	Not present	Not present
Kalamazoo Creek	Originates in Mtn Block	Stream	Game fish	Not present
Keegan Spring Complex	Alluvial Fan / Valley Floor	Spring, Wetland, Meadow	Transplanted Fish, Amphibian	Relict Dace, Northern leopard frog
Minerva Spring Complex	Alluvial Fan / Valley Floor	Spring, Wetland, Meadow	Amphibian, Springsnail	Northern leopard frog
Negro Creek	Originates in Mtn Block	Stream	Game fish	Not present
Pine and Ridge Creeks	Originates in Mtn Block	Stream	Native fish	Bonneville cutthroat trout [Lower limit: upstream of diversion pipeline, approx 7,100 ft-amsl]
Rock Spring	Mtn Block	Spring	Springsnail	Bifid duct pyrg
Shingle Creek	Originates in Mtn Block	Stream	Game fish	Not present
Shoshone Ponds	Alluvial Fan / Valley Floor	Pond, Springbrook, Wetland, Meadow [Well source]	Transplanted Fish, Amphibian	Pahrump poolfish, Relict dace, Northern leopard frog
South Millick Spring	Valley Floor	Spring	Amphibian	Northern leopard frog
Stonehouse Spring Complex	Alluvial Fan / Valley Floor	Spring, Wetland, Meadow	Transplanted fish, Springsnail	Relict Dace
Swallow Spring	Alluvial Fan	Spring	Not present	Not present
Swamp Cedar North	Valley Floor	Woodland	Not present	Not present
Swamp Cedar South	Alluvial Fan / Valley Floor	Woodland	Not present	Not present
Unnamed 5 Spring	Valley Floor	Spring	Amphibian, Springsnail	Northern leopard frog
West Spring Valley Complex	Alluvial Fan / Valley Floor	Spring, Wetland, Meadow	Amphibian, Springsnail	Northern leopard frog
Willow Spring	Alluvial Fan / Valley Floor	Spring	Springsnail	Not present

2009b). More information on the spring and associated plants and animals is available in survey reports by BIO-WEST (2007a, 2009) and McLendon et al., (2011).

Blind Spring is currently monitored by the BWG and TRP (Monitoring Plans: BWG, 2009 and SNWA, 2009a; Annual reports: SNWA, 2010a, 2010b, 2011a, and 2011b).

Four Wheel Drive Spring, located on the valley floor / alluvial fan interface in middle Spring Valley, is a small spring with a very limited wetland and woody riparian area. The area is used by livestock as part of a BLM grazing allotment that SNWA holds the permit to. Although Four Wheel Drive Spring does not support any aquatic Special Status Species, riparian trees may provide habitat for Special Status bird and bat species. More information on the spring and associated plants and animals is available in survey reports by BIO-WEST (2009) and McLendon et al., (2011).

Four Wheel Drive Spring is currently monitored by the BWG and TRP (Monitoring Plans: BWG, 2009 and SNWA, 2009a; Annual reports: SNWA, 2010a, 2010b, 2011a, and 2011b).

Keegan Spring Complex, located on the valley floor / alluvial fan interface in middle Spring Valley, is a large spring complex with surrounding sub-irrigated wetlands and meadows. Portions of this complex are on SNWA Northern Resources properties, on other private properties, and grazed as part of BLM grazing allotments. Two aquatic Special Status Species occur at the Keegan Spring Complex: northern leopard frog, which has been documented to reproduce in some spring pools (SNWA, 2009b, 2010a and 2011a); and a translocated population of relict dace (not native to Spring Valley). More information on the springs and associated plants and animals is available in survey reports by BIO-WEST (2007a, 2009) and McLendon et al., (2011).

Keegan Spring is currently monitored by the BWG and TRP (Monitoring Plans: BWG, 2009 and SNWA, 2009a; Annual reports: SNWA, 2010a, 2010b, 2011a, and 2011b).

Minerva Spring Complex, located on the valley floor / alluvial fan interface in southern Spring Valley, is a large spring complex with surrounding sub-irrigated wetlands and meadows that extend partway down onto the valley floor. The majority of this complex is on SNWA Northern Resources properties, with fringes grazed as part of a BLM grazing allotment. The site includes extensive irrigation ditches and two reservoirs. One aquatic Special Status Species occurs at Minerva Spring Complex: the northern leopard frog, which has been documented to reproduce in some spring pools and irrigation ponds (SNWA, 2009b and 2011a). The Toquerville pyrg also occurs at this site, but the species is wide-spread and common and is not a Special Status Species. More information on the springs and associated plants and animals is available in survey reports by BIO-WEST (2007a, 2009) and McLendon et al., (2011).

Minerva Spring Complex is currently monitored by the BWG and TRP (Monitoring Plans: BWG, 2009 and SNWA, 2009a; Annual reports: SNWA, 2010a, 2010b, 2011a, and 2011b).

Shoshone Ponds, located on the valley floor / alluvial fan interface in middle Spring Valley, is characterized by man-made ponds, springbrooks, wetlands, and meadows maintained by six artesian wells. The site is part of the Shoshone Ponds Area of Critical Environmental Concern and is grazed as part of a BLM grazing allotment held by SNWA. Three aquatic Special Status Species occur at Shoshone Ponds. The federally endangered Pahrump poolfish occurs in two refuge ponds (North and Middle), the Stock Pond, and a springbrook (all man-made and maintained by artesian wells). Relict dace occur in the south refuge pond (also man-made and maintained by artesian wells). Neither of these fish species are native to Spring Valley. The northern leopard frog has been documented at Shoshone Ponds, but reproduction at this site appears limited (SNWA, 2010a and 2011a). One of the two valley-floor Rocky Mountain juniper populations occurs in the Shoshone Ponds area. Although

Rocky Mountain junipers are widespread and common, this population is of interest to BLM (see Swamp Cedar South below). More information on the ponds and associated plants and animals is available in survey reports by BIO-WEST (2007a, 2009) and McLendon et al., (2011).

Shoshone Ponds is currently monitored by the BWG and TRP (Monitoring Plans: BWG, 2009 and SNWA, 2009a; Annual reports: SNWA, 2010a, 2010b, 2011a, and 2011b). NDOW also conducts annual fish monitoring at the refuge ponds and Stock Pond (field reports available through NDOW).

South Millick Spring, located on the valley floor in middle Spring Valley, has associated spring brooks that fan out downstream into wetlands and meadows. The area is used by livestock as part of a BLM grazing allotment. The aquatic Special Status Species northern leopard frog has been documented in South Millick Spring and, while the species has not been observed to reproduce at the site, there appears to be potential breeding habitat in the downstream areas (SNWA, 2009b, 2010a and 2011a). More information on the spring and associated plants and animals is available in survey reports by BIO-WEST (2007a, 2009) and McLendon et al., (2011).

South Millick Spring is currently monitored by the BWG and TRP (Monitoring Plans: BWG, 2009 and SNWA, 2009a; Annual reports: SNWA, 2010a, 2010b, 2011a, and 2011b).

Stonehouse Spring Complex, located on the valley floor / alluvial fan interface in northern Spring Valley, is a spring complex characterized by marshy wetlands and deep pools. The majority of this complex is on SNWA Northern Resources properties, and has been historically grazed. The aquatic Special Status Species relict dace, a non-native to Spring Valley, occurs at Stonehouse Spring Complex. The Toquerville pyrg also occurs at this site, but the species is wide-spread and common and is not a Special Status Species. More information on the springs and associated plants and animals is available in survey reports by BIO-WEST (2007a, 2009) and McLendon et al., (2011).

Stonehouse Spring Complex is currently monitored by the BWG and TRP (Monitoring Plans: BWG, 2009 and SNWA, 2009a; Annual reports: SNWA, 2010a, 2010b, 2011a, and 2011b).

Swallow Spring, located on the alluvial fan in southern Spring Valley, is a relatively confined spring with a narrow riparian woodland at the springhead and a springbrook that extends partway down onto the valley floor. The spring and the majority of this springbrook is on SNWA Northern Resources properties, and the springbrook is modified by diversions. Although Swallow Spring does not support any aquatic Special Status Species, riparian trees may provide habitat for special status bird and bat species. More information on the spring and associated plants and animals is available in survey reports by BIO-WEST (2007a, 2009) and McLendon et al., (2011).

Swallow Spring is currently monitored by the BWG and TRP (Monitoring Plans: BWG, 2009 and SNWA, 2009a; Annual reports: SNWA, 2010a, 2010b, 2011a, and 2011b).

Swamp Cedar North and **Swamp Cedar South**, located on the valley floor and valley floor / alluvial fan interface (respectively) in middle Spring Valley, are dominated by Rocky Mountain juniper trees. Rocky Mountain junipers are widespread and common, and are not a Special Status Species. However, these populations are of interest to the BLM, as this species usually occurs at higher elevations in the region. These populations also are the largest woodlands on the valley floor

of Spring Valley, and may provide habitat for breeding birds and big game. More information on these plant communities is available in a survey report by McLendon et al., (2011).

Swamp Cedar North and Swamp Cedar South are currently monitored by the BWG (Monitoring Plan: BWG, 2009; Annual reports: SNWA, 2010a and 2011a).

Unnamed 5 Spring, located on the valley floor in middle Spring Valley, has an associated spring brook with adjacent wetland and meadow areas. The spring and approximately half of the springbrook is on SNWA Northern Resources properties, with a portion of the downstream area grazed as part of a BLM grazing allotment. The aquatic Special Status Species northern leopard frog has been documented to reproduce in one of the spring pools at Unnamed 5 (SNWA, 2009b, 2010a and 2011a). The Toquerville pyrg also occurs at this site, but the species is wide-spread and common and is not a Special Status Species. More information on the spring and associated plants and animals is available in survey reports by BIO-WEST (2009) and McLendon et al., (2011).

Unnamed 5 Spring is currently monitored by the BWG and TRP (Monitoring Plans: BWG, 2009 and SNWA, 2009a; Annual reports: SNWA, 2010a, 2010b, 2011a, and 2011b).

West Spring Valley Complex, located on the valley floor / alluvial fan interface in middle Spring Valley, is a series of springs with surrounding wetlands. The majority of this complex is on private land that was historically grazed but is no longer managed as a working ranch. The aquatic Special Status Species northern leopard frog has been documented to reproduce within West Spring Valley Complex (SNWA, 2009b and 2010a). The Toquerville pyrg also occurs at this site, but the species is wide-spread and common and is not a Special Status Species. More information on the spring and associated plants and animals is available in survey reports by BIO-WEST (2007a, 2009) and McLendon et al., (2011).

West Spring Valley Complex is currently monitored by the BWG and TRP (Monitoring Plans: BWG, 2009 and SNWA, 2009a; Annual reports: SNWA, 2010a, 2010b, 2011a, and 2011b).

Willow Spring, located on the valley floor / alluvial fan interface in northern Spring Valley, is a small spring with a limited wetland area. The area is used by livestock as part of a BLM grazing allotment. Although Willow Spring does not support any aquatic Special Status Species, the widespread and common Toquerville pyrg is present. More information on the spring and associated plants and animals is available in survey reports by BIO-WEST (2007a, 2009) and McLendon et al., (2011).

Willow Spring is currently monitored by the BWG and TRP (Monitoring Plans: BWG, 2009 and SNWA, 2009a; Annual reports: SNWA, 2010a, 2010b, 2011a, and 2011b).

Rock Spring, located in the mountain block at over 500 ft above the valley floor, is a small carbonate spring with a springbrook. The aquatic Special Status Species bifid duct pyrg occurs at this site. More information on the spring and associated plants and animals is available in a survey report by BIO-WEST (2009).

Rock Spring was excluded as a biological monitoring site by the BWG due to its location in the mountain block. Rock Spring is currently monitored by the TRP (Monitoring Plan: SNWA, 2009a; Annual reports: SNWA, 2010b and 2011b).

Cleve, **Kalamazoo**, **Negro**, **Pine, Ridge**, and **Shingle** creeks originate in the mountain block in Spring Valley. The creeks are diverted at or near the mountain block and are taken across the alluvial fans to the valley floor where the water is used to irrigate crops and/or meadows. The aquatic Special Status Species Bonneville cutthroat trout occur in Pine and Ridge creeks at over 7,000 ft-amsl. These streams have a diversion and the fish are located above it.

These creeks were excluded as biological monitoring sites by the BWG because they are mountain block-originating streams diverted for agriculture before reaching the valley floor. Cleve Creek is currently monitored by the TRP (Monitoring Plan: SNWA, 2009a; Annual reports: SNWA, 2010b and 2011b).

2.3.2 Cave Valley

Cave Valley is an isolated valley within the Great Basin Desert situated between the southern reaches of the Egan Range on the west and the Schell Creek Range on the east. Cave Valley is approximately 40 mi long and 10 mi wide. The majority of the valley is within Lincoln County, and the northern quarter of the valley lies within White Pine County. The lowest valley floor elevations are in southern Cave Valley (approximately 5,970 ft-amsl), with the highest elevations in the bordering mountains at approximately 11,000 ft-amsl.

The majority of the valley floor and valley floor / alluvial fan interface in Cave Valley is composed of shrubland habitats. According to the SWReGAP, the valley floor and valley floor / alluvial fan interface is composed largely of Inter-Mountain Basins Big Sagebrush Shrubland, with a large swath of Inter-Mountain Basins Greasewood Flat in southern Cave Valley (USGS, 2004).

The approximately 14,700 acres of greasewood- and rabbitbrush-dominated shrublands on the valley floor of southern Cave Valley appear to be supported by precipitation and perhaps perched groundwater as depth to water in this area is greater than 150 ft-bgs (Appendix C.2.0 in Burns and Drici, 2011). Greasewood and rabbitbrush typically do not use groundwater at depths greater than 50 and 15 ft, respectively (Meinzer, 1927). This is further supported by the estimates of precipitation on this area which exceed the ET demand of the vegetation (Burns and Drici, 2011). It is therefore concluded that the greasewood and rabbitbrush-dominated shrublands in southern Cave Valley are not supported by groundwater connected to the aquifer system of the valley (Burns and Drici, 2011).

Approximately 1,000 acres (<1 percent of the basin) of spring, wetland, and meadow habitat on the valley floor and valley floor / alluvial fan interface of northern Cave Valley (north of Shingle Pass) is characterized by groundwater-influenced vegetation (Figure 2-2; Burns and Drici, 2011). The depth to water in this area is at or near the ground surface and ET demand of the wetland/meadow vegetation exceeds the rate of precipitation that occurs there (Burns and Drici, 2011). These areas have been affected by anthropogenic factors such as grazing, and surface water and groundwater diversion.

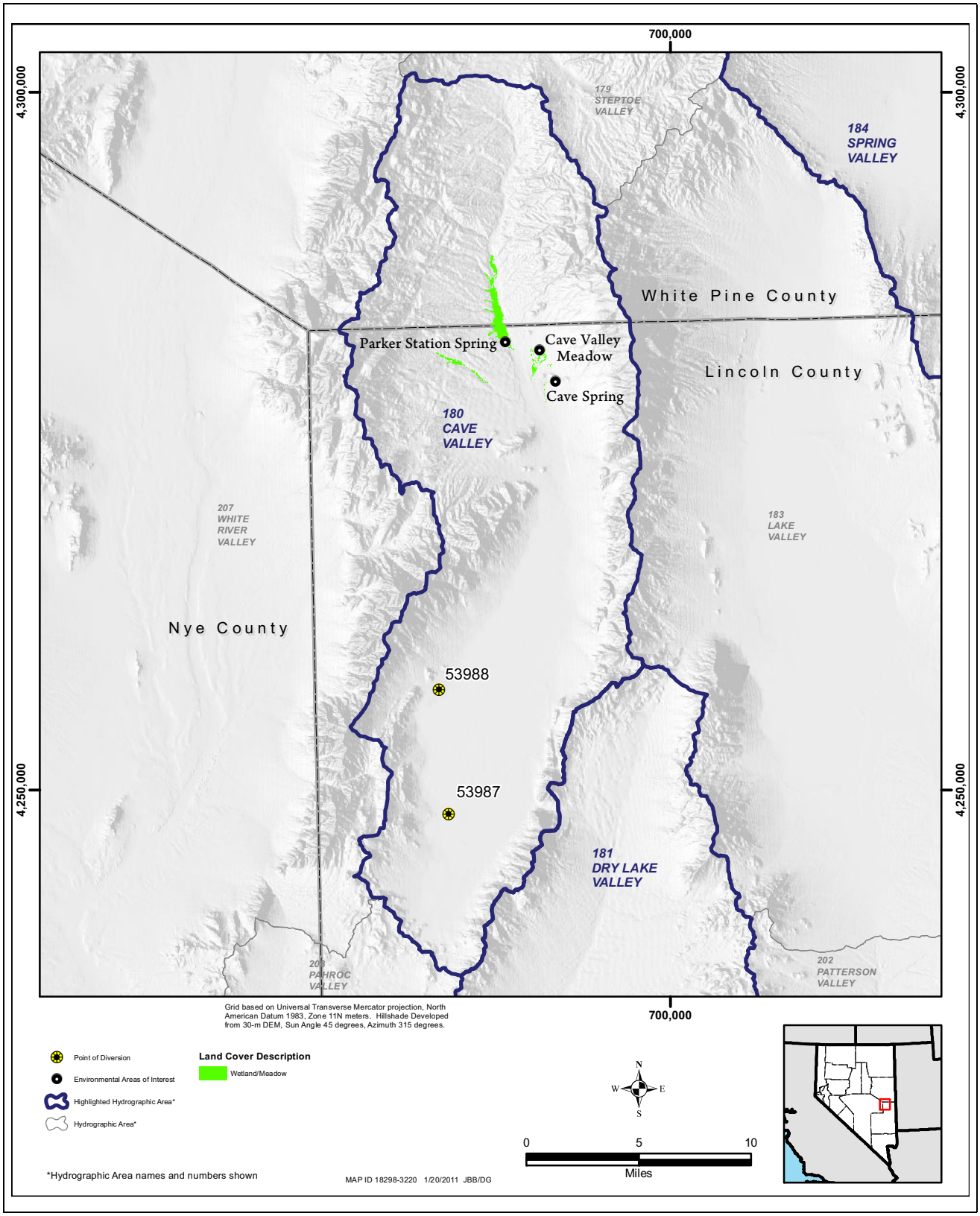

Figure 2-2
ET Land Cover Mapping, Environmental Areas of Interest and POD Locations in Cave Valley

Biota of Interest in Groundwater-influenced Habitats

One aquatic Special Status Species, the Hardy pyrg (*Pyrgulopsis marcida*), occurs below the mountain block in Cave Valley at Parker Station Spring (Table 2-1). The Hardy pyrg and Parker Station Spring will be monitored by the BRT (BRT, 2011), and Parker Station Spring is currently monitored by the TRP (Monitoring Plan: SNWA, 2009c; Annual reports: SNWA, 2010d and 2011d).

Terrestrial Special Status Species that occur below the mountain block and use groundwater-influenced habitats in Cave Valley include birds and bats. Greater Sage-Grouse, a Federal candidate species, uses wet meadows, riparian areas and irrigated agricultural fields near sagebrush during the summer months (Connelly et al., 2000; Sage Grouse Conservation Team, 2004). Greater Sage-Grouse have been documented on private ranchlands in northern Cave Valley during the summer months, largely in the Cave Valley Meadow area (BRT, 2011). In addition to Greater Sage-Grouse, various other Special Status Species birds occur below the mountain block and use groundwater-influenced habitats in Cave Valley for foraging and breeding (Floyd et al., 2007; GBBO, 2007a), and Special Status Species bats have been documented to forage above Cave Spring in northern Cave Valley (O'Farrell Biological Consulting, 2006). Annual habitat-based bird monitoring is coordinated state-wide by the GBBO, including in Cave Valley (GBBO, 2011). Groundwater-influenced habitats used by birds (including Greater Sage-Grouse) and bats in northern Cave Valley will be monitored by the BRT (BRT, 2011), and springs used by birds and bats in northern Cave Valley are currently monitored by the TRP (Monitoring Plan: SNWA, 2009c; Annual reports: SNWA, 2010d and 2011d).

Elk, mule deer, and pronghorn are of management interest in Cave Valley. Pronghorn habitat mainly occurs across the valley floor and up onto the alluvial fans, while mule deer and elk habitats occur throughout much of the basin (NDOW, 2004). These areas of probable big game use, which do not include crucial summer or crucial winter ranges, occur in part in groundwater-influenced habitats on the valley floor / alluvial fan interface in northern Cave Valley (including Parker Station Spring and Cave Valley Meadow) (NDOW, 2004; SNWA, 2004). Although big game migration corridors occur mostly at higher elevations, a mule deer corridor exists in northeastern Cave Valley that crosses the valley floor / alluvial fan interface at Parker Station Spring and Cave Valley Meadow (NDOW, 2004; SNWA, 2004). Springs and wetlands are likely sources of water for all three of these species. Groundwater-influenced habitats used by big game in northern Cave Valley will be monitored by the BRT (BRT, 2011), and springs used by big game in northern Cave Valley are currently monitored by the TRP (Monitoring Plan: SNWA, 2009c; Annual reports: SNWA, 2010d and 2011d).

Environmental Areas of Interest

Three Environmental Areas of Interest in Cave Valley selected for the environmental evaluation (Section 7.0 and 8.0) are highlighted in the below discussion and detailed in Table 2-3, Table 7-1, and Figure 2-2. One site is below the mountain block and supports an aquatic Special Status Species, and the remaining two sites are sites of interest.

All three of the Environmental Areas of Interest in Cave Valley are DDC Stipulation monitoring sites. For more summary information on the Biological Monitoring Plan (BRT, 2011) and Hydrologic Monitoring and Mitigation Plan (SNWA, 2009c), see Section 3.0.

Table 2-3 DDC Valleys Environmental Areas of Interest: Groundwater-Influenced Habitats and Aquatic Biota of Interest

Site Name	Hydrographic Area	Geographic Location	Groundwater-Influenced Habitat	Aquatic Biota of Interest	Aquatic Special Status Species
Cave Spring	Cave Valley	Mtn Block	Spring, Cave	Cave dwellers	Not present
Cave Valley Meadow	Cave Valley	Alluvial Fan / Valley Floor	Spring, Wetland, Meadow	Not present	Not present
Parker Station Spring	Cave Valley	Alluvial Fan / Valley Floor	Spring	Springsnail	Hardy pyrg
Grassy Spring	Delamar Valley	Mtn Block	Spring	Not present	Not present
Coyote Spring	Dry Lake Valley	Mtn Block	Spring	Not present	Not present
Meloy Spring	Dry Lake Valley	Mtn Block	Spring	Springsnail	Flag pyrg

Cave Spring, located in the mountain block in northern Cave Valley, is a carbonate spring arising from limestone rock with fringing wetland/meadow vegetation. Spring flow varies greatly across seasons, and at times the spring does not flow at all (Appendix D in SNWA, 2011d). The spring, springbrook and associated wetland/meadow vegetation is on private ranchland. The headwaters are located on land covered by SNWA's conservation easement. More information on this site is available in BIO-WEST (2007a).

Cave Spring was excluded as a biological monitoring site by the BWG because it is a local mountain-block spring. Cave Spring is currently monitored by the TRP (Monitoring Plan: SNWA, 2009c; Annual reports: SNWA, 2010d and 2011d).

Parker Station Spring, located on the valley floor / alluvial fan interface of northern Cave Valley, is a spring complex with surrounding wetlands and meadows. Approximately half of the larger Parker Station Spring area is on private ranchland, and approximately 250 acres of wetlands/meadows are located on land covered by SNWA's conservation easement. The aquatic Special Status Species Hardy pyrg occurs at this site. More information on this site is available in BIO-WEST (2007a).

Parker Station Spring will be monitored by the BRT (BRT, 2011) and is currently monitored by the TRP (Monitoring Plan: SNWA, 2009c; Annual reports: SNWA, 2010d and 2011d).

Cave Valley Meadow, located on the valley floor / alluvial fan interface of northern Cave Valley, is a meadow complex that includes over 20 small, local springs. The entire meadow is on private ranchland. Although no aquatic Special Status Species occur at this site, the terrestrial Special Status Species Greater Sage-Grouse uses the meadow during the summer months (BRT, 2011).

Cave Valley Meadow will be monitored by the BRT (BRT, 2011).

2.3.3 Dry Lake Valley

Dry Lake Valley is located in Lincoln County, Nevada, situated between the Burnt Springs Range to the east and the North Pahroc Range to the west. The northern portion of the valley is in the Great Basin Desert, and the southern portion of the valley is in the transition zone between the Great Basin Desert and Mojave Desert. Dry Lake Valley lies directly north of Delamar Valley, where it is difficult to define the boundary because there are no pronounced geographic features distinguishing the two basins (U.S. Highway 93 is considered the basin border). Together, Dry Lake Valley, and Delamar Valley function as a superficially closed basin that contains no perennial streams (Eakin, 1963; Burns and Drici, 2011). Elevations in Dry Lake Valley range from approximately 4,570 ft-amsl on the valley floor to over 7,800 ft-amsl in the bordering mountains.

The majority of the valley floor and valley floor / alluvial fan interface in Dry Lake Valley is composed of shrubland habitats. According to the SWReGAP, the valley floor and valley floor / alluvial fan interface is composed largely of Inter-Mountain Basins Semi-Desert Shrub Steppe, Inter-Mountain Basins Mixed Salt Desert Scrub, Inter-Mountain Basins Playa, Inter-Mountain Basins Greasewood Flat, and Inter-Mountain Basins Big Sagebrush Shrubland (USGS, 2004).

The Inter-Mountain Basins Greasewood Flat areas identified by SWReGAP (USGS, 2004) on the valley floor of middle and southern Dry Lake Valley are not supported by the underlying groundwater aquifers. There is no groundwater ET within Dry Lake Valley (Burns and Drici, 2011), and depth to water in middle and southern Dry Lake Valley exceeds 400 ft-bgs (Section C.2.0 in Burns and Drici, 2011). Therefore, it is concluded that these greasewood areas are not supported by the groundwater aquifer.

Biota of Interest in Groundwater-influenced Habitats

No groundwater-influenced habitats or aquatic Special Status Species occur below the mountain block in Dry Lake Valley. Terrestrial Special Status Species (birds and bats), species of management interest (big game), and associated habitat on the valley floor and valley floor / alluvial fan interface are not supported by the groundwater aquifer. One aquatic Special Status Species, the Flag pyrg (*Pygrolopsis breviloba*), occurs in the mountain block at Meloy Spring (Table 2-1). The Flag pyrg and Meloy Spring will be monitored by the BRT if private property access is granted (BRT, 2011).

Environmental Areas of Interest

Two Environmental Areas of Interest in Dry Lake Valley were selected for the environmental evaluation (Section 7.0 and Section 8.0) and are detailed in Table 2-3, Table 7-1, and Figure 2-3. Both of these sites are mountain-block springs, one of which has an aquatic Special Status Species, and the other of which is representative of mountain-block springs in Dry Lake Valley.

Both Environmental Areas of Interest in Dry Lake Valley are DDC Stipulation monitoring sites. For more summary information on the Biological Monitoring Plan (BRT, 2011) and Hydrologic Monitoring and Mitigation Plan (SNWA, 2009c), see Section 3.0.

Meloy Spring, located in the mountain block in northern Dry Lake Valley, is a small shallow spring with a limited wetland area. The spring is on private land, with a short springbrook extending onto

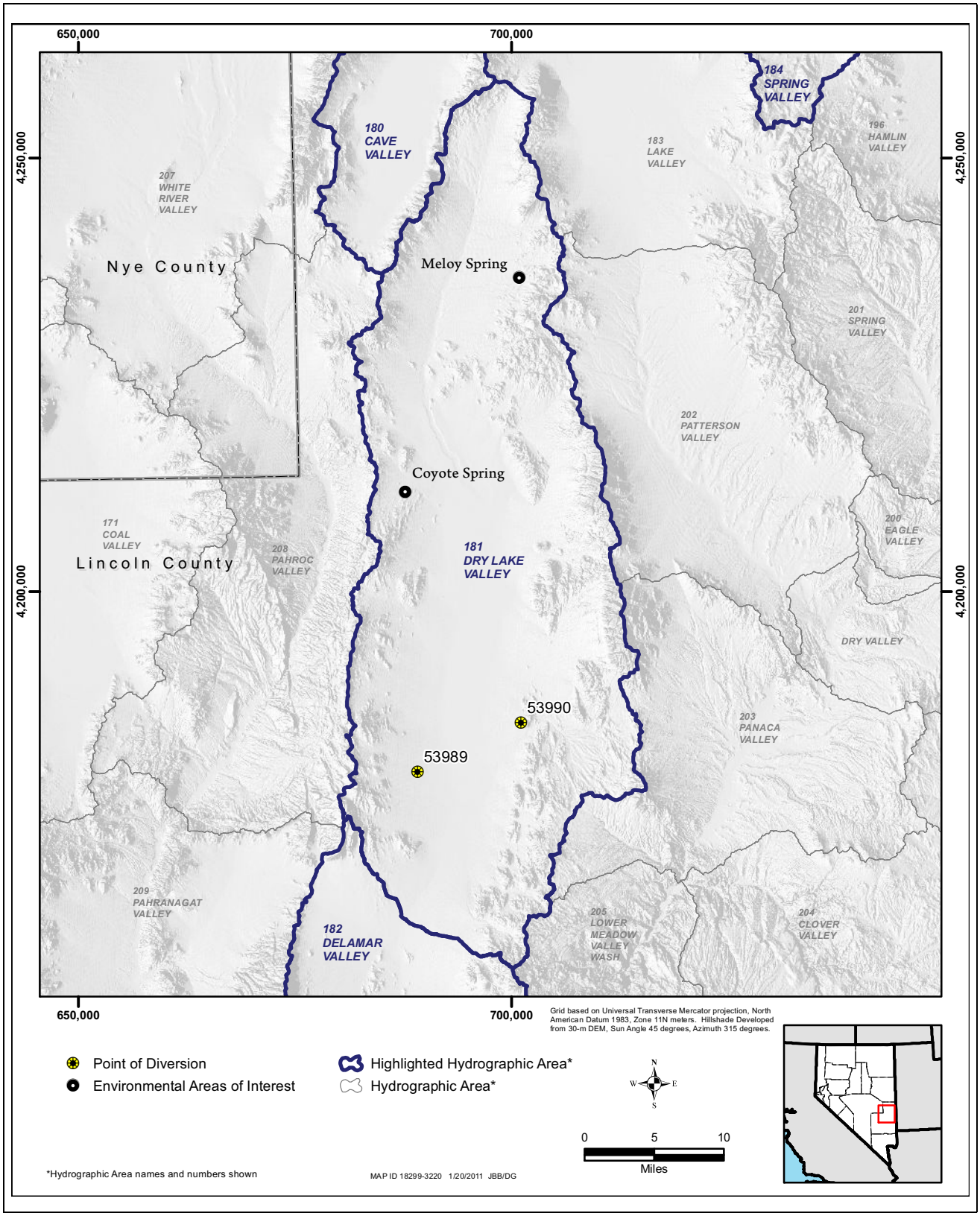

Figure 2-3
Environmental Areas of Interest and POD Locations in Dry Lake Valley

BLM land. The aquatic Special Status Species Flag pyrg occurs at this site. More information on this site is available in BIO-WEST (2007a).

Meloy Spring will be monitored by the BRT if private property access is granted (BRT, 2011). Littlefield Spring (a similar spring 1.4 mi south of Meloy Spring), a proxy for Meloy Spring, is currently monitored by the TRP and will be monitored by the BRT if access is not granted to Meloy Spring (Monitoring Plan: SNWA, 2009c; Annual reports: SNWA, 2010d and 2011d).

Coyote Spring, located in the mountain block in middle Dry Lake Valley, is a small and highly modified spring used for stock watering. There is a grove of cottonwood trees that suggests subsurface flow, but much of the spring flow is piped to support stock watering tanks (BRT, 2011). The spring and cottonwood grove is on SNWA Northern Resources properties. Although Coyote Spring does not support any aquatic Special Status Species, the cottonwood grove may provide habitat for special status bird and bat species. More information on this site is available in BIO-WEST (2007a).

Coyote Spring will be monitored by the BRT (BRT, 2011) and is currently monitored by the TRP (Monitoring Plan: SNWA, 2009c; Annual reports: SNWA, 2010d and 2011d).

2.3.4 Delamar Valley

Delamar Valley is located in Lincoln County in the transition zone between the Great Basin Desert and Mojave Desert, situated between the Southern Pahroc Range to the west and the Delamar Mountains to the east. This valley lies directly south of Dry Lake Valley, where it is difficult to define the boundary because there are no pronounced geographic features distinguishing the two basins (U.S. Highway 93 is considered the basin border). Together, Delamar Valley and Dry Lake Valley function as a superficially closed basin that contains no perennial streams (Eakin, 1963; Burns and Drici, 2011). Elevations range from approximately 4,500 ft-amsl on the valley floor to over 7,200 ft-amsl in the bordering mountains.

The majority of the valley floor and valley floor / alluvial fan interface in Delamar Valley is composed of shrubland habitats. According to the SWReGAP, the valley floor and valley floor / alluvial fan interface is composed largely of Inter-Mountain Basins Semi-Desert Shrub Steppe, Inter-Mountain Basins Mixed Salt Desert Scrub, Inter-Mountain Basins Playa, and Inter-Mountain Basins Big Sagebrush Shrubland (USGS, 2004). Depth to groundwater on the valley floor exceeds 650 ft-bgs (Appendix C.2.0 in Burns and Drici, 2011), and no phreatophytic plant communities occur below the mountain block (SNWA, 2004).

Biota of Interest in Groundwater-influenced Habitats

No groundwater-influenced habitats or associated aquatic Special Status Species occur below the mountain block in Delamar Valley. Terrestrial Special Status Species (birds and bats), species of management interest (big game), and associated habitat on the valley floor and valley floor / alluvial fan interface are not supported by the groundwater aquifer.

Environmental Area of Interest

One Environmental Area of Interest in Delamar Valley was selected for the environmental evaluation (Section 7.0 and Section 8.0) and is detailed in Table 2-3, Table 7-1, and Figure 2-4. This site is representative of mountain-block springs in Delamar Valley.

The Environmental Area of Interest in Delamar Valley is a DDC Stipulation monitoring site. For more summary information on the Biological Monitoring Plan (BRT, 2011) and Hydrologic Monitoring and Mitigation Plan (SNWA, 2009c), see Section 3.0.

Grassy Spring, located in the mountain block in northern Delamar Valley, is a small and highly modified spring used for stock watering. Much of the spring flow is piped to support a livestock pond, and the area is grazed as part of a BLM grazing allotment. No aquatic Special Status Species occur at this site. More information on this site is available in BIO-WEST (2007a).

Grassy Spring will be monitored by the BRT (BRT, 2011) and is currently monitored by the TRP (Monitoring Plan: SNWA, 2009c; Annual reports: SNWA, 2010d and 2011d).

2.4 Adjacent Basins

Adjacent basins and the Environmental Areas of Interest contained therein were selected and considered in this report based on the conceptualized understanding of interbasin flow, CCRP Model output and the occurence of Special Status Species and their groundwater-influenced habitats.

2.4.1 Snake Valley

Snake Valley is located mostly in the Great Basin Desert, straddling the Nevada/Utah border. Approximately 95 mi long and ranging from 12 to 50 mi wide, Snake Valley spans 4 counties (White Pine County in Nevada, and Millard, Juab, and Tooele counties in Utah). The valley floor ranges from 4,700 to 5,200 ft-amsl. To the west, the valley is bounded by the Deep Creek Range and Snake Range, which extend over 12,000 ft and accumulate snow that supports a number of perennial streams. The mountains on the east side are lower in elevation, under 7,500 ft-amsl. Surface and groundwater generally flows south to north toward the Great Salt Lake Desert. The area of focus for this report is that portion of Snake Valley south of Preuss Reservoir, encompassing the Big Springs Creek / Lake Creek system.

Groundwater-influenced habitats in the Big Springs Creek / Lake Creek area include streams, springs, wetlands, meadows and phreatophytic shrublands (BWG, 2009; SNWA, 2004). These habitats have been greatly affected by anthropogenic factors such as grazing and farming. Approximately half of the groundwater-influenced habitats in this area are private ranchlands, and grazing is common. The Big Springs Creek / Lake Creek system is also highly modified by surface water diversions.

Approximately 41,000 acres on the valley floor and valley floor / alluvial fan interface in the Big Springs Creek / Lake Creek area is characterized by groundwater-influenced vegetation (Figure 2-5; SNWA, 2004). The majority of this lowland groundwater-influenced habitat (approx. 38,000 acres) is

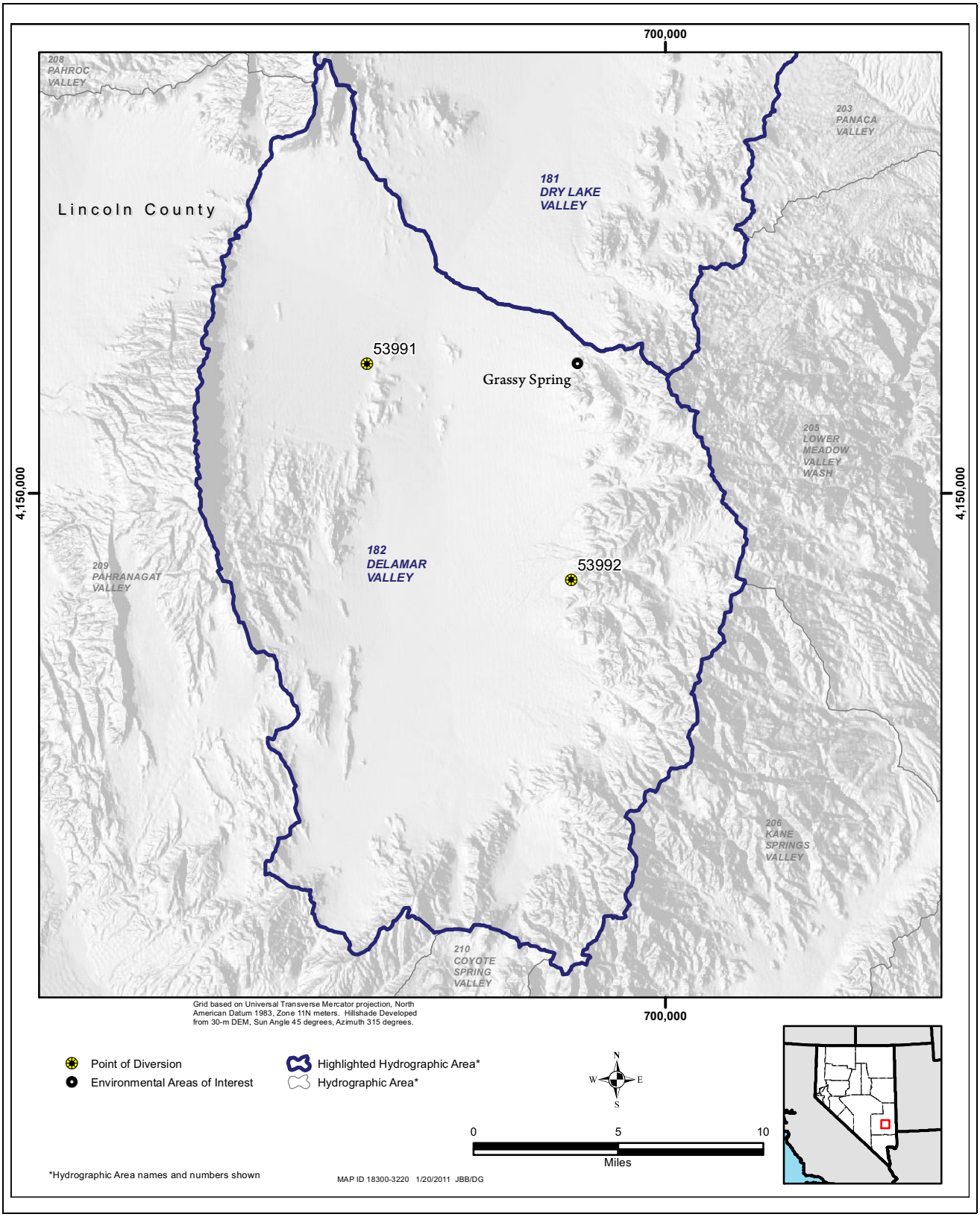

Figure 2-4
Environmental Areas of Interest and POD Locations in Delamar Valley

phreatophytic shrubland. Approximately 3,200 acres are wetland/meadows associated with the Big Springs Creek / Lake Creek system and nearby springs (SNWA, 2004).

Biota of Interest in Groundwater-influenced Habitats

Aquatic Special Status Species below the mountain block in the Big Springs Creek / Lake Creek area include three native fish species: redside shiner (*Richardsonius balteatus*), Utah chub (*Gila atraria*), and Utah sucker (*Catostomus ardens*) (Table 2-4). These species are part of a five-species assemblage of native Bonneville Basin fishes (BIO-WEST, 2007a; BWG, 2009). The entire native fish community is of conservation interest and is currently being monitored by the BWG. The Big Springs Creek / Lake Creek system is currently monitored by the BWG and TRP (Monitoring Plans: BWG, 2009 and SNWA, 2009a; Annual reports: SNWA, 2010a, 2010b, 2011a, and 2011b).

Other aquatic Special Status Species below the mountain block in the Big Springs Creek / Lake Creek area include two species of springsnails: the longitudinal gland pyrg (*Pyrgolopsis anguina*) and the bifid duct pyrg (Table 2-4). Locations where the longitudinal gland pyrg occur include Clay Spring North, Stateline Springs, Big Springs, and Unnamed springs north of Big Spring (including Unnamed 1 Spring North of Big Springs). The bifid duct pyrg also occurs at Big Springs. The longitudinal gland pyrg and bifid duct pyrg are currently monitored by the BWG; four sites are currently monitored by the BWG, and three sites are currently monitored by the TRP (Monitoring Plans: BWG, 2009 and SNWA, 2009a; Annual reports: SNWA, 2010a, 2010b, 2011a, and 2011b).

Aquatic Special Status Species in the mountain block in southern Snake Valley include Bonneville cutthroat trout (Table 2-4). In the southern Snake Range, Bonneville cutthroat trout occur in South Fork Baker Creek, South Fork Big Wash, and Big Wash, Snake Creek, Mill Creek, and Strawberry Creek. All of these streams originate in the mountain block and are derived by local precipitation and controlled by discharge from local or perched groundwater systems (Burns and Drici, 2011). These sites are not being monitored by the BWG because their source waters are in the mountain block.

Terrestrial Special Status Species that occur below the mountain block and use groundwater-influenced habitats in the Big Springs Creek / Lake Creek area include birds and bats. Greater Sage-Grouse, a federal candidate species, uses wet meadows, riparian areas and irrigated agricultural fields near sagebrush during the summer months (Connelly et al., 2000; Sage-Grouse Conservation Team, 2004). Other Special Status Species birds use various groundwater-influenced habitats in southern Snake Valley for foraging and breeding (Floyd et al., 2007), and Special Status Species bats have been documented to forage above springs and associated wetlands in southern Snake Valley (O'Farrell Biological Consulting, 2006). Selected groundwater-influenced habitats used by birds and bats in Snake Valley are currently monitored by the BWG and TRP (Monitoring Plans: BWG, 2009 and SNWA, 2009a; Annual reports: SNWA, 2010a, 2010b, 2011a, and 2011b).

Elk, mule deer, and pronghorn (big game species) are of management interest in southern Snake Valley. Pronghorn habitat typically occurs across the valley floor and up onto the alluvial fans, while mule deer and elk habitat tends to be mostly in the uplands and at higher elevations. Springs and wetlands are likely sources of water for all three of these species. Selected groundwater-influenced habitats used by big game in southern Snake Valley are currently monitored by the BWG and TRP (Monitoring Plans: BWG, 2009 and SNWA, 2009a; Annual reports: SNWA, 2010a, 2010b, 2011a, and 2011b).

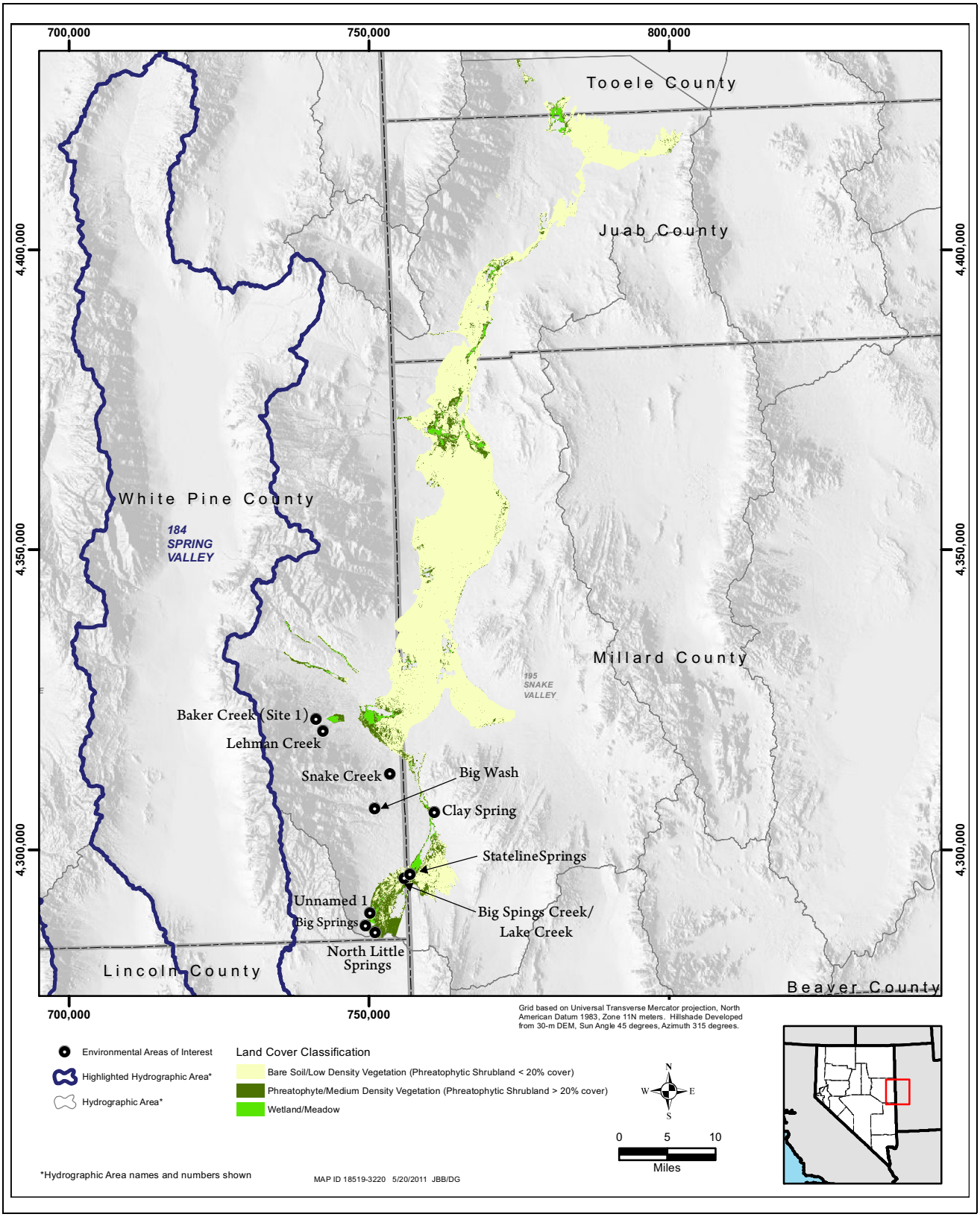

Figure 2-5
ET Land Cover Mapping and Environmental Areas of Interest in Snake Valley

Table 2-4 Aquatic Special Status Species in Environmental Areas of Interest in Basins Adjacent to Spring Valley

Aquatic Species	Status[a]	Groundwater-Influenced Habitat
Snake Valley (south)		
Fish		
Bonneville cutthroat trout	NVP, UTP, BLM	Mountain-block stream
Redside shiner	UTP	Alluvial fan / valley floor springs & stream
Utah chub	UTP	Alluvial fan / valley floor springs & stream
Utah sucker	UTP	Alluvial fan / valley floor springs & stream
Invertebrate		
Bifid duct pyrg	NS	Alluvial fan / valley floor spring
Longitudinal gland pyrg	NS	Alluvial fan / valley floor spring
Lake Valley (north)		
Amphibian		
Northern leopard frog	BLM	Alluvial fan / valley floor & mtn block spring
Invertebrate		
Lake Valley pyrg	NS	Alluvial fan / valley floor spring

[a] Highest ranks listed. FE = Federally Endangered. NVP = Nevada State Protected. UTP = Utah State Protected. BLM = BLM Sensitive. NS = NatureServe global imperiled rank 1 or 2.

Environmental Areas of Interest

Ten Environmental Areas of Interest in southern Snake Valley selected for the environmental evaluation (Section 7.0 and Section 8.0) are detailed in Table 2-5, Table 7-1, and Figure 2-5. Five of the ten sites are located below the mountain block and support aquatic Special Status Species. One site below the mountain block does not have Special Status Species but is a representative site in the region. Four sites located in the mountain block are sites of interest that, in part, occur within the GBNP, and three of these sites have aquatic Special Status Species.

Six of the ten Environmental Areas of Interest in southern Snake Valley are Spring Valley Stipulation monitoring sites (Table 7-1). For more summary information on the Biological Monitoring Plan (BWG, 2009) and Hydrologic Monitoring and Mitigation Plan (SNWA, 2009a), see Section 3.0.

2.4.2 Hamlin Valley

Hamlin Valley, located in the Great Basin Desert, straddles the Nevada-Utah border and separates the southern portions of Spring and Snake valleys. Northern Hamlin Valley, which receives groundwater from inter-basin flow from Spring Valley (Burns and Drici, 2011), is the focus of this report.

Table 2-5 Snake Valley Environmental Areas of Interest: Groundwater-Influenced Habitats and Aquatic Biota of Interest

Site Name	Geographic Location	Groundwater-Influenced Habitat	Aquatic Biota of Interest	Aquatic Special Status Species
Baker Creek (incl. S Fork)	Originates in Mtn Block	Stream	Native fish	Bonneville cutthroat trout [Lower limit: S Fork Baker Ck / Baker Ck convergence, approx 8,000 ft-amsl]
Big Springs	Alluvial Fan	Spring	Native fish community, Springsnails	Redside shiner, Utah chub, Utah sucker, Longitudinal gland pyrg, Bifid duct pyrg
Big Springs Creek / Lake Creek	Alluvial Fan / Valley Floor	Stream	Native fish community	Redside shiner, Utah chub, Utah sucker
Big Wash (incl. S Fork)	Originates in Mtn Block	Stream	Native fish	Bonneville cutthroat trout [Lower limit: end of native stream / upstream of canal ditches, approx 6,400 ft-amsl]
Clay Spring North	Alluvial Fan	Spring	Springsnail	Longitudinal gland pyrg
Lehman Creek	Originates in Mtn Block	Cave, Stream	Cave dwellers; Game fish	Not present
North Little Spring	Alluvial Fan	Spring	Not present	Not present
Snake Creek	Originates in Mtn Block	Stream	Native fish	Bonneville cutthroat trout [Lower limit: upstream of 3-mi diversion pipeline, approx 7,600 ft-amsl]
Stateline Springs	Alluvial Fan / Valley Floor	Spring	Springsnail	Longitudinal gland pyrg
Unnamed 1 Spring N of Big	Alluvial Fan	Spring	Springsnail	Longitudinal gland pyrg

Approximately 2,000 acres on the valley floor and valley floor / alluvial fan interface in northern Hamlin Valley is characterized by groundwater-influenced vegetation (Figure 2-6; SNWA, 2004). All of this lowland groundwater-influenced habitat is phreatophytic shrubland (SNWA, 2004).

Biota of Interest in Groundwater-influenced Habitats

No aquatic Special Status Species occur below the mountain block in northern Hamlin Valley. It is possible that Special Status Species birds use the phreatophytic shrublands for foraging and breeding.

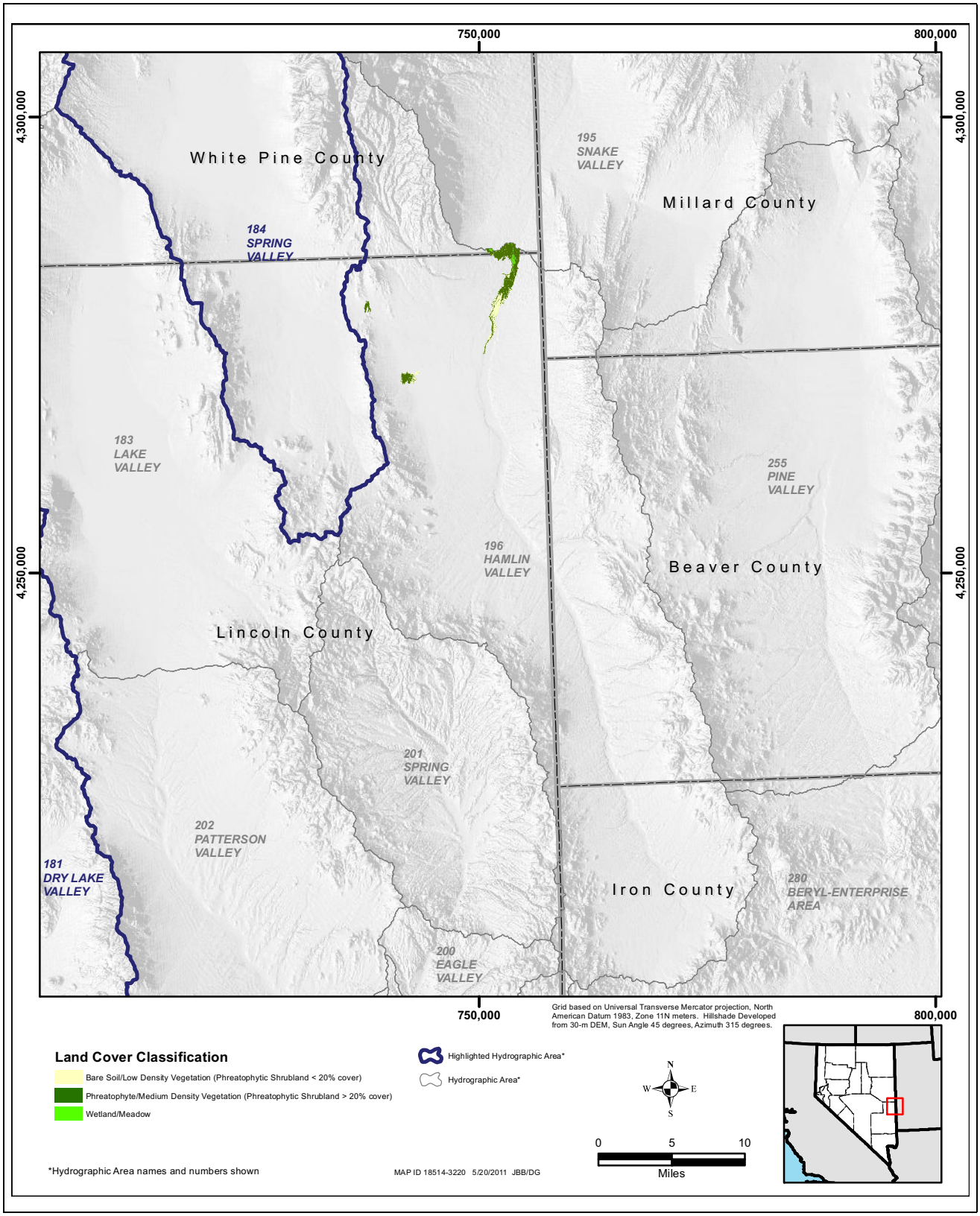

Figure 2-6
ET Land Cover Mapping and Environmental Areas of Interest in Hamlin Valley

Mule deer and pronghorn (big game species) are of management interest in northern Hamlin Valley. Pronghorn habitat mainly occurs across the valley floor and up onto the alluvial fan (NDOW, 2004). Mule deer habitat occurs mostly in the uplands and at higher elevations, but it does occur within a low pass between Spring and Hamlin valleys (NDOW, 2004). The lowland areas of probable big game use occur, in part, in groundwater-influenced habitats (NDOW, 2004; SNWA, 2004).

The phreatophytic shrublands in northern Hamlin Valley, which may be used by Special Status Species birds and big game, are currently monitored by the BWG (Monitoring Plan: BWG, 2009; Annual reports: SNWA, 2010a and 2011a).

Environmental Areas of Interest

Because of the lack of aquatic habitats, no Environmental Areas of Interest were selected for evaluation in northern Hamlin Valley. However, the phreatophytic plant community in northern Hamlin Valley is currently monitored under the Spring Valley Stipulation (Stipulation, 2006). For more summary information on the Biological Monitoring Plan for the Spring Valley Stipulation (BWG, 2009), see Section 3.0.

2.4.3 Lake Valley

Lake Valley is southwest of Spring Valley and east of Cave Valley in Nevada. Approximately 25 percent of the basin is in White Pine County and 75 percent is in Lincoln County. The area of focus for this report is northern Lake Valley, north of and including Wambolt Spring Complex.

Groundwater-influenced habitats in northern Lake Valley include springs, streams, wetlands, meadows, and phreatophytic shrublands (SNWA, 2004). These habitats have been affected by anthropogenic factors such as grazing.

Approximately 8,500 acres on the valley floor and valley floor / alluvial fan interface in northern Lake Valley is characterized by groundwater-influenced vegetation (Figure 2-7; SNWA, 2004). The majority of this lowland groundwater-influenced habitat (approx. 7,000 acres) is phreatophytic shrubland. Approximately 1,500 acres is lowland wetland/meadow habitat (SNWA, 2004).

Biota of Interest in Groundwater-influenced Habitats

Aquatic Special Status Species below the mountain block in northern Lake Valley includes the Lake Valley pyrg (*Pyrgolopsis sublata*) and northern leopard frog (Table 2-4). The Lake Valley pyrg is considered endemic to Wambolt Springs (Hershler, 1998), and northern leopard frogs have been documented at Wambolt Spring Complex and Geyser Creek Spring (BIO-WEST, 2007).

Terrestrial Special Status Species that occur below the mountain block and use groundwater-influenced habitats in northern Lake Valley include bats and birds. Greater Sage-Grouse, a federal candidate species, has been documented in the region (NDOW, 2010). It is possible that other Special Status Species birds use the phreatophytic shrublands for foraging and breeding. Special Status Species bats have been documented at Wambolt Spring Complex foraging above springs and associated wetland/meadows (O'Farrell Biological Consulting, 2006).

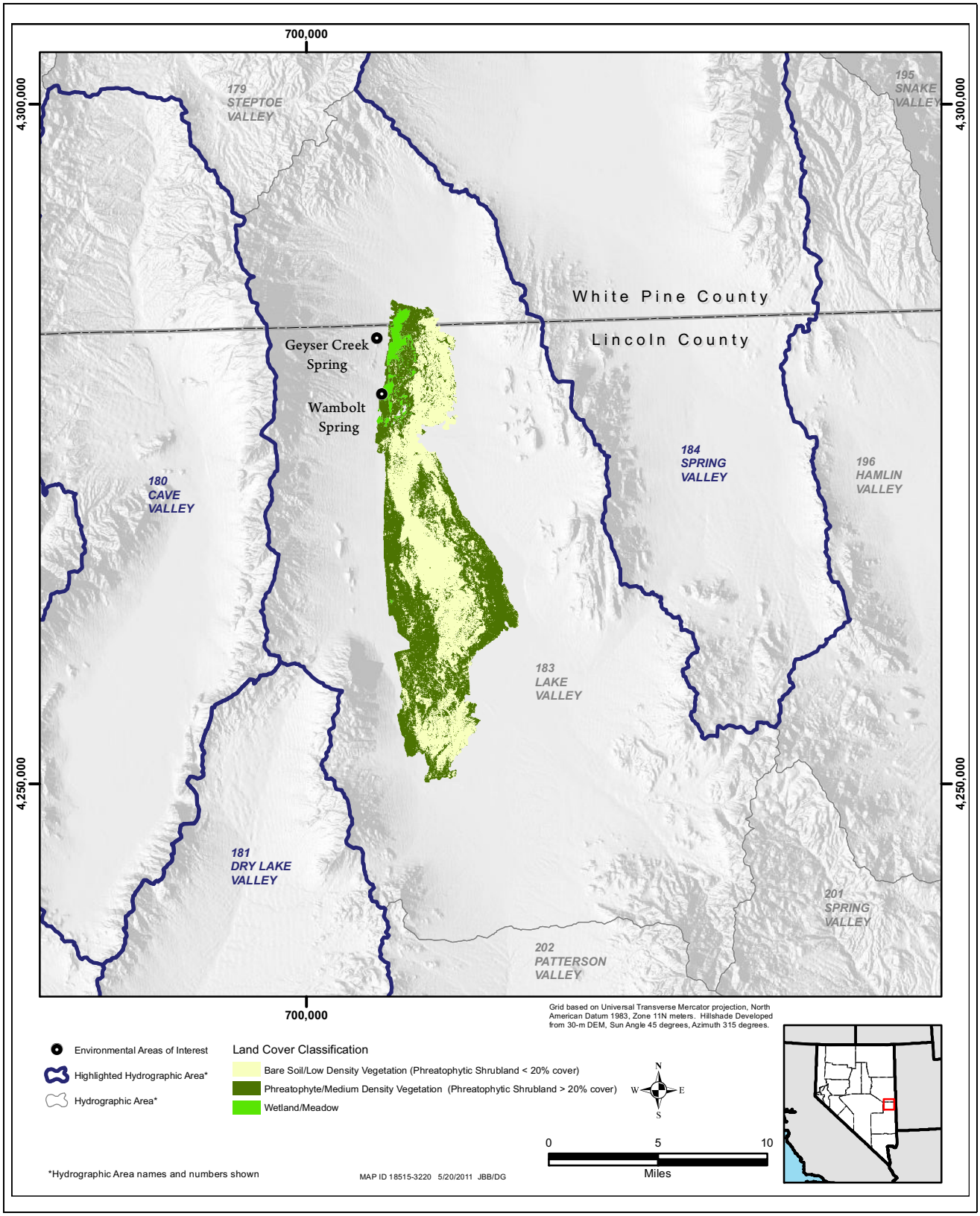

Figure 2-7
ET Land Cover Mapping and Environmental Areas of Interest in Lake Valley

Elk, mule deer, and pronghorn (big game species) are of management interest in northern Lake Valley. Habitat and migration corridors for all three species occur, in part, in groundwater-influenced habitats on the valley floor and valley floor / alluvial fan interface (NDOW, 2004; SNWA, 2004). Springs and wetlands are likely sources of water for all three of these species.

Environmental Areas of Interest

Two Environmental Areas of Interest in northern Lake Valley selected for the environmental evaluation (Section 7.0 and Section 8.0) are detailed in Table 2-6, Table 7-1, and Figure 2-7. One of these sites is located below the mountain block and has aquatic Special Status Species. The other site, which is located in the mountain block, also has an aquatic Special Status Species.

Table 2-6 Lake Valley Environmental Areas of Interest: Groundwater-Influenced Habitats and Aquatic Biota of Interest

Site Name	Geographic Location	Groundwater-Influenced Habitat	Aquatic Biota of Interest	Aquatic Special Status Species
Geyser Creek Spring	Mtn Block	Spring	Amphibian	Northern leopard frog
Wambolt Spring Complex	Alluvial Fan / Valley Floor	Spring	Amphibian, Springsnail	Northern leopard frog, Lake Valley pyrg

2.4.4 White River Valley

White River Valley is located in the Great Basin Desert in Nye, Lincoln, and White Pine Counties. The valley floor ranges from 5,300 to 5,700 ft-amsl, and the surrounding mountain ranges exceed 9,000 ft-amsl. The southeastern portion of White River Valley borders Cave Valley. The area of focus for this report is southern White River Valley, south of and including Shingle Pass.

Groundwater-influenced habitats located in southern White River Valley include springs, wetlands, meadows and phreatophytic shrublands (SNWA, 2004). These habitats have been affected by anthropogenic factors such as grazing. A portion of these groundwater-influenced habitats are included in the highly-managed Kirch Wildlife Management Area (WMA).

Approximately 43,000 acres on the valley floor and valley floor / alluvial fan interface in southern White River Valley is characterized by groundwater-influenced vegetation (Figure 2-8; SNWA, 2004). The majority of this lowland groundwater-influenced habitat (approx. 39,000 acres) is phreatophytic shrubland, and approximately 4,000 acres is lowland wetland/meadow habitat (SNWA, 2004). Flag Springs Complex, which occurs in the Kirch WMA, also supports a narrow woody riparian corridor.

Biota of Interest in Groundwater-influenced Habitats

Aquatic Special Status Species below the mountain block in southern White River Valley include five fish species (Table 2-7). White River spinedace (*Lepidomeda albivallis*), White River sculpin (*Cottus* sp. 3) and Moorman White River springfish (*Crenichthys baileyi thermophilus*) are restricted to a few sites, while White River speckled dace (*Rhinichthys osculus* spp.) and White River desert sucker (*Catostomus clarkia intermedius*) are more broadly distributed (BRT, 2011). The Special Status

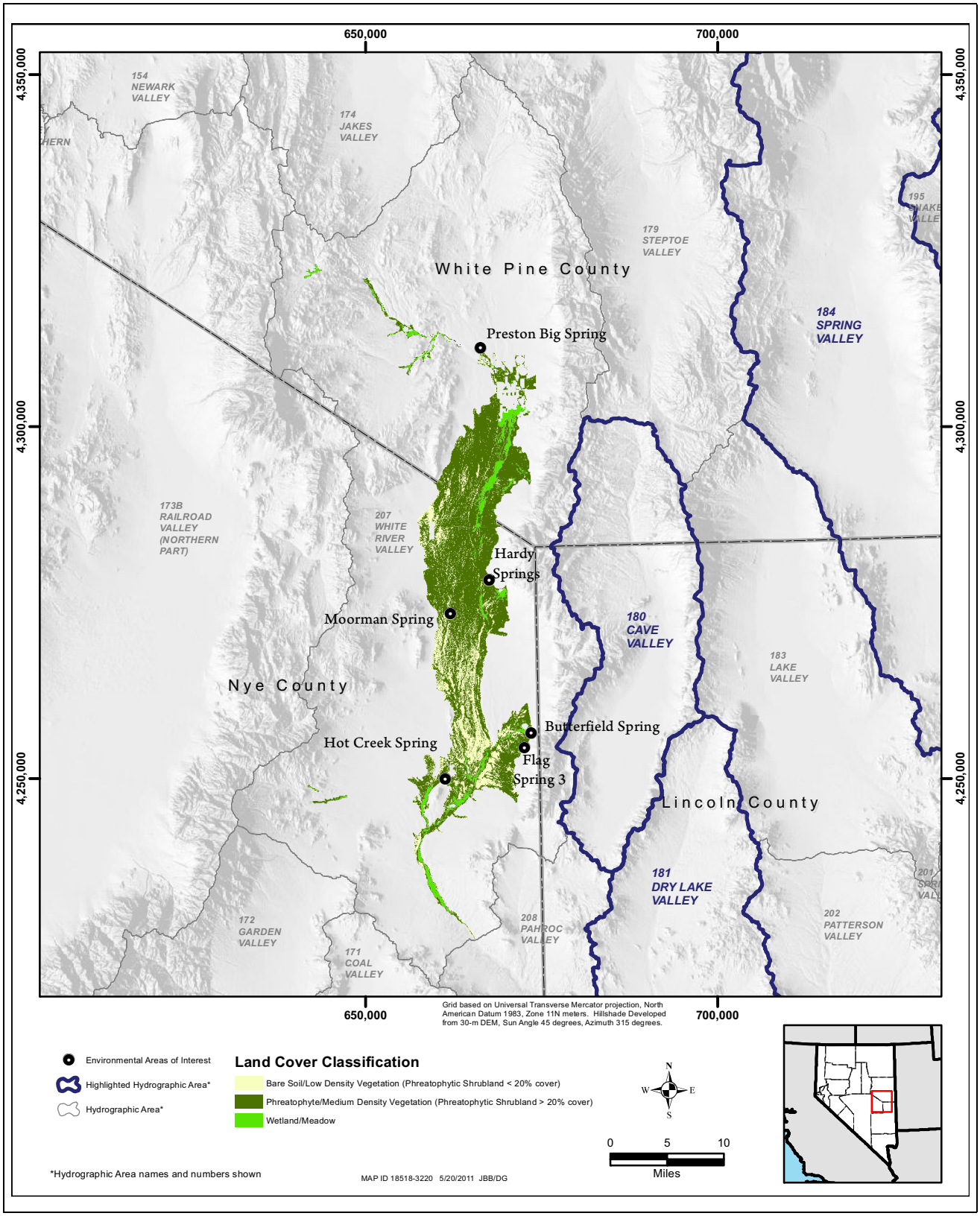

Figure 2-8
ET Land Cover Mapping and Environmental Areas of Interest in White River Valley

Species Preston White River springfish (*Crenichthys baileyi albivallis*), located in northern White River Valley (approximately 20 mi north of Shingle Pass), is also restricted to a few sites. All five Special Status fish species in southern White River Valley will be monitored by the BRT (BRT, 2011). Five sites with Special Status Species fish will be monitored by the BRT and are currently monitored by the TRP (Monitoring Plans: BRT, 2011 and SNWA, 2009c; Annual reports: SNWA, 2010d and 2011d).

Table 2-7 Aquatic Special Status Species in Environmental Areas of Interest in Basins Adjacent to Cave, Dry Lake and Delamar Valleys

Aquatic Species	Status[a]	Groundwater-Influenced Habitat
White River Valley (south)		
Fish		
Moorman White River springfish	NVP, BLM	Valley floor spring
Preston White River springfish	NVP, BLM	Alluvial fan / valley floor spring
White River desert sucker	NVP, BLM	Alluvial fan / valley floor spring
White River sculpin	NS	Alluvial fan / valley floor spring
White River speckled dace	NVP, BLM	Alluvial fan / valley floor spring
White River spinedace	FE	Alluvial fan / valley floor spring
Invertebrate		
Butterfield pyrg	NS	Alluvial fan / valley floor spring
Flag pyrg	NS	Alluvial fan / valley floor spring
Grated tryonia	BLM	Valley floor spring
Hardy pyrg	NS	Alluvial fan / valley floor spring
Pahranagat pebblesnail	NS	Valley floor spring
White River Valley pyrg	NS	Alluvial fan / valley floor spring
Pahranagat Valley		
Fish		
Hiko White River springfish	FE	Valley floor spring
Pahranagat roundtail chub	FE	Valley floor stream
Pahranagat speckled dace	NVP, BLM	Alluvial fan / valley floor spring
White River springfish	FE	Valley floor spring
Amphibian		
Northern leopard frog	BLM	Alluvial fan / valley floor spring

Table 2-7 Aquatic Special Status Species in Environmental Areas of Interest in Basins Adjacent to Cave, Dry Lake and Delamar Valleys (Continued)

Aquatic Species	Status[a]	Groundwater-Influenced Habitat
Invertebrate		
Ash Springs riffle beetle	NS	Valley floor spring
Grated tryonia	BLM	Valley floor spring
Hubbs pyrg	NS	Valley floor & alluvial fan / valley floor springs
Pahranagat naucorid bug	NS	Valley floor spring
Pahranagat pebblesnail	NS	Valley floor spring

a Highest ranks listed. FE = Federally Endangered. NVP = Nevada State Protected.
UTP = Utah State Protected. BLM = BLM Sensitive. NS = Nature Serve global imperiled rank 1 or 2.

Other aquatic Special Status Species below the mountain block in southern White River Valley include six species of springsnails (Table 2-7). All six springsnail species will be monitored by the BRT (BRT, 2011). Five sites with Special Status Species springsnails will be monitored by the BRT and are currently monitored by the TRP (Monitoring Plan: BRT, 2011 and SNWA, 2009c; Annual reports: SNWA, 2010d and 2011d).

Terrestrial Special Status Species that occur below the mountain block and use groundwater-influenced habitats in southern White River Valley include bats and birds. Habitat for Greater Sage-Grouse, a federal candidate species, occurs across the region (NDOW, 2010). It is possible that other Special Status Species birds also use the groundwater-influenced habitats in southern White River Valley, and Special Status Species bats have been documented at Hot Creek Spring (O'Farrell Biological Consulting, 2006). Groundwater-influenced habitat used by birds and bats in southern White River Valley will be monitored by the BRT (BRT, 2011) and are currently monitored by the TRP (Monitoring Plan: SNWA, 2009c; Annual reports: SNWA, 2010d and 2011d).

Elk, mule deer, and pronghorn (big game species) are of management interest in southern White River Valley. Habitat and migration corridors for all three species occur, in part, in groundwater-influenced habitats on the valley floor and valley floor / alluvial fan interface (NDOW, 2004; SNWA, 2004). Springs and wetlands are likely sources of water for all three of these species. Selected groundwater-influenced habitat used by big game in southern White River Valley will be monitored by the BRT (BRT, 2011) and are currently monitored by the TRP (Monitoring Plan: SNWA, 2009c; Annual reports: SNWA, 2010d and 2011d).

Environmental Areas of Interest

Six Environmental Areas of Interest selected in White River Valley for the environmental evaluation (Section 7.0 and Section 8.0) are detailed in Table 2-8, Table 7-1, and Figure 2-8. Four of the six sites are located south of Shingle Pass. All six Environmental Areas of Interest in White River Valley are located below the mountain block and have aquatic Special Status Species.

Five of the six Environmental Areas of Interest in White River Valley are DDC Valleys Stipulation monitoring sites (Table 7-1). For more summary information on the Biological Monitoring Plan (BRT, 2011) and Hydrologic Monitoring and Mitigation Plan (SNWA, 2009c), see Section 3.0.

Table 2-8 White River Valley Environmental Areas of Interest: Groundwater-Influenced Habitats and Aquatic Biota of Interest

Site Name	Geographic Location	Groundwater-Influenced Habitat	Aquatic Biota of Interest	Aquatic Special Status Species
Butterfield Spring	Alluvial Fan / Valley Floor	Spring	Native fish, Springsnails	White River speckled dace, White River sculpin, Butterfield pyrg, Hardy pyrg
Flag Springs [a]	Alluvial Fan / Valley Floor	Spring	Native fish, Springsnails	White River spinedace, White River speckled dace, White River desert sucker, Flag pyrg, White River Valley pyrg
Hardy Springs	Alluvial Fan / Valley Floor	Spring	Springsnail	Hardy pyrg
Hot Creek Spring [a]	Valley Floor	Spring	Native fish, Springsnails	Moorman White River springfish, Pahranagat pebblesnail, Grated tryonia
Moorman Spring	Valley Floor	Spring	Native fish, Springsnails	Moorman White River springfish, Pahranagat pebblesnail, Grated tryonia
Preston Big Spring	Alluvial Fan / Valley Floor	Spring	Native fish, Springsnail	White River speckled dace, Preston White River springfish, White River Valley pyrg

[a]Flag Springs outflow: Sunnyside Creek, Hot Creek Spring outflow: Hot Creek.

2.4.5 Pahranagat Valley

Pahranagat Valley (Lincoln County, Nevada) is located mostly within the Mojave Desert, with the northeastern portion of the valley in the transition zone between the Mojave Desert and Great Basin Desert. The valley floor ranges from 3,500 to 4,500 ft-amsl, and the mountain ranges extend over 8,000 ft-amsl. Pahranagat Valley borders Delamar Valley to the west.

Groundwater-influenced habitats located in Pahranagat Valley include a narrow run of springs, wetlands, meadows, riparian woodlands and phreatophytic shrublands down the middle of the valley (SNWA, 2004). Three regional springs (Ash, Crystal, and Hiko) supply a majority of the water to the down-stream habitats, including the highly-managed Pahranagat NWR. The groundwater-influenced habitats in Pahranagat Valley have been greatly affected by anthropogenic factors such as grazing, farming and surface water impoundment and diversion.

Approximately 6,800 acres on the valley floor and valley floor / alluvial fan interface in Pahranagat Valley is characterized by groundwater-influenced vegetation (Figure 2-9; SNWA, 2004). Approximately 60 percent (approx. 4,300 acres) of this lowland groundwater-influenced habitat is wetland/meadow habitat, and approximately 40 percent (approx. 2,500 acres) is lowland phreatophytic shrubland (SNWA, 2004). Ash Spring, Crystal Spring, Pahranagat Ditch, and Pahranagat NWR also support woody riparian galleries (BRT, 2011).

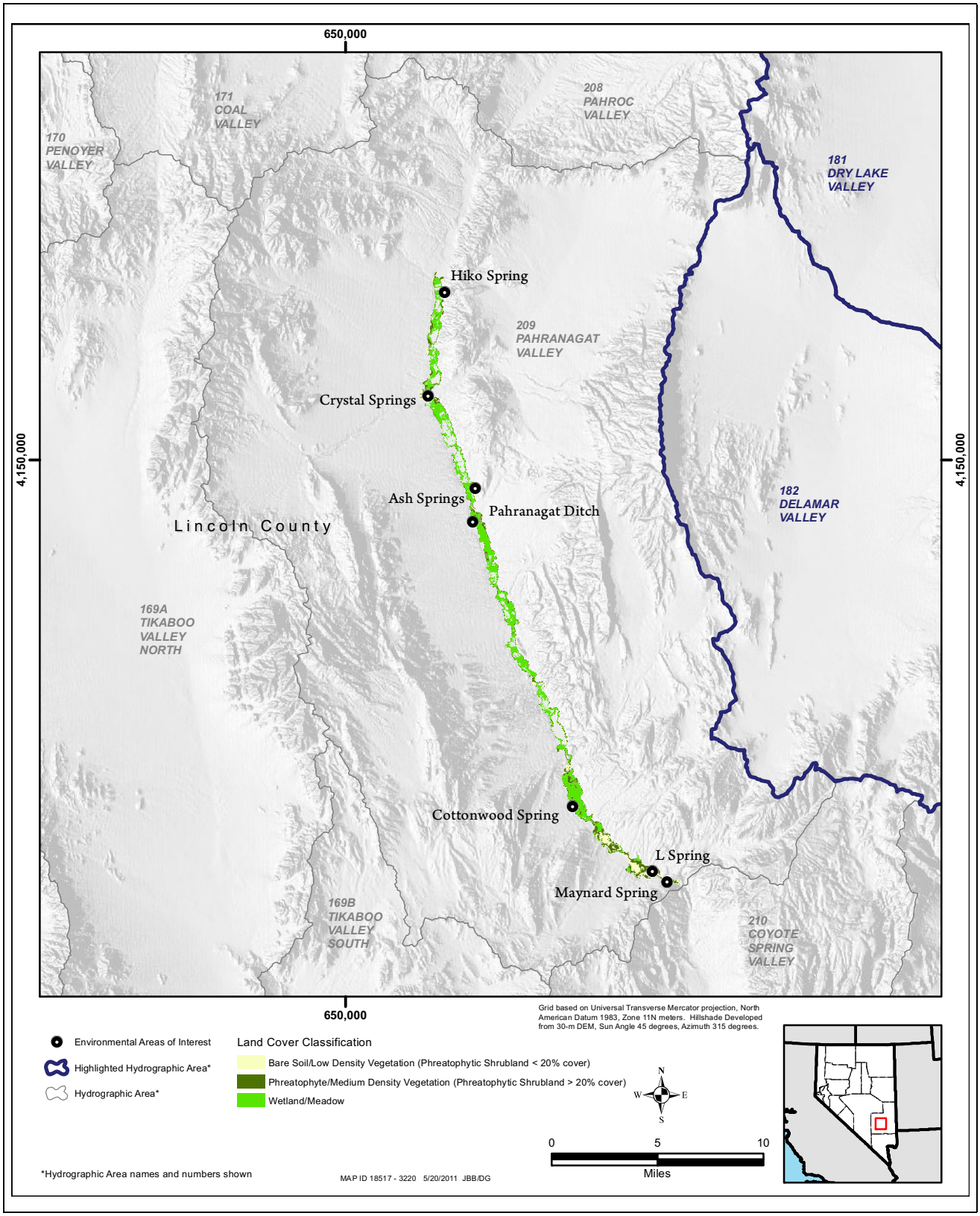

Figure 2-9
ET Land Cover Mapping and Environmental Areas of Interest in Pahranagat Valley

Hiko Spring provides water to irrigation for crops and two reservoirs on Key Pittman WMA (BRT, 2011).

Biota of Interest in Groundwater-influenced Habitats

Aquatic Special Status Species below the mountain block in Pahranagat Valley include four native fish species (Table 2-7). All four fish species are restricted to a few sites (BRT, 2011). White River springfish (*Crenichthys baileyi baileyi*), Hiko White River springfish (*Crenichthys baileyi grandis*) and Pahranagat roundtail chub (*Gila robusta jordani*) will be monitored by the BRT (BRT, 2011). Four sites with Special Status Species fish will be monitored by the BRT, and four sites with Special Status Species fish are currently monitored by the TRP (Monitoring Plans: BRT, 2011 and SNWA, 2009c; Annual reports: SNWA, 2010d and 2011d).

Other aquatic Special Status Species below the mountain block in Pahranagat Valley include one amphibian species (northern leopard frog) and five invertebrate species, including three springsnails (Table 2-7). Northern leopard frog and all five invertebrate species will be monitored by the BRT (BRT, 2011). One site with northern leopard frogs and four sites with springsnails will be monitored by the BRT, and one site with northern leopard frogs and three sites with springsnails are currently monitored by the TRP (Monitoring Plan: BRT, 2011 and SNWA, 2009c; Annual reports: SNWA, 2010d and 2011d).

Terrestrial Special Status Species that occur below the mountain block and use groundwater-influenced habitats in Pahranagat Valley include bats and birds. Western Yellow-Billed Cuckoo (*Coccyzus americanus occidentalis*), a federal candidate species, has been documented along Pahranagat Ditch, although breeding has not been confirmed (NDOW, 2008). Southwestern Willow Flycatcher (*Empidonax traillii extimus*), an endangered species, is known to breed in woody riparian galleries in the highly-managed Key Pittman WMA and Pahranagat NWR. Special Status Species bats have been documented at Crystal Spring (O'Farrell Biological Consulting, 2006). Groundwater-influenced habitat used by birds and bats in Pahranagat Valley will be monitored by the BRT (BRT, 2011) and are currently monitored by the TRP (Monitoring Plan: SNWA, 2009c; Annual reports: SNWA, 2010d and 2011d).

Another terrestrial Special Status Species that occurs below the mountain block and uses groundwater-influenced habitats in Pahranagat Valley is the Pahranagat Valley montane vole (*Microtus montanus fucosus*). Pahranagat Valley montane vole is known to currently occur at Crystal Spring, and has been historically documented near Hiko Spring, Ash Spring, and on the Pahranagat NWR (BRT, 2011). The Pahranagat Valley montane vole will be monitored by the BRT (BRT, 2011). Three sites with potential Pahranagat Valley montane vole occurrence will be monitored by the BRT, two of which are currently monitored by the TRP (Monitoring Plans: BRT, 2011 and SNWA, 2009c; Annual reports: SNWA, 2010d and 2011d).

Mule deer (big game species) are of management interest in Pahranagat Valley. Migration corridors for this species occurs, in part, in groundwater-influenced habitats on the valley floor and valley floor / alluvial fan interface (NDOW, 2004; SNWA, 2004). Springs and wetlands are likely sources of water for all three of these species. Groundwater-influenced habitat used by big game in Pahranagat Valley will be monitored by the BRT (BRT, 2011) and are currently monitored by the TRP (Monitoring Plan: SNWA, 2009c; Annual reports: SNWA, 2010d and 2011d).

Environmental Areas of Interest

Seven Environmental Areas of Interest selected in Pahranagat Valley for the environmental evaluation (Section 7.0 and Section 8.0) are detailed in Table 2-9, Table 7-1, and Figure 2-9. All seven sites are located below the mountain block and support aquatic Special Status Species.

Table 2-9 Pahranagat Valley Environmental Areas of Interest: Groundwater-Influenced Habitats and Aquatic Biota of Interest

Site Name	Geographic Location	Groundwater-Influenced Habitat	Aquatic Biota of Interest	Aquatic Special Status Species
Ash Spring	Valley Floor	Spring	Native fish, Springsnails, Other invertebrates	White River springfish, Pahranagat pebblesnail, Grated tryonia, Ash Springs riffle beetle, Pahranagat naucorid bug
Cottonwood Spring	Alluvial Fan / Valley Floor	Spring	Native fish	Pahranagat speckled dace
Crystal Spring	Valley Floor	Spring	Native fish, Springsnail	Hiko White River springfish, Hubbs pyrg
Hiko Spring	Valley Floor	Spring	Native fish; Springsnail possible	Hiko White River springfish
L Spring	Alluvial Fan / Valley Floor	Spring	Amphibian; Springsnail possible	Northern leopard frog
Maynard Spring	Alluvial Fan / Valley Floor	Spring	Amphibian; Springsnail possible	Northern leopard frog
Pahranagat Ditch	Valley Floor	Stream, Riparian woodland	Native fish	Pahranagat roundtail chub

Six of the seven Environmental Areas of Interest in Pahranagat Valley are DDC Valleys Stipulation monitoring sites (Table 7-1). For more summary information on the Biological Monitoring Plan (BRT, 2011) and Hydrologic Monitoring and Mitigation Plan (SNWA, 2009c), see Section 3.0.

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3.0 STIPULATED AGREEMENTS

On September 8, 2006, SNWA and four DOI agencies (USFWS, BIA, BLM, and NPS) (collectively referred to as the "Parties") entered into a Stipulation for Withdrawal of Protests regarding SNWA groundwater applications 54003-54021 in the Spring Valley Hydrographic Basin (Spring Valley Stipulation; Stipulation, 2006). On January 7, 2008, SNWA and the same four DOI agencies entered into a Stipulation for Withdrawal of Protests regarding SNWA groundwater applications 53987-53992 in Delamar, Dry Lake, and Cave Valley Hydrographic Basins (DDC Stipulation; Stipulation, 2008). This section summarizes the Common Goals of these Stipulations, the key participants in the implementation of the Stipulations, and the development and implementation of associated Biological Monitoring Plans.

3.1 Common Goals of the Stipulations

The Spring Valley and DDC Stipulations (Stipulation, 2006 and 2008) declare the Common Goals of the Parties. These Common Goals are applied to Areas of Interest. The Area of Interest for the Spring Valley Stipulation includes the Spring Valley Hydrographic Basin (Spring Valley) and 15 surrounding valleys, most of which are in the Great Salt Lake Desert Flow System (Figure 1 in Stipulation, 2006). The Initial Biological Monitoring Area (IBMA), which is within the Area of Interest, includes Spring Valley, northern Hamlin Valley, and the Big Springs Creek sub-watershed in southern Snake Valley (Figure 2 in Exhibit B of Stipulation, 2006). The Area of Interest for the DDC Stipulation includes the Delamar, Dry Lake, and Cave Valley Hydrographic Basins, as well as the southern portion of White River Valley (south of Hardy Springs) and Pahranagat Valley (including the Pahranagat NWR) (Figure 1 in Stipulation, 2008).

As stated in the Spring Valley and DDC Stipulations (Stipulation, 2006 and 2008), the Common Goals of the Parties include the following:

Spring Valley Stipulation

- To manage the development of groundwater by SNWA in Spring Valley without causing injury to certain defined Federal Water Rights and/or unreasonable adverse effects to defined Federal Resources in the Area of Interest;
- To accurately characterize the groundwater gradient from Spring Valley to Snake Valley via Hamlin Valley;
- To avoid any effect on Federal Resources located within the boundaries of Great Basin National Park from groundwater withdrawal by SNWA in Spring Valley;
- To manage the development of groundwater by SNWA in Spring Valley in order to avoid unreasonable adverse effects to wetlands, wet meadow complexes, springs, streams, and riparian and phreatophytic communities (referred to as Water-dependent Ecosystems) and

maintain the biological integrity and ecological health of the Area of Interest over the long term;
- To avoid any effects to Water-dependent Ecosystems within the boundaries of Great Basin National Park; and,
- To manage the development of groundwater by SNWA in Spring Valley to avoid an unreasonable degradation of the scenic values of the visibility from Great Basin National Park due to a potential increase in airborne particulates and loss of surface vegetation which may result from groundwater withdrawals by SNWA in Spring Valley.

DDC Stipulation

- To manage the development of groundwater by SNWA in DDC without causing injury to Federal Water Rights and/or unreasonable adverse effects to Federal Resources and Special Status Species[1] within the Area of Interest as a result of groundwater withdrawals by SNWA in DDC; and,
- The above Common Goals include taking actions that protect and recover those Special Status Species that are currently listed pursuant to the Endangered Species Act and avoid listing of currently non-listed Special Status Species.

3.2 Key Participants in the Implementation of the Stipulations

The framework set forth in the Stipulations for achieving the Common Goals of the Parties is the development and implementation of hydrologic and biological monitoring, management, and mitigation plans to which the development of groundwater by SNWA is subject (Exhibits A and B in Stipulation, 2006; Exhibit A in Stipulation, 2008). Specifically, the Stipulations impose management requirements (including creation of technical and management teams and establishment of a consensus-based decision-making process), monitoring requirements (including development of Biological Monitoring Plans, collection of baseline data, and monitoring for early warning of unreasonable adverse effects to Federal Resources), and mitigation requirements (including management of groundwater development and restoration or establishment of habitat) (Exhibits A and B in Stipulation, 2006; Exhibit A in Stipulation, 2008).

The monitoring, management, and mitigation plans in the Stipulations are implemented by teams of managers and scientists from the Stipulation Parties. The teams are composed of:

1. the BWG (Spring Valley Stipulation) and BRT (DDC Stipulation), consisting of representatives with biologic expertise from each of the Parties;
2. the TRP, consisting of representatives with hydrologic expertise from each of the Parties; and,

1. Special Status Species are defined in the DDC Stipulation as species that are groundwater-dependent (i.e., dependent upon groundwater levels and/or local and regional spring flows) and have been given a special status designation recognized by the DDC Stipulation. Per the DDC Stipulation, this includes federally threatened, endangered, proposed or candidate species under the ESA; Nevada BLM sensitive species; Nevada state protected species; and species ranked critically imperiled or imperiled across their entire range (G1 or G2 rank) by NatureServe / Nevada Natural Heritage Program (NNHP).

3. the EC, consisting of managers from each of the Parties. The technical teams engage in rigorous analysis and follow established protocols to effect the Common Goals of the Stipulations.

3.2.1 Team Responsibilities for Implementation of the Stipulations

The BWG and BRT are responsible for the development and implementation of Biological Monitoring Plans and oversight of implementation of the biological monitoring, management, and mitigation efforts under the Stipulations. If the BWG determines that a Water-dependent Ecosystem Effect[1] is occurring or will occur in the Spring Valley Stipulation Area of Interest as a result of SNWA's groundwater development in Spring Valley, the BWG develops a recommended course of action and refers this to the EC. Likewise, if the BRT determines that a predicted or measured change in groundwater levels or biological parameters would result in unreasonable adverse effect to Federal Resources and/or Special Status Species in the DDC Stipulation Area of Interest, the BRT develops a recommended course of action and refers this to the Executive Committee. The BWG and BRT are also responsible for monitoring the success of avoidance or mitigation actions to carry out the Common Goals of the Stipulation.

The TRP carries out hydrologic monitoring, management, and mitigation requirements of the Spring Valley and DDC Stipulations. The TRP's responsibilities include forming recommendations about monitoring, modeling, groundwater management, and mitigation, and making such recommendations to the Executive Committee. To collaboratively carry out the Common Goals of the Stipulations, the TRP and BWG or BRT share expert opinions that inform the hydrologic and biological monitoring, management, and mitigation efforts under the Stipulations. Further summary information about the TRP and associated hydrologic monitoring plans are in Prieur (2011).

The EC serves as a management oversight and decision-making body for the Spring Valley and DDC Stipulations. The EC:

1. oreviews BWG recommendations for actions to avoid Water-dependent Ecosystem Effects in the Spring Valley Stipulation Area of Interest from groundwater development by SNWA in Spring Valley, seeks a negotiated resolution of a course of action, and implements the action;
2. reviews TRP recommendations for actions to reduce or eliminate an injury to Federal Water Rights and/or unreasonable adverse effects to Federal Resources in the Spring Valley Stipulation Area of Interest, and/or any effect on Federal Resources within the boundaries of GBNP from groundwater withdrawals by SNWA in Spring Valley;
3. reviews BRT and/or TRP recommendations for actions to reduce or eliminate an injury to Federal Water Rights and/or unreasonable adverse effects to Federal Resources or Special Status Species in the DDC Stipulation Area of Interest from groundwater withdrawals by SNWA from DDC; and,
4. negotiates a resolution in the event that the BWG, BRT, and/or TRP cannot reach consensus as to any of their responsibilities as set forth in Stipulations.

1. As defined in the Spring Valley Stipulation, unreasonable adverse effect(s) to Water-dependent Ecosystems within the Area of Interest or any effect(s) to Water-dependent Ecosystems within the boundaries of GBNP.

3.2.2 Participants in the Creation of the Biological Monitoring Plans

Spring Valley Stipulation

In January-February 2009, the Biological Monitoring Plan for the Spring Valley Stipulation (Spring Valley Plan; BWG, 2009) was approved by the EC and the NSE (NSE, 2009). The Spring Valley Plan is designed to be consistent with the Common Goals of the Spring Valley Stipulation and biological monitoring requirements in the vacated NSE Ruling 5726 (NSE, 2007).

The Spring Valley Plan was developed by the BWG, involving full, active participation of biologists from all five Stipulation Parties. Development of the Spring Valley Plan was a consensus-based process facilitated by The Nature Conservancy (TNC). The BWG invited outside entities to provide additional technical expertise in developing the Spring Valley Plan. NDOW and Utah Division of Wildlife Resources (UDWR) fully participated as invited contributors in Spring Valley Plan development. With BWG consensus, SNWA hired environmental consultants BIO-WEST, Inc. and KS2 Ecological Field Services to attend BWG meetings, provide expert advice, and execute the writing of the Spring Valley Plan under BWG direction. The GBBO and DRI also provided additional expert advice on specific topics.

The Spring Valley Plan was developed with input by the NSE office. An NSE representative participated in numerous BWG meetings and joined the BWG and TRP on a joint tour of potential monitoring sites. As an invited and regular participant of the TRP, a second NSE representative also provided expert advice to the BWG. The NSE representatives provided comments on the draft Spring Valley Plan, which were incorporated into the final Spring Valley Plan. On January 23, 2009, the NSE's office accepted the Spring Valley Plan, finding it to be comprehensive and compliant with the NSE's requirement for the development of a biological monitoring plan (subject to modification) in NSE Ruling 5726.

DDC Stipulation

In January 2011, the Biological Monitoring Plan for the Delamar, Dry Lake, and Cave Valley Stipulation (DDC Plan; BRT, 2011) was approved by the EC. The DDC Plan is designed to be consistent with the Common Goals of the DDC Stipulation and biological monitoring requirements in the vacated NSE Ruling 5875 (NSE, 2007).

Like the Spring Valley Plan, the DDC Plan was cooperatively developed by the BRT, involving active participation of biologists from four Stipulation Parties (SNWA, USFWS, BLM, and BIA; NPS contributed to draft reviews). The BRT invited outside entities to provide additional technical expertise in developing the DDC Plan. NDOW fully participated as an invited contributor in the DDC Plan development. With BRT consensus, SNWA hired environmental consultants BIO-WEST, Inc. and KS2 Ecological Field Services to attend BRT meetings, provide expert advice, and execute the writing of the DDC Plan under BRT direction. The GBBO and Desert Research Institute (DRI) provided additional expert advice on specific topics, and TNC facilitated numerous BRT meetings.

The DDC Plan was developed with input by the NSE office. An NSE representative participated in three BRT meetings and joined the BRT and TRP on a joint tour of the Area of Interest. As an invited

and regular participant of the TRP, a second NSE representative also provided expert advice to the BRT. The Spring Valley Plan, which was approved by the NSE, served as an example for the DDC Plan.

3.3 Implementing the Stipulations

3.3.1 Development and Implementation of the Spring Valley Plan

The Spring Valley Plan (BWG, 2009) outlines the following goals:

1. establish baseline conditions of groundwater-influenced ecosystems within the IBMA and identify trends in indicators of the condition of these biotic communities prior to groundwater withdrawal by SNWA;
2. establish the range of variability for indicators of the condition of groundwater-influenced ecosystems in the IBMA prior to groundwater withdrawal by SNWA;
3. assess the response of groundwater-influenced ecosystems to groundwater withdrawal by SNWA;
4. give early warning of unreasonable adverse effects to groundwater-influenced ecosystems in the IBMA and/or any adverse effect to GBNP due to groundwater withdrawal by SNWA;
5. determine if an observed or predicted response is likely attributable to SNWA's groundwater withdrawal; and,
6. direct and evaluate management actions for the purpose of maintaining or enhancing the baseline biological integrity and ecological health of the IBMA over the long term.

The BWG used components of TNC's Conservation Action Planning (CAP) process to develop the Spring Valley Plan. The CAP process is a proven and internationally-used science-based approach to conservation planning. Figure 3-1 illustrates how the BWG applied the CAP process to construct the Spring Valley Plan. The BWG applied the CAP process to:

1. identify groundwater-influenced ecosystems and species that will be the targets of BWG conservation efforts;
2. identify key ecological attributes essential to the long-term viability of those targets; and,
3. identify indicators to assess each key ecological attribute, including those that may be used to predict potential adverse effects and/or show early warning of effects from SNWA's groundwater pumping.

Using the CAP process, the BWG selected groundwater-influenced ecosystems within the IBMA to monitor which, with reasonable judgment, could be directly or indirectly impacted by SNWA withdrawal of groundwater from Spring Valley. The BWG also considered the perennial or ephemeral nature of systems and their relative reliance on groundwater, with a goal of maximizing the BWG and TRP's ability to predict, detect and explain potential effects. Based on these criteria, the BWG selected seven groundwater-influenced ecosystems to monitor within the IBMA established by the Stipulation: springs, ponds, perennial streams, wetlands, meadows, phreatophytic shrublands, and swamp cedar woodlands [i.e., Rocky Mountain juniper woodlands]. Ecosystems considered but subsequently dismissed from inclusion the Spring Valley Plan were mountain block springs,

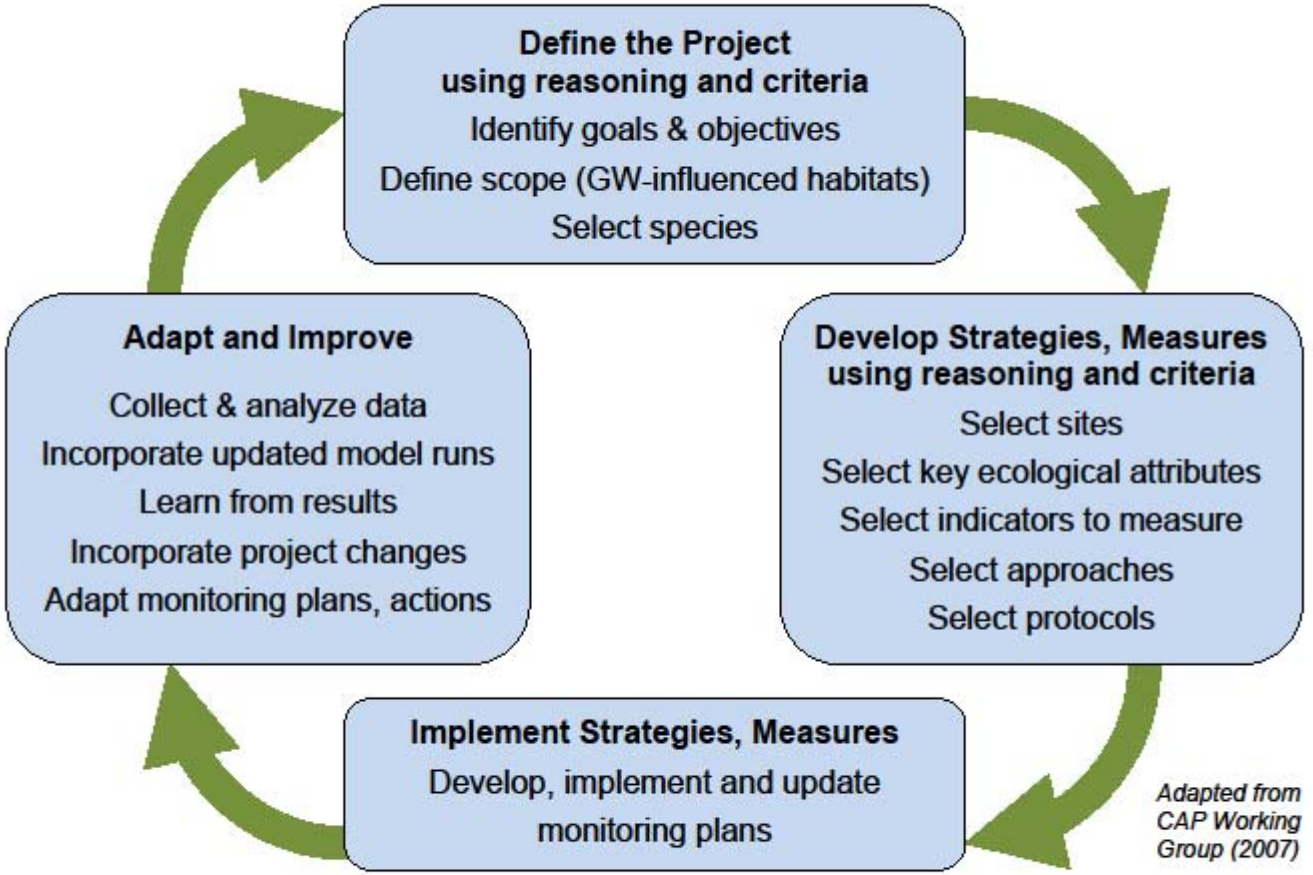


Figure 3-1
BWG and BRT Use of TNC Conservation Action Planning (CAP) Process

mountain block originating streams, ephemeral streams, and playas. In coordination with the TRP, the BWG based dismissal of these ecosystems due to no or low likelihood of direct or indirect impacts by SNWA withdrawal of groundwater from Spring Valley.

To provide the best opportunity for achieving the Common Goals of the Stipulation, the BWG used explicit decision-making criteria to select species, key ecological attributes and indicators to monitor. The BWG selected species to monitor based on the following criteria:

1. dependent upon a groundwater-influenced ecosystem that may be affected by SNWA groundwater withdrawal;
2. known to occur or may potentially occur in the IBMA where they rely on a groundwater-influenced ecosystem for one or more life stages; and,
3. either

    a. federally listed threatened or endangered species, Nevada BLM sensitive species, or Nevada- or Utah-listed species; or,
    b. designated by the BWG based on their ecological role in the IBMA.

The BWG selected key ecological attributes and indicators to measure based on the following criteria:

1. strongly related to the status of the groundwater-influenced ecosystem and possibly essential to its viability;
2. good indicator of ecosystem health, including those that may provide early warning of adverse impacts due to SNWA groundwater withdrawal; and,
3. reasonably feasible and efficient to measure.

The BWG also applied clear reasoning to select monitoring sites within the IBMA. The BWG selected monitoring sites based on the following factors:

1. presence of species to be directly monitored (see below);
2. habitat requirements of species to be indirectly monitored via a habitat-based approach (see below);
3. location relative to hydrologic monitoring;
4. location relative to points of diversion granted in the vacated Ruling 5726 (NSE, 2007) and SNWA groundwater exploratory areas;
5. spatial coverage within the IBMA;
6. levels of disturbance;
7. mitigation potential;
8. access; and,
9. possible use as a reference site. A total of 28 biological monitoring sites across the IBMA were established (Figure 3-2).

The Spring Valley Plan encompasses two approaches to monitoring. The first is direct monitoring of species that have strong ties to aquatic groundwater-influenced ecosystems (fish, springsnails, amphibians, macroinvertebrates, and aquatic and phreatophytic vegetation), along with components

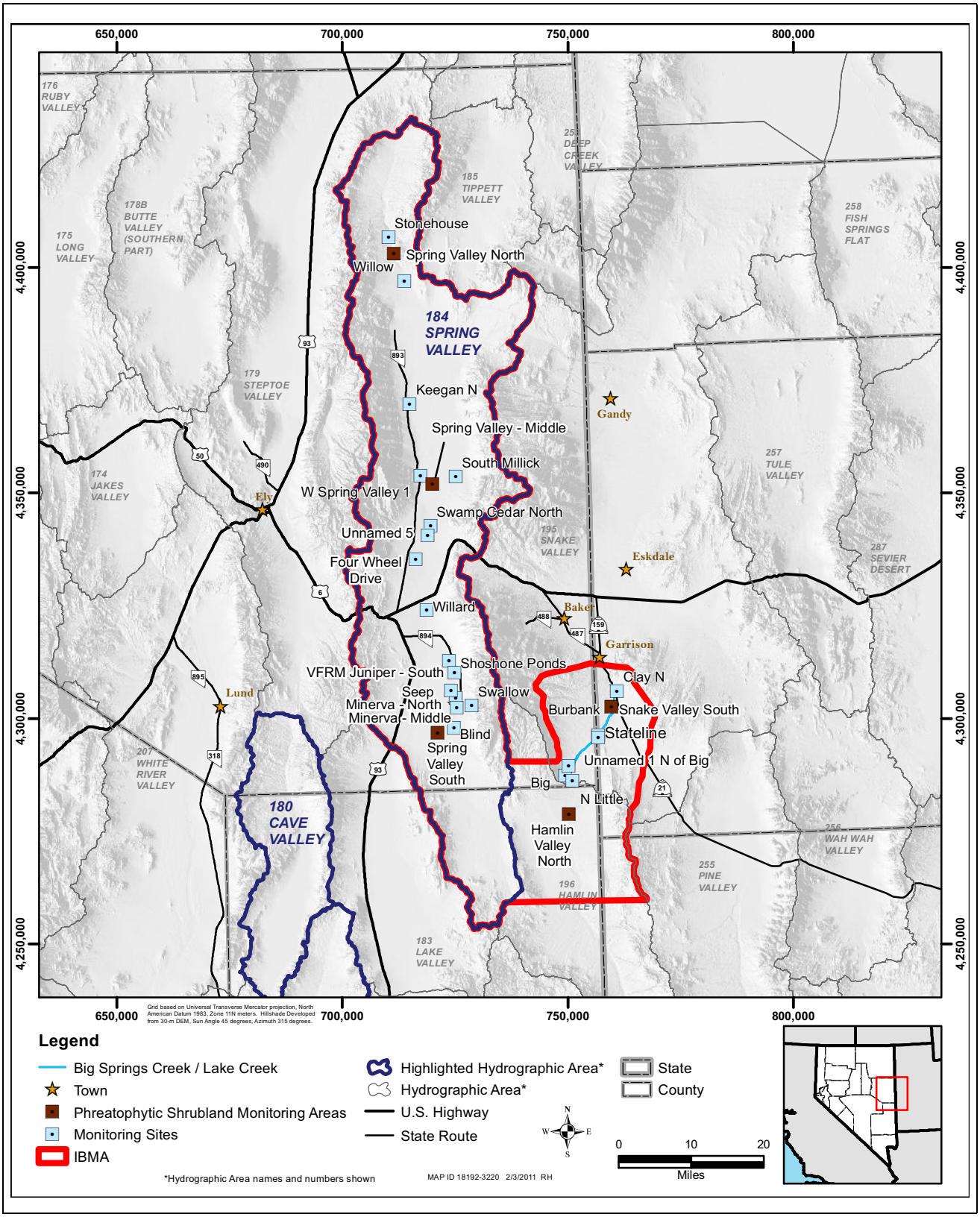


Figure 3-2
Biological Monitoring Sites in the IBMA, Spring Valley Stipulation

of their abiotic and biotic habitat. Selecting these species for direct monitoring provides the BWG the best opportunity to correlate species' responses with ecosystem changes that may result from SNWA groundwater withdrawal. The second is indirect monitoring of wide-ranging or migratory animals (e.g., birds, bats and big game) that use aquatic groundwater-influenced ecosystems but are not ideal species to monitor because of the many other factors of influence across their range. These species are indirectly monitored via a habitat-based approach, meaning that particular components of the species' habitat are monitored, but not the species themselves. Using both approaches, the BWG considered habitat requirements when determining habitat indicators to monitor.

In accordance with the most up-to-date scientific approach to long-term monitoring, the Spring Valley Plan is designed to be adaptive (Figure 3-1 and Figure 6-3). The adaptive approach allows the Spring Valley Plan to evolve in response to new information and technologies, changes in monitoring questions or goals, and changes in analytical approach, while ensuring the integrity of the long-term data record. As part of this adaptive approach, the BWG and TRP will routinely evaluate hydrology data (e.g., spring discharge, spring water quality, and groundwater monitoring well data) and groundwater flow modeling results, as well as consider any future NSE rulings, changes in permitted points of diversion, and production well locations, to inform biological monitoring, management, and mitigation needs.

The Spring Valley Plan requires that seven years of baseline biological data be collected prior to SNWA groundwater withdrawal from Spring Valley, and that biological data collection continue during groundwater withdrawal. Biologic monitoring efforts were conducted in accordance with the Spring Valley Stipulation and the vacated NSE Ruling 5726 in 2009 and 2010; annual reports (SNWA, 2010a and 2011a) have been submitted to the EC and NSE. Currently, the BWG is conducting a scientific evaluation of the Spring Valley Plan, and will revise components, methods and approaches as needed to continue to meet the needs of the Stipulation and future NSE rulings. To meet Spring Valley Plan requirements, the BWG plans to resume full monitoring efforts five years prior to GWD Project groundwater withdrawal from Spring Valley.

3.3.2 Development and Implementation of the DDC Plan

The DDC Plan (BRT, 2011) outlines the following goals:

1. describe baseline conditions of Special Status Species[1] and/or their habitats within the Area of Interest that may be affected by SNWA groundwater withdrawal;
2. identify the range of variability and trends for indicators of the conditions of Special Status Species and/or their habitats;
3. assess the response of Special Status Species and/or their habitats with respect to hydrologic changes resulting from SNWA groundwater withdrawal;
4. determine if an observed or predicted change in an indicator is likely attributable to SNWA groundwater withdrawal;

1. In accordance with Exhibit A of the DDC Stipulation, the DDC Plan is focused on Special Status Species and their habitats within the Area of Interest that are most likely to be affected by any hydrologic changes that may result from SNWA's groundwater withdrawals in DDC.

5. detect and provide early warning of potential unreasonable adverse effects to Federal Resources, Special Status Species and/or their habitat; and,
6. provide recommendations to the EC regarding potential actions and timelines to avoid and/or mitigate unreasonable adverse effects to Federal Resources, Special Status Species and/or their habitat.

Like the Spring Valley Plan, the BRT used components of TNC's CAP process to develop the DDC Plan. The CAP process is a proven and internationally-used science-based approach to conservation planning. Figure 3-1 (adapted from CAP Working Group, 2007) illustrates how the BRT applied the CAP process to construct the DDC Plan. The BRT applied the CAP process to:

1. identify groundwater-influenced ecosystems and Special Status Species that will be the targets of BRT conservation efforts;
2. identify key ecological attributes essential to the long-term viability of those targets; and,
3. identify indicators to assess each key ecological attribute, including those that may be used to predict potential adverse effects and/or give early warning of effects from SNWA's groundwater withdrawal.

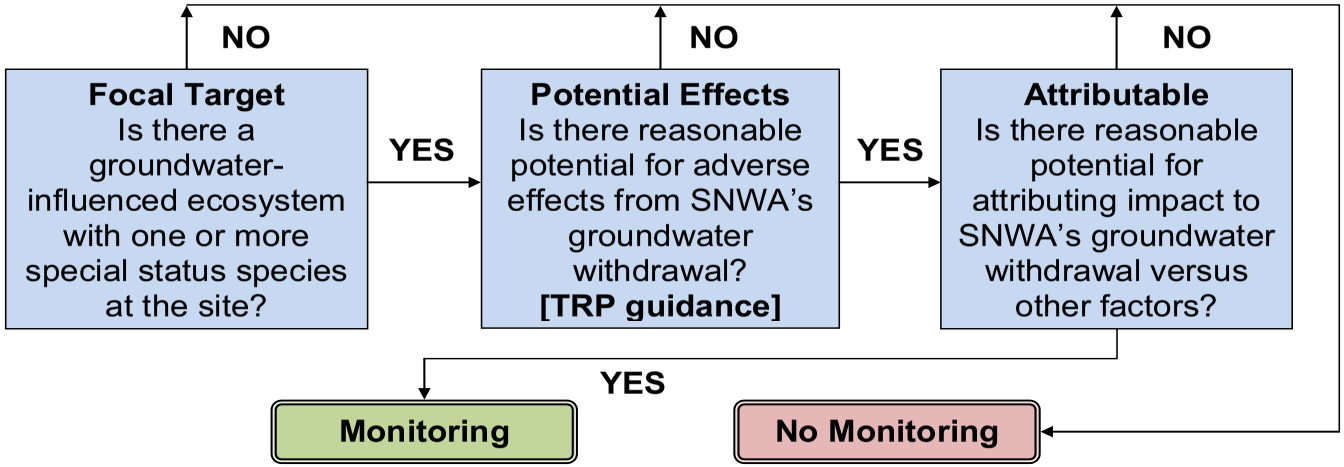
Using the CAP process, the BRT selected groundwater-influenced ecosystems to monitor that might be directly or indirectly impacted by SNWA withdrawal of groundwater from DDC based on best available information and TRP guidance. The BRT also considered the perennial or ephemeral nature of systems and their relative reliance on groundwater, with a goal of maximizing the BRT and TRP's ability to predict, detect and explain potential effects. Based on these criteria, the BRT selected three groundwater-influenced ecosystems to monitor within the Area of Interest: spring complexes, perennial streams, and meadows.

To provide the best opportunity for achieving the Common Goals of the Stipulation, the BRT used explicit decision-making criteria to select key ecological attributes and indicators to monitor. The BRT selected key ecological attributes and indicators to monitor based on the following criteria:

1. strongly related to the status or condition of the groundwater-influenced ecosystem or Special Status Species habitat and possibly essential to its viability;
2. good indicator of ecosystem health, and may provide early warning of adverse effects resulting from SNWA groundwater withdrawal; and,
3. reasonably feasible and efficient to measure.

The BRT used a decision-making tree to assist in selecting monitoring sites within the Area of Interest. Figure 3-3 illustrates the decision-making process for selecting monitoring sites. Stepwise criteria within the decision making tree are:

1. is there a groundwater-influenced ecosystem with one or more Special Status Species at the site; if so,
2. is there reasonable potential for adverse effects from SNWA groundwater withdrawal; and if so,
3. is there a reasonable potential for attributing impact to SNWA groundwater withdrawal versus other factors.



Some sites are monitored although they do not meet all three criteria (e.g., DDC sites not predicted to be impacted).

Additional Factors

- Proximity to hydrologic monitoring sites
- Access
- Anthropogenic or natural disturbance
- Mitigation potential
- Possible use as a reference site
- BRT or public interest

Figure 3-3
BRT Decision-making Process for Selecting Monitoring Sites

The BRT relied heavily on guidance from the TRP relative to the second criterion. Additional factors influencing site selection included proximity to hydrologic monitoring sites, access, level of anthropogenic or natural disturbance, mitigation potential, and possible use as a reference site. As specified in the Stipulation, the BRT focused on valley floor and range-front sites where Special Status Species occur; considered Greater Sage-Grouse breeding/late brood rearing habitat; and considered areas managed by state and federal agencies for wildlife (Pahranagat NWR, Key Pittman WMA, and Kirch WMA).

The DDC Plan establishes a total of 16 biological monitoring sites across the Area of Interest (Figure 3-4). The BRT selected ten biological monitoring sites in southern White River and Pahranagat valleys and six monitoring sites in DDC. Not all of these sites meet the three criteria listed above. Based on current hydrologic evidence and CCRP Model simulations, SNWA predicts that some of the White River Valley and Pahranagat Valley monitoring sites are unlikely to be affected by SNWA groundwater withdrawal; however, the sites were included in the DDC Plan because of a lack of BRT and TRP consensus on the matter. The DDC Plan also includes reference sites that the BRT and TRP agreed would be unlikely to be affected. The BRT and TRP were in consensus that there was no reasonable potential for adverse effects to areas of interest in DDC from SNWA groundwater withdrawal. However, because these are valleys of proposed groundwater withdrawal, the BRT selected biological monitoring sites that provide the best available representation of water resources in DDC (according to the TRP), including sites with Special Status Species.

The DDC Plan encompasses two approaches to monitoring. The first is direct monitoring of species that have strong ties to aquatic groundwater-influenced ecosystems (fish, springsnails, amphibians, macroinvertebrates, and aquatic and phreatophytic vegetation), along with components of their abiotic and biotic habitat. Selecting these species for direct monitoring provides the BRT the best opportunity to correlate species' responses with ecosystem changes that may result from SNWA groundwater withdrawal. The second is indirect monitoring of wide-ranging or migratory animals (e.g., birds, bats, and big game) that use the aquatic groundwater-influenced ecosystems but are not ideal species to monitor because of the many other factors of influence across their range. These species will be indirectly monitored via a habitat-based approach, meaning that particular components of the species' habitat are monitored, but not the species themselves. To be in accordance with Exhibit A of the Stipulation, the BRT focused on Special Status Species. Using both approaches, the BRT considered habitat requirements when determining habitat indicators to monitor.

In accordance with the most up-to-date scientific approach to long-term monitoring, the DDC Plan is designed to be adaptive (Figure 3-1 and Figure 6-3). The adaptive approach allows the DDC Plan to evolve in response to new information and technologies, changes in monitoring questions or goals, and changes in analytical approach, while ensuring the integrity of the long-term data record. As part of this adaptive approach, the BRT and TRP will routinely evaluate hydrology data (e.g., spring discharge, spring water quality, and groundwater monitoring well data) and groundwater flow modeling results, as well as consider any future NSE rulings, changes in permitted points of diversion, and production well locations, to inform biological monitoring, management, and mitigation needs.

The DDC Plan requires that three years of baseline biological data be collected prior to SNWA groundwater withdrawal from DDC, and that biological data collection continue during groundwater

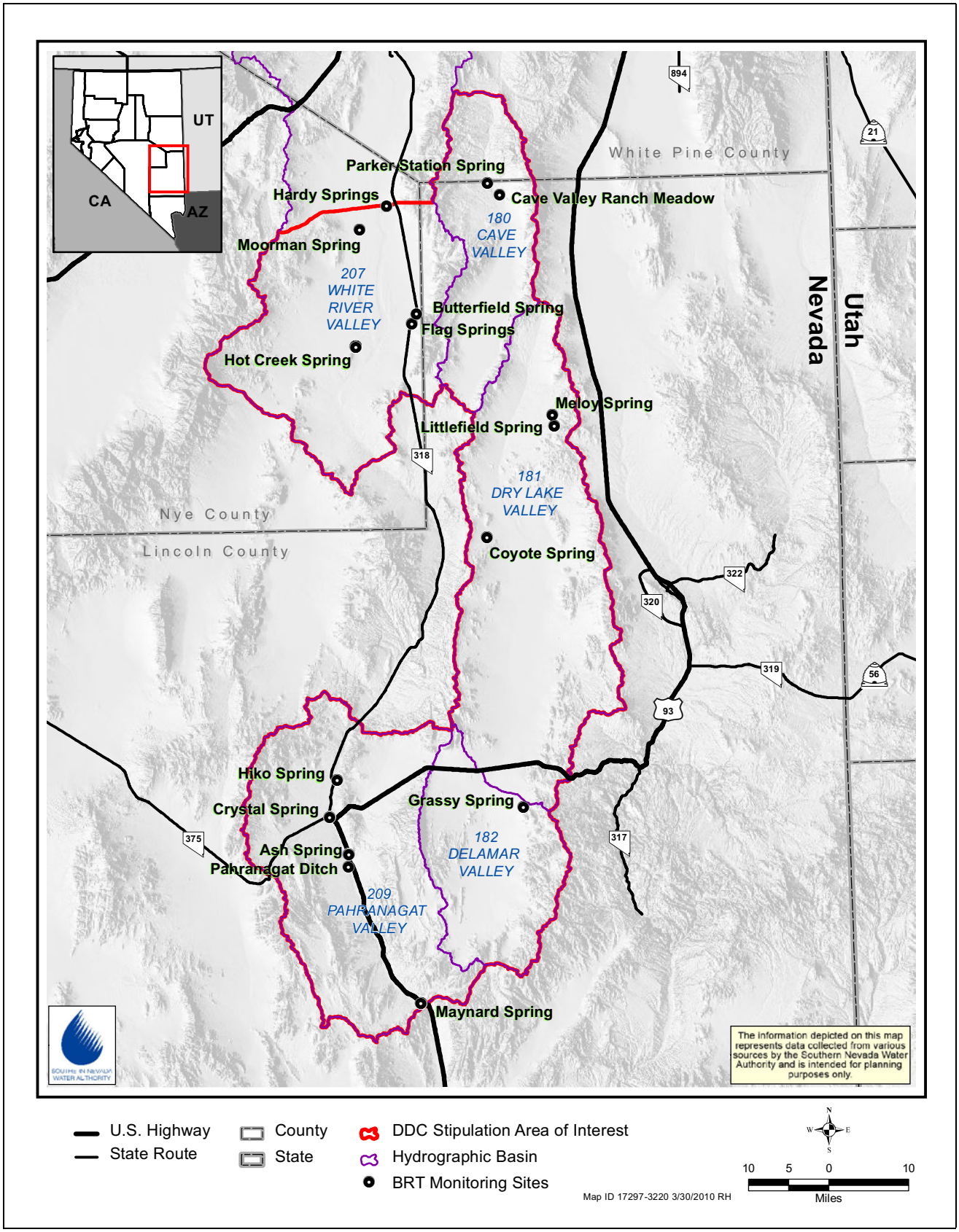


Figure 3-4
Biological Monitoring Sites in the Area of Interest, DDC Stipulation

withdrawal. To address the fact that areas of interest in DDC are in the mountain block and are not predicted to be affected by SNWA groundwater withdrawal from DDC, and that the technical findings in the vacated NSE Ruling 5875 (NSE, 2007) did not predict effects to White River Valley for decades or Pahranagat Valley for centuries, the DDC Plan is designed to collect a basic suite of baseline data during the initial phases of monitoring and scale up to more intensive baseline data collection starting ten years prior to predicted potential effects at a given site (using adaptive monitoring). The BRT plans to initiate biological monitoring efforts three years prior to projected SNWA groundwater withdrawal from DDC.

4.0 BASELINE BIOLOGICAL INVESTIGATIONS

SNWA has conducted, contracted, or assisted with biological investigations across 40 valleys in the vicinity of the GWD Project area since 2000 (Table 4-1). Investigations have been conducted in the project basins (Delamar, Dry Lake, Cave, and Spring valleys), adjacent valleys within the White River and Great Salt Lake Desert Flow systems, and other surrounding valleys. Focal areas of biological investigations include:

1. groundwater-influenced habitats within and adjacent to GWD Project valleys (springs, ponds, perennial streams, wetlands, meadows, phreatophytic shrublands, phreatophytic woodlands, and playas);
2. GWD Project proposed and alternate pipeline and power line alignments; and,
3. SNWA groundwater exploratory areas.

The primary objectives of collecting baseline biological data have been to support and inform environmental planning, environmental compliance, and optimize GWD Project design. Specifically, biological investigations have been conducted to:

1. provide baseline data for the GWD Project Environmental Impact Statement (EIS);
2. provide baseline data for the GWD Project Section 7 consultation;
3. inform and implement the Biological Monitoring Plans pursuant to the Spring Valley and DDC Stipulations (Stipulation, 2006 and 2008);
4. inform future conservation agreements and stipulated agreements within the GWD Project area;
5. inform future conservation, management, and mitigation on SNWA Northern Resources properties; and,
6. inform GWD Project design to help minimize impacts to sensitive environmental resources and sensitive areas (Table 4-1).

As part of this process, SNWA has also assisted with state-wide wildlife monitoring efforts and Recovery Implementation Team (RIT) efforts for federally listed species.

The data provided by the biological investigations listed in Table 4-1 as well as other well-documented external investigations conducted by outside scientists and organizations, provide the basis for the information presented in this report. All biological investigations listed in Table 4-1 were conducted using standard state and federal agency protocols; standard scientific protocols; and/or protocols developed through scientific collaboration among scientists, organizations, and agencies. Protocols were either applied directly or were modified or enhanced to meet the needs of the data collection efforts in a scientifically appropriate manner. All data were collected and are being managed in a transparent and standardized manner, and all finalized data sets and reports are available to the public.

4.1 Stipulated Agreements

4.1.1 Biological Monitoring Plan for the Spring Valley Stipulation

Biologic monitoring efforts were conducted in accordance with the Biological Monitoring Plan for the Spring Valley Stipulation in 2009 and 2010 (SNWA, 2010a and 2011a). Surveys took place within the stipulated IBMA, which includes Spring Valley, northern Hamlin Valley, and the Big Springs Creek sub-watershed in southern Snake Valley (Figure 4-1). Aquatic surveys were conducted at 17 spring sites, 1 pond site and 6 perennial stream reaches; wetland/meadow vegetation surveys were conducted at 8 sites; phreatophytic shrubland vegetation surveys were conducted at 5 sites distributed across the IBMA; and woodland vegetation surveys were conducted within 2 valley-floor Rocky Mountain juniper (swamp cedar) populations. Depending on occurrence, fish, northern leopard frogs, springsnails, macroinvertebrates, vegetation, and habitat data were collected as part of the aquatic surveys. Protocols were followed as described in the Biological Monitoring Plan; developed collaboratively by the BWG, the protocols are modified standard protocols from DRI, NPS, United States Geological Survey (USGS), Nevada Department of Wildlife (NDOW), and UDWR.

A total of 81,112 lines of data (in Excel) were collected for the 2 years combined. Additionally, SNWA staff contributed 2,160 person days of time for 2009 and 2010 combined. This included administration, field data collection and data processing, and report writing efforts. This number does not include environmental consultant time or time spent by the other members of the BWG assisting with data Quality Assurance/Quality Control (QA/QC). Annual reports for the 2009 and 2010 surveys (SNWA, 2010a and 2011a) were submitted to the NSE and disseminated to the BWG and State Engineer as described in section 3.0 of this report.

4.2 Aquatic Ecosystems

4.2.1 Ecological Evaluation of Aquatic Ecosystems in the GWD Project Study Area

From 2004 through 2006, SNWA contracted BIO-WEST Inc. to conduct an ecological evaluation of aquatic ecosystems within 13 hydrographic basins in the GWD Project study area, including Delamar, Dry Lake, Cave, White River, Pahranagat, Spring, Hamlin, and Snake valleys. The purpose of this effort was to obtain baseline information on the aquatic communities in and around the proposed GWD Project area. Protocols were developed collaboratively and/or provided by DRI, NPS, USFWS, USGS, NDOW, and SNWA.

Fish, amphibian, springsnail, macroinvertebrate, vegetation, and habitat data were collected primarily at spring complexes at a total of 92 sites (Figure 4-2). A two-volume report was compiled (479 pages) documenting survey results, information gathered from literature review for the 92 surveyed sites plus additional in-accessible spring sites, and vegetation maps (BIO-WEST, 2007a), as well as a digital vegetation map dataset.

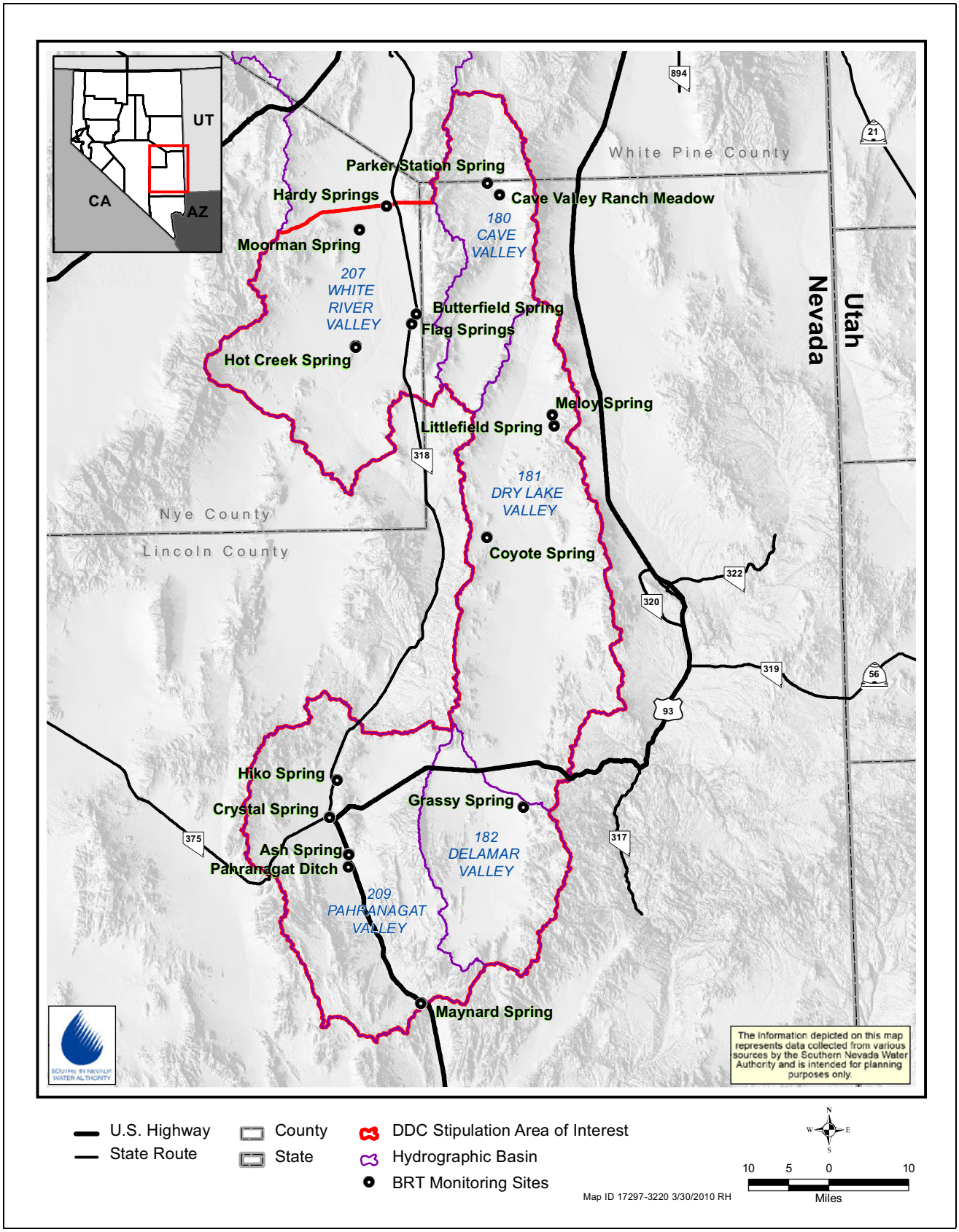


Figure 4-1
Locations of Biological Monitoring Sites for Spring Valley Stipulation

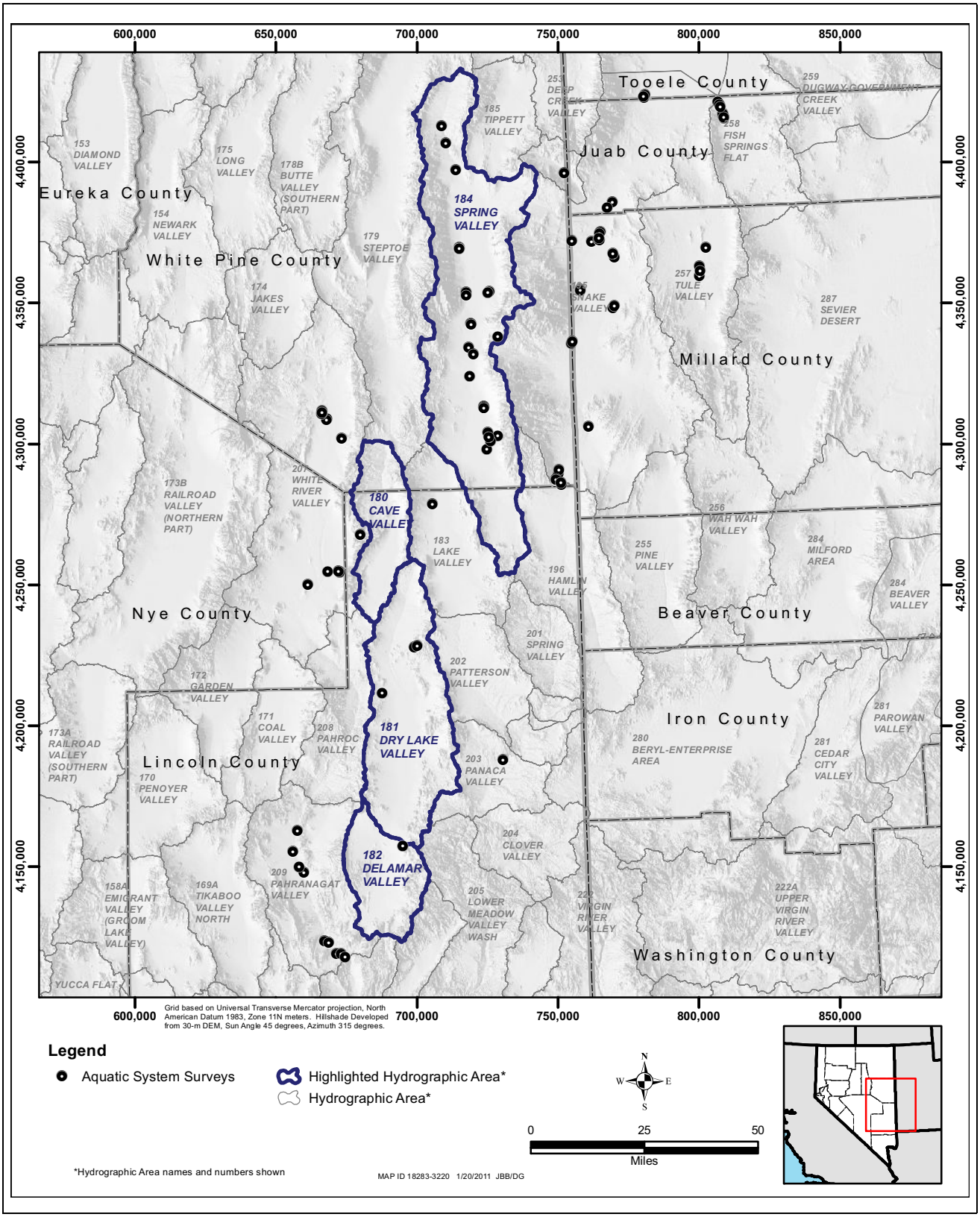


Figure 4-2
Ecological Evaluation Sites

4.2.2 Ecological Evaluation of Aquatic Ecosystems to Support Spring Valley Stipulation Biological Monitoring Plan Implementation

In 2008, SNWA contracted BIO-WEST, Inc. to conduct an ecological evaluation of selected spring complexes and pilot surveys within Spring and Snake valleys to support Spring Valley Stipulation Biological Monitoring Plan implementation. Specific objectives were to gain additional information regarding the spring complexes, better quantify the various abiotic and biotic components of the spring complexes, and test data collection protocols. This information was used to inform biological monitoring site selection and protocol development for the Biological Monitoring Plan. Protocols developed collaboratively by BWG were followed, which were modified standard protocols from DRI, NPS, USFWS, USGS, and NDOW.

Springs identified by the BWG as potential biological monitoring sites were sampled within Spring Valley (23 springs), and southern Snake Valley (3 springs) by BIO-WEST, Inc. from May through July 2008 (Figure 4-3). Data were collected on aquatic extent, water quality, physical habitat, fish, northern leopard frogs, macroinvertebrates, springsnails, and vegetation. A final report was prepared and disseminated to BLM, USFWS, and NDOW (BIO-WEST, 2009).

4.3 Amphibians

4.3.1 Amphibian Survey

In 2007, SNWA conducted surveys for amphibian occurrence and potential habitat at springs and wetlands in Spring, Snake, and Hamlin valleys (Figure 4-4). The purpose of this effort was to survey the valley floor within the GWD Project area. The western U.S. population of northern leopard frog is currently under 12-month status review by the USFWS for listing under the Endangered Species Act. The northern leopard frog was documented at two sites during this survey. This survey documented species within the region. A final report was prepared and disseminated to BLM, USFWS, and NDOW (SNWA, 2008 and SNWA, 2011c).

4.3.2 Northern Leopard Frog Survey

Focused surveys were conducted by SNWA in 2008-2009 to determine northern leopard frog distribution, breeding areas and potential habitat within Spring and Snake valleys (Figure 4-4). The purpose of this effort was to inform conservation, management, and mitigation on SNWA Northern Resources properties, and to support Spring Valley Stipulation Biological Monitoring Plan efforts. Area searches were conducted at springs and wetlands using a standard pedestrian survey protocol. A final report was prepared and disseminated to BLM, USFWS, and NDOW (SNWA, 2009b).

Out of the 25 sites visited in Spring Valley in 2008, 13 were found to have northern leopard frogs present (SNWA, 2009b). Eleven of the 25 sites in Spring Valley were designated as northern leopard frog monitoring sites in the Biological Monitoring Plan for the Spring Valley Stipulation (BWG, 2009).

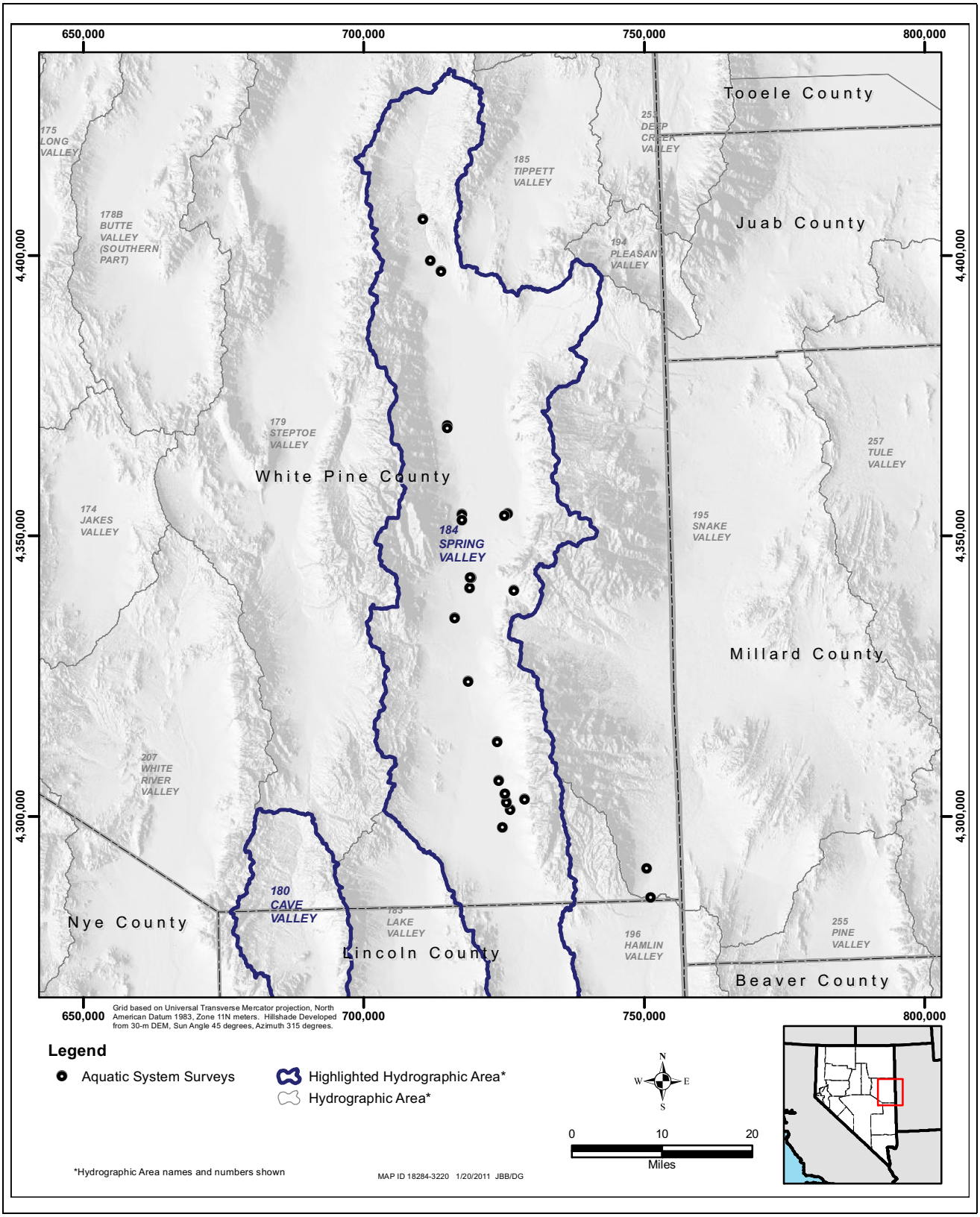


Figure 4-3
Aquatic Ecosystems Site Evaluations

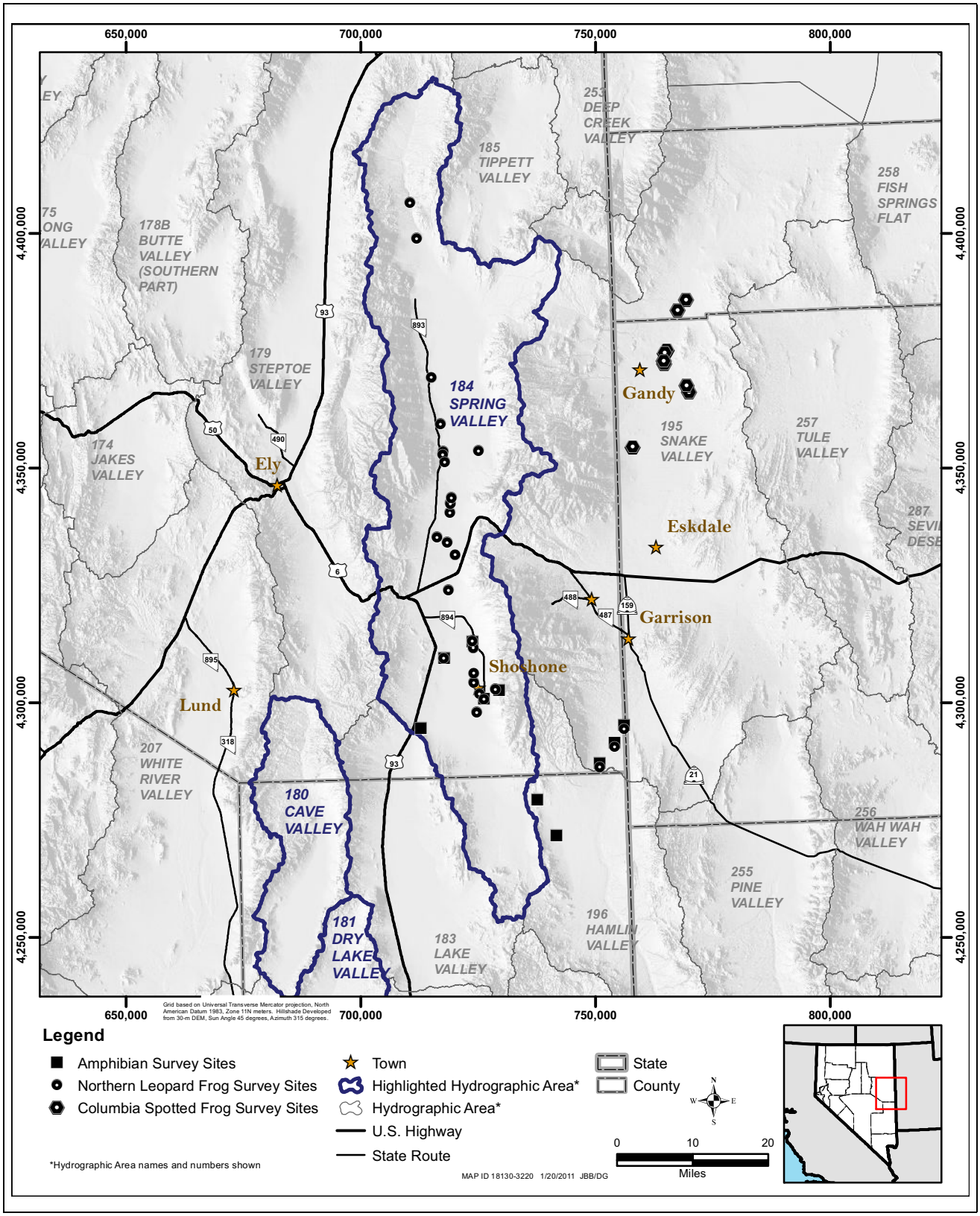


Figure 4-4
Amphibian Surveys

4.3.3 Columbia Spotted Frog

The Columbia spotted frog is considered a Conservation Species in the state of Utah. In August of 2009, SWNA became a signatory to the Conservation Agreement and Strategy for Columbia spotted frog (*Rana luteiventris*) in the state of Utah (UDWR, 2009a). As part of the conservation strategy, an annual population survey is conducted by the UDWR throughout the Utah distribution of Columbia spotted frog. This survey includes the population in northern Snake Valley which is spread over several sites. In March of 2006, 2009, and 2010, SNWA staff assisted in the annual population survey in Snake Valley, Utah (Figure 4-4). Population size and trend is determined by the number of egg masses documented at each location. A total of 1,732 Columbia spotted frog egg masses were documented at 6 sites in northern Snake Valley in 2009 (UDWR, 2009a). Annual reports are available to the public through UDWR.

4.4 Birds

4.4.1 Breeding Bird Surveys

The GBBO coordinated breeding bird surveys with SNWA as part of a long-term, state-wide breeding bird monitoring program. SNWA has provided assistance and funding to GBBO to increase the number of sampling areas and conduct surveys within 10 hydrographic basins in the vicinity of the GWD Project area, including Cave, White River, Pahranagat, Spring, Snake, Dry Lake, and Steptoe valleys (Figure 4-5). Surveys were conducted in various breeding habitats, including groundwater-influenced habitats (springs, perennial streams, wetlands, meadows, phreatophytic shrubland, and phyreatophytic woodlands). These surveys were conducted from 2004 to 2010, and contribute to the state-wide 1997-current database. Standard state-wide GBBO protocol, developed collaboratively with Partners in Flight, was followed. All data generated by this effort was provided to GBBO, which maintains the state-wide breeding bird database.

Breeding birds were inventoried using point count transects, supplemented with some targeted spot-mapping. Point count surveys were conducted throughout the project area and adjacent control area. Point count transects were 3 km long, on average, and contained 10 sample points along their length. Twenty-nine of these transects were established in 2004; the remainder were added in 2005 and 2006. Most of the 36 transects were visited multiple times in each of the 7 years.

A total of 114 species were detected during standard point count surveys in the project and control transects during the 7 years of survey. A total of 134 bird species were observed at project and control point count transects, and an additional 26 species were observed only during migratory shorebird surveys. A final report was prepared summarizing 2004-2007 data (GBBO, 2007a).

As part of GBBO and Partners in Flight breeding bird monitoring efforts, SNWA also contributed funding to the development of the Nevada Breeding Bird Atlas (Floyd et al., 2007), which is a 581-page published text with results, summaries and interpretations of the state-wide breeding bird counts. The atlas data base provided 7,729 records of confirmed breeding dates for birds of Nevada.

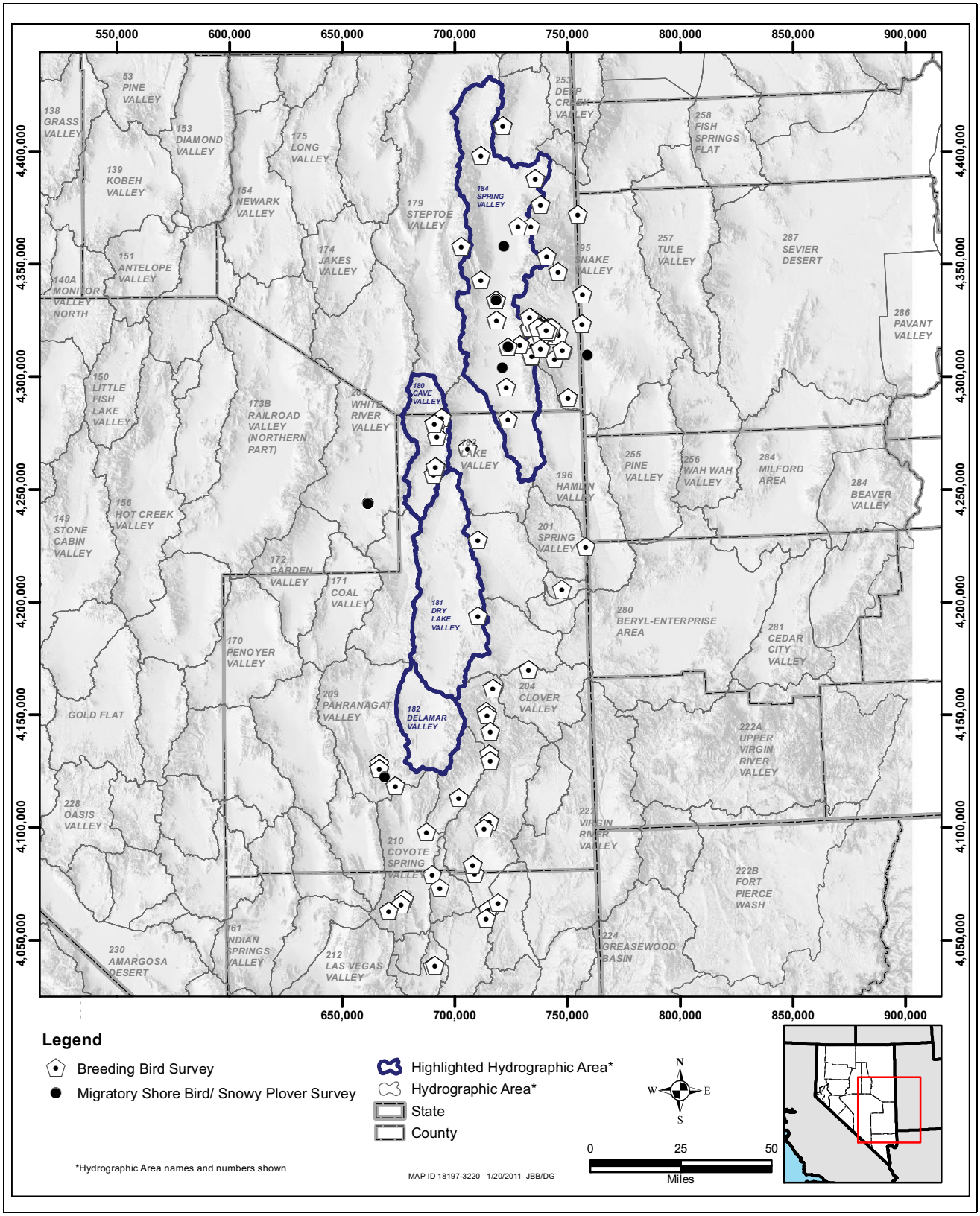


Figure 4-5
Breeding Bird, Migratory Shore Bird, and Snowy Plover Surveys

4.4.2 Migratory Shorebird and Snowy Plover Surveys

From 2004-2006, SNWA contracted GBBO to conduct a baseline inventory of migratory shorebirds within White River, Pahranagat, Spring, and Snake valleys (Figure 4-5). Migratory shorebird surveys focused on known major wetland and open-water complexes within the SNWA project area, including Pruess Reservoir, Pahranagat NWR, Kirch WMA, Key Pittman WMA, and Steptoe Valley WMA. Surveys were conducted at springs, ponds, lakes and wetlands, and a standardized state-wide protocol developed by GBBO in collaboration with Partners in Flight was followed.

In addition to multi-species surveys of aquatic sites, specific searches were conducted for Snowy Plovers in the project area, as part of the range-wide Western Snowy Plover inventory initiated by the USFWS and supported by the SNWA. The Snowy Plover surveys were conducted in all wetland sites that had historic records of the species and/or provided potentially suitable breeding or foraging habitat for the species. For the project area, the following Nevada sites were included: Yelland Dry Lake (north Spring Valley), Baking Powder Flat (south Spring Valley), Kirch WMA, and Key-Pittman WMA (Figure 4-5).

During the aquatic bird surveys focusing on migratory shorebirds, 62 species were detected at the 5 survey sites. Of the 62 species, 18 are conservation priority species in Nevada. Of these, all but 9 species were observed in the majority of the surveyed sites. Snowy Plovers were not detected at any of the Nevada sites surveyed. A final report was prepared and is publicly available (GBBO, 2007a).

4.4.3 Ferruginous Hawk Survey

SNWA provided funding to augment NDOW's ferruginous hawk nest surveys in 2005 as part of a long-term state-wide effort. SNWA funded additional helicopter time to allow NDOW to conduct helicopter and ground-truthing surveys for nests and potential nest habitat within nine valleys in the GWD Project area, including Delamar, Dry Lake, Cave, Spring, Hamlin, and Snake valleys (Figure 4-6). Standard NDOW protocol was followed.

During the 2005 survey, 94 feature events were recorded, consisting of 16 active nests, 47 inactive nests, and 31 other observations. Nine different species were positively identified, while two observations were unidentifiable and recorded as unknown raptors. A final report is publicly available (NDOW, 2005).

4.4.4 Greater Sage-Grouse Lek Survey

Since 2007, SNWA has assisted NDOW with annual monitoring of Greater Sage-Grouse leks as part of a long-term, state-wide effort. Using standard NDOW protocol, SNWA conducted surveys within Dry Lake, Cave, Lake, Spring, Hamlin, Snake, and Steptoe valleys, and has conducted searches for new leks and monitoring of known leks (Figure 4-7 and Figure 4-8). The surveys consisted of aerial helicopter surveys and on-the-ground lek visits. The main goal of the aerial survey was to establish the locations of any previously unidentified leks within 1 mi of the proposed alignment and laterals. Aerial lek surveys were flown for a total of 170 mi of the GWD proposed alignment (Figure 4-7).

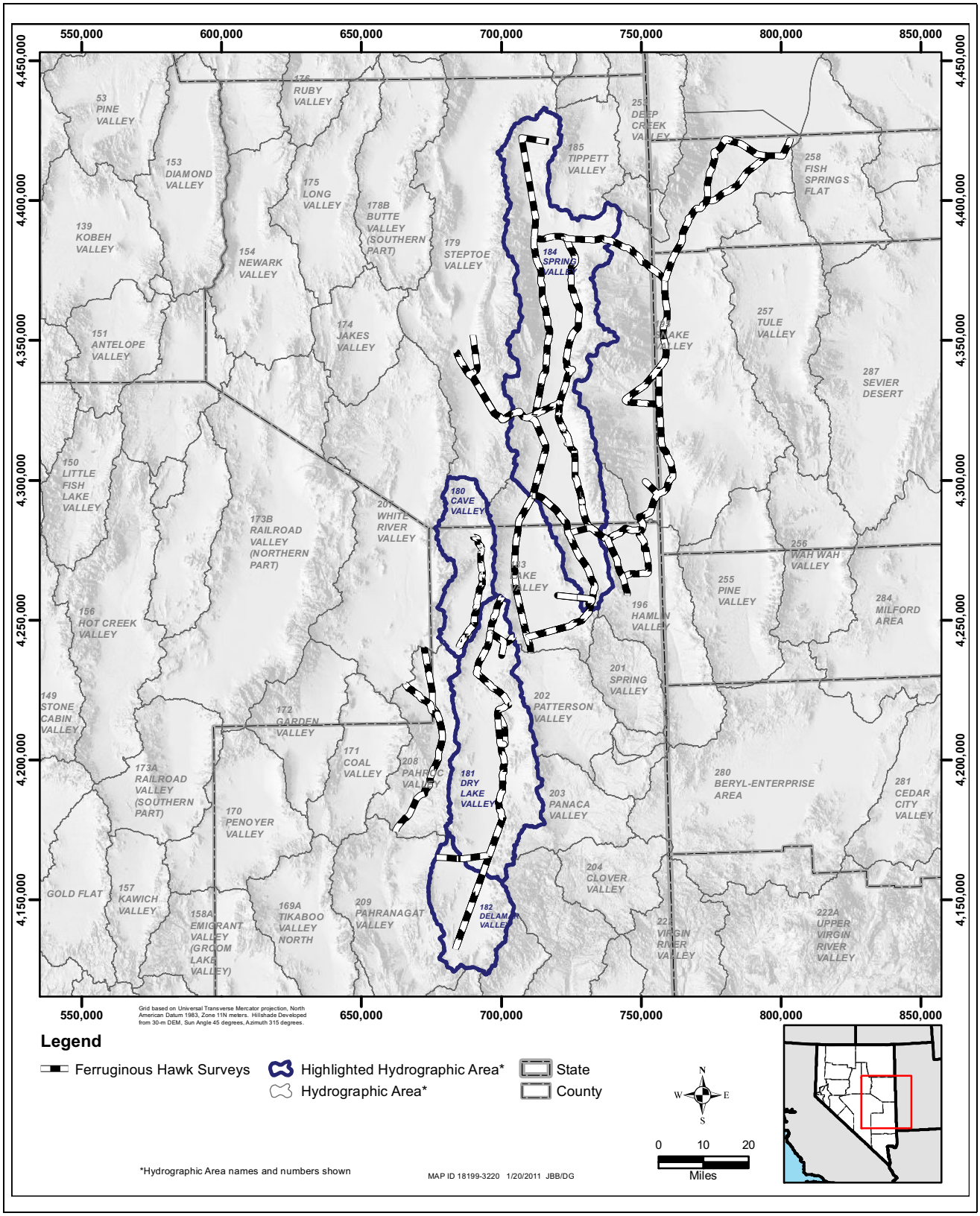


Figure 4-6
Ferruginous Hawk Survey

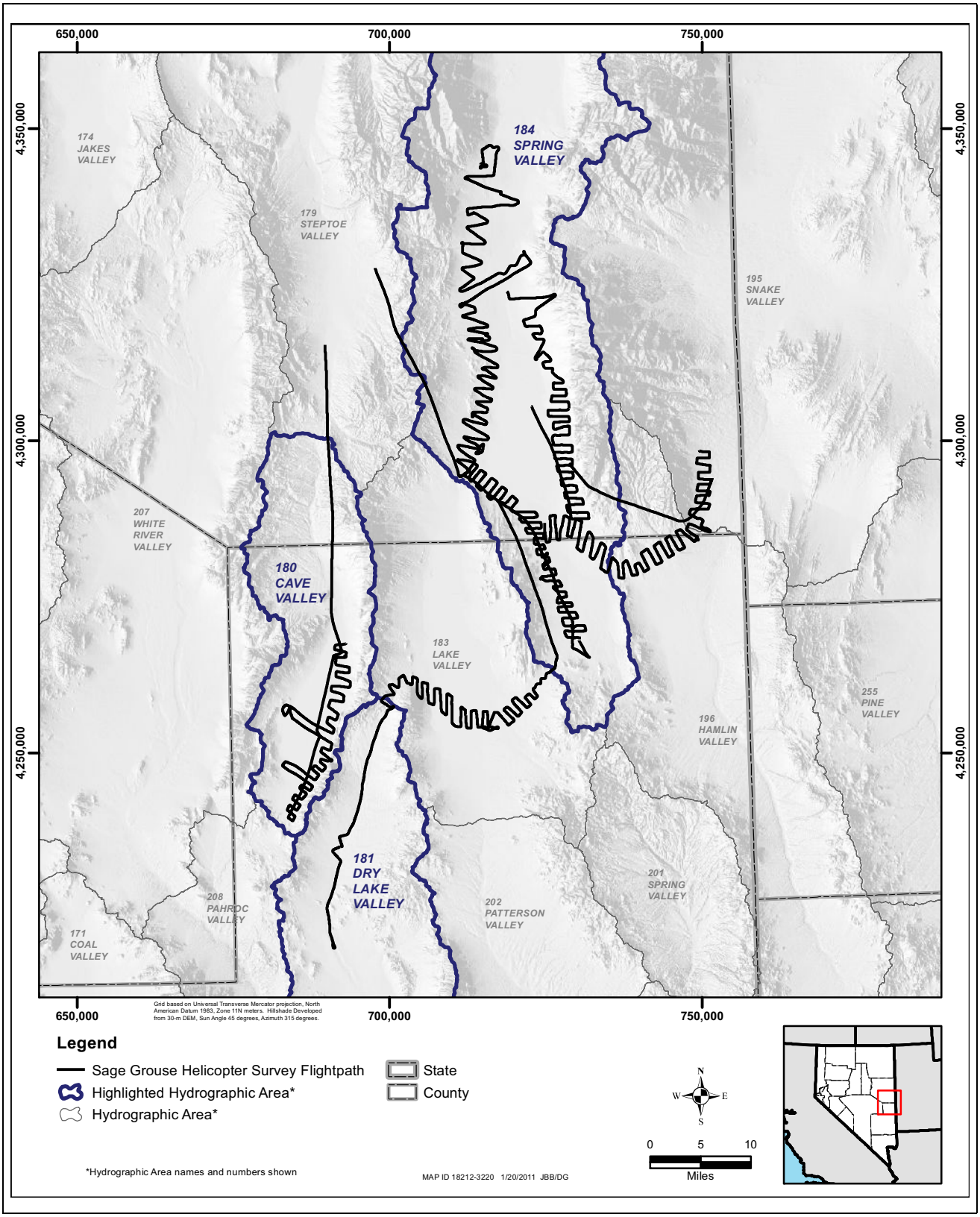


Figure 4-7
Greater Sage-Grouse Lek Surveys

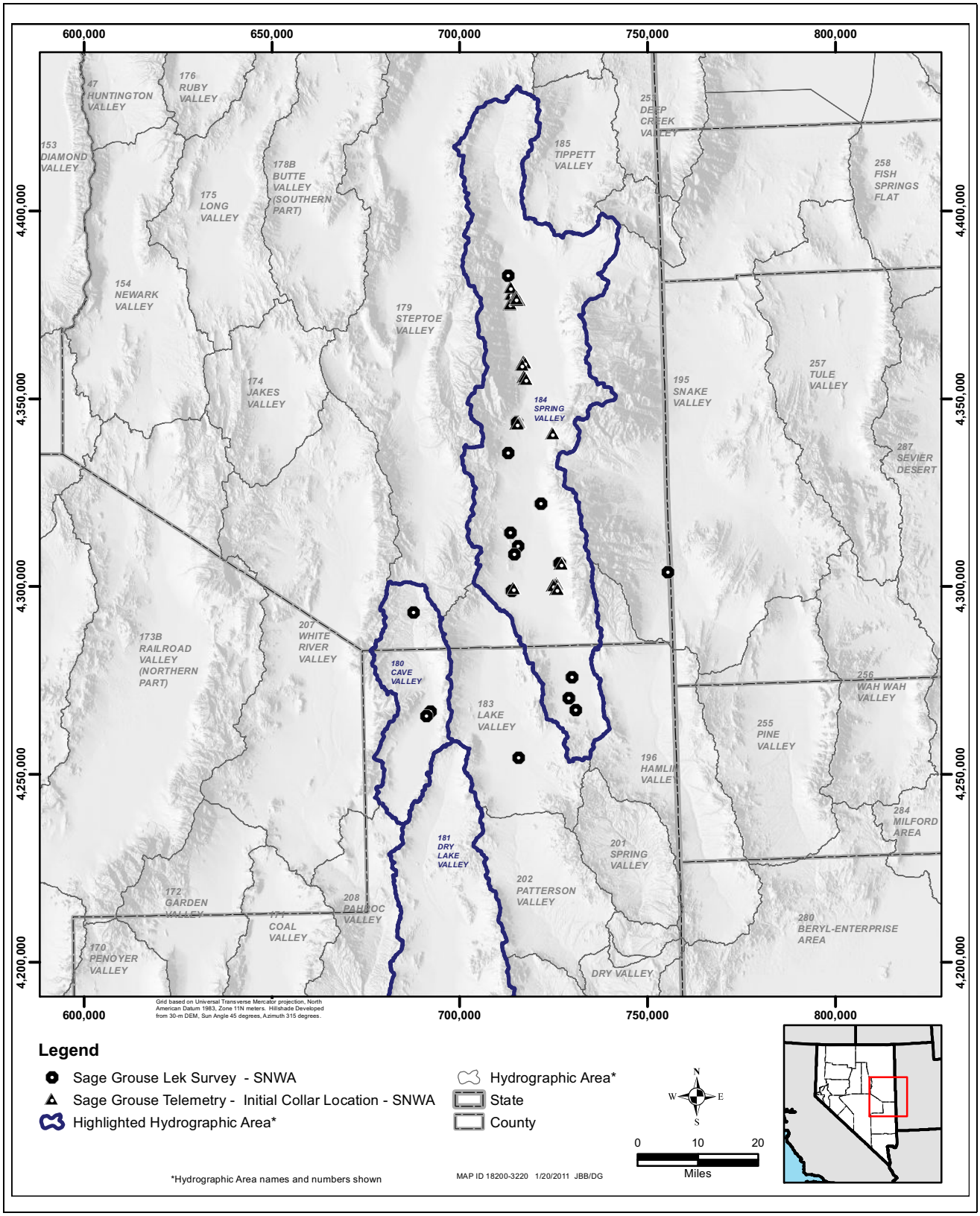


Figure 4-8
Greater Sage-Grouse Surveys

Eleven known lek locations were investigated with only one showing activity. No new lek locations were documented.

Currently, SNWA is conducting annual trend lek surveys in collaboration with NDOW at six sites in Spring Valley, which entails multiple visits to each lek during the breeding season. Three out of the six trend leks are on SNWA Northern Resources properties. All data is provided to NDOW, which maintains the state-wide Greater Sage-Grouse database, and final reports have been submitted (SNWA, 2007a and 2009b).

4.4.5 Greater Sage-Grouse Telemetry Survey

SNWA conducted a telemetry study from 2008 through 2010 to determine Greater Sage-Grouse movements within Spring Valley (Figure 4-8). The purpose of this research study was to inform conservation, management, and mitigation on SNWA properties and grazing allotments, including the development of a Candidate Conservation Agreement with Assurances with the USFWS. This study is part of a larger collaborative effort between NDOW, BLM, GBBO, and SNWA to gather information on Greater Sage-Grouse in eastern Nevada. Following standard NDOW protocol, collared birds were tracked every two weeks for over two years. Greater Sage-Grouse were tracked within a variety of habitats that included upland breeding areas (leks), brood rearing areas (wetlands and meadows), and wintering habitat.

During the two-year study, a total of 34 birds were collared and tracked. SNWA telemetry data has revealed the presence of two apparently unknown leks in Spring Valley. Individuals documented at multiple leks have been tracked to SNWA Northern Resources properties and associated grazing allotments. A report on the first year of data collection has been submitted (SNWA, 2009b and 2010c).

4.4.6 Southwestern Willow Flycatcher, Western Yellow-Billed Cuckoo, and Yuma Clapper Rail Surveys

Since 2000, SNWA has collaborated with NDOW and USFWS to survey for and monitor endangered, threatened and candidate bird species (Southwestern Willow Flycatcher, Western Yellow-Billed Cuckoo, and Yuma Clapper Rail (*Rallus longirostris yumanensis*), respectively) within southern and eastern Nevada. These surveys are part of long-term monitoring efforts to support the implementation of Recovery Plans and other state and federal conservation efforts. Data have been collected within eight valleys, including Pahranagat Valley, focusing on areas of known occurrence or potential breeding habitat at springs, perennial streams, lakes, and wetlands (Figure 4-9). Protocols used by neighboring state-wide monitoring programs are followed, as well as enhanced USFWS protocols for secretive marsh bird surveys. Survey results from SNWA's participation include observing Southwestern Willow Flycatcher and Yellow-Billed Cuckoo in Pahranagat Valley. Annual and summary reports are publicly available through NDOW (NDOW, 2008).

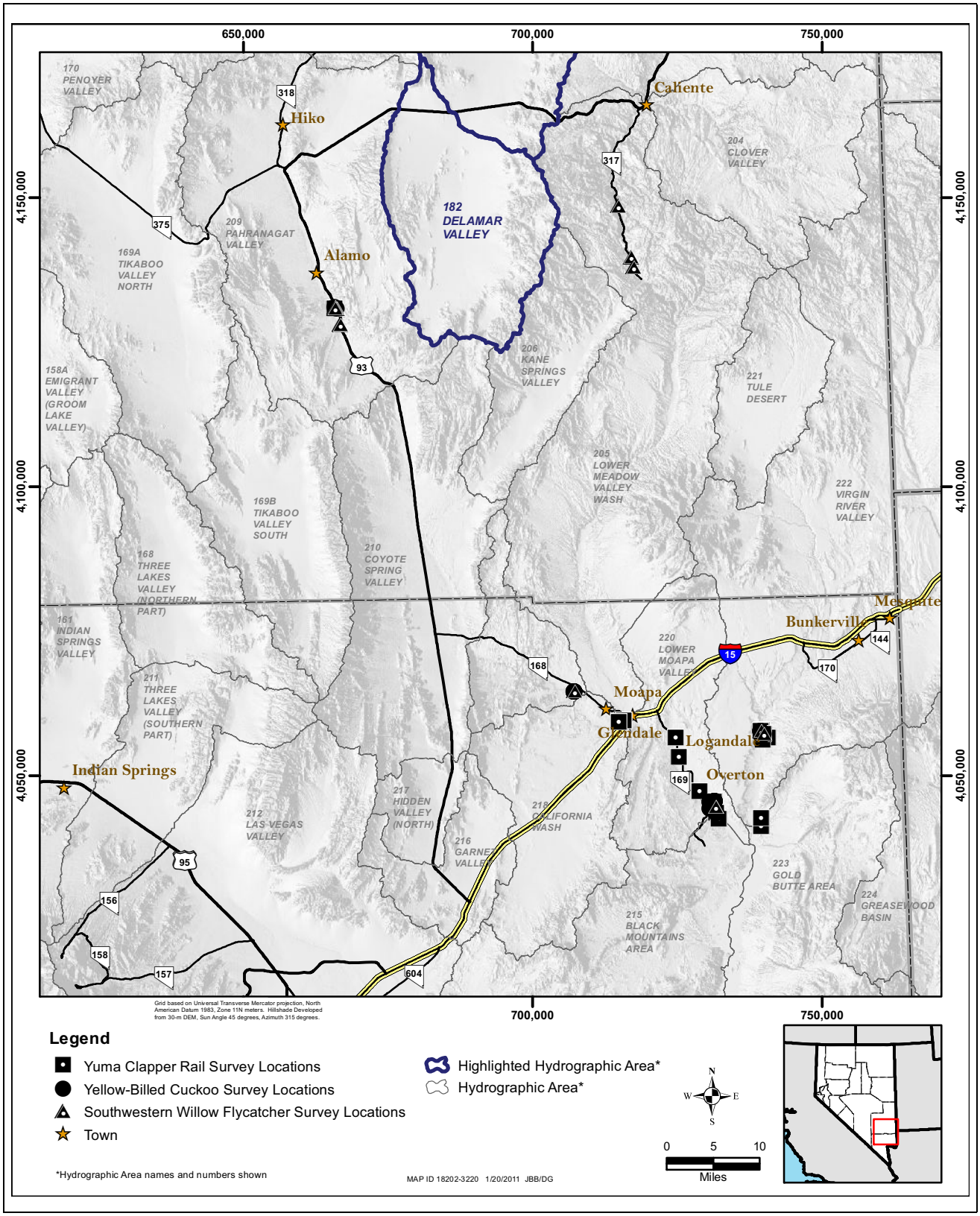


Figure 4-9
Southwestern Willow Flycatcher, WesternYellow-Billed Cuckoo, and Yuma Clapper Rail Surveys

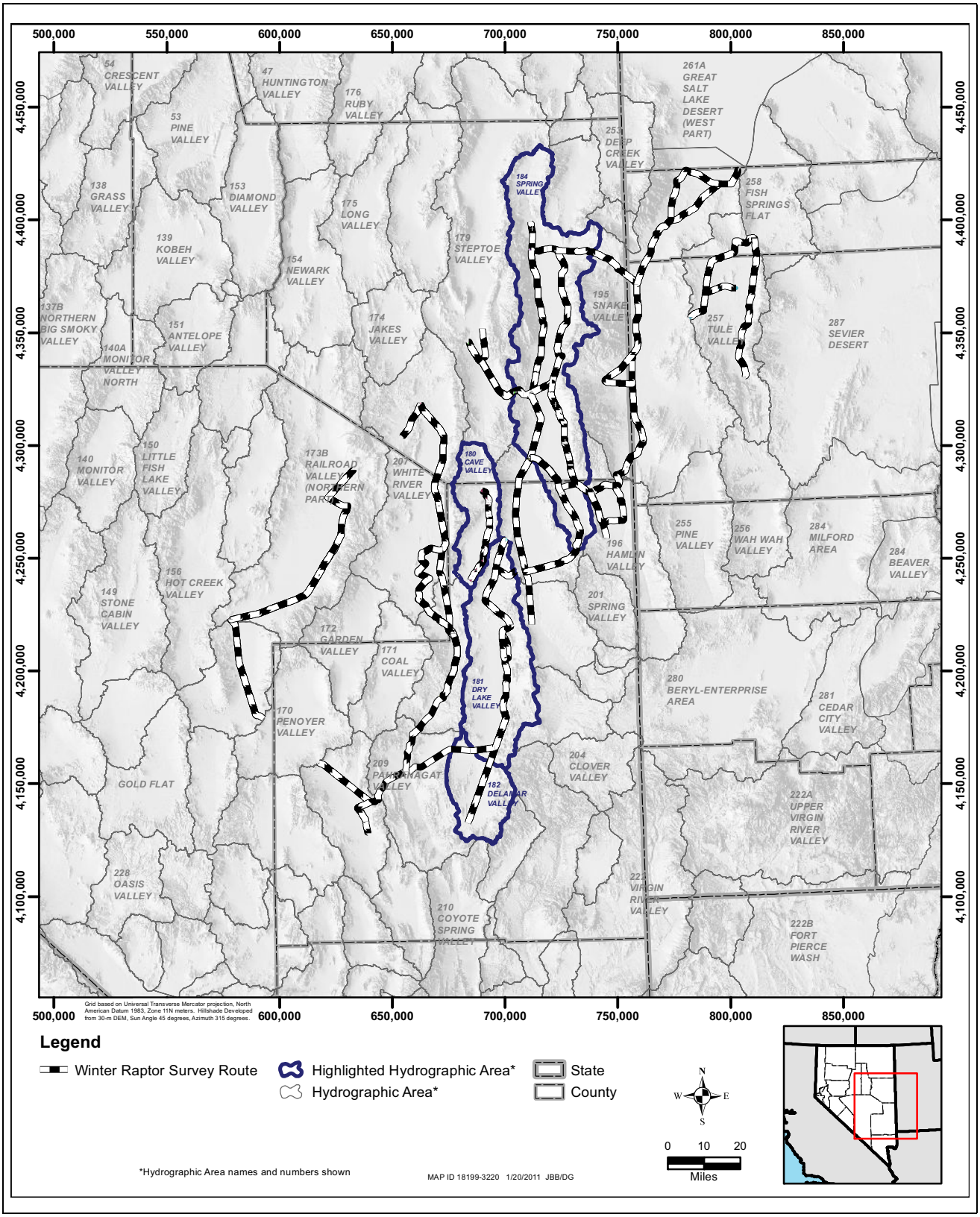


Figure 4-10
Winter Raptor Surveys

4.4.7 Winter Raptor Surveys

SNWA coordinated winter raptor surveys with GBBO as part of a long-term, state-wide winter raptor monitoring inventory. SNWA has provided assistance and funding to GBBO to increase the number of sampling areas and conduct surveys within 18 hydrographic basins, covering 800 mi, in the vicinity of the GWD Project area, including Delamar, Dry Lake, Cave, White River, Pahranagat, Spring, Hamlin, Snake, Tule, and Pahroc valleys (Figure 4-10). Surveys were conducted in various breeding habitats, including groundwater-influenced habitats. These surveys were conducted from 2005 to current, and contribute to the state-wide 2005-current database. A standardized state-wide protocol developed by GBBO in collaboration with Partners in Flight was followed.

Six hundred thirty-eight raptors were detected, totaling 11 species. The most abundant raptors included the Golden Eagle, Red-tailed Hawk, Northern Harrier, and Rough-legged Hawk. All data collected by this effort has been provided to GBBO, which maintains the state-wide winter raptor database. A final report that summarized the 2005-2007 data was prepared and disseminated to federal and state agencies (GBBO, 2007b).

4.5 Mammals

4.5.1 Acoustic Bat Surveys

Acoustic surveys for bats were conducted in 2005-2006 within 12 valleys in the GWD Project study area, including Delamar, Dry Lake, Cave, White River, Pahranagat, Spring, Snake, Tule, and Lake valleys (Figure 4-11). The purpose of the survey was to provide a baseline inventory of bat occurrence and habitat use. With expert assistance from SNWA contractor Dr. O'Farrell, SNWA employed AnaBat units to collect bat vocalizations at 32 sites (primarily spring sites) at various times of the year. Dr. O'Farrell acoustically identified the bat species using standard scientific protocol that he and his colleges have developed (Kalko et al., 1996; Ochoa et al., 2000; O'Farrell and Gannon, 1999).

A total of 16 species of bats were recorded across 12 valleys. Seven of the species are listed as Federal Species of Special Concern, two of them are State-listed Sensitive and three are State-listed Protected. A final report was prepared and disseminated to federal and state agencies (O'Farrell Biological Consulting, 2006).

4.5.2 Bat Mist Netting Survey

Mistnetting surveys for bat occurrence were also conducted by SNWA in 2005-2008 in Dry Lake, Cave, Spring, Snake, and Steptoe valleys (Figure 4-11). Ten of the acoustic bat survey spring sites were selected for mistnetting surveys to provide additional confirmation of species identification, and to provide a more complete species list for each site. Six of the sites included in the 2008 mist net survey are on SNWA deeded lands and/or associated grazing allotments. Five springs included in the 2008 mist netting survey are included in the Biological Monitoring Plan for the Spring Valley Stipulation (BWG, 2009).

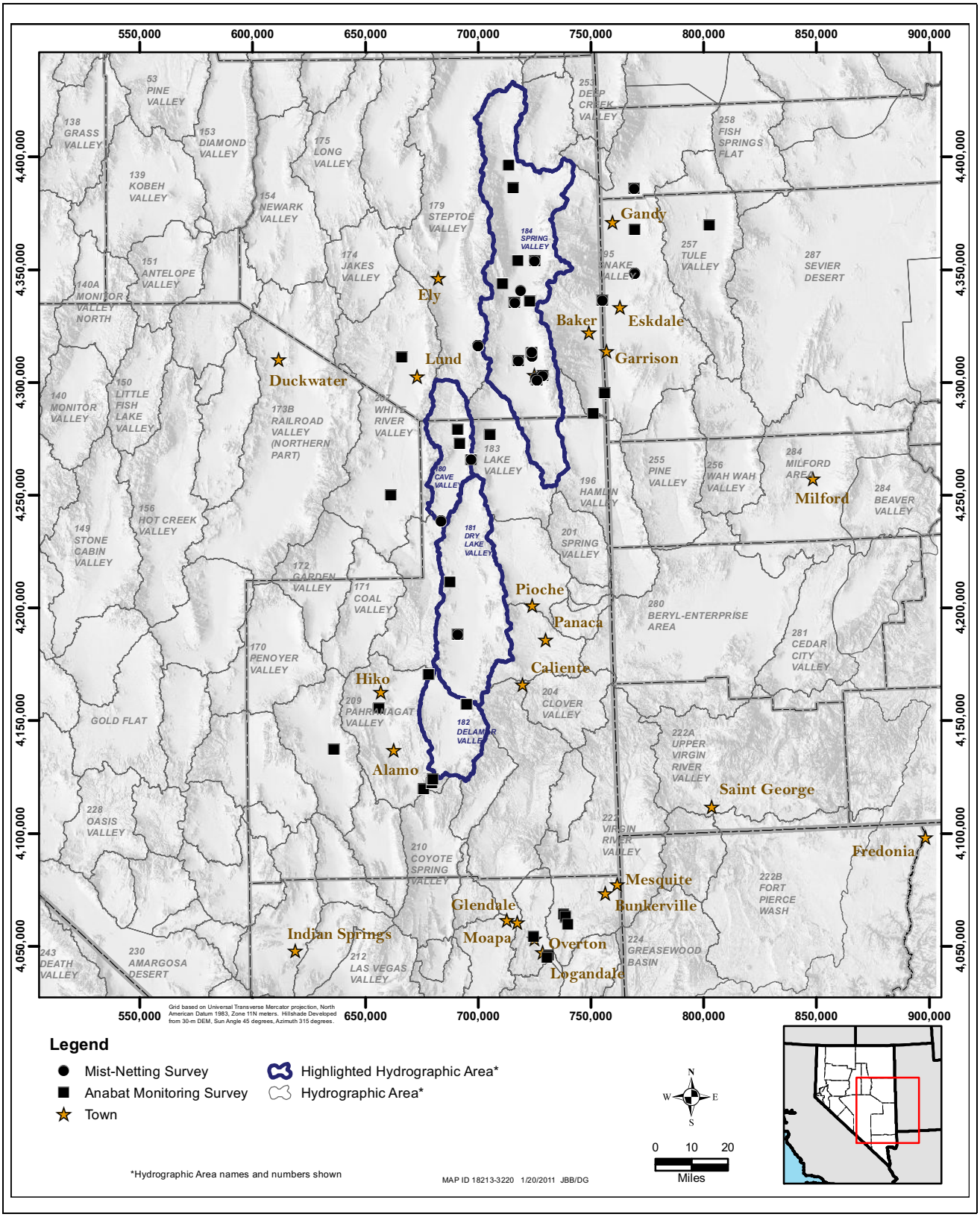


Figure 4-11
Bat Surveys

A total of nine species were recorded during SNWA's 2008 bat mist net survey across five valleys. These nine species were also recorded during the AnaBat acoustic bat survey project conducted in 2005-2006 (O'Farrell Biological Consulting, 2006). A final report was prepared (SNWA, 2009b).

4.5.3 Pygmy Rabbit Surveys

Pygmy Rabbit Surveys were conducted in 2005, 2006, and 2008 within and adjacent to proposed GWD Project rights-of-way (ROWs), within the pygmy rabbit distribution and appropriate pygmy rabbit habitat (Figure 4-12). Surveys were conducted in Dry Lake, Cave, Lake, Spring, Hamlin, Snake, and Steptoe Valleys during the 2005-2006 survey and in Steptoe and Snake valleys in 2008.

In the 2005-2006 survey, 56 locations were surveyed for a total of 28 mi of alignment and approximately 84 transect mi of adjacent habitat in 2005 and 2006. Using the past and present pygmy rabbit survey data and the SWReGAP vegetation data (USGS, 2004), it appears that approximately 40 mi of proposed alignment passes through confirmed pygmy rabbit habitat. The data also suggests that the proposed alignment passes through approximately 25 mi of possible pygmy rabbit habitat. Of the locations surveyed, 15 had pygmy rabbit signs. BLM protocols were followed and final reports were prepared and disseminated to federal and state agencies (SNWA, 2007b).

In 2008 ten transects were surveyed along new GWD alignments in Steptoe and Snake valleys. A total of 6.5 mi of alignment and approximately 8.0 transect mi of adjacent habitat were surveyed. Of the ten locations, four had confirmed pygmy rabbit sign, all within Steptoe Valley.

4.5.4 Small Mammal Surveys

Small mammal surveys were conducted to determine occurrence within the Great Basin Desert portion of the GWD Project area. In 2005-2006, SNWA surveyed for small mammals within Delamar, Dry Lake, Cave, White River, Lake, Spring, Hamlin, and Snake valleys (Figure 4-13). The study area encompassed over 12,000 mi^2 of eastern Nevada and a portion of western Utah. The specific survey site locations, 83 in total, were chosen based on the SWReGAP vegetation data (USGS, 2004), field observations of specific vegetation communities and substrate type. A variety of habitats were surveyed, including groundwater-influenced habitats (springs, wetlands, meadows, phreatophytic shrubland, and phreatophytic woodland). At the recommendation of Dr. O'Farrell, a modified standard protocol was used to conduct the survey.

The 2005-2006 survey effort resulted in a total of 9,194 trap nights. Seventeen species of rodents were captured. This study gave important insight into the small mammal diversity and distribution within the study area. Of particular importance, it documented the distribution and abundance of the state protected species Desert Valley Kangaroo Mouse (*Microdipodops megacephalus albiventer)* and documented 14 species associated with riparian and/or phreatophytic plant communities (i.e. greasewood flats). A final report was prepared and disseminated to federal and state agencies (SNWA, 2007c).

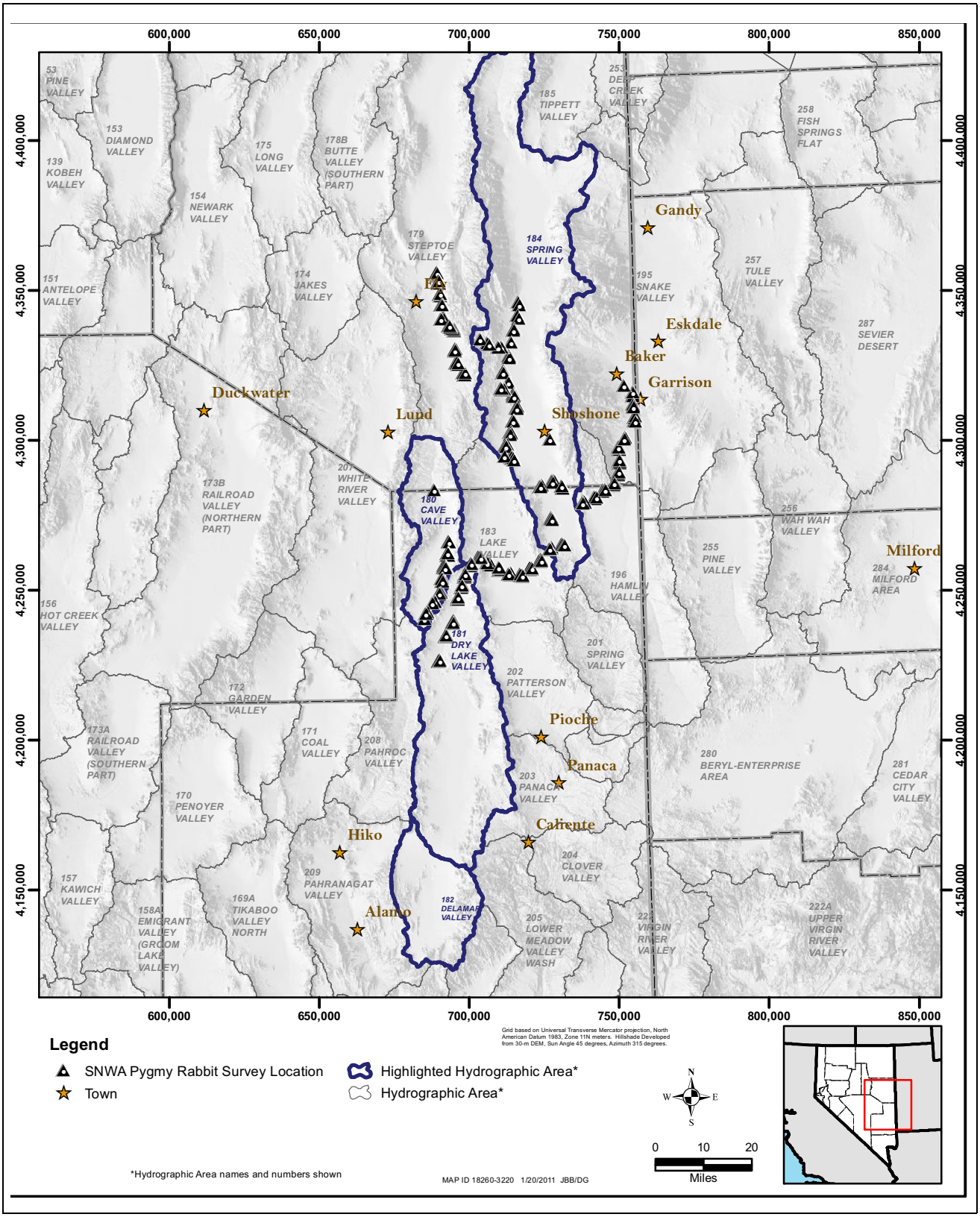


Figure 4-12
Pygmy Rabbit Surveys

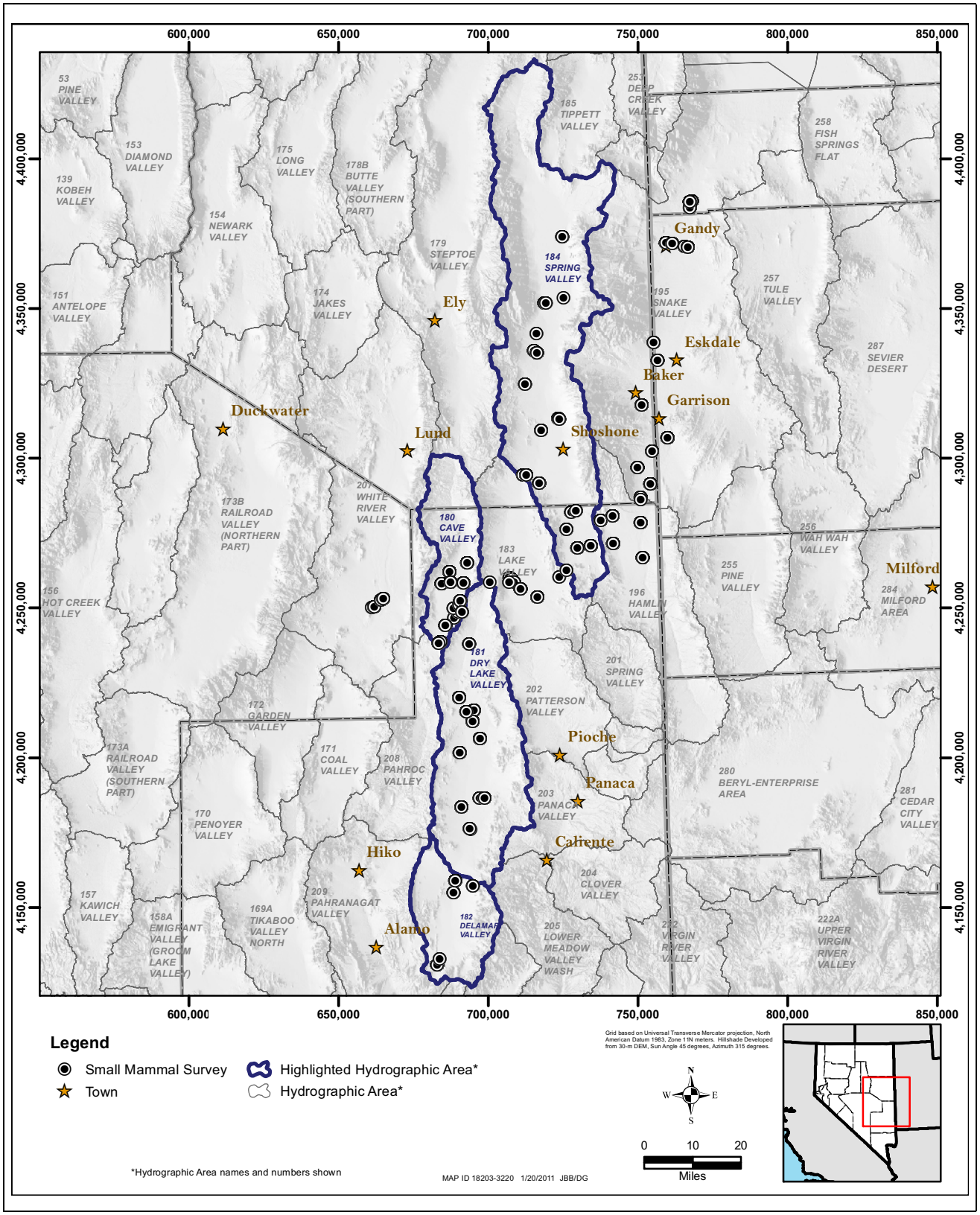


Figure 4-13
Small Mammal Surveys

4.6 Reptiles

4.6.1 Desert Tortoise Surveys

The Mojave population of the desert tortoise is federally listed as threatened by the USFWS. SNWA contracted Wildland International and Jones & Stokes to survey the proposed and alternative GWD Project pipeline and power line alignments for desert tortoise occurrence in 2005-2007 and 2009. The entire alignment and alternative alignments within desert tortoise habitat were surveyed (Figure 4-14). The surveys included the alignment and a zone-of-influence (ZOI). Standard USFWS protocol was followed (USFWS, 1992).

In 2005, starting at the southern project terminus, Jones & Stokes biologists conducted protocol-level pedestrian surveys along 75 mi of the proposed alignment and ZOI. A total of 330 desert tortoise signs, such as carcasses, burrows, scat, and tracks were observed for all project facilities combined. A final report was prepared and disseminated to federal and state agencies (Jones and Stokes, 2005).

Also, between 2005 to 2007 Wildland International conducted desert tortoise surveys for a 13.6 mi reroute of the proposed project alignment near Kane Springs in Coyote Spring Valley. Additionally the Apex Alternative alignments were surveyed. A total of 253 desert tortoise signs were observed for all surveys combined. A final report was prepared and disseminated to federal and state agencies (Wildland International, 2007).

In 2009, Wildland International conducted desert tortoise surveys on approximately 36 mi of adjusted proposed project pipeline and power line alignments between Garnet Valley and Delamar Valley. A total of 82 desert tortoise signs were observed for all project facilities combined. A final report was prepared and disseminated to federal and state agencies (Wildland International, 2009).

4.6.2 Reptile Surveys

Reptile surveys were conducted to determine occurrence within the Great Basin Desert portion of the GWD Project area. In 2007, SNWA surveyed for reptiles within Dry Lake, Cave, Lake, Spring, Hamlin, and Snake valleys (Figure 4-15). A variety of habitats were surveyed, including groundwater-influenced habitats (springs, wetlands, meadows, phreatophytic shrubland, and phreatophytic woodland). A modified standard scientific protocol for drift fences and traps was used.

The study area encompassed over 2,000 mi^2 of eastern Nevada. Twenty drift fence locations were surveyed as part of this effort and 20 sites were surveyed for a total of 80 sample days. Fourteen reptile species were documented within the study area, including 231 lizards and 11 snakes. A final report was prepared and disseminated to BLM, USFWS, and NDOW (SNWA, 2008).

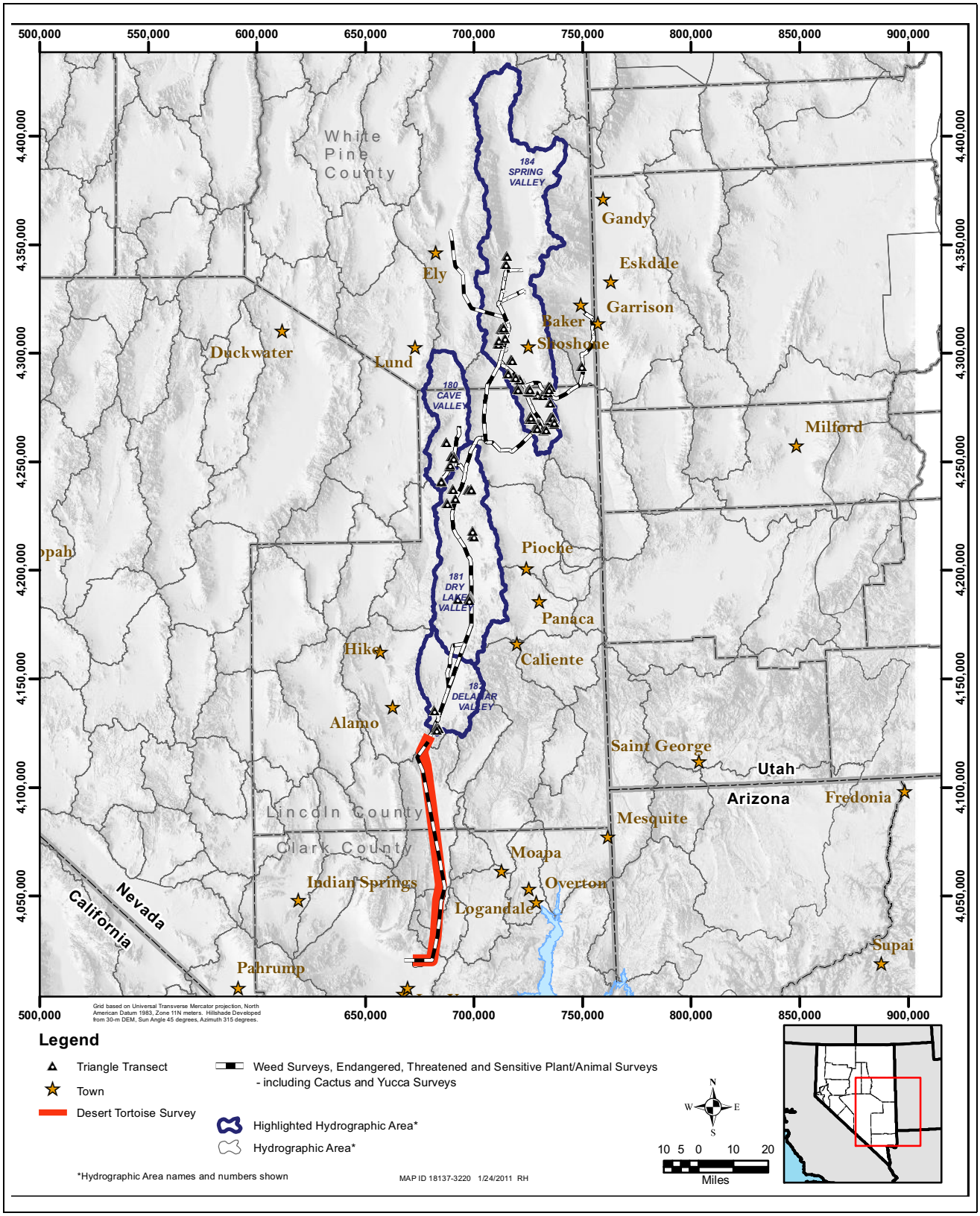


Figure 4-14
Biological Surveys of Proposed Alignment

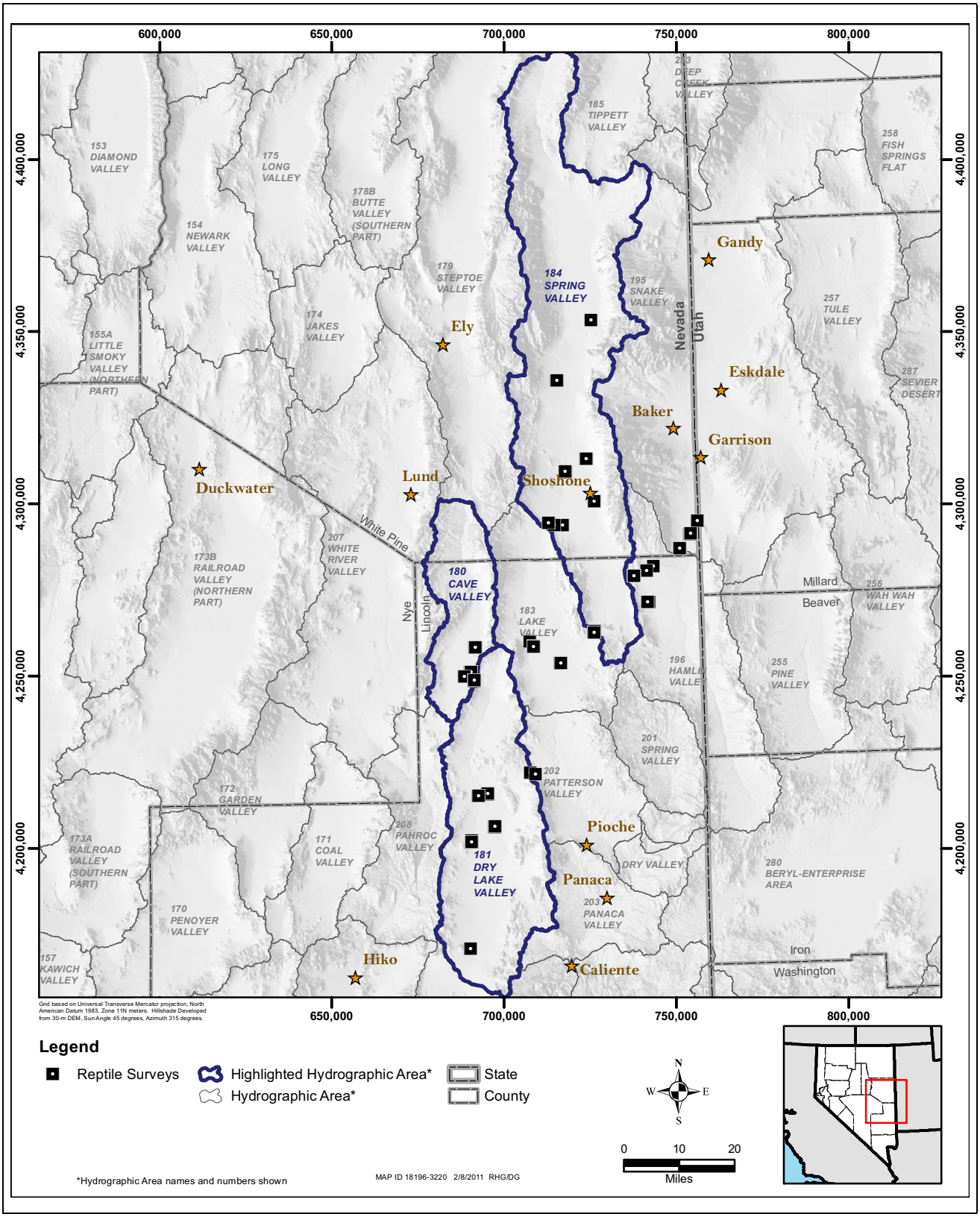


Figure 4-15
Reptile Surveys

4.7 Fish

4.7.1 Pahrump Poolfish Surveys

NDOW leads an annual sampling effort of Pahrump poolfish at Shoshone Ponds in Spring Valley (Figure 4-16) as part of a state and federal effort to support the endangered species' Recovery Implementation Plan. The Pahrump poolfish was federally listed as endangered in 1967. The sample area includes refuge ponds one and two (North and Middle Ponds) and a large stock pond. SNWA provided assistance for 2006-current surveys, and standard NDOW protocol is followed.

Estimates by NDOW in 2009 concluded that the north pond held 191 fish, the middle pond held 260 fish, and the stock pond held 3,695 fish (Appendix in SNWA 2010a). The most recent population estimates by NDOW in 2010 concluded that the north ponds held 116 fish, the middle pond held 579 fish, and the stock pond held 3,832 fish (Appendix in SNWA 2010a). Results of the 2009 and 2010 effort are included in the 2009 and 2010 Spring Valley Stipulation Biological Monitoring Plan Annual Reports (SNWA, 2010a and 2011a). Annual reports are also publicly available through NDOW.

4.7.2 Moapa Dace Surveys

Moapa dace habitat is managed under the Recovery Plan for the Rare Aquatic Species of the Muddy River Ecosystem using a standard NDOW and USFWS protocol (USFWS, 1995a). The Moapa dace was federally listed as endangered by the USFWS in 1967. Since 2005, SNWA has assisted NDOW and USFWS in monitoring the Moapa Dace (*Moapa coriacea*) in the upper Muddy River system (Figure 4-16).

Surveys estimate the population of Moapa dace has numbered 462 in 2008, 508 in 2009, and 697 in 2010 (USFWS, 2010). Additional monitoring and conservation efforts are also conducted under the Coyote Spring Valley Stipulation Hydrologic Monitoring, Management, and Mitigation Plan, the Muddy River Memorandum of Agreement, and SNWA's Warm Springs Natural Area Stewardship Plan.

4.7.3 Fish Recovery Implementation Team Surveys

Since 1995, SNWA has participated on RITs such as the Pahranagat Valley Native Fishes RIT, White River Valley Native Fishes RIT and Big Springs Spinedace RIT. These teams implement native fish management plans and USFWS Recovery Plans for threatened and endangered species and their habitat. RIT activities include monitoring, management, and conservation efforts (Figure 4-16).

4.8 Invertebrates

4.8.1 Terrestrial Invertebrate Survey

In 2006, SNWA contracted Ecological Sciences to conduct a terrestrial invertebrate survey within 11 hydrographic basins in the vicinity of the GWD Project, including Delamar, Dry Lake, Cave, White River, Pahranagat, Spring, and Snake Valley Hydrographic Basins (Figure 4-17). Seventy-six

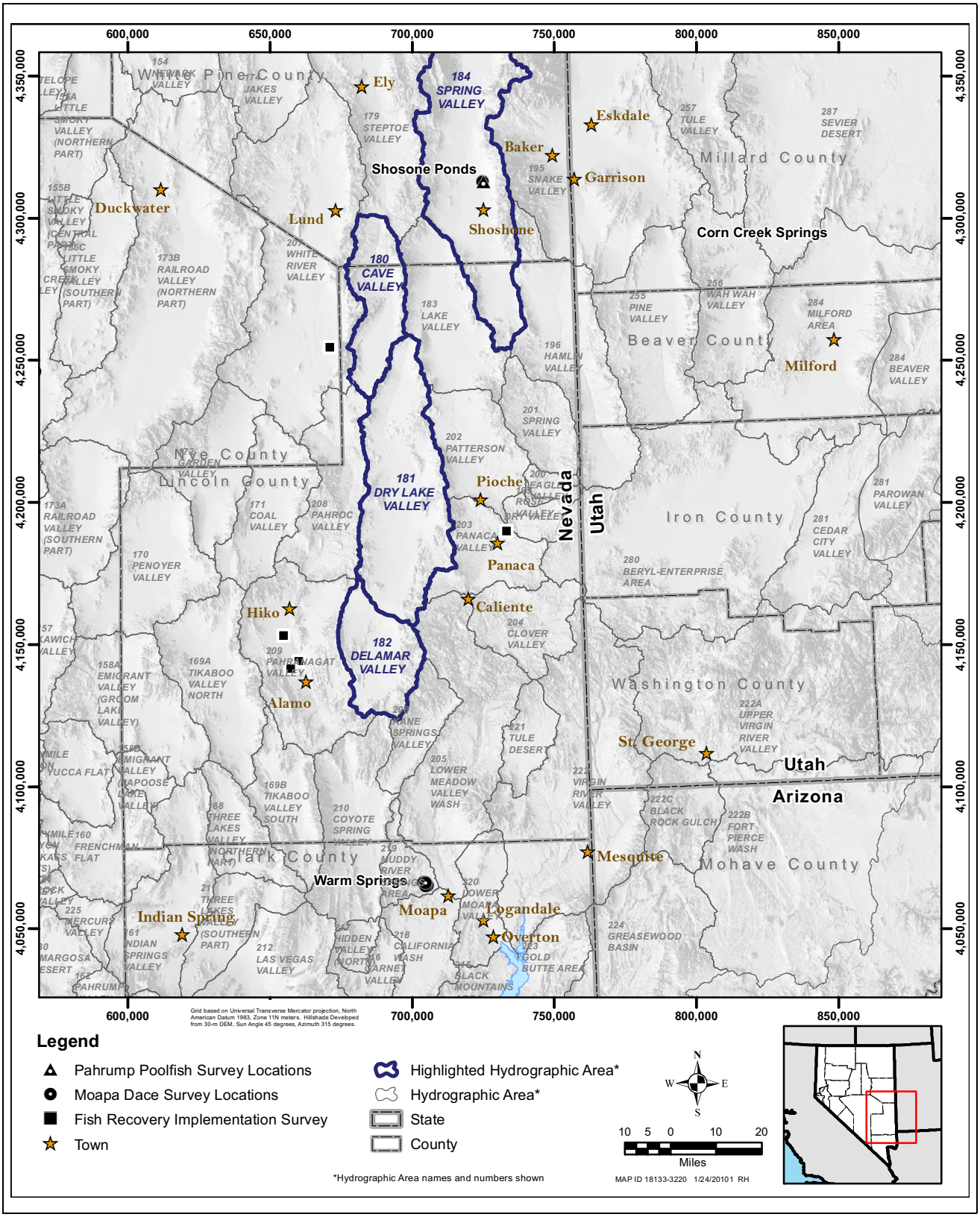


Figure 4-16
Fish Surveys

locations were established and visited/sampled a total of 131 times during the course of the survey effort using modified standard scientific protocols (Ecological Sciences, 2007). General direction was provided by SNWA to initially focus on sampling sites within Spring Valley in White Pine County, Nevada and later in Snake Valley in Millard County, Utah. Additional sampling was conducted in the Coyote Spring, Delamar, Pahranagat, Dry Lake, Cave, White River, Lake, Steptoe, and Pleasant Valley watershed regions located throughout portions of Clark, Lincoln, and White Pine Counties in Nevada, and Millard and Juab Counties in Utah.

Over 2,500 terrestrial invertebrate specimens were sorted and identified to the lowest level practicable. A total of 681 species in 149 families from 21 invertebrate orders were identified, many of which have aquatic larval stages. Specimens were mounted for a permanent SNWA collection. A final report was prepared and provided to the BLM (Ecological Sciences, 2007).

4.9 Sensitive Animals

4.9.1 Sensitive Animal Surveys

Sensitive animals were documented during terrestrial wildlife surveys of the proposed GWD Project ROWs. SNWA contracted Wildland International and Jones & Stokes to survey the proposed and alternative GWD Project pipeline and power line alignments in 2005-2007 and 2009. The entire pipeline and power line alignments (including within and adjacent to the alignments) were surveyed (Figure 4-14). Standard BLM protocols were followed.

Jones and Stokes observed nine sensitive species during the biological surveys (Jones and Stokes, 2005). Between 2005 and 2007, Wildland International observed 13 sensitive species. (Wildland International, 2007). In 2009, Wildland International observed 11 sensitive species (Wildland International, 2009).

4.10 Vegetation

4.10.1 Endangered, Threatened, and Sensitive Plant Surveys

SNWA contracted Wildland International and Jones & Stokes to survey the proposed GWD Project pipeline and power line alignments for the endangered, threatened, and sensitive plants in 2005-2007 and 2009 (Figure 4-14).

In 2005, Jones and Stokes surveyed approximately 75 mi of combined proposed pipeline and power line alternatives for the GWD Project. Only one federal species of concern and BLM sensitive species was observed during the survey. USFWS or state-listed plant species were not observed. A final report was prepared and disseminated to federal and state agencies (Jones and Stokes, 2005).

Between 2005 and 2007 Wildland International and its biological/botanical teams inventoried approximately 349 mi of the combined proposed pipeline and power line alternatives and 115 of the proposed facilities/staging areas (145 total, but major facilities encompass sub-facilities) in the Great Basin and Mojave Desert. Due to project adjustments a 13.6 mi reroute of the proposed

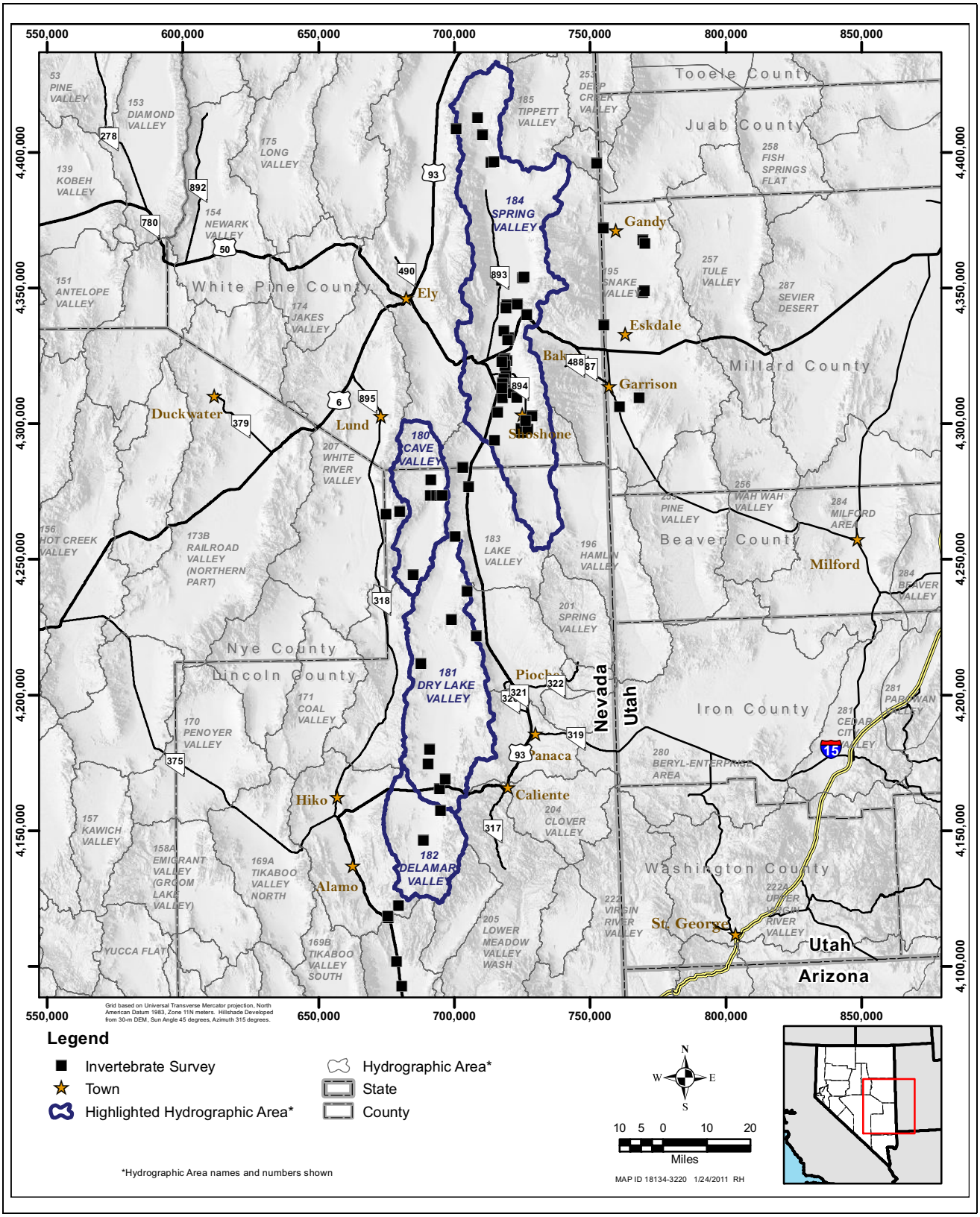


Figure 4-17
Terrestrial Invertebrate Surveys

pipeline/power line corridor was also inventoried in Coyote Spring Valley in 2006 and 2.5 mi in the Apex area in 2007. Pedestrian survey methodology was used. In addition, due to the large size and scale of the groundwater exploratory areas (some as large as 700 mi^2), equilateral triangles in two sizes (large and small) were chosen as the most effective technique to survey the target areas. The large triangles were 1.5 mi on a side or 4.5 mi of total transect length and the small triangles were 1 mi on a side or 3 mi in length. The vegetation sampling triangle surveys in Spring Valley was the largest effort of all the groundwater exploratory areas investigated. Thirty-two sampling triangles (16 large, 16 small) were inventoried over an area covering 285 mi^2 extending from near Cleve Creek in the north to Atlanta in the south end of Spring Valley. This survey effort represented 240 man mi of inventory over a significant cross section of Spring Valley. Along the parallel transects, 19 sensitive plant species were observed along the proposed GWD alignments. Twenty-one sensitive plant species were documented within the sampling triangles. A final report was prepared and disseminated to federal and state agencies (Wildland International, 2007).

In 2009, Wildland International provided a biological inventory of sensitive plant species within 19 nursery sites and 36 mi of the 53.2 mi of proposed alignment adjustments (Wildland International, 2009). Standard USFWS protocol for plant surveys was followed. Parallel transects were used to cover the width of the alternative pipeline/power line alignment adjustments and nursery sites. One sensitive species, the bashful four o'clock (*Mirabilis pudica*), was observed in Pahranagat Canyon and along the proposed alignment adjustment. Sensitive species were not observed at the 19 nursery sites. A final report was prepared and disseminated to federal and state agencies (Wildland International, 2009).

4.10.2 Cactus and Yucca Surveys

SNWA contracted Wildland International and Jones & Stokes to survey the proposed GWD Project pipeline and power line alignment for cactus and yucca in 2005-2007 and 2009. The entire alignment was surveyed (within and adjacent to the ROWs) (Figure 4-14), and standard BLM protocol for cactus surveys was followed.

In 2005, Jones and Stokes surveyed approximately 75 mi of combined proposed pipeline and power line alternatives for the GWD development project. A total of 34,914 cacti representing 11 species were observed within the survey area. Additionally, 106,284 Mojave yuccas (*Yucca schidigera)*, 4,252 Joshua trees (*Yucca brevifolia)*, and 2,670 banana yuccas (*Yucca baccata)* were counted. A final report was prepared and disseminated to federal and state agencies (Jones and Stokes, 2005).

Between 2005 and 2007 Wildland International inventoried approximately 349 mi of the combined proposed pipeline and power line alternatives and 115 of the proposed facilities/staging areas (145 total, but major facilities encompass sub-facilities) in the Great Basin and Mojave Desert. Due to project adjustments a 13.6 mi reroute of the proposed pipeline/power line corridor was also inventoried in Coyote Spring Valley in 2006 and 2.5 mi in the Apex area in 2007. A complete inventory and total stem count for cactus and yucca species was conducted within the proposed project alignment and associated facility locations. Four species of yucca were documented in the survey areas, totaling 61,186 individual plants. Seventeen species of cacti were observed, totaling 23,540 individual plants. A final report was prepared and disseminated to federal and state agencies (Jones and Stokes, 2005; Wildland International, 2007).

In 2009, Wildland International returned to survey 19 nursery sites and 36 mi of the 53.2 mi of proposed alignment adjustments. Standard USFWS protocol for plant surveys was followed. A final report was prepared and disseminated to federal and state agencies (Wildland International, 2009).

4.10.3 Weed Surveys

SNWA contracted Tri-County Weed Coalition (TCWC) to survey the proposed GWD Project pipeline and power line alignment in 2005-2007 (TCWC, 2007). The entire alignment was surveyed (within and adjacent to the ROWs) (Figure 4-14), and standard TCWC and BLM protocol for weed surveys was followed. Surveys were conducted in Las Vegas, Garnet, Hidden (North), Coyote, Spring, Pahrangat, Delamar, Dry Lake, Cave, Lake, Spring, Steptoe, Hamlin, and Snake valleys.

4.10.4 Ute Ladies'-Tresses

Ute ladies'-tresses (ULT) were listed as Threatened under the ESA on January 17, 1992, because of its rarity, small population sizes, and the threat of lost or modified habitats. In 1995, Section 7 of the ESA provided consultation guidelines for ULT by identifying Priority Survey Areas in states containing ULT populations, as well as adjacent states known to have potential habitat (USFWS, 1995b).

SNWA contracted BIO-WEST, Inc. in 2006 to survey for the threatened plant species ULT (*Spiranthes diluvialis*) occurrence and potential habitat. Using USFWS protocol, a total of 32 aquatic ecosystems in Spring, Snake, Hamlin, and Panaca valleys were surveyed for the occurrence of ULT and potential of suitable habitat (Figure 4-18).

ULT were not documented in Snake, Spring, or Hamlin valleys, although potential habitat was identified. ULT was documented in Panaca Valley by other researchers and verified by BIO-WEST, Inc. A final report was prepared and made available to BLM and USFWS (BIO-WEST, 2007b).

4.10.5 Evapotranspiration (ET) Land Cover Mapping

In 2004, SNWA classified and mapped phreatophytic vegetation and land cover using remote sensing and field surveys. Medium resolution, 25-m (approximately 82-ft), pixel resolution satellite imagery was used for the land cover classification and analysis. For base year analysis of the ET Project Area seven Landsat7 Enhanced Thematic Mapper Plus (ETM+) scenes, acquired in the late spring of 2002 were used. The purpose of the project was to create a digital database to inform environmental studies and planning. Standard scientific protocols for remote sensing, Global Positioning System (GPS) and Geographic Information System (GIS) were used, and the data were ground-truthed and statistically assessed for accuracy.

Mapping of ET Land Cover type was conducted within 26 hydrographic basins in the vicinity of the GWD Project study area, including Cave, White River, Pahranagat, Spring, Hamlin, and Snake valleys (Figure 4-19). Groundwater-influenced habitats were captured in the mapping process and classified within higher-level land covers. Approximately 925,139 acres of vegetation were classified for this study.

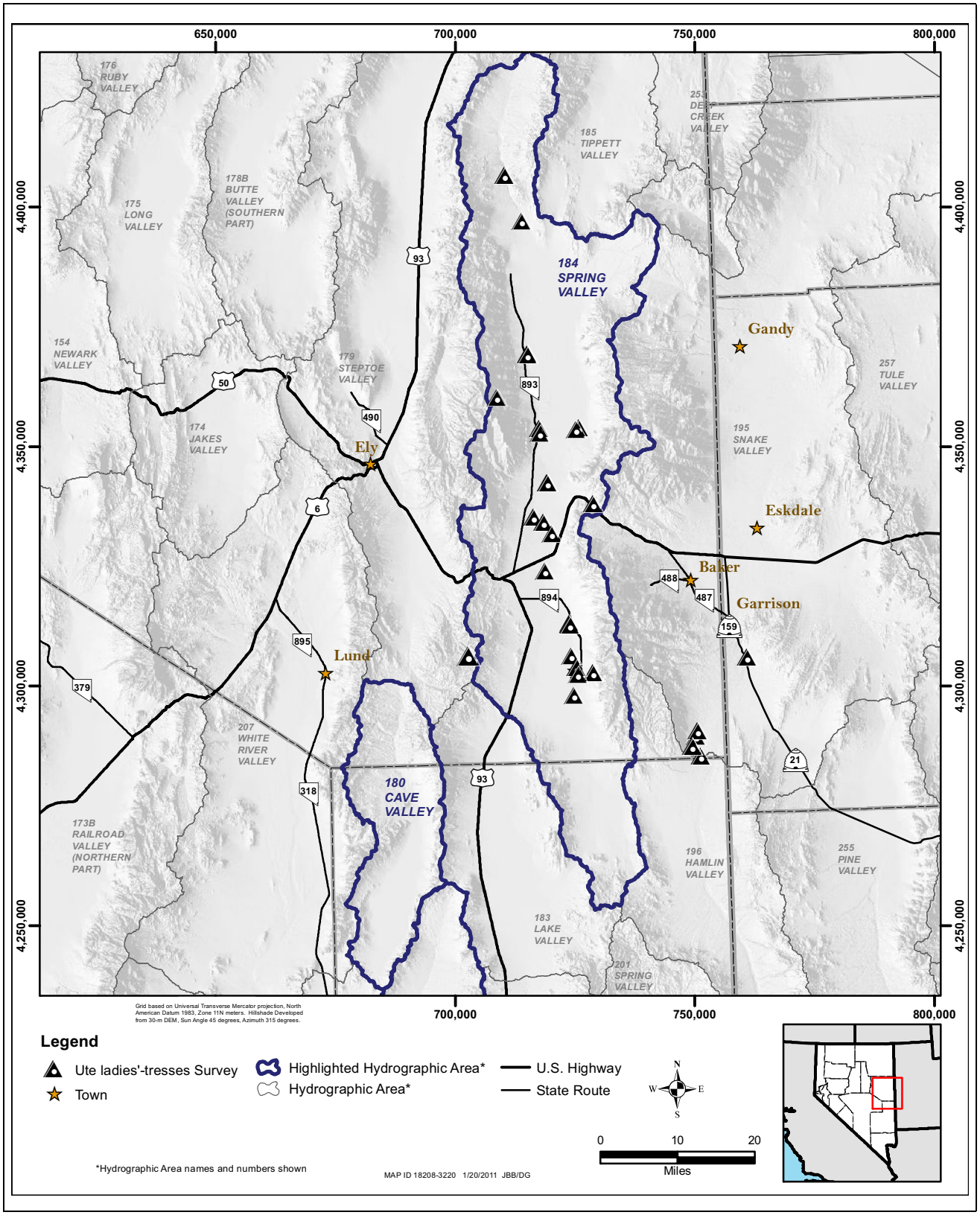


Figure 4-18
Ute Ladies'-Tresses Surveys

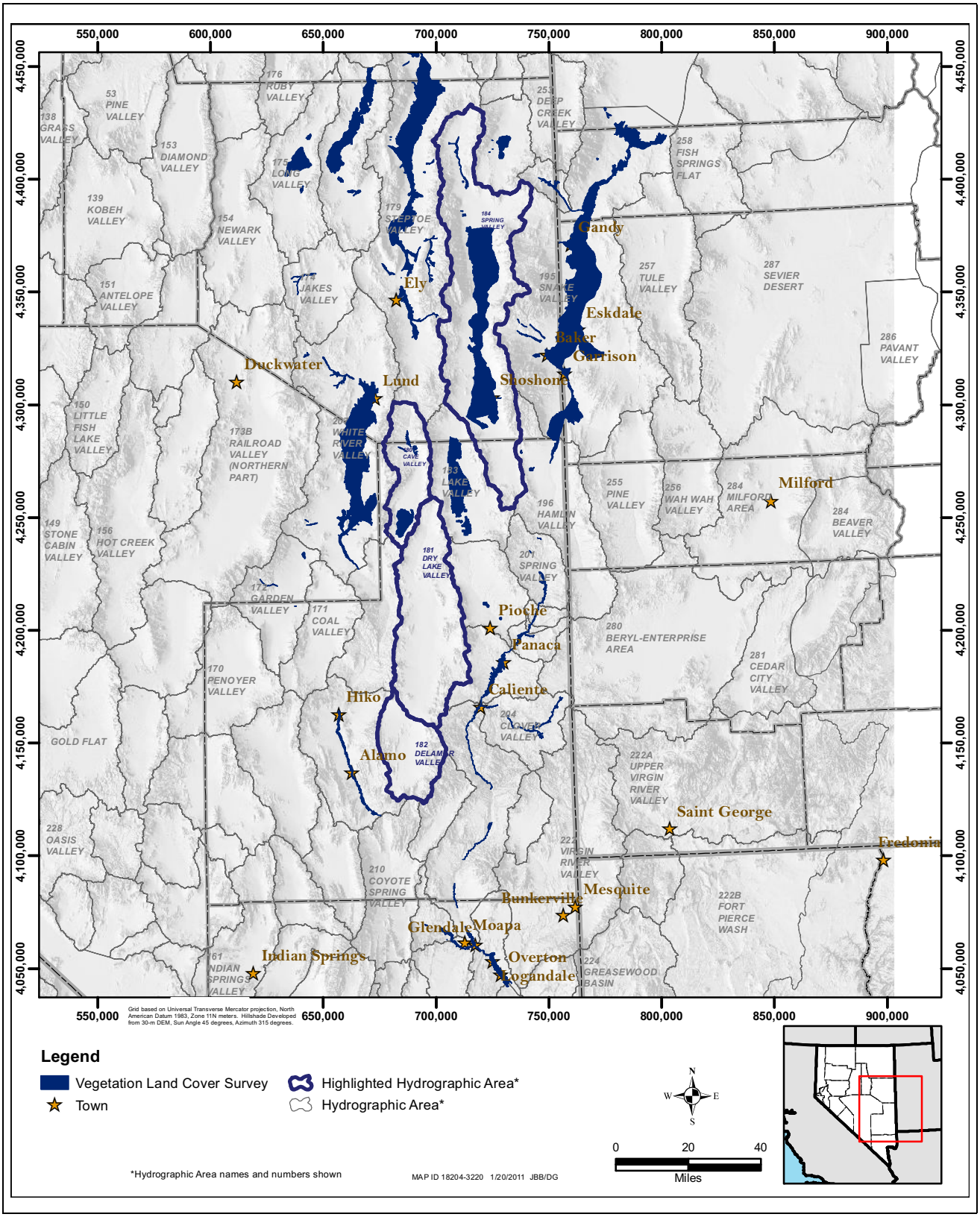


Figure 4-19
ET Land Cover Mapping

4.10.6 Groundwater-Influenced Vegetation Community Mapping

From 2007 through 2009, SNWA contracted BIO-WEST, Inc. and KS2 Ecological Field Services to develop a detailed map of vegetation communities within groundwater-influenced habitats in Spring Valley. The purpose of the mapping effort was to inform conservation, management, and mitigation on SNWA Northern Resources properties, and support Spring Valley Stipulation Biological Monitoring Plan efforts. Modified standard scientific protocols were followed for field mapping and GIS.

All springs, wetlands, wet meadows, and potentially phreatophytic woodlands (valley-floor Rocky Mountain juniper) were mapped, as well as adjacent phreatophytic shrubland, within the valley bottom, totaling 24,655 acres (Figure 4-20). For this particular survey, a community is comprised of the three most abundant species in terms of ground cover, in order of abundance. A total of 2,693 communities were mapped. A final report is publicly available (McLendon et al., 2011).

4.10.7 Rangeland Vegetation Surveys

Since 2007, SNWA has collected ecological site assessment data for upland vegetation on SNWA Northern Resources properties and associated grazing allotments. The purpose of the effort was to characterize baseline conditions in order to support sustainable rangeland management. SNWA and Eastern Nevada Landscape Coalition (ENLC) conducted the field surveys using a BLM line intercept method. In total, vegetation cover and composition data was collected on 14 grazing allotments across 6 valleys (Figure 4-21).

4.11 Aerial Imagery

SNWA contracted Digital Mapping, Inc. (DMI) to capture 6-inch multi-spectral aerial imagery within Spring, Hamlin and Snake valleys (2007) and Cave, White River, and Pahranagat valleys (2008) (Figure 4-22). SNWA post-processed the imagery to create a seamless digital file to use in support of biological and hydrologic efforts. Standard aerial imagery and GIS protocols were followed. Also, in 2006 and 2010 SNWA provided funding for the U.S. Department of Agriculture's National Agriculture Imagery Program (NAIP), which resulted in the collection of 1-m resolution multi-spectral aerial imagery for the entire GWD Project area (Figure 4-22).

4.12 Data Management

SNWA has developed a data management system to ensure the quality, transparency, traceability, and security of biological data. A workflow process is implemented that ensures data integrity (i.e., accuracy and consistency) from field data collection to data storage in a Relational Database Management System to data distribution. Archival storage is provided for all hardcopy data sheets, original and provisional digital data sheets, and provisional and final data within the database. A Secure Digital Repository (Repository) on a network provides storage for all original and provisional digital data files described in the data management workflow. Repository access is limited and is backed up on a regularly scheduled basis.

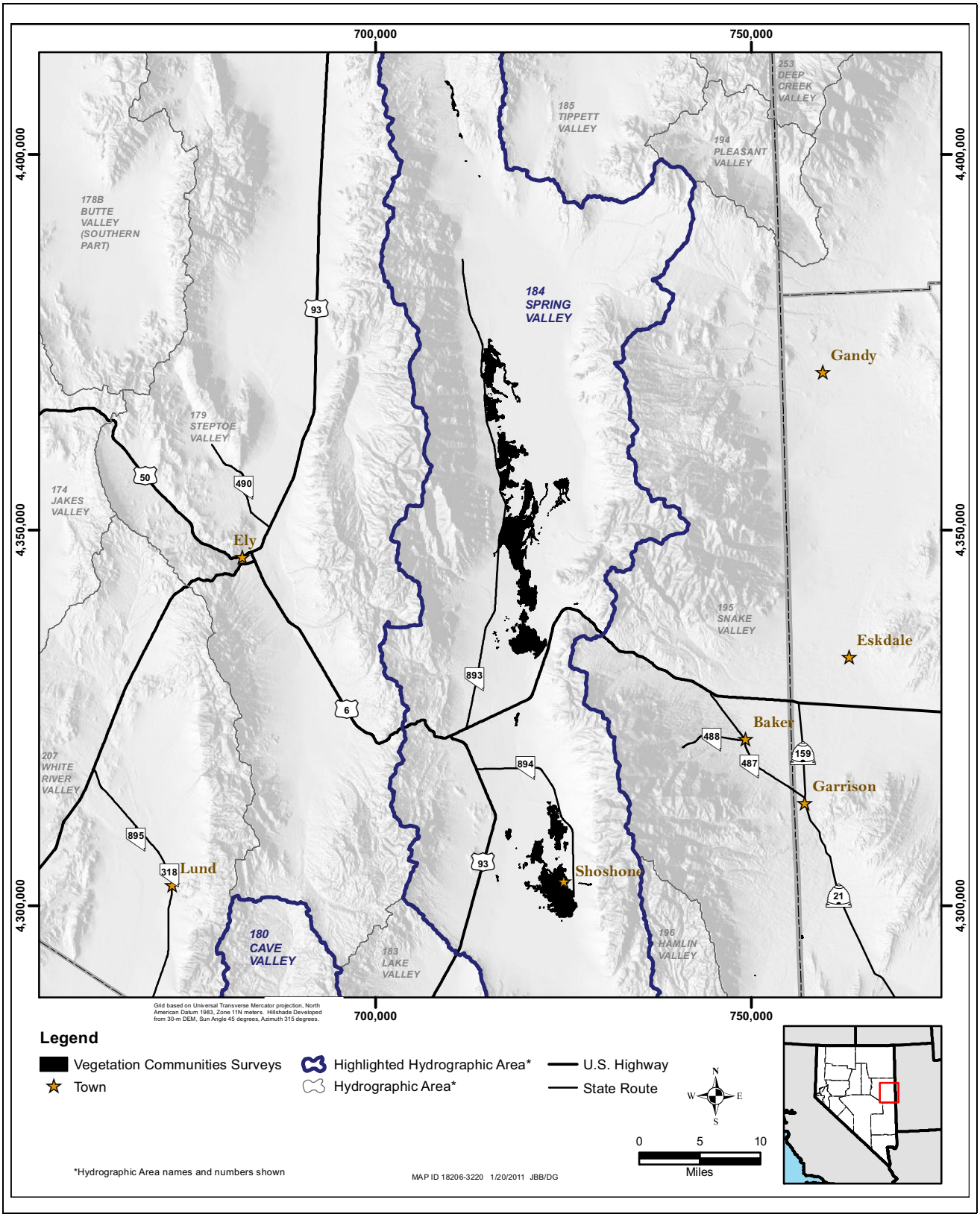


Figure 4-20
Groundwater-Influenced Vegetation Community Mapping

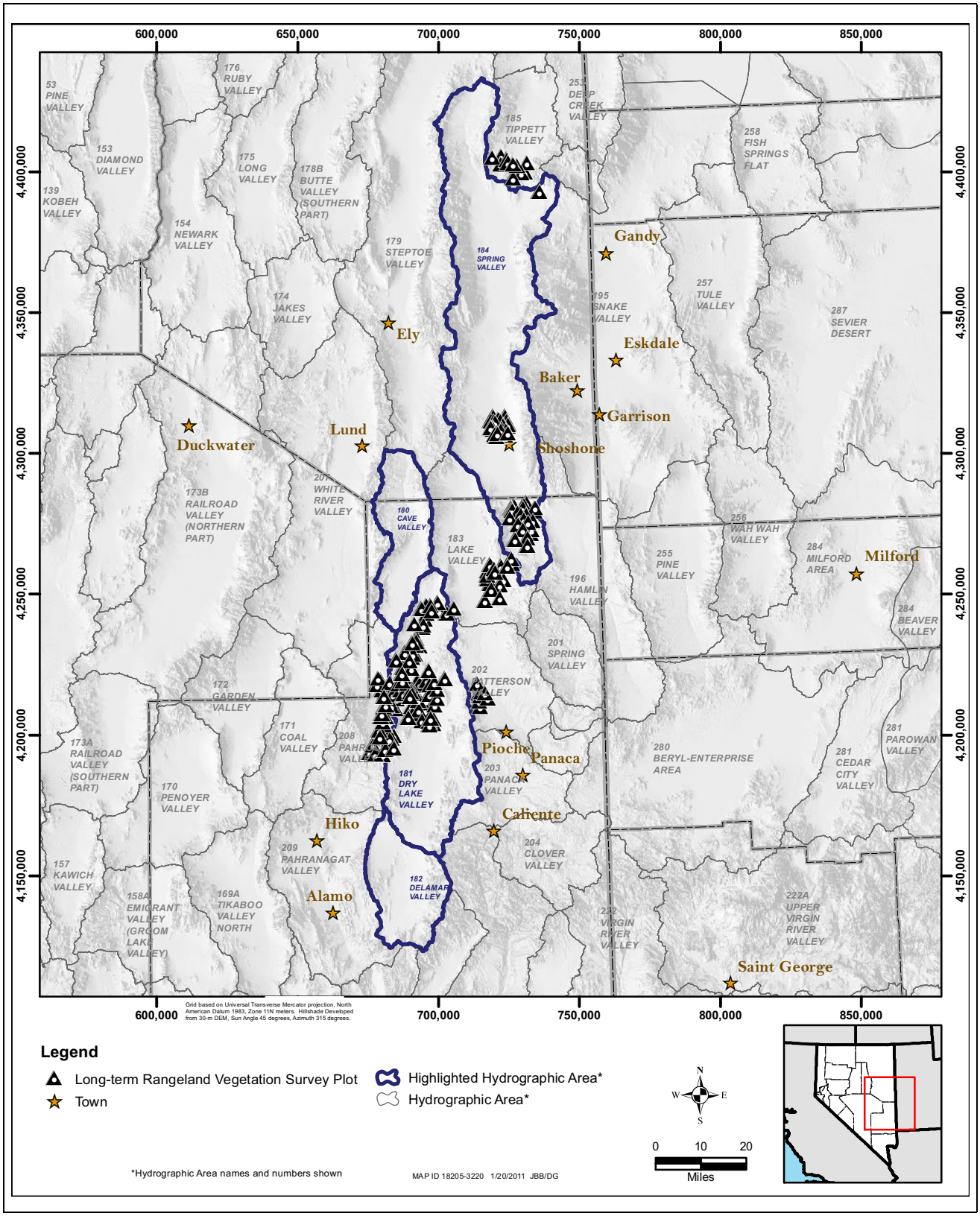


Figure 4-21
Rangeland Vegetation Surveys

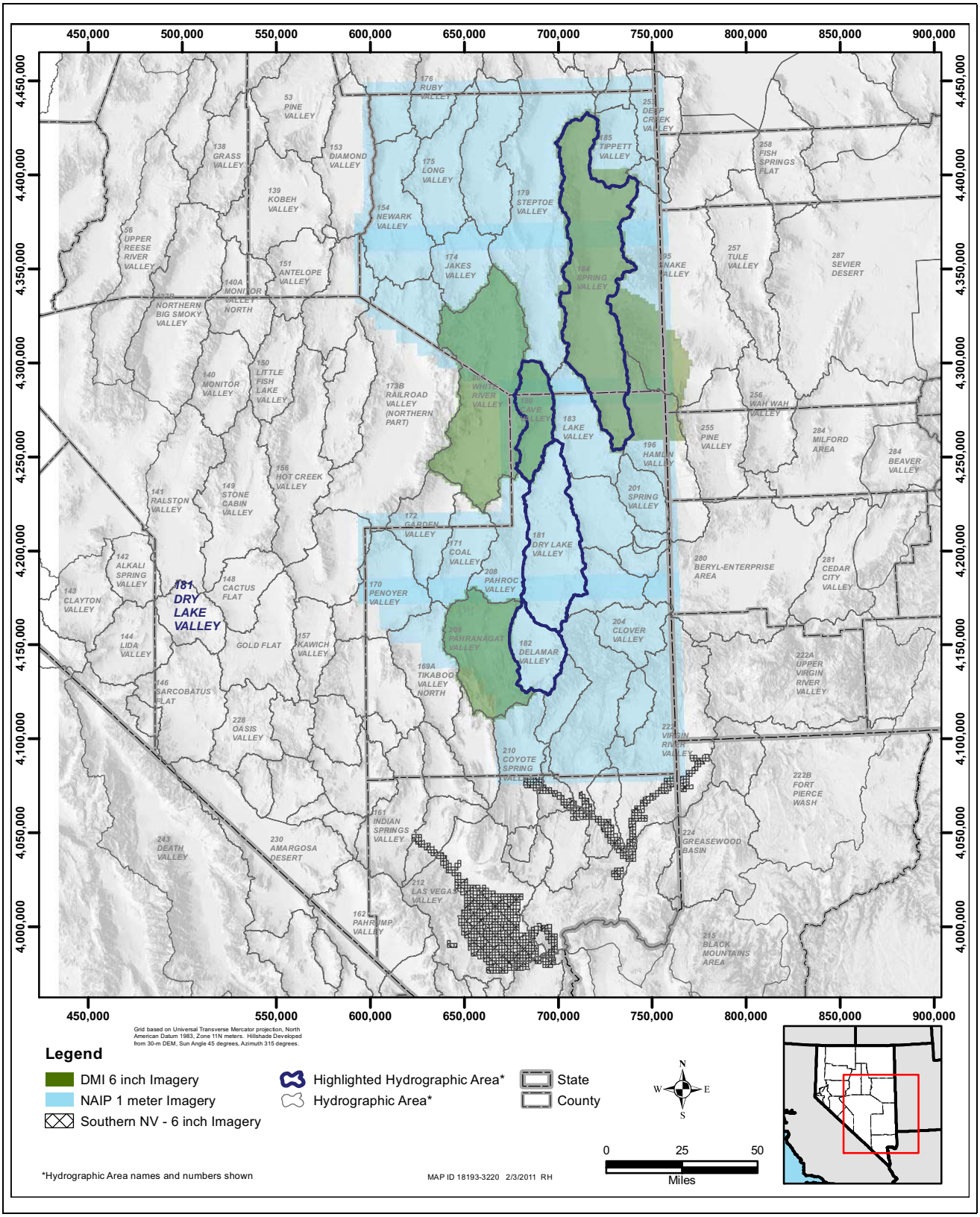


Figure 4-22
Aerial Imagery

Table 4-1 Baseline Biological Investigation (Page 1 of 7)

Survey Type	Biota of Focus	Purpose of Study	Habitat	Who	When	Study Location(s)
Aerial imagery		Collection of six-inch aerial imagery used to support biological and hydrologic efforts	Springs, Ponds, Perennial Streams, Wetlands, Meadows, Phreatophytic Shrubland, Phreatophytic Woodland, Playa, Non-Groundwater Influenced Habitats	SNWA contractor (Digital Mapping Inc.) and SNWA	2007, 2009	Spring, Hamlin, Snake, Cave, White River and Pahranagat
Amphibians	Frogs	Annual population survey as part of the Conservation Agreement and Strategy for Columbia spotted frog	Springs, Ponds, Wetlands	UDWR with SNWA assistance	2006, 2009, 2010	Snake
Amphibians	Frogs and toads	Survey for amphibian occurrence and potential habitat; baseline data for BA and EIS	Springs, Wetlands	SNWA	2007	Spring, Snake and Hamlin
Amphibians	Northern leopard frog	Surveys to determine northern leopard frog distribution, breeding areas and potential habitat; to inform conservation, management, and mitigation on SNWA Northern Resources property; to support Spring Valley Stipulation Biological Monitoring Plan efforts; baseline data for BA and EIS	Springs, Ponds, Wetlands	SNWA	2008-2009	Spring and Snake
Animals	Sensitive animals	Sensitive animal survey within and adjacent to proposed Rights of Way and within groundwater exploratory areas; baseline data for EIS	Non-Groundwater Influenced Habitats, Phreatophytic Shrubland, Playa	SNWA contractors (Wildland Intl, Jones & Stokes)	2005-2007, 2009	Las Vegas, Garnet, Hidden (North), Coyote Spring, Pah-ranagat, Delamar, Dry Lake, Cave, Lake, Spring, Steptoe, Hamlin and Snake

Table 4-1 Baseline Biological Investigation (Page 2 of 7)

Survey Type	Biota of Focus	Purpose of Study	Habitat	Who	When	Study Location(s)
Aquatic Ecosystems	Fish, amphibians, springsnails, macro-invertebrates, vegetation and habitat	Ecological evaluation of aquatic habitats (primarily spring complexes) and pilot surveys in support of Spring Valley Stipulation Biological Monitoring Plan implementation; baseline data for BA and EIS	Springs, Ponds, Wetlands, Meadows	SNWA contractor (BIO-WEST)	2008	Spring, Hamlin and Snake
Aquatic Ecosystems	Fish, amphibians, springsnails, macro-invertebrates, vegetation and habitat	Ecological evaluation of aquatic habitats (primarily spring complexes); baseline data for BA and EIS	Springs, Ponds, Wetlands, Meadows	SNWA contractor (BIO-WEST)	2004-2006	Spring, Snake, White River, Pahranagat, Tule, Delamar, Cave, Dry Lake, Panaca, Lake, Pleasant, Hamlin, and Fish Springs Flat
Biological Monitoring Plan for the Spring Valley Stipulation	Fish, northern leopard frog, springsnails, macro-invertebrates, valley-floor rocky mountain juniper (swamp cedar), vegetation and habitat	Surveys conducted under the Biological Monitoring Plan for the Spring Valley Stipulation	Springs, Ponds, Perennial Streams, Wetlands, Meadows, Phreatophytic Shrubland, Phreatophytic Woodland	SNWA, SNWA contractors (BIO-WEST, KS2), and assistance from other BWG participants	2009-2010	Spring, Snake, and Hamlin
Birds	Breeding birds	Breeding bird monitoring inventory, part of long-term state-wide effort; 581-page published Breeding Bird Atlas; baseline data for BA and EIS	Springs, Perennial Streams, Wetlands, Meadows, Phreatophytic Shrubland, Phreatophytic Woodland, Non-Groundwater Influenced Habitats	GBBO and SNWA	2004-current (part of long-term GBBO effort 1997-current)	Steptoe, Tippett, Snake, Hamlin, Lake, Patterson, Eagle, Pahranagat, Clover, Lower Meadow Valley Wash, Kane Springs, Coyote Spring, Muddy River, Lower Moapa, California Wash, Garnet, Cave, Dry Lake, Spring

Table 4-1 Baseline Biological Investigation (Page 3 of 7)

Survey Type	Biota of Focus	Purpose of Study	Habitat	Who	When	Study Location(s)
Birds	Ferruginous hawk (raptor)	Surveys to find ferruginous hawk nests and potential nesting habitat; part of long-term state-wide effort; baseline data for EIS; environmental compliance	Non-Groundwater Influenced Habitats	NDOW and SNWA	2005	Dry Lake, Delamar, Pahroc, Cave, Lake, Spring, Steptoe, Hamlin, and Snake
Birds	Greater sage grouse	Discovery and monitoring of greater sage grouse leks (mating grounds with breeding birds); part of a long-term state-wide effort; to inform conservation, management, and mitigation on SNWA Northern Resources property; to inform GWD Project design; baseline data for BA and EIS	Wetlands, Meadows, Non-Groundwater Influenced Habitats	SNWA, coordinated with NDOW	2007-current (part of long-term NDOW effort 1970-current)	Dry Lake, Cave, Lake, Spring, Steptoe, Hamlin and Snake
Birds	Greater sage grouse	Telemetry study to determine greater sage grouse movements; to inform conservation, management, and mitigation on SNWA Northern Resources property; baseline data for BA	Wetlands, Meadows, Phreatophytic Shrubland, Non-Groundwater Influenced Habitats	SNWA, coordinated with NDOW	2008-2010	Spring
Birds	Migratory shorebirds	Migratory shorebird and snowy plover survey within project and adjacent basins; baseline data for EIS	Springs, Ponds, Lakes, Wetlands	SNWA contractor (GBBO)	2004-2006	White River, Pahranagat, Spring and Snake
Birds	Southwestern willow flycatcher, yellow billed cuckoo, and Yuma clapper rail	State and federal monitoring of endangered and candidate bird species to support Recovery Implementation Plans and conservation measures; baseline data for BA and EIS	Springs, Perennial Streams, Lakes, Wetlands	USFWS and NDOW with SNWA funding assistance	2000-current (part of long-term NDOW / USFWS effort)	Pahranagat, Lower Meadow Valley Wash, Virgin River, Muddy River Springs Area, Lower Moapa, California Wash, Gold Butte Area, Black Mountains Area

Table 4-1 Baseline Biological Investigation (Page 4 of 7)

Survey Type	Biota of Focus	Purpose of Study	Habitat	Who	When	Study Location(s)
Birds	Winter raptors	Winter raptor monitoring inventory, part of long-term state-wide effort; baseline data for EIS	Springs, Ponds, Lakes, Perennial Streams, Wetlands, Meadows, Phreatophytic Shrubland, Phreatophytic Woodland, Playa, Non-Groundwater Influenced Habitats	GBBO and SNWA	2005-current (part of long-term GBBO effort 2005-current)	Pahranagat, Lower Meadow Valley Wash, Virgin River, Muddy River Springs Area, Lower Moapa, California Wash, Gold Butte Area, Black Mountains Area, Delamar, Dry Lake, Cave, Spring, Snake, Pahroc, Hamlin, Tule, Lake, Steptoe, White River and Railroad
Fish	Moapa dace	State and federal monitoring of Moapa dace (endangered fish species) to support Recovery Implementation Plan	Springs, Perrenial stream	USFWS and NDOW with SNWA assistance	2005-current	Muddy River Springs Area
Fish	Pahrump poolfish	State and federal monitoring of Pahrump poolfish (endangered fish species) to support Recovery Implementation Plan	Ponds	USFWS and NDOW with SNWA assistance	2006-current (part of long-term NDOW / USFWS effort 1989-current)	Spring
Fish	Recovery Implementation Teams (RITs)	Pahranagat Valley Native Fishes, White River Valley Native Fishes, and Big Springs Spinedace (RITs) implement native fish management plans and USFWS Recovery Plans for threatened and endangered species and their habitat.	Ponds and Perrenial Streams	USFWS with SNWA assistance	2004, 2005, 2007, 2009	Pahranagat, White River Valley, Panaca
Invertebrates	Terrestrial invertebrates	Survey of terrestrial invertebrate species occurrence; baseline data for EIS	Springs, Wetlands, Phreatophytic Shrublands, Non-Groundwater Influenced Habitats	SNWA contractor (Ecological Sciences)	2006	Spring, Snake, Coyote Spring, Delamar, Pahranagat, Dry Lake, Cave, White River, Lake, Steptoe, and Pleasant

Table 4-1 Baseline Biological Investigation (Page 5 of 7)

Survey Type	Biota of Focus	Purpose of Study	Habitat	Who	When	Study Location(s)
Mammals	Bats	Acoustic survey for bat occurrence; baseline data for EIS	Springs, Ponds	SNWA and SNWA contractor (Dr. O'Farrell)	2005 and 2006	Cave, Dry Lake, Delamar, Lake, Lower Moapa, Spring, Snake, Tule, Tikaboo (North), Pahranagat, Virgin River and White River
Mammals	Bats	Mistnetting survey for bat occurrence; baseline data for EIS	Springs, Ponds	SNWA	2005-2008	Cave, Dry Lake, Spring, Snake, and Steptoe
Mammals	Pygmy rabbit	Pygmy rabbit survey within and adjacent to proposed Rights of Way; baseline data for EIS	Non-Groundwater Influenced Habitats	SNWA	2005-2006, 2008	Dry Lake, Cave, Lake, Spring, Snake, Steptoe, and Hamlin
Mammals	Small mammals	Survey for small mammal occurrence and potential habitat; baseline data for EIS	Springs, Wetlands, Meadows, Phreatophytic Shrubland, Phreatophytic Woodland, Non-Groundwater Influenced Habitats	SNWA	2005-2006	Delamar, Dry Lake, Cave, Lake, Spring, Snake, Hamlin and White River
Reptiles	Desert tortoise	Desert tortoise (endangered species) survey within and adjacent to proposed Rights of Way and within groundwater exploratory areas; baseline data for BA and EIS	Non-Groundwater Influenced Habitats, Phreatophytic Shrubland	SNWA contractors (Wildland Intl, Jones & Stokes)	2005-2007, 2009	Las Vegas, Garnet, Hidden (North), Coyote Spring, Pah-ranagat, Delamar, Dry Lake, Cave, Lake, Spring, Steptoe, Hamlin and Snake
Reptiles	Snakes and lizards	Survey for reptile occurrence; baseline data for EIS	Springs, Wetlands, Meadows, Phreatophytic Shrubland, Phreatophytic Woodland, Non-Groundwater Influenced Habitats	SNWA	2007	Cave, Dry Lake, Lake, Spring, Snake, and Hamlin

Table 4-1 Baseline Biological Investigation (Page 6 of 7)

Survey Type	Biota of Focus	Purpose of Study	Habitat	Who	When	Study Location(s)
Vegetation	Cactus and yucca	Survey for cactus and yucca within proposed Rights of Way; baseline data for BA and EIS	Non-Groundwater Influenced Habitats	SNWA contractors (Wildland Intl, Jones & Stokes)	2005-2007, 2009	Las Vegas, Garnet, Hidden (North), Coyote Spring, Pahranagat, Delamar, Dry Lake, Cave, Lake, Spring, Steptoe, Hamlin and Snake
Vegetation	Endangered, threatened and sensitive plants	Plant survey within and adjacent to proposed Rights of Way and within groundwater exploratory areas; baseline data for EIS	Non-Groundwater Influenced Habitats, Phreatophytic Shrubland, Playa	SNWA contractors (Wildland Intl, Jones & Stokes)	2005-2007, 2009	Las Vegas, Garnet, Hidden (North), Coyote Spring, Pahranagat, Delamar, Dry Lake, Cave, Lake, Spring, Steptoe, Hamlin and Snake
Vegetation	Invasive and noxious weeds	Weed survey within and adjacent to proposed Rights of Way; baseline data for EIS	Non-Groundwater Influenced Habitats, Phreatophytic Shrubland, Playa	SNWA contractor (TCWC)	2005-2007	Las Vegas, Garnet, Hidden (North), Coyote Spring, Pahranagat, Delamar, Dry Lake, Cave, Lake, Spring, Steptoe, Hamlin and Snake
Vegetation	Phreatophytic vegetation	Classification and mapping of phreatophytic vegetation and land cover; comprehensive GIS database; water budgeting; baseline data for EIS	Springs, Ponds, Perennial Streams, Wetlands, Meadows, Phreatophytic Shrubland, Phreatophytic Woodland, Playa, Non-Groundwater Influenced Habitats	SNWA	2004	Black Mountains Area, Lower Moapa, California Wash, Muddy River Springs Area, Lower Meadow Valley Wash, Pahranagat, Clover, Panaca, Dry, Rose, Eagle, Patterson, Spring (Basin 201), Lake, Cave, White River, Garden, Hamlin, Snake, Spring, Pleasant, Tippett, Steptoe, Jakes, Long, and Butte (South)

Table 4-1 Baseline Biological Investigation (Page 7 of 7)

Survey Type	Biota of Focus	Purpose of Study	Habitat	Who	When	Study Location(s)
Vegetation	Phreatophytic vegetation	Detailed vegetation community mapping of groundwater-influenced habitats within Spring Valley; comprehensive GIS database; to inform conservation, management, and mitigation on SNWA Northern Resources properties; to support Spring Valley Stipulation Biological Monitoring Plan efforts	Springs, Wetlands, Meadows, Phreatophytic Shrubland, Phreatophytic Woodland	SNWA contractors (BIO-WEST, KS2) and SNWA	2007-2009	Spring
Vegetation	Upland vegetation	Sustainable rangeland management of SNWA Northern Resources properties and associated grazing allotments	Wetlands, Meadows, Phreatophytic Shrubland, Non-Groundwater Influenced Habitats	SNWA and SNWA contractor (ENLC)	2007-current	Spring, Lake, Dry Lake, Patterson, Tippett, and Pahroc
Vegetation	Ute ladies'-tresses	Survey for Ute ladies'-tresses (threatened plant species) occurrence and potential habitat; baseline data for BA and EIS	Springs, Wetlands	SNWA contractor (BIO-WEST)	2006	Spring, Snake, Hamlin and Panaca

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5.0 GROUNDWATER PROJECT FEDERAL ENVIRONMENTAL COMPLIANCE

SNWA has proposed the GWD Project to develop and convey groundwater rights that are permitted to or have been purchased by SNWA in Spring, Snake, Cave, Dry Lake, and Delamar Valleys, Nevada (SNWA, 2011e). The GWD Project is being planned to convey up to 217,655 afy of water, including up to 184,655 afy of groundwater developed by SNWA and the remaining capacity provided for Lincoln County (Table 5-1).

Table 5-1 Groundwater Rights and Applications Analyzed for Conveyance through the GWD Project

Hydrographic Basin	Existing Agricultural Groundwater Rights (afy)	Groundwater Applications (afy)
SNWA Water		
Spring Valley	8,000	91,224
Snake Valley		50,679
Cave Valley [a]		11,584
Dry Lake Valley [a]		11,584
Delamar Valley [a]		11,584
Subtotal	8,000	176,655
Lincoln County Water		
Lake Valley	11,300[b]	
Additional Capacity – Source to be Determined	21,700	
Subtotal	33,000	
TOTAL	217,655	

[a] 3,000 afy of water rights from these valleys would be transferred to Lincoln County in accordance with a 2003 cooperative agreement.
[b] Privately owned water rights (allocated to Tuffy Ranch Properties, now owned by Coyote Spring Investments) are anticipated to be conveyed for Lincoln County.

The GWD Project includes the construction, operation, and maintenance of groundwater production, conveyance and treatment facilities, and power conveyance facilities (SNWA, 2011e). In August 2004, SNWA submitted an application to the BLM for ROWs for the primary water and power conveyance facilities of the GWD Project (BLM Case File No. N-78803). These facilities include:

- Approximately 306 mi of buried water pipelines, between 30 and 96 in in diameter
- Five pumping stations

- Six regulating tanks
- Three pressure reducing stations
- Water treatment facility and buried storage reservoir
- Approximately 323 mi of 230, 69, and 25 kilovolt overhead power lines
- Two primary and five secondary electrical substations

Additional facilities will be required to develop permitted groundwater rights, including groundwater production wells and collector pipelines to connect into the primary conveyance pipelines. These facilities have not yet been located and those ROWs will be requested in the future.

The BLM is required to comply with federal environmental regulations prior to making a decision on SNWA's requested ROWs. These regulations among others include:

- National Environmental Policy Act
- Endangered Species Act
- Migratory Bird Treaty Act
- Bald and Golden Eagle Protection Act
- National Historic Preservation Act
- Clean Water Act
- Clean Air Act

The federal and state environmental regulations, permits, and approvals that will be required for the GWD Project can be found on Table 5-2.

5.1 Environmental Impact Statement

The BLM has determined that preparation of an Environmental Impact Statement (EIS) is required to comply with NEPA. The EIS will assess the direct, indirect, and cumulative effects of the GWD Project on the physical, biological, and human environment, so BLM can make an informed decision on the request for ROWs. A range of alternatives, including both alignment alternatives and groundwater development alternatives, will also be identified and analyzed in the EIS. In accordance with NEPA, the EIS will have an extensive public involvement process, including public review of the draft and final EIS.

The BLM is using a tiered approach for NEPA compliance on the GWD Project. The EIS will analyze the site-specific impacts of SNWA's current ROW request for the primary water and power conveyance facilities. The potential water-related effects of groundwater development will be generally analyzed (programmatic analysis), based upon SNWA's assumptions for future facilities and utilizing a regional groundwater model encompassing a broad region of study. When the future groundwater production wells and collector pipelines are located and SNWA submits the associated ROW requests, the BLM will conduct subsequent site-specific NEPA analysis for those facilities.

That subsequent site-specific NEPA analysis will tier from the EIS, and may include additional or more detailed analysis of site-specific water-related effects, as needed.

Table 5-2 Potentially Required Federal and State Permits and Reviews

Agency	Permit/Approval
Federal	
Federal Highway Administration	Permit for pipeline and transmission lines across or within federal highway rights-of-way
U.S. Army Corps of Engineers	Section 404 Clean Water Act permit
U.S. Bureau of Land Management	Temporary and permanent rights-of-way grants Conformity with Las Vegas and Ely Field Offices Resource Management Plans National Environmental Policy Act National Historic Preservation Act Section 106 consultation Indian trust responsibility
U.S. Fish and Wildlife Service	Section 7 Endangered Species Act consultation and Biological Opinion Migratory Bird Treat Act consultation Bald and Golden Eagle Protection Act consultation
U.S. Bureau of Indian Affairs	Indian trust responsibility
Advisory Council on Historic Preservation	Section 106 National Historic Preservation Act participation
U.S. Environmental Protection Agency	Section 309 Clean Air Act EIS review
State	
Nevada Department of Cultural Affairs, State Historic Preservation Office	Section 106 National Historic Preservation Act review and concurrence
Nevada Division of Environmental Protection, Bureau of Water Pollution Control	Section 401 Water Quality Certification General storm water permit Temporary discharge permit Temporary groundwater discharge permit Working in waterways permit Underground injection control permit
Nevada Division of Environmental Protection, Bureau of Safe Drinking Water	Letter of approval to construct
Nevada Department of Transportation	Encroachment into State Highway rights-of-way Rights-of-way occupancy permits
Nevada Department of Wildlife	Handling permit for desert tortoise, Gila monster, and other sensitive species
Nevada Division of Forestry	Collection permit for state-listed plants
Nevada Division of Water Resources	Water right permits Well driller's permit Dam safety permit Recharge, storage, and recovery of underground water permit
Nevada Division of State Lands	State Land rights-of-way
Nevada Division of Environmenal Protection, Bureau of Air Pollution Control	Dust control permits Operating permits for backup generators

To ensure that the best available information is utilized for the EIS, the BLM has gathered a group of 16 Cooperating Agencies and a Technical Advisory Agency (Table 5-3) to assist in the development of the EIS. The cooperating agencies have either a jurisdictional authority or special expertise

pertinent to the GWD Project area, and they provide information and participate in preliminary document development and review.

Table 5-3 Cooperating Agencies

Federal Agencies	State and Local Agencies
Army Corps of Engineers	Central Nevada Regional Water Authority
Bureau of Indian Affairs	Clark County, Nevada
Bureau of Reclamation	Juab County, Utah
Fish and Wildlife Service	Lincoln County, Nevada
Forest Service	Millard County, Utah
National Park Service	Nevada Department of Wildlife (NDOW)
Nellis Air Force Base (U.S. Air Force)	State of Utah
U.S. Geological Survey (Technical Advisor)	Tooele County, Utah
	White Pine County

SNWA has submitted a list of over 300 applicant-committed environmental protection measures that will be implemented as part of construction and operation of the GWD Project to minimize and reduce potential environmental effects (Table 5-4). These measures include design features, best management practices, monitoring, standard operating procedures, and other practices. They also include measures SNWA has previously agreed upon in stipulations or other agreements with Federal, State or local agencies. The applicant-committed environmental protection measures have been divided into three categories:

1. detailed measures associated with the current ROW request;
2. programmatic measures associated with future ROWs; and,
3. landscape-scale measures associated with water-related effects of groundwater development.

The landscape-scale measures are intended to address the direct and potential indirect effects of groundwater withdrawals. Because of inherent uncertainties in predicting effects of groundwater withdrawals, SNWA has developed an adaptive management approach for use in determining whether and how additional environmental protection measures should be implemented.

The BLM will also identify additional mitigation measures in the EIS, as needed, to further reduce resource specific impacts under the BLM's jurisdiction. The BLM is planning to separately identify monitoring and mitigation measure recommendations for water-related effects, which can be considered in the subsequent NEPA analyses depending upon predicted effects from those site-specific analyses of groundwater development.

Public scoping for the EIS was initially conducted in April to August of 2005. A second public scoping was conducted in July to October of 2006 to address the incorporation of conveyance capacity for Lincoln County in the GWD Project. Over 1,200 substantive comment letters were received from agencies, businesses, and individuals during both scoping periods. Since then, the BLM has been preparing the Draft EIS. The Draft EIS was released for public review June 10, 2011.

The Final EIS and Record of Decision are anticipated in 2012. In addition to the EIS process, other Federal and State permits and approvals that will be required to construct and operate the GWD Project are identified in Table 5-2.

Table 5-4 SNWA Environmental Protection Measures

Category	Number of Measures
General Construction Practices	89
General Operation Practices	13
Geologic Hazards and Soils	3
Water Resources	2
General Biological Resources	8
Special Status Plants	7
Desert Tortoise	21
Banded Gila Monster and Chuckwalla	3
Burrowing Owls and Kit Fox	9
Greater Sage-Grouse	8
Pygmy Rabbit	4
Desert Valley Kangaroo Mouse	1
Migratory Birds (including Raptors)	8
Big Game and Wild Horses	7
Game Fish	2
Paleontological Resources	3
Cultural Resources	8
Land Use and Range Management	4
Noise	4
Air Quality	8
Visual Resources	4
Socioeconomics	4
Programmatic Measures – Future ROWs	11
Measures from SNWA Agreements	49
Adaptive Management Measures	22

5.2 Endangered Species Act Section 7 Consultation

A Biological Assessment (BA) is being prepared for consultation with the USFWS, in accordance with Section 7 of the ESA. The BLM is precluded under ESA from taking actions that will jeopardize the continued existence of federally listed species or result in the destruction or adverse modification of designated critical habitat for such species. The BA will evaluate direct, indirect and cumulative effects on Federal listed and conference species and designated critical habitat (Table 5-5), and will include measures to minimize and mitigate anticipated effects to covered species and habitat. The BA

will be used to initiate formal Section 7 consultation with the USFWS and obtain a Biological Opinion (BO) for the GWD Project. As described for the EIS, the BO will use a tiered approach with site-specific analysis for the current ROW request of the primary water and power conveyance facilities, and a programmatic analysis of water-related effects associated with future facilities for groundwater development. The BO will provide ESA coverage for the current ROW request, and additional tiered consultations with the USFWS will be required in the future for subsequent ROW requests for groundwater production wells and collector pipelines.

Table 5-5 Species Addressed in the Biological Assessment

Species	Status	Basin(s) Present
Southwestern Willow Flycatcher (*Empidonax traillii extimus*)	Endangered	LMR, LMV, PAH, UMR
Yuma Clapper Rail (*Rallus longirostris yumanensis*)	Endangered	LMR
Desert Tortoise (*Gopherus agassizii*)	Threatened	LV, GA, HI, CS, PAH
Pahrump Poolfish (*Empetrichthys latos*)	Endangered	SPR
White River Spinedace (*Lepidomeda albivallis*)	Endangered	WR
Big Spring Spinedace (*Lepidomeda mollispinis pratensis*)	Threatened	PAN
White River Springfish (*Crenichthys baileyi baileyi*)	Endangered	PAH
Hiko White River Springfish (*Crenichthys baileyi grandis*)	Endangered	PAH
Pahranagat Roundtail Chub (*Gila robusta jordani*)	Endangered	PAH
Moapa Dace (*Moapa coriacea*)	Endangered	UMR
Ute ladies'-tresses (*Spiranthes diluvialis*)	Threatened	Not Present
Greater Sage-Grouse (*Centrocercus urophasianus*)	Candidate	CV, LK, SPR, SNK
Northern Leopard Frog (*Lithobates* (=*Rana*) *pipiens*)	Petitioned	SPR
Longitudinal Gland Pyrg (*Pyrgulopsis anguina*)	Petitioned	SNK
Flag Pyrg (*Pyrgulopsis breviloba*)	Petitioned	WR, CV
Butterfield Pyrg (*Pyrgulopsis lata*)	Petitioned	WR, DRL
Lake Valley Pyrg (*Pyrgulopsis sublata*)	Petitioned	LK
Blaine's Pincushion (*Sclerocactus blainei*)	BLM Sensitive	DRL

CS=Coyote Spring Valley; CV=Cave; DRL=Dry Lake Valley; GA=Garnett Valley; HI=Hidden Valley; LMR=Lower Muddy River; LK=Lake Valley; LMV=Lower Meadow Valley Wash; LV=Las Vegas Valley; PAH=Pahranagat Valley; PAN=Panaca Valley; SNK=Snake Valley; SPR=Spring Valley; UMR=Upper Muddy River; WR=White River Valley
*The least chub *(Iotichthys phlegethentis)* was also recommended for conference by the USFWS, however it is not within the proposed or programmatic action areas and thus is not assessed in the BA.

5.3 National Historic Preservation Act Section 106 Compliance

A Programmatic Agreement to comply with Section 106 of the National Historic Preservation Act is being developed with the BLM, Nevada State Historic Preservation Office, U.S. Army Corps of Engineers, and federal Advisory Council on Historic Preservation. The Programmatic Agreement outlines steps to identify and evaluate cultural resources, identify potential effects, and develop

measures to avoid, reduce, or mitigate effects. This agreement is undergoing a public involvement process, and Native American tribes are also afforded an opportunity to be concurring parties.

The BLM is also conducting government-to-government consultations with federally recognized Native American tribes, in accordance with its federal Indian trust responsibility. Federal agencies must assess the impact of Federal government activities on tribal trust resources and assure that tribal government rights and concerns are considered. The BLM is consulting with 16 federally recognized tribes, which are either located in or have traditional ties to the study area.

5.4 Clean Water Act Section 404 Compliance

SNWA conducted a jurisdictional determination for the current GWD Project ROWs in 2008, to determine the location and extent of any Waters of the U.S. for which a Clean Water Act Section 404 permit may be required. The U.S. Army Corps of Engineers concurred with the determination in 2009. (McQueary pers. comm., 2009)

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6.0 CONSERVATION AGREEMENTS AND ADAPTIVE INTEGRATED RESOURCE MANAGEMENT

6.1 Conservation Agreements, Strategies, and Plans

SNWA is a voluntary participant in a number of conservation initiatives and programs throughout the project basins and adjacent basins. Table 6-1 provides a summary of some of the conservation programs in which SNWA takes part. These programs are discussed in greater detail below.

Table 6-1 Conservation Initiatives in Which SNWA Voluntarily Participates

Conservation Agreements and Strategies	Conservation Initiatives	Implementation Teams for USFWS Recovery Plans
Conservation Agreement and Strategy for Least Chub *(Iotichthys phlegethontis)* in the State of Utah	Greater Sage-Grouse Conservation Plan for Nevada and Eastern California	Pahranagat Valley Native Fishes RIT
Conservation Agreement and Strategy for Columbia Spotted Frog *(Rana luteiventris)* in the State of Utah	Greater Sage-Grouse Conservation Plan for the Bi-State Plan Area of Nevada and Eastern California	White River Valley Native Fishes RIT
Bureau of Land Management National Sage-Grouse Habitat Conservation Strategy	Nevada Sage-Grouse Conservation Project	Big Springs Spinedace RIT
	White Pine County Portion (Lincoln/White Pine Planning Area) Sage-Grouse Conservation Plan	
	Lincoln County Sage-Grouse Conservation Plan	
	Candidate Conservation Agreement with Assurances	

6.1.1 Least Chub Conservation Agreement and Strategy

SNWA is a signatory to the Conservation Agreement and Strategy for Least Chub (*Iotichthys phlegethontis*) in the State of Utah (UDWR, 2009b). As a signatory to the Conservation Agreement and Strategy, SNWA has committed to:

1. providing a representative to the Least Chub Conservation Team, which is made up of representatives from the various signatories;
2. cooperating with the State of Utah and the other signatories to implement the Least Chub Conservation Strategy; and,
3. considering potential effects of SNWA activities and plans on least chub and their habitat, with the goal of avoiding and/or mitigating such effects when possible.

As stated in the Conservation Agreement and Strategy (UDWR, 2009b), the least chub Conservation Agreement was developed to expedite implementation of conservation measures for least chub in Utah as a collaborative and cooperative effort among resource agencies. Threats that might warrant future listing under the ESA should be significantly reduced or eliminated through implementation of the Conservation Agreement and Strategy. The goal is to ensure the long-term persistence of least chub within its historic range and support development of range-wide conservation efforts. Objectives are to eliminate or reduce threats to least chub and its habitat, and to maintain and restore self-sustaining populations throughout its historic range that will ensure the continued existence of the species.

The least chub is a federal Candidate species and a Utah State Species of Special Concern. Within the GWD Project area, the species occurs in northern Snake Valley.

6.1.2 Columbia Spotted Frog Conservation Agreement and Strategy

SNWA is a signatory to the Conservation Agreement and Strategy for Columbia Spotted Frog in the State of Utah (UDWR, 2009a). As a signatory to the Conservation Agreement and Strategy, SNWA has committed to:

1. providing a representative to the Columbia Spotted Frog Conservation Team, which is made up of representatives from the various signatories;
2. cooperating with the State of Utah and the other signatories to implement the Columbia Spotted Frog Conservation Strategy; and,
3. considering potential effects of SNWA activities and plans on Columbia spotted frog and their habitat, with the goal of avoiding and/or mitigating such effects when possible.

As stated in the Conservation Agreement and Strategy (UDWR, 2009a) the Columbia spotted frog Conservation Agreement was developed to expedite implementation of conservation measures for Columbia spotted frog in Utah as a collaborative and cooperative effort among resource agencies. Threats that might warrant future listing under the ESA should be significantly reduced or eliminated through implementation of the Conservation Agreement and Strategy. The goal is to ensure the long-term persistence of Columbia spotted frog within its historic range and support development of state-wide conservation efforts. Objectives include eliminating or reducing threats to Columbia spotted frog and its habitat, and maintaining and restoring self-sustaining populations throughout its historic range.

The Columbia spotted frog is a Utah State Species of Special Concern. Within the GWD Project area, the species occurs in northern Snake Valley.

6.1.3 Greater Sage-Grouse Conservation Plans, Strategy and Project

Federal, state, local, and private entities are undertaking efforts to conserve Greater Sage-Grouse and their sagebrush habitat. The level of attention that Greater Sage-Grouse have received demonstrates that serious efforts have been made to ensure the species' survival and recovery. Greater Sage-Grouse conservation efforts most relevant to species occurrences in the GWD Project area include the following:

- The Bureau of Land Management National Sage-Grouse Habitat Conservation Strategy (BLM, 2004) provides a comprehensive management strategy for sage-grouse protection. The goals of the strategy include improving the effectiveness of management frameworks for addressing conservation needs of sage-grouse lands administered by BLM;
- The Greater Sage-Grouse Conservation Plan for Nevada and Eastern California (Governor's Sage-Grouse Conservation Team, 2004) and an established implementation subcommittee makes recommendations to local working groups by offering strategies on how to reduce risk factors to Greater Sage-Grouse in the area;
- The Greater Sage-Grouse Conservation Plan for the Bi-State Plan Area of Nevada and Eastern California (Bi-State Local Planning Group, 2004) provides recommendations regarding agency collaboration, implementation, financial strategies, and adaptive management. The goal of the plan is to maintain sagebrush ecosystems for the benefit of the Greater Sage-Grouse;
- The Nevada Sage-Grouse Conservation Project (NDOW Sage-Grouse Conservation Team, 2007) proposes projects to support the survey and inventory of Greater Sage-Grouse conservation planning efforts and to coordinate research projects regarding Greater Sage-Grouse;
- The White Pine County Portion (Lincoln/White Pine Planning Area) Sage-Grouse Conservation Plan (White Pine County Sage-Grouse Technical Review Team, 2004) presents strategies to monitor research needs, recommend management actions, and establish guidelines for addressing risk factors to Greater Sage-Grouse in the area; and,
- The Lincoln County Sage-Grouse Conservation Plan (Lincoln County Sage-Grouse Technical Review Team, 2004) aims to develop a sound scientific basis for land management decisions. BLM is currently implementing this plan by conducting Greater Sage-Grouse studies and habitat restoration in Lincoln County (including Cave, Hamlin, and south Spring valleys).

As a grazing permit holder, SNWA is cooperating with BLM efforts to restore Greater Sage-Grouse habitat in southern Spring Valley in accordance with the BLM National Sage-Grouse Habitat Conservation Strategy (BLM, 2004) and the Lincoln County Sage-Grouse Conservation Plan (Lincoln County Sage-Grouse Technical Review Team, 2004). SNWA also collected radio telemetry data on Greater Sage-Grouse movements and habitat use in Spring Valley concurrent with a BLM and NDOW telemetry study, which may also inform a Candidate Conservation Agreement with Assurances on SNWA Northern Resources property (Section 6.1.4).

The Greater Sage-Grouse is a federal Candidate species and a BLM Sensitive Species. Within the GWD Project area, the species occurs in Cave, White River, Lake, Snake, Spring, and Hamlin valleys.

6.1.4 Candidate Conservation Agreement with Assurances

SNWA has entered into discussions with the USFWS regarding the development of a Candidate Conservation Agreement with Assurances (CCAA) to provide benefit to species of interest that occur on SNWA properties in Spring Valley. CCAAs are voluntary agreements between the USFWS and a non-federal landowner intended to facilitate the conservation of federally Proposed and Candidate species and species with a reasonable likelihood of becoming a federal Candidate species in the foreseeable future. CCAAs have been effective mechanisms for conserving declining species, particularly candidate species, and have, in some instances, precluded or removed any need to list some species. Under a CCAA, SNWA would commit to implement voluntary and proactive conservation measures on SNWA Northern Resources property. To date, discussions have focused on the Greater Sage-Grouse, northern leopard frog, and pygmy rabbit.

6.2 Fish Recovery Implementation Teams

Since 1995, SNWA has participated on RITs such as the Pahranagat Valley Native Fishes RIT, White River Valley Native Fishes RIT and Big Springs Spinedace RIT. These teams typically include representatives from NDOW, BLM, USFWS, and USGS, and work to implement native fish management plans and Recovery Plans for threatened and endangered species and their habitat. RIT activities include monitoring, management, and conservation efforts.

The following species of interest have been the focus of RIT efforts toward which SNWA has contributed:

- Pahranagat Valley Native Fishes RIT
    - Hiko White River springfish (Endangered)
    - Pahranagat roundtail chub (Endangered)
    - White River springfish (Endangered)
- White River Valley Native Fishes RIT
    - White River spinedace (Endangered)
    - Moorman White River springfish (NV Protected)
    - White River desert sucker (NV Protected)
    - White River speckled dace (NV Protected)
- Big Spring Spinedace RIT
    - Big Spring Spinedace (Threatened)

6.3 Adaptive Integrated Resource Management

Adaptive management as defined by the DOI's NEPA regulations is "a system of management practices based on clearly identified outcomes and monitoring to determine whether management actions are meeting desired outcomes; and, if not, facilitating management changes that will best ensure that outcomes are met or re-evaluated. Adaptive management recognizes that knowledge about natural resource systems is sometimes uncertain." (43 C.F.R. § 46.30) The DOI encourages its agencies to use adaptive management, "particularly in circumstances where long-term impacts may be uncertain and future monitoring will be needed to make adjustments in subsequent implementation decisions" (43 C.F.R. § 46.145, see also Department of Interior Adaptive Management Technical Guide, 2007) (Williams et al., 2007). Figure 6-1 illustrates the basic adaptive management process.

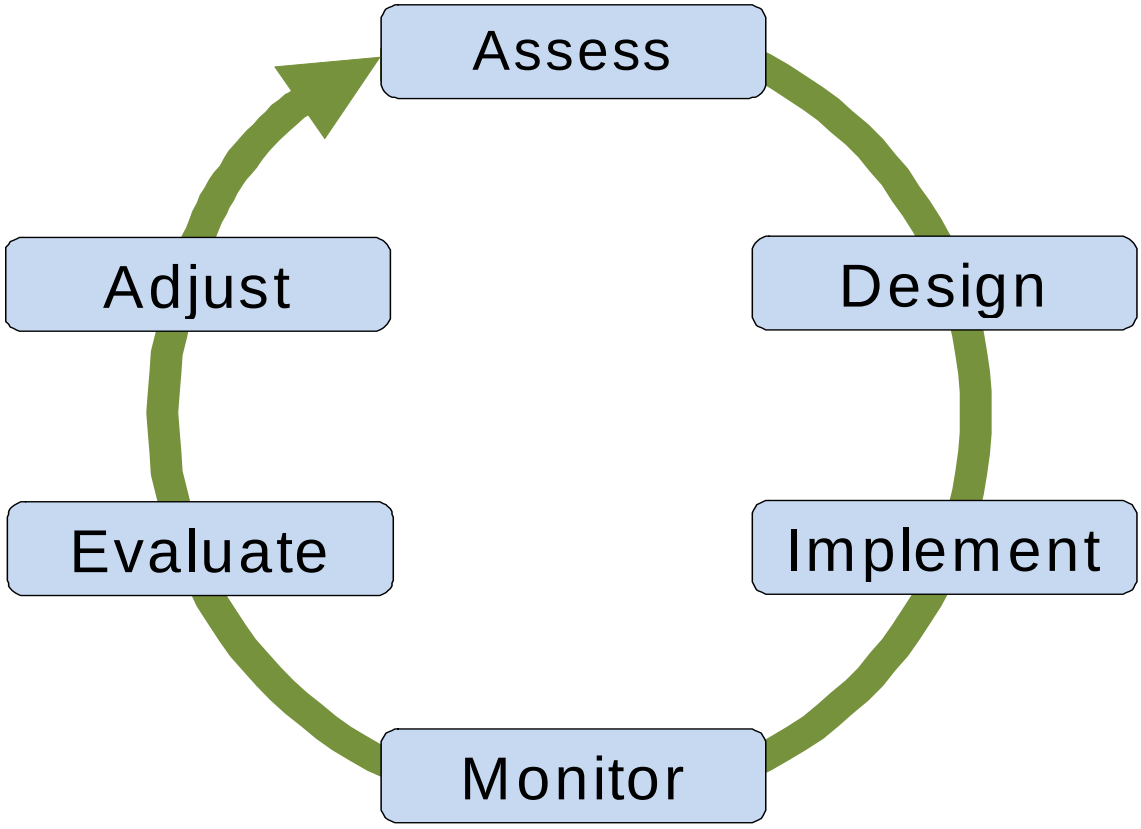

Figure 6-1 Adaptive Management Flow Diagram, Department of Interior Adaptive Management Technical Guide 5 (2007)

As presented here, integrated resource management is a process that coordinates the management of water, land, vital ecosystems, Special Status Species, and other related natural resources to ensure their long-term sustainability. When coupled with adaptive management, and an expansive tool box, adaptive integrated resource management is a strategy that enables the sustainable development of groundwater resources in the Project Basins while minimizing environmental conflicts.

SNWA's extensive deeded lands with associated grazing allotments, livestock, and water rights provide the ability and flexibility to implement adaptive integrated resource management, and ensure

sustainable groundwater withdrawal from the Project Basins. Over 90 percent of SNWA's deeded lands and associated grazing allotments occur in the Project Basins and adjacent basins, and are collectively referred to as SNWA Northern Resources. SNWA Northern Resources are composed of approximately 23,500 acres (37 mi^2) of deeded lands; 900,000 acres (1,400 mi^2) of associated BLM and FS grazing allotments; and 64,000 afy of associated surface, ground and supplemental water rights (Figure 6-1). Also part of SNWA Northern Resources is the Cave Valley Ranch Conservation Easement, a 1,480-acre (2 mi^2) easement on privately-owned land in Cave Valley (Figure 6-1).

A major component of SNWA Northern Resources are land holdings in the Great Basin, composed of ranch properties in and around Spring Valley that total approximately 23,500 acres, or 37 mi^2 (Figure 6-2). Over 95 percent of these properties are in Spring Valley, with remaining acreages in Dry Lake Valley and Steptoe Valley. Water rights that were acquired with the ranch properties include approximately 33,900 afy of surface water rights, 6,000 afy of groundwater rights, and 23,800 afy of supplemental rights. Approximately 40 percent (over 4,000 acres) of the wetland/meadow habitats in the valley floor and valley floor / alluvial fan interface of Spring Valley occur within the SNWA land holdings (SNWA, 2004; SNWA et al., 2011). These deeded properties encompass, in part, the majority of Stonehouse Spring Complex; the majority of Minerva Spring Complex; a portion of Keegan Spring Complex; portions of Swamp Cedar North and Swamp Cedar South; Swallow Spring; and Unnamed 5 Spring. The properties are used by the aquatic Special Status Species northern leopard frog and relict dace; the Toquerville pyrg; the terrestrial Special Status Species Greater Sage-Grouse; valley-floor Rocky Mountain juniper trees; and, big game.

Four of the ranch properties are base properties to federal grazing allotments that are managed by BLM or FS. The grazing allotments span eight hydrographic areas (Tippett, Spring, Steptoe, Hamlin, Lake, Dry Lake, Patterson, and Pahroc Valleys) and total approximately 900,000 acres, or 1,400 mi^2 (Figure 6-2). The majority of these grazing allotments are in Spring Valley (>60 percent) and northern Dry Lake Valley (>30 percent). Approximately 40 percent (over 4,500 acres) of the wetland/meadow habitats and 40 percent (approx. 60,000 acres) of the phreatophytic shrublands on the valley floor and valley floor / alluvial fan interface of Spring Valley occur within the allotments (SNWA, 2004; SNWA et al., 2011). These grazing allotments encompass, in part, Shoshone Ponds; Blind Spring; Four Wheel Drive Spring; a portion of Keegan Spring Complex; a small portion of Minerva Spring Complex; South Millick Spring; portions of Swamp Cedar North and Swamp Cedar South; a downstream channel of Unnamed 5 Spring; and Willow Spring. The allotments are used by the aquatic Special Status Species northern leopard frog and relict dace; the Toquerville pyrg; the terrestrial Special Status Species Greater Sage-Grouse; valley-floor Rocky Mountain juniper trees; and, big game.

Another component of SNWA Northern Resources is the Cave Valley Ranch Conservation Easement, which totals approximately 1,480 acres (2 mi^2). This conservation easement was purchased by SNWA from the private landowner (Cave Valley Ranch). The conservation easement encompasses, in part, a portion of the Parker Station Spring complex (approx. 250 acres of spring/wetland/meadow habitat) and the headwaters of Cave Spring. The purpose of the conservation easement is to conserve and protect in perpetuity the natural habitat located on the property.

As the owner of approximately 23,500 acres of land in the project area, over 95 percent of which occur in Spring Valley, SNWA will have direct land access and decision-making abilities to enable the

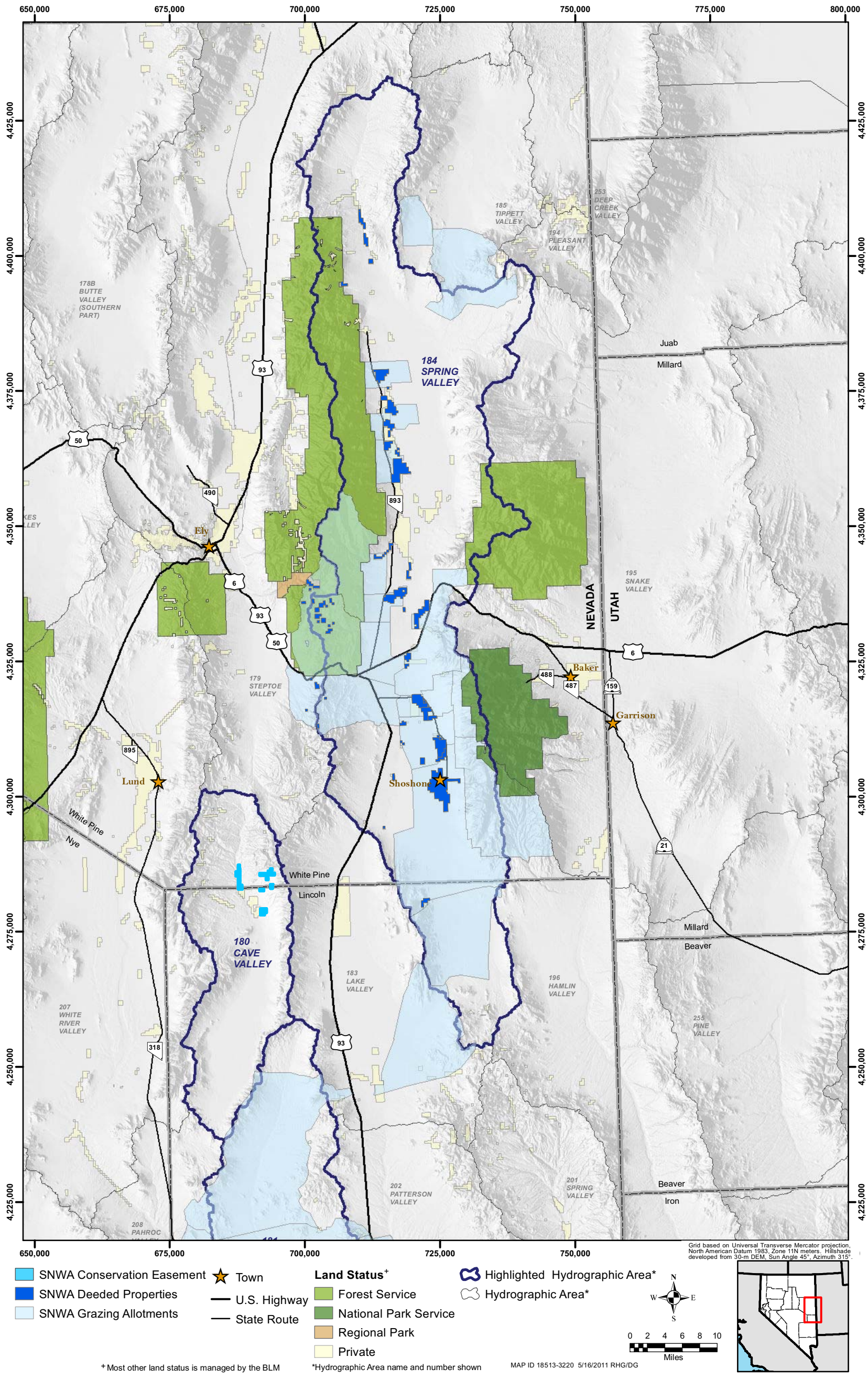

Figure 6-1
SNWA Northern Properties and Associated Grazing Allotments

study and management of groundwater-influenced habitats and other natural resources. SNWA has a proven track record of conducting studies, as described in Section 4.0, and implementing conservation programs such as the Las Vegas Wash stabilization and restoration (LVWCC, 2011). Future environmental commitments may include development of CCAAs (Section 6.1.4) and the implementation of applicant-committed conservation measures under NEPA and ESA (Section 5.0). Other SNWA environmental commitments currently implemented include the Spring Valley and DDC Valley Stipulated Agreements (Stipulation, 2006 and 2008; Section 3.0); the Cave Valley Ranch Conservation Easement (discussed above); the Coyote Spring Valley Stipulation (Stipulation, 2001); the Muddy River Memorandum of Agreement (USFWS, 2006); and, the creation of the Warm Springs Natural Area**.**

As a permittee of approximately 900,000 acres of Federal grazing allotments, >90 percent of which occur in Spring and Dry Lake Valleys, SNWA will have collaborative decision-making abilities to enable study and management of groundwater-influenced habitats and other natural resources in conjunction with the BLM and FS. Established SNWA environmental commitments implemented on BLM grazing allotments include the Spring Valley Stipulated Agreement and the DDC Stipulated Agreement, both signed by SNWA, USFWS, BLM, NPS, and BIA (Stipulation, 2006 and 2008; Section 3.0); and, grazing permitting compliance measures in accordance with NEPA and BLM Resource Management Plans. Other potential environmental commitments include integrated SNWA/BLM grazing management plans and SNWA/USFWS/BLM Candidate Conservation Agreements.

Collectively, SNWA's Northern Resources provide a significant set of resources and management options (the tool box) that will allow for the implementation of an adaptive and integrated resource management program that works to avoid and/or mitigate effects of groundwater development on sensitive environmental resources (Figure 6-3). Potential management actions could include facilitated recharge projects, improved and/or modified grazing and irrigation practices to benefit target species/habitats, weed management, rangeland restoration and aquatic habitat enhancement. SNWA is currently managing the Northern Resources properties with the goal of maintaining current conditions while initial resource studies are completed and baseline monitoring data is collected pursuant to the Spring Valley Stipulated Agreement (Stipulation, 2006), and BLM prepares the GWD Project EIS. Development of the GWD Project will include the preparation of integrated resource management plans that utilize these lands, water, and livestock resources to address potential effects as future facilities are sited.

SNWA resource management on its deeded lands and associated grazing allotments is one of four large-scale processes that will guide adaptive integrated resource management (Figure 6-4). Other processes include NSE Rulings and regulations, including any conditions such as monitoring and reporting; Stipulated Agreements signed by SNWA, USFWS, BLM, NPS, and BIA and that require monitoring, management, and mitigation; Federal environmental compliance under NEPA and ESA as part of the process of obtaining ROW, including applicant-committed measures and other mitigation measures; and, public resource management dictated by Federal and State programs or pursued as part of collaborative efforts between SNWA, Federal Bureaus, State Agencies, and/or other entities. Together, these processes will ensure adaptive integrated resource management and sustainable groundwater development in the Project Basins is achieved.

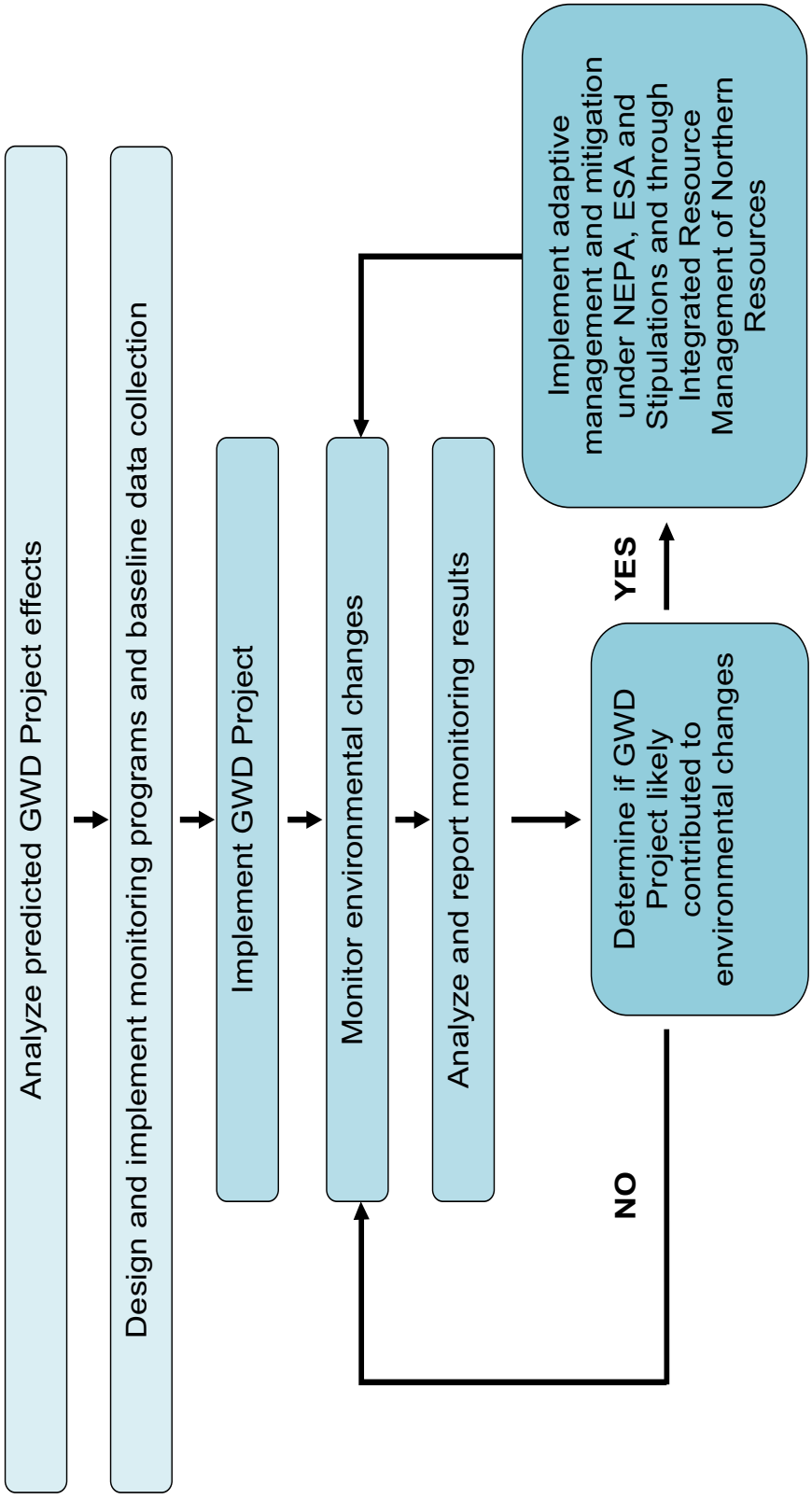

Figure 6-3
Implementation Process for Adaptive Integrated Resource Management

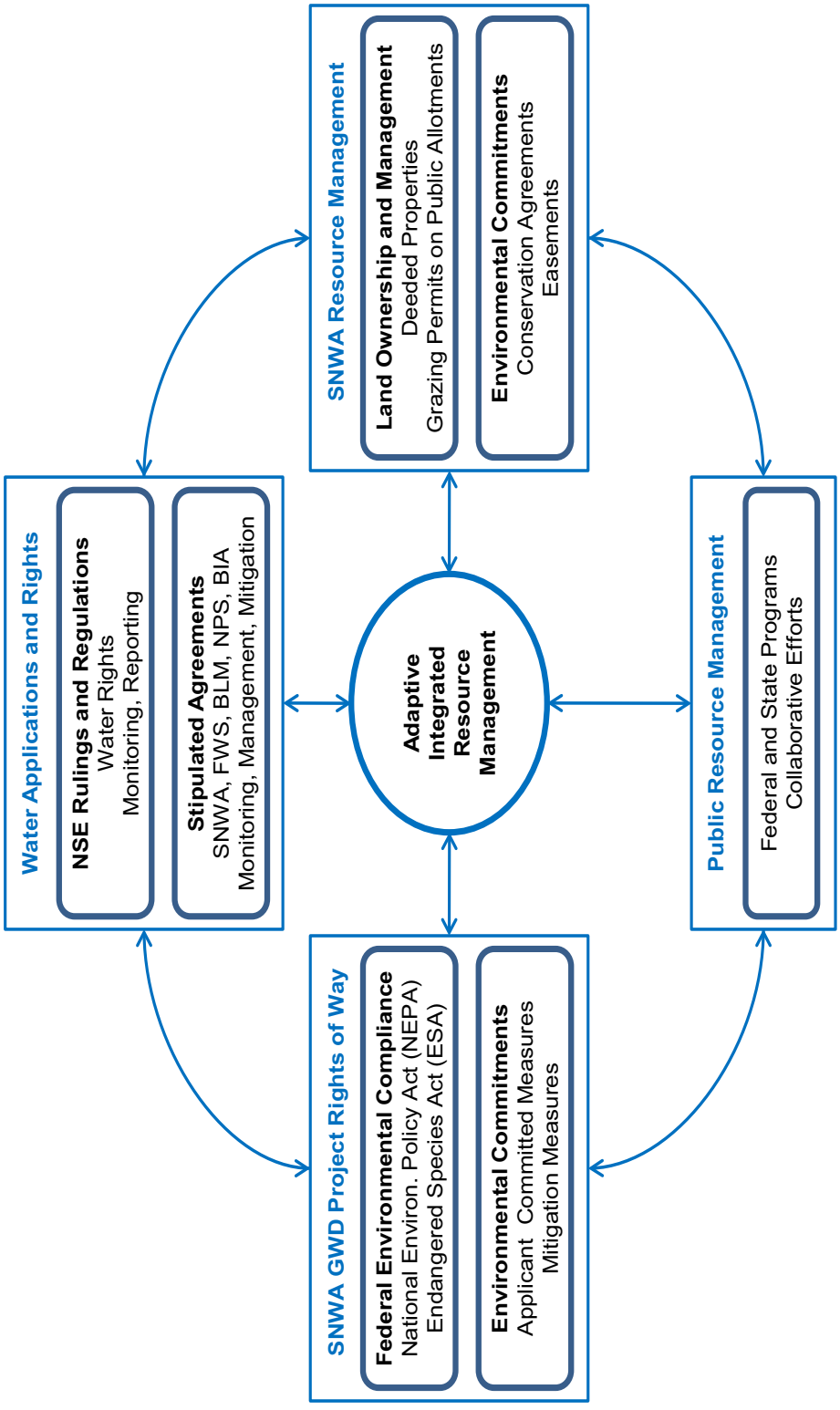

Figure 6-4
Processes that Guide Adaptive Integrated Resource Management Decisions

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7.0 SUMMARY OF SNWA HYDROLOGIC EFFECTS ANALYSIS

Environmental Areas of Interest, (Figure 7-1 and Table 7-1) were selected for analysis to provide a broad representation of groundwater-influenced habitats within and outside the area potentially affected by the proposed SNWA groundwater development in the Project Basins. These areas include groundwater-influenced habitats that have been found to provide habitat for Special Status Species (e.g. Pahrump poolfish), are unique habitats that are potentially groundwater influenced (e.g. swamp cedars) or sites that represent similar groundwater-influenced habitats in the general vicinity. Many of the Environmental Areas of Interest have been selected for hydrologic and/or biological monitoring pursuant to the Spring Valley and DDC stipulations. A qualitative analysis and where appropriate, quantitative analyses using the CCRP Model were applied to each of these sites in the report entitled, "Conflicts Analysis Related to Southern Nevada Water Authority Groundwater Applications in Spring, Cave, Dry Lake, and Delamar Valleys, Nevada and Vicinity," (Watrus and Drici, 2011).

The quantitative hydrologic analysis (Watrus and Drici, 2011) uses the CCRP Model to simulate the effects of SNWA groundwater development in the Project Basins at the following five time steps:

- December 31, 2029: 10 years after initiation of pumping in Cave, Dry Lake, and Delamar valleys.
- December 31, 2042: Start of full production of application volumes in Spring, Cave, Dry Lake, and Delamar valleys.
- December 31, 2062: 20 years after the start of full production.
- December 31, 2082: 40 years after the start of full production.
- December 31, 2117: 75 years after the start of full production.

Environmental Areas of Interest, where the CCRP Model simulations were applied, were evaluated and sites were identified when the simulated change in groundwater elevation exceeded 50 ft or a decrease in spring flow exceeded 15 percent. These criteria were selected by Watrus and Drici (2011) and were, "based upon the confidence of the model's predictions" (Watrus and Drici, 2011). Of the 51 total sites that were considered in the analysis, 34 sites were found to warrant evaluation using CCRP Model output, 3 sites were within an area where the model simulated a change in depth to groundwater greater than 50 ft and 3 sites were simulated to have a reduction in spring flow greater than 15 percent.

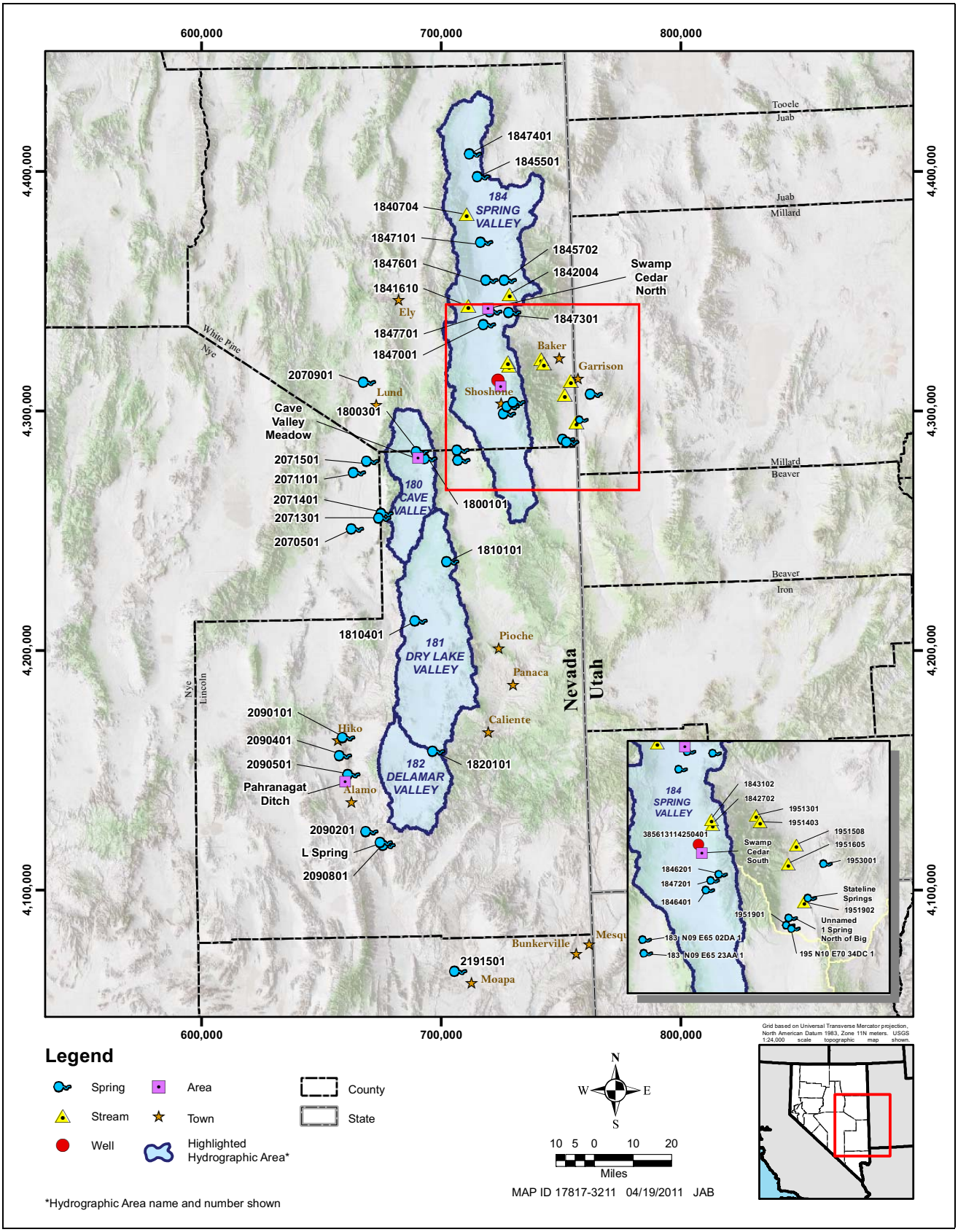

Figure 7-1 Environmental Areas of Interest

Table 7-1
Environmental Areas of Interest
(Page 1 of 6)

Site ID	Name	Location[a]		Elevation(ft)	Geographic Location	Selection Factor
		UTM Northing (m)	UTM Easting (m)			
Cave, Dry Lake, Delamar Valleys and Vicinity						
1800101	Cave Spring	4,279,249	691,760	6,486	Mountain Block	DDC Stipulation monitoring site; Site of interest
---	Cave Valley Meadow	4,280,420	690,235	6,467	Valley Floor	DDC Stipulation monitoring site; Below mountain block; Site of interest
1800301	Parker Station Spring	4,282,096	688,179	6,490	Valley Floor	DDC Stipulation monitoring site; Below mountain block; Aquatic Special Status Species
1820101	Grassy Spring	4,157,323	694,969	5,786	Mountain Block	DDC Stipulation monitoring site; Representative site in Delamar Valley
1810401	Coyote Spring	4,211,513	687,693	5,224	Mountain Block	DDC Stipulation monitoring site; Representative site in Dry Lake Valley
1810101	Meloy Spring	4,236,201	700,888	6,178	Mountain Block	DDC Stipulation monitoring site; Aquatic Special Status Species (mtn block)
Lake Valley						
183 N09 E65 02DA 1	Geyser Creek Spring	4,282,764	705,194	6,101	Mountain Block	Representative site in northern Lake Valley; Aquatic Special Status Species (mtn block)
183 N09 E65 23AA 1	Wambolt Springs	4,278,675	705,543	5,950	Alluvial Fan/Valley Floor	Below mountain block; Aquatic Special Status Species

Table 7-1
Environmental Areas of Interest
(Page 2 of 6)

Site ID	Name	Location[a]		Elevation(ft)	Geographic Location	Selection Factor
		UTM Northing (m)	UTM Easting (m)			
Muddy River Springs Area						
2091501	Moapa National Wildlife Refuge Warm Springs West[c]	4,065,272	704,211	1,772	Valley Floor	Coyote Spring Valley Stipulation / Muddy River MOA monitoring site; Below mountain block; On Moapa NWR; Aquatic Special Status Species
Pahranagat Valley						
2090501	Ash Springs	4,147,460	659,684	3,603	Valley Floor	DDC Stipulation monitoring site; Below mountain block; Aquatic Special Status Species
2090201	Cottonwood Spring	4,123,643	667,261	3,238	Alluvial Fan/Valley Floor	DDC Stipulation monitoring site; Site of interest; Below mountain block; On Pahranagat NWR
2090401	Crystal Springs	4,155,348	656,165	3,803	Valley Floor	DDC Stipulation monitoring site; Below mountain block; Aquatic Special Status Species
2090101	Hiko Spring	4,162,744	657,549	3,878	Valley Floor	DDC Stipulation monitoring site; Below mountain block; Aquatic Special Status Species
---	L Spring	4,119,155	673,202	3,159	Alluvial Fan/Valley Floor	Below mountain block; On Pahranagat NWR; Aquatic Special Status Species
2090801	Maynard Spring	4,117,909	674,444	3,107	Alluvial Fan/Valley Floor	DDC Stipulation monitoring site; Below mountain block; Aquatic Special Status Species
---	Pahranagat Ditch	4,145,350	659,798	3,559	Valley Floor	DDC Stipulation monitoring site; Below mountain block; Aquatic Special Status Species

Table 7-1
Environmental Areas of Interest
(Page 3 of 6)

Site ID	Name	Location[a]		Elevation(ft)	Geographic Location	Selection Factor
		UTM Northing (m)	UTM Easting (m)			
Snake Valley						
1951403	Baker Creek (incl. S. Fork Baker Ck)	4,319,788	742,379	6,588	Mountain Block	Site of interest (Baker Ck); In GBNP (perennial reach); Aquatic Special Status Species (S Fork Baker Ck, mtn block)
1951901	Big Springs[b]	4,287,293	749,422	5,578	Alluvial Fan	Spring Valley Stipulation monitoring site; Below mountain block; Aquatic Special Status Species
1951902	Big Springs Creek / Lake Creek[b]	4,295,165	755,908	5,450	Alluvial Fan/Valley Floor	Spring Valley Stipulation monitoring site; Below mountain block; Aquatic Special Status Species
1951605	Big Wash (incl. S. Fork Big Wash)	4,306,797	750,951	6,187	Mountain Block	Site of interest; In GBNP (upper reach of S Fork); Aquatic Special Status Species (mtn block)
1953001	Clay Spring	4,306,147	760,875	5,446	Alluvial Fan	Spring Valley Stipulation monitoring site; Below mountain block; Aquatic Special Status Species
1951301	Lehman Creek	4,321,757	741,187	6,734	Mountain Block	Site of interest; In GBNP (upper reach)
195 N10 E70 34DC	North Little Springs	4,286,207	751,006	5,562	Alluvial Fan	Spring Valley Stipulation monitoring site; Below mountain block
1951508	Snake Creek	4,312,614	753,449	5,576	Mountain Block	Site of interest; In GBNP; Aquatic Special Status Species (mtn block)
---	Stateline Springs[b]	4,295,881	756,735	5,423	Alluvial Fan/Valley Floor	Spring Valley Stipulation monitoring site; Below mountain block; Aquatic Special Status Species
---	Unnamed 1 Spring North of Big Springs	4,289,483	750,194	5,572	Alluvial Fan	Spring Valley Stipulation monitoring site; Below mountain block; Aquatic Special Status Species

Table 7-1
Environmental Areas of Interest
(Page 4 of 6)

Site ID	Name	Location[a]		Elevation(ft)	Geographic Location	Selection Factor
		UTM Northing (m)	UTM Easting (m)			
Spring Valley						
3856131142 50401	184 N12 E67 02ACBA1 USBLM (Shoshone Pond Well)	4,312,898	723,711	5,781	Alluvial Fan/Valley Floor	Spring Valley Stipulation monitoring site; Below mountain block; Aquatic Special Status Species
1846401	Blind Spring	4,298,025	724,717	5,773	Valley Floor	Spring Valley Stipulation monitoring site; Below mountain block; Aquatic Special Status Species
1841610	Cleve Creek	4,343,870	710,765	5,964	Mountain Block	Spring V Stipulation monitoring site; Site of interest
1847001	Four Wheel Drive Spring	4,335,256	716,255	5,754	Alluvial Fan/Valley Floor	Spring Valley Stipulation monitoring site; Below mountain block
1840704	Kalamazoo Creek	4,382,169	710,123	6,233	Mountain Block	Representative site in Spring V
1847101	Keegan Spring near Piermont, NV	4,369,664	715,050	5,617	Alluvial Fan/Valley Floor	Spring Valley Stipulation monitoring site; Below mountain block; Aquatic Special Status Species
1847201	Minerva Spring	4,301,025	726,101	5,825	Alluvial Fan/Valley Floor	Spring Valley Stipulation monitoring site; Below mountain block; Aquatic Special Status Species
1842004	Negro Creek	4,348,593	727,948	6,032	Mountain Block	Representative site in Spring Valley
1842702	Pine and Ridge Creeks	4,318,879	727,728	7,345	Mountain Block	Site of interest; In GBNP (upper reach); Aquatic Special Status Species (mtn block)
1847301	Rock Spring	4,340,204	726,798	6,364	Mountain Block	Spring Valley Stipulation monitoring site; Aquatic Special Status Species (mtn block)
1843102	Shingle Creek	4,320,388	727,332	7,309	Mountain Block	Site of interest; In GBNP (upper reach)

Table 7-1
Environmental Areas of Interest
(Page 5 of 6)

Site ID	Name	Location[a]		Elevation(ft)	Geographic Location	Selection Factor
		UTM Northing (m)	UTM Easting (m)			
Spring Valley (continued)						
1845702	South Millick Spring	4,353,754	725,031	5,593	Valley Floor	Spring Valley Stipulation monitoring site; Below mountain block; Aquatic Special Status Species
1847401	Stonehouse Spring	4,406,507	710,511	6,256	Alluvial Fan/Valley Floor	Spring Valley Stipulation monitoring site; Below mountain block; Aquatic Special Status Species
1846201	Swallow Springs	4,302,920	728,597	6,080	Alluvial Fan	Spring Valley Stipulation monitoring site; Below mountain block
---	Swamp Cedar North	4,342,717	719,507	5,621	Valley Floor	Spring Valley Stipulation monitoring site; Below mountain block; Site of interest
---	Swamp Cedar South	4,310,128	724,802	5,813	Alluvial Fan/Valley Floor	Spring Valley Stipulation monitoring site; Below mountain block; Site of interest
1847701	Unnamed 5 Spring	4,340,641	718,911	5,645	Valley Floor	Spring Valley Stipulation monitoring site; Below mountain block; Aquatic Special Status Species
1847601	West Spring Valley Complex 1	4,353,812	717,309	5,603	Alluvial Fan/Valley Floor	Spring Valley Stipulation monitoring site; Below mountain block; Aquatic Special Status Species
1845501	Willow Spring	4,397,069	713,756	5,987	Alluvial Fan/Valley Floor	Spring Valley Stipulation monitoring site; Below mountain block

Table 7-1
Environmental Areas of Interest
(Page 6 of 6)

Site ID	Name	Location[a]		Elevation(ft)	Geographic Location	Selection Factor
		UTM Northing (m)	UTM Easting (m)			
White River Valley						
2071401	Butterfield Spring	4,256,472	673,530	5,324	Alluvial Fan/Valley Floor	DDC Stipulation monitoring site; Below mountain block; Aquatic Special Status Species
2071301	Flag Spring [b]	4,254,416	672,579	5,294	Alluvial Fan/Valley Floor	DDC Stipulation monitoring site; Below mountain block; Aquatic Special Status Species
2071501	Hardy Springs	4,278,196	667,553	5,354	Alluvial Fan/Valley Floor	DDC Stipulation monitoring site; Below mountain block; Aquatic Special Status Species
2070501	Hot Creek Spring near Sunnyside, NV[b]	4,249,926	661,290	5,229	Valley Floor	DDC Stipulation monitoring site; Below mountain block; Aquatic Special Status Species
2071101	Moorman Spring	4,273,440	662,053	5,299	Valley Floor	DDC Stipulation monitoring site; Below mountain block; Aquatic Special Status Species
2070901	Preston Big Spring	4,311,153	666,296	5,732	Alluvial Fan/Valley Floor	Below mountain block; Aquatic Special Status Species

Source: Environmental Areas of Interest Identified in Marshall (2011).

[a]UTM, NAD83, Zone 11N

b Big Springs outflow: Big Springs Ck. Stateline Springs flow into Lake Ck (cont. of Big Spg Ck in UT). Flag Springs outflow: Sunnyside Ck. Ash Spring & portion of Crystal Spring outflow: Pahranagat Ditch. Hot Creek Spring outflow: Hot Creek.

c Muddy River Springs Area is not adjacent to the project basins, but is an area of interest downstream in the White River flow system.

8.0 EVALUATION OF POTENTIAL EFFECTS ON GROUNDWATER-INFLUENCED HABITATS

Groundwater-influenced habitats in the Project Basins that have some potential of being affected by SNWA groundwater development generally include phreatophytic plant communities where the depth to groundwater is less than 50 ft and aquatic habitats (seeps, springs, streams, and ponds) that occur below the mountain block. In adjacent basins, certain springs down gradient of the Project Basins in southern Snake, northern Lake, southern White River, and Pahranagat valleys may also be affected over extended periods of time. This section utilizes results from the above discussed analyses (Watrus and Drici, 2011) and other sources to evaluate the range of potential effects at the Environmental Areas of Interest in context with Federal regulatory oversight and the many monitoring, management, and mitigation tools available to SNWA.

8.1 Project Basins

8.1.1 Spring Valley

In those areas where current depth to groundwater is less than 50 ft and groundwater-influenced vegetation occur, gradual and substantial lowering of the water table is likely to result in plant community transition from communities dominated by shallow-rooted mesic species to communities dominated by deep-rooted and/or precipitation-dependent species (McLendon, 2011). CCRP Model simulation outputs identify central and southern Spring Valley as areas where SNWA groundwater development may cause some plant communities in the valley floor to transition from groundwater-influenced to precipitation-dependent through the year 2117. Specific site characteristics including soil type, immediate hydrogeology, surface water drainage, plant community composition, precipitation patterns, and disturbance factors will ultimately determine how each community responds to changing groundwater levels.

Where greasewood shrublands are ultimately replaced by big sagebrush shrublands, an ecological benefit (increased vertebrate diversity) may be realized (Germano and Lawhead, 1986). However in those areas where flows to aquatic habitats are substantially diminished, a decline in species diversity can result (Poff, 2010). This may also be the case with groundwater-influenced wetlands and wet meadows that are replaced by more xeric habitats.

In Spring Valley, four Environmental Areas of Interest were identified by Watrus and Drici (2011) as having a simulated change in depth to groundwater of greater than 50 ft or a reduction in spring flow exceeding 15 percent (evaluation criteria) by the year 2117. Swamp Cedar North Area, Unnamed 5 Spring, Four Wheel Drive Spring and South Millick Spring are all located in the southern half of northern Spring Valley and are in the valley floor. Unnamed 5 Spring and South Millick Spring support small populations of the only aquatic Special Status Species in the immediate area (northern

leopard frog) and all of these and similar adjacent sites provide habitat for bird, bat and big game populations (SNWA, 2008).

All four of the above sites are included in the Biological Monitoring Plan for the Spring Valley Stipulation and the initial phase of monitoring data collection occurred in the years 2009 and 2010.

Groundwater drawdown and reduced spring flow at these sites has the potential to further degrade existing habitat and cause the redistribution of mobile species. However, the aquatic habitats in this area are relatively small, and through the use of the available monitoring and management tools described in above sections, unreasonable adverse effects can be avoided and/or mitigated to ensure the sustainable management of the associated biological resources. As for the Swamp Cedar North Area, it is currently unknown to what extent this tree population relies upon groundwater (McLendon, 2011). Monitoring, research and adaptive management are all tools available to SNWA and the other signatories of the Spring Valley Stipulation to avoid unreasonable adverse effects and ensure the long-term conservation of this tree population.

Although CCRP simulations of depth to groundwater change at the Shoshone Ponds site did not meet the evaluation criteria over the period of analysis, the presence of the endangered Pahrump poolfish and the general location of the site in Spring Valley solicits further consideration. Within the Shoshone Ponds site there is a stock pond and a set of three constructed, refugium pond habitats currently being used to maintain populations of the Pahrump poolfish and the NV state protected relict dace. Although the population of Pahrump poolfish at this site is one-of-three and is critical to the long-term conservation of the species, the ponds are not particularly well suited for maintaining stable population levels (NDOW, 2010) and the recovery plan identifies establishing additional populations at transplant sites as a priority action (USFWS, 1980). Significant modification and/or replacement of the existing ponds is necessary to accomplish the goals for the recovery plan.

The Shoshone Ponds site is monitored by the BWG and TRP (Monitoring Plans: BWG, 2009 and SNWA, 2009a; Annual reports: SNWA, 2010a, 2010b, 2011a, and 2011b). NDOW also conducts annual fish monitoring at the refuge ponds and Stock Pond (field reports available through NDOW). In the unlikely event that groundwater development does have an adverse effect, mitigating impacts to this site may best be accomplished by deepening the artesian wells and/or by following through with the recommended actions in the recovery plan by establishing other refugium populations of Pahrump poolfish elsewhere. However, Pahrump poolfish is one of the federally listed species that is being considered in the Section 7 consultation between the BLM and USFWS regarding the GWD Project, and until other populations are established, this population will be rigorously protected by the USFWS under the authority of the Endangered Species Act of 1973, as amended.

8.1.2 Cave Valley

In Cave Valley, Watrus and Drici (2011) evaluated three Environmental Areas of Interest (Cave Spring, Cave Valley Meadow and Parker Station Spring), and found all three to lack hydraulic continuity with either the alluvial or carbonate-rock aquifers. Further to the south, depth to groundwater exceeds 50 ft (Burns and Drici, 2011) and there are no groundwater-influenced habitats present. Although no effects to springs or other groundwater-influenced habitats are expected, the

Biological Monitoring Plan for DDC includes Cave Valley Meadow and Parker Station Spring as monitoring sites to ensure avoidance of unreasonable adverse effects.

8.1.3 Dry Lake Valley

In Dry Lake Valley, Watrus and Drici (2011) evaluated two Environmental Areas of Interest (Coyote Spring and Meloy Spring), and found both to lack hydraulic continuity with either the alluvial or carbonate-rock aquifers. Depth to groundwater exceeds 50 ft throughout the valley (Burns and Drici, 2011; SNWA, 2011c) and there are no groundwater-influenced habitats present in the valley floor. Although no effects to springs or other groundwater-influenced habitats are expected, the Biological Monitoring Plan for DDC includes monitoring of Coyote, Meloy, and Little Field Spring.

Meloy Spring will be monitored by the BRT if access is granted (BRT, 2011). Littlefield Spring (a similar spring 1.4 mi south of Meloy Spring), a proxy for Meloy Spring, is currently monitored by the TRP and will be monitored by the BRT if access to Meloy Spring is not granted (Monitoring Plan: SNWA, 2009c; Annual reports: SNWA, 2010d and 2011d).

Coyote Spring will be monitored by the BRT (BRT, 2011) and is currently monitored by the TRP (Monitoring Plan: SNWA, 2009c; Annual reports: SNWA, 2010d and 2011d).

8.1.4 Delamar Valley

In Delamar Valley, Watrus and Drici (2011) evaluated one Environmental Area of Interest (Grassy Spring), and found that it lacked hydraulic continuity with either the alluvial or carbonate-rock aquifers. As in Dry Lake Valley, depth to groundwater exceeds 50 ft throughout the valley (Burns and Drici, 2011; SNWA, 2011c) and there are no groundwater-influenced habitats present in the valley floor. Although no effects to springs or other groundwater-influenced habitats are expected, the Biological Monitoring Plan for DDC includes Grassy Spring as a monitoring site to ensure avoidance of unreasonable adverse effects.

8.2 Adjacent Basins

8.2.1 Snake Valley

Ten Environmental Areas of Interest were evaluated by Watrus and Drici (2011) in Snake Valley, and five were found to warrant quantitative analysis using the CCRP Model. At these 5 sites (Clay Spring, Stateline Springs, Unnamed 1 Spring North of Big Springs, Big Spring and North Little Springs) none were found to meet or exceed the evaluation criteria (50 ft drawdown or 15 percent change in discharge). Clay Spring, Stateline Springs, Unnamed 1 Spring North of Big Springs and Big Spring are inhabited by aquatic Special Status Species, and all five of the Environmental Areas of Interest that were quantitatively evaluated are included as monitoring sites in the Biological Monitoring Plan for Spring Valley.

8.2.2 Hamlin Valley

In Hamlin Valley, no aquatic Environmental Areas of Interest were identified as warranting analysis. In the northern valley floor depth to groundwater is less than 50 ft and phreatophytic vegetation is present, however CCRP Model simulations out to the year 2117 did not indicate a change in depth to groundwater in this area that met or exceeded the evaluation criteria (50 ft of change). The Biological Monitoring Plan for Spring Valley established five vegetation monitoring transects within this phreatophytic plant community. Data collection at these sites began in 2009 and future monitoring there will help to ensure avoidance of unreasonable adverse effects.

8.2.3 Lake Valley

In Lake Valley, two Environmental Areas of Interest (Geyser Spring and Wambolt Spring) were evaluated by Watrus and Drici (2011). Geyser Spring was found to lack hydrologic continuity with either the alluvial or carbonate-rock aquifers, and Wambolt Spring (a valley floor spring) was evaluated with the CCRP Model. Although Wambolt Spring was not found to meet or exceed the threshold criteria out to the year 2117, the presence of two Special Status Species (northern leopard frog and Lake Valley springsnail), the spring's position on the valley floor and its adjacency to Spring Valley suggest that this site should be periodically evaluated and considered for monitoring as new information becomes available.

8.2.4 White River Valley

In White River Valley, six Environmental Areas of Interest were quantitatively evaluated by Watrus and Drici (2011) using CCRP Model simulations. Of these six only Butterfield Spring and Flag Springs were found to meet or exceed the spring flow evaluation criteria (15 percent change), which occurred by the year 2042. Butterfield Spring is on private property and provides habitat for aquatic Special Status Species. Flag Springs complex is located on the Wayne E. Kirch Wildlife Management Area and is currently the only location where the endangered White River spinedace occurs.

Little is known about the specific ecological requirements of the aquatic species present in the Flag Springs and Butterfield Spring systems, therefore it is currently not possible to predict how these systems will respond to incremental changes in flow. However, substantial reduction in flow at these springs may result in degradation of the available habitat and ultimately population declines in the native species present in each system (Poff, 2010). Both of these spring systems are included in the DDC Stipulation biological and hydrologic monitoring programs, and a network of groundwater monitoring wells has been put in place to provide early warning of effects. Furthermore, the endangered White River spinedace is one of the federally listed species that is being considered in the Section 7 consultation between the BLM and USFWS regarding the GWD Project. This population will be rigorously protected by the USFWS under the authority of the Endangered Species Act of 1973, as amended.

8.2.5 Pahranagat Valley

Seven Environmental Areas of Interest were evaluated by Watrus and Drici (2011) in Pahranagat Valley, and three were found to warrant quantitative analysis using the CCRP Model. At these three sites (Hiko Spring, Crystal Spring and Ash Spring) none were found to meet or exceed the evaluation criteria (50 ft drawdown or 15 percent change in discharge) by the year 2117. All three of these spring systems are inhabited by aquatic Special Status Species, and all are included as monitoring sites in the Biological Monitoring Plan for the DDC Stipulation. In addition, each of these springs provides habitat for an endangered subspecies of the White River springfish, which are being considered in the Section 7 consultation between the BLM and USFWS regarding the GWD Project.

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9.0 CONCLUSION

Since the year 2000, SNWA, with the assistance of contractors, universities, research institutes, federal and state agencies, and non-profit conservation organizations, has collected an enormous amount of information on the biological resources within and around the GWD Project area. The collection, analysis, and dissemination of this information have required many thousands of professional hours and represent a significant contribution to the body of knowledge concerning biological resources in the region. As a basis for developing and implementing monitoring programs, conducting environmental analyses, and ultimately making adaptive resource management decisions, this information has and will continue to be an invaluable resource.

The current and future Federal environmental compliance processes (NEPA, ESA, etc.) required to develop the GWD Project will ensure a thorough analysis of potential direct, indirect and cumulative effects on environmental resources that may result from both the construction and operation of the GWD Project. The documents being prepared and the procedures being followed are intended to help public officials make informed decisions based on an understanding of environmental consequences. They also will result in formalization of measures that will be implemented to protect, restore, and enhance the environment.

Both the Spring Valley and DDC stipulated agreements require the implementation of extensive hydrologic and biological monitoring programs and avoidance of unreasonable adverse effects, and provide for extensive DOI and NSE oversight. These agreements will help to inform GWD Project development and operations, and will ensure the protection of environmental resources throughout the life of the project by way of informed adaptive management. SNWA has the intent and ability to develop the GWD Project in a manner that is environmentally sound and in the best interest of the public. SNWA has developed monitoring plans based on an accepted science-based approach while soliciting input from other federal, state, and local resource managers. SNWA has provided numerous environmental safeguards through Federal stipulated agreements, the Federal permitting process, and regional conservation initiatives. In addition, SNWA's Northern Resources allow it to integrate the adaptive management of land, water, and livestock such that environmental conflicts are minimized and vital ecosystems and Special Status Species are protected into the future. Based on the analysis in this report, development of the GWD Project will not threaten the public interest and will be environmentally sound.

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