3.0 SNAKE/SALT RIVER BASIN SETTING AND DESCRIPTION

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3.0 SNAKE/SALT RIVER BASIN SETTING AND DESCRIPTION

3.1 PHYSICAL DESCRIPTION

The Snake/Salt River Planning Basin in Wyoming is a part of the Snake River basin and the Columbia River drainage which flows to the Pacific Ocean. Figure 3-1 shows all of the Snake River Basin including the portion within Wyoming. Wyoming's portion covers approximately 5,100 square miles and includes all of Teton County and portions of Lincoln, Sublette, and Fremont Counties. Grand Teton National Park and portions of Yellowstone National Park are also part of the Snake/Salt River Basin.

FIGURE 3-1: SNAKE RIVER BASIN

3.1.1 LAND AREA AND OWNERSHIP

Teton County and northern Lincoln County make up almost 89 percent of the lands in the basin (Table 3-1). The basin area within Fremont County is small (3.1 percent) and consists primarily of national forest lands. Additionally, 8.2 percent of the basin area is within northwestern Sublette County.

Land ownership in the Snake/Salt River Basin is predominantly federal with 90 percent of the lands owned by several federal agencies while private lands make up only eight percent of the land ownership within the basin (Table 3-2 and Figure 3-2).

TABLE 3-1: SNAKE/SALT RIVER BASIN AREA BY COUNTY

County	Acres	Percent of Area
Fremont	100,527	3.1
Lincoln	731,167	22.3
Sublette	267,714	8.2
Teton	2,174,524	66.4
Total	***3,273,932***	***100***

TABLE 3-2: LAND OWNERSHIP IN THE SNAKE/SALT RIVER BASIN

Land Ownership	Acres
Federal Lands	
Bureau of Land Management	8,056
National Park Service	655,521
National Wildlife Refuge	24,783
U.S. Forest Service Wilderness/Wild & Scenic Rivers	741,236
U.S. Forest Service National Forest	1,520978
Total Federal Lands	***2,950,574***
State Lands	
State Wildlife Habitat Management Areas	4,531
Wyoming State Lands	9,709
Total State Lands	***14,240***
Private Lands	**256,340**
Water (Rivers, Lakes and Reservoirs)	**52,778**
Grand Total	***3,273,932***

3.1.2 PHYSIOGRAPHY AND TOPOGRAPHY

The Snake/Salt River Basin is part of the Middle Rocky Mountain Province. It is mountainous with intermountain valleys and has very complex geology. Several of the mountain ranges and valleys have been created by thrust faults with the mountains rising sharply from the valley floor. Elevations vary from 13,770 feet at Grand Teton Peak to 5,500 feet at Palisades Reservoir. The mountain ranges and topographic structures that define the Snake/Salt River Basin boundaries are shown in Figure 3-3. The largest intermountain valleys are Jackson Hole and Star Valley. A majority of the basin population resides in these valleys.

3.1.3 DRAINAGE SYSTEMS

There are many rivers and streams that make up the seven Snake River sub-basins in Wyoming. These sub-basins are shown in Figure 3-4 and include the Greys-Hoback Basin, Gros Ventre Basin, Henrys Fork Basin, Palisades Basin, Salt Basin, Snake Headwaters Basin, and Teton Basin. Three of the sub-basins, Henrys Fork, Palisades and Teton, drain directly into Idaho and are not tributary to the Snake River in Wyoming.

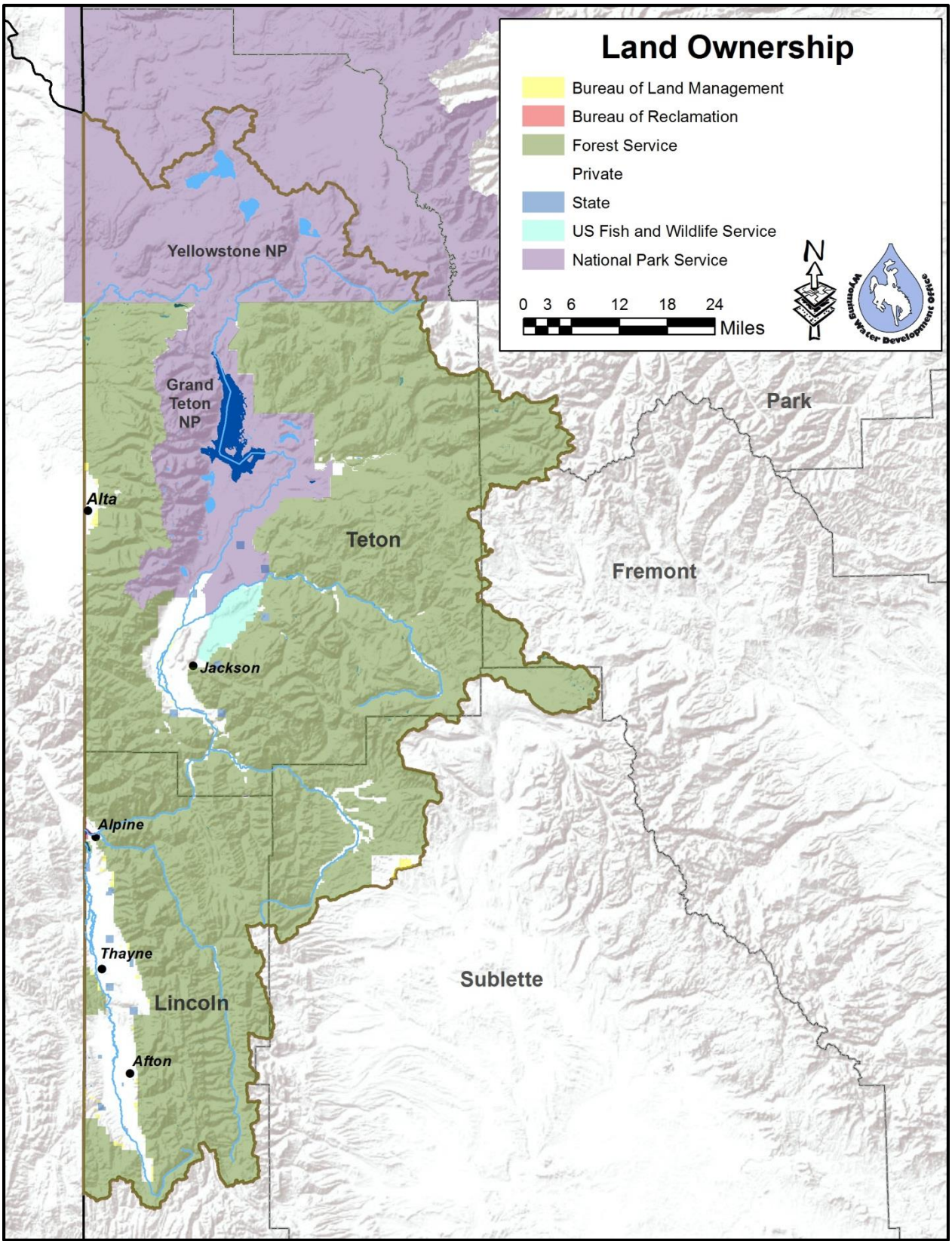

FIGURE 3-2: SNAKE/SALT RIVER BASIN LAND OWNERSHIP

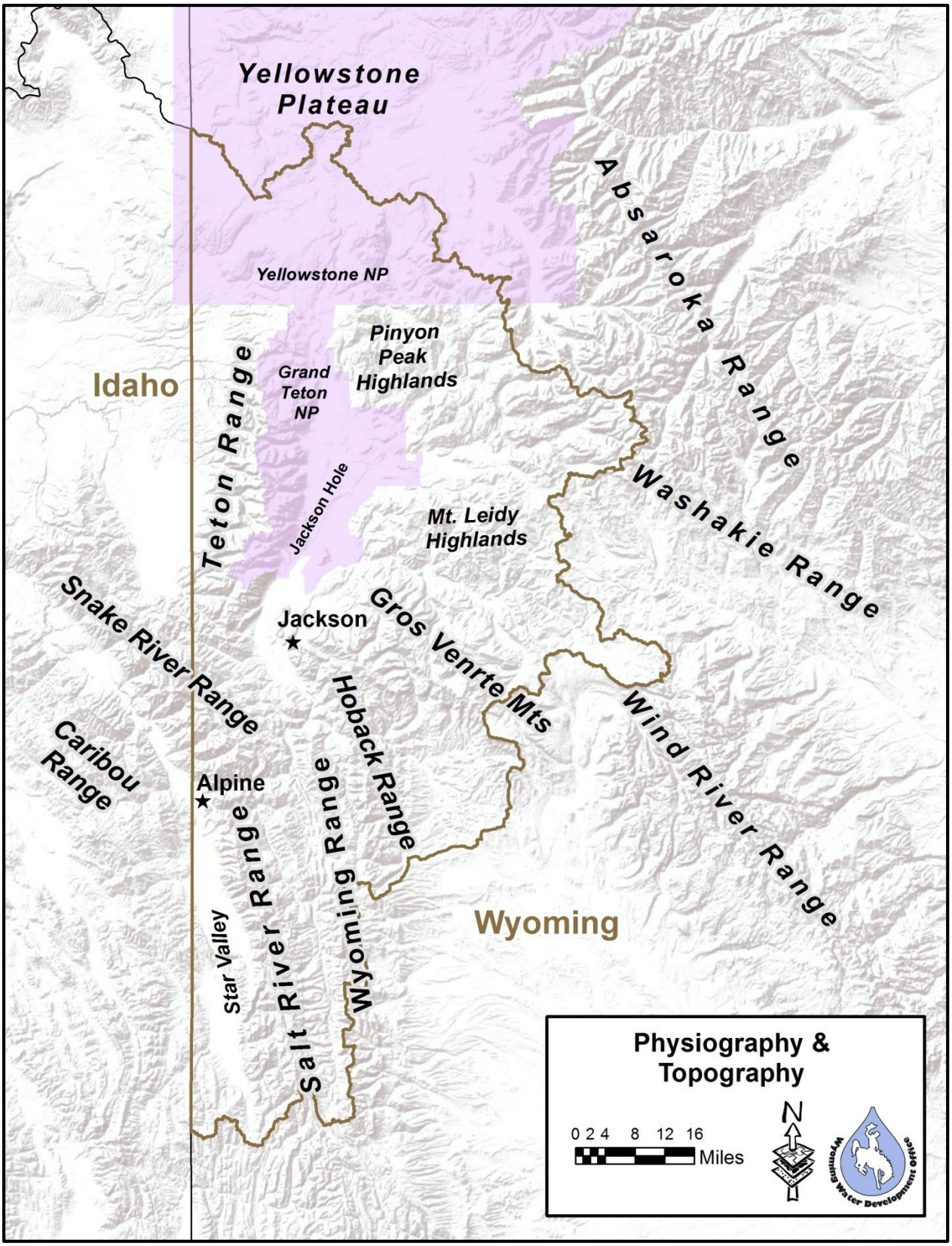

FIGURE 3-3: SNAKE/SALT RIVER BASIN PHYSIOGRAPHY AND TOPOGRAPHY

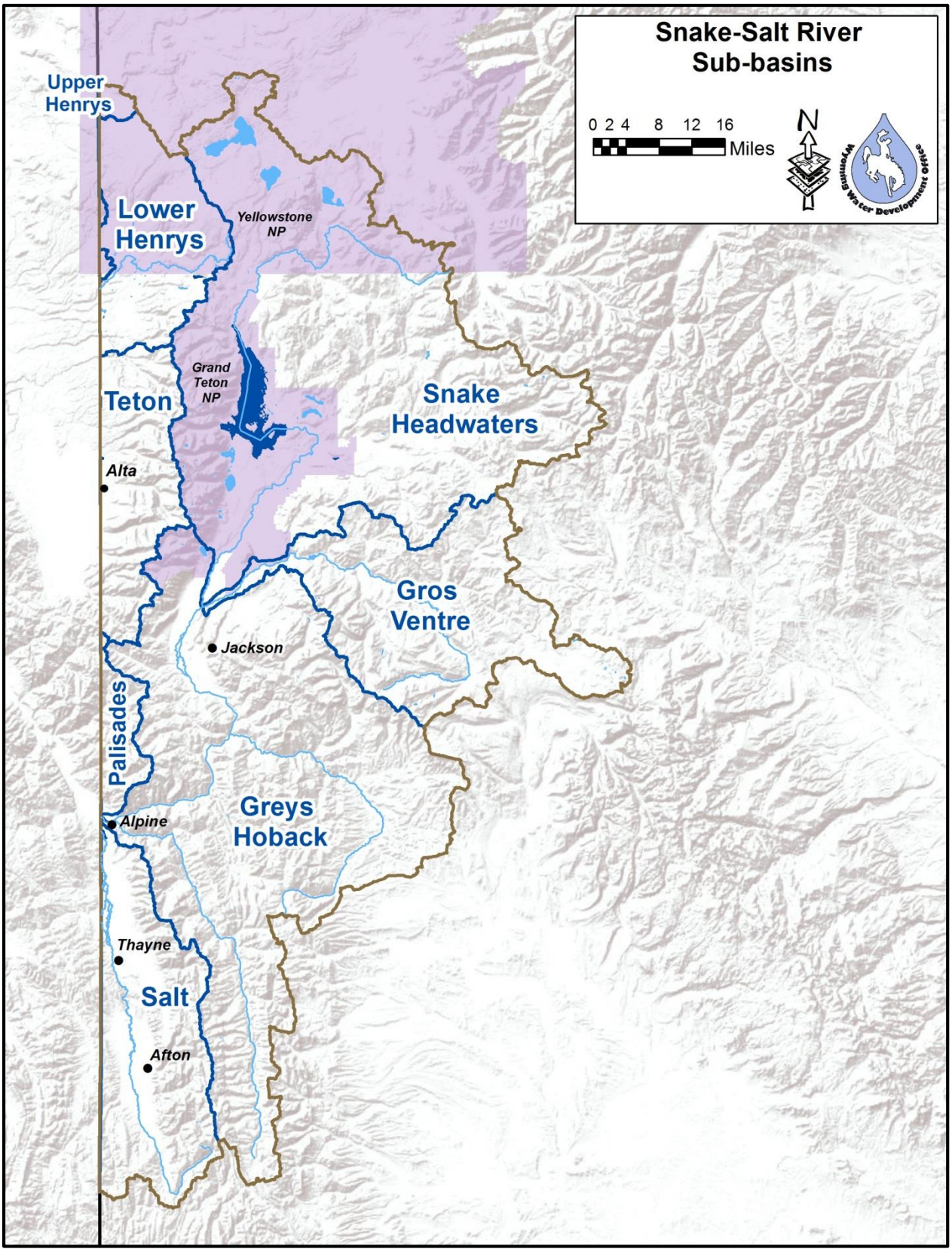

FIGURE 3-4: SNAKE/SALT RIVER BASIN SUB-BASINS

3.2 CLIMATE

This section summarizes the climate within the Snake/Salt River Basin in terms of precipitation, temperature and growing season. Additional information is presented in *Technical Memorandum, Tab XVI: Climate*

3.2.1 PRECIPITATION

Wyoming's Snake/Salt River Basin receives a mean annual precipitation of just less than 36 inches. However, with elevations ranging from about 5,500 feet at Palisades Reservoir, where the Snake River leaves the state, to 13,770 feet at the summit of Grand Teton Peak, the basin has quite a variation in total precipitation. As illustrated in Figure 3-5, the average annual precipitation in the Wyoming portion of the basin ranges from a low of 16 inches just south of Jackson to a high of 95 inches at the southern end of the Teton Range.

Two major types of precipitation patterns exist in the basin. The first is a snow-dominated winter precipitation pattern, where the greatest precipitation contributions come during the months of November/December through January. Typically this pattern is seen in the higher elevation areas where annual precipitation totals are 40 inches or greater.

Within the snow-dominated pattern, there are two *transitional* patterns. The first transitional pattern has winter precipitation dominance, but the May peak starts to become apparent and begins to overtake the snow-derived precipitation. The second transitional pattern relates to the snow-dominated pattern, but the months of November through May provide more equal contributions to the annual total. In this latter precipitation pattern, the June through October period is usually noticeably drier than the rest of the year. This transitional pattern is most noticeable in areas receiving between 25 and 40 inches for the year. Generally, when going from areas with low annual precipitation to areas with high annual precipitation, the contribution of May precipitation to the whole becomes less, and the graph of monthly precipitation across the year takes on the appearance of an inverse bell.

The second pattern in the basin has a more uniform distribution of precipitation throughout the year. May typically has the greatest precipitation and occasionally there is a second peak in July. This pattern is usually seen in the areas of the basin receiving less than 25 inches of annual precipitation.

3.2.2 TEMPERATURE

The average, maximum and minimum temperatures in the Snake/Salt River Basin are illustrated on Figure 3-6. Average monthly maximum temperatures in the valleys are generally highest in July and lowest in December. Average monthly minimum temperatures are lowest in January, except at Alta where the minimum temperatures are lowest in December.

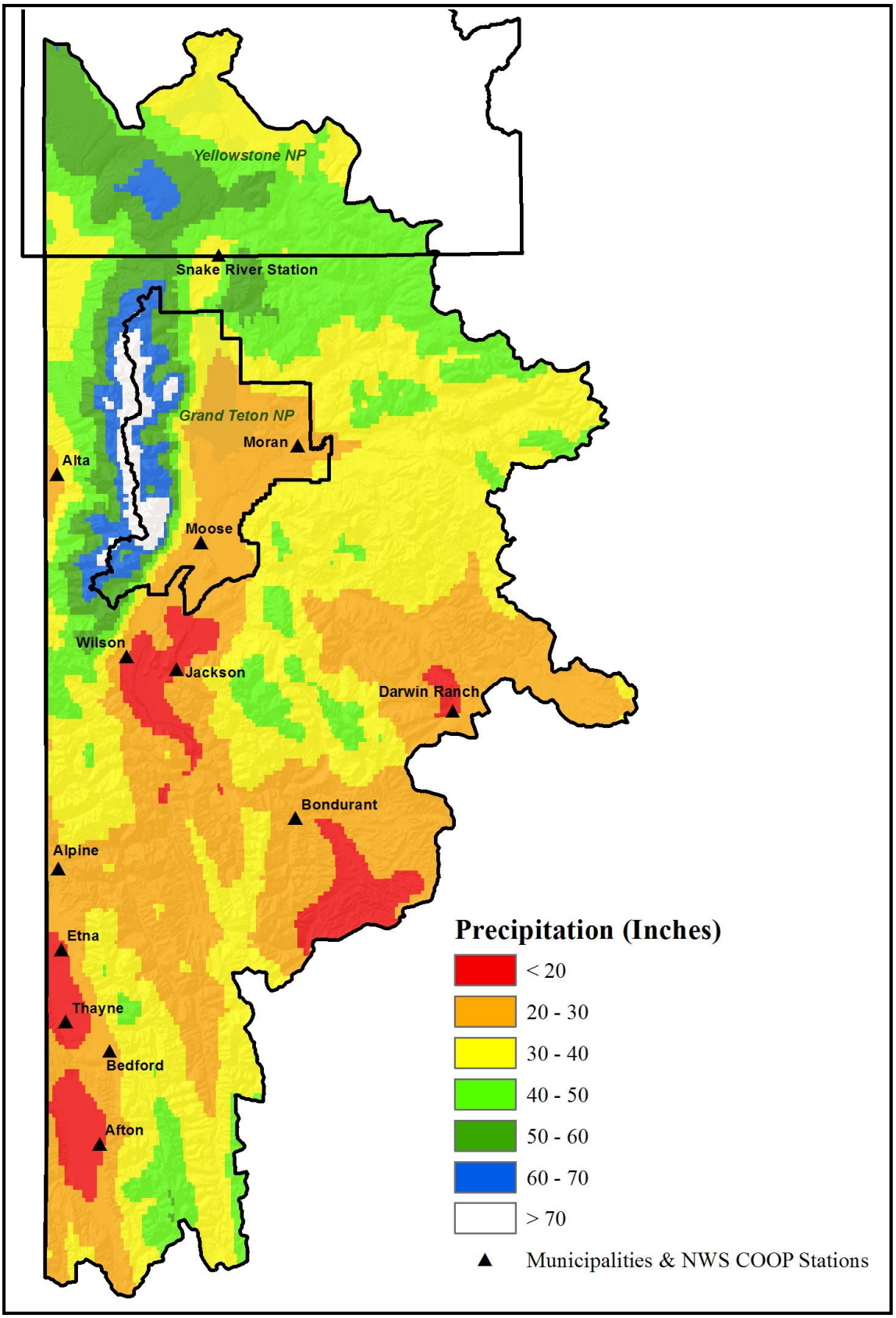

FIGURE 3-5: ANNUAL PRECIPITATION IN THE SNAKE/SALT RIVER BASIN

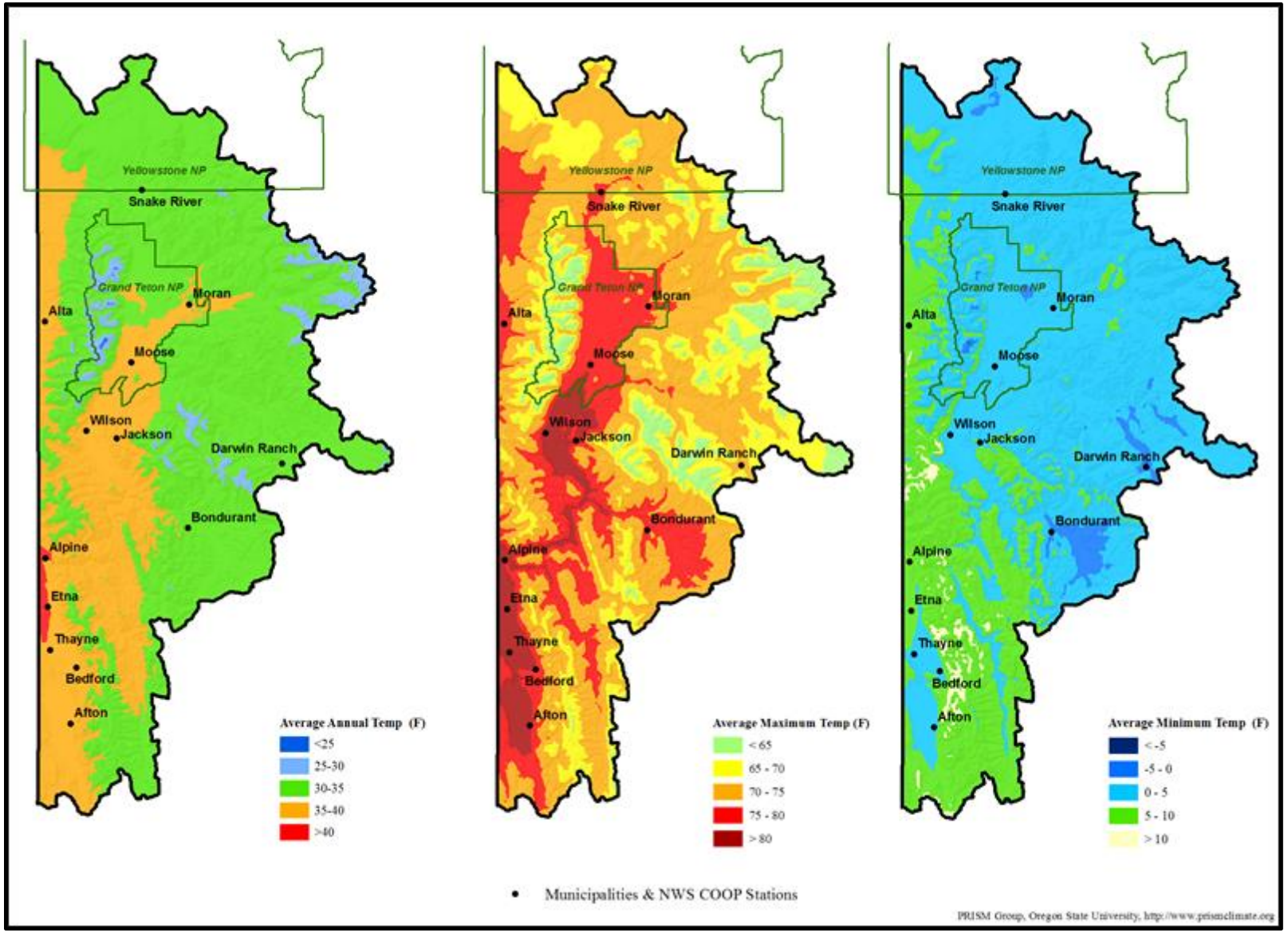

FIGURE 3-6: AVERAGE, MAXIMUM, AND MINIMUM TEMPERATURES IN THE SNAKE/SALT RIVER BASIN

3.2.3 GROWING SEASON

The growing season in the Snake/Salt River Basin is quite short due to the high elevation. Minimum elevation of the basin is 5,500 feet near Palisades Reservoir. The average last frost (≤ 32°F) in Afton occurs on July 1 while the average first frost is on August 26, resulting in a frost-free season of just 55 days. With regards to freezes (≤ 28°F), the average last freeze in spring for Afton is June 7, and the average first freeze in fall is September 7. Bedford's season is very similar with dates of last and first frost being June 25 and August 28, respectively, while the last and first freeze dates are June 4 and September 12, respectively. The higher elevation climate station site of Darwin Ranch has an even shorter frost-free season with the average last frost in spring occurring July 23 and the average first frost of the fall occurring August 6, resulting in an average frost-free season of only 13 days. When considering freeze dates for Darwin Ranch, the average last freeze is around July 11, while the average first freeze in the fall is around August 16. Table 3-3 presents a list of frost/freeze dates for select climate stations within the Snake/Salt River Basin.

TABLE 3-3: FREEZE AND FROST DATES FOR CLIMATE STATIONS IN THE SNAKE/SALT RIVER BASIN

Station	Average Date of:			
	Last Freeze ≤ 28°F	Last Frost ≤ 32°F	First Frost ≤ 32°F	First Freeze ≤ 28°F
Afton	07 Jun	01 Jul	26 Aug	07 Sep
Alta 1NNW	02 Jun	29 Jun	30 Aug	11 Sep
Bedford 3SE	04 Jun	25 Jun	28 Aug	12 Sep
Bondurant	15 Jul	27 Jul	04 Aug	10 Aug
Darwin Ranch	11 Jul	23 Jul	06 Aug	16 Aug
Jackson	20 Jun	10 Jul	16 Aug	30 Aug
Moose	12 Jun	02 Jul	22 Aug	03 Sep
Moran 5WNW	16 Jun	10 Jul	17 Aug	01 Sep
Snake River	05 Jul	21 Jul	08 Aug	15 Aug

Source: High Plains Regional Climate Center CLIMOD System

3.3 POPULATION AND ECONOMICS

This section presents a brief summary of population and economics within the Snake/Salt River Basin. More detailed information can be found in *Technical Memorandum, Tab XVII: Population Projections and Economic Conditions.*

3.3.1 POPULATION

Population of the three counties that make up a majority of the Snake/Salt River Basin (Lincoln, Sublette and Teton) remained constant during the 1950s and 1960s. The population grew rapidly in the 1970s, showed slow but steady growth during the 1980s, and grew rapidly again in the 1990s (Sunrise Engineering, Inc., 2003) (BBC Research and Consulting, Inc., 2002). The portion of Sublette County within the basin is small and has little impact on the total population of the basin. Historically, population changes in Teton and Lincoln Counties have been driven by immigration to meet increasing job opportunities.

The 2002 basin population was estimated to be 26,370 in the 2003 Plan, and the Wyoming Department of Administration and Information, Economic Analysis Division (DAIEAD) estimated the population to be 34,473 in 2012. This shows a moderate growth rate of about three percent annually over approximately ten years. Table 3-4 shows population estimates provided by DAIEAD for the portions of the three counties within the Snake/Salt River Basin and the basin total (DAIEAD, 2012). Teton County showed the greatest population growth over the period from 2003 to 2012 and has the greatest projected growth to 2030. Sublette County has only a small area within the Snake/Salt River Basin, and this area showed limited growth from 2003 to 2012.

TABLE 3-4: POPULATION ESTIMATES FOR COUNTIES MAKING UP THE SNAKE/SALT RIVER BASIN, 2003 – 2012

County	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Lincoln	10,903	11,172	11,339	11,625	11,957	12,315	12,536	12,574	12,645	12,730
Teton	18,417	18,870	19,154	19,636	20,196	20,802	21,174	21,239	21,360	21,503
Sublette	206	211	214	219	225	232	236	237	238	240
Total	***29,526***	***30,252***	***30,707***	***31,480***	***32,378***	***33,350***	***33,946***	***34,050***	***34,244***	***34,473***

Note: Estimates presented in this table were prepared by DAIEAD.

3.3.2 ECONOMICS

Historically, agriculture and tourism have been the major economic sectors of the Snake/Salt River Basin. In the 2003 Plan, these were the two important economic sectors considered. Industry was a minor economic sector with only three businesses including Star Valley Cheese Corporation, Northern Foods and Water Star Bottling Company.

Currently, agriculture and tourism remain important economic sectors, and agriculture is the largest water use sector. However, agriculture is decreasing in importance and tourism is the main economic driver. Industry has been a minor part of the economy in the basin and has actually decreased with the closing of the three businesses described in the 2003 Plan.

The economy and population grew steadily from 2002 to 2008 and slowed during the recession from 2008 to 2012. Planners within the basin indicate that the economy is beginning to pick-up again in 2012 (Teton County, 2012) (Town of Jackson, 2012) (Lincoln County Planning and Engineering, 2012).

3.4 DISCUSSION OF COMPACTS AND LEGAL CONSTRAINTS

In recent years, federal and state laws, rules, regulations, and policies have affected water development and management. This section identifies and discusses some of these institutional constraints on the development and use of water as related to issues in the Snake/Salt River Basin. Additional information can be found in *Technical Memorandums, Tab XVIII: Institutional Constraints; Tab XIX: Palisades Reservoir Contract; and, Tab XX: Salmon Recovery Efforts in the Snake River Basin.*

3.4.1 WYOMING WATER LAW

Wyoming water law is based on the prior appropriation doctrine as characterized in the shorthand phrase, “first in time, first in right.” The state’s water laws are administered by the State Engineer’s Office and State Board of Control. Under the prior appropriation doctrine, during periods when there is insufficient water to fulfill all water rights, those water users having an earlier (senior) priority date on their water right are entitled to receive their full amount of water for beneficial use before those water rights that have a later priority date, referred to as the "junior" water rights.

The State Engineer’s Office also administers the Wyoming laws associated with safety of dams. The general requirements of the law outlines the need to submit and receive approval from the State Engineer of a set of engineered plans and construction specifications for any dam equal to or greater than 20 feet in height or 50 acre-feet in capacity. These public health safety laws must be considered in the planning and design of any dam that may affect the public safety. The law also outlines a safety of dam inspection program, where every dam meeting the above size criteria must be physically inspected by the agency every five years.

3.4.2 INTERSTATE COMPACTS

Wyoming is a headwater state; its mountain ranges are often the highest elevation source of water for many of the most significant rivers in the western United States. Wyoming straddles a portion of the continental divide and is a primary contributing source of water to the Colorado River, the Missouri River and the Columbia River. As such, the waters originating in Wyoming are shared by water users in many surrounding downstream states.

As a result of more rapid development and population growth in downstream states, an upstream state is critically interested in protecting its long-term right and ability to develop the waters of a shared interstate river. Soon after the turn of the 20th century, upstream states were concerned that the “first in time, first in right” doctrine, uniformly adopted for intrastate distribution of water, would be applied across state lines to the detriment of “junior” or later developing upstream water uses. To address these concerns and circumstances, legal processes were established over the past ninety years to provide for the orderly allocation and protection of the use, rights, and privileges of the waters of streams and rivers that flow across state lines.

There are two basic ways the rights and allocations of water sources shared between states are established. The first is a result of litigation between states that is resolved by a decree of the Courts of the United States that equitably apportions the shared water resources between the states. The second way is established cooperatively through an interstate compact, which is an agreement between the participating states, with the consent of Congress, dividing the waters of an interstate stream. Wyoming has many such arrangements for the interstate rivers and streams leaving our borders, including the Snake/Salt River Basin. The rights of Wyoming and Idaho to the waters of Teton Creek and South Leigh Creek, on the west side of the Teton Mountain Range, have been settled by a decree of the District Court of the United States for the District of Wyoming, and the rights to the waters of the Snake and Salt River watersheds are included in the Snake River Compact.

3.4.2.1 SNAKE RIVER COMPACT

Congress, by the Act of June 3, 1948, provided their consent to Wyoming and Idaho negotiating a compact over the waters of the Snake River. The Snake River Compact, negotiated by the representatives of both states with participation of a representative of the United States, was signed on October 10, 1949. The compact divided the waters of the Snake and Salt River watersheds between the states of Idaho and Wyoming. This agreement was subsequently ratified by the State of Idaho on February 11, 1950, by the State of Wyoming on February 20, 1950 and by an act of Congress on March 21, 1950.

The compact recognizes, without restriction, all existing water rights in Wyoming and Idaho established prior to July 1, 1949. It permits Wyoming unlimited use of water for domestic and stock watering purposes, providing stock water reservoirs shall not exceed 20 acre-feet in capacity. The compact allocates to Wyoming, for all future uses, the right to divert or store four percent of the Wyoming-Idaho state line flow of the Snake River. Idaho is entitled to the remaining 96 percent of the flow. The use of water is limited to diversions or storage within the Snake River drainage basin unless both states agree otherwise. The compact also provides preference for domestic, stock and irrigation water use over storage for the generation of power.

The historical perspective of this seemingly "un-equitable" division of water was the fact that the majority of the existing and potential future use of water was in Idaho. In 1949, the lack of arable land for irrigation and the high percentage of federal land (national parks, national forests and wildlife reserves) in the Wyoming portion of the Snake River Basin were factors in the negotiations.

One unique aspect of the Snake River Compact, compared to other compacts to which Wyoming is a party, is a requirement that calls for Wyoming to provide Idaho replacement storage for one-third of any usage after the first two percent is put to beneficial use. Early estimates of these replacement storage quantities, based upon the average state line flow, are 33,000 acre-feet.

3.4.2.2 ROXANA DECREE

The Roxana Decree is a shorthand name for a United States District Court decision resolving an interstate dispute between water users in Wyoming and Idaho diverting from Teton Creek and South Leigh Creek. The District Court for the District of Wyoming Docket Equity No. 2447, Roxana Canal Co., a Corporation, et al. v. Daniels, et al. entered its decision and decree on February 4, 1941. This decree adopted a stipulation of agreement entered into by the water user parties to the case located within Wyoming and Idaho, dated March 20, 1940.

The stipulation generally sets forth that Wyoming water users shall be unlimited in their diversions from Teton Creek and its tributaries until the measured flow of the creek diminishes to 170 cubic feet per second (cfs). After that, the Wyoming water users are limited to a diversion of one cfs for each 50 acres of irrigated land. When the flow further reduces to 90 cfs, the flow of Teton Creek and its tributaries is divided equally between the Wyoming and Idaho water users.

For South Leigh Creek, the stipulation generally provides the appropriators in Wyoming unlimited diversion of water from South Leigh Creek until the natural flow of the creek diminishes to a total of 16 cfs, after which time the Wyoming water users are permitted to divert one-half of the streamflow and Idaho water users can divert the balance.

3.4.3 WYOMING WATER DEVELOPMENT PROGRAM

Planning, constructing and implementing a water project is costly. Adding the costs to acquire state and federal permits can be overwhelming for many small public and private entities in Wyoming. In 1975, recognizing water development was becoming more difficult and additional water development was necessary to meet the economic and environmental goals and objectives of the state, the Wyoming Legislature authorized the Wyoming Water Development Program and defined the program in W.S. 41-2-112(a), which states the following:

> *The Wyoming water development program is established to foster, promote, and encourage the optimal development of the state's human, industrial, mineral, agricultural, water and recreation resources. The program shall provide through the commission, procedures and policies for the planning, selection, financing, construction, acquisition and operation of projects and facilities for the conservation, storage, distribution and use of water, necessary in the public interest to develop and preserve Wyoming's water and related land resources. The program shall encourage development of water facilities for irrigation, for reduction of flood damage, for abatement of pollution, for preservation and development of fish and wildlife resources [and] for protection and improvement of public lands and shall help make available the water of this state for all beneficial uses, including but not limited to municipal, domestic, agricultural, industrial, instream flows, hydroelectric power and recreational purposes, conservation of land resources and protection of the health, safety and general welfare of the people of the state of Wyoming.*

The task of setting priorities under the above all-encompassing definition falls to the WDC, which was also authorized by the Wyoming Legislature. The WDC is made up of ten Wyoming citizens appointed by the Governor. The director and staff of the WDO administer the Wyoming Water Development Program.

3.4.4 INSTITUTIONAL CONSTRAINTS

In the late 1960's and early 1970's, Congress passed legislation to protect the environment. Prior to the passage of these laws, most water projects were designed and operated for specific consumptive uses for municipal, agricultural, or industrial purposes or to provide flood control or recreational benefits. Any environmental benefits derived from the projects were indirect and incidental to the purposes for which they were designed. While such benefits could be considerable, they were not protected or required by law. With passage of environmental laws, a variety of environmental protection and mitigation actions became a “standard” consideration in the development of water projects as well as for many other types of projects. These considerations often included minimum streamflow releases and mitigation for impacted wetlands as requirements of federal approvals or permits for a particular project. At the same time, the economic and environmental benefits of recreation, fisheries, wetlands and other habitats were documented and became more apparent to the public and developers alike, which

resulted in minimum reservoir pools or streamflows often becoming a planned component of reservoir operations.

Water supply development often requires "federal action" that initiates or triggers federal environmental law reviews and permitting. These actions or where there is a "federal nexus" include, but are not necessarily limited to, the following:

1. Issuance of special use, right-of-way or other permits for new water projects on federal lands, including those lands administered by the U.S. Forest Service (USFS), National Park Service (NPS), Bureau of Land Management (BLM), and other federal agencies.
2. Renewal of special use, right-of-way or other permits for existing water projects located on federal lands, including those lands administered by the USFS, NPS, BLM and other federal agencies.
3. Contracting for storage space or water from federal reservoirs, such as those owned and operated by the U.S. Bureau of Reclamation (USBR) or U.S. Army Corps of Engineers (COE).
4. Renewal of existing contracts for storage space or water from federal reservoirs. For example, in the Snake/Salt River Basin water users have contracts for storage space and water in Jackson Lake, Grassy Lake and Palisades Reservoir.
5. Actions that involve the discharge of dredged and/or fill material into waters of the United States, including rivers, streams, and wetlands, require the issuance of a Section 404 permit under the Clean Water Act (e.g. the construction or repair of dams, diversion dams, pipeline crossings, levees, etc.). These types of permits are issued by the COE.
6. Procurement and renewal of licenses from the Federal Energy Regulatory Commission (FERC) to produce hydropower at private or federal dams and reservoirs.
7. Use of federal funds, loans or grants to construct a new water project or rehabilitate an existing water project.

The only water development activity not subject to federal environmental laws is drilling a well with non-federal funds on non-federal lands outside the banks of rivers, streams, and wetlands. However, piping the water from such wells across federal lands or rivers, streams, and wetlands could initiate a federal environmental review and a federal permitting or approval action. A full discussion of the laws that must be considered when undertaking an action requiring federal permitting or approval is presented in *Technical Memorandum, Tab XVIII, Institutional Constraints.*

Water development in the 21st century is often difficult and costly. However, if a project proponent has a need for water, with patience and adequate financial resources, the federal environmental review and permitting processes can be successfully completed and permits obtained for construction of water projects. In the Snake/Salt River Basin, the extensive amount of federal lands and particularly the national parks and forests act as a practical limitation on extensive water development in the basin. However, carefully sized and smartly located water development projects to meet the needs of basin citizens are institutionally possible.

The State of Wyoming has historically been proactive in dealing with institutional constraints that may impact its ability to develop water resources as allocated by court decrees and interstate compacts. State officials routinely monitor water related activities in downstream states, review proposed federal legislation and federal mandates that are derived from a variety of sources such as new federal environmental legislation, regulations or forest and park management plans, to interject the state's position on these matters and provide for a state perspective in their development and implementation. These efforts are important to Wyoming water users and citizens and should continue.

3.4.5 PALISADES RESERVOIR CONTRACT

As a result of evaluation and involvement by the State of Wyoming with the reservoir and river operations, use of storage space set aside by the U.S. Bureau of reclamation (USBR) became the state's primary opportunity for addressing several important issues in the Snake/Salt River Basin. First, the quantity of storage space "reserved" by the USBR was the amount estimated to be required to meet Wyoming's compact replacement storage space obligations. By securing the replacement storage space, Wyoming would assure its long-term ability to continue to develop and beneficially use the waters allocated from the Snake/Salt River Basin. Secondly, by holding a contract for storage space in the USBR's reservoir system, through an exchange of storage water between Palisades and Jackson Lake reservoirs, the state could also provide water or protection for the minimum river flow regime below Jackson Lake Dam and for the maintenance of higher levels in Jackson Lake during periods of drought.

To accomplish these dual benefits, the State initiated a negotiation and contracting process with the USBR to obtain control over the "set aside" storage space in 1988 and eliminate any other potential water user from obtaining this water resource. On July 13, 1989, the USBR commissioner approved the "basis of negotiation," an internal USBR document authorizing the regional representatives to move forward with the detailed negotiations. The USBR entered the final contract effective October 31, 1990.

The contract provides Wyoming with 33,000 acre-feet or 2.75 percent of the 1,200,000 acre-feet of active storage space in Palisades Reservoir. Wyoming is entitled to the water accruing to this space in priority for a variety of purposes, including the compact replacement storage space obligations, subcontracting the use of storage water to others, and to maintain instream flows and lake levels within Wyoming, through an exchange. Wyoming is contractually treated, for the most part, like any other storage spaceholder in Palisades Reservoir under contract with the USBR, with the same general rights and obligations for the use, accounting, and administration of the storage space.

Under the spaceholder's contract, Wyoming agreed to pay a proportion of the USBR's construction costs allocated to irrigation and a corresponding share of the interest during construction for the 33,000 acre-feet (2.75 percent) of Palisades Reservoir storage space. This amount totaled $567,270, which was appropriated from the Water Development Program Account I by the Wyoming legislature during the 1991 session. In addition, Wyoming annually pays a proportion (2.75 percent) of the Palisades Reservoir operation and maintenance costs.

The amount of replacement storage space is based upon the provisions of Article III A of the Snake River Compact (1949). Under the Compact, four percent of the waters of the Snake River Basin (including the Greys and Salt Rivers) are allocated to Wyoming for direct diversion or storage. The first half or two percent of the compact allocation can be diverted or stored without any storage space replacement requirement. Wyoming shall provide replacement storage space equal to one-third of any additional use under the second half of the four percent allotment. It is estimated that Wyoming's four percent share at the Wyoming-Idaho border is approximately 200,000 acre-feet (5,000,000 acre-feet times 4 percent). One-half is approximately 100,000 acre-feet and one-third of this amount is 33,000 acre-feet of storage space. This was the amount "set aside" by the USBR and, in 1990, placed under contract with Wyoming.

3.4.6 SALMON RECOVERY EFFORTS

In the Snake River Basin, the primary downstream issue relates to the on-going efforts of recovering a variety of salmon and steelhead fish species that are listed as either threatened or endangered by the National Marine Fishery Service (NMFS) pursuant to the Endangered Species Act (ESA). These anadromous fish species are located along the Columbia River and Lower Snake River in western Idaho. There are additional listed species of trout, snails, and plants located along the Snake River upstream of the river reaches directly affected by the salmon and steelhead yet downstream of the Wyoming/Idaho border. These ESA listings are under the management of the Fish and Wildlife Service (FWS), and the flow and habitat needs of these species often conflict with the desired flow regimes for the listed anadromous fish.

For a number of years, federal agencies, primarily through the COE and NMFS, have committed extensive financial resources to a variety of scientific studies and structural changes to existing COE dams and hydropower plants. River and reservoir operational changes within the Columbia River system were also addressed. These studies and suggested changes address moving salmon and steelhead juveniles more rapidly to the ocean. This study evaluated methods of moving the juveniles more rapidly to the ocean.

One alternative proposed was to increase the downstream river flow velocity to convey the juvenile fish to and through the Columbia River and the existing set of mainstem reservoirs to the ocean. Another controversial alternative to achieve this same migration result was an evaluation of removing some of the mainstem COE dams and reservoirs thereby eliminating flow impediments and slack water regimes. With regard to river flow augmentation alternative, the COE and NMFS requested that the USBR evaluate their Upper Snake River reservoir operations and identify additional water resources that could be committed to the recovery of the listed fish species. Separate from facilities owned by Idaho Power Company, all of the larger reservoirs in the Snake River system upstream of Lower Granite Dam are owned and operated by the USBR. This system of reservoirs has a combined capacity of about seven million acre-feet of active storage space. While most of this space is contracted for irrigation purposes, some quantities are also assigned to environmental quality, other water supplies, and flood control.

In 1995, the USBR agreed to annually provide 427,000 acre-feet of water to these recovery efforts. Depending on water availability, half of this amount is derived from the Upper Snake River Rental Pool, the purchase of a small amount of natural flow water rights, and un-contracted storage space in the USBR's extensive Snake River reservoir system. The other half

is derived from the Boise and Payette River Basins. This initial commitment of water did not significantly impact the operations of Palisades or Jackson Lake Reservoirs or the Snake River flow regime through Wyoming. However, the USBR has reported that there have been some problems and concerns expressed by residents, irrigators, the states, tribes, and elements of the federal government.

In 1997, the COE requested that the USBR analyze the effects of providing flow augmentation for the listed species at an additional one million acre-feet of water from the entire Snake River basin upstream of Lower Granite Dam. This is a commitment of water beyond the 427,000 acre-feet already being provided for the recovery efforts. This study evaluated the possible effects of acquiring both natural flow water rights and reservoir storage space in USBR facilities located in the Boise, Payette, and Owyhee River basins as well as the upper Snake River. The USBR study developed new water demand schedules up to a total of 1,427,000 acre-feet under several reservoir operation scenarios and then evaluated the environmental, economic, social, cultural, and recreational effects of meeting these new demands.

The USBR study identified a block of water coming from natural flow water rights in Wyoming (approx. 30,000 acre-feet) as well as from other areas of the basin. The USBR simply assumed for their study that they would be able to acquire certain quantities of water rights from existing appropriators in Wyoming and from Nevada, Idaho, and Oregon that would be a portion of the additional one million acre-feet. These blocks of water would then be managed together with significant amounts of water from reservoir storage space in USBR reservoirs that would also be acquired or reassigned from irrigation to the new purposes under evaluation pursuant to federal and state laws. The amount of actual water yield was then estimated and routed through the reservoir and river system using a computer simulation model over a 62-year period of historic streamflow conditions from 1928 to 1989. This period of record provided results that could be reviewed under wet (1983), dry (1977), and average hydrologic circumstances.

The results from the model were used to evaluate the potential effects or impacts upon other resources in the river basin. Because of the abbreviated and broad basin-wide nature of the USBR study, specific and definitive impacts on the resources within Wyoming are not provided. A summary of the general findings related to Jackson Lake and Palisades Reservoir follows:

1. In the areas where natural flow water rights are acquired, the report indicated there would be job losses related to irrigated agriculture and the quality and character of rural communities would be irreversibly changed.
2. The recreation impacts, measured in terms of visitations, had predictable losses ranging between 6 and 14 percent for river recreation and between one and 11 percent for the reservoirs.
3. Negligible changes were identified between the current or base conditions and the additional one million acre-feet conditions for the cultural, wild and scenic rivers, and Indian trust asset resources.
4. Slightly adverse effects were identified for the quality and amount of habitat for aquatic snails, bald eagles, plants, and other general fish species. Slight decreases in water quality were also noted in the Wyoming river reaches.

5. Some improvements in streamside wildlife and riparian areas were anticipated.

The USBR's "million acre-feet study" was submitted to the COE. Since that time, no further actions evaluating or implementing the options and alternatives presented have been pursued.

3.5 BASIN WATER DEVELOPMENT STUDIES AND PROJECTS

This section discusses Wyoming Water Development Program studies and construction projects funded by the Wyoming WDC in the Snake/Salt River Basin. A full list of studies and projects funded by the WDC is presented in Table 3-5 at the end of this section.

All of the studies and projects conducted in the basin have been for community water systems except one irrigation diversion dam project and one reservoir enlargement project. An irrigation study was conducted on the Etna diversion dam, and the dam was replaced for the Etna Irrigation District in a WWDC Level III construction project. An enlargement of Cottonwood Lake has also been undertaken, and that project is scheduled to go to Level III construction. The enlargement project has an irrigation component and a recreational component.

Many of the community water system studies and construction projects conducted in the 1980s and 1990s were in response to system deterioration. Many of the systems were spring developments and had been developed in the late 1940s and early 1950s. Because the systems were old and had deteriorated to the point where they were vulnerable to contamination, the water supply would not meet increasingly stringent federal drinking water standards. The spring developments were not always fully enclosed and were subject to surface contamination.

More recent studies and projects have been designed to improve and protect the community water system supplies to meet the needs of population growth. A 2009 study prepared for the WDC and sponsored by Lincoln County looked at developing regional water systems within the Star Valley area. Star Valley is an area with many small community water systems. The study led by Sunrise Engineering was titled Star Valley Regional Master Plan (Sunrise Engineering, Inc., 2009). The WDC encourages regionalization of community water systems for operation and maintenance efficiency and cost effectiveness. The study concluded that, "the most feasible alternative is to develop two regional systems, one for the upper valley and one for the lower valley." To advance regionalization in Star Valley, Level II feasibility projects should be conducted as sponsors become interested in regionalization. The areas that may have potential for the first developments of a regional system are listed below. They would be small regional systems that could lead to further regional developments.

- Alpine, North Alpine and North Star Utilities
- Bedford and Thayne
- Afton and Auburn
- Smoot, Happy Valley, Osmond and West View

TABLE 3-5: WATER DEVELOPMENT PROGRAM STUDIES AND PROJECTS COMPLETED WITHIN THE SNAKE/SALT RIVER BASIN

Study and/or Project Title	Level	Date	Notes
Afton Municipal Water Study Level II Study	II	1990	Recommended to upgrade system & construct hydropower facility
Afton Water Supply Level III Construction	III	1994	Construct spring renovation, pipeline, & storage tank & drill well Hydropower facility constructed under other funding
Afton Water Supply Project, Level II	II	1999	Recommended to upgrade transmission pipeline & add telemetry
Afton Springs Water Supply Level III	III	2000-2001	Renovated spring intake & pipeline to protect from rock fall
Afton Groundwater Exploration Grant	GW Grant	2004	Drill well to add supply to the system
Afton Well, Level III	III	2006-2008	Hook well to system & add well house, meter, controls, and pipeline
Alpine Water Supply	III	1995-1997	Drill well & construct pipeline & storage tank
Alpine Spring Irrigation Supply Project	II	2001	Recommended to use spring water for green area irrigation
Alpine Raw Water	III	2002-2005	Pipeline & tank constructed for green area irrigation
Alpine Master Plan Update Level II	II	2009	Recommended to upgrade well and water transmission system
Alpine Water Supply	III	Underway 2012	Construct transmission pipelines
Alpine Wells Rehabilitation	III	Underway 2012	Upgrade well, & add generator & construct control building
Alpine Junction Water Study Level I	I	1995	Recommended to construct a test well & form a district
North Alpine Rehabilitation Level II	II	2002	Determined feasibility of drilling a well & developing a water system (Name changed from Alpine Junction to North Alpine after district formed)
North Alpine Rehabilitation Level III	III	2003-2005	Drill well, construct transmission lines, & storage tank
Alta Master Plan Level I	I	2002	Water system needed due to growth. Recommended to form a district & apply for Level ll test well
Alta Groundwater Supply Study Level II	II	2007	Test wells were drilled
Alta/Targhee Towne Water Supply	III		Two wells drilled, well houses & pipeline constructed
Bedford Water Supply Study, Level I	I	1986	Recommended to form a district, upgrade spring water source, upgrade transmission lines, & develop storage
Bedford Water Supply Study Level II	II	1987	Recommended to follow Level I recommendations & also drill a water supply well
Bedford Water Supply	III	1988-1989	Spring source upgraded, drilled well, & upgraded transmission lines
Bedford Water Tank	III	2004-2007	Constructed storage tank

Study and/or Project Title	Level	Date	Notes
Buffalo Valley Level I Water Supply Project	I	1996	Recommended Level II test wells & look at feasibility of storage tank & pipeline
Buffalo Valley Water Supply Project Level II	II	1997	Drilled 2 test wells & recommended storage tank & pipeline
Buffalo Valley Water Supply	III	2001/2005-2005	Drilled wells, constructed storage tank & transmission line
Cottonwood Lake Enlargement Level II Study	II	2006	Recommended constructing new dike & enlarge reservoir
Cottonwood Lake Enlargement Level II Study	II	2009	Continuing study of reservoir enlargement
Cottonwood Lake Enlargement	III	2013	Funded for construction 2013
Etna Diversion Dam Project Level II Study	II	1990	Irrigation project. Recommended replacement of diversion dam
Etna Diversion Dam	III	1991	Irrigation project. Replaced diversion dam
Etna Water and Sewer District Water Supply System – Star Valley Level II Study	II	1993	(Part of Star Valley Municipal Water Supply, Level II Study, 1991) Study needed because of water quality problems. Recommended to repair 1 spring & redevelop a second spring
Well Construction and Testing Program Level II Etna, WY	II	1993	Drilled & tested a new well
Etna Water Supply	III	1994/1998-2002	Redevelop a spring & connect the new well & transmission line
Freedom Water and Sewer District Water Supply System – Star Valley Level II Study	II	1992	(Part of Star Valley Municipal Water Supply, Level II Study 1991) Recommended replace existing well with new well
Construction and Testing Report, Freedom No. 2 Test Well, Freedom, WY	II	1993	Drill well & test (part of 1992 Level II)
Freedom Water Supply	III	1993-1997	Develop new well, construct storage tank & pipeline
Fairview Water Supply	III	1992-1995	(Part of Star Valley Municipal Water Supply, Level II Study 1991) Drill new well, construct storage tank & pipeline
Grover Water Supply	III	1992-1995	(Part of Star Valley Municipal Water Supply, Level II Study 1991) Rehabilitate one spring, drill a well & construct storage tank & pipeline
Hoback Junction Water Supply Study Level I	I	2006	Adequate groundwater would be available to serve a water district. No district was formed & there was no further action.
Indian Paintbrush Water Supply	II	On-going 2014	Well may need replaced and system upgraded
Jackson Water Feasibility Study		1984	Groundwater Exploration Program
Town of Jackson Groundwater Exploration Program	GW Grant	1985	Drilled two exploratory wells & one test well
Town of Jackson Groundwater Exploration	GW	1993	Drilled two exploratory wells

Study and/or Project Title	Level	Date	Notes
Program	Grant		
Jackson Water Supply	III	1994-1998	Drill 3 new wells & constructed a control building (also see Teton County)
Kennington Springs Pipeline Company Level I Water System Reconnaissance Study	I	2003	Recommended upgrade to spring protection & improve transmission pipeline This project has not advanced at this time
North Canal Master Plan Level I	I	2003	Recommended improvements to the canal system. This project has not advanced at this time
Porto Canal Rehabilitation Project Level II Study	II	1994	Recommended placing open ditches in pipelines
Porto Canal	III	1996-1997	Open ditches were converted to pipeline
Rafter J Water Supply Level II Study	II	1998	Recommended drilling a third well & adding transmission pipelines. This project has not advanced at this time
Rafter J Rehabilitation	III	2003 – 2012	Drill new well & replacement well and construct storage tank
Smoot Water Supply	III	1991-1994	(Part of Star Valley Municipal Water Supply, Level II Study 1991) Drilled well, made spring improvements & constructed storage tank & pipeline
Squaw Creek Water Supply Project Level I	I	1991	Recommended drilling deep well, test existing spring & investigate other spring sources
Squaw Creek Water District Test Well #1		1993	Test Well SQ #1 could not be completed correctly
Squaw Creek Water Supply Project Level II, Well Siting, and Construction – Alternative sites	II	1993	Proposed looking at drilling deep well & also look at alluvial wells
Squaw Creek Water Supply Project Level II	II	1994	Recommended drilling Game Creek alluvial wells
Squaw Creek Water Supply	III	1995 – 1998	Drilled Game Creek alluvial wells, constructed pipeline & storage tank.
Squaw Creek Water Supply	GW Grant	2004 – 2005	Drilled test well but the well did not produce adequate water
Squaw Creek Water Supply	III	2006	Funding turned back The well drilled under the GW grant was not adequate
Squaw Creek Water Supply	GW Grant	2007	Second attempt to drill a deep well was unsuccessful
Squaw Creek Water Supply Level II Study	II	2012	Examined past work & requested expansion of Level II Study & increase in budget to drill test well near Teton County Well, request was approved
Star Valley Municipal Water Supply Level I Study	I	1989	Evaluated six community water systems – Etna/Fairview/Freedom/Grover, Osmond/Smoot, all had water quality violations & need water system improvements.

Study and/or Project Title	Level	Date	Notes
Star Valley Municipal Water Supply Level II Study	II	1991	Provided recommended improvements for the six community water systems See individual water system recommendations
Star Valley Regional Master Plan	I	2009	Provided reasonable alternatives for establishing regional water systems
Water System Master Plan – Star Valley Ranch Association	I	1996	Recommended drilling a new well, upgrading undersized pipelines, & adding third storage tank
Star Valley Ranch Master Plan	I	2008	The Town of Star Valley Ranch was formed from the Star Valley Ranch Association in 2006, recommended new wells, additional storage, & improvement of pipelines
Star Valley Ranch Groundwater Level II Study	II	2009	Drilled & tested a new well & designed other improvements
Star Valley Ranch Water Supply	III	Ongoing	Connected the new well to the system, constructed additional storage, & improved the transmission pipeline system
Teton County Water Supply Master Plan Level I	I	1999	Groundwater quantities/quality are good, some areas may be suitable for regional systems, while other areas are too isolated, individual wells & septic systems may be a problem
Jackson Raw Water Supply	III	1999-2001	Drilled wells for irrigation & thawing Flat Creek, constructed pipeline
Jackson Storage Tanks	III	2010-ongoing	Designed and constructed 2 storage tanks
Teton Village Water Supply Study Level I	I	1991	Recommended drilling 2 new high yield wells
Teton Village Water Supply	III	1992-1996	Drilled 2 wells & constructed a pipeline
Teton Village Water Supply	III	2009-ongoing	Drilled a new high yield well & constructed a storage tank & pipeline
Thayne Area Water Supply	I	1995	Recommended redevelop spring, drill well, emergency tie to Bedford & install meters Recommended for Bedford - construct storage tank, larger pump in well, booster pump to increase pressures in area, loop system.
Thayne Water Supply Level II Study	II	1997	Recommended redevelop spring, drill well, construct pipeline, & install meters
Turnerville Water Supply	II	1998	(Part of Thayne Area Water Supply Level II Study 1997) Recommended redevelop spring & build storage tank, pipeline, disinfection facility & install meters
Turnerville Water Supply Project	III	2004/2006-2009	Redeveloped spring, constructed pipeline & storage tank
Thayne Water Supply	III	1998-2002	Drilled well, developed spring & constructed pipeline
Thayne Storage, Level II Study	II	2012	There is not a need for storage if booster pump station is completed. Water use is well above average, there is need for metering use.

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