Platte River Basin Plan 2016 Update
Volume 5
Future Water Use Issues and Water Supply Strategies

Prepared for:

Wyoming Water Development Commission

6920 Yellowtail Road
Cheyenne, WY 82002

Prepared by:
Wenck Associates
1904 East 15th Street
Cheyenne, WY 82001

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Lidstone & Associates, a Wenck Company
Harvey Economics
HDR Engineering

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December 2016

Explanation of Cover Photos

Lake Marie in the Snowy Range Mountains. Lake Marie lies south in the shadow of the quartzite massif of 12,847-foot Medicine Bow Peak at an elevation of 11,000-feet. Winter and Spring precipitation in the Snowing Range constitutes an important portion of the water supply in the Platte River Basin.

The bald eagle (*Haliaeetus leucocephalus*, from Greek hali "sea", aiētos "eagle", leuco "white", cephalos "head"). It is a common, frequently observed breeding and winter resident in the North Platte Basin of Wyoming. The bird is strongly associated with large rivers, lakes and reservoirs with an abundant food supply and riparian environments with large trees used for roosting and nesting. The bald eagle is an opportunistic predator which subsists primarily on fish. During the winter, they also feed on dead or injured waterfowl and road or winter killed deer and antelope. The bald eagle is both the national bird and national animal of the United States of America. It is the most familiar success story of the Federal Endangered Species Act. During the latter half of the 20th century it was on the brink of extirpation in the contiguous United States and was one of the first species to receive protections under the precursor to the Endangered Species Act in 1967. Populations have since recovered and the species was removed from the U.S. government's list of endangered species on July 12, 1995 and transferred to the list of threatened species. It was removed from the List of Endangered and Threatened Wildlife in the Lower 48 States on June 28, 2007 but remains protected under the provisions of the Bald and Golden Eagle Protection Act.

Historical photo of flood irrigation. Flood irrigation is an ancient method of irrigating crops and was the first form of irrigation used by humans as they began cultivating crops. In the Platte River Basin, it is still commonly used to irrigate grass hay. In areas of the Platte River Basin where higher value crops are raised such as corn, sugar beets and alfalfa hay, conversion to sprinkler irrigation has the dual benefits of improved crop yields while conserving water.

The Dave Johnston Power Plant is named for W.D. “Dave” Johnston a former PacifiCorp Vice-President. The plant generates power by burning coal that produces steam under high pressure. The steam drives turbines and the turbine blades to engage generator that produce electricity. The plant was commissioned in 1958. There have been four phases of plant expansion to-date and numerous upgrades to comply with changing environmental requirements. The present power generation capacity is 817 megawatts.

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The Platte River Basin Plan 2016 Update is a planning tool developed for the Wyoming Water Development Office. It presents estimated current and estimated future uses of water in Wyoming's Platte River Basin. The Plan is not intended to be used to determine compliance with the administration of state law, federal law, court decrees, interstate compacts, or interstate agreements.

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5.0 Summary

"However beautiful the strategy, you should occasionally look at the results"
- Winston Churchill

5.1 INTRODUCTION

This volume discusses the issues affecting water supply development and use in the Platte River Basin and strategies for developing water supplies to meet future demands.

There are significant constraints imposed on the use of water in the Platte River Basin (Basin) based on allocations and apportionment within the North Platte Modified Decree, the Laramie River Decree and Wyoming's participation within the Platte River Recovery Implementation Program (PRRIP). The limitations affect the management of existing water uses and future water opportunities. A timeline presenting these legal, institutional and environmental activities is presented in **Figure 5.1**. Any new major water developments within the Basin are unlikely without mitigation efforts to offset the proposed new depletions. Constraints to development of new water supplies in the Platte River Basin are discussed in Section 5.2 (*Issues Affecting Future Water Use*) of this volume.

Small water development projects resulting in net water depletions less than 20 acre-feet per year are allowed under the provisions of Wyoming's Depletion Plan and include future developments that serve domestic, stock, recreation, fish and wildlife, environmental and other deminimus uses. The Depletion Plan presently provides coverage for depletions authorized by existing uses and water activities with valid Wyoming water rights with a priority date prior to July 1, 1997, the date negotiations began to frame and develop the PRRIP. **Figure 5.2** presents a graphic summary showing the complexity of Platte River water supply allocations between Wyoming, Colorado and Nebraska.

Also discussed in Section 5.2 are the Federal environmental laws notably the Clean Water Act and the Endangered Species Act that impose compliance requirements on the development of many large and small water supply projects. These and other state and federal environmental laws and programs need to be considered in the planning and permitting of surface and groundwater supplies.

Section 5.3 presents the water quality impairments, progress made since the 2006 Platte Basin Plan and measures that are being taken to address water quality that is not supporting designated uses in specific reaches within the Platte River Basin. Climate and weather issues are addressed in Section 5.4. Data is presented showing precipitation and temperature trends since the late 1800's.

Figure 5.1 Platte River Significant Water Resources Events

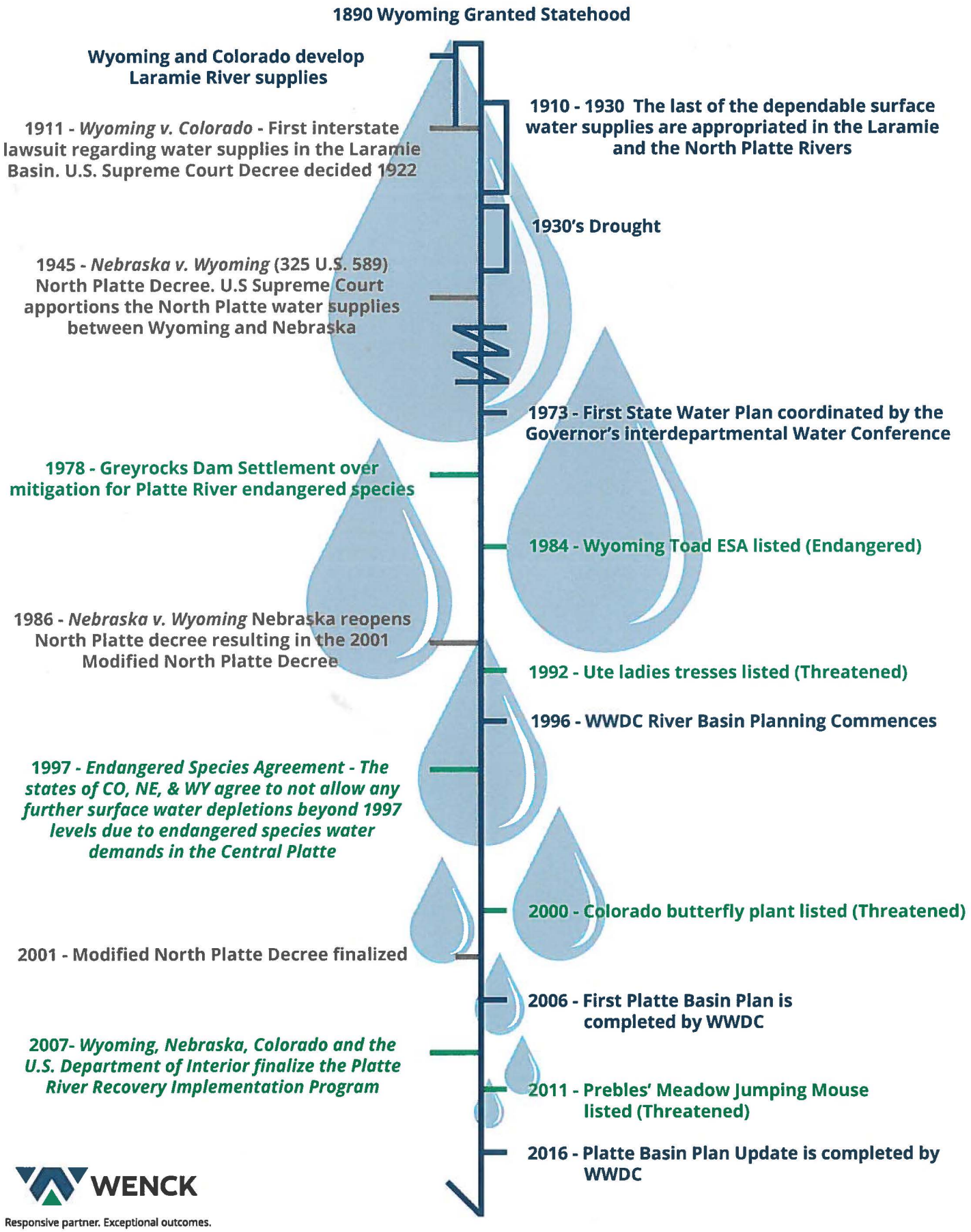

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Figure 5.2: North Platte and Laramie River Decrees and Environmental Regulations

1. Intentionally irrigated acreage limitation for the **Laramie River,** downstream of Wheatland Irrigation District's Tunnel No. 2 and its tributaries including irrigation by hydrologically connected groundwater wells, exclusive of Wheatland Irrigation District lands.

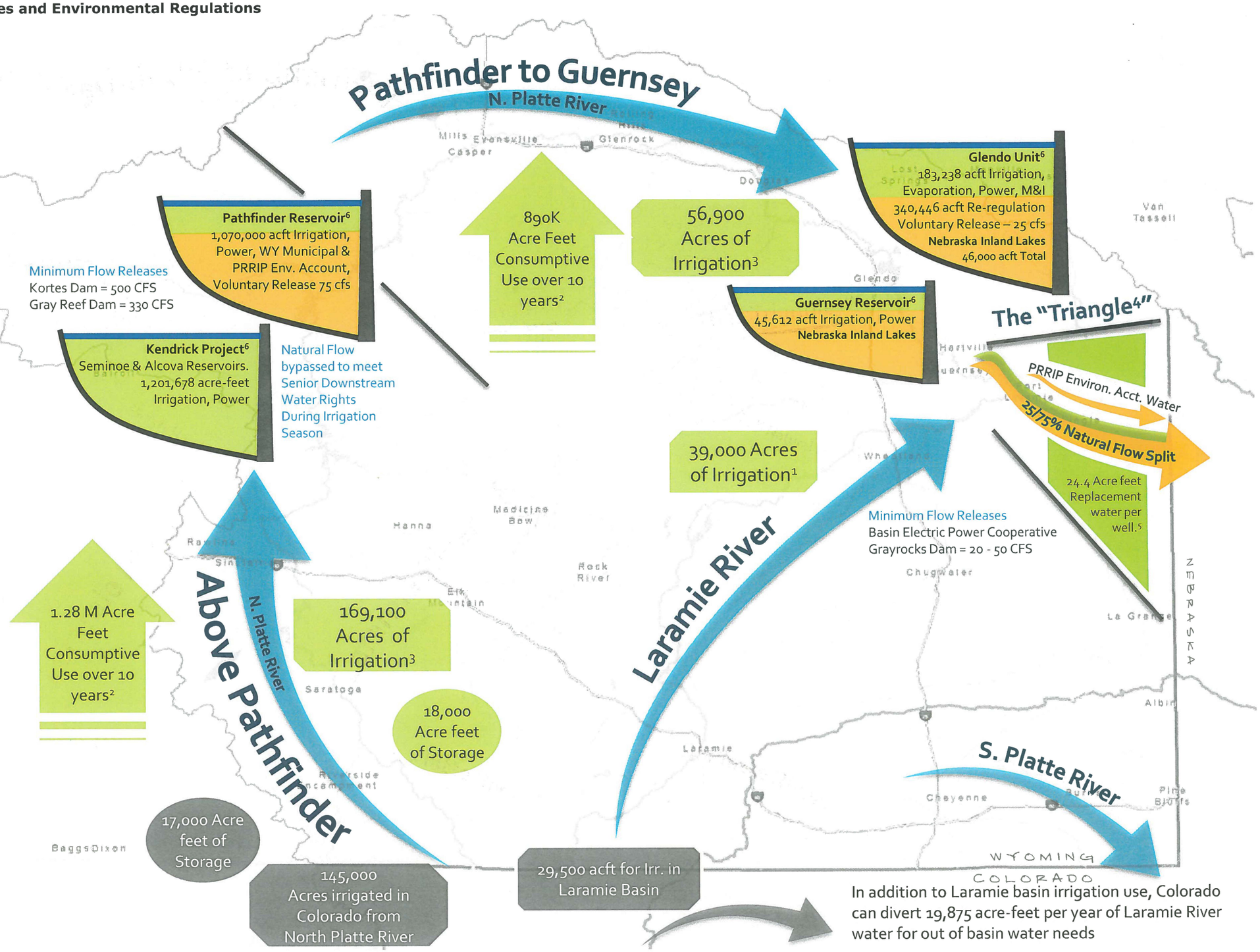
2. For the **North Platte River** and its tributaries above Pathfinder Reservoir and for Pathfinder to Guernsey Reservoir subbasins, including water from hydrologically connected groundwater wells, Wyoming is enjoined from consuming more than quantities of water historically consumed for irrigation from such sources in any consecutive ten-year period according to Decree approved methods.

3. Intentionally irrigated acreage limitations for the **North Platte River** and its tributaries above Pathfinder Reservoir and for Pathfinder to Guernsey Reservoir subbasins, including water from hydrologically connected groundwater wells, in Wyoming during any one irrigation season, exclusive of the Kendrick Project.

4. The **Triangle** is defined as the area bounded by Whalen Diversion Dam on the west, 300 feet south of the Fort Laramie Canal on the south, one mile north of the Interstate Canal on the north and extending downstream to the WY/NE state line on the east.

5. During a period of natural flow deficiency, Wyoming must provide **replacement water** annually of 24.4 acre feet per well for every active baseline well in the year following the year in which the wells were active. New wells are assessed 80 acre feet per well per year. Wells with priority dates prior to Oct. 1945 (date of the original North Platte Decree) are not affected.

6. The **federal reservoir storage** in the North Platte is segregated among various storage ownership accounts and allocations and physically stored in different reservoirs within the system. The total ownership water right quantities are provided along with the water right uses for each of the reservoirs. The color shading indicates that reservoir storage ownerships are shared between Wyoming and Nebraska appropriators for North Platte Project reservoirs and for Glendo Reservoir. The Environmental Account in Pathfinder Reservoir is operated to benefit endangered species within Central Nebraska under the PRRIP.



In addition to Laramie basin irrigation use, Colorado can divert 19,875 acre-feet per year of Laramie River water for out of basin water needs

Wyoming
Nebraska
Colorado

Sources: Purcell. 2014. *Settlement of the Nebraska v. Wyoming Lawsuit, North Platte River Basin Plan Update.* WY Water Development Commission
Trihydro Corp. 2006. *Summary of the North Platte River and Laramie River Decrees, Chapter 1 Appendix, North Platte River Basin Plan.* WY Water Development Commission

The efforts and outcomes of evaluating water strategies in the Basin and seeking input from stakeholders to gather, assess, and recommend strategies are documented in Sections 5.3, 5.5, and 5.7 of this updated Basin Plan. The 2006 Platte River Basin Plan included a list of structural and non-structural opportunities for the Basin. The current Basin Plan team members reviewed the short list of opportunities. The purpose of this review effort was to evaluate any changes or updates, and gather any new information that became available since the previous Basin Plan. The high priority strategies were sorted into three major categories. The categories were evaluated to develop and define other opportunities and to align the strategies with the anticipated growth and demands and water use changes over the 10 to 30-year planning horizon. The high priority categories, individual strategies and implementations efforts summarized in this volume are:

- Operational Enhancements – Existing Storage and Conservation
  - Re-operation of Glendo Reservoir
  - Above Pathfinder - Irrigation Reservoir Storage
  - Municipal and Agricultural Water Use Conservation
  - Weather Modification
- New, Imported, Exchanged, and Transferred Water Supplies
  - Industrial Water Use Changes
  - Transbasin Diversions
  - Watershed Planning and Small Storage Program
- Control and Enhancement of Groundwater Resources
  - Laramie County Regulatory Controls
  - Aquifer Storage and Recovery

These water opportunities and strategies are successfully being implemented in the North Platte River basin with new and expanded activities anticipated in the future.

- The development of non-hydrologically connected groundwater sources for existing and new wells serving municipal and other water uses are being used extensively for domestic and agricultural use in Laramie County. The Cities of Cheyenne, Laramie and Douglas have also tapped non-hydrologically connected groundwater sources to meet some of their water supply needs.
- The development and reliance on raw water sources to irrigate municipal green areas. Laramie, Rawlins and Casper have implemented or are studying the feasibility of developing or expanding raw water supplies for new or existing golf courses and other open space areas.
- Expansions are planned for the City of Cheyenne's successful reuse system.
- Pathfinder Modification Project provides water storage helping to secure water supplies for Wyoming's municipalities affected by water rights administration and provides replacement water for groundwater wells in the "triangle" located below Whalen Diversion Dam and extending downstream on both sides of the North Platte River in Goshen County.
- Reapportioning conserved water as successfully demonstrated in a cooperative project between Casper-Alcova Irrigation District (CAID) and the City of Casper with an agricultural conservation project that benefits municipal water needs.

Wyoming is a premier destination for hunting, fishing, camping and all forms of outdoor recreation and tourism. These asset qualities depend upon the availability of adequate water

supplies and existing land uses that need to be properly protected and enhanced. This Basin Plan update offers strategies and opportunities for addressing recreation and environmental water needs. The existing agricultural water uses provide for a ranching and farming lifestyle that can be very complementary to other water use sectors. The anticipated water use changes may occur by relying on strategies and agreements to conserve and transfer water supplies to meet a variety of anticipated water needs in the future. One particular strategy is future cooperative agreements between agricultural and recreation and environmental organizations, with the shared goal of conserving irrigation water for the benefit of multiple water users by wisely and effectively meeting agricultural water needs as well as addressing the water needs of fish and wildlife, recreation and the environment. Future updates to this Basin Plan are needed to capture substantial changes and to provide updated socioeconomic forecasting. A repeat development of the entire Platte River Basin planning process would not be necessary or efficient in the near future.

Ongoing, consistent implementation of a focused and effective public information and involvement program is essential to building and maintaining support for water management and development projects in the Platte River Basin. Some of the activities that are recommended for implementation include: 1) Periodic newsletters e-mailed to interested organizations and individuals, 2) Booths and displays at meetings of water users, the State Fair and county fairs, 3) Wyoming Water Development Commission (WWDC) sponsored seminars and activities addressing water supply needs and planning efforts, 4) Annual or bi-annual economic updates in each basin using data compiled by the Wyoming Department of Administration and Information, and, 5) Working with Conservation Districts to encourage development of small storage projects under the Small Water Project Program (SWPP) to benefit agriculture, wildlife and public recreation.

5.2 ISSUES AFFECTING FUTURE WATER USE

5.2.1 Introduction

The primary objective of this section is to identify issues that influence future water management strategies and water use opportunities in the Basin. The North Platte basin is unique in Wyoming with the federal reservoir system that serves a variety of water needs in addition to providing agricultural water supplies to meet both in-state and out-of-state needs. The North Platte 2001 Modified Decree governs the allocation of uses of water in the North Platte basin. In addition, the PRRIP requires tracking and reporting of water uses in both the North and South Platte basins. A detailed description of this interstate decree and the endangered species recovery program is provided in **Appendix 5-A**. Brief synopses are included here to summarize how the interstate issues affect management strategies and future water use opportunities in the Basin.

In Wyoming, the North Platte River Basin is considered fully appropriated. In a fully appropriated basin there are more water permits allowing the diversion of water than there is water available in drier or lower runoff years. Therefore, water rights filed for a new "current day" priority would not produce a reliable or firm water supply.

5.2.2 Interstate Decrees and Settlements

Litigation and the court decrees affect the apportionment and future management of water supplies within the North Platte Basin. The key apportionment and entitlements within the basin were defined within the 1945 North Platte Decree and amended within the 2001 Modified North Platte Decree. A review and analysis of the modified decree has been prepared by Mike Purcell and is presented in **Appendix 5-A**.

North Platte River Basin

The basin consisting of the North Platte River mainstem and tributaries in southeast Wyoming extends from the Colorado Stateline to the Nebraska Stateline. The different subbasins within the North Platte Basin are affected differently by the interstate decrees and settlements.

Intentionally Irrigated Acreage Limitation. The 2001 Modified North Platte Decree established a limitation of 226,000 intentionally irrigated acreage. The acreage was further allocated to 56,900 acres in the Guernsey Reservoir to Pathfinder Reservoir reach and 169,100 for the basin above Pathfinder Reservoir.

Intentionally irrigated acreage is monitored and mapped by inspectors performing annual on-the-ground surveys for the Wyoming State Engineer's Office (SEO). This acreage limitation for the above Guernsey Reservoir reach does not include the Kendrick Project, which is operated and maintained by the CAID. The Kendrick Project is limited to 24,248.23 irrigated acres in accordance with its water right. The irrigated acreage of the Kendrick Project is monitored by the U.S. Bureau of Reclamation (USBR) in Mills, Wyoming.

The lands solely irrigated by non-hydrologically connected groundwater wells are excluded from the intentionally irrigated acreage limitation. A non-hydrologically connected groundwater well is a well located and constructed such that if water were intentionally withdrawn by the well continuously for 40 years, the cumulative stream depletion would be less than 28% of the total groundwater withdrawn by that well. "Green area" maps have

been developed and are available in the Wyoming Water Development Office (WWDO) and the SEO website. These maps depict the areas in which the groundwater is deemed non-hydrologically connected and, therefore, well construction and groundwater use are not subject to limitations under the Decree. In addition, any returns flow from the water uses

supplied by the non-hydrologically connected wells can be considered as an accretion to the overall North Platte River system.

Water Rights Administration. The 2001 modified decree established specific conditions when water rights administration would occur within designated reaches of the Basin. Water rights administration can occur during a water shortage period referred to as an "allocation year" when it is forecasted that the overall irrigation water supply for the North Platte Project (storage ownerships of Pathfinder Reservoir, Guernsey Reservoir, and the Inland Lakes) is less than an established trigger level of 1,100,000 acre-feet. During an "allocation" year, USBR automatically places a call for the benefit of the federal reservoirs. If the SEO agrees USBR's call is valid, water rights administration occurs.

Water rights may be administered above Pathfinder Reservoir for the benefit of Pathfinder Reservoir in February, March, and April with a priority date of December 6, 1904. Water rights may be administered for the above Guernsey Reservoir reach in February, March, and April for the benefit of Guernsey Reservoir with a priority date of April 20, 1923. Glendo Reservoir may exercise a call with a priority date of August 30, 1951. In addition, water rights in this reach may be subject to administration in April for the benefit of the Inland Lakes in Nebraska with a priority date of December 6, 1904. Further, irrigation rights can be regulated on the mainstem of the North Platte River between Guernsey and Pathfinder Reservoirs in an "allocation" year when diversions exceed 6,600 acre-feet in a 2-week period. During the irrigation season this limitation is monitored by the SEO staff. The mainstem irrigation diversions have not exceeded this limitation since the North Platte Decree was modified in 2001.

Another water rights administration condition known as "negative natural flow" can occur in the Pathfinder to Guernsey. Reclamation releases storage water from Pathfinder Reservoir through Gray Reef Dam. The Modified Decree procedures apply conveyance losses to the releases to determine the amount of storage water that should pass the North Platte River above Glendo Reservoir at the Orin gage. If water measured at the Orin gage is less than the amount anticipated by water managers, water rights could be administered to rectify the situation. This situation has rarely occurred and when it did occur, the situation was managed without strict water rights administration. If municipal and other irrigation season water uses increase in the future within this reach, the possibility of a "negative natural flow" situation becomes more likely to occur later in the irrigation season. If the conditions cannot be justified based on errors in the streamflow data and conveyance timing considerations, junior irrigation water rights would likely be the water rights that are administered first to address the situation.

Consumptive Use Limitations. Consumptive use limitations for irrigation use were established in the Modified North Platte Decree. The above Pathfinder Reservoir consumptive use limitation for irrigation is 1,280,000 acre-feet for the preceding 10-year period. Within the Pathfinder to Guernsey Reservoirs reach, consumptive use is limited to 890,000 acre-feet for the10-year period. The limitation is monitored by the decree parties as a 10-year running average. The annual consumptive use is calculated in the same

manner that was used to develop the limitation although the parties to the decree have considered alternate methods to calculate consumptive use. The annual methodology to calculate consumptive use remains consistent with the methods prescribed during the establishment of the limitation. To comply with the modified decree, SEO calculates consumptive use for irrigation above Guernsey Reservoir on an annual basis and reports to the parties.

Triangle Groundwater Depletions. During the settlement proceedings, Nebraska alleged that Wyoming had violated the 1945 Decree due to surface water depletions and reductions in return flows reaching Nebraska because of Wyoming's development of groundwater resources. Wyoming groundwater development was reviewed throughout the basin but the focus of the depletion concerns centered in an area defined as the "triangle" located below Whalen Diversion Dam that extends downstream on both sides of the North Platte River in Goshen County. Through the settlement negotiations and expert reports prepared by both parties, an approach was developed for tracking the active pumping of wells and for Wyoming to provide a source of replacement water during the following irrigation season to supplement impacts to natural flows in the reach of the North Platte River between Whalen Diversion Dam and the Nebraska Stateline. This reach of the river is subject to a 25% to 75% apportionment of natural flow between Wyoming and Nebraska during May 1 through September 30, a longstanding mutually-agreed allocation that originated within the 1945 Decree. The settlement proceeding placed a requirement for Wyoming to provide replacement water due to the operation of irrigation wells in the "triangle" area based on an average effect on natural flow of 24.4 acre-feet per well.

Laramie River Basin

The Laramie River drainage was not addressed in the 1945 North Platte Decree. In 1911 Wyoming started proceedings in the Supreme Court against Colorado to limit State of Colorado diversions from the Laramie River. The case was settled with a court decree in 1922. The 1922 Laramie River Decree allowed Colorado to divert 4,250 acre-feet annually to irrigate meadows and 33,500 acre-feet for transbasin water needs. In 1957 the 1922 Decree was vacated and a new decree was entered by the Supreme Court allowing Colorado 19,875 acre-feet of water per year for transbasin water needs and 29,500 acre-feet for irrigation of meadows that were mapped and attached to the decree.

During the 1978 construction of Grayrocks Dam along the Laramie River, the State of Nebraska and several environmental groups filed a complaint and an injunction against the Basin Electric Power Cooperative and the U.S. Army Corps of Engineers (USACE). Their complaints stated that the environmental impact statement and issuance of federal 404 Permit did not address impacts to endangered species and their habitat in Central Platte River in Nebraska. A settlement was reached by the end of 1978 which resulted in payments to a Whooping Crane Trust and increased minimum flow releases from Grayrocks Dam for the downstream purposes serving fish and wildlife.

During the *Nebraska v. Wyoming* lawsuit proceedings, Nebraska was concerned about Wyoming's irrigation uses in the Lower Laramie River basin and its effect on the inflows into Grayrocks Reservoir. Wyoming agreed to annually inspect, map, and report intentionally irrigated acreage in the Lower Laramie River basin, exclusive of the Wheatland Irrigation District (WID), subject to an annual acreage limitation of 39,000 acres. The 2001 Modified Decree requirement does not apportion flows of the Lower Laramie River basin and lands irrigated within the WID which are excluded because of their entitlement under the Laramie River Decree.

5.2.3 Regulatory Issues and Constraints

New or rehabilitation water projects in the Basin involving federal lands, funding, authorizations, and programs would be subject to the National Environmental Policy Act (NEPA) and other federal regulations. The federal regulations are administered primarily through various federal agencies based on the land ownership and applicable regulatory authorization; i.e., U.S. Bureau of Land Management (BLM), USACE, U.S. Environmental Protection Agency (EPA), Natural Resources Conservation Service (NRCS), U.S. Forest Service (USFS), and U.S. Fish and Wildlife Service (USFWS). State agencies with regulatory

oversight and permitting approval that would require coordination on water projects include, but are not limited to, the SEO, Wyoming Department of Environmental Quality (DEQ), State Historic Preservation Office, State Lands and Investment Board (SLIB), and Wyoming Game and Fish Department (WGFD). A list of the major environmental regulations and general description of the permitting processes are discussed below.

The actual permit and clearance approvals for the proposed projects would depend on the site-specific project and its location. Permitting and clearance requirements for a specific project should be identified in the initial planning to achieve regulatory compliance, lower project costs, and avoid construction interruptions or design modifications.

National Environmental Policy Act

Compliance with the National Environmental Policy Act of 1969 (42 U.S.C., §4321) applies whenever the proposed project in the basin is located within federal lands, would need right-of-way across federal lands, would be funded entirely or partially by federal agencies or programs, or would require federal permits or federal authorizations. The NEPA process is intended to help sponsors and agencies perform a review of the potential project effects and involve the public in making informed decisions about the environmental consequences of the proposed water project.

With a significant amount of both USFS and BLM federal lands within the basin, the BLM or the USFS could likely be considered the lead agencies in the NEPA process. Typically, these federal agencies execute a Memorandum of Understanding (MOU) to outline responsibilities and roles of the agencies when a proposed project involves multiple agencies. The NEPA process facilitates the approvals of meeting other environmental review requirements; such as, the Endangered Species Act; the National Historic Preservation Act; and other federal, state, tribal, and local laws and regulations.

Other potentially applicable environmental regulations and agencies include:

- Clean Water Act, Section 404 (U.S. Army Corps of Engineers)
- Clean Water Act, Section 401 (Wyoming Department of Environmental Quality)
- Endangered Species Act (U.S. Fish and Wildlife Service)
- Safe Drinking Water Act (U.S. Environmental Protection Agency)
- 1964 Wilderness Act
- Fish and Wildlife Coordination Act (U.S. Fish and Wildlife Service and Wyoming Game and Fish Department)
- Wyoming State Engineer's Office
- Wyoming State Lands and Investments Board
- Natural Resources Conservation Service
- U.S. Bureau of Reclamation
- Wyoming Game and Fish Department
- Special Use Permits/Rights-of-Way/Easements

Clean Water Act

The federal Water Pollution Control Act was passed in 1972 and amended in 1977, when the law became known as the Clean Water Act (CWA), 33 U.S.C. §§ 1251 through 1387. CWA regulates the discharges of pollutants into the waters of the United States. The CWA laws have generally been adopted by state environmental agencies. A significant change in the

original 1977 CWA legislation is expanding the regulatory focus from water chemistry to biological and physical properties and from point sources of potential water pollution to non-point sources.

CWA Section 404 established a program to regulate the discharge of dredged or fill materials into waters of the United States. The premise behind the 404 program is that no discharge of dredged or fill material may be permitted if a practical alternative exists that is less damaging to the aquatic environment or if the nation's waters would be significantly degraded. The USACE Wyoming Regulatory Office is responsible for issuing 404 Dredge and Fill Permits in Wyoming. Dredge/fill activities can be authorized under USACE Nationwide, Wyoming Regional General or Individual Permits. Common activities that typically require a 404 Dredge and Fill Permit include, but are not limited to:

- Placement of fill in a wetland or other water
- Dredging or excavating bodies of water
- Stream bank stabilization or alteration
- Stream channel or bank restoration
- Construction of a bridge, road, utility or pipeline crossing over a waterbody
- Dredging or excavating potentially contaminated sediments
- Construction of any type of permanent or temporary dam, causeway, levee or other related structure
- Construction of a pond, wetland, detention basin or related feature
- Dock/ramp construction
- Hydroelectric Power Projects: Federal licensing for hydroelectric power projects by the Federal Energy Regulatory Commission.

Elements of the CWA are administered in Wyoming by the WDEQ, Water Quality Division (WQD) consistent with the Wyoming Environmental Quality Act. The WQD administers the National Pollution Discharge Elimination System (NPDES) Permit and Section 401 Certification. Wyoming point sources of pollution are administered by WQD through the Wyoming Pollutant Discharge Elimination System (WYPDES) Program. The Section 401 Certification is the State's approval to ensure that the activities authorized under Section 404 meet state water quality standards and do not degrade water quality. Any discharge of pollutants into the broadly defined "waters of the state" requires application to, and permit issuance by WQD, in accord with WQD's Rules and Regulations. This body of regulations sets forth classification of surface and groundwater uses and establishes water quality standards. The permits issued by the State's WYPDES Program provide site-specific discharge criteria for municipal wastewater treatment plants, confined animal feeding operations, industrial and commercial wastewater treatment plants, stormwater discharges in larger municipalities, and erosion and sediment control at construction sites.

Endangered Species Act

The federal Endangered Species Act (ESA), 16 U.S.C. §1531 through 1544, was adopted in 1973 based on the intent to protect plant and animal species that are believed to be on the "brink of extinction" by protecting ecosystems that are inhabited by such species. The ESA is administered primarily by the USFWS of the U.S. Department of the Interior (DOI) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce. Under the ESA, plant and animal species may be listed as either "endangered" or "threatened" based on assessment of the imminent or foreseeable risk of extinction. This Act requires that federal agencies insure that any action authorized, funded, or carried out

by the federal agencies would not likely jeopardize the continued existence of the listed species or modify their critical habitats.

The lead federal agency prepares a biological assessment to determine project effects on threatened and endangered plant and animal species listed or proposed for listing (candidate species) under the Endangered Species Act (16 U.S.C. §1531 et. Seq.). USFWS would then issue an opinion on whether federal actions are likely to jeopardize the continued existence of a threatened or endangered species, or destroy or adversely modify critical habitat. USFWS must approve the preparation of a biological assessment to comply with the ESA in order to render its decision. If USFWS determines that the preferred alternative would jeopardize the continued existence of a species, it may offer a reasonable and prudent alternative that would preclude jeopardy.

Platte River Recovery Implementation Program

Water management and development in the North Platte River Basin has been constrained since designation of critical habitat for whooping cranes, piping plover, and least terns in the Central Platte River in Nebraska was finalized in the 1970s. In 2007 the states of Wyoming, Nebraska, and Colorado entered into a cooperative agreement for the PRRIP with the DOI. The term of the first period is 13 years. The ESA provided the USFWS the authority to require the replacement of existing water depletions in Nebraska and the upstream states to achieve a water supply goal for the critical habitat in the Central Platte River in Nebraska. The water supply goal for the PRRIP was 417,000 acre-feet per year. In addition, the USFWS could assess depletion fees to acquire 29,000 acres of habitat in the Central Platte River in Nebraska.

The PRRIP serves as the reasonable and prudent alternative under the ESA for irrigation, municipal, industrial, and other water uses in place on or before July 1, 1997 in each state. Without the PRRIP, the USFWS would use the ESA consultations required for future federal actions (permits, including renewals; funding; contracts; easements; and others) to require water users (irrigators, municipalities, industries, and others) to replace existing and proposed new depletions until the water goals were met.

The goal of the PRRIP is to provide approximately 150,000 acre-feet of water and 10,000 acres of habitat in the Central Platte River. In addition, the states agreed to curtail new depletions that would impact the PRRIP's water goals. Water users seeking a reliable water supply in Wyoming would likely need to transfer water rights from other uses to secure a firm supply. A transfer of water rights from other uses is not considered a new depletion under the PRRIP.

Each state completed a depletion plan to address managing existing and future water depletions. The Wyoming Depletions Plan (referred to as the "Depletion Plan") identifies existing and new water related activities that are covered by the PRRIP. The Depletion Plan presently provides coverage for depletions authorized by existing, valid Wyoming water rights with a priority date prior to July 1, 1997; the date negotiations began to formulate the PRRIP. In addition, the Depletion Plan addresses new depletions in the North Platte River basin if the proposed water project does not exceed 20 acre-feet per year in water depletions. It is the State of Wyoming's goal to provide any necessary offset or mitigation to any permitted water use activity with a pre-July 1, 1997 priority water right. If Wyoming is unable to provide the offset and all the state-sponsored mitigation that is required in the future, the State may require water users to provide their own mitigation.

Water users seeking water rights for water projects exceeding 20 acre-feet per year of net depletions will likely need to mitigate those depletions by retiring existing water uses in the same quantities and timing as the new depletions or by providing other forms of mitigation.

The SEO North Platte Coordinator is responsible for determining whether the depletions can be covered by the Depletion Plan, reviewing new depletions, and approving any proposed mitigation plans required for new depletions. Prior to 2019, the states and the federal government will likely extend the PRRIP with a second increment.

Other Threatened or Endangered Species in the Platte River Basin in Wyoming

There are four other species associated with aquatic and wetland environments found in the Platte River Basin of Wyoming. When evaluating the feasibility of new or enlarged surface water development projects, compliance with the ESA is required and USFWS office in Cheyenne should be contacted. These species include:

- The Wyoming toad (*Anaxyrus baxteri*) is a federally listed Endangered Species and is found only in Albany County. A description of the toad and map showing the Area of Influence where any project located within it should consider potential effects to the species is shown in **Appendix 5-B**.
- The Preble's meadow jumping mouse (*Zapus hudsonius preblei*) is a federally listed Threatened Species and is found in Albany, Converse, Laramie, Goshen and Platte Counties. A description of the mouse and map showing the Area of Influence where any project located within it should consider potential effects to the species is shown in **Appendix 5-B**.
- Ute Ladies'-tresses (*Spiranthes diluvialis*) is a Threatened Species of orchid that is widely distributed but nonetheless rare throughout its range. The plant is potentially found in every county within the Platte River Basin in Wyoming. A description of the plant and map showing the Area of Influence where any project located within it should consider potential effects to the species is shown in **Appendix 5.B**.
- The Threatened Colorado butterfly plant (*Gaura neomexicana coloradensis*) is a perennial herb endemic to moist soils in wet meadows of flood plain areas. This plant occurs in southeastern Wyoming, north-central Colorado, and extreme western Nebraska between elevations of 5,000 and 6,400 feet. In Wyoming, this plant is known to occur in Laramie, Goshen and Platte Counties. A description of the plant and map showing the Area of Influence and designated critical habitat is shown in **Appendix 5.B**. **It is important to note that critical habitats have been designated in Laramie and Platte Counties.**

National Historic Preservation Act

Because federal approvals are likely involved with any of the identified alternatives, a consideration of effects on cultural resources must be undertaken (Section 106 consultation), as required under the National Historic Preservation Act of 1966 (16 U.S.C. § 470 et seq.).

Wyoming Board of Land Commissioners

The Wyoming Board of Land Commissioners through SLIB is responsible for regulating all activities on state lands, including granting of rights-of-way. Any facility, utility, road, railroad, ditch or reservoir to be constructed on state or school lands must have a right-of-way, as required in the "Rules and Regulations Governing the Issuance of Rights Of Way" (W.S. 36-20 and W.S. 36-202).

Wyoming State Engineer's Office

The SEO administers the water rights system of appropriation within the state. New water right permits are obtained from the Surface Water and Groundwater Divisions of the SEO. The applicant must obtain the necessary water rights permits from the State of Wyoming for

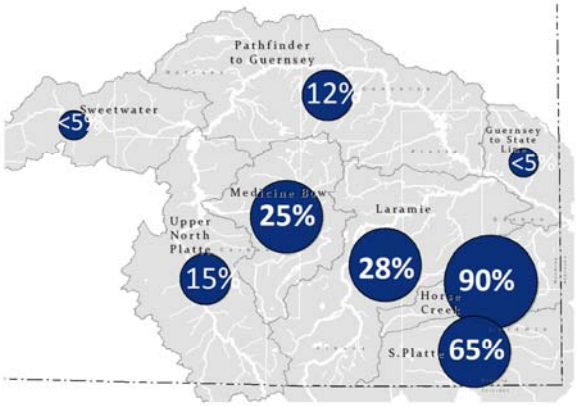
the diversion and storage of the State's groundwater and surface water. The Wyoming Dam Safety Law requires that any persons, public company, government entity or private company who proposes to construct a dam which is greater than 20 feet high or which will impound more than 50 acre-feet of water, must obtain approval for construction of the dam or ditch from the SEO. The approval by the SEO of a dam's construction is contingent upon the Office's review and approval of all dam plans and specifications, which must be prepared by a registered professional engineer licensed in Wyoming. Design, construction, and operation of jurisdictional dams must also comply with dam safety regulations promulgated pursuant to the Dam Safety Act.

5.2.4 Water Resiliency

Quantifying water availability on a system as managed and sought after as the Platte is difficult and perhaps unnecessary given that water is considered fully appropriated in the Basin. However, providing an understanding of how well the system can handle short term disturbance to supply is possible using a few key indicators from the modeling work:

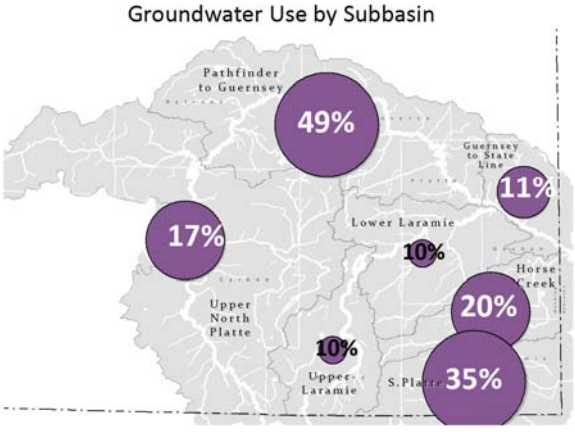
- Water use (relative to the amount of water in the subbasin)
- Access and reliance on groundwater,
- Variability in stream flows from a wet to a dry year, and
- Availability of stored water in reservoirs.

Annual Water Use



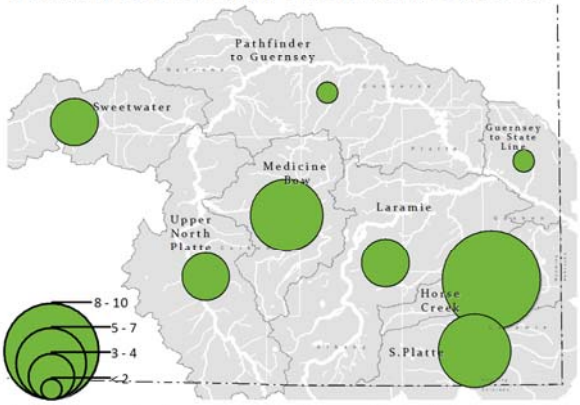
Water Use as a % of annual yield (gains) on average.

Groundwater Use by Subbasin



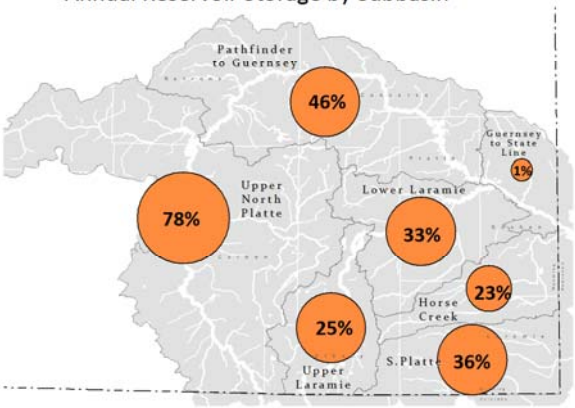
Proportion of consumptive use from groundwater.

Variability of Water Supply Under Existing Conditions



Ratio of annual wet year gains to dry year. Higher is more variable.

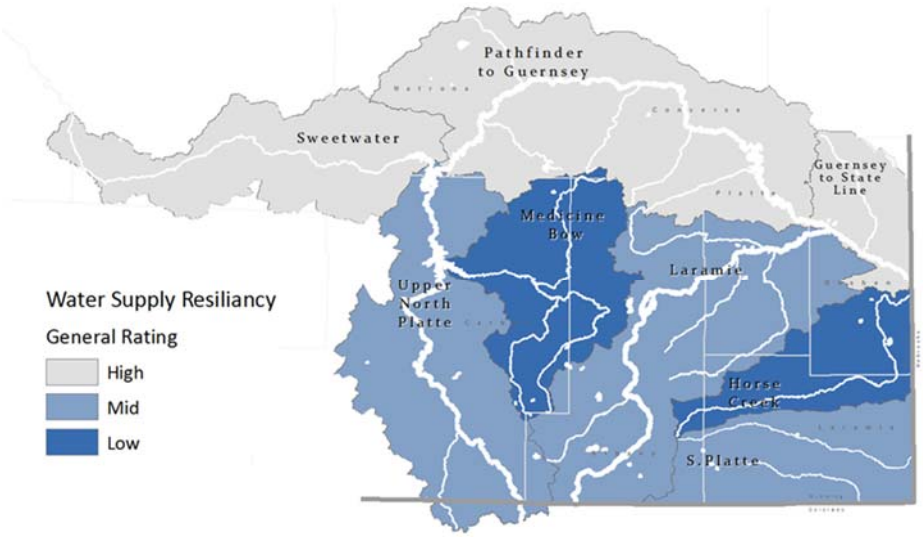
Annual Reservoir Storage by Subbasin



Proportion of avg. annual yield (gains) stored in reservoirs.

Using these four variables we can get an idea of how resilient a subbasin might be to short term impacts to water supply. For example, water users in a subbasin with a highly variable streamflow regime, with a high amount of surface water use and low storage supply would be highly impacted by drought. Conversely, if there are fairly consistent stream flows from a wet to dry year, and a low water use, a drought may not be as serious of a problem.

This map summarizes the four indicators to illustrate short term water resiliency relative to other subbasins within the Platte. A high resiliency rating means a more dependable water supply. The results are described below:



Above Pathfinder has significant spring runoff available due to the high mountain ranges on either side of the valley and varies less from a wet to dry year than in lower ranges of the Platte. Even with the highest amount of irrigation of any subbasin, the consumptive use is low compared to the natural yield of the Basin. Within the subbasin, the **Medicine Bow** stands out as highly variable stream flows and a relatively high amount of water use. This is somewhat buffered by storage in the Basin; however, most of the storage is not available in the Medicine Bow since it is stored in Seminoe and Pathfinder reservoirs. High overall resiliency rating on **Sweetwater** subbasin reflects the low water use average of 6,500 acre feet.

Pathfinder to Guernsey subbasin is more resilient relative to other subbasins due to availability of reservoir storage, low amount of water use, consistency of stream flows, and significant amount of groundwater use.

Guernsey to State Line has a high resiliency due to the consistency of flows, largely due to regulated flows from Guernsey and other upstream federal reservoir projects.

Upper Laramie has a fairly high amount of annual use to yield, and a lower access to stored water than the North Platte or the Lower Laramie subbasins. With an annual stream flow that is only three times lower on a dry year from wet year the lower variability improves its resiliency.

Lower Laramie has a similar score to Upper Laramie but mainly due to the amount of storage that is available.

Horse Creek subbasin gets the lowest resiliency score due to highly variable streamflows from dry years to wet years, a low amount of storage on average under 25% of water yield, and a high amount of water use.

South Platte also has highly variable stream flows, but is moderated by reservoir storage and diversions from outside of the South Platte subbasin and significant groundwater use. For these reasons, it has a higher resilience than the similar Horse Creek subbasin.

5.2.5 Funding Sources

Various state and federal funding sources could be available for different water supply projects within the Platte River Basin depending upon the type of the project being planned and the specific funding requirements and available funds of the respective funding agencies.

State of Wyoming Funding Sources

Table 5.1 at the end of this section summarizes the requirements and limitations of the potential State of Wyoming funding programs described below.

Table 5.1: State of Wyoming Funding Programs

Program	Agency	Grant/Loan Requirements	Maximum Funding Amount
Non-Point Source Pollution Control	WDEQ	Grant funds to address water quality issues	$200,000
Level I and II Planning Studies	WWDC	Grant funding for reconnaissance and feasibility level studies	
Level III New Development and Rehab Program	WWDC	67% grant / 33% loan or equivalent local match Grant % up to 75% based on public/non-agricultural benefits and sponsor hardship	$15M
Level III Dam and Reservoir Program	WWDC	67% grant / 33% loan or equivalent local match Grant % up to 75% based on public/non-agricultural benefits and sponsor hardship	Subject to Legislative approval
Small Water Project Program	WWDC	Total costs must be less than $135,000. Maximum WWDC contribution 50% of project costs or $35,000 maximum.	$35,000
State Loan and Investment Board Farm Loan Program	Office of State Lands and Investments	Grant/Loan Program, legal entity meeting individual requirements	$600,000 or $150,000 loans (subject to appropriation for some programs)
Wyoming Wildlife and Natural Resource Trust	Independent Wyoming State Agency	Grant funds, applications accepted in September and April	$200,000 or more large project

Wyoming Department of Environmental Quality. The DEQ has a non-point source program which focuses on water quality issues and may be a funding source depending on the project. These are Federal monies administered by the DEQ. The drawback is that the maximum funding is in the $200,000 range and only $2 million per year is available through this program for the entire state of Wyoming. The priority for this program is those projects or improvements that reduce seepage or return flows thereby improving the water quality of the receiving waters of the State.

State Lands and Investment Board. The Wyoming SLIB provides farm loans to foster and encourage agriculture, dairying, and livestock production in the State. Loans are also available for the development and improvement of farm lands. SLIB offers regular farm

loans, beginning agricultural producer's loans, and small water development project loans. The specific information for SLIB loan programs is summarized below.

Single regular farm loans or combination of loans made to an individual, or entity, shall not exceed $600,000. The loan interest rates vary (depending on the amount of the loan versus the appraised value of the security land and improvements) and are established by SLIB rules with the term of the loan not exceeding 30 years.

Small water development project loans have been authorized to finance projects for development and use of water upon agricultural lands for agricultural purposes. Individual loans may be made for sums not to exceed $150,000 at interest rates established by SLIB rules (term not to exceed 30 years). Loans may be provided to court-approved water districts, agencies of State and local government, persons, corporations, associations, and other legal entities in the State of Wyoming.

Federal mineral royalty capital construction grants and loans are available for municipal, county or special districts and involve the planning, construction, acquisition, improvement or emergency repair of public facilities and acquisition of emergency vehicles. Each

application is considered individually by the SLIB with the amount of funding varying, but up to 75% of the total project cost. The funding source is federal mineral royalties, and is subject to appropriation.

Wyoming Water Development Commission. The WWDC includes new development, rehabilitation, dam and reservoir, and water resources planning. Level I studies are reconnaissance level analysis and comparison of development alternatives. Level II projects typically consist of two phases which serve first to address project feasibility, and if a project is determined feasible, to refine the project to the status of being ready for a Level III funding request. Level III work activities include project design, permitting, land acquisition, construction and construction engineering. WWDC Level III funding packages currently offer a maximum of 67% in grant money with 33% in loans. A funding package with a higher percentage of grant monies can be sought for multi-purpose projects that propose public access and non-agricultural benefits, such as wildlife habitat enhancement and fishery benefits.

Given the age and deterioration of irrigation infrastructure within the State of Wyoming, obtaining funds through the rehabilitation program is becoming highly competitive. Furthermore, there is no guarantee of the amount of monies provided through appropriations by the State Legislature.

The Dam and Reservoir Program is applicable to proposed new dams with storage capacity of 2,000 acre-feet or more and proposed expansions of existing dams of 1,000 acre-feet or more. The funds available in this program are currently less competitive than the rehabilitation program.

WWDC Small Water Project Program. The SWPP is intended to be compatible with the conventional WWDC program described above. The purpose of the SWPP is to participate with land management agencies and sponsoring entities in providing incentives for improving watershed condition and function. Projects eligible for SWPP grant funding assistance include the construction or rehabilitation of small reservoirs, wells, pipelines and conveyance facilities, springs, solar platforms, irrigation works, windmills, and wetland developments. A small project is defined as one where estimated construction or rehabilitation costs, permit procurement, construction engineering and project land procurement are $135,000 or less. Units of government and court approved special districts are eligible to apply. SWPP funding is a "one-time" grant so that ongoing operation and

maintenance costs are not included. Loans are not available under SWPP. The SWPP will fund up to 50% of the total project costs up to a maximum amount of $35,000.

Wyoming Wildlife and Natural Resource Trust. The Wyoming Wildlife and Natural Resource Trust (WWNRT) was authorized by the Wyoming State Legislature and signed into law by the Governor in 2005 to preserve and enhance Wyoming's wildlife habitat and natural resources. Projects funded by WWNRT must provide public benefits such as continued agricultural production to maintain open space and healthy ecosystems, enhancements to water quality, and maintenance or enhancement of wildlife habitat. Funding is by grant with no matching funds required. Non-profit and governmental organizations, including watershed improvement districts, conservation districts, and irrigation districts are eligible for funding.

Federal Government Funding Sources

Table 5.2 lists federal funding programs which may provide funding for potential water management and improvement projects in the Basin. Most if not all programs require a local match that could be met with a WWDC grant.

Table 5.2: Federal Funding Programs

Program	Agency	Eligibility Requirements	Maximum Funding Amount	Applications / Available Funding
Soil and Water Conservation	USDA NRCS	Grant – planning, applying resource conservation practices; irrigation district applicable; 50% cost share	$150,000	
Watershed Protection, PL 566	USDA NRCS	Grant – irrigation water management and other purposes; 50% local cost share	$5M w/o Congressional approval	Backing of $1.8B in projects
Environmental Quality Incentives (EQIP)	USDA NRCS	Focus on agricultural producers; 50% cost share	$150,000	Up to $20M
Water and Environmental Programs	USDA, Rural Development WEP	Grants/Loans for governmental entities serving less than 10,000 people	Grants may be available	Up to $4.5M annually in Wyoming
WaterSMART	USBR	Grant – Water and Energy Efficiency, 50% cost share	$1M	Up to $14M
US Fish and Wildlife Service	USFWS	Grants, 50% cost share match	$50k	

Although these programs are potential sources of funding for infrastructure upgrades, some programs are easier to access than others. Applications for funding from any Federal program will require substantial effort to prepare. All of the Federal programs will require adherence and approvals following the NEPA process before any project disturbance activities. There is always a risk that the application will not be funded and the time devoted to the application process will be unproductive.

USDA PL 566 and Environmental Quality Incentives Program. The U.S. Department of Agricultural (USDA) programs include Watershed Protection assistance under Public Law 566, Soil and Water Conservation funding programs, and Environmental Quality Incentives

Program (EQIP). The largest pool of money is within the PL 566 program. Eligibility for this funding is based on watershed protection. Significant water quality issues and/or threats to water quality must be documented in the application. The program requires a 50% cost share from the applicant. Up to $5M can be granted without Congressional approval. Larger amounts are available with Congressional approval.

The EQIP program requires a 50% cost share and its total funding is limited to $150,000 per project. However, if organized through farmer initiatives for projects such as lateral improvements or construction of other on-farm structures, EQIP funding is easier to obtain than other Federal monies.

The application process for USDA funding programs requires a commitment of time and effort. USDA and other federal programs are not geared to crisis response or immediate availability as the review and approval process can be lengthy. Furthermore, the money provided by federal sources is generally accompanied by more stringent permitting requirements.

Rural Development Water and Environmental Program. Through the Rural Utilities Service Water and Environmental Programs, rural communities obtain the technical assistance and financing necessary to develop drinking water and waste disposal systems. Safe drinking water and sanitary waste disposal systems are vital not only to public health, but also to the vitality of rural America. The program provides low interest loans and loans may be combined with grants to keep users' costs reasonable. The funds may be used to finance the acquisition, construction, or improvement of drinking water sources, treatment, storage or distribution as well as sewer collection, transmission, treatment and disposal; and storm water collection, transmission and disposal.

WaterSMART. The USBR provides grants for projects that implement water savings or energy efficiencies. Agricultural water saving grants are popular, particularly with irrigation districts that are served by Federal water projects. The WaterSMART funding requires a 50% cost share commitment by September 1 of the year the Funding Opportunity Announcement (FOA) is released. The FOA is released in the fall and awards are announced in the early summer months.

U.S. Fish and Wildlife Service. Technical and financial assistance is available to private landowners, profit or non-profit entities, public agencies, and public-private partnerships under several programs addressing the management, conservation, and restoration or enhancement of wildlife and aquatic habitat (including riparian areas, streams, wetlands, and grasslands). These programs include, but are not necessarily limited to the North American Wetlands Conservation Act Grant Program (NAWCA) and Landowner Incentive Program. The NAWCA grants are limited to $75,000 for one project.

Local Funding Sources

Conservation Districts, county and municipal governments may have funds available for development of water focused recreation facilities, resource protection and enhancement projects.

Private Funding Sources

There are a number of non-governmental organizations that support natural water resource and watershed conservation, protection and enhancement activities including: 1) The Nature Conservancy, 2) Ducks Unlimited, 3) Trout Unlimited, 4) The Rocky Mountain Elk Foundation and, 5) Pheasants Forever among others.

5.2.6 References

Platte River Recovery Implementation Program, 2006. Governance Committee, Program Document, Attachment III, Section 7, Depletions Plan, Platte River Basin, Wyoming (Wyoming's Depletions Plan), October 24, 2006.

Squillace, Mark, 1989. A Critical Look at Wyoming Water Law, Land and Water Law Review, Vol. 24, University of Wyoming, WWRC-89-44.

Wyoming Water Strategy, 2015. Leading the Charge, Governor Mathew H. Mead, State of Wyoming.

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Wyoming Water Development Commission, 2014. Settlement of the Nebraska v. Wyoming Law Suit, North Platte River Basin Planning Study, Mike Purcell, March 31, 2014.

5.3 WATER QUALITY ISSUES

5.3.1 Introduction

This section presents an update on water quality issues within the Platte River Basin of Wyoming affecting existing and future uses. The principal focus of this water quality update to the Platte River Basin Plan (Trihydro, 2006) has been to identify measures that have been implemented since and during the past 10 years. This update includes the identification of areas within the Basin where water quality issues are being investigated by state, federal and other governmental entities, including the DEQ, SEO, WGFD, the Wyoming Association of Conservation Districts (WACD), BLM, NRCS, the U.S. Geologicl Survey (USGS), and the EPA.

A discussion of state and federal water quality regulations, Wyoming water quality standards, total maximum daily loads (TMDL) per Section 305(b) of the Clean Water Act, Wyoming stream classifications, the NPDES, and the DEQ Beneficial Use Reconnaissance Program within the Platte River Basin was provided in Trihydro, 2006, Technical Memorandum 5-3. Surface and groundwater impact studies performed within the Basin on selenium, storm water, nitrates and pesticides were addressed in Trihydro, 2006. Technical Memorandum 5-3 (Trihydro, 2006) also discussed ongoing (as of 2005) water quality monitoring and remediation efforts by conservation districts located within the Platte River Basin and identified water quality issues.

The information presented herein identifies and updates on-going watershed management planning being performed by state and federal agencies and discusses opportunities for cooperation and coordination of these efforts. Finally, this update provides recommendations and strategies for protecting and improving water quality within the basin.

5.3.2 State and Federal Regulations

In 2015, EPA finalized updates to the federal water quality standards regulations (40 CFR 131) pursuant to provisions of the CWA. The basic structure of these regulations was last revised in 1983. Minor revisions were made in 2000 ("Alaska Rule") and 2004 ("Beach Act Rule"). In finalizing these revisions, EPA stated that "*the updated rules provide a better defined pathway for states, territories and authorized tribes to improve water quality and protect high quality waters through the enhancement of the current regulation's effectiveness, water quality standards transparency, and better opportunity for meaningful public engagement at the state, territorial, tribal and local levels*" (EPA, 2015).

EPA believes that these updated regulations accomplish several goals for protecting the country's water resources, including: 1) allowing EPA, states or tribes to communicate directly on those areas where water quality standard improvements should be made and establish a more transparent regulatory process; 2) ensuring that appropriate water quality standards are in place to help restore and maintain aquatic ecosystems and promote resilience to emerging water quality stressors; 3) providing for a transparent review process of water quality standards so that states and tribes can update the standards when necessary and consider the latest science available as reflected in the CWA Section 304(a) criteria recommendations; 4) promoting public transparency and enhance antidegradation through clearer requirements and expectations of what is required; 5) promoting the appropriate use of water quality variances when applicable standards are not attainable now but may become attainable in the future; and, 6) clarifying how states and tribes can utilize permit compliance schedules while ensuring public transparency on the process.

As of November 2015, EPA is also considering several revisions to the Safe Drinking Water Act to clarify certain issues with the current lead prohibition in Section 1417 of the Rule,

regulate the levels of perchlorate in drinking water, revision downward of the maximum contaminant levels for chromium, and revision of the Lead and Copper Rule to improve public health protections and further enhance the quality of the nation's drinking water.

5.3.3 Updated Watershed Management Activities to Resolve Water Quality Issues

Wyoming Department of Environmental Quality, Water Quality Division

Total Maximum Daily Load Coordination. In accordance with Section 305(b) of the CWA, the DEQ, WQD continues to prepare a water quality assessment report every two years describing the water quality of all navigable waters within the state. While WQD is working to complete the 2014 report, the most recent final report that is currently available was completed in 2012. As of 2012, 18,713, or 3.3% of the 569,269 acres of Wyoming's Lakes, Reservoirs and Ponds had been assessed and use support status determined, whereas 17,515, or 6.2% of the 280,804 miles of Wyoming's streams had use support determinations. EPA guidance specifies that all surface waters of the state be placed into one of five designated use attainment categories. Category 1 waters are those that support all their designated uses and have no water quality threats or impairments. Category 2 waters are those for which some designated uses are supported, but the status of others remains unknown. Category 3 waters are those waters for which insufficient data exists to make use support determinations. Category 4 waters are those waters which have a designated use that is impaired or threatened and either a TMDL has been completed (4A); other pollution control measures are expected to address the impairment (4B); or pollution (e.g. flow alteration) not a pollutant is the source of impairment (4C). Lastly, Category 5 waters, or those on the state's 303(d) List, are waters where one or more uses are either impaired or threatened and a TMDL is required. There are currently no known Category 1 streams in the state of Wyoming (WQD, 2012).

WQD includes in each report a list (required by the CWA, Section 303(d)) of Category 5 streams that are impaired or threatened from meeting beneficial uses. For each stream that is included in the 303(d) list, WQD must calculate a TMDL for each pollutant of concern within the stream. **Table 5.3.1** includes a listing of 303(d) listed streams in the Platte River Basin along with the reason for their listing and the TMDL date. Note: Streams highlighted in yellow are also 303(d) listed in 2004.

As shown on **Figures 5.3.1 through 5.3.5**, 303(d) listed and Category 4 streams have thus far been identified in five of the subbasins. The longest impaired reaches have been identified along the North Platte River near the Kendrick Project as shown on **Figure 5.3.2**, on Rock and Wheatland Creeks near Wheatland as shown on **Figure 5.3.4**, and along Crow Creek near Cheyenne as shown on **Figure 5.3.5**.

Table 5.3.1: 2012 303(d) Listed Streams in the Platte River Basin

Waterbody	305(b) Identifier	Class	Location	Miles / Acres	Uses	Cause(s)	List Date	TMDL Date
					Use Support	Source(s)		
North Platte River Basin								
Lander Creek	WYNP101800060104_01	2AB	A 0.5 section of Lander Creek between two unnamed tributaries and adjacent to County Route 132 (in SW S8 T29N R103W, within HUC 12 boundary 101800050104)	0.5 mi	Recreation	E. coli	2012	2023
					Not Supporting	Grazing		
Crooks Creek	WYNP101800060603_01	2AB	From the confluence with Mason Creek to a point 1.4 miles downstream	1.4 mi	Cold Water Game Fishery, Aquatic Life other than Fish	Oil and Grease	1998	2012
					Not Supporting	Petroleum Production		
North Platte River	WYNP101800070300_01	2AB	From Casper Canal downstream to the confluence with the North Platte River	36.8 mi.	Cold Water Game Fishery, Aquatic Life other than Fish	Selenium	1998	2009
					Not Supporting	Irrigated Crop Production, Natural Sources		
Poison Spring Creek	WYNP101800070302_01	3B	From Casper Canal downstream to the confluence with the North Platte River	8.2 mi.	Aquatic life other than fish	Selenium	2000	2009
					Not Supporting	Irrigated Crop Production, Natural Sources		
Rasmus Lee Lake	WYNP101800070302_02	3B	Within the Kendrick Reclamation Project	85.2 mi.	Aquatic life other than fish	Selenium	2000	2009
					Not Supporting	Irrigated Crop Production, Natural Sources		
Goose Lake	WYNP101800070302_03	3B	Within the Kendrick Reclamation Project	30.1 ac.	Aquatic life other than fish	Selenium	2000	2009
					Not Supporting	Irrigated Crop Production, Natural Sources		

Table 5.3.1: 2012 303(d) Listed Streams in the Platte River Basin

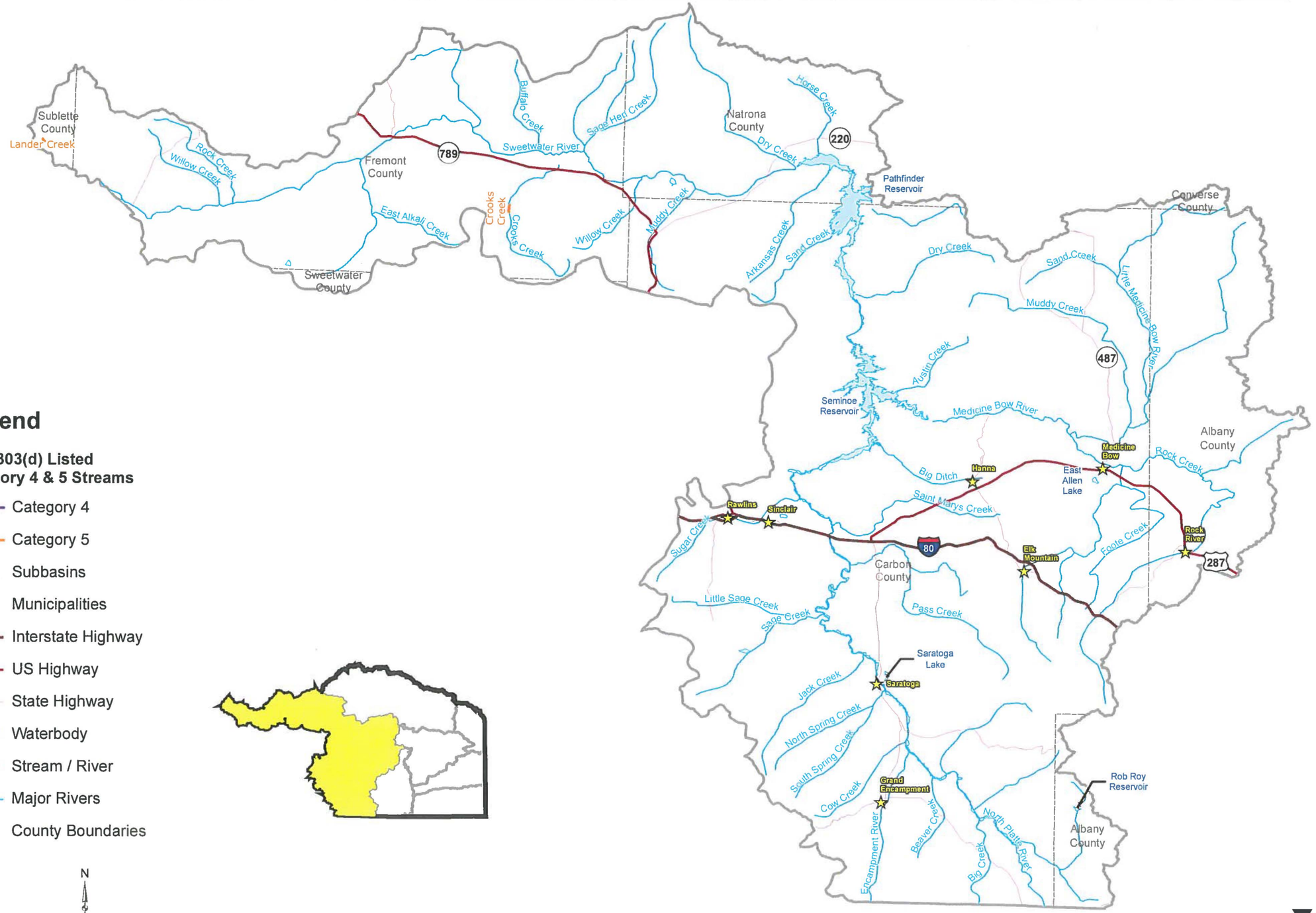
Waterbody	305(b) Identifier	Class	Location	Miles / Acres	Uses	Cause(s)	List Date	TMDL Date
					Use Support	Source(s)		
Oregon Trail Drain	WYNP101800070303_01	3B	Within the Kendrick Reclamation Project	8.6 mi.	Aquatic life other than fish	Selenium	2000	2009
					Not Supporting	Irrigated Crop Production, Natural Sources		
Poison Spider Creek	WYNP101800070406_01	2AB	From the confluence with the North Platte River to the confluence with Iron Creek, within the Kendrick Reclamation Project	1.3 mi.	Cold Water Game Fishery, Aquatic Life other than Fish	Selenium	2000	2009
					Not Supporting	Irrigated Crop Production, Natural Sources		
Poison Spider Creek	WYNP101800070406_02	2C	From the confluence with Iron Creek to a point 5.8 miles upstream	5.8 mi	Non-Game Fishery, Aquatic Life other than Fish	Selenium	2000	2009
					Not Supporting	Irrigated Crop Production, Natural Sources		
Poison Spider Creek	WYNP101800070406_03	3B	From the HUC 12 boundary (101800070406) to a point 6.0 miles downstream, within the Kendrick Reclamation Project	6.0 mi	Aquatic Life other than Fish	Selenium	2000	2009
					Not Supporting	Irrigated Crop Production, Natural Sources		
Illco Pond	WYNP101800070503_01	3B	NE S13 T35N R81W, within HUC 12 boundary (101800070503)	1.1 ac	Aquatic Life other than Fish	Selenium	2000	2009
					Not Supporting	Irrigated Crop Production, Natural Sources		
Casper Creek	WYNP101800070504_01	2AB	From the confluence with the North Platte River to a point 21.1 miles upstream, within the Kendrick Reclamation Project	21.1 ac	Cold Water Game Fishery, Aquatic Life other than Fish	Selenium	2000	2009
					Not Supporting	Irrigated Crop Production, Natural Sources		
Thirty Three Mile Reservoir	WYNP101800070703_01	3B	Along South Fork Casper Creek within Kendrick Reclamation Project	30.2 ac	Aquatic Life other than Fish	Selenium	2000	2009
					Not Supporting	Irrigated Crop Production, Natural Sources		

Table 5.3.1: 2012 303(d) Listed Streams in the Platte River Basin

Waterbody	305(b) Identifier	Class	Location	Miles / Acres	Uses	Cause(s)	List Date	TMDL Date
					Use Support	Source(s)		
Laramie River	WYNP101800100201_01	2AB	From State Highway 10 to a point 0.3 miles upstream	0.3 mi	Recreation Not Supporting	*E. coli* Unknown	2012	2023
Little Laramie River	WYNP101800100605_01	2AB	From Mandel Lane upstream to Snowy Range Road	15.7 mi	Recreation Not Supporting	*E. coli* Unknown	2012	2023
Laramie River	WYNP101800100707_01	2AB	A 2.9 mile section of stream intersecting Ione Lane, below Bosler Junction	2.9 mi	Recreation Not Supporting	*E. coli* Unknown	2012	2023
Wheatland Creek	WYNP101800110502_01	2C	From the confluence with Rock Creek downstream to Wheatland Highway	2.4 mi	Non-Game Fishery, Aquatic Life other than Fish Not Supporting	Ammonia Municipal WWTF	1996	2014
Wheatland Creek	WYNP101800110502_01	2C	From the confluence with Rock Creek downstream to Wheatland Highway	2.4 mi	Non-Game Fishery, Aquatic Life other than Fish Not Supporting	pH Municipal WWTF	1996	2014
Wheatland Creek	WYNP101800110502_01	2C	From the confluence with Rock Creek downstream to Wheatland Highway	2.4 mi	Recreation Not Supporting	Fecal Coliform Unknown	2002	2014
Rock Creek	WYNP101800110502_02	2C	Entire watershed above the confluence with Wheatland Creek	34.9	Recreation Not Supporting	Fecal Coliform Unknown	2002	2014
South Platte River Basin								
Middle Fork Crow Creek	WYSP101900090101_01	2AB	A 1.5 mile section of creek at FS Road 700 crossing	1.5 mi	Recreation Not Supporting	*E. coli* Grazing	2010	2015
North Branch North Fork Crow Creek	WYSP101900090104_01	2AB	From FS Road 701 upstream 300 yards	0.2 mi	Recreation Not Supporting	*E. coli* Grazing	2004	2015
Crow Creek	WYSP101900090107_01	2C	From the inlet of Hereford Reservoir #2 upstream to the outlet of Hereford Reservoir #	9.4 mi	Recreation Not Supporting	Fecal Coliform Stormwater	1996	2010
Crow Creek	WYSP101900090107_02	2C	From 0.7 miles below Morrie Avenue downstream to the inlet of Hereford Reservoir #1	3.7 mi	Non-Game Fishery, Aquatic Life other than Fish Not Supporting	Selenium Petroleum Production	2010	2010
Crow Creek	WYSP101900090107_02	2C	From 0.7 miles below Morrie Avenue downstream to the inlet of Hereford Reservoir #1	3.7 mi	Recreation Not Supporting	*E. coli* Stormwater	2012	2010

Table 5.3.1: 2012 303(d) Listed Streams in the Platte River Basin

Waterbody	305(b) Identifier	Class	Location	Miles / Acres	Uses	Cause(s)	List Date	TMDL Date
					Use Support	Source(s)		
Crow Creek	WYSP101900090107_02	2C	From 0.7 miles below Morrie Avenue downstream to the inlet of Hereford Reservoir #1	3.7 mi	Non-Game Fishery, Aquatic Life other than Fish	Sediment	2012	2010
					Not Supporting	Stormwater		
Crow Creek	WYSP101900090107_03	2C	From 0.7 miles below Morrie Avenue downstream to the inlet of Hereford Reservoir #1	0.7 mi	Non-Game Fishery, Aquatic Life other than Fish	Sediment	2010	2010
					Not Supporting	Stormwater		
Crow Creek	WYSP101900090107_03	2C	From Morrie Avenue to a point 0.7 miles downstream	0.7 mi	Recreation	*E. Coli*	2012	2010
					Not Supporting	Stormwater		
Crow Creek	WYSP101900090107_04	2AB	From Morrie Avenue to a point 0.7 miles downstream	3.4 mi	Recreation	*E. Coli*	2012	2010
					Not Supporting	Stormwater		
Crow Creek	WYSP101900090107_04	2AB	From Morrie Avenue upstream to Happy Jack Road	3.4 mi	Cold Water Game Fishery, Aquatic Life other than Fish	*E. Coli*	2012	2010
					Not Supporting	Stormwater		
Crow Creek	WYSP101900090107_05	2AB	From Morrie Avenue upstream to Happy Jack Road	3.1 mi	Recreation	*E. Coli*	2012	2010
					Not Supporting	Unknown		
Crow Creek	WYSP101900090203_01	2C	From Missile Road (HWY 217) upstream to the outlet of Hereford Reservoir #2	10.1 mi	Recreation	*E. Coli*	1996	2010
					Not Supporting	Unknown		
Note: Streams highlighted in yellow are also 303(d) listed in 2004.								



Legend

2012 303(d) Listed Category 4 & 5 Streams

- Category 4
- Category 5
- Subbasins
- Municipalities
- Interstate Highway
- US Highway
- State Highway
- Waterbody
- Stream / River
- Major Rivers
- County Boundaries

N

0 10 20 40 Miles

Figure 5.3.1: 2012 305(b) and 303(d) Listed Category 4 & 5 Streams Above Pathfinder Dam Subbasin

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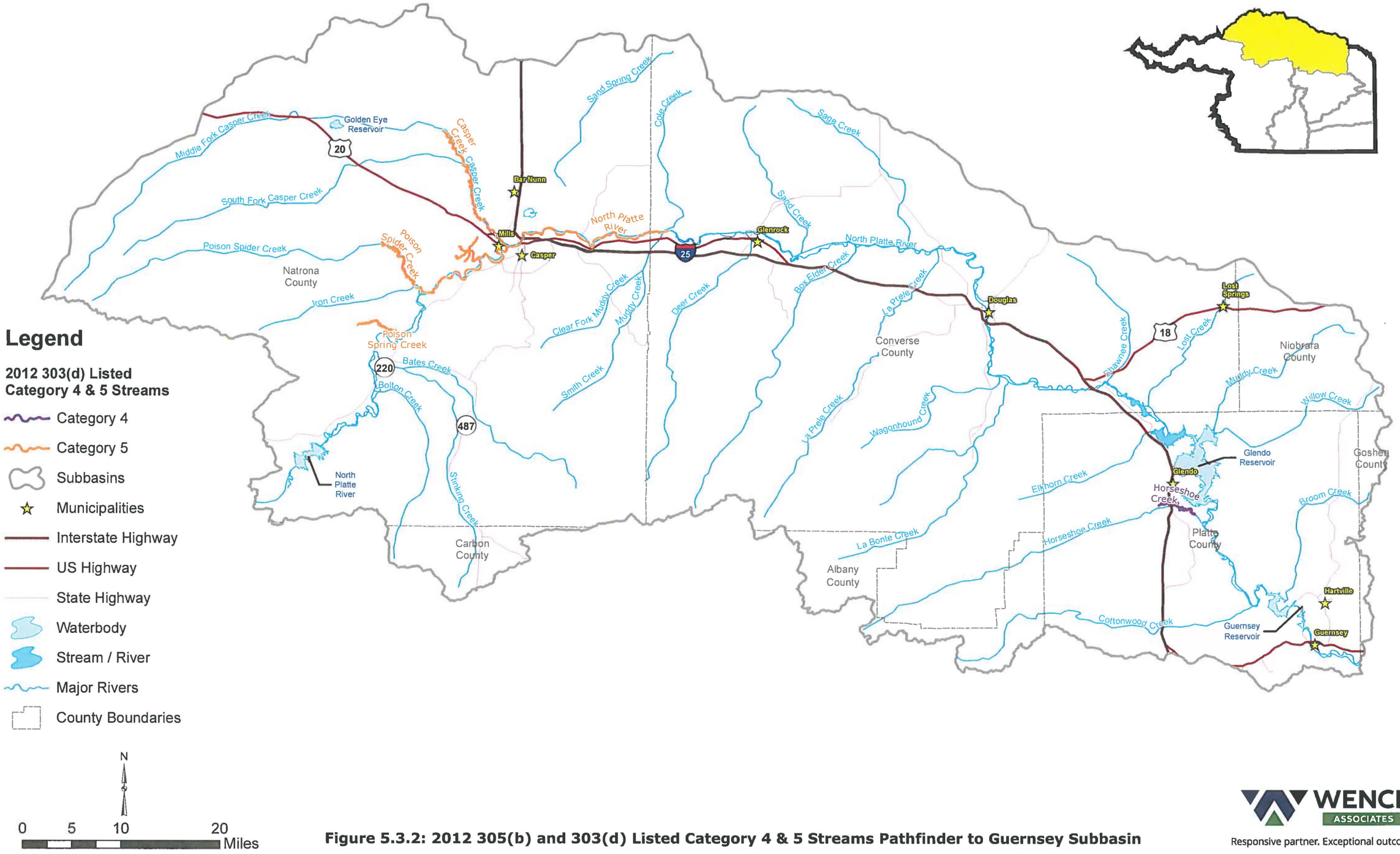

Figure 5.3.2: 2012 305(b) and 303(d) Listed Category 4 & 5 Streams Pathfinder to Guernsey Subbasin

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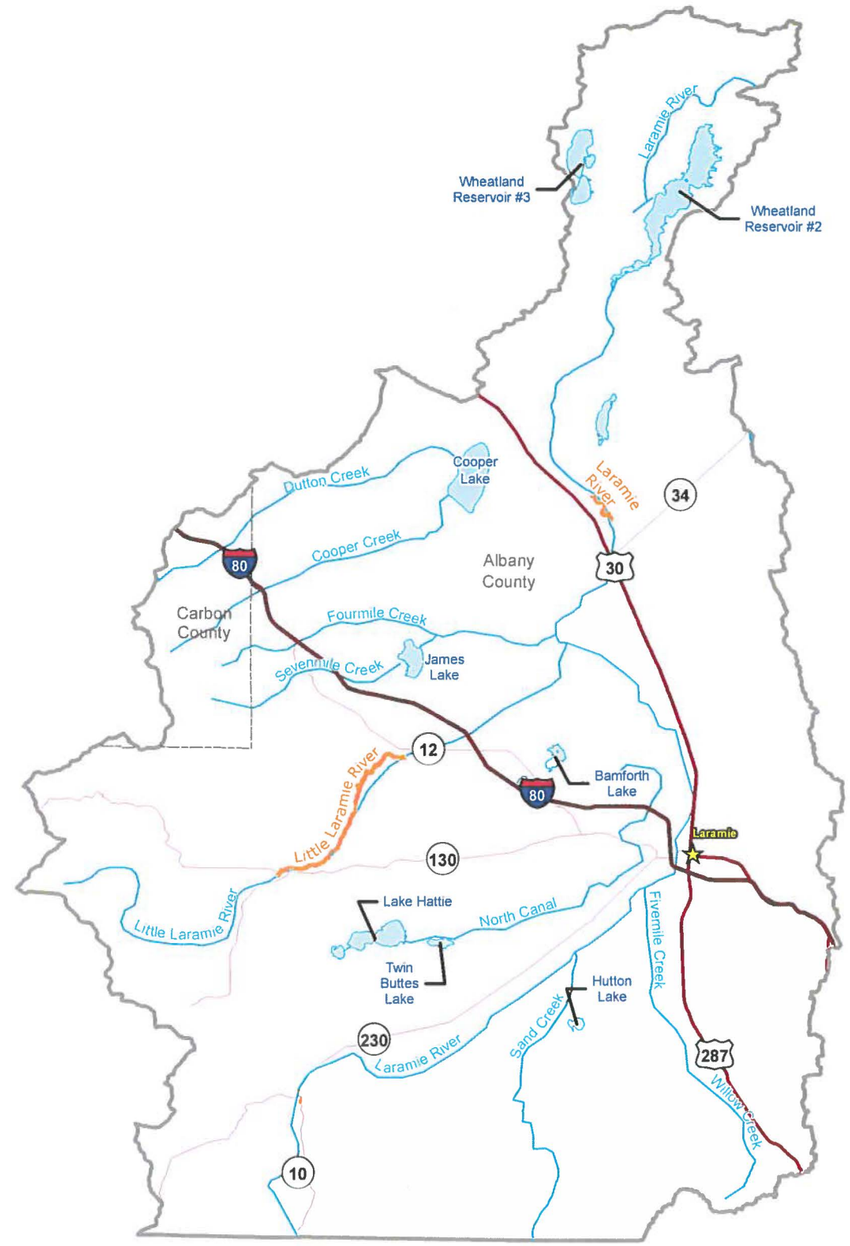

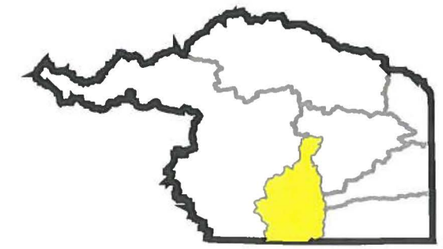

Legend

2012 303(d) Listed Category 4 & 5 Streams

- Category 4
- Category 5
- Subbasins
- Municipalities
- Interstate Highway
- US Highway
- State Highway
- Waterbody
- Stream / River
- Major Rivers
- County Boundaries

N

0 5 10 20 Miles

Figure 5.3.3: 2012 305(b) and 303(d) Listed Category 4 & 5 Streams Upper Laramie Subbasin

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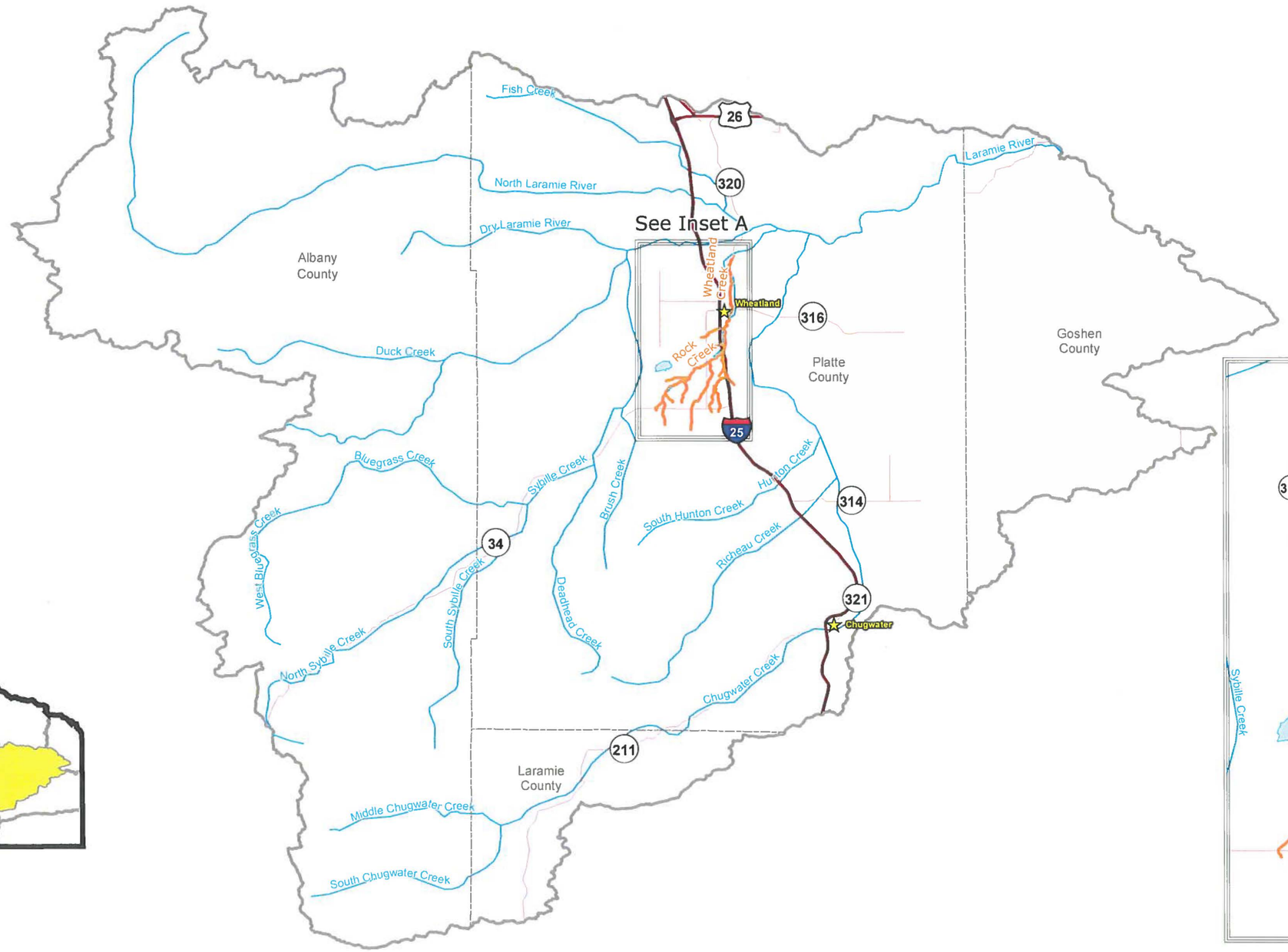
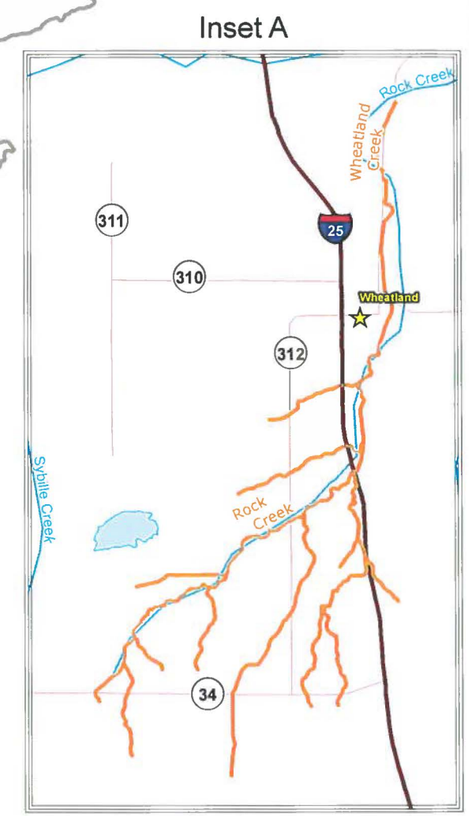
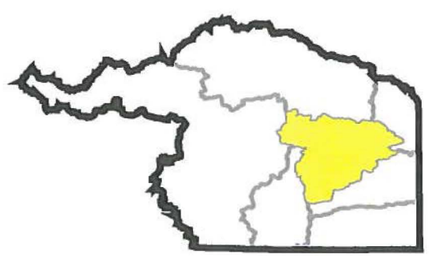
Legend

2012 303(d) Listed Category 4 & 5 Streams

- Category 4
- Category 5
- Subbasins
- Municipalities
- Interstate Highway
- US Highway
- State Highway
- Waterbody
- Stream / River
- Major Rivers
- County Boundaries







N

0 5 10 20 Miles

Figure 5.3.4: 2012 305(b) and 303(d) Listed Category 4 & 5 Streams Lower Laramie Subbasin

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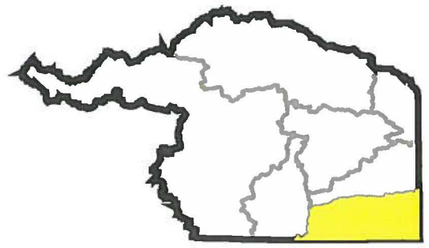
Legend

2012 303(d) Listed Category 4 & 5 Streams

- Category 4
- Category 5
- Subbasins
- Municipalities
- Interstate Highway
- US Highway
- State Highway
- Waterbody
- Stream / River
- Major Rivers
- County Boundaries



N

0 5 10 20 Miles

Figure 5.3.5: 2012 305(b) and 303(d) Listed Category 4 & 5 Streams South Platte Subbasin

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WQD continues to evaluate TMDL projects and actively encourages participation from local stakeholders within each watershed in the development of assumptions, calculations and restoration methods. WQD considers public outreach and involvement critical for the success of a TMDL project.

Nutrient Reduction Plan. To assist in the development and implementation of a nutrient reduction strategy, WQD formed the Wyoming Nutrient Workgroup comprised of a group of stakeholders, including representatives from the agriculture industry, municipalities, water and wastewater management, land and resource management and environmental groups.

Nutrients, such as nitrogen and phosphorus, are necessary for maintaining a healthy aquatic ecosystem. However, excessive quantities of these nutrients can result in excessive growth of vegetation within the system leading to oxygen depletion, high pH and general degradation of the aquatic resource. Nutrient pollution in drinking water supplies may require costly treatment, while surface waters with excessive nutrients may impact the use of water for recreation, livestock and wildlife.

In 2011, EPA issued a "Framework for Managing Nitrogen and Phosphorus Pollution" to assist in the development of a Wyoming specific nutrient reduction plan (EPA, 2011a). The framework recommends that the State:

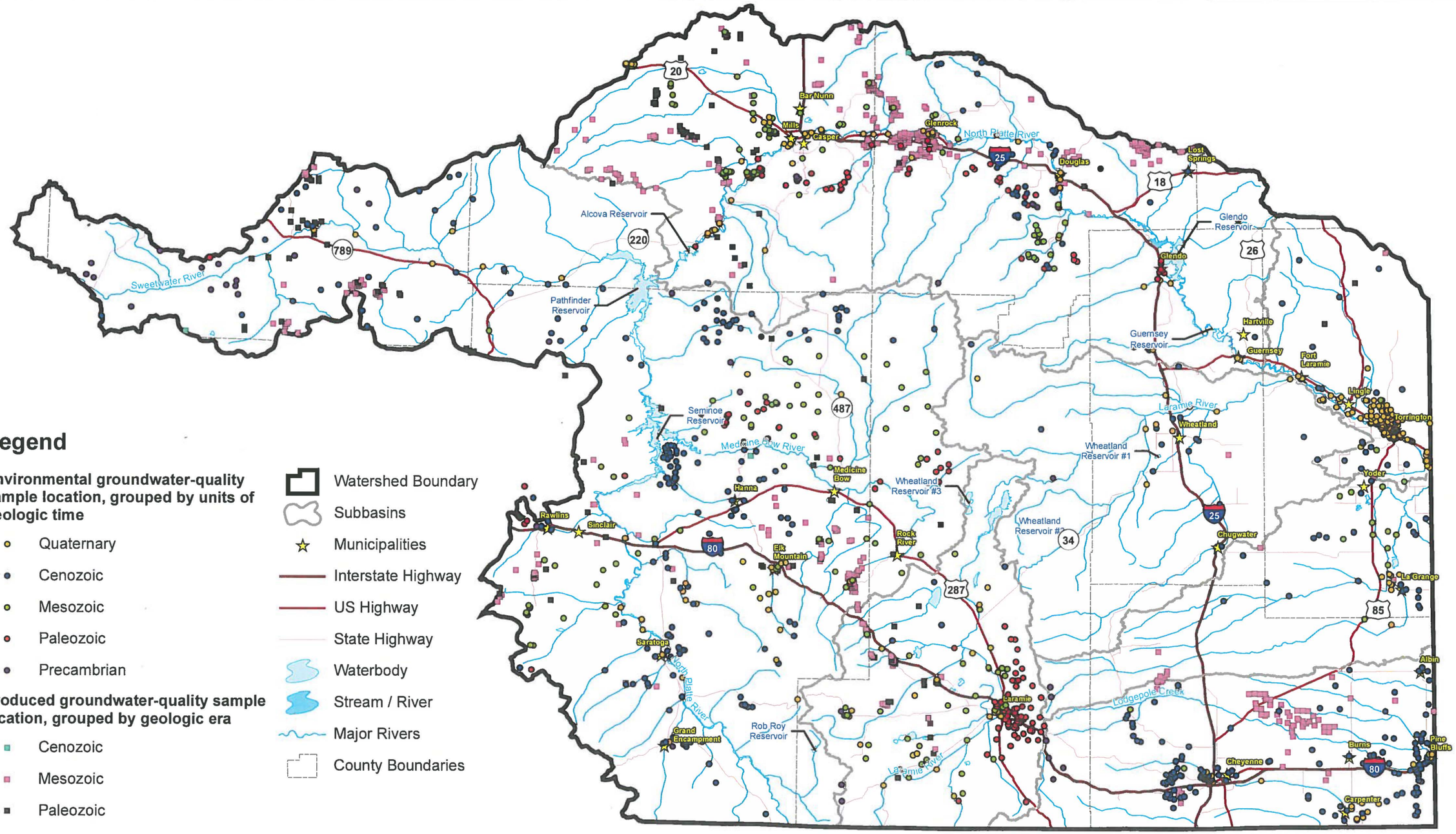
- Prioritize watersheds on a statewide basis for nitrogen and phosphorus loading reductions.
- Set watershed load reduction goals based on the best available information.
- Ensure effectiveness of point source permits in targeted/priority sub-watersheds.
- Identify and implement agricultural conservation practices in targeted areas.
- Identify and implement improvements to storm water systems, septics, lawn fertilizers and detergents.
- Verify and document load reductions.
- Report implementation activities annually and load reductions biannually.

Since 2005, WQD has been analyzing nutrient concentrations at levels low enough to assist with nutrient criteria development. In 2013, WQD began sampling lakes and reservoirs specifically for numeric nutrient criteria development. WQD's goal for the program is to develop nutrient criteria for streams/rivers and lakes/reservoirs within the next three to six years.

Wyoming State Geological Survey

In 2013, the Wyoming State Geological Survey, the USGS, and the Water Resources Data System (WRDS) under contract with the WWDC issued an update to the 2005 Available Groundwater Determination Technical Memorandum, titled "Platte River Basin Water Plan Update Groundwater Study Level 1 (2009-2013) – Available Groundwater Determination Technical Memorandum" (Taucher, et al., 2013). The WDEQ, SEO and the Wyoming Oil and Gas Commission were cooperating agencies in developing (Taucher, et al., 2013). Taucher, et al., (2013) updates, revises and expands the 2005 Available Groundwater Determination Technical Memorandum with a compilation of available Platte River Basin groundwater data obtained by state and federal agencies between 2005 and 2013.

Taucher, et al., (2013) included a map showing the sampling locations of groundwater from various geologic formations in the Platte River Basin. This information is presented in **Figure 5.3.6**. Groundwater samples of produced water from oil and gas operations as well



Legend

Environmental groundwater-quality sample location, grouped by units of geologic time

- Quaternary
- Cenozoic
- Mesozoic
- Paleozoic
- Precambrian

Produced groundwater-quality sample location, grouped by geologic era

- Cenozoic
- Mesozoic
- Paleozoic

- Watershed Boundary
- Subbasins
- Municipalities
- Interstate Highway
- US Highway
- State Highway
- Waterbody
- Stream / River
- Major Rivers
- County Boundaries

N

0 12.5 25 50 Miles

Figure 5.3.6: Environmental and Produced Groundwater Quality Sample Locations

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as those from SEO and USGS monitoring wells, municipal wells, and environmental wells were compiled and presented in Taucher, et al., (2013).

Wyoming State Engineer's Office

On January 1, 2007, the State of Wyoming entered the Platte River Recovery Implementation Program together with and in cooperation with the DOI, and the States of Colorado and Nebraska. The purpose of the PRRIP is to ensure the continued use and development of Wyoming's water in the Platte River Basin while maintaining compliance with the ESA. There are three primary elements to the program, including:

- Increasing stream flows in the central Platte River Basin during certain times of each year;
- Enhancing, restoring and protecting habitats for ESA target bird species; and,
- Allowing for new water related activities within the basin through approved depletion plans (SEO, 2015).

The program is being implemented incrementally, with the first increment covering the period from 2007 through 2019. The program is managed by a Governance Committee which consists of representatives from the States of Colorado, Nebraska and Wyoming, USBR, USFWS, North and South Platte River water users, Nebraska water users and environmental groups. Public involvement is implemented through use of a public calendar of program activities, landowner information and encouragement to visit the Central Platte River Basin area. Details related to the PRRIP can be found on the SEO website at http://seo.wyo.gov/interstate-streams/know-your-basin/platte-river-basin.

Wyoming Game and Fish Department

The WGFD (WGFD, 2010) published their Wildlife Action Plan for the Platte River Basin in 2010. The report identifies areas of value for conservation of native aquatic species as well as recommending conservation actions and monitoring programs that will further enhance aquatic life in the Platte River Basin. The locations of these aquatic wildlife conservation areas are shown on **Figure 5.3.7**. Primary threats to aquatic wildlife habitat in the basin were reported to be:

- Human related water development and altered flow regimes;
- Aquatic invasive species (AIS); and
- Drought/climate change.

WGFD adopted the Strategic Habitat Plan in 2009 which guides the Department's habitat management efforts. The Strategic Habitat Plan includes five goals:

- Conserve and manage habitats that are crucial to wildlife populations now and into the future;
- Enhance, improve and manage degraded priority habitats;
- Increase wildlife-based recreation through habitat enhancements that maintain or increase wildlife productivity;
- Increase public awareness related to habitat issues; and
- Promote collaborative habitat management efforts with the public, conservation partners, private landowners, and land management agencies.

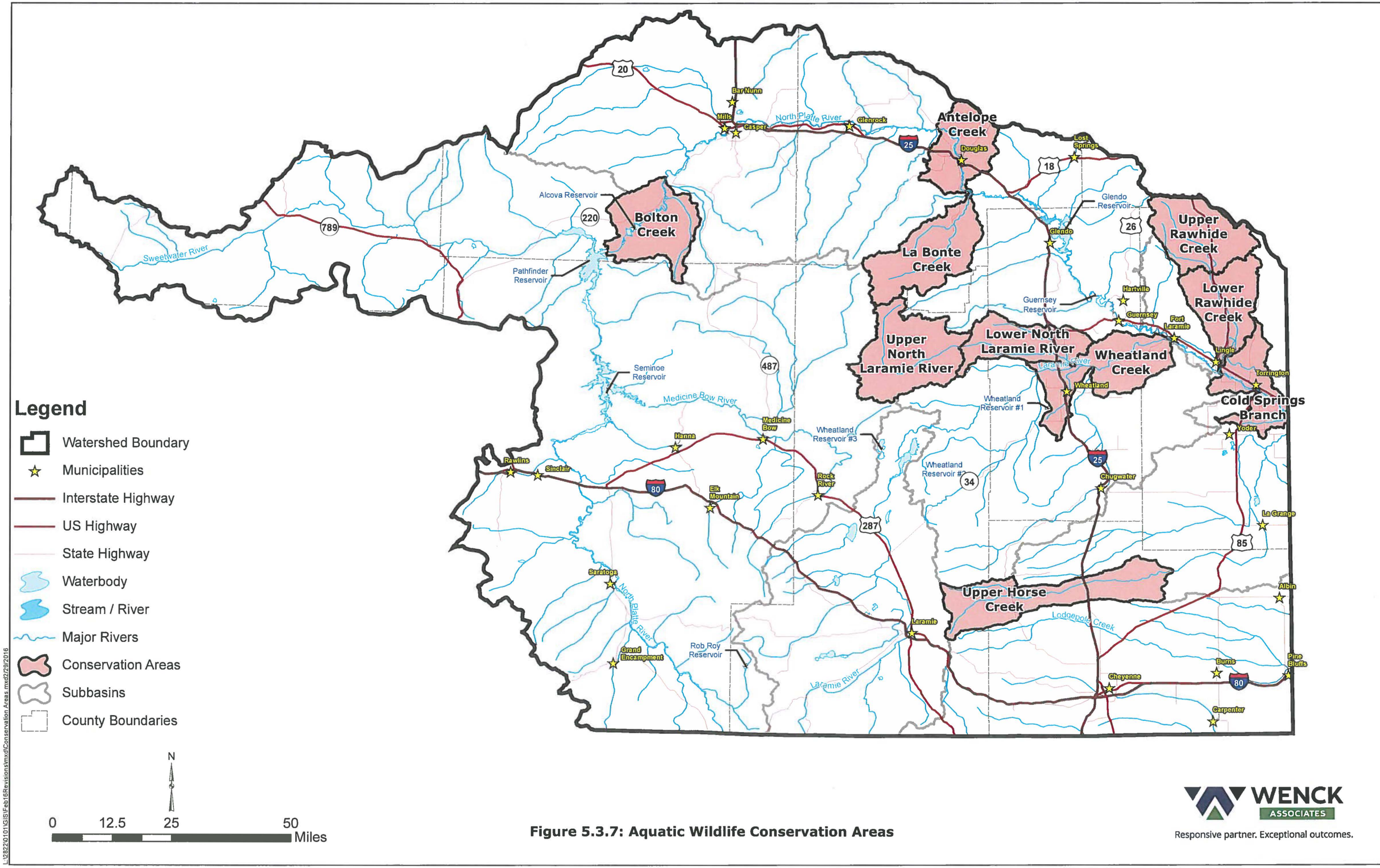

Figure 5.3.7: Aquatic Wildlife Conservation Areas

WENCK ASSOCIATES
Responsive partner. Exceptional outcomes.

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Between 2005 and 2010, WGFD conducted multiple projects to assess habitat conditions and fish communities within the Platte River Basin. These projects used multiple sources of funding and were either performed by WGFD staff or by partnering with local universities.

The Wyoming Wildlife Natural Resource Trust was created by the Wyoming Legislature in 2005 and funded by donations, legislative appropriations and interest earned on a permanent account. The purpose of the trust is to provide for enhancement and conservation of wildlife habitat and natural resource values within the state. WGFD has partnered with the WWNRT on a wide range of wildlife conservation projects across the state, including the Platte River Basin. Other entities WGFD has partnered with include Landscape Conservation Cooperatives, National Fish Habitat Action Plan and the Great Plains Fish Habitat Partnership.

WGFD continues to cooperate with other agencies, such as the SEO and WWDO by recommending in-stream flows to facilitate water rights adjudication and with private water right holders to manage stream diversions and uses. They also work cooperatively with landowners and other entities to implement water management strategies that will benefit aquatic resources.

Wyoming Association of Conservation Districts

The WACD represents 34 local conservation districts throughout the State of Wyoming and provides leadership for the conservation of Wyoming's soil and water resources and protection of the state's surface water and groundwater resources. Individual conservation districts within the Platte River Basin include Natrona County, Laramie County, Laramie Rivers and Platte County.

Natrona County Conservation District. Technical Memorandum 5.3 (Trihydro, 2006) provided a detailed history of selenium contamination at the Kendrick Irrigation Project near Casper between 1985 and 2005. The locations of the impaired streams are shown on **Figure 5.3.2**, and described in more detail in **Table 5.3.1**. Much of the investigative work performed at the Kendrick site during that time was performed by the National Irrigation Water Quality Program (NIWQP). However, as reported in the 2005 memorandum, the NIWQP stopped working on the Kendrick project in 2005 due to a lack of funding. Concurrent with the development of the 2005 technical memorandum, the Natrona County Conservation District (NCCD) prepared and released a draft Kendrick Watershed Plan. The proposed plan was discussed in detail in the 2005 Technical Memorandum 5-3. The plan was approved and signed by DEQ in 2006 and implemented by NCCD in mid-2008. Cooperating entities include the CAID, NRCS, local landowners, sportsmen and environmental groups. Despite the best management practices implemented by the plan, selenium continued to be a concern within the Kendrick watershed. Consequently, a TMDL for selenium was initiated in 2009 and completed in 2011. As of 2014, 40 to 50% of irrigators in the North Platte River drainage area had changed their irrigation methods per the recommendations of the watershed plan (Casper Journal, 2014). Even with all the efforts made, selenium remains a problem in the watershed and is being further exacerbated by increased housing development and highway construction which releases additional selenium from the soil. The NCCD continues to work with other state and federal agencies as well as landowners and other stakeholders within the watershed area to resolve the selenium issue.

Laramie County Conservation District. The Laramie County Conservation District (LCCD) initiated watershed planning in the early 2000s with the development of the Crow Creek Watershed Plan in 2004 and the Upper Crow Creek Watershed Plan in 2007. The locations of the impairments are shown on **Figure 5.3.5**, and described in more detail in **Table 5.3.1**. LCCD has been working with DEQ on the development of three TMDLs (E. coli, sediment, and selenium) for those portions of Crow Creek that flow through Cheyenne. The TMDL for

selenium was approved by EPA in March 2013. The sediment and E. coli TMDLs have been submitted to EPA, but had not been approved as of July 2015. The district also performs its own surface water sampling program within the Crow Creek basin of the South Platte River subbasin (WACD, 2015).

Laramie Rivers Conservation District. From 2011 through 2014, the Laramie Rivers Conservation District (LRCD) implemented and completed the Laramie River Restoration project, which is designed to reduce non-point source sediment pollution within the City of Laramie. During the same time period, LRCD partnered with NRCS on two stream bank restoration projects. They cost shared with the NRCS and several landowners on post-fire erosion mitigation projects in the Laramie and Medicine Bow mountain ranges. The district also initiated a watershed study in 2015 through the WWDC which is designed to identify upland water development projects and funding options to carry out the projects. At locations shown on **Figure 5.3.3**, monitoring of the Big Laramie and Little Laramie Rivers has shown exceedances for E. coli in certain segments of the rivers during 2011 through 2013 (WACD, 2015).

Platte County Resource District. Since 2005, the Platte County Resource District completed a watershed plan for the Rock Creek area in 2007 and has been working with landowners and conservation partners to implement Best Management Practices to improve range management practices, control of invasive species, agriculture waste management practices and planting of natural windbreaks. The area of concern is shown on **Figure 5.3.4**. Since 2010, the district has been working on an animal feeding operation/ concentrated animal feeding operation project in the Rock Creek watershed area (WACD, 2015).

Environmental Protection Agency

Acknowledging the need to increase the protection of the nation's healthy watersheds, EPA in March 2011 issued their "Coming Together for Clean Water" strategy for protecting and restoring the nation's waters (EPA, 2011b). From the strategy, EPA developed and published a Healthy Watersheds Initiative National Framework and Action Plan (EPA, 2011c). The Initiative provides an implementation framework for EPA and States to guide efforts in maintaining healthy and restored watersheds. To further promote the Healthy Watersheds Initiative, EPA entered into a MOU with The Nature Conservancy and the Association of Clean Water Administrators in February 2013 (EPA, 2013). Under the MOU, the group will work with states and other partners to identify healthy watersheds, implement healthy watershed protection plans and integrate the plans into EPA programs, and increase awareness and understanding amongst partners and the public of the importance of protecting healthy watersheds. The MOU promotes data gathering and sharing, and the evaluation of conservation and environmental outcomes resulting from watershed program implementation.

U.S Bureau of Reclamation

The Cooperative Watershed Management Program was established in 2009 as part of the Cooperative Watershed Management Act (Public Law 111-11). The Act authorized the Secretary of the Interior to establish a grant program, development of locally led watershed groups and facilitate the development of multi-stakeholder watershed management projects. Although there is multiple agency participation in the program (USBR, USGS, and BLM), the USBR has taken the lead in the development and implementation of the program. Since implementation of the program in 2012, USBR has financial assistance to form new watershed groups, expand existing groups and/or conduct one or more watershed management projects.

Other water funding programs administered by the USBR include the Title XVI Water Reclamation and Reuse Program (Public Law 102-575, as amended) and the WaterSMART (Sustain and Manage American Resources for Tomorrow) Program. The Title XVI Program provides funding for projects that reclaim and reuse municipal, industrial, domestic, or agricultural wastewater and naturally impaired ground or surface waters. The WaterSMART Program, established in 2010, works with states, tribes, local governments, and non-governmental organizations to secure and stretch water supplies to benefit people, the economy and the environment now and into the future (USDOI, 2011). Projects for Platte River Basin watersheds would be administered by the USBR Wyoming Area Office, located in Casper.

U.S. Bureau of Land Management

In 1995, the BLM grazing regulations were modified to better address fundamentals of rangeland health, in part, by promoting healthy, sustainable rangeland ecosystems and, accelerating restoration and improvement of public rangelands to properly functioning conditions. In 1997, the Wyoming BLM State Office adopted standards and guidelines for assessing healthy rangelands and livestock grazing management on BLM administered public lands. Assessments were initially conducted on a grazing allotment basis. However, it became apparent that assessing by allotments did not focus on all potential uses that could impact public lands. Additionally, assessing watersheds, water quality and habitats would be more effectively evaluated on a larger scale. In January 2001, BLM issued Instruction

Memorandum No. 2001-079 transmitting to field offices guidance for conducting rangeland health assessments and evaluations on a watershed basis. The assessments must consider six separate standards that address what BLM considers to be rangeland health fundamentals. These fundamentals include:

- properly functioning watersheds;
- naturally cycling water;
- nutrients and energy;
- air and water quality; and,
- habitats for special status species.

The assessment areas are defined by watershed boundaries within each field office area and are evaluated/re-evaluated on a 10-year cycle. Recommendations for enhancement projects are made in the reports and are carried out during the post assessment 10-year period. The effectiveness of these projects is assessed during the re-evaluations. Interagency cooperation between BLM, other federal agencies and the State of Wyoming as well as non-governmental stakeholders, is necessary for these evaluations to be effectively performed.

The BLM Rawlins Field Office first evaluated the Lower and Upper North Platte Watersheds in 2003 and 2004, respectively (BLM, 2004 and 2005). They were re-evaluated in 2013 (BLM, 2014) and 2014, respectively. The 2014 report for the Upper North Platte Watershed was not available as of February 2016. An evaluation of the Lower Laramie River Watershed was performed in 2006 (BLM, 2007), and is scheduled for re-evaluation during the 2016 field season. The Big Laramie River Watershed assessment was performed in 2007 (BLM, 2008 and will be re-evaluated during the 2017 field season.

National Resource Conservation Service

The Watershed and Flood Prevention Act of 1954, as amended, authorizes the NRCS to provide watershed surveys and planning activities with the primary objective of assisting federal, state and local agencies and tribal governments with their efforts of protecting watersheds from damage caused by erosion, floods, and sediment and the conservation and development of water and land resources. Issues addressed by the program include water

quality, water conservation, wetland and water storage capacity, drought issues, rural development, municipal and industrial water needs, upstream flood damages and water needs for industries based on fish, wildlife and forestry. Projects performed by the NRCS include watershed plans, river basin surveys and studies, flood hazard analyses and flood plain management.

U.S. Geologic Survey

The statewide baseline sampling program for pesticides described in Technical Memorandum 5-3 (Trihydro, 2006) was completed in 2006. The results of the study were published in 2009 (Eddy-Miller and others, 2009). The study results showed that of the 296 wells sampled, pesticides were detected in approximately 23%. However, no concentrations exceeded EPA drinking water standards or health advisory levels. During the period 2008-2010, the USGS, in cooperation with the Wyoming Department of Agriculture, resampled 52 of the 296 wells to compare detected compounds and concentrations between the two sampling periods and to evaluate any detections of new compounds (Eddy-Miller and others, 2013). The 52 wells were distributed similarly to the baseline study wells with respect to geography and land use. The results showed no or minor changes in pesticide types and concentrations when compared to the baseline study.

USGS has also been collecting samples from Wyoming rivers and streams for pesticide analysis since 2006 (Eddy-Miller, 2011). To date, sampling results indicate that:

- Detected concentrations are all less than associated drinking water standards;
- Most detected pesticides were herbicides or degradates of herbicides; and,
- Detections and concentrations were not flow dependent.

Other programs administered by the USGS that provide water data and information for Wyoming's watersheds include, but are not limited to, the National Water Information Service at http://waterdata.usgs.gov/wy/nwis/, the National Water Quality Assessment Program at http://water.usgs.gov/nawqa/, the Water Resources Research Institute Program at http://water.usgs.gov/wrri/index.php , and the High Plains Groundwater Availability Study at http://txpub.usgs.gov/HPWA/index.html.

5.3.4 Cooperation and Coordination

There continues to be good and effective interagency cooperation and coordination between local, state and federal entities. The programs described in the 2005 Technical Memorandum continue to the present or have been supplemented with enhanced monitoring and management programs. All agencies and other groups involved remain committed to improving the water quality of basin streams and educating the public on what can be done to further improve water quality within the Basin for the benefit of the public and all stakeholders.

5.3.5 Conclusions and Recommendations

Water quality remains a serious issue within the Platte River Basin. State, federal and local entities, both public and private, continue to work together to further improve water quality, prevent impairment and educate the public on water quality issues and the means by which the Basin's overall water quality can be further improved for the benefit of the public, wildlife and the environment.

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5.4 CLIMATE AND WEATHER ISSUES

5.4.1 Introduction

Section 5.4 provides a summary of climate in the Platte River Basin of Wyoming as it relates to water resources. We also describe climate related studies and developments at the state and national level that may be relevant to the Platte River Basin Watershed.

Most of the Platte River Basin is located within Wyoming's Climate Divisions 8 (Lower Platte) and 10 (Upper Platte) (Curtis and Grimes, 2004). The relationship between the basin and the climatic zones is shown on **Figure 5.4.1**. Climate within the basin ranges from semi-arid to humid-alpine depending on altitude, latitude, and topography. The Lower Platte tends to be one of the warmest regions of the Basin with monthly average temperatures ranging from 23°F in January to approximately 68°F in July (NOAA, 2016). **Figure 5.4.2** displays the average annual temperature of this climate division (WRDS, 2016a). The Upper Platte is slightly cooler with an average January temperature of approximately 18°F and a July average of approximately 65°F (NOAA, 2016). **Figure 5.4.3** presents the average annual temperature of this climate division since 1895 (WRDS, 2016a). According to NOAA's (NOAA, 2015) National Centers for Environmental Information, average annual temperatures in both Climate Divisions 8 and 10 have increased at a rate of 0.3°F per decade between 1895 and 2015.

The mountain ranges in the western (Medicine Bow Range), central, and northern (Laramie Range) areas of the basin capture much of the annual precipitation due to atmospheric vertical uplift. This results in greater annual precipitation in the mountainous areas while decreasing the amount of precipitation that falls in the Basin interiors as illustrated on **Figure 5.4.4**. Most of the annual precipitation at higher elevations in the mountains occurs as snow during the winter and spring months, and at lower elevations as rain related to convective thunderstorms during the summer months. As shown on **Figure 5.4.4**, average annual precipitation ranges from 9 to 15 inches in the Basin interior areas, to as much as 60 inches in the high mountain ranges (WSGS, 2013). As shown on **Figures 5.4.5 and 5.4.6** since 1895, the Lower Platte Climate Division received a higher average annual precipitation of 15 inches while the Upper Platte Climate Division received an annual average of 13 inches (WRDS, 2016b).

5.4.2 Climate Studies Relevant to Platte River Basin Water Resources

Since 2005, there have been several climate related studies that are relevant to water resources within the Platte River Basin. Some of the more applicable studies are summarized in this section.

Since Martner (1986) completed the original climate atlas, the Wyoming Climate Atlas was updated and published online in 2004. The primary purpose of the atlas is to provide to the public an objective assessment and as comprehensive as possible dataset of Wyoming's climatic trends. The atlas is also available in hard copy but may be accessed on the internet at http://www.wrds.uwyo.edu/sco/climateatlas/title_page.html.

The Climate Program Office (CPO), established in 2005, resides within the National Oceangic and Atmospheric Association (NOAA) and conducts climate research on:

1. Competitive grant programs that advance and extend climate research capabilities;
2. Partnerships with academia, businesses and other governmental agencies to produce climate research tools and data products; and,

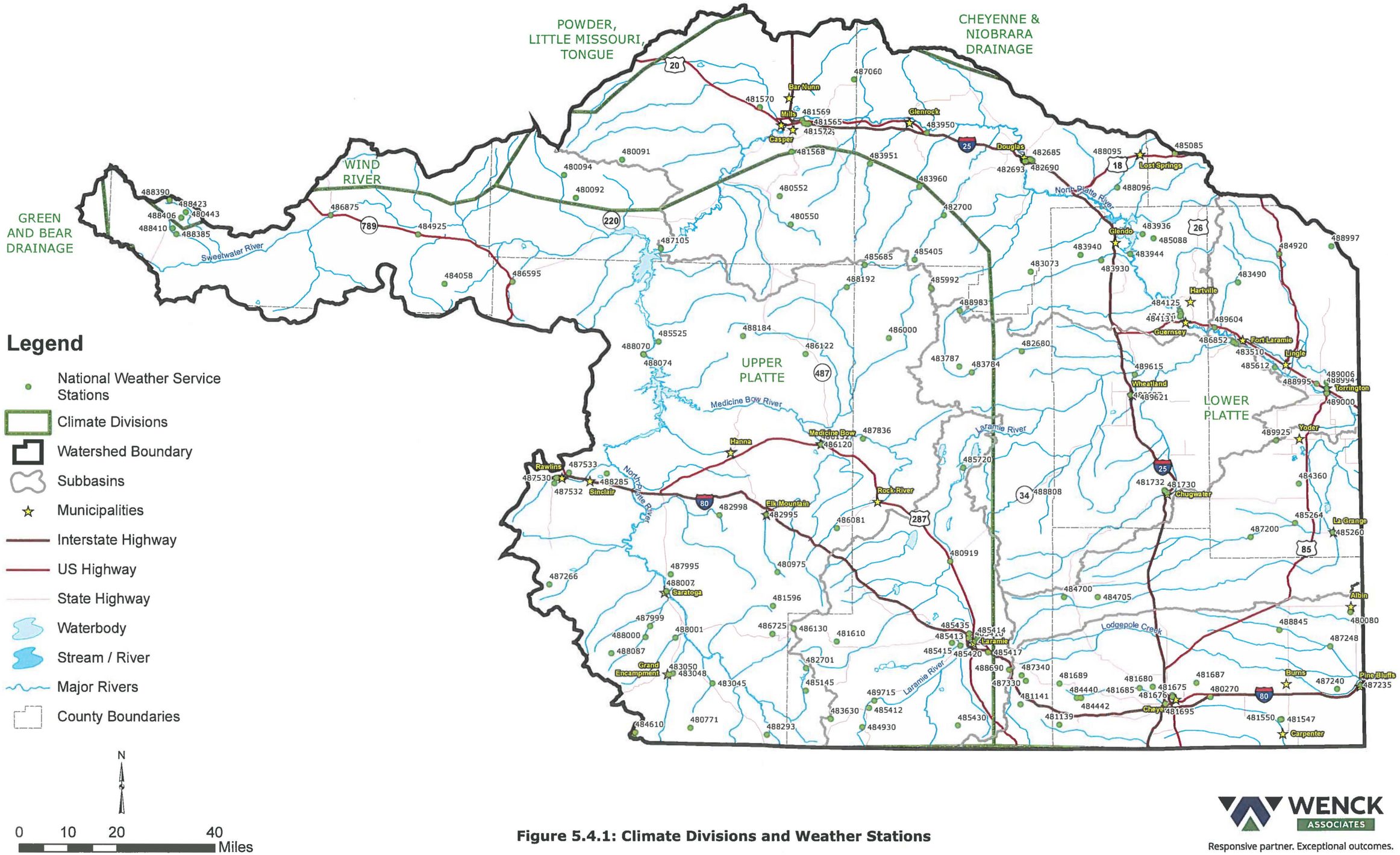

Figure 5.4.1: Climate Divisions and Weather Stations

WENCK ASSOCIATES
Responsive partner. Exceptional outcomes.

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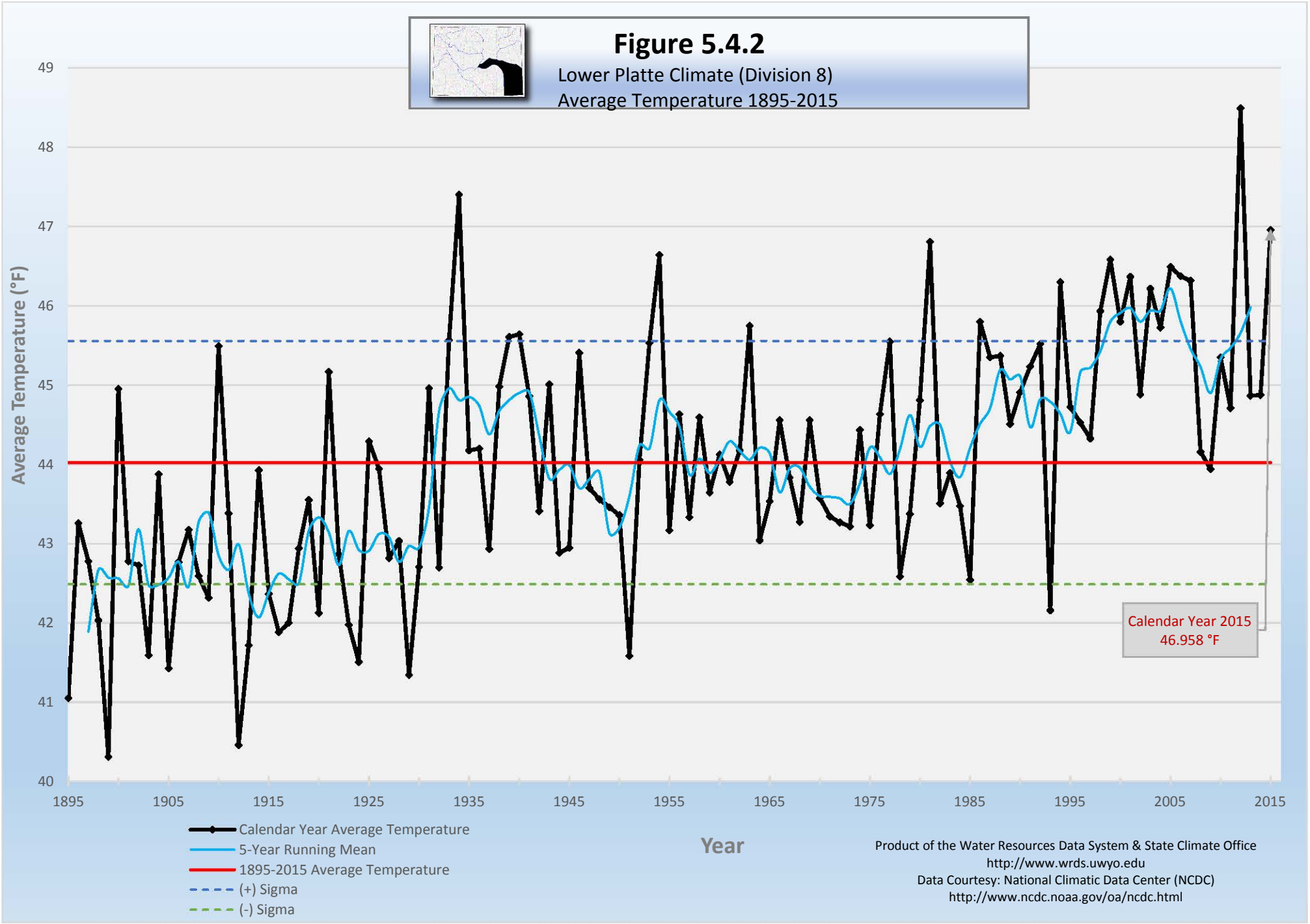


Figure 5.4.2
Lower Platte Climate (Division 8)
Average Temperature 1895-2015
Average Temperature (°F)
49
48
47
46
45
44
43
42
41
40
1895
1905
1915
1925
1935
1945
1955
1965
1975
1985
1995
2005
2015
Year
Calendar Year 2015
46.958 °F
Calendar Year Average Temperature
5-Year Running Mean
1895-2015 Average Temperature
(+) Sigma
(-) Sigma
Product of the Water Resources Data System & State Climate Office
http://www.wrds.uwyo.edu
Data Courtesy: National Climatic Data Center (NCDC)
http://www.ncdc.noaa.gov/oa/ncdc.html

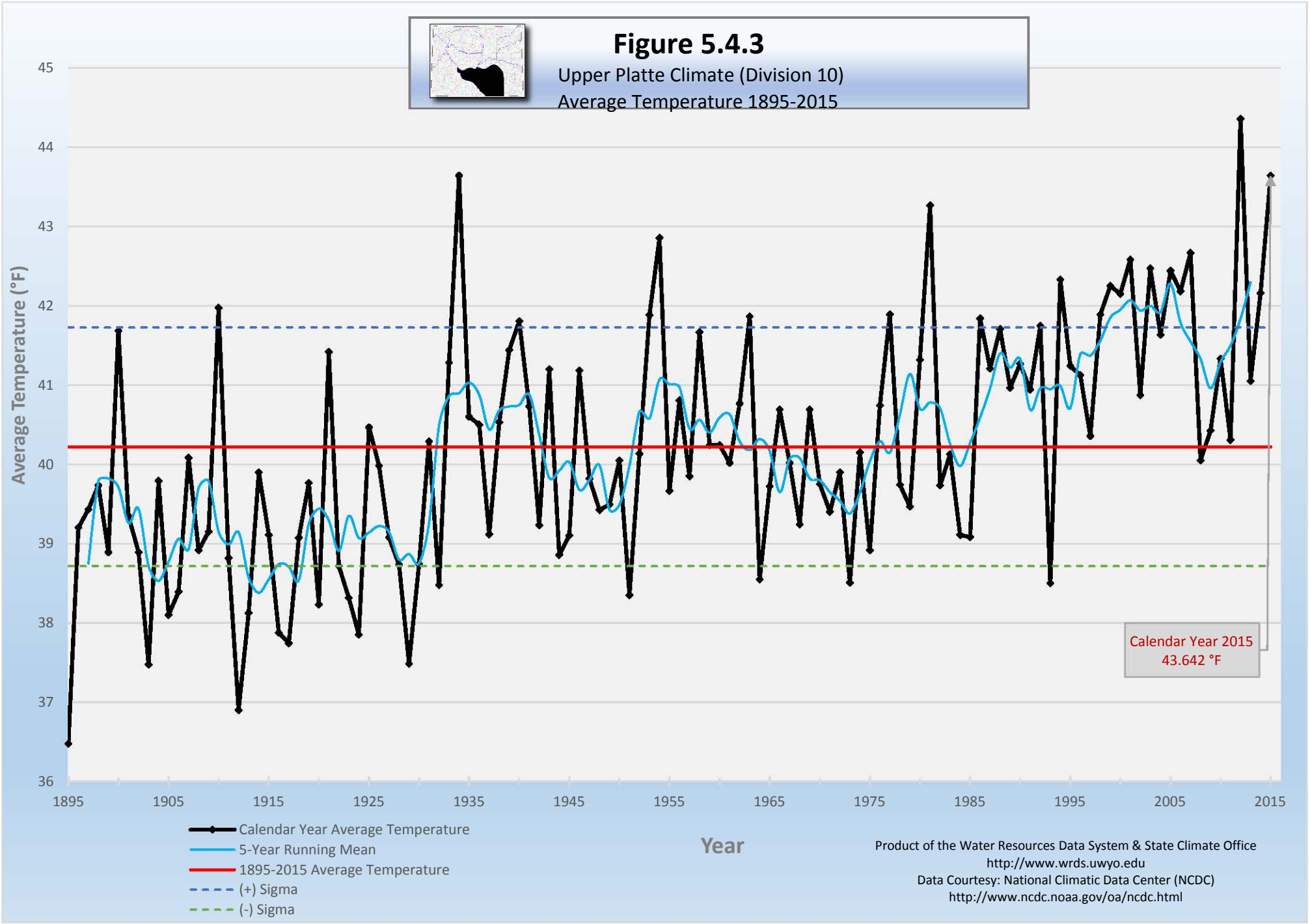


Figure 5.4.3
Upper Platte Climate (Division 10)
Average Temperature 1895-2015
Average Temperature (°F)
45
44
43
42
41
40
39
38
37
36
1895
1905
1915
1925
1935
1945
1955
1965
1975
1985
1995
2005
2015
Year
Calendar Year 2015
43.642 °F
Calendar Year Average Temperature
5-Year Running Mean
1895-2015 Average Temperature
(+) Sigma
(-) Sigma
Product of the Water Resources Data System & State Climate Office
http://www.wrds.uwyo.edu
Data Courtesy: National Climatic Data Center (NCDC)
http://www.ncdc.noaa.gov/oa/ncdc.html

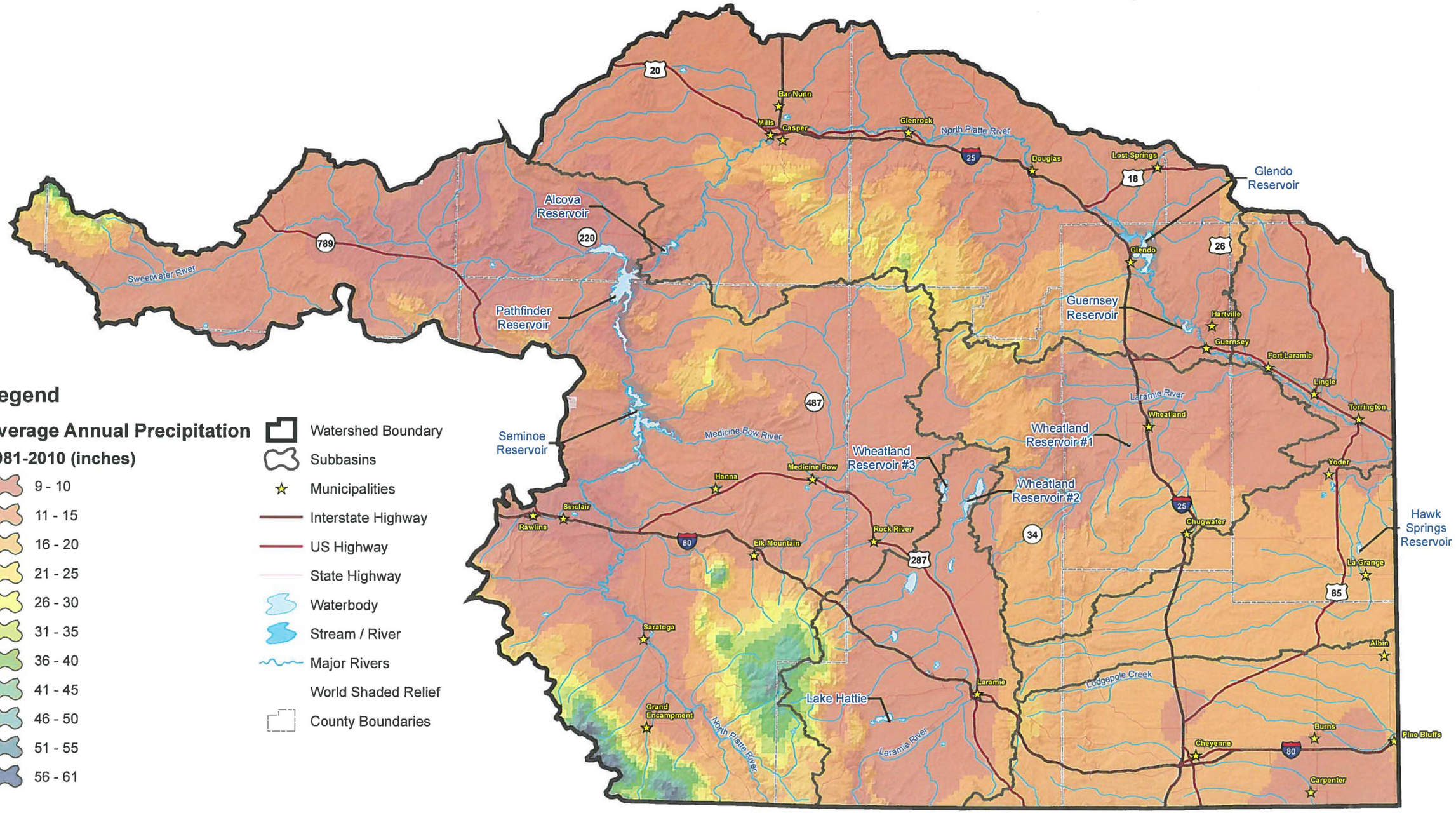


Figure 5.4.4: Average Annual Precipitation

WENCK ASSOCIATES
Responsive partner. Exceptional outcomes.

L:\2822101\GIS\Feb16Revisions\mxd\Precip Data.mxd3/17/2016

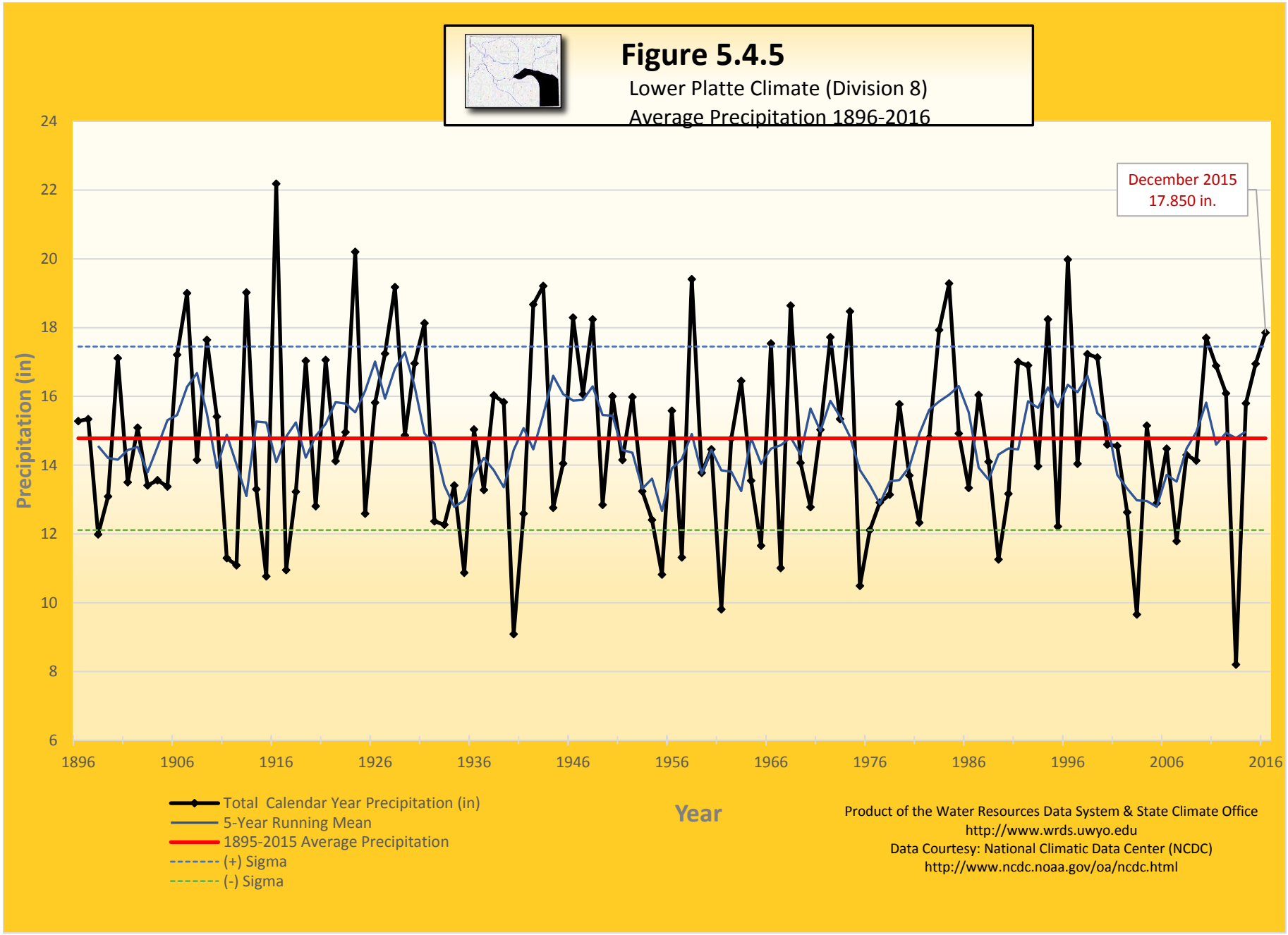


Figure 5.4.5
Lower Platte Climate (Division 8)
Average Precipitation 1896-2016
December 2015
17.850 in.
Precipitation (in)
24
22
20
18
16
14
12
10
8
6
1896
1906
1916
1926
1936
1946
1956
1966
1976
1986
1996
2006
2016
Year
Total Calendar Year Precipitation (in)
5-Year Running Mean
1895-2015 Average Precipitation
(+) Sigma
(-) Sigma
Product of the Water Resources Data System & State Climate Office
http://www.wrds.uwyo.edu
Data Courtesy: National Climatic Data Center (NCDC)
http://www.ncdc.noaa.gov/oa/ncdc.html

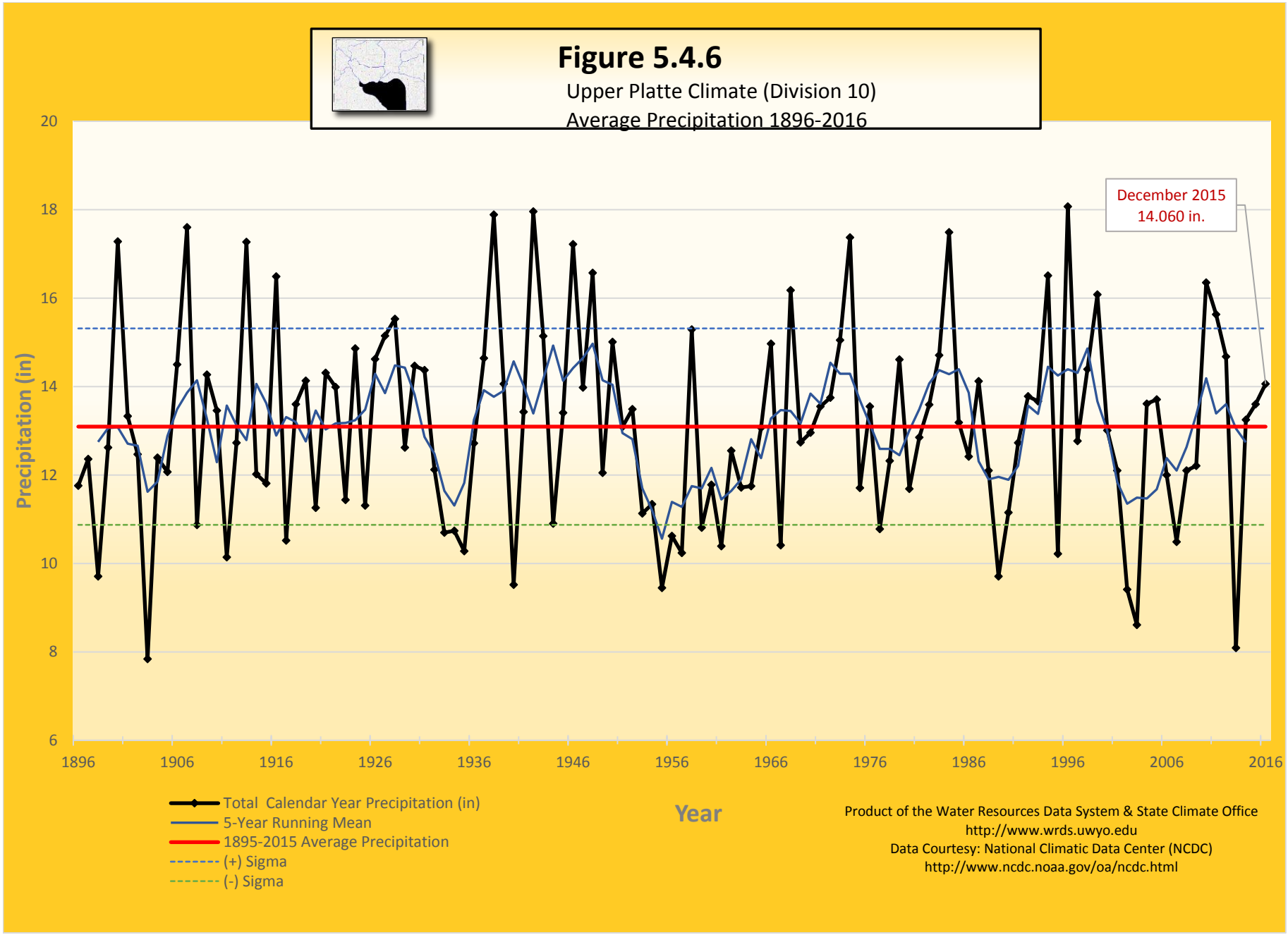


Figure 5.4.6
Upper Platte Climate (Division 10)
Average Precipitation 1896-2016
December 2015
14.060 in.
Precipitation (in)
20
18
16
14
12
10
8
6
1896
1906
1916
1926
1936
1946
1956
1966
1976
1986
1996
2006
2016
Year
Total Calendar Year Precipitation (in)
5-Year Running Mean
1895-2015 Average Precipitation
(+) Sigma
(-) Sigma
Product of the Water Resources Data System & State Climate Office
http://www.wrds.uwyo.edu
Data Courtesy: National Climatic Data Center (NCDC)
http://www.ncdc.noaa.gov/oa/ncdc.html

3. Dissemination of information that will improve public knowledge about climate and improve decision making related to maintaining economic and societal sustainability in a changing climate environment.

Through their active grant program and partnering activities, recent accomplishments by the CPO include:

1. Climate Reference Network, NOAA's nationwide climate observing network at http://cpo.noaa.gov/ClimatePrograms/ClimateObservation.aspx;

2. Implementation of the sustained Global Ocean Observing System which provides information about the state of the world's oceans and their regional variations to address important societal needs related to the Earth's climate at: http://cpo.noaa.gov/ClimatePrograms/ClimateObservation/OceanClimateObservation.aspx;

3. Support of climate training workshops;

4. Provision of climate science, data and information to the public to help in the understanding of changing climate conditions and assist in addressing climate change challenges; and,

5. More than 700 published papers each year contributing to the nation's understanding of climate variability and change.

The CPO manages competitive climate science research programs through which NOAA funds, by federal grants, climate assessments, decision support research, public outreach, and education that will advance understanding of Earth's climate system and enable effective decision making. Research is conducted in regions across the country, and includes projects focused on drought information, increased understanding of climate change and its potential impact on the environment and populations, and the effect of extreme events on water resources. Grants for 2016 that could be pertinent to planners within the North Platte River Basin include:

1. "Fires in the Western U.S.: Emissions and Chemical Transformations";

2. "Research to Advance Prediction of Subseasonal to Seasonal Phenomena";

3. "Coping with Drought in Support of the National Integrated Drought Information System"; and,

4. "Water Resources and Extreme Events".

More information on these grants and the CPO in general can be found at: http://cpo.noaa.gov/GrantsandProjects.aspx.

Climatic variability can influence the hydrological cycle, the continuous movement of water above and below the surface of the earth, which subsequently affects discharge of water to streams. Climate variability can be predicted by oceanic-atmospheric oscillations which provide opportunities for streamflow forecasts. In 2010, Soukup et al performed an evaluation of oceanic-atmospheric climate variability on streamflow in the upper North Platte River basin utilizing Singular Value Decomposition Statistics (SVD), sea surface temperatures (SST), and a 500 mbar geopotential height (Z500). SVD is considered to be the most widely-used multivariate statistical technique used in the atmospheric sciences. The purpose of the technique is to reduce a dataset containing a large number of values to a dataset containing significantly fewer values, but which still contains a large fraction of the

variability present in the original data. (IRI, 2016). Geopotential height approximates the actual height of a pressure surface above mean sea level, considered to be a gravity-adjusted height. It is common to speak of the geopotential height of a certain pressure level, which would correspond to the geopotential height necessary to reach the given pressure. The 500 mbar geopotential height is often referred to as the steering level, as most weather systems and precipitation follow the winds at this level (IRI, 2016).

Using Upper North Platte River Basin streamflow measurements for the period 1949 to 2006, Pacific/Atlantic Ocean SSTs, the 500 mbar geopotential height values and the above statistical analysis, Soukup et al developed a "long lead time" exceedance probability forecast model for the North Platte River that can predict streamflows at three and six month intervals. This model can be a useful predictive tool for water managers and planners.

The primary water supply of the North Platte River is summer snowmelt from mountains in northern Colorado and southeastern Wyoming and is used to support agriculture, energy development and urban/community development. Based upon multiple decisions by the U.S. Supreme Court, the Platte River water has been apportioned amongst Colorado, Wyoming and Nebraska. Negative changes in the regional climate will therefore have a direct impact on societal and economic infrastructure within the three states. Although there is tree ring evidence of severe multi-decade megadroughts during prehistoric times, there is no historic evidence or data for these types of drought during the historic period. In 2010 Shinker et al evaluated the severity of recent and prehistoric droughts using various data sources, including modern temperature, precipitation, stream gauge data, evidence of low-lake stands, and related estimates of past hydroclimate change (Shinker et al, 2010). Their evaluation of the prehistoric and modern data indicates the potential for persistent shifts in regional hydrology and climate patterns which should be considered as part of long-term economic and legal planning for future use of North Platte River waters.

In 2012, Acharya et al. published an article that assessed the long-term water availability over the North Platte River watershed utilizing hydrologic modeling and streamflow projections under anthropogenic climate change conditions. Based on their streamflow projections, the model showed a possibility for increased annual streamflow for the North Platte River watershed through 2100, with maximum streamflow occurring during the period 2085-2090. The simulated annual streamflows for future periods varied from 20% to 62% more with respect to their baseline period of 1971 to 2000 (Acharya et al., 2012). In the simulations, the wet months were getting wetter, whereas the summer months were found to be getting drier. The study was designed to be used by decision makers when developing future water supply and demand management decisions.

In 2013 Kelly (et al.) published the results of a study relating population growth and climate change in the Big Horn Basin during the Holocene. The study compares population data (radiocarbon dated archaeological site data) to temperature and moisture records, to evaluate possible association between climate changes and past human populations. The results indicated that the population within the basin over the past 13,000 years decreased during warm and dry periods and increased during cooler wet periods. The study results indicated that low effective moisture and high temperatures are both associated with low population levels. The data collected show that the average temperature in the Bighorn Basin 7,000 years ago was approximately 1.5 to 2°C warmer than during the 20th Century. This temperature change could cause rivers, like the Platte and Bighorn, to dry up during portions of the summer. This change in the quantity of available water would have likely impacted the human population in the area significantly as food resources became depleted due to a lack of water (Kelly, et al., 2013). Based on the Bighorn Basin study results, the authors conclude that climate may well impact cultures through episodic severe events and

as a slow variable control on regional resources that can influence population size and trajectory (Kelly, et al., 2013).

5.4.3 Climatic Indicators Used to Track Basin Wide Drought and Water Supply Changes

Climatologists have used several different methods and indicators for determining drought conditions. Drought conditions are triggered by an extreme decrease in precipitation over an extended period of time and a corresponding increase in temperature and evaporation. Drought indices assimilate a variety of data on rainfall, snowpack, streamflow, soil moisture, and other water supply indicators into an accessible picture or framework. A drought index value is typically a single number that reveals the severity of drought based on several parameters, and can be used by decision makers to assess current and historic drought conditions. There are several indices that measure how much precipitation for a given period of time has deviated from historically established norms. Although none of the major indices is inherently superior to the rest in all circumstances, some indices are better suited than others for certain uses.

According to Curtis and Grimes (2004) and Hayes (2015), these major indices include the following:

1. The Palmer Drought Severity Index (PDSI) was developed by Wayne Palmer in the 1960s and uses temperature and rainfall information in a formula to determine dryness. While it has become the semi-official drought index, it is not necessarily the most accurate measure in Wyoming because most surface water is derived from mountain snowpack (i.e., the snow-water equivalent (SWE) as measured at a number of SNOTEL sites). Western states, with mountainous terrain and the resulting complex regional microclimates, have found it useful to supplement Palmer values with other indices such as the Surface Water Supply Index (SWSI), which takes snowpack and other unique conditions into account.

2. The Standardized Precipitation Index was developed at Colorado State University in 1993 and measures the precipitation departure using the 1971-2000 average monthly totals. The National Drought Mitigation Center has been using this index to monitor moisture supply conditions. Distinguishing traits of this index are that it identifies emerging droughts months sooner than the PDSI and that it is computed on various time scales.

3. The Crop Moisture Index (CMI) developed by Palmer in 1968 uses a meteorological approach to monitor week-to-week crop conditions and was derived from procedures within the calculation of the PDSI. Whereas the PDSI monitors long-term meteorological wet and dry spells, the CMI was designed to evaluate short-term moisture conditions across major crop-producing regions. It is based on the mean temperature and total precipitation for each week within a climate division, as well as the CMI value from the previous week.

4. The SWSI was developed by Shafer and Dezman in 1982 to complement the PDSI for moisture conditions across the state of Colorado. The PDSI is basically a soil moisture algorithm calibrated for relatively homogeneous regions, but it is not designed for large topographic variations across a region and it does not account for snow accumulation and subsequent runoff. Shafer and Dezman designed the SWSI to be an indicator of surface water conditions and described the index as "mountain water dependent", in which mountain snowpack is a major component. The objective of the SWSI was to incorporate both hydrological and climatological features into a single index value resembling the Palmer Index for each major river basin in the

state of Colorado. These values would be standardized to allow comparisons between basins. Four inputs are required within the SWSI: snowpack, streamflow, precipitation, and reservoir storage.

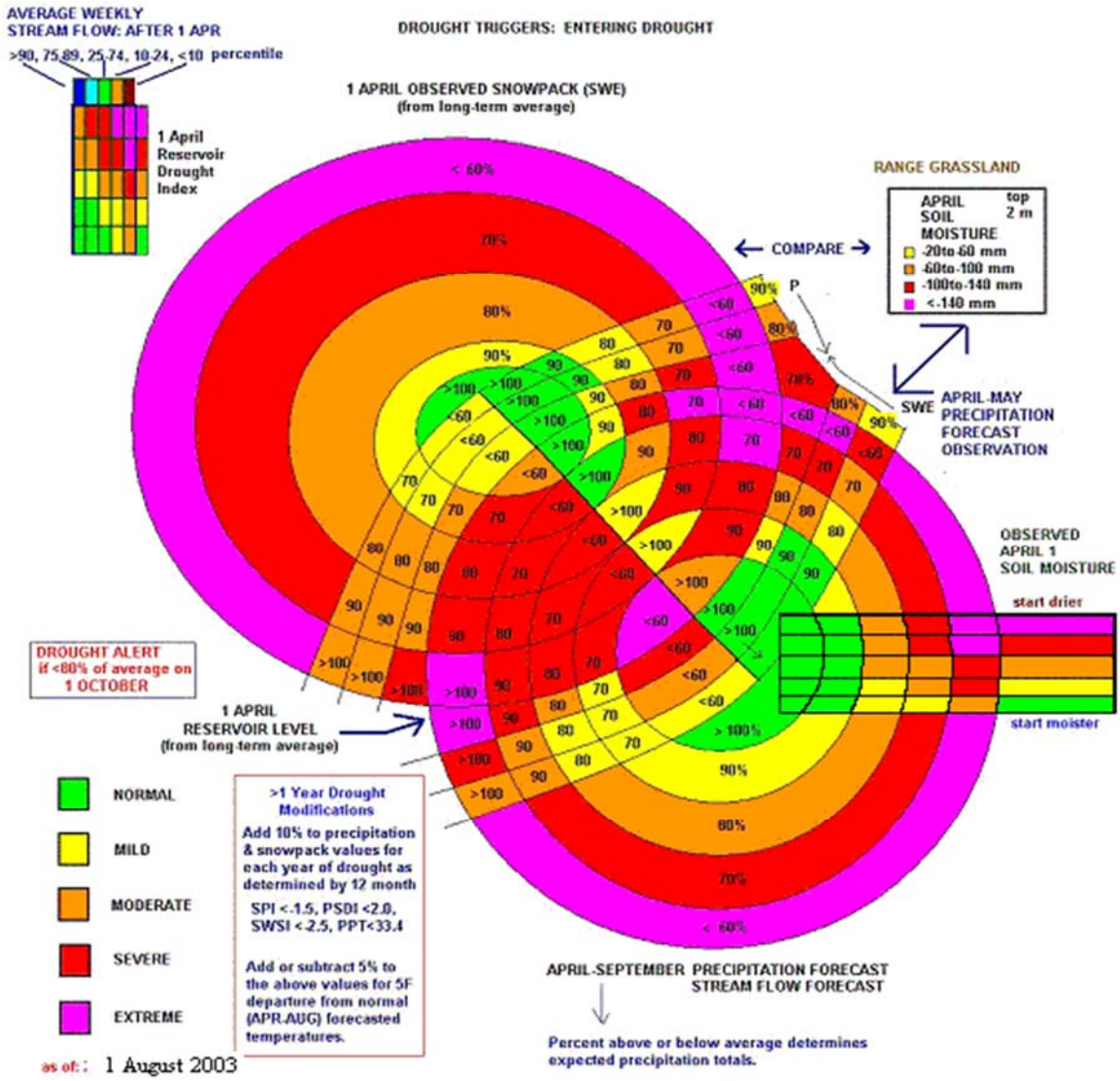
5. The Reclamation Drought Index (RDI) was developed after 1988 as a tool for defining drought severity and duration, and for predicting the onset and end of periods of drought. The impetus to devise the RDI came from the Reclamation States Drought Assistance Act of 1988, which allows states to seek assistance from the USBR to mitigate the effects of drought. Like the SWSI, the RDI is calculated at a river basin level, and incorporates the supply components of precipitation, snowpack, streamflow, and reservoir levels. The RDI differs from the SWSI in that it builds a temperature-based demand component and a duration into the index. The RDI is adaptable to particular regions and its main strength is its ability to account for both climate and water supply factors.

Curtis and Grimes (2004) presented an additional method specific to Wyoming to determine the beginning, intensity, and end of a drought. The Wyoming drought nomogram, shown on **Figure 5.4.7**, is based on snow water equivalent, soil moistures, and reservoir levels. According to the description provided by Curtis and Grimes (2004), this index begins by examining October 1 reservoir levels (the start of the water year). If levels are less than 80% of normal, a drought alert is issued. Next, the April 1 reservoir levels are compared to SWE data for the basin along with the forecasted spring and summer streamflow, and the spring and summer precipitation forecast. If, for example, a reservoir level is 70%, the SWE is 90%, and the precipitation forecast and/or streamflow forecast is 80% of normal, then the reservoir drought index is classified as "yellow", indicating a mild drought (**Figure 5.4.7**). Since streams tend to thaw after April 1, stream gauge accuracy improves after that time, and the next step in the drought assessment is to use the average weekly streamflow (upper left corner). If, as in this example, weekly streamflow is at the less than 10 percentile level, then the drought index is classified as "orange", or at a moderate drought level for agricultural and recreational interests. However, since drought is also determined by soil moisture, the template on the lower right circle can also be used. If the soil moisture is mildly dry (see range grassland table on **Figure 5.4.7**), "yellow", but the April precipitation forecast (using the same rings as the April-September precipitation forecast) is for less than 60% of normal, then, the range grassland index is determined to be "red", or severe, for ranching interests. Note that, independent of the April 1 soil moisture conditions, average precipitation during the 60 days following April 1 will probably result in normal or near normal grass yields.

Using this methodology, one would need to increase the values of the rings within each circle by 10% for each drought year as determined by the greater than one year drought modifications table (lower left corner) in **Figure 5.4.7**. Additional adjustments for above or below average summer temperatures should be made as well. The SWSI in the table refers to the Surface Water Supply Index which is produced between January and May using reservoir and streamflow data. No annual adjustment is required for the SWE or April-September streamflow forecast for rangeland forecasted conditions.

Because droughts in Wyoming are relatively common events, they are carefully monitored by the Wyoming State Engineer, the Wyoming Department of Agriculture, the Wyoming Climate Office, agricultural producers, and municipalities dependent upon surface water supplies. In addition to the indices noted above, local climatic and snowpack conditions are closely monitored by the users noted above.

Figure 5.4.7: Wyoming Drought Nomogram



5.4.4 Impacts of Climatic Extremes Related to Historic Droughts

Wyoming developed a drought response plan in 2000, which was revised in 2003. The purpose of the plan is to provide an approach for minimizing the impacts of drought on the people and resources of the state. Wyoming used the already existing Nebraska and Colorado drought response plans as a template for their plan. The Wyoming State Climate Office monitors the state's climate and participates in many drought planning efforts, including:

1. Participation in the State Water Plan process;
2. Participation in the Governor's Climate Issues Committee;
3. Development of drought summaries and drought related outreach products; and,
4. Support for research on causes and consequences of drought.

Additional information can be found at http://www.wrds.uwyo.edu/sco/drought/drought.html.

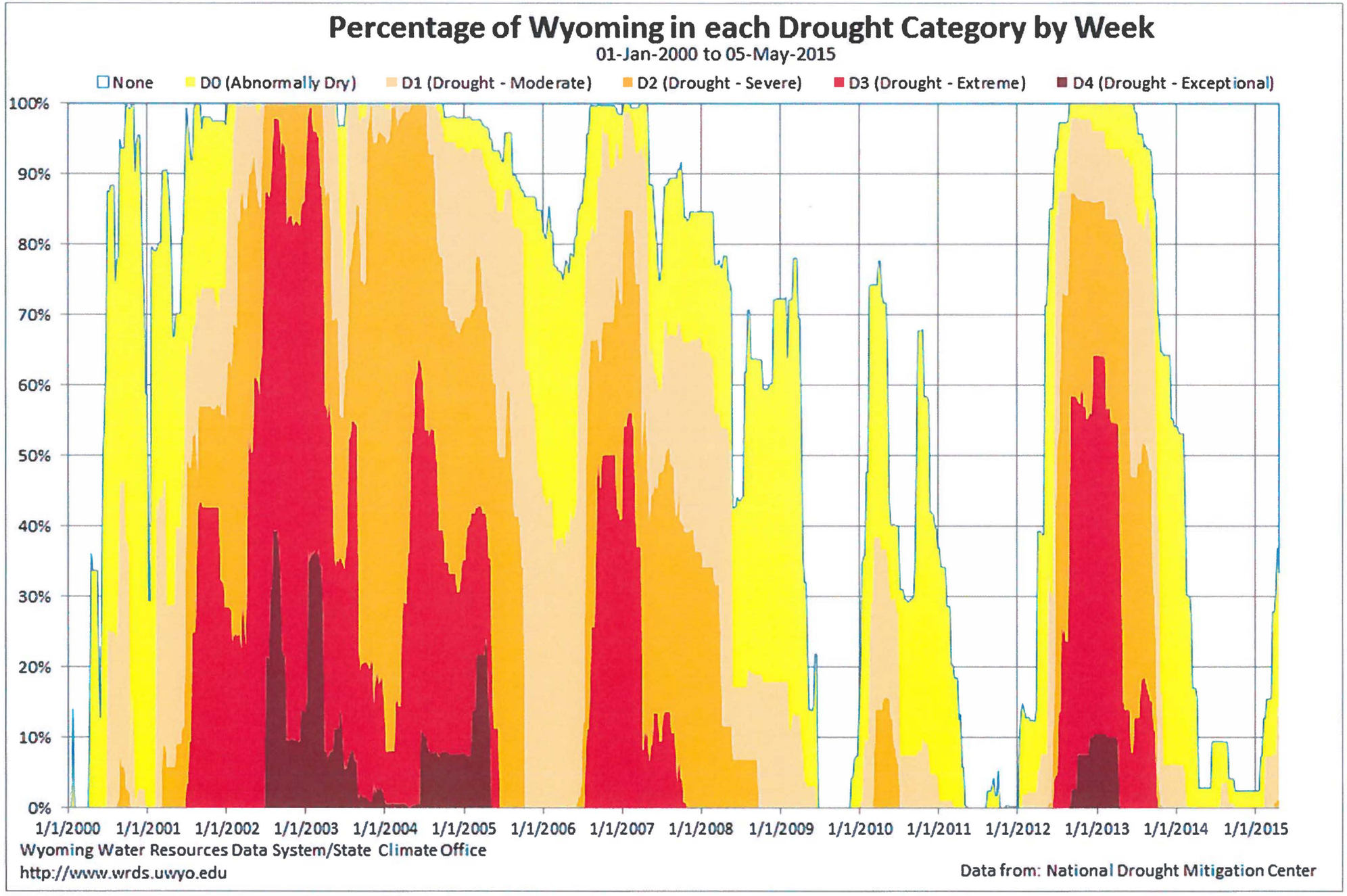
Wyoming is the fifth driest state in the country, and as such, drought is a constant threat (Wyoming State Climate Office, 2016). Drought occurs in four stages and is defined as a function of magnitude (dryness), duration, and regional extent. Severity is the most commonly used term for measuring drought conditions and is a combination of magnitude and duration (Curtis and Grimes, 2004). The first stage of drought is called meteorological drought and includes any precipitation shortfall of 75% of normal lasting for three months or longer. The second stage is called agricultural drought and occurs when soil moisture becomes deficient to the point where plants are stressed and plant yield is reduced. The third stage is called hydrological drought which results in reduced streamflow and inflows to lakes and reservoirs. The fourth stage is called socioeconomic drought and refers to the situation when water shortages begin to affect people (Curtis and Grimes, 2004; Wyoming Office of Homeland Security, 2016).

Between 2001 and 2008, more than half of the state was experiencing moderate to severe drought conditions as shown on **Figure 5.4.8**. Although this prolonged drought varied from year to year and counties or regions within the state experienced varying levels of drought impacts, this drought was a significant event, and the state will continue to feel the effects for years to come (Wyoming State Climate Office, 2016). Drought conditions returned to most of the state again from 2012 to 2014.

According to instrument records and based on the Palmer Hydrological Drought Index, there have been a total of seven severe droughts in Wyoming since 1895 that lasted for three years or more (Curtis and Grimes, 2004, Wyoming Homeland Security, 2016). Of these recorded droughts, the Platte River Basin (Climate Divisions 8 and 10) was most impacted by the 1952 to 1956 drought, based on the percent of annual average precipitation deficit (Curtis and Grimes 2004). Droughts can occur in individual river basins. In fact, Wyoming averages severe or extreme drought conditions 10% of the time in the eastern plains to more than 20% of the time in the southwestern portions of the state (Curtis and Grimes, 2004).

Numerous studies throughout the world demonstrate that instrumental weather records are insufficient for capturing the full range of climate that people need to plan for, especially for understanding extreme events like droughts. Instrumental records rarely exceed 100 years in length (since 1895 for Wyoming), and therefore provide only a small sample of single and multi-year drought events. Additionally, instrumental records are not effective when examining long term (i.e., greater than 50 years) trends and cycles that may underlie year to year precipitation variability (Curtis and Grimes, 2004).

Figure 5.4.8: Wyoming Drought Percentage



Most trees in the western U.S. produce a single layer of growth called a "tree-ring" for each year of their lives. During years of favorable climate, trees will produce wide rings compared to the narrower rings formed in years of unfavorable climate conditions. Tree-rings, therefore, provide a means for developing long-duration climate records that can overcome most of the limitations inherent to instrumental observations. Tree-rings yield continuous, reliably-dated proxies of climate that are highly replicated. When properly analyzed, tree-rings provide records of seasonal to annual climate, and can be used to assess climate variability on time scales of decades to millennia (Curtis and Grimes, 2004).

Tree rings have commonly been used to reconstruct the climate of the southwestern United States for more than 40 years. However, the use of tree rings in Wyoming to build a long-term climate database is relatively new. A recent study conducted in the Bighorn Basin resulted in the development of a precipitation record for the period of time between 1260 and 1998 A.D. The study results show that dry events in the 13th to 18th centuries were more severe and lasted longer than any droughts within the basin since 1900. Notably, the 14th, 15th and 16th centuries had large numbers of droughts of greater severity and duration than any of the events recorded instrumentally since 1900 (Curtis and Grimes, 2004). Another study conducted in the Green River Basin of southwestern Wyoming identified several extended drought periods between 1576 and 1786 that equaled or exceeded the severity and duration of droughts recorded since 1900 (Curtis and Grimes, 2004).

Tree ring studies completed to date indicate that severe droughts in Wyoming and the Rocky Mountain West lasting 10 years or more have been a common climatic feature for the past 700 to 800 years (Curtis and Grimes, 2004). The results of these studies together with the instrument recorded events should assist in the planning of the State's economic and agricultural development going forward, as well as the management of the State's natural resources, including timber, wildlife, and livestock production and water resources. Although no tree ring data have been evaluated for the Platte River Basin, Shinker et al. (2010) documented the severity of recent and prehistoric droughts in the North Platte River Basin using a combination of data sources, including historic and prehistoric evidence of low lake-levels. Their evaluation showed that although lakes in the basin have only experienced

minor hydrologic changes during the historic period, many were desiccated during prehistoric dry periods occurring during the past 12,000 years. Prehistoric lake shorelines indicate that water supplies were substantially smaller during previous centuries and millennia, within the timeframe of more than 8,000 to less than 5,000 years before the present. The magnitude of these droughts likely caused changes in streamflows resulting in shifts in the regional hydrology (Shinker et al. 2010). Shinker suggested that these regional hydrologic shifts be taken into consideration as part of long-term economic and legal planning for the North Platte River Basin.

Due to the uncertainty of how long drought will last and the adverse consequences of any drought, it is imperative to quickly identify and evaluate the potential impacts of drought on water resources, and to mitigate its impacts. Recognizing the potential for economic loss in every county, the Wyoming Office of Homeland Security (2016) addressed drought in its most recent Wyoming Drought Mitigation Plan. As noted by the Wyoming Office of Homeland Security (2016), most counties within the Platte River Basin have also adopted their own hazard mitigation plans. The following drought management recommendations are made by the references cited for the uses listed.

Agricultural Use

Davitt (2011) completed a water budget for the South Platte river basin for 1979 through 2006, which included the 2002 drought. Knutson and Haigh (2013) engaged ranchers and advisors to develop a drought planning methodology for Great Plains ranch operators. Based

on this work, several drought management tools were proposed, including but not limited to, the following:

- Educate community on crop insurance and education programs encompassing multi-hazard insurance for business, resident and government application.
- Monitor soil moisture, precipitation, range condition and forage production, water resources, and local weather conditions to plan crop plantings and rotations, and/or assess livestock production and health.
- Implement grazing management systems to foster desirable plant species and improve overall pasture health.
- Invest in water delivery infrastructure to allow effective grazing.
- Maintain a ranch resource inventory to identify appropriate actions and strategies given severity of drought conditions.
- Reduce overall water use based on changes in monthly and annual well production.
- Increase efficiency of water applied to the crops by improving methods of delivery. Methods vary depending on whether surface or groundwater is applied.
- Change type of crop grown to better match available water supply, including use of dryland crops.
- Reduce number of cultivated acres to reduce amount of water needed to raise crop.

Municipal Use

The City of Cheyenne (2011) developed its own response plan following the 2002 drought. The following strategies that the City implemented could be applied to other municipalities in the basin:

- Promote the wise use of water resources by residents served by the water system.
- Monitor the condition of all water supply sources.
- Encourage use of native vegetation and drought tolerant landscaping.
- Implement water use restrictions based on diminishing reservoir storage levels, changes to groundwater production rates from wells, or reductions in recharge to surface and groundwater sources.
- Regulate outside irrigation watering schedules for residents and municipal parks to specific days and times based on the severity of the drought.
- Reduce or implement conservation measurements on washing hard surfaces or vehicles.
- Develop programs and educate the public on the potential uses of wastewater.

Industrial Use

Much like municipal and agricultural users, industrial water users will have to find or develop ways to best use and manage their limited water resources as supplies shrink. Drought management recommendations include the following:

- Monitor the condition of all water supply sources.
- Implement or improve process water recycling to limit requirements for additional water.

- Develop and use water produced from fresh or brackish sources non-tributary to the North Platte River or South Platte River.
- Develop groundwater from aquifers beneath those used for other purposes to limit competition for water.
- Treat developed water to meet the intended industrial purpose.
- Acquire temporary use permits for existing water sources if the intended purpose requires short term use.
- Develop joint ventures with other industries to maximize the benefit of the water used prior to discharge.

Recreational and Environmental Use

Due to diminished surface water supplies, recreational and environmental uses face daunting drought challenges due to competing water uses. The following drought management strategies are presented for consideration:

- Maintain instream flows where possible to support fisheries, wildlife habitat, and recreational river uses.
- Replace golf course turf grass with a more drought tolerant grass.
- Change outside irrigation schedules to more effectively water existing turf.
- Curtail recreational access depending upon drought severity.
- Encourage wildfire risk awareness and mitigation measures especially during times of drought.

Water Use from Storage

As the drought develops and reservoir levels change, wise management of the remaining storage volume is imperative. The following drought management strategies are recommended:

- Maintain a drought emergency plan.
- Seek additional opportunities for water storage and augmentation.
- Continue to permit and implement the Medicine Bow Mountains weather modification program.
- Line conveyance channel to reduce seepage loss.

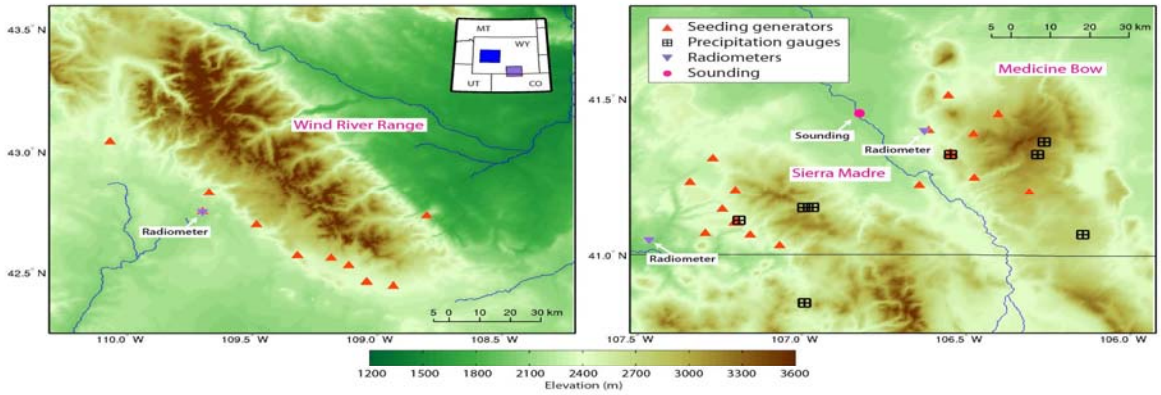
5.4.5 Weather Modification Efforts

Weather modification, commonly known as cloud seeding, is the application of scientific technology that can enhance a cloud's ability to produce precipitation. Interest and investment in weather modification practices have historically been driven by a need for an increase in fresh water supplies and a reduction in damage caused by hazardous weather conditions. Cloud seeding is used primarily to promote additional rain or snow to increase local water supplies. The principle of cloud seeding was first discovered in 1946, and the results of the first cloud seeding experiments were reported to Congress in 1951 (National Research Council, 2003). Efforts by private, academic, governments and military organizations worldwide to improve and refine the process have taken place periodically during the ensuing 80 years. Weather modification programs in the United States are generally funded by state and local government entities and utilities that generate hydroelectric power. Several western states, ranging from California to North Dakota and Texas have implemented operational cloud seeding programs, and other countries such as

China, Australia, France, Saudi Arabia, Turkey, Greece, and Venezuela are conducting cloud seeding research and operational studies.

Following a WWDC 2005 feasibility study that indicated potential success for cloud seeding within Wyoming, the WWDC funded the Wyoming Weather Modification Pilot Program (WWMPP) research project to determine the viability of cloud seeding to increase existing water supplies. The study also sought to quantify the potential increase in water supply due to seeding and the associated costs. The WWMPP was conducted from 2006 to 2014, and included three mountain ranges in Wyoming, the Medicine Bow and Sierra Madre Mountains (MBSM), and the Wind River Range (WRR). The program was primarily focused on the Medicine Bow and Sierra Madre Mountains, which includes a portion of the Upper North Platte River Basin. There were also additional evaluation and operational components that were focused on the WRR. **Figure 5.4.9** shows the location of the WWMPP study target areas. (WWMPP Draft Executive Summary, 2014).

Figure 5.4.9: Wyoming Weather Modification Pilot Program Mountain Range Target Areas and Facilities.



Other entities collaborating with the WWDC on the WWMPP included Weather Modification, Inc. (WMI), the National Center for Atmospheric Research (NCAR), the University of Wyoming, the Desert Research Institute (DRI), Heritage Environmental Consultants (Heritage), the University of Alabama, the University of Nevada Las Vegas, and the University of Tennessee.

The WWMPP provided a robust, state-of-the-art scientific assessment of weather modification as a strategy for long-term water management. The accumulation of evidence from the statistical, physical and modeling analysis suggested a positive seeding effect on the order of 5 to 15% (WWMPP Draft Executive Summary, 2014).

Based on the positive results of the pilot program the Wyoming State Legislature appropriated $1.4M to "jumpstart" the transition from research to operational cloud seeding in the Medicine Bow/Sierra Madre Mountains, and to conduct a conceptual design and siting study in the Bighorn and Laramie Ranges.

NCAR, in collaboration with WMI, and Heritage was awarded the MBSM and Bighorn Mountains projects which began in June 2015. Scoping meetings for both projects were held in September 2015 in each prospective target area. Work towards developing an operational design, the siting of facilities, permitting, and a cost/benefit analysis is underway for the MBSM Mountains. Draft results from the MBSM final design and permitting study are expected to be available in the winter of 2016. During the winter of 2015/2016, a microwave radiometer and three high resolution snow gauges were installed in the Bighorn Mountains for data collection purposes. A public hearing to present the Bighorn Mountains draft results, and to receive public comment, was held on August 15, 2016 in Sheridan, Wyoming, and on August 17, 2016 in Worland, Wyoming. The final report is scheduled for completion early in 2017.

DRI, in collaboration with TREC, Inc., was awarded the Laramie Range project which also began in June 2015. During the winter of 2015/2016, a microwave radiometer was deployed in the Laramie Range for data collection purposes. A public hearing to present the Laramie Range conceptual design and siting study draft results, and to receive public comment, was held on August 18, 2016 in Douglas and Wheatland, Wyoming. The final report is scheduled for completion in early 2017.

From 2006 through the spring of 2014, cloud seeding operations in the WRR were conducted within the context of the WWMPP. Though the WWMPP concluded in the spring of 2014, local and regional interest in continuing operations remained. Recognizing this interest, funding for three operational cloud seeding seasons (2014-15, 2015-16 and 2016-17) has been provided in part by the Wyoming State Legislature in each session's "*Omnibus Water Bill – Construction*." Per the legislation, the appropriated funds could only be expended once formal cost-share agreements with interested parties were in place. For each season, Wyoming's cost-share allowance has been set at 25%, with other interested funding partners contributing the other 75%. The requested appropriation reflects the continuation of a 25/75% cost-share funding scenario between Wyoming and other interested parties. Cloud seeding operations in the WRR represent the continuation of a collaborative, operational program focused on snowpack augmentation to enhance local and regional water supplies.

Potential Water Rights Implications of Cloud Seeding

To mitigate potential tort litigation related to water rights or damages to landowners from the effects of weather modification efforts, states have promulgated regulations specifying how the additional water that may have been produced by weather enhancement and how adjacent landowners may be protected from potential harm caused by these operations (i.e., floods, droughts, hail damage, etc.). Pertaining to water rights, the State of California's Weather Modification Regulations state that water gained from cloud seeding is treated the same as natural supply. Many states are now writing into their permitting regulations that cloud seeding contractors provide financial proof, in the form of liability insurance that will give reasonable assurance of protection to the public in the event damages are caused by cloud seeding projects. The States of Utah and Colorado require this as part of their cloud seeding permit process. Colorado also requires a minimum $1,000,000 of liability insurance or three times the value of the cloud seeding project, whichever is greater. In Wyoming, cloud seeding operators are required to obtain a SEO permit to engage in weather modification activities. Much like California, Wyoming also mandates, in legally binding Agreements with operational cloud seeding cost-share partners that, "water developed by cloud seeding is part of the natural water supply and subject to all applicable laws." Further considerations recognized by Wyoming are addressed in the Wyoming Legislative Report (2014, 2015 and 2016) for the WRR operational program. The language states that, "no water ownership is implied by the participation in [collaborative weather

modification programs], nor is there any expectation of a specific amount of water being delivered downstream, and any additional precipitation and subsequent streamflow that is produced through the program is treated as a natural event, and subject to Wyoming Water Law." Although Wyoming does not have the statutory authority to develop rules and regulations pertaining to weather modification, they have put into practice many of the same protections as other states.

5.4.6 References

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5.5 CONSERVATION STRATEGIES

5.5.1 Introduction

"Conservation: a careful preservation and protection of something; especially planned management of a natural resource to prevent exploitation, destruction, or neglect."

- Merriam-Webster

The purpose of this section is to discuss and encourage implementation of conservation measures, identify strategies to further address the demand management side of the supply/demand equation and encourage voluntary conservation activities. Finger pointing is counter-productive. The examples cited in this discussion are intended to highlight successful strategies that are already being employed in Wyoming and to initiate discussion on the benefits of more widespread implementation.

Conservation cannot make or develop new water supplies but existing supplies can be used more wisely to serve the public good. Conservation activities can extend water supplies for beneficial uses including municipal, agricultural, recreational, environmental and industrial uses. Conservation is one cornerstone of water supply planning and can be an effective and economical way to extend usable storage. When there is widespread buy-in, an effective conservation program fosters a cooperative, collaborative environment for addressing difficult resource allocation issues and unites stakeholders with differing agendas. As a water management tool, conservation can mitigate the effects of drought by reducing both short and long term demands of domestic, agricultural and industrial users. Conservation can be a powerful unifying strategy to facilitate the dialog surrounding the dynamic and often contentious tug between water supply and demand.

In the Platte River Basin, where water supplies are fully appropriated and highly regulated, conservation plays a critical role in meeting growing demands and future needs. The benefits of effective conservation programs include 1) reducing future water storage needs, 2) increasing public awareness of a critical and limited resource, 3) reducing waste water streams, 4) facilitation of the federal permitting processes for water storage projects, and 5) considering the importance of water resource management in our daily lives. In the Platte Basin, conservation may provide the only opportunities for enhancing municipal, agricultural, industrial, and environmental/recreation water supplies. In many cases, the role of conservation in various water supply and land planning scenarios is being addressed in the WWDC's Watershed Planning Program.

"Conservation is a state of harmony between men and land."

- Aldo Leopold

5.5.2 Municipal Water Conservation Strategies

Water savings resulting from conservation activities can reduce demands thus saving water providers money by reducing treatment costs and reducing the need for infrastructure expansion. The City of Cheyenne, Board of Public Utilities (BOPU) has implemented a water conservation program that includes 1) a tiered water rate schedule where the cost of 1,000 gallons of water increases with higher usage, 2) non-potable reuse for watering parks, and 3) a "Plan for Wise Water Use". Conservation measures (codified in City Ordinance) that are presented on the BOPU web page include:

1. Wasting water is prohibited. Wasting water by allowing water to run down streets is prohibited. There is a link to help homeowners learn how to keep water from their irrigation system out of the gutter.

2. Watering lawns and trees:

i. Water no more than three days per week. Avoid watering when windy or during rain.
ii. From May 1 to September 1, no watering between 10 a.m. and 5 p.m. for all users.

3. Watering gardens and flowers. From May 1 to September 1, watering between 10 a.m. and 5 p.m. is prohibited.

4. Washing vehicles. Wash cars and other vehicles using a hose equipped with a shut-off spray nozzle and/or bucket.

5. Washing parking lots, sidewalks or driveways. Cleaning hard surfaces such as parking lots, sidewalks or driveways using a hose is prohibited except for construction, safety and health reasons.

6. Watering new sod or grass seed.

   i. Soil must be amended prior to installing sod or seed with a minimum of 3.5 cubic yards of organic material per 1,000 square feet; tilled or disced to a depth of 6-inches. The web page has a link for landowners and landscapers to find out more about soil amendments.
   ii. From May 1 to September 1, no watering between 10 a.m. and 5 p.m.

7. Commercial and industrial customers must implement best management practices to save water. These include:

   i. Restaurants: Serve water only upon customer request.
   ii. Hotels and motels
      a) Offer guests staying more than one night the option of not changing linens and towels.
      b) Routinely inspect rooms for leaky faucets, showers and recreation equipment.

8. Construction sites

   i. Treated water used for construction must be used in the city.
   ii. Hoses must be equipped with shut-off nozzles.
   iii. Water used at construction sites must be metered.

9. Car washes

   i. Check equipment and facilities routinely for leaks, plugged nozzles, poor pressures or faulty equipment.
   ii. All hoses must be equipped with automatic shut-off nozzles.

The web page also provides the following advice to water users noting that there are more ways to reduce water use and save on water bills:

1. Repair leaks. Did you know that one out of every 10 gallons of water that is delivered to homes or businesses is lost to leaks?

2. Replace toilets, faucets, shower heads, washing machines and dish washing machines with water efficient models. How do you know if it is a water efficient model? Look for the ***WaterSense*** label.

3. Use less water by taking shorter showers, running full loads in the dishwasher or clothes washer, and by not letting water run from faucets or hoses when not in use.

5.5.3 Agricultural Water Conservation Strategies

Implementation of on-farm and irrigation conservation practices can save irrigation districts and individual irrigators money, reduce evaporation and transpiration losses, and reduce non-beneficial water consumption without affecting productivity. Secondary environmental benefits can also be realized by reducing irrigation return flows and diversions. Diverting less water can benefit carry-over reservoir storage and having water available for late season supplies irrigation. Conservation practices resulting in greater efficiency are capable of increasing crop yields and providing a buffer against drought. In the Platte River Basin, the implementation of conservation measures such as canal lining, conversion of open conveyance systems to pipes and conversion of furrow irrigation to sprinkler irrigation systems is most prevalent in Goshen, Platte, Natrona, and Converse Counties where higher value crops are grown or, in the case of the Casper-Alcova Irrigation District, Casper has provided financial assistance to the District in return for the use of the saved water. Sprinkler systems are increasingly being utilized elsewhere in the Platte River Basin where their use has reduced labor costs and improved hay yields. In Laramie County where most of the irrigated acreage uses non-tributary groundwater wells are being metered.

Irrigation provides water supplies to lands where rainfall is insufficient to meet the consumptive needs of crops. Irrigation is achieved by diverting water from streams or lakes through canals, ditches, or pipelines. Conveyance losses may occur in these facilities and the factors that affect conveyance losses are topography, soils, infrastructure type (unlined ditch/canal, pipeline, lined ditch/canal, etc.), age of the infrastructure, and maintenance history to name a few. Conveyance loss is the water that is diverted that never reaches the crops. Some of these losses result from evaporation, transpiration by plants adjacent to the canals/ditches and seepage that is recharging shallow or deep aquifers. In some cases, the seepage losses provide wildlife habitat and water lost from ditches/canals may return to streams as return flows. Water accrued to streams from irrigation return flows may be available for use by other owners of water rights. Some conveyance loss is permanent – lost to evaporation or deep percolation. Water lost to evaporation and deep percolation may have limited benefit to agriculture, wildlife, or other beneficial uses. Conveyance losses are greatest in systems operated by individuals or small privately owned operations using flood irrigation with unlined and poorly maintained canals.

Once the water reaches the field, it is either used by crops or becomes on-farm losses. Irrigation provides water to the crop's root zone to meet crop needs. Water consumptively used by the crop is incorporated in the biomass of the plant or is transpired by the plant into the atmosphere. On-farm losses include runoff to adjacent non-cropped areas or evaporation directly from the soil surface.

The WWDC has been proactive in reducing conveyance losses in canals/ditches and aging pipes and siphons. The program has assisted nearly every large irrigation district in the basin improve canals, laterals and diversions with more efficient infrastructure including replacement of open ditches with pipelines within the Goshen Irrigation District and canal lining and replacement of open ditches with pipelines within the WID. Improvements to irrigation reservoirs operated by the WID have reduced losses from embankments and outlet structures.

The City of Casper, Wyoming, financed canal lining on portions of the CAID to reduce conveyance losses resulting from seepage. The District is a USBR project that maintains a 59-mile long canal and 190-mile lateral system. In return for their assistance, the City of Casper obtained approximately 7,000 acre-feet of water for municipal use.

Where water law allows and there may be willing water right owners, conserved agricultural water may be re-directed to provide environmental enhancement to wildlife habitat and

development of wetland banks. In conjunction with the SWPP, the opportunities for implementing this kind of cooperative project could be further explored. Recreational user fees or selling credits in wetland banks could be explored as potential revenue generating options. Further, irrigation water reuse, system wide and on-farm conservation practices may improve water quality by reducing irrigation return flows transporting sediments and agricultural chemicals.

5.5.4 Industrial Water Conservation Strategies

In the Platte Basin, the principal industrial uses of water include mining, oil and gas extraction and electric power generation. These activities have a water-energy nexus. Water and energy are inextricably linked. Water is needed to produce the mechanical components of energy generation and to cool fossil fuel-fired generation facilities. Energy is needed to produce water. Power is needed to drill wells, pump water, treat water to electric utility standards, and treat wastewater. Except for wind and solar power generation, water is needed to produce electricity. However, water is still needed in the manufacturing of wind turbines, solar equipment and the electrical components needed to move electricity from generation facilities to end users.

Market factors drive conservation in the industrial sector. Manufacturers and producers are constantly seeking ways to cut costs. If conservation measures are economical, the private sector will usually embrace them.

Economics and environmental constraints will likely shape the water conservation actions taken by industrial users. Coal fired electric generation is in decline nationwide and this trend is likely to continue as these plants age and environmental constraints increase operating costs. Electric generation will likely shift to more distributed systems relying on natural gas, wind, and solar. Research in the field of energy storage is rapidly moving forward at universities, national research facilities and private engineering firms. When economic and environmentally friendly storage systems are developed the paradigm of power generation may shift rapidly and radically depart from current technologies. Wyoming, with an abundance of wind and solar resources may likely be on the forefront of this change.

The possibility exists that as coal fired and gas fired electric generation is replaced by renewable energy sources, industrial water demands may decrease. This could result in re-purposing water resources to other beneficial uses.

5.5.5 Environmental/Recreational Water Conservation Strategies

The environmental benefits of conservation in other sectors can have either positive or negative effects on wetland, riparian and aquatic ecosystems. The benefits of conservation in the agricultural, municipal, or industrial sectors include greater availability to provide water to environmental uses such as instream flows, wetland development and maintenance and upland wildlife habitats. Water saved and stored can be better directed to critical habitat areas when and where it is needed resulting in better habitat and better water management.

A downside of water conservation on farms and within irrigation delivery systems is the loss of seepage wetlands and irrigation tailwater wildlife habitats. However, in many cases these are marginal, lower value and isolated habitats that may be mitigated by acreage that is managed to maximize wildlife and habitat values.

5.6 WATERSHED PLANNING STRATEGIES

5.6.1 Watershed Planning Goals and Objectives

As described in several completed watershed studies, the watershed plans inventory and describe physical and biological information including geology, hydrology, soils, climate, plant communities, wildlife habitat, and geomorphic characterization of the stream systems. The characterization of these resource areas is intended to identify water supply problems in the watershed. This information is incorporated into development, rehabilitation, and management plans along with cost estimates for potential future project activities. The watershed plans are useful tools for providing information which factors into the Basin Plans.

The watershed studies are initiated through application to the WWDC by a Conservation District or other appropriate entity. The watershed studies are planning tools to identify projects that may be eligible for funding under the SWPP. Once a Watershed Study is completed, any eligible project in the watershed can be funded through the SWPP. The WWDC's operating criteria for the SWPP describes the program:

> *"The purpose of the Small Water Project Program (SWPP) is to participate with land management agencies and sponsoring entities in providing incentives for improving watershed condition and function. Projects eligible for SWPP grant funding assistance include the construction or rehabilitation of small reservoirs, wells, pipelines and conveyance facilities, springs, solar platforms, irrigation works, windmills and wetland developments. Projects should improve watershed condition and function and provide benefit for wildlife, livestock, and the environment. Projects may provide improved water quality, riparian habitat, habitat for fish and wildlife and address environmental concerns by providing water supplies to support plant and animal species or serve to improve natural resource conditions."*

The SWPP of the WWDC is a key component of Wyoming's overall conservation strategy. An important output of the watershed planning process is identifying projects that are eligible for funding through the SWPP. The program results in collaborative projects with conservation districts and other political subdivisions to provide water supply and environmental benefits to agricultural uses and the public. The program is expanded with 30 to 50 applications being submitted to WWDC annually with a biennial budget of about $750,000.00. More information regarding the SWPP is available at: http://wwdc.state.wy.us/small_water_projects/SWPPopCriteria.html

By undertaking the Watershed Studies and the SWPP, WWDC has played an important role in fostering a statewide conservation ethic in water resources management. The agency has funded water supply efficiency improvements for nearly every public water provider and most of the irrigation districts in the Platte River Basin. In addition, Watershed Studies are underway or have been completed (and are being implemented) in the following North Platte Basin tributary drainages:

1. Sweetwater River Watershed Study (Basinwide Watershed Management Plan) 2012
2. Sweetwater River Watershed (Phase I, Long Creek Watershed Management Plan) 2012
3. Sweetwater River Watershed Study (Phase II, Muddy Creek and Horse Creek Watershed Management Plan) 2012

4. Sweetwater River Watershed Study (Phase III, Alkali Creek/Crooks Creek/Buffalo Creek Watershed Management Plan) 2012
5. Sweetwater River Watershed Study (Phase IV, Willow Creek/Sage Hen Creek/Dry Creek Watershed Management Plan) 2012
6. Middle North Platte Watershed Study Watershed Management Plan 2014
7. Upper North Platte River Watershed Plan 2015
8. Medicine Bow River Watershed Plan 2016
9. Upper Laramie Watershed Study 2016
10. Middle North Platte Watershed Management Plan 2016
11. South Platte Watershed Study (2017)

The watershed plans, basin plans and statewide plan are dynamic and interrelated documents that reflect snapshots in time. In a sense, some of the information provided in this basin plan and other WWDC planning documents may constitute forward thinking projections based on past history that may, or may not, reflect actual future conditions. Perhaps the greatest good that these documents can provide is a reasonable estimation of future conditions with high and low scenarios provided to address unforeseen contingencies.

Because of the legal and institutional constraints affecting water development in the Platte Basin, the SWPP may provide the most cost effective and environmentally acceptable means of developing water supplies in the basin.

5.7 WATER SUPPLY AND WATER MANAGEMENT STRATEGIES

"Sound strategy starts with having the right goal."
- Michael Porter

5.7.1 Introduction

This section summarizes the strategies or opportunities for meeting the future water needs of the Basin. The lists of opportunities previously identified in the 2006 plan have been expanded to capture the strategies identified during the past 10 years. New information has become available regarding water use, conservation, and storage options.

The Platte River Basin has a varied history of water development and water conflicts. The Basin contains a system of federal reservoirs that primarily supply water for agricultural water use and provide flood control benefits. In addition, these reservoirs provide water for hydropower generation, municipal and industrial use. Finally, they provide environmental recreational benefits within the region. The Platte River Basin is the largest of Wyoming's seven river basins and is known for its economic diversity. Litigation and court decrees have affected the apportionment and future management of water supplies within the Basin. The key apportionment and entitlements within the Basin were originally defined within the 1945 North Platte Decree and amended within the 2001 Modified North Platte Decree (2001 Decree).

In the more recent history, the ESA, CWA and other environmental legislation has affected existing water uses and continues to significantly influence future water development and water use opportunities. Based on allocations and apportionment within interstate decrees and the State's participation within an ESA recovery program, any new major water developments within the Basin is unlikely without mitigation to offset the proposed new depletions. Water supplies from the development of non-hydrologically connected water or the importing of non-native sources would not be considered depletive.

The PRRIP is the ESA recovery program initiated in 2007 which allows for the continued use of existing water uses in Wyoming for irrigation, municipal, industrial and other water uses in place on, or before, July 1, 1997. Each State completed a depletion plan to address and manage existing and future water depletions. The Wyoming Depletions Plan (referred to as the "Depletion Plan") identifies existing and new water related activities that are covered by the Program. The Depletion Plan presently provides coverage for depletions authorized by existing uses and for water activities with valid Wyoming water rights with priority dates prior to July 1, 1997; the date negotiations began to formulate the Program.

For the future development of small water uses serving domestic, stock, recreation, fish and wildlife, environmental, and other deminimus uses; the Depletion Plan addresses new depletions in the North Platte River basin if the proposed water project does not exceed 20 acre-feet per year in net water depletions.

It is the State of Wyoming's goal to provide any necessary offset or mitigation to any permitted water use activity with a pre-July 1, 1997 priority water right and for any new water projects in the Basin that do not exceed 20 acre-feet of net depletion a year. If Wyoming is unable to provide the necessary offset and all the state sponsored mitigation that is required in the future, the State may require water users to provide their own mitigation. Wyoming's future of limited water development opportunities, and the tracking and reporting requirements within the Depletion Plan will likely continue during the anticipated extension of the Program beginning in 2020.

5.7.2 Water Supply Opportunities/Strategies

At the onset of this project, the Basin Plan team members reviewed the list of opportunities developed during the previous Basin Plan. The purpose of this review effort was to evaluate any changes or updates, and gather any new information that became available since the previous Basin Plan was published.

During the previous Basin Plan, a long list of water use opportunities was developed. The list was based on a summary of water use opportunities discussed in technical memoranda as well as capturing opportunities listed in other basin plans that could be applicable to the Platte River Basin. Other sources of information were input from WWDC staff and the Commission, a literature review, and specific recommendations from Basin Advisory Group members and stakeholders. The long list was refined into a short list of structural and non-structural opportunities for the Basin. A short list of opportunities were identified in the previous basin plan:

Non-Structural Future Use Opportunities

- Drought response planning
- Weather modification
- Water conservation
- Water right transfers
- Enhancing recreational use of water resources
- Increasing runoff from national forests based on USFS policies and practices
- Water exchange/banking
- Multi-purpose flood control program
- Utilization of WWDC's SWPP

Structural Future Use Opportunities

- Groundwater augmentation – non-hydrologically connected to North Platte River surface water
- Upper Laramie River storage opportunities
- Transbasin diversions
- Snow fences
- Stormwater capture, storage, treatment, and management; irrigation with treated municipal wastewater, grey water irrigation; and municipal irrigation using untreated water
- Modification of the Pathfinder Dam and Reservoir
- Conversion of coal bed natural gas (methane) wells
- Regionalization of public water supply systems
- Improving agricultural irrigation system efficiencies

5.7.3 Completed and On-Going Non-Structural Opportunities/Strategies

The Wenck Team evaluated changes or updates and gathered new information that became available since the 2006 Basin Plan. The short list from the previous Basin Plan was further refined and the top priority strategies were identified. The strategies were evaluated to develop and define other opportunities and to align the strategies with the anticipated growth and demands and water use changes over the 10 to 30-year planning horizon.

Potential Operational Enhancements – Existing Storage and Conservation

Water supply shortages coupled with legal and institutional constraints affect water development and water management in the Platte River Basin. The North Platte Basin has been considered as fully appropriated since the 1950's. Interstate decrees and an ESA recovery implementation program affect the development of water supplies. The highest priority strategies for maximizing the available water supplies are operational enhancements of existing storage and water conservation

The first two potential opportunities under operational enhancement category of operational enhancements uses (Re-Operation of Glendo Reservoir and Above Pathfinder Irrigation Reservoir Storage) could be achievable in the near-term planning horizon over the next 10 years and the implementation of some of the operational enhancements could occur over a longer planning period up to 30 years into the future.

Re-operation of Glendo Reservoir. The State of Wyoming, through WWDC, is moving forward with a storage feasibility study with the objective of more efficient use of a portion of Glendo Reservoir's flood pool to meet downstream beneficial uses. Of the total dam storage capacity of 1,092,290 acre-feet, approximately half is reserved for flood control and surcharge. The USACE oversees flood control operations when the reservoir elevation reaches elevation 4,635 feet, and ceases at elevation 4,653 feet. A total of 271,017 acre-feet of flood pool storage is managed by the USACE to the flood pool. The flood pool operating rules prescribe evacuating water from the flood pool as quickly as possible without any consideration of downstream beneficial water needs. The initial estimates indicate that up to 20,000 to 40,000 acre-feet of flood pool storage may be available under this Glendo re-operation project.

The proposed project meets the goal of enhancing existing water storage in Wyoming, a high priority initiative within the Wyoming Water Strategy issued by Governor Mathew Mead. There are complex issues confronting this project but interagency coordination is planned at the onset of the project and the feedback received will affect the entire study. WWDC is aware that mitigation will be required; particularly due to the anticipated effects of high water levels on Glendo State Park's recreation and infrastructure facilities.

When the USACE-authorized flood pool releases occur before large irrigation demands become active downstream, no benefits to storage water supplies are achieved. The project proposes the retiming of released water to assist in meeting downstream irrigation demands and to conserve overall storage supplies. Contractors of federal storage supplies and natural flow diverters both downstream and upstream of Glendo Reservoir would realize benefits of storage water conservation because the additional storage water can be used in lieu of normal water supplies throughout the entire North Platte River system.

Above Pathfinder - Irrigation Reservoir Storage*. Note: This strategy has both a non-structural and a structural component.* Volume 3, Section 3.6 of this updated Platte Basin Plan evaluated potential storage opportunities in irrigation reservoirs located in the basin above Pathfinder Reservoir exclusive of the Kendrick Project and Seminoe Reservoir. Specifically, Section 3.6.7 discussed both structural and non-structural alternatives for optimizing water storage for irrigation purposes above Pathfinder. One of the non-structural alternatives is to implement reservoir owner operating strategies.

In accordance with interstate Decree requirements, Wyoming is only able to accrue up to 18,000 acre-feet of water from the North Platte River and its tributaries above Pathfinder Reservoir for irrigation purposes during any one year. Wyoming's annual accrual amount has averaged 12,038 acre-feet since reporting began in 1951. The estimated overall total storage capacity of all the reservoirs (active and inactive combined) is 27,525 acre-feet so

there is a possibility of exceeding the cap in any one year; although Wyoming has never exceeded the accrual cap. A potential non-structural recommendation is to facilitate coordination of storage accruals amongst the reservoir owners. Reservoir operational plans that address targeted accrual quantities based on carryover amounts and anticipated runoff would be developed for the largest reservoirs. The new measuring device equipment installed on the largest 11 reservoirs allows for near real-time monitoring of accruals and maximum storage amounts. The objective of this operational strategy would be to maximize Wyoming's storage quantities up to the Decree allowance of 18,000 acre-feet in as many Water Years as possible.

Agricultural Water Use Conservation. Irrigated crop production within the agricultural sector represents the largest water use within the Basin and presents the largest opportunity for water savings through water conservation. Two potential objectives of water conservation are to reduce the non-beneficial water consumption or to reduce diversion. The proposed changes in methods and practices are opportunities to stretch existing water supplies to effectively meet existing water needs and to help meet future water needs. The conservation plans need to be evaluated individually to determine their potential effects on water rights, crop production, other existing water uses, and the environment.

It is important to understand the terminology of irrigation methods when reviewing potential conservation methods. Irrigation efficiency is considered as the ratio of the total amount of water diverted for an irrigation use to the amount of water needed by the crop, which is considered the consumptive use supplied by irrigation. Natural precipitation provides a portion of the water consumption needed by the plants. Irrigation efficiency can be further refined into water conveyance or delivery efficiency and on-farm efficiency. The conveyance losses occur between the point of diversion and the delivery of water to the field turnouts. The losses can occur through evaporation, consumptive use (evapo-transpiration) by non-crop vegetation or phreatophytes, and seepage. The on-farm water losses primarily include deep percolation, evaporation, and runoff from the fields.

Wyoming's primary land uses and history supports a ranching lifestyle that is complementary to other water uses. The primary crop in the Basin is native hay and most ranchers only perform one harvest cutting per year. Portions of the irrigated lands are not cultivated and only serve as pasture for livestock. Most ranchers within the above Pathfinder Reservoir and Upper Laramie River subbasins rely on flood irrigation practices although some center pivots and siderolls are present. The diversion locations can be a significant distance from the irrigated fields with earthen ditches cut along ground contours conveying water supplies. The overall runoff and active irrigation period can be relatively short for the tributary areas within the Basin due to the short period of high runoff, which primarily occurs in the spring and early summer months. The return flows from the flood operations often occur gradually following the flood irrigation providing for wetlands, recreation, and instream benefits.

The agricultural production below Pathfinder Reservoir, in the Lower Laramie, and within the South Platte and Horse Creek subbasins have varying amounts of row crop production and many producers have installed efficient conveyance and application facilities; which include pipeline conveyances, and center pivot or sideroll irrigation systems. The agricultural production methods within these subbasins are more amenable to water conservation and are more likely to be impacted by pressures by other water users; particularly for enhancing recreation and environmental water needs.

Wyoming water laws allow for the historic crop consumptive use by irrigation to be marketed and transferred to other types of beneficial use. The current water laws allow for the determining consumptive use as the amount of irrigation water the crop needs for

growth. Within the Basin, crop irrigation deficiencies occur due to many factors. Primary deficiencies include inadequate water supplies, and losses associated with conveyances, and on-farm practices. Because of these deficiencies, natural precipitation combined with the actual water delivered to the crop is not sufficient to meet the full supply requirement of the crop consumptive use during the crop's growing season for most of the time.

Throughout the Basin, where feasible and appropriate, open-ditch delivery systems have, and are being converted to closed pipelines virtually eliminating all conveyance losses. Flood and furrow irrigation is being replaced with more efficient application practices involving sprinklers, side rolls and drip systems where these practices are feasible. Many of the projects are state or federally funded with public entities and sponsors contributing much of the expense and labor. When funding is inadequate from the government and local and private entities, partnerships with other water users, foundations, or local organizations benefiting from the improvements should be considered. Agricultural water savings can provide significant benefits to recreation and instream flow. The foundations and non-profit organizations benefiting from the improved conservation methods may be willing to provide monetary and volunteer labor support.

Buy and Dry Transfers. The typical agricultural transactions in western states involve "buy and dry" transactions. The land sales and accompanying water rights transfers are completely market driven. For Wyoming, the agricultural developments in the Basin lost to municipal development are primarily limited to residential and commercial developments near larger communities; such as, Casper, Cheyenne, and Torrington. In Wyoming, as in other western states, an aging population of agricultural producers and a lack of younger people available for farming and ranching are affecting the trends of land use changes. The projected population growth effects in other western states have already removed large agricultural areas from production. As population grows these land use changes from agricultural to urban and residential developments is expected to continue if alternative water transfers are not implemented. Alternative water right transfer agreements are beginning to occur that prevent the complete demise of agriculturally based communities. A number of alternative water right transfer agreements have been executed in the State of Colorado. The Morgan Ditch Company formed a voluntary lease agreement with Xcel Energy. The agreement has allowed for Xcel Energy's Pawnee power station to receive a firm water supply within the eastern plains near Brush, Colorado. During dry years, a small portion of the water supply is provided to the power station since it is located in the vicinity of the main canal. Water is delivered to the power station but most of the ditch farmland remains fully irrigated with senior direct flow and senior reservoir rights. Other examples include the City of Thornton forming a short-term lease supply plan to provide for emergency water from the Platte River Power Authority and the Lower Arkansas Valley Super Ditch Company which allows irrigators to temporarily lease water to cities, towns, water districts but the ownership of the water is retained with the farms (Colorado's Water Plan, 2015). An alternative water right transfer agreement could allow for certainty of water availability to serve water needs of municipalities or other high value markets periodically when the demand occurs but the water right appropriation's primary purpose is to serve and maintain agricultural production in the future.

Legislative Strategies. In many water law settings, there is a "use it or lose it" policy which requires that water users exercise their individual water rights to protect them. However, in specific situations, Wyoming water laws can be a barrier to conservation improvements.

Wyoming's water users may consider the need for legislative reform to address the concerns with existing water laws being a disincentive to improving agricultural conservation and efficiency. Other western states have enacted bills and legislation that protect appropriators

from abandonments if the appropriator has agreed to participate in a state or federal water conservation program that is approved by a state agency. The primary types of water sharing transactions being evaluated or implemented in other western states to prevent further reductions in irrigated lands include the following agreements:

- Purchase and lease-back
- Rotational fallowing (short and long term)
- Water banks
- Reduced crop consumptive use
- Interruptible water supply agreement

Rotational fallowing and raising crops with lower consumptive use are techniques for reduced consumptive use of the irrigated crop. The accounting of water depletions under Wyoming's Depletion Plan for the Program allows for the accounting of underrun depletions of various water uses to offset the overruns by the other water uses when the depletions are summed and translated to the Wyoming Stateline with Nebraska. The accounting system can be considered as a de facto water bank that is accounted for and tracked by the State of Wyoming. This water bank accounting provides flexibility to water users under the Depletion Plan. In addition, the replacement of abandoned or active irrigation wells in the "Triangle Area" in Goshen County allows for Wyoming to maintain the "water bank" of wells allowed under the 2001 Modified North Platte Decree.

An interruptible water supply agreement (IWSA) protects an appropriator with an agreement with another water user. An IWSA allows an agricultural appropriator to temporarily lease their historic consumptive use without requiring a permanent change in their water rights. The IWSA's in Colorado allow for leasing periods with terms up to 10 years and can be renewed up to two times. The Colorado agreements allow the agricultural producers to rely on active use of the water right up to 3 years during the 10-year period. The agreements allow for flexible water use based on water supply conditions and the water needs of the two parties.

The SEO would need to be involved in reviewing and approving any long-term water leasing agreements to ensure that the physical water supply exchange process is manageable and practical and that other appropriators are not injured. Without similar legislation in Wyoming, there remains less flexibility and a disincentive for Wyoming's appropriators to lease or to conserve water supplies for the benefit of other water users or to provide for recreation or instream benefits. The attempts in Wyoming to address flexible water use transactions under existing Wyoming Statutes §41-3-110 providing for recreation or instream benefits have not been successful. This Statute allows for the temporary change of water rights acquired through purchase, gift, or lease for up to a 2-year term. These temporary water right transfers are subordinate to all other permanent water rights. When the 2-year term ends, the appropriation automatically reinvests back to the original water right unless the agreement is renewed.

Imported, Exchanged and Transferred Water Supplies. Because of water supply limitations along with significant regulatory and legal obstacles to the development and use of in-basin water resources, another strategy for meeting future demands is importation of out of basin water supplies. The City of Cheyenne has successfully implemented this strategy in their development of the Stage I and Stage II water supply projects. Further, transferring existing water supplies with adjudicated rights to other users is an option that may be feasible to better use existing water rights. The existing water rights may be retired or abandoned entirely or just portions of the water rights may be retired or transferred temporarily. This action requires SEO approval.

The endangered species recovery program for the Central Platte River in Nebraska allows for project proponents in Wyoming to rely on non-native water supplies imported into the Basin to meet proposed water projects with new depletions. In addition, the Program covers any existing water uses in place in Wyoming as of July 1, 1997, water rights transfers approved by the Wyoming Board of Control are not considered new depletions.

Public and private entities in Wyoming have existing infrastructure in-place for importing non-native water supplies into the Basin. For example, the City of Cheyenne BOPU provides imported water from the Little Snake River Basin that is released in the North Platte River drainage in exchange for the water imported to Cheyenne from the North Platte Basin under Wyoming's Stage II Project. Cheyenne BOPU's existing reuse system relies on the non-native imported water that is available at the wastewater plants and can be used to extinction. As the population of Cheyenne increases and the reuse system is expanded, the water supplies imported through this Stage II project will also increase. If the City of Cheyenne has surplus water supplies available in any one Water Year, municipal, industrial, and other water users may purchase water from the Cheyenne BOPU and the State of Wyoming.

The State of Wyoming and appropriators within Laramie County have been engaged in evaluating remedial measures to address depleted groundwater resources. The non-native water supplies available through the Stage II Project could assist with recharge of the depleted groundwater areas within the Laramie County Control Area near the Crow Creek drainage.

Transbasin diversion projects have been investigated for importing water supplies from other Wyoming basins into the North Platte River Basin. These projects can be very complex and difficult to obtain permits and authorizations because of significant environmental mitigation requirements and opposition by the affected water basin. The extent of public support or opposition to the project can affect the development of the project. The water supplies must be physically and legally available within the basin of origin. No large water development project is anticipated within the 10-year planning period. Other feasible water supply options described in this volume can meet water needs anticipated within the 10-year period. The studies completed within the Basin include the following.

- A joint collaborative effort is underway between Colorado and Wyoming entities to investigate the feasibility of an interstate water project to bring water from the Green River Basin in Wyoming to the Platte River Basin and Colorado front range communities. The Flaming Gorge Pipeline Project as it is known, involves a coalition of Wyoming communities including the City of Cheyenne, City of Torrington and Laramie County. The Colorado entities engaged in the project are Douglas County, the 13 members of the South Metro Water Supply Authority, Donala Water and Sanitation District, and Cherokee Metro District in the Pikes Peak Region. The project would take unappropriated water from the Flaming Gorge Reservoir in Wyoming and deliver it to project participants in Wyoming and Colorado through existing channels and new pipeline and storage infrastructure.
- A Wind River Export study to import water from the Wind River Basin with yields up to 36,000 acre-feet in dry years (Level 1, ECI, 2002). The water was delivered to the North Platte River through the Sweetwater River conveyance. Current WWDC storage feasibility studies are evaluating tribal and district water rights and Wind River Basin water supply irrigation shortages.

Industrial Water Use Changes. The economic demand projections within the high scenario of this Basin Plan predict the possibility of a new gas-fired power plant and a new

coal conversion facility within the next 30-year planning period. The water demands for oil and gas development affected by the cyclical boom and bust conditions are expected to increase in the next 10 to 20 years under the High (growth) Scenario. In subbasins where water supplies are limited, oil and gas producers have executed water leasing agreements with existing water users that require the user to temporarily forgo the use of a portion of their water right. Expansions and development of mines serving the uranium extraction industry are anticipated to occur under both mid-range and high-growth scenarios in this Basin Plan.

In addition, new wind turbine farms are in various planning stages with some larger-scale projects built and active within the Basin. The water needs and demands for construction and operation of windfarms is small in comparison to other industrial water uses. A couple of former oil refineries within the City of Casper have been shut down for many years and are in different phases of remediation and re-development of the refinery properties. In the recent past, an ethanol facility in Torrington has ceased operations and a sugar processing plant in Torrington is anticipated to close within the next few years. An existing coal-fired power plant that diverts and relies on significant water supplies from the North Platte River is located near Glenrock. A second coal-fired power plant near Wheatland relies on water supplies from the Laramie River and Grayrocks Reservoir. Both plants are not planning any expansions and reductions in water use could occur due to market and environmental regulation conditions over the short and long-term planning period. Other coal-fired power plants within the State have converted their plants into gas-fired operations.

With the potential water use changes expected by various industrial water users, water supplies made available by the retiring or the leasing of pre-1997 water rights may likely be adequate to satisfy new water right demands. The temporary leasing of water rights is allowed under Wyoming's Temporary Water Use Agreement Statute and permanent water right transfers would be reviewed and approved by the Wyoming Board of Control. Water rights of industrial users that are reducing or closing operations and not transferring their consumptive use to other water uses either temporarily, or permanently, could be subject to involuntary water right abandonment actions.

Laramie County Regulatory Controls. The South Platte subbasin water uses, particularly irrigated agriculture, are very dependent upon groundwater supplies with little surface water supplies available in the subbasin. Due to declining groundwater levels and water use pressures in the High Plains Aquifer, the State Engineer issued a corrective control Order on April 1, 2015 guiding development for the next five years within the Laramie County Groundwater Control Area. Within the LCCA, the SEO requires documentation of water use in the past 5 years through inspection of aerial photography or other documentation such as well pumping power records or water meter readings.

These recent actions occurring within the South Platte subbasin within Laramie County are an example of regulatory controls taken to protect and enhance an existing groundwater resource within the Basin. The State of Wyoming established Groundwater Control Areas to address concerns with groundwater resources within the State when demands exceed available supplies. The Laramie County Groundwater Control Area (LCCA) is contained within the eastern two-thirds of Laramie County within the South Platte subbasin. Since the 1970's, much of the High Plains aquifer system has been heavily appropriated and the LCCA was formed in 1981 to address groundwater depletion concerns.

Due to declining groundwater levels and water use pressures in the High Plains Aquifer, the State Engineer issued a corrective control Order on April 1, 2015 for the LCCA that affects groundwater development for the next five years. A groundwater model had been developed for Laramie County to evaluate the effects of current and proposed groundwater

withdrawals. The model was relied upon to evaluate various control options. One requirement of the Order is that all large capacity wells shall be metered within the LCCA prior to water year 2017. The Order stops the drilling of new large capacity wells in specific heavy use irrigation areas and requires spacing, water use and monitoring in the "Conservation Area" defined within central and western parts of the LCCA. Wells completed in formations deeper than the High Plains Aquifer also have metering, spacing, and monitoring requirements.

In southeast Wyoming, the oil and gas development in Laramie County has primarily occurred within the LCCA. The SEO has encouraged water leasing of existing water rights, primarily leading to agreements with existing groundwater appropriators willing to forgo the use of a portion of their irrigation water rights. During water years 2011 and 2012, approximately 117 water leasing agreements for meeting oil and gas water needs were reviewed and approved by SEO. An important requirement of the Temporary Water Use Agreement Statute (W.S. 41-3-110) is that "*Only that portion of the water right so acquired which has been consumptively used under the historic use made of the water right, may be diverted by the temporary user*."

Aquifer Storage and Recovery. Aquifer recharge and aquifer storage and recovery (ASR) wells is a method proposed to replenish or store water in an aquifer. The purpose of the recharge is to store water underground and to recover groundwater from a well for beneficial uses. The water can be injected with a well or by surface water infiltration from riverbeds of recharge basins. The water injected is typically treated to meet primary and secondary drinking water standards. The viability and feasibility of potential artificial recharge sites in the Basin needs to be assessed. Potential problems that can occur with artificially recharged water are geochemical reactions that occur in the subsurface that adversely affect aquifer water quality. The project design needs to control the water supply stored within the aquifer space without allowing water to escape within the aquifer system. The proposed construction, operation, and maintenance of the artificial recharge project needs to be technically feasible. A project can be tested through pilot scale studies.

When compared to alternative surface water reservoirs, ASR can provide economic savings. The technology has been found to be good for the environment, aquatic, and terrestrial ecosystem as compared with new surface water storage. The ASR typically store water during times of flood or overly wet conditions when water quality is good, and recover water during times of drought or dry conditions when water quality from surface water sources may be degraded. The suitable aquifers can be aquifers that have experienced long-term declines in water levels due to heavy pumping to meet municipal, industrial, or agricultural water needs. ASR can provide water supply during emergencies; as a back-up supply, such as severe floods, earthquakes, contamination incidents, pipeline breaks, or damage due to warfare or sabotage.

One method of recharge is from recharge basins or spreader dikes to provide infiltration with surface water supplies. The recharge can also occur through increasing or enhancing the flow of water in natural drainages and channels within reaches that lose flow to the subsurface. A potential application for the Basin is the recharge of surface water supplies within the South Platte subbasin in Laramie County. Previous studies have reviewed the acceptability of recharging the High Plains Aquifer with surface water supplies of the City of Cheyenne water collection and distribution systems in the Crow Creek drainage. Another alternative is the supply of recharge water from discharge at the wastewater treatment plants or treated reuse water supplies. An aquifer recharge project in the Basin will face permitting and technical challenges so feasibility and planning studies are needed to evaluate potential projects and screen for fatal flaws.

5.7.4 Completed and On-Going Structural Opportunities and Strategies

Many of the water use opportunities and strategies are in different phases of being implemented with more details of the status of various implementation efforts below. Many of the successful water supply projects are completing or planning expansions or enhancement to the existing systems.

Wyoming Water Development Commission Projects. The WWDC has been actively engaged in assisting municipalities, domestic water districts and irrigation districts improve the efficiency of their systems and develop new water supplies. Since 2006, the WWDC has committed more than $111M to construct 78 projects in the Platte River Basin. As shown in **Table 5.7.1** there are currently 45 projects underway with appropriations totaling nearly $70M. Thirty-three completed projects are shown in **Table 5.7.2** and total more than $41M.

Table 5.7.1: WWDC Construction Projects in Process in the Platte River Basin Since 2006

Project	Program	Session	Account	Appropriation	Due Date
Casper Poplar Transmission Pipeline	New Development	2007	I	$3,200,000	2012
Casper Zone II 2015	New Development	2007	I	$3,200,000	2012
Laramie Transmission Pipeline	New Development	2008	I	$880,000	2013
Goshen Irrigation District Rehabilitation 2013	Rehabilitation	2009	II	$1,200,000	2014
Laramie Transmission Pipeline	New Development	2009	I	$6,850,000	2014
Casper Alcova Rehabilitation 2010	Rehabilitation	2010	II	$477,040	2015
Casper Poplar Transmission Line	New Development	2010	I	$663,300	2015
Casper Zone II 2015	New Development	2010	I	$663,300	2015
South Laramie Water Supply	New Development	2010	I	$3,100,000	2015
Central Wyoming Regional Zone IIB	New Development	2011	I	$1,959,750	2016
Cheyenne Southern Pipeline	New Development	2011	I	$14,029,800	2016
Douglas Box Elder Spring-Phase 1	New Development	2011	I	$1,487,400	2016
Goshen Irrigation District Rehabilitation 2013	Rehabilitation	2011	II	$1,100,000	2016
Wheatland Irrigation District Rehabilitation 2015	Rehabilitation	2011	II	$723,600	2016
Wheatland Rehabilitation 2011	Rehabilitation	2011	II	$723,600	2016
Casper Poplar Transmission Pipeline	New Development	2012	I	$1,541,000	2017
Casper Zone 3 Improvements	New Development	2012	I	$1,541,000	2017
Casper Zone II 2015	New Development	2012	I	$1,541,000	2017
Fort Laramie Storage Tank	Rehabilitation	2012	I	$53,600	2017
Lake Hattie Dam	Rehabilitation	2012	II	$840,000	2017
Lake Hattie Dam	Rehabilitation	2008/2012	II	$282,000	2017
Laramie Transmission Pipeline	New Development	2012	I	$3,120,000	2017
Rolling Hills Water Supply	New Development	2012	I	$160,000	2017
Rolling Hills Water Supply	New Development	2014	I	$1,184,000	2017
South Laramie Water Supply	New Development	2012	I	$2,638,170	2017
Casper Raw Water Supply II	New Development	2013	I	$487,600	2018
Cheyenne Southern Pipeline	New Development	2013	I	$4,261,200	2018
Cheyenne Southern Pipeline	New Development	2014	I	$0	2018
Evansville Emergency Connection	New Development	2013	I	$141,370	2018
Fort Laramie Storage Tank	Rehabilitation	2013	I	$1,085,500	2018
Goshen Irrigation District Rehabilitation 2013	Rehabilitation	2013	II	$1,400,000	2018
Jeffrey City Water System Improvements	New Development	2013	I	$418,750	2018
Savery Creek Diversions Phase II	Rehabilitation	2013	II	$1,900,000	2018
Casper Zone 3 Improvements	New Development	2014	I	$3,685,000	2019
Central Wyoming Regional Elevated Tank	Rehabilitation	2014	I	$1,648,200	2019
Cheyenne Southern Pipeline Phase III	New Development	2014	I	$1,206,000	2019
Glenrock Transmission Pipeline	New Development	2014	I	$381,900	2019
Laramie North Side Tank	New Development	2014	I	$1,200,000	2019
Medicine Bow Transmission Pipeline	Rehabilitation	2014	II	$1,052,000	2019
Pine Bluffs North Well Field	New Development	2014	I	$1,811,000	2019
Rock River Transmission Line Replacement	Rehabilitation	2014	II	$1,159,100	2019
Goshen Irrigation District-Guernsey Spillway Rehabilitation	Rehabilitation	NA	NA	NA	NA
Hill Irrigation District-Guernsey Spillway Rehabilitation	Rehabilitation	NA	NA	NA	NA
Savery-Little Snake-Battle Creek Diversion	Rehabilitation	NA	NA	NA	NA
Wheatland No. 7 Well	New Development	NA	NA	NA	NA
				$74,996,180	

Table 5.7.2: WWDC Projects Completed in the Platte River Basin Since 2006

Project	Year Completed	Category	Source	Program	Actual Expenditures
33 Mile Pump Station	2013	MUN	GW	New Development	$129,827.53
Albin 2005 Well	2008	MUN	GW	New Development	$155,274.35
Burns Storage Tank	2013	MUN		New Development	$889,581.00
Casper Alcova Ditch Rehabilitation	2009	IRR	SW	Rehabilitation	$742,261.00
Casper Alcova Rehabilitation 2009	2010	IRR	SW	Rehabilitation	$83,855.00
Casper Paradise Valley Pipeline	2011	MUN	SW	New Development	$595,993.60
Casper Rock Creek Dam Rehabilitation	2011	MUN	RES	Rehabilitation	$834,150.00
Casper Zone III	2012	MUN	SW	New Construction	$1,873,847.71
Casper Zone IV Improvements	2012	MUN	GW	New Development	$475,538.10
Cheyenne's Granite Dam Spillway Improvements	2009	MUN	RES	Rehabilitation	$473,730.23
Chugwater Water Supply	2007	MUN	GW	New Development	$1,302,436.00
Glendo Well	2011	MUN	GW	New Development	$292,404.37
Glenrock Tank Rehabilitation	2008	MUN	GW	New Development	$846,617.26
Glenrock Well	2011	MUN	GW	New Development	$614,137.00
Goshen Rehabilitation 2009	2012	IRR/MUN	SW/R	Rehabilitation	$1,126,138.93
Goshen Rehabilitation 2011 Project	2013	IRR/MUN	SW/R	Rehabilitation	$1,100,000.00
Laramie County Archer Water Supply	2012	MUN	GW	New Development	$115,153,31
Laramie Water Management Project (meters)	2008	MUN	GW	Rehabilitation	$70,421,76
Mile-Hi Water Supply Project	2011	MUN	GW	New Development	$595,593.42
Pathfinder Modification Project	2013	MUN	RES	Dams/Reservoirs	$5,997,076.07
Pine Bluffs Deep Well 2009	2012	MUN	GW	New Development	$319,343.69
Pine Bluffs Lance, Fox Hills Well	2011	MUN	GW	New Development	$318,889.90
Poison Spider Pipelines	2013	MUN	GW/SW	New Development	$1,027,859.00
Rawlins Atlantic Rim Pipeline	2011	MUN	RES	Rehabilitation	$2,621,202.45
Rawlins Pipeline & Atlantic Rim Reservoir	2013	MUN	RES	Rehabilitation	$5,972,112.36
Rawlins Treated Water Tank Rehabilitation	2009	MUN	GW/SW	Rehabilitation	$1,154,298.00
Saratoga Well field	2010	MUN	GW	Rehabilitation	$3,079,680.00
Sundance Meadows Water Supply	2011	MUN	SW	New Development	$280,923.99
Torrington Water Supply	2008	MUN	GW	New Development	$3,391,795.00
Wardell Water Supply Improvements	2013	MUN		New Development	$4,206,458.93
Wheatland Black Mountain II Water Supply	2009	MUN	GW	New Development	$222,440.00
Wheatland Re-regulating Reservoirs	2010	IRR	SW	Rehabilitation	$74,591.00
Yoder Water Supply	2013	MUN	GW	New Development	$179,232.00
					$41,162,862,06

Weather Modification. In addition to the structural projects noted above that are completed or underway, the WWDC has also sponsored cloud seeding studies since 2005. Pilot programs were undertaken for six winters in Sierra Madre and Snowy Range Mountains and the researchers concluded the following (WWDC, 2014):

> *"A pilot program for the accumulation of evidence from statistical, physical, and modeling analysis suggests that cloud seeding is a viable technology to augment existing water supplies, for the Medicine Bow and Sierra Madre Ranges. While the primary statistical analysis did not show a significant impact of seeding, statistical analysis stratified by generator hours showed increases of 3-17% for seeded storms (Figure 3). A climatology study based on high-resolution model data showed that ~30% of the winter time precipitation over the Medicine Bow and Sierra Madre Ranges fell from storms that met the WWMPP seeding criteria. Ground-based silver iodide measurements indicated that ground-based seeding reached the intended target, and in some cases well downwind of the target. High-resolution modeling studies by NCAR that simulated half of the total number of seeding cases showed positive seeding effects between 10-15% (Figure 3).*
>
> *In spite of the result of no seeding effect from the primary randomized statistical experiment, ancillary studies, using physical considerations to stratify the RSE* (Relative Standard Error) *data, and modeling studies over full winter seasons, led to an accumulation of evidence from the statistical, modeling, and physical analysis which suggest a positive seeding effect on the order of 5 to 15%.*

Based on a potential increase in precipitation from seeded storms of 5 to 15%, affecting 30 to 80% of the cloud seeding impact area, the VIC hydrological model indicated an increased streamflow for Wyoming water in the NPRB ranging from 0.4 to 3.7%. Using the lower cost estimate for an operational cloud seeding program, along with the range of seeding effects and cloud seeding impact areas, the cost of the water ranges from $27 to $214 per acre-foot. Applying the higher cost operational program option with evaluation, the costs range from $53 to $427 per acre-foot."

Groundwater Supplies – Non-hydrologically Connected to North Platte River Surface Water. Examples of municipal wells that have been deemed to be non-hydrologically connected are the City of Rawlins's Nugget Wellfield and Town of Elk Mountain's well producing from the Cloverly Formation. In addition, the Town of Saratoga completed a new wellfield to serve as their primary municipal water supply, replacing a surface water supply from the North Platte River. A portion of the new wellfield is not hydrologically connected, but it has not been deemed to be entirely non-hydrologically connected in accordance with the 2001 Modified Decree methodology. Return flows that are not connected are considered accretions to the North Platte River in accordance with the PRRIP.

As future municipal water supplies are developed in the Basin, the state-funded feasibility studies consider and evaluate whether developing non-hydrologically connected groundwater sources is practical.

Non-hydrologically connected wells known as, "the Split Rock Wells" were further evaluated for meeting the Wyoming's Decree replacement water requirements in a WWDC-funded 2007 study. In addition, a screening process prioritized a long list of prospective sites throughout the Basin into the top ten locations for development of non-hydrologically connected groundwater supplies. The use of the wells for Decree replacement was not found to be cost effective; primarily due to prohibitively high electrical costs to pump water from the significant depth of the groundwater source at the best-selected site, which was the Split Rock Wells location west of Pathfinder Reservoir.

Municipal Irrigation Using Untreated Water. An example of municipal irrigation of untreated water is the new raw water wellfield developed by funding from WWDC and the City of Casper. The new wells serve the North Casper Athletic Complex and replace a surface water supply, which has had maintenance problems. The new wells also address expansions of new baseball fields at the Complex. Another raw water project is in the works for the University of Wyoming Golf Course in Laramie. Other municipalities and public entities within the Basin are evaluating the feasibility of developing new raw water supplies to meet irrigation needs.

Irrigation with Treated Municipal Wastewater. An example of municipal irrigation with treated water is the City of Cheyenne's BOPU non-potable reuse system that provides irrigation to green areas in the City. The first phase was completed in 2007 and the second phase was completed in 2009. In future phases, the City is planning to further expand the distribution system to serve additional customers. The wastewater is treated to WDEQ Class A standards. As defined by WDEQ Water Quality Chapter 12 Rules and Regulations, the Class A treated wastewater is allowed for irrigation of land with a potential for public exposure. Existing customers include parks, cemeteries, golf courses, and schools. With the anticipated growth in the customer base, Cheyenne BOPU anticipates doubling the size of the system to serve approximately 130 acres of green areas in the next 50 years. The system relies on non-native imported water that is available at the wastewater plants and

can be used to extinction. Other municipalities in the Basin are evaluating the feasibility of providing non-potable reuse water to irrigate green areas within their municipal boundaries.

Modification of Pathfinder Dam and Reservoir. The Pathfinder Modification Project has been completed. The 2.4 feet of spillway raise to Pathfinder Dam has recaptured 53,493 acre-feet of storage space in the reservoir that was lost to accumulated sediment. The Program administered through Reclamation operates a 33,493 acre-foot Environmental Account for the benefit of endangered species and their habitat in Central Nebraska. The State of Wyoming has the exclusive right to the remaining 20,000 acre-feet of storage space within the Wyoming Account that provides a firm yield of 9,600 acre-feet which is considered the last large water development opportunity developed to serve future municipal growth in the Basin. The State of Wyoming, through WWDC, has contracted with Casper, Rawlins, Mills, Evansville, and Glenrock for providing replacing water during periods of water rights administration. The Wyoming account also provides water for meeting Wyoming's replacement obligation for groundwater irrigation depletions in Goshen County under the 2001 Modified Decree.

Improving Agricultural Irrigation System Efficiencies. The Casper-Alcova Irrigation District provides irrigation water to approximately 23,500 acres with over 300 miles of canal and lateral infrastructure. The water supplies for CAID were authorized under the Kendrick Project with storage held within Seminoe Reservoir. CAID is located west of Casper and its water supply is diverted from the North Platte River. In 1982, the USBR, the City of Casper, and CAID executed a 40-year agreement concerning municipal water made available from an agricultural water conservation project. The City of Casper had agreed to pay for canal lining of portions of CAID's canal and lateral system. The benefits of this agricultural water conservation project accrue to storage within Seminoe Reservoir, so the City acquired up to 7,000 acre-feet of storage in Seminoe Reservoir based on the estimated annual water savings.

Other potential partnerships between agricultural entities and local governmental, industrial or environmental organizations could plan, design and implement successful water conservation projects that benefit the agricultural water users and provide for water supplies to meet existing and future water for municipal and industrial uses and/or recreation and environmental benefits.

5.8 PUBLIC INVOLVEMENT AND COMMUNICATION STRATEGY

5.8.1 Introduction

"If people work together in an open way with porous boundaries - that is, if they listen to each other and really talk to each other - then they are bound to trade ideas that are mutual to each other and be influenced by each other. That mutual influence and open system of working creates collaboration."

- Richard Thomas

This section presents an assessment of water related issues and opportunities within the basin from conversations held with interested parties. The content of this section has been prepared from information gathered from meetings held during the plan update period in various locations, and from an interest poll that was distributed in January 2016 to 260 residents of the Basin by WWDC staff.

5.8.2 Public Meetings

As a means of gathering concerns and relaying information, the WWDC advertised and arranged three meetings for stakeholders and interested parties in the basin including members of the original Basin Advisory Group. The meetings were held open house style and conducted in Saratoga, Casper, and Wheatland between January 27 and 29, 2015. Representatives from the WWDC, Wenck, SEO, and Water Resource Data System were present to meet attendees, receive input, and answer questions. Wenck displayed numerous aspects of the Basin Plan update to the various attendees at the meetings. However, attendance at the meetings was generally limited with the Saratoga meeting having the largest turnout. No specific issues were identified through these meetings. In addition, a project update was given at a public meeting on May 11, 2015.

5.8.3 Water Development Commission Poll

To develop additional perspective on water related concerns in the Basin, the WWDC (2016) coordinated a Google poll that asked numerous questions of the surveyed individuals. The distribution list for the poll originated from the Basin Advisory Group contact list database and Water Resource Data System Platte River local agency list. Of the 260 that were surveyed, 56 responded, but not necessarily to all the questions. The intent of the survey was to understand the water resource issues of current interest.

The results of the survey indicated a wide range of concern related to the top water resource issues, and indicated a majority believe there is insufficient water supply to provide for additional development. The top five issues included groundwater resources, water quality, effects of growth and development, agriculture, and water supply and scarcity. Groundwater resources were listed by 50% of the respondents, and water supply and scarcity was listed by 41% of the respondents. The next tier of concerns included fish and wildlife, conservation, and drought preparation. Drought was listed by only 34% of the respondents, despite the hydrologic droughts of 2002 and 2012. Approximately 58% of the respondents indicated they believed there was insufficient water in the Basin to provide for additional development, population growth, industry, and agricultural demand.

With respect to water resource data, the respondents varied in the data they use and what additional data they'd like to see collected. Sixty-two percent indicated they use available water resource data, and many indicated they would like to see additional hydrologic data collected. Their responses for additional hydrologic data included everything from precipitation data to groundwater levels to water quality and water usage in order to better understand and utilize the available resource. When asked whether water usage and

hydrologic data should be developed to improve planning in the basin, 60% of the respondents indicated they would like to see it happen.

The survey also assessed how frequently water providers or irrigators experience insufficient supplies. Most of the surveyed respondents (73%) indicated the question did not apply to them. Of the remainder, more than half indicated they experienced supply deficits at least 2 of every 10 years. The rest experienced a supply deficit only once every 10 years.

5.8.4 Public Meetings Conducted After Release of the Draft Platte River Basin Plan 2016 Update

Public meetings were conducted in Casper on February 13, 2017 and Laramie on February 16, 2017. Peter Gill, WWDC Project Manager; Mike Carnevale, Wenck Associates Project Manager; and Brandon Gebhart, HDR Project Manager presented the findings of the study. A slide show as shown in **Appendix 5-C** was presented to the attendees. Two comment letters were submitted from the public and are also presented in **Appendix 5-C**. Verbal feedback from the audience was also received and noted. Generally, regarding the administration of Wyoming water law in the Upper Laramie Subbasin, there was sentiment expressed to maintain the status quo.

5.8.5 Potential Public Information and Public Involvement Strategies

Communication is an exchange of ideas. The stakeholder groups and public may have good ideas that the WWDC staff and their contractors missed. Therefore, timely dissemination of information to the public is essential to keep effective lines of communication open. To facilitate public understanding and successful implementation of water resource development and enhancement projects, the following actions are being considered by the WWDC:

1. Twice annual or quarterly newsletters e-mailed to local governmental organizations, non-government organizations and interested parties with updates on projects underway in the basin, status of watershed plans, projects being considered for funding, regulatory/environmental issues and notices for meetings that are of interest to water users.

2. A WWDC booth at the Wyoming Water Development Association, county fairs in the basin and the Wyoming State Fair with reports, brochures and water related swag that brings attention to the basin planning, watershed planning and funding programs of the WWDC.

3. WWDC sponsored seminars and activities addressing basin, sub-basin or watershed water supply needs, planning efforts and funding opportunities for rehabilitation and new development projects (large and small).

4. Annual or bi-annual economic updates in each basin using data compiled by the Wyoming Department of Administration and Information.

5. WWDC is working with Conservation Districts to encourage development of small storage projects under the SWPP. These projects benefit agriculture, wildlife, and public recreation.

5.8.6 References

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Water Law and Water Administration - Summary of the Settlement of the Nebraska v. Wyoming Law Suit Filed in 1986 and Resolved in 2001

Prepared by:
Mike Purcell, P.E.
Reviewed by the Wyoming Attorney General
and
the Wyoming State Engineers Office

Introduction

The purpose of this document is to assist in the development of the North Platte Basin Planning Study being prepared by the Wyoming Water Development Program. The following is a summary of the settlement of the Nebraska v. Wyoming law suit filed in 1986 and resolved in 2001 (Settlement).

The following are the key points in the 1945 North Platte Decree that was amended by 2001 Modified North Platte Decree. These points are offered as a benchmark for the subsequent discussions.

1. Wyoming was enjoined from diverting water for the irrigation of more than 168,000 acres from the mainstem of the North Platte River above Guernsey Reservoir and its tributaries above Pathfinder Dam. *(The tributaries between Pathfinder Dam and Guernsey Reservoir were not included under this limitation.)*
2. Wyoming was enjoined from storing more than 18,000 acre-feet per year for irrigation above Pathfinder Dam.
3. Natural flow in the Guernsey Dam to Tri-State Dam reach was apportioned 75% to Nebraska and 25% to Wyoming during the irrigation season (May 1 through September 30).
4. The priority for filling the federal reservoirs was: 1) Pathfinder Reservoir; 2) Guernsey Reservoir; 3) Seminoe Reservoir; 5) Alcova Reservoir; and 6) Glendo Reservoir. *(The Inland Lakes were not included in this list.)*

It is also important to note what the 1945 Decree did not do:

1. Groundwater, as it pertains to acreage accounting or the apportionment of North Platte water below Guernsey Dam, was not discussed.
2. The 1945 Decree did not address the water of the Laramie River.
3. There were no consumptive use limitations.
4. There was no winter time (October through April) apportionment between the States except the reference to federal reservoir priorities.

Historically, Wyoming administered its water rights in a manner that recognized that each of the three North Platte River segments (above Pathfinder Dam, Pathfinder Dam to Guernsey Dam, and Guernsey Dam to the Wyoming/Nebraska state line) have their respective entitlements under the North Platte Decree. Therefore, during the irrigation season, each section is independently administered under Wyoming water law. For example, a call from a senior water right in Goshen County would not be administered against a junior water right

in Carbon County. Such a call would likely be considered futile given the complexity of the system between the appropriators. A call for regulation is considered futile when administering the junior water right would not benefit calling the senior water right. This practice was preserved in the settlement.

Key Dates and Corresponding Important Events Related to the Settlement

A time line of the events that impacted the settlement is presented below. The following list does not include all of the events that occurred during the litigation, just those that most affected the settlement.

October 6, 1986: The State of Nebraska filed its complaint against the State of Wyoming in the U.S. Supreme Court (Court). The complaint alleged Wyoming is violating or threatening to violate Nebraska's equitable apportionment by:

1. Depleting the flows of the North Platte River by the operations of Grayrocks Reservoir on the Laramie River.
2. Depleting the flows of the North Platte River by the proposed construction of the additional river pumping, diversion and storage facilities at the confluence of the Laramie and North Platte River. *(Corn Creek Project)*
3. Depleting the natural flows of the North Platte River by proposed construction of storage capacity on tributaries entering the North Platte River between Pathfinder and Guernsey Reservoirs. *(Deer Creek Project)*
4. Actions by state officials to prevent the United States Bureau of Reclamation's continued diversions of North Platte water through the Interstate Canal for storage in the Inland Lakes *(Entitlements of the Inland Lakes in Nebraska.).*

The issues in the original complaint were straight forward. However, the case became more complex as it was expanded based on requests by Nebraska and approvals by the Special Master and Court.

1988: Nebraska moved to amend its pleadings to seek injunctions against Wyoming, Colorado, and the United States prohibiting further depletions in order to protect wildlife habitat along the North Platte and Platte Rivers in Nebraska. The Supreme Court summarily denied Nebraska's motion without opinion. This issue surfaces later in the litigation and negotiations.

1991: Nebraska submitted a motion to amend its pleadings to:

1. Equitably apportion the un-apportioned, non-irrigation season flows of the North Platte River. This request would be denied by the Court in April 1993. However, this issue was again brought up by Nebraska during both the law suit and settlement negotiations.
2. Allege that Wyoming violated the Decree by allowing irrigation diversions greater than 1 cfs per 70 acres, allowing groundwater that is hydrologically connected to the North Platte River to be used to irrigate lands within the 168,000-acre limitation area, thereby exceeding the 168,000 acre limit, failing to keep accurate records on acres irrigated, depleting return flows and depleting natural flows in the river by allowing additional consumption of tributaries entering the North Platte River below Alcova Reservoir. The Court referred this matter to the Special Master.
3. Request that the U.S. be enjoined from increasing its depletion of storage water and natural flows in violation of the Decree, alleging that the U.S. had contracted for use

of storage water in Glendo Reservoir in Wyoming that were not authorized by the Decree. The Court referred this matter to the Special Master.

1993: In response to Wyoming's motions for summary judgment, the U.S. Supreme Court issued an opinion on the following issues:

1. The Court established that the Inland Lakes were to be filled on the basis of a priority date of December 6, 1904, the same priority as Pathfinder Reservoir. This issue will be discussed later in this report.

2. Despite arguments from Wyoming that the waters of the Laramie River were completely apportioned between Wyoming and Colorado in the 1922 Laramie River Decree, the Court found, while Laramie River flows were not apportioned in the 1945 North Platte Decree, those flows were considered and counted and, therefore, Wyoming could not freely dewater the Laramie River.

1994: Nebraska filed a motion to:

1. Add allegations that Wyoming's violations of the Decree included "reducing the flows of tributaries entering the North Platte River below Alcova by means of groundwater development, the depletions of return flows, and the construction of reservoirs."

2. Allege that re-regulation reservoirs and canal linings in the Goshen Irrigation District and Horse Creek Conservation District threatened to violate Nebraska's apportionment under the Decree.

3. Again allege the U.S. was violating the Decree by contracting for uses of water from Glendo Reservoir that were not authorized by the Decree.

4. Allege Wyoming was violating the Decree by the proposed Corn Creek Project, the construction and use of new pumping facilities on the Laramie River *(GID pump station)*, refusing to administer the minimum flow released under the Grayrocks Settlement Agreement, and reducing the Laramie River flows through groundwater development.

5. Seek an apportionment of non-irrigation season flows, including flows for wildlife and endangered species uses.

   The Court referred these matters to the Special Master, who accepted the first four matters, but denied the motion regarding the apportionment of non-irrigation season flows.

1995: In response to Wyoming's and Nebraska's (1994) motions to amend the law suit, the Supreme Court rendered a decision that:

1. Basically brought groundwater, federal storage administration, and other issues offered by Nebraska into the case.

2. Agreed with the Special Master that he could hear evidence on downstream interests, including evidence of injury to wildlife and wildlife habitat.

July 1, 1997: The Cooperative Agreement was executed in which Nebraska, Colorado, Wyoming, and DOI agree to develop the Platte River Recovery Implementation Program. *(This date becomes important during the development of each states depletions plan, which will be discussed later in this report.)*

September 10, 1997: Wyoming, Nebraska, Colorado, and the U.S. submitted stipulations pertaining to Glendo Reservoir, storage accounting above Pathfinder, conveyance (river carriage) losses, and Pathfinder Modification Project to the Special Master.

December, 1998: The parties submitted the "allocation stipulation" to the Court. However, Nebraska would not agree to the Wyoming and USBR proposal to resolve the groundwater issues.

May 10, 2000: The settlement teams completed the Principles of Settlement, which were approved by the Governors the evening before trial was to begin in Pasadena, California. The proceeding was suspended by the parties, subject to a Final Settlement Stipulation being submitted to and accepted by the Court.

March, 2001: The attorneys submitted the Final Settlement Stipulation and supporting documents to Special Master Owen Olpin.

October, 2001: Special Master Owen Olpin submitted his final report to the Court recommending approval of the stipulation.

November, 2001: The U.S. Supreme Court approved the settlement.

Final Settlement

The following discussion will attempt to provide additional background information of issues in the settlement in the order provided in the Joint Settlement Agreement, dated October 12, 2001, which we have informally designated as the "Brown Book." It is important to note that this paper is not meant to have sufficient detail to implement the settlement. The reader must read the settlement (Brown Book) to fully understand the implementation of requirements therein.

Article III of the Modified Decree-Inland Lakes

There had been a long standing disagreement between the USBR, Nebraska and Wyoming as to the priority date under which the Inland Lakes should be filled. The historic practice allowed the Inland Lakes to fill under the same priority date as Pathfinder Reservoir. The USBR and Nebraska believed this was appropriate as the Inland Lakes and Pathfinder Reservoir were designated as components of the federal North Platte Project and, therefore, should have the same priority date. Wyoming contended that, unlike Pathfinder Reservoir, the Inland Lakes did not have a Wyoming water right that allowed the diversion of water in Wyoming for the Inland Lakes. Further, the Inland Lakes were not included in the priority for filling federal reservoirs within the 1945 Decree.

In 1993, the Supreme Court established that the Inland Lakes were to be filled on the basis of a priority date of December 6, 1904, the same priority as Pathfinder Reservoir. This ruling gave the USBR the right to divert 46,000 acre-feet of water during the months of October, November, and April for storage in the Inland Lakes. While there was some discussion about timing and quantity of deliveries during the negotiations, this 1993 decision basically resolved the matter and maintained the status quo, as outlined in the Natural Flow and Ownership Procedures.

Appendix C-Amendment of the 1953 Order to Provide for Use of Glendo Storage Water

Nebraska alleged that the U.S. was violating the Decree by contracting for uses of water from Glendo Reservoir that were not authorized by the Decree. The 1953 Stipulation to the Decree limited the allocated use of Wyoming's Glendo storage water to irrigation purposes in southeastern Wyoming below Guernsey Reservoir. The U.S., through the USBR,

contracted Glendo storage water for short term municipal and industrial use upstream of the reservoir through exchanges and temporary water use agreements. Wyoming approved these transactions through provisions of Wyoming water law. Interestingly, Nebraska was also bending the restrictions within the Decree in the use of its allocation of Glendo storage water. Nebraska's use of Glendo storage water was limited to irrigation purposes in the North Platte River basin in western Nebraska. A portion of Nebraska's storage water allocation was being contracted for, delivered to, and stored in Lake McConaughy for hydropower and irrigation uses downstream of western Nebraska in the Platte River Basin, below the confluence of the North and South Platte Rivers.

It was apparent that the DOI, Nebraska, and Wyoming wanted additional flexibility in the use of Glendo storage water. The settlement, as documented in Appendix C, gives unrestricted use to Nebraska and Wyoming for its respective share of storage in Glendo Reservoir below Guernsey Reservoir and in the Platte River Basin, subject to contracts with the USBR, ESA, and NEPA compliance.

Appendix C also provides provisions whereby Wyoming's allocation of Glendo storage water may be used upstream of Glendo Reservoir, subject to certain specified mitigation of lost return flow downstream of Glendo Reservoir. Appendix C also allows that the mitigation for return flow may be used for environmental purposes downstream of Glendo Reservoir to provide mitigation for the upstream use, if mandated by the valid exercise or enforcement of federal law within Wyoming.

In addition, Appendix C allows for the use of Glendo storage water for fish and wildlife purposes downstream of Glendo Reservoir subject to the approval of the USBR and the respective state to which the water is allocated. This provision allows for the use of the storage water by the Platte River Recovery Implementation Program.

Appendix D-Procedures for 1945 Decree Paragraph II(b) [now paragraph II(e) of the Modified Decree] Storage Accounting

The 1945 Decree allows Wyoming to annually store a total of 18,000 acre-feet of water for irrigation purposes from the North Platte River and its tributaries above Pathfinder Reservoir between October 1 and September 30. In order to meet its annual reporting obligations regarding the amount of water stored in the area, State Engineer personnel visited and manually measured the storage in as many of the 85 reservoirs in this area as possible. Admittedly, the accuracy of the measurements could be questioned as access to many of

the reservoirs was limited due to their remote locations and snowpack in the spring. However, Wyoming was sure that it was logistically unlikely that the limitation was being exceeded.

Nebraska alleged that the annual storage accounting completed by Wyoming was inadequate and incomplete. While it was probably not admitted, this was an easy matter to resolve as Wyoming officials wanted a less cumbersome and more accurate means to measure the annual storage in the reservoirs. Therefore, Wyoming agreed to install and monitor measuring devices on the eight largest reservoirs in the specified area, which stored over 60% of the allowed 18,000 acre-feet capacity. Appendix D also establishes monitoring requirements for smaller reservoirs and requires the installation of measuring devices on any new reservoirs with a capacity in excess of 600 acre-feet. As a matter of policy, Wyoming decided to ultimately invest more into measuring devices for the largest eleven reservoirs to more closely monitor Wyoming's use of storage water.

Appendix E-Stipulation Among the State of Wyoming, the State of Nebraska, and the United States Relating to the Allocation of Water During Periods of Shortage

The federal North Platte Project consists of Pathfinder Reservoir and Guernsey Reservoir in Wyoming and the Inland Lakes in Nebraska. The project provides storage water for irrigators in eastern Wyoming and western Nebraska. The irrigators in Nebraska enjoy approximately 80% of the benefits of the North Platte Project, while the major storage facilities are located in Wyoming and are administered under Wyoming water law and the Decree. Nebraska was concerned that Wyoming would allow its appropriators to operate in a manner that would impact the inflow entitlements of the North Platte Project.

Wyoming alleged that the U.S. was violating the Decree in its allocation of storage water. Wyoming believed that the U.S. operating procedures were inconsistent and haphazard.

In 1988-89, the Area Manager for the USBR made a call for administration of water rights for the benefit of Pathfinder Reservoir and other federal reservoirs. The Wyoming State Engineer honored the call for the non-irrigation season. The water rights administration ended on May 1, the beginning of the irrigation season. Wyoming's logic was that the irrigators upstream of Pathfinder Reservoir were entitled by the Decree to irrigate a specified number of acres during the irrigation season (May 1 through September 30). In addition, the issue of sectionalized administration of the North Platte River was considered which, in part, was to administer the upper basin above Pathfinder Dam independent of the downstream river segments from Pathfinder to the state line.

The purpose of this stipulation was to define criteria that would be used to initiate and administer future calls. It must be emphasized that this stipulation only addresses calls in the months of February, March, and April for the benefit of Pathfinder, Guernsey, and Glendo Reservoirs and in April for the Inland Lakes. The issue of the water rights administration in the irrigation season for the benefit of these reservoirs was discussed but never resolved with the parties agreeing to disagree without impacting their respective positions on the matter.

The parties reviewed historic information provided by the USBR regarding the water usage of the North Platte Project in Wyoming and Nebraska. It was agreed that if the annual forecasted supply (including carryover storage) is less than 1,100,000 acre-feet, it would be considered a time of shortage and an allocation would be declared. The USBR generates the forecasts based on the amount of water stored and forecasted inflow through July.

Appendix E introduces and memorializes the concept of "separate storage accounts" during allocation years. Water available to the North Platte Project is allocated first to each state and then the states' allocation is allocated to each federal North Platte Project storage contractor within that state. Each contractor independently decides the amount of its allocation it wants to use during the irrigation season of the allocation year. If a contractor decides not to use all of its allocation, that contractor may enjoy the benefits of the carryover storage the following year. Section C of Appendix E provides extensive examples regarding the accounting for and use of the carryover storage.

Exhibit 5 (Procedure for Administration Upstream of Guernsey Reservoir during Allocation Years) provides additional information on this issue, which will be discussed later in this report.

Appendix F-Amendment of the 1953 Order to Provide for the Modification of Pathfinder Reservoir

In the late 1970's, the Wyoming Legislature provided for the funding for the Cheyenne Stage II Trans-basin Diversion Project. As this was the first project funded under the

Wyoming Water Development Program, there was considerable debate and discussion related to the funding. In order to secure support for the project, the Laramie County delegation promised that they would support funding for a storage project in the Little Snake River Drainage. This promise was maintained until the High Savery Project was constructed in the early 2000's. In addition, the funding statutes for the Cheyenne Stage II Project discussed the potential of a Stage III Project. The Stage III was another trans-basin diversion project that would serve municipalities in the North Platte Basin. A joint powers board made up of representatives from Casper, Mills, Evansville, Rawlins, Edgerton, Midwest, Glenrock and others was formed to sponsor the Stage III Project and participate in the feasibility studies being conducted by the WWDC. Unfortunately, the feasibility studies concluded that the trans-basin project was cost prohibitive and that acquisition of the needed special use permits on the Medicine Bow Forest would be very difficult, if not impossible, to obtain. Therefore, the WWDC turned its attention to storage projects located in the North Platte River Basin in Wyoming.

The best in-basin project was the Deer Creek Dam and Reservoir Project. The project was a 66,000 acre-foot reservoir on Deer Creek, a tributary of the North Platte River between Pathfinder and Guernsey Reservoirs. Obviously, the project would deplete the flows of the North Platte River. The Wyoming State Engineer and Division I Superintendent initially contended that the reservoir would not be administered for water rights on the main stem of the North Platte River, including rights of the federal reservoirs, as the tributaries in this portion of the basin were not expressly addressed in the Decree. The yield of the reservoir would be approximately 22,000 acre-feet per year without such regulation, 9,600 acre-feet per year with regulation for the downstream federal reservoirs in Wyoming, and 6,400 acre-feet per year if, in addition, the reservoir was regulated in April for the Inland Lakes in Nebraska. The WWDC was committed to the project despite the outcome of the water right deliberations and agreed to address yield scenarios in the environmental impact study for the project. In order to resolve the matter of the water rights for the Inland Lakes, in part, to better define the operations of the Deer Creek project, the Wyoming Attorney General's Office filed suit against the USBR in state district court on October 3, 1986. Three days later, Nebraska filed its complaint with the U.S. Supreme Court. Wyoming's law suit against the USBR was stayed and ultimately dismissed.

At the time of the complaint by Nebraska, the design of the Deer Creek Project was 95% complete, land was acquired, water rights were issued, and the federal dredge and fill 404 permit had been secured from the U.S. Army Corps of Engineers. Construction was to begin in the spring of 1987.

As previously noted, the construction of the Deer Creek project was one of the issues cited in Nebraska's complaint. As the negotiations progressed, it became apparent that Nebraska was not necessarily concerned about the development of a new water supply for the Wyoming municipalities. However, Nebraska was concerned about the precedent established by the federal 404 permit for the project. The permit required the acquisition of endangered species habitat in the Central Platte River basin. Wyoming achieved this requirement through the purchase of 470 acres near Kearney, Nebraska. However, there were no conditions within the permit requiring Wyoming to provide water to offset depletions resulting from the operation of the Deer Creek Project. Wyoming convinced the USACE that any water provided to offset depletions would not arrive at the critical habitat because Nebraska would not or could not protect the water from the state line to the habitat. Therefore, Nebraska was very concerned that Wyoming was permitted to build a storage project by simply buying and retiring Nebraska land without providing mitigation for water depletions. Ultimately, Nebraska filed suit against the USACE in Nebraska District Court challenging the 404 permit for the Deer Creek Project. The case was designated as Jess v. West. Colonel West was the head of the Omaha District of the USACE. There was another

underlying concern shared by Nebraska and the USBR. Nebraska and the USBR were concerned about Wyoming's administration of the Deer Creek Dam, given the initial position of Wyoming water officials that the project should not be regulated for main stem rights, including the rights of the federal reservoirs.

John Lawson and Ken Randolph of the USBR came up with the concept of the Pathfinder Modification Project (PMP). The concept was derived from the precedent established in the enlargement of the Buffalo Bill Dam near Cody, Wyoming. Storage space lost to sediment was recaptured as a component of the enlargement. Water was allowed to be stored in the recaptured space under the original water right. Lawson and Randolph presented their idea to Mike Purcell, Director of the Wyoming Water Development Program. The WWDC acquired funding for the evaluation of the concept. The USBR and WWDC completed feasibility studies which indicated that the proposal had merit.

The Project was accomplished by raising the elevation of the existing spillway by approximately 2.4 feet with the installation of an ogee crest to recapture the 53,493 acre-feet of storage space lost to sediment. Section 1 of Appendix F states, in part: *"The recaptured storage space would store water under the existing 1904 storage right for Pathfinder Reservoir and would enjoy the same entitlements as other uses in the reservoir with the exception that the recaptured storage space could not place regulatory calls on the existing water rights upstream of Pathfinder Reservoir other than the rights pertaining to Seminoe Reservoir."*

During the evaluation of the feasibility of the PMP, hydrologic analyses relating to the potential effects of the project were completed. Based on these analyses, it was apparent that the impacts of the project would be borne primarily by the Kendrick Project (Seminoe Reservoir), as its water right was junior to the reservoirs within the North Platte Project. Moderate impacts were also identified to the North Platte Project (Pathfinder, Guernsey, and Inland Lake Reservoirs). It was understood that these and other impacts would need to be mitigated in order to obtain the change in federal authorization from Congress, the partial change of use for the Wyoming water right for Pathfinder Reservoir from the Wyoming Board of Control, and approval by the Wyoming legislature to export water from the project.

These impacts have been addressed in the following manner:

1. Section 5 of the stipulation states: *"In order to address the effects the Pathfinder Modification Project may have on contractors for water from Glendo, Pathfinder and Seminoe Reservoirs in Wyoming, upon completion of the Pathfinder Modification Project, Wyoming will pay the Wyoming and Nebraska federal storage water contractors' share of the Safety of Dams Modifications to the federal reservoirs to be implemented by the Bureau of Reclamation in the near future."* Funds have been appropriated and deposited in the project's debt service account to pay the federal contractors' share of dam safety requirements that have or may be imposed on these dams.

2. Section 6 of the stipulation states: *"In order to address the effects the Pathfinder Modification Project may have on the Kendrick Project, upon completion of the Pathfinder Modification Project, Wyoming will assist the Casper Alcova Irrigation District with the resolution of existing selenium issues that are impacting its existing operation."* The WWDC, through an agreement with the Attorney General's Office, has been working with the Casper Alcova Irrigation District to improve the efficiency of its irrigation water delivery system to enhance water conservation and assist in the resolution of selenium issues within the boundaries of the district.

3. The hydrologic analyses completed in the feasibility stage of the Project indicated that the Project could affect the water levels of Seminoe and Pathfinder Reservoirs. In response, the WWDC and Wyoming Game and Fish Department completed a mitigation plan with a $2M budget for reservoir fisheries.

4. Some water users in the Upper North Platte River Basin expressed concern that the project could increase the number of months in which the USBR advises that an allocation is likely resulting in additional water right administration in the basin. Exhibit 5-Procedure for Administration Upstream of Guernsey Reservoir was amended to address these concerns. The amendments will be discussed later in this report.

The Environmental Account within the Pathfinder Modification Project is comprised of 33,493 acre-feet of the recaptured space. It is operated by the PRRIP through the USBR, for the benefit of the endangered species and their habitat in Central Nebraska. The Environmental Account is the state's contribution to the PRRIP on behalf of its water users as it will serve as the reasonable and prudent alternative under the ESA for the depletions occurring in Wyoming on or before July 1, 1997. The PRRIP will be discussed later in this report.

The State of Wyoming, through the Wyoming Water Development Program, has contracted with the USBR for the exclusive right to use 20,000 acre-feet of the enlargement capacity in a Wyoming Account. The USBR operates the 20,000 acre-feet of storage to provide a firm annual yield of 9,600 acre-feet. This is the same yield that was anticipated from the proposed Deer Creek Dam and Reservoir.

The Wyoming Account serves the following purposes, <u>in order of priority</u>:

1. A supplemental water supply for Wyoming's municipalities during times of water rights regulation.

2. A replacement water supply to meet certain obligations agreed to in the Nebraska v. Wyoming settlement agreement, which will be discussed later in this report.

3. A replacement water supply to mitigate water use in excess of Wyoming's existing water related baselines defined in Wyoming's Depletions Plan for the PRRIP.

4. An additional water supply for the PRRIP under temporary annual lease agreements with the WWDC if there is water remaining after the first three purposes have been met.

The Stage III Project and the Deer Creek Dam were proposed as municipal water supply projects. The operation of the Pathfinder Modification Project is similar to that proposed for the Deer Creek Dam. The WWDC realized Deer Creek Dam, now PMP, was probably the last opportunity to develop water for future municipal growth and wanted to make sure the water was used for this purpose. Therefore, municipalities cannot access storage in PMP unless their water rights are being administered. A maximum water use from the PMP for any individual users within the municipalities' service boundaries is 100 acre-feet per year to ensure that the water will not be used for future industrial development. These conditions are documented in the stipulation and in the water supply contracts with the municipal customers.

The operating plans for the customers allows for exchanges with the irrigation account in Pathfinder Reservoir, so that municipal customers above and below Pathfinder Reservoir can benefit from the project. The municipalities continue to divert even though their water rights are being administered. Their water in the PMP replaces their depletions (diversions less measurable return flow) that occurred during administration. The depletion information

must be submitted by the customers to the Wyoming State Engineer for verification and approval. The approved depletion is deducted from the customer's storage water in the PMP and added to the irrigation account in Pathfinder Reservoir.

Appendix G-North Platte Decree Committee Charter

Before the law suit, communication between the water officials of Nebraska and Wyoming was limited to focusing on the annual "Natural Flow and Ownership" meeting which annually discussed the reservoir storage, river operations, and delivery of water. The communications to solve differences of opinions on legal matters and differences between federal and state regulations were contentious.

The North Platte Decree Committee (NPDC) was established by the parties to improve communications among the parties and serve to solve problems before they became contentious. The Charter addresses the organization and powers of the NPDC.

Exhibit 1 - NPDC Representatives' Mailing Addresses-No comments needed.

Exhibit 2 - North Platte River Ownership and Natural Flow Accounting Procedures for Water Year 2000

These procedures are subject to annual review, revision, and adoption by the parties. One of the powers and authorities of the NPDC is to review and modify the North Platte Ownership and Natural Flow Accounting Procedures. The NPDC will review the procedures and adopt changes, as deemed appropriate, during its spring meeting. The 2000 version of the procedures was incorporated in the "Brown Book" as an example and a place-holder for future NPDC deliberations.

Exhibit 3 - Water Administration of the Lower Laramie River System Relating to Basin Electric Power Cooperative's Water Rights

This document, between Wyoming and Basin Electric Power Cooperative (BEPC), was prepared to clarify and modify the administration of the operation of the Laramie River from the gaging station above Grayrocks Dam to the mouth of the Laramie River at its confluence with the North Platte River. The modifications were necessary to accommodate previous Board of Control decisions and the Final Settlement Stipulation. The following background information is offered.

The Grayrocks Reservoir is owned by the BEPC and is operated to provide water to the Laramie River Station. The reservoir has a capacity of approximately 104,000 acre-feet. In October 1978, during the construction of the Grayrocks Dam, the State of Nebraska, along with several environmental groups, filed a complaint in Nebraska District Court against BEPC and the U.S. Army Corps of Engineers, contending that the environmental impact statement, which was the basis for the issuance of the federal 404 dredge and fill permit, did not adequately address impacts to the endangered species and their habitat in the Central Platte River in Nebraska. They requested and received an injunction on the construction of the Grayrocks Dam and Laramie River Station. As construction of these facilities was well underway, BEPC was forced to negotiate with Nebraska and the other parties, as the costs of construction were being drastically impacted by the injunction.

A preliminary agreement was reached in 28 days and the injunction was lifted. The final "Agreement of Settlement and Compromise" (ASC) was dated December 4, 1978. BEPC was required to provide $7.5M which was used to establish the Whooping Crane Trust. In addition, BEPC was required to increase the minimum flow releases previously specified in the 404 permit. The purpose of the increased flows downstream from the dam was for fish

and wildlife purposes. Nebraska brought its claims in the law suit despite the fact that BEPC had fully complied with all provisions of the 1978 ASC.

The commitment to increase the minimum flow releases put a strain on the yield of Grayrocks Reservoir. Further, a portion of the storage in Grayrocks Reservoir was obligated through a separate arrangement with the Corn Creek Irrigation District for the Corn Creek Project.

The Corn Creek Irrigation District was proposing the construction of river pumping, diversion and storage facilities which would deplete flows at the confluence of the Laramie and North Platte River. Nebraska's 1986 complaint is related to the Corn Creek Project, which was listed among the projects to be considered by the Wyoming Water Development Program. The project proposed the installation of large alluvial wells and construction of a pump station and pipeline, which would deliver water to a proposed Teeters Reservoir. The stored water would be used to develop additional irrigated acres in Goshen County. The Corn Creek Irrigation District (CCID) was the project proponent. At the time that Nebraska filed its complaint, the project was on "hold" status within the Wyoming Water Development Program as it did not appear to be economically feasible. The CCID had contacted the USBR in Mills, Wyoming and reserved Wyoming's share of the unallocated storage water in Glendo Reservoir, which was approximately 10,600 acre-feet. In addition, the CCID was a partner, of sorts, in the Grayrocks Reservoir. The CCID secured state funding for a proportion of the costs of Grayrocks Reservoir through loans provided by the State Farm Loan Board. The CCID made the payments on the loans from funds provided by BEPC. In return, CCID received a markup from BEPC on each payment made. In addition, CCID had an entitlement to 22,500 acre-feet of water from Grayrocks Reservoir. If the Corn Creek Project ever became a reality and exercised its entitlements, the ability of the reservoir to meet the demand of the Laramie River Station would be further impacted.

The amount of the minimum flow releases is predicated on reservoir levels in Grayrocks Reservoir.

If the storage in Grayrocks Reservoir is less than 50,000 acre-feet, the required releases are reduced. This explains Nebraska's desire to protect inflows into Grayrocks Reservoir and the concern that the Corn Creek Project would reduce the storage in the reservoir.

Nebraska's concerns about the protection of the flows below Grayrocks Reservoir were based on the potential implementation of the Corn Creek Project. However, Nebraska was also concerned about water rights held by the Goshen Irrigation District (GID) on the Laramie River. GID held a senior 100 cfs supplemental water right to divert from the Laramie River just upstream of the confluence with the North Platte River, which had been reduced through a prior abandonment action to 25 cfs. GID requested and received funding from the WWDC to construct a pump station to allow for a more efficient use of the right. Therefore, the GID pump station and the Corn Creek Project could do real damage to the minimum flow releases with respect to their use by Nebraska as they were considered by the State Engineer to be natural flow available for diversion downstream of Grayrocks Reservoir. However, there were no provisions requested of or granted by Wyoming to protect the minimum flow releases to the mouth of the Laramie River and, certainly, not to the Nebraska/Wyoming state line.

Nebraska's Laramie River claim that Wyoming had consistently refused to administer the releases provided by the BEPC and Nebraska settlement was addressed, in part, by suggestions from the Wyoming State Engineer. In the mid-1990's, BEPC sought and obtained a modification of its water storage rights in Grayrocks Reservoir to include environmental and wildlife uses. BEPC also obtained a secondary permit which allowed for the protection of storage releases to the mouth of the Laramie River for environmental and

wildlife purposes. These BEPC and Wyoming Board of Control actions, along with the fact that Nebraska had previously agreed to the Corn Creek Project in its settlement with BEPC, resulted in the dismissal of Nebraska's claims in the Nebraska v. Wyoming law suit relating to Corn Creek on March 26, 1999.

Nonetheless, as part of the settlement, Wyoming agreed to acquire the rights pertaining to the Corn Creek Project and to cancel all water rights and BEPC obligations to provide water to the project. The logic of this agreement was that Wyoming wanted to secure the remaining 10,600 acre-feet of Glendo storage water, which was being reserved by the USBR for the CCID. Wyoming needed this water to provide replacement water for wells and diversions on the tributaries and drains below Whalen Diversion Dam. The transactions related to the demise of the CCID have been completed by Wyoming and the WWDC has secured a long term contract for the Glendo storage water.

In addition, GID was not utilizing its new pump station. The District was concerned about the pumping costs. Therefore, Wyoming, through the Attorney General's Office, purchased and demolished the pump station and abandoned its water rights. *(See Paragraph VI.B of the Final Settlement Stipulation.)* Wyoming was to change the use and point of diversion of the water right to the confluence of the Laramie and North Platte Rivers. However, there was not sufficient historic use of the water right to support a successful request for such changes by the State Board of Control.

In any event, Exhibit 3 serves as a tool for the administration of Grayrocks Reservoir and documents the changes in that administration resulting from the settlement of the law suit. Exhibit 3 was executed by the Wyoming State Engineer and BEPC. However, the document cannot be modified without the approval of the NPDC and BEPC.

Exhibit 4: Procedure for Administration Upstream of Guernsey Reservoir Acreage Accounting

In 1991, Nebraska alleged that Wyoming violated the Decree by allowing groundwater that is hydrologically connected to the North Platte River to be used to irrigate lands within the 168,000-acre limitation area, thereby exceeding the 168,000 acre limit and failing to keep accurate records on acres irrigated. The Special Master's response to groundwater issues will be discussed later in this report.

Historically, Wyoming had come very close to exceeding the limitation of 168,000 acres in the original Decree. The original limitation addressed the acreage irrigated from the mainstem of the North Platte River above Guernsey Reservoir and its tributaries above Pathfinder Dam. The acreage on the tributaries between Pathfinder and Guernsey Reservoir was not included. Nebraska was interested in extending the acreage limitation to include these tributaries. Wyoming was interested in improving its position under the acreage limitation. The issue was resolved by the agreement that Wyoming may irrigate no more than 226,000 acres between the Colorado/Wyoming state line and Guernsey Reservoir, exclusive of the Kendrick Project. Basics of the agreement included:

1. Wyoming agreed to provide a base map on the irrigated acres to Nebraska for review. Further, Nebraska officials were allowed to review Wyoming's annual acreage reporting methods.

2. Acres irrigated by hydrologically connected groundwater wells were included under the revised acreage limitation. A hydrologically connected groundwater well was defined as a well that is so located and constructed that if water is pumped continuously for 40 years, the cumulative stream depletion would be greater than or equal to 28% of the total groundwater withdrawn by that well. "Green Area Maps" were developed, reviewed, and approved by NPDC. Green Area Maps identified those

areas in which groundwater wells would not be considered hydrologically connected for the purposes of the Modified Decree. In addition, existing and proposed wells outside the "Green Areas" would not be considered hydrologically connected if the well owners could verify that their wells did not meet the criteria for hydrological connection.

3. Previously, vegetation along ditches and canals, sub-irrigated lands, and other riparian vegetation that was likely the result of irrigation were counted as irrigated acreage. This procedure rectified this situation by defining irrigated lands to be counted against the Modified Decree limitations as lands that in any year are "intentionally irrigated." Intentionally irrigated lands is the acreage irrigated through the efforts of man using a ditch delivery system or pump from surface water, hydrologically connected groundwater, or reservoir storage. This new definition added clarity to the recording, mapping and reporting processes. The term "intentionally irrigated" is now applied to Wyoming's annual acreage inventory.

4. Acres that are irrigated solely from reservoirs are also included under the limitation. This was not a major issue as most of the storage in the existing reservoirs is used as a supplemental supply to acreage already included under the limitation.

5. Nebraska was adamant that the acreage limitation should be divided between the area from the Colorado/Wyoming state line to Pathfinder Reservoir and from Pathfinder Reservoir to Guernsey Dam, including the tributaries in this lower reach. Nebraska cited that the irrigation efficiency and consumptive use per acre was higher in the lower basin and they feared Wyoming would move acreage from the upper basin to the lower basin, thus potentially increasing the depletions to the North Platte River. As per the original Decree, Wyoming had been measuring all irrigated acreage above Pathfinder and along the main stem of the North Platte River. However, there was no historic, reliable information on the acres being irrigated under the tributaries between Pathfinder Dam and Guernsey Reservoir.

Therefore, Wyoming was concerned about splitting the acreage limitation between the upper and lower basins. The compromise was to agree to a total acreage limitation of 226,000 acres above Guernsey Reservoir, exclusive of the Kendrick Project, with the requirement that the acreage limitation be split by Wyoming between the upper and lower basins after 10-years of experience. This split has been successfully completed.

The following table compares the acreage measured in 2009, the year in which the most acres were irrigated since the settlement, to the split submitted to the NPDC and approved by the Court in 2011.

Above Pathfinder	**2009 Actual**	**2011 Split**
Surface Water	148,639	
Sole Source Reservoir	924	
Groundwater	1,177	
Transfers	1,826	
Subtotal	152,566	169,100
Pathfinder to Guernsey	**2009 Actual**	**2011 Split**
Surface Water	32,589	
Sole Source Reservoir	2,897	
Groundwater	1,909	
Mainstem	11,969	
Transfers	2,208	
Subtotal	51,572	56,900
TOTAL	**204,137**	**226,000**

Exhibit 5: Procedure for Administration Upstream of Guernsey Reservoir during Allocation Years.

Water Rights Administration

At the time of the first delivery of storage, if the forecasted supply for the North Platte Project is less than 1,100,000 acre-feet in any one year, that year becomes an "allocation year" (see Appendix E). The forecasted supply, estimated beginning in October, and then again monthly from February through June, is the sum of the existing storage water in Pathfinder and Guernsey Reservoirs and the storable forecasted inflow into both reservoirs. In an allocation year, it is deemed that the USBR has placed a priority call for the federal reservoirs in the months of February, March, and April. This simply means that the USBR does not need to send a letter requesting the call for water rights administration. The call must undergo the same scrutiny as any other calls under Wyoming water law, in that, the Wyoming State Engineer determines whether the call is valid and warrants the regulation of water rights upstream of the calling right. The automatic call is sectionalized. If the call is deemed to be valid, there is water rights administration upstream of Pathfinder Reservoir for the benefit of Pathfinder Reservoir during the months of February, March, and April. In addition, there is water rights administration between Pathfinder and Guernsey Reservoirs for the benefit of Glendo Reservoir and Guernsey Reservoir in February, March, and April and the Inland Lakes in April. Wyoming favored this approach for the following reasons:

1. It would equitably resolve and provide consistency on the long standing issue regarding the administration of the federal water rights under state law as influenced by the North Platte Decree.
2. The procedure recognizes and documents Wyoming's position regarding sectionalized administration of the North Platte Basin in Wyoming.
3. The call and any resulting administration ends on May 1, the beginning of the irrigation season.

Water users upstream of Pathfinder Reservoir had long been concerned about water right administration for the benefit of Seminoe and Pathfinder Reservoirs and the resulting impacts on their water supply. Their primary concern was water right administration in the irrigation season. However, some of the water users were concerned that the Pathfinder Modification Project would result in additional allocation years and, therefore, cause additional regulation in the non-irrigation season. The Town of Saratoga filed a partial abandonment action to abandon the 53,493 acre-feet of storage space that was to be recaptured by the Pathfinder Modification Project. Ultimately, the Town of Saratoga's request for abandonment was withdrawn. The water users then formally protested the USBR's application to the Wyoming Board of Control for the partial change of use of the storage right for Pathfinder Reservoir needed to implement the Pathfinder Modification Project.

This matter was resolved in a "Stipulation and Settlement Agreement," dated October 16, 2008 between the Upper North Platte Valley Water Users, the Upper North Platte Valley Water Conservation Association, the USBR, and the WWDO. The USBR agreed to stipulate that the operation and use of the 53,493 acre-foot portion of Pathfinder Reservoir would not result in requests for water right administration. On October 15, 2007, the NPDC adopted revisions to Exhibit 5. The revisions established a new methodology for the calculations to insure the Pathfinder Modification Project would not increase the number of allocation years. The Board of Control Order approved the change of use on January 26, 2009. The Order states, in part:

"The recaptured storage space would store water under the existing 1904 storage right for Pathfinder Reservoir and would enjoy the same entitlements as other uses in the reservoir <u>with the exception that the recaptured storage space could not place regulatory calls on existing water rights upstream of Pathfinder Reservoir</u> other than the rights pertaining to Seminoe Reservoir." (Emphasis added.)

Cumulative Irrigation Diversion Procedure

It is not effective for irrigators diverting from the North Platte River between Pathfinder and Guernsey to construct and operate surface water diversions in the river. Therefore, pumps are used. Historically, irrigators along the North Platte River had difficulty delivering their water at the prescribed rate in their water right (1 cfs or 2 cfs/70 acres). It was inefficient to pump at these low rates, plus the fluctuating river levels and flows added difficulties. Often, the SEO hydrographers allowed these irrigators ("the pumpers") to deliver more water for shorter durations. For example, the pumpers were allowed to pump 4 cfs or 8 cfs/70 acres for a period of 6 hours. The impact to the river was the same as though the pumpers delivered 1 cfs or 2 cfs/70 acres for a period of 24 hours.

Nebraska and the USBR questioned this practice. Ultimately, it was agreed that the practice could continue. However, metering of all pumpage was required and a limitation on pumpage was established during allocation years. In an allocation year, the cumulative volume amount of water that can be pumped from this reach for irrigation purposes is 6,600 acre-feet per 2 week period.

Exhibit 6: Procedure for Consumptive Use Accounting

Nebraska wanted to add limitations to Wyoming's consumptive use of water throughout the settlement. Wyoming balked because such limitations seemed unwarranted and Nebraska's views of the limitations were too restrictive. It became apparent later in the negotiations that there may not be a settlement unless a concession was made by Wyoming on this

matter. Ultimately, a solution was reached which would provide some certainty to Nebraska, while maintaining flexibility for Wyoming. Information from the Wyoming and Nebraska technical experts in the law suit was combined to come up with the final detailed methodology and procedure to calculate the consumptive use of irrigation water. It was recognized by the settlement parties that the methodology was not necessarily technically correct (due to the limited data and information gaps across a large river basin), but it was deemed politically acceptable despite its imperfections. The consumptive use limitation, expressed as a volume of water for the irrigation above Pathfinder Dam, is 1,280,000 acre-feet for a period of 10 consecutive years and the consumptive use limitation for the area between Pathfinder Dam and Guernsey Reservoir is 890,000 acre-feet for a period of 10 consecutive years. The 10 consecutive years include the year of the annual report and the preceding 9 years, plus the annual amount of water consumed in each of the same 10 years under a water right transferred from irrigation use to another use.

Again, it was understood by the parties that the methodology was certainly not perfect. However, as the methodology was used to both set and to enforce the limitations, it was fair. If the methodology is changed in the future, the consumptive use limitations must also be changed to ensure that Wyoming maintains the flexibility it has under the existing methodology and limitations.

Exhibit 7: Procedure to Eliminate Negative Natural Flow Upon Occurrence

Negative natural flow is the term used to address the situation when storage deliveries from Pathfinder Reservoir are not arriving in sufficient quantity at the Orin gage above Glendo Reservoir. The storage deliveries are assessed conveyance losses and travel times. The river

administrators use detailed daily river and storage accounting to determine if the storage water is arriving at the Orin gage. If not, the assumptions are that either there may be problems with the measuring devices or other intervening diverters are intercepting the delivery of storage water. In the past, the SEO had solved the problem without formal water rights administration. The water officials typically know where the problem may be and handle the issue directly with those water users causing the problem. Basically, this procedure simply codified the actions that were being taken by Wyoming before the settlement. Negative natural flow has never been a big issue and the increased conveyance losses (river carriage) in Exhibit 9 will make the problem even less likely. It is interesting to note that there is an unofficial exchange that occurs in this reach of the river. If the intervening tributaries and basin runoff are providing sufficient water at the Orin gage to meet the calculated required storage deliveries from Pathfinder Reservoir, the releases to the river are fair game for upstream natural flow diverters. This unofficial exchange has benefited the municipalities and other users in the Pathfinder to Glendo reach for years.

Exhibit 8: Procedure for Reservoir and Storage Right Evaporation Losses

This procedure provides for an updated method for accounting for evaporation losses in the large federal reservoirs in Wyoming. Previously, this issue was addressed by the Decree. This exhibit replaces the previous language in the Decree, thereby allowing future changes to this technical matter through NPDC rather than a modification to the Decree, which must be approved by the Court.

There had been a long standing practice of storing water in excess of the ownership accounts of the federal reservoirs in Glendo Reservoir and releasing that water to augment natural flow, thereby, delaying the need to call for storage water. The practice serves to reduce "spills" from the reservoir system at times when the water is not needed and benefits the storage inventory in the basin for the water users in Wyoming and Nebraska. In 2000, the Wyoming Board of Control clarified this practice and provided that Glendo Reservoir could be used to reregulate these flows. The Modified Decree embraced the clarification provided by the Wyoming Board of Control and, therefore, codified the practice in the Glendo Reservoir storage water right held by the USBR. This procedure also outlines the conditions under which water in the reregulation space can be used to offset evaporation losses of the federal reservoirs.

Exhibit 9: Procedure for River Carriage (Conveyance) Losses

The parties had realized for quite some time that the conveyance losses being assessed storage water below Pathfinder Dam were too low. A jointly funded study was prepared in 1989 to provide more accurate evaporation and riparian ET rates. **No adjustments were made to the conveyance losses specified in the Decree, in part, because the conveyance losses were specified in the Decree and any changes would have to be approved by the Court.** Ultimately, it was agreed to remove the losses in the Decree and, instead, include them in this Exhibit 9 procedure, thereby allowing the NPDC to make future changes if deemed appropriate. The conveyance losses to the Wyoming/Nebraska state line were increased to approximate the evaporation losses estimated in the 1989 report. Conveyance losses were added for the river segments to Lake McConaughy in Nebraska, as measured at the Lewellan gage. The increased duty on storage deliveries basically increased the amount of natural flow available for use in Wyoming and Nebraska and reduced the potential for negative natural flow at the Orin gage. (See the discussion on Exhibit 7.) The available natural flow may have increased 5,000 to 20,000 acre-feet per year which benefits water users in the Grey Reef to Orin gage reach and the irrigators in Wyoming and Nebraska diverting in the Guernsey to Whalen Dam segment.

Exhibit 10: Procedure for Whalen Diversion Dam to the State Line Reach Administration of Irrigation Groundwater Water Rights

The following is offered to provide a backdrop to the settlement of the Nebraska v. Wyoming lawsuit as it relates to the requirement for replacement water for the operation of certain specified groundwater wells and surface water diversions in Goshen County, Wyoming.

In 1994, groundwater became an issue in the case with Nebraska's submittal of amended pleadings. Count I of Nebraska's amended pleadings alleged Wyoming was violating or threatening to violate the Decree by: "*(i) reducing the flow of tributaries entering the stream below Alcova Reservoir through groundwater development and the depletion of return flows and the construction of reservoirs and (ii) reducing the flow of tributaries and the mainstem as well as canal and lateral flows reaching Nebraska through the same sorts of actions.*"

Wyoming responded by noting that the existing Decree did not address groundwater and that it was not equitable to limit Wyoming's use of groundwater while Nebraska had thousands of groundwater wells. On September 9, 1994, Special Master Olpin issued his "Third Interim Report on Motions to Amend the Pleadings." The Special Master not only agreed with Nebraska, he also derided Wyoming's arguments. This made it clear that groundwater would need to be addressed in the settlement.

While groundwater issues surfaced in the negotiations related to acreage accounting procedures above Guernsey and in the Lower Laramie River basin, the most contentious issue related to Wyoming's groundwater use in the "triangle." The triangle is defined as the area bounded by Whalen Diversion Dam on the west, 300 feet south of the Fort Laramie Canal on the south, 1 mile north of the Interstate Canal on the north and extending downstream to the Wyoming/Nebraska state line on the east. This area was selected because it was clear that the wells therein were hydrologically connected to the segment of the North Platte River subject to the 75/25 apportionment between Nebraska and Wyoming in May through September.

Ultimately, the parties agreed to an approach that came from data from expert reports. The approach can best be described as follows:

1. The average total pumping of irrigation wells in the triangle from 1946 to 1994 was 48,525 acre-feet per year.
2. The average net consumption of the water pumped from the irrigation wells from 1946 to 1994 was 29,783 acre-feet per year.
3. There were an estimated 335 irrigation wells in the triangle.
4. Estimates suggested that the irrigation wells depleted an average of 8,158.2 acre-feet per year from the flow in the North Platte River at defined times when there was insufficient natural flow to meet irrigation demands in the Whalen to state line reach.
5. Therefore, the parties determined that the average effect on natural flows in the river during shortages is 24.4 acre-feet per year per well (8,158.2 acre-feet/335 wells).

The above analyses were used to negotiate the provisions of Exhibit 10, which documents:

1. Wells with irrigation groundwater right priority dates prior to October 8, 1945 (date of the original North Platte Decree) are not affected by Exhibit 10.

2. Wyoming was required to develop a list of baseline wells, which are irrigation wells with priority dates on or after October 8, 1945 that were active 10 years immediately prior to court approval of the settlement i.e. 1992 through 2001. There are 314 baseline wells in the triangle.

3. Each year, Wyoming determines the number of active wells, wells that were pumping for any length of time during the previous irrigation season (May through September). Any well that operates for irrigation purposes during the previous irrigation season whether it pumped for one hour or throughout the entire season is an active well.

4. Wyoming must provide replacement water annually in a quantity equal to 24.4 acre-feet per well for every active well in the year following the year in which the wells were active. For example, if 314 irrigation wells are active in 2013, Wyoming would need to provide 7,662 acre-feet of water to the segment during the period of natural flow deficiency in the 2014 irrigation season. New wells are assessed 80 acre-feet per well per year.

5. Exhibit 10 contains provisions providing for the NPDC to periodically review the above analyses and make changes in the replacement water requirements if warranted.

Exhibit 10 contains the following provisions related to replacement water:

1. Replacement water may be provided from a variety of sources including, but not limited to, Wyoming's allocation of storage water from Glendo Reservoir, the Wyoming Account in the PMP, other storage releases, replacement from other surface and groundwater supplies or cancellation or transfer of water rights. Replacement water sources are contingent upon being able to demonstrate to the NPDC that the replacement water will actually become a part of the natural flow in the Whalen Diversion Dam to State Line reach.

2. The replacement water must be available to supplement the natural flow in the Whalen Diversion Dam to State Line reach of the North Platte River and be provided each year during the irrigation season (May 1 and September 30) when natural flow is insufficient to meet the demands of both Wyoming and Nebraska irrigators who divert from the river at or above Tri-State diversion dam. Replacement water, because it is considered natural flow, is split 75% to Nebraska and 25% to Wyoming.

The settlement teams wrestled with the scenario wherein Wyoming would not be able to provide the necessary replacement water. The parties were aware that Wyoming's allocation in Glendo Reservoir certainly did not provide a firm supply. In fact, there were years in the past when very little or no water accrued to the Wyoming or Nebraska storage accounts in Glendo Reservoir. While the parties documented their support for the PMP, they were aware that the PMP would require several federal and state approvals before it could become a reality. Therefore, the settlement teams agreed to the following provision (subsection 3.a) in Exhibit 10 that states in part:

> *"If Wyoming is unable to assure or provide the required replacement water in any one year, Wyoming will be required to regulate ground water right irrigation wells within the area of administration. In years, when Wyoming does not anticipate having adequate replacement water available for the base line wells, Wyoming will regulate, i.e. prevent from pumping for the entire irrigation season, a sufficient number of baseline wells to equal the anticipated shortfall in replacement water."*

Subsection C.3.a. of the Exhibit also provides an example for determining the number of wells to be regulated: *"For example, as 24.4 acre-feet per well is the replacement water requirement, if Wyoming is unable to provide 1,220 acre-feet of the required replacement amount, Wyoming will regulate, i.e. prevent from pumping 50 of the irrigation wells during the entire irrigation season."*

The above language clearly states that regulation of the wells was only offered as an alternate to providing replacement water if Wyoming "is unable to assure or provide" the replacement water or "does not anticipate having adequate" replacement water. The language indicates that the settlement teams preferred to provide replacement water rather than regulate wells. Clearly, regulation was and is viewed as the option of last resort. But, equally as clear, regulation is allowed to meet the replacement requirements under extraordinary conditions when replacement water cannot be obtained.

An interim replacement water supply strategy was developed until the PMP was completed. The WWDC annually acquired available Glendo storage water. In addition, a storage account was acquired in Glendo Reservoir. Through 2012, water was purchased from the Cheyenne Board of Public Utilities and Pacificorp and transferred into the storage account. There were years when water was obtained from Upper Rock Creek Reservoir and the Torrington and New Grattan Ditch Companies donated water. All of the replacement water was acquired through temporary water use agreements. This strategy was costly, but successful, as Wyoming's replacement obligations were met and the regulation of wells was avoided.

The long term strategy for replacement water is to use storage water from Glendo Reservoir and the Wyoming Account in the PMP. The WWDC has entered into a long term contract for Glendo storage water and has completed the construction of the PMP. These actions should ensure the availability of replacement water for quite some time. However, as municipalities use more water from the PMP, there will be a need to look for other new replacement water alternatives. There are alternatives available. For example, the WWDC completed a successful groundwater exploration program whereby a non-hydrologically connected groundwater well was located at the Split Rock site in the Sweetwater River basin.

Exhibit 11: Procedures for Whalen Diversion Dam to the State Line Reach Administration of Surface Water Rights from Tributaries and Drains

Nebraska contended that Wyoming diversions from the tributaries, such as Rawhide Creek and other small streams should be counted against Wyoming's 25% share of the natural flow in the reach. Originally, Nebraska concerns also included the Laramie River and Horse Creek below the Gering-Fort Laramie canal. The concerns relating to the Laramie River were addressed by other aspects of the settlement. Wyoming convinced Nebraska that the Horse Creek Drainage upstream of the Gering-Fort Laramie Canal was over appropriated and did not contribute water to the reach apportioned by the Decree. The issues relating to the Horse Creek Drainage were dropped.

Nebraska argued that Wyoming was unfairly diverting return flow in the drains, such as Katzer Drain and others, to the detriment of flows in the North Platte River, thereby reducing Nebraska's 75% share of the natural flow. Wyoming did not administer these tributaries and drains for shortages on the mainstem.

Ultimately, Wyoming agreed to replace 50% of the diversions or administer the tributaries and drains in times of mainstem regulation. Wyoming has and will continue to provide replacement water for the depletions.

Depletions from diversions on the tributaries and drains are replaced the month after the month the depletions occur. September depletions are replaced the following year. Wyoming is providing the replacement water from the same supplies as discussed under Exhibit 10.

Exhibit 12: Procedure for Lower Laramie River Basin Acreage Accounting

In order to address Nebraska's concerns regarding inflows into Grayrocks Reservoir, Wyoming agreed to limit irrigated acreage in the Lower Laramie River basin, exclusive of the area within the WID, so that the total intentionally irrigated acreage will not exceed 39,000 acres. The measurement, mapping, and reporting procedures, including those related to hydrologically connected groundwater wells, parallel those included in Exhibit 4.

The area of administration is the area downstream of WID's tunnel no. 2 exclusive of the area within the WID. WID was excluded because Wyoming made it clear that lands within the District were irrigated from Wyoming's entitlements under the Laramie River Decree. The settlement acknowledges that the Modified North Platte Decree does not apportion flows of the Lower Laramie River and that the only limitation in this area is the acreage limitation. It is stipulated that the implementation of the procedure depicted in Exhibit 12, or any future amendments thereto, will not affect the Laramie River Decree between Colorado and Wyoming.

These procedures were primarily adopted to improve communications between Nebraska and Wyoming:

Exhibit 13: Procedure for Reporting Post-2000 Irrigation Wells within Wheatland Irrigation District

Exhibit 14: Procedure for Reporting New Municipal, Industrial, and Export Permits

Exhibit 15: Procedure for Reporting Permits for New Dams, Enlargements or Groundwater Recharge Projects

3.7.4. Endangered Species

In 1995, the Supreme Court rendered a decision agreeing with the Special Master that he could hear evidence on downstream interests, including evidence of injury to wildlife and wildlife habitat.

In 1999, there was new leadership in the Nebraska Department of Natural Resources (NDNR). The newly appointed Director of the NDNR shared Wyoming's concern about endangered species issues being addressed by the law suit. Nebraska, Colorado, and Wyoming agreed in the importance of the development of the Platte River Recovery Implementation Program to dissuade the Special Master and Supreme Court from pursuing the matter in the litigation.

There are references in the final settlement regarding the use of Glendo storage water for fish and wildlife purposes and PMP storage water for the PRRIP. However, the Modified Decree and Final Settlement Stipulation left the resolution of endangered species issues to the PRRIP.

Background

Endangered species issues began affecting water development and management in the North Platte River in Wyoming in the late 1970's. As previously discussed, the construction of Grayrocks Dam and Reservoir by Basin Electric Power Cooperative was delayed due to

lawsuits relating to mitigation requirements under ESA for the whooping cranes and their habitat located along the Platte River in Central Nebraska.

Wyoming, Nebraska, and Colorado became interested in a recovery program in the 1990's when it became apparent that the ESA provided the USFWS the authority to require the replacement of existing depletions until it achieved its water supply goal for the critical habitat in the Central Platte River in Nebraska. The USFWS's water supply goal was 417,000 acre-feet per year. In addition, the U.S. Fish and Wildlife Service could assess depletion fees in order to acquire 29,000 acres of habitat in the Central Platte.

After 13 years, the negotiations between the Department of Interior and the states were completed and the PRRIP was implemented. The Wyoming Legislature approved the state's financial contribution of $6M and Governor Freudenthal executed the necessary agreements. The Program commenced on January 1, 2007.

The term of first increment of the PRRIP is 13 years. However, there can be extensions to this term if approved by the parties. Provisions call for additional increments if needed and if approved by the states and the Department of Interior. However, it is important to note that the Governor can pull Wyoming out of the PRRIP at any time if it is determined that the program is progressing counter to the best interests of our state.

The water supply goal in the first increment is to provide 130,000 to 150,000 acre-feet of water per year to reduce shortages to the U.S. Fish and Wildlife target flows in the Central Platte. The three states are contributing 80,000 acre-feet of water per year. Wyoming's water contribution on behalf of its water users is the Environmental Account in the PMP. Nebraska contributed water from Lake McConaughy and Colorado is providing their water contribution through a groundwater recharge project. The remaining supplies are being developed by the PRRIP. The PRRIP is looking at potential supplies in the area of the habitat in the Central Platte in Nebraska. The PRRIP is presently leasing water from the Wyoming Account in the PMP that is not needed to meet Wyoming's demands. This is likely the only PRRIP water that will come from Wyoming.

The land goal is to acquire, protect, and maintain 10,000 acres of habitat in the Central Platte. Wyoming's share is approximately 460 acres of habitat in the Central Platte acquired originally for mitigation for the Deer Creek project. Upon completion of the PMP, these lands were contributed to the PRRIP, through the USFWS. This contribution serves as credit to Wyoming under the PRRIP and provides mitigation for the PMP.

An adaptive management scientific approach is being implemented to determine the water and habitat needs of the endangered birds (whooping crane, least tern, and piping plover) in the Central Platte River Basin in Nebraska and the pallid sturgeon in the Lower Platte River Basin in Nebraska. Wyoming has a seat at the table during the development of this information, which will become the best scientific information available for ESA purposes and will become the basis of future consultations.

The PRRIP is being implemented by a Governance Committee in which the State of Wyoming and Wyoming water users (including Nebraska water users that use federal storage water from Wyoming reservoirs) have individual members. The Committee operates on a consensus basis, which provides Wyoming protection that its views must be addressed. The Director of the Wyoming Water Development Program serves as the Governor's representative on the Governance Committee.

The monetary budget is approximately $187M for the first increment. The federal government is providing approximately $157M and the states are providing $30M. Wyoming's share is $6M. In addition, the states received credit of approximately $130M for their water and land contributions. The Program will be funded approximately 49.5%

($157M) by the Department of Interior and approximately 50.5% ($160M) by the states. The states' contributions include the $30M in cash and the $130M credit for water and land. Therefore, the total budget for the first increment is $317M.

Why did the states stay the course during 14 years of negotiations relating to the PRRIP? The state representatives had several meetings and discussions relating to future life for water supplies for all Wyoming users without a Program and came to the following conclusions:

The USFWS would be obligated under ESA to undertake separate ESA consultations on the federal reservoirs and other major reservoirs in each state. The likely outcome would be that the operations of those reservoirs that are presently serving our water users would be reconfigured to provide water for the endangered species and their habitat. This would result in the loss of 417,000 acre-feet of water in the three states rather than the 130,000 to 150,000 acre-feet of water to be provided by the Program. The loss of this water would "ripple" through each state's water right system impacting not only the users of the federal storage water but also all water users in each of the three states.

Prolonged and costly lawsuits would likely be initiated by each state or by the states interpretation of the ESA. Recent case history indicates that unless there is meaningful reform to ESA, investments in such litigation would likely be lost. The states decided that cooperation served us better than litigation in this particular situation.

Issues in the Nebraska vs. Wyoming lawsuit extended to the critical habitat for endangered species (whooping crane, least tern, and piping plover) in Central Nebraska. All of the principle parties to the final settlement felt that endangered species issues were best addressed in the separate negotiations that ultimately led to the PRRIP.

Wyoming's Depletion Plan

In addition to providing money and water, the states of Wyoming, Nebraska, and Colorado agreed to curtail their water related activities to the depletions that occurred prior to July 1, 1997, the date the states agreed to develop the PRRIP. As previously noted, the PRRIP is the reasonable and prudent alternative under the ESA for existing water related activities that occurred prior to July 1, 1997. These existing water related activities include:

1. The federal reservoirs in Wyoming, including Wyoming's full allocation of Glendo storage water.
2. The Pathfinder Modification Project.
3. Transfers of water rights approved by the Wyoming Board of Control or temporary water use agreements approved by the Wyoming State Engineer.
4. Existing water uses covered by the existing water related baselines defined in Wyoming's Depletion Plan.

The plan includes two existing water related baselines:

The first baseline addresses irrigation water use in the North Platte River basin above Guernsey Reservoir. Compliance with the Nebraska v. Wyoming settlement will provide confirmation that Wyoming is not exceeding this baseline for purposes of the PRRIP.

The second baseline addresses irrigation water use below Guernsey Reservoir and in the Laramie River and Horse Creek Drainages. It also addresses municipal, industrial, and other water uses in the North Platte, Laramie, and Horse Creek Drainages. A benchmark

was established for each use and each municipal and industrial water user. The benchmarks were based on the maximum annual water depletions of the users during the period of 1992 through 1996. Annual shortages under a benchmark can offset annual overruns in other benchmarks. This allows for checks and balances. The total depletions under this baseline, based on the depletions under the various benchmarks, should not exceed the limitation during the term of the first increment of the PRRIP, which ends on December 31, 2019. Likely, the parties to the PRRIP will agree to a second increment of the PRRIP. Wyoming's Depletion Plan will likely be revisited at that time.

References

"Depletions Plan, Platte River Basin, Wyoming, (Wyoming's Depletions Plan)," October 24, 2006.

Owen Olpin, "Final Report of the Special Master," October 12, 2001.

Owen Olpin, "Third Interim Report on Motions to Amend the Pleadings," September 9, 1994.

"Proposed Joint Settlement (Brown Book)," October 12, 2001.

Purcell, Mike, "Level I Feasibility Study-Mitigation North Platte Drainage System," November 1, 2007.

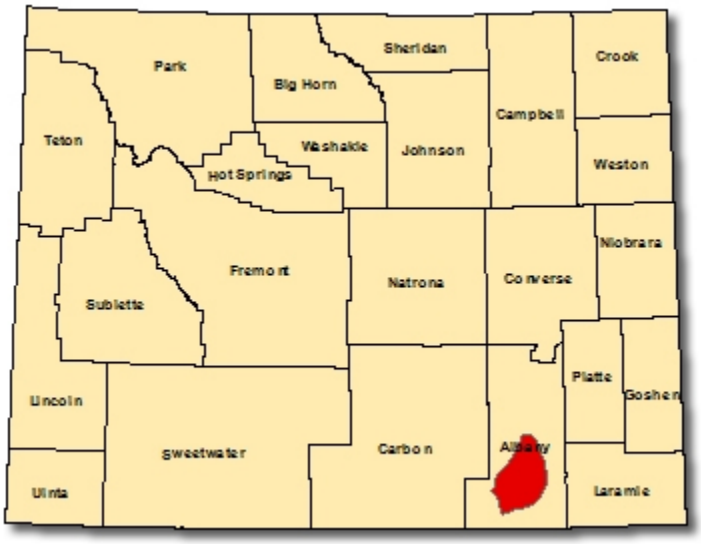
Wyoming Attorney General's Office, "Briefing-North Platte River Basin," November 25, 2003.

Federally Listed Threatened and Endangered Species Associated with Aquatic, Wetland and Riparian Habitats in the Platte River Basin of Wyoming

Wyoming Toad (*Anaxyrus baxteri*)

Status: Endangered

Photo Credit: WY Toad SSP - Armstrong



Potential Distribution in Wyoming

Area of Influence for Wyoming Toad in Wyoming

Areas of Influence (AOI) identify areas where any project located within should consider potential effects to the Threatened, Endangered, Proposed, and Candidate species and designated and proposed Critical Habitat in reference to Section 7 of the Endangered Species Act of 1973, as amended. AOI typically encompass larger areas than simply where the species is known to exist because of direct and indirect effects to the species and their habitat. It is important to consider potential effects to the species and their habitat within these larger areas. Action agencies are encouraged to refer to the Service's **Information, Planning, and Conservation System (IPAC)** or contact the **FWS Wyoming Ecological Services Office** for additional information. The AOI boundaries are based on the best available data at time of development. The AOI will be updated as new information becomes available.

Species Information

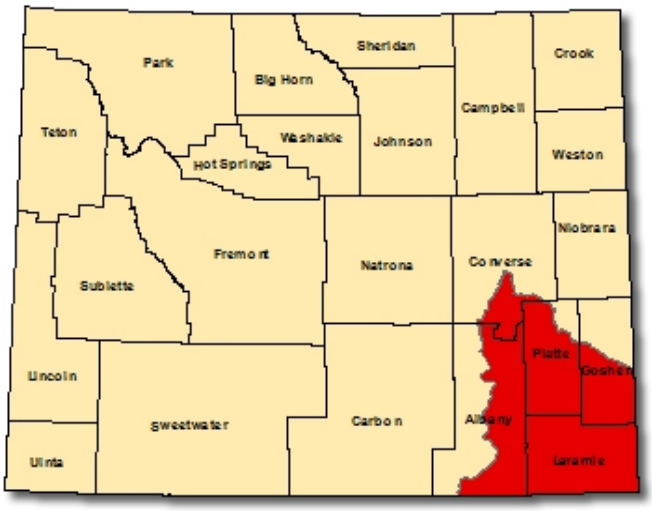
The Wyoming toad (*Anaxyrus (Bufo) baxteri*) historically occupied flood plains, ponds, and seepage lakes associated with shortgrass communities occurring between 7,000 and 7,500 feet in elevation in the Laramie Basin. The toad was associated with both the Big and Little Laramie Rivers. Populations of the Wyoming toad suffered a dramatic decline in the 1970s and the current distribution is limited to Mortenson Lake National Wildlife Refuge and possibly Hutton Lake National Wildlife Refuge. The Service recommends surveys when a proposed project will occur within 1-mile of Mortenson Lake or Hutton Lake National Wildlife

Refuges. These guidelines may change as new sites for Wyoming toad populations are established.

Preble's Meadow Jumping Mouse (*Zapus hudsonius preblei*)

Status: Threatened

Photo Credit: FWS



Potential Distribution in Wyoming. The Area of Influence (AOI) for Preble's Meadow Jumping Mouse in Wyoming is shown in the figure above.

Areas of Influence (AOI) identify areas where any project located within should consider potential effects to the Threatened, Endangered, Proposed, and Candidate species and designated and proposed Critical Habitat, in reference to Section 7 of the Endangered Species Act of 1973, as amended. AOI typically encompass larger areas than simply where the species is known to exist because of direct and indirect effects to the species and their habitat. It is important to consider potential effects to the species and their habitat within these larger areas. Action agencies are encouraged to refer to the Service's **Information, Planning, and Conservation System (IPAC)** or contact the **FWS Wyoming Ecological Services Office** for additional information. The AOI boundaries are based on the best available data at time of development and the AOI will be updated as new information becomes available.

Species Information

Federal listing status under the ESA for Preble's meadow jumping mouse (*Zapus hudsonius preblei*) as a threatened species in Wyoming was reinstated on August 6, 2011 (76 FR 47490). Preble's meadow jumping mouse is a small rodent in the Zapodidae family and is one of 12 recognized subspecies of *Z. hudsonius*, the meadow jumping mouse. This species has a body length of 3 to 4 inches, a bicolored tail 4 to 6 inches in length, large hind feet adapted for jumping, and a distinct dark stripe down the middle of its back bordered on either side by gray to orange-brown fur. Their diet consists of seeds, fruits, fungi, and insects. Preble's meadow jumping mouse is primarily nocturnal or crepuscular, but has been observed during daylight. Hibernation occurs from October to May in small burrows the mouse excavates several centimeters underground.

Preble's meadow jumping mouse exhibits a preference for lush vegetation along watercourses or herbaceous understories in wooded areas near water. The mouse occurs in low undergrowth consisting of grasses or forbs; in wet meadows and riparian corridors; or areas where tall shrubs and low trees provide adequate cover. The species uses upland habitats as far as 330 feet beyond the 100-year floodplain. In Wyoming, Preble's meadow jumping mouse has been documented in Albany, Laramie, Platte and Converse counties, and may occur in Goshen County. If a proposed project will disturb suitable habitat within any of these five counties, surveys should be conducted prior to any action. Due to the difficulty in identifying the Preble's meadow jumping mouse, surveys should be conducted by knowledgeable biologists trained in conducting these surveys.

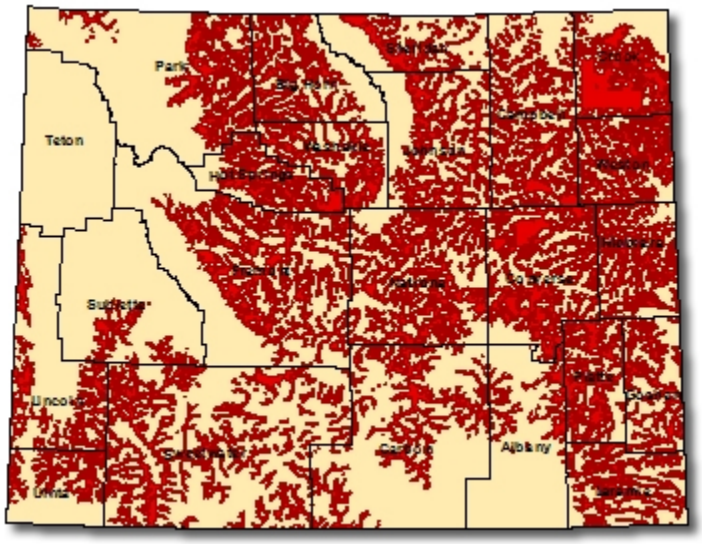
Additional Information and Recent Actions

- **U.S. FWS Region 6 Preble's Meadow Jumping Mouse information**
- May 23, 2013 Federal Register: **12-Month Finding on Two Petitions to Delist the Preble's Meadow Jumping Mouse**
- May 2013 Press Release: **Preble's Meadow Jumping Mouse Retains Protections Under the ESA**

Ute Ladies'-tresses (*Spiranthes diluvialis*)

Status: Threatened

Photo Credit: FWS/Lindstrom



Potential Distribution in Wyoming

Area of Influence for Ute Ladies'-tresses in Wyoming

Areas of Influence (AOI) identify areas where any project located within should consider potential effects to the Threatened, Endangered, Proposed, and Candidate species and designated and proposed Critical Habitat, in reference to Section 7 of the Endangered Species Act of 1973, as amended. AOI typically encompass larger areas than simply where the species is known to exist because of direct and indirect effects to the species and their

habitat. It is important to consider potential effects to the species and their habitat within these larger areas. Action agencies are encouraged to refer to the Service's **Information, Planning, and Conservation System (IPAC)** or contact the **FWS Wyoming Ecological Services Office** for additional information. The AOI boundaries are based on the best available data at time of development. The AOI will be updated as new information becomes available.

Species Information

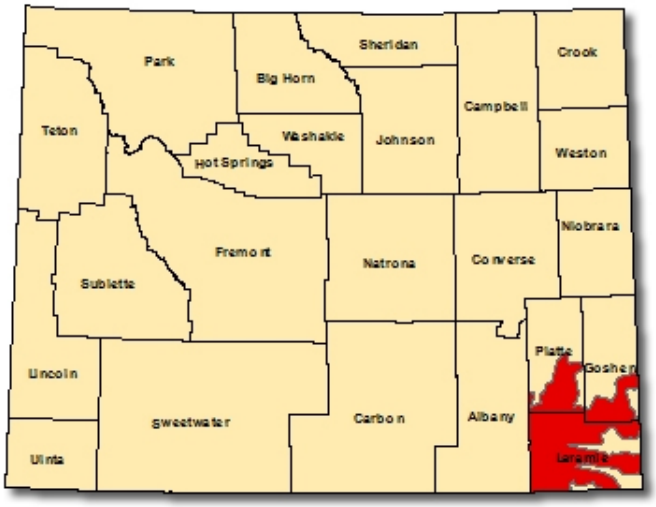
Ute ladies'-tresses (*Spiranthes diluvialis*) is a perennial orchid, 8 to 20 inches tall, with white or ivory flowers clustered into a spike arrangement at the top of the stem. Ute ladies'-tresses typically blooms from late July through August. However, it may bloom in early July or still be in flower as late as early October, depending on location and climatic conditions. Ute ladies'-tresses is endemic to moist soils near wetland meadows, springs, lakes, and perennial streams where it colonizes early successional point bars or sandy edges. The elevation range of known occurrences is 4,200 to 7,000 feet (although no known populations in Wyoming occur above 5,500 feet). Soils where Ute ladies'-tresses have been found typically range from fine silt/sand, to gravels and cobbles, as well as to highly organic and peaty soil types. Ute ladies'-tresses is not found in heavy or tight clay soils or in extremely saline or alkaline soils. Ute ladies'-tresses typically occurs in small, scattered groups found primarily in areas where vegetation is relatively open.

Many orchid species take 5 to 10 years to reach reproductive maturity; this appears to be true for Ute ladies'-tresses (FR 57 2048). Furthermore, reproductively mature plants do not flower every year. For these reasons, 2 to 3 years of surveys are necessary to determine presence or absence of Ute ladies'-tresses. Surveys should be conducted by knowledgeable botanists trained in conducting rare plant surveys.

Colorado Butterfly Plant (*Gaura neomexicana coloradensis*)

Status: Threatened

Photo Credit: FWS



Potential Distribution in Wyoming

Area of Influence for Colorado Butterfly Plant in Wyoming

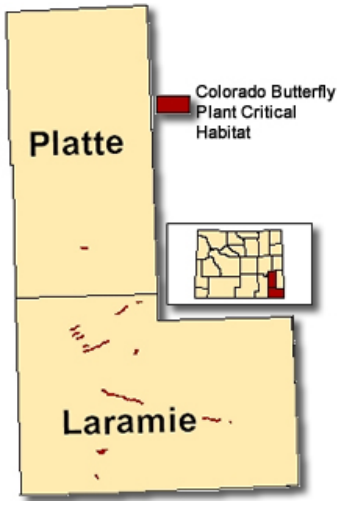
Areas of Influence (AOI) identify areas where any project located within should consider potential effects to the Threatened, Endangered, Proposed, and Candidate species and designated and proposed Critical Habitat, in reference to Section 7 of the Endangered Species Act of 1973, as amended. AOI typically encompass larger areas than simply where the species is known to exist because of direct and indirect effects to the species and their habitat. It is important to consider potential effects to the species and their habitat within these larger areas. Action agencies are encouraged to refer to the Service's **Information, Planning, and Conservation System (IPAC)** or contact the **FWS Wyoming Ecological Services Office** for additional information. (AOI boundaries based on the best available data at time of development. AOI will be updated as new information becomes available).

Species Information

The Colorado butterfly plant (*Gaura neomexicana coloradensis*) is a perennial herb endemic to moist soils in wet meadows of flood plain areas. This plant occurs in southeastern Wyoming, north-central Colorado, and extreme western Nebraska between elevations of 5,000 and 6,400 feet. These plants are often found in low depressions or along bends in wide meandering stream channels a short distance upslope of the actual channel. Threats to the plant include non-selective herbicide spraying, haying and mowing schedules that inhibit the setting of seed, land conversion for cultivation, and competition from noxious weeds. Low numbers and limited distribution contribute to the plant's vulnerability. Surveys should be conducted during flowering season, which normally occurs in July and August. Temporal variability in the flowering period exists from site to site and from year to year depending on annual climatic conditions. Surveys should be conducted by knowledgeable botanists trained in conducting rare plant surveys. The Service does not maintain a list of "qualified" surveyors but can refer those wishing to become familiar with the Colorado butterfly plant to experts who can provide training/services. Critical habitat is designated for Colorado butterfly plant in specific wet meadows and riparian areas within Laramie and Platte Counties of Wyoming (see 50 CFR 17.96(a)).

Colorado Butterfly Plant Critical Habitat

Critical habitat for this species is designated in Platte and Laramie Counties in Wyoming.



Appendix 5-C

Public Involvement

Comment Letters

Comment from Clay Thompson, NRCS, Laramie, WY <Clay.Thompson@wy.usda.gov>

Date: Tue, Feb 21, 2017 at 3:06 PM
Subject: Comments on Platte River Basin Plan
To: "Peter.Gill@wyo.gov" <Peter.Gill@wyo.gov>

Peter,

I met you at the meeting last week. Thank you for the presentation.

I am a landowner and irrigator on the Big Laramie River above Laramie. I'm also a Civil Engineering Technician for the NRCS and work on irrigation systems, livestock water projects and other engineering projects in Albany and Carbon counties. A lot of my work is in the Platte River basin.

I have two main comments:

1.) I do not trust or agree with the conclusion that irrigation has decreased 16% and will continue to decrease in the future based on two aerial photos.

2.) WE SHOULD NOT CHANGE WYOMING WATER LAWS, PERIOD!!

My first comment is directed at the conclusion that irrigation has decreased 16% from 2005 to 2015. Using just two aerial photo flights ten years apart should not lead to any conclusions unless precip, drought, snowpack, reservoir levels, calls on the river, etc. that may have been happening those two years were factored in. Were the photos taken the same time of year? I work with aerial photos in my job and they can change drastically from year to year due to these factors. In our area the biggest factor leading to reduction of irrigated acres is lack of enough irrigation water. I think the conclusions that irrigated acres have decreased could be very misleading. Especially when it is used to project further decreases in the future. With more data analysis it may be proved correct, but there is a good chance it won't be. There should be more research on this before any conclusions should be made that could affect the future of irrigation on the Platte River system.

The second item I wanted to comment on is the report's strategies for the future. In the report there are several references to making changes to Wyoming water law so landowners would have more flexibility to sell off their water. **I CANNOT STRESS ENOUGH MY OPPOSITION TO MAKING CHANGES TO WYOMING WATER LAWS!!** Wyoming has the best water laws of any western state and changing them will lead to people selling off the water to the Front Range of Colorado. We need to do everything we can to keep our water in Wyoming to benefit our state. The notion that someone could 'lease' the water for a few years and then it would come back to the land is a dream. Once it is gone it will never come back!

The total value of flood irrigation needs to be studied better. We need to put a dollar value on our migratory bird habitat, wetlands, flood control, storage of water in our underground aquifers, and wildlife values to really understand the importance of how we use the water. We can be more efficient in how we irrigate to save water, but at what cost to the environment and wildlife that use these areas.

Lastly, I just want to say **DON'T CHANGE WYOMING WATER LAWS!!**

Sincerely,

Clay Thompson

Comment received from Carol Price, Rancher, Rock River, WY

Fri, Feb 24, 2017 at 7:05 AM, Carol P <cprice19@gmail.com> wrote:

To the Wyoming Water Development Office

As you requested at the February 16, 2017 meeting in Laramie, WY, here are some comments concerning the Platte River Basin Plan Update 2017.

Is the Wyoming Water Development Office interested in having a resilient sub-basin? If resiliency is the main objective, future updates need to address how to make the sub-basin more resilient. While smaller reservoirs are an answer, what is the proportion of evaporative loss compared with a larger reservoir? The water in the Above Pathfinder and Upper Laramie River is seasonal. How does the Wyoming Water Development Office propose encouraging recreation when there is limited water, if any, in the streams? Without a way to store the water to have late season in-stream flow, the plan ideas for increased recreation are not going to come to fruition.

From page 19, how are return flows and inefficiencies in a sub-basin a bad thing? The water is being recycled and is benefitting users down stream.

Forest health plays a role in slowing down the snowmelt.

A reevaluation of "crop" consumptive use needs to be accomplished for native and Garrison hay meadows. If the private landowners data and information would remain private there may be more cooperation but they do not want to have their competition (their neighbor) to know their exact numbers (trade secret).

Photo comparisons need to be done at the same time each year and preferably four times a year so the differences can be attributed to weather, grazing, and other factors. The photos for 2005 should have limited residual plant life due to the drought in 2002. In 2015, there was old grass standing and the reduction in cattle numbers had already occurred. It would make it harder to see where the water covered the landscape in 2015 compared with 2005.

Precise quantities are nice for the researchers but what is the data going to be used for? This is not a black or white question. There is an ulterior motive.

Wyoming Water Law is very protective of our water and it should remain that way. It is one of the few things still in place that can protect agriculture.

Thank you for your time.

Sincerely,

Carol Price
Rancher
PO Box 202
Rock River, WY 82083
cprice19@gmail.com

Response from Peter Gill, GISP, River Basin Planning Project Manager

Thank you Carol. Your comments will be appended to the final report.

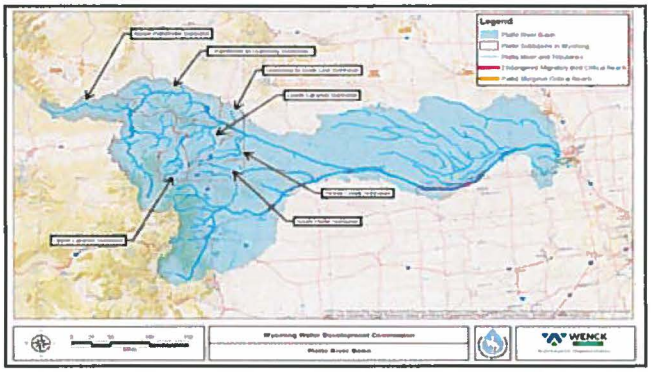
Regarding your questions, resiliency and dependable water supplies are important. One of our recommendations to the Commission is to encourage more small reservoirs and maximize the use of existing large reservoirs. The reference to inefficiently irrigation water use was not intended to reflect good or bad, simply to note that small amount of the diverted water is used by the crops. Yes, particular crop information would have to be aggregated to protect business interests. More precise water availability numbers would help the State bring in new water dependent enterprises. Labeling the entire basin "fully appropriated" prevents investment in the area.

We appreciate your feedback.

Slide Show

Introduction and Background

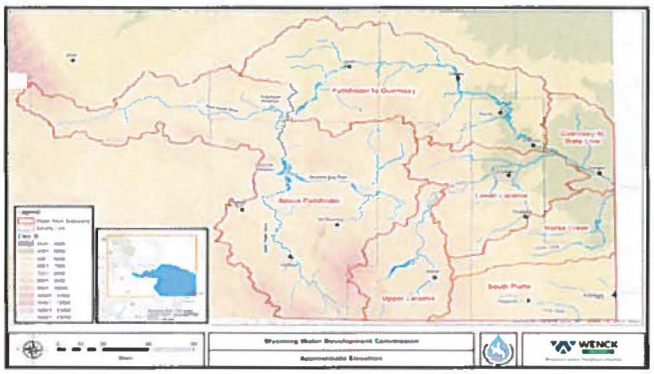
- History of the Wyoming Water Development Program
  - Governor Ed Herschler's Vision
    - ✓WWDC established in 1975 to promote the optimal development of the state's human, industrial, mineral, agricultural, water and recreational resources
- History of Wyoming Water Planning
  - Driving Factors:
    - ✓Water Shortages
    - ✓Interstate Allocation Issues
    - ✓Changing Societal And Environmental Needs
  - WWDC Basin Planning began in 1997
    - ✓Purpose: Quantify existing water uses and project future needs of this important resource



Location and Geographic Setting

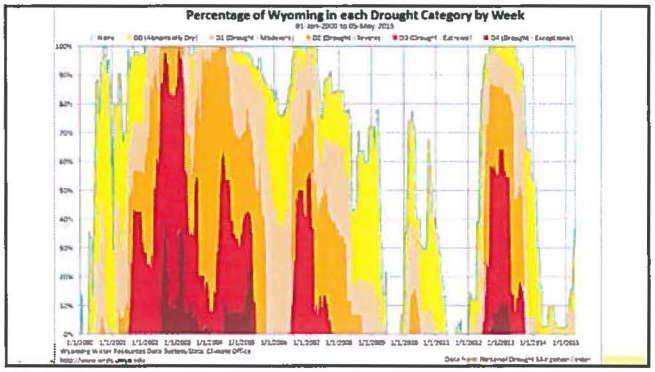
- Location: Southeast quarter of Wyoming - 24% of Wyoming land mass - about 24,000 square miles - Elevations range from over 12,000' msl to about 4,025' msl – mountains and mountain valleys to short grass prairie
  - Two Major Subbasins: North Platte 22,000 square miles; South Platte 2,000 square miles
  - There are seven subbasins that comprise the Platte River Basin
  - Mountains provide the major water supplies to the valleys and plains where the cities, farms / ranches, and industrial facilities are located
- Major Tributaries
  - North Platte River, Sweetwater River, Laramie River
- Numerous Smaller Tributaries
  - Casper Creek, LaPrele Creek, Deer Creek, Horse Creek, Crow Creek

"Although mountains may guide migrations, the plains are the regions where people dwell in greatest numbers"
- Elsworth Huntington



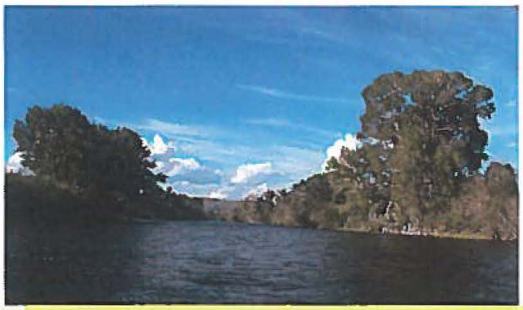
Weather and Climate

- Highly Variable: Large Temperature / Precipitation Variances
- Typical Continental Climate
- Winters: Cold - *Windy* – Dry – Low Humidity
- Summers: Warm - Hot - Dry - Low Humidity
- *Wind*
  - Rawlins, Laramie, Casper and Cheyenne are the windiest cities in the Cowboy State
- Drought is a constant threat! Wyoming is the Fifth Driest State in the United States *(Wyoming State Climate Atlas)*
- A portion of Wyoming is almost always in drought - According to paleoclimatic records dating back thousands of years, drought is a defining feature of Wyoming's climate.

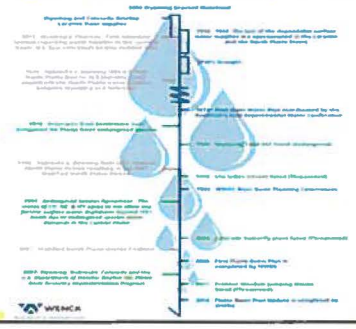


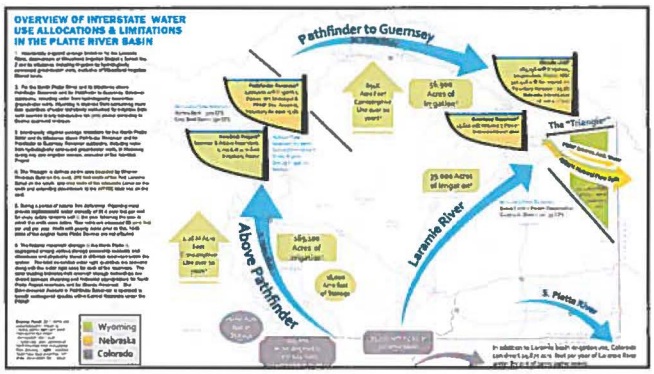
City	Average Annual Temp(F°)	Average Annual Precip (in)
Rawlins, WY	42.35	9.24
Laramie, WY	41.15	11.45
Casper, WY	45.25	12.48
Douglas, WY	45.65	12.63
Wheatland, WY	49.55	13.7
Torrington, WY	44.55	13.8
Denver, CO	50.7	14.16
Cheyenne, WY	46.4	15.92
Fort Collins, CO	50.25	16.05
North Platte, NE	49	20.77
Grand Island, NE	50.75	26.61

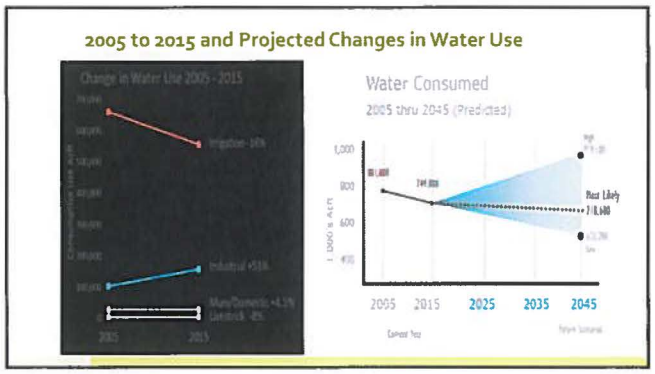
Water Resource Analyses

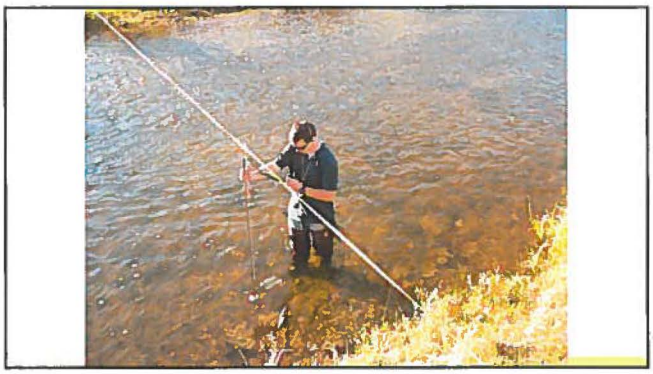


Legal Constraints on Wyoming Water Use

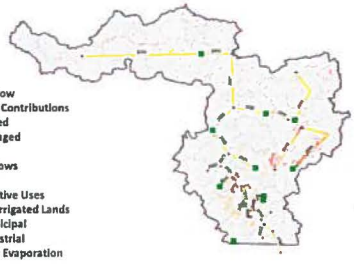








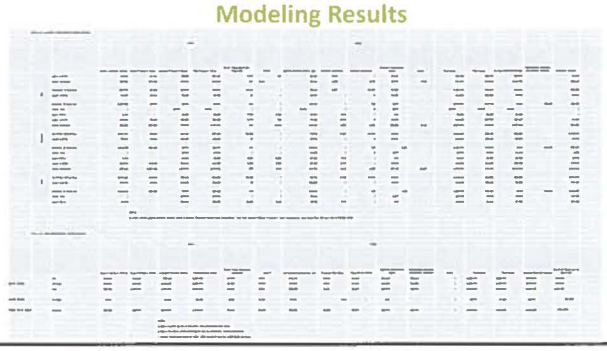
Modeling



Gains
- Stream Flow
- Tributary Contributions
  - Gaged
  - Ungaged
- Imports
- Return Flows

Losses
- Consumptive Uses
  - Ag/Irrigated Lands
  - Municipal
  - Industrial
- Reservoir Evaporation
- Exports

Modeling Results



Benefits, Deficiencies and Recommendations

Benefits

- Initial Model
- Data
- Collected and housed
- Incorporate into future modeling
- Formatting and Manipulation

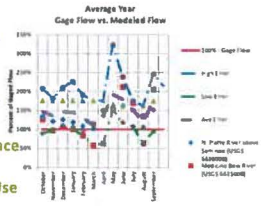
Deficiencies

- Actual CU vs. Depletion
- Accuracy of Non-gaged calculations
- Federal Reservoir Accounting
- Lack of Gaged Data
- Environmental water usage
- Does not account for priority

Recommendations

Future Needs

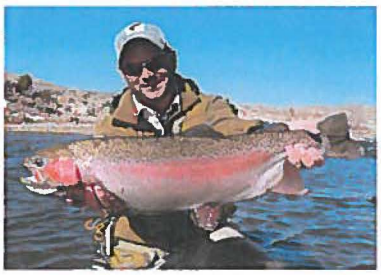
- Additional Gages - Yearly
- Environmental Losses
  - Vegetation
  - Aquifer/Groundwater
- Irrigation Accounting
  - Groundwater vs. Surface Water
  - Actual Consumptive Use Calculations
- Future Models i.e. StateMOD

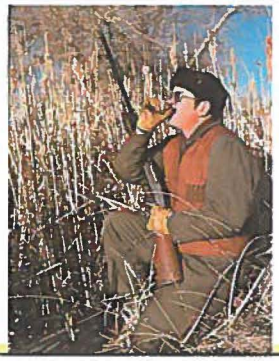


Socioeconomics

- 44% of Wyoming's population lives in the Platte Basin
- From 2000 – 2014 the population in the Basin increased by more than 36,000 to 220,860 (16.3%)
- Between 2002 and 2014, Basin employment increased by 27,200 to 172,800 (16.2%)
- 80% of the growth occurred in the South Platte and Pathfinder to Guernsey Subbasins
- In-migration contributed more to population growth than resident births; Household size decreased and the average resident is about one year older
- Government is the largest employment sector followed by retail trade, healthcare, lodging and food service, construction and mining, and agriculture

Recreational Opportunities





Recreation Opportunities

- The Platte Basin has some the most outstanding and accessible fishing, boating, hunting and camping opportunities in the United States
- Five major BOR reservoirs, hundreds of miles of streams and numerous smaller lakes, ponds and large wetland areas provide amenities for residents and attract numerous out of state visitors
- The Goshen/Lower Platte and Laramie Plains wetlands alone total more than 107,000 acres
- Recreation Strategies:
  - Promote "Ecotourism"
  - Promote trophy fishing and encourage development and enhancement of privately owned recreation areas
  - Target the Colorado Front Range Market for advertising water based recreation opportunities
  - Evaluate enhancement of water based recreation through purchasing, gifting, or leasing water rights
  - Evaluate the value of recreation to the economy of the Basin

Water Development Strategies and Recommendations

- Operational Enhancements – Existing Storage and Conservation
  - Evaluating re-operation of Glendo Reservoir
  - Municipal and Agricultural Water Use Conservation
  - Evaluating more efficient use of reservoir storage in the Above Pathfinder Subbasin
- Weather Modification (Cloud Seeding)
- New, Imported, Exchanged, and Transferred Water Supplies
  - Industrial Water Use Changes
- Transbasin Diversion
- Watershed Planning and Small Storage Program
- Development, Regulation and Enhancement of Groundwater Resources
  - Regulatory Controls on Groundwater Use Imposed by the SEO
  - Aquifer Storage and Recovery

Platte Water Resources Quick Facts – Last Thoughts

- Since 2006 the WWDC has committed more than $41 M to construct 33 projects in the basin… another 45 Projects are underway totaling nearly $75 M…$111 M - Total
- The SEO considers the Platte River Basin in Wyoming "Fully Appropriated"
- WWDC's Small Project Program and Groundwater Development Program are feasible mechanisms for developing water resources
- Agricultural water use may be declining – the data used to determining agricultural water use in the Basin Plan should be updated more often
- http://waterplan.state.wy.us/plan/platte/2017/platte-plan.html

Your Thoughts and Suggestions

The WWDC is here to provide the residents of Wyoming with adequate, affordable water supplies to enhance municipal, agricultural, industrial and environmental uses of this critical resource

http://waterplan.state.wy.us/plan/platte/2017/platte-plan.html