

Platte River Basin Plan 2016 Update Volume 1 Executive Summary



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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In Association With:
Lidstone & Associates, a Wenck Company
Harvey Economics
HDR Engineering

**PLATTE RIVER BASIN PLAN 2016 UPDATE
VOLUME 1
EXECUTIVE SUMMARY**

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", aiētōs "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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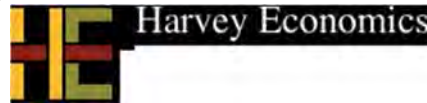
Wenck Associates
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The Platte River Basin Plan 2016 Update is a planning tool developed for the Wyoming Water Development Office. It presents estimated current and estimated future uses of water in Wyoming's Platte River Basin. The Plan is not intended 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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1.0 Executive Summary

1.1 PREFACE

“Water is Wyoming’s most important natural resource. It is critically important not only to Wyoming but to our country. Wyoming is a headwaters state. The water that begins in our mountains travels down our nation’s great rivers. Water that starts here makes its way to the Pacific Northwest, the Gulf of California, and the Gulf of Mexico. From statehood, we have recognized the need to protect and develop our water.”

- Matthew H. Mead, Governor

This document is a planning tool developed for the Wyoming Water Development Office. It presents estimated current and future water uses of Wyoming’s Platte River Basin (Platte Basin). This Plan has not been prepared to determine compliance with or administration of state law, federal law, court decrees, interstate compacts, or interstate agreements. In 2006, the Wyoming Water Development Commission (WWDC) published the ***Platte River Basin Plan, Final Report***. This 2016 document updates, revises and expands upon the information presented in the 2006 Platte Basin Plan.

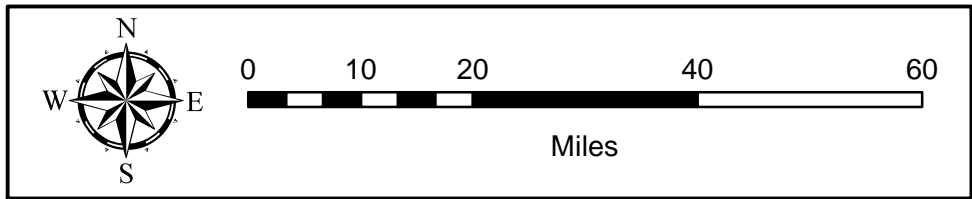
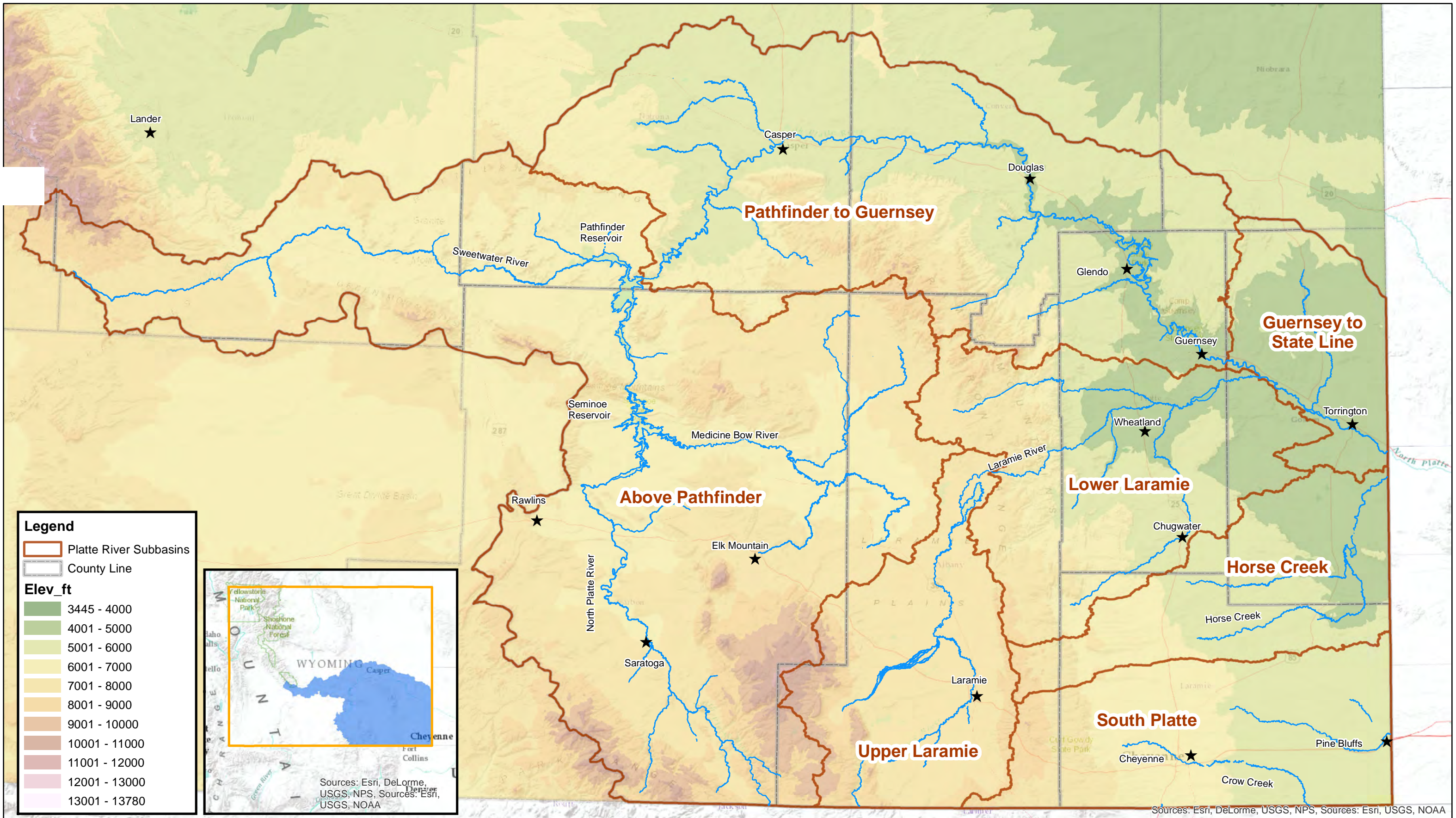
The Wyoming River Basin Plans (Basin Plans) are prepared by the WWDC with funding provided by the Wyoming Legislature. As broadly described on the WWDC website, the mission of the Basin Plans is to *“develop essential information concerning the current status and future availability of water resources in Wyoming”*. The purpose of the river basin planning efforts is to quantify existing water uses and project future needs in each of the seven major river basins in the State (Bear, Green, Platte, Northeast, Powder/Tongue, Snake/Salt, and Wind/Bighorn). The intent of the river basin planning process is to generate and regularly update the documents to assess current water use in the municipal, agricultural, industrial, and environmental/recreation sectors, document changes in economic conditions affecting water use and to identify and prioritize water development opportunities. The Basin Plans assist Wyoming municipalities, irrigation districts, and other public entities’ efforts to plan for the future. Basin Plans often serve as the basis for preparing more focused watershed studies and specific rehabilitation, new development, and dam projects.

1.2 LOCATION

“I’ve lived out west some... I’ve always liked the high plains area - eastern Colorado, eastern Wyoming, western Nebraska.”

- Charles Frazier

The Platte Basin is located in southeast Wyoming with headwaters in Wyoming and Colorado (**Figure 1.1**). The Platte Basin is comprised of two major subbasins: 1) the North Platte subbasin and 2) the South Platte subbasin. The North Platte River flows north into Wyoming from Colorado and sweeps east and south in a horseshoe bend nearly 350 miles long, draining the entire southeast quarter of the state. The Sweetwater River, one of the North Platte’s major tributaries, flows into Pathfinder Reservoir from the west. The South Wind River Mountains are the primary source of water supply for the Sweetwater River. The Wyoming portion of the North Platte subbasin covers 21,907 square miles and, in the far southeast corner of the state, Wyoming’s portion of the South Platte subbasin encompasses approximately 2,000 square miles. Within the South Platte subbasin, Crow Creek waters originating in Wyoming flow into northeastern Colorado and Lodgepole Creek flows into the



Wyoming Water Development Commission

Figure 1.1: Map of the Platte River Basin



southern portion of the Nebraska panhandle. The North Platte exits Wyoming near Torrington and becomes the Platte River at the confluence with the South Platte near North Platte, Nebraska. The Platte traverses Nebraska before joining the Missouri south of Omaha (**Figure 1.2**). As a headwater stream in the Missouri/Mississippi River system, water originating in Wyoming and Colorado flows through or forms the border of 10 other downstream states.

As shown in **Figure 1.1**, the Platte Basin is divided into the following subbasins:

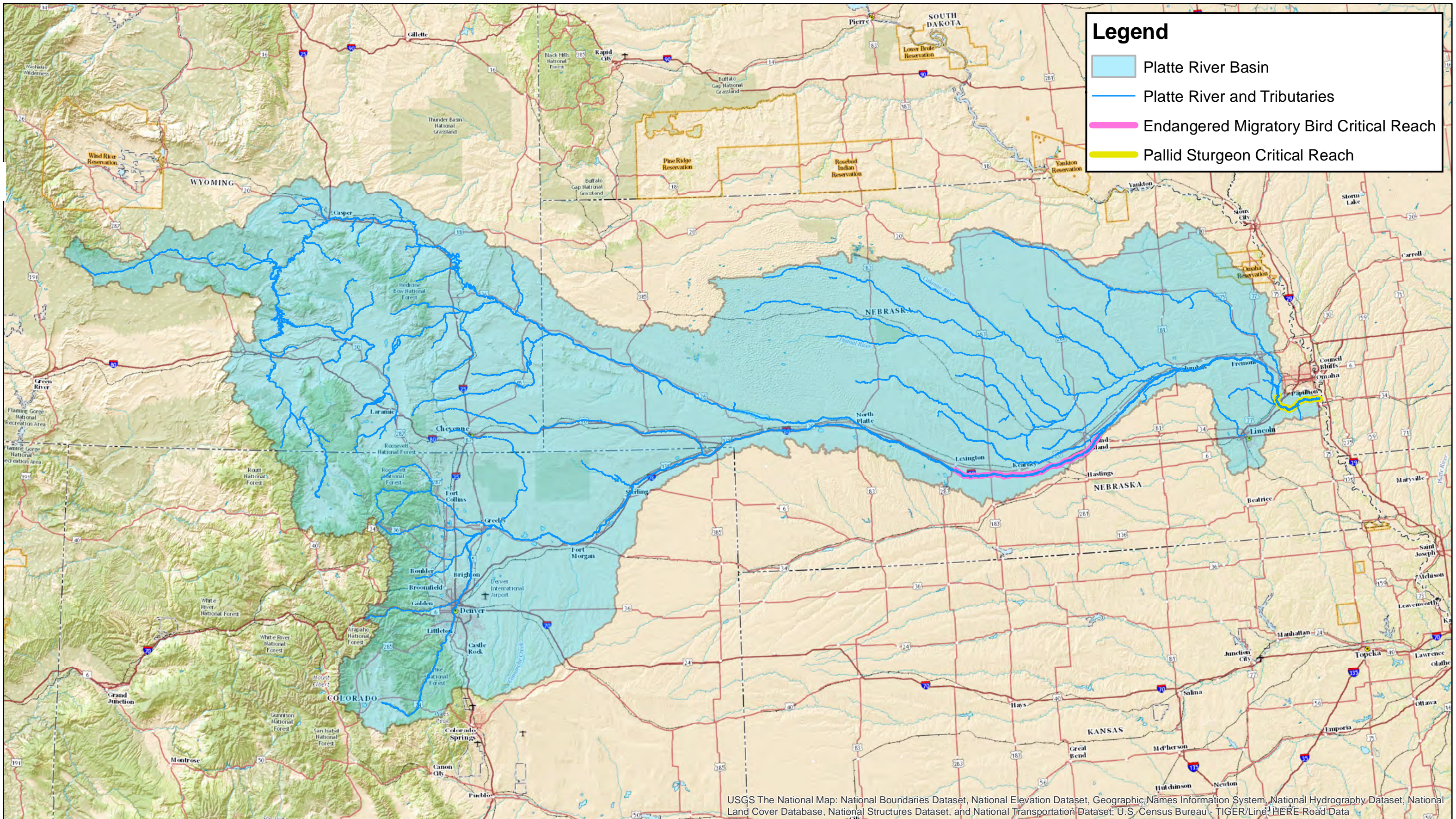
- ▲ Above Pathfinder Dam (comprising the upper North Platte River, Medicine Bow River, and the Sweetwater River drainages)
- ▲ Pathfinder Dam to Guernsey Dam
- ▲ Guernsey Dam to the State Line
- ▲ Upper Laramie (The Laramie River drainage above the Wheatland Tunnel Diversion)
- ▲ Lower Laramie (The Laramie River drainage below the Wheatland Tunnel Diversion downstream with the confluence of the Laramie River with the North Platte River)
- ▲ Horse Creek
- ▲ South Platte

Estimated subbasin water yield from precipitation and water usage by the agriculture, industry and municipal sectors is shown in the table below. **Figure 1.3** graphically presents the annual variance and volume of water usage by the agriculture, industry, and municipal sectors within the Platte Basin. Generally, except for the Lower Laramie subbasin, water supply and water usage are not evenly balanced. The North Platte above Pathfinder and Upper Laramie watersheds provide most of the water used in the other basins. The Crow Creek watershed in the South Platte Basin receives significant water supplies from the upper North Platte watershed and the Colorado River drainage on the west slope of the Sierra Madre Mountains.

Platte River Subbasin	Estimated Subbasin Yield	Agriculture Use	Municipal Use	Industrial Use	Total Use
	ac-ft	ac-ft	ac-ft	ac-ft	ac-ft
Above Pathfinder Dam	1,577,006	122,000	3,100	18,900	144,000
Upper Laramie	536,092	81,600	3,600	2,800	88,000
Pathfinder to Guernsey	517,948	77,800	10,700	85,200	173,700
Lower Laramie	190,000	88,800	1,200	20,100	110,100
Guernsey to State Line	20,000	107,700	1,800	4,200	113,700
Horse Creek	50,000	46,600	300	7,900	54,800
South Platte ¹	52,314	37,200	9,500	18,200	64,900
Total	2,943,360	561,700	30,200	157,300	749,200

Note: 1. Estimated subbasin yield included 8,314 ac-ft of water imported via L.S. Exchange.

On its' way to the Gulf of Mexico, the waters of the Platte Basin contribute to the economic and ecological life blood of much of the mid-continental United States. In Wyoming, the Platte Basin is the most densely populated major watershed in the state. In fact, Wyoming's three largest population centers (Cheyenne, Casper, and Laramie) are all located in the Platte Basin. The Platte Basin in Wyoming supports a diverse economy based upon agriculture, industry, higher education, recreation, and government services.



USGS The National Map: National Boundaries Dataset, National Elevation Dataset, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; U.S. Census Bureau - TIGER/Line; HERE Road Data



Wyoming Water Development Commission
Figure 1.2: Platte Watershed in Wyoming, Colorado and Nebraska Showing Critical Endangered Species Habitat Reaches in Nebraska



Figure 1.3
Overall Water Use Profile
within the Platte River Basin



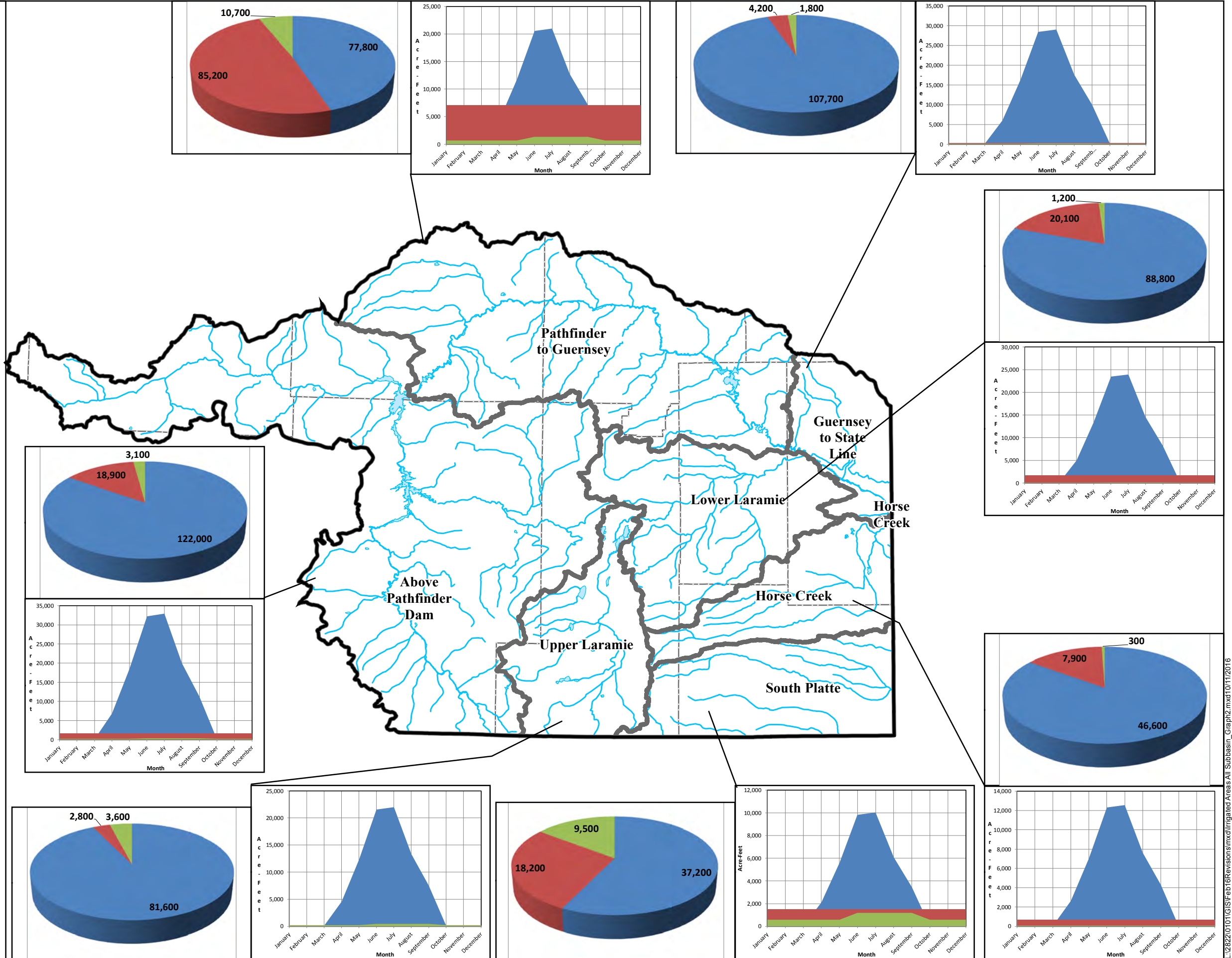
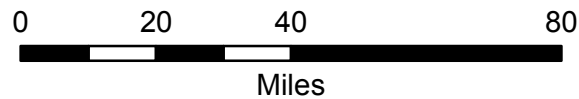
Legend

- Watershed
- Subbasins
- Waterbody
- Stream / River
- Major Rivers
- County

Graphs show estimated monthly consumptive use in an average year in acre feet.

Pie Charts show total annual consumptive use in acre feet in an average year.

- Agricultural
- Industrial
- Municipal/Domestic



The importance of this waterway as a historic thoroughfare by native people and white settlers is well documented. Traversing Nebraska, the waters of the Platte Basin sustain a vibrant agricultural economy. Water usage in the Platte Basin has been contested for over a century. The dependence on this vital resource shared by Wyoming, Colorado and Nebraska has generated disagreements, legally binding agreements, lawsuits, court settlements and court decrees regulating where and how the water can be used. **Figure 1.4** shows the historical progression of legal water apportionment in the Basin. Water usage in the basin apportioned to Wyoming, Colorado and Nebraska is presented in **Figure 1.5**.

The water supplies in the Platte Basin are some of the most regulated in Wyoming. A court decree apportioning the water between Wyoming and Nebraska and contentious legal battles have shaped the use and regulation of Platte Basin water resources in Wyoming.

Wyoming, Colorado, Nebraska, and the U.S. Department of Interior entered into an agreement effective January 1, 2007 to improve and maintain migration habitat for the endangered whooping crane, reproductive habitat for the endangered least tern and reproductive habitat for the threatened piping plover. Additionally, the agreement also reduces the likelihood that other species found in the critical habitat area will be listed under the Endangered Species Act and is testing the assumption that managing water flow in the central Platte River also improves the endangered pallid sturgeon's lower Platte River habitat. The agreement set in motion a recovery plan for these species that has implications for management of water resources within the Platte Basin in Wyoming. The cooperative agreement institutionalized the Platte River Recovery Implementation Program (PRRIP) with the three states and the Department of Interior.

The Endangered Species Act provides the U.S. Fish and Wildlife Service (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. **It is very important to note that the PRRIP serves as the reasonable and prudent alternative under the Endangered Species Act 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 Endangered Species Act 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 Threatened and Endangered (T&E) species targeted in the recovery plan are shown in **Figure 1.6**.

Figure 1.4 Platte River Significant Water Resources Events

1890 Wyoming Granted Statehood

Wyoming and Colorado develop Laramie River supplies

1911 - *Wyoming v. Colorado* - First interstate lawsuit regarding water supplies in the Laramie Basin. U.S. Supreme Court Decree decided 1922

1910 - 1930 The last of the dependable surface water supplies are appropriated in the Laramie and the North Platte Rivers

1930's Drought

1945 - *Nebraska v. Wyoming* (325 U.S. 589) North Platte Decree. U.S Supreme Court apportions the North Platte water supplies between Wyoming and Nebraska

1973 - First State Water Plan coordinated by the Governor's interdepartmental Water Conference

1978 - Greyrocks Dam Settlement over mitigation for Platte River endangered species

1984 - Wyoming Toad ESA listed (Endangered)

1986 - *Nebraska v. Wyoming* Nebraska reopens North Platte decree resulting in the 2001 Modified North Platte Decree

1992 - Ute ladies tresses listed (Threatened)

1996 - WWDC River Basin Planning Commences

1997 - *Endangered Species Agreement* - The states of CO, NE, & WY agree to not allow any further surface water depletions beyond 1997 levels due to endangered species water demands in the Central Platte

2000 - Colorado butterfly plant listed (Threatened)

2001 - Modified North Platte Decree finalized

2006 - First Platte Basin Plan is completed by WWDC

2007- *Wyoming, Nebraska, Colorado and the U.S. Department of Interior* finalize the Platte River Recovery Implementation Program

2011 - Prebles' Meadow Jumping Mouse listed (Threatened)

2016 - Platte Basin Plan Update is completed by WWDC

Figure 1.5: Overview of Interstate Water Use Allocations & Limitations in the Platte River Basin

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.

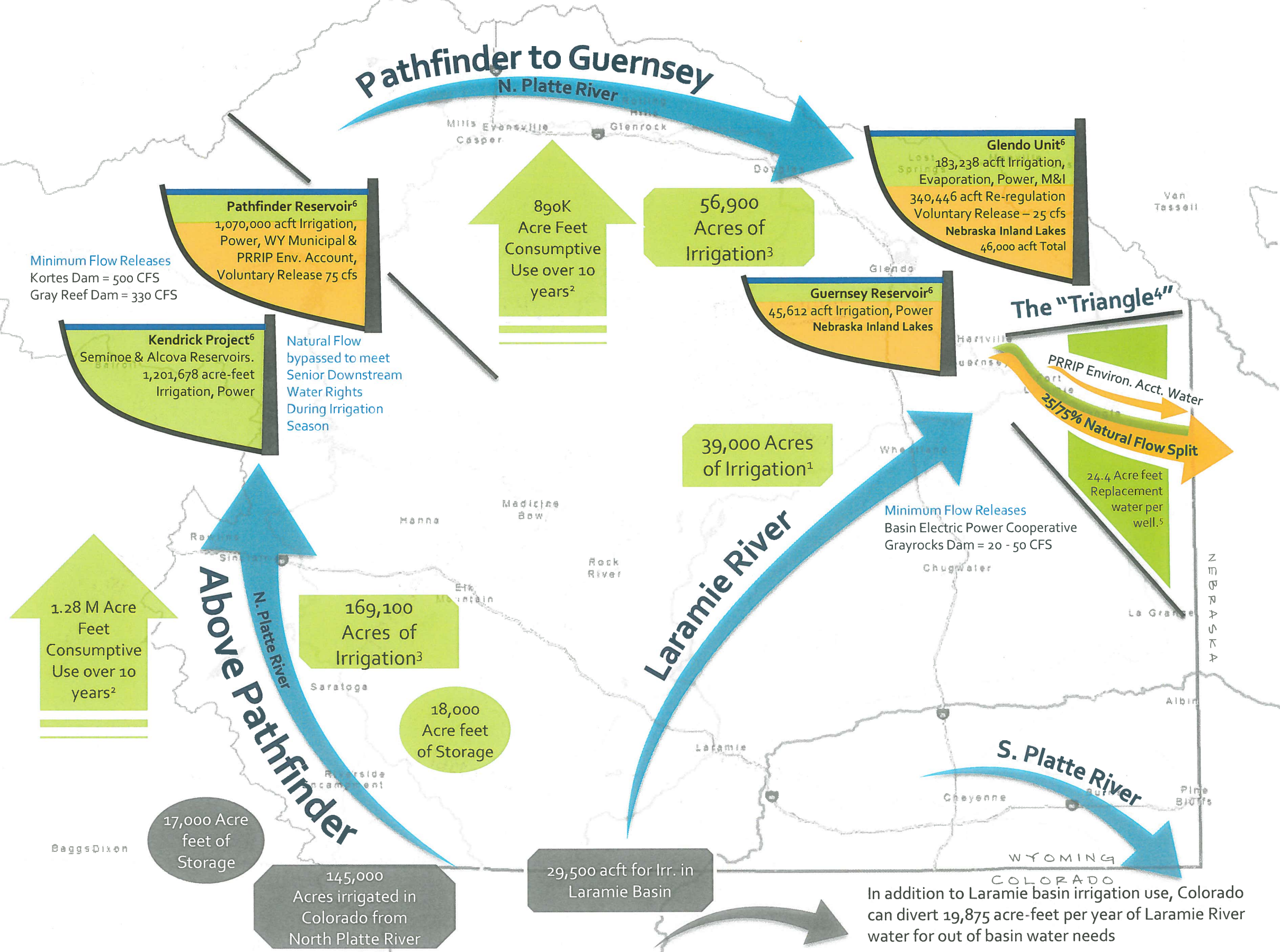
2. For the **North Platte River** and its tributaries above Pathfinder Reservoir and for Pathfinder to Guernsey Reservoir subbasins, including water from hydrologically connected groundwater wells, Wyoming is enjoined from consuming more than quantities of water historically consumed for irrigation from 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.



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

Figure 1.6: T&E Species Addressed Under the Platte River Recovery Implementation Plan



Clockwise from upper left: 1) Whooping Crane, 2) Interior Least Tern, 3) Pallid Sturgeon, and 4) Piping Plover.

Although there are no interstate agreements in place for their protection, there are four other water dependent T&E species found in the Platte River Basin in Wyoming:

- ▲ The Wyoming toad (*Anaxyrus baxteri*) is a federally listed Endangered Species, found only in Albany County.



Photo Credit: WY Toad SSP - Armstrong

- ▲ The Preble's meadow jumping mouse (*Zapus hudsonius preblei*), a federally listed Threatened Species is found in Albany, Converse, Laramie, Goshen and Platte Counties.



Photo Credit: FWS

- ▲ 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.



Photo Credit: FWS/Lindstrom

- ▲ 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 is known to occur in Laramie, Goshen, and Platte Counties. Critical habitat has been designated in Laramie and Platte Counties.

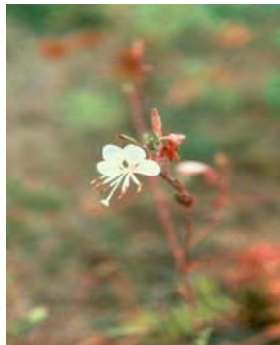


Photo Credit: FWS

1.3 GEOMORPHOLOGY AND TOPOGRAPHY

“Although mountains may guide migrations, the plains are the regions where people dwell in greatest numbers.”

- Elsworth Huntington

Located in the Rocky Mountains, Wyoming Basin and Great Plains physiographic provinces, the Platte River Basin spans a wide variety of landscapes. The headwaters of the Platte River Basin find their sources in the mountains of Wyoming and Colorado. Snowfall in the Park and Front Range Mountains in Colorado, the southern Wind River, Sierra Madre, Snowy, and Laramie Ranges in Wyoming are the primary sources of water supply for the entire drainage. However, smaller mountain ranges are locally important contributors of water supply. The Haystack, Shirley, Ferris, Seminoe, Pedro, Granite, Casper, Rattlesnake, and Laramie mountains are the sources of freshwater springs that provide livestock water and wildlife habitat in some of the arid portions of the Basin. Topography within the Basin varies considerably. Elevations in the Basin range from over 12,000 feet above mean sea level (msl) in the Snowy Range to 4,025 feet msl where the North Platte crosses into Nebraska. Intermountain basins characterize much of the land area in the Upper Laramie subbasin and the Platte drainage above Pathfinder Dam. East of the Laramie Range, the topography is primarily high plains shaped by the erosive forces of wind and water.

The North Platte River Basin in Wyoming looks like a fist with the index finger pointing west. The Sweetwater River drainage, flowing in from the west, forms the “finger”. The North Platte River sources in the mountains surrounding Colorado’s North Park. The North Platte flows north into Wyoming and sweeps east and south in a horseshoe bend nearly 350 miles long, draining the entire southeast quarter of the state. As the river flows north then east, it gathers significant flow from tributaries draining the mountain ranges listed in the previous paragraph. On its’ journey through Wyoming, the North Platte traverses an intermountain valley before reaching Seminoe Reservoir, the first major U.S. Bureau of Reclamation (USBR) impoundment on the mainstem of the North Platte. After flowing Downstream from Seminoe there are six more mainstem USBR reservoirs: Kortes, Pathfinder, Alcova, Grey Reef, Glendo and Guernsey before the river flows into Nebraska.

A major tributary, the Laramie River flows north into Wyoming from the Colorado Front Range Mountains and traverses the Laramie Plains, a broad high elevation deflation basin, in a meandering northeasterly course. As the river drains the Laramie Plains, the elevation changes little from 8,000 feet at Woods Landing to a little less than 7,000 feet at Wheatland Reservoir #2.

1.4 CLIMATE

“The most important thing about global warming is this: Whether humans are responsible for the bulk of climate change is going to be left to the scientists, but it's all of our responsibility to leave this planet in better shape for the future generations than we found it.”

- Mike Huckabee

The overall climate of the Platte Basin in Wyoming is described in a word: Variable. Broadly separated into Highland (Alpine) and Semi-Arid Steppe, the temperature can exceed 100° F during the summer in the lower elevations and sink below -20° F in the winter. In the Snowy and Sierra Madre Mountains, snow has been recorded every month of the year. Temperature swings can come quickly with changes of more than 30° F occurring in a few hours. The saying *“If you don’t like the current weather conditions in Wyoming just wait a couple days”* describes the rapidity of some temperature and precipitation changes in the Platte Basin.

Generally, the Basin is characterized by cold, windy winters and warm, relatively dry summers. Summer rains, often in the form of isolated, intense, short duration thunderstorms, often producing hail, are common. These storms can scour small and medium sized tributary channels resulting in flash flooding. Hail storms, especially on the eastern plains are common and frequently damage property and crops (Wyoming Climate Atlas, 2004). In much of the North Platte basin, evaporation significantly exceeds precipitation. The combination of low humidity, breezy conditions and summer heat result in significant pan evaporation and evapotranspiration losses in agricultural areas of eastern Wyoming. A precipitation map of the Platte Basin is presented in **Figure 1.7**.

Comparing the general topography of the Platte River Basin presented in **Figure 1.1** with the precipitation map in **Figure 1.7**, a clear association can be made between elevation and precipitation.

Finally, it is worth noting that in 2016 the Wyoming State Climate Office identified the Cowboy State as the fifth driest state in the country. As such, drought is a constant, and frequent threat. Between 2001 and 2008, more than half of the state experienced moderate to severe drought conditions as shown on **Figure 1.8**. Although this prolonged drought varied from year to year and from county to county and from region to region within the state, this drought was a significant event. Drought conditions returned to most of the state again from 2012 to 2014. The economic impacts of drought are often felt for several years after the precipitation has returned to “normal”. Since 1950, droughts have become more frequent and more intense as shown in **Figure 1.9**

1.5 SOCIO-ECONOMIC CHARACTERISTICS

“We are the sum of who we are and what we do”

- Anonymous

During an energy boom, between 2000 and 2014, the Platte River Basin’s population increased by over 36,000 people, or about 16.3% - an average 1.22% per year. In comparison, the entire State of Wyoming population grew slightly faster than the Platte River Basin, with total population growth of about 18.3% over that period. Eighty percent of the Platte River Basin’s growth occurred in the South Platte and Pathfinder to Guernsey subbasins; other subbasins grew by much smaller amounts. The Above-Pathfinder and Lower Laramie subbasin populations grew insignificantly over the 15-year period and the Guernsey to State Line subbasin experienced growth that averaged less than 1% annually. **Overall, the Platte River Basin makes up about 44% of the State’s population.**

Subbasin/City	Population		Total Growth	Percent Growth
	2000	2014	2000-2014	2000-2014
Above Pathfinder Dam	16,381	16,909	527	3.2%
Guernsey to State Line	9,967	10,839	873	8.8%
Horse Creek	2,389	2,676	287	12.0%
Lower Laramie	7,844	8,002	158	2.0%
Pathfinder to Guernsey	73,662	87,915	14,253	19.3%
South Platte	80,349	94,909	14,560	18.1%
Upper Laramie	30,299	35,745	5,446	18.0%
Total	220,891	256,996	36,105	16.3%
State of Wyoming	493,782	584,153	90,371	18.3%

Figure 1.7: Average Annual Precipitation in the Platte Basin of Wyoming

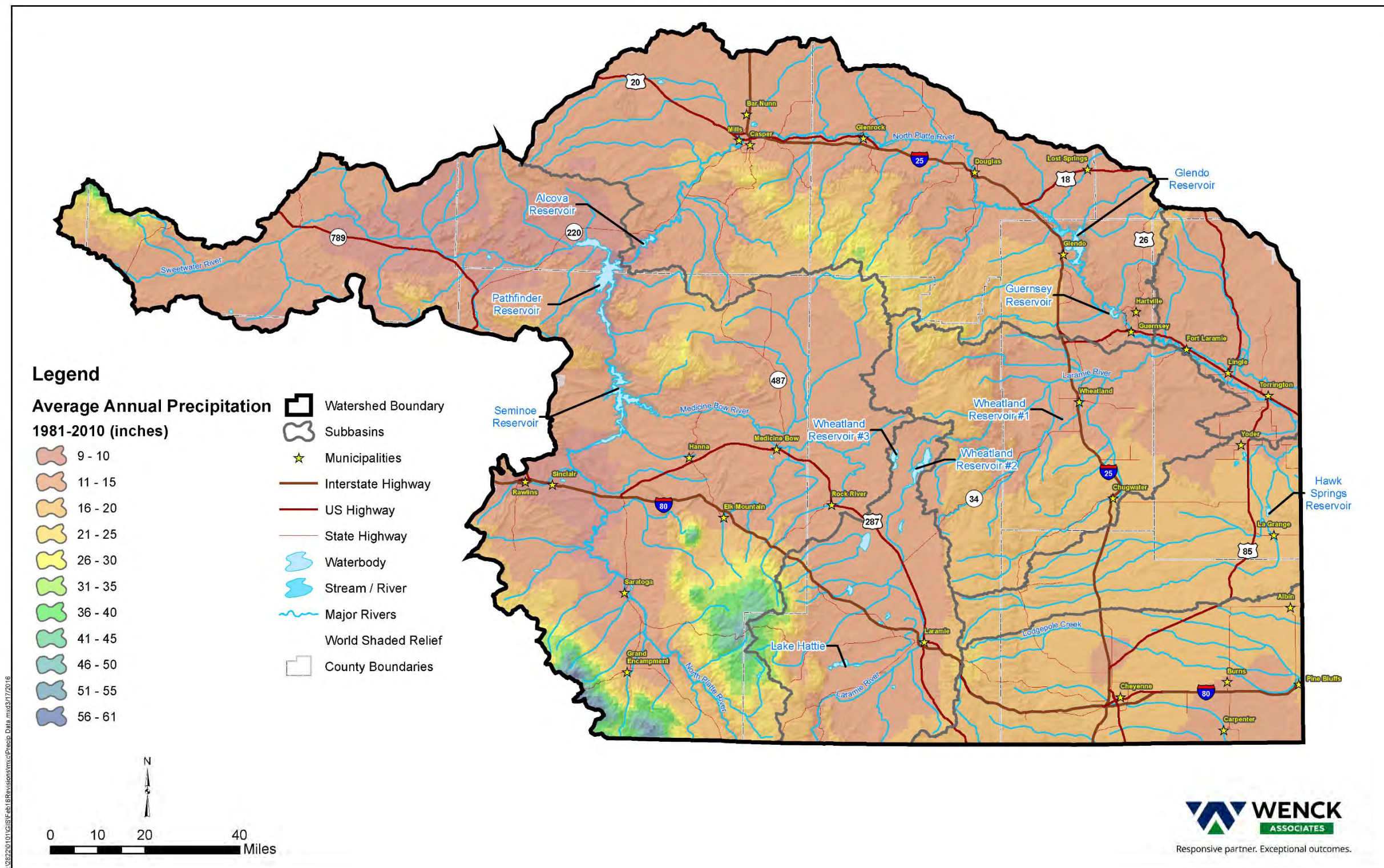


Figure 1.8: Wyoming Drought Percentage 2000-2014

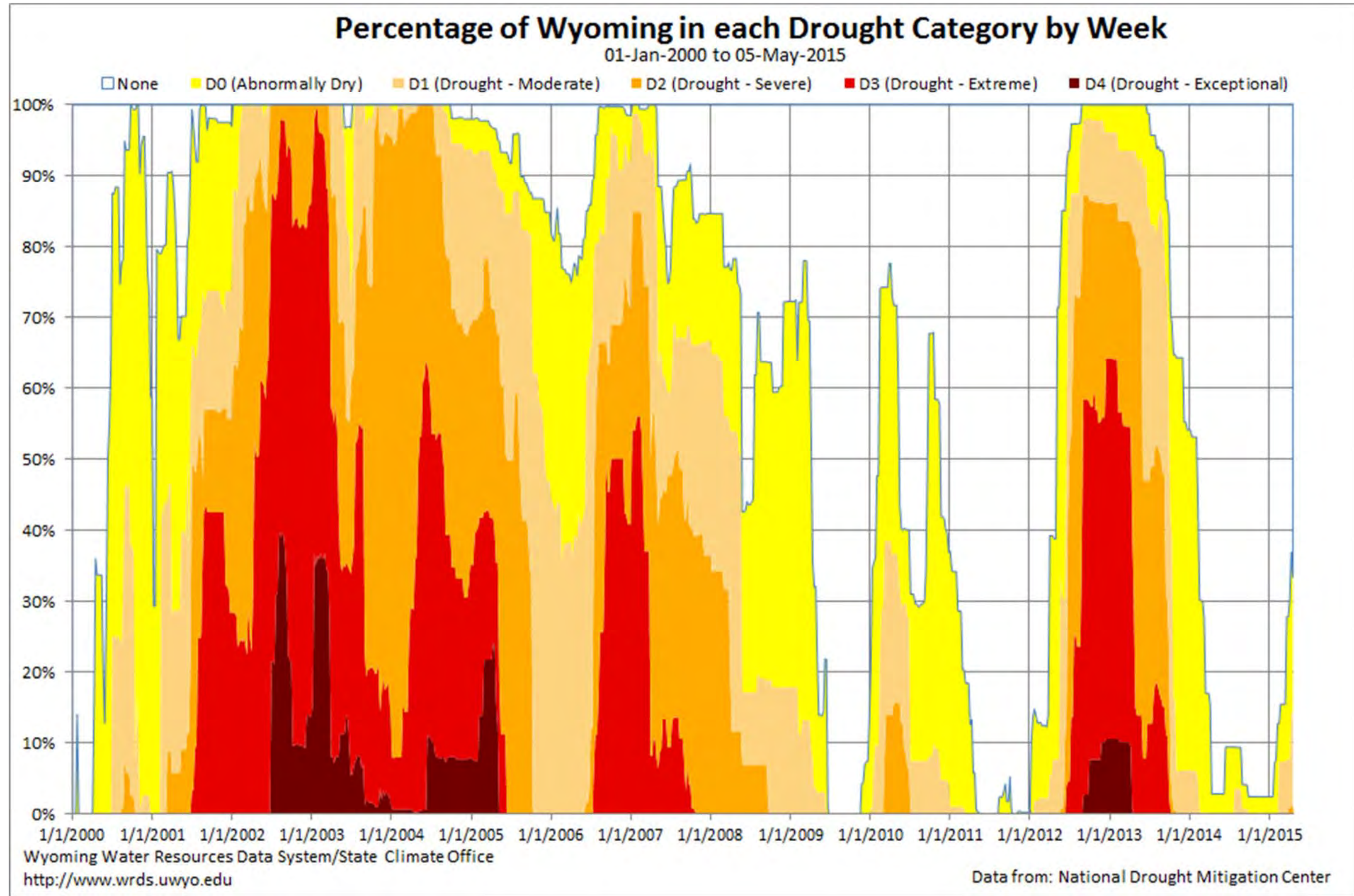
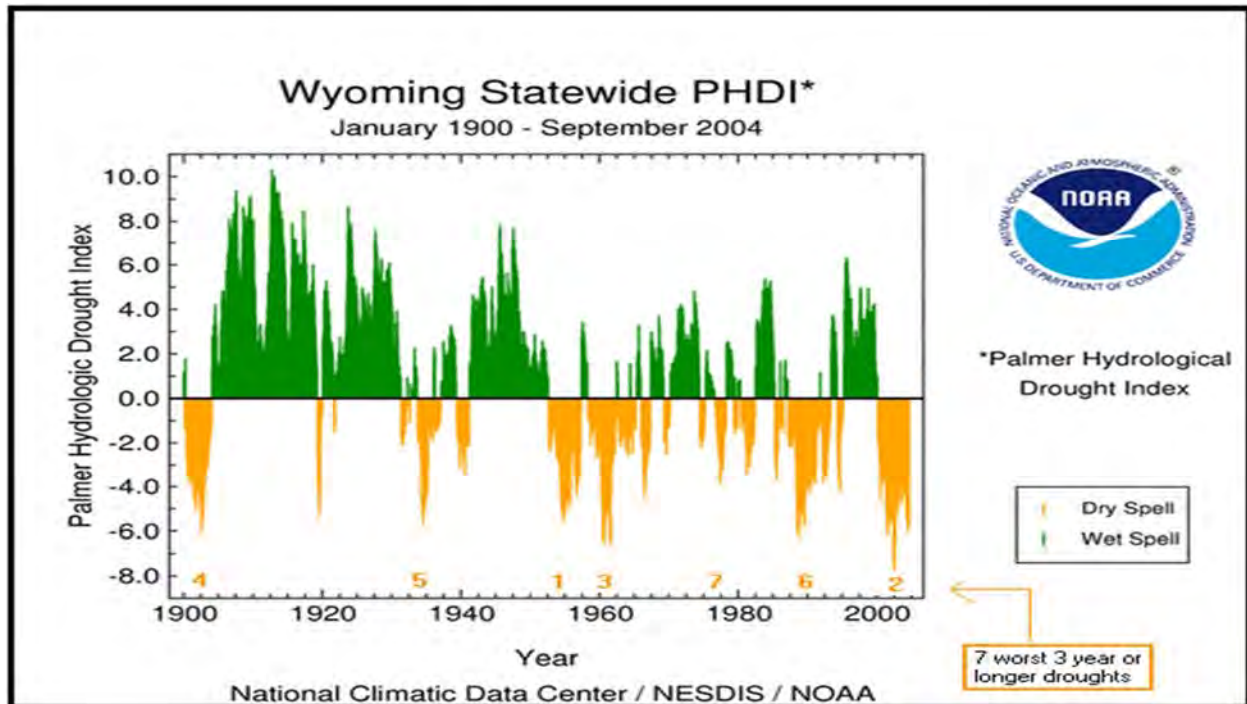


Figure 1.9: Wyoming Droughts 1900-2008



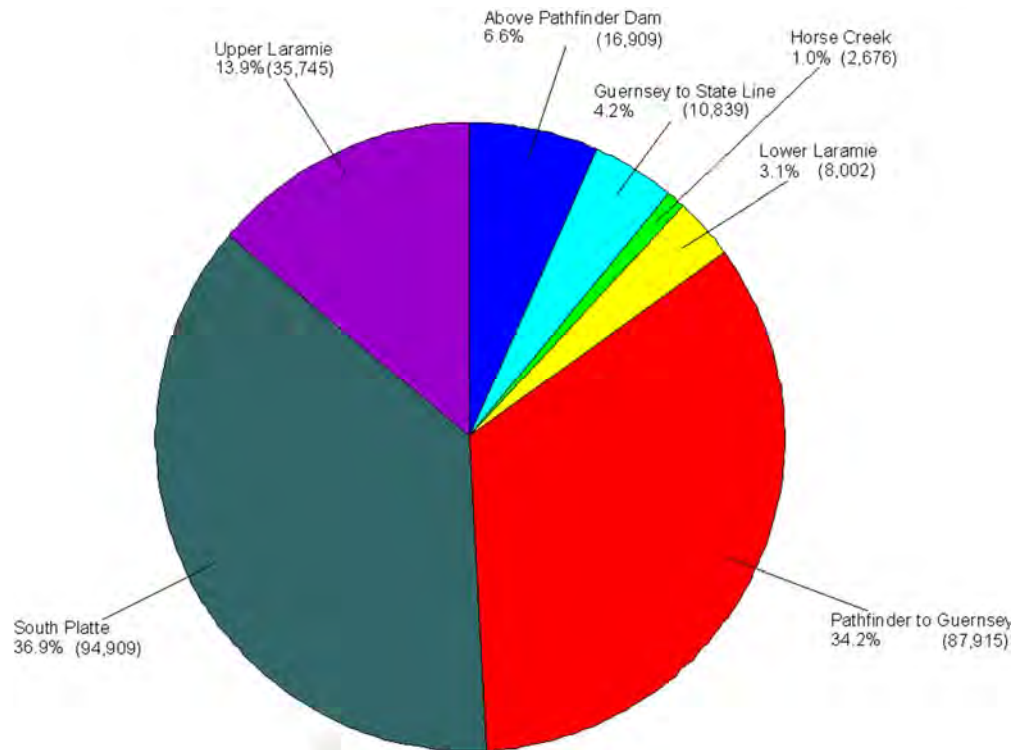
In-migration has been a much more important component of population growth over the last decade, as compared to more historical periods. Between 2000 and 2013, in-migration comprised about half the Basin's population growth. Other demographic changes include an aging population and decreasing household size. The slight decrease in labor force participation rates is also likely the result of the aging population. **Figure 1.10** presents a graphical depiction of the 2014 population distribution by subbasin.

1.5.1 Employment

Between 2002 and 2014, the total number of jobs in the Basin increased by about 27,200, from 145,600 full and part-time positions in 2002 to 172,800 total positions in 2014. Over this period, Basin jobs accounted for about 43% of total jobs in Wyoming. Employment growth in individual Basin counties ranged from 0.6% per year up to 2.6% per year over this period; both Basin employment and statewide employment grew at an average rate of about 1.6% annually.

The Basin's largest employment sectors include the government sector, followed by retail trade; healthcare; accommodation and food service; construction and mining. As the largest employment sector by far, the government sector (federal, military, state and local government jobs); included about 37,400 jobs, or about 22% of total Basin jobs, in 2014. Mining accounts for about 5.5% of Basin jobs; the majority of those are located in the Above Pathfinder Dam and the Pathfinder to Guernsey subbasins. Agriculture is a key sector in the Basin in terms of water use; however, employment in that sector is relatively small. Annual earnings within each economic sector vary widely, but averaged about \$51,800 in 2014.

Figure 1.10: Platte Basin Population by Subbasin



1.5.2 Key Economic Sectors

From a water use standpoint, important sectors in the Basin include agriculture, energy, minerals, utilities, and recreation.

Agriculture

Agriculture is comprised primarily of cattle ranching and hay production. Irrigated acreage has decreased in recent years (a 14% reduction over about the last decade), likely due to increases in technology and changes in commodity prices, among other factors. Currently, there are about 524,000 irrigated acres in the Basin and about 656,000 head of livestock, compared to about 613,000 irrigated acres and 686,000 head of livestock at the time of the previous 2006 Basin Plan. Basin wide agricultural water use appears to have decreased somewhat in recent years, although fluctuations in water use do occur from year to year. The acreage of irrigated land is strongly correlated with water availability. There are several possible explanations for this change:

- ▲ Market forces may affect the amount of acreage planted, hay harvested and livestock raised
- ▲ Changes in production costs may also affect amount of acreage planted, hay harvested and livestock raised
- ▲ Weather fluctuations (timing of precipitation, availability of water supplies and temperature fluctuations also affect amount of acreage planted, hay harvested and livestock raised
- ▲ The method(s) used to assess changes in crop acreage and to a lesser extent, livestock numbers may have changed over the ten-year period from 2006 to 2016. A 15% variance between 2006 and 2016 may simply be a result of sampling error.

Oil and Gas

A large portion of the State's oil production comes from within the Basin (about 21% produced in Basin counties in 2002 and about 38% by 2014). Oil production from Basin counties has increased annually through 2015, with crude oil production reaching over 34.5 million barrels in that year. There are three oil refineries in the Basin, which use large amounts of water. In 2015, about 16% of the State's natural gas was produced in Basin counties but annual production has generally declined in recent years. However, both 2014 and 2015 saw small increases in natural gas production in the Basin, even as total statewide production continued to decline. Permitted water use in the oil and gas sector increased by more than 50% over the last 10 years in the Basin.

Minerals

The amount of uranium produced in the Basin has remained relatively constant over the last decade. All coal mines in the Basin have now closed and no coal is currently produced within the Basin.

Power Generation

In terms of major power generation facilities, USBR operates six hydropower facilities within the Basin, and the Laramie River Station and Dave Johnston Power Plant are also located in the Basin. In 2014, the 132 MW natural-gas fired Cheyenne Prairie Generating Station began operation. Water demands for power generation have increased slightly since the previous Basin Plan.

Environment and Recreation

Water in the Basin provides for a number of environmental and recreational (E and R) uses, including supporting wetlands and other aquatic habitat; and fishing, boating, swimming, and other recreational activities. E and R water uses exist throughout the Basin, although some subbasins include a greater concentration of E and R amenities than others. The Basin contains a number of major recreational reservoirs, as well as blue, red, and yellow ribbon trout streams. E and R water uses are highly dependent on traditional water uses. The analysis of future demands for this sector is a reflection of the interactions of traditional water uses and non-consumptive uses. Under the High Scenario, recreational water use will be stable or will decline modestly; environmental water use is likely to expand. The Low Scenario will have mostly positive effects on recreational water use, but the outlook for environmental water uses is mixed. E and R uses under the Mid Scenario would largely remain similar to current conditions.

Other Economic Activity

In addition to the activities described above, the Basin is the seat of Wyoming State Government and home to the University of Wyoming in Laramie, the Wyoming State Penitentiary in Rawlins and several large retailers and distribution facilities located in larger cities. On the downside, the Wyoming Ethanol facility in Torrington closed in 2015 and the Western Sugar Cooperative plans on closing its Torrington plant by 2017.

1.6 WATER USAGE

"What you are aware of you are in control of; what you are not aware of is in control of you."

- Anthony De Mello

Water resources in the Platte Basin are extensively utilized and legally contested. On a macro scale, water resources in the basin are some of the most regulated in the western United States and have been called "fully appropriated" by some resource managers. The

Wyoming State Engineer's Office works closely with the USBR and the U.S. Army Corps of Engineers (USACE) to manage water in the Basin. The USACE manages the flood storage pool in Glendo Reservoir.

The Platte Basin supports the majority of Wyoming's population. Industry, agriculture, government services, higher education and outdoor recreation are the primary economic drivers in the Basin. Strategically located in the central United States, close proximity to the Colorado front-range communities, served by major railroads and bisected by two major interstate highways, the southeast quarter of Wyoming is an attractive hub for commerce and recreation. The value of the Platte Basin water resources cannot be overstated...They are the vital economic lifeblood of southeast Wyoming.

Wyoming is a premier destination for hunting, fishing, camping and all forms of outdoor recreation and tourism. The quality of these assets depends upon the availability of adequate water supplies and existing land uses that need to be properly protected and enhanced. 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 by different sectors can occur by relying on adaptive management strategies and agreements to conserve and transfer water supplies to meet a variety of anticipated water needs in the future.

There are significant constraints imposed on the use of water in the Platte River Basin based on allocations and apportionment within the North Platte Modified Decree, the Laramie River Decree and Wyoming's participation within the PRRIP. The limitations affect the management of existing water uses and future water opportunities. A timeline presenting these legal and institutional activities has been presented in **Figure 1.4**. Any new major water developments within the Basin are unlikely without mitigation efforts to offset the proposed new depletions. For the future development of small water uses serving domestic, stock, recreation, fish and wildlife, environmental and other deminimus uses; Wyoming's 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. A graphic summary of the water allocated between Wyoming, Colorado and Nebraska is presented in **Figure 1.5**.

Between 2005 and 2015, total estimated consumptive use in the Basin (under normal year conditions) decreased by about 6.5%. That net decrease was made up of changes in individual sectors: 1) a 16% decrease in total agricultural water demand (due to a reduction of about 88,000 irrigated acres and 30,000 fewer head of livestock); 2) about a 4.5% increase in municipal/rural domestic demand (population growth and changes in per capita water usage); and 3) an almost 51% increase in industrial demands (increased water demands for oil and gas production, mining activity, power generation, aggregate production and other miscellaneous industrial demands).

Economic Sector	Estimated Consumptive Use (AF)	
	2005	2015
Irrigated Agriculture	662,000	556,000
Livestock	6,300	5,800
Municipal/ Rural Domestic	28,910	30,200
Industrial	104,200	157,300
Total Water Usage	801,410	749,300

Current consumptive water demands in the Basin are estimated to be about 749,300 AF per year, with about 75% of that demand coming from the agricultural sector. Current projections for 2045 reflect higher consumptive use under the High Scenario and lower

consumptive demands under the Low and Mid Scenarios. Year 2045 water demands, in terms of consumptive use, range from 633,200 AF up to 939,100 AF. The reduction in total consumptive use demands under the Low and Mid Scenarios is largely due to an assumed reduction in irrigated acres over time.

Economic Sector	Estimated Consumptive Use (AF)			
	2016 Basin Plan			
	2015	Year 2045		
High Scenario		Low Scenario	Mid Scenario	
Irrigated Agriculture	55,000	671,000	436,000	497,000
Livestock	5,800	6,900	5,000	5,800
Municipal/Rural Domestic	30,200	51,200	35,500	41,100
Industrial	157,30	210,000	156,700	174,700
Total Water Usage	749,300	939,100	633,200	718,600

1.7 WATER SUPPLY STRATEGIES

“Problems only exist in the human mind.”

- Anthony De Mello

There are many challenges to develop and manage water resources in the Platte River Basin in Wyoming. Conflicting uses including water allocation among three states, water quality, periodic droughts and environmental considerations are just a few. However, working together in trusting, collaborative and open-minded groups can develop solutions that serve the greatest good.

Perhaps Wallace Stegner has stated this sentiment best:

“One cannot be pessimistic about the West. This is the native home of hope. When it fully learns that cooperation, not rugged individualism, is the quality that most characterizes and preserves it, then it will have achieved itself and outlived its origins. Then it has a chance to create a society to match its scenery.”

- Wallace Stegner: *The Sound of Mountain Water*

The efforts and outcomes of evaluating water strategies in the Platte Basin and seeking input from stakeholders to gather, assess, and recommend strategies are addressed in detail in Volume 5 of this updated Basin Plan. In summary, the high priority categories, individual strategies, and implementations efforts 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

- ▲ 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.

Many of the water opportunities and strategies are successfully being implemented in the North Platte River Basin.

- ▲ The strategy and implementation of developing and relying upon non-hydrologically connected groundwater sources for existing and new wells serving municipal and other water uses.
- ▲ The development and reliance on raw water sources to irrigate municipal green areas. Municipalities and other entities are performing feasibility analysis studying the development of raw irrigation for new or existing golf courses and other green 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.
- ▲ A cooperative project between Casper-Alcova Irrigation District and the City of Casper is an example of an agricultural conservation project that benefits municipal water needs.

1.8 PUBLIC INPUT AND ONGOING INVOLVEMENT IN PLAN DEVELOPMENT AND IMPLEMENTATION

There are many challenges and many opportunities to managing water in the Platte Basin. A cooperative approach is needed to successfully protect and wisely use this resource. 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) 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 to benefit agriculture, wildlife and public recreation.

"Eventually, all things merge into one, and a river runs through it."

- Norman Maclean