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RSI-2856

# FINAL REPORT
# NIOBRARA–LOWER NORTH PLATTE RIVERS WATERSHED STUDY, LEVEL I
# WATERSHED MANAGEMENT PLAN

**Topical Report RSI-2856**

*prepared for*

Wyoming Water Development Commission
6920 Yellowtail Road
Cheyenne, Wyoming 82002

April 2019

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WATERSHED MANAGEMENT PLAN
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**Topical Report RSI-2856**

*by*

RESPEC
3824 Jet Drive
Rapid City, South Dakota 57703

prepared for

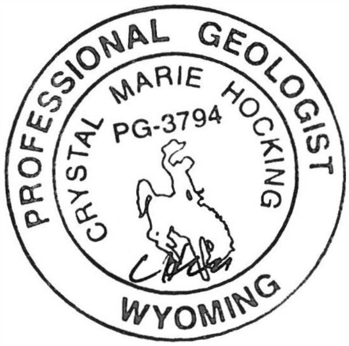
Wyoming Water Development Commission
6920 Yellowtail Road
Cheyenne, Wyoming 82002

September 2019

I hereby certify that this report was prepared by us or under our direct supervision and that we are duly licensed Professional Geologists and Engineers under the laws of the state of Wyoming.

Crystal M. Hocking, PG

Peter P. Rausch, PE



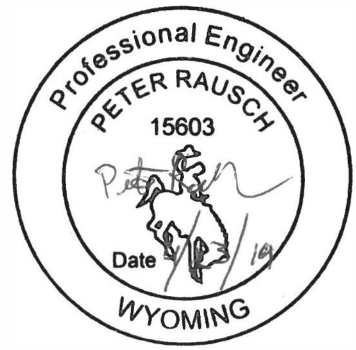



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FIGURE PAGE

# LIST OF ACRONYMS

| | |
|---|---|
| ACEP | Agricultural Conservation Easement Program |
| AMP | Allotment Management Plan |
| ARS | Agricultural Research Service |
| BLM | US Bureau of Land Management |
| BMP | best management practice |
| CEAP | Conservation Effects Assessment Project |
| CFS | cubic feet per second |
| CMP | corrugated metal pipe |
| COOP | Cooperative Observer Network |
| CREP | Conservation Reserve Enhancement Program |
| CRMP | Coordinated Resource Management Plan |
| CRP | Conservation Reserve Program |
| CSP | Conservation Stewardship Program |
| CWA | Clean Water Act |
| DDCT | Density and Disturbance Calculation Tool |
| DEM | digital elevation model |
| DMI | domestic, municipal, and industrial |
| DOT | US Department of Transportation |
| DU | Ducks Unlimited, Inc. |
| DWSRF | Drinking Water State Revolving Loan Fund |
| EA | Environmental Assessments |
| ECP | Emergency Conservation Program |
| EIS | Environmental Impact Statement |
| EPA | US Environmental Protection Agency |
| EQIP | Environmental Quality Incentives Program |
| ESA | Endangered Species Act |
| ETS | Enterprise Technology Services |
| EVH | existing begetation height |
| EVT | existing vegetation type |
| FEMA | Federal Emergency Management Agency |
| FIRM | Flood Insurance Rate Map |
| FSA | Farm Service Agency |
| GCA | Prairie Center Groundwater Control Area |
| GHWC | Goshen Hole Wetland Complex |
| GID | Goshen Irrigation District |
| GIS | geographic information system |
| gpm | gallons per minute |
| GRP | Grassland Reserve Program |
| HDPE | high-density polyethylene |
| HUC | hydraulic unit code |
| IDF | inflow design flood |

# LIST OF ACRONYMS (continued)

| | |
|---|---|
| INPS | invasive, nonnative plant species |
| KNWA | Key Nongame Wildlife Area |
| LCGP | Large Construction General Permit |
| LFLCD | Lingle-Ft. Laramie Conservation District |
| MRLC | Multi-Resolution Land Characteristics Consortium |
| MSC | Map Service Center |
| NAIP | National Agriculture Imagery Program |
| NASS | National Agricultural Statistics Service |
| NCD | Niobrara Conservation District |
| NeDNR | Nebraska Department of Natural Resources |
| NEPA | National Environmental Policy Act |
| NFWF | National Fish and Wildlife Foundation |
| NHD | National Hydrography Dataset |
| NLCD | National Land Cover Database |
| NPMS | National Pipeline Mapping System |
| NPVCD | North Platte Valley Conservation District |
| NRCS | Natural Resources Conservation Service |
| NVCS | National Vegetation Classification Standard |
| NWI | National Wetlands Inventory |
| OSLI | Office of State Lands and Investments |
| PAWS | Platte Alliance Water Supply |
| PCRD | Platte County Resource District |
| PIMMA | Pipeline Information Management and Mapping Application |
| PIP | plastic irrigation pipeline |
| PMF | Probable Maximum Flood |
| PMP | Pathfinder Modification Project |
| POD | points of diversion |
| PRISM | Parameter-Elevation Regressions on Independent Slopes Model |
| PRRIP | Platte River Recovery Implementation Program |
| RCPP | Regional Conservation Partnership Program |
| SCGP | Small Construction General Permit |
| SEO | Wyoming State Engineer's Office |
| SGCD | South Goshen Conservation District |
| SGCN | Species of Greatest Conservation Need |
| SHPO | Wyoming State Historic Preservation Office |
| SWPP | Small Water Project Program |
| SWPPP | Storm Water Pollution Prevention Plan |
| TNC | The Nature Conservancy |
| TSS | Total suspended sediment |
| UNWNRD | Upper Niobrara White Natural Resources District |

# LIST OF ACRONYMS (continued)

| | |
|---|---|
| USACE | US Army Corp of Engineers |
| USBR | US Bureau of Reclamation |
| USDA | US Department of Agriculture |
| USDI | United States Department of the Interior |
| USFWS | US Fish and Wildlife Service |
| USGS | US Geological Survey |
| WDEQ | Wyoming Department of Environmental Quality |
| WGFD | Wyoming Game and Fish Department |
| WLCI | Wyoming Landscape Conservation Initiative |
| WPA | Wyoming Pipeline Authority |
| WRDS | Water Resources Data System |
| WRE | Wetlands Reserve Easements |
| WSEO | Wyoming State Engineer's Office |
| WSGA | Wyoming Stock Growers Association |
| WSGS | Wyoming State Geological Survey |
| WWDC | Wyoming Water Development Commission |
| WWDO | Wyoming Water Development Office |
| WWNRT | Wyoming Wildlife and Natural Resource Trust |
| WYNDD | Wyoming Natural Diversity Database |
| WYPDES | Wyoming Pollutant Discharge Elimination System |

# 1.0 INTRODUCTION AND OVERVIEW

## 1.1 INTRODUCTION

In 2014, the Niobrara Conservation District (NCD), in cooperation with the other sponsoring conservations districts—Platte County Resource District (PCRD), Lingle-Ft. Laramie Conservation District (LFLCD), and the North Platte Valley Conservation District (NPVCD)—requested that the Wyoming Water Development Commission (WWDC) conduct a comprehensive study of the Niobrara–Lower North Platte Rivers Watershed. The local sponsors requested that the Level I watershed study evaluate the current watershed condition and function, river and creek geomorphic classification, irrigation system efficiency, groundwater resources, water and flood storage, and wetland and riparian areas, and identify water development opportunities on irrigated lands, rangelands, wetlands, and streams. In 2017, the WWDC approved funding for the watershed study and then contracted with RESPEC to provide professional services for the Niobrara–Lower North Platte Rivers Watershed Study.

## 1.2 OVERVIEW

The Niobrara–Lower North Platte Rivers Watershed Study is a comprehensive evaluation and an initial inventory of the water and land resources within the study area. This Level I study provides important information that the NCD, LFLCD, and NPVCD (the study's local sponsors) and neighboring conservation districts and the WWDC (the study's sponsor) could use in developing water resources and implementing conservation practices that address water- and land- resource concerns within the study area. This watershed study includes in-depth descriptions about needed water development projects that could provide economic, ecological, and social benefits to the state of Wyoming and its citizens.

The intent of this report, which is accompanied by the study's digital library and Geographic Information System (GIS) geodatabase, is to provide the results of the Niobrara–Lower North Platte Rivers Watershed Study. This Level I watershed study included reviewing previously conducted work that was contained in multiple databases, studies, and reports regarding the natural resources within the study area. Additionally, the information that was reviewed and determined to be relevant to the study's purpose was compiled into a digital library and a GIS dataset. Information in the digital library was combined with the data collected during the inventory effort and used to generate proposed conceptual alternatives that are outlined in Chapter 4.0 of this report.

### 1.2.1 What Is a Watershed Study?

A watershed is defined in the Merriam-Webster Dictionary as "a region or area bounded peripherally by a divide and draining ultimately to a particular watercourse or body of water" [Merriam-Webster, 2013]. The *Operating Criteria of the Wyoming Water Development Program* [WWDC, 2018] describes Level I studies as preliminary analyses and compares development alternatives. Although, a Level I study is also used for master plans, watershed improvement studies, and other water-planning studies. Specifically, the *Operating Criteria of the Wyoming Water Development Program,* [WWDC, 2018a] describes watershed studies as:

> *These studies provide a detailed evaluation of an individual watershed. The studies may identify water development and system rehabilitation projects as well as address erosion*

*control, flood control or other non-water development related environmental issues. Watershed improvement studies are an integral part of the Small Water Project Program, which has its own specific criteria. The studies may identify projects that may be eligible for the New Development, Rehabilitation, or Dam and Reservoir Programs.*

However, a watershed study was perhaps best explained in "Conservation and Watershed Studies. What's the Connection?", which is an article that appeared in the WWDC's *Water Planning News* Fall 2009 newsletter [WWDC, 2009].

*Today, conservation by watershed is an old concept with new horizons. Watersheds have long been recognized in the western Unites States for their significant natural resources and the interrelationships found contained in land areas connected by stream systems. These relationships were recognized by John Wesley Powell from his early expeditions of the west and resulted in proposed conservation, low density open grazing, irrigation systems and state boundaries based on watershed areas.*

*The conservation concept developed over time to coalesce in the early 1930's with the formation of special districts whose boundaries were often based on watersheds. At that time the relationship between stream systems and landscape function was recognized. This relationship was broadened to embrace watershed condition and quality and its response to human influences. This further provided some understanding of the historic land use effect on watershed condition and how management and restoration needs to be based on local landscape characteristics.*

*Today, these relationships are embraced by the Wyoming Water Development Commission and Office through a watershed study program. On behalf of a local community sponsor, a watershed study can provide a comprehensive evaluation, analysis and description of the resources associated with a watershed and the watershed's water development opportunities. It is best stated that information related to the physical sciences is incorporated into a biological system.*

*There are three prominent issues that are important considerations in a watershed information review and study. The first is surface water storage. Surface water storage is often of significant interest to a watershed community in order to address seasonal and/or annual shortages of water supply, augment late season stream flow to benefit riparian habitat and wildlife, address flood impacts, enhance recreation opportunities, improve water quality and steam channel stability.*

*Second is the evaluation of irrigation infrastructure and development of information necessary to guide its rehabilitation. Of interest to local water users are ways to improve water delivery and on-farm irrigation efficiencies often timed to address annual or seasonal shortages of water supply or irrigation water delivery issues.*

*Third is the enhancement of upland water resources and distribution for livestock and wildlife that allows grazing management adjustments for range resource improvement. Benefits to the watershed, through plant community invigoration, reduction of erosion and stream channel stabilization, can be achieved from water development projects being strategically implemented over the watershed. Other issues and opportunities such as* *making beneficial use of produced water and removal of high water demand invasive species can also be important.*

*A watershed study, providing management and rehabilitation plans for water storage, irrigation systems and upland water development, can help empower a community to proactively enhance their watershed. Conservation by watershed can be an effective holistic approach to embracing the natural resource challenges and opportunities facing a community. A watershed study can provide the information to meet those challenges.*

### 1.2.2 Study Area

The study area for the Niobrara–Lower North Platte Rivers Watershed, as shown in Figure 1.1, encompasses the drainage for the Niobrara River and its tributaries, from its headwaters to the Wyoming–Nebraska State Line and the drainage for the North Platte River and its tributaries just east of Guernsey, Wyoming downstream to the Wyoming–Nebraska State Line. The terms "watershed" and "study area" are used interchangeably in this report. The study area covers approximately 2,022 square miles or 1,294,160 acres. The watershed is primarily located within the central and northern portions of Goshen County and southern part of Niobrara County with a small area situated in the southeastern portion of Platte County. The city of Torrington and the towns of Fort Laramie, Lingle, Lusk, Manville, and Van Tassell are located within the watershed. Approximately 70.3 percent of the watershed is located in Goshen County, 24.0 percent in Niobrara County, and 5.7 percent in Platte County. The watershed also covers portions of five conservation districts with approximately 35.6 percent located in the LFLCD, 30.5 percent in the NPVCD, 24.0 percent in the NCD, 5.7 percent in the PCRD, and 4.2 percent within the South Goshen Conservation District (SGCD).

The watershed is approximately 70 miles north-south and 35 miles east-west and is bounded on the north by the Cheyenne drainage. The study area is bounded to west by the Middle North Platte–Glendo drainage and the Laramie drainage and to the south by the Horse Creek drainage. The study area is bounded to the east by the Wyoming–Nebraska State Line, respectively.

The Niobrara River and its tributaries (Bergreen Creek, Duck Creek, Niobrara River, North Branch Silver Springs Creek, North Duck Creek, Quinn Creek, Silver Springs Creek, and Van Tassell Creek) and the North Platte River and its tributaries (Aego Creek, Cold Springs Branch, Crystal Creek, Dry Rawhide Creek, JM Creek, Laramie River, Molly Fork, Muskrat Creek, Negro Baby Creek, Pine Ridge Creek, Rawhide Creek, Red Cloud Creek, Red Cloud Slough, and Sixmile Creek) are located within the study area. Approximately 1,945 stream miles are located within the watershed and approximately 215 stream miles are classified as perennial. While the headwaters of Sheep Creek are located within the study area, the creek does not flow into the North Platte River in Wyoming but enters the river downstream in Nebraska. Tributaries are also located in southern Goshen County, such as Box Elder Creek and Cherry Creek, which are intermittent and do not reach the North Platte River.

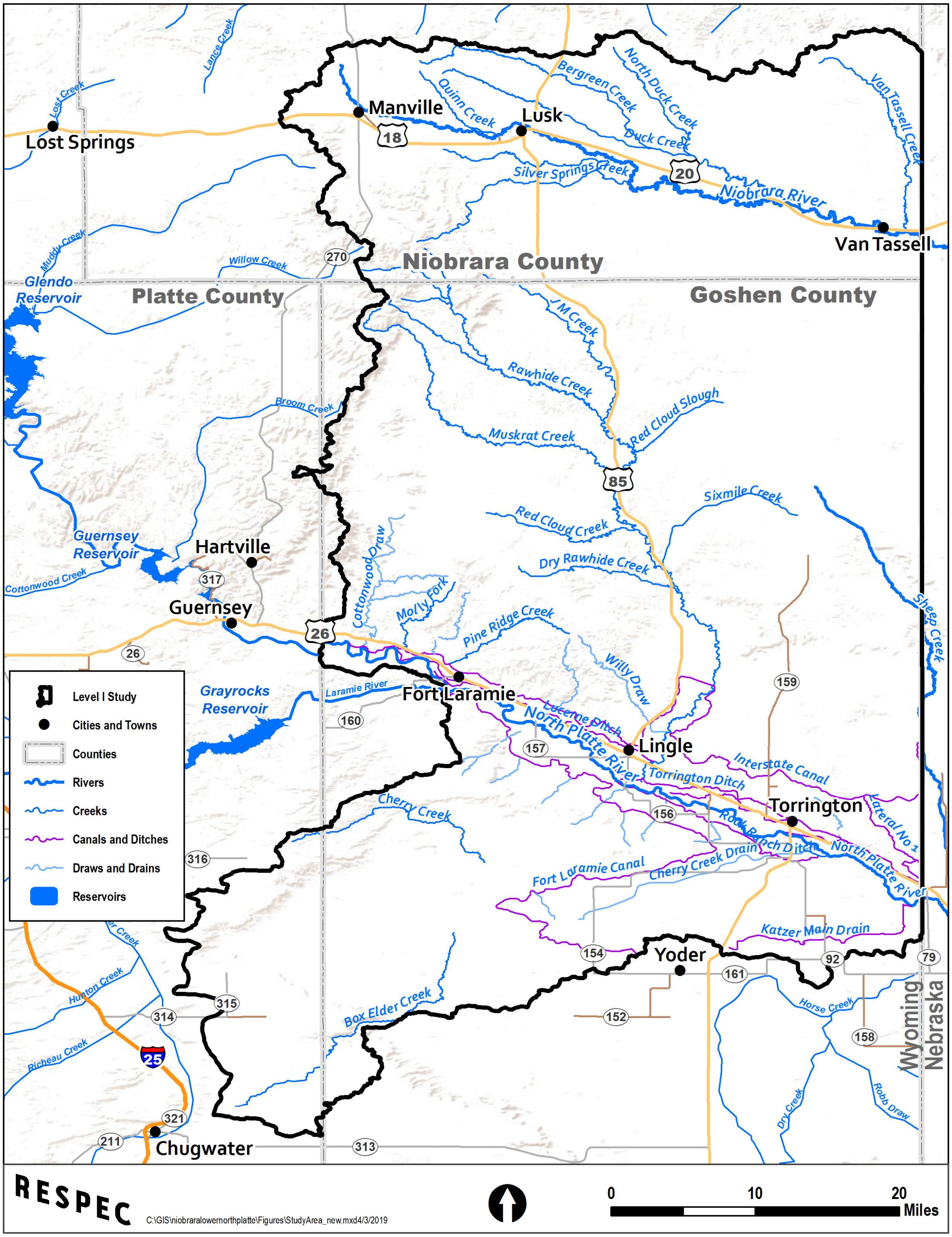


**Figure 1.1.** Niobrara–Lower North Platte Rivers Level I Watershed Study Area.

## 1.3 INSTITUTIONAL ISSUES IN THE NIOBRARA–LOWER NORTH PLATTE RIVERS WATERSHED

Because the watershed is downstream of the Pathfinder, Seminoe, Alcova, Glendo, and Guernsey Reservoirs, the constraints and limitations for water development within the study area must be understood. Pathfinder Reservoir is one of the five largest reservoirs and waterbodies in Wyoming [Jacobs and Brosz, 1993]. The study area is located on the North Platte River downstream from the Pathfinder Dam and Reservoir. The watershed is located within the Guernsey to State Line Subbasin, as shown in Figure 1.2. Management of Pathfinder, Seminoe, Alcova, Glendo, and Guernsey Reservoirs influence the North Platte River and the water- and land-use activities within the study area. More importantly, this understanding is crucial in identifying potential opportunities, recommended alternatives, and proposed projects outlined in Chapter 4.0.

### 1.3.1 North Platte River Decree

In Wyoming, the State Engineer's Office (SEO) is responsible for regulating and administrating the state's water resources and administers all matters that involve Wyoming's interstate compacts and court decrees. The rights of Wyoming, Colorado, and Nebraska to the waters of the North Platte River have been established by decree of the US Supreme Court [Supreme Court of the United States, 2001; SEO, 2006a]. Before the decree, the apportionment of water between Wyoming, Colorado, and Nebraska for irrigation use was disputed between the three states [Trihydro, 2006]. In 1934, Nebraska filed a lawsuit against Colorado and Wyoming in the US Supreme Court over the flows of the North Platte River and claimed that priority rights in Nebraska were not being honored [SEO, 2006a; Trihydro, 2006].

In 1945, the US Supreme Court handed down a decree that apportioned the waters of the North Platte among the states, set limitations on water appropriations in Wyoming, and included the following provisions [Supreme Court of the United States, 2001; SEO, 2006a; Trihydro, 2006; Purcell, 2014]:

1. *Exclusive of the Kendrick Project and Seminoe Reservoir, the state of Wyoming is enjoined from diverting water from the North Platte River above the Guernsey Reservoir and from the North Platte River and its tributaries above Pathfinder Dam, for the irrigation of more than a total 168,000 acres of land during irrigation season.*
2. *Exclusive of the Kendrick Project and Seminoe Reservoir, the state of Wyoming is enjoined from storing more than 18,000 acre-feet of water from the North Platte River and its tributaries above the Pathfinder Reservoir for irrigation during any 1 year.*
3. *The storage rights of the Pathfinder, Guernsey, Seminoe, and Alcova Reservoirs are junior to 1,165 cubic feet per second (cfs) for the irrigation of land in western Nebraska, and the state of Wyoming is enjoined from storing or permitting the storage of water in these reservoirs otherwise than in accordance with the rule of priority.*
4. *The natural flow of the North Platte River in the section of the river between the Guernsey Dam and Tri-State Dam, or approximately the Wyoming-Nebraska state line, between May 1 and September 30 of each year, is apportioned 25 percent to Wyoming and 75 percent to Nebraska.*

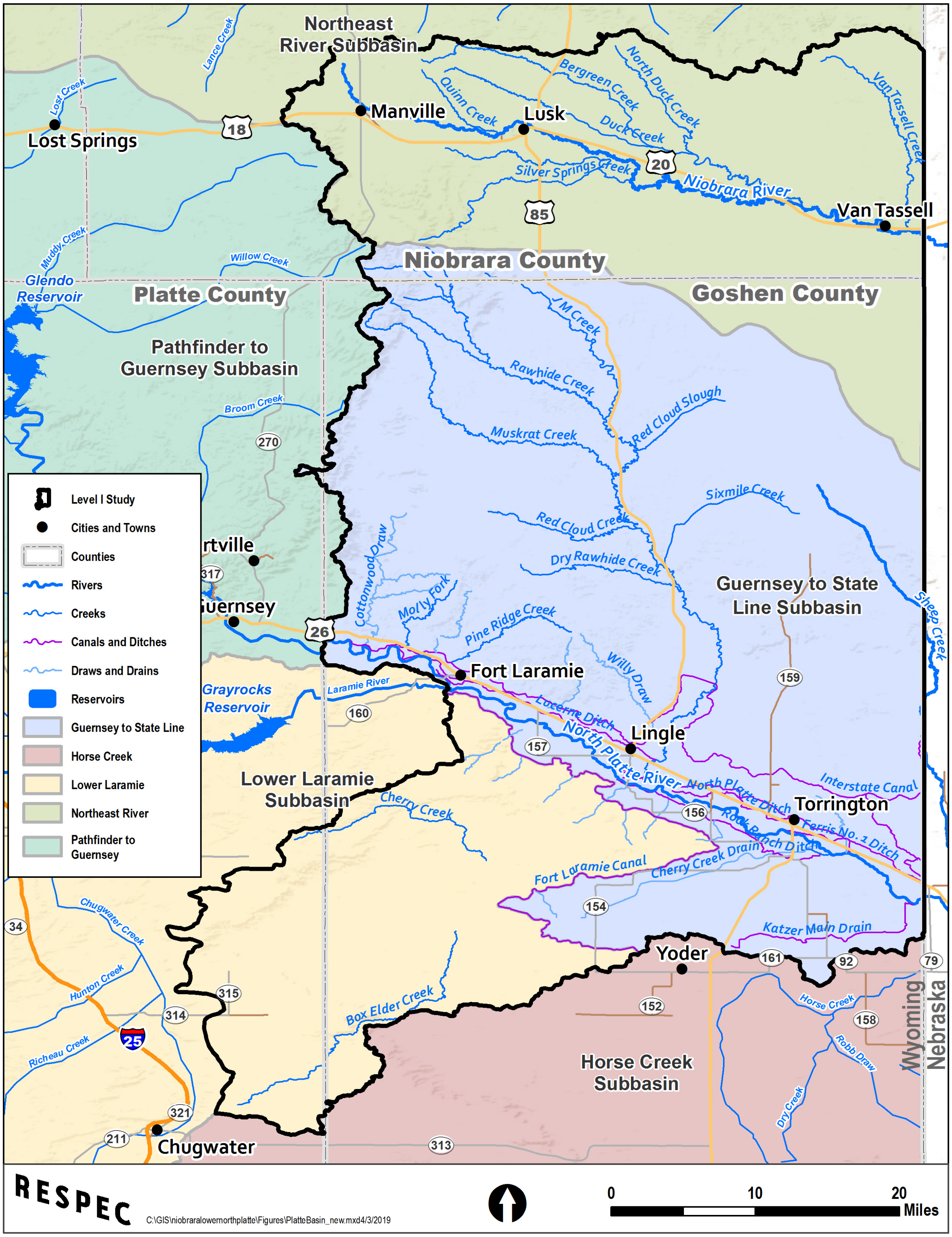


**Figure 1.2.** Niobrara–Lower North Platte Rivers Watershed's Location Within the Platte Basin.

The 1945 decree also limited the number of irrigated acres, water storage, and diversions annually within the North Platte River Basin in Colorado [SEO, 2006a]. Subsequently, the 1945 decree was amended in 1953 with a stipulation agreed to by the three states and approved by the US Supreme Court, which increased the irrigated acreage in Colorado and permitted Wyoming and Nebraska to store water in Glendo Reservoir [SEO, 2006a]. In 1986, Nebraska filed a lawsuit in the US Supreme Court alleging that Wyoming had violated the 1945 decree, which reopened the decree and resulted in the US Supreme Court approving the Final Settlement Stipulation. The US Supreme Court also ordered the Modified North Platte Decree in 2001 that replaced the 1945 decree and its 1953 modification [Supreme Court of the United States, 2001; SEO, 2006a; Trihydro, 2006; Purcell, 2014].

More information about the Final Settlement within the North Platte Basin can be found in Appendix A, *Settlement of the Nebraska v. Wyoming Law Suit, North Platte River Basin Planning Study*, prepared by Mike Purcell, past Director of the WWDC [Purcell, 2014]. A brief summary of the provisions in the 1945 North Platte Decree and 2001 Modified Decree include but are not limited to the following [Supreme Court of the United States, 2001; SEO, 2006a; Trihydro, 2006; Purcell, 2014]:

1. *Excluding the Kendrick Project, for the North Platte River and its tributaries upstream of Guernsey Reservoir (including water from hydrologically connected groundwater wells), Wyoming is enjoined from intentionally irrigating more than a total of 226,000 acres of land during any one irrigation season. Ten years after the settlement date, this provision will be replaced with two injunctions: one intentionally irrigated limitation for the area above Pathfinder Reservoir and one for the area between Guernsey Reservoir and Pathfinder Reservoir. The total of the two injunctions shall not exceed 226,000 acres.*
2. *The storage limitation injunction from the 1945 Decree is unchanged in the 2001 Modified North Platte Decree: Wyoming is enjoined from storing or permitting the storage of more than 18,000 acre-feet of water for irrigation purposes upstream of Pathfinder Reservoir exclusive of Seminoe Reservoir during any 1 year.*
3. *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.)*

The 2001 Decree's acreage limitations include water from hydrologically connected groundwater wells. These wells are defined as being located and constructed such that if water were intentionally withdrawn by the well continuously for 40 years, the cumulative stream depletion would be greater than or equal to 28 percent of the total groundwater withdrawn by that well [Supreme Court of the United States, 2001]. The SEO has developed "Green Area" maps that delineate areas where groundwater resources are considered nonhydrologically connected to the river and its tributaries under the 2001 Decree, the Wyoming Depletions Plan, and the Platte River Recovery Implementation Program (Program) [SEO, 2015]. The study area is located in the "Guernsey to State Line" "Green Area" map and is available at the SEO website (*http://seo.wyo.gov/documents-data/maps-and-spatial-data*). Additional information about the "Green Area" within the study area is included in Section 3.6.1.6.

The Final Settlement Stipulation and the 2001 Modified North Platte Decree contain many provisions and several articles that pertain to the interstate apportionment of water in the North Platte River. For additional information regarding the 2001 Modified North Platte Decree, visit the SEO's website (*http://seo.state.wy.us/*). The SEO's Interstate Streams Division also compiled documents regarding interstate streams into a report titled *Wyoming's Compacts, Treaties, and Court Decrees* (*https://sites.google.com/a/wyo.gov/seo/seo-files/Wyoming_Compacts_Treaties_Decrees.pdf*). The report includes a summary of the North Platte Decree, modifications, and final settlement stipulations for water-rights administration and consumptive use limitations [SEO, 2006a]. More information can be obtained, if needed, by contacting the SEO North Platte Coordinator.

Water users upstream of Pathfinder Reservoir have long been concerned about water-rights administration for the benefit of Seminoe and Pathfinder Reservoirs and that the Pathfinder Modification Project (PMP) would result in additional allocation years and, therefore, cause additional regulation in the nonirrigation season [Purcell, 2014]. The water users formally protested the US Bureau of Reclamation's (USBR) application to the Wyoming Board of Control to change part of the use of the storage right for Pathfinder Reservoir needed to implement the PMP [Purcell, 2014]. However, this matter was resolved in a Stipulation and Settlement Agreement, dated October 16, 2008, between the Upper North Platte Valley Water Users, Upper North Platte Valley Water Conservation Association, USBR, and Wyoming Water Development Office (WWDO) [Purcell, 2014].

### 1.3.2 Platte River Recovery Implementation Program

This section was authored by Mr. Michael K. Purcell, who was the past director of the WWDC [Purcell, 2014; RESPEC and Anderson Consulting Engineers, Inc., 2014]. More information about the Final Settlement is included in Appendix A, *Settlement of the Nebraska v. Wyoming Law Suit, North Platte River Basin Planning Study*, [Purcell, 2014].

> *The Endangered Species Act (ESA) and the critical habitat for whooping cranes, piping plover, and least terns in the Central Platte River in Nebraska has impacted water management and development in the North Platte River Basin since the 1970s. Therefore, the states of Wyoming, Nebraska, and Colorado entered into a cooperative agreement in 1997 for the Platte River Recovery Implementation Program (referred to as the Program) with the US Department of Interior (USDI). The states became interested in the Program when it became apparent that the ESA provided the US Fish and Wildlife Service (USFWS) with the authority to require replacing existing depletions until it achieved its water-supply goal of 417,000 acre-feet per year for critical habitat in the Central Platte River in Nebraska [RESPEC and ACE, 2014]. The USFWS could also assess fees to acquire 29,000 acres of habitat in the Central Platte River [Purcell, 2014; RESPEC and ACE, 2014].*
>
> *The Program serves as a reasonable alternative under the ESA for irrigation, municipal, industrial, and other water uses in place on or before July 1, 1997 [Purcell, 2014; RESPEC and ACE, 2014]. Without the Program, the USFWS could use the ESA consultations required for future federal actions (permits including renewals, funding, contracts, easements) to require water users to replace existing and new depletions until the water goals were met [Purcell, 2014; RESPEC and ACE, 2014]. The goal of the Program is to provide approximately 150,000 acre-feet of water and 10,000 acres of habitat in the Central Platte River [USDI, 2006; Purcell, 2014; RESPEC and ACE, 2014]. Additionally, the states agreed to curtail new depletions. In Wyoming, the Platte Basin is fully appropriated, which means that there are*

*more water rights than there is water in dry and some average years [Purcell, 2014; RESPEC and ACE, 2014]. Therefore, water rights with a current priority would not produce a reliable water supply and would likely need to transfer water rights from other uses to secure that supply [Purcell, 2014; RESPEC and ACE, 2014].*

*Each state wrote a depletion plan that explained existing and future depletion management as part of the cooperative agreement [USDI, 2006]. The Wyoming Depletions Plan (referred to as the Plan) identifies existing and new water-related activities that are covered by the Program [SEO, 2006b]. The goal of the Plan is to provide coverage for depletions that were authorized by existing, valid Wyoming water rights with a priority date before July 1, 1997. The Plan also addresses new depletions if they do not exceed 20 acre-feet per year [Purcell, 2014]. The SEO's North Platte River Coordinator is responsible for determining the depletions covered by the Plan, identifying new depletions requiring mitigation, and approving mitigation plans for new depletions [RESPEC and ACE, 2014].*

### 1.3.3 Upper Niobrara River Compact

The study area also includes the headwaters of the Niobrara River located in an area from northwest of Manville to east of Van Tassell and near the Wyoming–Nebraska state line. The state of Wyoming's rights to the waters of the Niobrara River were settled by the Upper Niobrara River Compact in 1962, which divided Niobrara River water between Nebraska and Wyoming and was then approved by Congress in 1969. Stock water reservoirs with a capacity of 20 acre-feet or less in Wyoming are not restricted except by Wyoming law. No restrictions were placed on the diversion or storage of water in Wyoming, except on the specific segments of the mainstem Niobrara River and Van Tassell Creek near the state line. The diversions in those segments are regulated on an interstate priority basis with lands in Nebraska. Groundwater development was also addressed in the compact, which provides for investigation of groundwater resources and possible apportionment.

The Wyoming SEO administers and oversees all matters involving Wyoming's interstate and intrastate streams and rivers. A primary objective of the agency is to safeguard the state's current and future water supplies by preserving Wyoming's ability to use and develop our water allocations under our interstate compacts and court decrees. Annually, the Wyoming SEO personnel meet with the Nebraska Department of Natural Resources (NDNR) and Upper Niobrara White Natural Resources District (UNWNRD) personnel at the Upper Niobrara River Compact Meeting to report on basin activities, review studies' efforts, and discuss compact management. In 2011, an integrated management plan was jointly developed by the Board of Directors of the UNWNRD and NDNR to manage surface and groundwater supplies in the fully appropriated portion of the UNWNRD in an equitable manner and maintain Nebraska's compliance with the Wyoming–Nebraska Compact on Upper Niobrara River, as adopted on October 26, 1962, and ratified by Congress on August 4, 1969.

## 1.4 STUDY ISSUES AND UNDERSTANDING

This Level I watershed study provides a comprehensive description and preliminary analysis of the Niobrara–Lower North Platte Rivers Watershed and includes the Watershed Management and Rehabilitation Plan, which is included in Chapter 4.0 of this report. The Watershed Management and Rehabilitation Plan outlines the proposed practical and feasible alternatives that address water- and land-resource issues and concerns. The expectation of the NCD, LFLCD, NPVCD, PCRD, and WWDC was to identify water development opportunities within the study area. In developing the Watershed Management and Rehabilitation Plan, the consultant worked with the local sponsors, the WWDO, and several study participants to address the key issues within the watershed, as listed in Table 1.1.

**Table 1.1. Key Issues Within the Watershed and Applicable Report Sections**

| Key Issues Within the Watershed | Applicable Section(s) of the Report |
|---|---|
| Surface-water availability and storage opportunities | 3.2.1 Surface Water<br>3.4.3 Water Storage<br>4.6 Surface-Water Storage Opportunities |
| Irrigation system inventory and potential improvements | 3.4.1 Agriculture Water Use<br>4.3 Irrigation System Proposed Projects<br>6.1 Irrigation System Components Cost Estimates |
| Rangeland and grazing inventory and potential improvements | 3.3.2 Land Cover<br>3.3.2.3 Vegetation<br>4.4 Livestock/Wildlife Watering Opportunities<br>4.5 Grazing Management Opportunities<br>6.2 Livestock/Wildlife Water Components |
| Wetland and riparian area restoration and channel stability | 3.2.2 Geomorphology<br>3.3.2.1 Riparian Areas<br>3.3.2.2 Wetlands<br>4.7 Channel Stability Opportunities<br>4.8 Wetlands Enhancement Opportunities |

## 1.5 PURPOSE AND SCOPE

The purpose of this Level I watershed study was to combine the available data and information with study-generated inventory data to develop a comprehensive Watershed Management and Rehabilitation Plan that outlines the proposed and potential water development opportunities. To accomplish this effort, the following objectives were completed:

- Encourage communication among the landowners, NCD, LFLCD, NPVCD, PCRD, and WWDC
- Solicit public participation in the watershed study
- Inventory and evaluate the watershed conditions
- Perform a geomorphic classification to identify impaired reaches and improvement options
- Assess existing irrigation systems and generate rehabilitation alternatives for the irrigators
- Evaluate potential opportunities to improve water availability for livestock and wildlife
- Develop alternatives for improvements in a Watershed Management and Rehabilitation Plan
- Identify permits, easements, and clearances necessary for plan implementation
- Estimate costs for proposed improvement alternatives and potential projects
- Complete an economic analysis and identify potential sources of funding.

# 2.0 PROJECT MEETINGS

## 2.1 INTRODUCTION

Public involvement and landowner participation were important elements of the Niobrara–Lower North Platte Rivers Watershed Study effort because of the amount and complexity of the water and land issues and concerns within the study area. Therefore, considerable emphasis and time were placed on this aspect of the study. RESPEC was awarded the contract in June 2017 and began gathering background information and preparing for planned scoping meetings.

## 2.2 SCOPING MEETINGS, OPEN HOUSES, AND COORDINATION MEETINGS

Scoping meetings, landowner open houses, landowner meetings, and on-site field visits were conducted by RESPEC and Anderson Consulting Engineers, Inc. (ACE) staff in cooperation with the Niobrara Conservation District (NCD), Lingle-Ft. Laramie Conservation District (LFLCD), North Platte Valley Conservation District (NPVCD), Platte County Resource District (PCRD), and the Wyoming Water Development Commission (WWDC). Scoping meetings, landowner open houses, landowner meetings, and field visits were coordinated by RESPEC with assistance from NCD, LFLCD, NPVCD, PCRD, and WWDC personnel. Table 2.1 lists the meetings conducted during the watershed study. Scoping meetings typically included formal presentations conducted by RESPEC staff. The objectives of the scoping meeting, landowner open houses, and landowner meetings included the following:

- Discuss the purpose, existing data, and available information for the watershed study
- Obtain input and opinions from residents and landowners about the study area
- Identify concerns and answer questions regarding the area's water and land resources
- Request participation in the study effort and coordinate inventory activities
- Present initial results and preliminary findings from the watershed study.

Invitations to the two scoping meetings (held in Lusk and Torrington) and two open houses (held in Lusk and Torrington) for the watershed study were sent to more than 1,175 addresses within the watershed on two different occasions. The scoping meetings and open houses were also advertised in the local newspapers, including the *Lusk Herald*, *Torrington Telegram,* and the *Wyoming Livestock Roundup*. Additionally, announcements for the scoping meetings and open houses were included in the conservation district website (*http://www. conservegoshen.org/*).

During the scoping meetings in Lusk and Torrington in the summer of 2017, which are shown in Figures 2.1 and 2.2, RESPEC representatives summarized the study's purpose and outlined tasks. Maps were generated with GIS data and presented to inform attendees of the study. Some attendees asked questions during the meetings, but most discussions took place between the attendees and representatives from local sponsors and partners after the meeting. A total of 13 landowners attended the scoping meeting in Lusk and 28 landowners attended the scoping meeting in Torrington.

**Table 2.1. Scoping, Sponsor, and Coordination Meetings**

| Date | Type | Location |
|---|---|---|
| June 28, 2017 | Coordination Meeting | Conference Call |
| July 11, 2017 | Local Sponsor Meeting | LFLCD UW SAREC, Lingle |
| July 19, 2017 | Scoping Meeting | Niobrara County Fairgrounds, Lusk |
| July 20, 2017 | Landowner Meeting | Hoblit Ranch, Lusk |
| July 20, 2017 | Scoping Meeting | Platte Valley Bank, Torrington |
| September 12, 2017 | Landowner Meeting | Smith Ranch, Lusk |
| September 12, 2017 | Landowner Meeting | Spivey Property, Van Tassell |
| October 11, 2017 | Landowner Meeting | Johnson Property, Casper |
| October 25, 2017 | Landowner Meeting | Larson Property, Lusk |
| October 25, 2017 | Landowner Meeting | Nelson Ranch, Lusk |
| October 25, 2017 | Landowner Meeting | Bar J L Livestock, Manville |
| October 25, 2017 | Landowner Meeting | Smith Ranch, Lusk |
| November 6, 2017 | Landowner Meeting | Saul Farm, Lingle |
| November 6, 2017 | Landowner Meeting | Demcheck Farm, Lingle |
| November 7, 2017 | Landowner Meeting | Tatman Farm, Lingle |
| November 7, 2017 | Landowner Meeting | Cronk Ranch, Lingle |
| November 7, 2017 | Landowner Meeting | Hays Property, Torrington |
| April 24, 2018 | Lusk Open House | Niobrara County Fairgrounds, Lusk |
| April 26, 2018 | Landowner Meeting | McDowell Ranch, Fort Laramie |
| April 26, 2018 | Landowner Meeting | Conway Ranch, Fort Laramie |
| April 26, 2018 | Torrington Open House | Platte Valley Bank, Torrington |
| May 8, 2018 | Landowner Meeting | Sturman Ranch, Lusk |
| May 8, 2018 | Landowner Meeting | Smith Ranch, Lusk |
| May 8, 2018 | Landowner Meeting | Hoblit Ranch, Lusk |
| May 8, 2018 | Landowner Meeting | Lamb Ranch, Manville |
| May 9, 2018 | Landowner Meeting | Cain Ranch, Fort Laramie |
| May 9, 2018 | Landowner Meeting | Interstate Canal, Lingle |
| May 10, 2018 | Landowner Meeting | Ridenour Ranch, Yoder |
| May 10, 2018 | Landowner Meeting | Rawhide WHMA, Lingle |
| July 18, 2018 | Landowner Meeting | Speckner Farm, Lingle |
| July 18, 2018 | Landowner Meeting | Mulhern Ranch, Lingle |
| July 18, 2018 | Local Sponsor Meeting | NPVCD Office, Torrington |
| July 18, 2018 | Landowner Meeting | Dillman Estates, Torrington |
| July 19, 2018 | Landowner Meeting | Slash J Bar Ranch, Jay Em |
| July 19, 2018 | Landowner Meeting | Cushman Farm, Huntley |
| July 19, 2018 | Landowner Meeting | Swanson Farm, Lingle |
| July 31, 2018 | Local Sponsor Meeting | NCD Office, Lusk |
| August 1, 2018 | Landowner Meeting | Ridenour Ranch, Yoder |
| August 1, 2018 | Landowner Meeting | Bass Ranch, Fort Laramie |


**Figure 2.1.** Level I Study Scoping Meeting in Lusk, Wyoming.


**Figure 2.2.** Level I Study Scoping Meeting in Torrington, Wyoming.

In the spring of 2018, two open houses were held in Lusk and Torrington. Fifteen landowners attended both of the open houses. During the open houses, landowners discussed their concerns and potential projects with the consultant and representatives from the NCD, LFLCD, NPVCD, and the WWDC. Consultant staff presented maps, explained findings, and described alternatives. The consultant also attended the LFLCD, NCD, and NPVCD board meetings during the watershed study.

## 2.3 LANDOWNER MEETINGS AND FIELD VISITS

RESPEC staff met with 15 landowners during two open houses and met with 27 landowners during field visits. During a scoping meeting or open house, landowners invited the consultant and NCD, LFLCD, NPVCD, or the WWDC staff to discuss their project. Field visits were then scheduled at the landowners' residence or property where discussions focused on their land- and water-resource issues. Typically, the landowner gave a tour of the property to the consultant. During these visits, preliminary planning and conceptual designs were discussed for potential projects.

For efficiency, field inventory efforts were conducted in coordination with planned meetings, open houses, district board meetings, and landowner visits. Field activities focused on irrigation inventory, upland livestock/wildlife water opportunities, riparian and stream-channel conditions, dam and reservoir assessment, and hydrologic investigations. Throughout the study, local ranchers, irrigators, and residents who discussed issues and concerns with the consultant staff demonstrated comprehensive knowledge and valuable insight about the watershed. Because of the willingness of landowners to share information and insight, the study team was able to incorporate this knowledge and experience into the study and provide a more effective evaluation of the watershed.

# 3.0 WATERSHED DESCRIPTION AND INVENTORY

## 3.1 INTRODUCTION AND PURPOSE

A substantial amount of information exists about the land and water resources within the Niobrara–Lower North Platte Rivers Watershed. The objective of the watershed description and inventory task was to gather, review, and compile data and findings in existing databases, studies, and reports regarding the resources within the study area into a digital library and geographic information system (GIS) geodatabase. This material was then used to describe, characterize, and summarize key features; identify problems or issues; and outline water-development opportunities and improvement alternatives within the watershed. This description and inventory chapter covers many of the study area's physical, biological, and anthropogenic systems. Brief reviews of the current conditions of these systems are also included along with summary data tables and mapped features of the watershed.

## 3.2 PHYSICAL SYSTEMS

The setting and environment for the watershed are discussed in the following sections.

### 3.2.1 Surface Water

#### 3.2.1.1 *Hydrography*

The Niobrara–Lower North Platte Rivers Watershed is in the eastern portion of the Guernsey to State Line Subbasin of the Platte River Basin and in the southeastern portion of the Northeast River Subbasin in eastern Wyoming. Approximately 1,945 stream miles are located within the watershed with 215 miles of streams classified as perennial, 1,380 miles are categorized as intermittent, and another 350 miles are classified as canals and ditches. The Niobrara River and its tributaries (Bergreen Creek, Duck Creek, North Branch Silver Springs Creek, North Duck Creek, Quinn Creek, Silver Springs Creek, and Van Tassell Creek) and the North Platte River and its tributaries (Aego Creek, Cold Springs Branch, Crystal Creek, Dry Rawhide Creek, JM Creek, Laramie River, Molly Fork, Muskrat Creek, Negro Baby Creek, Pine Ridge Creek, Rawhide Creek, Red Cloud Creek, Red Cloud Slough, and Sixmile Creek) are important streams within the watershed. Other tributary streams within the watershed include Box Elder Creek and Cherry Creek, which are intermittent, stream flows that do not reach the North Platte River. The headwaters of Sheep Creek are located within the study area; however, the creek stream does not flow into the North Platte River in Wyoming but enters the river downstream in Nebraska.

The US Geological Survey (USGS) has delineated watersheds through a hydrologic classification that divides and subdivides the nation into continually smaller watersheds. These organized levels of watersheds are called hydrologic units and assigned a hydraulic unit code (HUC). The HUC identifies the level based on the size and locale of the unit. The classification currently has six levels. The first level divides the nation into 21 regions, which is referred to as an HUC 2, because a two-digit code identifies each region. Each region is split into second, third, fourth, fifth, and sixth levels that represent HUC 4, HUC 6, HUC 8, HUC 10, and HUC 12, respectively. An HUC 12 is represented by 12 digits, which assign it to all of the above levels. The Niobrara–Lower North Platte Rivers Watershed for this Level I study was defined by the Middle North Platte-Scotts Bluff HUC 10180009 and Niobrara Headwaters HUC 10150002, within the state of Wyoming. Figure 3.1 displays the HUC 10 watersheds within the study area.

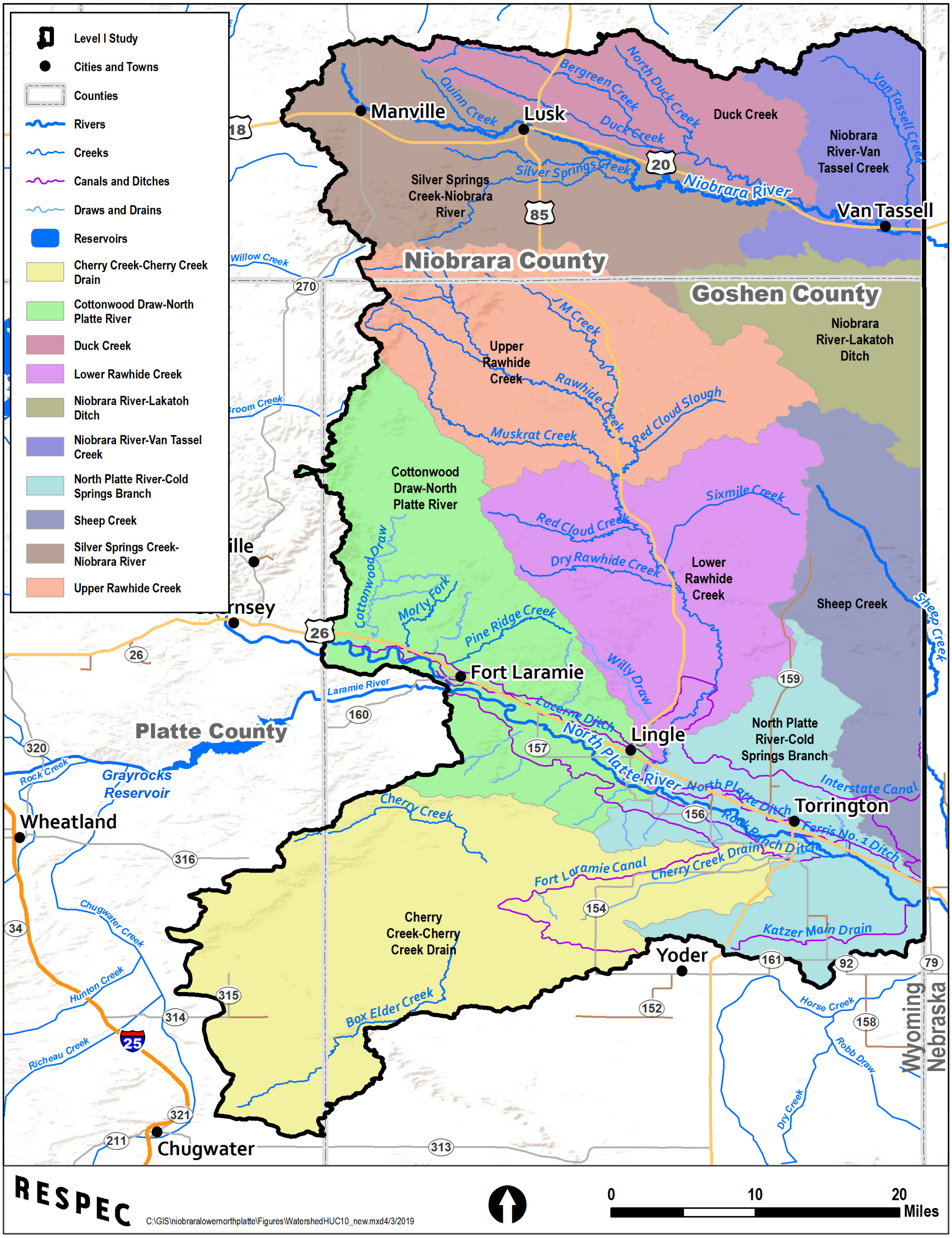


**Figure 3.1.** 10-Digit Hydrologic Units (HUC 10) Watersheds Within the Study Area.

### 3.2.1.2 *Water Quality*

The Water Quality Division of the Wyoming Department of Environmental Quality (WDEQ) has classified 19 surface waterbodies in the watershed for water quality standards designation and attainment. Table 3.1 shows the use designation associated with each classification. Table 3.2 shows the waterbody count by surface water classification within the study area as defined in Chapter 1 of the WDEQ's *Water Quality Rules and Regulations* [WDEQ, 2013].

**Table 3.1. Wyoming Surface Water Classification and Use Designations**

| Designated Use | Surface Water Classification | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2AB | 2A | 2B | 2C | 3A | 3B | 3C | 4A | 4B | 4C |
| Drinking Water | X | X | X | | | | | | | | |
| Game Fish | X | X | | X | | | | | | | |
| Nongame Fish | X | X | | X | X | | | | | | |
| Fish Consumption | X | X | | X | X | | | | | | |
| Other Aquatic Life | X | X | X | X | X | X | X | X | | | |
| Recreation | X | X | X | X | X | X | X | X | X | X | X |
| Wildlife | X | X | X | X | X | X | X | X | X | X | X |
| Agriculture | X | X | X | X | X | X | X | X | X | X | X |
| Industry | X | X | X | X | X | X | X | X | X | X | X |
| Scenic Value | X | X | X | X | X | X | X | X | X | X | X |

**Table 3.2. Surface Water Classifications Within the Study Area**

| Surface Water Classification | Waterbody Type | |
|---|---|---|
| | River, Stream, Creek, or Draw | Reservoir, Pond, Pit, Dam, or Lake |
| 2AB | 8 | 0 |
| 2C | 3 | 0 |
| 3B | 5 | 1 |
| 4C | 2 | 0 |
| **Total** | **18** | **1** |

### 3.2.1.3 *North Platte River Assessment*

In 2007, the WDEQ published a water quality conditions report of the North Platte River, which analyzed water quality monitoring data, identified potential causes and sources of excess sediment, and evaluated the chemical, physical, and biological condition of the river to assess the degree of designated use support [WDEQ, 2007]. The WDEQ assessment indicated that the stretch of the North Platte River, which extends through the study area, is classified as a Class 2AB water [WDEQ, 2007].

In 2002, five stations (four WDEQ stations and one USGS station) within the study area were monitored for chemical, physical, and biological water quality data and included in the WDEQ assessment. Water quality results indicated that water temperatures on dates sampled were generally below the WDEQ/WQD maximum criteria of 20 degrees Celsius for a cold-water fishery and that dissolved oxygen concentrations were above the acceptable 1-day minimum (8 milligrams per liter [mg/L]) although dissolved oxygen concentrations can fall below the 8 mg/L during the summer low-flow months when demands on the river are at their peak [WDEQ, 2007].

Concentrations of total phosphorous at most stations were below detection (< 0.1 mg/L); although a single sample collected at USGS Station 06674500 exceeded the recommended maximum concentration for total phosphorous [WDEQ, 2007]. Nitrate-nitrogen concentrations at the WDEQ and USGS monitoring stations exceeded the federally recommended maximum concentration [WDEQ, 2007]. Total ammonia was not detected (< 0.1 mg/L) in samples collected immediately above and below the City of Torrington's wastewater treatment facility [WDEQ, 2007].

Total suspended sediment (TSS) increased with distance downstream, and was partially caused by sediment from irrigation return flows [WDEQ, 2007]. The annual Guernsey silt run, which is an exception to the state of Wyoming's turbidity criteria, also occurs on the North Platte River below Guernsey Dam [WDEQ, 2007]. The silt run is a practice of flushing silt from Guernsey Reservoir into the North Platte River downstream where the silt-laden water is diverted by irrigators to help seal canals and laterals reducing seepage losses [WDEQ, 2007; US Bureau of Reclamation, 2018]. In 2017, the silt run was initiated on July 10 and continued for 14 days [US Bureau of Reclamation, 2018]. Typically, during these 2 weeks, in-stream turbidity is elevated, and a substantial amount of sediment enters the canals and the North Platte River directly and via returns [WDEQ, 2007]. Chloride concentrations were all below the 230 mg/L criterion [WDEQ, 2007]. Concentrations of total selenium and total arsenic above and below the Torrington wastewater treatment facility were non-detect (< 5 × micrograms per liter [ug/L] ) [WDEQ, 2007]. The five-sample/30-day geometric means for fecal coliform concentrations in samples collected immediately above and below the Torrington wastewater treatment facility were below the criterion of 126 colonies per 100 milliliters (col/100 mL) on waters designated for primary contact recreation [WDEQ, 2007].

#### 3.2.1.4 *Wyoming Pollutant Discharge Elimination System Permitted Discharges*

The watershed has 32 Wyoming Pollution Discharge Elimination System (WYPDES) point-source discharge permits with a total of 38 outfalls. A list of WYPDES permits is shown in Table 3.3. Of the WYPDES permits, two are listed as Sanitary Wastewater: City of Torrington (WY0020231) and Town of Fort Laramie (WY0020567). No Municipal Separate Storm Sewer Systems (MS4s) are in the watershed.

#### 3.2.1.5 *Clean Water Act Section 303d Listed Streams*

There are no stream segments or waterbodies within the watershed that have been listed on *Wyoming's 303(d) List of Impaired Waters*. The Niobrara Conservation District monitored Silver Spring Creek, a tributary to the Niobrara River, from 2001 through 2007. Data were collected from the confluence with the Niobrara River to a point 17.8 miles upstream and indicated a biological reference condition. Silver Spring Creek is classified as a Class 3B and is fully supporting its aquatic life use in the upper perennial and intermittent reaches.

**Table 3.3. Wyoming Department of Environmental Quality's Wyoming Pollutant Discharge Elimination System Permitted Discharges Within the Watershed (Page 1 of 2)**

| WYPDES Permit Number | Permittee | Facility Name | Permit/ Type | Outfalls |
|---|---|---|---|---|
| WYR001187 | Croell, Inc. | Lusk Plant | Industrial Stormwater | 1 |
| WYR001265 | City of Torrington | City of Torrington Landfill (IGP) | Industrial Stormwater | 1 |
| WYR001278 | TDS Collection Service, Inc. | TDS Landfill | Industrial Stormwater | 1 |
| WYR001429 | Wyoming Ethanol LLC | Wyoming Ethanol, LLC (June 5, 2015–August 31, 2017) | Industrial Stormwater | 1 |
| WYR001480 | Union Pacific Railroad | UPRR Lusk Facility | Industrial Stormwater | 1 |
| WYR105605 | Caylor & Genz Earthmovers Inc. | Waste Water Treatment Plant Finishing Pond Dike Improvements | Construction Stormwater | 1 |
| WYR105699 | Simon Contractors | Wyoming Department of Transportation (WYDOT) SCP-TC-0805156 Sugar Factory Road (West Section) | Construction Stormwater | 1 |
| WYR105729 | JTL Group Inc. dba Knife River | Lusk - Van Tassell (East Section) | Construction Stormwater | 1 |
| WYR320237 | Mobile Concrete, Inc. | Timberline Manville Quarry SP712 | Industrial Stormwater | 1 |
| WYR320719 | Croell, Inc. | Bone Pit | Industrial Stormwater | 1 |
| WYR320797 | Bald Butte Land Co., LLC | Bald Butte Quarry | Industrial Stormwater | 1 |
| WYR320819 | Heritage Material and Supply LLC | Heritage Material & Supply LLC Gravel Pit | Industrial Stormwater | 1 |
| WY0020231 | Torrington, City of | Torrington Wastewater Lagoons | Sanitary Wastewater | 1 |
| WY0020231 | Torrington, City of | Torrington Wastewater Lagoons | Sanitary Wastewater | 1 |
| WY0020567 | Fort Laramie, Town of | Fort Laramie Wastewater Lagoon | Sanitary Wastewater | 1 |
| WY0022233 | Miller Cattle & Feedyards, LLC | Miller Feedlot Runoff C Control Structure | CAFO | 1 |
| WY0022233 | Miller Cattle & Feedyards, LLC | Miller Feedlot Runoff Control Structure | CAFO | 2 |
| WY0022501 | Great Western Cattle Company LLC | Great Western Feedyard 08/15 (previously Frontier Feeders) | CAFO | 1 |
| WY0031976 | Dinklage Feed Yard, Inc. | Dinklage Cattle Feedlot | CAFO | 1 |
| WY0031976 | Dinklage Feed Yard, Inc. | Dinklage Cattle Feedlot | CAFO | 2 |

**Table 3.3. Wyoming Department of Environmental Quality's Wyoming Pollutant Discharge Elimination System Permitted Discharges Within the Watershed (Page 2 of 2)**

| WYPDES Permit Number | Permittee | Facility Name | Permit/ Type | Outfalls |
|---|---|---|---|---|
| WY0031976 | Dinklage Feed Yard, Inc. | Dinklage Cattle Feedlot | CAFO | 3 |
| WY0031976 | Dinklage Feed Yard, Inc. | Dinklage Cattle Feedlot | CAFO | 1 |
| WY0035416 | Rock Creek Ranch I, Ltd. | Platte River Ranch | CAFO | 1 |
| WY0035602 | Wyoming Ethanol LLC | Torrington Ethanol Plant | Industrial | 1 |
| WY0050016 | Shipley Farms, Inc. | Shipley Feed Lot | CAFO | 1 |
| WY0051047 | Rock Creek Ranch, LTD | Lone Star Land and Cattle Feed Lot | CAFO | 1 |
| WY0053465 | H & T Ranch | H & T Ranch | CAFO | 1 |
| WY0053465 | H & T Ranch Co | H & T Ranch | CAFO | 2 |
| WY0055123 | Duck Creek Ranch | Duck Creek Ranch | CAFO | 1 |
| WY0055123 | Duck Creek Ranch | Duck Creek Ranch | CAFO | 2 |
| WY0095401 | Lewis Feedlot | Lewis Feedlot | CAFO | 1 |
| WY0095842 | Lanphier, Inc. | Lanphier, Inc. | CAFO | 1 |

CAFO = concentrated animal feeding operation

### 3.2.1.6 *Flooding and Runoff*

Flood history reports from the Water Resources Data System (WRDS) indicate that, within the study area, there have been 6 damaging floods in Niobrara County since 1960 and 12 damaging floods in Goshen County since 1955. The most recent events occurred in June 2015 in Lusk and Niobrara County when a large, slow-moving thunderstorm delivered 3–7 inches (in) of rain and hail in 2–4 hours within the Niobrara River drainage. This rainfall event created severe flooding in Lusk and Manville and throughout the surrounding area. The storm caused the collapse of the US Highway 85 bridge over the Union Pacific railroad line, drowned livestock, closed highways, flooded homes and businesses, and damaged bridges, culverts, and roads. The USGS estimated that the peak discharge of the Niobrara River flood was 9,300 cubic feet per second (cfs). Figures 3.2 and 3.3 show the flood damage on the Niobrara River at the Northside Park in Lusk [Niobrara Conservation District, 2018].

In July 2015, a flood-related Federal Disaster Declaration was declared when severe storms and flooding occurred in Johnson and Niobrara Counties during the period of June 10–11, 2015, and a multi-hazard mitigation plan was proposed for Niobrara County. [Federal Emergency Management Agency, 2015a]. The main goal for the plan was to mitigate natural hazards to reduce potential injury and loss of life, and property damage in Lusk, Manville, and Van Tassell, and all of Niobrara County. Action plan projects for flood mitigation include erosion control, construction of permanent bridges, and drain and fill road crossings. Each of these projects were deemed responsible for completion by the county. Other mitigation projects within the multi-hazard mitigation plan aim to mitigate crop stress during a drought, enhance warnings before impacts to allow for preparation, and increase effectives and skill set of first responders.

**Figure 3.2.** Niobrara River Flood at Lusk's Northside Park (Photograph by Niobrara Conservation District).


**Figure 3.3.** Niobrara River Flood at Lusk's Northside Park (Photograph by Niobrara Conservation District).

In July 2011, a flood-related Federal Disaster Declaration was declared when severe storms, flooding, and landslides occurred in 15 counties, including Goshen County, from May 18, 2011, to July 8, 2011 [Federal Emergency Management Agency, 2011]. In May 2016, flooding on the Laramie River and the North Platte River was triggered by snowmelt runoff and heavy rains and caused damage near Fort Laramie and the surrounding areas in Goshen and Platte Counties. In June 2016, strong thunderstorms hit the city of Torrington and the surrounding area, depositing an estimated 3 to 5 inches of rainfall that caused damage to streets, roads, and basements.

Goshen County has a well-documented flood history and in 2007, Goshen County approved their Local Hazard Mitigation Plan, which expired in 2012 [Goshen County, 2006; Federal Emergency Management Agency, 2015b]. Following widespread flooding in 2011 within Wyoming, the emergency management agencies with the state of Wyoming and Goshen County coordinated with the Federal Emergency Management Agency (FEMA) Region VIII Office in assessing flood risk and mitigating flood impacts statewide and Wyoming's Multi-Hazard Mitigation Plan received a comprehensive update in 2014. On March 2, 2015, the state of Wyoming, Goshen County, and FEMA held a meeting in Torrington to identify areas of concern and priorities of communities within the watershed and determine areas for further flood risk assessment [FEMAa, 2015]. Information on flood-risk and mitigation priorities from communities was gathered to identify previous flooding events, local flooding hazards, and flood mitigation risks during the meeting. Table 3.4 lists the mitigation actions and projects discussed during FEMA's meeting in Torrington. In 2017, Goshen County adopted the State of Wyoming's Region 7 Hazard Mitigation Plan to augment the county's emergency planning efforts.

**Table 3.4. Mitigation Actions or Projects Discussed During the Federal Emergency Management Agency Meeting in Torrington, Wyoming, on March 2, 2015**

| Community | Mitigation Action or Project Discussed | Description | Status |
|---|---|---|---|
| Ft. Laramie | Sand-bagging | Ft. Laramie is a National Historic Site; therefore, actions are taken to protect the area from flooding when necessary. | Ongoing flood mitigation activity |
| Ft. Laramie, Goshen County, LaGrange, and Lingle | Coordination with US Bureau of Reclamation (USBR) | Because of number of dams in the area, yearly meetings are held to discuss impact and potential of flooding. | Action identified in the Hazard Mitigation Plan |
| Ft. Laramie | Flood protection | When the dams were built after the 1950s flooding, flooding has been minimized. Dams are inspected yearly. | Ongoing flood mitigation activity |
| Goshen County | Site new buildings according to existing Goshen County floodplain ordinances | The intent is to prevent new development from being allowed in an existing flood risk area and therefore prevent flood damage. It was discussed that planners should be more involved in implementation of this action. | Action identified in HMP |
| Goshen County | Updated flood maps | Updates to flood risk information were requested by communities. | Action identified in HMP |

#### 3.2.1.7 *Federal Emergency Management Agency Flood Zone Mapping*

FEMA defined flood zones corresponding to various levels of flood risk based on the severity or type of flooding in the area and then mapped these zones on a community's Flood Insurance Rate Map (FIRM) or Flood Hazard Boundary Map. These flood zone maps can be obtained from the FEMA's Flood Map Service Center (MSC) via the website (*https://msc.fema.gov/portal/home*). These FIRMs are available for Goshen County but remain unmapped in Niobrara County outside of the Town of Lusk, which is included in a Zone A flood zone and is defined as an area with a 1 percent annual chance of flooding and a 26 percent chance of flooding over the life of a 30-year mortgage, based on the FIRM issued March 18, 1986 [Wyoming Department of Transportation, 2015]. In Goshen County, the available FIRM, issued March 18, 1986, designated the Zone A flood zones but the digital flood hazard mapping is not available.

In areas where digital FIRMs are not available, the State of Wyoming's hazard mitigation plan used Hazus to model and develop a 1-percent annual chance flood hazard area or the 100-year floodplain statewide boundary [FEMAa, 2015]. This Hazus-MH MR2 model was used to model the 100-year floodplains and included analysis for all 23 counties on streams draining at least 10 square miles, using 30-meter digital elevation models (DEMs) [FEMA, 2014]. This modeling effort employed many assumptions to define areas most vulnerable to flooding and is included within this Level I study as the best available flood hazard data within the watershed. Figure 3.4 shows Hazus modeled areas with a 1 percent annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet.

### 3.2.2 Geomorphology

The watershed's geomorphology can be described as rolling plains, buttes, escarpments, and tablelands dissected by canyons, gullies, channels, and valleys draining to the Niobrara River in the north and the North Platte River in the south. Elevations within the watershed gradually decrease from west to east. Structural features of the watershed include the Hartville Uplift on the west boundary of the watershed and the Goshen Hole Lowlands in the southwest area of the watershed. Surficial geology within the watershed includes residuum, alluvium, and eolian units while Quaternary and Tertiary bedrock geologic deposits underlie almost the entire watershed.

The objectives of the geomorphic task were to classify stream systems within the watershed using the Rosgen Stream Classification System and to assess the channel structure, morphology, and stability of streams where appropriate. This classification can aid in understanding channel forms and identifying suitable measures for improving stream segments. This initial Rosgen classification consists of a broad geomorphic characterization that is based on the available data including soils, climate, basin and valley shape, and the plan, profile, and pattern of a river or creek channel.

The project team's classification incorporates aerial imagery, geospatial data, digital terrain models, and available studies to determine channel sinuosity, channel slope, and corresponding Rosgen stream channel type. There are approximately 1,945 stream miles in the study area with 215 miles classified as perennial streams; 1,380 miles categorized as intermittent streams; and another 350 miles classified as canals and ditches. The Rosgen classification that was completed focused on the Niobrara River and the North Platte River and their major tributaries because of the availability of information, existence of problem areas, and likelihood for improvements projects on those stream segments.

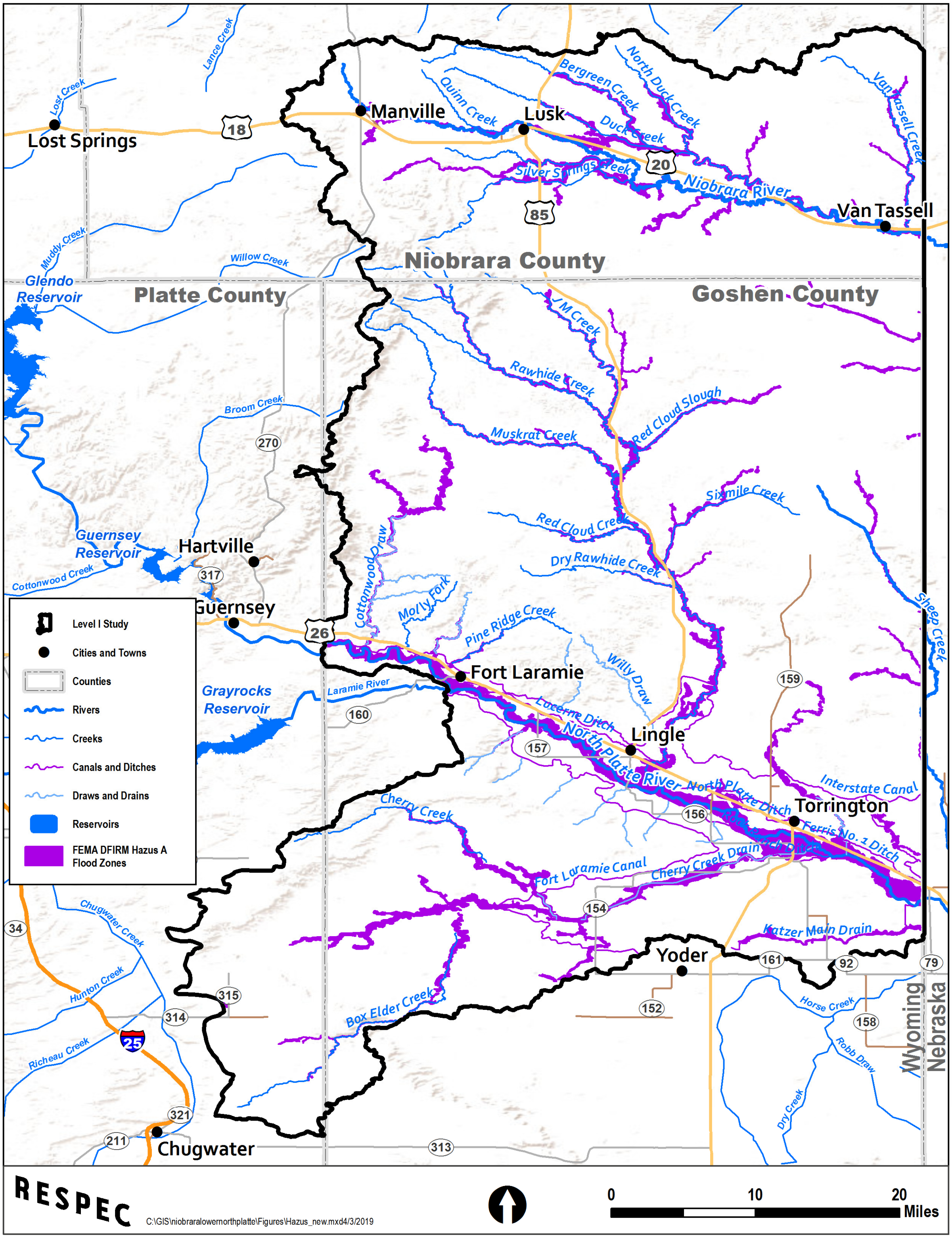


**Figure 3.4.** Hazus Modeled the 1-Percent Flood Hazard Area (100-Year Floodplain) Statewide Boundary Within the Watershed.

#### 3.2.2.1 *Stream Classification*

The Rosgen Stream Classification System is based on the stream's existing channel morphology, such as the sinuosity, slope, width/depth ratio, and size of channel materials used to classify the stream into one of the various stream channel types [Rosgen, 1996]. The Rosgen classification has four levels; each level is more detailed than the previous. Figure 3.5 illustrates the hierarchy of the levels and the general nature of effort associated with each level. For the purposes of this watershed study, the Rosgen Level I geomorphic characterization was completed and qualitatively classified streams into one of eight broad stream channel types. This initial classification provides an inventory of the study area's overall stream geomorphology, serves as a basis for further detailed stream assessments, and maps the approximate location and proportion of stream types within the study area. Rosgen major stream types are often associated with their location in the watershed such as from the headwaters to the lowlands. For example, A type streams are located in headwaters; C and E stream types are located in meandering lowlands.

***Level I Methods***

The Level I geomorphic classification effort was conducted using existing information incorporated into the study's geodatabase. Several analytical tools were developed and integrated into the GIS to evaluate various geomorphic parameters (e.g., sinuosity, slope, and stream station determination). The data incorporated in the study's GIS include National Agriculture Imagery Program (NAIP) imagery, USGS topographic maps, a DEM, and the National Hydrography Dataset (NHD) hydrography data layer. The most current data available were used in the geomorphic evaluation. Because the DEM was limited to a 10-meter grid, elevations and subsequent slope calculations are approximate. Stream alignments were digitized by using 2015 aerial imagery and represent the best available estimate of current channel alignment.

The evaluated streams were divided into reaches based on the definable geographic factors (e.g., confluences with tributaries, major road crossings) or where their geomorphic character displayed changes. Each reach was evaluated based on the characteristics required at the Level I classification. These parameters, as indicated in Figure 3.6, were channel slope, channel shape, channel patterns, and valley morphology. Note that in the Level I classification, these parameters are not typically quantified, and the relative magnitude (i.e., moderate, slightly) is used to classify the stream. The result of this classification is the determination of the major stream types (A through G). Figure 3.7 shows the major stream types within the Rosgen Classification System along with their relative locations within a typical watershed. Brief descriptions of the various stream types in the watershed are presented in the following text.

**A-type channels** are relatively steep channels that form in headwater areas as well as within bedrock canyons. These channels are entrenched and confined by steep valley margins such that little to no floodplain area borders them. Because the boundaries of A-type channels are typically highly resistant to erosion, these stream types are generally resilient with regarding human impacts. The most common cause of geomorphic change within A-type channels is large-scale sediment transport events, (e.g., landslides, debris flows, and debris jam failure) that may result in blockage or deflection of channel flow. There were no stream reaches identified as A-type channels from the Level I geomorphic classification effort. However, some headwater streams originating in the Hartville Uplift or occurring in steep, narrow canyons within the watershed could be described as A-type channels.

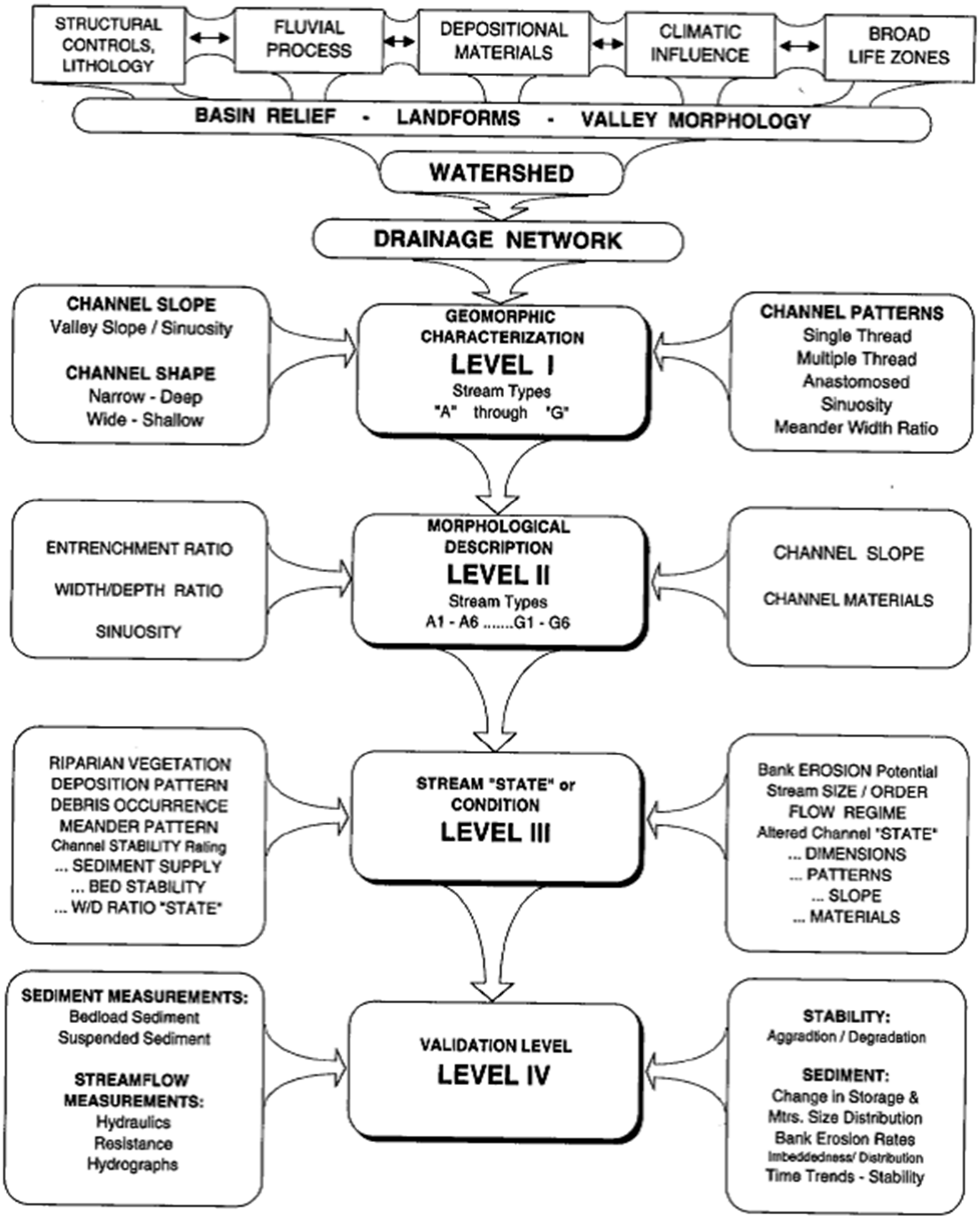


**Figure 3.5.** Hierarchy of the Rosgen Stream Classification System [Rosgen, 1996].

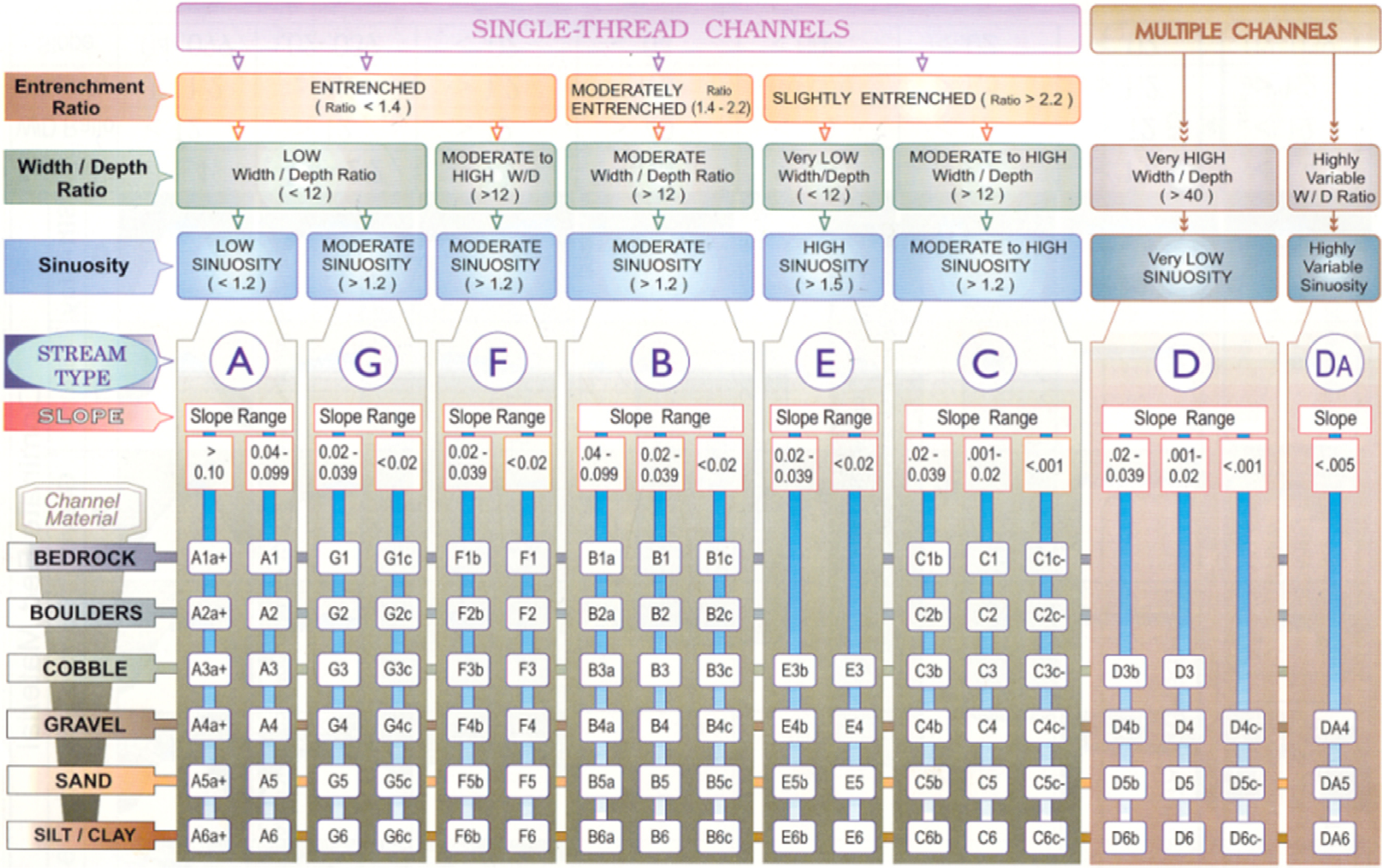


**Figure 3.6.** Rosgen Classification System Matrix [Rosgen, 1996].

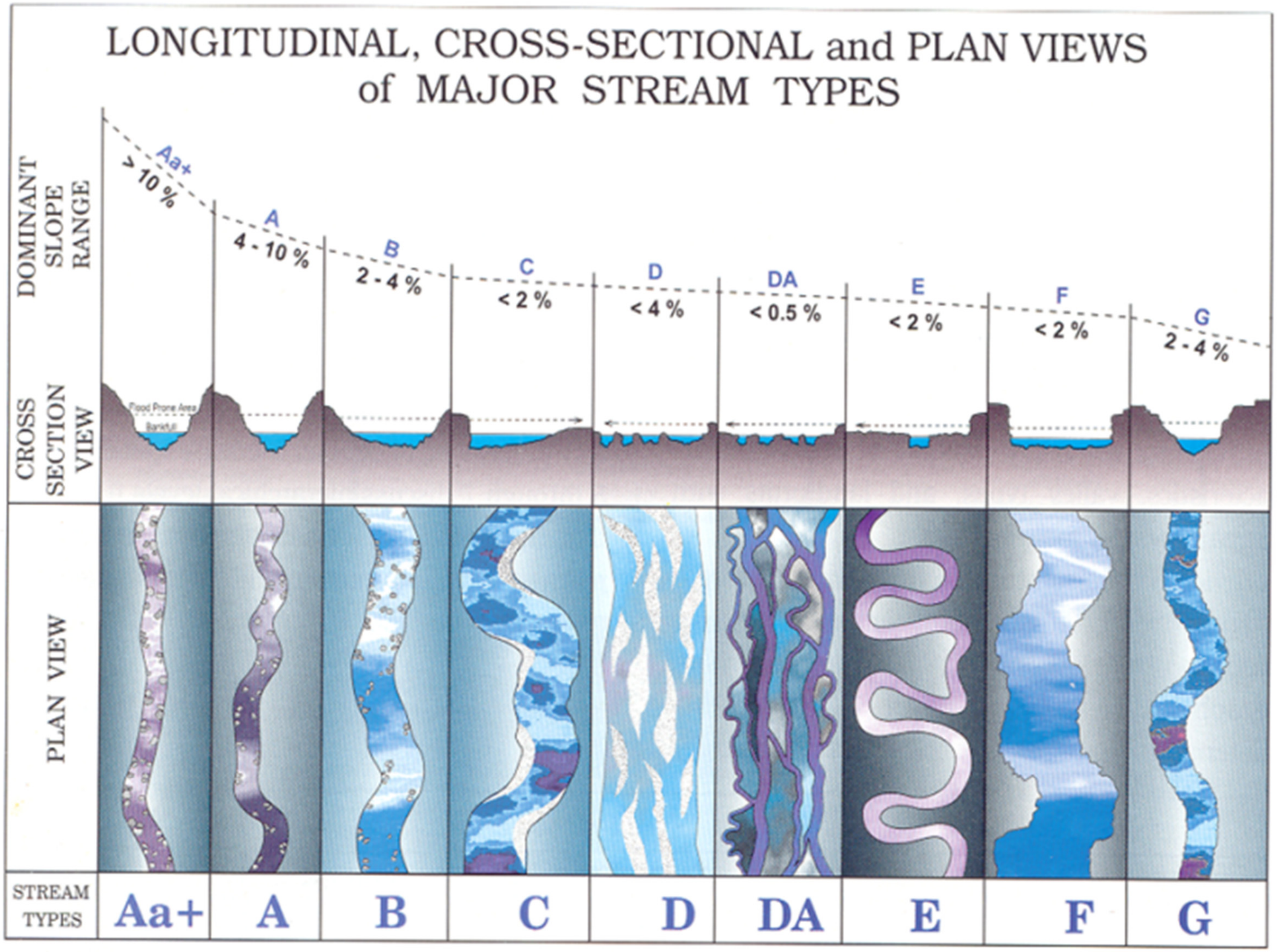


**Figure 3.7.** Major Stream Types Within the Rosgen Classification System [Rosgen, 1996].

**B-type channels** tend to form downstream of headwater channels, in areas of moderate slope where the watershed transitions from headwater environments to valley bottoms, such as Rawhide Creek as shown in Figure 3.8. B-type channels are characterized by moderate slopes, moderate entrenchments, and stable channels. Because of the relatively steep channel slopes and stable channel boundaries, B-type channels are moderately resistant to human impacts; although, their reduced slopes relative to headwater areas can make them prone to sediment deposition and subsequent adjustment after a large sediment transport event (e.g., an upstream landslide, debris flow, or flood). Reaches of the Niobrara River and Aego, Bergreen, Cherry, Crystal, Molly Fork, Muskrat, Quinn, Rawhide, Sand Draw, Sheep, Silver Springs, and Van Tassell Creeks are described as B-type channels from the Level I classification in the study area.

**Figure 3.8.** Example of a B-Type Channel: Rawhide Creek.

**C-type channels** are typically characterized by relatively low slopes, meandering planforms (i.e., the shape that would be seen from above, as on a map or aerial photographs), and pool/riffle sequences, such as the Niobrara River near Lusk as shown in Figure 3.9 and the North Platte River near Torrington shown in Figure 3.10. The channels tend to occur in broad alluvial valleys and are typically associated with broad floodplain areas; these channels are not entrenched and still have “access” to their floodplains. C-type channels tend to be relatively sinuous and follow a meandering course within a single channel. In systems where the boundaries of C-type channels consist of alluvial sediments, channels tend to be dynamic and adjust rapidly in response to disturbance. Reaches of the Niobrara River, North Platte River, and Box Elder, Duck, J M, Muskrat, North Branch Silver Springs, North Duck, Pine Ridge, and Spring Canyon Creeks are described as C-type channels from the Level I geomorphic classification within the study area.

**Figure 3.9.** Example of a C-Type Channel: Niobrara River.

**Figure 3.10.** Example of a C-Type Channel: North Platte River.

**D-Type Channels** are typically characterized by multiple channels or braided streams with high width/depth ratio and a gentle stream gradient. These channel types occur occasionally in glacial trough valleys, glacial outwash valleys, broad alluvial mountain valleys, and deltas. These streams also are not incised and can have high bank erosion rates supplying an indefinite amount of sediment resulting in bars and islands that adjust frequently within the channel. No channels were described as D-type channels from the Level I geomorphic classification within the study area.

**E-type channels** are somewhat similar to C-type channels because they form as single threads with defined, accessible floodplain areas, such as Rawhide Creek as shown in Figure 3.11. However, E-type channels tend to have fine-grained channel margins, which provide cohesion and support dense bank vegetation. The fine-grained, vegetation-reinforced banks allow for steep banks; very sinuous planforms; and relatively deep, U-shaped channels to develop. E-type channels commonly form in low-gradient areas with fine-grained source areas and mountain meadows. E-type channels tend to have very stable planforms, and efficient sediment transport capacities because of low width/depth ratios. Reaches of the Niobrara River and Dry Rawhide, Duck, North Duck, Rawhide, Red Cloud, Silver Springs, Sixmile, and Van Tassell Creeks are described as E-type channels from the Level I classification within the study area.

**Figure 3.11.** Example of an E-Type Channel: Rawhide Creek.

**F-type channels** typically have low slopes (< 2 percent), which is similar to C- and E-type channel. The difference between C- and E-type channels and F-type channels is entrenchment. F-type channels are entrenched, which means that the floodplain is narrow relative to the channel width. The entrenchment of F-type channels typically indicates a past downcutting event. F-type channels may form in resistant boundary materials (e.g., U-shaped bedrock canyons) and erodible alluvial materials (e.g., arroyos). No channels were described as F-type channels from the Level I classification within the study area. However, some segments occurring as C- and E-type channels could be described as F-type channels.

**G-type channels** are narrow, steep, entrenched gullies. G-type channels typically have high bank erosion rates and a high sediment supply. Channel degradation and sideslope rejuvenation processes are typical. No G-type channels were identified within the study area.

***Level I Classification Results***

The results of the Level I classification effort are presented in Table 3.5 and graphically in Figure 3.12. This figure displays a map of the study area and depicts the various stream types and the reach designations used in the classification effort. Many of the channels were classified as either as C- and E-type channels, which are meandering stream channels that have access to their floodplains and are only slightly entrenched, as shown in Figure 3.7.

These channels are typically erosive, actively downcutting, or widening. Entrenchment occurs for a variety of reasons, including the presence of erosive soils coupled with land-use practices (e.g., road construction, energy development, and grazing). Observing channel conditions revealed entrenchment that ranged from slight to severe. In the case of many streams in the watershed, channels appear to have stabilized or be in the process of stabilizing after episodes of incision.

#### 3.2.2.2 *Channel Structure and Stream Stability*

The channels in the watershed generally appear stable and functioning. However, some segments on the Niobrara River and the North Platte River have channels that have changed or perhaps are changing. Recent periods of drought and low flows followed by increased precipitation, high flows, and flooding events likely contributed to these changing conditions. Some river segments that were visited during the inventory had reaches that are adjusting to disturbances from natural and/or man-made events which mainly included high flows associated with floods. Field visits conducted on participating landowners' properties involved evaluating some unstable channels that indicated streambank erosion, sediment deposition, and lateral instability. A few of those reaches also appeared to be entrenched and lacked adequate vegetative cover to resist erosion during runoff or high flow events.

Channel morphologies and hydrologic regimes of the Platte River and its tributaries, the South Platte and North Platte Rivers in Colorado, Wyoming, and Nebraska have undergone major changes since 1860, when the water resources of the Platte Basin began to be developed for agricultural, municipal, and industrial uses [Eschner et al., 1983]. Reservoir storage and river flows are managed to provide water for irrigation water delivery, hydroelectric power production, municipal and industrial water supply, flood control, outdoor recreation, and fish and wildlife preservation in Wyoming and Nebraska [US Bureau of Reclamation, 2018]. The dominant characteristic of the North Platte River is its flow-regulated conditions controlled by seven impoundments; Seminoe, Kortes, Pathfinder, Alcova, Gray Reef, Glendo, and Guernsey Reservoirs [WDEQ, 2007]. The impoundments and diversions greatly influence the ecological structure and function of the North Platte River in Segments 2–4 [WDEQ, 2007].

**Table 3.5. Summary of Rosgen Level I Classification Results (Page 1 of 2)**

| Stream | Station (Distance from Mouth) Start (mi) | End (mi) | Length (mi) | Sinuosity | Slope (%) | Rosgen Type |
|---|---|---|---|---|---|---|
| Aego Creek | 0.0 | 2.7 | 2.7 | 1.14 | 0.015 | B |
| Aego Creek | 2.7 | 4.6 | 1.9 | 1.10 | 0.036 | B |
| Bergreen Creek | 0.0 | 3.9 | 3.9 | 1.03 | 0.003 | B |
| Bergreen Creek | 3.9 | 9.4 | 5.5 | 1.17 | 0.004 | B |
| Bergreen Creek | 9.4 | 14.4 | 5.0 | 1.27 | 0.005 | B |
| Bergreen Creek | 14.4 | 19.3 | 4.9 | 1.21 | 0.009 | B |
| Box Elder Creek | 0.0 | 3.2 | 3.2 | 1.10 | 0.005 | C |
| Box Elder Creek | 3.2 | 8.8 | 5.6 | 1.21 | 0.007 | C |
| Box Elder Creek | 8.8 | 16.8 | 8.0 | 1.12 | 0.013 | C |
| Box Elder Creek | 16.8 | 22.9 | 6.1 | 1.06 | 0.008 | C |
| Cherry Creek | 0.0 | 7.4 | 7.4 | 1.05 | 0.005 | B |
| Cherry Creek | 7.4 | 14.9 | 7.5 | 1.04 | 0.015 | B |
| Crystal Creek | 0.0 | 3.2 | 3.2 | 1.12 | 0.031 | B |
| Dry Rawhide Creek | 0.0 | 3.7 | 3.7 | 1.10 | 0.005 | E |
| Dry Rawhide Creek | 3.7 | 11.0 | 7.3 | 1.23 | 0.007 | E |
| Duck Creek | 0.0 | 12.2 | 12.2 | 1.53 | 0.001 | E |
| Duck Creek | 12.2 | 17.4 | 5.2 | 1.07 | 0.001 | E |
| Duck Creek | 17.4 | 23.3 | 5.9 | 1.02 | 0.004 | E |
| Duck Creek | 23.3 | 32.2 | 8.9 | 1.23 | 0.009 | C |
| J M Creek | 0.0 | 3.4 | 3.4 | 1.18 | 0.004 | C |
| J M Creek | 3.4 | 11.1 | 7.7 | 1.40 | 0.004 | C |
| J M Creek | 11.1 | 17.7 | 6.6 | 1.09 | 0.011 | C |
| Molly Fork | 0.0 | 1.9 | 1.9 | 1.06 | 0.009 | B |
| Molly Fork | 1.9 | 6.1 | 4.2 | 1.30 | 0.011 | B |
| Molly Fork | 6.1 | 8.2 | 2.1 | 1.05 | 0.016 | B |
| Muskrat Creek | 0.0 | 11.3 | 11.3 | 1.42 | 0.003 | C |
| Muskrat Creek | 11.3 | 18.1 | 6.8 | 1.47 | 0.006 | C |
| Muskrat Creek | 18.1 | 24.7 | 6.6 | 1.23 | 0.012 | B |
| Muskrat Creek | 24.7 | 29.1 | 4.4 | 1.11 | 0.018 | B |
| Niobrara River | 0.0 | 13.2 | 13.2 | 1.31 | 0.001 | C |
| Niobrara River | 13.2 | 34.4 | 21.2 | 1.42 | 0.001 | C |
| Niobrara River | 34.4 | 49.6 | 15.2 | 1.40 | 0.002 | E |
| Niobrara River | 49.6 | 57.6 | 8.0 | 1.40 | 0.003 | C |
| Niobrara River | 57.6 | 61.4 | 3.8 | 1.11 | 0.002 | B |
| Niobrara River | 61.4 | 64.9 | 3.5 | 1.07 | 0.007 | B |
| North Branch Silver Springs Creek | 0.0 | 4.9 | 4.9 | 1.07 | 0.001 | C |

**Table 3.5. Summary of Rosgen Level I Classification Results (Page 2 of 2)**

| Stream | Station (Distance from Mouth) | | Length (mi) | Sinuosity | Slope (%) | Rosgen Type |
|---|---|---|---|---|---|---|
| | Start (mi) | End (mi) | | | | |
| North Branch Silver Springs Creek | 4.9 | 10.0 | 5.1 | 1.30 | 0.004 | C |
| North Branch Silver Springs Creek | 10.0 | 13.0 | 3.0 | 1.05 | 0.016 | C |
| North Duck Creek | 0.0 | 6.2 | 6.2 | 1.26 | 0.002 | E |
| North Duck Creek | 6.2 | 11.3 | 5.1 | 1.13 | 0.005 | C |
| North Platte River | 0.0 | 9.9 | 9.9 | 1.07 | 0.001 | C |
| North Platte River | 9.9 | 21.9 | 12.0 | 1.10 | 0.001 | C |
| North Platte River | 21.9 | 36.8 | 14.9 | 1.15 | 0.001 | C |
| North Platte River | 36.8 | 48.6 | 11.8 | 1.05 | 0.001 | C |
| Pine Ridge Creek | 0.0 | 4.8 | 4.8 | 1.12 | 0.005 | C |
| Pine Ridge Creek | 4.8 | 10.4 | 5.6 | 1.33 | 0.013 | C |
| Quinn Creek | 0.0 | 7.3 | 7.3 | 1.11 | 0.010 | B |
| Rawhide Creek | 0.0 | 12.3 | 12.3 | 1.24 | 0.002 | E |
| Rawhide Creek | 12.3 | 22.4 | 10.1 | 1.14 | 0.002 | E |
| Rawhide Creek | 22.4 | 29.2 | 6.8 | 1.19 | 0.002 | E |
| Rawhide Creek | 29.2 | 36.1 | 6.9 | 1.23 | 0.002 | E |
| Rawhide Creek | 36.1 | 50.3 | 14.2 | 1.34 | 0.004 | E |
| Rawhide Creek | 50.3 | 60.2 | 9.9 | 1.57 | 0.003 | E |
| Rawhide Creek | 60.2 | 64.1 | 3.9 | 1.16 | 0.008 | B |
| Rawhide Creek | 64.1 | 70.9 | 6.8 | 1.06 | 0.014 | B |
| Red Cloud Creek | 0.0 | 6.5 | 6.5 | 1.57 | 0.003 | E |
| Red Cloud Creek | 6.5 | 11.3 | 4.8 | 1.12 | 0.008 | E |
| Red Cloud Slough | 0.0 | 6.6 | 6.6 | 1.08 | 0.006 | E |
| Sand Draw | 0.0 | 3.3 | 3.3 | 1.11 | 0.006 | B |
| Sand Draw | 3.3 | 7.3 | 4.0 | 1.25 | 0.009 | B |
| Sheep Creek | 0.0 | 4.7 | 4.7 | 1.05 | 0.004 | B |
| Sheep Creek | 4.7 | 11.3 | 6.6 | 1.05 | 0.005 | B |
| Silver Springs Creek | 0.0 | 6.2 | 6.2 | 1.06 | 0.003 | E |
| Silver Springs Creek | 6.2 | 13.1 | 6.9 | 1.06 | 0.005 | B |
| Silver Springs Creek | 13.1 | 16.7 | 3.6 | 1.08 | 0.034 | B |
| Sixmile Creek | 0.0 | 4.7 | 4.7 | 1.04 | 0.005 | E |
| Sixmile Creek | 4.7 | 11.0 | 6.3 | 1.04 | 0.008 | E |
| Spring Canyon | 0.0 | 1.6 | 1.6 | 1.07 | 0.006 | C |
| Spring Canyon | 1.6 | 4.1 | 2.5 | 1.12 | 0.012 | C |
| Spring Canyon | 4.1 | 7.6 | 3.5 | 1.11 | 0.019 | C |
| Van Tassell Creek | 0.0 | 5.6 | 5.6 | 1.15 | 0.003 | E |
| Van Tassell Creek | 5.6 | 10.8 | 5.2 | 1.08 | 0.003 | E |
| Van Tassell Creek | 10.8 | 17.5 | 6.7 | 1.03 | 0.006 | B |

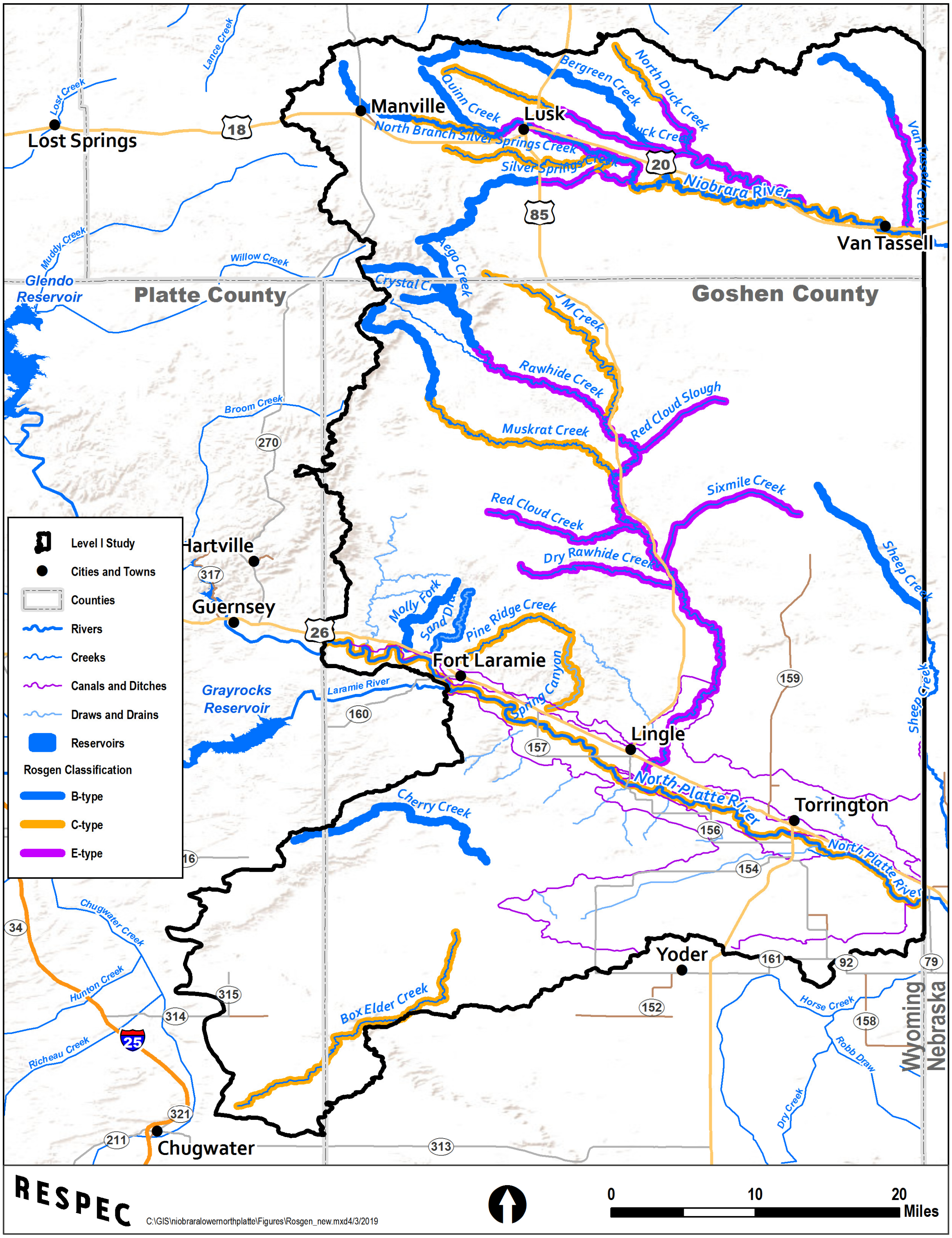


**Figure 3.12.** Rosgen Stream Classifications Within the Watershed.

The largest of these diversions is the Whalen Diversion shown in Figure 3.13, which is located on the North Platte River approximately 10 miles upstream of Fort Laramie. The diversion supplies water to the Interstate Canal and the Fort Laramie Canal. Figure 3.14 shows the Whalen Diversion and other irrigation diversions located on the North Platte River in the study area including: the Ferris Ditch, Grattan Ditch, Lucerne Canal, North Platte Ditch, Rock Ranch Ditch, and Torrington Ditch. When a diversion becomes unstable during high water, it can influence channel stability as exhibited with the Rock Ranch Diversion near Lingle and shown in Figure 3.15. The diversion has been damaged by high flow events in the past, which resulted in increased streambank erosion and mid-channel downstream sediment deposition.

**Figure 3.13.** Whalen Diversion Dam: North Platte River.

An example of an area where the river has experienced channel deposition and streambank erosion is at the Wyoming–Nebraska state line on the North Platte River shown in Figure 3.16. The State Line Gage is located here and is an important site that provides flow measurement in accordance with the North Platte Modified Decree and Final Settlement Stipulation. In 2009, a geomorphic analysis was performed on the State Line Gage site which indicated that the channel had been relatively stable from 1993 to 2006 but then severe erosion on the south bank occurred upstream of the control weir and a large sand bar formed near the north bank [Aqua Engineering, Inc., 2009]. The study also recommended the installation of bendway weirs upstream of the control weir to reduce scour along the south bank, move the flow path away from the south bank, and improve stability of the State Line Gage site. More information about this geomorphic study can be found by visiting the website (*ftp://dnrftp.dnr.ne.gov/pub/NorthPlatte2/).*

In 2010, the North Platte Decree Committee contracted with RMC Consultants to construct seven bendway weir structures to stabilize and restore the North Platte River channel as it traverses through the State Line site near Henry, Nebraska. In 2011, RMC Consultants restored the channel using rock riprap and innovative geotextile sand tubes to construct the bendway weirs [RMC Consultants, 2018]. The installed bendway weirs can be seen in Figure 3.16 and more information can be found at the website (*https://www.rmc-consultants.net/projects/north-platte-river-bank-stabilization/).*

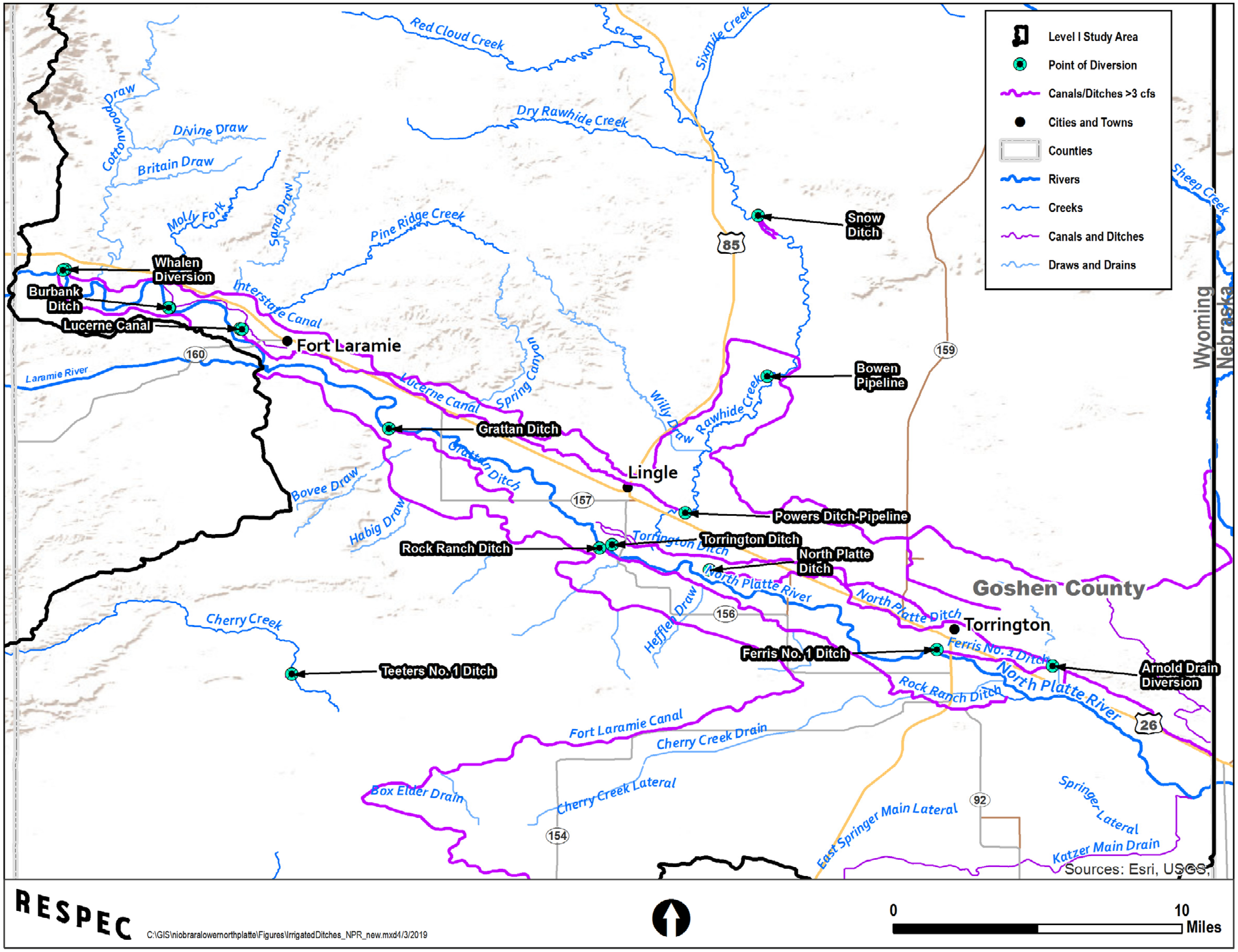


**Figure 3.14.** Irrigation Ditches and Diversions With Flows Greater Than 3 Cubic Feet Per Second Within Goshen County.

**Figure 3.15.** Rock Ranch Diversion Dam: North Platte River.


**Figure 3.16.** State Line Gage Site: North Platte River.

#### 3.2.2.3 *North Platte River Assessment*

In 2002, the WDEQ evaluated the habitat condition, streambanks, channel morphology, sediment supply, and stream stability for these five stations within the watershed Generally, banks downstream of Guernsey Dam were considered moderate to highly unstable with large percentages of bank susceptible to erosion and sloughing during high flows [WDEQ, 2007]. Bank armoring with concrete riprap, abandoned vehicles and other material were common downstream of Guernsey Dam [WDEQ, 2007]. Vegetation/coarse material protection along these banks was less than optimal with areas of bare soil, close cropped vegetation and species of riparian vegetation with inadequate root mass to maintain bank integrity [WDEQ, 2007]. Much of the channel substrate downstream of Guernsey Dam consisted of mobile sand overlain by unembedded gravel bars which constitute the riffles in the segment [WDEQ, 2007]. Sediment deposition is prevalent in the channel downstream of Guernsey Dam with large expanses of newly developed point and mid-channel bars [WDEQ, 2007]. Sediment deposition in the river is likely caused loss of sediment transport capacity from flow removal and regulation, sediment releases during the annual Guernsey Reservoir's silt run, and sediment inputs from irrigation return flows [WDEQ, 2007].

Reservoir flow fluctuations have also caused changes in channel morphology and contributed to sediment deposition by increasing near-bank stress that results in scour, bank erosion and deposition [WDEQ, 2007]. Municipal stormwater drains may also contribute sediment to the river [WDEQ, 2007].

#### 3.2.2.4 *Guernsey Reservoir Silt Run*

The Guernsey Dam was completed in 1927 and is located on the North Platte River approximately 10 miles upstream of this Level I study area. From 1927 to 1957, approximately 29,000 acre-feet of sediment accumulated in the reservoir thereby reducing the reservoir's original capacity from 73,180 acre-feet to 44,800 or 45,612 acre-feet [Lidstone & Anderson, 1993; Trihydro, 2002]. The release of sediment-free water from the reservoir eroded the clay and silt that were deposited in previous years from the canal banks within the Fort Laramie and Interstate Canals, which induced an increase in bank sloughing and seepage therefore reducing the conveyance capacity of the canals [Lidstone, 1993]. Since 1936, the USBR has conducted silt runs on Guernsey Reservoir that release accumulated reservoir sediments downstream into the river and canals [Trihydro, 2002]. Guernsey Reservoir water level is typically lowered twice each year for a relatively brief period to conduct the silt runs [Wenck, 2016]. The silt runs provide silt-laden water that are diverted into the Goshen, Gering-Fort Laramie, and Pathfinder Irrigation Districts' irrigation canals, resulting in decreased canal seepage loss, increased canal bank stability, and maintaining the Guernsey Reservoir's storage capacity [Trihydro, 2002; Wenck, 2016].

There have been at least eight studies that evaluated the silt run and have documented many benefits and impacts to the reservoir, river, and canals [Lidstone, 1993]. Aquatic macroinvertebrates are reduced during the silt run and recovery is slow following reduction in turbidity [US Bureau of Reclamaton, 2005]. The silt run degrades the riverine habitat because of excessive turbidity resulting from delivery of sediment for 10–14 days each summer and is exempted from the state's turbidity criteria [US Bureau of Reclamaton, 2005; WDEQ, 2007].

### 3.2.3 Groundwater

Groundwater in the watershed is important for livestock/wildlife water, private domestic wells, municipal water, and stream flow. Groundwater availability within the watershed is variable because of the diverse aquifer characteristics and hydrogeological properties in the study area. Site-specific groundwater investigations were not conducted; hydrogeologic investigations and possibly modeling should be included in the planning for any proposed groundwater development project. This section presents a summary of groundwater resources; although, the recently completed *Platte River Basin Water Plan Update Groundwater Study, Level I (2009–2013*) [Taucher et al., 2013] *and Lusk Area Groundwater Level 1 Study* [Hinckley et al., 2009] provide a more thorough treatment on the topic. Contained in Taucher et al. [2013] are maps with groundwater potentiometric surface elevations and contours for selected aquifers within the Platte River Basin.

#### 3.2.3.1 *Aquifers*

An aquifer is geologic unit that is permeable and saturated enough to yield sufficient quantities of water. Several aquifers or hydrostratigraphic units occur throughout the watershed as shown on Figure 3.17; the most significant units are listed in Table 3.6. Quaternary and Tertiary aquifers are grouped into the High Plains Regional Aquifer System, which is a significant aquifer not only throughout southeastern Wyoming but also the central United States. Within the watershed, this Aquifer System consists of several lithostratigraphic units including: Quaternary Alluvial and Terrace aquifers, the Ogallala aquifer, Arikaree aquifer, and the White River aquifer (including the Brule aquifers and confining units and locally in the Goshen Hole area the Chadron aquifer).

The Quaternary Alluvial aquifer principally occurs within the North Platte River Valley (Figure 3.17). The aquifer consists of permeable sand and gravel deposits along with interbedded silts and clay. As noted by Rapp et al. [1957], alluvial thickness in Goshen County varies considerably from 0 to 200 feet or more. Because alluvial aquifers are confined to stream valleys, they are limited in aerial extent, often unconfined, and are in hydraulic connection with water in adjacent streams and rivers [Taucher et al., 2013]. Two studies in Goshen County, including pump test data [Weston Engineering, 1998] indicate that the North Platte River alluvial aquifer is in “minimal hydraulic connection with underlying bedrock hydrogeologic units” [Taucher et al., 2013]. The North Platte River alluvial aquifer supplies water to stock, domestic, and irrigation wells, as well as provides municipal water in Torrington and Fort Laramie [Taucher et al., 2013]. Rapp et al. [1957] also estimated that amount of groundwater flow within the alluvial aquifer at the Wyoming–Nebraska state line to range from 6,500 to 7,000 acre-feet per year.

Along with the alluvial aquifer mapped by the Wyoming State Geological Survey (WSGS), other unconsolidated quaternary deposits, particularly terrace and loess deposits, form local aquifers. In Goshen County, terrace deposits are up to 210 feet thick [Rapp et al., 1957]. These units are primarily recharged through irrigation practices, including loss from unlined irrigation canals and ditches; water levels fluctuate in response to seasonal application of water for irrigation and well yields typically fluctuate based on amount of recharge [Taucher et al., 2013]. Groundwater flow in the quaternary terrace-deposit aquifers generally follows surface topography, though near Torrington groundwater flow direction in the Quaternary is influenced by bedrock topography [Rapp et al., 1957]. Note that loess deposits are generally unsaturated in the watershed but serve as a soil type with enhanced filtration [Rapp et al., 1957].

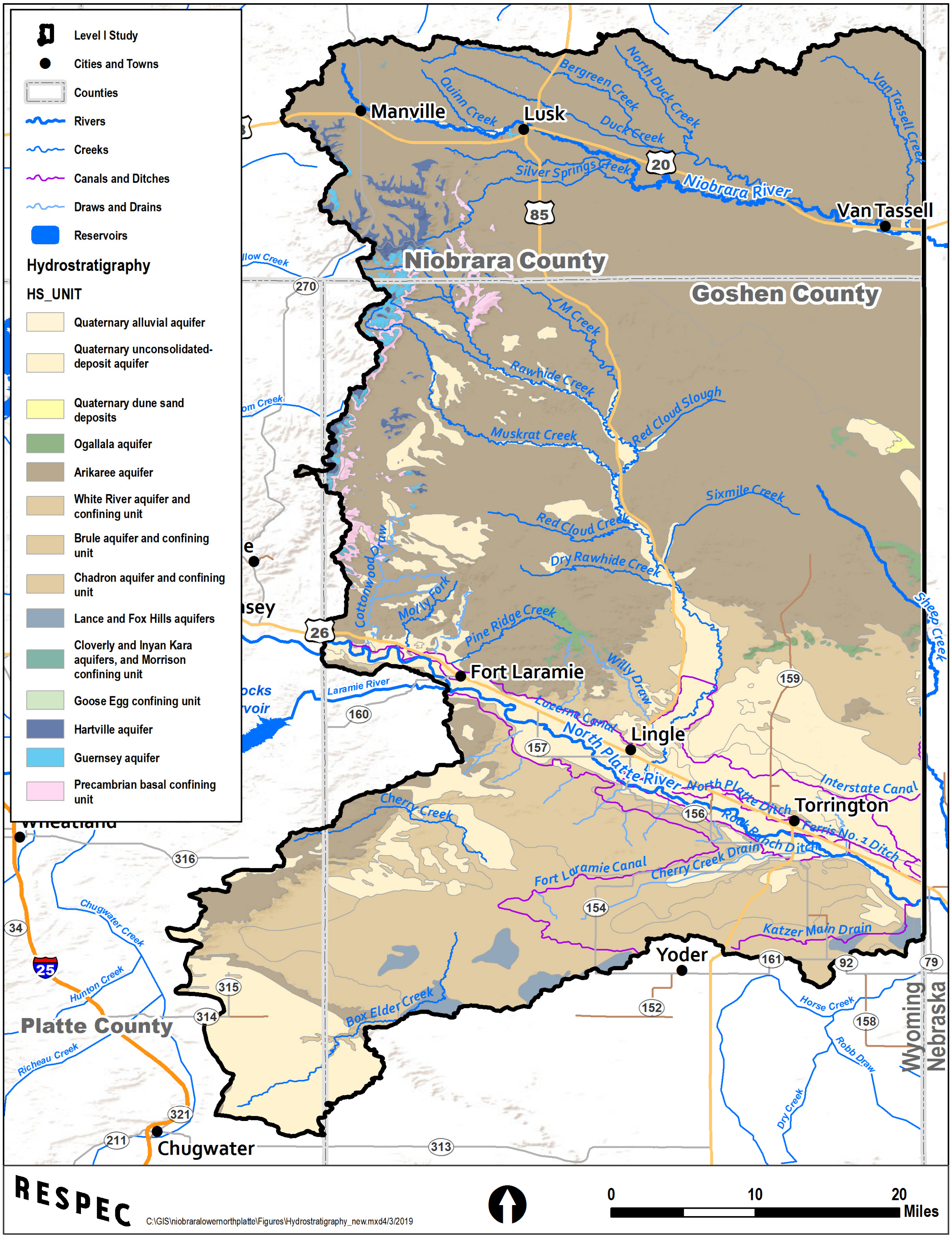


**Figure 3.17.** Recharge Areas of Hydrostratigraphic Units Within the Study Area.

**Table 3.6. Significant Aquifers or Hydrostratigraphic Units Within the Watershed (Modified from Taucher et al., [2013])**

<table>
<tr><th>Erathem</th><th>System</th><th>Series</th><th colspan="2">Lithostratigraphic Unit</th><th colspan="2">Hydrogeologic Role/Unit</th></tr>
<tr><td rowspan="5">Cenozoic</td><td>Quaternary</td><td>Holocene and Pleistocene</td><td colspan="2">Alluvial and terrace deposits</td><td rowspan="5">High Plains Aquifer System</td><td>Quaternary unconsolidated deposit aquifers</td></tr>
<tr><td rowspan="4">Tertiary</td><td rowspan="2">Miocene</td><td colspan="2">Ogallala Formation</td><td>Ogallala Aquifer</td></tr>
<tr><td colspan="2">Arikaree Formation</td><td>Arikaree Aquifer</td></tr>
<tr><td>Oligocene</td><td rowspan="2">White River Group</td><td>Brule Formation*</td><td>Brule Aquifer/confining unit</td></tr>
<tr><td>Eocene</td><td>Chadron Formation*</td><td>Confining unit with local aquifers</td></tr>
<tr><td>Mesozoic</td><td>Triassic to Cretaceous</td><td></td><td colspan="2">Chugwater to Lance formations</td><td></td><td>Confining unit; Inyan Kara may yield small quantities of water</td></tr>
<tr><td rowspan="2">Paleozoic</td><td>Pennsylvanian</td><td></td><td colspan="2">Hartville Formation</td><td></td><td>Hartville Aquifer</td></tr>
<tr><td>Mississippian and Devonian</td><td></td><td colspan="2">Guernsey Formation</td><td></td><td>Guernsey Aquifer</td></tr>
<tr><td>Precambrian</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

(a) Part of the High Plains Aquifer System where permeable and in hydraulic connection with overlying aquifers or laterally adjacent to other Tertiary aquifers.

The Ogallala Formation is exposed only in small scattered outcrops within the watershed. The Ogallala Aquifer is a heterogeneous fluvial deposit consisting of gravel, sand, silt, clay, and minor volcanic ash [Taucher et al., 2013]. Because of the heterogeneity of the deposit, wells drilled into the aquifer may have fair to very low well yields [Taucher et al., 2013].

The Miocene-age Arikaree Aquifer is present at the surface over nearly the entire northern half of the watershed and across much of the extent of the High Plains Aquifer System throughout the Midwest [Taucher et al., 2013]. The Arikaree consists of 0 to 1,000 feet of interbedded volcanic sandstone and siltstone [Rapp et al., 1957]. The Arikaree Aquifer is a low permeability aquifer though larger yields are seen where fractures have added secondary permeability [Rapp et al., 1957]. In Niobrara County, the Arikaree Aquifer is a major source of water and supplies water to stock and domestic wells as well as municipal water supplies at Lusk and Manville [Whitcomb, 1965; Hinckley et al., 2009].

The White River Group consists of the upper Brule Formation and lower Chadron Formation. In general, the White River Group forms a confining unit below the High Plains Aquifer System; however, locally such as in the Goshen Hole, permeable sandstone and conglomerate beds may form small local aquifers, particularly where in hydraulic connection with overlying Tertiary aquifers. In Goshen County, Rapp et al. [1957] describe the Brule Formation as 0–420 feet thick, and the Chadron Formation is 0–245 feet thick. The Brule Formation is primarily siltstone, and the Chadron Formation an upper siltstone and a lower fluvial deposit [Crist, 1975]. Wells in the White River often have low yields, except where secondary fracture permeability increases yield [Taucher et al., 2013].

Paleozoic units outcrop at the Hartville Uplift and along the northwestern edge of the watershed. The Hartville Formation or Hartville Aquifer is a confined aquifer except where it outcrops. The Hartville

Aquifer consists of limestone and dolomite with sandstone beds at the top and base of the formation. Most study area wells in the Hartville Aquifer are located near the Rawhide Buttes and are completed in the upper Converse Sandstone [Hinckley et al., 2009]. The Hartville Aquifer is underlain by the Mississippian age Guernsey Aquifer [Rapp et al., 1957] as having an upper cherty limestone and lower dolomitic and dolomitic siltstone unit. These Paleozoic aquifers are penetrated by relatively few wells in the watershed and do not represent widespread use as depth increases and water quality decreases away from the outcrop area.

#### 3.2.3.2 *Groundwater Levels and Flow Direction*

Depending on the location in the watershed, groundwater can be found at varying depths; areas near streams and alluvial valleys have shallower groundwater with depths from 5 feet or more. Other locations in the watershed have deeper aquifers with depths several hundred feet below the ground surface. Groundwater flow is driven by gravity and hydraulic head. Within the watershed, groundwater generally flows from areas of higher elevation on the western side of the watershed eastward to areas of lower elevation at the state line. Particularly in Quaternary alluvial aquifers, groundwater flow is toward streams or in the direction of streamflow [Taucher et al., 2013]. Potentiometric surface or water level maps for select aquifers are contained within Crist [1975] and Taucher et al. [2013].

In the central and east-central portions of the watershed, several wells are completed in confined aquifers and have artesian conditions [Rapp et al., 1957]. Water-level monitoring indicates seasonal fluctuations in the water table driven primarily by irrigation. On average, the water table rises 5 feet during the irrigation season because of seepage from canals and irrigation; in areas where canals are higher above the water table changes can be as much as 25 feet [Rapp et al., 1957]. However, long-term trends seem to indicate a small, consistent decline in water levels across the region [Hinckley et al., 2009]. Declines have occurred in the Prairie Center area; and near Lusk, the Arikaree Aquifer has experienced water level declines up to 30 feet between 1960 through 2008 [Hinckley et al., 2009].

Within Niobrara County, the State Engineer's Office (SEO) actively monitors water levels at three wells. Groundwater levels and annual precipitation at the Torrington 29N NWS Station are shown in Figures 3.18, 3.19, and 3.20 for the Node well, Niobrara Co. No. 1 well, and the Niobrara Co. No. 2 well, respectively. In northern Goshen County, the SEO actively monitors water levels at seven wells. Groundwater levels and annual precipitation at the Torrington 29N NWS Station are shown in Figures 3.21 through 3.27 for the Sandstone #1, Goshen No. 1, Goshen No. 2, Prairie Center No. 3, Prairie Center No. 4, Prairie Center No. 5, and Prairie Center No. 6 wells, respectively. Since monitoring began, there have been water level declines in most of the monitoring wells except in the Niobrara No. 2 well and the Sandstone #1 well.

#### 3.2.3.3 *Groundwater System Flux*

Changes in the volume of water in an aquifer system are related to the flux of water into and out of the aquifer. Within southeastern Wyoming, recharge to groundwater aquifers occurs via precipitation infiltration, losses or seepage along streams and unlined canals, or from application of irrigation waters. In irrigated areas recharge is from a combination of these mechanisms, though in non-irrigated areas recharge is dominated by direct precipitation. Groundwater discharge occurs in several ways including spring flow, seepage into streams (gaining streams) as baseflow, leakage between hydrostratigraphic

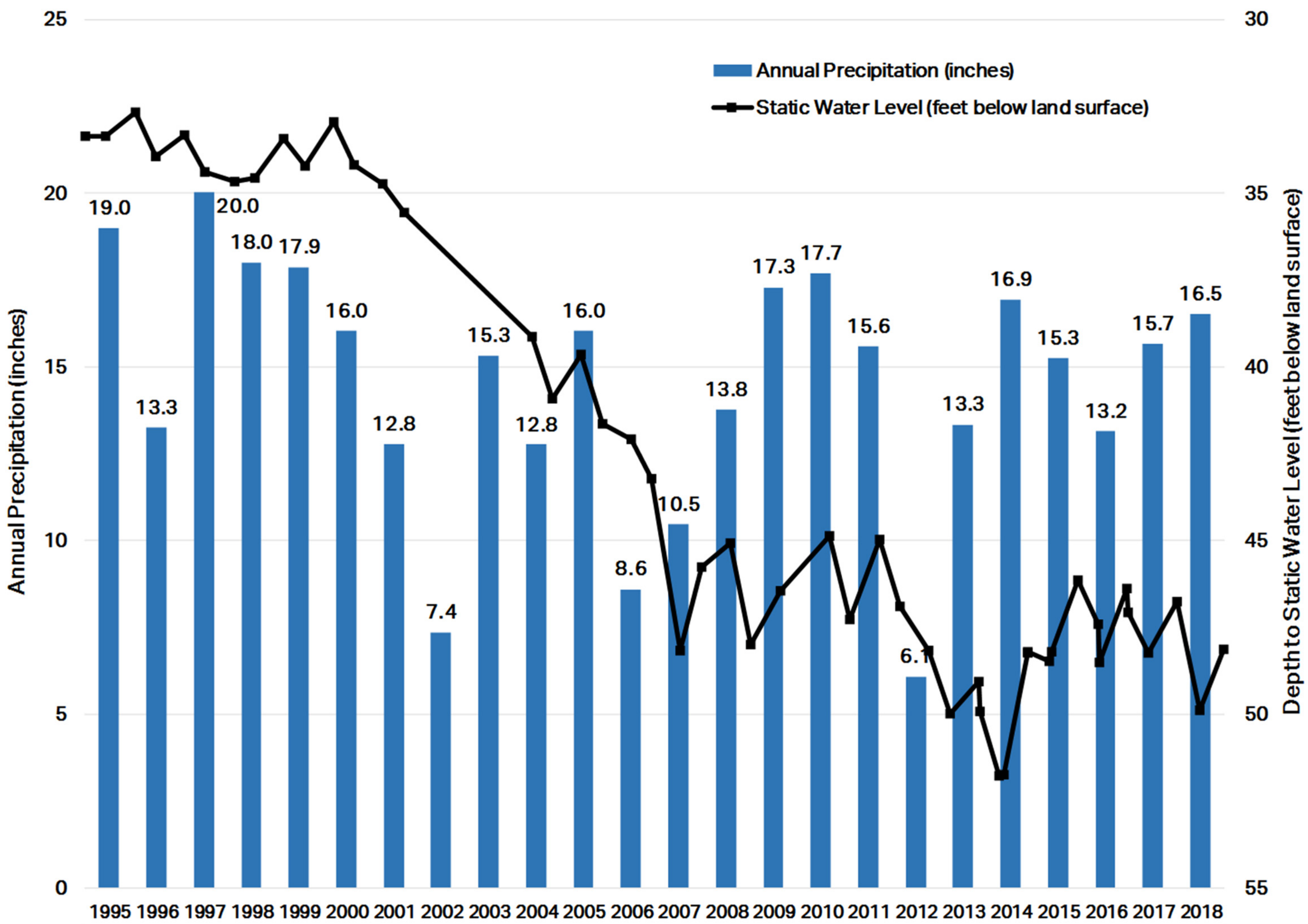


**Figure 3.18.** Annual Precipitation at the Torrington 29N NWS Station and Depth to Water Level at Node Well in Niobrara County.

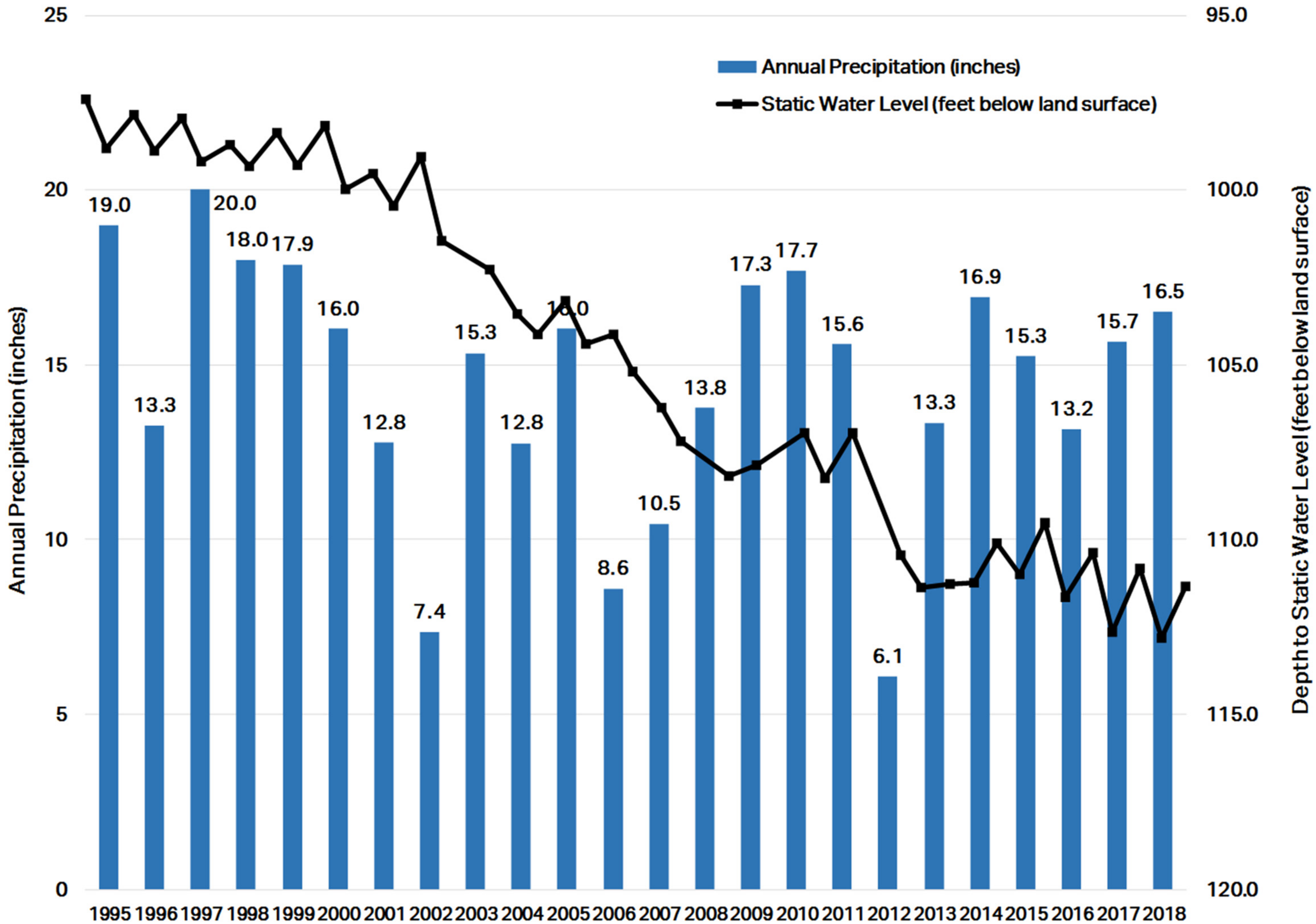


**Figure 3.19.** Annual Precipitation at the Torrington 29N NWS Station and Depth to Water Level at Niobrara No. 1 Well in Niobrara County.

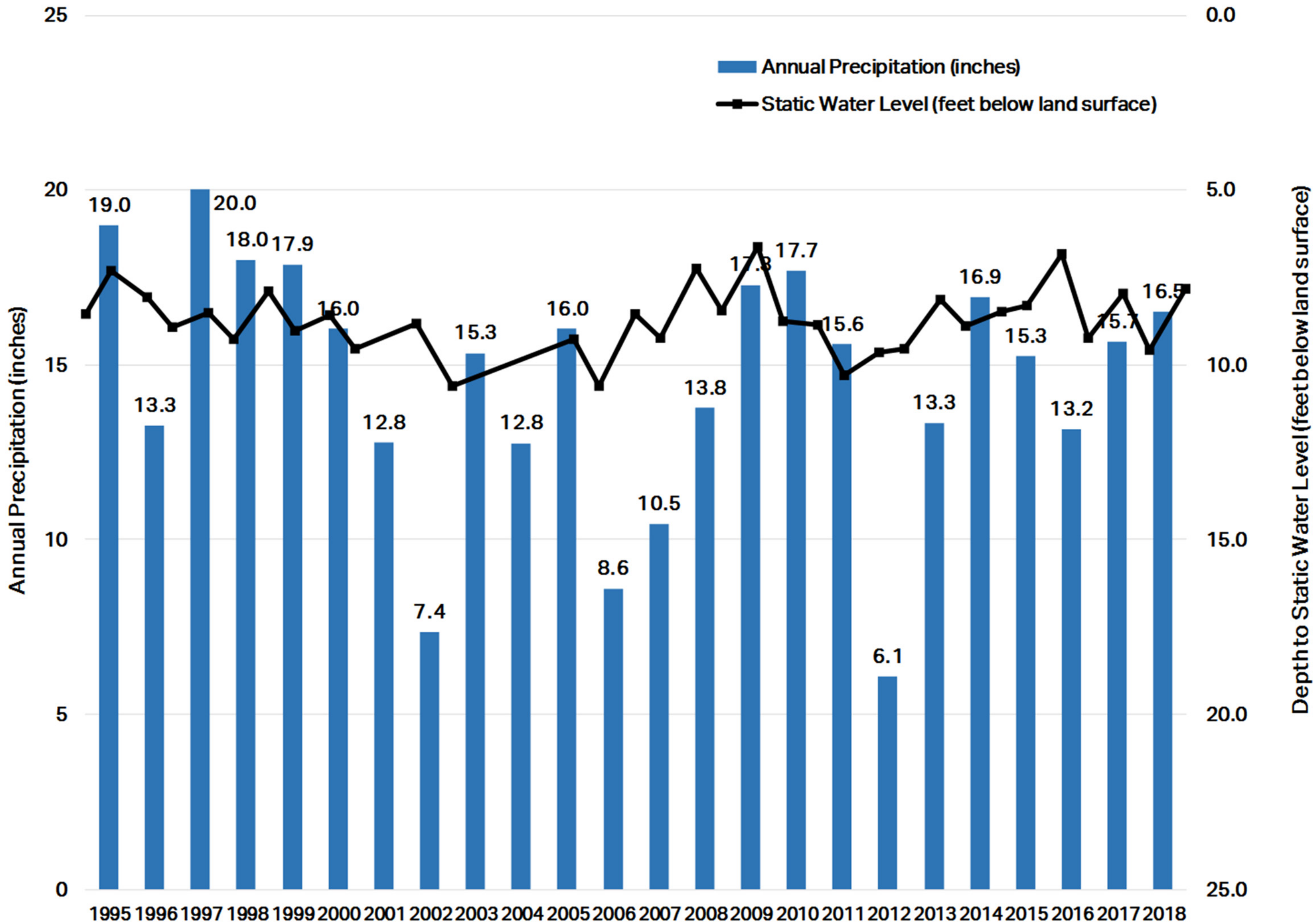


**Figure 3.20.** Annual Precipitation at the Torrington 29N NWS Station and Depth to Water Level at Niobrara No. 2 Well in Niobrara County.

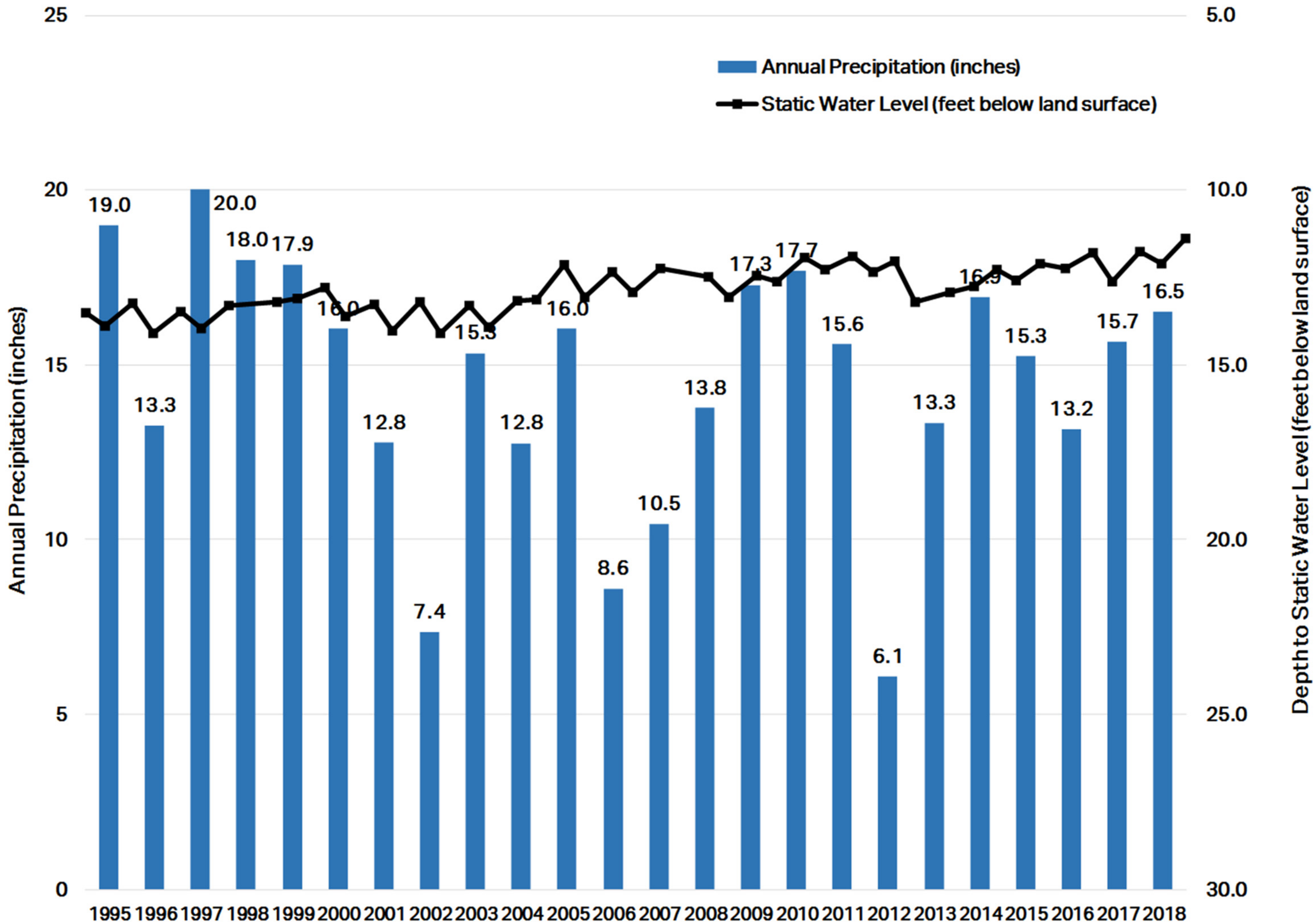


**Figure 3.21.** Annual Precipitation at the Torrington 29N NWS Station and Depth to Water Level at Sandstone No. 1 Well in Goshen County.

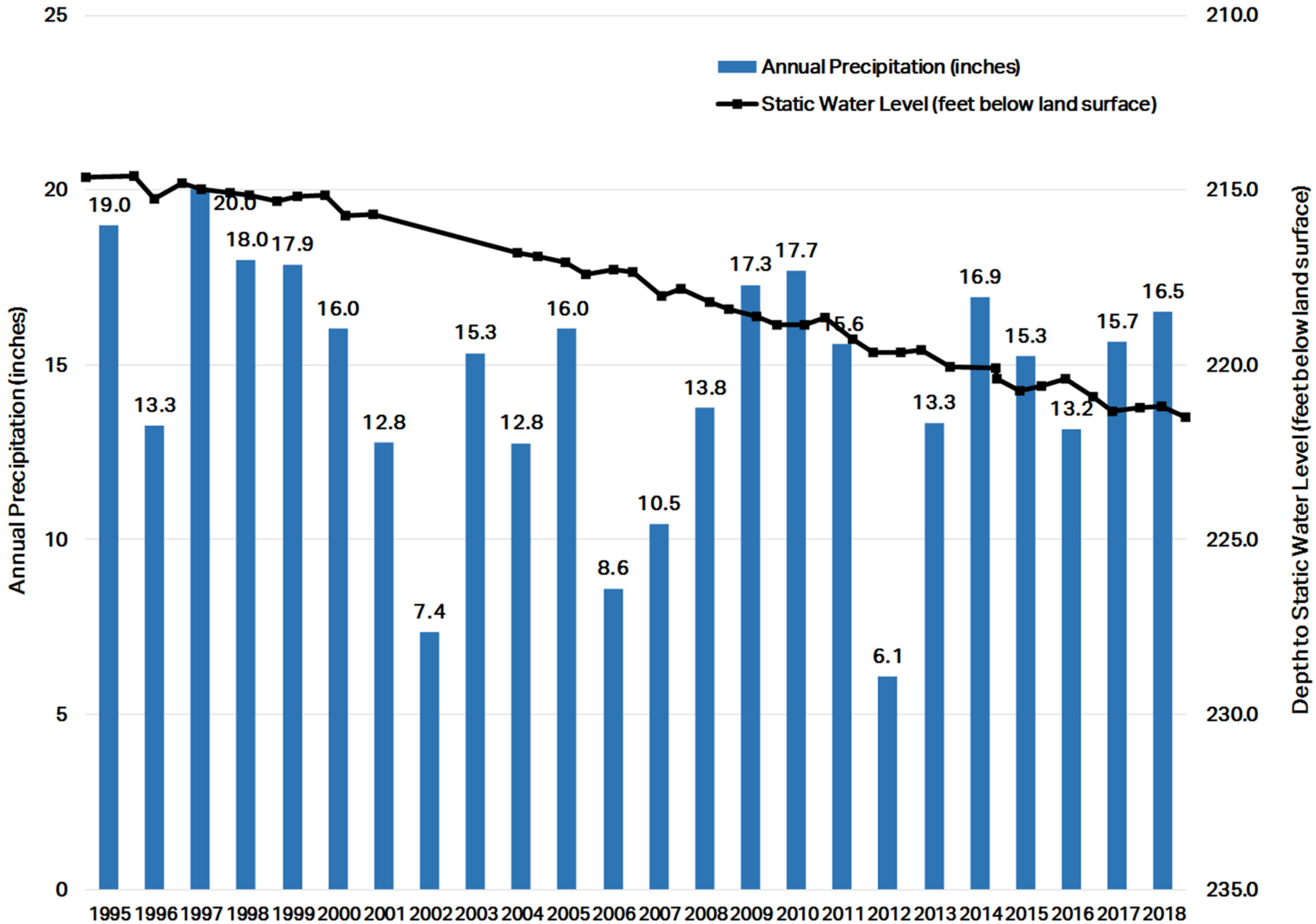


**Figure 3.22.** Annual Precipitation at the Torrington 29N NWS Station and Depth to Water Level at Goshen No. 1 Well in Goshen County.

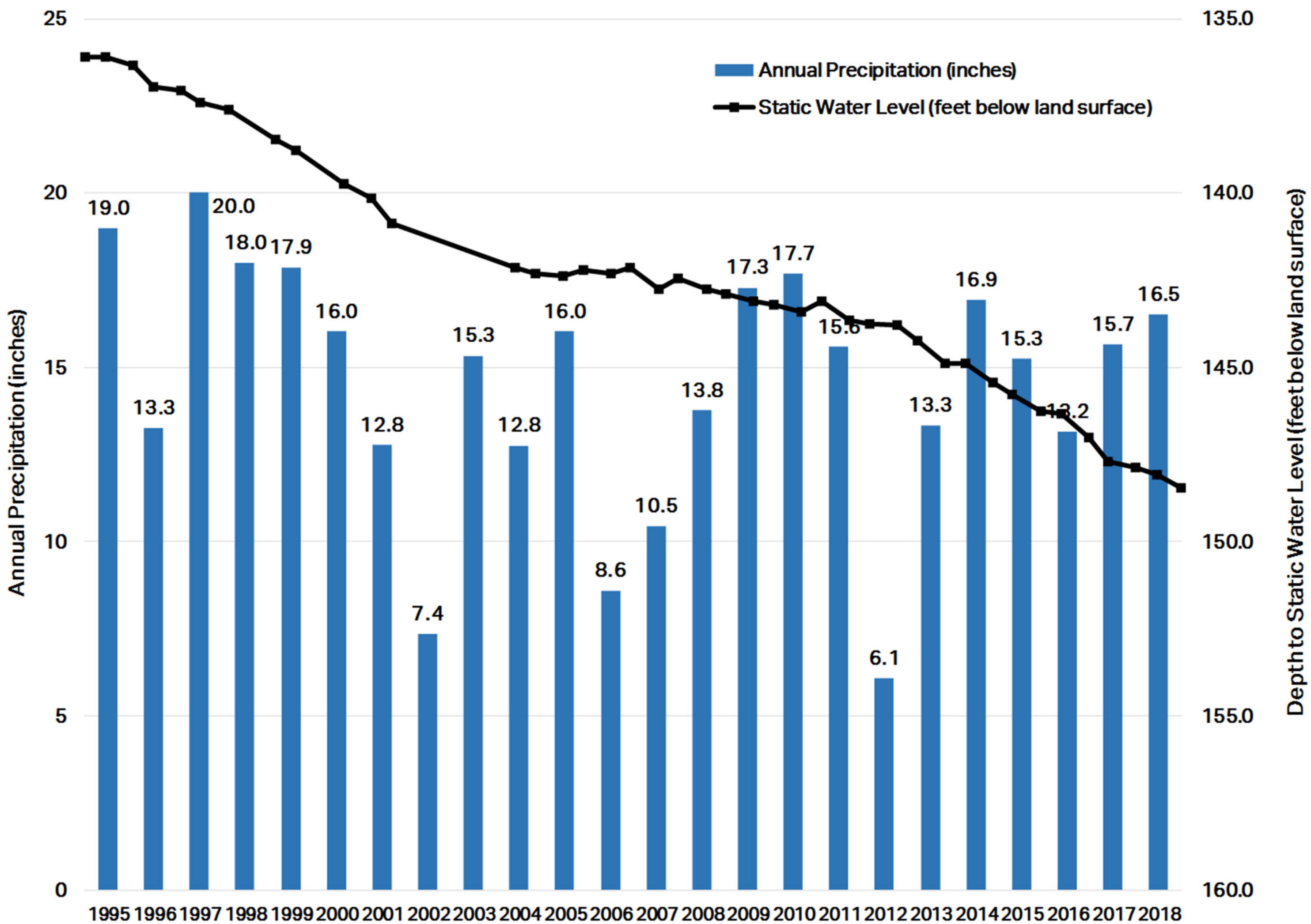


**Figure 3.23.** Annual Precipitation at the Torrington 29N NWS Station and Depth to Water Level at Goshen No. 2 Well in Goshen County.

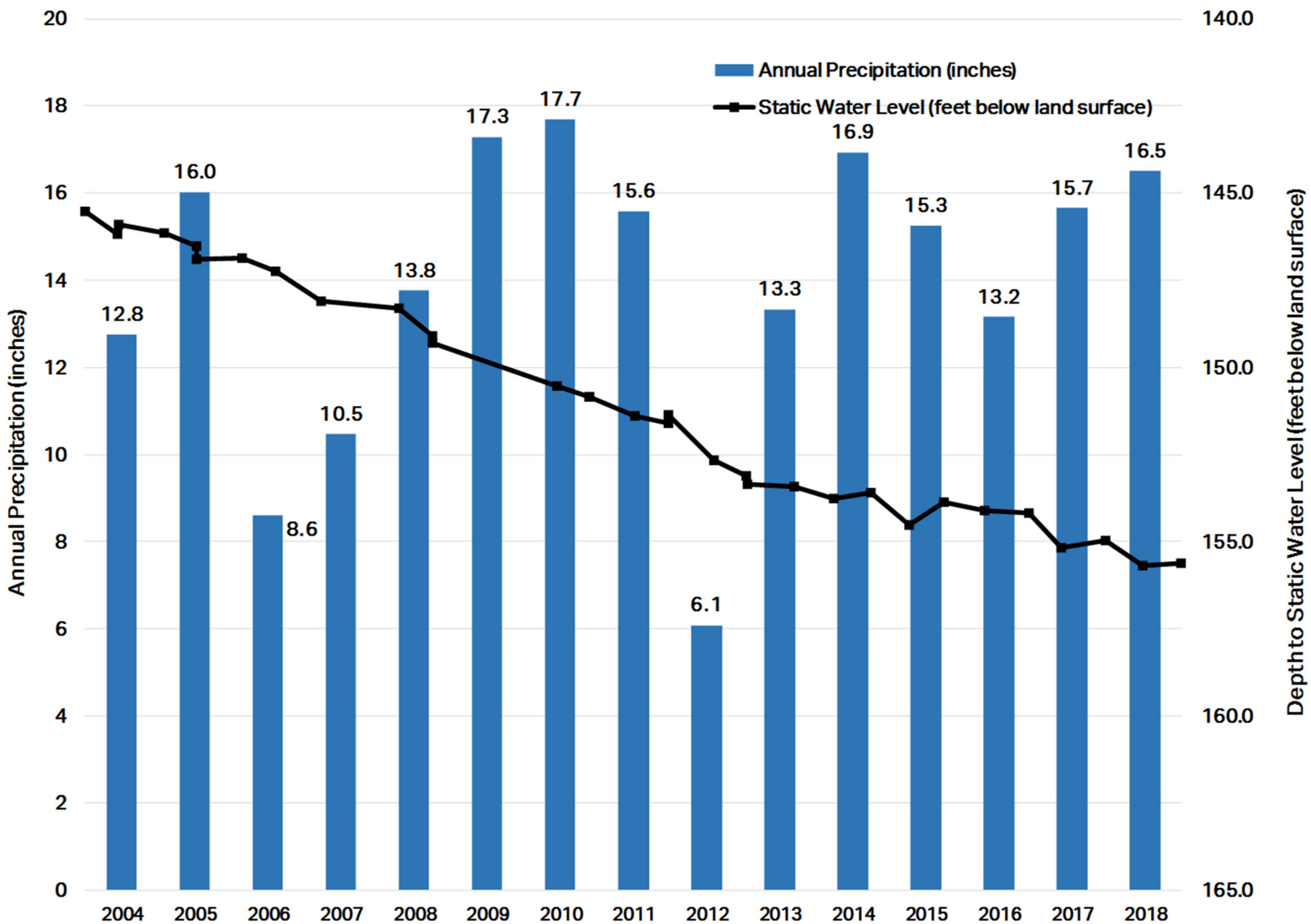


**Figure 3.24.** Annual Precipitation at the Torrington 29N NWS Station and Depth to Water Level at Prairie Center No. 3 Well in Goshen County.

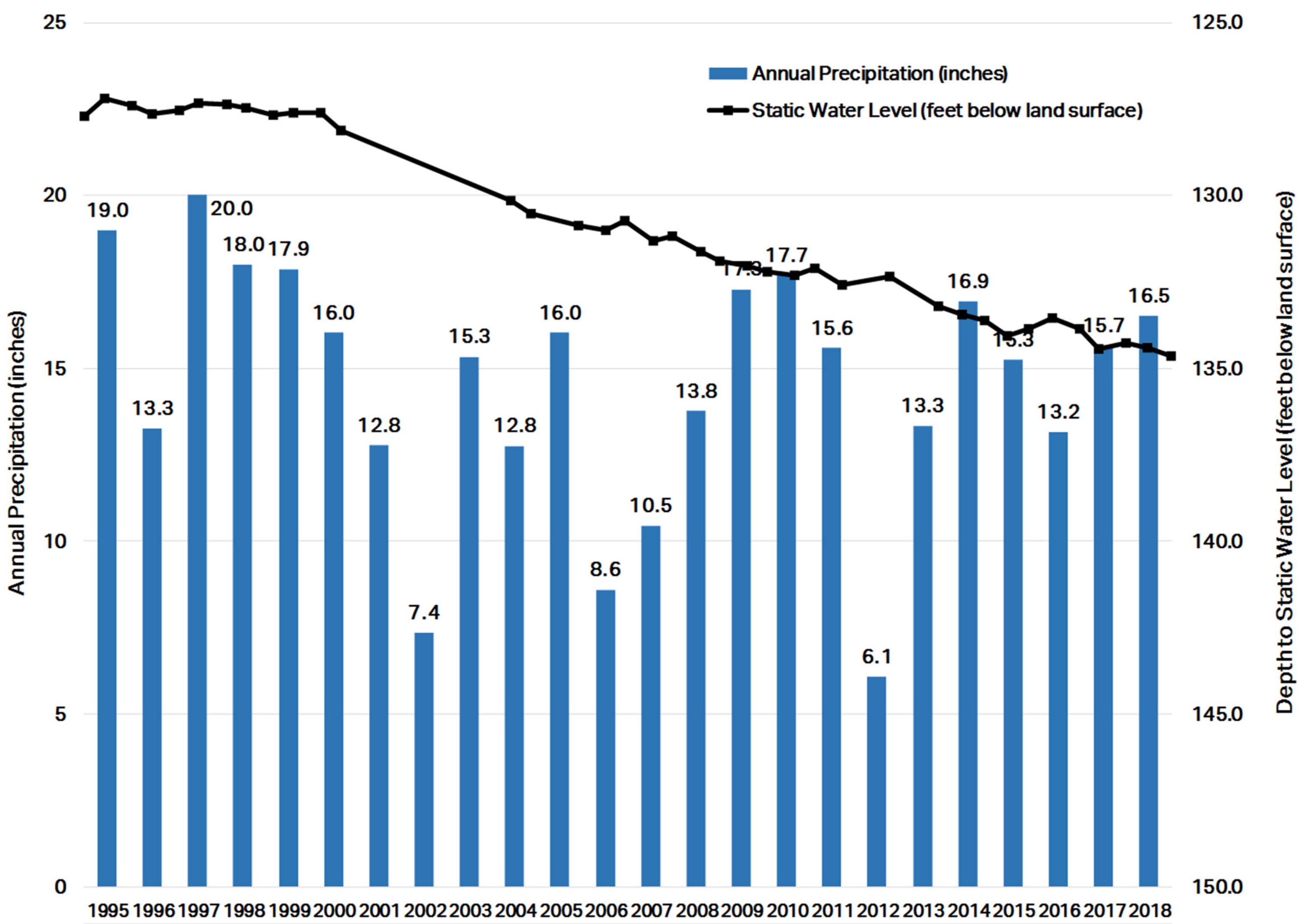


**Figure 3.25.** Annual Precipitation at the Torrington 29N NWS Station and Depth to Water Level at Prairie Center No. 4 Well in Goshen County.

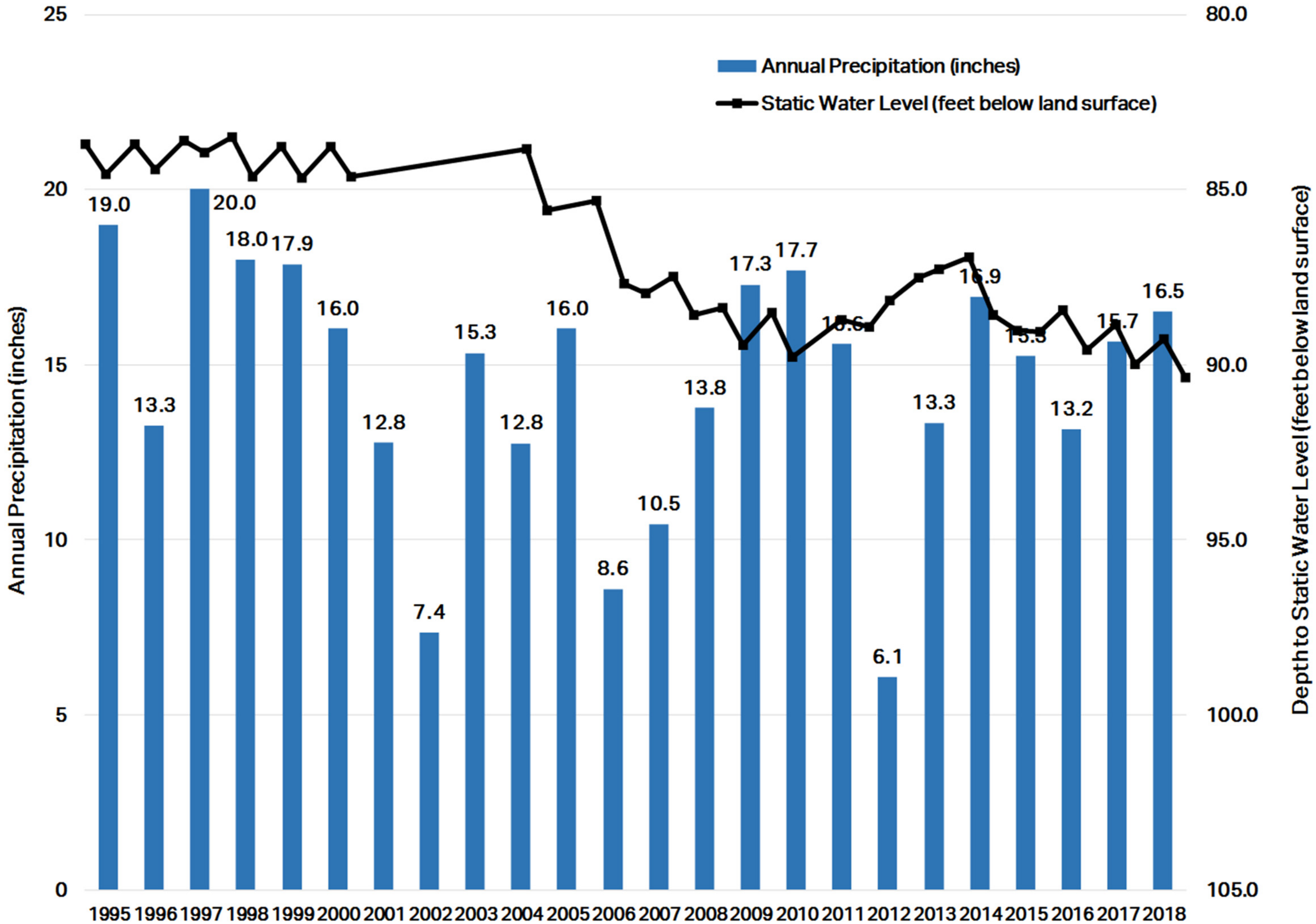


**Figure 3.26.** Annual Precipitation at the Torrington 29N NWS Station and Depth to Water Level at Prairie Center No. 5 Well in Goshen County.

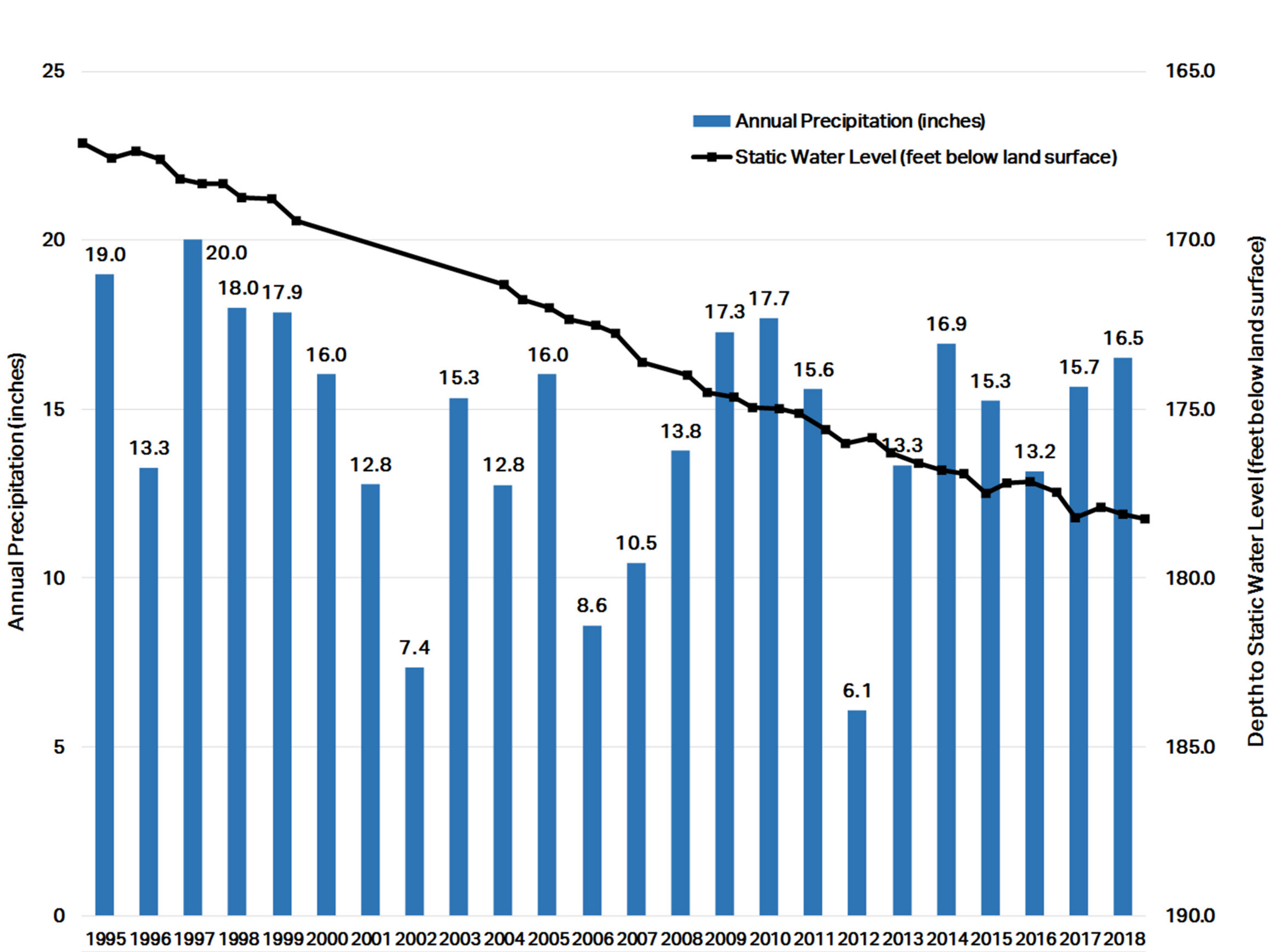


**Figure 3.27.** Annual Precipitation at the Torrington 29N NWS Station and Depth to Water Level at Prairie Center No. 6 Well in Goshen County.

units, evapotranspiration, and well withdrawal. A simplified flow system schematic for the Niobrara River by Hinckley et al. [2009] is reproduced as Figure 3.28.

#### 3.2.3.4 *Recharge*

Precipitation that infiltrates and percolates downward enters an aquifer as recharge. While recharge is difficult to accurately quantify, recharge is estimated based on precipitation and percolation percentages for soil/vegetation combinations. Recharge is most notable at bedrock aquifer and alluvial aquifer outcrops that border mountain ranges and uplifts as well as recharge to alluvial aquifers along losing stream channel segments. The estimated net annual aquifer recharge rate in the watershed is 1–5 inches per year (in/year) across most of the watershed, though recharge rates are lower, approximately 0.25–0.75 in/year, along the North Platte River and other stream channels [Taucher et al., 2013].

Aquifer recharge was also estimated as a percentage of net annual precipitation (which varies from 11–15 in/year); recharge percentage varies from 1.5 to 5 percent along the North Platte River and major drainages and increases to 5.1–10 percent across most the rest of the watershed, though small areas have higher recharge percentages at 10–20 percent [Taucher et al., 2013]. Within the shallow aquifers of the watershed, though, recharge is heavily influenced by agricultural practices. Surficial aquifers such as the Quaternary Alluvial Aquifer receive significant recharge from unlined canal and ditch seepage as well as some recharge from infiltration of irrigation water over fields [Taucher et al., 2013]. Rapp et al. [1957] describe the cycle and interconnection of groundwater and surface water in the watershed as illustrated in Figure 3.29.

#### 3.2.3.5 *Springs and Natural Groundwater Discharge*

Where the water table of an aquifer is above the land surface elevation, springs may form. Nearly 110 springs have been identified within the study area, as illustrated in Figure 3.30. Springs occur where permeable material overlies low permeability material, particularly at the contact between the Brule and Arikaree formations. Most springs are located in the Wildcat Hills, Rawhide Buttes, and Goshen Hole Rim areas of the watershed as well as near the North Platte River near Torrington. Notable springs within the study area include Bowen, Habig, Moore, Muskrat, Reynolds, Silver, Wolf, and Woodworth springs. According to Rapp et al. [1957], area springs are all gravity fed and are not under artesian pressure.

#### 3.2.3.6 *Base Flow Contribution*

Within the study area, groundwater discharge is dominated by discharge to streams as baseflow, primarily the result of irrigation recharge to alluvial aquifers which feeds local streams. Rapp et al. [1957] describe that “prior to irrigation no perennial streams flow into the North Platte River between Torrington and the State Line; at present three perennial drains (the Cherry Creek, Katzer, and Arnold drains) contribute to the flow of the river.” The North Platte River is generally a gaining stream during the summer, though is a losing stream during the winter [Parks, 1991]. Analysis of groundwater baseflow along the North Platte River from 2¼ miles downstream of Whalen Dam to ¼ mile upstream of the state line indicate that much of the North Platte River is a gaining stream with baseflow contributions from groundwater varying from 76,320 to 179,000 acre-feet per year [Crist, 1975; Rapp et al., 1957].

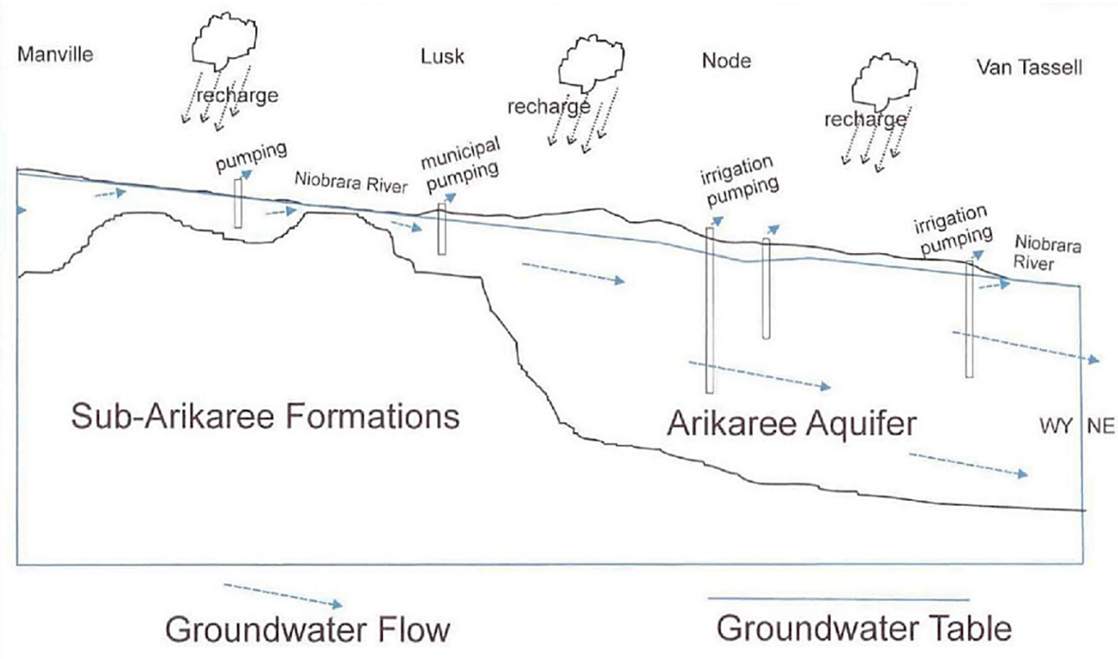


**Figure 3.28.** Schematic of Water Balance Components Along the Niobrara River and Arikaree Aquifer [Hinckley et al., 2009].

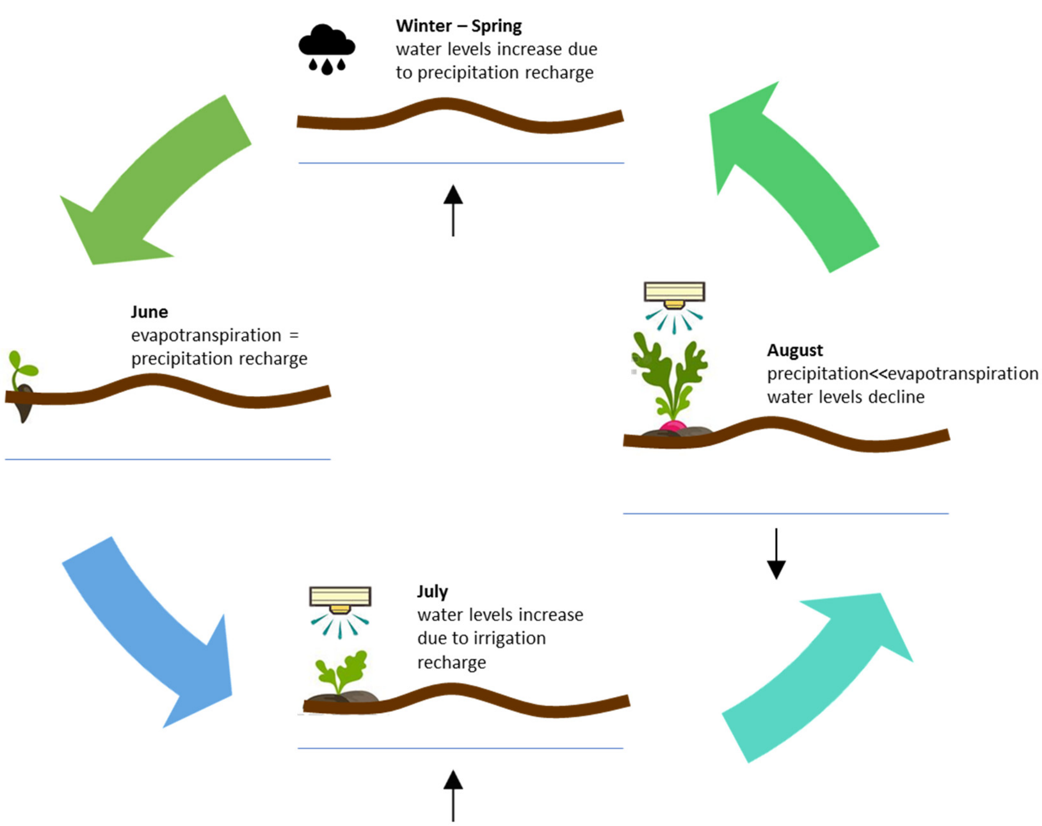


**Figure 3.29.** Typical Cycle of Groundwater Recharge in Irrigated Areas.

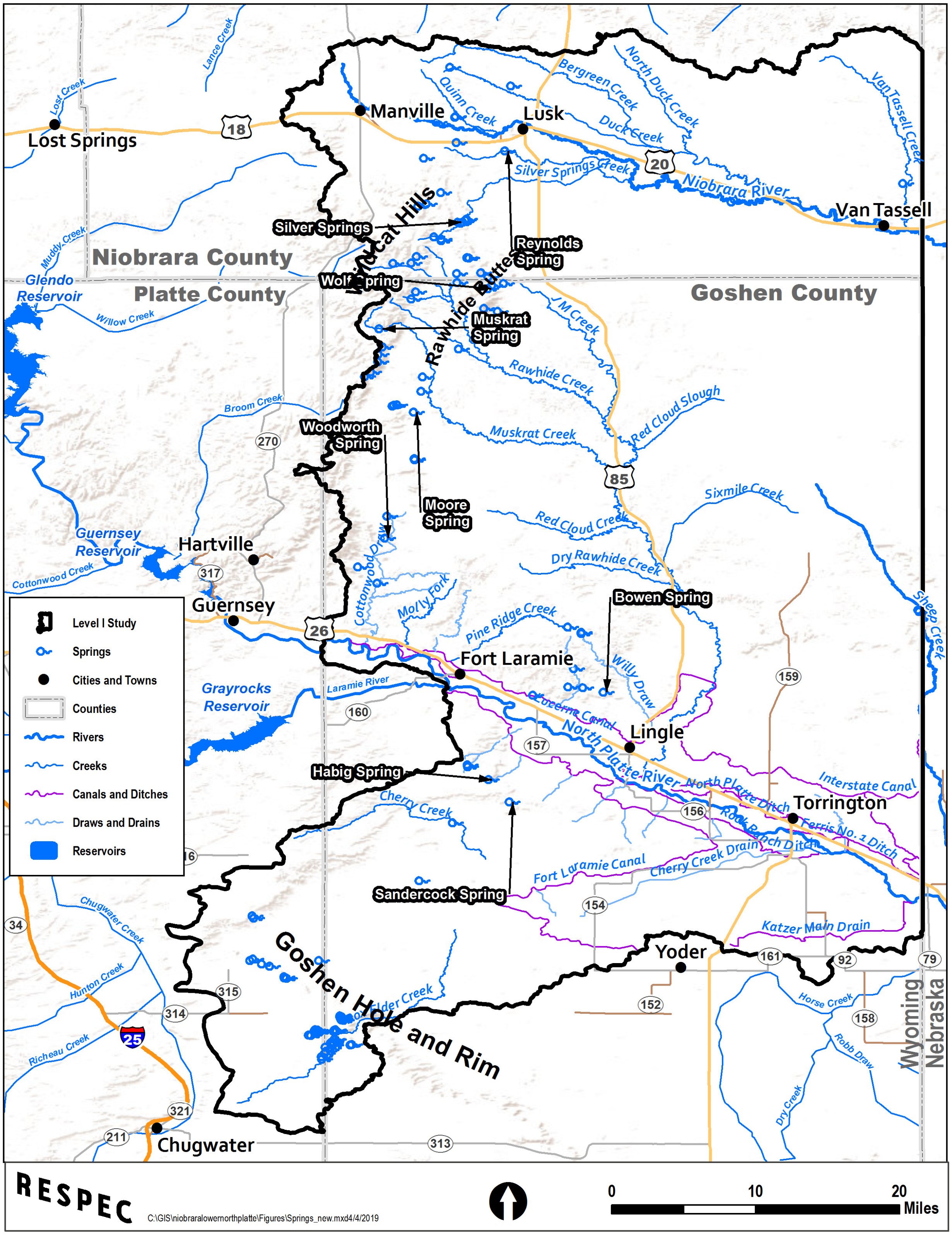


**Figure 3.30.** Springs Located Within the Study Area.

Based on potentiometric contours, Crist [1975] described Rawhide Creek as "a gaining stream in the upper reach and a losing stream in the lower reach near the North Platte." Horse Creek has flows entirely derived from groundwater baseflow [Rapp et al., 1957]. On the Niobrara River, groundwater and springs supplied by the Arikaree Aquifer contribute a significant portion of baseflow to the river [Whitcomb, 1965]. In 2016, the WSGS published a statewide groundwater recharge study that included estimates of the baseflow component of groundwater [Taboga and Stafford, 2016]. This investigation incorporated data for climate, evapotranspiration, land cover, streamflow, and hydrogeology. As shown in Figure 3.31, the baseflow contribution to streamflow varies from 0 to 5 centimeters per year (cm/year) (1 to 2 in/year) within the watershed, though aquifers across most of the watershed contribute less than 1 cm/year (less than 0.4 in/year) to baseflow.

#### 3.2.3.7 *Wells and Groundwater Usage*

Groundwater information and water well databases were obtained from the SEO. Permitted water well information, including locations, yields, and depths, was collected and compiled in the study's GIS geodatabase. As shown in Figure 3.32, the watershed contains approximately 5,426 permitted wells. Wells occur throughout the watershed, though are more densely concentrated near Torrington, the North Platte River, and Lusk. Generally, water consumption peaks during the summer because of increased irrigation.

There are 2,311 domestic wells as shown in Figure 3.33 along with approximately 36 municipal wells, 15 industrial wells, and 713 irrigation wells as shown in Figure 3.34. There are 1,773 stock wells as shown in Figure 3.35. The remaining 578 wells are permitted for other uses. Irrigated lands are supplied from 713 irrigation wells, including 380 irrigation wells in the North Platte River Valley, 52 irrigation wells within the Prairie Center Groundwater Control Area, 190 irrigation wells in Niobrara County, and another 91 irrigation wells in other portions of Goshen and Platte Counties. Well depths are typically less than 500 feet with domestic and stock wells typically yielding 3 to 80 gallons per minute (gpm) and high capacity wells typically yielding 700 to 1,200 gpm with some wells producing 2,000 to 4,000 gpm. Groundwater is pumped from the alluvial aquifer and used to supplement irrigation from surface water between the two major canals, though "north of the Interstate Canal and east of Rawhide Creek, groundwater is the principal source of irrigation water" [Crist, 1975].

As shown in Figure 3.35, 1,773 stock wells are distributed throughout the watershed. Depths range from 0 to 850 feet deep but are typically shallower than 400 feet. Approximately 2,311 domestic wells are located in the watershed and are primarily concentrated within the North Platte River Valley between Fort Laramie and Torrington and with similar depths of 50–500 feet. In the Lusk area, stock and domestic wells typically penetrate less than 50 feet of water while higher capacity irrigation wells penetrate more than 200 feet.

There have been 36 municipal wells completed within the watershed. The Wyoming Water Development Commission's (WWDC's) *2016 Public Water System Survey Report* lists five towns, one water and sewer district, and one city that provide potable water within the study area including the towns of Fort Laramie, Lingle, Lusk, Manville, Yoder, South Torrington Water and Sewer District, and the city of Torrington. According to the WWDC's *Platte River Basin Plan 2016 Update*, the total annual diversions in 2013 for the Fort Laramie, Lingle, and Torrington municipal water systems were 18.77, 83.42, and 583.02 millions of gallons, respectively. At Lusk, municipal wells are up to 180 feet deep completed within the Arikaree Aquifer.

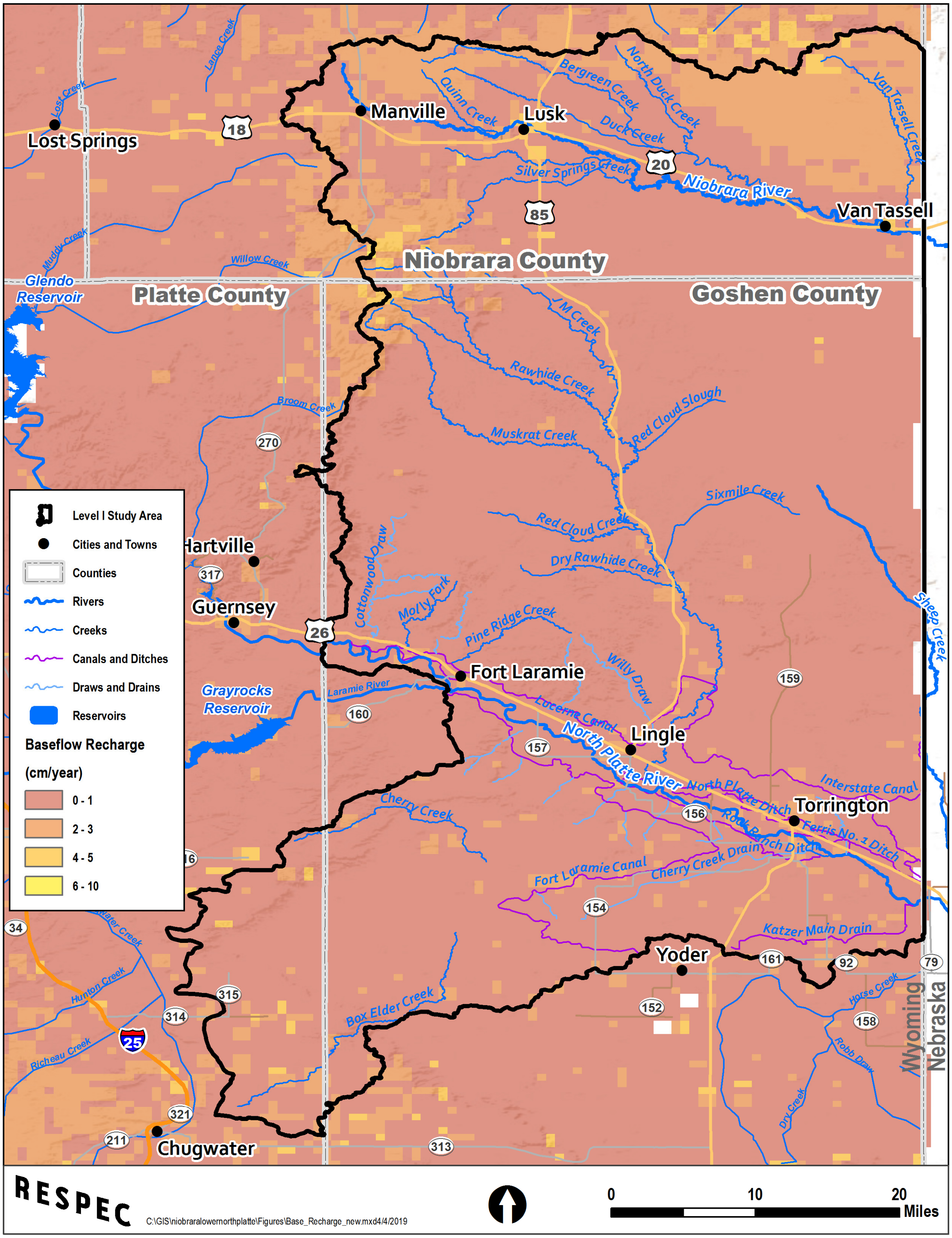


**Figure 3.31.** Baseflow Contributions Within the Study Area (Modified from Taboga and Stafford, [2016]).

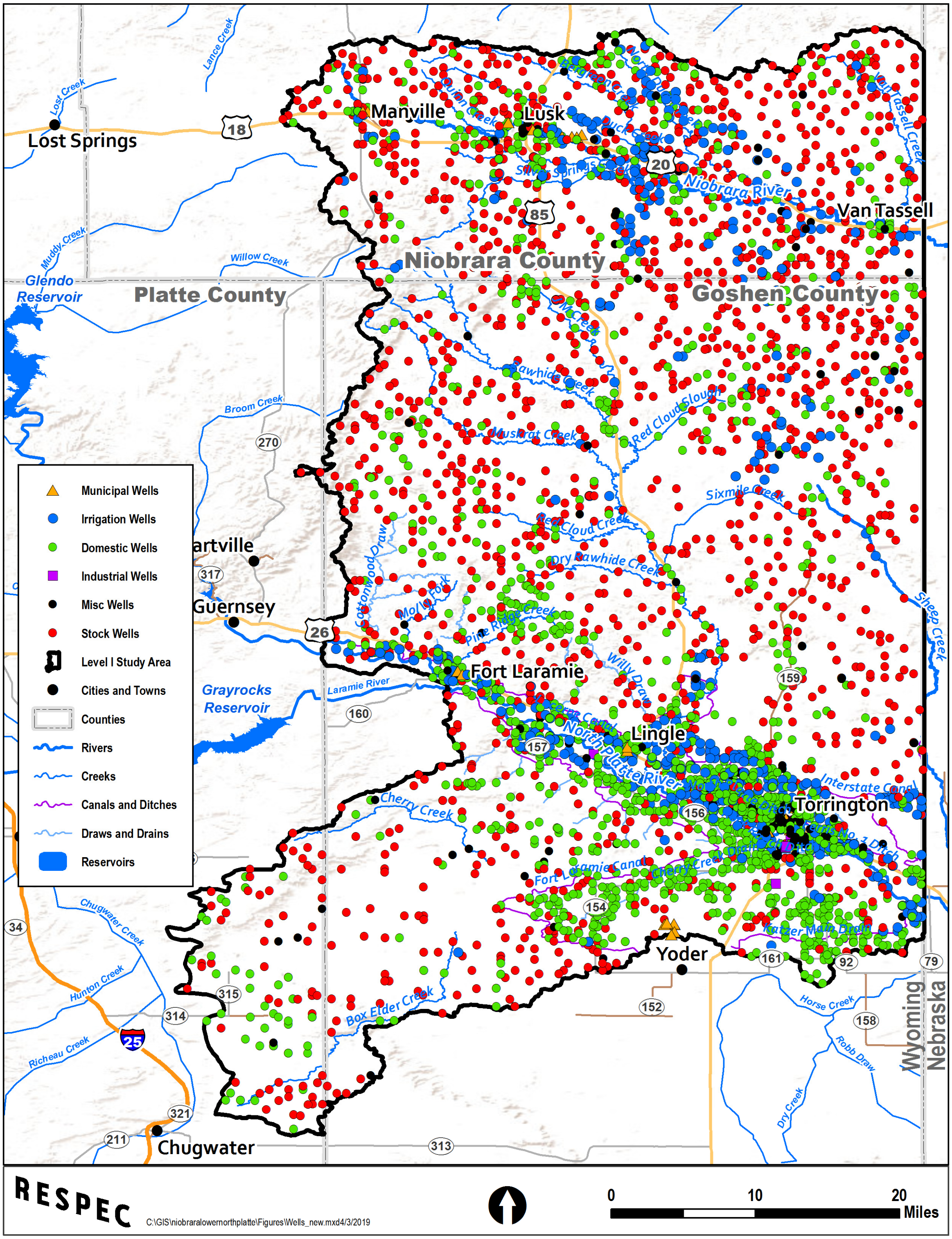


**Figure 3.32.** Permitted Water Wells Located Within the Study Area.

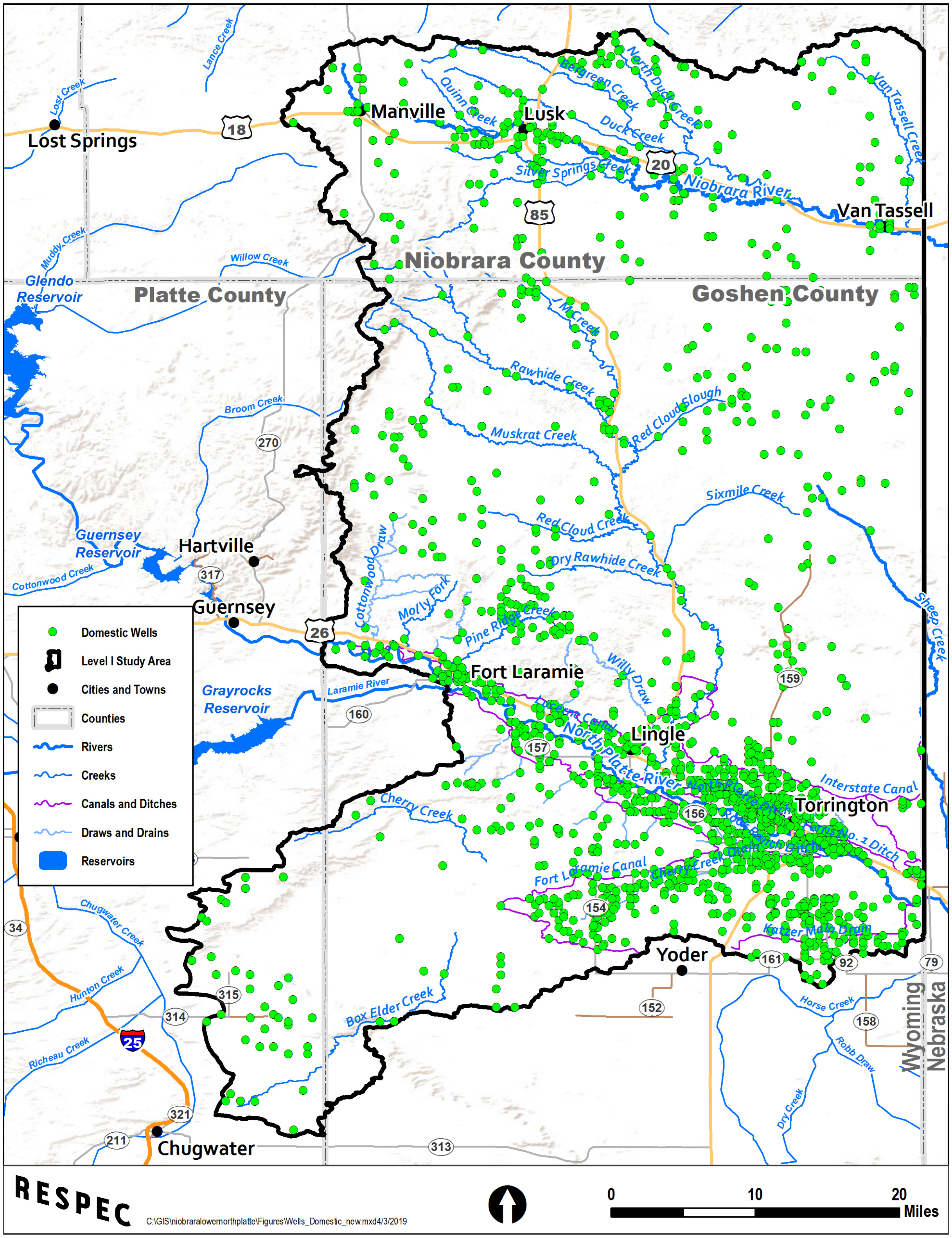


**Figure 3.33.** Permitted Domestic Water Wells Located Within the Study Area.

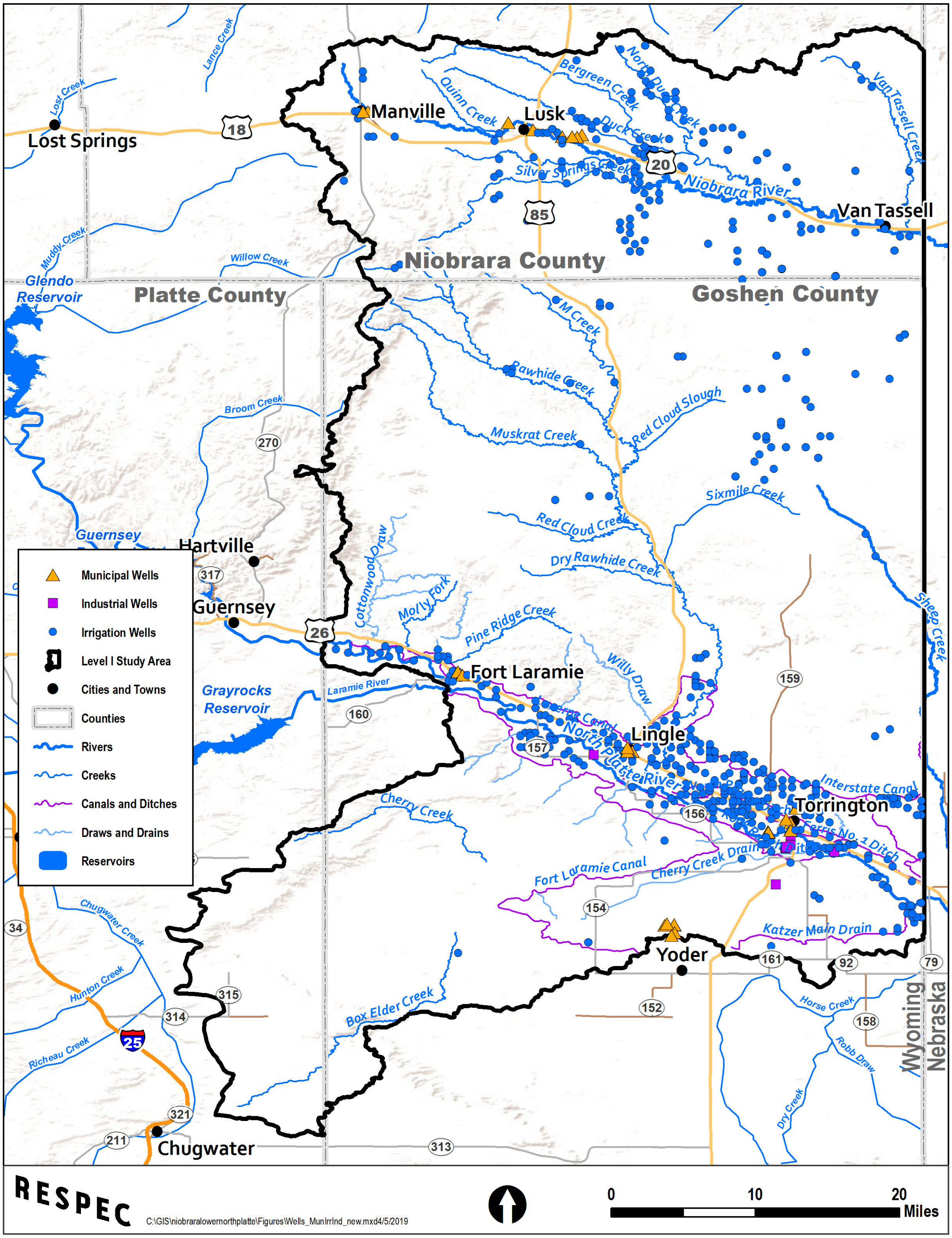


**Figure 3.34.** Permitted Municipal, Industrial, and Irrigation Water Wells Located Within the Study Area.

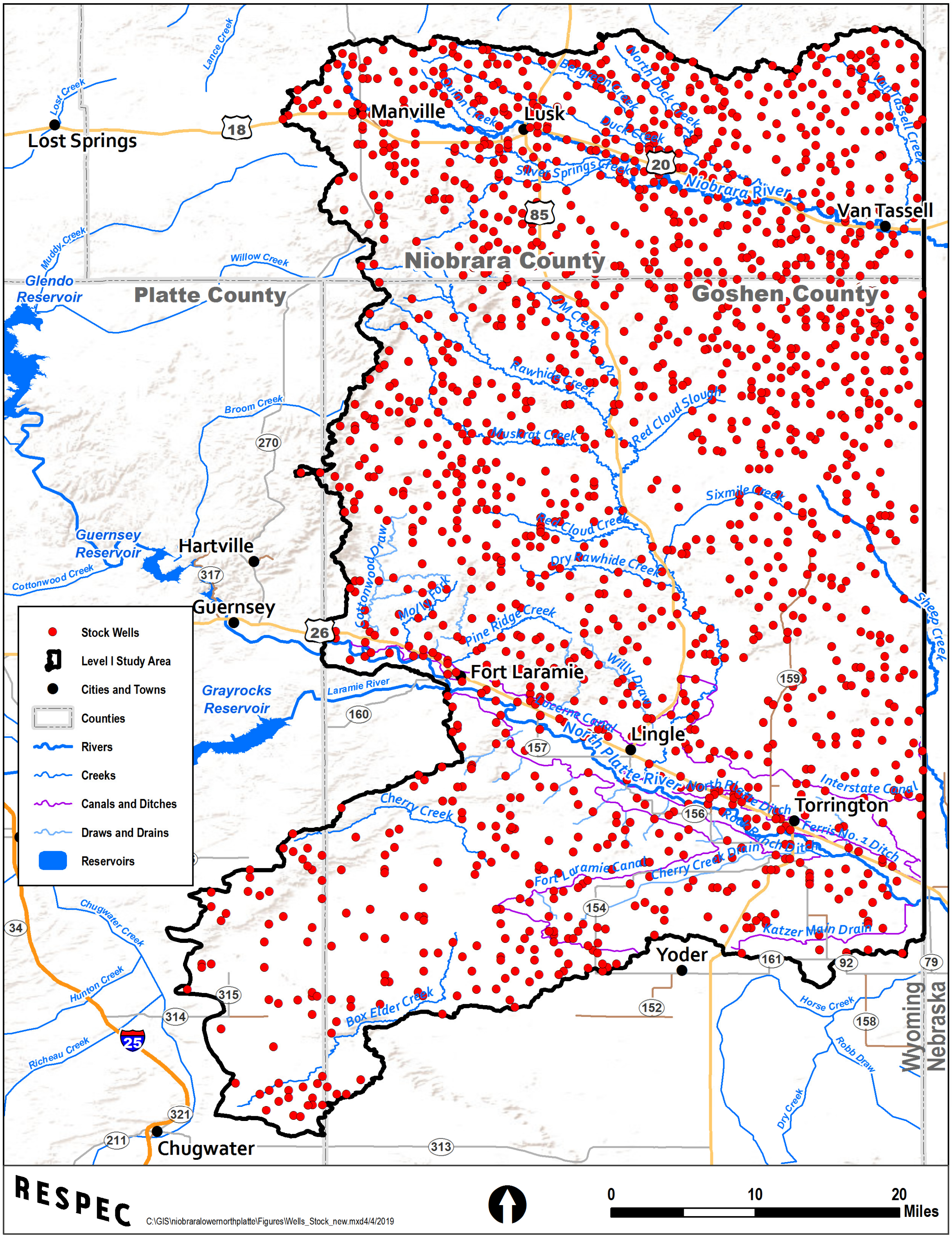


**Figure 3.35.** Permitted Stock Water Wells Located Within the Study Area.

There are 198 monitoring wells within the watershed, and most are located in the Torrington area because nitrates were discovered in the mid-1980s in Torrington's municipal wells [Baker and Associates, 1994]. In 1994, Torrington began monitoring groundwater quality in their wellhead protection area [City of Torrington, 1997; Eddy-Miller and Gerhard, 1999]. Fifteen industrial wells are located within the study area; the primary uses include ethanol, concrete, and sugar production.

#### 3.2.3.8 *Green Areas*

As a result of water scarcity and fully-appropriated surface water rights on the North Platte River, the 2001 Modified Decree emplaced stipulations regarding groundwater use in areas that are hydrologically connected to surface water (Section 1.3.1). A hydrologically connected groundwater well is a well that is located and constructed so that if water were intentionally withdrawn by the well continuously for 40 years, the cumulative stream depletion would be greater than or equal to 28 percent of the total groundwater withdrawn by that well. "Green Area" maps have been developed and are available at the SEO's website (*http://seo.wyo.gov/documents-data/maps-and-spatial-data*). These maps depict the areas in which the groundwater at any depth is deemed nonhydrologically connected and, therefore, well construction and groundwater use are not subject to the 2001 Modified Decree.

Green Areas in the watershed are shown in Figure 3.36 and only includes the North Platte portion of the study area. Approximately 722,200 acres or 56 percent of the study area is a groundwater Green Areas. Most of the area north and southwest of the North Platte River, at a distance of 2–3 miles or more from the river, is considered a Green Area (Figure 3.36). Several portions of the North Platte River watershed occur outside the Green Area and are covered by the 2001 Modified Decree as groundwater contributes to surface flows; these areas include the North Platte River Valley, approximately 12 miles of Rawhide Creek above the confluence with the North Platte, along the Katzer Main Drain, and a swath of land extended west-southwest from Torrington (Figure 3.36). For these zones outside the Green Areas, the SEO typically does not approve water-rights permits for new irrigated lands, and the applicant must demonstrate a lack of hydraulic connectivity.

#### 3.2.3.9 *Prairie Center Groundwater Control Area*

The Prairie Center Groundwater Control Area (GCA), shown in Figure 3.37, was established in 1977. Originally the GCA included portions of northern Goshen and southern Niobrara counties, but Niobrara County lands were removed from the GCA in 1979 [Hinckley et al., 2009]. As part of the creation of the GCA, all unadjudicated groundwater permits had to be adjudicated, an advisory board was established, and public notification and opportunity for input on water-rights permitting was increased. The advisory board meets to evaluate applications for new or modified groundwater rights in excess of 25 gpm. Notices are published and open to public input before the advisory board meets to discuss the application. However, the SEO is not required to follow the recommendations of the GCA board in granting well permits; the SEO generally accepts most groundwater rights permits on the basis that unappropriated groundwater is still available. Therefore, the GCA has made little difference in groundwater development [Hinckley et al., 2009]. While the GCA may choose to develop a comprehensive groundwater management strategy to include regulation of existing users, the Prairie Center GCA advisory board has not taken up the issue. Note that the GCA is designated as "not-hydrologically connected" to surface water by the North Platte Decree and, therefore, has no overlapping restrictions on groundwater development.

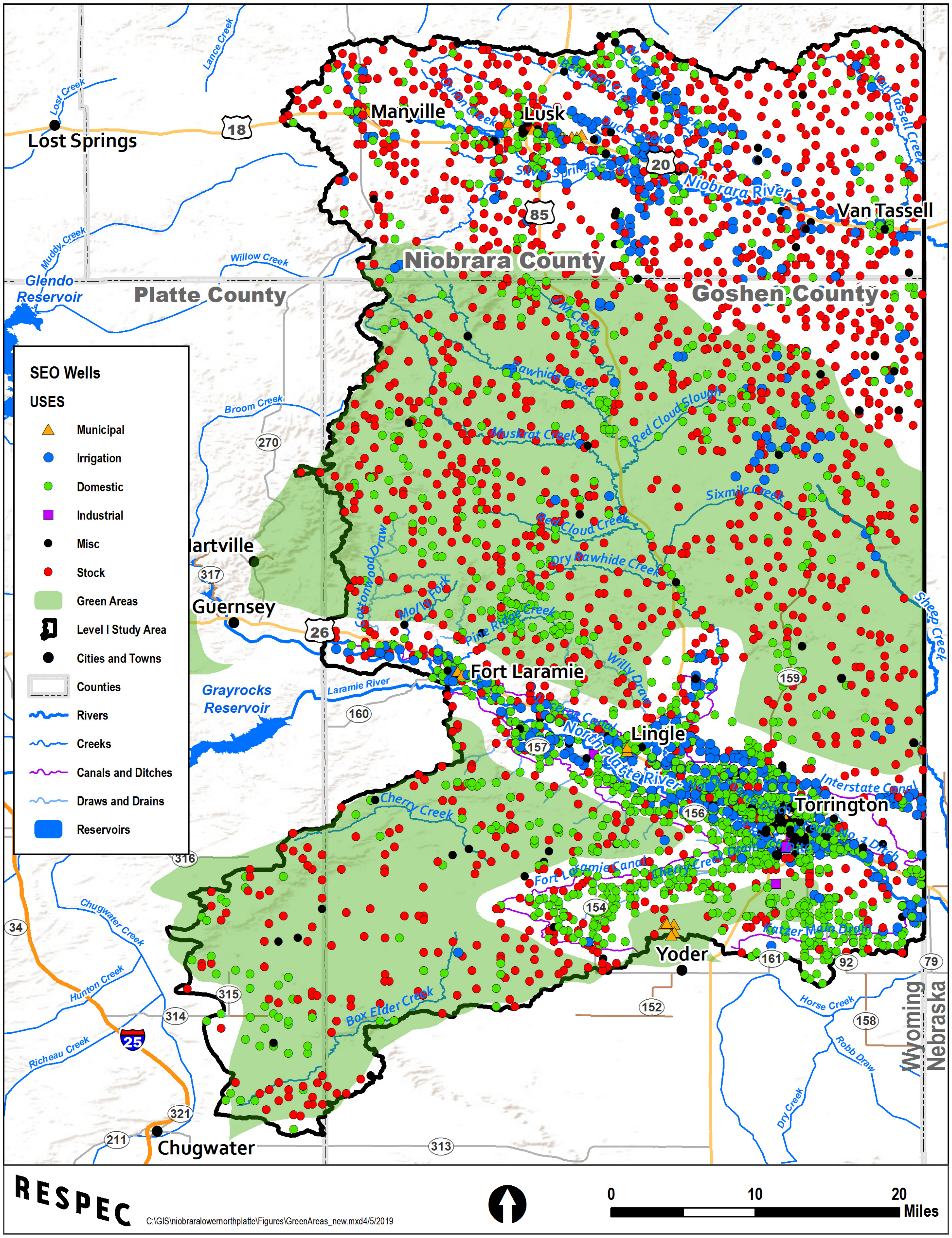


**Figure 3.36.** Green Area Map: Areas Determined Not to be in Hydrologic Connection With the North Platte River and its Tributaries Under Application of the 2001 Modified North Platte Decree.

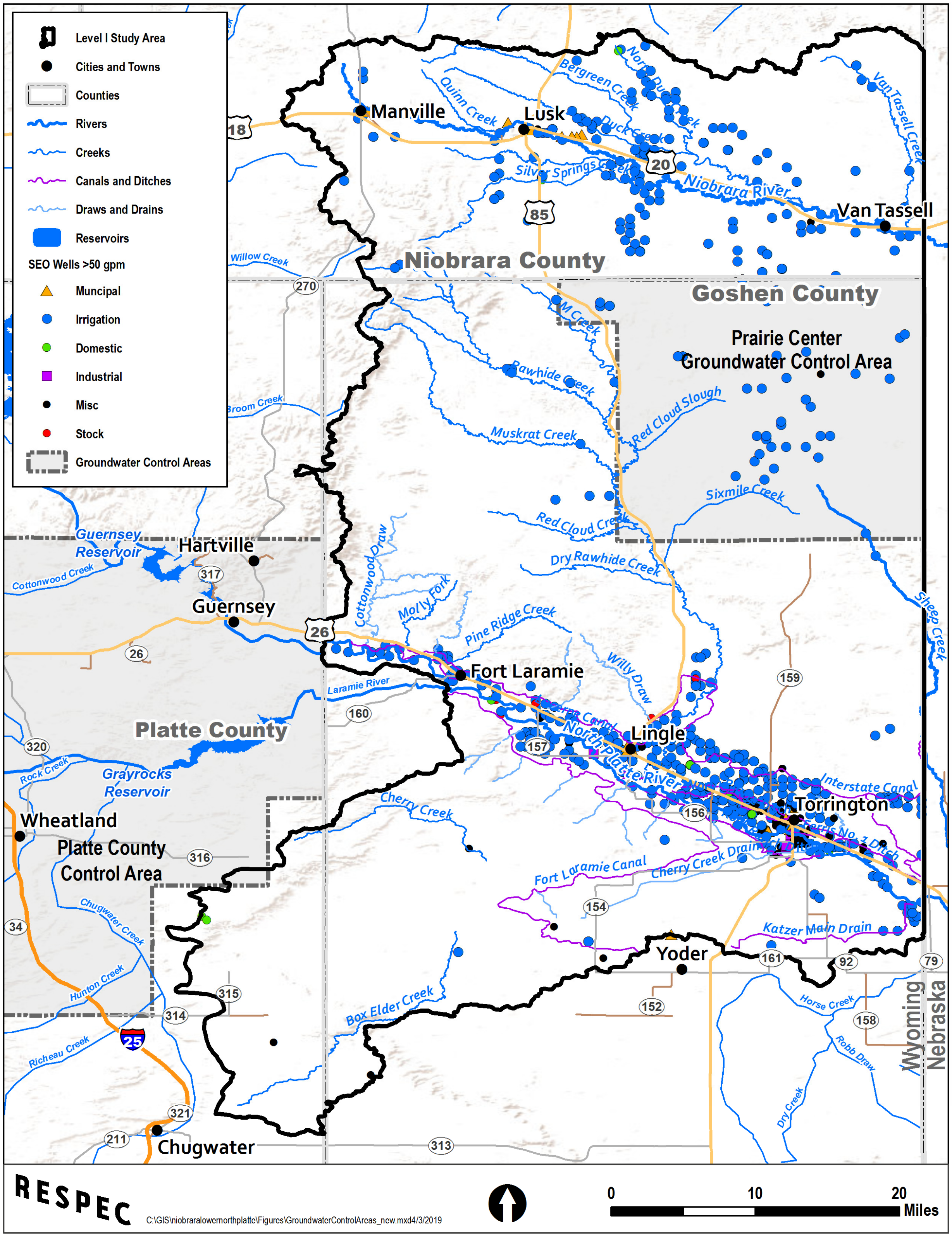


**Figure 3.37.** Groundwater Control Areas Within the Study Area.

## 3.2.4 Geology

### 3.2.4.1 *Topography*

The Niobrara–Lower North Platte Rivers Watershed covers parts of the Central High Plains and Mixed Sandy and Silty Tableland and Badlands of the Western Great Plains Range and Irrigated Region. This land area has a varied topography with steep slopes along the higher parts of buttes, tablelands that range from nearly level to moderately sloping, and steeper areas that are situated on the sides of ridges and canyons. The escarpments and steep-walled valleys of the Hat Creek Breaks and 77 Hills bound the study area on the north with the gently sloping tableland to the south. Areas of the Badlands have eroded walls, escarpments, and tablelands with nearly level to very steep slopes that are dissected by multiple streams, gullies, buttes, and canyons. The southern portion of the watershed includes the North Platte Valley and part of the Goshen Hole Rim, which is a shallow basin with level to gently rolling topography, surrounded by escarpments and canyons to the south of the North Platte River.

On the Niobrara River, elevations range from 4,685 feet above mean sea level (amsl) at the Wyoming–Nebraska state line to approximately 6,075 feet amsl at Lone Tree Hill, which is south of Manville. Elevations range from 4,025 feet amsl at the Wyoming–Nebraska state line on the North Platte River to approximately 6,135 feet amsl at Wildcat Hill and 6,052 feet above msl at Rawhide Buttes, which are southwest of Lusk. Elevation ranges gradually increase from east to west. Throughout the watershed slopes are low at angles less than 5 degrees, though slopes are notably steeper and more rugged near the Hartville Uplift and along the Goshen Rim escarpment that rings the Goshen Hole Lowlands. No significant landslide deposits have been mapped within the watershed, though site geotechnical surveys are recommended for significant structures on or immediately adjacent to steep slopes.

### 3.2.4.2 *Surficial Geologic Units*

Surficial geologic units influence the watershed by providing the parent material for the soil formations and plant communities; surficial deposits also impact stream morphology. Surficial geologic units are listed in Table 3.7 and shown in Figure 3.38. The study area's surface geology consists of residuum mixed with alluvium, eolian, slopewash, grus, and/or bedrock outcrops; eolian mixed with scattered deposits of residuum, alluvium, and slopewash; and alluvium with scattered deposits of terrace, slopewash, eolian, residuum, and grus. The residuum and eolian are distributed throughout the watershed. Alluvium and terrace deposits occur along the rivers as well as smaller creeks and drainages. Fan deposits are concentrated along the western side of the watershed near the Wildcat Hills and the Haystack Range. Additional surficial units include benches, mesa, terrace, slopewash, colluvium, and bedrock.

### 3.2.4.3 *Bedrock Geology*

General geologic maps and discussions are presented to define the formations present that could potentially affect development of improvement projects and reservoir storage. Our team has reviewed and summarized key geologic information from WSGS, USGS, and other geologic and hydrogeologic reports. The bedrock geologic units that underlie the watershed study area predominantly consist of Tertiary sedimentary units and are listed in Table 3.8 and shown in Figure 3.39. A stratigraphic chart of units present at depth and approximate thickness within the area is provided in Table 3.9. Groundwater aquifers are described in Section 3.2.3.1.

**Table 3.7. Surficial Geologic Units Within the Study Area**

| Surficial Geology Unit Type | Area (acres) | Percent of Study Area |
|---|---|---|
| Residuum mixed with alluvium, eolian, slopewash, grus, and/or bedrock outcrops | 449,074 | 34.7 |
| Eolian mixed with scattered deposits of residuum, alluvium, and slopewash | 403,778 | 31.2 |
| Slopewash and colluvium mixed with scattered deposits of slopewash, residuum, grus, glacial, periglacial, alluvium, eolian, and/or bedrock outcrops | 144,946 | 11.2 |
| Alluvium with scattered deposits of terrace, slopewash, eolian, residuum, grus and glacial | 125,534 | 9.7 |
| Terrace deposits mixed with scattered deposits of alluvium, residuum, eolian, slopewash, and outwash | 82,826 | 6.4 |
| Dissected terrace deposits mixing with alluvium, residuum, eolian, and slopewash | 28,472 | 2.2 |
| Dissected alluvial fan and gradational fan deposits mixed with scattered deposits of slopewash and residuum | 22,001 | 1.7 |
| Shallow terrace deposits mixed with scattered deposits of eolian and residuum | 18,118 | 1.4 |
| Dissected bench with scattered deposits of residuum, slopewash, landslide, and eolian | 14,236 | 1.1 |
| Bench including eolian, slopewash, outwash, and bench and/or mesa | 3,882 | 0.3 |
| Mined areas mixed with scattered deposits of residuum, slopewash, and/or bedrock outcrops | 1,294 | 0.1 |
| **Total** | **1,294,160** | **100.0** |

**Table 3.8. Bedrock Geologic Units Within the Study Area**

| Unit Symbol | Geologic Unit Name | Area (acres) | Percent of Study Area |
|---|---|---|---|
| Qa | Alluvium and colluvium | 100,828 | 7.8 |
| Qs | Dune sand and loess | 135,338 | 10.5 |
| Qt | Gravel, pediment, and fan deposits | 10,996 | 1.0 |
| Tmo | Lower Miocene and Upper Oligocene rocks, White River Group | 739,054 | 57.1 |
| Twr | White River Group | 51,971 | 4.0 |
| Twrb | Brule Member | 92,964 | 7.2 |
| Twrc | Chadron Member | 111,797 | 8.6 |
| Kl | Lance Formation | 11,103 | 1.0 |
| P&h | Hartville Formation | 12,768 | 1.0 |
| | Other units less than 1-percent of Study Area | 27,343 | 1.8 |
| **Total** | | **1,294,162** | **100.0** |

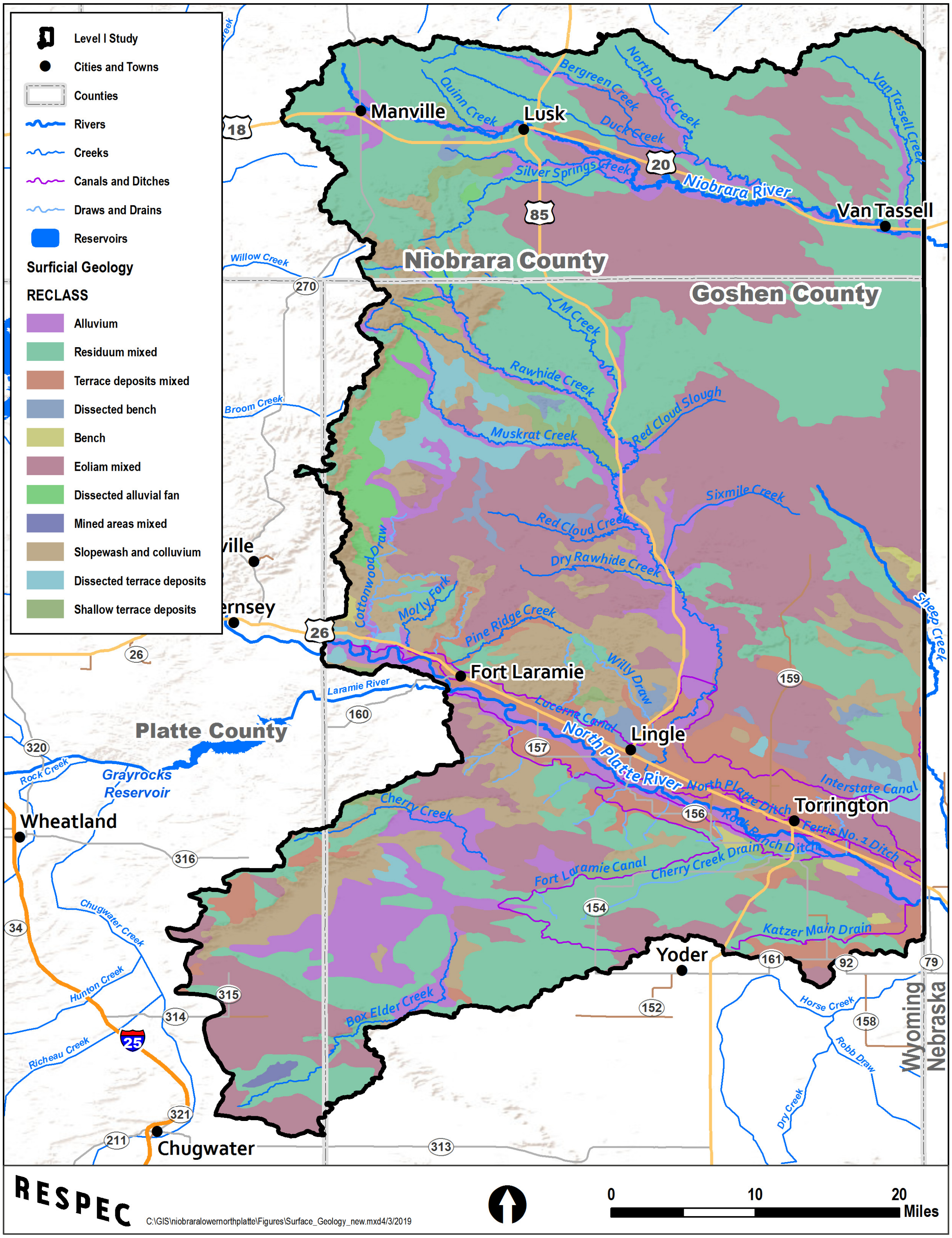


**Figure 3.38.** Surficial Geology of the Watershed.

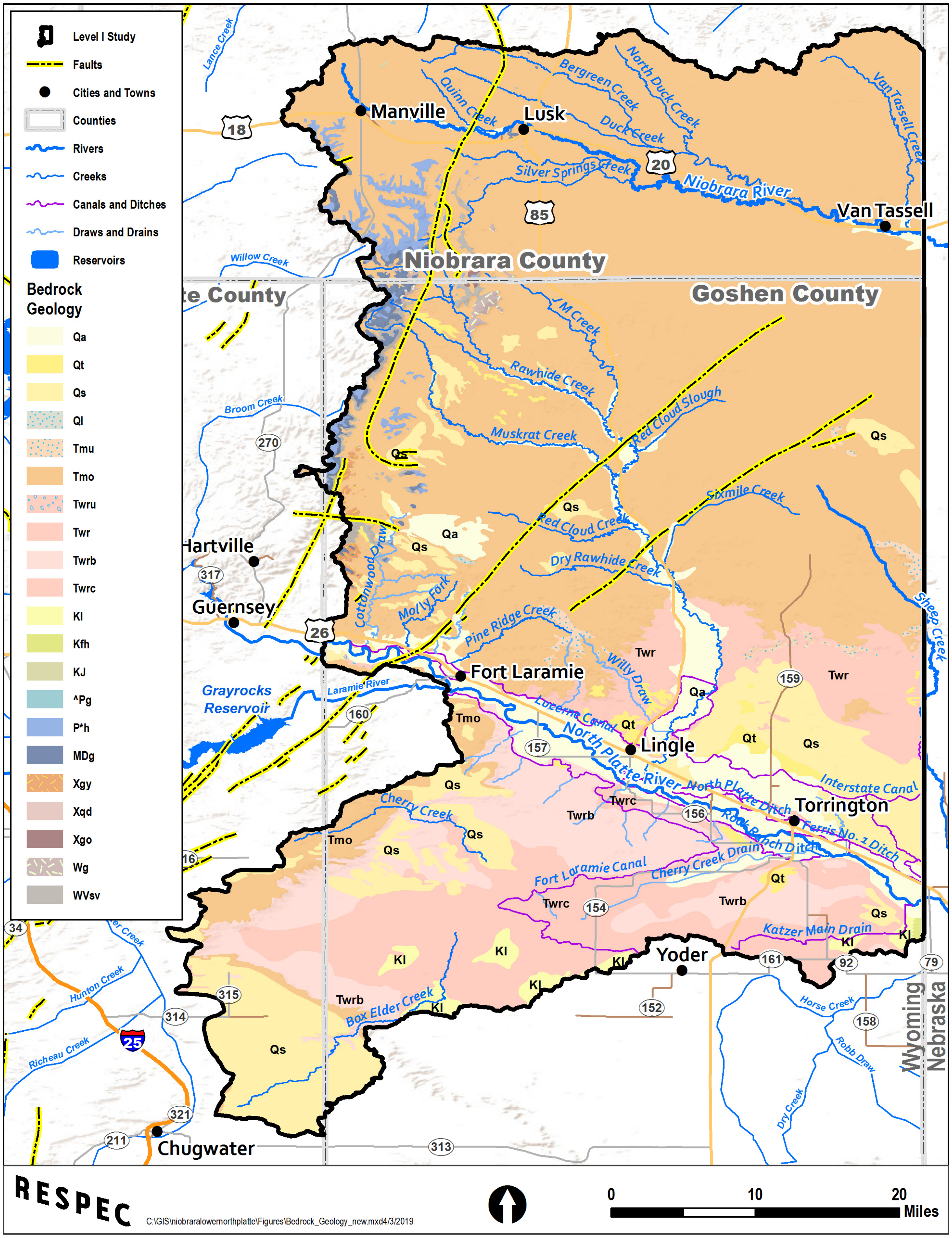


**Figure 3.39.** Bedrock Geology of the Watershed.

**Table 3.9. General Stratigraphic Sequence Near the Hartville Uplift and Northern Denver Basin (Modified From Love et al. [1996]; Rapp et al. [1957]; and Taucher et al. [2013])**

| System | Series | Stratigraphic Unit | Hydrogeologic Unit | Thickness (feet) |
|---|---|---|---|---|
| Quaternary | | Dune Sand | High Plains Aquifer system | 0–30 |
| | | Alluvial Floodplain and Terrace | | 0–200+ |
| Tertiary | Miocene | Ogallala Formation | | 0–330 |
| | | Arikaree Formation | | 0–1,200 |
| | Oligocene | White River Group<br>Brule Formation<br>Chadron Formation | | <br>0–450<br>0–700 |
| Cretaceous | Upper Cretaceous | Lance Formation | Lance-Fox Hills Aquifer | 0–1,400 |
| | | Fox Hills Sandstone | | 0–190 |
| | | Pierre Shale | Cretaceous confining unit | 0–5,500 |
| | | Niobrara Formation<br>Carlile Shale<br>Greenhorn Formation<br>Belle Fourche Shale<br>Mowry Shale | | 0–345<br>0–1,400 |
| | Lower Cretaceous | Inyan Kara Group | Inyan Kara Aquifer | 0–160 |
| Jurassic | | Morrison Formation | Morrison Aquifer and confining unit | 0–220 |
| | | Sundance | Sundance Aquifer | 0–480 |
| Triassic | | Chugwater | Chugwater confining unit | 0–400 |
| Permian | | Minnekahta Limestone | | 0–40 |
| | | Opeche Shale | Confining unit | 0–80 |
| Permian-Mississippian | | Hartville Formation | Paleozoic Aquifer system | 0–1,225 |
| Mississippian | | Guernsey Formation/ Madison Limestone | | 0–200? |
| Mississippian/Devonian | | Englewood Limestone | | |
| Devonian | | Fremont Canyon Sandstone | | |
| Precambrian | | Igneous and metamorphic rocks | Precambrian confining unit | |

Quaternary and Tertiary deposits cover over 95 percent of the watershed. The most expansive unit is mapped as undifferentiated Lower Miocene and Upper Oligocene rocks (Tmo) which covers approximately 57 percent of the watershed; the Tmo may include portions of the White River Group (including the Brule and Chadron Formations), Arikaree Formation, and other unnamed beds [Rapp et al., 1957]. These units are comprised of soft sandstone and interbedded claystone, siltstone, and thin limestones. Quaternary age dune sand and loess deposits make up approximately 10 percent of the watershed and overlay Tertiary units along the North Platte River as well as the southernmost tip of the watershed; these shifting silts and sands are some of the most notable eolian deposits in the US. Alluvial deposits cover approximately 8 percent of the watershed, concentrated along the North Platte River and Rawhide Creek; in places, these units can be up to 200 feet thick [Libra et al., 1981].

Paleozoic and Cretaceous rocks have very limited surface exposure, accounting for less than three percent of the watershed and occurring right along the western edge of the watershed as part of the Hartville Uplift. Precambrian rocks are exposed in windows where the Tertiary sediments have been eroded at the edges of the Hartville Uplift along the westernmost edge of the watershed and account for less than 1 percent of the bedrock. There are no significant deposits of expansive or swelling clays in the watershed.

The area has a complex structural history extending back 2.1 billion years [Sims et al., 1996]. The primary structural features of the watershed include the Hartville Uplift along the western edge of the watershed and the Goshen Hole Lowlands (which is part of the Denver-Julesburg Basin) in the southwest corner of the watershed as shown in Figure 3.40. Within the Denver-Julesburg basin, there are up to 12,000 feet of sedimentary rocks [Libra et al, 1981]. The Hartville Uplift is a Laramide-age anticline consisting of a deformed Precambrian core. Within the watershed, there are three long faults that trend north-northeast or north-east as shown in Figure 3.39. These faults are part of the structural arch between the Laramie Range and the Black Hills. The westernmost fault is the Hartville Fault, a high angle reverse thrust fault; while the Hartville Uplift represents over 8,000 feet of structural uplift, topographic relief across the area is relatively low. The other two principal faults form the Whalen-Wheatland Fault System.

### 3.2.5 Climate

The topography of the watershed results in a semiarid climate with typical annual precipitation rates ranging from 13 to 15 in/year in the central portion of the watershed and lee side of the Wildcat Hills, while the northern portion and higher elevations of the watershed receives 16 to 18 in of annual precipitation. Maximum precipitation occurs as rain during the spring and summer months, with high-intensity thunderstorms occurring in late summer. Precipitation during the winter generally accumulates as snowfall with likely freezing temperatures from October through April. Data from the Parameter-Elevation Regressions on Independent Slopes Model (PRISM) were used to display the average annual precipitation in and surrounding the watershed as shown in Figure 3.41.

The watershed has an average growing season of 112 days at the Lusk (483960) meteorological station to a growing season of 129 days at the Torrington (484126) meteorological station. Eight historic and current National Weather Service Cooperative Observer Network (COOP) stations are located within the study area, with varying periods of data records. Figure 3.42 displays the period of record for each meteorological station and their locations.

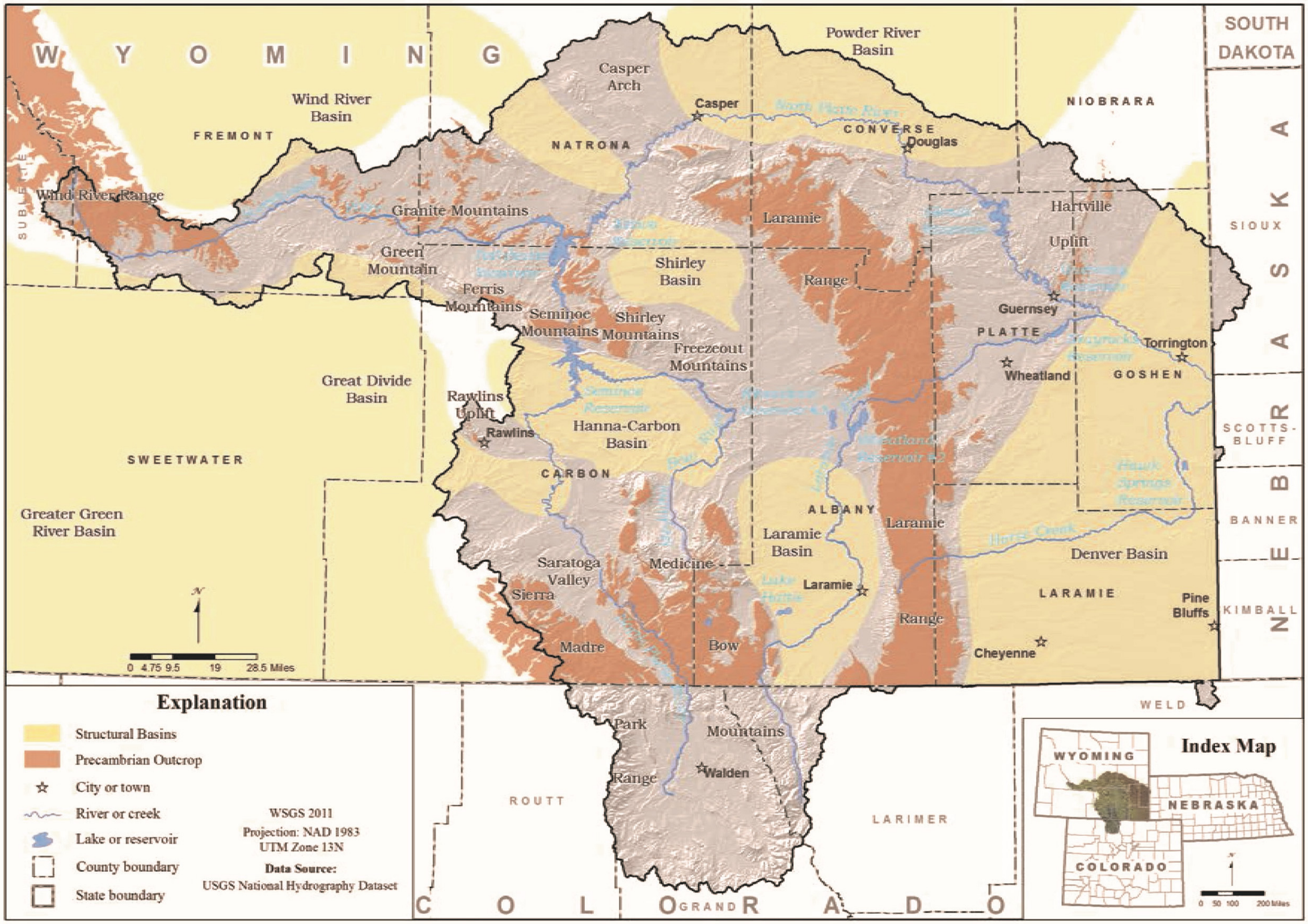


**Figure 3.40.** Major Basins and Ranges of the Platte River Basin [Taucher et al., 2013].

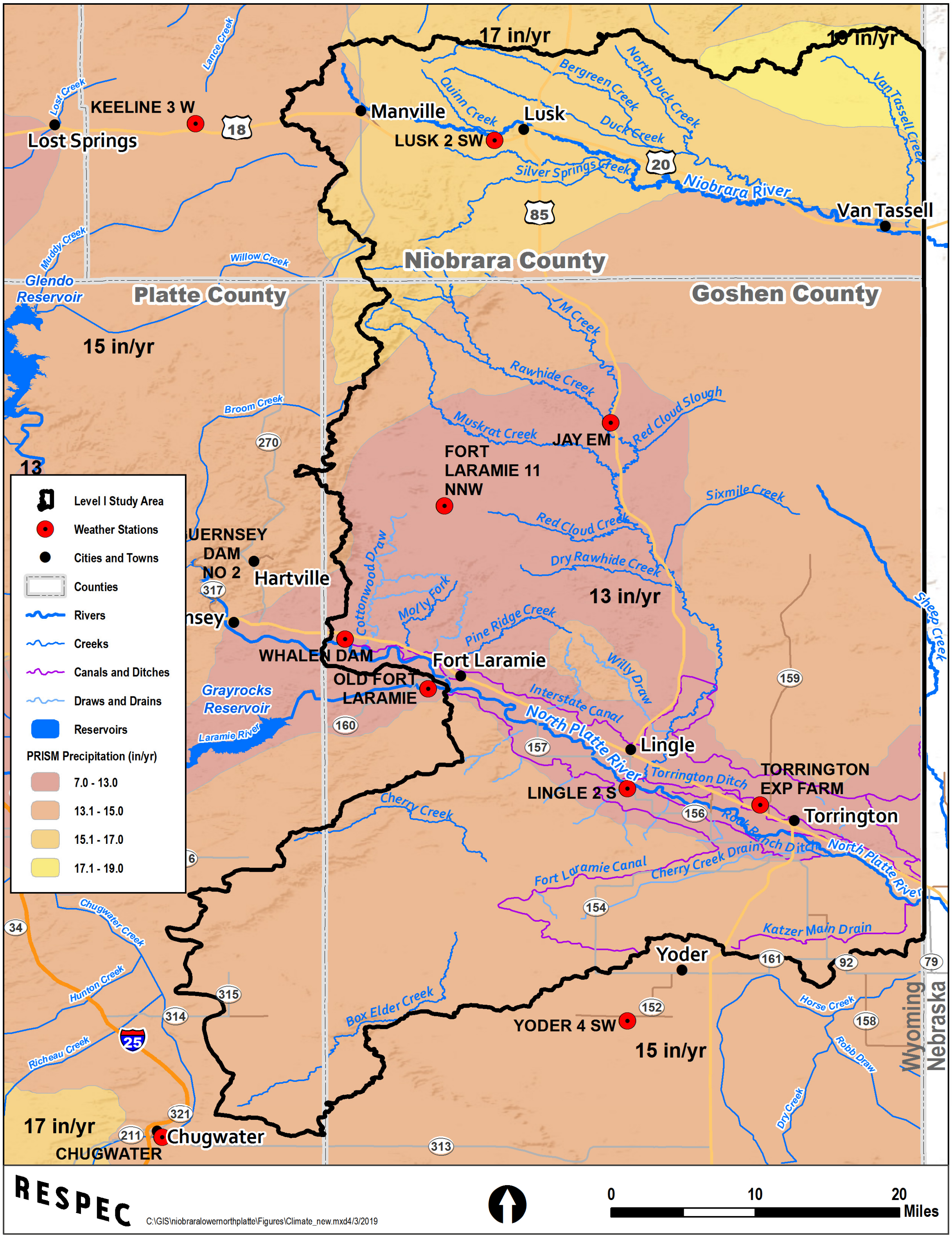


**Figure 3.41.** Average Annual Precipitation Throughout the Study Area [PRISM, 2016].

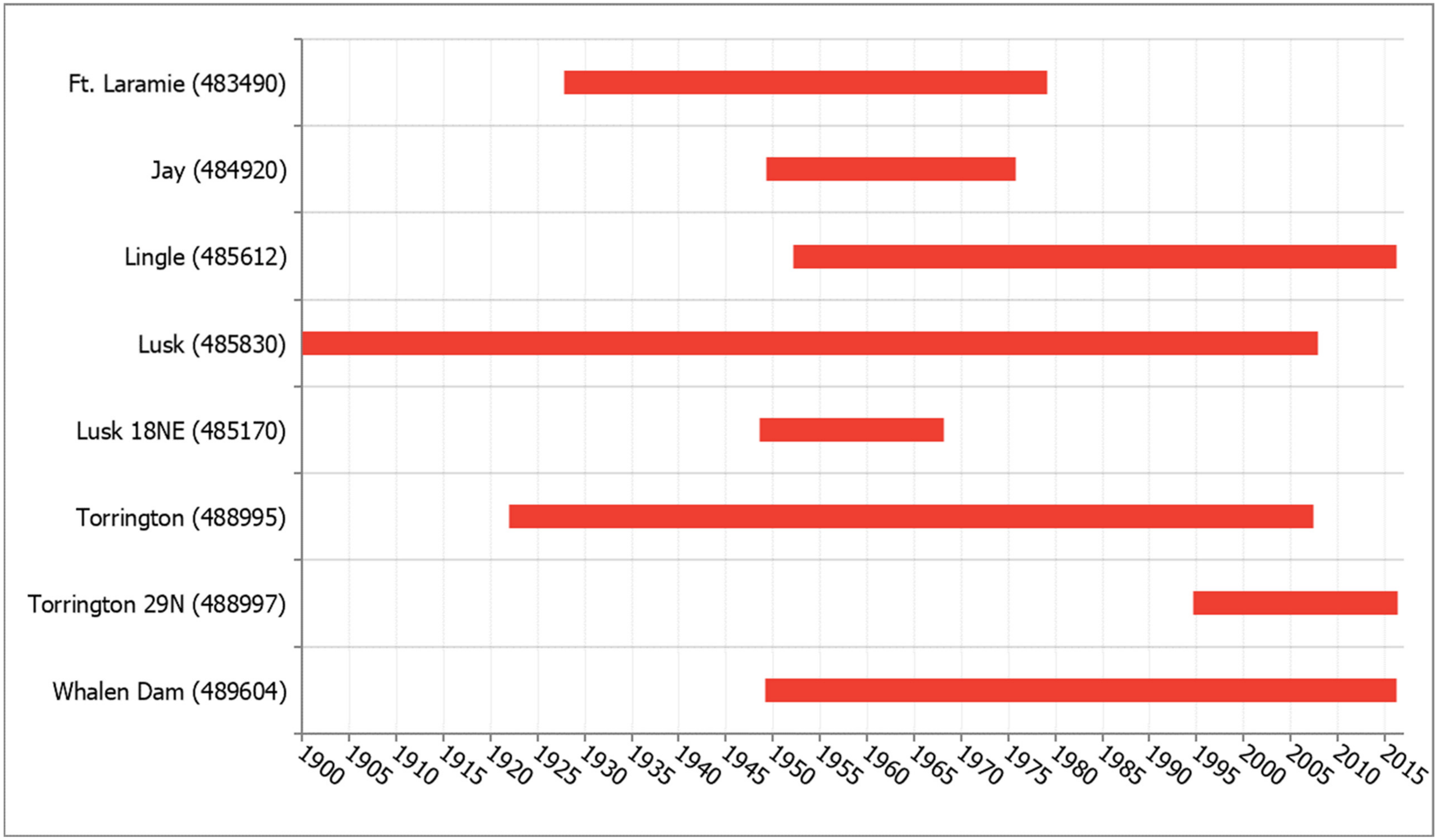


**Figure 3.42.** Period of Records for Meteorological Stations Within the Watershed.

Climatic data were obtained for five meteorological stations that are chosen because of their period of record, available data, and location, which are accessible through Water Resources Data System (WRDS) (*http://www.wrds.uwyo.edu/sco/data/datamap.html*). Table 3.10 summarizes the climatic data by month and by station, while Figure 3.43, Figure 3.44, and Figure 3.45 display the average maximum air temperature trends by month, average minimum air temperature, and average monthly precipitation, respectively. Figure 3.46 shows the annual precipitation from 1893 through 2008 for the Lusk Weather Station (485830), which is located roughly 2 miles southwest of Lusk, Wyoming. Figure 3.47 shows annual precipitation from 1949 to 1991 and from 2013 to 2017 for the Whalen Dam Weather Station (489604), which is located roughly 6 miles west of the town of Fort Laramie.

## 3.3 BIOLOGICAL SYSTEMS

### 3.3.1 Fish and Wildlife

Wyoming's waters and landscapes support over 800 species of wildlife with 120 species of mammals, 426 species of birds, 12 species of amphibians, 27 species of reptiles, 78 species of fish, several thousand species of invertebrates, and over 13,100 species of plants [Wyoming Game and Fish Department, 2010]. The Wyoming Game and Fish Department (WGFD) provides a system of control, propagation, management and protection, and regulation of all wildlife in Wyoming. The WGFD monitors and maintains big game, small game, nongame, and fish populations through studies, surveys, and habitat analysis. The WGFD has developed geodata that shows big game areas, ranges, and routes. Additionally, the WGFD has developed geodata that shows crucial stream corridors, blue ribbon streams, key nongame areas, and habitat priority areas within the state of Wyoming.

#### 3.3.1.1 *Fisheries*

Fish habitats within the study area include perennial and intermittent streams, springs, lakes, and ponds that support fish through at least a portion of the year with aquatic habitat quality that varies by location, landforms, and vegetation [Bureau of Land Management, 2007]. A total of ten fish species are considered native to the watershed based on observed and documented species from the Wyoming Natural Diversity Database (WYNDD). Several species of Dace, Minnow, Shiner, and Darter fish are present within the study area. Table 3.11 lists the fish species that populate this region, based on WYNDD documentation. In addition, the Lower North Platte River is locally important to sport fishery in the Torrington area, specifically rainbow trout [WGFD, 2010].

There are no streams within the study area classified by the WGFD as a Blue or Red Ribbon stream. Figure 3.48 displays the habitat priority areas within the watershed, while only one terrestrial Crucial Habitat and one aquatic Enhancement Priority Area is within the watershed. Aquatic Crucial Habitats include the Niobrara River, Lower North Platte River, Rawhide Watershed, and Rawhide Creek. Riparian areas are the only Terrestrial Crucial areas, while the Lower North Platte River is also listed as an Enhancement Area.

#### 3.3.1.2 *Wildlife Habitat, Game, and Sensitive Species (Plant and Animal)*

Wildlife is abundant and diverse with fish species, big game, nongame mammals, as well as reptiles and amphibians, furbearers, and birds are known to occur within the study area [WYNDD, 2018]. Big game species, including antelope, mule deer, white-tailed deer, and elk, are known to occur within the study area. Raptors in the area include, but are not limited to, golden and bald eagles; ferruginous and Swainson's hawks; American kestrel; and peregrine falcon [WYNDD, 2018].

**Table 3.10. Monthly Climatic Data for Weather Stations Within the Study Area (Page 1 of 2)**

| Parameter | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **LINGLE 2 WSW (485612) 1952–2016** | | | | | | | | | | | | | |
| Average Maximum Temperature (F) | 42.1 | 43.4 | 53.2 | 61.3 | 69.4 | 82.0 | 90.9 | 88.5 | 80.2 | 65.2 | 53.1 | 39.7 | 64.1 |
| Average Minimum Temperature (F) | 13.9 | 15.1 | 22.8 | 30.7 | 40.0 | 49.7 | 55.0 | 52.7 | 42.2 | 30.8 | 20.1 | 12.8 | 32.1 |
| Average Total Precipitation (in) | 0.29 | 0.29 | 0.66 | 1.61 | 2.61 | 2.61 | 1.49 | 1.14 | 0.90 | 0.81 | 0.32 | 0.37 | 13.1 |
| Average Total Snow Fall (in) | 2.9 | 4.20 | 4.0 | 3.5 | 0.40 | 0.0 | 0.0 | 0.00 | 0.1 | 1.6 | 1.60 | 3.7 | 22.0 |
| Average Snow Depth (in) | 1.0 | 1.00 | 0.0 | 0.0 | 0.00 | 0.0 | 0.0 | 0.00 | 0.0 | 0.0 | 0.00 | 1.0 | 0.0 |
| **TORRINGTON (488995) 1922–2007** | | | | | | | | | | | | | |
| Average Maximum Temperature (F) | 40.4 | 45.1 | 51.1 | 61.9 | 71.3 | 81.5 | 89.3 | 87.4 | 78.0 | 66.2 | 51.0 | 42.4 | 63.8 |
| Average Minimum Temperature (F) | 10.9 | 15.2 | 21.6 | 30.7 | 41.0 | 49.9 | 55.7 | 53.1 | 42.3 | 30.6 | 20.2 | 13.1 | 32.0 |
| Average Total Precipitation (in) | 0.29 | 0.36 | 0.73 | 1.68 | 2.49 | 2.45 | 1.66 | 1.10 | 1.17 | 0.96 | 0.50 | 0.36 | 13.72 |
| Average Total Snow Fall (in) | 4.1 | 4.80 | 6.0 | 3.3 | 0.60 | 0.0 | 0.0 | 0.00 | 0.3 | 1.6 | 4.40 | 5.3 | 30.4 |
| Average Snow Depth (in) | 1.0 | 1.00 | 0.0 | 0.0 | 0.00 | 0.0 | 0.0 | 0.00 | 0.0 | 0.0 | 0.00 | 1.0 | 0.0 |
| **WHALEN DAM (489604) 1949–2016** | | | | | | | | | | | | | |
| Average Maximum Temperature (F) | 40.0 | 44.7 | 50.8 | 60.6 | 70.9 | 82.1 | 90.1 | 88.4 | 78.6 | 66.9 | 51.1 | 42.2 | 63.9 |
| Average Minimum Temperature (F) | 10.4 | 15.8 | 22.0 | 31.4 | 41.2 | 50.5 | 56.3 | 53.9 | 43.0 | 32.0 | 20.6 | 12.7 | 32.5 |
| Average Total Precipitation (in) | 0.3 | 0.3 | 0.7 | 1.5 | 2.5 | 2.2 | 1.6 | 1.0 | 1.1 | 0.7 | 0.4 | 0.4 | 12.6 |
| Average Total Snow Fall (in) | 3.1 | 2.9 | 8.7 | 1.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.4 | 3.3 | 21.1 |
| Average Snow Depth (in) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **LUSK 2 SW (485830) 1893–2008** | | | | | | | | | | | | | |
| Average Maximum Temperature (F) | 35.6 | 38.8 | 45.6 | 56.6 | 66.4 | 77.2 | 85.6 | 84.4 | 74.5 | 61.5 | 46.6 | 37.5 | 59.2 |
| Average Minimum Temperature (F) | 10.9 | 14.0 | 19.6 | 28.8 | 38.1 | 47.0 | 52.8 | 50.9 | 41.1 | 30.6 | 20.5 | 13.1 | 30.6 |
| Average Total Precipitation (in) | 0.5 | 0.5 | 1.0 | 1.9 | 2.8 | 2.4 | 1.7 | 1.1 | 1.2 | 0.9 | 0.6 | 0.5 | 15.1 |
| Average Total Snow Fall (in) | 6.9 | 7.0 | 9.5 | 8.1 | 1.8 | 0.2 | 0.0 | 0.0 | 0.4 | 2.5 | 5.7 | 7.4 | 49.6 |
| Average Snow Depth (in) | | | | | | | | | | | | | |

**Table 3.10. Monthly Climatic Data for Weather Stations Within the Study Area (Page 2 of 2)**

| Parameter | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **FT LARAMIE 11 NNW (483490) 1927–1979** | | | | | | | | | | | | | |
| Average Maximum Temperature (F) | 39.6 | 44.5 | 50.1 | 60.8 | 69.8 | 80.1 | 89.6 | 87.7 | 78.8 | 67.0 | 51.8 | 43.4 | 63.6 |
| Average Minimum Temperature (F) | 8.7 | 11.8 | 19.5 | 27.6 | 38.6 | 46.8 | 53.4 | 50.7 | 40.3 | 29.3 | 17.8 | 12.0 | 29.7 |
| Average Total Precipitation (in) | 0.31 | 0.31 | 0.59 | 1.41 | 2.38 | 2.13 | 1.71 | 1.13 | 1.18 | 0.74 | 0.36 | 0.32 | 12.6 |
| Average Total Snow Fall (in) | 4.1 | 4.40 | 6.4 | 5.8 | 0.80 | 0.1 | 0.0 | 0.00 | 0.4 | 2.0 | 3.40 | 4.3 | 31.7 |
| Average Snow Depth (in) | 1.0 | 1.00 | 0.0 | 0.0 | 0.00 | 0.0 | 0.0 | 0.00 | 0.0 | 0.0 | 0.00 | 1.0 | 0.0 |
| **TORRINGTON (488997) 1997 - 2016** | | | | | | | | | | | | | |
| Average Maximum Temperature (F) | 37.2 | 38.8 | 47.6 | 55.6 | 65.1 | 76.9 | 88.1 | 85.9 | 75.0 | 60.3 | 46.6 | 37.1 | 59.5 |
| Average Minimum Temperature (F) | 12.7 | 15.1 | 21.3 | 29.1 | 38.6 | 47.9 | 56.0 | 53.7 | 43.4 | 31.8 | 21.0 | 13.1 | 32.0 |
| Average Total Precipitation (in) | 0.24 | 0.25 | 0.63 | 1.79 | 2.48 | 2.62 | 1.95 | 1.47 | 1.34 | 1.06 | 0.34 | 0.30 | 14.46 |
| Average Total Snow Fall (in) | 5.1 | 5.40 | 8.0 | 7.9 | 1.30 | 0.0 | 0.0 | 0.00 | 0.9 | 3.6 | 5.70 | 6.6 | 44.5 |
| Average Snow Depth (in) | 1.0 | 1.0 | 1.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 |

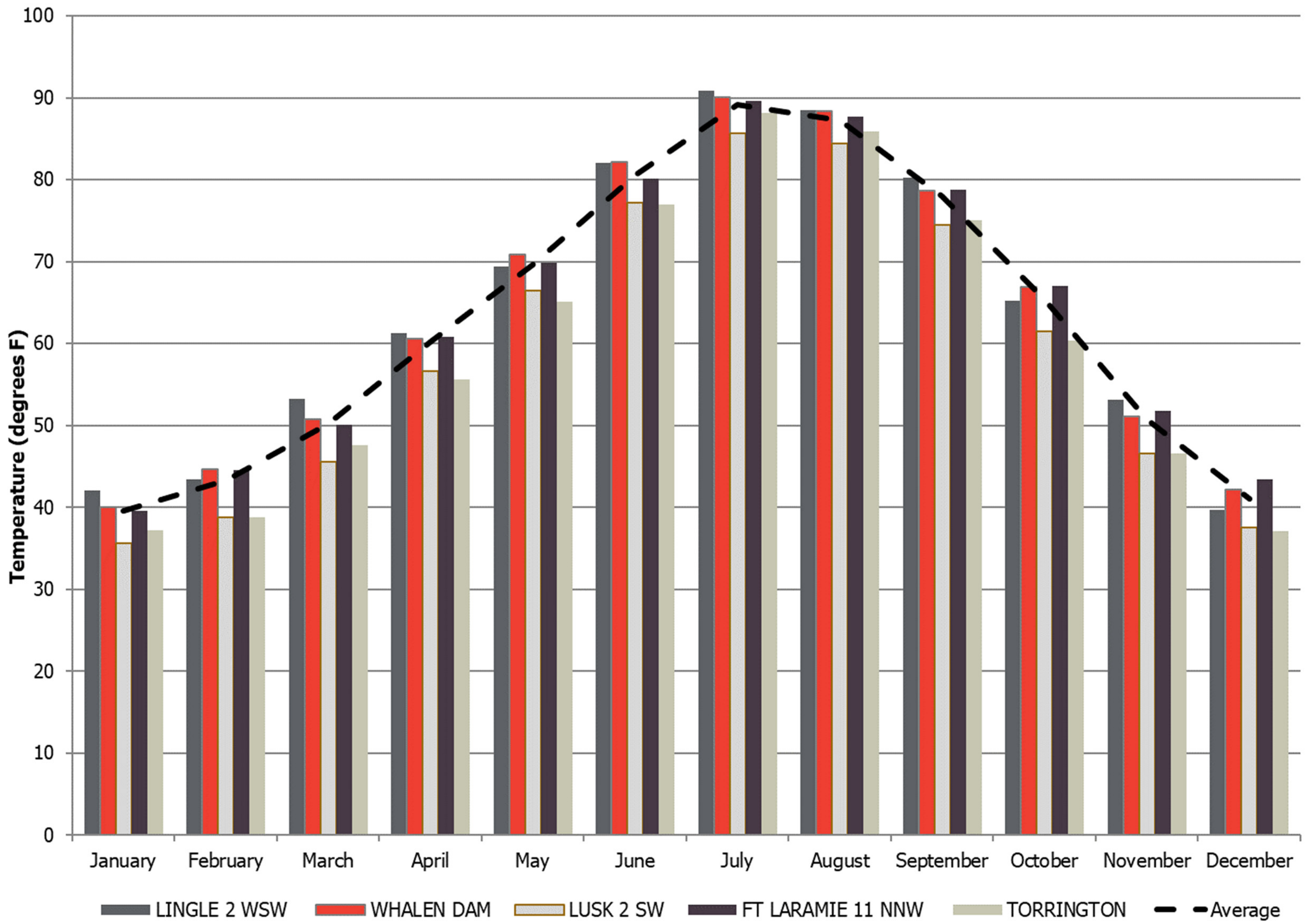


**Figure 3.43.** Monthly Average Maximum Temperature for Weather Stations Across the Study Area.

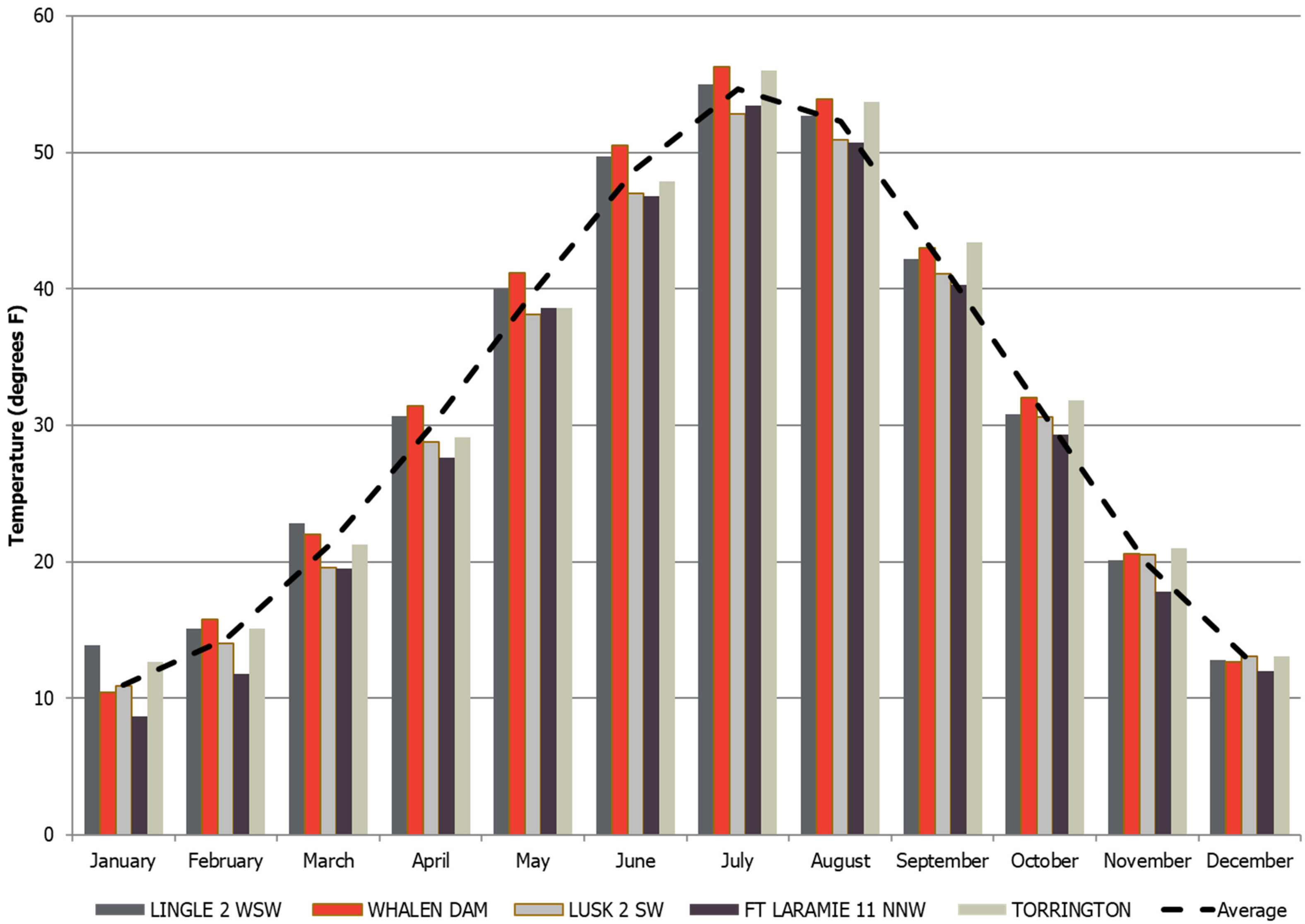


**Figure 3.44.** Monthly Average Minimum Temperature for Weather Stations Within the Study Area.

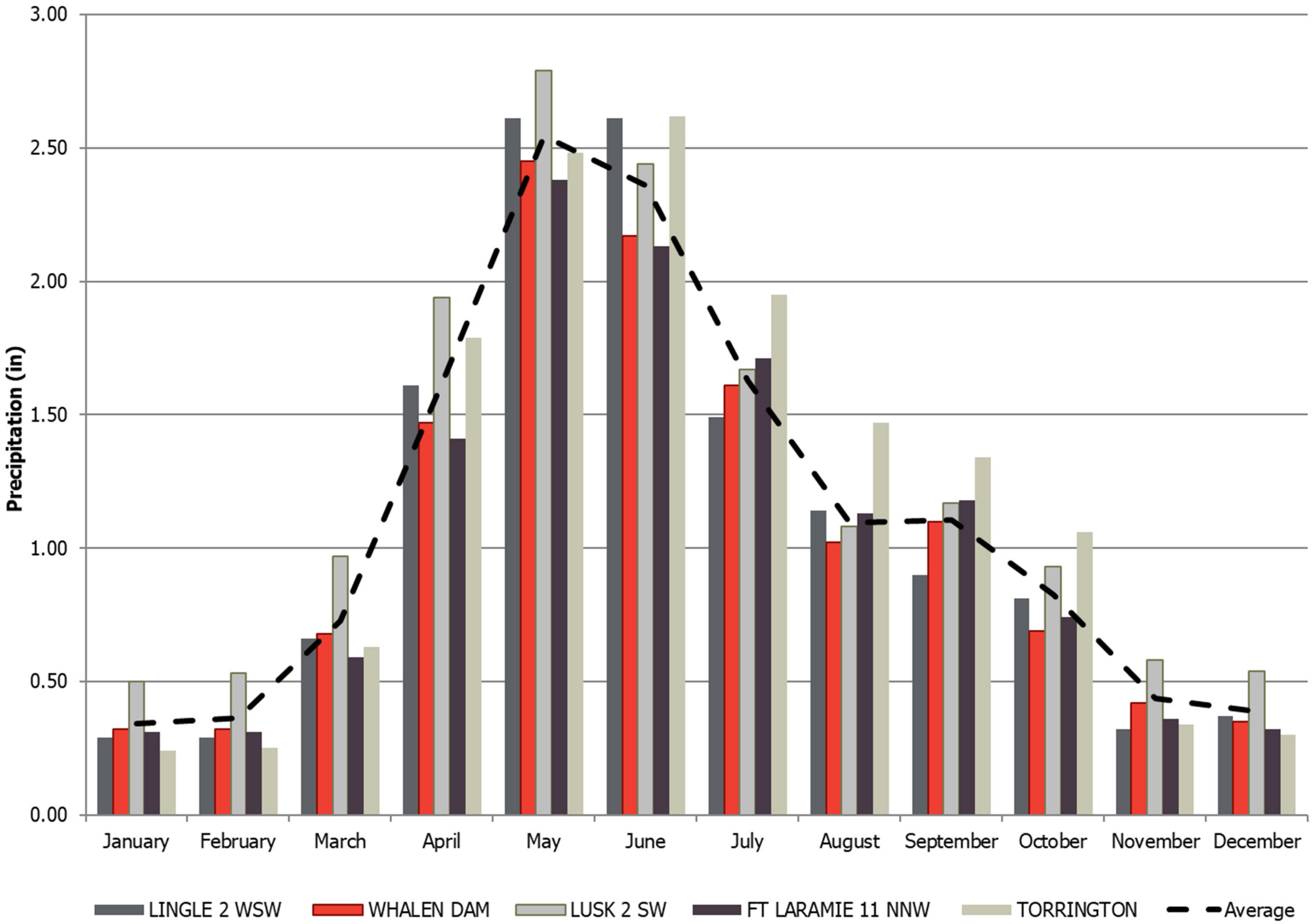


**Figure 3.45.** Monthly Average Rainfall Totals for Weather Stations Within the Study Area.

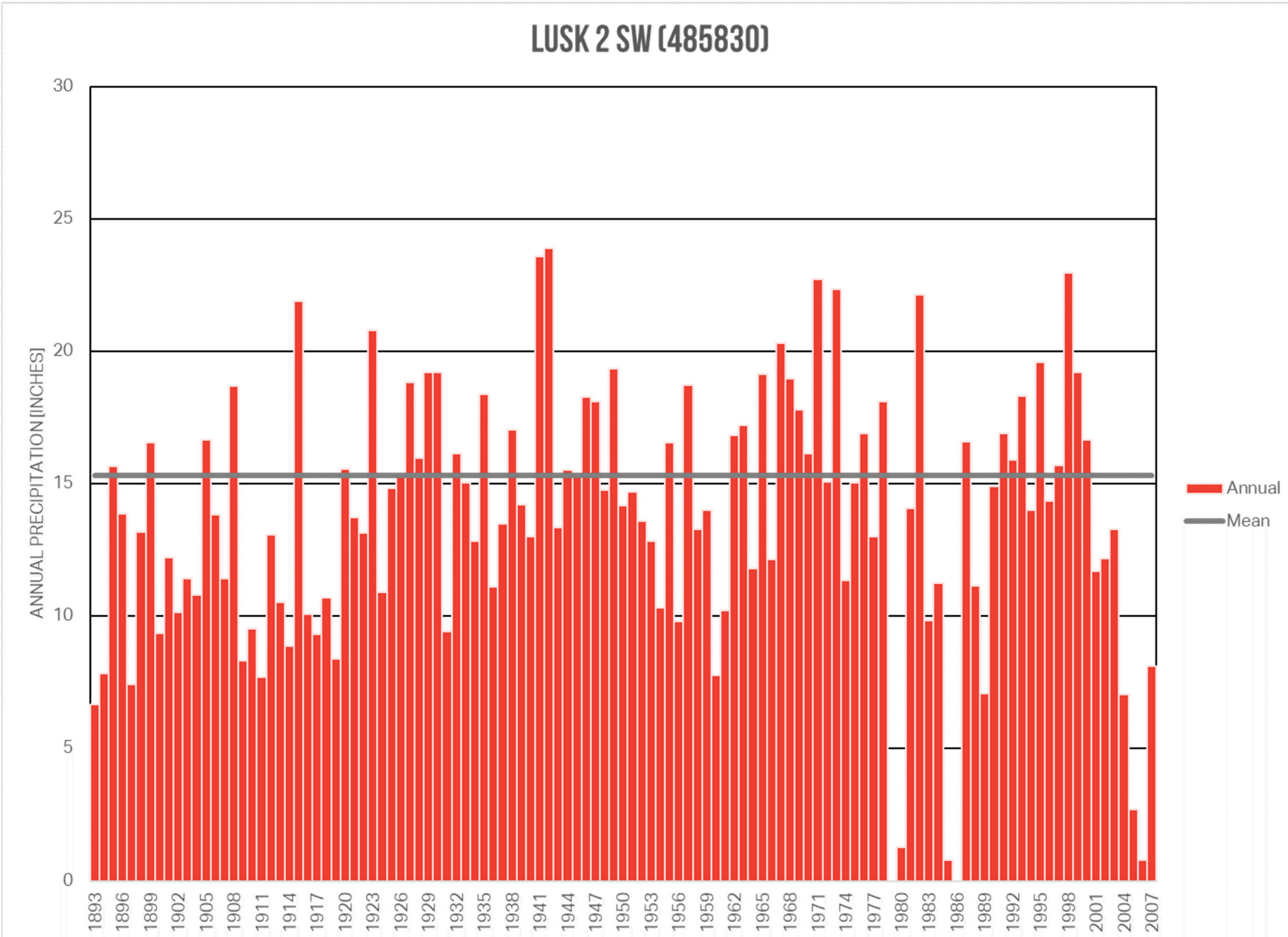


**Figure 3.46.** Annual Precipitation From 1893 to 2008 for the Lusk 2 SW Weather Station (485830).

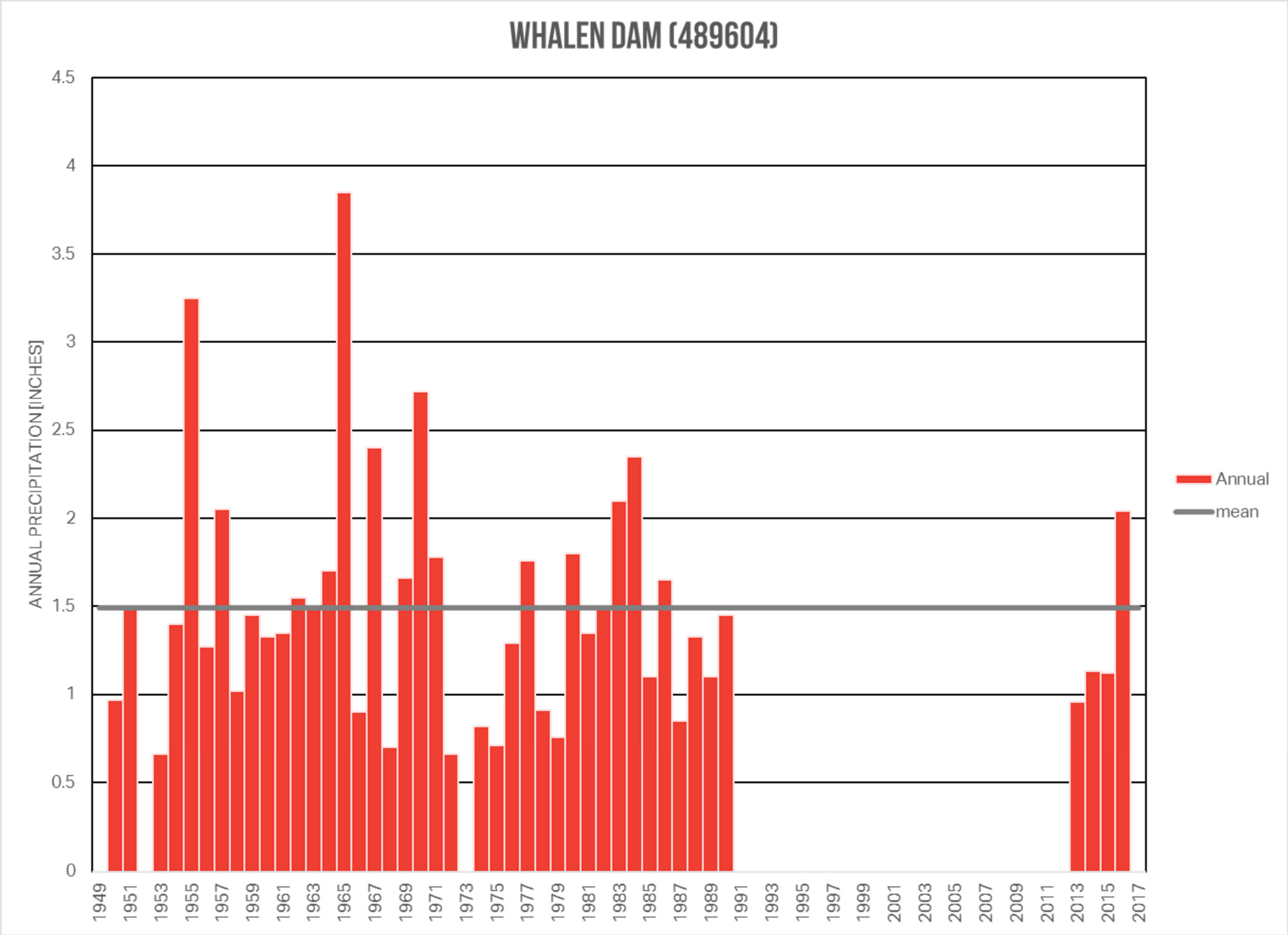


**Figure 3.47.** Annual Precipitation From 1949 to 1991 and From 2013 to 2017 for the Whalen Dam Weather Station (489604).

**Table 3.11. Wyoming Natural Diversity Database: Fish Species Within the Study Area**

| Scientific Name | Common Name | Sensitivity |
|---|---|---|
| Chrosomus neogaeus | Finescale Dace | Nonsensitive |
| Etheostoma exile | Iowa Darter | Nonsensitive |
| Etheostoma spectabile | Orangethroat Darter | Nonsensitive |
| Fundulus kansae | Northern Plains Killifish | Nonsensitive |
| Fundulus sciadicus | Plains Topminnow | Nonsensitive |
| Hybognathus hankinsoni | Brassy Minnow | Nonsensitive |
| Luxilus cornutus | Common Shiner | Nonsensitive |
| Margariscus nachtriebi | Northern Pearl Dace | Nonsensitive |
| Notropis dorsalis | Bigmouth Shiner | Nonsensitive |
| Phenacobius mirabilis | Suckermouth Minnow | Nonsensitive |

***Wildlife Habitat and Migration Corridors***

The Lower North Platte River and a western portion of the study area are identified as a Key Nongame Wildlife Area (KNWA) by the WGFD because of the existence of more than 115 bat roosts in the area, as well as several Species of Greatest Conservation Need (SGCN) mammals. The SGCN lists 11 bird and 15 mammal species that occur in the Guernsey KNWA. The Guernsey KNWA is also shown in Figure 3.36. The WGFD has developed geodata that shows hunt areas, herd units, seasonal range, crucial ranges, parturition areas, and migration routes and barriers for antelope, elk, mountain lion, mule deer, and white-tailed deer [WGFD, 2015]. Approximately 65,485 acres of the study area has been classified as crucial range for antelope and mule deer. Figures 3.49 through 3.52 display the herd units, crucial range, and seasonal range areas for antelope, elk, mule deer, and white-tailed deer.

***Nonsensitive and Sensitive Species***

The WYNDD records and maintains a list of species in Wyoming that are thought to be rare or sensitive. Data obtained from the WYNDD list 131 fish and wildlife species that are documented within the study area. Table 3.12 lists the fish, birds, amphibians and reptiles, snails and mollusks, and mammals listed from WYNDD. Out of the 131 species within the study area, 115 are listed as sensitive species. In addition, 28 species of plants are listed on WYNDD's native species list, while 5 are labeled as sensitive. A list of native plant species is displayed in Section 3.3.2.3.

#### 3.3.1.3 *Sage Grouse*

The greater sage-grouse are known to occur within the study area; however, no core areas are situated within the watershed. Additional information about Wyoming's sage-grouse management including mitigation, *de minimus* activities, core area maps and data, and the Density Disturbance Calculation Tool (DDCT) can be found at the WGFD's website (*https://wgfd.wyo.gov/Habitat/Sage-Grouse-Management*).

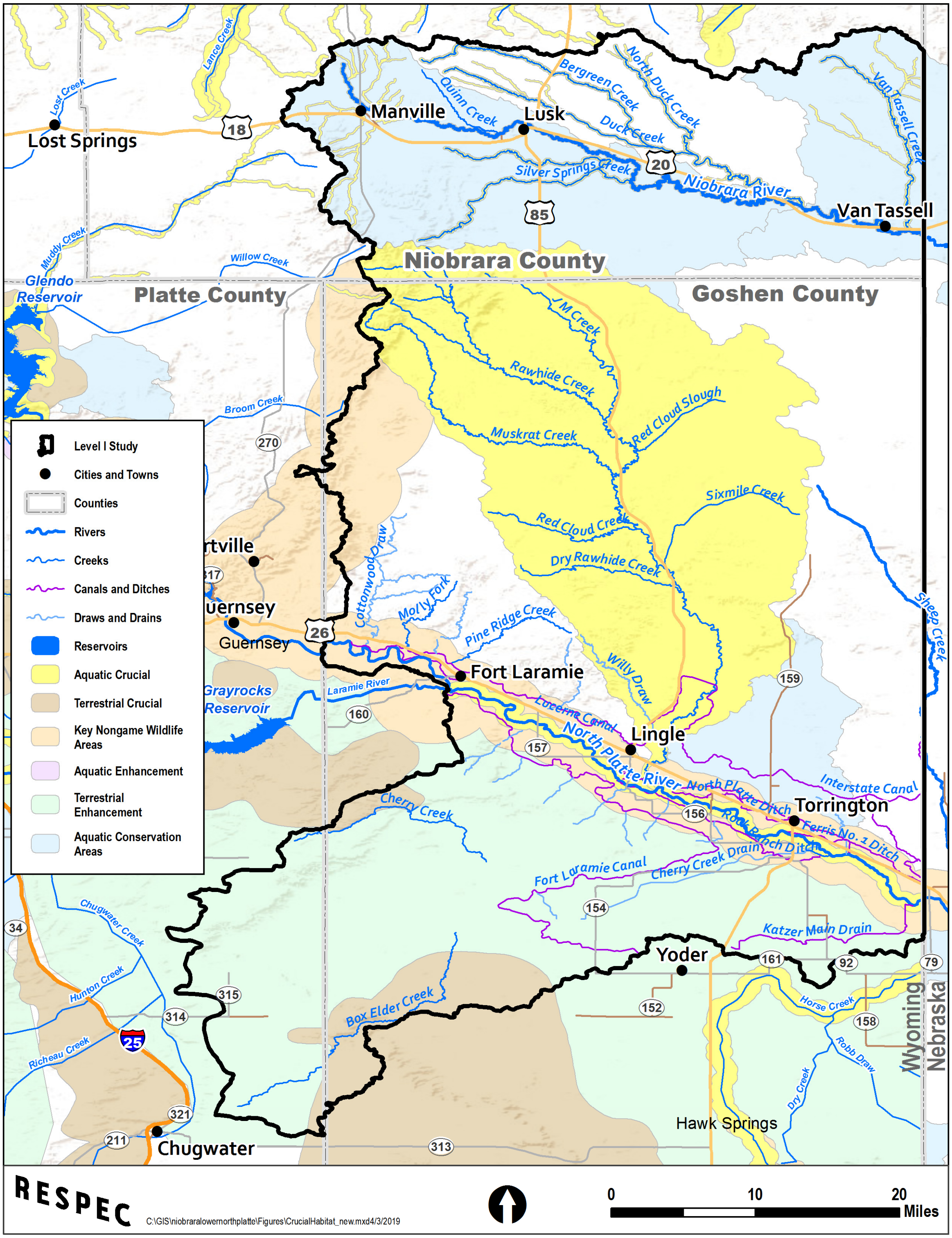


**Figure 3.48.** Habitat Priority Areas in the Watershed.

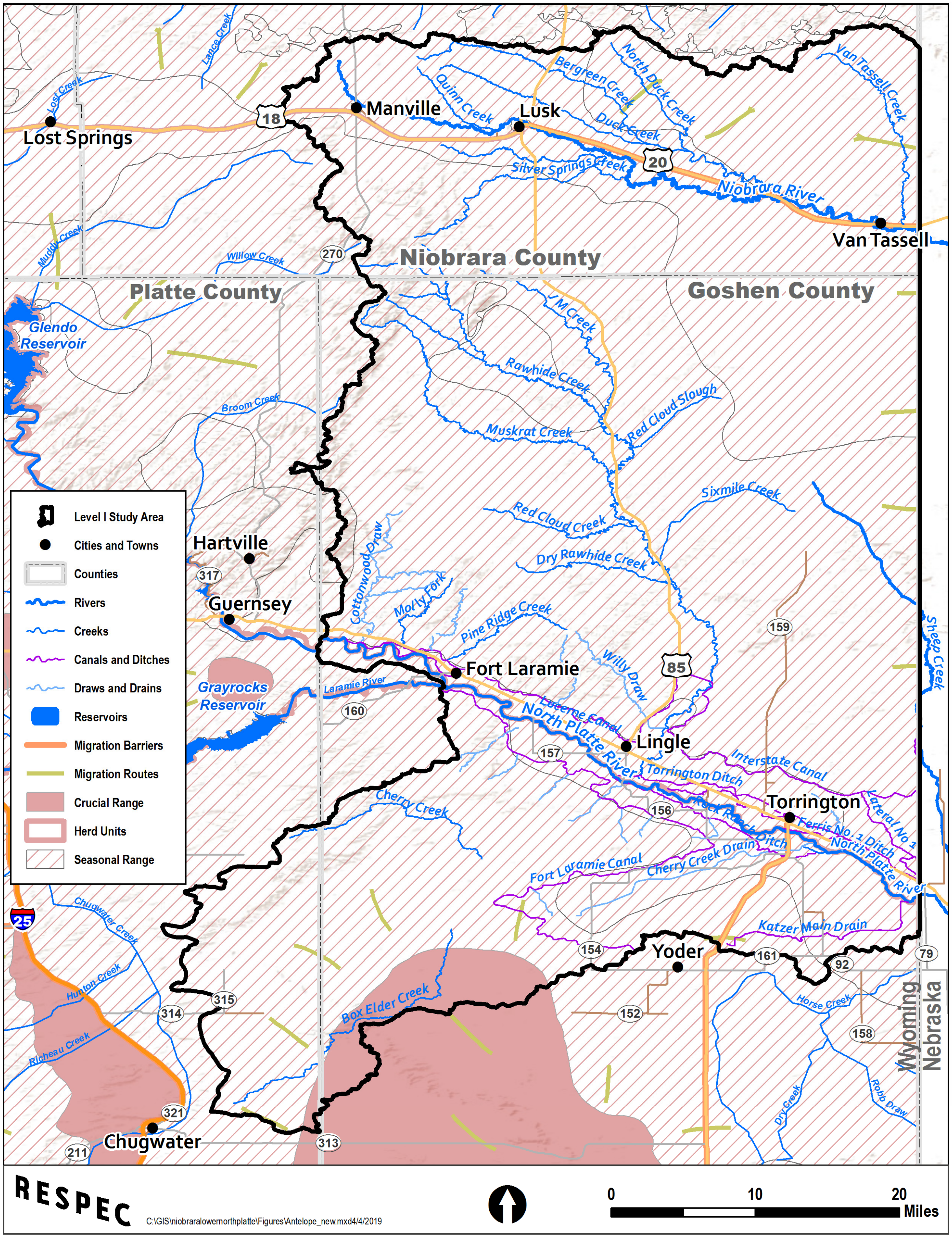


**Figure 3.49.** Antelope Habitat Within the Watershed.

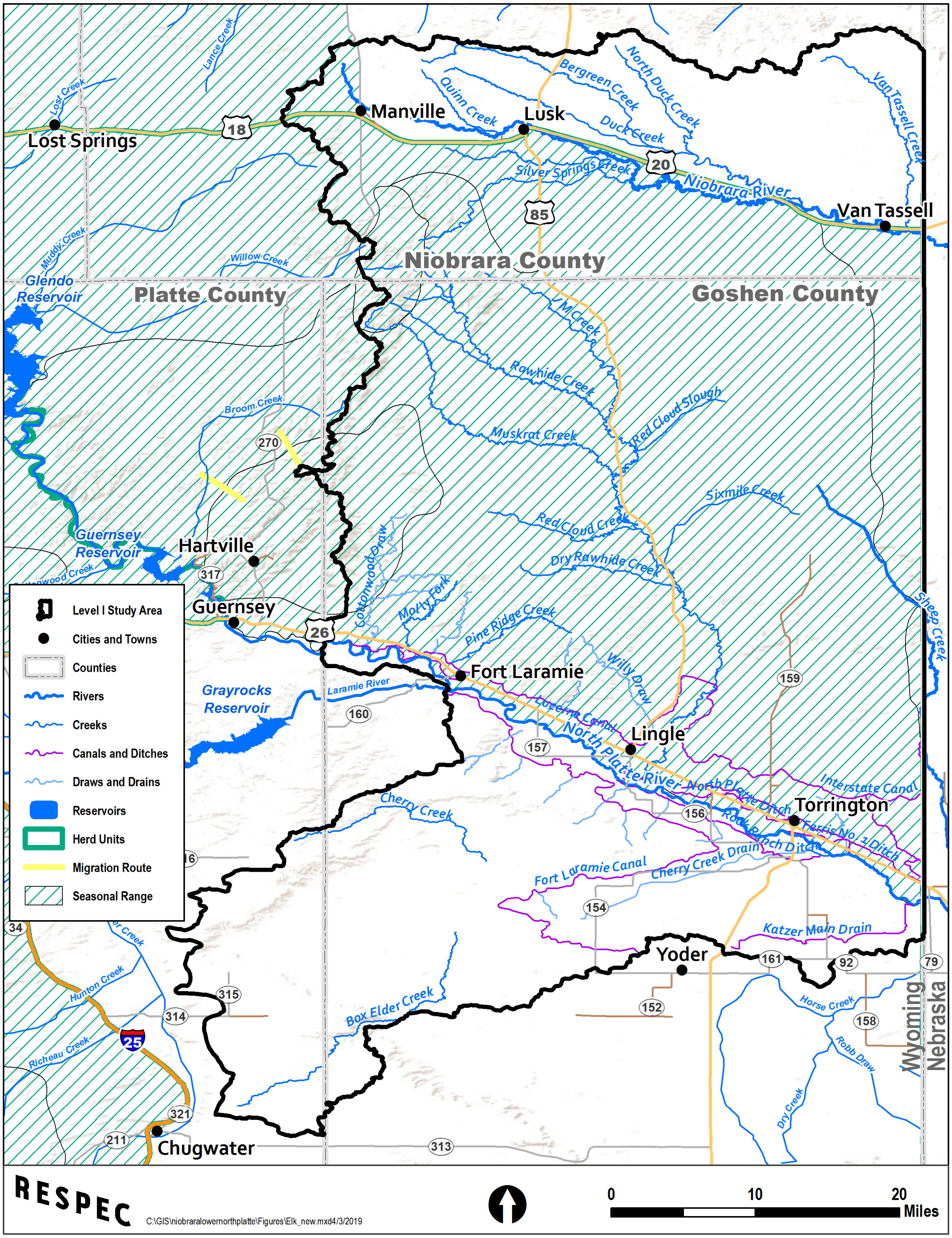


**Figure 3.50.** Elk Habitat Within the Watershed.

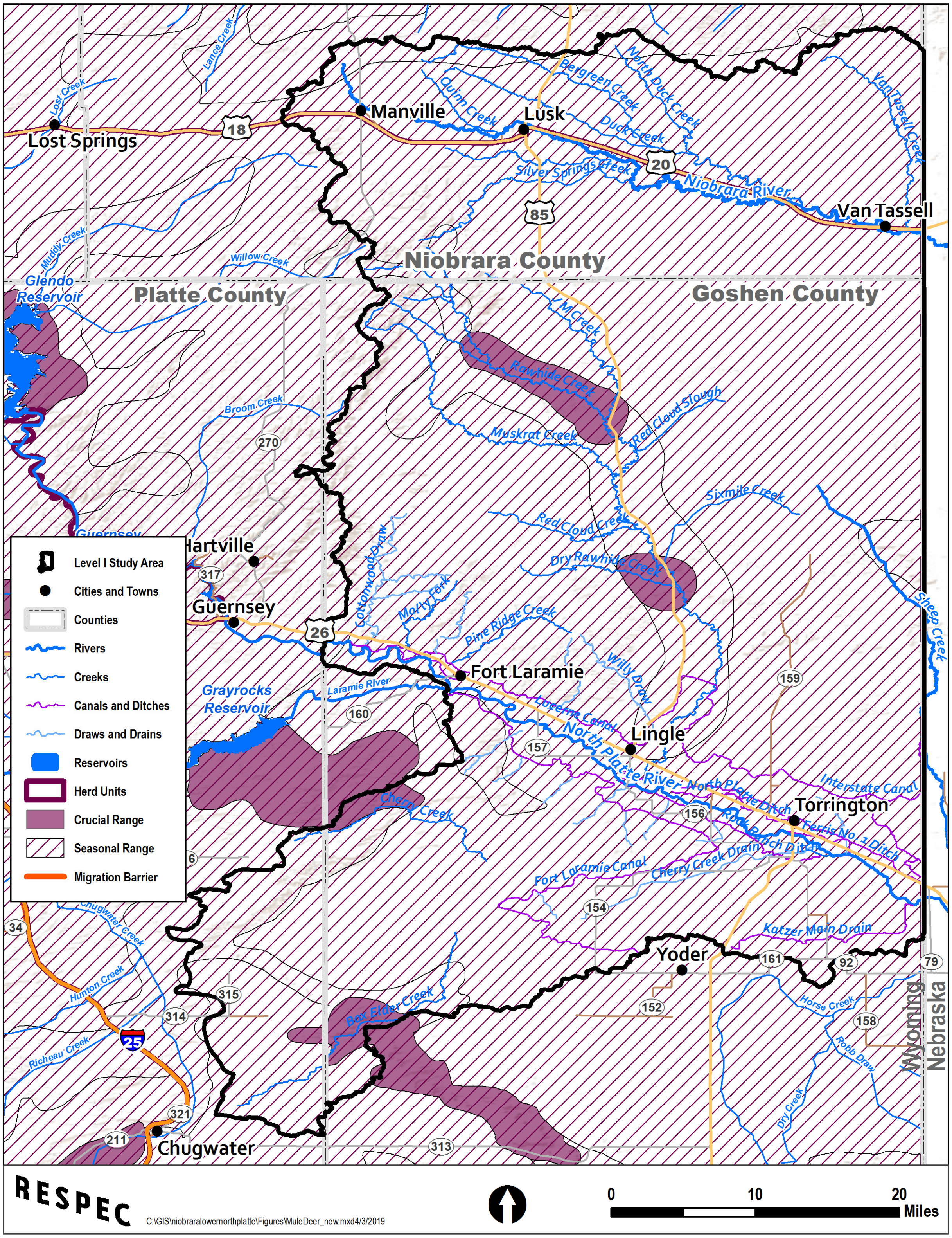


**Figure 3.51.** Mule Deer Habitat Within the Watershed.

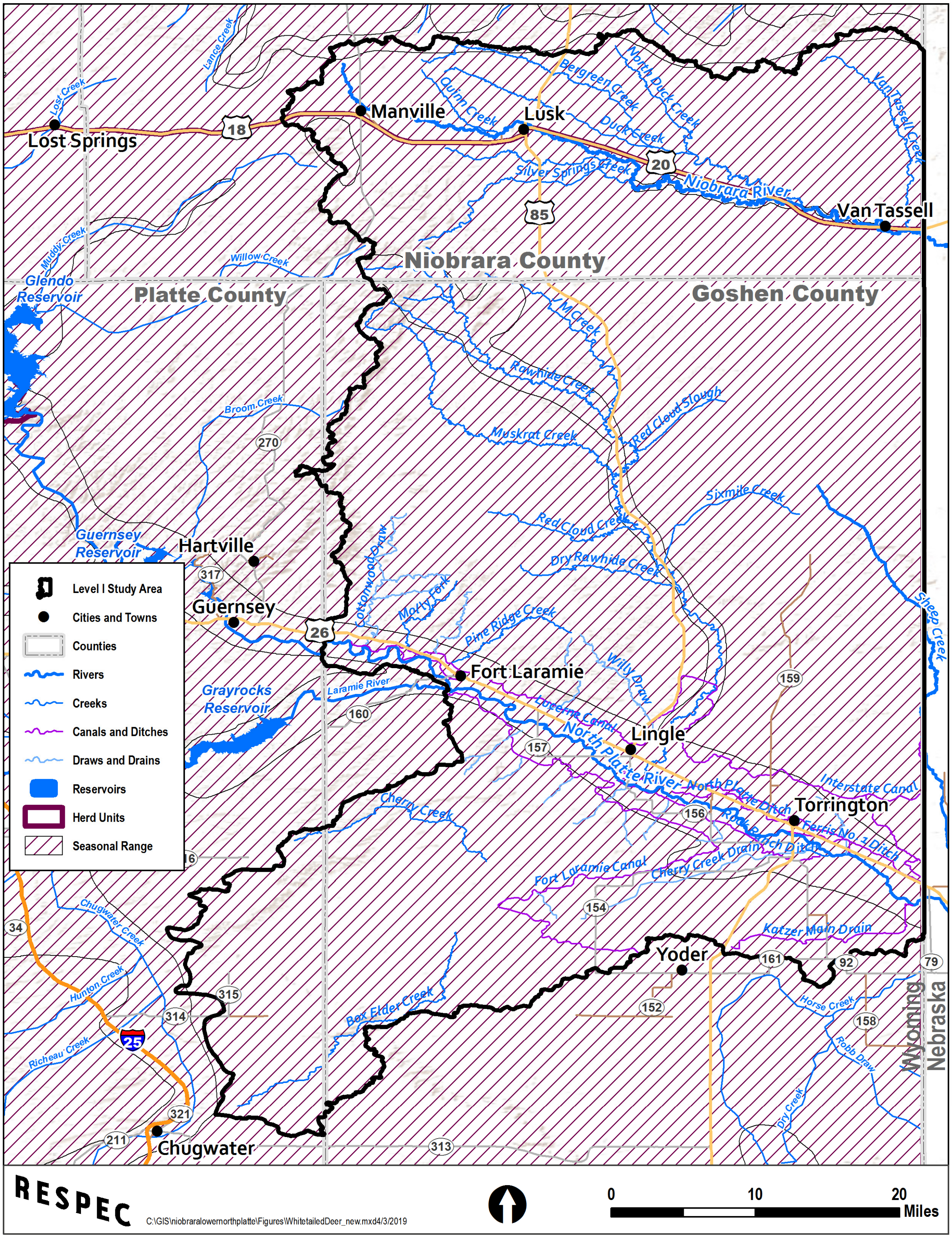


**Figure 3.52.** White-Tailed Deer Habitat Within the Watershed.

**Table 3.12. Wyoming Natural Diversity Database: Wildlife Species Within the Study Area (Page 1 of 4)**

| Scientific Name | Common Name | Sensitivity |
|---|---|---|
| **Amphibians and Reptiles** | | |
| Ambystoma mavortium | Western Tiger Salamander | Sensitive |
| Apalone spinifera | Eastern Spiny Softshell | Sensitive |
| Chrysemys picta bellii | Western Painted Turtle | Sensitive |
| Coluber constrictor flaviventris | Eastern Yellow-bellied Racer | Sensitive |
| Crotalus viridis | Prairie Rattlesnake | Sensitive |
| Heterodon nasicus | Plains Hog-nosed Snake | Sensitive |
| Holbrookia maculata | Great Plains Earless Lizard | Sensitive |
| Lampropeltis gentilis | Western Milksnake | Sensitive |
| Lithobates pipiens | Northern Leopard Frog | Sensitive |
| Opheodrys vernalis | Smooth Greensnake | Sensitive |
| Phrynosoma hernandesi | Greater Short-horned Lizard | Sensitive |
| Phrynosoma hernandesi brevirostris | Plains Short-horned Lizard | Sensitive |
| Pituophis catenifer sayi | Bullsnake | Sensitive |
| Plestiodon multivirgatus | Northern Many-lined Skink | Sensitive |
| Sceloporus consobrinus | Prairie Lizard | Sensitive |
| Spea bombifrons | Plains Spadefoot | Sensitive |
| Thamnophis radix | Plains Gartersnake | Sensitive |
| **Snails and Slugs** | | |
| Ferrissia rivularis | Creeping Ancylid | Nonsensitive |
| Fossaria bulimoides | Prairie Fossaria | Nonsensitive |
| Helisoma anceps | Two-ridge Rams-horn | Nonsensitive |
| Physa acuta | Pewter Physa | Nonsensitive |
| Physa gyrina | Tadpole Physa | Nonsensitive |
| **Birds** | | |
| Accipiter gentilis | Northern Goshawk | Sensitive |
| Aechmophorus clarkii | Clark's Grebe | Sensitive |
| Aechmophorus occidentalis | Western Grebe | Sensitive |
| Aquila chrysaetos | Golden Eagle | Sensitive |
| Ammodramus savannarum | Grasshopper Sparrow | Sensitive |

**Table 3.12. Wyoming Natural Diversity Database: Wildlife Species Within the Study Area (Page 2 of 4)**

| Scientific Name | Common Name | Sensitivity |
|---|---|---|
| **Birds** | | |
| Antigone canadensis | Sandhill Crane | Sensitive |
| Ardea herodias | Great Blue Heron | Sensitive |
| Artemisiospiza nevadensis | Sagebrush Sparrow | Sensitive |
| Asio flammeus | Short-eared Owl | Sensitive |
| Athene cunicularia | Burrowing Owl | Sensitive |
| Aythya collaris | Ring-necked Duck | Sensitive |
| Bartramia longicauda | Upland Sandpiper | Sensitive |
| Botaurus lentiginosus | American Bittern | Sensitive |
| Bubulcus ibis | Cattle Egret | Sensitive |
| Bucephala albeola | Bufflehead | Sensitive |
| Bucephala clangula | Common Goldeneye | Sensitive |
| Buteo regalis | Ferruginous Hawk | Sensitive |
| Buteo swainsoni | Swainson's Hawk | Sensitive |
| Calcarius ornatus | Chestnut-collared Longspur | Sensitive |
| Catherpes mexicanus | Canyon Wren | Sensitive |
| Centrocercus urophasianus | Greater Sage-Grouse | Sensitive |
| Chaetura pelagica | Chimney Swift | Sensitive |
| Charadrius montanus | Mountain Plover | Sensitive |
| Chordeiles minor | Common Nighthawk | Sensitive |
| Circus hudsonius | Northern Harrier | Sensitive |
| Coccyzus americanus | Yellow-billed Cuckoo | Sensitive |
| Coccyzus erythropthalmus | Black-billed Cuckoo | Sensitive |
| Colinus virginianus | Northern Bobwhite | Sensitive |
| Cygnus buccinator | Trumpeter Swan | Sensitive |
| Cygnus columbianus | Tundra Swan | Sensitive |
| Egretta thula | Snowy Egret | Sensitive |
| Empidonax traillii | Willow Flycatcher | Sensitive |
| Falco columbarius | Merlin | Sensitive |
| Falco peregrinus | Peregrine Falcon | Sensitive |
| Falco sparverius | American Kestrel | Sensitive |
| Gavia immer | Common Loon | Sensitive |

**Table 3.12. Wyoming Natural Diversity Database: Wildlife Species Within the Study Area (Page 3 of 4)**

| Scientific Name | Common Name | Sensitivity |
|---|---|---|
| **Birds** | | |
| Geothlypis tolmiei | MacGillivray's Warbler | Sensitive |
| Geothlypis trichas | Common Yellowthroat | Sensitive |
| Gyraulus parvus | Ash Gyro | Nonsensitive |
| Haliaeetus leucocephalus | Bald Eagle | Sensitive |
| Junco hyemalis | Dark-eyed Junco | Sensitive |
| Lanius ludovicianus | Loggerhead Shrike | Sensitive |
| Larus argentatus | Herring Gull | Sensitive |
| Larus californicus | California Gull | Sensitive |
| Larus delawarensis | Ring-billed Gull | Sensitive |
| Leucophaeus pipixcan | Franklin's Gull | Sensitive |
| Loxia curvirostra | Red Crossbill | Sensitive |
| Loxia leucoptera | White-winged Crossbill | Sensitive |
| Megascops asio | Eastern Screech-Owl | Sensitive |
| Megascops kennicottii | Western Screech-Owl | Sensitive |
| Melanerpes erythrocephalus | Red-headed Woodpecker | Sensitive |
| Melanerpes lewis | Lewis's Woodpecker | Sensitive |
| Myiarchus cinerascens | Ash-throated Flycatcher | Nonsensitive |
| Nucifraga columbiana | Clark's Nutcracker | Sensitive |
| Numenius americanus | Long-billed Curlew | Sensitive |
| Nycticorax | Black-crowned Night-Heron | Sensitive |
| Oreothlypis virginiae | Virginia's Warbler | Sensitive |
| Pandion haliaetus | Osprey | Sensitive |
| Passerina caerulea | Blue Grosbeak | Sensitive |
| Passerina cyanea | Indigo Bunting | Sensitive |
| Pelecanus erythrorhynchos | American White Pelican | Sensitive |
| Peucaea cassinii | Cassin's Sparrow | Sensitive |
| Pheucticus ludovicianus | Rose-breasted Grosbeak | Sensitive |
| Psiloscops flammeolus | Flammulated Owl | Sensitive |
| Rallus limicola | Virginia Rail | Sensitive |
| Recurvirostra americana | American Avocet | Sensitive |
| Rhynchophanes mccownii | McCown's Longspur | Sensitive |

**Table 3.12. Wyoming Natural Diversity Database: Wildlife Species Within the Study Area (Page 4 of 4)**

| Scientific Name | Common Name | Sensitivity |
|---|---|---|
| Sayornis phoebe | Eastern Phoebe | Sensitive |
| Selasphorus rufus | Rufous Hummingbird | Sensitive |
| Sialia sialis | Eastern Bluebird | Sensitive |
| Spiza americana | Dickcissel | Sensitive |
| Spizella breweri | Brewer's Sparrow | Sensitive |
| Spizella pallida | Clay-colored Sparrow | Sensitive |
| Tympanuchus cupido | Greater Prairie Chicken | Sensitive |
| Tyto alba | Barn Owl | Sensitive |
| Vireo olivaceus | Red-eyed Vireo | Nonsensitive |
| **Mammals** | | |
| Antrozous pallidus | Pallid Bat | Sensitive |
| Canis lupus | Gray Wolf | Sensitive |
| Corynorhinus townsendii | Townsend's Big-eared Bat | Sensitive |
| Cynomys ludovicianus | Black-tailed Prairie Dog | Sensitive |
| Geomys lutescens | Sand Hills Pocket Gopher | Sensitive |
| Gulo | Wolverine | Sensitive |
| Ictidomys tridecemlineatus | Thirteen-lined Ground Squirrel | Sensitive |
| Lasionycteris noctivagans | Silver-haired Bat | Sensitive |
| Lontra canadensis | Northern River Otter | Sensitive |
| Lynx rufus | Bobcat | Sensitive |
| Mustela nigripes | Black-footed Ferret | Nonsensitive |
| Myotis ciliolabrum | Western Small-footed Myotis | Sensitive |
| Myotis evotis | Long-eared Myotis | Sensitive |
| Myotis lucifugus | Little Brown Myotis | Sensitive |
| Myotis thysanodes | Fringed Myotis | Sensitive |
| Myotis volans | Long-legged Myotis | Sensitive |
| Ovis canadensis | Bighorn Sheep | Sensitive |
| Reithrodontomys montanus | Plains Harvest Mouse | Nonsensitive |
| Scalopus aquaticus | Eastern Mole | Nonsensitive |
| Sylvilagus floridanus | Eastern Cottontail | Sensitive |
| Urocyon cinereoargenteus | Common Gray Fox | Sensitive |
| Vulpes velox | Swift Fox | Sensitive |
| Xerospermophilus spilosoma | Spotted Ground Squirrel | Sensitive |

### 3.3.2 Land Cover

The 2011 National Land Cover Database (NLCD) classifications summarize the characteristics of the land surface and include but are not limited to shrub/scrub, grassland/herbaceous, deciduous or evergreen forest, developed urban, crops, wetlands, water, and barren ground. The NLCD is distributed by the Multi-Resolution Land Characteristics Consortium (MRLC) and serves as the definitive Landsat-based, 30-meter resolution, land-cover database with a 16-category classification that is applied across the US [Homer et al., 2012]. The 2011 NLCD was obtained and used in determining the predominant surface cover types that exist within the watershed.

An analysis of the 2011 NLCD data indicates that approximately 870,005 acres (67.2 percent) of land cover within the study area is composed of grassland/herbaceous. Another 216,474 acres (16.7 percent) of the watershed are classified as cultivated crops, and 130,833 acres (10.1 percent) as shrub/scrub cover. The remaining areas consist of developed/open space, pasture and hay, woody wetlands, emergent wetlands, evergreen forest, and other small classes. Barren land (which includes rock, sand, and clay occurring on bedrock, scarps, sand dunes, strip mines, and gravel pits) covers approximately 7,319 acres (0.6 percent) of the study area. Approximately 1,371 acres of water cover 0.1 percent of the study area. Table 3.13 is a summary of land-cover classifications NLCD data in 2011. In summary, approximately 77 percent of the watershed's land cover consists of grass and shrub lands, which are typically used for livestock grazing. The remaining 23 percent of the study area consists of cropland, pasture and hay, woody wetlands, evergreen forest, and water based on the 2011 NLCD.

#### 3.3.2.1 *Riparian Areas*

Riparian areas are the most productive wildlife habitat type in Wyoming, supporting more wildlife diversity than any other habitat [Bureau of Land Management, 2007]. In addition to providing wildlife habitats and forage, shade and water for livestock, riparian areas also provide functions such as improving water quality, sustaining base flows, and lessening the impacts of floods. The LANDFIRE existing vegetation type (EVT) data were analyzed for the study area, and the dominant riparian/wetland EVTs within this area are Herbaceous Wetlands (0.4 percent), Western Great Plains Floodplain Systems (0.37 percent), and Recently Burned Herbaceous Wetlands (less than 0.01 percent). All EVT areas cover approximately 0.77 percent of the watershed and are primarily located along the Niobrara River, Rawhide Creek, Lower North Platte River, and Box Elder Creek.

The WGFD have identified the riparian regions as Crucial and Enhanced Habitat areas, as discussed in Section 3.3.1.1. Riparian and wetland habitat areas support the high SGCN species diversity, including native fish, amphibian, and reptile species. The Lower North Platte River was selected as an Enhanced Habitat area for the potential of sport fishery and its habitat for native nongame fish species. Niobrara and Rawhide Creek were identified as crucial habitats for their unique prairie fish assemblage for Wyoming and the Rawhide Watershed was selected because of its high diversity of SGCN species and for representing the highest amphibian and reptile diversity in the Casper region.

**Table 3.13. 2011 National Land Cover Database Classifications Within the Study Area**

| Classification | Description | Area (acres) | Percent of Study Area |
|---|---|---|---|
| Grassland and Herbaceous | Gramanoid or herbaceous vegetation, generally greater than 80 percent of total vegetation cover. These areas are not subject to tilling but are used for grazing. | 869,676 | 67.2 |
| Cultivated Crops | Productions of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Accounts for greater than 20 percent of total vegetation and includes all land being actively tilled. | 216,125 | 16.7 |
| Shrub and Scrub | Shrubs less than 16 feet tall with canopy typically greater than 20 percent of total vegetation. This class includes shrubs and trees in early successional stages or stunted from environmental conditions. | 132,004 | 10.2 |
| Developed, Open Space | A mixture of constructed materials, but mostly lawn grasses. Impervious surfaces account for less than 20 percent of cover. These areas commonly include single-family housing units, parks, golf courses, and vegetation planted for recreation, erosion control, or aesthetics. | 20,707 | 1.6 |
| Pasture and Hay | Grasses, legumes, or mixtures planted for livestock grazing or the production of seed or hay crops on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation. | 12,942 | 1.0 |
| Woody Wetlands | Forests or shrublands account for greater than 20 percent and the soil is periodically covered with water. | 11,647 | 0.9 |
| Evergreen Forest | Trees greater than 16 feet tall, and greater than 20 percent of total vegetation cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage. | 10,353 | 0.8 |
| Emergent Herbaceous Wetlands | Perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically covered with water. | 7,789 | 0.6 |
| Barren Land (Rock/Sand/Clay) | Bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other earthen material. Vegetation accounts for less than 15 percent of total. | 7,741 | 0.6 |
| Developed, Low Intensity | A mixture of constructed materials and vegetation. Impervious surfaces account for 50 percent to 79 percent of the total cover. These areas most commonly include single-family housing units. | 2,588 | 0.2 |
| Open Water | Open water, less than 25 percent cover of vegetation/ soil. | 1,371 | 0.1 |
| Other | Areas with less than 0.1 percent of the study area. | 1,217 | 0.1 |
| **Total** | | **1,294,160** | **100.0** |

### 3.3.2.2 *Wetlands*

A wetland is an area that is periodically inundated or saturated by surface or groundwater on an annual or seasonal basis, displays hydric soils, and typically supports or is capable of supporting hydrophytic vegetation [Black, 1997]. Wetlands can enhance watershed function by accumulating rainfall or runoff and storing that water in diverse quantities and periods within the wetland's vegetation and soils. The National Wetlands Inventory (NWI) was established by the US Fish and Wildlife Service (USFWS) to map existing wetlands based on vegetative, hydrologic, and soil features using aerial imagery and field verification. The NWI geospatial wetland data was obtained and mapped to identify approximately 8,775 acres of all wetland types, which cover approximately 1.04 percent of the study area and occur throughout the area, or 13,409 acres. Riverine wetlands directly associated with the Lower North Platte River account for approximately 5,142 acres (38 percent) of the wetlands within the study area. The distribution of wetlands by type is shown in Figure 3.53 and listed in Table 3.14. Because the NWI wetlands are small in size and scarcely visible at the watershed scale, the mapped wetland polygons were outlined with a thicker border to increase their visibility as shown in Figure 3.54.

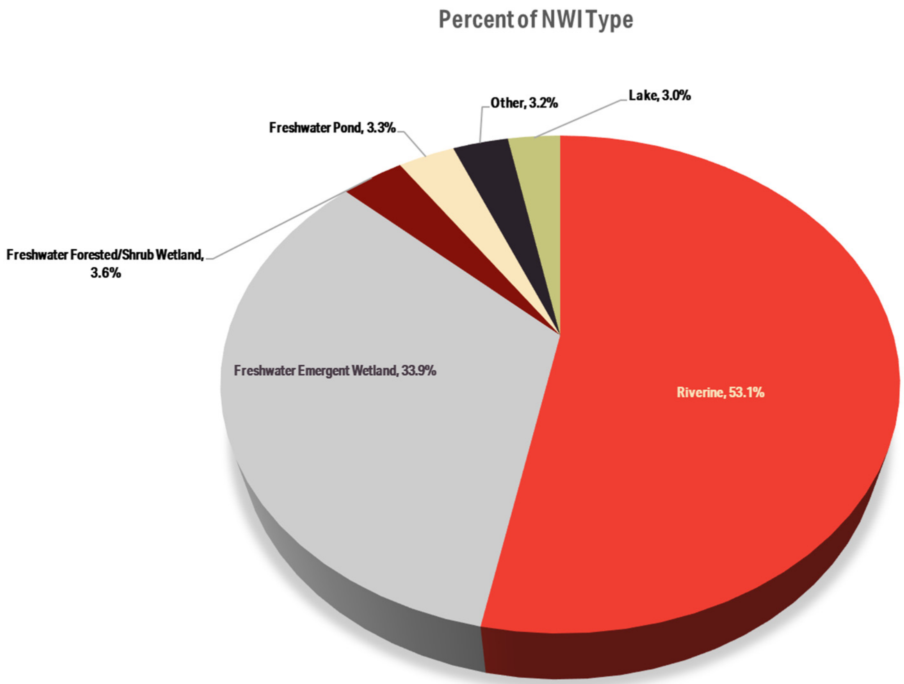


**Figure 3.53.** Percent Distribution of National Wetlands Inventory Types Within the Study Area.

In 2009, The Nature Conservancy (TNC) in cooperation with the WGFD and USFWS delineated and prioritized wetland complexes throughout Wyoming [Copeland et al., 2010; Wyoming Joint Ventures Steering Committee, 2010]. The Wyoming Joint Ventures Steering Committee [2010] identified nine wetland complexes to focus project implementation; however, the Goshen Hole Wetland Complex (GHWC) was the only complex located within the study area. The GHWC contains approximately 9,669 acres of wetlands with high waterfowl and waterbirds production, migration stopover, and winter habitat [Tibbets et al., 2016]. The complex is in a low-lying basin, known as Goshen Hole, within the low North Platte River floodplain, predominately composed of Freshwater Emergent wetlands which include irrigated hayfields, wet meadows, and emergent vegetation zones around rivers and ponds.

**Table 3.14. National Wetlands Inventory Wetland Types Within the Study Area Table**

| Wetland Type | Area (acres) | Percent of Wetland Area |
|---|---|---|
| Riverine | 7,118 | 53.1 |
| Freshwater Emergent Wetland | 4,542 | 33.9 |
| Freshwater Forested/Shrub Wetland | 480 | 3.6 |
| Freshwater Pond | 437 | 3.3 |
| Other | 428 | 3.1 |
| Lake | 404 | 3.0 |
| **Total** | **13,409** | **100.0** |

### 3.3.2.3 *Vegetation and Plant Communities*

Existing vegetative cover in the watershed was evaluated by using data obtained through the LANDFIRE program [USGS, 2010]. LANDFIRE vegetation maps are mostly derived from the NatureServe ecological classifications. Other data are derived from the NLCD, National Vegetation Classification Standard (NVCS) Alliances, and LANDFIRE specific types. The LANDFIRE data includes many relevant attributes such as EVT, existing vegetation height (EVH), and existing vegetation cover (EVC).

The LANDFIRE existing vegetation data specify 14 different vegetation classes and 57 different vegetation types within the study area. The LANDFIRE EVT data were analyzed, and all the classifications are summarized in Table 3.15. The dominant EVTs include Western Great Plains Shortgrass Prairie (34.8 percent), Introduced Upland Vegetation-Annual Grassland (13.8 percent), Northwestern Great Plains Mixed Grass Prairie (12.2 percent), NASS-Close Grown Crop (9.1 percent), and Western Great Plains Sand Prairie (8.7 percent) all cover a total of 43.8 percent of the watershed. The remaining 21.4 percent of the watershed consisted of 52 different vegetation types. LANDFIRE EVT data are mapped in Figure 3.55, to illustrate the existing vegetation types within the study area.

Most of the study area has grassland vegetation, which primarily occur at lower elevations on rolling plains or foothills. Most grassland communities have been influenced by grazing, fire or fire suppression, and Invasive, Nonnative Plant Species (INPS). Within the watershed, livestock grazing is one of the major income-producing industries. Mixed-grass vegetation is predominately used for livestock and wildlife grazing. Vegetative communities within the study area vary because of the differing topography, geology, soils, climate, fire history, and surface management. In addition to many grass species, 23 native flowering plants identified by the WYNDD that occur in the watershed and listed in Table 3.16.

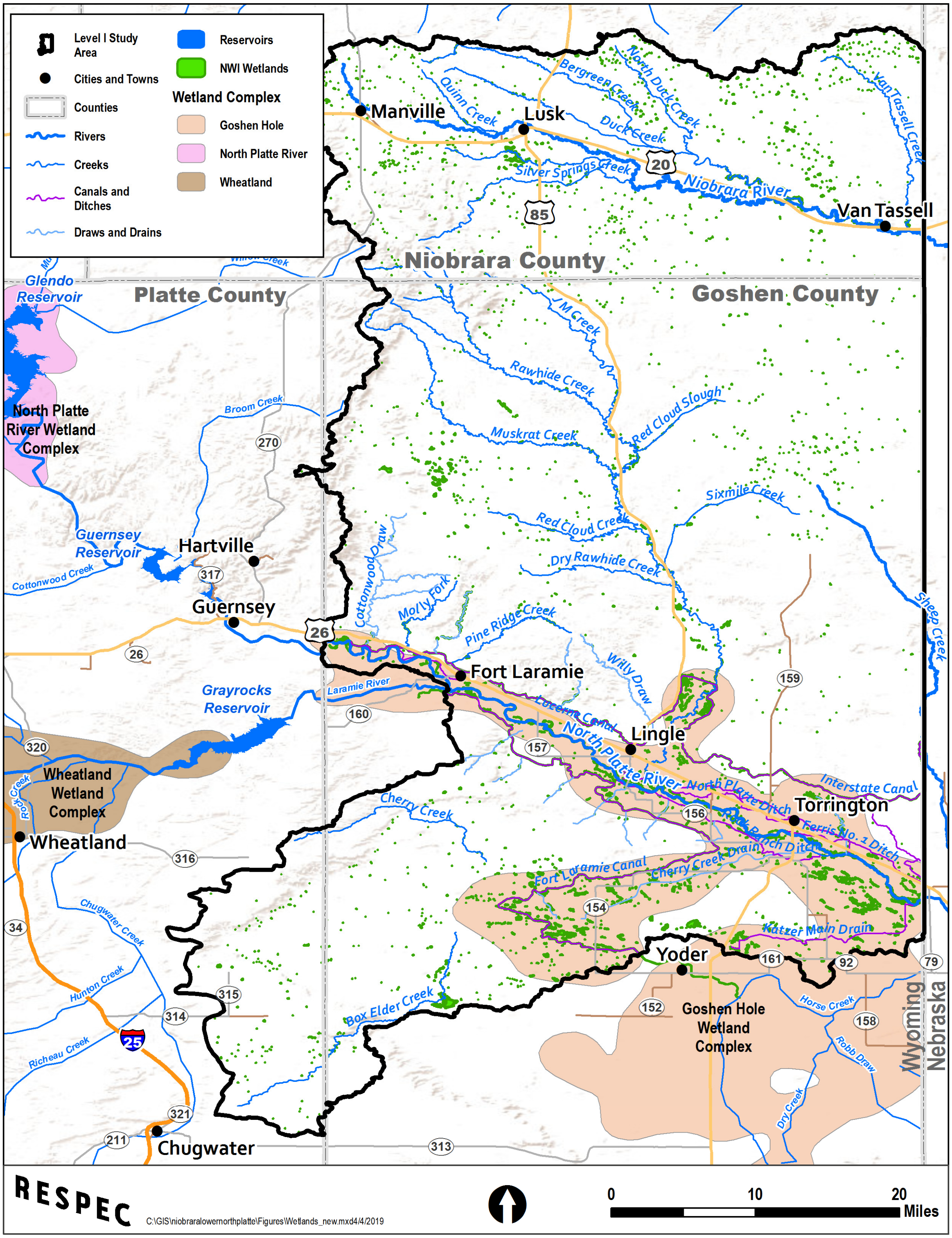


**Figure 3.54.** National Wetlands Inventory Wetlands Located Within the Study Area.

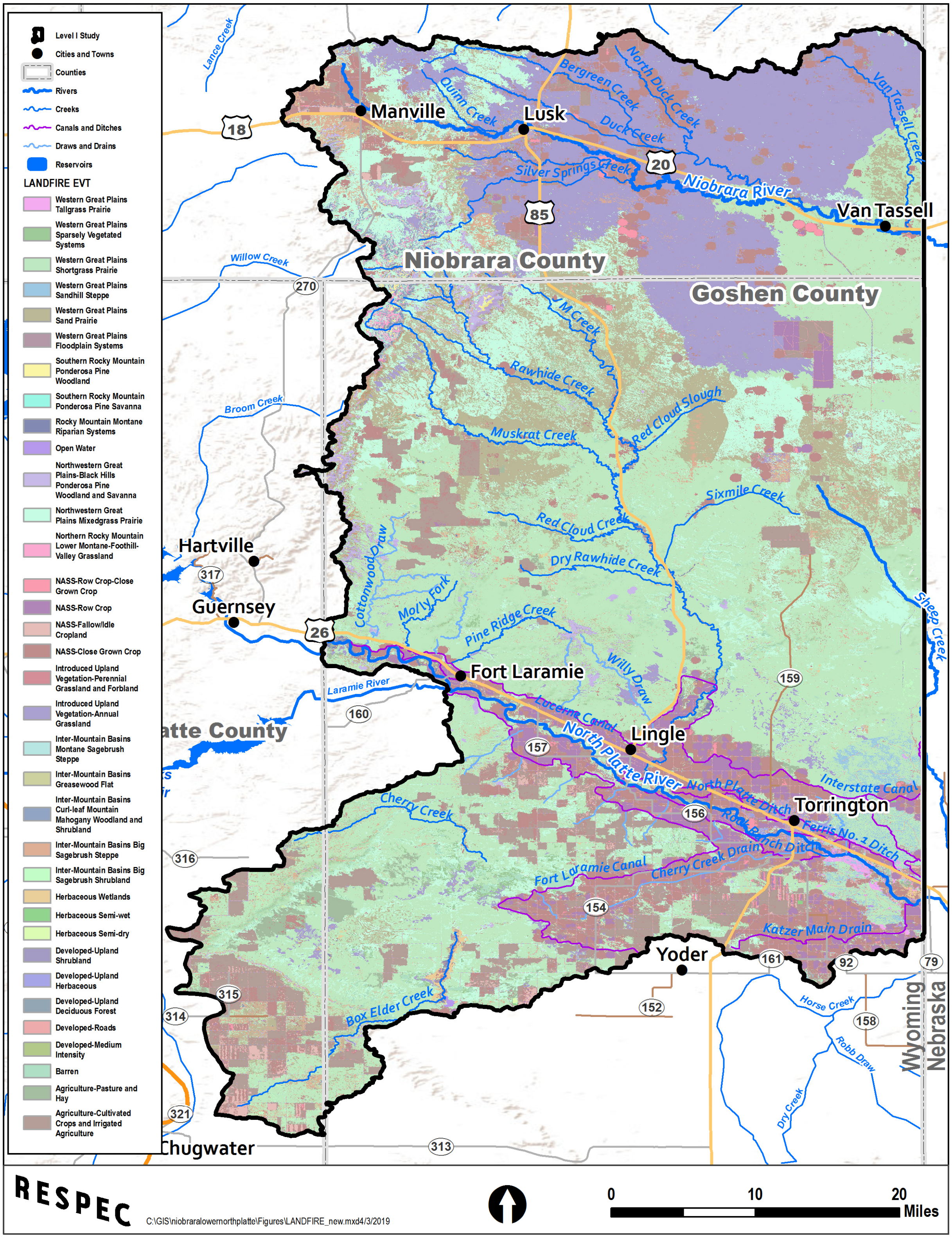


**Figure 3.55.** Existing Vegetation Types (LANDFIRE) Located Within the Study Area.

**Table 3.15. Existing Vegetation Types (LANDFIRE) Within the Study Area**

| Existing Vegetation Type | Area (acres) | Percent of Study Area |
|---|---|---|
| Western Great Plains Shortgrass Prairie | 450,593 | 34.8 |
| Introduced Upland Vegetation-Annual Grassland | 178,168 | 13.8 |
| Northwestern Great Plains Mixed Grass Prairie | 158,011 | 12.2 |
| NASS-Close Grown Crop | 117,791 | 9.1 |
| Western Great Plains Sand Prairie | 112,579 | 8.7 |
| Agriculture-Cultivated Crops and Irrigated Agriculture | 92,438 | 7.1 |
| NASS-Row Crop | 34,776 | 2.7 |
| Inter-Mountain Basins Big Sagebrush Steppe | 32,464 | 2.5 |
| Developed-Roads | 13,881 | 1.1 |
| Other (Less Than 1.0 Percent) | 103,461 | 8.0 |
| **Total** | **1,294,162** | **100.0** |

**Table 3.16. Wyoming Natural Diversity Database: Plant Species Within the Study Area**

| Scientific Name | Common Name | Sensitivity |
|---|---|---|
| *Asclepias arenaria* | sand milkweed | Nonsensitive |
| *Carex emoryi* | Emory's sedge | Nonsensitive |
| *Celtis occidentalis* | common hackberry | Nonsensitive |
| *Chenopodium subglabrum* | smooth goosefoot | Nonsensitive |
| *Chenopodium watsonii* | Watson's goosefoot | Nonsensitive |
| *Cuscuta indecora var. neuropetala* | bigseed dodder | Nonsensitive |
| *Cuscuta megalocarpa* | bigfruit dodder | Nonsensitive |
| *Cuscuta plattensis* | prairie dodder | Nonsensitive |
| *Cyperus acuminatus* | tapertip flatsedge | Nonsensitive |
| *Cyperus bipartitus* | slender flatsedge | Nonsensitive |
| *Dalea cylindriceps* | Andean prairie clover | Sensitive |
| *Dalea villosa var. villosa* | silky prairie clover | Nonsensitive |
| *Diaperia prolifera var. prolifera* | bighead pygmycudweed | Sensitive |
| *Euphorbia geyeri var. geyeri* | Geyer's sandmat | Nonsensitive |
| *Eustoma grandiflorum* | showy prairie-gentian | Nonsensitive |
| *Fimbristylis puberula var. interior* | hairy fimbry | Sensitive |
| *Ipomopsis longiflora ssp. longiflora* | flaxflowered ipomopsis | Nonsensitive |
| *Liatris lancifolia* | lanceleaf blazing starp | Nonsensitive |
| *Lipocarpha aristulata* | awned halfchaff sedge | Nonsensitive |
| *Lobelia siphilitica var. ludoviciana* | great blue lobelia | Nonsensitive |
| *Monarda pectinata* | pony bee balm | Nonsensitive |
| *Palafoxia rosea* | rosy Palafox | Nonsensitive |
| *Pediomelum digitatum* | palmleaf Indian breadroot | Nonsensitive |
| *Penstemon angustifolius var. caudatus* | broadbeard beardtongue | Nonsensitive |
| *Schoenoplectus saximontanus* | Rocky Mountain bulrush | Nonsensitive |
| *Sparganium eurycarpum* | broadfruit bur-reed | Sensitive |
| *Spiranthes diluvialis* | Ute lady's tresses | Sensitive |
| *Triodanis holzingeri* | Holzinger's Venus' looking-glass | Nonsensitive |

## 3.4 ANTHROPOGENIC SYSTEMS

### 3.4.1 Agricultural Water Use

Water is primarily used by agricultural producers to irrigate crop and hay lands for grain and forage production including alfalfa, corn, dry edible beans, pasture grasses, sugar beets, potatoes, and wheat crops within the watershed. Irrigation development along the North Platte River and tributaries had an early history beginning in the 1840s near Fort Laramie [McKinley, 1938]. Today, irrigation within the watershed is supplied by surface and groundwater sources providing water to more than 108,000 acres in the North Platte Valley, Goshen Hole, and near Prairie Center, Lusk, Manville, and Van Tassell.

Agricultural producers also provide drinking water for livestock including beef cows and calves, sheep and lambs, hogs and pigs, and horses. Agricultural lands and producers also provide drinking water and aquatic habitat for resident and migratory wildlife including big game and small mammals, reptiles and amphibians, furbearers, raptors, waterfowl, upland game birds, nongame birds, and native and nonnative fishes throughout the study area. Currently, there are more than 1,750 permitted stock wells and 220 stock reservoirs providing water for livestock within the watershed.

#### 3.4.1.1 *Irrigated Lands*

Irrigated lands within the watershed mainly consist of center pivot systems and gated-pipe flood-irrigated corn and alfalfa crop fields which are managed to produce grain and hay for livestock forage. These irrigated lands are mostly located on alluvium-derived soils found on the valleys along the North Platte River and Niobrara River. Irrigated lands are also located on tablelands from northeast of Lusk to south of Prairie Center and east of Jay Em, which are supplied by wells drilled into the Arikaree Formation.

Irrigated lands polygons from WWDC's Platte River Basin Plan Update and the Northeast Basin Plan Update studies were overlaid onto the NAIP aerial imagery to determine irrigated acreages within the study area. These irrigated layers were updated using 2015 NAIP imagery for the study and incorporated in to the project geodatabase. Detailed field mapping of irrigated lands was not part of the scope of this Level I study.

In 2006, approximately 108,135 acres of irrigated land were identified within the study area, which comprised 8.4 percent of the study area. In 2012, that amount dropped to approximately 98,055 irrigated acres, indicating an estimated 9.3 percent reduction from 2006. The reduction in irrigated acres in 2012 was a result of diminished runoff period and low streamflows caused by below-average precipitation and snowpack within the Platte Basin during the 2012 water year [SEO, 2012]. In 2015, approximately 105,895 irrigated acres were identified in the study area, which comprised 8.2 percent of the watershed.

The location of irrigated lands within the study area have been categorized by county and HUC 10 watershed. Of the 105,895 total irrigated acres, the majority (83.7 percent) are located within Goshen County and the remaining 16.3 percent are located within Niobrara County. By HUC 10 watershed, the largest portion (38.7 percent) is located within the North Platte River-Cold Springs Branch Watershed, which encompasses the area just east of Lingle along the North Platte Valley to the state line. The next largest amount of irrigated lands is situated in the Cherry Creek-Cherry Creek Drain Watershed (17.0 percent) within the Goshen Hole and in the Cottonwood Draw-North Platte River Watershed

(14.0 percent) along the area just east of Guernsey along the North Platte Valley to Lingle. Table 3.17 lists the amount of irrigated lands by county, Table 3.18 lists the amount by HUC 10 watershed, and Table 3.19 lists the amount of irrigated lands by irrigation method within the watershed.

**Table 3.17. Irrigated Lands by County Within the Study Area**

| County | 2015 Estimated Area (acres) | 2015 Irrigated Acres (%) |
|---|---|---|
| Goshen | 88,683 | 83.7 |
| Niobrara | 17,212 | 16.3 |
| **Total Acres** | **105,895** | **100.0** |

**Table 3.18. Irrigated Lands by HUC 10 Watershed Within the Study Area**

| Watershed (HUC 10) | 2015 Estimated Area (acres) | 2015 Irrigated Acres (%) |
|---|---|---|
| Cherry Creek-Cherry Creek Drain | 18,000 | 17.0 |
| Cottonwood Draw-North Platte River | 14,818 | 14.0 |
| Duck Creek | 5,819 | 5.5 |
| Lower Rawhide Creek | 6,466 | 6.1 |
| Niobrara River-Lakatoh Ditch | 2,221 | 2.1 |
| Niobrara River-Van Tassel Creek | 2,846 | 2.7 |
| North Platte River-Cold Springs Branch | 40,938 | 38.7 |
| Sheep Creek | 3,437 | 3.2 |
| Silver Springs Creek-Niobrara River | 7,959 | 7.5 |
| Upper Rawhide Creek | 3,391 | 3.2 |
| **Total Estimated Acres** | **105,895** | **100.0** |

**Table 3.19. Irrigation Methods on Irrigated Lands Within the Study Area**

| Irrigation Method | 2015 Estimated Area (acres) | 2015 Irrigated Acres (%) |
|---|---|---|
| Flood (wild and gated pipe) | 44,123 | 41.7 |
| Multiple Irrigation Methods | 1,156 | 1.1 |
| Other (sideroll, handline, and big gun) | 1,812 | 1.7 |
| Center Pivot | 58,804 | 55.5 |
| **Total** | **105,895** | **100.0** |

### 3.4.1.2 *Irrigation Conveyances*

A total of 18 irrigation canals and ditches carry 3 cfs or more of fully adjudicated water rights from existing points of diversion (POD) within the watershed. These canals and ditches total approximately 191.5 miles of conveyance. However, this total does not include the numerous laterals, ditches, and drains that are operated as part of five irrigation districts and six ditch companies within the study area. Almost all these conveyances carrying more than 3 cfs are in the North Platte River-Cold Springs Branch and Cherry Creek-Cherry Creek Drain watersheds along the North Platte Valley from just west of the Whalen Diversion, which is located on the North Platte River approximately 6½ miles west-northwest of the town of Fort Laramie to the state line. Table 3.20 lists the 3 cfs irrigation canals and ditches and Figure 3.56 shows the canals, ditches, and PODs within the study area.

**Table 3.20. Canals and Ditches With Flow Greater Than 3 Cubic Feet per Second Within the Study Area**

| Facility Name | Length (feet) | Length (miles) | Township | Range | Section |
|---|---|---|---|---|---|
| Bartlett No. 2 Ditch | 6,297 | 1.2 | 29N | 63W | 25 |
| Bredthauer No. 1 Ditch | 2,612 | 0.5 | 32N | 64W | 11 |
| Burbank Ditch | 26,382 | 5.0 | 26N | 64W | 23 |
| Christian Ditch | 7,727 | 1.5 | 31N | 61W | 4 |
| E B Wilson Ditch | 9,186 | 1.7 | 32N | 64W | 5 |
| Enl. Gratton Ditch | 26,783 | 5.1 | 25N | 63W | 22 |
| Enl. Bartlett No. 1 Ditch | 14,337 | 2.7 | 29N | 63W | 25 |
| Ferris No. 1 Ditch | 46,043 | 8.7 | 24N | 60W | 34 |
| Fort Laramie Canal | 276,773 | 52.4 | 23N | 65W | 11 |
| Hill Irrigation District Main Canal | 21,750 | 4.1 | 24N | 61W | 2 |
| Interstate Canal | 286,841 | 54.3 | 26N | 65W | 11 |
| Lucerne Canal | 78,210 | 14.8 | 26N | 64W | 21 |
| North Platte Ditch | 66,171 | 12.5 | 24N | 60W | 19 |
| Patrick and Smith Ditch | 5,556 | 1.1 | 28N | 62W | 5 |
| Rock Ranch Ditch | 73,275 | 13.9 | 24N | 61W | 23 |
| Snow Ditch | 9,340 | 1.8 | 27N | 62W | 35 |
| Teeters No. 1 Ditch | 941 | 0.2 | 24N | 64W | 23 |
| Torrington Ditch | 52,948 | 10.0 | 24N | 61W | 9 |
| **Total** | **1,011,172** | **191.5** | | | |

The irrigation ditches were delineated using existing digitized flowline data from the NHD and confirmed with 2015 NAIP aerial imagery, USGS topographic maps, and SEO Linen Plats. The delineated, existing ditch flowlines were then cross-referenced with water rights information from the SEO e-Permit online database (*http://seoweb.wyo.gov/e-Permit*) to determine the status of water rights and the name of the ditch. Because existing NHD flowlines were used, these mapped ditches are a general estimate of actual alignments and lengths.

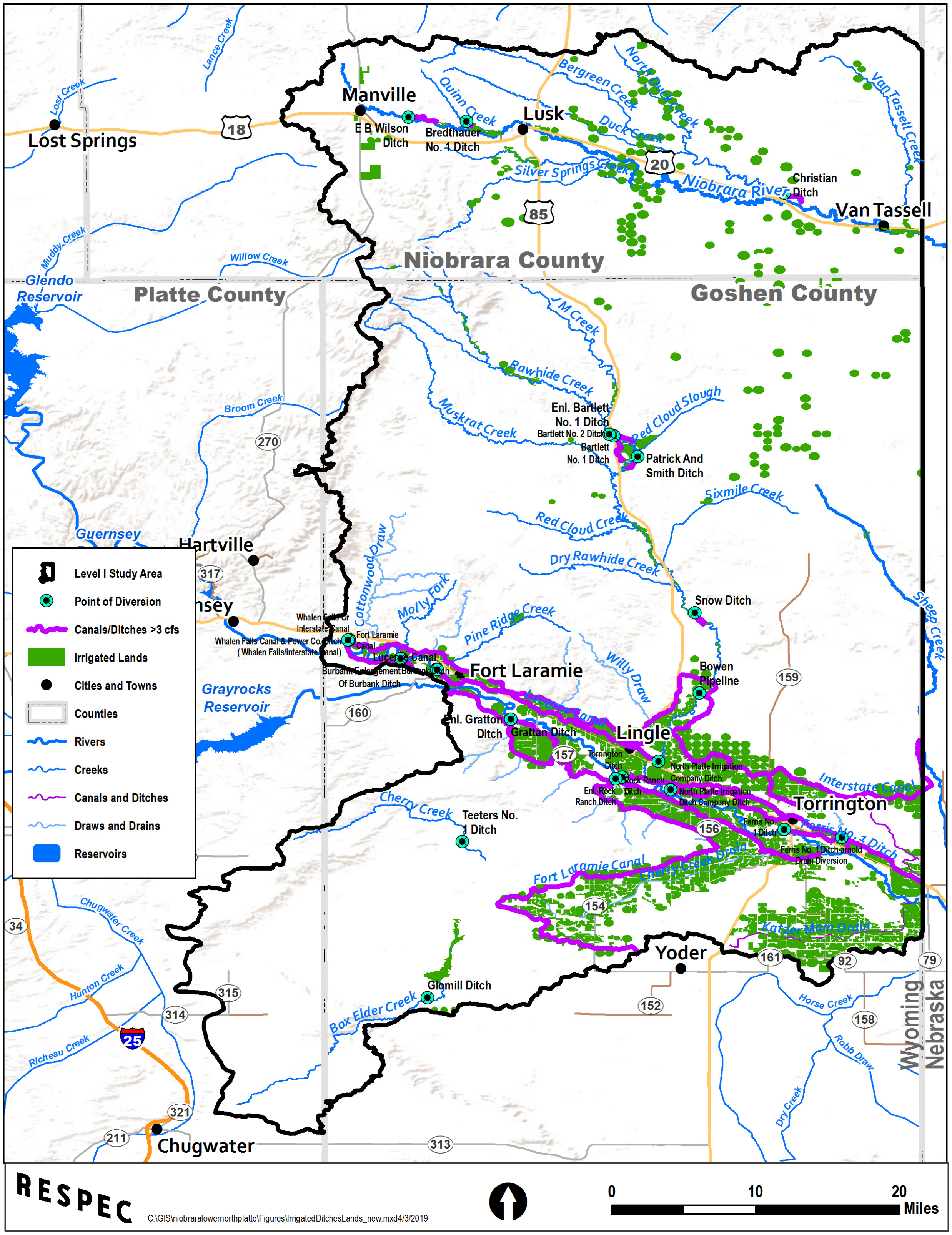


**Figure 3.56.** Irrigation Ditches With Flows Greater Than 3 Cubic Feet per Second and Irrigated Lands Within the Watershed.

### 3.4.1.3 *North Platte Project*

The North Platte Project in Wyoming and Nebraska consists of Pathfinder Dam and Reservoir; Guernsey Dam, Reservoir and Powerplant; Whalen Dam; Northport, Fort Laramie, and Interstate Canals; and four off stream inland reservoirs on the Interstate Canal along with 1,602 miles of canals and laterals; and, 352 miles of open drains, and 194 miles of electric transmission lines [Autobee, 1996; USBR, 2018]. The North Platte project extends 111 miles along the North Platte Valley from Guernsey, Wyoming to Bridgeport, Nebraska and provides irrigation water to about 226,000 acres within four irrigation districts and 109,000 acres within 8 water-user associations [Autobee, 1996; USBR, 2018]. Since 1909, irrigation water has been diverted at Whalen Dam on the North Platte River into the Fort Laramie Canal on the south side of the river and into the Interstate Canal on the north side of Whalen Dam. The Fort Laramie Canal was completed in 1924 with a capacity of 1,500 cfs and delivers water for 129 miles to an area south of Gering, Nebraska. The Interstate Canal was completed in 1915 with a capacity of 2,100 cfs and delivers water for 95 miles to Lake Alice and Lake Minatare (i.e., Inland Lakes) northeast of Scottsbluff, Nebraska.

### 3.4.1.4 *Irrigation Districts*

The WWDC's *2017 Irrigation System Survey Report* lists thirteen entities including four irrigation districts, seven ditch companies, and two water-user associations operating within the study area. The four irrigation districts deliver water to over 59,320 irrigated acres and more than 500 water users. The ditch companies provide water to another 9,160 irrigated acres and 55 water users while the water-user associations deliver water to approximately 13,480 acres and 97 water users within the watershed. Table 3.21 is a summary of the entities' responses about their diversions, conveyances, and needed improvements included in the WWDC's 2017 survey. Figure 3.57 shows the general locations of the irrigation districts, diversions, canals, and ditches delivering more than 3 cfs of irrigation water within the study area.

The four irrigation districts within the watershed include: the Goshen Irrigation District (GID), Hill Irrigation District, Pratte-Ferris Irrigation District, and the Torrington Irrigation District. Irrigation water for approximately 15,000 acres to the Hill Irrigation District and the Lingle Water Users Association is delivered under USBR contracts via the Interstate Canal which is operated by the Pathfinder Irrigation District headquartered in Mitchell, Nebraska. In addition to the irrigation districts, there are two water-user associations; the Goshen Hole Water Users Association and the Lingle Water Users Association along with seven companies including; Burbank Ditch, Goshen Mutual Reservoir & Ditch Company, Lucerne Canal & Power Company, New Grattan Ditch Company, New North Platte Irrigation & Ditch Company, Rock Ranch Ditch Company, and Wright & Murphy Ditch Company, which deliver water to irrigated acres within the watershed. These entities are also listed in Table 3.21 but detailed information about these systems was unavailable.

***Goshen Irrigation District***

The GID was formed in 1926 following the construction of the North Platte Project by the USBR and assumed responsibilities for the Fort Laramie Canal, which is also known as the Gering-Fort Laramie Canal [Autobee, 1996; Anderson Consulting Engineers, Inc., 2008]. The Fort Laramie Canal begins at Whalen Dam and provides irrigation water for 52,484 acres predominantly located south of the North Platte River and north of the Fort Laramie Canal in Wyoming. The canal also delivers irrigation water to 54,850 acres of land in Nebraska.

**Table 3.21. Summary of Irrigation District, Ditch Company, and Water-User Association Responses From the Wyoming Water Development Commission 2017 Irrigation System Survey**

| Entity | Surface Source | Diversion Type | Conveyance Type | Conveyance Length (miles) | Conveyance Loss (%) | Irrigated Acres | Number of Water Users | Needed Improvements |
|---|---|---|---|---|---|---|---|---|
| Angel Draw Irrigation District | NA | NA | NA | NA | NA | NA | NA | NA |
| Burbank Ditch | North Platte | Pump | Ditch and Pipe | 5 | 20-30 | 391 | 1 | Inadequate water supply |
| Goshen Hole Water Users Association | Horse Creek | Old Concrete | NA | NA | 30 | 2516 | 5 | Entire system needs upgrades |
| Goshen Irrigation District | North Platte | Whalen Diversion | Ditch | Canal 85 miles, Laterals 70+ miles | 40 | 52478 | 420 | Inadequate water source, seepage problems |
| Goshen Mutual Reservoir & Ditch Company | Horse Creek | Diversion Dam | Ditch | 4 | 60 | 641 | 9 | drought, excessive water loss |
| Hill Irrigation District | Glendo and Guernsey Reservoir | NA | NA | NA | NA | 3844.6 | 79 | NA |
| Lingle Water Users Association | North Platte | Whalen Diversion | Canal | 0 | 17 | 10970 | 92 | None |
| Lucerne Canal and Power Company | North Platte | NA | NA | NA | NA | NA | NA | NA |
| New Grattan Ditch Company | Glendo Contract | Dam | Ditch | 4 | 50 | 1323 | 4 | Structure Replacement |
| New North Platte Irrigation & Ditch Company | North Platte | Dam, Headgate | Ditch and Pipe | 12 | 30 | 3000 | 18 | Diversion dam on river |
| Pratte-Ferris Irrigation District | North Platte | Headgate | Ditch | 10 | NA | 600 | 2 | Improvements for conveyance loss |
| Rock Ranch Ditch Company | North Platte | Dam, Headgate | Ditch | 14.5 | NA | 3561 | 22 | Diversion dam on river |
| Torrington Irrigation District | North Platte, Rawhide Creek | Dam | NA | 25 | 15-20 | 2400 | NA | NA |
| Wright & Murphy Ditch Company | Glendo, North Platte | GID Canal | Ditch | 1 | 0 | 245 | 1 | NA |
| Corn Creek Irrigation District | NA | NA | NA | NA | NA | NA | NA | NA |

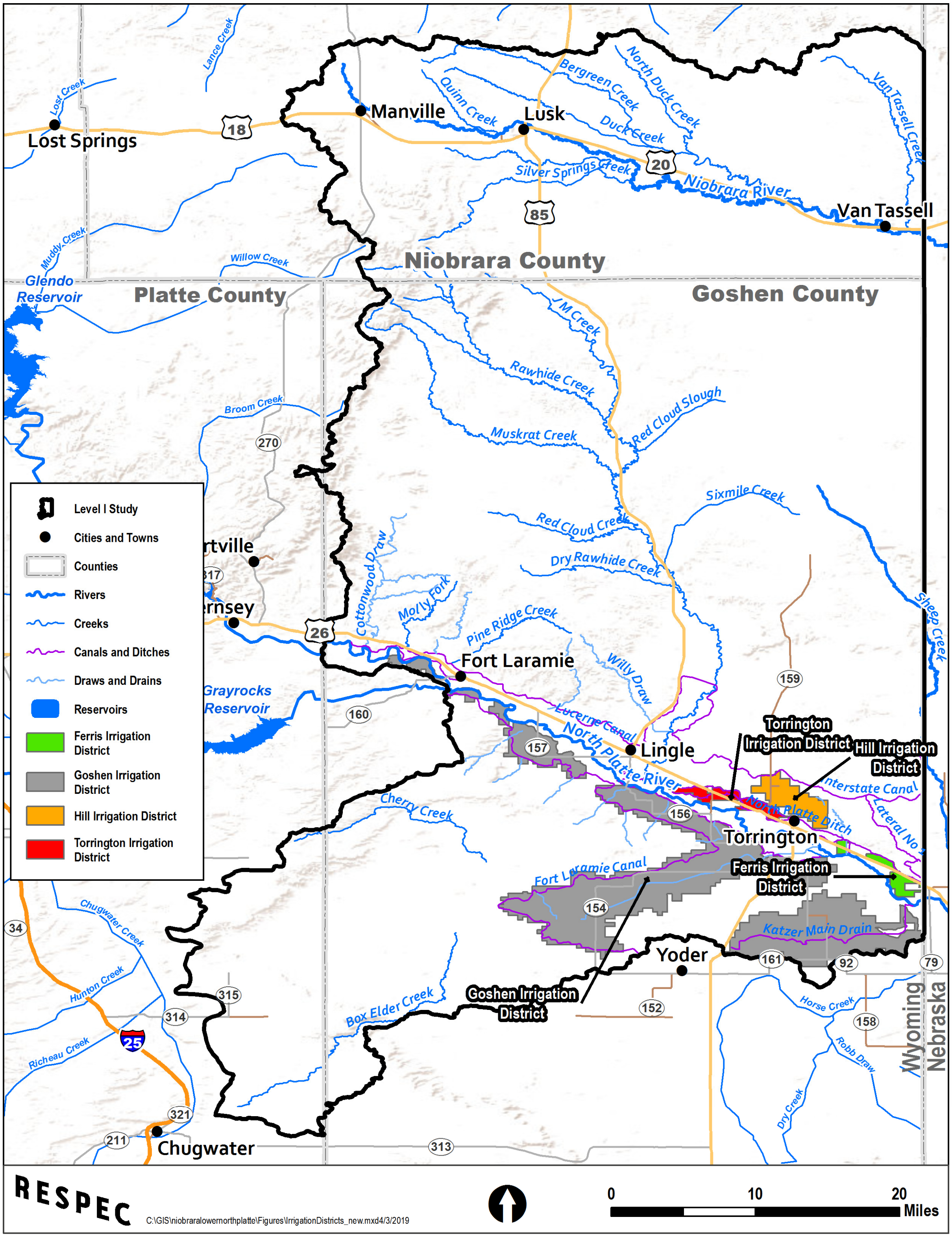


**Figure 3.57.** Irrigation Districts and Irrigated Canals Within the Watershed.

The GID's source of irrigation water is the North Platte River direct flows and stored water in Pathfinder and Guernsey Reservoirs. The GID's primary conveyances include 86 main canal miles, two tunnels, many siphons, two lateral canals, pipelines, and numerous spillways/wasteway structures [Anderson Consulting Engineers, Inc., 2008]. In the past, there have been many Level I and Level II studies completed on behalf of the WWDC, which pertain to the GID and include the following publications:

- Kennedy Engineering, 1985. Final Report on Goshen Irrigation District Rehabilitation Project, November.
- Lidstone & Anderson, Inc., 1991. Goshen Irrigation District Rehabilitation Project Level II, Final Report, December.
- Lidstone & Anderson, Inc., 1993. Final Report for Goshen Irrigation District Horse Creek Re-Regulating Reservoir, Level II Project, December.
- Lidstone & Anderson, Inc., 1999. Goshen Hole and Goshen Mutual Irrigation Canal Companies Improvements Project Level II, Final Report, January.
- Anderson Consulting Engineers, Inc., 1999. Goshen Irrigation District Rehabilitation Project Level II, Final Report, November.
- Anderson Consulting Engineers, Inc., 2008. Final Report for Goshen Irrigation District Master Plan Level I, August.

As part of the GID's 2008 Master Plan, a review of facilities indicated that the GID had implemented 75 of the 106 improvements identified in the previous studies [Anderson Consulting Engineers, Inc., 2008]. The project also included proposed improvements database, structure inventory and assessment, seepage loss determinations, GID geospatial database, conceptual design and costs, and plan improvements economic estimates. Since 2008, the GID has received Level III funding from the WWDC to implement many projects that include but are not limited to the following improvements:

- Automate three canal spillway gates
- Automate 11 control sites for regulating flows
- Convert 16 miles of ditches in 29 pipe segments
- Rehabilitate the Check Structure 45.1, Main Canal Lateral 45.1 and Tunnel No. 1.
- Convert the Table Mountain Lateral and Springer Main ditches to pipelines
- Rehabilitate tile pipeline laterals, 6.7 and 45.1, with poly vinyl chloride (PVC) pipe.

***Hill Irrigation District***

The Hill Irrigation District delivers water from the North Platte River via the Interstate Canal to approximately 3,800 irrigated acres situated north and east of Torrington. The Hill Irrigation District began operating around 1900 and their system includes a headgate and weir for diverting and measuring water from the Interstate Canal; approximately 5 miles of main canal; and numerous field turnouts and crossings [Lidstone & Anderson, Inc., 1997]. The GID can divert between 54.4 cfs and 108.8 cfs at the headgate on the Interstate Canal, depending on availability of surplus flow with many irrigators supplementing their water supplies through irrigation wells [Lidstone & Anderson, Inc., 1997]. As part of the GID's Level II Project, an inventory of existing structures was completed; a rehabilitation plan for recommended improvements was developed; and conceptual designs and potential costs were estimated.

***Pratte-Ferris Irrigation District***

The Pratte-Ferris Irrigation District (formerly Ferris Irrigation District) was formed in 1989 [Kennedy Engineering, 1990]. The Ferris Canal (Ferris No. 1 Ditch) diverts at a diversion dam on the North Platte River just upstream of US Highway 85 near Torrington and delivers water to the District which is located southeast of the city of Torrington to the state line south of the Ferris Canal and north of the North Platte River [Kennedy Engineering, 1990]. The Ferris Canal (Ferris No. 1 Ditch) has a territorial water right priority of May 22, 1886 which allows the diversion of 22.01 cfs for irrigation of 1,655 acres [Kennedy Engineering, 1990]. In the past, Phase I, Phase II and Level II studies have been completed on behalf of the WWDC, which pertain to the Ferris Irrigation District and include the following reports:

- Eastern Wyoming Engineering and Surveying, 1989. Ferris Ditch Diversion Rehabilitation Project, Phase I Report, June 9, 1989, June.
- Eastern Wyoming Engineering and Surveying, 1989. Ferris Ditch Diversion Rehabilitation Project, Phase II Report, Final Report, October.
- Kennedy Engineering, 1990. Ferris Irrigation District Canal Improvements Project Level II Feasibility Report, December.

In 1989, the Pratte-Ferris Irrigation District's diversion dam and a portion of the main canal from the diversion dam to US Highway 85 were identified as needing reconstructed, which led to the construction in 1992 of a new diversion dam, the rehabilitation of the canal from the diversion dam to US Highway 85, and the reconstruction of the second wasteway and the main measuring flume located near Highway 26 [Eastern Wyoming Engineering and Surveying Professionals, 1989; Kennedy Engineering, 1990]. These improvements optimized the Pratte-Ferris Irrigation District's use of this early season water [Kennedy Engineering, 1990].

***Torrington Irrigation District***

The Torrington Irrigation District delivers water from the North Platte River via the Torrington Ditch to approximately 2,400 irrigated acres that are situated west of the city of Torrington. The Torrington Irrigation District began operating as the Torrington Ditch Company around 1890 and their system includes a diversion dam and 25 miles of conveyances [WWDC, 2017]. The Torrington Irrigation District can divert 34.88 cfs from the North Platte River and Rawhide Creek and stored water in the Glendo Reservoir [Trihydro, 2006; WWDC, 2017].

***Pathfinder Irrigation District***

The Pathfinder Irrigation District was formed in 1926 in Nebraska after the construction of the North Platte Project by the USBR and has assumed responsibilities for the Interstate Canal, which delivers water from the Whalen Diversion Dam on the North Platte River via the Interstate Canal to approximately 68,886 acres in both Wyoming and Nebraska [Autobee, 1996; Pathfinder Irrigation District, 2017; USBR, 2018]. The Pathfinder Irrigation District operates and maintains approximately 98 miles of the Interstate Canal (54 miles in Wyoming and 44 in Nebraska), 82 miles of secondary canals, and 600 miles of open laterals and buried pipelines as part of the USBR North Platte Project's Interstate Division [Pathfinder Irrigation District, 2017]. The Interstate Canal flows east on the north side of the river for 54 miles to the state line and then continues to flow east into Nebraska for 44 miles and enters Lake Alice and Lake Minatare Reservoirs (i.e. Inland Lakes) northeast of Scottsbluff, Nebraska [Pathfinder Irrigation District, 2017]. The USBR's Interstate Division by contract provides irrigation water for approximately 15,000 acres to the Hill Irrigation District and the Lingle Water Users in Wyoming [Pathfinder Irrigation District, 2017].

In 2004, the USGS, in cooperation with the North Platte Natural Resources District, used continuous resistivity profiling techniques to map near-surface lithologies of the Interstate and Tri-State Canals in western Nebraska and eastern Wyoming. This study provided information needed for a groundwater flow model and improved the general understanding of groundwater recharge [Ball, et al., 2006]. Test holes were drilled at multiple locations in both canals to verify the results of the resistivity surveys, to compare the effectiveness of the two techniques, and to develop an interpretive scale that was used to estimate the relative canal leakage potential [Ball et al., 2006]. Ball et al. [2006] applied the interpretive scale to the vertically averaged resistivity and classified areas of the canals as having either high, moderate, or low canal leakage potential as shown in Figure 3.45. The Interstate Canal intersects multiple outcrops of the Brule Formation, and typically is bordered by dry rangeland to the north and irrigated cropland to the south [Ball et al., 2006]. A wide range of canal leakage potential values was observed along the Interstate Canal; however, the highest canal leakage potential in the canal was found west of the state line in Wyoming as shown in Figure 3.58.

## 3.4.2 Domestic, Municipal and Industrial Water Use

### 3.4.2.1 *Potable Water Systems*

The domestic, municipal, and industrial (DMI) water systems use groundwater to supply their water users, communities, and customers. The watershed contains 2,362 permitted DMI wells including 2,311 domestic wells, 15 industrial wells, and 36 municipal wells. The WWDC's *2016 Public Water System Survey Report* lists five towns, one water and sewer district, and one city that provide potable water within the study area including the towns of Fort Laramie, Lingle, Lusk, and Manville, South Torrington Water & Sewer District, and the city of Torrington. The municipalities of Fort Laramie, Lingle, Lusk, Manville, and Torrington have groundwater wells with depths ranging 70–1,100 feet deep. According to the WWDC's *Platte River Basin Plan 2016 Update*, the total annual diversions in 2013 for the Fort Laramie, Lingle, and Torrington municipal water systems were 18.77, 83.42, and 583.02 millions of gallons, respectively.

In 2010, Goshen County, the City of Torrington, Scotts Bluff County, and City of Scottsbluff entered into an agreement with the USBR through the federal Rural Water Supply Program to conduct an Appraisal Investigation for the Platte Alliance Water Supply (PAWS) [USBR, 2014]. The Goshen County Commission is the sponsor of the project, which is examining the concept of replacing existing municipal and rural water source supply wells with a regional (interstate) surface water treatment plant and delivery transmission system [WWDC, 2017]. The source of water would be the North Platte River via available and existing storage, consolidation of key correlative municipal/domestic groundwater rights, and other potential tributary or water right purchase opportunities that may be identified [WWDC, 2017]. The study area is comprised of an interstate stretch of the North Platte River Valley and environs extending from Guernsey Reservoir in Wyoming to Bridgeport, Nebraska [WWDC, 2017]. More information is available at the PAWS website (*http://www.plattealliancewatersupply.com/*).

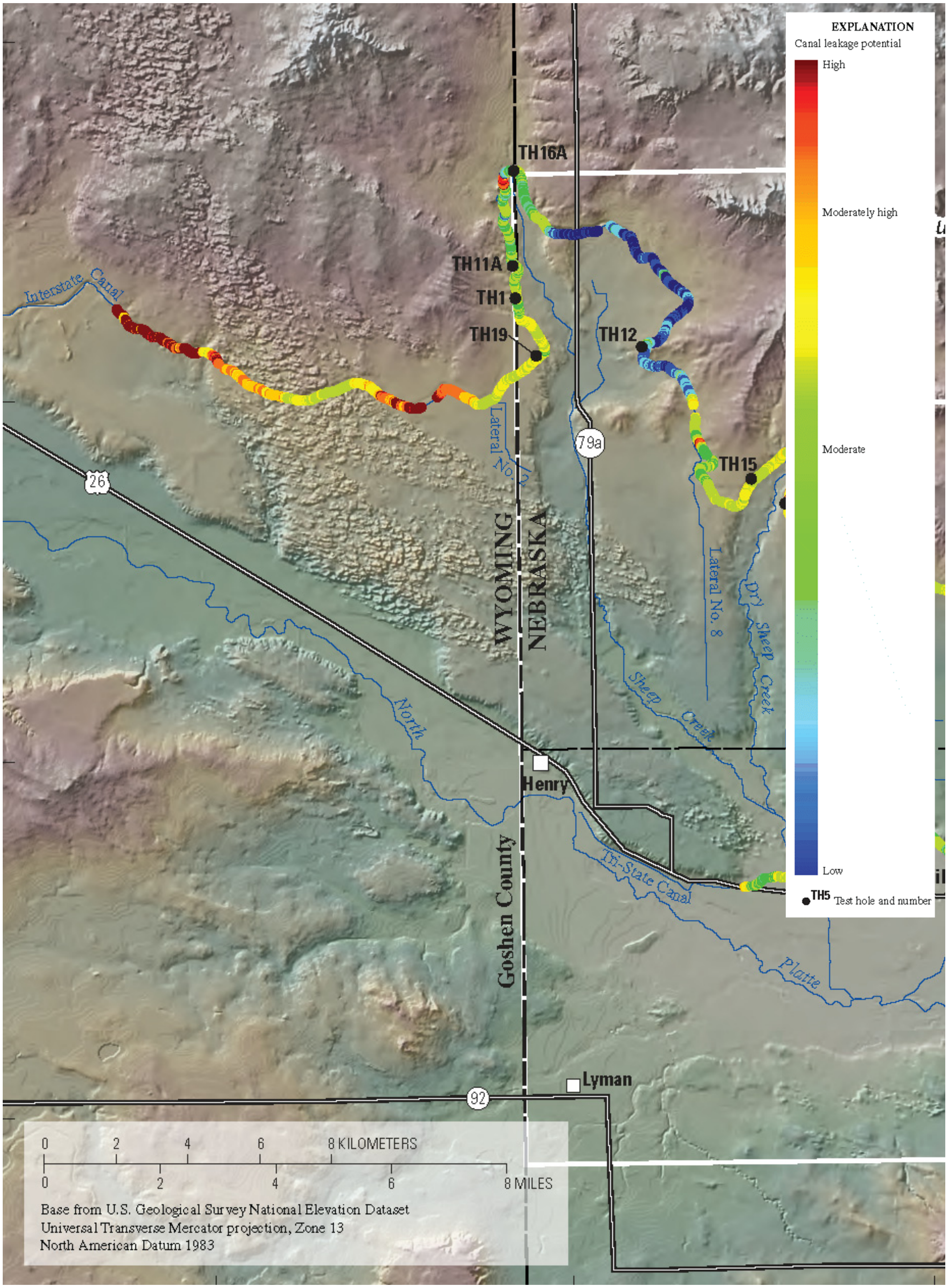


**Figure 3.58.** Potential for Canal Leakage From the Interstate Canal (Adapted From Ball et al. [2006]).

### 3.4.3 Water Storage

Water-storage development within the watershed has been affected by institutional constraints related to the 2001 Modified Decree and/or the Platte River Recovery and Implementation Program (PRRIP), which limits the opportunity to create new reservoir projects or increase existing storage reservoirs through enlargement. Water users identified problems with existing reservoirs that limit the potential to store water in these facilities. Field visits and initial assessments were conducted on ponds, stock reservoirs, and irrigation reservoirs that were identified by participants and are included in Chapter 4.0. Reservoirs with a permitted capacity of 500 acre-feet or greater within the watershed were also mapped and described along with summarizing previously proposed reservoirs within the watershed.

#### 3.4.3.1 *Large Reservoirs*

There are approximately 238 permitted reservoirs/ponds within the watershed. Most of these reservoirs/ponds are considered reservoirs because they have an embankment dam and are constructed on a drainage. These reservoirs/ponds range in total capacity from 0.03 acre-feet to 2,207 acre-feet with a mean capacity of 78.4 acre-feet and median capacity of 6.6 acre-feet. Approximately 150, or two-thirds, of these reservoirs have a capacity of greater than one acre-foot and cumulatively store 11,780 acre-feet.

Existing reservoirs with a permitted capacity of 500 acre-feet or greater within the watershed were mapped and described as part of the study. Six reservoirs with a capacity of 500 acre-feet or greater exist within the study area and include the following facilities: Detention Reservoir Pine Ridge–1, Detention Reservoir Case Bier–1, Arnold Reservoir, Glomill Reservoir, A-3 Reservoir, and Katzer No. 2 Reservoir. Table 3.22 summarizes the e-Permit data, beneficial uses, status, and geographic location of the reservoirs and Figure 3.59 displays the reservoirs with a capacity of 500 acre-feet or greater in the watershed.

**Table 3.22. Reservoirs With a Capacity of 500 Acre-Feet or Greater Within the Study Area**

| Water Rights Number | Reservoir Name | Uses | Permitted Capacity (acre-feet) | Status (Functional or Nonfunctional) | Latitude | Longitude |
|---|---|---|---|---|---|---|
| P6423.0R | Detention Reservoir Pine Ridge - 1 | Flood Control | 2,207.7 | Functional | 42.23123684 | −104.5127512 |
| P6422.0R | Detention Reservoir Case Bier - 1 | Flood Control | 1,458.9 | Functional | 42.24903639 | −104.5410561 |
| CR CR05/092 CR05/002 | Arnold Reservoir Arnold Reservoir, Enlargement | Flood Control | 1,134.5 | Functional | 42.07921133 | −104.144146 |
| CR CR39/554 CR CR08/391 | Glomill Reservoir Glomill Reservoir, Enlargement | Irrigation | 1,296.4 | Functional | 41.8932563 | −104.5358368 |
| CR CR06/003 | A-3 Reservoir | Flood Control | 762.0 | Functional | 42.06988 | −104.35188 |
| CR CC20/178 | Katzer No. 2 Reservoir | Irrigation; Stock | 520.0 | Functional | 41.96244655 | −104.0768072 |

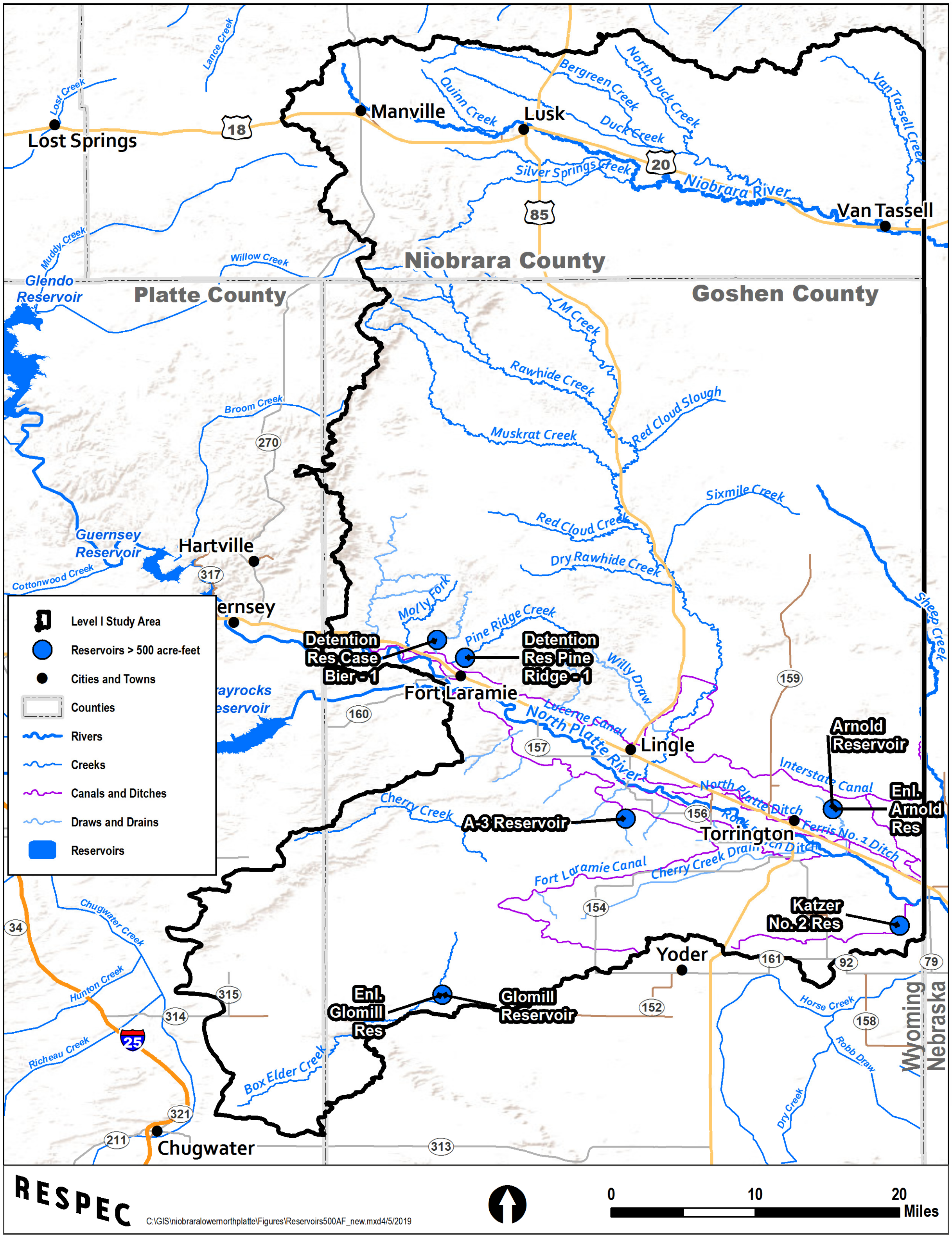


**Figure 3.59.** Reservoirs With a Capacity of 500 Acre-Feet or Greater Within the Watershed.

### 3.4.3.2 *Detention Reservoir Pine Ridge – 1 Reservoir*

The Detention Reservoir Pine Ridge – 1 (Gross Reservoir) is a functional flood control dam and reservoir located on Eaton Draw/Pine Ridge Creek, which is a tributary to the North Platte River. The reservoir is located approximately 1 mile north Fort Laramie in the SW¼ of NW¼ of Section 14 of Township 26 North, Range 64 West in Goshen County. The reservoir was permitted in 1958 (Permit No. P6423.0R) with a capacity of 2,207.7 acre-feet. An aerial view of the reservoir is shown in Figure 3.60.


**Figure 3.60.** Detention Reservoir Pine Ridge – 1 Located North of Fort Laramie.

### 3.4.3.3 *Detention Reservoir Case Bier - 1*

The Detention Reservoir Case Bier – 1 is a functional flood control dam and reservoir located on Case Bier Draw (Sand Draw or Spring Canyon), which is a tributary to the North Platte River. The reservoir is located approximately 2½ miles northwest of Fort Laramie in the SE¼ of SE¼ of Section 4 of Township 26 North, Range 64 West in Goshen County. The reservoir was permitted in 1958 (Permit No. P6422.0R) with a capacity of 1,458.9 acre-feet. An aerial view of the reservoir is shown in Figure 3.61.


**Figure 3.61.** Detention Reservoir Case Bier – 1 Located North of Fort Laramie.

### 3.4.3.4 *Arnold Reservoir and Enlargement*

The Arnold Reservoir is a functional flood control dam and reservoir located on Arnold Drain, which is a tributary to the North Platte River. The reservoir is located approximately 1½ miles northeast of Torrington in the NE¼ of SW¼ of Section 1 of Township 26 North, Range 61 West in Goshen County. The reservoir was permitted in 1934 (CR CR05/092) with a capacity of 770.0 acre-feet, and the enlargement was permitted in 1963 (CR05/002) with a capacity of 364.5 acre-feet for a total capacity of 1,134.5 acre-feet. An aerial view of the reservoir is shown in Figure 3.62.

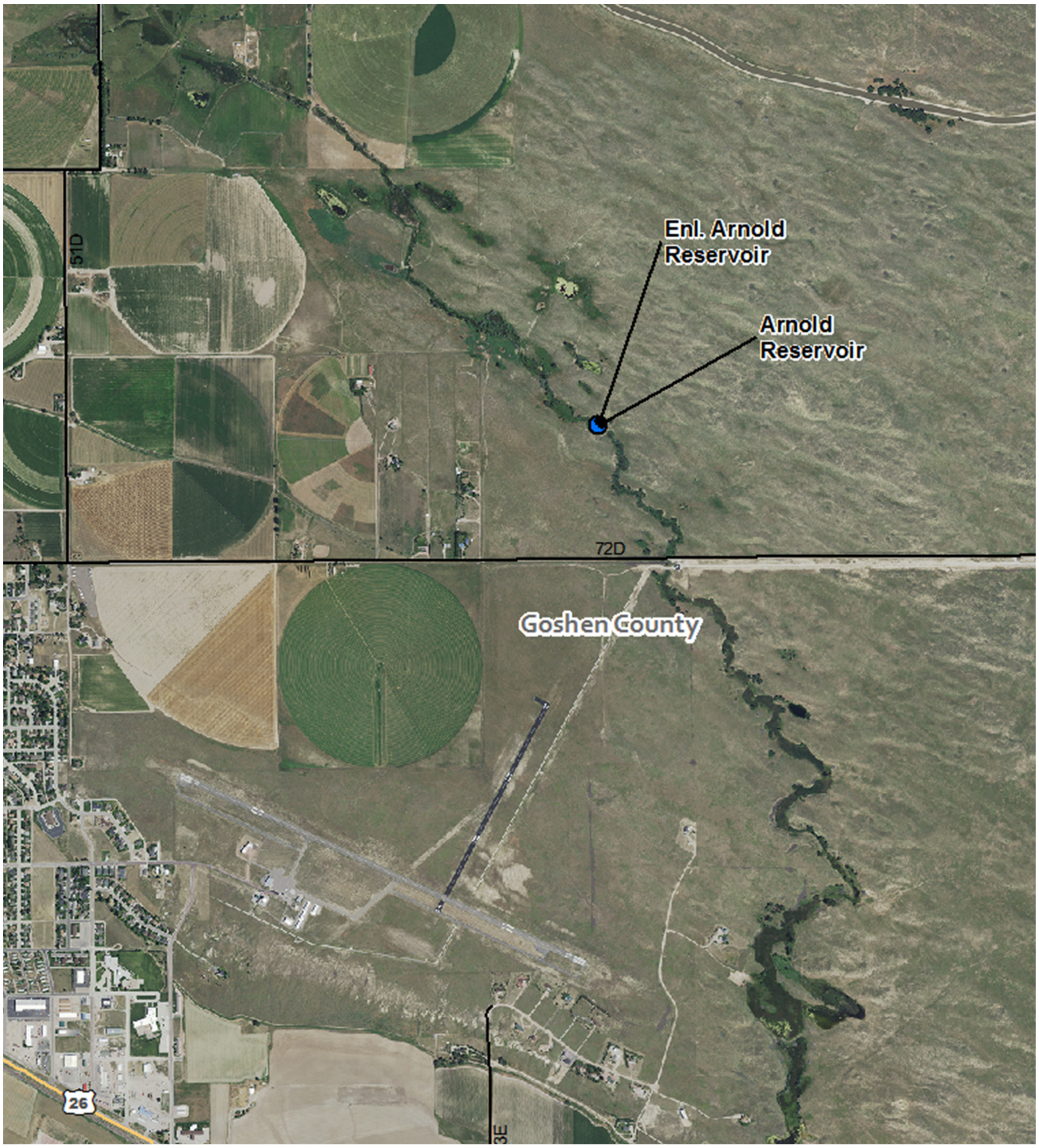


**Figure 3.62.** Arnold Reservoir and Enlargement Located Northeast of Torrington.

### 3.4.3.5 *Glomill Reservoir and Enlargement*

The Glomill Reservoir is a functional, off-channel irrigation dam and reservoir that is located adjacent to Box Elder Creek. The reservoir is located approximately 13 miles west of Yoder in the NW¼ of SW¼ of Section 10 of Township 22 North, Range 64 West in Goshen County. The reservoir was permitted in 1910 (CR CR39/554) with a capacity of 810.0 acre-feet, and the enlargement was permitted in 1975 (CR CR08/391) with a capacity of 486.4 acre-feet for a total capacity of 1,296.4 acre-feet. An aerial view of the reservoir is shown in Figure 3.63.

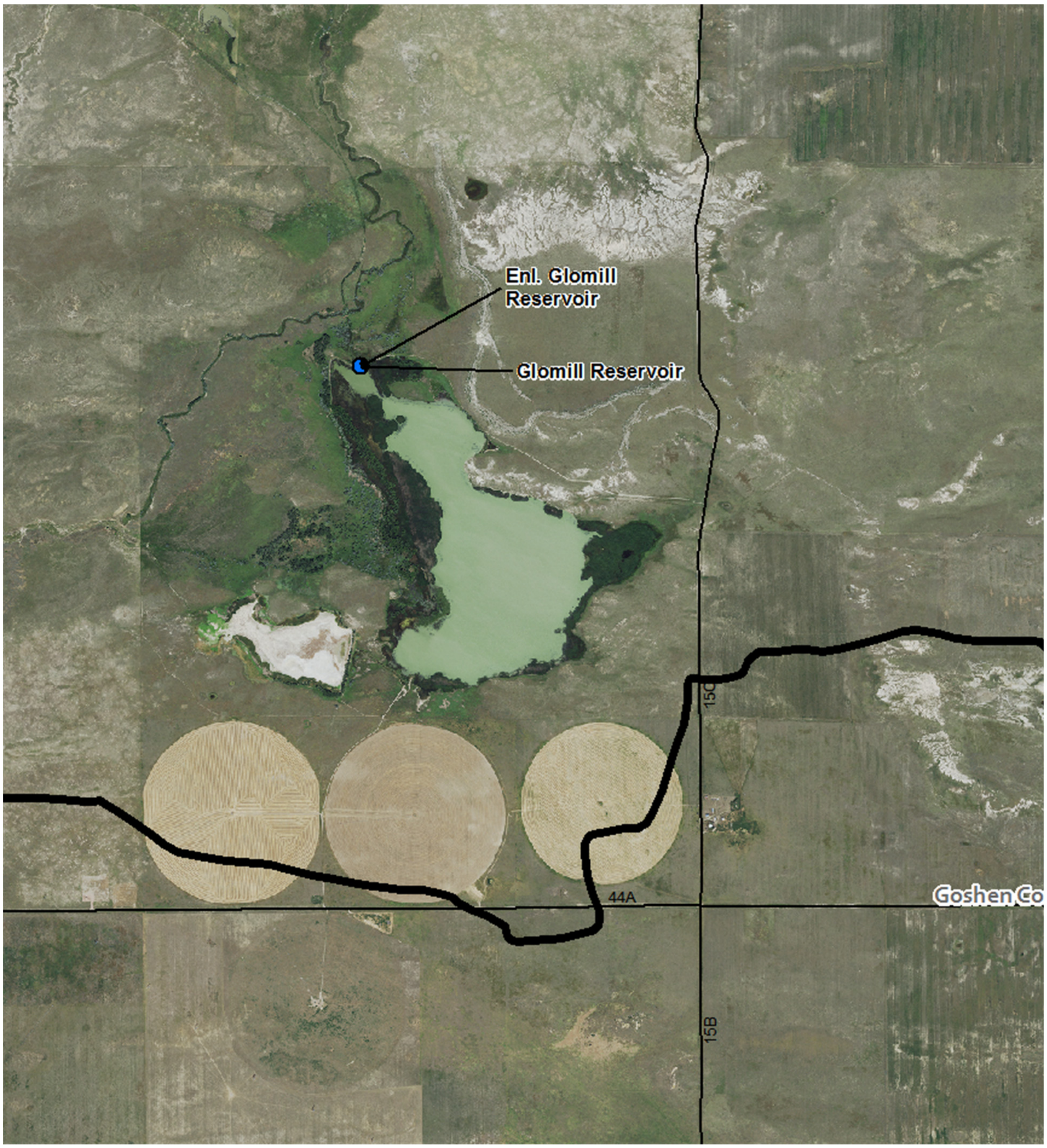


**Figure 3.63.** Glomill Reservoir and Enlargement Located West of Yoder.

### 3.4.3.6 *A-3 Reservoir*

The A-3 Reservoir is a functional flood control dam and reservoir located on Angel Draw, which is a tributary to the North Platte River. The reservoir is located approximately 5 miles south o of Lingle in the SW¼ of NE¼ of Section 7 of Township 24 North, Range 62 West in Goshen County. The reservoir was permitted in 1968 (CR CR06/003) with a capacity of 762.0 acre-feet. An aerial view of the reservoir is shown in Figure 3.64.


**Figure 3.64.** The A-3 Reservoir Located South of Lingle.

### 3.4.3.7 *Katzer No. 2 Reservoir*

The Katzer No. 2 Reservoir is a functional off-channel irrigation and stock dam and reservoir located on adjacent to the Spring Lateral and Katzer Main Drain, which is a tributary to the North Platte River. The reservoir is located approximately 9 miles southeast of Torrington in the NE¼ of SE¼ of Section 16 of Township 23 North, Range 60 West in Goshen County. The reservoir was permitted in 1904 (CR CC20/178) with a capacity of 520.0 acre-feet. An aerial view of the reservoir is shown in Figure 3.65.


**Figure 3.65.** Katzer No. 2 Reservoir Located Southeast of Torrington.

### 3.4.3.8 *Previously Proposed Water-Storage Development*

Since 1933, there are ten previous studies on potential reservoir development that were completed within the watershed; the Wyoming Water Development Office (WWDO) has compiled a list of proposed reservoirs from these studies. Currently, no WWDC Dam and Reservoir planning projects are within the study area. Table 3.23 lists the reservoir and dam projects proposed in the watershed. Using information found for the general location of the sites (township, range, and section), proposed locations were mapped and can be seen in Figure 3.66.

**Table 3.23. Previously Proposed Reservoirs Within the Watershed**

| Project Name/ Water Source | Approximate Location | Estimated Storage (acre-feet) | Water Use | Estimated Cost ($) |
|---|---|---|---|---|
| **Report on North Platte River Investigation Report; Interstate Streams Commission, 1933, Wyoming Water Development Office and State Library** | | | | |
| Torrington Reservoir/ North Platte River | Goshen County | 106,750 | Agriculture | NA |
| **Study of the Water Resources of the Missouri River Basin in Wyoming: North Platte, Laramie, South Platte Level 1, Wyoming State Planning Board, 1937, located at the Wyoming Water Development Office and State Library; Revised Project List Irrigation and Storage State of WY by Drainage Basins Report, Wyoming State Planning Board, 1937, located at the Wyoming Water Development Office** | | | | |
| Snow Reservoir/ Rawhide Creek | Sec 34, T27N, R62W, Goshen | 4,256 | Agriculture | 5,800 |
| Cherry Creek #3 Reservoir | Sec 11, T27N, R65W, Goshen | 765 | Agriculture | 5,500 |
| Etta Erwin Reservoir/ Cottonwood Creek | Sec 3, T28N, R64W, Goshen | 590 | Agriculture | 3,000 |
| Rawhide Reservoir/ Rawhide Creek | Sec 9, T27N, R62W, Goshen | 36,244 | Agriculture | 235,000 |
| Snow #2 Reservoir/ Rawhide Creek | Sec 16, T27N, R62W, Goshen | 1,900 | Agriculture | 18,000 |
| Yoder Reservoir/ North Platte River | Sec 28, T22N, R62W, Goshen | 2,151 | Agriculture | 10,900 |
| **Working Paper Platte River Basin Cooperative Study Wyoming Level 1, USDA, 1980, located at the Wyoming Water Development Office and the State Library** | | | | |
| Molly Fork Reservoir/ | Sec 32, T27N, R64W, Goshen | 550 | Flood Protection | 1,200,000 |
| **Corn Creek Irrigation Project Level 2, Wyoming Water Development Commission and CH2Hill, 1983, located at the Wyoming Water Development Office and the State Library** | | | | |
| Teeters Reservoir/ North Platte pumping | T24N, R64W, Goshen | 15,000 | Agriculture | 4,200,000 |
| Glomill Reservoir Rehabilitation/ North Platte pumping | T24N, R64W, Goshen | 10,600 | Agriculture | 5,100,000 |

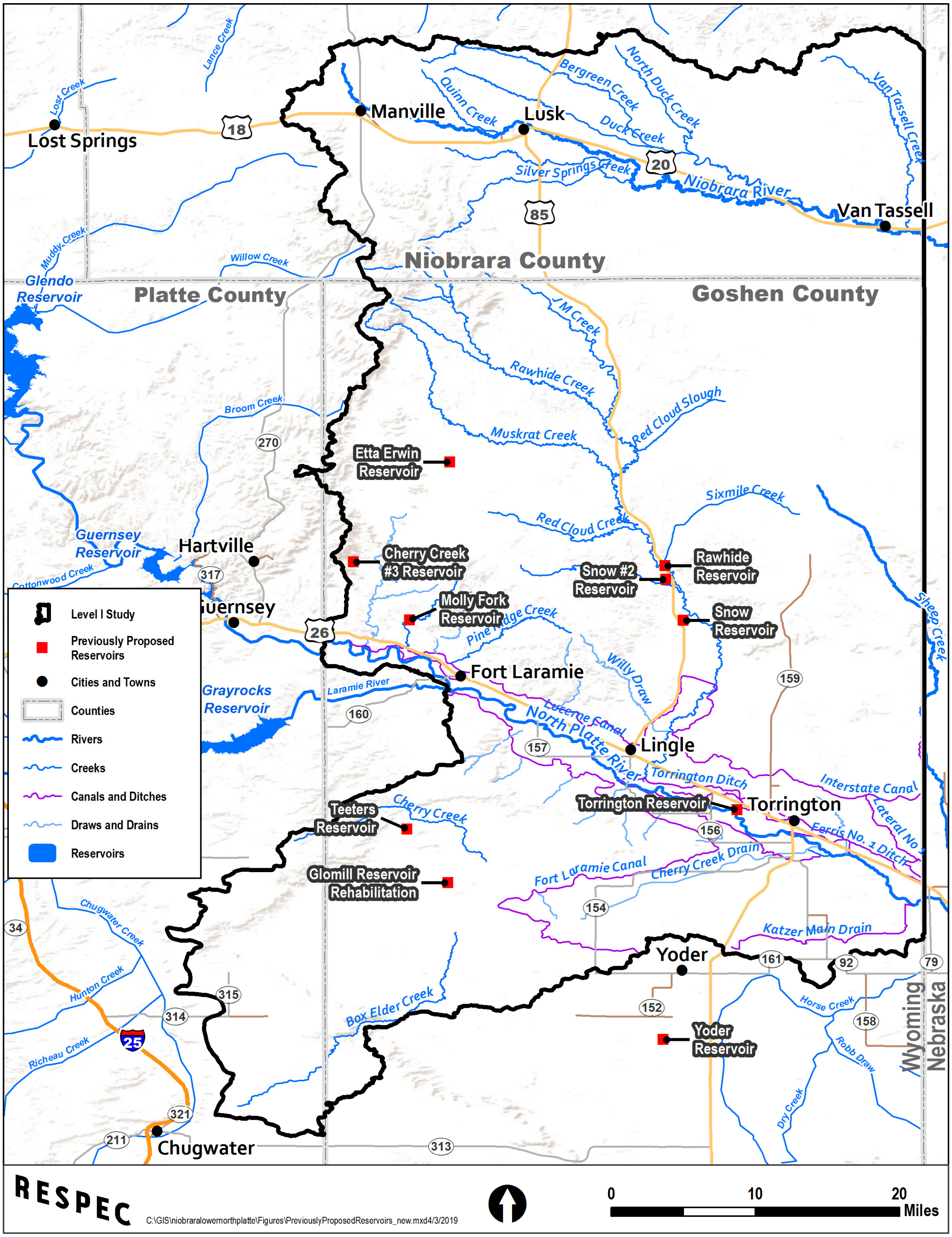


**Figure 3.66.** Previously Proposed Reservoir and Dam Project Locations Within the Watershed.

### 3.4.3.9 *Upland Water Storage*

Approximately 3,211 stock/domestic wells, 177 stock reservoirs/ponds, and 38 springs are permitted within the watershed. Existing livestock and wildlife water sources within the watershed are mapped and described along with inventorying existing water sources and potential water developments on properties of participating landowners within the study area. Study participants' properties covered approximately 29,094 acres (2.3 percent) of the study area. Mapping was not completed for most private lands in the watershed because many landowners did not participate in the study. The mapping is not a complete account of all viable water sources but serves as a starting point for estimating livestock and wildlife water needs within the watershed. Mapping of viable water sources within the watershed included the following items:

- Maps of springs were created from the NHD data and USGS topographic maps.
- Maps of stock wells were created by using data obtained from the SEO and WWDO.
- Interviews with landowners were conducted during study meetings and field visits.
- Maps were developed of existing stock reservoirs/ponds, wells, and springs from inventoried locations during field visits with participating landowners and by using aerial imagery, topographic maps, and hydrography datasets within the study's GIS.

The Wyoming SEO's e-Permit online database was queried for water-rights data and then was overlain on NAIP aerial imagery to determine whether these reservoirs/ponds were functional, ephemeral or intermittent, or nonfunctional regarding their status of beneficial uses. The reservoirs/ponds that contained water and showed no breaches of the dam or spillway were determined to be viable water sources and designated functional. Other facilities that were observed to be dry and not breached were designated as ephemeral/intermittent but viable water sources. The reservoirs/ponds that showed evidence of dam and/or spillway breaches were determined to be nonviable and designated as nonfunctional. During field visits with participating landowners, these reservoirs/ponds were also discussed and inventoried and any necessary improvements were identified. To illustrate the viable and nonviable reservoir evaluation mapping, Figure 3.67 displays an example of a breached, nonviable, nonfunctional reservoir, and Figure 3.68 shows a functioning, viable reservoir.

Springs, tanks/troughs, storage tanks, and wells were evaluated regarding their viability as sources of livestock/wildlife water within the watershed. These facilities were mapped then verified by field inventory and discussions with participating landowners about their condition and function. Wells were considered nonviable when they no longer provided the necessary amount of water for current use or could not pump any water at all. Wells that were located on properties where the owner did not participate in the study were designated as unevaluated wells.

### 3.4.3.10 *Existing Livestock/Wildlife Water Sources*

Dependable water supplies are essential in providing adequate amounts of suitable-quality water for livestock and wildlife. Many upland water sources currently exist within the watershed, and many rangeland improvements and grazing projects have developed existing water sources such as wells, springs, and perennial streams. These projects often included storage tanks, ponds, reservoirs, windmills, pumping plants, and spring developments with pipelines carrying livestock/wildlife water to water tanks.

**Figure 3.67.** Example of a Nonviable Reservoir (Breached).

**Figure 3.68.** Example of a Viable Reservoir (Functional).

There are approximately 1,773 permitted stock wells and another 1,438 domestic wells that have combined domestic and stock watering uses within the watershed. Of the 238 reservoirs/ponds within the watershed, 115 (48 percent) reservoirs/ponds were determined to be functional and viable, 102 (43 percent) reservoirs/ponds were ephemeral/intermittent and viable, and 13 reservoirs/ponds were nonfunctional and nonviable. Approximately 177 of these 238 facilities are permitted for stock use although the other 61 are viable sources of livestock/wildlife water. Additionally, 38 permitted springs are located within the study area.

As explained previously, existing wells, tanks/roughs, windmills, pumps, and spring developments were evaluated only on properties of participating landowners within the study area. No evaluation of these facilities was completed on non-participating landowners' properties. The results of this evaluation for existing wells, tanks, and springs on participant's properties indicated that 99 wells, 114 tanks, and 9 springs are viable livestock/wildlife water sources within the watershed. Twenty nonviable wells and one nonviable spring were inventoried. The mapping also indicated the existence of 24 stock reservoirs/ponds and 10 springs located on participating landowners' properties. Of these 24 facilities, 14 facilities were rated functional and viable and 10 facilities were designated as ephemeral/intermittent and viable. These sources are presented in Figure 3.69, which does not include any streams or nonviable reservoirs/ponds.

#### 3.4.3.11 *Areas Needing Additional Water Development*

The watershed has a considerable amount of water development for livestock and wildlife. Many wells and tanks are located throughout the study area as shown in Figure 3.69. However, reservoirs and ponds are less abundant mainly because of the lack of perennial streams within the watershed. Well development for livestock/wildlife water depends on the availability of groundwater within the watershed. Because of the diverse aquifers and hydrogeology in the study area, well depths can vary from 0 to 850 feet deep but are typically shallower than 400 feet. In the North Platte Valley, stock wells typically have depths of 50 to 250 feet while stock wells near Lusk typically are less than 50 feet deep. During field visits and inventory, many wells that were drilled many decades earlier were still functioning as viable water sources. Landowners commonly indicated that the wells were 30–80 years old and still provided adequate quantities and quality for livestock and wildlife. Twenty wells were identified as nonfunctional and proposed for rehabilitation as part of this Level I study.

### 3.4.4 Land

The study area covers approximately 2,022 square miles, or 1,294,160 acres. The watershed is primarily located within the central and northern portion of Goshen County and the southern part of Niobrara County with a small area situated in the southeastern portion of Platte County. The city of Torrington and the towns of Fort Laramie, Lingle, Lusk, Manville, and Van Tassell are located within the watershed. Approximately 70.3 percent of the watershed is located in Goshen County, with 24.0 percent in Niobrara County, and 5.7 percent in Platte County. The watershed also covers portions of five conservation districts as shown in Figure 3.70 with approximately 35.6 percent located in the LFLCD, 30.5 percent in the NPVCD, 24.0 percent in the NCD, 5.7 percent in the Platte County Resources District (PCRD), and 4.2 percent within the SGCD.

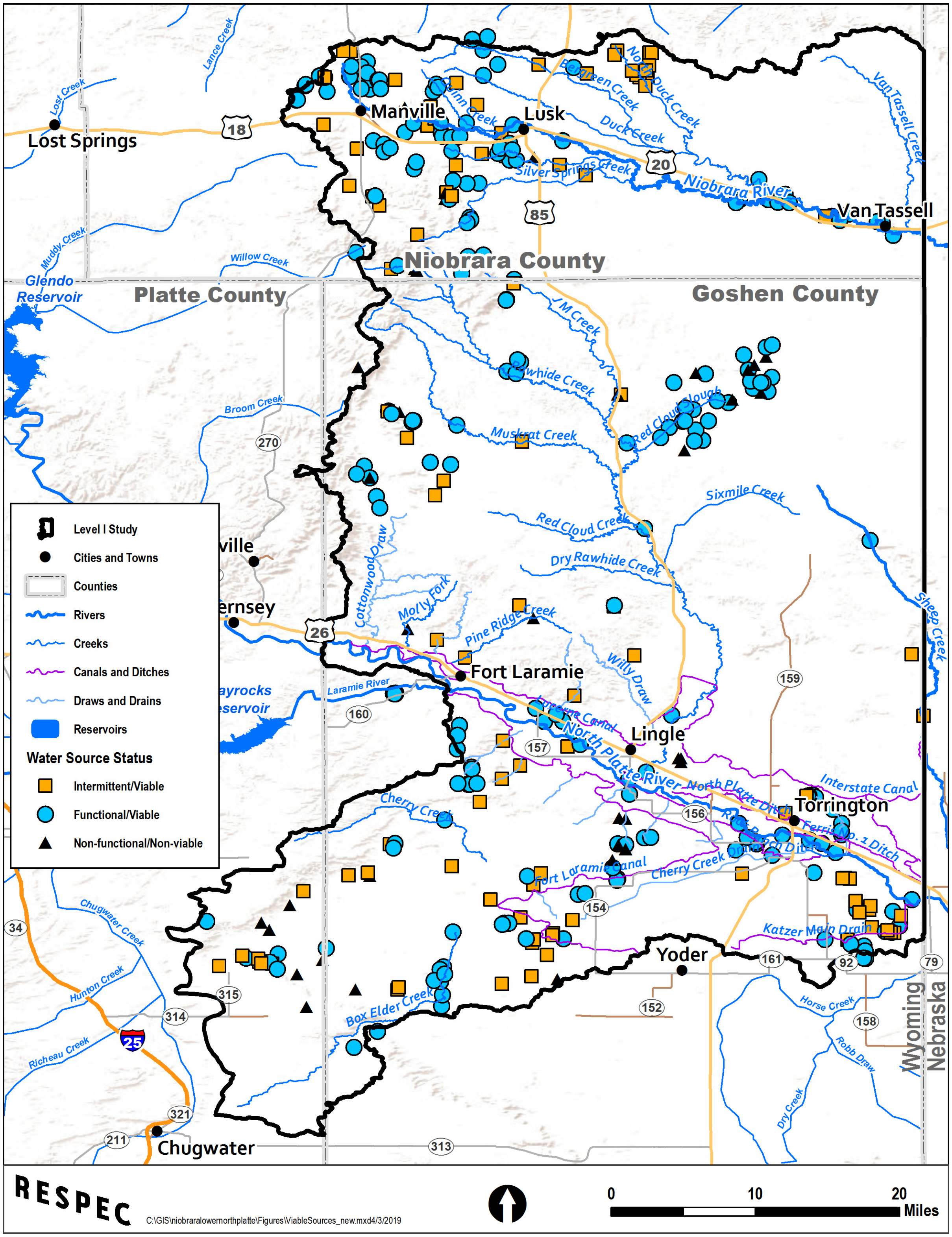


**Figure 3.69.** Known Viable and Non-Viable Water Sources Within the Study Area.

### 3.4.4.1 *Land Use*

Agriculture is the principal industry and land use within the study area. Other major industries include oil-and-gas development, manufacturing, healthcare, government, and education. Grazing is the predominant land use in the watershed. Other land uses (such as irrigated pasture and hay forage, oil-and-gas production, wind energy generation, wildlife habitat, and recreation) are also often components of the agricultural operations within the watershed. Livestock use is primarily cattle along with sheep, horses, bison, and goats. Because of the importance of the livestock grazing and ranching within the watershed, rangelands provide the foundation for this land use. Commonly, ranching operations will manage their livestock, pasture and hay, wildlife, and water resources in combination with recreational hunting uses.

Transportation and energy corridors are concentrated in the watershed along US Highway 26 from Guernsey to the state line, US Highway 85 from Torrington to Lusk, and US Highway 18 from Manville through Lusk and to the Wyoming–Nebraska border, as shown in Figure 3.71. The Colorado and North Wyoming Railroad extends from Manville to the State of Nebraska, parallel to US Highway 85 and the Burlington Northern is located along US Highway 18 across the southern portion of the watershed. Major roads and railroads in the watershed are also shown on Figure 3.71. Power and energy development within the watershed includes wind power complexes with several power transmission lines located throughout the study area. In 2014, the USGS mapped 294 industrial wind turbine locations on two wind farms within the study area as shown in Figure 3.72. These maps of the power lines that traverse the study area are general estimates of the locations and alignment.

Several energy pipelines are also located within the study area; however, information about current pipeline locations and operations should be obtained by accessing the US Department of Transportation's (DOT) National Pipeline Mapping System (NPMS) Pipeline Information Management and Mapping Application (PIMMA). PIMMA is a web-based mapping application that can be accessed on the DOT's website (*https://www.npms.phmsa.dot.gov/)*. Access to NPMS data is limited by user type, so private or governmental entities have several restrictions in place for data viewing or downloading. Information and maps from PIMMA must be treated as DOT proprietary information, but only NPMS staff have the right to redistribute maps or information from the NPMS [USDOT, 2015]. The Wyoming Pipeline Authority (WPA) also has a database for the state, which is available by contacting the WPA by telephone (307.237.5009) or visiting their website (*https://www.wyopipeline.com/web-based-interactive-map/)*. Because of the restrictions regarding pipeline data, pipeline locations were not included in map figures within the final report; although publicly available data are included in the study's GIS data.

### 3.4.4.2 *Land Ownership*

Land ownership within the watershed is predominantly private at 1,837 square miles, or 90.9 percent of the watershed. Of the private land, approximately 1,433 square miles (78.0 percent) consist of range and forest grazing land. More than 151 square miles (8.2 percent) of the private lands are irrigated and represents 99 percent of all the irrigated lands within the watershed. The categories of land management are displayed in Figure 3.73.

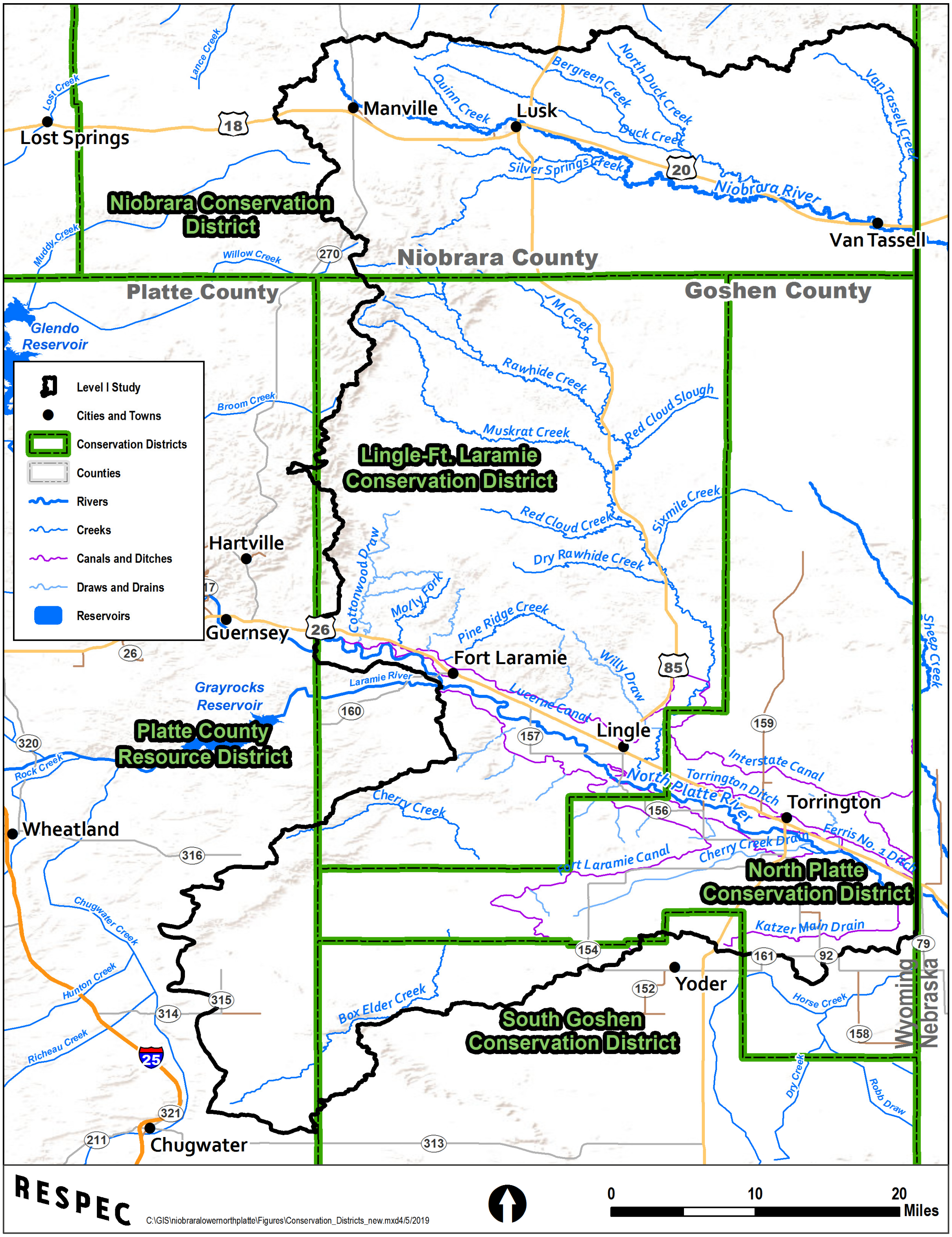


**Figure 3.70.** Conservation Districts in the Study Area.

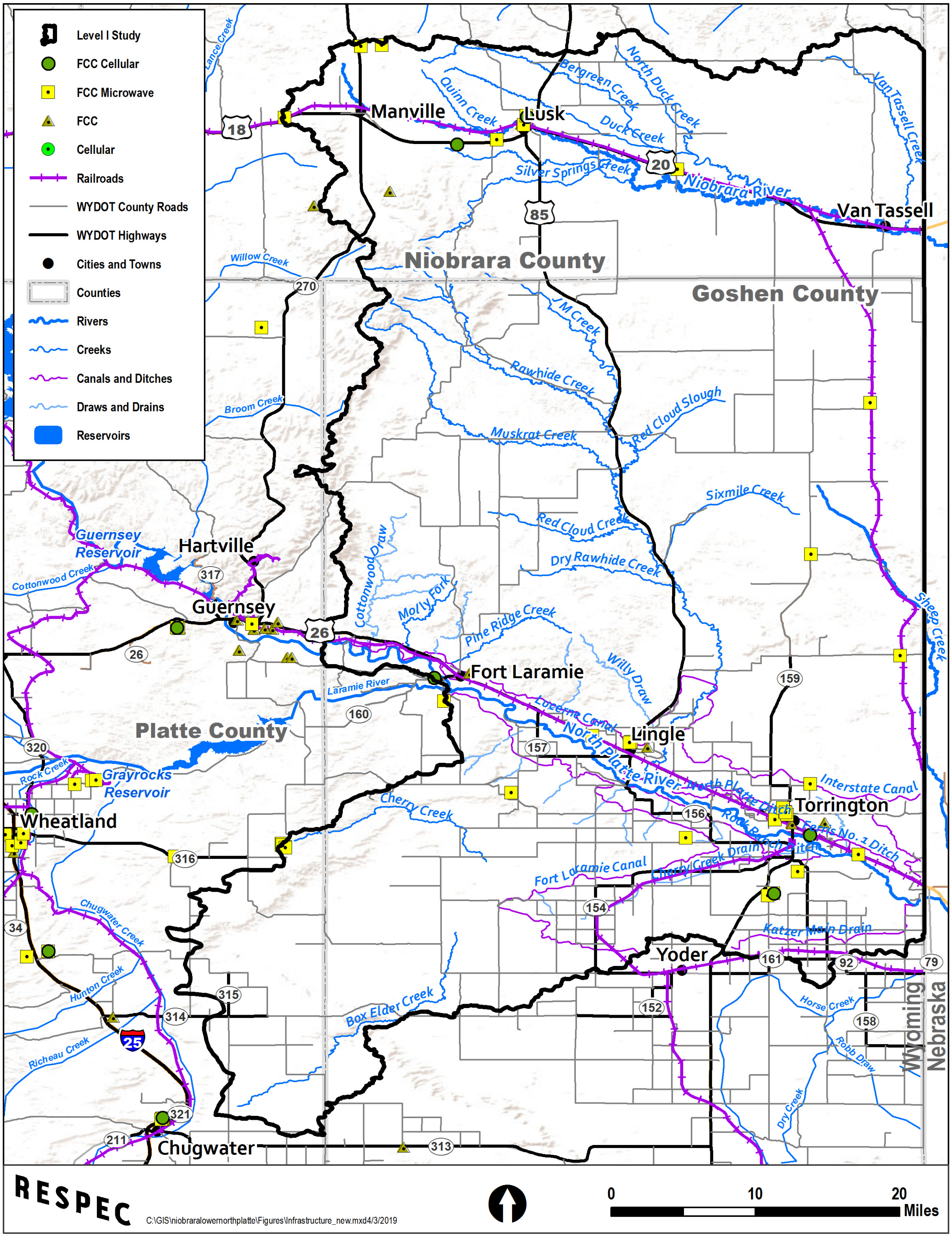


**Figure 3.71.** Infrastructure Features in the Study Area.

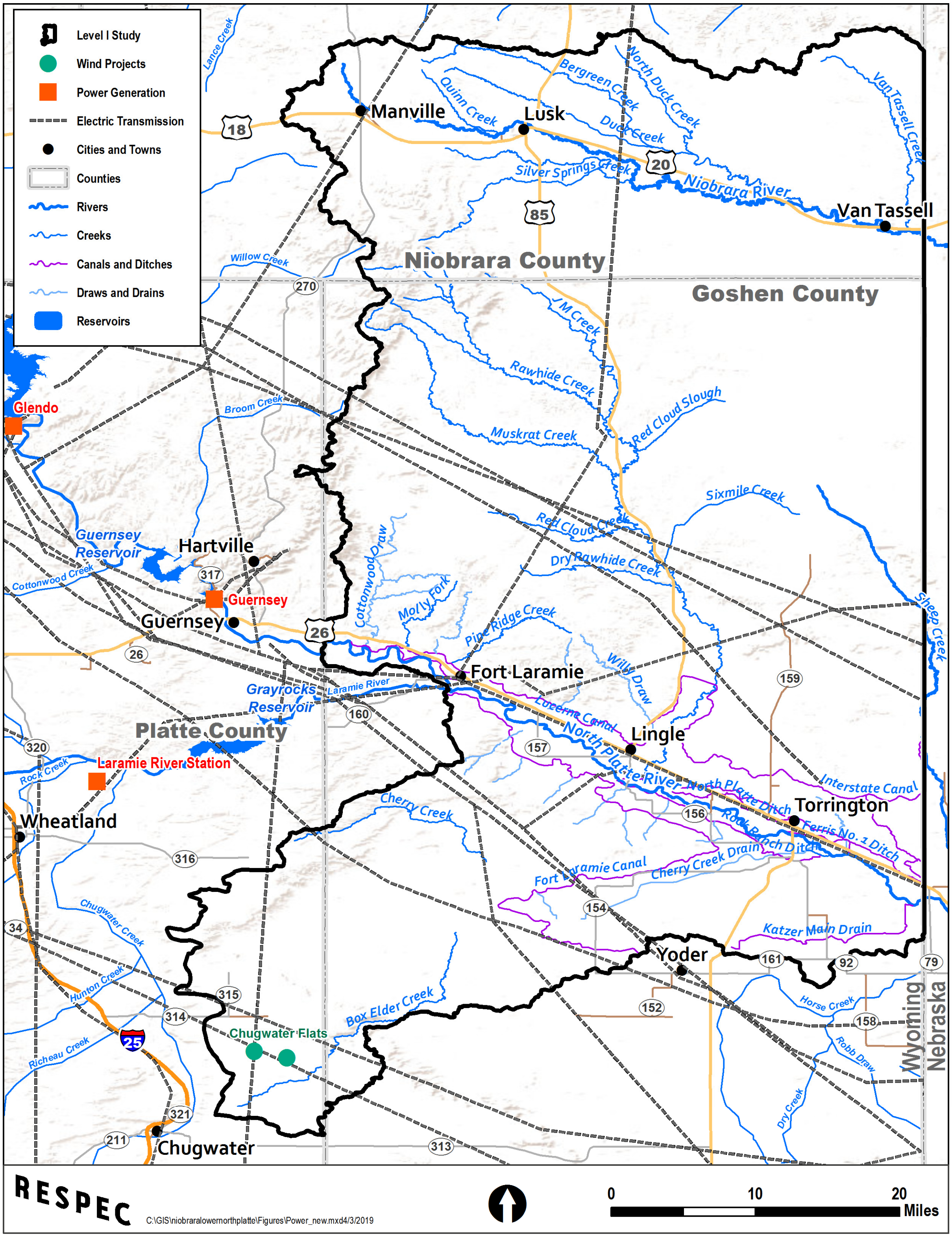


**Figure 3.72.** Power Generation and Transmission Lines in the Study Area.

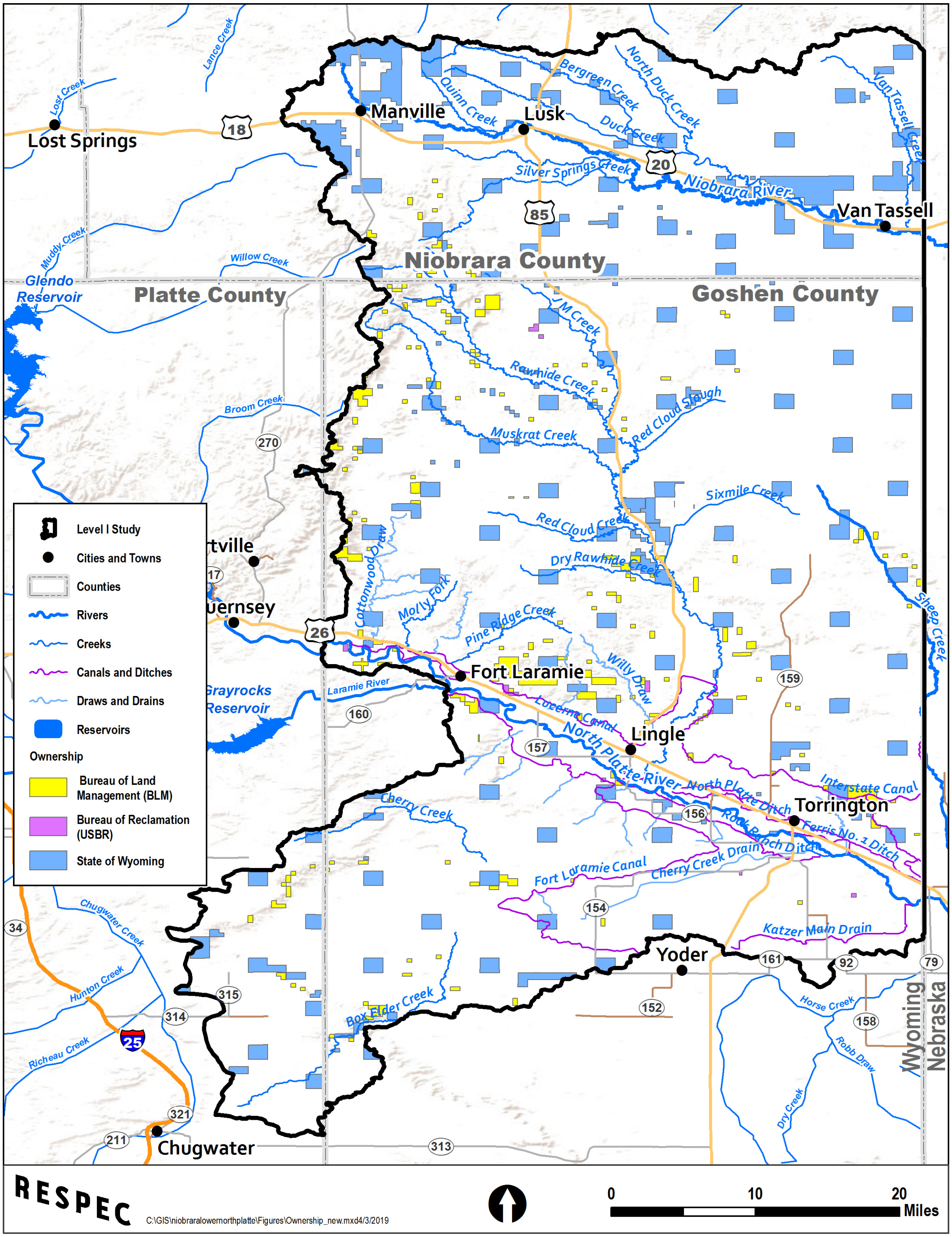


**Figure 3.73.** Categories of Land Ownership Within the Study Area.

Because significant portions of the grazing and irrigated lands within the study area are private lands, the management of grazing animals, the development of watering facilities, and the operation and maintenance of irrigation infrastructure facilities are the responsibilities of individual landowners and lessees. The capital necessary for developing and operating these facilities on private land often involves additional revenue input from other land-use activities such as oil-and-gas production, mineral extraction, wind energy generation, hunting/recreational opportunities, and small acreage development. While private landowners typically control the land surface, there are some private lands where the mineral estate is owned by the federal government and administered by the Bureau of Land Management (BLM).

The state of Wyoming owns 149 square miles (7.4 percent) of the watershed, and 30.5 square miles (1.51 percent) are federal lands under management of the BLM, USBR, NPS, and the US Department of Defense. Nearly 138 square miles of state land consists of range and forest grazing land, while federal agencies manage approximately 29 square miles for grazing. Neither the state nor the federal agencies control a significant amount of irrigated land, at a combined total of less than 4 square miles.

Grazing on state lands is essential to livestock operations within the study area. Although, the landowners' use of state grazing lands differs between operations, most landowners use some state land grazing as part of their operations. The land ownership pattern of predominantly private lands interspersed with state and federal lands affects livestock management because of the variability of forage conditions and availability of dependable watering sources.

Because of the scale of the land management spatial data, the total estimated areas and corresponding percentages have been rounded up to the nearest square mile. In addition to the land ownership and management, the BLM's surface management data and county parcel data from Goshen, Niobrara, and Platte Counties were collected and included in the study's GIS.

#### 3.4.4.3 *Land Management and Upland Water Resources*

Approximately 1,600 square miles of rangelands and forestlands are located within the watershed and cover more than 79 percent of the study area. Rangeland acres were approximated by using the hay and pasture, shrub/scrub, and grassland herbaceous vegetative cover types; the forestland acres were approximated by using the deciduous, evergreen, and mixed forest vegetative cover types from the NLCD.

Approximately 1,583 square miles of grass and shrub lands comprise the rangelands located in the watershed. Approximately 1,420 (89.7 percent) of the 1,583 square miles of rangelands are privately owned. Almost 136 (approximately 8.6 percent) are owned by the state of Wyoming; 26 square miles (1.6 percent) of the 1,583 square miles of rangelands are managed by the BLM. The remaining 1.4 square miles (less than 0.1 percent) of rangelands are managed by other agencies, including the USBR and Department of Defense, as displayed in Table 3.24.

In addition to the rangelands in the watershed, forestlands cover approximately 17 square miles in the watershed. Private land encompasses approximately 14 square miles (81.5 percent) of the forestlands within the study area. The BLM manages roughly 1.7 square miles (10.1 percent), and the state of Wyoming owns 1.4 square miles (8.3 percent) of forestlands within the watershed. Less than 0.1 percent of the watershed, forestlands are owned by the USBR and US Department of Defense, as shown in Table 3.25.

**Table 3.24. Rangelands by Ownership or Management Within the Study Area**

| Land Ownership or Management | Area (miles$^2$) | Percent of Rangelands |
|---|---|---|
| Private | 1,420.0 | 89.7 |
| State of Wyoming | 136.0 | 8.6 |
| BLM | 26.0 | 1.6 |
| Other (USBR, DoD, NPS, water) | 1.4 | 0.1 |
| **Total** | **1,583.4** | 100.0 |

**Table 3.25. Forestlands by Ownership or Management Within the Study Area**

| Land Ownership or Management | Area (miles$^2$) | Percent of Forestlands |
|---|---|---|
| Private | 14.0 | 81.5 |
| BLM | 1.7 | 10.1 |
| State of Wyoming | 1.4 | 8.3 |
| Other (USBR, DoD, NPS, Local) | 0.02 | 0.1 |
| **Total** | **17.12** | 100.0 |

***Private Lands***

Private land encompasses approximately 1,420 square miles (89.7 percent) of the rangelands and approximately 14 square miles (81.5 percent) of the forestlands within the study area. Grazing practices on private lands are established by the landowner and/or manager and often with technical assistance from the local Natural Resources Conservation Service (NRCS) Field Office or a range consultant. Management practices and improvements on private lands are implemented and owned by the landowner or manager. Landowners and managers who voluntarily participate in Farm Bill programs may be required to follow NRCS standards and specifications or an approved grazing plan included in a conservation plan that was developed for the enrolled property or applicable Farm Bill program. Private grazing lands are often managed for multiple uses, including mining, oil-and-gas production, wildlife habitat, and recreation. Public land-management policies directly affect the management of the private grazing lands because public leases and federal allotments are integral components of a typical private grazing operation within the study area.

***State of Wyoming Lands***

State land encompasses approximately 136 square miles (8.6 percent) of the rangelands and approximately 1.4 square miles (8.3 percent) of the forestlands within the study area. Most of the state lands within the watershed are leased to private landowners for grazing. These leases are issued by the Wyoming State Board of Land Commissioners (SBLC) and administered by the Wyoming Office of State Lands and Investments (OSLI). State grazing and agricultural leases allow lessees to construct lease-related improvements on state land, subject to board approval. Grazing management and the operation of installed improvements on state grazing leases are usually implemented by the lessee. After transferring a state grazing lease, the new lessee reimburses the previous lessee for improvements.

***Federal Grazing Allotments***

An allotment generally consists of federal rangelands and forestlands but could also include private and/or state parcels. BLM grazing allotments encompass approximately 224,874 acres of federal, state, and private rangelands and forestlands within the watershed. These BLM allotments are typically managed under an Allotment Management Plan (AMP) or a Coordinated Resource Management Plan (CRMP). An AMP or CRMP usually involves collaborative resource planning between the agency and permittees to create a livestock grazing management plan specifying the land areas, animal units, grazing schedule, and needed improvements in order to achieve multiple use resource management objectives and grazing land health standards.

#### 3.4.4.4 *Cultural Resources*

The Wyoming State Historic Preservation Office (SHPO) maintains a database of inventoried historic sites within the state. The SHPO makes a spatial data file available that generalizes the cultural resource inventory to the section level. This level of locating archaeological data protects the sites from unauthorized disturbance. The attributes recorded for each section include the site count, inventory acres, report numbers, and eligible site number.

Figure 3.74 displays the SHPO cultural resource inventory results graphically. Sections within the study area have been color-coded based on the number of inventoried sites that are determined to be eligible for inclusion in the National Register of Historic Places. The National Register of Historic Places, our nation's official list of cultural and historic sites, is administered by the National Park Service and managed within the Wyoming SHPO.

Twenty Seven historical monuments and markers sites are listed on the National Registry of Historic Places and located within the study area. The most prominent historic sites are the Fort Laramie National Historic Site, the Oregon Trail, and the Cheyenne-Deadwood Stage Road. The Oregon, California, and Mormon Trails traverse through the watershed along the North Platte Valley.

**Fort Laramie National Historic Site**

Fort Laramie was established by the US Army in 1849 along the North Platte River when the government bought a trading station, Fort John, belonging to the American Fur Company [Mattes, 1980]. Before the military fort's establishment, Fort William, Fort John, and Fort Platte were trading and supply forts that existed in the area from 1834 to 1849. Fort Laramie served as headquarters for military campaigns in the West and was an important milestone for emigrants traveling the Oregon, California, and Mormon Trails. The US Army abandoned the fort in 1890. Today, the Fort Laramie Historic Site is operated by the National Park Service and includes restored buildings, interpretive exhibits, and visitor center. Figure 3.74 also displays the historic trails, sites listed on the National Registry of Historic Places, and historic monuments and markers within the state of Wyoming.

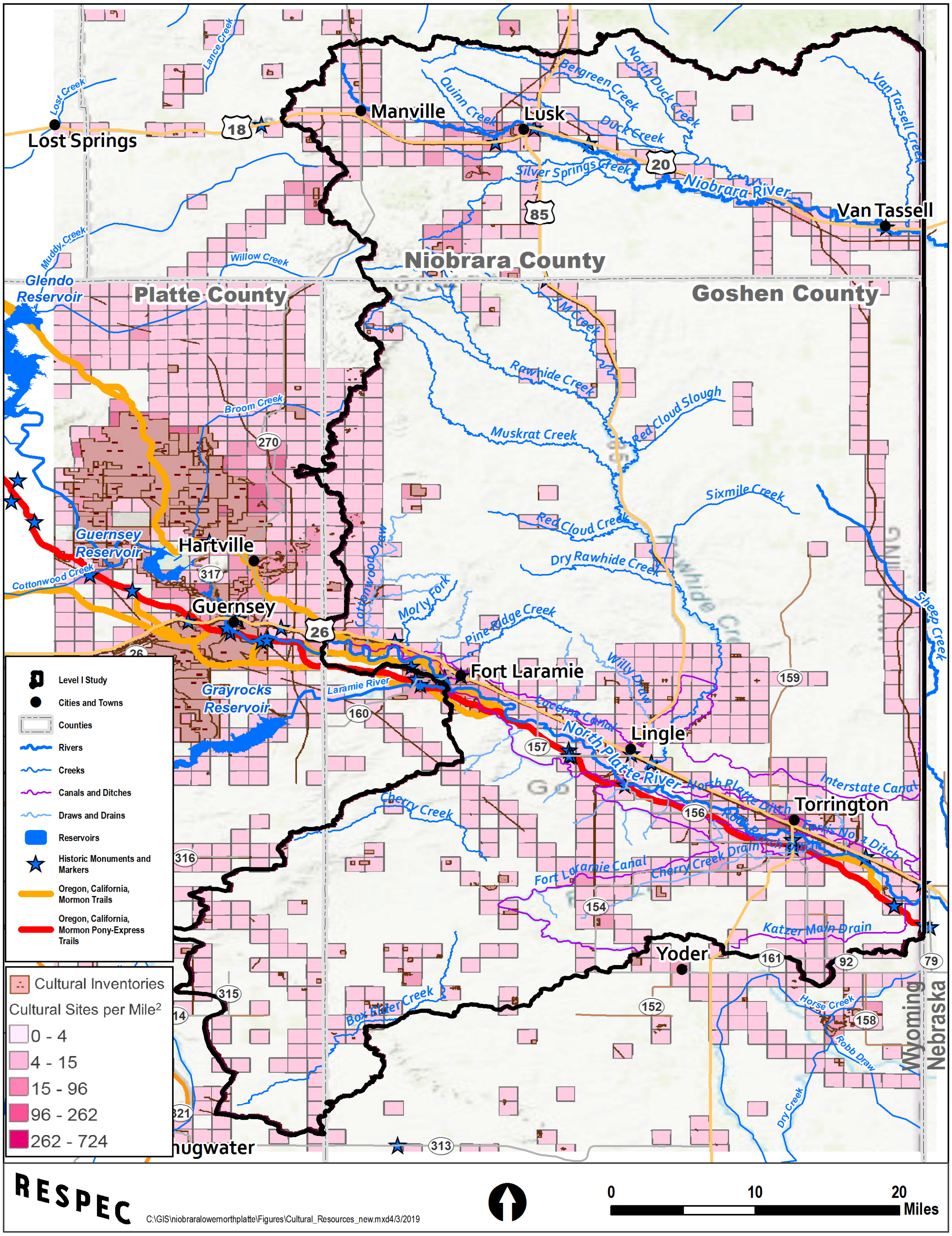


**Figure 3.74.** Historic Sites, Pioneer Trails, and Cultural Sites per Section Within the Study Area.

## 3.5 STREAMFLOW HYDROLOGY

### 3.5.1 Gage Stations

Available data and information from gage stations within the study area operated by the USGS, SEO, USBR and the Nebraska Department of Natural Resources (NDNR) were obtained and summarized as part of the Level I study. A total of 12 gage stations are located within the watershed and are listed in Table 3.26 and shown in Figure 3.75. Gage station monthly mean discharge data were analyzed and are listed in Table 3.27 and shown in Figure 3.75. The USGS has operated nine streamflow gages within the study area in the past but are currently only operate two active gages (06674500/North Platte River at Wyoming–Nebraska state line and 06657000/North Platte River below Whalen Dam) within the watershed.

**Table 3.26. Gage Stations Located Within the Study Area**

| Station Identifier | Station Name | Period of Record | Drainage Area ($mi^2$) | Latitude (decimal degrees) | Longitude (decimal degrees) | Gage Elevation (feet) |
|---|---|---|---|---|---|---|
| 06454000 | Niobrara River at WY-NE State Line | 10/01/1955 to Current | 455 | 42.65913278 | −104.0654939 | 4,687 |
| 06657000 WHWY | North Platte River below Whalen Dam, WY | 01/01/1915 to Current | 16,237 | 42.24102331 | −104.6279601 | 4,280 |
| 06670900 | North Platte River near Lingle, WY | 05/01/1968 to 09/29/1975 | 21,136 | 42.10357691 | −104.3510643 | 4,131 |
| 06671000 0112RCWY | Rawhide Creek near Lingle, WY | 05/01/1928 to Current | 522 | 42.12552095 | −104.3271743 | 4,160 |
| 06672000 | North Platte River at Torrington, WY | 05/01/1918 to 09/29/1939 | 25,742 | 42.05357595 | −104.2085616 | 4,100 |
| 06672500 0114CCWY | Cherry Creek Drain near Torrington, WY | 05/01/1931 to Current | 356 | 42.03940911 | −104.1691168 | 4,080 |
| 06673000 | Arnold Drain near Torrington, WY | 05/01/1931 to 09/29/1942 | N/A | 42.03774228 | −104.1438386 | N/A |
| 06673500 0114KDWY | Katzer Drain near Henry, NE | 09/01/1928 to Current | 46 | 41.97913148 | −104.0713382 | 4,040 |
| 06674500 HEWY | North Platte River at WY-NE State Line | 05/01/1929 to Current | 22,218 | 41.98857554 | −104.0532823 | 4,025 |
| 0114FCWY | Fort Laramie Canal at M.P. 0.8 | 12/29/1899 to Current | N/A | 42.23722222 | −104.6266667 | N/A |
| 0114ICWY | Interstate Canal at M.P. 1.0 | 12/29/1899 to Current | N/A | 42.24333333 | −104.6133333 | N/A |
| 0114LCWY | Lucerne Canal at Fort Laramie | 04/26/2018 to Current | N/A | 42.20638889 | −104.5077778 | N/A |

The SEO currently operates six gage stations that measure flows within the study area. Three of the gage sites were previously operated by the USGS and have corresponding site numbers as displayed in Table 3.26. Three sites are also located on canals, two sites are on drains, and one site is situated on Rawhide Creek. Data were obtained from the SEO's Surface Water Data website (*http://seoflow.wyo.gov/*). Data were obtained for the gage located on the Niobrara River (06454000/Niobrara River at Wyoming–Nebraska State Line) from the NDNR Stream-gaging Stations List website (*https://nednr.nebraska.gov/RealTime/Gage/Index*).

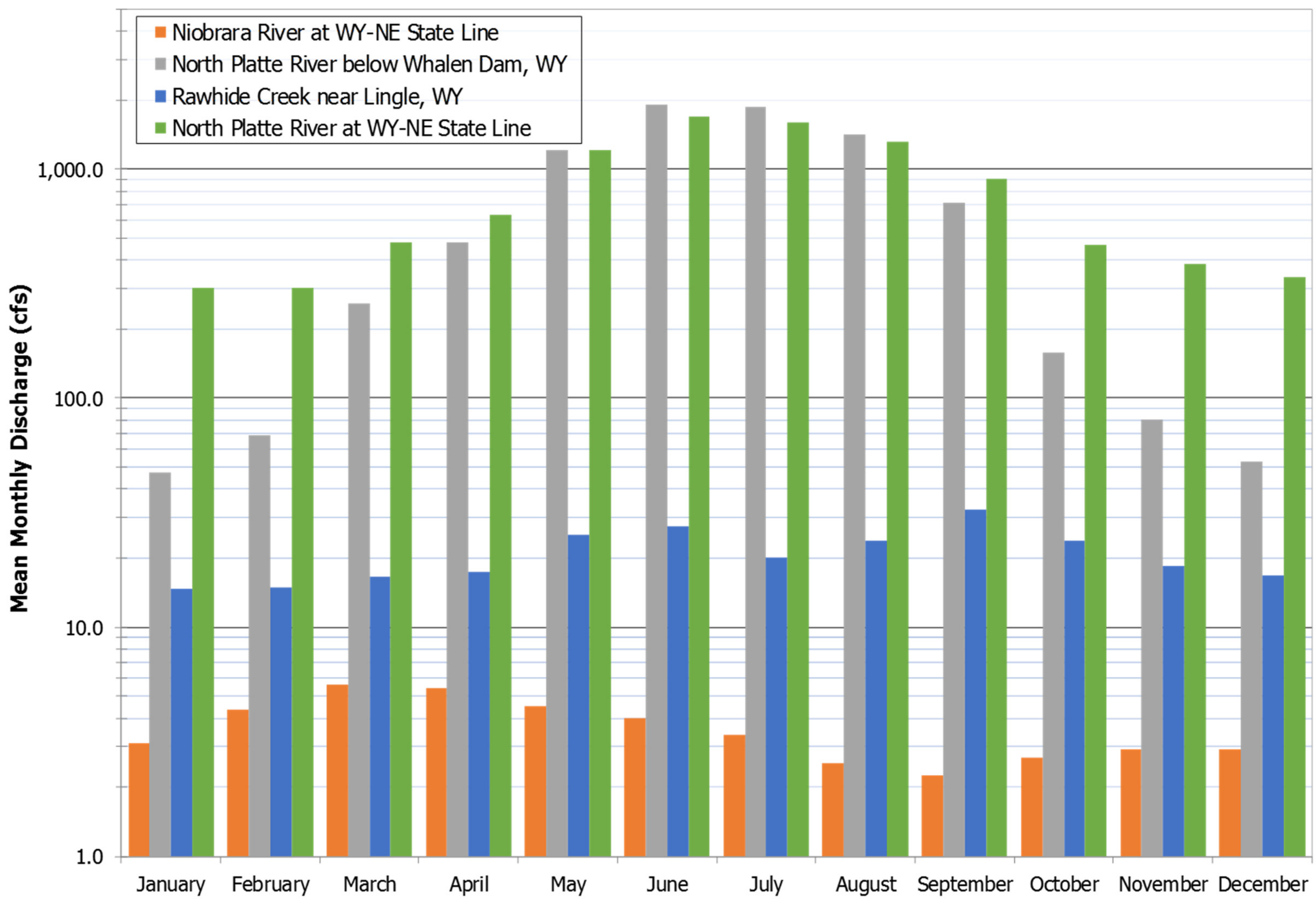


**Figure 3.75.** Mean Monthly Discharge for Selected Gage Stations Within the Study Area.

**Table 3.27. Monthly Mean Discharge Rates for Selected Gage Stations Within the Study Area**

| | **Station Number** | 06454000 | 06657000 | 06671000 | 06674500 |
|---|---|---|---|---|---|
| | **Site** | Niobrara River at WY-NE State Line | North Platte River below Whalen Dam, WY | Rawhide Creek near Lingle, WY | North Platte River at WY-NE State Line |
| **Historical Monthly Mean Discharge (cfs)** | January | 3.1 | 47.2 | 14.8 | 301.3 |
| | February | 4.3 | 68.4 | 14.9 | 304.6 |
| | March | 5.6 | 259.5 | 16.6 | 479.9 |
| | April | 5.4 | 476.8 | 17.3 | 628.3 |
| | May | 4.5 | 1,207.2 | 25.3 | 1,216.1 |
| | June | 4.0 | 1,906.1 | 27.5 | 1,694.7 |
| | July | 3.4 | 1,879.2 | 20.0 | 1,601.4 |
| | August | 2.5 | 1,422.2 | 23.9 | 1,317.5 |
| | September | 2.2 | 714.7 | 32.7 | 901.5 |
| | October | 2.7 | 158.5 | 23.9 | 468.5 |
| | November | 2.9 | 80.8 | 18.5 | 386.5 |
| | December | 2.9 | 52.8 | 16.8 | 339.3 |

The USBR also operates and maintains multiple automated hydrologic monitoring stations, which have been called HYDROMET stations, within the study area. These stations remotely log field data for various hydrologic and meteorological parameters. Seven USBR HYDROMET stations are located within the watershed and are placed at the two USGS active gage sites and at five of the SEO gage sites. The USBR Great Plains Region's station data can be obtained by visiting the HYDROMET Data System website (*http://www.usbr.gov/gp/hydromet/hydromet_arcread.html*).

## 3.5.2 Wyoming Water Development Commission Temporary Gaging Stations

No temporary gaging stations were installed within the watershed as part of this Level I study.

## 3.5.3 Available Flow and Hydrologic Condition

The wet, normal, and dry year hydrologic conditions for the four long-term, operating streamflow gages were computed by analyzed daily discharge data obtained online from the USGS, SEO, and NDNR for each station's period of record. The four long-term gaging stations that were used to analyze the available flow and hydrologic conditions in the study area are Niobrara River at WY-NE State Line (06454000); North Platte River below Whalen Dam (06657000); Rawhide Creek near Lingle (06647500); and North Platte River at the WY-NE State Line (06674500).

Wet, normal, and dry flow statistics were calculated for each of the long-term flow gages. The daily discharge values with non-exceedance probabilities of 20 percent or less are categorized as dry, and values with exceedance probabilities of 20 percent or less are selected as wet years. The 50$^{th}$ percentile, range, and average discharge in each percent exceedance category were computed for each gage station's period of record, as shown in Table 3.28.

**Table 3.28. Wet, Normal, and Dry Streamflow Statistics for Selected Gages Within the Watershed**

| Gage Station | Flow Zone (cfs) | | |
|---|---|---|---|
| **Niobrara River at WY-NE State Line (06454000)** | **Wet** | **Normal** | **Dry** |
| 50th Percentile (cfs) | 5.5 | 3.0 | 1.8 |
| Range (cfs) | 4.2–429.0 | 2.1–4.1 | 0.5–2.1 |
| Average (cfs) | 7.7 | 3.0 | 1.8 |
| **North Platte River below Whalen Dam (06657000)** | **Wet** | **Normal** | **Dry** |
| 50th Percentile (cfs) | 1,910 | 113 | 4.4 |
| Range (cfs) | 1,300–19,500 | 8.5–1,290 | 0.0–8.5 |
| Average (cfs) | 2,581 | 311.1 | 4.2 |
| **Rawhide Creek near Lingle WY (06671000)** | **Wet** | **Normal** | **Dry** |
| 50th Percentile (cfs) | 38.0 | 18.0 | 8.0 |
| Range (cfs) | 31–1,330 | 12.0–30.0 | 0.0–11.0 |
| Average (cfs) | 46.6 | 19.1 | 7.4 |
| **North Platte River at WY-NE State Line (06674500)** | **Wet** | **Normal** | **Dry** |
| 50th Percentile (cfs) | 1,500 | 446 | 172 |
| Range (cfs) | 1,160–17,600 | 231–1,150 | 0.0-230.0 |
| Average (cfs) | 2,302 | 524.8 | 160.2 |

At the Niobrara River at WY-NE State Line (06454000) gage, measured discharge averaged 7.7 cfs in the wet flow zone and 1.8 cfs in the dry flow zone. Average discharge at the North Platte River below Whalen Dam (06657000) gage ranged from 2,581 cfs in the wet zone to 4.2 cfs in the dry zone. Flows at the Rawhide Creek near Lingle (06647500) gage averaged 46.6 cfs in the wet flow zone and 7.4 cfs in the dry flow zone. Flows at the North Platte River at the WY-NE State Line (06674500) gage averaged 2,302 cfs in the wet flow zone and 160.2 cfs in the dry flow zone.

# 4.0 NIOBRARA–LOWER NORTH PLATTE RIVERS WATERSHED MANAGEMENT AND REHABILITATION PLAN

## 4.1 OVERVIEW

The objective of this Level I watershed study is to generate a Watershed Management and Rehabilitation Plan that is technically sound, practical in nature, and economically feasible. Along with developing the study's Geographic Information System (GIS), the inventory focused on assessing the watershed and identifying potential improvement opportunities that are categorized into the following:

- **Irrigation System Conservation and Rehabilitation.** The inventory and evaluation of the existing infrastructure were completed, and improvements for rehabilitating existing structures and potentially conserving existing irrigation diversions and conveyances were identified.
- **Livestock/Wildlife Watering.** Based on an evaluation of existing water sources, potential upland water-source development and rehabilitation projects were identified.
- **Grazing-Management Opportunities.** Based on discussions with study participants and field observations, grazing-management opportunities and recommendations were determined.
- **Surface-Water Storage Opportunities.** The results of field inventories and previous investigations pertaining to developing and rehabilitating water-storage opportunities within the watershed were included.
- **Channel Stability Opportunities.** Stream channels and their conditions and stability within the watershed were characterized. Unstable channels were identified by study participants for further evaluation and development of proposed stabilization projects.
- **Wetlands Enhancement Opportunities.** Opportunities to establish new wetlands or enhance existing wetlands within the watershed were explained.

In this chapter, the conceptual plans developed within each watershed component are described with respect to improving the existing water supply through conservation. To track the individual components of the Watershed Management Plan, a unique project or "improvement" number was designated for each component. The following prefixes were used for each improvement to describe its category in the Watershed Management Plan:

- Project Components I: Irrigation System Proposed Projects (Section 4.3)
- Project Components LW: Livestock/Wildlife Watering Opportunities (Section 4.4)
- Project Components G: Grazing-Management Opportunities (Section 4.5)
- Project Components S: Surface-Water Storage Opportunities (Section 4.6)
- Project Components C: Channel Stability Opportunities (Section 4.7)
- Project Components W: Wetlands Enhancement Opportunities (Section 4.8).

## 4.2 POTENTIAL EFFECTS AND BENEFITS OF PLAN COMPONENTS

The Wyoming Water Development Commission (WWDC) Level I watershed study is a fundamental landscape analysis that is confined to a hydrologically connected drainage area or watershed and is focused on two primary components. The first component is identifying the physical attributes of that study area, which is accomplished by conducting a comprehensive inventory of the natural resources to describe the current resource conditions. The second component is a long-range plan that outlines the management and/or rehabilitation opportunities and activities that address ecological enhancement and watershed function.

Such activities in the conservation community are commonly referred to as best management practices (BMPs) or conservation practices. These BMPs and conservation practices are eligible for grant funding assistance through the WWDC's Small Water Project Program (SWPP). The WWDC's SWPP funds are used for installing ponds, water wells, water pipelines, stock tanks, spring developments, solar platforms and pumps, environmental and wetland restoration, windmills, and irrigation system improvements.

One or more benefits can result from implementing BMPs and conservation practices. Such benefits can be quantitative, qualitative, or both. Benefits can be local or global and specific or surrogate, depending on multiple factors that are unique and specific to the BMP or conservation practice, ecological site, watershed, or major land-resource area. BMPs and conservation practices also provide opportunities to relieve the grazing pressure on riparian areas and create the potential to induce improvements to soil health, plant community diversity, and improved forage production. These practices allow for grazing deferment if rest is required because of invasive species control efforts, which can also stimulate water release.

The benefits to watershed functionality and landscape health can be and is a response to soil health, water infiltration/percolation, and a functioning water cycle. Expected project benefits can be related to watershed function (e.g., collecting and storing water), ecological enhancements (e.g., plant and animal habitat and stream corridor or riverine stability), and societal values (e.g., economic stability and open-space maintenance). Multiple benefits can result from improvement opportunities for water resources, which are critical to meet the daily water demands of humans and animals; develop, increase, or extend irrigation water availability; and improve fishery habitat and potential recreational benefits.

### 4.2.1 Natural Resources Conservation Service Conservation Effects Assessment

In 2003, the Conservation Effects Assessment Project (CEAP) was initiated by the Natural Resources Conservation Service (NRCS) to provide quantitative information about the environmental impacts of its conservation practices on agricultural lands within the contiguous 48 states. The CEAP is a joint effort of the NRCS, Agricultural Research Service (ARS), National Institute for Food and Agriculture, other federal agencies, and university scientists to quantify the environmental effects of NRCS conservation practices and to develop the science base for managing the agricultural landscape for environmental quality. While initially focused on croplands, the CEAP has been expanded to include wildlife, wetlands, pastures, and rangelands. The CEAP findings have been used to guide US Department of Agriculture (USDA) conservation policy and program development that assist conservationists, farmers, and ranchers with informed conservation decisions [Spaeth et al., 2013]. The end product of the CEAP is a literature review and concise collection of information from hundreds of published scientific papers, journals, and additional references. So, the CEAP provides valuable information that pertains to the various items in this plan and is referenced throughout the remainder of this section.

### 4.2.2 Watershed Function

Identifying improvement opportunities for hydrologic and watershed function—including water quantity, yield, and use—are an essential element of the Level I watershed study. Hydrologically, a watershed has three fundamental functions [Black, 1997]:

1. Collecting water from rainfall, snowmelt, and storage that becomes runoff
2. Storing various amounts and durations
3. Discharging water as runoff.

Watershed characteristics (e.g., geologic structure, soils, landform, topography, vegetation, and climate) influence the capture or collection of precipitation, infiltration and storage of surface water and groundwater, and runoff or discharge of water.

Implementing BMPs and conservation practices can affect water quantity through improved plant communities, vegetative diversity, and ecological site health achieved from water development. Creating reliable water sources in areas without such allows grazing systems to establish and changes in grazing distribution. The hydrological responses to grazing are strongly contingent on the vegetative community composition with communities that provide greater cover and obstruction to overland flow, such as midgrass-dominated communities that have greater hydrological function (including infiltration rate) than shortgrass-dominated communities [Wood and Blackburn, 1981; Thurow, 1991; NRCS, 2011].

Poor water distribution has been the primary cause of poor livestock distribution [Holechek, 1997]. Livestock distribution and grazing behavior can be modified by adjusting the location of supplemental feed and water, implementing patch burns, and herding in addition to fencing [Williams, 1954; Ganskopp, 2001; Fuhlendorf and Engle, 2004; Bailey, 2005]. The NRCS [2011] reviewed many studies and found that water distribution, steep slopes, and high elevations clearly influenced the livestock distribution. Sufficient evidence existed to recommend that the NRCS increase the role of herding and supplement placement along with water development and fences for managing livestock distribution [NRCS, 2011].

Soil vegetative cover is widely recognized as a critical factor in maintaining soil-surface hydrologic condition and reducing soil erosion [Gifford, 1985; NRCS, 2011]. Regardless of the grazing system, stocking rates reduce soil-surface vegetative cover below a site-specific threshold, increase detachment and mobilization of soil particles because of raindrop impact, decrease soil organic matter and soil aggregate stability, and increase soil-surface crusting, which reduces soil-surface porosity. Therefore, infiltration decreases while soil erosion and sediment-transport increases [Blackburn, 1984]. Sufficient vegetative cover, critical soil cover, or residual biomass must remain during and after grazing to protect soil-surface condition (e.g., porosity, aggregate stability, and organic matter) and hydrologic properties (e.g., infiltration); however, these site-specific vegetation cover requirements vary depending on cover type (e.g., vegetation, litter, or rock), soil type, rainfall intensities, and water quality goals [Gifford, 1985]. The erosive energy of water and long-term reduction of organic matter adversely affect many soil properties through the increase of bulk density, disruption of biotic crusts, reduced aggregate stability, and organic matter content, which collectively reduce infiltration and increase sediment runoff [NRCS, 2011]. These efforts can increase water infiltration or percolation, stimulate spring flows, and increase flow volume and duration.

### 4.2.3 Ecological Enhancement

An ecological enhancement is any activity that improves an ecosystem, such as stabilizing erosive soils; increasing soil quality; planting or maintaining native grasses, shrubs, or trees; removing and controlling invasive species; and improving or maintaining riparian/wetland areas. The potential benefits achieved from project activities and implementations that influence the condition of those ecological sites and characteristics are also just as complex and varied. Conjunctive to soil function is plant community diversity, health and productivity, subsequent forage diversity, production, and wildlife habitat. Benefits that are accrued to water quality are significant because improvements to the chemical, physical, and biological constituents of a waterbody produce local site enhancements and enhancements that are transferred downstream. Wetland restoration provides benefits to water quality and quantity. Watersheds function by providing diverse sites and pathways along which vital chemical reactions occur and by furnishing habitat for the flora and fauna that constitute the biological elements of ecosystems [Black, 1997].

#### 4.2.3.1 *Plant and Animal Habitat*

Locations of conservation practices and rangeland infrastructure can have a large, indirect impact on overall vegetation change with the spatial design of infrastructure, including fence locations, watering points, and feeders that are used to modify patterns of animal movement and forage utilization; the livestock behavior, template of topography, and plant communities to which livestock respond are also considered [Laca, 2009; NRCS, 2011]. Using rangelands for sustainable livestock production has the potential to ensure that the wildlife habitat will continue into the future [NRCS, 2011]. Wildlife responses to conservation practices are usually species- and even species-habitat specific, which means that each species may respond differently to any specific practice and a single species may respond differently to the same practice in different vegetation associations or conditions [NRCS, 2011].

Free-standing water is a resource that influences distribution and abundance of many wildlife species in arid regions of the US; and water developments have been used since the 1940s to improve wildlife habitat [Simpson et al., 2011]. Simpson et al. [2011] evaluated available literature for evidence of the effects of water sources on wildlife populations. Positive effects of water developments on wildlife have been documented, and species that were previously thought not to use free-standing water developments do so when it is available [Simpson et al., 2011]. Researchers also studied the effects of wildlife water developments in southwestern Arizona and found that water developments were used by a diverse array of wildlife, including mule deer, game birds, and several nongame species [Rosenstock et al., 2004].

#### 4.2.3.2 *Stream Corridors and Riparian/Wetland Areas*

Reducing the impact to riparian plant communities by developing upland water resources can result in stream corridor benefits. Riparian plant diversity and regeneration of preferred woody species can help restore local water tables, trap sediments, increase wildlife habitat and migration corridors, and stabilize streambanks. Aquatic population benefits can also accrue, and recreation potential can be realized.

Livestock distribution practices (such as water developments, supplement placement, and herding) are effective means of managing the timing of grazing in riparian areas [NRCS, 2011]. The grazing season also determines effects on riparian-vegetation communities, particularly woody plants, and can be managed to conserve riparian habitats [NRCS, 2011]. Riparian-grazing-management has been demonstrated to maintain or enhance key riparian-vegetation attributes (i.e., species composition, root mass and root density, cover, and biomass). Stream-channel and riparian soil stability have also been enhanced and support ecosystem services, such as flood and pollutant attenuation and high-quality riparian habitat [NRCS, 2011]. Peer-reviewed literature generally supports the effectiveness of water developments, supplement placement, and herding for reducing riparian vegetation use, or time spent in riparian areas [NRCS, 2011].

### 4.2.4 Societal Value

Natural resource stewardship not only has economic value in terms of forage, livestock, and wildlife production relationships but also can have noneconomic value placed on those conservation practices by society. Those values can even influence the perception of those who implement conservation practices and can be as much of an influence in the decision process to implement conservation as economic value. A BMP or conservation practice can possibly provide an ecological service to accrue more value to society in general than to a landowner. Ecosystem services are things or experiences that are produced by the natural systems on which humans place value [NRCS, 2011].

Noneconomic values can and should be considered in determining watershed-enhancement programs, particularly when considering public investment in conservation. NRCS [2011] found little to no research exists that shows the direct noneconomic effects of BMPs and conservation practices on individuals, households, or social systems but acknowledged that producers likely realize psychological benefits from conservation because stewardship typically ranks high among the management goals of livestock producers [Huntsinger and Fortmann, 1990; Sayre, 2004]. Moreover, producers who strongly believe in a responsibility to society are more likely to engage in environmentally sound management practices, such as invasive weed control and riparian protection [Kreuter et al., 2005].

In 2012, in cooperation with the Wyoming Stock Growers Association (WSGA), University of Wyoming, and University of California-Davis, researchers with the USDA's ARS Rangeland Resources Research Unit in Cheyenne, who were investigating the effects of rangeland management decision-making, asked WSGA producer members about their goals, ranching operations, and management practices via a mail survey. A total of 307 ranchers responded to the survey [Kachergis et al., 2013; Mealor, 2013]. Livestock and forage production were the top management goals; ecosystem characteristics that support these goals (e.g., soil health and water quality) were secondary [Kachergis et al., 2013; Mealor, 2013].

Along with social values and ecological enhancements, open spaces have long been held in high value in Wyoming and other western states. From the perspectives of ranching, tourism, recreation, or real-estate industries, open space is significant. Open spaces are critical for upland and riparian connectivity, wildlife migrations and habitat, cultural resource preservation, and recreational opportunity.

## 4.3 IRRIGATION SYSTEM PROPOSED PROJECTS

This plan and its alternatives provide the irrigators and landowners with an assessment of conditions associated with the irrigation delivery infrastructure and associated hydraulic structures. The landowner or manager could use the conceptual plans as a starting point from which they could select projects for further design and for funding assistance from the WWDC's SWPP, the NRCS Environmental Quality Incentives Program (EQIP), or other participating conservation or watershed programs. Note that funding for sprinkler systems (including pivot and sideroll systems) is unavailable through the SWPP but could be obtained through EQIP depending on specific resource concerns and applicable ranking criteria.

At the request of those individuals who asked to participate in the study, irrigation components were inventoried. Based on the results of the inventory, conceptual project plans for rehabilitation and/or replacement were developed. The conceptual proposed projects were developed with the assumption that future installation might occur within the next 10 years unless otherwise noted that the structure has failed and is nonfunctional, which warrants installing components within the next 1–3 year time frame.

Conceptual irrigation rehabilitation components were planned for study participants. The typical component was assumed to replace a medium-sized diversion and headgate structure, and install a 10-inch buried plastic irrigation pipeline (PIP). Note that the actual alignment, volumes, dimensions, and lengths need to be determined for these conceptual projects and components included within this report. Additional work (such as design, permits, clearances, constructions specifications, financing, and bid solicitations) may be required before commencing any installation.

In Sections 4.3.1 through 4.3.10, the individual structures that were inventoried and planned are discussed. The structures that were inventoried and their respective component identifiers in the Watershed Management Plan are summarized in Table 4.1. This information has been incorporated to the study's GIS. Figure 4.1 displays the location of the proposed irrigation projects within the study area.

**Table 4.1. Summary of Recommended Irrigation System Improvements**

| Plan Item | Project Name | Component |
|---|---|---|
| I-01.1 | Hoblit Reservoir | Rehabilitate dam embankment, spillway, outlet |
| I-02.1 | Reynolds No. 1 and No. 2 | Rehabilitate main headgate structures |
| I-02.2 | Reynolds No. 1 | Install 2,775 feet of 8-inch PIP pipeline |
| I-02.3 | Reynolds No. 2 | Install 3,590 feet of 8-inch PIP pipeline |
| I-03.1 | Emma Ditch | Rehabilitate headgate and stabilize banks |
| I-03.2 | Emma Ditch | Install 2,825 feet of 8-inch PIP pipeline |
| I-04.1 | Peterson Draw | Install 300 feet of 12-inch PIP pipeline |
| I-05.1 | Ladwig No. 2 | Rehabilitate well and pump |
| I-05.2 | Ladwig No. 2 | Install 1,200 feet of 10-inch PIP pipeline |
| I-06.1 | Lucerne Canal | Rehabilitate diversion and headgate |
| I-07.1 | E B Wilson Ditch | Rehabilitate diversion and headgate |
| I-07.2 | E B Wilson Ditch | Install 2,400 feet of 8-inch PIP pipeline |
| I-08.1 | Glomill Ditch | Rehabilitate diversion/headgate and stabilize banks |
| I-08.2 | Glomill Ditch | Install 600 feet of 18-inch PIP pipeline |
| I-09.1 | East Draw Regulating Reservoir | Construct irrigation-regulating reservoir |
| I-10.1 | Peterson Draw Regulating Reservoir | Construct irrigation-regulating reservoir |

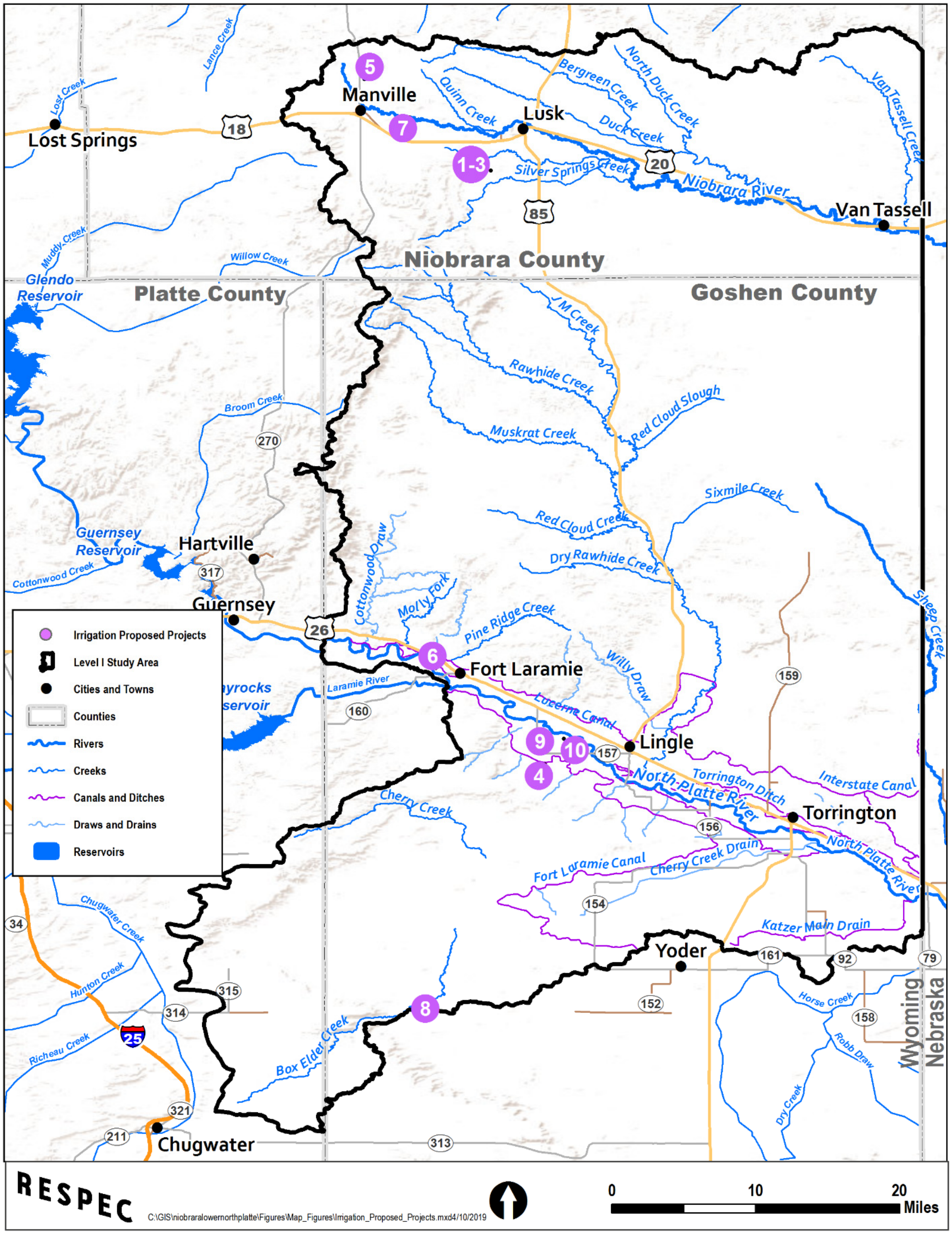


**Figure 4.1.** Conceptual Irrigation Proposed Projects Located Within the Study Area.

### 4.3.1 I-01: Hoblit Reservoir Rehabilitation

The I-01 project would involve rehabilitating an existing reservoir to supply water to a portion of the watershed that lacks adequate irrigation sources. The Hoblit Reservoir is located on a tributary to the North Branch Silver Springs Creek in Section 19 of Township 32 North, Range 63 West in Niobrara County. The Hoblit Reservoir (Permit No. P6553.0R) was permitted in 1960 with a capacity of 48.60 acre-feet and then enlarged (Permit No. P7451.0R) in 1971 with a total capacity of 59.67 acre-feet. This reservoir could be rehabilitated to provide irrigation, livestock/wildlife, fish propagation water and restoring functions of the wetland and riparian areas. This alternative would involve installing an inlet and outlet pipe-control structure in the embankment, shown in Figure 4.2, and stabilizing the installed structures and spillway with rock riprap. This alternative, as shown in Figure 4.4, includes the following:

- Inspecting the embankment and rehabilitating problem areas as needed.
- Rehabilitating the outlet facilities to control reservoir water levels. The installed structures would be stabilized with rock riprap.
- Excavating the earthen spillway will adequately convey necessary water volumes and stabilizing with rock riprap for spillway protection.
- Determining adequate sources of borrow material and rock riprap will allow for dam embankment repairs and spillway stabilization.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.2.** Top of Dam Embankment on Hoblit Reservoir.

### 4.3.2 I-02: Reynolds No. 1 and Reynolds No. 2 Diversion and Headgate

The I-02 project would involve rehabilitating an existing headgate structure to supply water to a portion of the watershed that lacks adequate irrigation water. The diversion/headgate is shown in Figure 4.3 and is located on the outlet of Hoblit Reservoir on a tributary to the North Branch Silver Springs Creek in Section 19 of Township 32 North, Range 63 West in Niobrara County. The Reynolds No. 1 Ditch (Permit No. P9676.0D) was permitted in 1910 and the Enlargement of Reynolds No. 1 Ditch (Permit No. P6426.0E) was permitted in 1971. The Reynolds No. 2 Ditch (Permit No. P9677.0D) was permitted in 1910 and the Enlargement of Reynolds No. 1 Ditch (Permit No. P6427.0E) was permitted in 1971. Based on a field evaluation, the diversion is nonfunctioning, and the proposed project would improve irrigation. The project shown in Figure 4.4 could involve the following components:

- Item No. I-02.1: Rehabilitate headgate structure and stabilize banks.
- Item No. I-02.2: Install approximately 3,590 feet of 8-inch PIP pipeline.
- Item No. I-02.3: Install approximately 2,775 feet of 8-inch PIP pipeline.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.3.** Headgate Structure on Hoblit Reservoir for Reynolds No. 1 and Reynolds No. 2 Ditches.

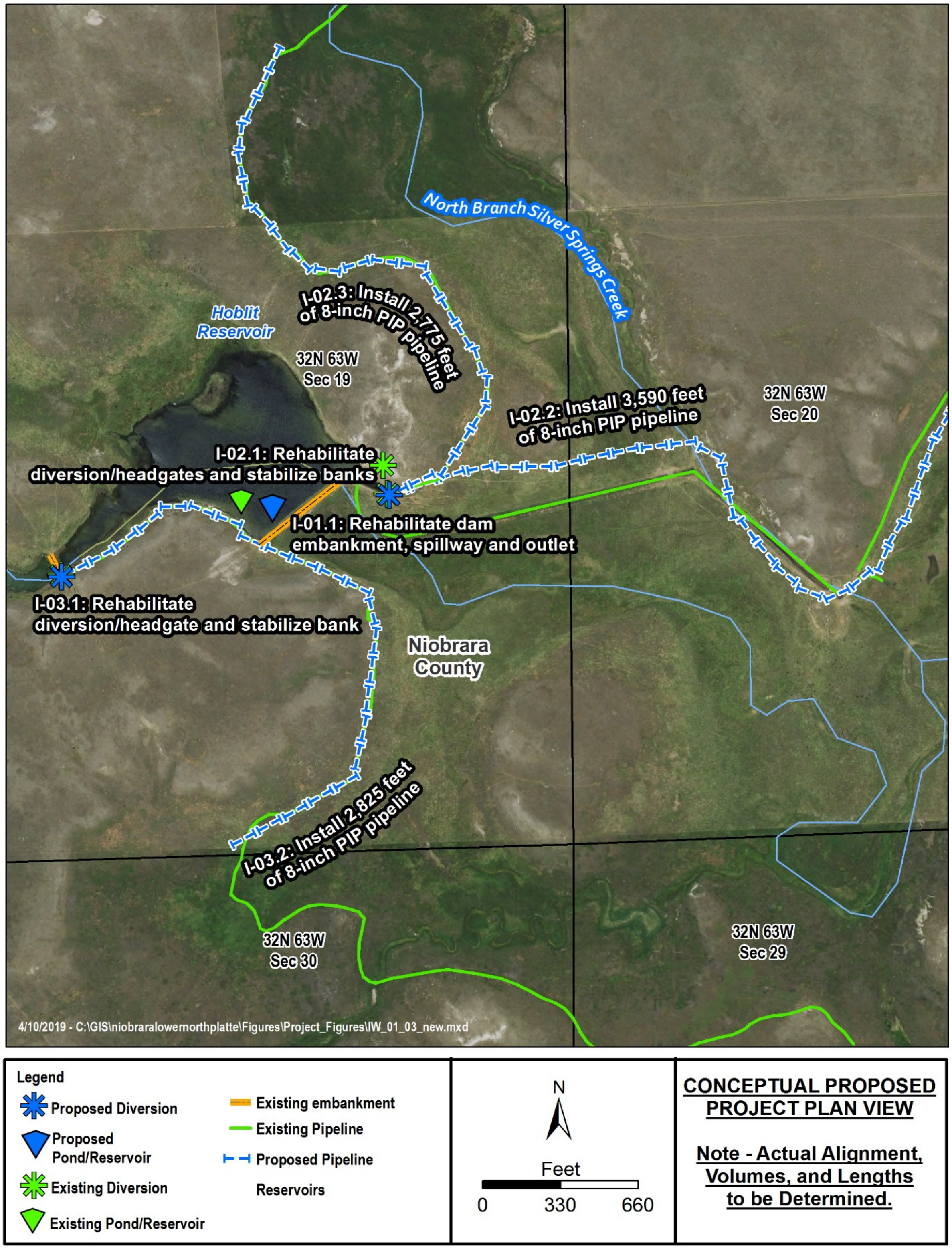


**Figure 4.4.** Proposed I-01 and I-02: Hoblit Reservoir, Reynolds No. 1, Reynolds No. 2 Projects.

### 4.3.3 I-03: Emma Ditch Diversion and Pipeline

The I-03 project would involve rehabilitating an existing headgate structure to supply water to a portion of the watershed that lacks adequate irrigation water sources. The diversion/headgate shown in Figure 4.5 is located immediately above Hoblit Reservoir on a tributary to the North Branch Silver Springs Creek in Section 19 of Township 32 North, Range 63 West in Niobrara County. The Emma Ditch (Permit No. P56.0D) was permitted in 1891. Based on a field evaluation, the diversion is nonfunctioning; the proposed project would improve irrigation, as shown in Figure 4.6, and involve the following components:

- Item No. I-03.1: Rehabilitate headgate structure and stabilize banks.
- Item No. I-03.2: Install approximately 2,825 feet of 8-inch PIP pipeline.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.5.** Headgate Structure on Hoblit Reservoir for the Emma Ditch.

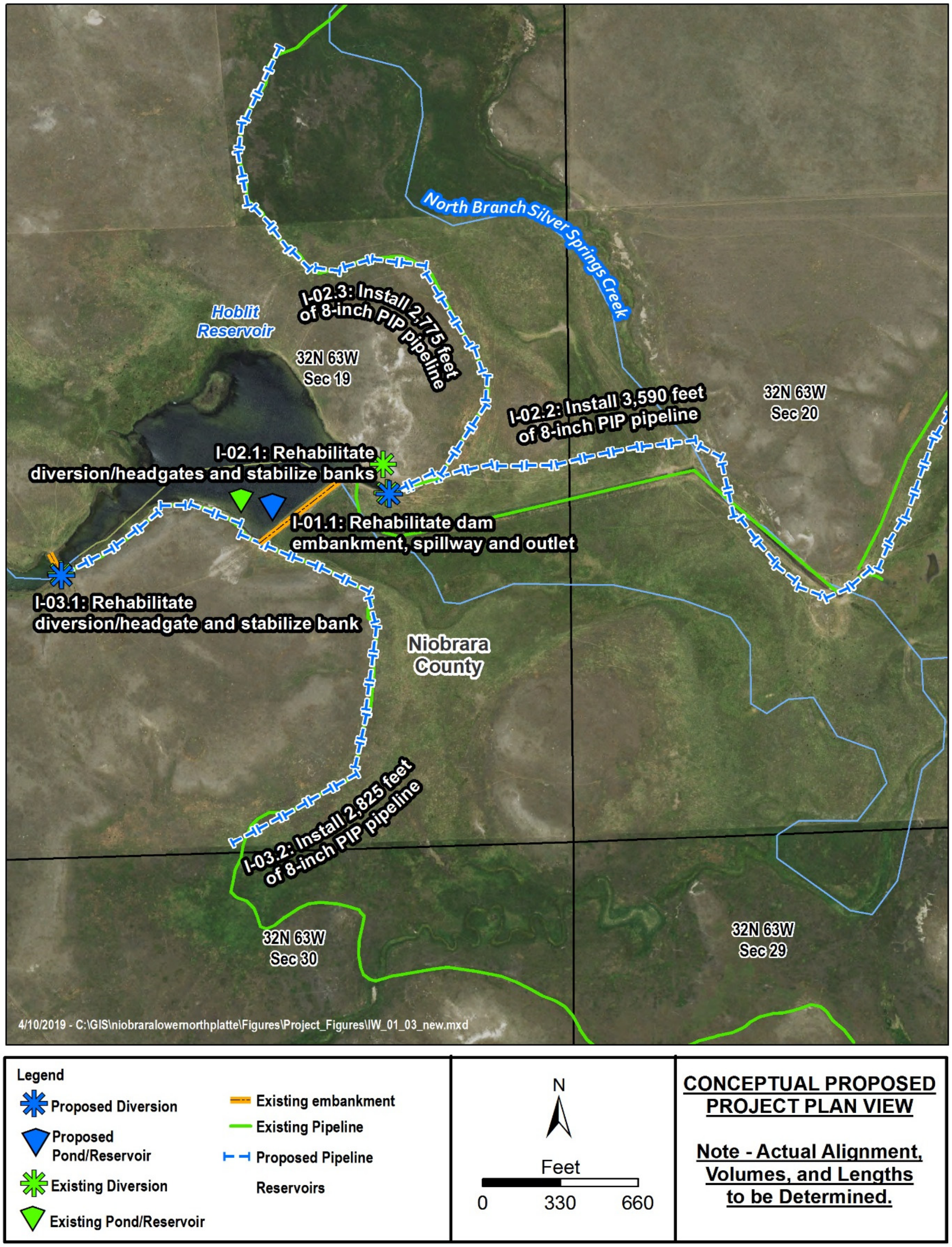


**Figure 4.6.** Proposed I-03: Emma Ditch Diversion and Pipeline Project.

### 4.3.4 I-04: Peterson Draw Diversion and Pipeline

The I-04 project would involve rehabilitating an existing headgate and converting an earthen ditch to a pipeline to supply water to a portion of the watershed that lacks efficient use of irrigation water. The proposed diversion and pipeline would divert water from the Goshen Irrigation District's (GID's) sublateral in Section 26 of Township 25 North, Range 63 West in Goshen County. The sublateral consists of a 300-foot earthen ditch, which is shown in Figure 4.7, that delivers irrigation water to hay fields along Peterson Draw, which is a minor drainage and intermittent tributary to the North Platte River.

The landowner identified the existing earthen ditch with excessive leakage, which results in inefficient application of irrigation water and excessive irrigation tailwater delivery to Peterson Draw. Based on a field evaluation, the proposed project would improve irrigation efficiency and, as shown in Figure 4.8, could involve the following components:

- Item No. I-04.1: Rehabilitate headgate structure.
- Item No. I-04.2: Install approximately 300 feet of 12-inch PIP pipeline.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.7.** Earthen Ditch Located West of Peterson Draw.

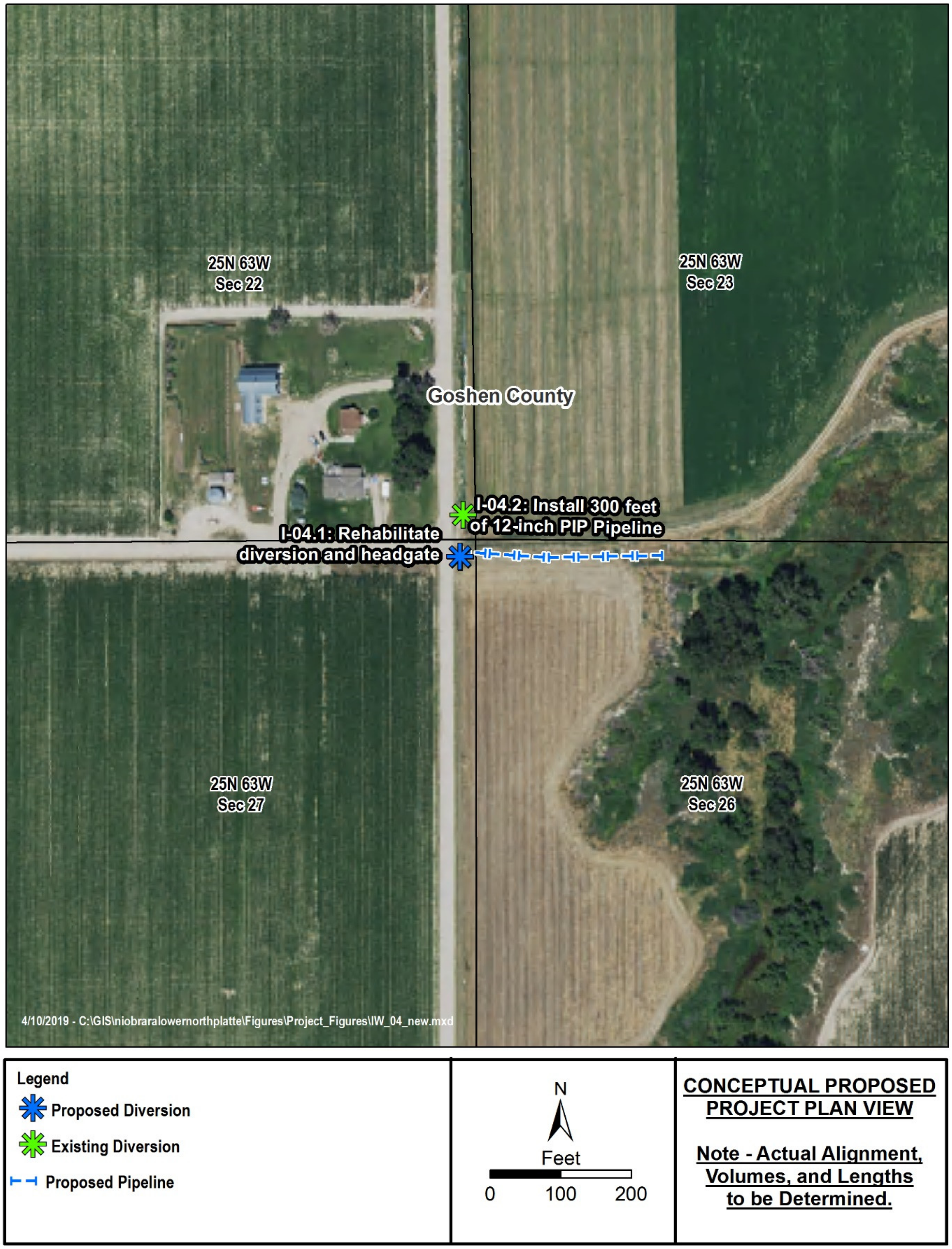


**Figure 4.8.** Proposed I-04: Peterson Draw Diversion and Pipeline Project.

### 4.3.5 I-05: Ladwig No. 2 Well Rehabilitation and Pipeline

The I-05 project would involve rehabilitating an existing irrigation well and pumping plant and convert an above ground mainline to a buried mainline for supplying water to a portion of the watershed that lacks efficient use of irrigation water sources. The Ladwig No. 2 well (Permit No. P40238.0W) was drilled in 1977 and is shown in Figure 4.9. The proposed project is located north of Manville in Section 25 of Township 33 North, Range 65 West in Niobrara County. The well, pumping plant, mainline, and sideroll sprinkler system, as shown in Figure 4.10 and Figure 4.11, deliver irrigation water to hay fields along an unnamed, intermittent tributary to the Niobrara River. Pivot sprinklers are difficult to fund through the SWPP and EQIP funding should be pursued but depends on specific resource concerns and applicable ranking criteria.

The existing pumping plant, mainline, and current wheeline sprinkler were identified as an inefficient use of irrigation water that results in excessive on-farm water use and possible aquifer overdraft. The proposed project would improve irrigation efficiency and management. Figure 4.12 shows the project could involve the following components:

- Item No. I-05.1: Rehabilitate the existing well and pumping plant.
- Item No. I-05.2: Install approximately 1,200 feet of 8-inch PIP pipeline.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.9.** The Ladwig No. 2 Well (Permit No. P40238.0W) Located North of Manville.

**Figure 4.10.** Existing Sideroll Sprinkler System Supplied by the Ladwig No. 2 Well.

**Figure 4.11.** Existing Above Ground Mainline Supplied by The Ladwig No. 2 Well.

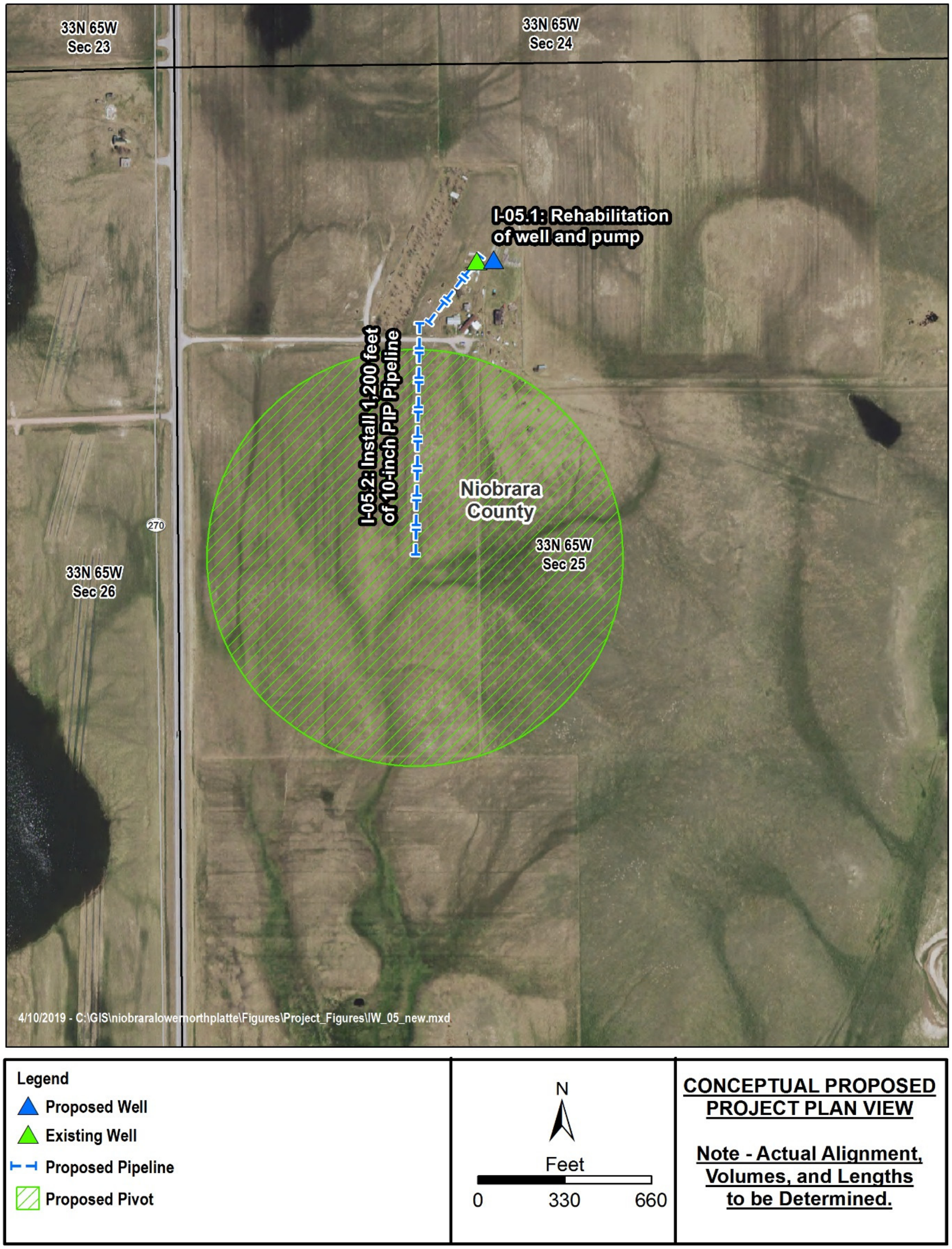


**Figure 4.12.** Proposed IW-05: Ladwig No. 2 Well Rehabilitation and Pipeline Project.

### 4.3.6 I-06: Lucerne Canal Diversion and Pipeline

The Lucerne Canal (also known as the Lucerne Ditch), which is shown in Figure 4.13, diverts water from the North Platte River in Section 21 of Township 26 North, Range 64 West in Goshen County. The Lucerne Canal (Permit No. P424.0D) was permitted in 1893 to divert 63.17 cubic feet per second (cfs). The diversion is located on the river roughly 1.3 miles west of Fort Laramie and delivers water with installation of approximately 14.8 miles of earthen canal to approximately 4,431 adjudicated irrigated acres. These irrigated acres are located on the north side of the river from 1 mile east of Fort Laramie to 1 mile east of Lingle.

The Lucerne Canal system at the time of this study indicated that the infrastructure components are aged and in need of rehabilitation; most of the canal needs maintenance and is hindered by seepage loss. Headgates along the Lucerne Canal located west of Lingle are shown in Figure 4.13. RESPEC recommends that the Lucerne Canal Company apply to the WWDC for consideration of completing an Irrigation Master Plan and investigate the feasibility of replacing and/or rehabilitating the canal's diversion, earthen conveyances, and headgate structures. The proposed project shown in Figure 4.14 would involve the following components:

- Item No. I-06.1: Rehabilitate the diversion and headgate structures.
- Item No. I-06.2: Install approximately 78,000 feet of 21-inch PIP pipeline.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.13.** A View of Field Turnout Headgates Along the Lucerne Canal Located West of Lingle.

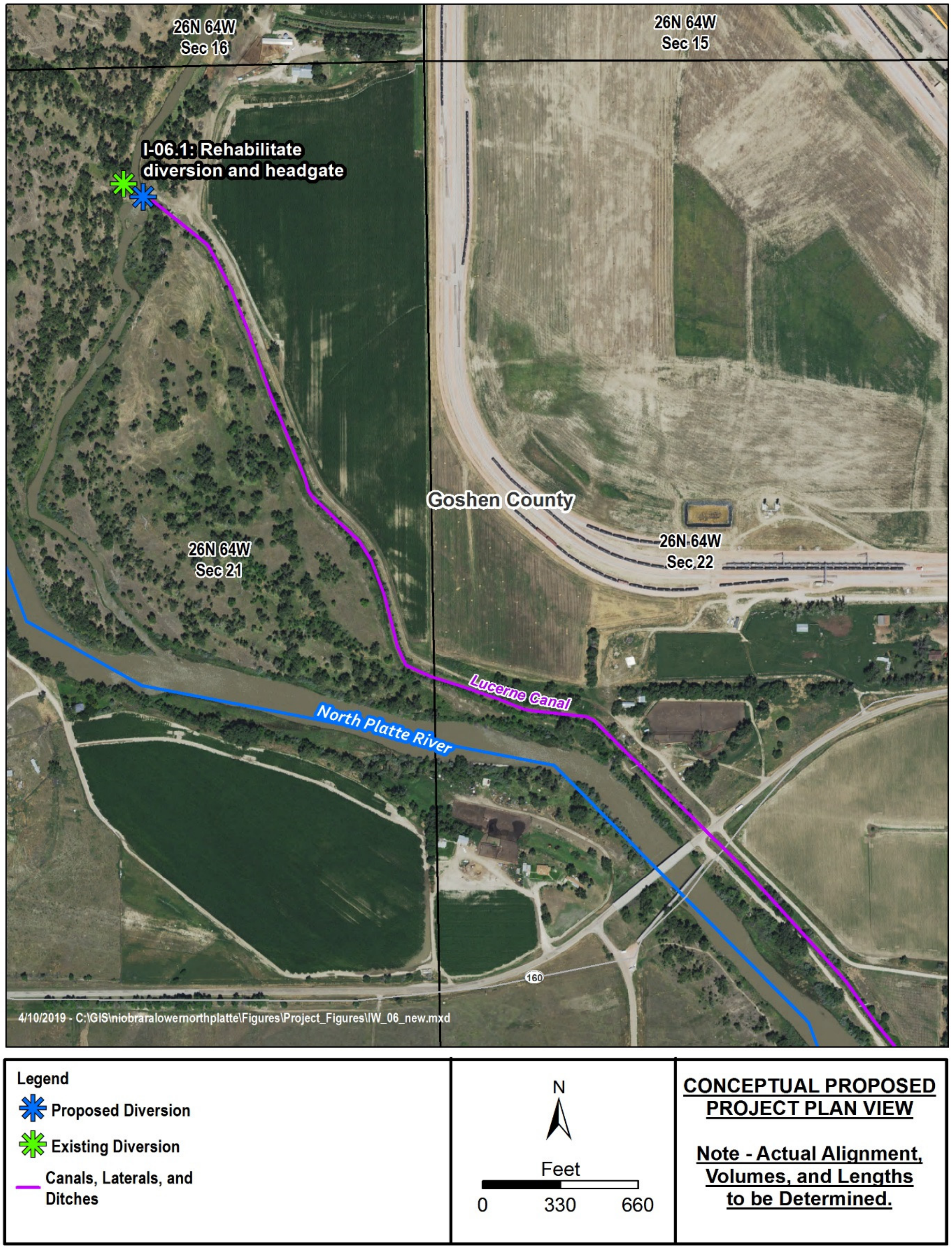


**Figure 4.14.** Proposed I-06: Lucerne Canal Diversion and Headgate Project.

### 4.3.7 I-07: E B Wilson Ditch Diversion and Pipeline

The I-07 project would involve rehabilitating an existing headgate structure to supply water to a portion of the watershed that lacks adequate irrigation water sources. The diversion/headgate is located on the Niobrara River in Section 5 of Township 32 North, Range 64 West in Niobrara County. The E B Wilson Ditch (T1476.0-) was appropriated in 1881 to divert 5.85 cfs for irrigation of approximately 400 adjudicated irrigated acres. Based on a field evaluation, the diversion, as shown in Figure 4.15, is nonfunctioning, and the proposed project would ensure deliver of irrigation water. The project as shown in Figure 4.16 could involve the following components:

- Item No. I-03.1: Rehabilitate diversion and headgate structure.
- Item No. I-03.2: Install approximately 2,400 feet of 8-inch PIP pipeline.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.15.** E B Wilson Ditch Diversion Structure on the Niobrara River.

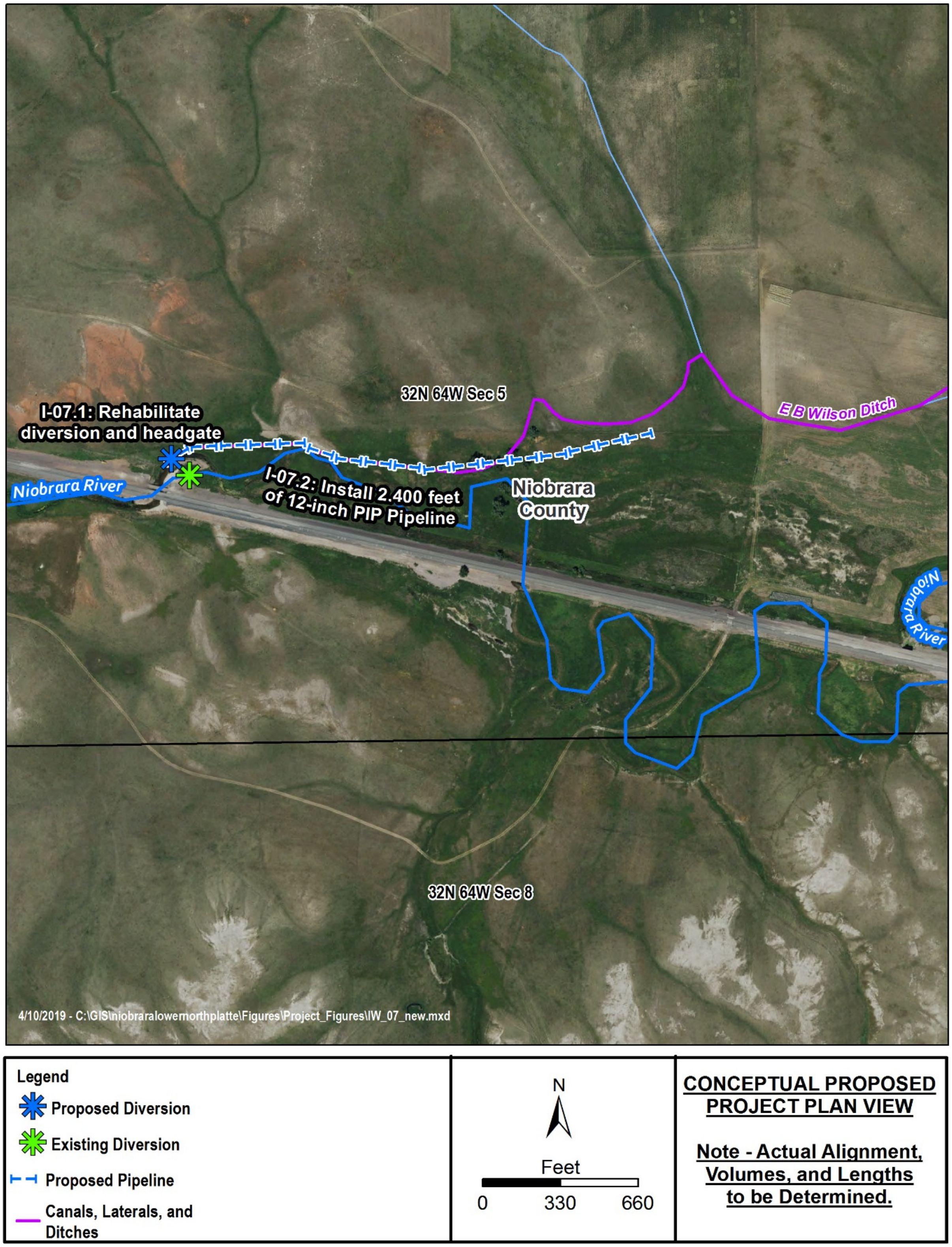


**Figure 4.16.** Proposed I-07: E B Wilson Ditch Diversion and Pipeline Project.

### 4.3.8 I-08: Glomill Ditch Diversion and Pipeline

The I-08 project would involve rehabilitating an existing diversion structure and pipeline to supply water to a portion of the watershed that lacks adequate irrigation water sources. The proposed project is located on Box Elder Creek in Section 9 of Township 22 North, Range 64 West in Goshen County. The Glomill Ditch (OR 20/137) was permitted in 1910 and several enlargements of the Glomill Ditch have been permitted since.

The landowner identified the existing diversion and earthen ditch, as shown in Figure 4.17, as an inefficient use of water, which results in excessive reservoir evaporation and inadequate on-farm irrigation water. Based on a field evaluation, the proposed project would improve irrigation efficiency and management. The project, which is shown in Figure 4.18, could involve the following components:

- Item No. I-08.1: Rehabilitate diversion and headgate structure.
- Item No. I-08.2: Install 600 feet of 21-inch PIP or Corrugated Metal Pipe (CMP) pipeline.
- Item No. I-08.3: Install rock chute/grade stabilization structure below pipe outfall.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

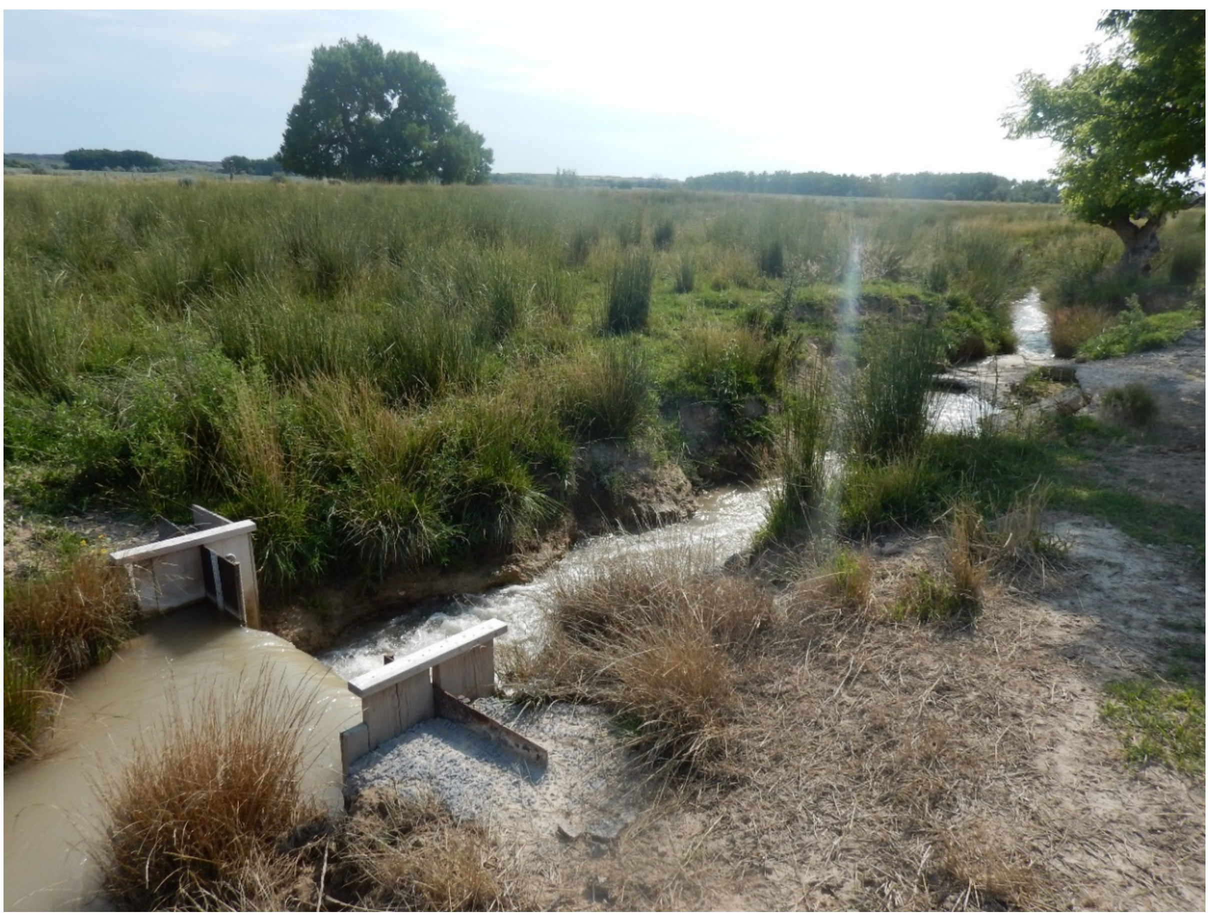

**Figure 4.17.** Weir and Downstream Failed Concrete Diversion on Box Elder Creek for Glomill Ditch.

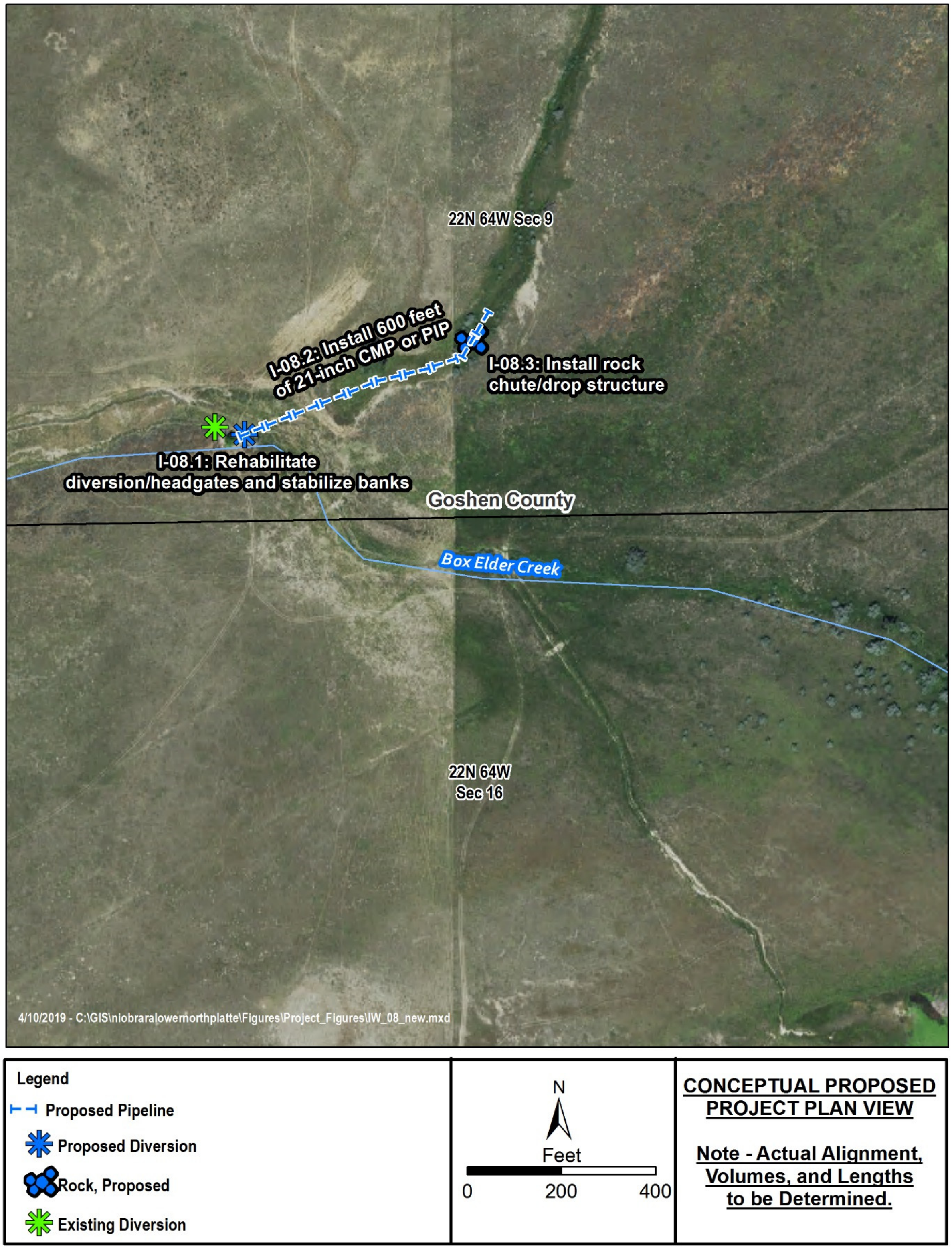


**Figure 4.18.** Proposed I-08: Glomill Ditch Diversion and Pipeline Project.

### 4.3.9 I-09: East Draw Regulating Reservoir Project

The I-09 proposed project would be located on an unnamed, intermittent tributary to the North Platte River in Section 23 of Township 25 North, Range 63 West in Goshen County. The water is delivered from a GID ditch to gated pipe that irrigates hay fields. The project area, which is shown in Figure 4.19, would involve constructing a small reservoir and would require investigating soil and geologic conditions and procuring permits. The proposed project, which is shown in Figure 4.21, would improve irrigation efficiency by providing temporary water storage allowing proper scheduling and reducing excessive return flows. The proposed project would involve the following components:

- Item No. I-09.1: Construct an irrigation-regulating reservoir with a volume less than 2 acre-feet.
- Investigating site-specific soil and geologic conditions will help determine site suitability and feasibility of structure installations or other conditions of the underlying formations.
- Installing an inlet/outlet control mechanism to control water levels and excavating an earthen, grass-lined spillway will adequately convey necessary water volumes, and the installed structures would be stabilized with rock riprap.
- Feasibility is contingent on determining adequate sources of borrow material and rock riprap for dam embankment construction and spillway stabilization.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.19.** Potential Regulating Reservoir Site Located in the East Draw.

### 4.3.10 I-10: Peterson Draw Regulating Reservoir Project

The I-10 proposed project would be located on Peterson Draw, an intermittent tributary to the North Platte River in Section 23 of Township 25 North, Range 63 West in Goshen County. The water is delivered from a GID earthen ditch to gated pipe that irrigates hay fields. The project area, which is shown in Figure 4.20, would involve constructing a small reservoir and would require investigating soil and geologic conditions and procuring permits. The proposed project shown in Figure 4.21 would involve the following components:

- Item No. I-10.1: Construct an irrigation-regulating reservoir with a volume less than 2 acre-feet.
- Investigating site-specific soil and geologic conditions to determine the site suitability and feasibility of structure installations or other conditions of the underlying formations.
- Installing an inlet and outlet control mechanism to control water levels. The installed structures would be stabilized with rock riprap.
- Excavating an earthen, grass-lined spillway will adequately convey the necessary water volumes, and stabilizing with rock riprap for spillway protection.
- Feasibility is contingent on determining adequate sources of borrow material and rock riprap for dam embankment construction and spillway stabilization.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.20.** Potential Regulating Reservoir Site Located in the East Draw.

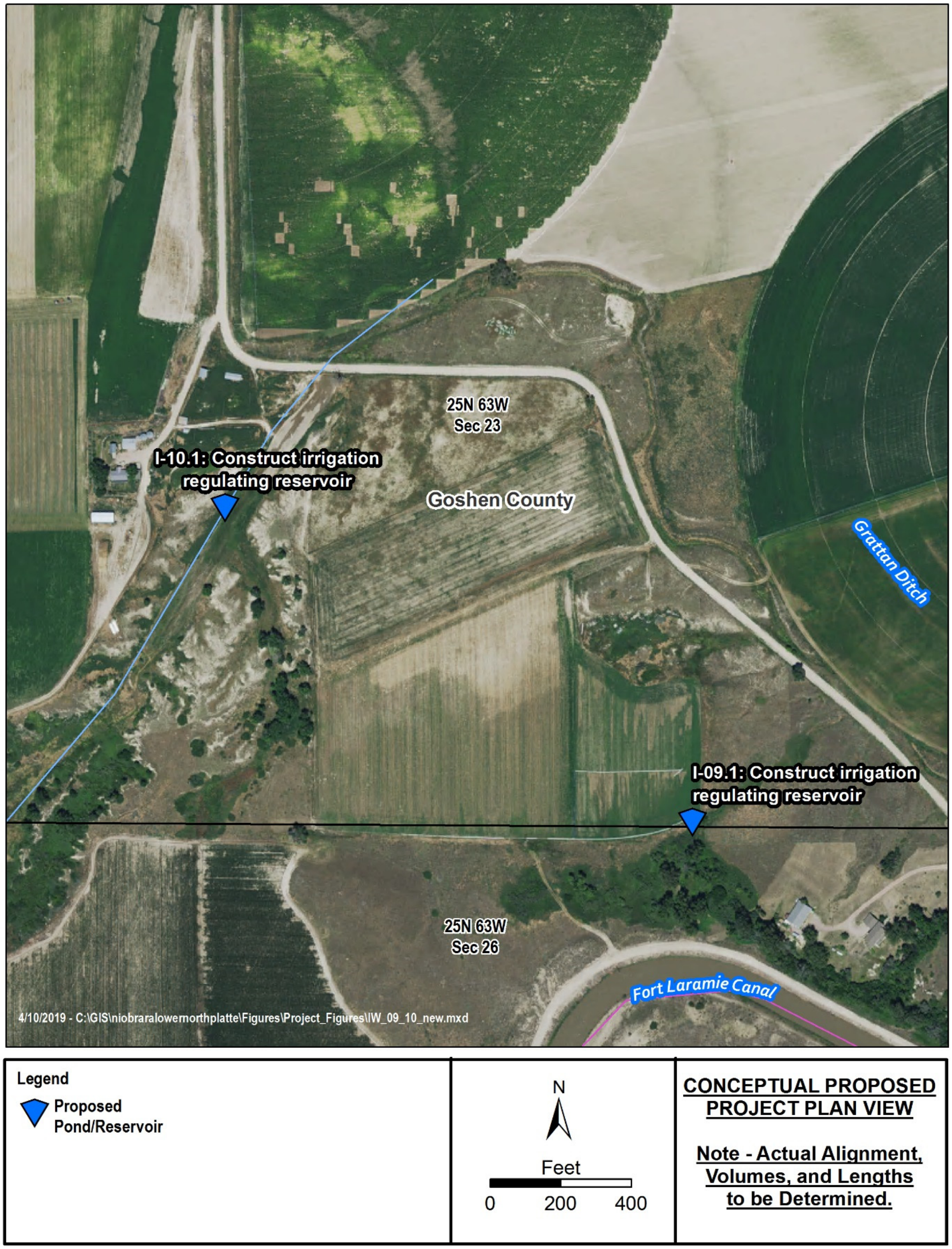


**Figure 4.21.** Proposed I-09: East Draw and I-10: Peterson Draw Regulating Reservoir Projects.

## 4.4 LIVESTOCK/WILDLIFE WATERING OPPORTUNITIES

### 4.4.1 Livestock/Wildlife Water Requirements

Water requirements for livestock/wildlife depend on the type, density, and seasonality of the grazing animals, along with the topography, water availability, and plant communities. Existing livestock/ wildlife water sources evaluated during the study were discussed in Section 3.4.3.9 and are displayed in Figure 3-69. The purpose of evaluating viable livestock/wildlife watering sources and facilities is to identify possible alternatives to unreliable supplies, inconsistently used rangelands, and nonfunctioning riparian areas.

The study area also contains areas where water sources are insufficient to meet the requirements for livestock/wildlife. Many of these sources are reservoirs that are located on intermittent streams and have inconsistent and unreliable runoff. Because of this uncertainty, some areas could benefit from upland water development. Participating landowners identified places where existing water sources could be improved.

Many springs located within the study area could be developed as livestock/wildlife water sources. However, before initiating any spring development project, a site-specific assessment should be performed to confirm that sufficient yield is present and identify necessary conservation measures. Any final plan and design of a livestock/wildlife water project should consider the available water, topography, component materials, design specifications, and number of animals served by the system.

For the purposes of this study, conceptual livestock/wildlife water components and the associated facilities were created and located on parcels, allotments, and pastures for landowners who participated in the study. The typical project component was assumed to consist of a rubber tire stock tank that provides approximately 1,200 gallons of livestock/wildlife water that was supplied by a well and solar pump with installation of a 1.5-inch high-density polyethylene (HDPE) pipeline. The stock tank would provide a volume of water for approximately 130 cattle per day, assuming a daily requirement of 15 gallons per head per day.

The water tanks could also provide water for antelope and mule deer, assuming a daily requirement of 2 gallons per animal per day. Closed storage tanks were also included in the components to better use the existing sources. Pipeline sizes were assumed based on potential future needs for expanding the distribution system requirements.

The project components in this study are conceptual only and are described in general for this report. Before the installation, the actual locations; specifications; alignments; volumes; and lengths of pipelines, tanks, wells, and pumps should be determined. Installing wildlife escape ramps and/or devices in the proposed water tanks and incorporating all of the valves, fittings, and appurtenances to facilitate managing flows and water levels are also recommended.

### 4.4.2 Conceptual Livestock/Wildlife Water Proposed Projects

Meetings held in Lusk and Torrington provided opportunities to meet interested landowners and residents, gain local input, hear resource concerns, and answer questions about the study. Participation in the study was voluntary, and a list of interested participants was created after these meetings. On-site, individual meetings were scheduled and conducted with study participants. During these meetings, the study team listened to the participants' concerns about water needs and visited potential project sites.

The participant meetings and information about existing water sources resulted in identifying areas within the study area that need livestock/wildlife water development and several conceptual water-development projects. These proposed projects were developed to provide reliable water sources for livestock/wildlife in areas that lack sufficient sources within the watershed. These project designs are conceptual only, and, if initiated, would require additional design work before installation. The proposed livestock/wildlife projects and components in the Watershed Management Plan are summarized in Table 4.2, and Figure 4.14 displays the locations of the proposed livestock/wildlife water projects.

Because state lands cover approximately 7.4 percent of the study area and are intermingled with private lands, some of the upland water-development projects would involve coordination with the Wyoming Office of State Lands and Investments (OSLI) before initiating construction. Some projects could also potentially involve cooperation among multiple landowners because of the locations of wells and routes for pipelines. For projects that span multiple landowners, written agreements would be necessary to outline the specific responsibilities and liabilities of the parties involved with each individual project. Moreover, environmental evaluations would be required for any potential effects that are identified for a specific project or project component, especially on federal and state lands. Therefore, coordination is necessary with the Bureau of Land Management (BLM) before implementing any project on BLM land, and coordination with the OSLI is required before constructing any improvements on state land.

A total of 23 proposed livestock/wildlife water-development projects with 53 components are described in Sections 4.4.2.1 through 4.4.2.2. These sections summarize well construction, stock pond/reservoir construction or rehabilitation, pipeline installation, and watering or storage tank components. Figures 4.15 through 4.28 display the conceptual plan maps of these proposed livestock/wildlife water-development and rehabilitation projects within the study area.

Future livestock/wildlife water projects are eligible for funding through the WWDC's SWPP. However, these projects would need additional coordination with interested landowners before applications are submitted to the WWDO by a sponsoring entity such as a conservation district, watershed improvement district, water conservancy district, irrigation districts, municipality, or a tribal business council. Additional information needed to pursue program funding could include but is certainly not limited to the following: program application, detailed project description, description of public benefit, outline of financial and technical contributions, project location map, project cost estimates, and any letters of authorization or commitment of participation that may be available from other funding sources. More information about these program application requirements are available at the WWDC's SWPP website (*http://wwdc.state.wy.us/small_water_projects/small_water_project.html*) and the Wyoming NRCS' EQIP website (*https://www.nrcs.usda.gov/wps/portal/nrcs/main/wy/programs/financial/eqip/*).

**Table 4.2. Summary of Livestock/Wildlife Water Proposed Plans and Components**

| Plan Item | Project Name | Solar Pump | Well | Spring Development | Pipeline | Stock Tank | Storage Tank | Pond-Reservoir |
|---|---|---|---|---|---|---|---|---|
| LW-01 | Hoblit Reservoir | 1 | | | 2,200 | 1 | | 1 |
| LW-02 | Siebken #3 | | 1 | | 1,500 | 2 | | 1 |
| LW-03 | Home Well #2 | | | | 3,900 | | 1 | |
| LW-04 | Tronvold #1 | | 1 | | 2,100 | 2 | | |
| LW-05 | Harmony Spring #1 | 1 | | 1 | 2,400 | 1 | | |
| LW-06 | Three Buttes | | 1 | | | 4 | 1 | |
| LW-07 | Upper Hefflen | 1 | | | 5,200 | 2 | 1 | |
| LW-08 | Ole Place 1 | | 1 | | | 3 | | |
| LW-09 | South Draw | | | 1 | | | | 1 |
| LW-10 | North Draw | | | 1 | | | | 1 |
| LW-11 | Owens Well #1 | | 1 | | 7,300 | 2 | 1 | |
| LW-12 | Twin Tanks | | 1 | | 7,400 | 3 | 1 | |
| LW-13 | Cistern Well | | 1 | | 3,600 | 2 | 1 | |
| LW-14 | Hoblit #1 | | 1 | | 3,200 | 2 | | |
| LW-15 | Hoblit #4 | | 1 | | | 2 | | |
| LW-16 | Hoblit #5 | | 1 | | | 1 | | |
| LW-17 | Hoblit #3 | | 1 | | 2,100 | 2 | | |
| LW-18 | Johnson | | 1 | | | 1 | | |
| LW-19 | Colters Pond | 1 | | | 1,300 | 2 | | 1 |
| LW-20 | Smith South | | | 1 | 450 | 1 | | 1 |
| LW-21 | Vondra #1 | 1 | 1 | | 5,750 | 4 | 1 | |
| LW-22 | Upper Moore | 1 | | 1 | 2,000 | 2 | | |
| LW-23 | Bass Draw | | | 1 | 400 | | | 1 |
| LW-24 | North Pasture #2 | 1 | 1 | | 100 | 1 | | |
| **Total** | | **7** | **14** | **6** | **50,900** | **40** | **7** | **7** |

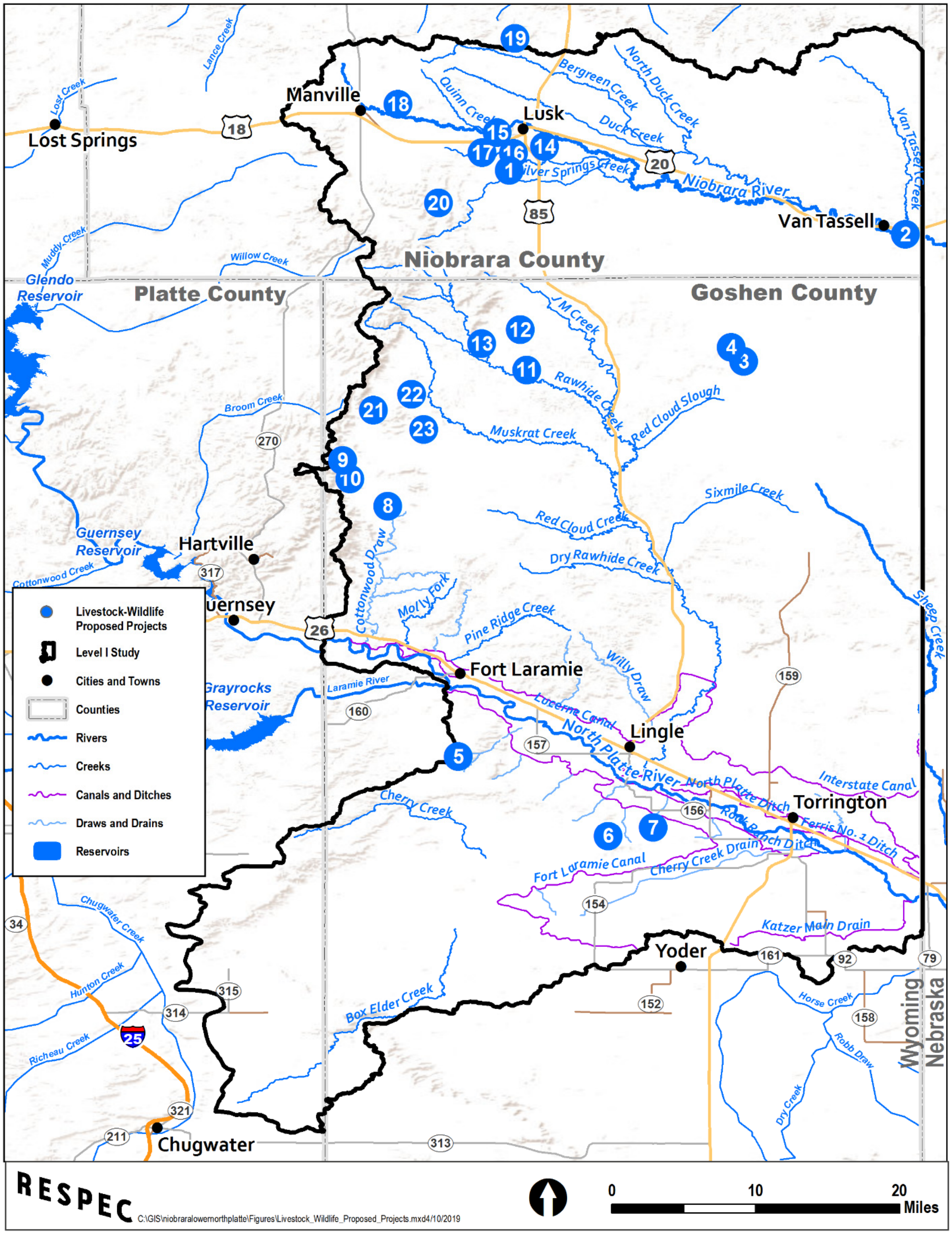


**Figure 4.22.** Conceptual Livestock/Wildlife Water Proposed Projects Within the Study Area.

#### 4.4.2.1 *LW-01: Hoblit Reservoir Rehabilitation Project*

The LW-01 proposed project would involve rehabilitating an existing reservoir to supply water to a portion of the watershed that lacks adequate livestock/wildlife water sources. The Hoblit Reservoir is located on a tributary to the North Branch Silver Springs Creek in Section 19 of Township 32 North, Range 63 West in Niobrara County. The Hoblit Reservoir (Permit No. P6553.0R) was permitted in 1960 with a capacity of 48.60 acre-feet and then enlarged (Permit No. P7451.0R) in 1971 to a total capacity of 59.67 acre-feet. The reservoir is also discussed in Section 4.3.1 and is shown in Figure 4.2. This reservoir could be rehabilitated to provide livestock/wildlife water along with restoring functions of the associated wetland and riparian areas. This alternative would involve installing an inlet and outlet pipe-control structure in the embankment and stabilizing the installed structures and spillway with rock riprap. This alternative, as shown in Figure 4.23, includes the following features:

- Inspecting the embankment and rehabilitating problem areas as needed.
- Rehabilitating the outlet facilities to control reservoir water levels. The installed structures would be stabilized with rock riprap.
- Excavating the earthen spillway to adequately convey necessary water volumes and stabilizing with rock riprap for spillway protection.
- Determining adequate sources of borrow material and rock riprap for dam embankment repairs and spillway stabilization.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

An additional component to this project would involve installing a solar platform from the existing stock reservoir to supply water to a portion of the watershed that lacks adequate livestock/wildlife water sources. Under this alternative, the following components, as shown in Figure 4.23, would be installed:

- A solar platform that consists of solar panels; solar-powered pump; batteries; and all of the regulators, connections, and appurtenances would be installed to pump from an existing stock reservoir equipped with a control structure to supply livestock/wildlife.
- From that rehabilitated reservoir, approximately 2,200 feet of buried 2.0-inch, HDPE low-pressure pipeline would be installed to supply a stock tank (1,200-gallon capacity).
- The required valves, fittings, and appurtenances would be incorporated to facilitate managing flow, pressure, and water level.
- Wildlife escape ramps or devices would be incorporated in the proposed stock tanks.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

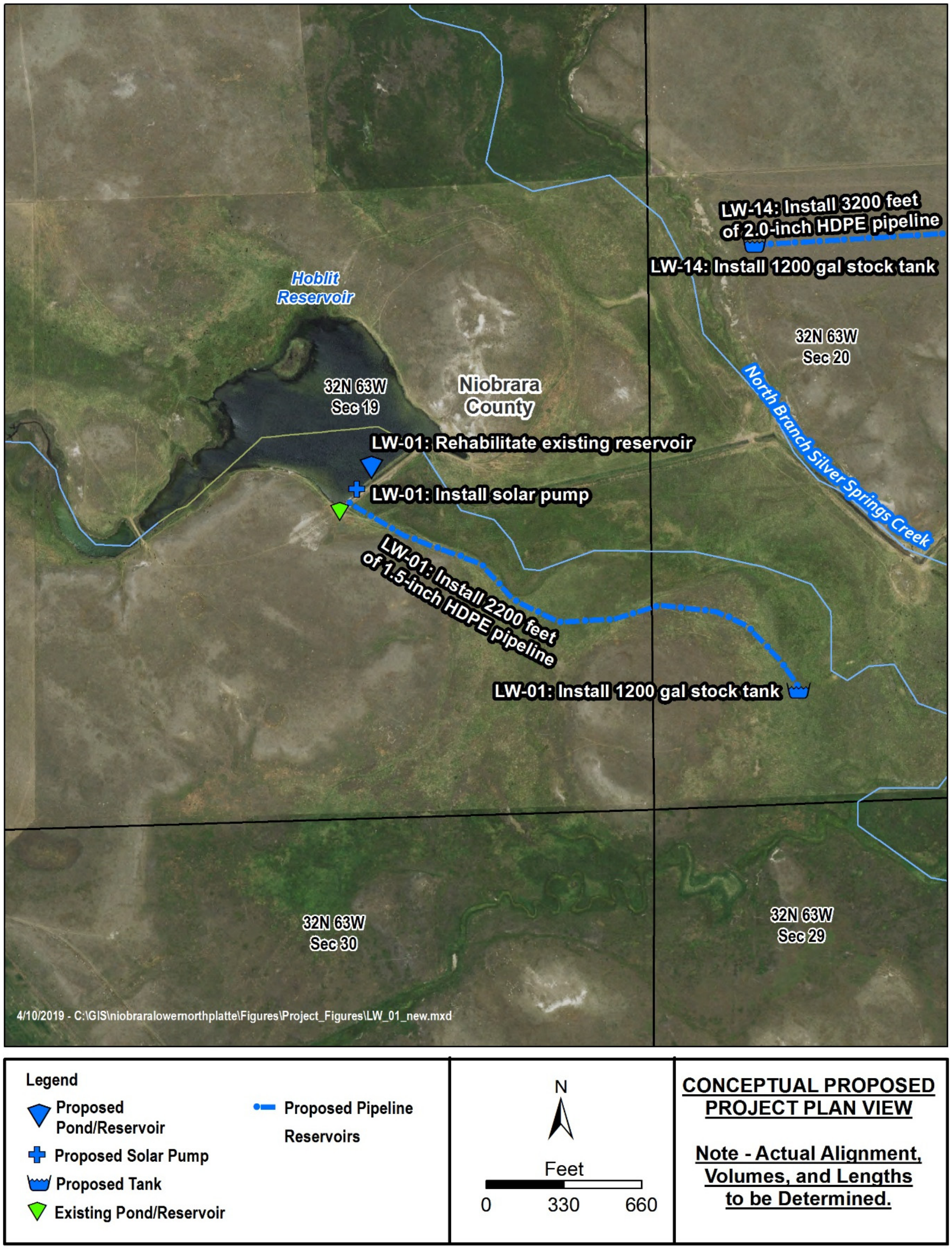


**Figure 4.23.** Proposed LW-01: Hoblit Reservoir Rehabilitation Project.

#### 4.4.2.2 *LW-02: Siebken #3 Stock Well, Pipeline, Tank, and Pond Project*

The LW-02 proposed project would involve rehabilitating an existing well to supply water to a portion of the watershed that lacks adequate livestock/wildlife water sources. The Siebken #3 well (Permit No. P3846.0P) was permitted in 1914 and is shown in Figure 4.24. Under this alternative, the following components shown in Figure 4.25 would be installed:

- An existing well would be rehabilitated to supply water. From that source, approximately 1,500 feet of buried 1.5-inch, HDPE low-pressure pipeline would be installed to supply two stock tanks (1,200-gallon capacity each). The overflow from the stock tanks would then be contained by a stock/wildlife pond.
- The required valves, fittings, and appurtenances would be incorporated to facilitate managing flow, pressure, and water level.
- Wildlife escape ramps or devices would be incorporated in the proposed stock tanks.
- Construct a small stock pond/reservoir that would have a capacity of less than 1 acre-feet.
- Investigate soil conditions to determine site suitability of pond construction.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.


**Figure 4.24.** Existing Seibken #3 Well and Stock Tank.

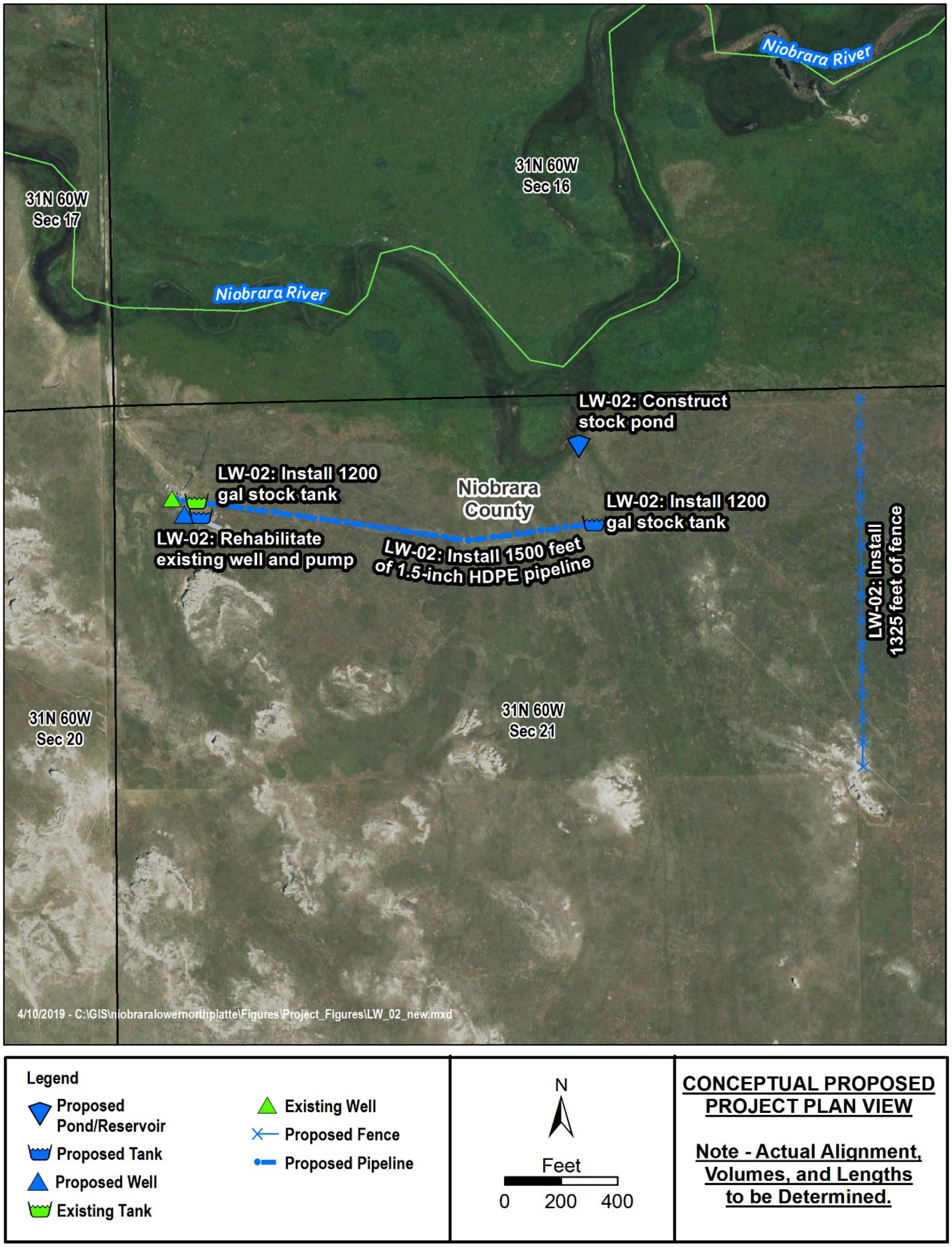


**Figure 4.25.** Proposed LW-02: Siebken #3 Well, Pipeline, Tank, and Pond Project.

#### 4.4.2.3 *LW-03: Home Well #2 Storage Tank Project*

The LW-03 proposed project would involve rehabilitating an existing well to supply water to a portion of the watershed that lacks adequate livestock/wildlife and rural fire suppression water sources. The existing Home Well #2 (Permit No. P136499.0W) was permitted in 2001, and the potential site for a storage tank is shown in Figure 4.26. The storage tank would provide livestock/wildlife water to existing stock tanks and pipelines. Furthermore, the storage tank would provide water for rural fire suppression for filling wildland engine and water tender trucks. Under this alternative, the following components shown in Figure 4.27 would be installed:

- From an existing well, approximately 3,900 feet of buried 2.0-inch, HDPE pipeline and 10,000-gallon storage tank would be installed to supply seven existing stock tanks and fitted to refill wildland fire engines and water tenders.
- The required valves, pumps, hoses, fittings, spouts, and appurtenances would be incorporated to facilitate water filling, managing flow, pressure, and water levels.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.26.** Potential Site for LW-03 Storage Tank for Home Well #2 Water System.

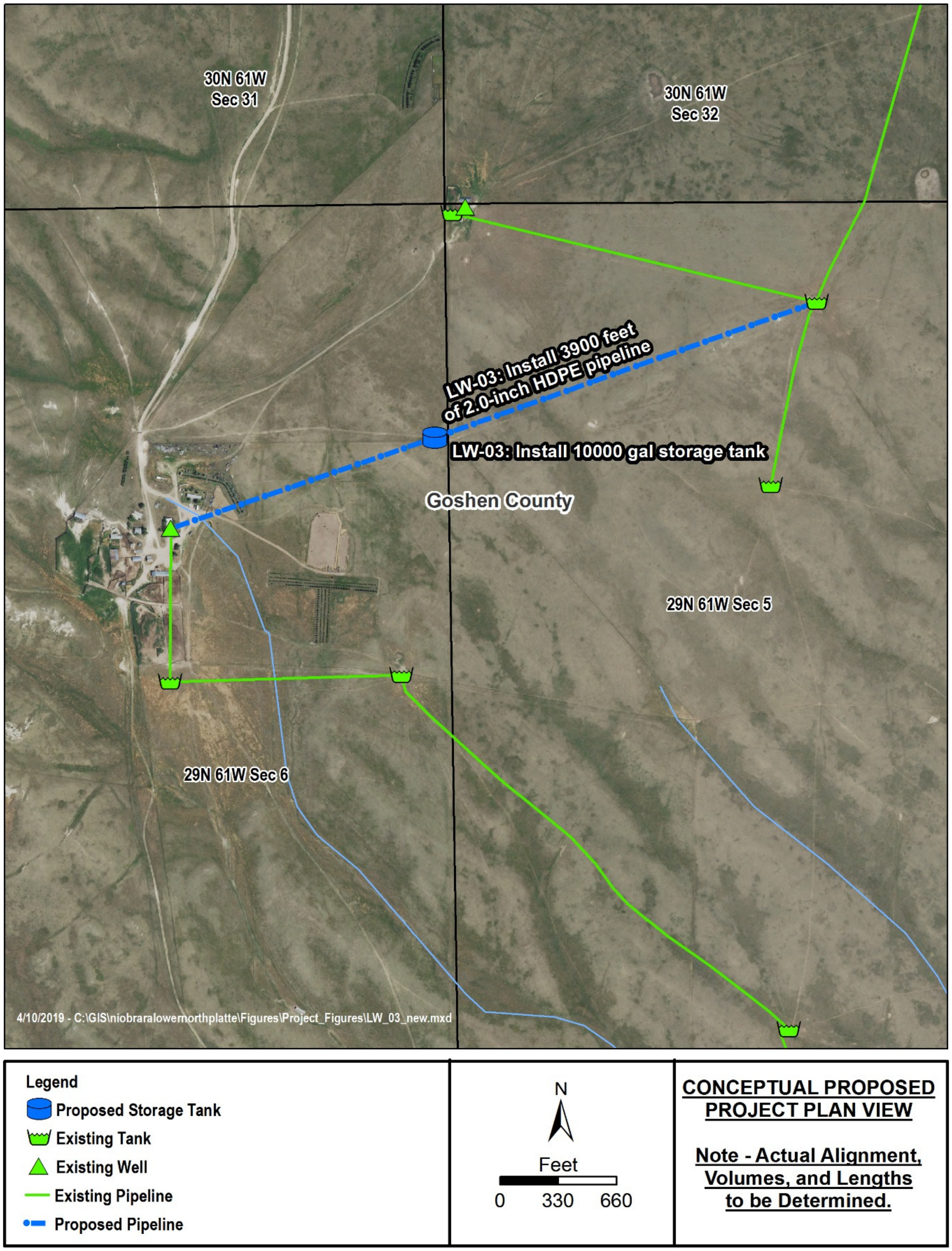


**Figure 4.27.** Proposed LW-03: Home Well #2 Pipeline and Storage Tank Project.

#### 4.4.2.4 *LW-04: Tronvold #1 Well, Pipeline, and Tank Project*

The LW-04 proposed project would involve rehabilitating an existing well to supply water to a portion of the watershed that lacks adequate livestock/wildlife water sources. The existing Tronvold #2 well (Permit No. P7518.0P) was permitted in 1956 and is shown in Figure 4.28. Under this alternative, the following components shown in Figure 4.29 would be installed:

- An existing well would be rehabilitated to supply water. From that source, approximately 2,100 feet of buried 1.5-inch, HDPE low-pressure pipeline would be installed to supply two stock tanks (1,200-gallon capacity each).
- The required valves, fittings, and appurtenances would be incorporated to facilitate managing flow, pressure, and water level.
- Wildlife escape ramps or devices would be incorporated in the proposed stock tanks.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.28.** Existing Tronvold #1 Well and Stock Tank.

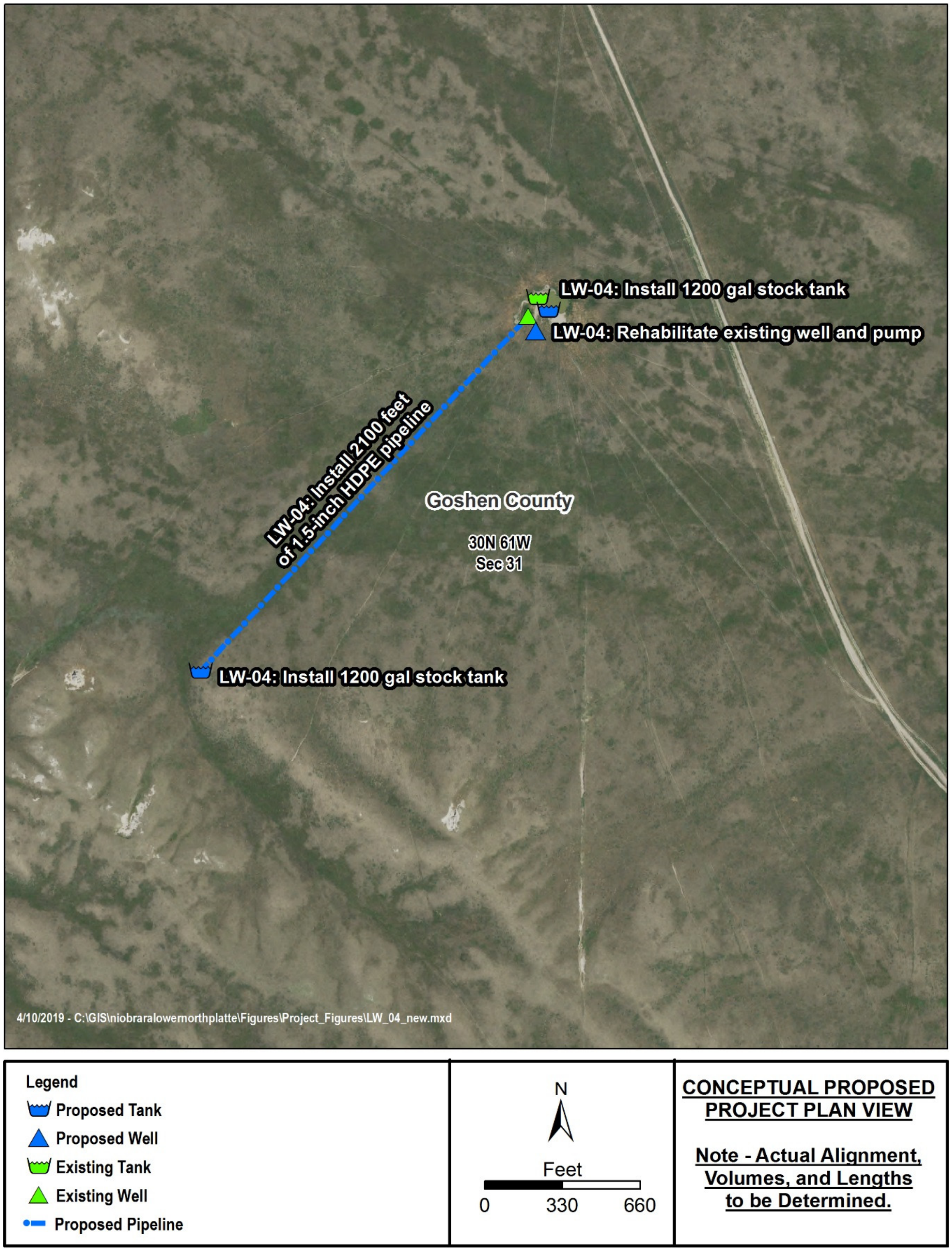


**Figure 4.29.** Proposed LW-04: Tronvold #1 Well, Pipeline, and Tank Project.

#### 4.4.2.5 *LW-05: Harmony Spring #1 Spring Pipeline and Tank Project*

The LW-05 proposed project would involve rehabilitating an existing spring to supply water to a portion of the watershed that lacks adequate livestock/wildlife water sources. The Harmony Spring #1 (Permit No. P183601.0W) was permitted in 2007 and enlarged (Permit No. P191106.0W) in 2009, which is shown in Figure 4.30. Under this alternative, the following components shown in Figure 4.31 would be installed:

- From an existing spring, a solar pump and approximately 2,400 feet of buried 1.5-inch, HDPE low-pressure pipeline and 10,000-gallon storage tank would be installed to supply a stock tank (1,200-gallon capacity).
- The required valves, fittings, and appurtenances would be incorporated to facilitate managing flow, pressure, and water level.
- Wildlife escape ramps or devices would be incorporated in the proposed stock tank.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.30.** Existing Spring Pond at Harmony Spring #1.

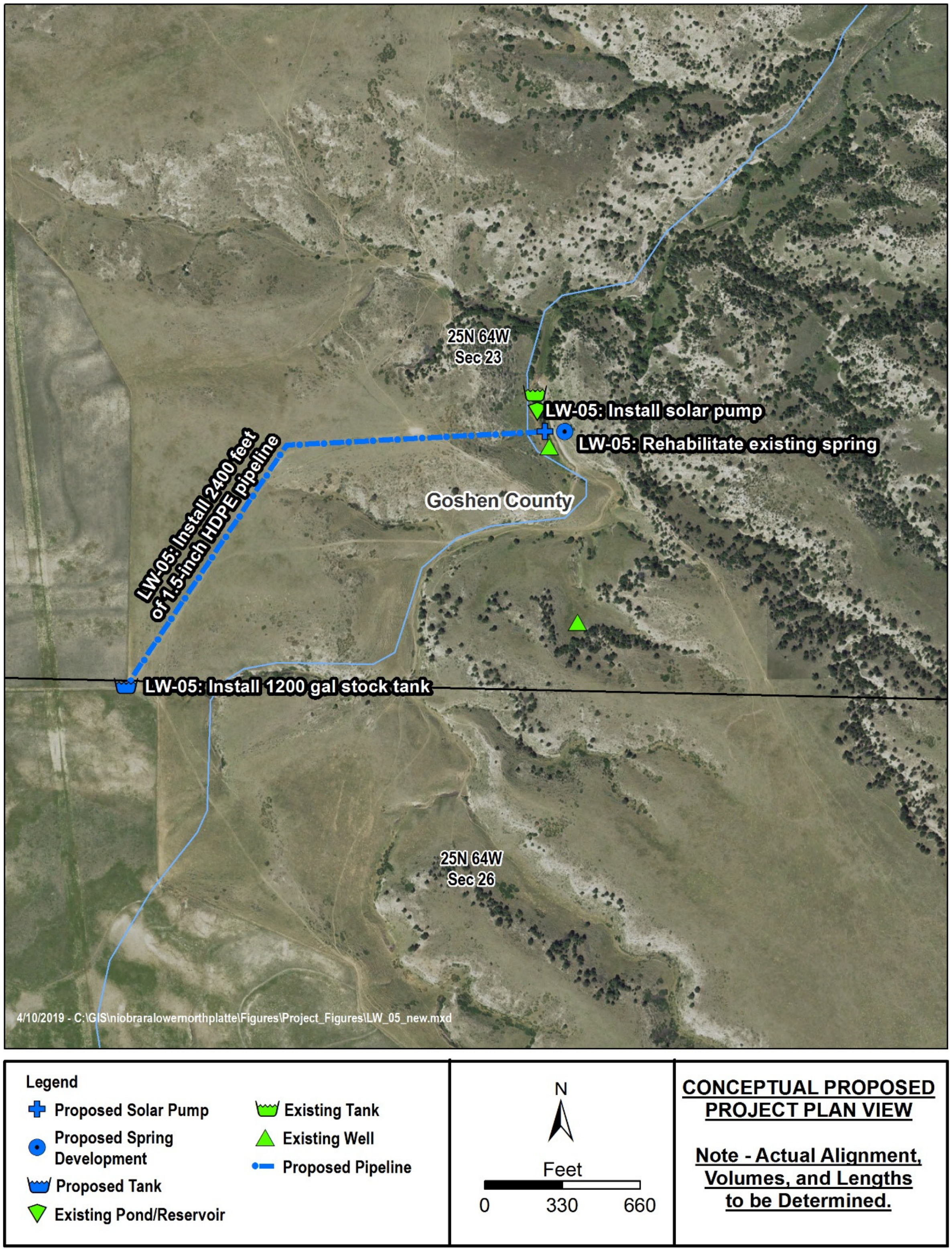


**Figure 4.31.** Proposed LW-05: Harmony Spring #1 Spring Pipeline and Tank Project.

#### 4.4.2.6 *LW-06: Three Buttes Storage Tank and Stock Tanks Project*

The LW-06 proposed project would involve rehabilitation an existing well and stock tanks to supply water to a portion of the watershed that lacks adequate livestock/wildlife water sources. The existing Raezer #1 well (Permit No. P181462.0W) was permitted in 2007 and is shown in Figure 4.32. Under this alternative, the following components shown in Figure 4.33 would be installed:

- From an existing well and pipeline, a 10,000-gallon storage tank would be installed to supply four existing, rehabilitated stock tanks (1,200-gallon capacity each).
- The required valves, fittings, and appurtenances would be incorporated to facilitate managing flow, pressure, and water level.
- Wildlife escape ramps or devices would be incorporated in the proposed stock tanks.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.32.** Existing Raezer #1 Well and Pump.

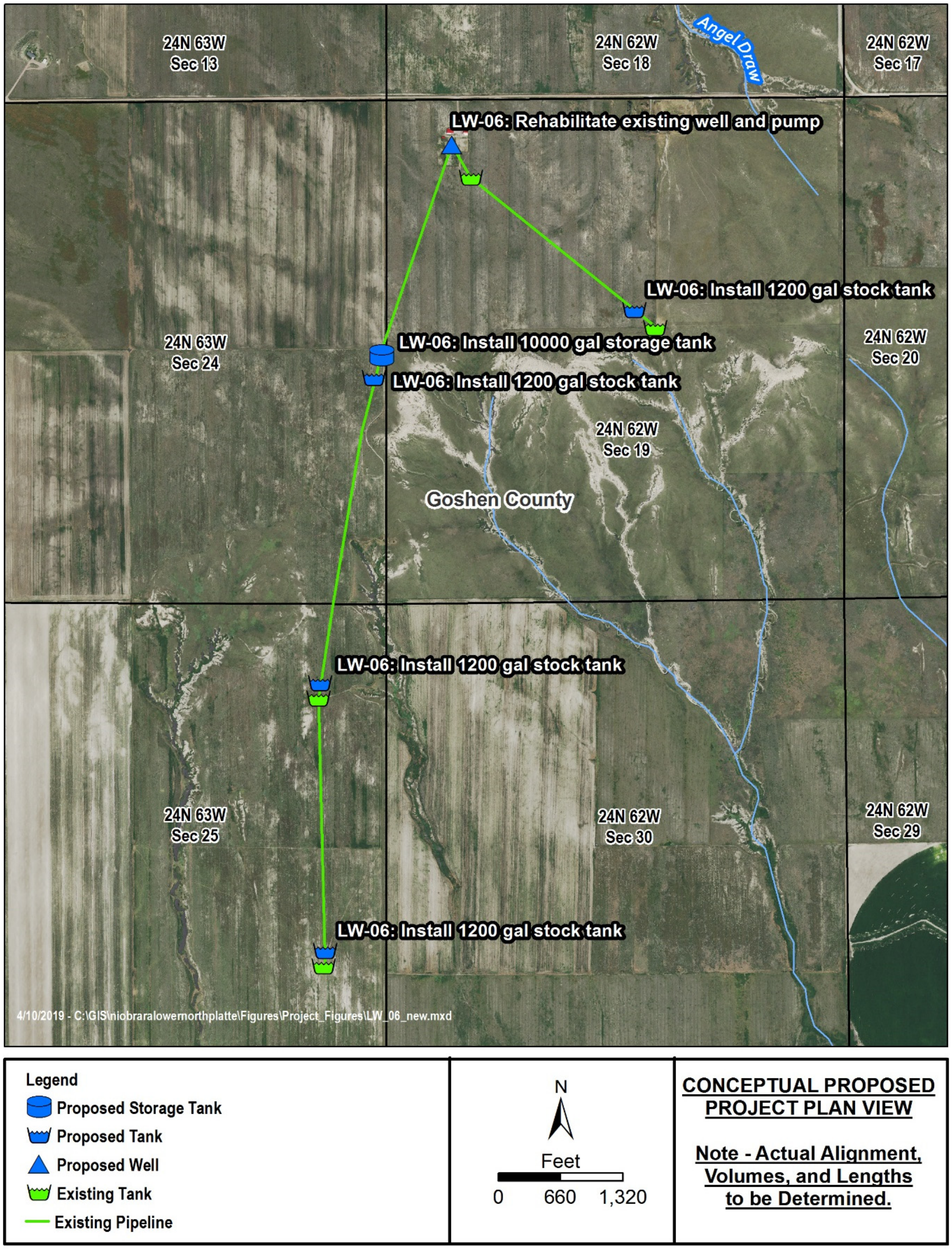


**Figure 4.33.** Proposed LW-06: Three Buttes Storage Tank and Stock Tanks Project.

### 4.4.2.7 *LW-07: Upper Hefflen Pipeline and Tanks Project*

The LW-07 proposed project would involve installing a solar platform, storage tanks, pipeline, and stock tanks to supply water to a portion of the watershed that lacks adequate livestock/wildlife water sources. The existing Raezer #2 well (Permit No. P199025.0W) was permitted in 2012 and is shown in Figure 4.34. Under this alternative, the following components shown in Figure 4.35 would be installed:

- An existing well would be developed and equipped with a solar platform that consists of solar panels, solar-powered pump, batteries, regulators, connections, and appurtenances.
- From an existing well, approximately 5,200 feet of buried 2.0-inch, HDPE pipeline, a 10,000-gallon storage tank would be installed to supply two new stock tanks (1,200-gallon capacity each).
- The required valves, fittings, and appurtenances would be incorporated to facilitate managing flow, pressure, and water level.
- Wildlife escape ramps or devices would be incorporated in the proposed stock tanks.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.34.** Existing Raezer #2 Well and Pump.

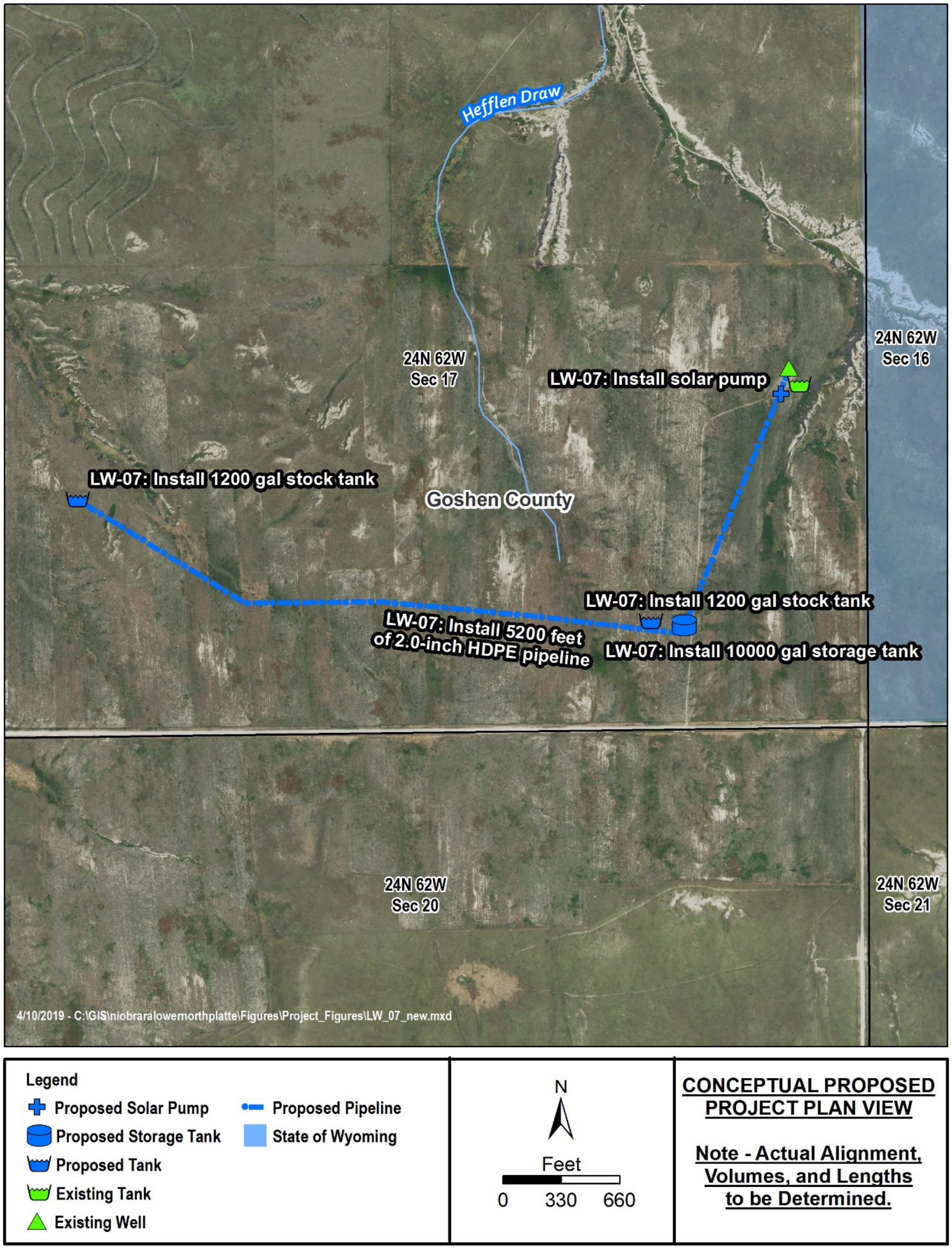


**Figure 4.35.** Proposed LW-07: Upper Hefflen Pipeline and Tanks Project.

#### 4.4.2.8 *LW-08: Ole Place 1 Well and Tank Project*

The LW-10 proposed project would involve rehabilitating an existing well to supply water to a portion of the watershed that lacks adequate livestock/wildlife water sources. The existing Ole Place 1 well (Permit No. P9529.0P) was permitted in 1916 and is shown in Figure 4.36. Under this alternative, the following components shown in Figure 4.37 would be installed:

- An existing well would be rehabilitated to supply water to three stock tanks (1,200-gallon capacity each).
- The required valves, fittings, and appurtenances would be incorporated to facilitate managing flow, pressure, and water level.
- Wildlife escape ramps or devices would be incorporated in the proposed stock tanks.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.36.** Existing Ole Place 1 Well and Stock Tank.

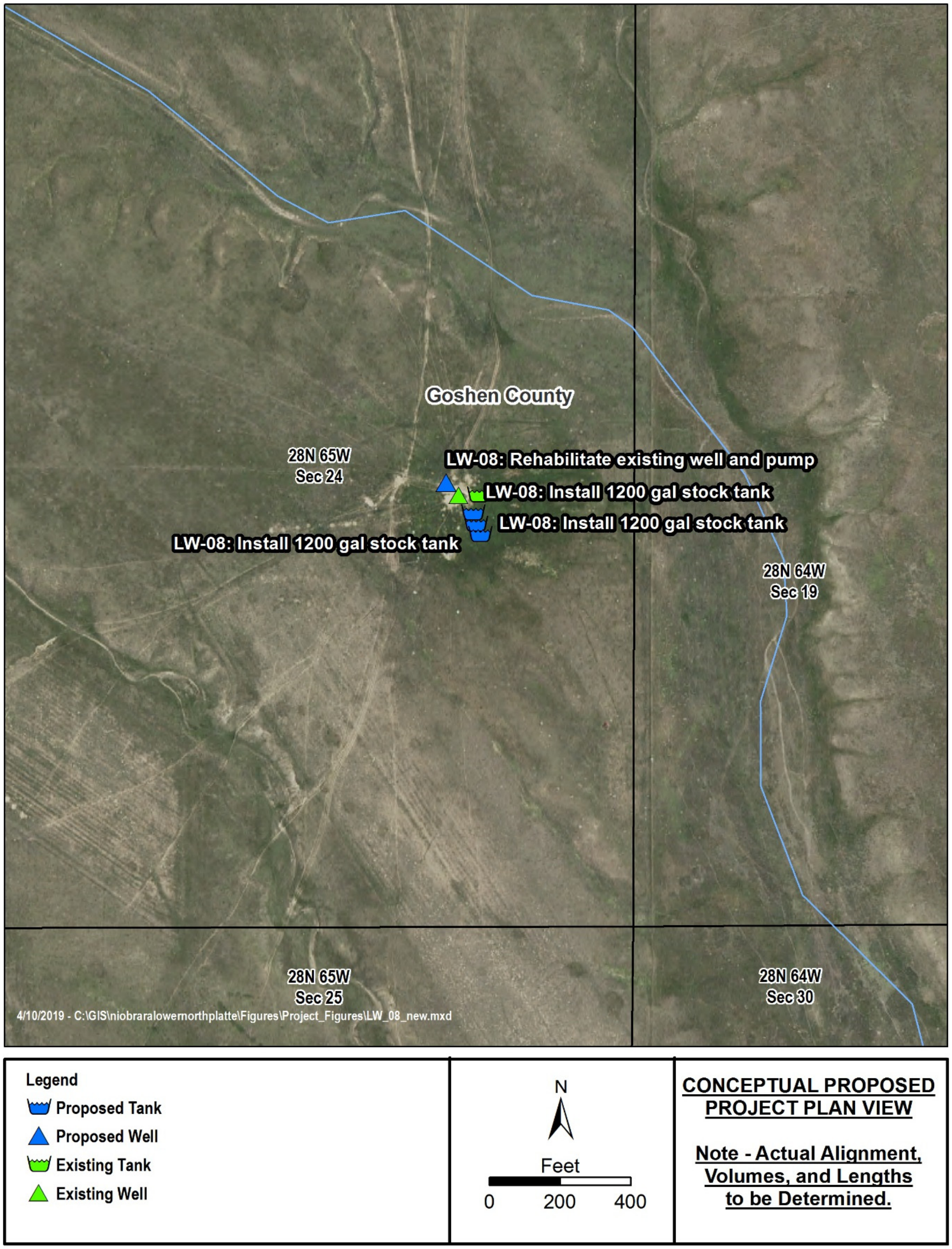


**Figure 4.37.** Proposed LW-08: Ole Place 1 Well and Tanks Project.

#### 4.4.2.9 *LW-09: South Draw Spring Development and Pond Project*

The LW-09 proposed project would involve rehabilitating an existing spring, which is shown in Figure 4.38, and constructing a pond to provide an additional source of livestock/wildlife water. The project would also require investigating soil and geologic conditions and procuring permits. The proposed site is located on an unnamed, intermittent stream within the Crescent Basin in Section 11 of Township 28 North, Range 65 West in Goshen County. This alternative shown in Figure 4.40 would include the following features:

- An existing spring would be developed, and a small pond constructed with a capacity of less than 1 acre-foot.
- Investigating site-specific soil and geologic conditions to determine site suitability and feasibility of structure installations or other conditions of the underlying formations.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.38.** Potential Spring Development Site Located in the South Draw.

#### 4.4.2.10 *LW-10: North Draw Spring Development and Pond Project*

The LW-10 proposed project would involve rehabilitating an existing spring, which is shown in Figure 4.39, and constructing a pond to provide an additional source of livestock/wildlife water. The project would also require investigating soil and geologic conditions and procuring permits. The proposed site is located on an unnamed, intermittent stream within the Crescent Basin in Section 11 of Township 28 North, Range 65 West in Goshen County. This alternative shown in Figure 4.40 would include the following features:

- An existing spring would be developed, and a small pond constructed with a capacity of less than 1 acre-foot.
- Investigating site-specific soil and geologic conditions to determine site suitability and feasibility of structure installations or other conditions of the underlying formations.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.39.** Potential Spring Development Site Located in the North Draw.

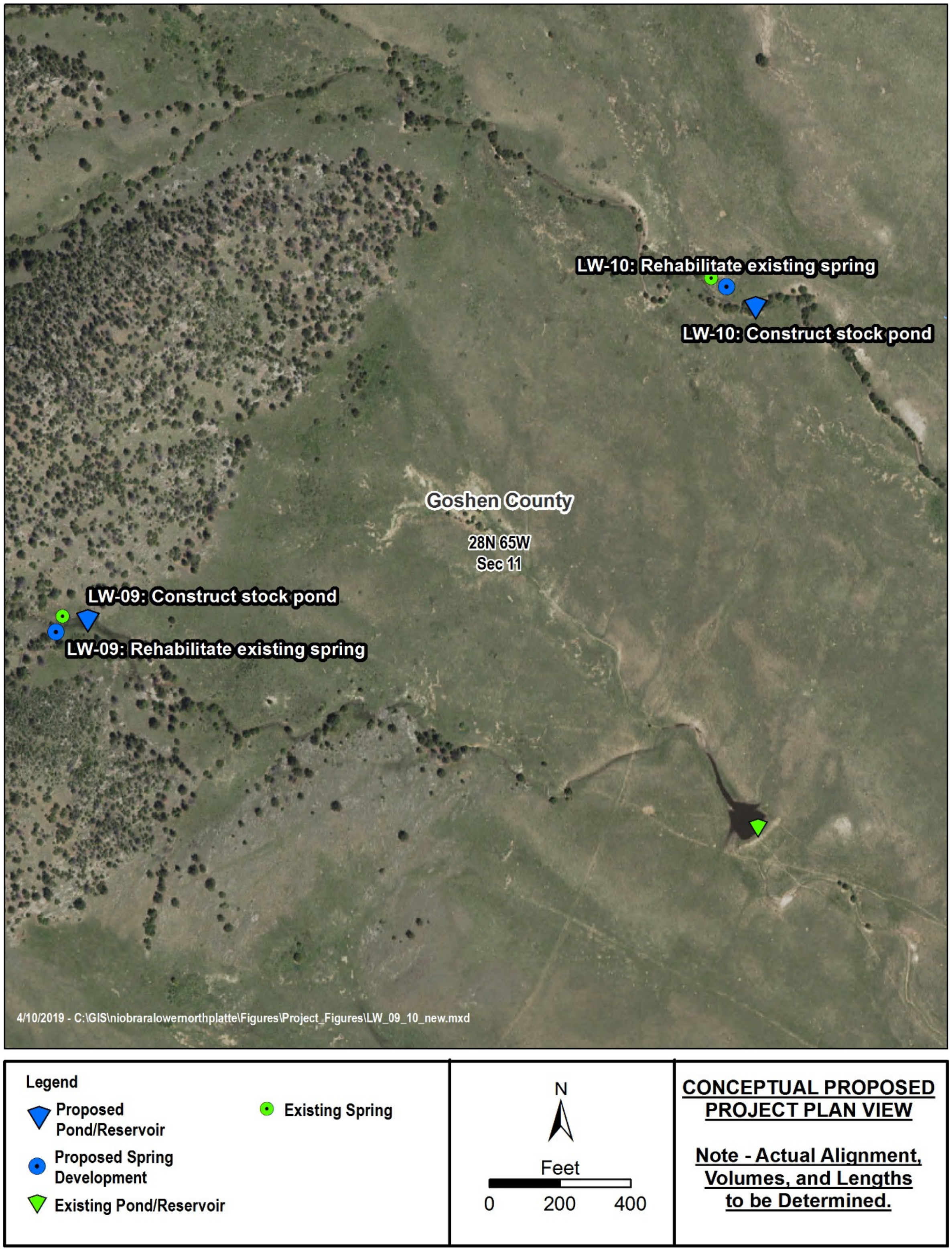


**Figure 4.40.** Proposed LW-09: South Draw and LW-10: North Draw Spring Development Projects.

#### 4.4.2.11 *LW-11: Owens Well #1 Well, Pipeline, and Tanks Project*

The LW-11 proposed project would involve rehabilitating an existing well to supply water to a portion of the watershed that lacks adequate livestock/wildlife water sources. The existing Owens Well #1 (Permit No. P2502.0P) was permitted in 1912 and is shown in Figure 4.41. Under this alternative, the following components shown in Figure 4.42 would be installed:

- An existing well would be rehabilitated to supply water to a new 10,000-gallon storage tank and two new stock tanks (1,200-gallon capacity each) with the installation of approximately 3,600 feet of buried 2.0-inch, HDPE low-pressure pipeline and another 3,700 feet of buried 2.0-inch, HDPE low-pressure pipeline.
- The required valves, fittings, and appurtenances would be incorporated to facilitate managing flow, pressure, and water level.
- Wildlife escape ramps or devices would be incorporated in the proposed stock tanks.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.41.** Existing Owens Well #1 and Stock Tank.

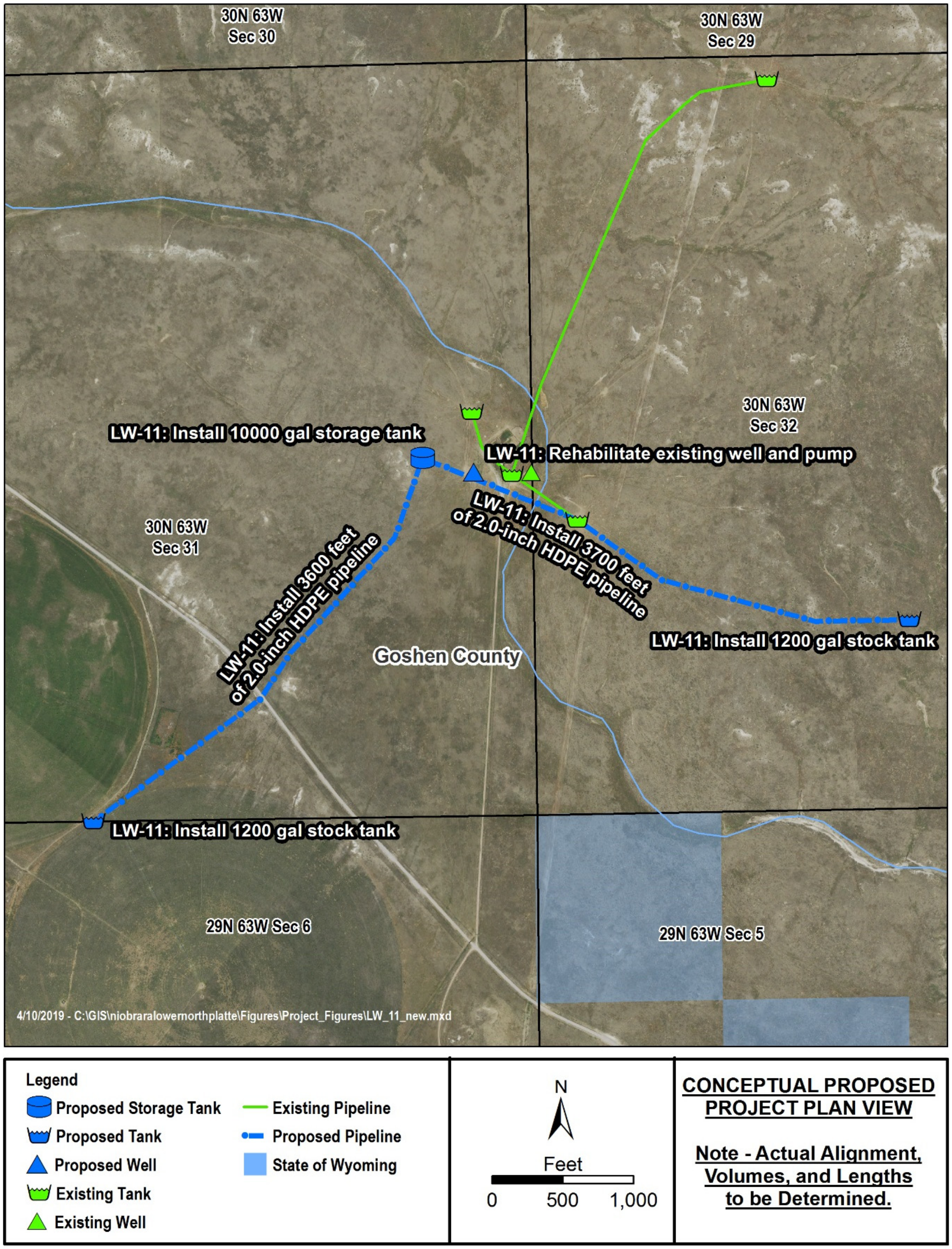


**Figure 4.42.** Proposed LW-11: Owens Well #1 Well, Pipeline, and Tanks Project.

### 4.4.2.12 *LW-12: Twin Tanks Well, Pipeline, and Tanks Project*

The LW-12 proposed project would involve rehabilitating an existing well to supply water to a portion of the watershed that lacks adequate livestock/wildlife water sources. The existing well was drilled in the early 1900s and is located in Section 11 of Township 28 North, Range 65 West in Goshen County. The well and tanks are shown in Figure 4.43. Under this alternative, the following components shown in Figure 4.44 would be installed:

- An existing well would be rehabilitated to supply water to a new 10,000-gallon storage tank and three new stock tanks (1,200-gallon capacity each) with the installation of approximately 3,700 feet of buried 2.0-inch, HDPE low-pressure pipeline and another 3,700 feet of buried 2.0-inch, HDPE low-pressure pipeline.
- The required valves, fittings, and appurtenances would be incorporated to facilitate managing flow, pressure, and water level.
- Wildlife escape ramps or devices would be incorporated in the proposed stock tanks.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.43.** Existing Twin Tanks Well and Stock Tank.

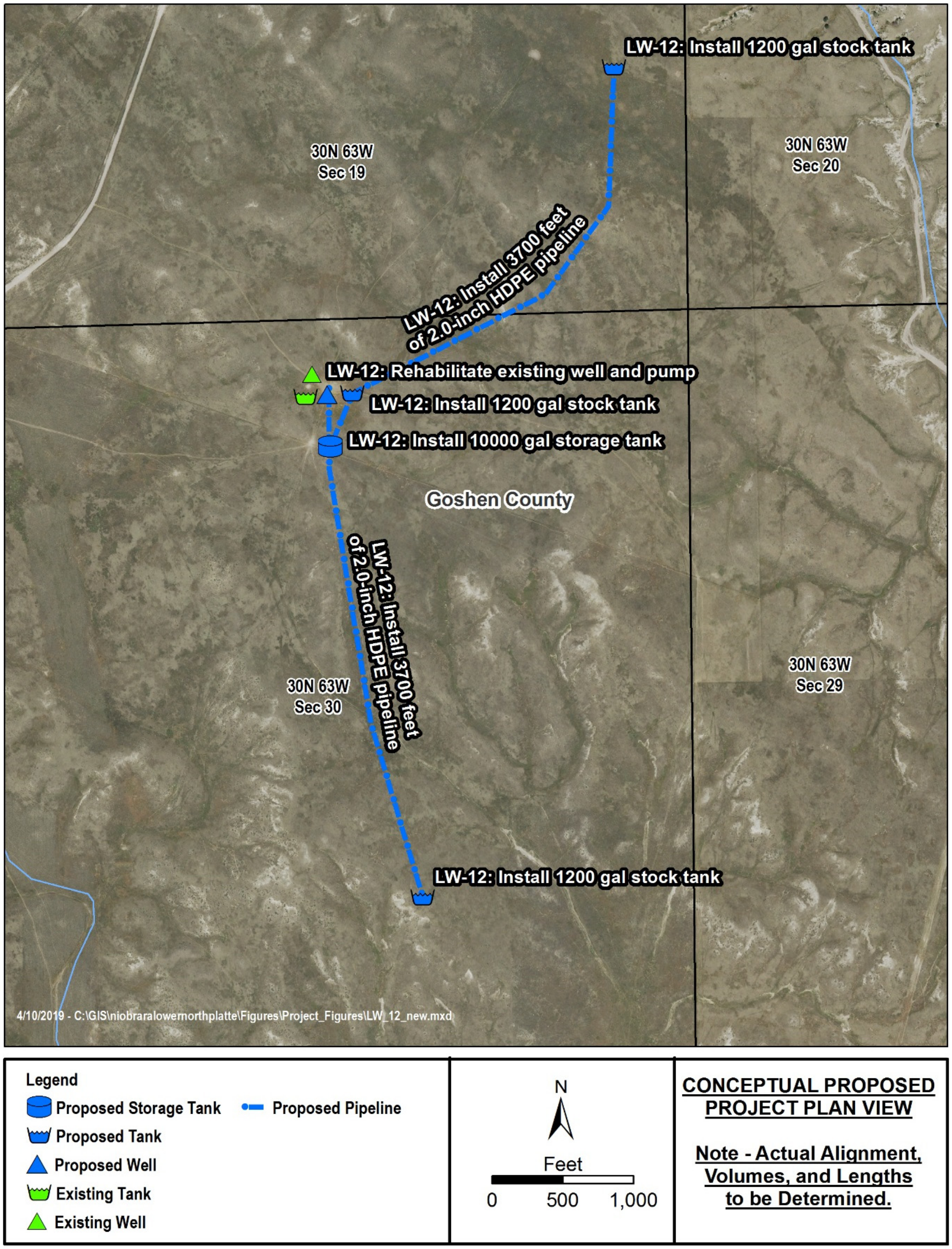


**Figure 4.44.** Proposed LW-12: Twin Tanks Well, Pipeline, and Tanks Project.

#### 4.4.2.13 *LW-13: Cistern Well, Pipeline, and Tanks Project*

The LW-13 proposed project would involve rehabilitating an existing well to supply water to a portion of the watershed that lacks adequate livestock/wildlife water sources. The existing well was drilled in the early 1900s and is located in Section 25 of Township 30 North, Range 64 West in Goshen County. The cistern and tank are shown in Figure 4.45. Under this alternative, the following components shown in Figure 4.46 would be installed:

- An existing well would be rehabilitated and approximately 3,900 feet of buried 2.0-inch, HDPE low-pressure pipeline would be installed to supply two stock tanks (1,200-gallon capacity each).
- The required valves, fittings, and appurtenances would be incorporated to facilitate managing flow, pressure, and water level.
- Wildlife escape ramps or devices would be incorporated in the proposed stock tanks.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.45.** Existing Cistern Well and Stock Tank.

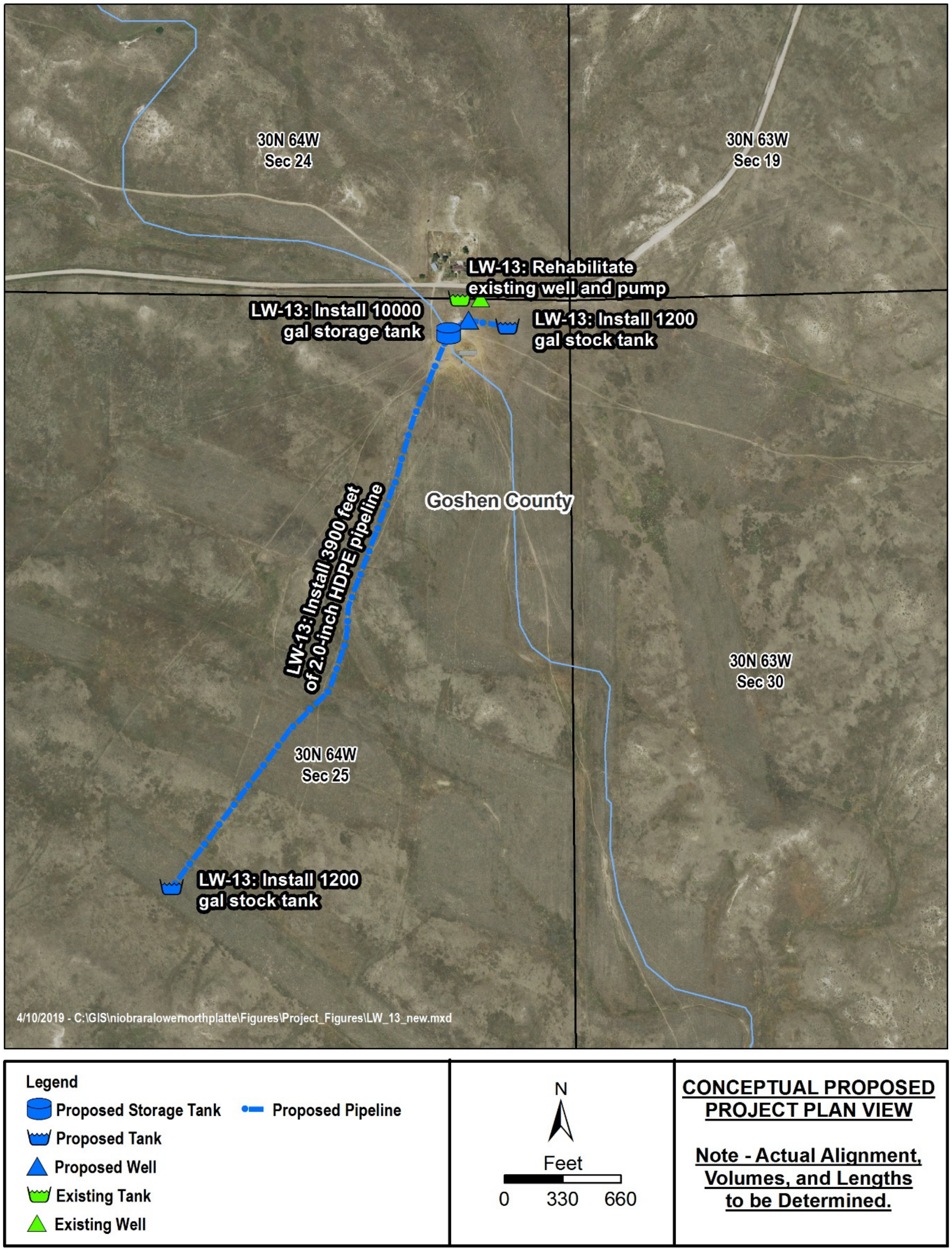


**Figure 4.46.** Proposed LW-13: Cistern Well, Pipeline, and Tanks Project.

### 4.4.2.14 *LW-14: Hoblit #1 Well, Pipeline, and Tank Project*

The LW-14 proposed project would involve rehabilitating an existing well to supply water to a portion of the watershed that lacks adequate livestock/wildlife water sources. The existing Hoblit #1 well (Permit No. P1713.0W) was permitted in 1966 and is shown in Figure 4.47. Under this alternative, the following components shown in Figure 4.48 would be installed:

- An existing well would be rehabilitated and approximately 3,200 feet of buried 2.0-inch, HDPE low-pressure pipeline would be installed to supply two stock tanks (1,200-gallon capacity each).
- The required valves, fittings, and appurtenances would be incorporated to facilitate managing flow, pressure, and water level.
- Wildlife escape ramps or devices would be incorporated in the proposed stock tanks.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.47.** Existing Hoblit #1 Well and Stock Tank.

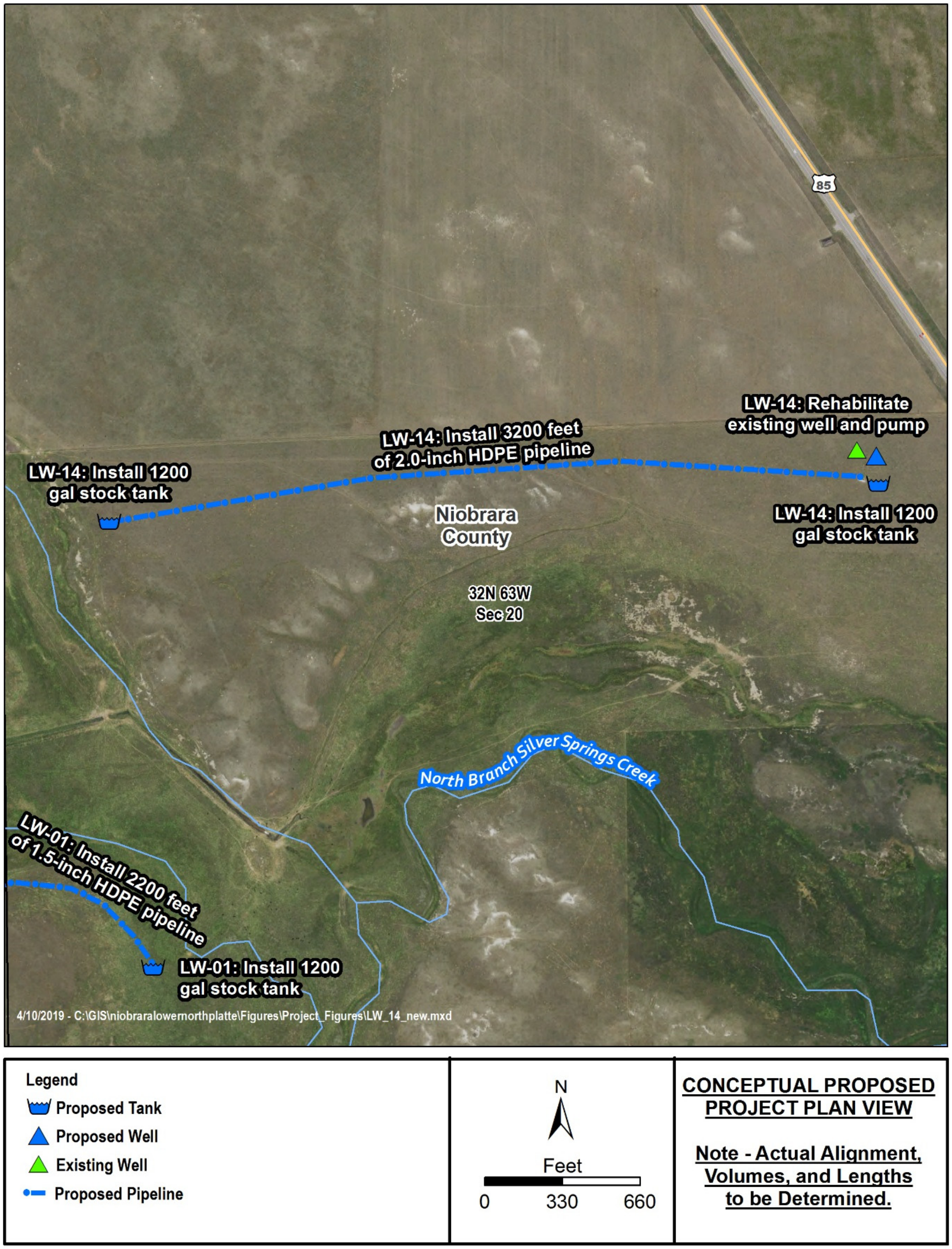


**Figure 4.48.** Proposed LW-14: Hoblit #1 Well, Pipeline, and Tanks Project.

### 4.4.2.15 *LW-15: Hoblit #4 Well, Pipeline, and Tank Project*

The LW-15 proposed project would involve rehabilitating an existing well to supply water to a portion of the watershed that lacks adequate livestock/wildlife water sources. The existing Hoblit #4 well (Permit No. P2075.0W) was permitted in 1940 and is shown in Figure 4.49. Under this alternative, the following components shown in Figure 4.50 would be installed:

- An existing well would be rehabilitated to supply water to two stock tanks (1,200-gallon capacity each).
- The required valves, fittings, and appurtenances would be incorporated to facilitate managing flow, pressure, and water level.
- Wildlife escape ramps or devices would be incorporated in the proposed stock tanks.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.49.** Existing Hoblit #4 Well and Stock Tank.

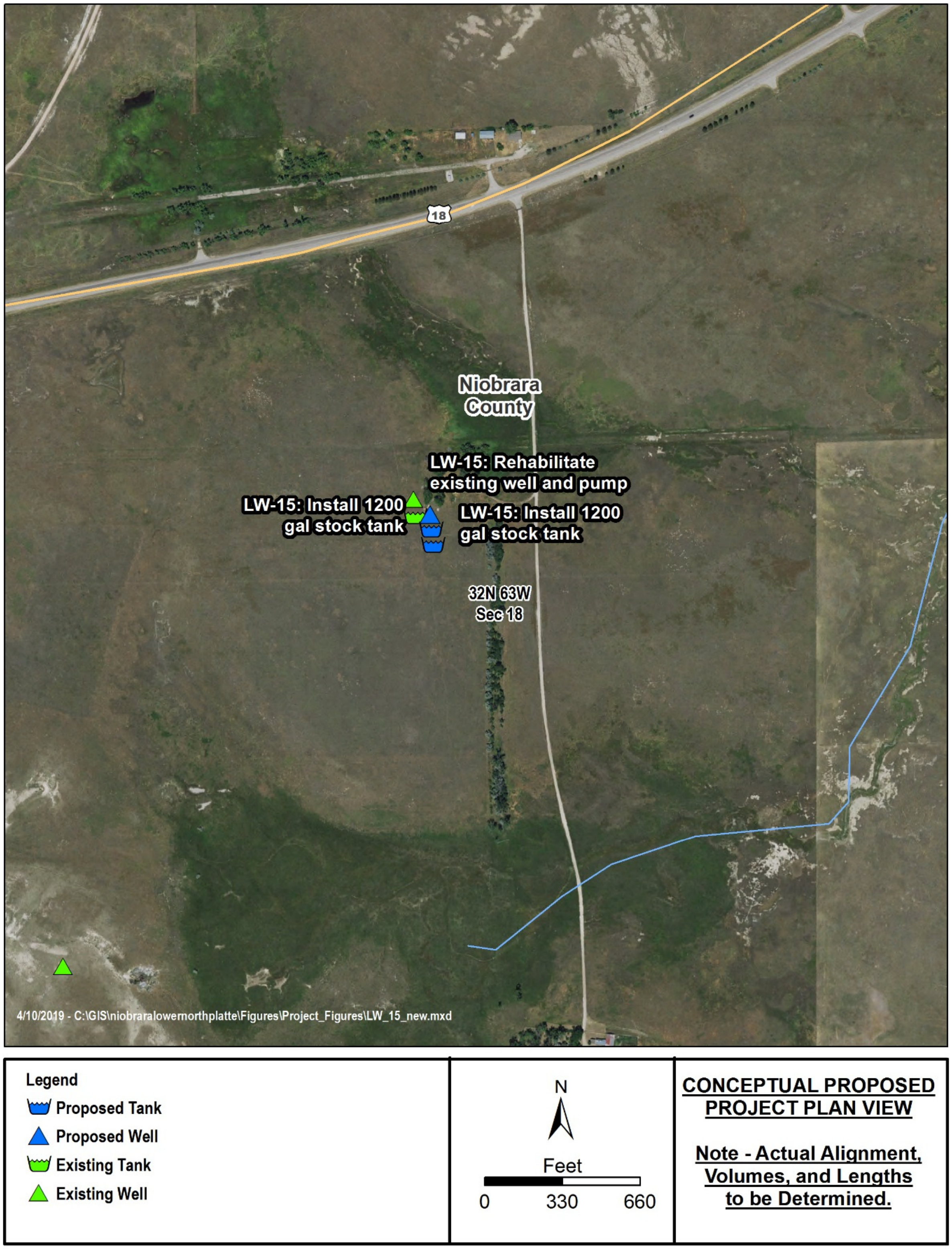


**Figure 4.50.** Proposed LW-15: Hoblit #4 Well and Tanks Project.

#### 4.4.2.16 *LW-16: Hoblit #5 Well, Pipeline, and Tank Project*

The LW-16 proposed project would involve rehabilitating an existing well to supply water to a portion of the watershed that lacks adequate livestock/wildlife water sources. The existing Hoblit #5 well (Permit No. P2076.0W) was permitted in 1940 and is shown in Figure 4.51. Under this alternative, the following components shown in Figure 4.53 would be installed:

- An existing well would be rehabilitated to supply water to a stock tank (1,200-gallon capacity).
- The required valves, fittings, and appurtenances would be incorporated to facilitate managing flow, pressure, and water level.
- Wildlife escape ramps or devices would be incorporated in the proposed stock tanks.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.51.** Existing Hoblit #5 Well and Stock Tank.

#### 4.4.2.17 *LW-17: Hoblit #3 Well, Pipeline, and Tank Project*

The LW-17 proposed project would involve rehabilitating an existing well to supply water to a portion of the watershed that lacks adequate livestock/wildlife water sources. The existing Hoblit #3 well (Permit No. P2074.0W) was permitted in 1940 and is shown in Figure 4.52. Under this alternative, the following components shown in Figure 4.53 would be installed:

- An existing well would be rehabilitated and approximately 2,100 feet of buried 2.0-inch, HDPE low-pressure pipeline would be installed to supply two stock tanks (1,200-gallon capacity each).
- The required valves, fittings, and appurtenances would be incorporated to facilitate managing flow, pressure, and water level.
- Wildlife escape ramps or devices would be incorporated in the proposed stock tanks.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.52.** Existing Hoblit #3 Well and Stock Tank.

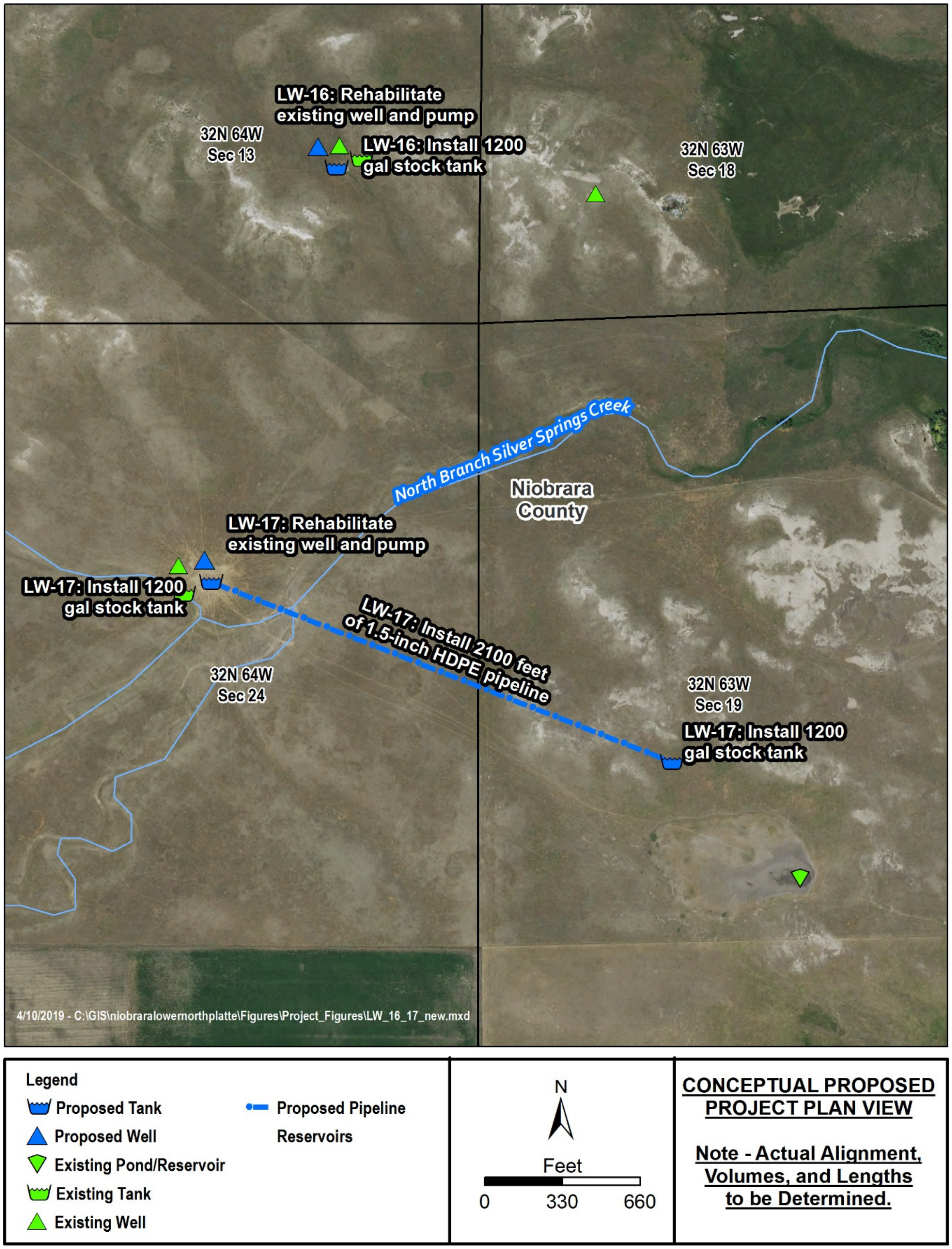


**Figure 4.53.** Proposed LW-16: Hoblit #4 and LW-17: Hoblit #3 Well and Tank Projects.

### 4.4.2.18 *LW-18: Johnson Well and Tank Project*

The LW-18 proposed project would involve drilling a new well to supply water to a portion of the watershed that lacks adequate livestock/wildlife water sources. The new well project would require a hydrogeologic investigation and would be located in the SW1/4 of Section 5 of Township 32 North, Range 64 West in Niobrara County. The potential site is shown in Figure 4.54, and under this alternative, the following components shown in Figure 4.55 would be included:

- A new well would be drilled to supply water to a stock tank (1,200-gallon capacity).
- The project requires a site-specific hydrogeologic investigation to determine feasibility of obtaining an adequate well yield and other conditions of the underlying aquifer formations.
- The required valves, fittings, and appurtenances would be incorporated to facilitate managing flow, pressure, and water level.
- Wildlife escape ramps or devices would be incorporated in the proposed stock tanks.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.54.** Potential Site of a New Well Drilled for the LW-18: Johnson Well and Tank Project.

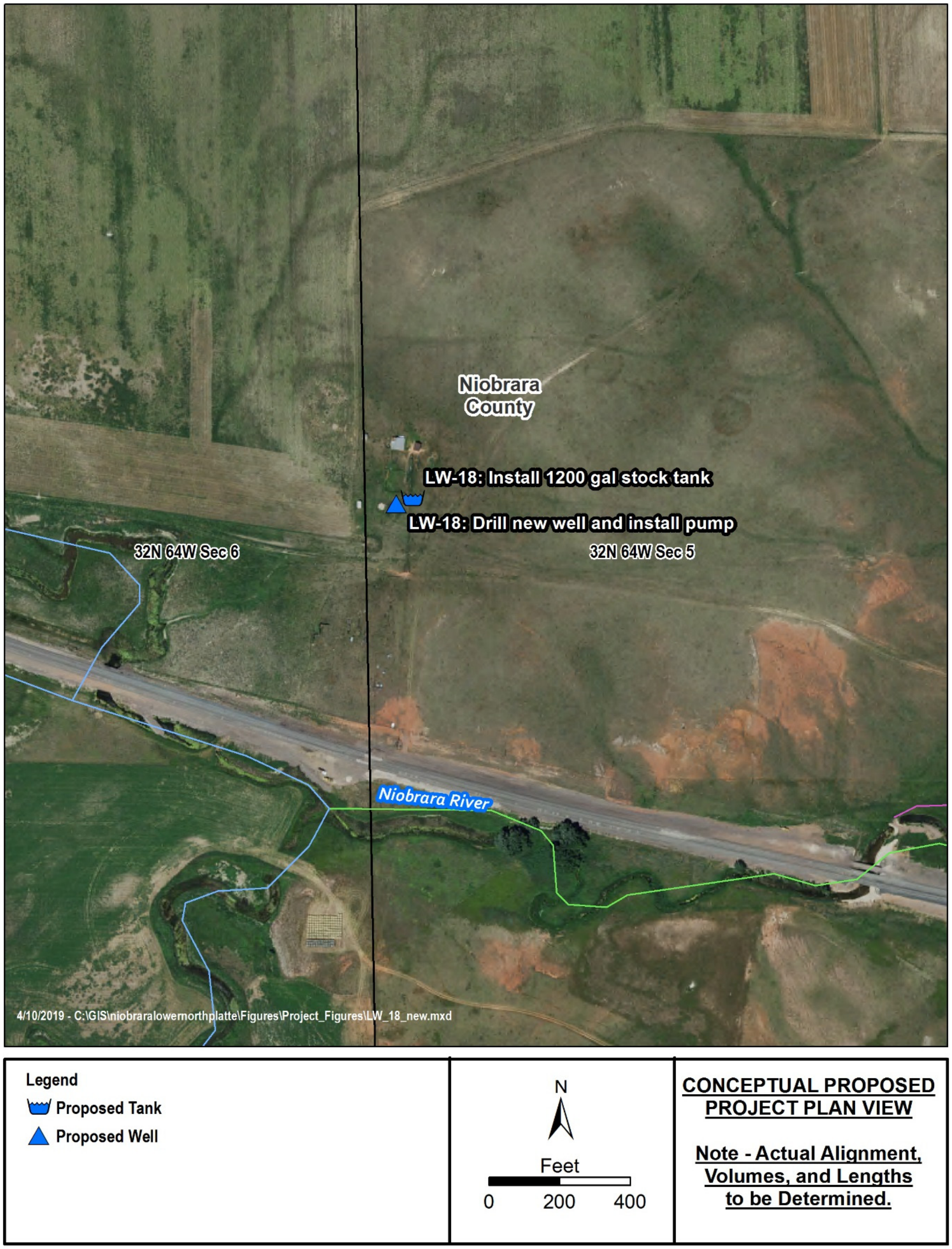


**Figure 4.55.** Proposed LW-18: Johnson Well and Tank Project.

#### 4.4.2.19 *LW-19: Colters Pond/Reservoir Rehabilitation, Pipeline and Tanks Project*

The LW-19 proposed project would involve rehabilitating an existing reservoir to supply water to a portion of the watershed that lacks adequate livestock/wildlife water sources. The Colters Pond stock reservoir is located on Copier Creek, which is a tributary to Old Woman Creek in Section 12 of Township 33 North, Range 64 West in Niobrara County. The reservoir (Permit No. P12635.0S) was permitted in 1996 with a capacity of 5.20 acre-feet. This reservoir could be rehabilitated to provide livestock/wildlife water along with restoring functions of the associated wetland and riparian areas. This alternative would involve installing an inlet and outlet pipe-control structure in the embankment, stabilizing the installed structures with rock riprap, and rebuilding the spillway. This alternative shown in Figure 4.56 includes the following features:

- Inspecting the embankment and rehabilitating problem areas as needed.
- Rehabilitating the outlet facilities to control reservoir water levels. The installed structures would be stabilized with rock riprap.
- Excavating the earthen spillway to adequately convey necessary water volumes and stabilizing with rock riprap for spillway protection.
- Determining adequate sources of borrow material and rock riprap for dam embankment repairs and spillway stabilization.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

An additional component to this project would involve installing a solar platform from the existing stock reservoir to supply water to a portion of the watershed that lacks adequate livestock/wildlife water sources. Under this alternative, the following components, as shown in Figure 4.55, would be installed:

- A solar platform that consists of solar panels; solar-powered pump; batteries; and all of the regulators, connections, and appurtenances would be installed to pump from an existing stock reservoir equipped with a control structure to supply livestock/wildlife water.
- From that rehabilitated reservoir, approximately 1,300 feet of 1.5-inch, HDPE low-pressure pipeline would be installed to supply two stock tanks (1,200-gallon capacity each).
- The required valves, fittings, and appurtenances would be incorporated to facilitate managing flow, pressure, and water level.
- Wildlife escape ramps or devices would be incorporated in the proposed stock tanks.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

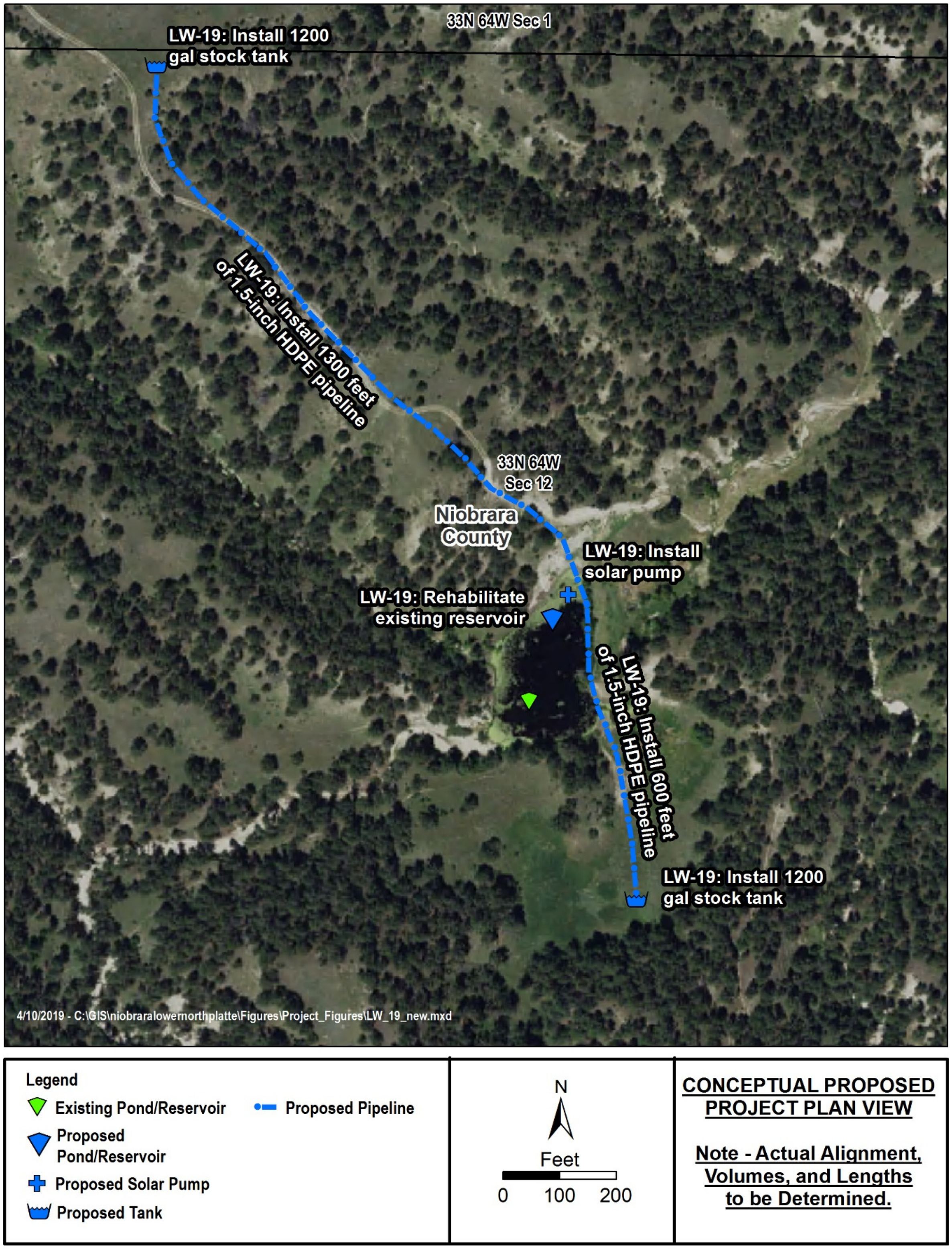


**Figure 4.56.** Proposed LW-19: Colters Pond/Reservoir Rehabilitation, Pipeline, and Tanks Project.

#### 4.4.2.20 *LW-20: Smith South Spring Development and Tank Project*

The LW-20 proposed project would involve rehabilitating an existing spring development, which is shown in Figure 4.57, along with rehabilitating a pipeline, stock tanks, and a stock pond to provide additional sources of livestock/wildlife water. The project would also require investigating soil and geologic conditions and procuring permits. The proposed site is located on an unnamed, intermittent tributary to Silver Springs Creek in Section 34 of Township 32 North, Range 64 West in Niobrara County. This alternative shown in Figure 4.58 would include the following features:

- An existing spring development would be rehabilitated. From the rehabilitated spring development, approximately 450 feet of buried 1.5-inch, HDPE low-pressure pipeline would be installed to supply a stock tank (1,200-gallon capacity), and a small pond would be rehabilitated with a capacity of less than 2 acre-feet.
- The required valves, fittings, and appurtenances would be incorporated to facilitate managing flow, pressure, and water level.
- Wildlife escape ramps or devices would be incorporated in the proposed stock tanks.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.57.** Existing Spring Development Located at the LW-20: Smith South Project Site.

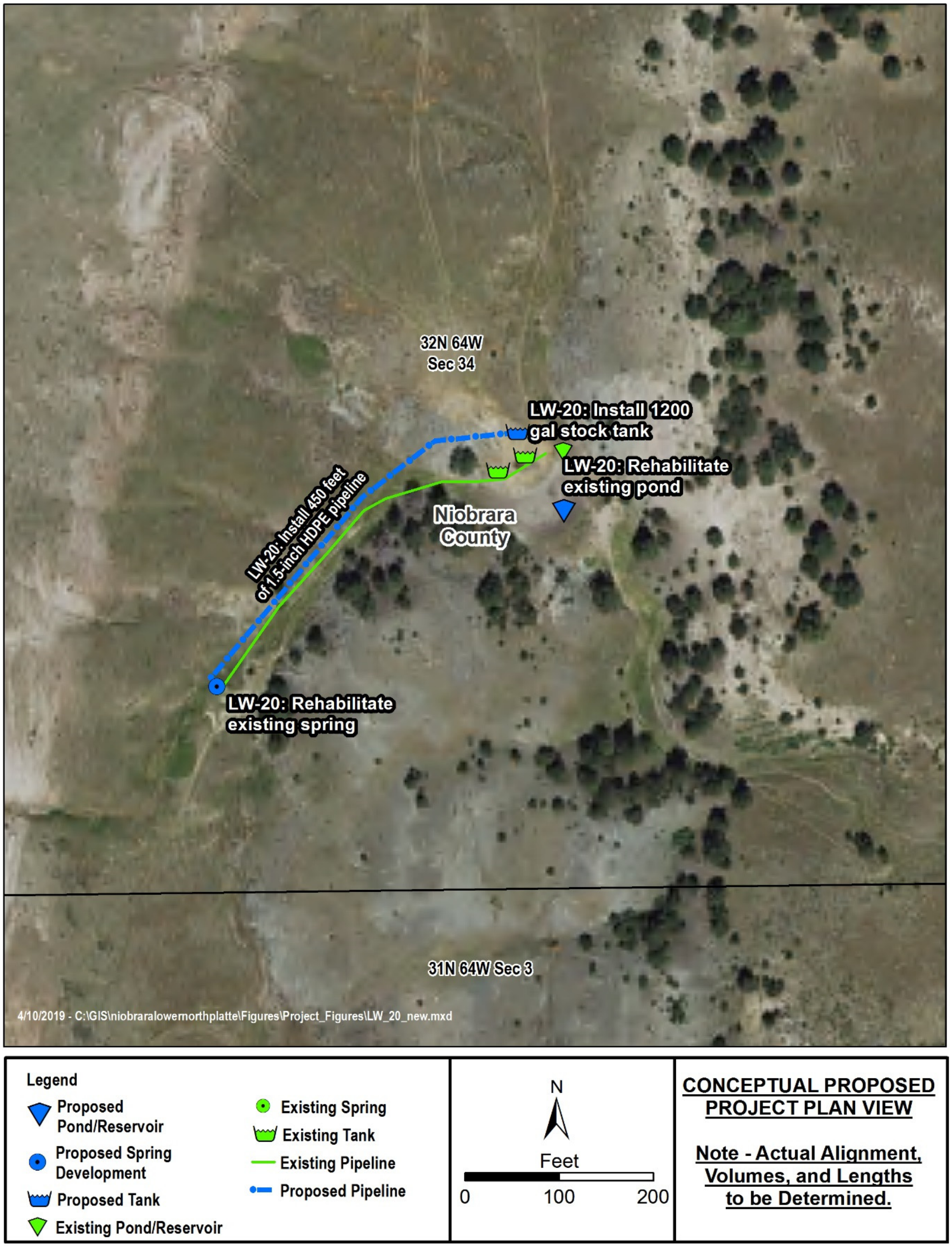


**Figure 4.58.** Proposed LW-20: Smith South Spring Development and Tank Project.

#### 4.4.2.21 *LW-21: Vondra #1 Well, Pipeline, and Tanks Project*

The LW-21 proposed project would involve rehabilitating an existing well to supply water to a portion of the watershed that lacks adequate livestock/wildlife water sources. The existing Vondra #1 (Permit No. P21055.0P) was permitted in 1959 and is shown in Figure 4.59. Under this alternative, the following components shown in Figure 4.60 would be installed:

- An existing well would be rehabilitated to supply water to a 10,000-gallon storage tank and four stock tanks (1,200-gallon capacity each) with installation of approximately 1,800 feet of buried 1.5-inch, HDPE low-pressure pipeline; 1,950 feet of buried 1.5-inch, HDPE low-pressure pipeline; and 2,000 feet of buried 1.5-inch, HDPE low-pressure pipeline.
- The required valves, fittings, and appurtenances would be incorporated to facilitate managing flow, pressure, and water level.
- Wildlife escape ramps or devices would be incorporated in the proposed stock tanks.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.59.** Existing Vondra #1 and Stock Tank.

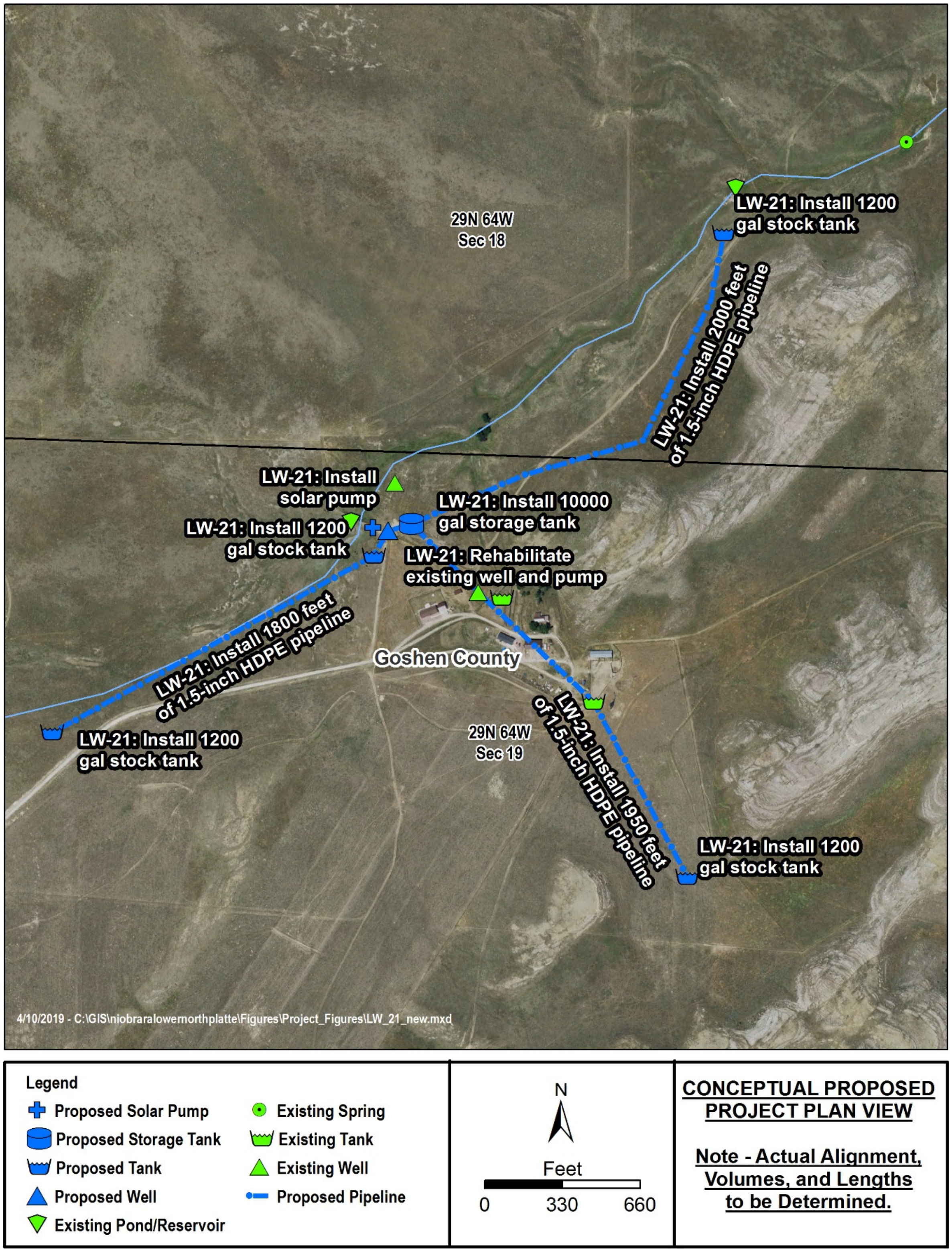


**Figure 4.60.** Proposed LW-21: Vondra #1 Well, Pipeline, and Tanks Project.

### 4.4.2.22 *LW-22: Upper Moore Spring Development and Tank Project*

The LW-22 proposed project would involve developing an existing spring and installing a pipeline to supply stock tanks to provide additional sources of livestock/wildlife water. The project would also require investigating soil and geologic conditions and procuring permits. The proposed site, which is shown in Figure 4.61, is located on an unnamed, intermittent tributary to Silver Springs Creek in Section 34 of Township 32 North, Range 64 West in Niobrara County. This alternative shown in Figure 4.62 would include the following features:

- An existing spring would be developed and a solar pump with approximately 2,000 feet of buried 1.5-inch, HDPE low-pressure pipeline would be installed to supply two stock tanks (1,200-gallon capacity each).
- The required valves, fittings, and appurtenances would be incorporated to facilitate managing flow, pressure, and water level.
- Wildlife escape ramps or devices would be incorporated in the proposed stock tanks.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.61.** Existing Spring Located at the LW-22: Upper Moore Project Site.

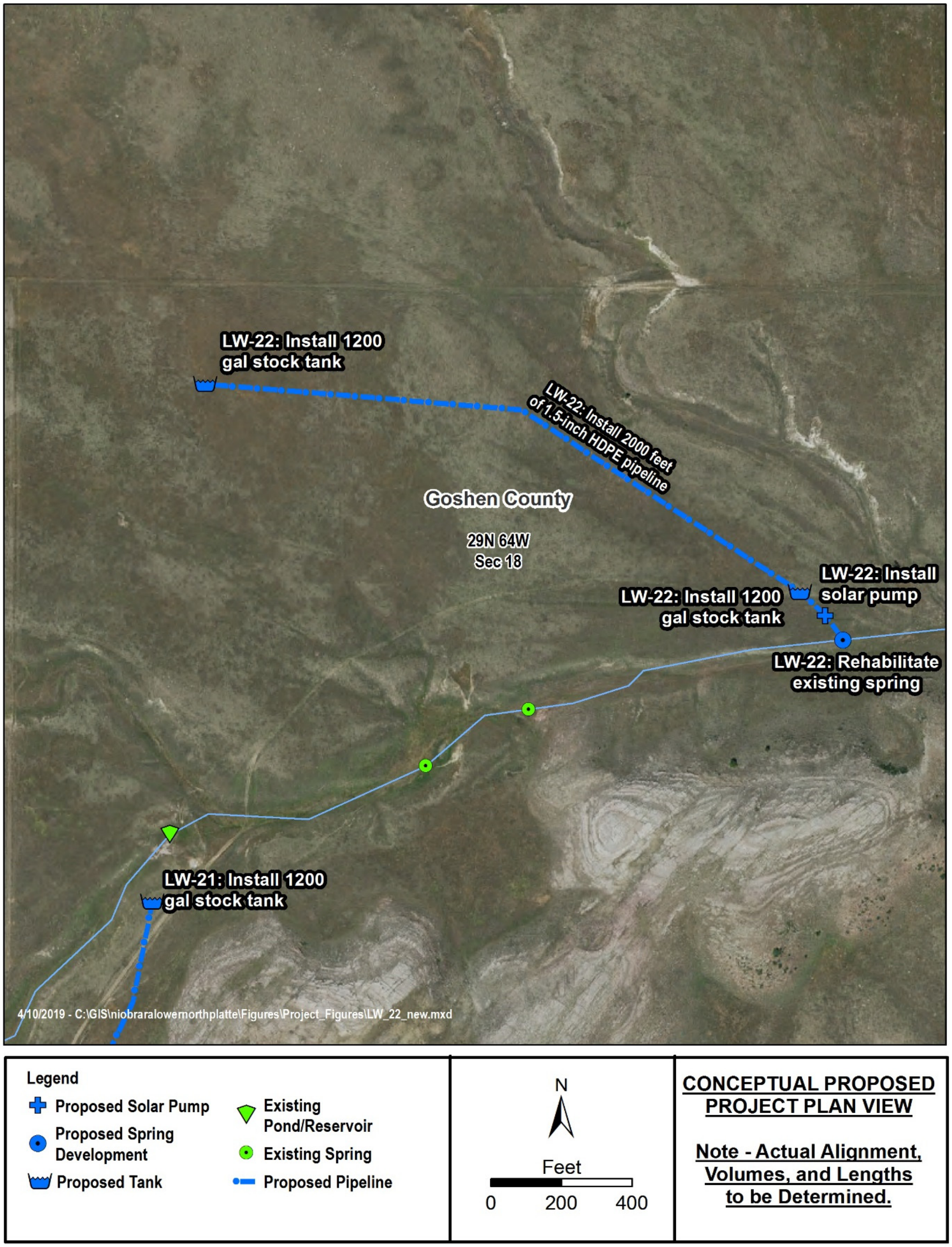


**Figure 4.62.** Proposed LW-22: Upper Moore Spring Development and Tank Project.

### 4.4.2.23 *LW-23: Bass Draw Well, Tank, and Pond Project*

The LW-23 proposed project would involve drilling a new well near the area shown in Figure 4.63, along with rehabilitating a pipeline, stock tank, and the Bass Ranch No. 1 stock pond to provide additional sources of livestock/wildlife water. The pond was built in 1950 and permitted (Permit No. P19657.0S) in 2012 with a capacity of 0.32 acre-feet. The proposed project is located in Bass Draw, an intermittent tributary to Roosevelt Creek in Section 20 of Township 29 North, Range 64 West in Goshen County. This alternative shown in Figure 4.64 would include the following:

- A new well would be drilled to supply water approximately 400 feet of buried 1.5-inch, HDPE low-pressure pipeline would be installed to supply to a stock tank (1,200-gallon capacity) and a rehabilitated livestock/wildlife pond (0.32 acre-feet capacity).
- The required valves, fittings, and appurtenances would be incorporated to facilitate managing flow, pressure, and water level.
- Wildlife escape ramps or devices would be incorporated in the proposed stock tanks.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.63.** Existing Spring Development Located at the LW-23: Bass Draw Project Site.

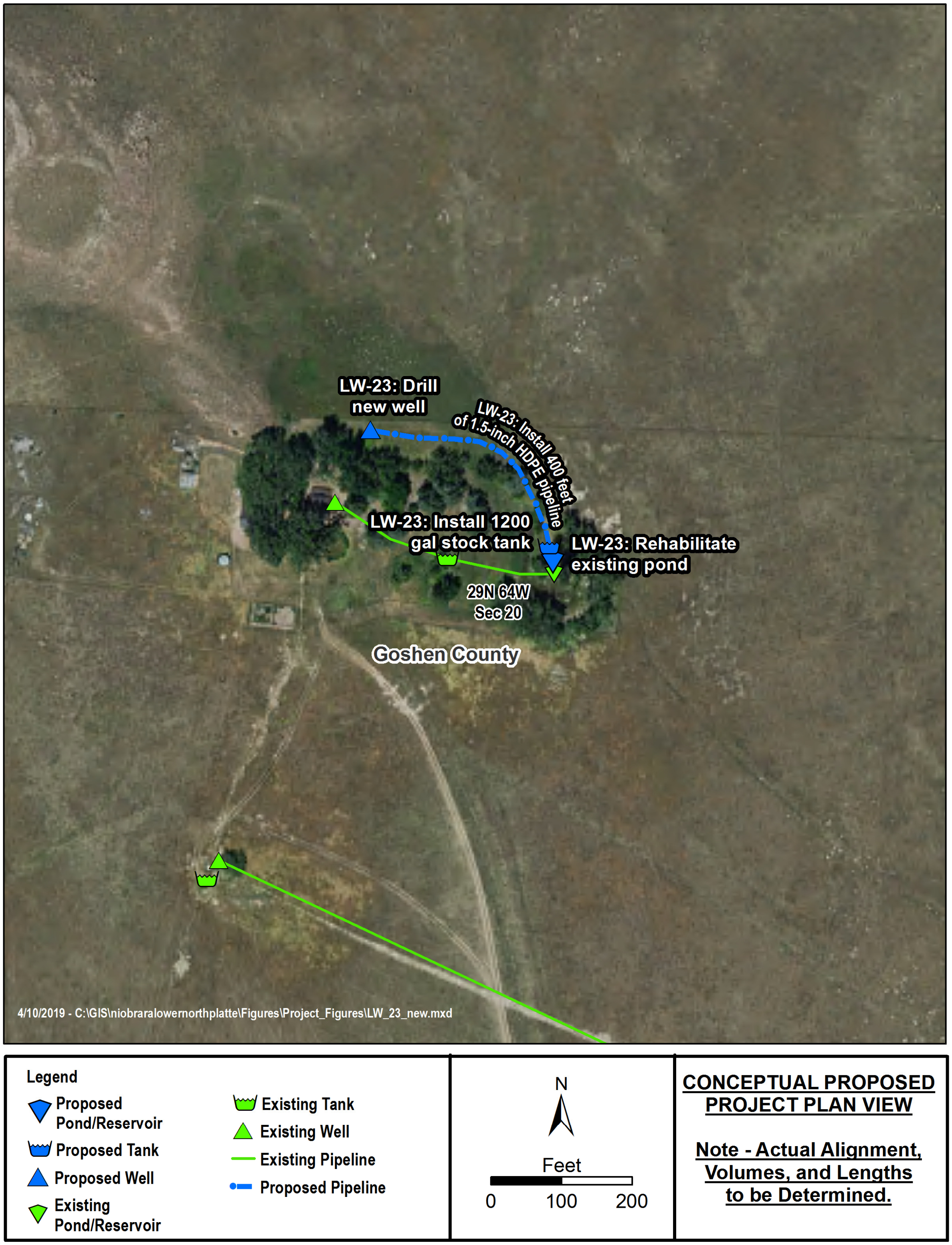


**Figure 4.64.** Proposed LW-23: Bass Draw Spring Development, Tank, and Pond Project.

#### 4.4.2.24 *LW-24: North Pasture #2 Well and Tank Project*

The LW-24 proposed project would involve rehabilitating an existing well to supply water to a portion of the watershed that lacks adequate livestock/wildlife water sources. The existing Ochsner windmill and tank is shown in Figure 4.65. Under this alternative, the following components shown in Figure 4.66 would be installed:

- An existing well would be replaced with a new well to supply water to a new stock tank (1,200-gallon capacity each) with the installation of approximately 100 feet of buried 1.5-inch, HDPE low-pressure pipeline.
- The required valves, fittings, and appurtenances would be incorporated to facilitate managing flow, pressure, and water level.
- Wildlife escape ramps or devices would be incorporated in the proposed stock tank.
- The proposed project is located entirely on private land.
- Additional engineering design, permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.65.** Existing Ochsner Windmill and Stock Tank.

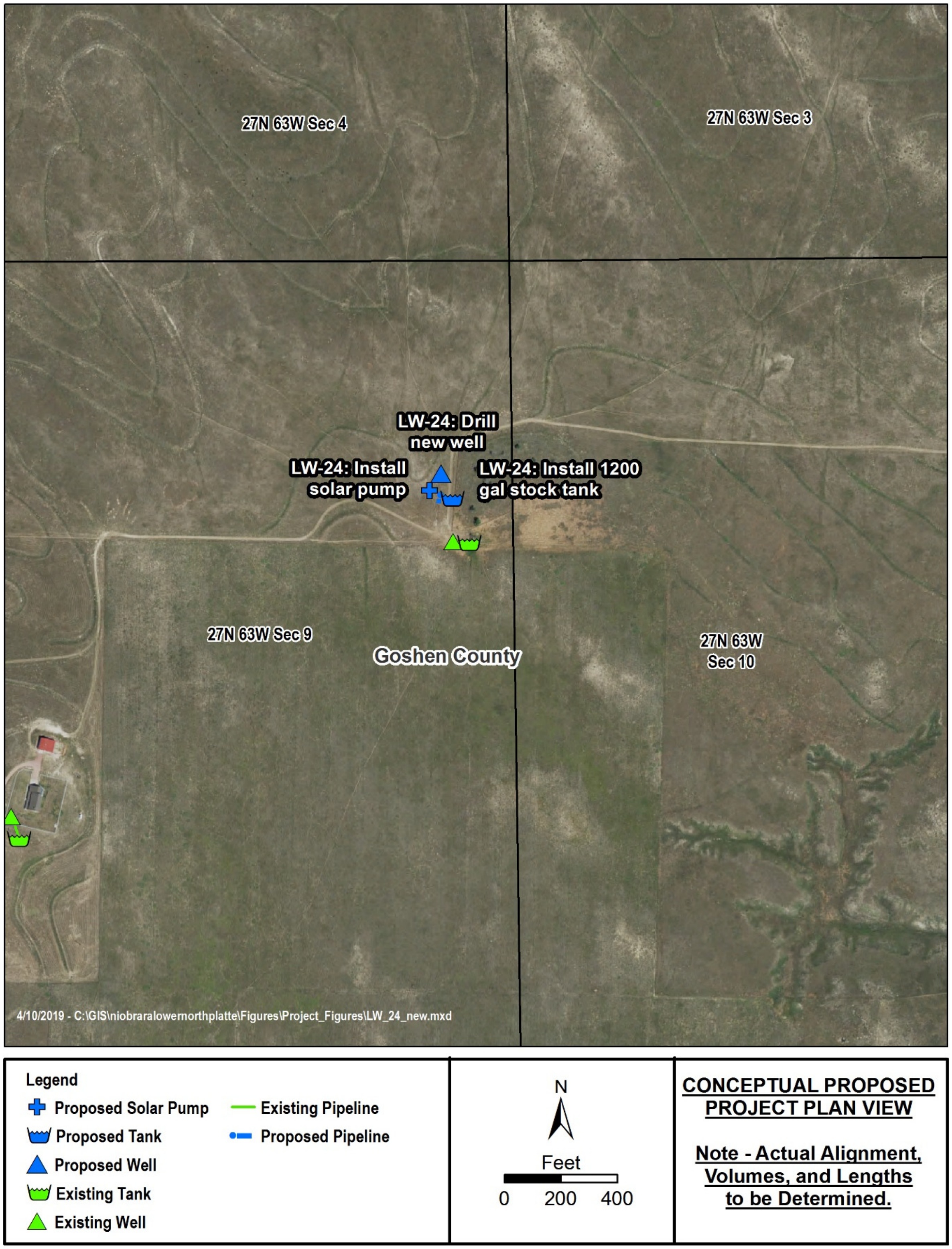


**Figure 4.66.** Proposed LW-24: North Pasture #2 Well and Tank Project.

#### 4.4.2.25 *Additional Wildlife Water-Development Opportunities*

Guzzlers are artificial catchments that provide sources of water in remote areas for wildlife. Larger systems could be employed for livestock-watering purposes. These systems rely entirely on precipitation; therefore, their reliability is only as good as can be expected in a water-short region. Installing guzzler water systems may be considered in areas where wildlife water is needed, and other options are unavailable, however no sites were identified as part of the study. Figure 4.67 shows a guzzler installed within the watershed. A guzzler system requires the following major components:

- **Catchment apron** – typically made of textured HDPE; secured with rocks that are placed on a grid and protected by fencing from trampling by wildlife or livestock
- **Catchment outlet** – pipe boot, clamps, and well screen
- **HDPE pipe** – typically 1.5–2 inches, 160 pounds per square inch (psi), SDR 11
- **Catchment tank** – HDPE tank sized to accommodate wildlife or livestock-watering needs with integral drinker (ideally with no float valve required) and overflow adapter
- **Small animal escape ladder** – installed in the storage tank
- **Overflow pipe** – with erosion protection at discharge.

**Figure 4.67.** An Installed Wildlife Guzzler System Within the Watershed.

## 4.5 GRAZING-MANAGEMENT OPPORTUNITIES

These opportunities can be used as tools to improve watershed function, particularly with implementing appropriate grazing-management strategies. Based on the information presented previously, the following items are presented for inclusion in the Watershed Management Plan:

- **Watershed Plan Component G-1:** Water developments can be used to expand grazing distribution into areas that do not currently have viable water sources. Riparian area plant community conditions can be enhanced by moving water developments into upland areas.
- **Watershed Plan Component G-2:** Fencing can be used to enhance grazing-management options and to facilitate the planned grazing system.
- **Watershed Plan Component G-3:** Strategic salting and herding are other tools that can be used to enhance grazing distribution.
- **Watershed Plan Component G-4:** Most rangeland or grazing practices that improve watershed conditions may also improve wildlife habitat. Wildlife needs should be considered when installing practices such as wildlife-friendly fences, wildlife escape ramps from tanks, and wildlife watering facilities (e.g., guzzlers, tanks, ponds, and reservoirs).
- **Watershed Plan Component G-5:** Obtain technical and financial assistance from private range consultants, conservation district, or NRCSpersonnel in order to improve grazing-management plans; evaluate animal and forage balance inventories; generate contingency plan alternatives for drought and/or fire; and monitor field indicators for assessing rangeland health.
- **Watershed Plan Component G-6:** Develop grazing-management strategies that assess rangeland health attributes and evaluate similarity indexes (range conditions) based on applicable state-transition models (STMs) associated with NRCS ecological site descriptions (ESDs) would optimize rangeland health through grazing-management plans and practices.
- **Watershed Plan Component G-7:** Prescribed fire may be used as a tool to assist in restoring range health areas that benefit from this treatment according to the STMs. Delineating specific areas that potentially benefit from this practice was beyond the scope of this Level I study.
- **Watershed Plan Component G-8:** Applying chemicals may be a tool to assist in restoring range health areas that benefit from this treatment according to the STMs. Delineating specific areas that potentially benefit from this practice was beyond the scope of this Level I watershed study.
- **Watershed Plan Component G-9:** Coordinate with the county Weed and Pest Districts, landowners, NRCS, and State Lands on noxious and invasive species control areas where livestock water development and improved grazing techniques could avoid reinfestation and improve preferred forage vegetation.

## 4.6 SURFACE-WATER STORAGE OPPORTUNITIES

Investigations to identify large water-storage reservoirs within the watershed have been the subject of several past studies and are summarized in Section 3.4.3 of this report. During this study, the scope of investigating water-storage opportunities focused on existing ponds and reservoirs. Field visits and initial reviews were conducted on the ponds and reservoirs identified by participants. Table 4.3 is a summary of the nine surface-water storage opportunities included in the proposed irrigation system projects in Section 4.3 and for the livestock/wildlife water projects in Section 4.4 of this chapter.

**Table 4.3. Summary of Surface-Water Storage Opportunities for Proposed Irrigation and Livestock/Wildlife Projects**

| Plan Item | Project Name | Component |
|---|---|---|
| I-01.1<br>LW-01 | Hoblit Reservoir | Rehabilitate dam embankment, outlet, and spillway facilities that would have a capacity of less than 59.67 acre-feet |
| I-09.1 | East Draw | Construct irrigation-regulating reservoir that would have a capacity of less than 2 acre-feet |
| I-10.1 | Peterson Draw | Construct irrigation-regulating reservoir that would have a capacity of less than 2 acre-feet |
| LW-02 | Siebken #3 | Construct a small stock pond that would have a capacity of less than 1 acre-feet |
| LW-09 | South Draw | Construct a small stock pond that would have a capacity of less than 1 acre-feet |
| LW-10 | North Draw | Construct a small stock pond that would have a capacity of less than 1 acre-feet |
| LW-19 | Colters Pond | Rehabilitate a small stock reservoir that would have a capacity of less than 5.20 acre-feet |
| LW-20 | Smith South | Rehabilitate a small stock pond that would have a capacity of less than 2 acre-feet |
| LW-23 | Bass Draw | Rehabilitate a small stock pond that would have a capacity of less than 1 acre-feet |

## 4.7 CHANNEL STABILITY OPPORTUNITIES

Investigations of stream channels and descriptions of channel conditions within the watershed were summarized in Section 3.2.2 of this report. During this Level I study, approximately 478 miles of channels on the main rivers and creeks within the watershed were classified using the Rosgen Level I method during the geomorphic task and included in Section 3.2.2.1. Field visits were conducted with landowners who identified rivers and creeks with eroding banks and channel stability issues. Based on observations during these field visits, several problem areas were identified and proposed conceptual project plans were developed and included in this report. These proposed channel stability projects are located on the North Platte River, which present substantial challenges in planning, designing, and installing cost-effective and practical channel-stabilization measures and warrant further flow and sediment modeling to determine the effectiveness of any channel-stabilization installations.

## 4.7.1 Conceptual Stream Channel Proposed Projects

### 4.7.1.1 *C-01: North Platte River Bank Erosion Upstream of State Highway 156*

The C-01 proposed project would be located south of Lingle on the North Platte River approximately 1 mile upstream of the bridge on State Highway 156 in Section 30 of Township 25 North, Range 62 West in Goshen County. Channel bank erosion is occurring in this reach, as shown in Figure 4.68. Channel-stabilization measures are recommended using one of several rock-based approaches similar to stabilization structures installed downstream near the State Highway 156 bridge. The proposed project shown in Figure 4.68 would at a minimum involve the following items:

- Item No. C-01: Install 2,300 feet of bank protection and install riparian buffer practices.
- Investigate site-specific soil, geomorphic, and flow conditions to determine feasibility of stabilization measures and other potential issues that may occur downstream near the State Highway 156 bridge.
- The proposed project is located on private, Bureau of Land Management (BLM), and Wyoming Game and Fish Department (WGFD) lands.
- Additional agency coordination, engineering design, state and federal permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.68.** View of an Eroding Bank on the North Platte River at the C-01 Proposed Project Site.

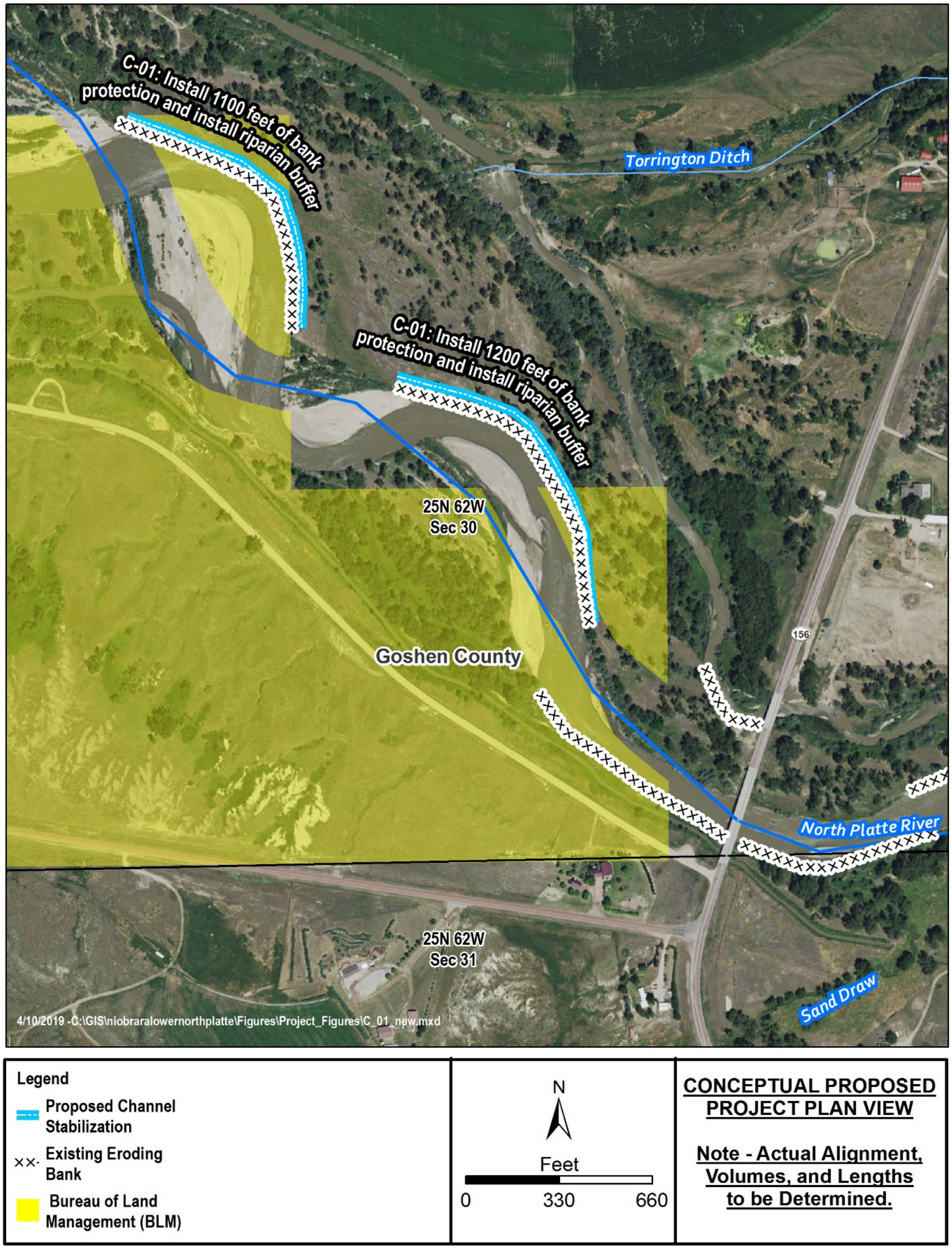


**Figure 4.69.** Proposed C-01: North Platte River Bank Erosion Upstream of State Highway 156.

#### 4.7.1.2 *C-02: North Platte River Bank Erosion Downstream of State Highway 157*

The C-02 proposed project would be located west of Lingle on the North Platte River approximately 2 miles downstream of State Highway 157 in Section 10 of Township 25 North, Range 63 West in Goshen County. Channel bank erosion is occurring in this reach, as shown in Figure 4.70. Channel-stabilization measures are recommended using one of several rock-based approaches similar to stabilization structures installed downstream near the State Highway 156 bridge. The proposed project shown in Figure 4.71 would include the following items:

- Item No. C-02: Install 3,520 feet of bank protection and install riparian buffer practices.
- Investigate site-specific soil, geomorphic, and flow conditions to determine feasibility of stabilization measures and other potential issues that may occur near the project area.
- The proposed project is located on private land, but adjoining eroding banks occur on neighboring private lands as well.
- Additional landowner coordination, engineering design, state and federal permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.70.** View of an Eroding Bank on the North Platte River at the C-02 Proposed Project Site.

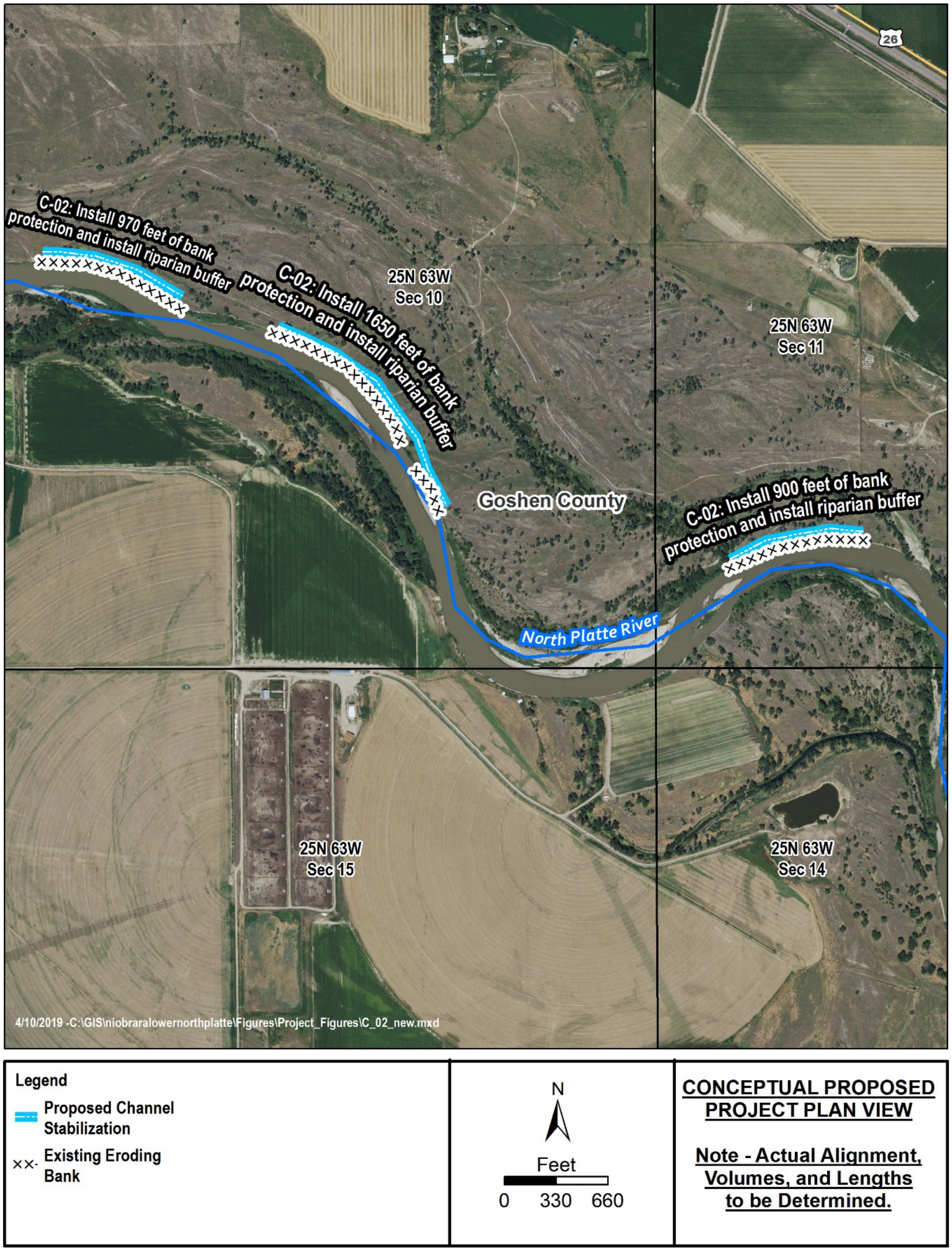


**Figure 4.71.** Proposed C-02: North Platte River Bank Erosion Downstream of State Highway 157.

### 4.7.1.3 *C-03: North Platte River Bank Erosion Downstream of US Highway 85*

The C-03 proposed project would be located southeast of Torrington on the North Platte River approximately 2 miles downstream of US Highway 85 in Section 23 of Township 24 North, Range 61 West in Goshen County. Channel bank erosion is occurring in this reach, as shown in Figure 4.72. Channel-stabilization measures are recommended using one of several rock-based approaches. The proposed project shown in Figure 4.73 would include the following items:

- Item No. C-03: Rehabilitate 1,850 feet of existing bank protection and install riparian practices.
- Investigate site-specific soil, geomorphic, and flow conditions to determine feasibility of stabilization measures and other potential issues that may occur near the project area.
- The proposed project is located on private land, but adjoining eroding banks occur on neighboring private lands as well.
- Additional landowner coordination, engineering design, state and federal permits, clearances, and constructions specifications are required before commencing construction on this project.

**Figure 4.72.** View of Channel Bank on the North Platte River at the C-03 Proposed Project Site.

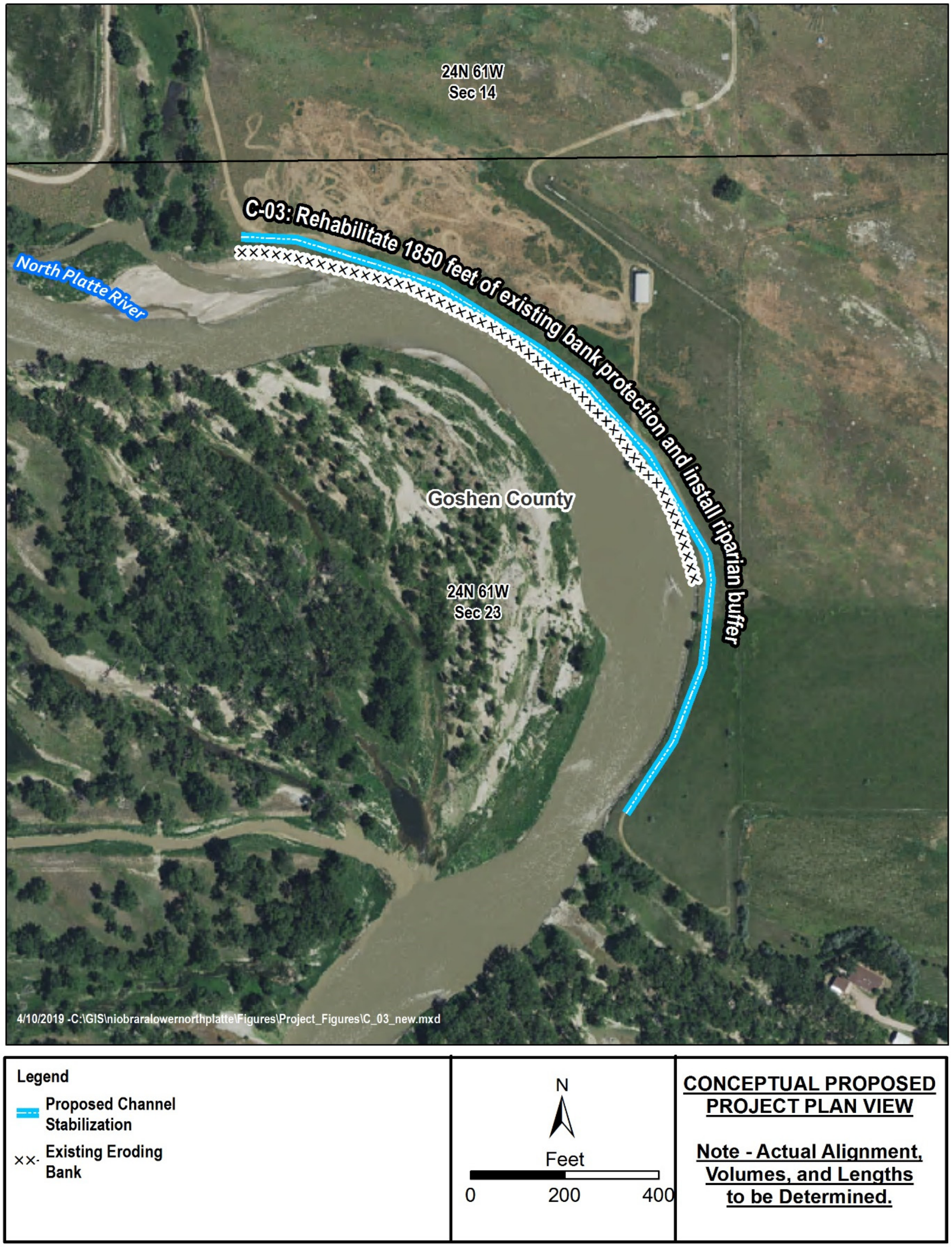


**Figure 4.73.** Proposed C-03: North Platte River Bank Erosion Downstream of US Highway 85.

### 4.7.2 Channel Stability Approaches

Various approaches for stabilizing streams can be used during channel-restoration efforts. Selecting the appropriate techniques depend on-site-specific information and a critical review of hydrologic and hydraulic data. Installing inappropriate structures or improper installation could exacerbate conditions. For example, methods of restoring incised channels may include constructing gradient restoration facilities (i.e., drop structures and check structures) within the incised channel. Reestablishing pre-incision channel elevations can be accomplished by installing gradient-stabilizing structures, which can be used to restore irrigation water delivery at diversions and headgates that were made inoperable by changes in channels.

Throughout most of the watershed, grazing management enhancements in conjunction with bioengineering stream practices could improve channel stability for several degraded channels on rivers and creeks. However, the North Platte River within the study area is characteristic of a flow-regulated system controlled by upstream reservoirs and downstream water demands. It would be practical and economical to analyze any extensive proposed channel stabilization or restoration project(s) on the river similar to the analysis completed for the channel project at the State Line Gage, which is described in Section 3.2.2.2 of this report. Based on the information presented above, the following items are presented for inclusion in the Watershed Management Plan:

- **Channel-Stabilization Recommendation 1:** Install stream-channel stabilization measures in conjunction with the proposed diversion and headgate rehabilitation projects for the facilities discussed in Section 3.4.7 (Irrigation Inventory) in Chapter 3.0 and included in Section 4.3. Based on-the site-specific evaluation of these facilities and channel conditions, the recommended measures should be "hard" engineering components (i.e. boulder/rock riprap) to promote irrigation structure and channel stability.
- **Channel-Stabilization Recommendation 2:** Investigate site-specific soil, geomorphic, and flow conditions to determine past, current, and future channel conditions along with evaluating the feasibility of any installed structures, stabilization measures, or other potential restoration efforts that may be proposed or planned along the North Platte River within the study area.

## 4.8 WETLANDS ENHANCEMENT OPPORTUNITIES

Wetland creation and enhancement opportunities exist within the watershed; however, no wetland-proposed projects or alternatives were identified by study participants. Although no specific wetland projects were identified, there are wetland and riparian improvements associated with certain irrigation, livestock/wildlife, and surface-storage proposed projects included in this plan. As explained in Section 3.3.2, existing wetland locations represent a variety of sites where wetlands could either be established or enhanced by restoring channel or hydric soil conditions. Some sites are disconnected floodplains and associated wetland features along the North Platte River and Niobrara River and their tributaries. Wetlands in the watershed have been influenced by regulated flows, geomorphic changes, and agricultural activities, but they still provide important habitat values. Furthermore, potential wetland creation and enhancement projects in the study area should consider site-specific conditions regarding the contributing surface water, groundwater, soil, and underlying geologic formation.

## 4.9 NIOBRARA–LOWER NORTH PLATTE RIVERS WATERSHED MANAGEMENT PLAN

The information presented in this section provides recommendations for improvements associated with the following:

- Irrigation system rehabilitation components
- Livestock/wildlife watering opportunities
- Grazing-management opportunities
- Surface-water storage opportunities
- Channel-stabilization opportunities
- Wetland-enhancement opportunities

Table 4.4 lists the itemized proposed project components of the Niobrara–Lower North Platte Rivers Watershed Management Plan. The conceptual cost estimates are tabulated in Chapter 6.0 of this report. To assist the local sponsors and WWDC, the potential funding program eligibility for each of the proposed projects was included in Table 4.4.

## 4.10 NETWORK EFFECTS FOR POTENTIAL PROJECTS

The potential effects and benefits that are associated with the proposed projects and components of the Watershed Management Plan were discussed in Section 4.2. The most common conservation practices in relation to the various proposed plan components include livestock/wildlife water, irrigation rehabilitation, grazing management, and stream-channel rehabilitation and stability. This section is included to provide the study participants, local sponsors, and decision-makers with the background necessary to make informed decisions regarding the potential positive and negative effects of the conceptual proposed projects and components in future planning efforts.

The NRCS prepares network effects diagrams (NEDs) of conservation practices that act together to achieve desired purposes. The NEDs "are flow charts of direct, indirect, and cumulative effects resulting from installation of the practices," [NRCS, 2016]. The NRCS NEDs are available at the website (*https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/technical/cp/ncps/*). Completed NEDs are an overview of expert consensus on the direct, indirect, and cumulative effects of installing proposed practice installation. Benefits that are associated with a particular conservation practice can be classified as direct, indirect, or cumulative.

Direct and indirect benefits would be considered measurable or tangible benefits. For example, constructing a reservoir that is designed to augment late-season irrigation water supply provides the direct or measurable benefit of providing a supply of water that is commensurate with its storage capacity. An indirect benefit could be the habitat provided to wildlife. Likewise, the same reservoir could provide the cumulative benefit of increased income to producers and improved health of the local economy. As discussed, such benefits can be quantitative, qualitative, or both. Benefits can be local or global and specific or surrogate, depending on factors unique and specific to the facility, conservation practice, watershed, or major land-resource area. Project benefits can be related to ecological enhancement, water quantity, economic stability, stream corridor or riverine stability, or maintenance of open spaces.

Table 4.4. Niobrara–Lower North Platte Rivers Watershed Management Plan (Page 1 of 2)

| Plan Item | Project Name | Potential Funding Source |
|---|---|---|
| | ***Irrigation Components*** | |
| I-01.1 | Hoblit Reservoir | WWDC SWPP, USBR WaterSMART, NRCS EQIP |
| I-02.1 | Reynolds No. 1 and No. 2 | WWDC SWPP, USBR WaterSMART, NRCS EQIP |
| I-02.2 | Reynolds No. 1 | WWDC SWPP, USBR WaterSMART, NRCS EQIP |
| I-02.3 | Reynolds No. 2 | WWDC SWPP, USBR WaterSMART, NRCS EQIP |
| I-03.1 | Emma Ditch | WWDC SWPP, USBR WaterSMART, NRCS EQIP |
| I-03.2 | Emma Ditch | WWDC SWPP, USBR WaterSMART, NRCS EQIP |
| I-04.1 | Peterson Draw | WWDC SWPP, USBR WaterSMART, NRCS EQIP |
| I-05.1 | Ladwig No. 2 | USBR WaterSMART, NRCS EQIP |
| I-05.2 | Ladwig No. 2 | USBR WaterSMART, NRCS EQIP |
| I-06.1 | Lucerne Canal | WWDC SWPP, USBR WaterSMART, NRCS EQIP |
| I-07.1 | E B Wilson Ditch | WWDC SWPP, USBR WaterSMART, NRCS EQIP |
| I-07.2 | E B Wilson Ditch | WWDC SWPP, USBR WaterSMART, NRCS EQIP |
| I-08.1 | Glomill Ditch | WWDC SWPP, USBR WaterSMART, NRCS EQIP |
| I-08.2 | Glomill Ditch | WWDC SWPP, USBR WaterSMART, NRCS EQIP |
| I-09.1 | East Draw Regulating Reservoir | WWDC SWPP, USBR WaterSMART, NRCS EQIP |
| I-10.1 | Peterson Draw Regulating Reservoir | WWDC SWPP, USBR WaterSMART, NRCS EQIP |
| | ***Livestock/Wildlife Water Components*** | |
| LW-01 | Hoblit Reservoir | WWDC SWPP, NRCS EQIP |
| LW-02 | Siebken #3 | WWDC SWPP, NRCS EQIP |
| LW-03 | Home Well #2 | WWDC SWPP, NRCS EQIP |
| LW-04 | Tronvold #1 | WWDC SWPP, NRCS EQIP |
| LW-05 | Harmony Spring #1 | WWDC SWPP, NRCS EQIP |
| LW-06 | Three Buttes | WWDC SWPP, NRCS EQIP |
| LW-07 | Upper Hefflen | WWDC SWPP, NRCS EQIP |
| LW-08 | Ole Place 1 | WWDC SWPP, NRCS EQIP |
| LW-09 | South Draw | WWDC SWPP, NRCS EQIP |
| LW-10 | North Draw | WWDC SWPP, NRCS EQIP |
| LW-11 | Owens Well #1 | WWDC SWPP, NRCS EQIP |
| LW-12 | Twin Tanks | WWDC SWPP, NRCS EQIP |
| LW-13 | Cistern Well | WWDC SWPP, NRCS EQIP |
| LW-14 | Hoblit #1 | WWDC SWPP, NRCS EQIP |
| LW-15 | Hoblit #4 | WWDC SWPP, NRCS EQIP |
| LW-16 | Hoblit #5 | WWDC SWPP, NRCS EQIP |
| LW-17 | Hoblit #3 | WWDC SWPP, NRCS EQIP |

**Table 4.4. Niobrara–Lower North Platte Rivers Watershed Management Plan (Page 2 of 2)**

| Plan Item | Project Name | Potential Funding Source |
|---|---|---|
| LW-18 | Johnson | WWDC SWPP, NRCS EQIP |
| LW-19 | Colters Pond | WWDC SWPP, NRCS EQIP |
| LW-20 | Smith South | WWDC SWPP, NRCS EQIP |
| LW-21 | Vondra #1 | WWDC SWPP, NRCS EQIP |
| LW-22 | Upper Moore | WWDC SWPP, NRCS EQIP |
| LW-23 | Bass Draw | WWDC SWPP, NRCS EQIP |
| LW-24 | North Pasture #2 | WWDC SWPP, NRCS EQIP |
| ***Channel Stability Components*** | | |
| C-01 | North Platte River Upstream of Highway 156 | WWDC SWPP, USBR WaterSMART, NRCS EQIP |
| C-02 | North Platte River Downstream of Highway 157 | WWDC SWPP, USBR WaterSMART, NRCS EQIP |
| C-03 | North Platte River Downstream of US Highway 85 | WWDC SWPP, USBR WaterSMART, NRCS EQIP |

### 4.10.1 Irrigation Rehabilitation Projects

The Watershed Management Plan includes various forms of conceptual irrigation projects.

***Irrigation Water Conveyance—Pipeline***

The rehabilitation and replacement of existing irrigation system delivery conveyance structures help efficiently deliver or convey water from a source of supply or diversion structures to areas of application or storage to facilitate in managing irrigation water. The practice reduces erosion, conserves water, and protects water quality. Underground pipelines serve as an integral part of the irrigation water distribution and significantly improve the overall efficiency of the system.

The following strategies are typically included to define the placement of irrigation water conveyance pipelines:

- Rehabilitation/replacement of existing structures
- Mitigation of seepage losses
- Enhanced delivery of irrigation water
- Reduced annual operation and maintenance costs
- Improved ditch management and efficiency through water management
- Facilitation of irrigation water management plans
- Economic practicality
- Physical feasibility.

Many direct and indirect effects and benefits of rehabilitating and improving water conveyance for irrigation systems exist and include the following:

- Water availability for irrigation
- Plant growth and productivity
- Infiltration and evaporation losses
- Increased plant growth and productivity
- Decreased leaching of nutrients
- Erosion associated with practice
- Decreased sediment delivery to surface waters.

Providing reliable water supplies has the following cumulative effects/benefits:

- Positive impacts to income and stability of individual producers and the community
- Improved aquatic health of humans, domestic animals, and wildlife
- Improved stream fauna and environmental quality.

### 4.10.2 Livestock/Wildlife Water Supply Projects

The Watershed Management Plan includes various conceptual livestock/wildlife water projects.

***Water Facilities***

Developing reliable watering facilities in areas that otherwise lack these facilities for livestock and wildlife help to promote improved rangeland conditions in several ways. Water facilities may be associated with wells, springs, streams, ponds, or hauled water. Reliable sources of water are integral aspects of any range-management plan that involves distributing livestock.

Placing water facilities typically involves the following strategies:

- Facilitating prescribed grazing-management plans
- Providing alternative water supplies to riparian sources
- Providing a reliable source where no other sources may exist
- Optimizing upland range resources.

Many direct and indirect effects and benefits of providing reliable water facilities for livestock and wildlife exist and include the following:

- Controlled access to streams, ponds, water supplies, and sensitive areas (when combined with proper fencing)
- Decreased loading of pathogens, sediments, and nutrients to existing surface waters
- Improved water quality, quantity, and distribution of livestock and wildlife
- Increased plant productivity
- Improved wildlife habitat

- Increased species diversity
- Increased livestock food sources

Cumulative benefits of provision of reliable water supplies include the following:

- Positive impacts to income and stability of individual producers and the community
- Improved aquatic health of humans, domestic animals, and wildlife
- Improved health of humans, domestic animals, and wildlife.

### 4.10.3 Grazing-Management Practices

The Watershed Management Plan includes conceptual alternatives and conservation practices such as water developments and other tools that can be used to facilitate and enhance grazing distribution and optimize range conditions through prescribed grazing practices.

***Prescribed Grazing***

Prescribed grazing is the controlled harvest of vegetation by grazing animals that are managed with the intent to achieve a specific objective. Prescribed grazing may be applied on lands where grazing and/or browsing animals are managed. A grazing schedule is prepared for pastures to be grazed. Vegetation removal by the grazing animals conforms with realistic yield goals, plant growth needs, and management goals. Grazing duration and intensity are based on desired plant health and expected productivity of the forage species to meet management objectives. Strategies for applying prescribed grazing involve managing the intensity, frequency, duration, distribution, and season of grazing through the following:

- Defining landowner and/or manager goals and objectives
- Identifying needs for reliable water sources and supplies
- Conducting feed and forage inventories and analyses
- Conducting range condition and health evaluations and assessments
- Managing desirable and undesirable plant communities to meet grazing objectives.

Many direct and indirect effects and benefits of implementing prescribed grazing management exist and include the following:

- Increased control of livestock grazing, feeding, and watering locations
- Decreased loading of pathogens, sediments, and nutrients to surface waters
- Increased manure distribution
- Increased soil quality
- Reduced contaminants, pathogens, and sediments to receiving waters
- Soil erosion and compaction
- Increased plant productivity and maintenance
- Increased livestock production and health
- Increased wildlife health and populations.

Implementing prescribed grazing could include the following:

- Positive impacts to income and stability of individual producers and the community
- Improved water quality and aquatic habitat
- Improved health of humans, domestic animals, and wildlife.

### 4.10.4 Stream-Channel Stabilization Projects

The Watershed Management Plan includes four recommendations. These alternatives include conservation practices such as installing stream-channel degradation/incision and streambank-erosion mitigation measures. These measures are based on a site-specific evaluation of conditions, along with routine monitoring of completed stream projects to identify maintenance repairs and determine their effectiveness. Appropriate measures could be "hard" engineering, "soft" approaches, or combinations of both.

***Streambank and Shoreline Protection***

Streambank and shoreline protection is stabilization and protection of streambanks, constructed channels, and shorelines of lakes and reservoirs. Strategies for applying streambank and shoreline protection involve the following:

- Creating streambanks of natural or constructed channels and shorelines of lakes and reservoirs where they are susceptible to erosion
- Using various materials to protect of streambanks and shorelines
- Creating a site-specific assessment to determine if the causes are local or systemic and that will be used to select appropriate treatment to achieve the desired objective
- Implementing functional and stable treatments for designs and that sustain higher flows
- Preventing the loss of adjacent land or damage to land uses or other facilities
- Protecting historical, archeological, and traditional cultural properties
- Reducing the off-site or downstream effects of sediment that result from bank erosion
- Improving the stream corridor for fish and wildlife habitat, aesthetics, and recreation.

Many direct and indirect effects and benefits of implementing streambank and shoreline protection conservation practices exist and include the following:

- Decreased streambank and/or shoreline erosion
- Increased soil quality
- Decreased sedimentation
- Increased flow capacity of streams and channels
- Increased streambank vegetation and root matrices
- Increased soil quality
- Increased native plant recruitment
- Decreased invasive/noxious species.

Implementing streambank and shoreline protection could include the following cumulative benefits:

- Positive impacts to income and stability of individual producers and the community
- Improved water quality and aquatic and/or terrestrial habitat
- Improved recreational opportunities.

# 5.0 PERMITS

## 5.1 OVERVIEW

Information regarding the permits, easements, and clearances for the proposed projects presented in Chapter 4.0 of this report are contained in the following sections. The purpose of this task is to identify the permits and clearances that may be required for implementing and/or constructing the proposed projects outlined in Chapter 4.0. Reviews, assessments, permits, clearances, or other requirements may be encountered when pursuing the implementation of the proposed projects and watershed management recommendations within the watershed. These processes usually involve permit application and environmental evaluation; coordinating with local, state, and federal agencies for review and/or approval; and determining potential impacts.

Irrigation and livestock/water project activities on private lands are not subject to local, state, and federal agency review and/or approval. However, almost all of the proposed projects included within this report would require some amount of review and/or approval from the appropriate local, state, or federal agency depending on the particular features of the proposed project because these projects typically involve constructing a permanent facility, such as a water well, irrigation diversion, or storage reservoir. In addition to the statutory requirements, review and/or approval may be necessary if local, state, or federal funds and/or technical services are used to implement the project. These requirements are program-specific and depend on the current programmatic criteria of the funding agency.

Some of the proposed projects described in this study could involve permitting and funding programmatic requirements and would be subject to state agency review and approval that requires application, coordination, and/or notification with the Wyoming State Engineer's Office (SEO), Wyoming Department of Environmental Quality (WDEQ), Wyoming State Historic Preservation Office (SHPO), Office of State Lands and Investments (OSLI), and Wyoming Game and Fish Department (WGFD). These proposed projects are also subject to the 2001 Modified Decree, which emplaced stipulations regarding surface water and groundwater use in areas that are hydrologically connected to surface water in Section 3.6.1.6. Green Area maps have been developed and are available at the SEO's website (*http://seo.wyo.gov/documents-data/maps-and-spatial-data*). These maps depict the areas in which the groundwater at any depth is deemed nonhydrologically connected and, therefore, well construction and groundwater use are not subject to the 2001 Modified Decree.

Furthermore, Executive Order 2015-4, Greater Sage-Grouse Core Area Protection, which was signed by Governor Mead in July 2015, requires state agencies to follow outlined procedures to minimize disturbances by locating proposed activities or developments in areas already disturbed or naturally unsuitable. Attachment B of Executive Order 2015-4, Permitting Process and Stipulations for Development in Greater Sage-Grouse Core Population Areas, describes the permitting process for activities and developments including the establishment of the Density and Disturbance Calculation Tool (DDCT), which is used to evaluate disturbances for proposed project areas. Attachment C of Executive Order 2015-4, Exempt (*de minimus*) Activities, including those with negligible or no impacts to greater sage-grouse core areas and are exempt from review under the order.

Identified, proposed projects that are described in this study and involve federal lands, federal agency regulations, or federal funding would be subject to the National Environmental Policy Act (NEPA) and/or other appropriate federal regulations. These federal regulations are administered primarily by the Bureau of Land Management (BLM), US Army Corp of Engineers (USACE), US Environmental Protection Agency (EPA), Natural Resources Conservation Service (NRCS), US Forest Service (USFS), Farm Service Agency (FSA), US Bureau of Reclamation (USBR), and US Fish and Wildlife Service (USFWS). A more in-depth discussion of NEPA can found in Section 5.9.

Local zoning ordinances and permit requirements are associated with building construction, floodplain development, and road or utility access, which may be applicable within the city and county boundaries of the study area. Current zoning and permitting requirements are known to exist within Goshen, Niobrara, and Platte Counties and are discussed in Sections 5.4.9 through 5.4.14. Zoning requirements also exist within jurisdiction of the City of Torrington. Permits or rights-of-way (ROW) access are required from WYDOT or utility/energy entities when construction involves their properties. Before excavation begins, notice to the One-Call of Wyoming Notification Center (811 or 1.800.849.2476) is required.

## 5.2 PROPERTY ACCESS, EASEMENTS, AND LAND PROCUREMENT

Permission should be obtained from the landowner, lessee, or management agency before any fieldwork is initiated on any proposed project area within the watershed. Verbal permission from landowners is sufficient for initial site visits. However, if project-specific field data need to be collected and potential project alternatives need to be developed, written permission should be acquired. Other negotiations could be necessary for securing easements, ROWs, and property access for planning or construction activities associated with a proposed project.

The Enterprise Technology Services' (ETS) Wyoming Statewide Parcel Viewer can be accessed via the website (*http://gis.wyo.gov/parcels/*) to help determine ownership information for any parcels that may be involved with a proposed project. Information regarding state land parcels and surface leases can be accessed from the OSLI's State Land Access website (*http://gis.statelands.wyo.gov/GIS/OSLIGIS/StateLandAccess/*) and OSLI's Search Surface Plat Book website (*http://statelands.wyo.gov/surfaceplatbook/*). County parcel data could also be obtained from Goshen, Niobrara, and Platte counties as discussed in Section 5.4.9 through Section 5.4.14. Permits or ROW access are required for the WYDOT and numerous utility and energy entities when project construction involves their properties.

### 5.2.1 Trespassing to Collect Data

Participation in the watershed study is voluntary, the consultant worked with the Wyoming Water Development Commission (WWDC), local sponsors, and landowners to gain permission before entering private land, which is required according to Wyoming Statute (W.S.) 6-3-414, *Trespassing to Unlawfully Collect Resource Data*. The consultant used global positioning system (GPS) units with parcel owner data and a GPS-enabled camera to collect field data, which ensured that field data collection occurred only on the participating landowners' properties.

### 5.2.2 Land Procurement, Right-of-Way, or Easement Acquisition

The proposed projects described in this study predominantly involve private lands and are situated within the parcel boundaries of the participating landowners. A small number of the proposed projects' components would involve access to ROWs along a county road or access to irrigation district infrastructure and would require temporary or conditional-use permits to be obtained from those entities. If a proposed project were to be located entirely or partially on federal lands, crossing federal lands, or funded by federal agencies or programs, additional requirements for compliance with the NEPA would apply, which is described more in Section 5.9. However, no proposed projects are currently located on state or federal land or on property that is not controlled by participating landowners. For the purposes of this study, the proposed projects included in the watershed management and rehabilitation plan do not require any additional land procurement or easement acquisitions. If these proposed projects are modified or revised in future efforts, additional access requirements may need to be reevaluated before commencing construction activities.

### 5.2.3 Utilities

Permits or ROW access are required for many utility and energy entities when project construction involves their easements or properties. The State of Wyoming's *Wyoming Underground Facilities Notification Act* requires everyone who owns underground facilities in the state to be a member of One-Call of Wyoming. Before any excavation begins, the excavator is required to provide advance notice (at least 2 business days before intending to dig) to the One-Call of Wyoming Notification Center at 811 (or if calling from out-of-state, 1.800.849.2476) [Wyoming State Legislature, 2013]. For more information about One-Call of Wyoming, please visit their website (*http://www.onecallofwyoming.com/*).

## 5.3 PERMITTING FOR PROPOSED PROJECTS

### 5.3.1 Livestock/Wildlife Water Projects

Permits, clearances, and approvals that need to be obtained on livestock/wildlife water projects for a typical project component (e.g., a water well, stock reservoir/pond, solar panel and pump, pipeline, and stock tank) are identified in Sections 5.3.1.1 through 5.3.1.4. Additional requirements from various entities may also exist and involve further investigation for some of the proposed projects. The extent of involvement and nature of coordination would be determined on a project-by-project basis. More detailed discussions of those requirements are included in Sections 5.4 through 5.9.

#### 5.3.1.1 *Water Well*

The majority of proposed projects within a watershed study typically include drilling a water well or rehabilitating an existing water well to provide a source of livestock/wildlife water within the watershed. In Wyoming, any person who drills a water well must obtain a water right appropriation before constructing any well by submitting an application to the SEO using their *Application for Permit to Appropriate Ground Water (U.W. 5 Form).* Work cannot begin until the permit is approved by the State Engineer according to *Title 41 Water, Chapter 3 Water Rights; Administration and Control* (W.S. 41-3-930). Groundwater applications, regulatory information, and form instructions can be accessed via the SEO's website (*https://sites.google.com/a/wyo.gov/seo/regulations-instructions*).

The drilling and/or pump contactor and the well owner must comply with the requirements of the *Rules and Instructions, Part III of the Water Well Minimum Construction Standards* (W.S. 41-3-909), which can be obtained via the website (*http://wwcb.state.wy.us/*). The water quality of the completed well must also be suitable for livestock and cannot exceed suitability constituents for any of the Class III standards (Table I) of *Chapter 8, Quality Standards for Wyoming Groundwaters* (W.S. 35-11-302), which can be accessed at (*http://deq.wyoming.gov/wqd/groundwater/resources/rules-regs/*).

Spring developments also need to be permitted by the SEO according to either their groundwater or surface-water rules and regulations. If a spring is for stock and/or domestic use, yields 25 gallons per minute or less, includes a man-made development, and is identifiable as groundwater, then the spring is permitted by submitting an application to the SEO using their Application for Permit to Appropriate Ground Water (Form U.W. 5). Work cannot begin until the permit is approved by the State Engineer in accordance with *Title 41 Water, Chapter 3 Water Rights; Administration and Control* (W.S. 41-3-930). If a spring development does not meet any of the described conditions, then the spring is permitted by completing and submitting a surface-water application via the SEO's website (*https://sites.google.com/a/wyo.gov/seo/regulations-instructions*).

#### 5.3.1.2 *Stock Reservoir/Pond*

Some of the proposed projects within the watershed include constructing or rehabilitating a stock reservoir or pond to provide a source of livestock/wildlife water. In Wyoming, a permit from the SEO is required before commencing construction of a dam or reservoir that involves storing or impounding water. Stock reservoirs must not exceed 20 acre-feet in capacity and cannot have a dam height greater than 20 feet; the stored water must be used for stock purposes only pursuant to *Title 41 Water, Chapter 3 Water Rights; Administration and Control, Article 3 Reservoirs* (W.S. 41-3-301). Any individual or entity who intends to construct a stock reservoir or pond must make application to the SEO using their *Application for Permit to Appropriate Surface Water (S.W.4 Form)* and cannot commence construction until the permit is approved by the State Engineer according to *Title 41 Water, Chapter 3 Water Rights; Administration and Control, Article 3 Reservoirs* (W.S. 41-3-301). Necessary surface-water applications including the *SW-4 Stock Reservoirs and SW-4A Stock Reservoir Multiple Points of Storage* forms, regulatory information, and form instructions can be accessed via the SEO's website (*https://sites.google.com/a/wyo.gov/seo/regulations-instructions*).

Wyoming's Safety of Dams legislation (W.S. 41-3-307 through 41-3-318), which is administered by the SEO, typically does not apply to stock reservoirs when the dam height is less than 20 feet high and reservoir capacity is less than 50 acre-feet. The water quality of a completed stock reservoir or pond must also be suitable for the agriculture water supply (including livestock watering) and cannot exceed any of the Class 2D, Class 3D, and Class 4 surface-water quality standards (Appendix B) of *Chapter 1, Wyoming Surface Water Quality Standards* (W.S. 35-11-101), which can be found at the website (*http://deq.wyoming.gov/wqd/surface-water-quality-standards-2/*).

Because many waterbodies and wetlands are considered waters of the United States, they are subject to the US Army Corps of Engineers' (USACE's) regulatory authority. Constructing or rehabilitating a reservoir would also typically involve discharging of dredged or fill material into waters of the United States and could require a Section 404 permit under the federal Clean Water Act (CWA). Permit applications can be obtained by contacting the USACE Omaha District Wyoming Regulatory Office in Cheyenne by telephone (307.772.2300) or website (*http://www.nwo.usace.army.mil/Missions/Regulatory-Program/Wyoming/*). As part of the 404 permitting process, when an applicant submits a preconstruction notification (PCN) to the USACE, the PCN is forwarded to the WDEQ for review under Section 401 of the CWA. The WDEQ then determines compliance with *Chapter 1, Wyoming Surface Water Quality Standards* (W.S. 35-11-101). If the project is compliant, then the WDEQ issues a 401 Water Quality Certification. Information about the WDEQ's 401 Certification process can be obtained by visiting their website (*http://deq.wyoming.gov/wqd/401-certification/*).

### 5.3.2 Irrigation Projects

A commonly proposed project within a watershed study is rehabilitating an existing diversion, ditch, or pipeline structure for diverting irrigation water from a river, creek, or reservoir to irrigated lands within the watershed. This type of a proposed project would require verifying the applicable water rights to ensure that the appropriation has been approved by the SEO pursuant with *Title 41 Water, Chapter 3 Water Rights; Administration and Control, Article 1 Generally* (W.S. 41-3-101). If the water rights appropriation has been verified or involves territorial appropriation and does not enlarge, change the point of use, or conveyance means of the existing diversion, ditch, pipeline, or other facility, then the proposed project typically does not require additional approval from the SEO.

However, any enlargement or change in point of use of the structure or facility would require submitting an application and/or petition to the SEO and the Board of Control for approval. Necessary application forms and instructions, including the SW-2 Enlargement of Ditches, Pipelines and Change in Point of Diversion and Means of Conveyance petition examples, can be obtained via the SEO's website (*https://sites.google.com/a/wyo.gov/seo/regulations-instructions*). Likewise, any individual or entity who intends to construct a new diversion structure, ditch, or pipeline from a stream that does not use an existing, permitted structure or facility must submit an application to the SEO using their Application for Permit to Appropriate Surface Water (S.W.1 Form) and cannot commence construction until the permit is approved by the State Engineer in accordance with *Title 41 Water, Chapter 3 Water Rights; Administration and Control, Article 1 Generally* (W.S. 41-3-101). Coordinating with the SEO should occur with any proposed project before rehabilitating or constructing an irrigation structure. Additional permissions or approvals may be necessary if the structure or facility supplies water to any other irrigators or water users.

In addition to the SEO requirements, constructing or rehabilitating a diversion structure (e.g., a headgate, weir, or diversion dam) along with any associated in-stream or streambank work would involve discharging the dredged or fill material into waters of the United States and could require permitting under Section 404 of the CWA. Coordination with the USACE should occur to determine any agricultural exemptions from Section 404 regarding constructing or maintaining irrigation ditches, including any construction or rehabilitation of siphons, pumps, headgates, wingwalls, weirs, screens, or other facilities as are appurtenant and functionally related to irrigation ditches. More information can be obtained by contacting the USACE's Wyoming Regulatory Office by telephone (307.772.2300) or visiting their website (*http://www.nwo.usace.army.mil/Missions/Regulatory-Program/Wyoming/*). When an applicant submits a 404 permit PCN to the USACE, the PCN is forwarded to the WDEQ for review under Section 401 of the

CWA to determine compliance with surface-water quality standards or approved total maximum daily loads (TMDLs). Information about the WDEQ's 401 Certification is available via the website (*http://deq.wyoming.gov/wqd/401-certification/*).

### 5.3.3 Water Storage Projects

#### 5.3.3.1 *Dam and Reservoir Permitting*

Proposed projects within the watershed include constructing a new dam and reservoir or the rehabilitating an existing dam and reservoir. Any individual or entity who intends to construct a new reservoir or enlarge an existing reservoir that exceeds 20 acre-feet in capacity or has a dam height greater than 20 feet must submit an application to the SEO using their Application for Permit to Appropriate Surface Water (SW-3 Form) and cannot commence construction until the permit is approved by the State Engineer according to *Title 41 Water, Chapter 3 Water Rights; Administration and Control, Article 3 Reservoirs (W.S. 41-3-301)*. Applications and instructions (SW-3 Reservoirs and SW-3A Special Application Reservoirs) can be obtained by accessing the website (*https://sites.google.com/a/wyo.gov/seo/applications-forms#Surface*).

Wyoming's Safety of Dams legislation (W.S. 41-3-307 through 41-3-318) requires that the State Engineer ensures the safety and structural integrity of water-storage facilities within Wyoming. Consequently, any individual or entity who proposes to construct, enlarge, repair, alter, or remove a dam with a height greater than 20 feet or a capacity of more than 50 acre-feet of water or a diversion system with headgates or diversion structures that carry 50 cubic feet per second (cfs) must have plans and specifications prepared by a Wyoming licensed professional engineer and shall be submitted to the State Engineer for approval pursuant to *Title 41 Water, Chapter 3 Water Rights; Administration and Control, Article 3 Reservoirs* (W.S. 41-3-308). On-site inspections of any new or rehabilitated facilities are conducted by the SEO personnel.

In addition to the SEO requirements, constructing or rehabilitating a reservoir or pond typically involves discharging dredged or fill material into waters of the United States and could require permitting under Section 404 of the CWA. Because many waterbodies and wetlands within the study area are considered waters of the United States, they are subject to the USACE's Section 404 regulatory authority. Section 404 applications and instructions can be obtained by visiting the website (*http://www.nwo.usace.army.mil/Missions/Regulatory-Program/Wyoming/*) or contacting the USACE's Wyoming Regulatory Office by telephone (307.772.2300). When an applicant submits a 404 permit PCN to the USACE, the PCN is forwarded to the WDEQ for review under Section 401 of the CWA to determine compliance surface-water quality standards or TMDLs. Information about the WDEQ's 401 Certification is available via the website (*http://deq.wyoming.gov/wqd/401-certification/*).

#### 5.3.3.2 *National Environmental Policy Act Process for Water Storage Projects*

Within the Platte River Basin and this study area, federal regulations in accordance with the NEPA and the Endangered Species Act (ESA) dictate the permitting requirements and review process of water-related projects, including water-storage projects. These review processes are required because of the need to secure permits under the federal CWA and Section 7 consultation under the federal ESA. The time frame for securing the necessary permits from federal agencies for water-storage projects could take several years depending on the complexity of the proposed facility because of the requirements of the NEPA and the ESA. Federal regulations direct that the USACE evaluate practicable and reasonable alternatives under the NEPA. A 404 permit for a discharge must only be issued for the least environmentally damaging, practicable alternative to the aquatic ecosystem that does not have other significant adverse environmental consequences.

The effort to comply with NEPA on any proposed reservoir project would probably require the preparation of an Environmental Impact Statement (EIS). The BLM or the USFS would likely be the lead agency for any water-storage project that is situated on federal land; the NRCS would likely be the lead agency for any reservoir project funded by the US Department of Agriculture (USDA) on private lands. For proposed reservoirs on private lands that are funded privately or by state programs, the permitting process still requires that NEPA is addressed and led by the appropriate local or state agency or landowner. The most important aspect regarding the permitting process for a new dam and reservoir storage project is developing a valid purpose and demonstrable need for the project.

#### 5.3.3.3 *Platte River Recovery Implementation Program*

In addition to the NEPA process, the requirements under the ESA for the critical habitat of whooping cranes, piping plover, and least terns in the Central Platte River in Nebraska resulted in signing a cooperative agreement in 1997 for the Platte River Recovery Implementation Program (PRRIP) between the United States Department of the Interior (USDOI); the USFWS; and the states of Wyoming, Nebraska, and Colorado. The PRRIP's purpose is to ensure agricultural, municipal, industrial, and other water uses while protecting critical habitat in the Central Platte River in compliance with the ESA. The state of Wyoming has adopted *Wyoming's Depletions Plan* [SEO, 2006b], which describes their current and future water-use management as part of the cooperative agreement with the PRRIP. The SEO's Basin Coordinator for the North Platte River is responsible for determining depletions and approving mitigation requirements. The USFWS has provided general guidance regarding the ESA consultations for developing water-related projects in the Platte River Basin in Wyoming under the PRRIP in the ESA Consultations Involving Platte River Depletions: Information for Project Proponents in Wyoming on the Platte River Recovery Implementation Program, which can be obtained by accessing the USFWS' website (*https://www.fws.gov/platteriver/*) or by visiting the SEO's website (*https://sites.google.com/a/wyo.gov/seo/interstate-streams/know-your-basin/platte-river-basin*).

### 5.3.4 Other Project Types

Permit and clearance approvals for any proposed projects are ultimately site-specific and depend on the project's location. The permits, clearances, and approvals discussed in Sections 5.3 through 5.5 could be applicable for any proposed municipal, groundwater exploration, weather modification, pipelines and conveyance facilities, wetland, environmental (e.g., streambank and erosion protection), and solar or windmill projects depending on the specific nature and/or location of the project.

### 5.3.5 Mitigation

Mitigation requirements may be necessary for a proposed project to address impacts to wetlands, riparian vegetation, stream-channel habitat, cultural resources, fish and wildlife resources, and threatened or endangered species. In developing the proposed projects within this study report, a decided effort was made to avoid potential impacts by evaluating and considering these resources as part of the conceptual plans. When necessary, the plan designs were and should be adjusted accordingly to avoid mitigating significant impacts. Avoiding potential impacts to species of concern and their associated habitats typically can be accomplished by scheduling construction activities outside of the relevant nesting, parturition, breeding, or migration seasons. Greater sage-grouse core area needs are discussed in Section 5.5.3.

## 5.4 AGENCY REQUIREMENTS AND NOTIFICATIONS

Several permits and clearances would need to be submitted to and approved by federal, state, and local agencies before constructing or installing any of the proposed projects presented in the Watershed Management and Implementation Plan along with any future projects. The permits and clearances that could potentially be required from the associated agencies are listed in Table 5.1.

### 5.4.1 US Army Corps of Engineers

The USACE's Wyoming Regulatory Office administers and enforces Section 404 of the CWA in Wyoming for the Omaha District. Under the CWA, a Section 404 permit is required for discharging dredged or fill material into waters of the United States. Many waterbodies and wetlands are considered waters of the United States and are subject to the USACE's regulatory authority. Permit applications can be obtained by contacting the USACE's Wyoming Regulatory Office in Cheyenne by telephone (307.772.2300) or via the website (*http://www.nwo.usace.army.mil/Missions/Regulatory-Program/Wyoming/*). Many nationwide permits have been developed, and the applicable permit depends on the nature of the proposed activity. Appendix E contains the USACE's description of Nationwide Permit 27.

### 5.4.2 US Fish and Wildlife Service

The ESA Section 7 requires federal agencies to conserve threatened and endangered species and ensure that these agencies' actions do not adversely affect the listed species or its critical habitat. Informal and formal Section 7 consultations take place between a federal agency and USFWS when that federal agency implements, finances, or approves a project that may affect a threatened or endangered species or its critical habitat. Typically, an informal consultation between the federal agency and the USFWS is conducted early in the planning of a project or program to ascertain if the agency's proposed project or program may affect the listed species. The federal agency typically completes a biological assessment to determine the proposed project's effect on the listed species. If the federal agency's biological assessment findings indicate that the listed species is likely to be adversely affected by the project or program, the agency would request a formal consultation with the USFWS. After reviewing information about the proposed action and listed species, the USFWS issues an opinion about whether the proposed project would harm the existence of the listed species.

A nonfederal agency can also be approved by the USFWS for an incidental take permit of threatened or endangered species under Section 10 of the ESA. However, the USFWS' approval usually depends on a habitat conservation plan (HCP), which, when followed, would minimize taking the listed species to the maximum extent practicable. Information can be obtained by contacting the USFWS's

Wyoming Ecological Services Field Office in Cheyenne, Wyoming, by telephone (307.772.2374) or website (*https://www.fws.gov/wyominges/index.php*). The USFWS's Information for Planning and Conservation (IPaC) is a web-based application and planning tool that is available to anyone who needs assistance in determining how their activity or project may affect migratory birds, ESA-proposed or listed species, or other sensitive resources. The IPaC can be accessed via the website (*https://ecos.fws.gov/ipac/*).

**Table 5.1. Potential Permits and/or Clearances for Proposed Projects**

| Agency | Potential Permit and/or Clearance |
|---|---|
| *Federal* | |
| USACE | Authorization of permit for discharging dredged or fill material (Section 404 permit)<br>Requires further delineation of jurisdictional wetlands and a wetland mitigation plan |
| USFWS | PRRIP; Endangered Species Act, Section 7 and 10 consultations |
| BLM | Clearance necessary if located or crossing BLM lands, NEPA review required |
| USFS | Clearance necessary if located or crossing USFS lands, NEPA review required |
| NRCS | Approval necessary if funded by Farmbill or USDA, NEPA review required |
| *State* | |
| SEO | Ground Water Division approval of Water Well Permits<br>Ground or Surface-Water Division approval of Spring Development Permits<br>Surface-Water Division approval of ditches, pipelines, and points of diversion<br>Surface-Water Division approval of diversion or headgates carrying 50 cfs<br>Surface-Water Division approval of reservoir permits<br>Safety of Dams approval of dam modifications<br>PRRIP |
| SHPO | Compliance letter for projects on federal land or that include a federal action |
| WGFD | Coordination for terrestrial and aquatic wildlife under the NEPA, the ESA, Section 404 of the federal CWA, and the Federal Fish and Wildlife Coordination Act<br>Greater sage-grouse core area protection |
| WDEQ | 401 Certification for 404 Permits under the federal CWA<br>WYPDES Construction General Permit (CGP) for large construction activity(> 5 acres) or small construction activity (between 1 and 5 acres)<br>Applicable water quality standards for wells, reservoirs, and streams |
| OSLI | Construction of Improvements on State Land application approval |
| Wyoming Department of Fire Protection and Electrical Safety | Electrical wiring permit to install electrical equipment on new construction or remodeling<br>Electrical installations must be performed by licensed electricians unless exempted |
| *Local* | |
| Town of Lusk | Contact the town office at 307.334.3612 for required permits |
| City of Torrington | Contact the city office at 307.532.5666 for required permits |
| Niobrara County | Contact the county office at 307.334.2211 for required permits |
| Goshen County | Contact the county office at 307.532.3852 for required permits |
| Special Districts | Contact the water and sewer, sanitary and improvement, flood control, irrigation, road, and improvement/service district for required permits |

### 5.4.3 Wyoming State Engineer's Office

The majority of proposed projects that are included in this watershed study would require a permit from the SEO. Proposed wells, livestock/wildlife water, irrigation rehabilitation, and water-storage projects would also require obtaining or modifying a water right approved by the State Engineer in accordance with *Title 41 Water, Chapter 3 Water Rights; Administration and Control, Article 1 Generally* (W.S. 41-3-101). Any project that includes constructing a new dam and reservoir or the rehabilitating an existing dam and reservoir that exceeds 20 acre-feet in capacity or has a dam height greater than 20 feet cannot commence construction until a permit is approved by the State Engineer pursuant to *Title 41 Water, Chapter 3 Water Rights; Administration and Control, Article 3 Reservoirs* (W.S. 41-3-301). Necessary water-rights applications, regulatory information, and instructions can be accessed via the website (*https://sites.google.com/a/wyo.gov/seo/regulations-instructions*). SEO permits can be accessed via the e-Permit website (*http://seoweb.wyo.gov/e-Permit/*).

### 5.4.4 Wyoming State Historic Preservation Office

Proposed projects within the watershed that are located on federal land, use federal funding, or need to secure a federal permit should have a review of cultural resources completed by the SHPO in accordance with Section 106 of the National Historic Preservation Act of 1966 and the Wyoming Antiquities Act of 1935 (W.S. 35-1-114 to 116). The SHPO reviews cultural resource reports, issues compliance letters for proposed projects, provides comments on activities that potentially affect historic properties or cultural resources, and recommends additional investigations if necessary. Additional SHPO compliance and review information can be obtained by contacting the SHPO by telephone (307.777.7697) or via the website (*http://wyoshpo.state.wy.us/Section106/Index.aspx*).

### 5.4.5 Wyoming Game and Fish Department

The Wyoming Game and Fish Commission encourages project sponsors, permitting agencies, and land managers to coordinate with the WGFD in the initial planning stage of a proposed project. The WGFD's involvement is essential in avoiding adverse impacts to wildlife during project development and implementation. The Wyoming Game and Fish Commission adopted a mitigation policy in 2016 to provide an approach to avoid impacts when possible and to formulate mitigation measures when necessary. The commission has directed the WGFD to resolve conflicts between land-use activities, wildlife, and their habitats pursuant to Wyoming Statutes and in cooperation with the USFWS and other federal agencies under the NEPA, the ESA, Section 404 of the CWA, and the Federal Fish and Wildlife Coordination Act. The WGFD's habitat information can be obtained via the website (*https://wgfd.wyo.gov/habitat/habitat-information*).

In July 2015, Executive Order 2015-4, Sage-Grouse Core Area Protection was signed by Governor Mead; this order requires state agencies to encourage development outside of the core areas and to focus management to the greatest extent possible on maintaining and enhancing habitat within them. Additional information about Wyoming's greater sage grouse management, including mitigation, *de minimus* activities, core area maps and data, and the Density Disturbance Calculation Tool (DDCT), can be found at the website (*https://wgfd.wyo.gov/Habitat/Sage-Grouse-Management*).

Sponsors of a WWDC Small Water Project Program (SWPP) project within the watershed will need to complete the WWDC's *Sage-Grouse Analysis Sheet*. Sponsors will have to determine if the proposed project is within the greater sage-grouse core area and is located within 0.6 mile of a greater sage-grouse lek as well as if the proposed project creates any wetlands or surface-water acres or provides enough water for mesic vegetation after construction. Additional information and operation criteria for the WWDC's SWPP can be found at the WWDC website (*http://wwdc.state.wy.us/small_water_projects/small_water_project.html*). For all of other proposed projects within the watershed, sponsors should contact the WGFD at least 60 days before submitting an application for a permit or project, so any issues related to the greater sage-grouse issues can be identified, and any stipulations can be incorporated before commencing project activities.

### 5.4.6 Wyoming Department of Environmental Quality

#### 5.4.6.1 *Section 401 Water Quality Certification*

For a proposed project that requires a USACE Section 404 permit, a PCN is submitted by the applicant to the USACE. The PCN is forwarded to the WDEQ for review under Section 401 of the CWA to determine compliance with *Chapter 1, Wyoming Surface Water Quality Standards* (W.S. 35-11-101). If the project is compliant, the WDEQ issues a 401 Water Quality Certification. WDEQ could require special conditions to the certification to guarantee compliance with surface-water quality standards or TMDLs. Information about the WDEQ's 401 Certification can be obtained by visiting the website (*http://deq.wyoming.gov/wqd/401-certification/*).

#### 5.4.6.2 *Permit to Construct*

Stormwater discharges are regulated under the federal CWA by the WDEQ's WYPDES program. For any proposed project within the watershed, the project sponsor should contact the WDEQ to determine if a Construction General Permit (CGP) is needed to construct the project components. The WYPDES program requires that construction activities that disturb 5 or more acres must obtain a Large Construction General Permit (LCGP), and construction activities that disturb at least 1 acre (but less than 5 acres) must obtain a Small Construction General Permit (SCGP). To obtain an LCGP, the applicant must also complete a Storm Water Pollution Prevention Plan (SWPPP). The WDEQ may also authorize temporary increases in turbidity above the numeric criteria of *Section 23, Chapter 1, Wyoming Surface Water Quality Standards* (W.S. 35-11-101) for certain short-term, construction-related activities conducted in live waters. Proposed projects involving irrigation diversions or streambank work typically occur in flowing water and would require application for a temporary turbidity waiver. For additional information or to obtain a WYPDES CGP or a temporary turbidity waiver, please contact the WDEQ by telephone (307.777.7781) or the WDEQ's Water Quality Division website (*http://deq.wyoming.gov/wqd/*).

### 5.4.7 Wyoming Office of State Lands and Investments

Some of the proposed projects within the watershed would be located on Wyoming state lands. When a project occurs on state land, a grazing and agricultural lessee is required to obtain permission from the Board of Land Commissioners before construction in accordance with *Title 36 Public Lands, Chapter 2 Board of Land Commissioners, Article 1 In General* (W.S. 36-2-107). The lessee must complete the OLSI's Application for Construction of Improvements on State Land and submit it to the OSLI for approval. The application includes the location, value, construction date, type of improvement, federal aid received, and applicable water rights for the improvement. Information can be obtained by contacting the OSLI by telephone (307.777.7331) or via the website (*http://lands.wyo.gov/lands/leasing/agricultural*).

### 5.4.8 Wyoming Department of Fire Protection and Electrical Safety

For any proposed project within the watershed that includes installing electrical equipment, the project sponsor should contact the Wyoming Department of Fire Protection and Electrical Safety to determine if a wiring permit is required before commencing work. A wiring permit is required when electrical equipment is installed in new construction or remodeling of a building, mobile home, or premises. The electrical installation must be performed by licensed electricians in accordance with *Title 35 Public Health and Safety, Chapter 9 Fire Protection, Article 1 Department of Fire Prevention and Electrical Safety* (W.S. 35-9-120 and W.S. 35-9-123). Applicable exemptions to these may exist for work done by an owner or lessee on their own property or on a farm or ranch of 40 acres or more on deeded land pursuant to *Title 35 Public Health and Safety, Chapter 9 Fire Protection, Article 1 Department of Fire Prevention and Electrical Safety, Division 3 Electrical Licensing* (W.S. 35-9-123). More information and the Application for Electrical Wiring Permit can be obtained by contacting the Wyoming Department of Fire Protection and Electrical Safety by telephone (307.777.7288) or via the website (*http://wsfm.wyo.gov/electrical-safety/wiring-permits*).

### 5.4.9 Goshen County

Goshen County has adopted regulations for land-use zoning and floodplain development within the project area. The county issues a permit for activities in the unincorporated areas of the county including but not limited to building structures, energy systems, and floodplain development. The project sponsor should contact the county to determine if any permits are needed to construct a proposed project within the watershed. More information and the permit applications can be obtained by contacting the Goshen County Planner by telephone (307.532.3852) or via the website (*http://www.goshencounty.org/*).

### 5.4.10 Niobrara County

Niobrara County has adopted regulations for land-use zoning and floodplain development within the project area. More information and the permit applications can be obtained by contacting the county by telephone (307.334.2211) or via the website (*http://niobraracounty.org/*).

### 5.4.11 Platte County

Platte County has also adopted regulations for land-use zoning and floodplain development within the project area. The county issues a permit for activities in the unincorporated areas of the county including but not limited to building structures, energy systems, water wells, septic systems, and floodplain development. The project sponsor should contact the county to determine if any permits are needed to construct a proposed project within the watershed. More information and the permit applications can be obtained by contacting the Platte County Planning and Zoning by telephone (307.322.1341) or via the website (*http://plattecountywyoming.com/*).

### 5.4.12 Special Districts

Special districts including water and sewer, sanitary and improvement, flood control, irrigation, road, and improvement/service districts located within the watershed. If a project involves the property and/or facility of a special district, then permission or a permit should be obtained from the special district before commencing construction. Special districts located within the project area include the Goshen Irrigation District; Hill Irrigation District, Pratte-Ferris Irrigation District, Torrington Irrigation District, South Torrington Water and Sewer, West Highway Water and Sewer, and the PV Bar Estates Improvement and Service.

## 5.5 ENVIRONMENTAL EVALUATION

### 5.5.1 National Environmental Policy Act Compliance

Complying with the NEPA typically applies whenever a proposed project that is included in the Watershed Management Plan is located on federal lands, needs passage across federal lands, is funded entirely or partially by federal agencies or programs, or needs to secure a federal permit. The NEPA process is intended to help sponsors and agencies review the potential project effects and involve the public in making informed decisions about the environmental consequences of a project. If any proposed project occurs on BLM and USFS lands or would receive the USDA Farm bill funding, the BLM, USFS, or NRCS would likely be considered the “lead or action agency” in the NEPA process.

The USACE usually has a role in reviewing proposed projects that involve impacting or enhancing a wetland, which would require a Section 404 permit. Typically, federal agencies have a Memorandum of Understanding (MOU) to outline responsibilities and roles of the agencies when a proposed project involves multiple agencies. Specifically, regarding the NRCS providing technical assistance to conservation districts and landowners on any proposed project that is funded by the WWDC’s SWPP, the NRCS’ *National Environmental Compliance Handbook, Subpart D – The National Environmental Policy Act, 610.40 Overview of NEPA Requirements,* 610.43 Federal Actions and Major Federal Actions states the following about federal actions:

> *A. Federal Actions*
> *(1) NEPA compliance is triggered when NRCS proposes a Federal action. A Federal action occurs when NRCS has control or responsibility over the implementation of a proposed activity including technical or financial assistance. Most NRCS Federal actions involve financial assistance through Farm Bill and watershed programs, or approvals, but Federal actions also include activities such as granting compatible uses agreements for easements where NRCS exercises control.*
> *(2) Federal actions do not usually include situations in which NRCS is only providing technical assistance because NRCS cannot control what the client ultimately does with that assistance. However, there may be instances where a project can become “federalized” due to a substantial input of Federal resources in the form of technical assistance or when NRCS has some control or responsibility in the result. When NRCS provides technical designs, standards, or specifications, the RFO should evaluate and determine whether NRCS has control or responsibility over the action, thus making it a Federal action subject to NEPA.*

*(3) Important note: NEPA only applies to Federal actions. It is NRCS policy and required by NRCS regulations to conduct an EE as a part of every planning activity, even if it is not considered a Federal action, (highly erodible land and wetland determinations are technical determinations and not considered planning activities). The results of this process are documented on the NRCS-CPA-52 worksheet, to— (i) Inform the landowner of the plan's impacts.*
*(ii) Provide a record that the EE was conducted.*

### 5.5.2 Proposed, Threatened, and Endangered Species

The species of concern within the study area (including any proposed, threatened, and endangered species) are discussed in detail in Section 3.2.1. The following threatened and endangered species have the potential to occur within the watershed study area [Wyoming Natural Diversity Database, 2018]:

- **Endangered:** Least tern (*Sterna antillarum*)
- **Threatened:** Piping Plover (*Charadrius melodus*)
  Colorado Butterfly plant (*Gaura neomexicana var. coloradensis*)
  Blowout penstemon (*Penstemon haydenii*)
  Ute ladies'-tresses (*Spiranthes diluvialis*)
  Western prairie fringed Orchid (*Platanthera praeclara*)
  Preble's Meadow Jumping Mouse (*Zapus hudsonius preblei*).

### 5.5.3 Other Species of Concern

Approximately 11 fish species, 24 big game populations or herd units, and nongame mammals, as well as 102 reptiles and amphibians, trophy game, furbearing animals, predatory animals, small game, and birds are known or expected to occur within the study area [Wyoming Natural Diversity Database, 2018]. Raptors in the area include but are not limited to golden and bald eagles, ferruginous and Swainson’s hawks, great blue heron, American kestrel, and peregrine falcon [Wyoming Natural Diversity Database, 2018].

Data obtained from the Wyoming Natural Diversity Database (WYNDD) list 137 non-game native species that range and are documented within the study area. Tables 3.11 and 3.12 lists the fish, birds, amphibians, mollusks, mammals, and reptiles listed from WYNDD. Out of the 137 non-game species within the study area, 113 species are listed as sensitive species. In addition, 23 species of plants are listed on WYNDD’s native species list, and 5 species are labeled as sensitive. A list of native plant species is displayed in Table 3.16.

On September 22, 2015, the USDOI determined that the greater sage-grouse does not require federal protection under the ESA and withdrew the greater sage-grouse from the USFWS’s candidate species list. However, the greater sage-grouse is still recognized as a sensitive species/species of concern by the BLM and a species of concern by WGFD. In June 2008, Executive Order 2008-2 was signed by the governor and stresses additional management consideration to sage-grouse and greater sage-grouse habitats statewide.

This original executive order has been extended most recently by Executive Order 2015-4, which was signed by Governor Mead in July 2015. The order includes requirements of state agencies to encourage development outside of the core areas and to focus management to the greatest extent possible on the maintenance and enhancements of habitat within them. The core areas for greater sage-grouse cover approximately 135,680 acres (6.5 percent) of the study area and are shown in Figure 3.77. Additional information about Wyoming's sage-grouse management including mitigation, *de minimus* activities, core area maps and data, and the DDCT can be found at the website (*https://wgfd.wyo.gov/Habitat/Sage-Grouse-Management/Sage-Grouse-Data*).

Sponsors of a WWDC SWPP project within the watershed will need to complete the WWDC's *Sage-Grouse Analysis Sheet*. The Sponsor will have to determine if the proposed project is within the sage-grouse core area and is located within 0.6 mile of a sage-grouse lek as well as if the proposed project creates any wetlands or surface-water acres or provides enough water for mesic vegetation after construction. More information and forms about the WWDC's SWPP can be found at the website (*http://wwdc.state.wy.us/small_water_projects/small_water_project.html*). For all of the other proposed projects within the watershed, sponsors should contact the WGFD at least 60 days before submitting an application for a permit or project so any sage-grouse-related issues can be identified and any stipulations can be incorporated before commencing project activities.

### 5.5.4 Fish Distribution, Wildlife Habitat Distribution, and Sensitive/Endangered Species

Available information and geospatial data regarding fish distribution, wildlife habitat distribution, and sensitive and threatened/endangered plant and animal species (e.g., greater sage-grouse) were obtained, mapped, and incorporated into the study's ArcGIS geodatabase and digital library. Information about these fish and wildlife species and their habitats are discussed in Section 3.5 of Chapter 3.0.

### 5.5.5 Wetland Delineation

Site-specific wetland delineation and inventories were not part of the scope of the watershed study. Geospatial data for the mapped NWI areas are listed in Table 3.15 and shown in Figure 3.12. This mapping was used to prepare conceptual proposed project plans that are listed in Chapter 4.0 for irrigation systems and livestock/wildlife water projects to avoid impacts to wetland resources. The alternatives for rehabilitating reservoirs, dam embankments, and inlet/outlet ditches may also affect wetland resources depending on the specific provisions of the plans, designs, and construction specifications. Entities should consult the USACE about any jurisdictional determinations when proposing any water-development projects with wetlands before implementing any proposed project. Specific mitigation measures would need to be formulated to compensate for wetland losses that are determined by certified wetland delineations.

## 5.6 PLANNING RESOURCES AND TOOLS

Sources of technical support and assistance for project planning and implementation within the watershed are primarily provided through partnerships between the local landowners, conservation districts, the NRCS, BLM, USFS, WGFD, and/or The Nature Conservancy (TNC). Additionally, online planning tools and publicly available maps are also available for planning efforts. These web-based mapping applications can help local sponsors assist landowners who are interested in moving forward with a conceptual project proposed in the Watershed Management Plan.

### 5.6.1 Wyoming Association of Conservation Districts – SuiteWater

The Wyoming Association of Conservation Districts (WACD), in partnership with the Wyoming Geographic Information Science Center (WyGISC), have created SuiteWater which is a web-based mapping application (*http://suitewater.wygisc.org/*) and planning tool developed by and for Wyoming conservation districts. SuiteWater provides users with integrated geospatial data, digital imagery, background information and documents, and user-generated data for developing natural-resource plans. However, access to SuiteWater is limited to the conservation districts and WACD directors, staff, and advisors. Requests for access to SuiteWater must be submitted to the WACD for approval.

### 5.6.2 Natural Resources Conservation Service – Web Soil Survey

Local sponsors, landowners, managers, and water users can access soils information via the NRCS' Web Soil Survey (WSS) (*http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm*). The WSS provides soil information produced by the National Cooperative Soil Survey in updated soil maps and data. Soil mapping data and interpretations can be used for general or local planning. No online account is necessary unless datasets are downloaded from the website. Site-specific soil maps of an area can be created and customized using the online tools to customize a soil map report, measure distances, explore interpretations and ratings, and download associated geospatial data. Although the WSS is useful in analyzing soils data during project planning, on-site soil investigations are recommended for most implementation activities including but not limited to reservoir, irrigation, and wetland construction or rehabilitation projects.

### 5.6.3 Wyoming Cultural Resource Information System

The SHPO has created online applications and web services for researching cultural resources within any proposed project area. The SHPO's online resources include the Natural Resource and Energy Explorer (NREX) via the website (*https://nrex.wyo.gov/*) and the Cultural Resource Management Tracker (CRMTracker) at the website (*http://www.gnomon.com/CRMTracker/CRMTracker_AllOrg/CRMTracker Home.aspx*). NREX has replaced the Cultural Research Information Summary Program (CRISP) and is discussed further in the following section. Additional cultural resource web service information can be obtained by contacting the SHPO by telephone (307.777.7697) or via the website (*http://wyoshpo.state.wy.us/OLResources/Index.aspx*).

### 5.6.4 Natural Resource and Energy Explorer

The NREX is a web- and GIS-based software tool that supports pre-planning development considerations by enabling discovery and energy analysis of environmental, cultural, socioeconomic, and infrastructural assets for user-defined, project-scale areas of interest in the state. The NREX can be accessed via the website (*https://nrex.wyo.gov*). The tool is designed to support the Energy Atlas concept within Governor Mead's Energy Strategy Initiative by providing public access to credible geographic data and information maintained by state agencies. The NREX can be used by developers, conservationists, consultants, planners, and managers for resource assessment.

### 5.6.5 Wyoming State Engineer's Office e-Permit System

The SEO's e-Permit system facilitates supervising and protecting surface-water and groundwater for the purpose of appropriation, distribution, and application to beneficial use of water in Wyoming. The SEO's e-Permit system is a web-based, online application that allows registered users to submit applications, petitions, and other requests; search the SEO's database of water rights; track the application process; access water-rights-related documents; and download streamflow and reservoir data. The SEO's e-Permit system can be accessed via the website (*http://seoweb.wyo.gov/e-Permit/*).

### 5.6.6 Wyoming Interagency Spatial Database and Online Management System

The Wyoming Interagency Spatial Database and Online Management (WISDOM) System (*http://wisdom.wygisc.org/*) is another online planning tool that allows individuals to access data regarding Wyoming's wildlife resources for use in developing project plans. WISDOM was developed as a partnership between the Western Governors' Association, WGFD, WyGISC, WYNDD, WDEQ, OSLI, WYDOT, NRCS, TNC, and USFWS. WISDOM provides users with landscape-level information for initial project planning phases; however, site-specific analysis with applicable agencies is still warranted regarding crucial wildlife habitat requirements and conservation potential. WISDOM preserves the confidentiality of sensitive data by displaying land ownership as federal, state, or private, and the records for certain species are generalized to prevent users from viewing specific location data.

### 5.6.7 Wyoming Density and Disturbance Calculation Tool for Greater Sage-Grouse

The WyGISC (in partnership with the WGFD, BLM, and USFS) created the DDCT (*http://ddct.wygisc.org/*), which is a web-based application tool that calculates number of disruptive activities averaged per square mile and total surface disturbance within the DDCT assessment area for proposed projects in protected greater sage-grouse core areas. The DDCT web application is used by individuals to prepare required permits for development activities. Users must register before the web application can be used.

### 5.6.8 US Fish and Wildlife Service Information for Planning and Conservation

The USFWS's IPaC (*https://ecos.fws.gov/ipac/*) is a web-based application that is available to anyone who needs assistance in determining how their activities may impact sensitive natural resources such as migratory birds, species listed under the ESA, or wetlands. Information that users obtain from IPaC is produced by USFWS field offices to help improve project planning, discussions, and recommendations. Additional information can be obtained by contacting the Wyoming Ecological Services Field Office by telephone (307.772.2374) or website (*https://www.fws.gov/wyominges/index.php*).

### 5.6.9 Wyoming State Agency GIS Web Applications

The State of Wyoming has increased the ability of state agencies to deliver quality, cost-effective services to Wyoming citizens by refining and establishing information services and technology. The current online mapping applications for state agencies are listed in Table 5.2. This list includes relevant GIS application information for agencies but is not conclusive for all of the state agencies.

**Table 5.2. Wyoming State Agency GIS Web Applications**

| Agency | Web Address | Description |
|---|---|---|
| Enterprise Technology Services (ETS) | *http://gis.wyo.gov/parcels/* | Statewide Parcels |
| State Parks and Historic Trails | *http://wysphst.maps.arcgis.com* | State Parks Events Info |
| Office of State Lands and Investment (OSLI) | *http://gis.statelands.wyo.gov/GIS/OSLIGIS/StateLandAccess/* | Public Access to State Lands |
| | *http://gis.statelands.wyo.gov/osligis/oilandgas/* | Oil-and-Gas Information |
| Wyoming Pipeline Authority (WPA) | *http://www.wyopipeline.com* | Pipeline Data |
| Public Service Commission (PSC) | *http://psc.state.wy.us/htdocs/Dwnload/CertMaps/electric.pdf* | Electric Utilities Areas |
| | *http://psc.state.wy.us/htdocs/Dwnload/CertMaps/Gas.pdf* | Gas Utilities Certificate Area Map |
| State Engineer's Office (SEO) | *https://sites.google.com/a/wyo.gov/seo/documents-data* | Water Data Information |
| Wyoming Department of Environmental Quality (WDEQ) | *https://gis.deq.wyoming.gov/maps/lqd_permit_public/index.html* | Viewer of Active Mining Permits |
| Wyoming Game and Fish Department (WGFD) | *http://wisdom.wygisc.org/* | G&F decision support system |
| Wyoming State Geological Survey (WSGS) | *http://www.wsgs.wyo.gov/wyoming-geology/mapping* | Geologic Maps |
| | *http://www.wsgs.uwyo.edu/Data/GIS/* | Maps by theme |
| Wyoming Geographic Information Science Center (WyGISC) | *http://www.uwyo.edu/wygisc/* | Home page for WyGISC |
| Wyoming State Climate Office | *http://www.wrds.uwyo.edu/sco/data/PRISM/PRISM.html* | PRISM Climate Data Server |
| | *http://www.wrds.uwyo.edu/sco/gis/IMS.html* | Water and Climate Map Server |

# 6.0 COST ESTIMATES

## 6.1 IRRIGATION SYSTEM COMPONENTS

The costs of irrigation system components of the Watershed Management Plan were estimated by using current unit costs from the National Resources Conservation Service (NRCS) 2019 State Payment Schedules for the USDA Farmbill programs are available at the website (*https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/financial*). These cost estimates were calculated using the 2019 Environmental Quality Incentives Program (EQIP) Payment Schedule for Wyoming when possible for conceptual proposed projects. The irrigation costs are estimated in Table 6.1 and included the following cost assumptions:

- Pipeline costs range from $7 to $30 per linear-foot of piping and trenching, depending on pipe rating and size, appurtenances, excavation depth, terrain, and geology.
- The costs for water-control structures (diversion and headgate) range from $6,900 to $19,600 each, depending on the structure design capacity, excavation quantity, and concrete volume. Costs for larger structures for water-control and diversions can often exceed more than $100,000 each.
- Irrigation-regulating reservoir costs range from $20,000 to $40,000 each, depending on the reservoir design capacity, borrow area proximity, and outlet facility requirements.

**Table 6.1. Irrigation System Rehabilitation Project Cost Estimates**

| Item Number | Project Name | Construction Costs ($) | Plans and Specifications ($) | Permits, Fees, Access ($) | Total Costs ($) |
|---|---|---|---|---|---|
| I-01.1 | Hoblit Reservoir | 134,024 | 13,402 | 6,701 | 154,127 |
| I-02.1 | Reynolds No. 1 and No. 2 | 19,293 | 1,929 | 965 | 22,187 |
| I-02.2 | Reynolds No. 1 | 27,069 | 2,707 | 1,353 | 31,129 |
| I-02.3 | Reynolds No. 2 | 35,019 | 3,502 | 1,751 | 40,272 |
| I-03.1 | Emma Ditch | 27,483 | 2,748 | 1,374 | 31,605 |
| I-03.2 | Emma Ditch | 27,557 | 2,756 | 1,378 | 31,691 |
| I-04.1 | Peterson Draw | 14,875 | 1,487 | 744 | 17,106 |
| I-05.1 | Ladwig No. 2 | 53,271 | 5,327 | 2,664 | 61,262 |
| I-05.2 | Ladwig No. 2 | 14,809 | 1,481 | 740 | 17,030 |
| I-06.1 | Lucerne Ditch | 106,541 | 10,654 | 5,327 | 122,522 |
| I-07.1 | E B Wilson Ditch | 27,483 | 2,748 | 1,374 | 31,605 |
| I-07.2 | E B Wilson Ditch | 41,829 | 4,183 | 2,091 | 48,103 |
| I-08.1 | Glomill Ditch | 54,957 | 5,496 | 2,748 | 63,201 |
| I-08.2 | Glomill Ditch | 24,718 | 2,472 | 1,236 | 28,426 |
| I-09.1 | East Draw Regulating Reservoir | 53,271 | 5,327 | 2,664 | 61,262 |
| I-10.1 | Peterson Draw Regulating Reservoir | 53,271 | 5,327 | 2,664 | 61,262 |
| **Total** | | **715,470** | **71,546** | **35,774** | **822,790** |

## 6.2 LIVESTOCK/WILDLIFE WATER COMPONENTS

The costs of livestock/wildlife water projects included in the Watershed Management Plan were estimated by using current unit costs from the 2019 NRCS EQIP Payment Schedules. The estimated costs are listed in Table 6.2 and the general cost assumptions for a proposed project include the following:

- Well costs range from $15,000 to $25,000 each or $40 to $50 per foot, depending on the well depth.
- Stock-water tank costs range from $2,500 to $4,000 each, depending on the stock-tank volume.
- Storage-tank costs range from $10,000 to $20,000 each, depending on the storage-tank volume.
- Pipelines range from $11,000 to $18,000 per mile, depending on the depth, terrain, and geology.
- Spring development costs range from $3,000 to $4,000, depending on the volume and capacity.
- Solar pump costs range from $9,000 to $13,000, depending on the depth and number of panels.
- Pond and reservoir costs range from $17,500 to $25,000, depending on the design requirements.

**Table 6.2. Livestock/Wildlife Water Project Cost Estimates**

| Item Number | Project Name | Construction Costs ($) | Plans and Specifications ($) | Permits, Fees, Access ($) | Total Costs ($) |
|---|---|---|---|---|---|
| LW-01 | Hoblit Reservoir | 66,982 | 6,698 | 3,349 | 77,029 |
| LW-02 | Siebken #3 | 52,862 | 5,286 | 2,643 | 60,792 |
| LW-03 | Home Well #2 | 23,895 | 2,390 | 1,195 | 27,479 |
| LW-04 | Tronvold #1 | 30,344 | 3,034 | 1,517 | 34,896 |
| LW-05 | Harmony Spring #1 | 30,786 | 3,079 | 1,539 | 35,404 |
| LW-06 | Three Buttes | 45,208 | 4,521 | 2,260 | 51,989 |
| LW-07 | Upper Hefflen | 51,419 | 5,142 | 2,571 | 59,132 |
| LW-08 | Ole Place 1 | 28,355 | 2,836 | 1,418 | 32,608 |
| LW-09 | South Draw | 24,499 | 2,450 | 1,225 | 28,174 |
| LW-10 | North Draw | 24,499 | 2,450 | 1,225 | 28,174 |
| LW-11 | Owens Well #1 | 57,889 | 5,789 | 2,894 | 66,572 |
| LW-12 | Twin Tanks | 62,075 | 6,208 | 3,104 | 71,387 |
| LW-13 | Cistern Well | 47,502 | 4,750 | 2,375 | 54,628 |
| LW-14 | Hoblit #1 | 33,432 | 3,343 | 1,672 | 38,447 |
| LW-15 | Hoblit #4 | 24,449 | 2,445 | 1,222 | 28,117 |
| LW-16 | Hoblit #5 | 20,543 | 2,054 | 1,027 | 23,625 |
| LW-17 | Hoblit #3 | 30,344 | 3,034 | 1,517 | 34,896 |
| LW-18 | Johnson | 20,543 | 2,054 | 1,027 | 23,625 |
| LW-19 | Colters Pond | 60,194 | 6,019 | 3,010 | 69,223 |
| LW-20 | Smith South | 36,474 | 3,647 | 1,824 | 41,945 |
| LW-21 | Vondra #1 | 77,412 | 7,741 | 3,871 | 89,024 |
| LW-22 | Upper Moore | 33,569 | 3,357 | 1,678 | 38,604 |
| LW-23 | Bass Draw | 32,428 | 3,243 | 1,621 | 37,292 |
| LW-24 | North Pasture #2 | 38,400 | 3,840 | 1,920 | 44,160 |
| | **Total** | **$915,706** | **$91,571** | **$45,785** | **$1,053,062** |

## 6.3 CHANNEL-STABILITY COMPONENTS

The costs of channel-stability projects included in the Watershed Management Plan were estimated by using current unit costs from the 2019 NRCS EQIP Payment Schedules. The estimated costs are listed in Table 6.3 and the general cost assumptions for a proposed project include the following:

- Channel stabilization costs using structural large wood material (large diameter trees and rootwads) on banks taller than 6 feet range from $120 to $140 per linear foot of channel bank.
- Channel stabilization costs using structural toe riprap with vegetation (i.e. bankfull bench construction/bank shaping/riparian-corridor revegetation/rock riprap/ large diameter trees/ rootwads) range from $130 to $150 per linear foot of channel bank.
- Channel stabilization costs using toe riprap, large wood material (large diameter trees and rootwads), and rock vanes range from $280 to $300 per linear foot of channel bank.

**Table 6.3. Channel-Stability Project Cost Estimates**

| Item Number | Project Name | Construction Costs ($) | Plans and Specifications ($) | Permits, Fees, Access ($) | Total Costs ($) |
|---|---|---|---|---|---|
| C-01 | North Platte River Erosion Upstream of State Highway 156 | 227,930 | 22,795 | 11,397 | 262,122 |
| C-02 | North Platte River Erosion Downstream of State Highway 157 | 663,027 | 66,303 | 33,150 | 762,480 |
| C-03 | North Platte River Erosion Downstream of US Highway 85 | 205,150 | 20,515 | 10,257 | 235,922 |
| **Total** | | **$1,096,107** | **$109,613** | **$54,804** | **$1,260,524** |

# 7.0 FUNDING OPPORTUNITIES

## 7.1 OVERVIEW

Sources of funding and financing for proposed projects within the watershed and the associated technical support are available from various local, private, state, and federal entities. The widespread opportunities described in this Level I Watershed Study, Watershed Management Plan, and the resulting proposed projects and alternatives make identifying and obtaining potential project funding dependent on local coordination and voluntary cooperation.

Local coordination is crucial in developing viable financing approaches that could be developed in implementing proposed projects and realizing beneficial watershed improvements. Voluntary cooperation between landowners, managers, irrigators, residents, organizations, and agencies is essential in addressing the identified land- and water-resource concerns within the Niobrara–Lower North Platte Rivers Watershed. Land and water users and managers who are interested in voluntarily implementing conservation projects and programs should be aware of the partnership opportunities and program incentives available for successfully achieving their watershed-improvement goals and objectives.

Local, state, and federal agencies, along with private organizations, provide technical assistance for watershed and conservation projects; a smaller number of these entities also provide financial assistance. Private contributions, such as in-kind provisions, are vital to developing and accomplishing a successful watershed or conservation project. Agencies and organizations with technical and financial assistance programs, which could potentially assist with proposed projects and alternatives, are provided in the subsequent sections. Funding and program information for potential conservation and watershed projects as well as assistance was obtained primarily from the following sources:

- **Water Management and Conservation Assistance Programs Directory** is an overview of local, state, and federal programs with associated contact information (*http://wwdc.state.wy.us/wconsprog/2014WtrMgntConsDirectory.html*).
- **Catalog of Federal Funding Sources for Watershed Protection** is a searchable database of financial assistance sources (grants, loans, and cost-sharing) available to fund a variety of watershed projects (*https://www.epa.gov/waterdata/catalog-federal-funding*).

Additional information about potential funding sources were reviewed and incorporated from previous watershed studies completed on behalf of the Wyoming Water Development Commission (WWDC) and specifically included excerpts from the *Blacks Fork River Watershed Study Basinwide Watershed Management Plan* [Anderson Consulting Engineers, Inc., 2015], the *Middle North Platte River Watershed Management Plan, Level I Watershed Study* [RESPEC and Anderson Consulting Engineers, Inc., 2014], and the *Medicine Bow River Watershed Management Plan, Level 1 Watershed Study* [RESPEC and Anderson Consulting Engineers, Inc., 2016]. These potential sources, which are described in this chapter, are certainly not an all-inclusive listing of the available opportunities for water management and conservation projects. Also, the available funding levels for these programs vary annually because they are subject to budget appropriations, spending authorizations, and (in some instances) donation amounts for organizations. The contact information for these sources changes occasionally. The following is a partial list of contact information for local conservation organizations:

- Lingle-Fort Laramie Conservation District (307.532.4880)
- North Platte Valley Conservation District (307.532.4880)
- Niobrara Conservation District (307.334.9957)
- Platte County Resource District (307.322.9060)
- South Goshen Conservation District (307.532.4880)
- Natural Resources Conservation Service Casper State Office (307.233.6750)
- NRCS Torrington Field Office (307.532.4880)
- NRCS Douglas High Plains Area Office (307.358.3050)
- NRCS Lusk Field Office (307.334.2953)
- NRCS Wheatland Field Office (307.322.9060)
- Bureau of Land Management Cheyenne State Office (307.775.6256)
- BLM Casper Field Office (307.261.7600)
- Wyoming Game and Fish Department Laramie Regional Office (307.745.4046).

## 7.2 LOCAL AGENCIES

### 7.2.1 Conservation Districts

Five conservation districts cover portions of the watershed, including Lingle-Fort Laramie Conservation District (LFLCD) (35.6 percent), North Platte Valley Conservation District (NPVCD) (30.5 percent), Niobrara Conservation District (NCD) (24.0 percent), Platte County Resource District (PCRD) (5.7 percent), and South Goshen Conservation District (SGCD) (4.2 percent).

Conservation districts are locally led and locally elected county government entities. These districts function as representatives of local people with a responsibility to natural-resource issues. Local conservation district boards perform as a liaison between local landowners and resource users and state and federal government agencies. Conservation districts provide information and education at the local level. Districts also provide technical assistance as local resources, capacity, and expertise allow and can assist in developing and implementing program and project design and funding by assisting in proposal preparation, presentation, and pursuit of grant assistance.

Conservation districts can also provide funding assistance, often through in-kind contributions, such as staff time and technical aid. Districts can administer programs, projects, and grants on behalf of recipients of state and federal natural-resource programs. Districts can also assist with developing leveraged, partnered programs and projects. Additional information can be found on the website (*http://www.conservewy.com*). Conservation districts also provide supplemental grants through cost-share programs to fund local residents with conservation projects and enhancements to their homes and community. Cost-share programs will vary from district to district, depending on the size and scope of the proposed conservation project.

### 7.2.2 County Weed and Pest Districts

County Weed and Pest Districts in Goshen, Niobrara, and Platte Counties also provide technical and financial assistance to landowners within the study area. These special-purpose districts deliver a wide range of support, including weed information, treatment education, field mapping, infestation control and eradication, early detection and response, and cost-share or discounted product incentives. Local contact information for the weed and pest control districts within the study area includes the following:

- Goshen County Weed and Pest (307.532.3713)
- Niobrara County Weed and Pest (307.334.3373)
- Platte County Weed and Pest (307.322.3210).

## 7.3 STATE PROGRAMS

### 7.3.1 Wyoming Water Development Commission

The WWDC is responsible for coordinating, developing, and planning Wyoming's water and related land resources. The commission, which consists of ten members who are appointed by the Governor with approval of the Senate, represents the four-state water divisions and the Wind River Reservation. Appointments are for a term of 4 years, and a political split on the commission is required. The commission serves public entities including but not limited to irrigation districts, conservancy districts, municipalities, water and sewer districts, joint powers boards, improvement and service districts, and tribal business councils. The WWDC administers and develops financing recommendations for the Wyoming Water Development Program, which was defined as the following by W.S. 41-2-112(a):

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

### 7.3.2 Wyoming Water Development Program

The main Wyoming Water Development Program encompasses new development, dams and reservoirs, rehabilitation, water-resource planning and construction. The information described in this section was abstracted from the Operating Criteria of the Wyoming Water Development Program (*http://wwdc.state.wy.us/opcrit/final_opcrit.pdf*). Sponsors can obtain the Project Application via the WWDC website (*http://wwdc.state.wy.us/project_application_info/project_app_info.html*) and/or contact the appropriate program manager at the WWDO before submitting a project application.

Current information on funding is important to review before submitting an application because WWDC's policies and procedures can and do change over time in response to legislative direction and/or commission action. Reviewing the available information at the listed websites and contacting the WWDC staff is recommended before beginning the application process. The following information in Sections 7.3.2.1 through 7.3.2.5 contains excerpts from Chapter II – Programs of the Operating Criteria of the Wyoming Water Development Program [WWDC, 2018a].

#### 7.3.2.1 *New Development Program*

The New Development Program provides an opportunity for sponsors to develop water supplies for existing and anticipated future needs to ensure that lack of water supply will not inhibit economic growth. The program encourages water development through state/local partnerships. The sponsor can complete a water supply project with state funding assistance. If a project is developed to meet the needs of the sponsor alone, the sponsor owns the project and its revenues. However, if an opportunity to sell water for other purposes occurs, the sponsor and state share in the revenues from the sale in proportion to the grant/loan mix. This partnership is discussed in further detail in subsection I of Chapter IV of these criteria.

*New development projects can proceed as sponsored projects or state projects.*

1. *Sponsored Projects*

*The project sponsor shall be a public entity that can legally receive state funds, incur debt, generate revenues to repay a state loan, hold title and grant a minimum of a parity position mortgage on the existing water system and improvements appurtenant to the project or provide other adequate security for the anticipated state construction loan. A project sponsor can be a municipality, irrigation district, joint powers board, or other approved assessment district, which will realize the major direct benefits of the project. The project sponsor must be willing and capable of financially supporting a portion of the project development costs and all operation and maintenance costs. Sponsors request project technical and financial assistance from the WWDC through the application process.*

*The sponsor may request that a Level I or Level II study be conducted to identify solutions and alternatives for addressing water supply issues or they may request funds for a Level III construction project, if it is determined the project is technically and economically feasible and serves to meet a water supply need or alleviate a water supply problem.*

2. *State Projects*

*The typical state project serves to benefit more than one entity and is multipurpose in nature. Another common characteristic of state projects is that each has a difficult permitting or political issue, which must be addressed. These issues may include developing a partnership with the federal government, another state, and/or private industry to encourage project development; resolving endangered species, water quality, or wetland issues; or addressing resistance to the project from downstream states. The WWDC shall consider investments in state projects on a case-by-case basis. However, it should be recognized that present federal laws and regulations make it difficult to achieve federal clearances for projects in which there is not a clearly defined purpose and need.*

### 7.3.2.2 *Rehabilitation Program*

The purpose of the Rehabilitation Program is to provide funding assistance for the improvement of water projects completed and in use for at least 15 years. The source of revenue for the program is Water Development Account No. II, which receives a percentage (2.10 percent) of the revenues that accrue to the state's severance tax distribution account and the interest earnings that have accrued to Water Development Account No. II. Legislative approval must be granted before allocating funds to a particular purpose or project.

Rehabilitation projects are initiated by an application from a project sponsor. If the application is approved, the project is usually assigned a Level II status and can proceed through construction if it is if the project is technically and economically feasible. The project sponsor must be willing and capable of financially supporting a portion of the project development costs plus all operation and maintenance costs. The Rehabilitation Program assists the project sponsors in keeping existing water supplies effective and viable to preserve their use for the future. Rehabilitation projects can improve an existing municipal, rural domestic, or agricultural system. The projects serve to ensure dam safety; decrease operation, maintenance, and replacement costs; and/or provide a more efficient means of using existing water supplies.

### 7.3.2.3 *Dam and Reservoir Program*

The proposed new dams with a storage capacity of 2,000 acre-feet or more and proposed expansions of existing dams of 1,000 acre-feet or more qualify for the Dam and Reservoir Program, which receives funding from the Water Development Account No. III. Legislative approval must be granted before allocating funds to a particular purpose or project. Dams and reservoirs typically provide opportunities for many potential uses. While water supply and use will be emphasized in developing reservoir operating plans, recreation, environmental enhancement, flood control, erosion control, and hydropower uses are explored as secondary purposes.

### 7.3.2.4 *Drinking Water State Revolving Fund*

By enacting W.S. 16-1-302, the Legislature authorized the use of water development account funds to provide 50 percent of the state's matching fund requirements for the federal Drinking Water State Revolving Loan Fund (DWSRF) program. The DWSRF program may be used to fund improvements to water treatment systems and to finance measures that address other Safe Drinking Water Act compliance issues. This program is not included in the annual Omnibus Water Bill considered by the Legislature. Water Development Program funds are appropriated automatically by statute to match 10 percent of the federal capitalization grant.

### 7.3.2.5 *Water Resource Planning*

The WWDC serves as the water-planning agency for the State of Wyoming. The water development planning function is an important aspect of the Water Development Program. Because the issues facing water development in the west are complex, the scope of the WWDC's planning efforts is not as closely defined as the New Development, Rehabilitation, and Dam and Reservoir Programs. The planning aspects of the Wyoming Water Development Program establish the framework for development strategies and serve to identify and resolve water issues. The source of revenue for the planning function of the program is typically Water Development Account No. I.

1. *River Basin Plans*
   *The program develops basin wide plans for each of the state's major drainage basins. These plans identify water supply problems and development opportunities. The plans serve to promote interest from water users who may become interested in a particular project and become project sponsors. Basin plans shall include the development of a water related database to provide data and information to developers and resource managers.*

2. *Watershed Studies*
   *These studies provide a detailed evaluation of an individual watershed. The studies may identify water development and system rehabilitation projects as well as address erosion control, flood control or other non-water development related environmental issues. Watershed improvement studies are an integral part of the Small Water Project Program, which has its own specific criteria. The studies may identify projects that may be eligible for the New Development, Rehabilitation, or Dam and Reservoir Programs.*

3. *Master Plans*
   *Master plans provide a service to municipalities, districts and other entities to assist in the preparation of planning documents, which serve as a blueprint for future water supply system improvements. Master plans also serve as a framework for the entities to establish project priorities and to perform the financial planning necessary to meet those priorities.*

   *In addition, master plans assist entities in preparing the reports necessary to achieve federal funding assistance for water development, flood control, erosion control, hydropower, rehabilitation, watershed improvements and other water related projects. Sound water planning serves to promote the effective and efficient use of available water resources. Master plans provide information to users as to whether the resource can adequately service the existing and anticipated demands for water within a certain area and provide reconnaissance level information regarding costs and scheduling.*

4. *Research*
   *Water development issues and problems may encompass watersheds, river basins or include the entire state. In order to address these issues, non-project specific research and data collection is necessary. The legislature has assigned the Water Development Program the following research tasks:*

   *Instream Flow*
   *The Wyoming Game and Fish Department (WGFD) select candidate stream segments for instream flows. The WWDC files water right applications with the State Engineer for permits to appropriate water for instream flows in those segments of stream recommended by the WGFD. Further, W.S. 41-3-1004 assigns the WWDC the responsibility to generate feasibility reports for all instream flow permit applications. The reports are hydrological analyses of water availability in the reach of the stream to which the applications apply. The analyses also quantify existing water rights above and within the stream segment. As the water-*

*planning agency, the WWDC also reviews instream flow requests to determine whether they may conflict with future water development opportunities.*

*(a) Groundwater Grant Program*
*W.S. 41-2-119 authorizes the Commission to grant funds to cities, towns, and special districts for exploration programs to evaluate the potential use of underground water for municipal and rural domestic purposes. Authorized entities are eligible to receive up to $400,000 in grant funds and are required to provide 25% of the total project costs in local matching funds. The primary purpose of the program is to inventory the available groundwater resources in the state. The program also serves to assist communities in the development of efficient water supplies. Unlike other projects within the Water Development Program, funding for projects that meet the criteria of the Groundwater Grant Program can be allocated directly by the WWDC without project specific legislation.*

*University of Wyoming's Office of Water Programs*
*The Wyoming Water Development Program provides funding each year to the UW Office of Water Programs to fund non-project water related research. Annually, topics for potential research projects are solicited from Wyoming stakeholders. A Selection Committee, made up of federal and state agency representatives, prioritizes these topics and issues requests for proposals to address these areas of concern. From these requests, proposals are selected based on peer-reviewed selection criteria.*

#### 7.3.2.6 *Key Criteria and Procedures*

An application for funding under the New Development and Rehabilitation Programs must meet the following key criteria that best applies to potential projects as identified in Chapter 4.0:

*The project sponsor shall be a public entity that can legally receive state funds, incur debt, generate revenues to repay a state loan, hold title and grant a minimum of a parity position mortgage on the existing water system and improvements or provide other adequate security for the anticipated state construction loan.*

*The proposed project must serve fifteen (15) or more municipal/domestic water taps of 2,000 or more water righted acres. The WWDC may waive the requirement for water meters if there is no existing water supply system or the sponsor demonstrates that water meters will be installed in the near future.*

Important procedures, deadlines, and requirements for applications to the New Development and Rehabilitation Programs include but are not necessarily limited to the following:

- A fee of $1,000 must be submitted with the initial project applications; the fee does not obligate the Water Development Commission or State of Wyoming to fund a study or provide construction funding for any proposed project or purpose.
- A certified resolution that was passed by the governing body of the sponsoring entity must accompany an application.
- The applicant must be a public entity before applying for a Level II study.

- Applications for Level I and II projects must be received by **March 1st** and Level III construction projects by **September 1st**.
- Before applying for project funding, the WWDC strongly recommends completing a Public Water System Survey or Irrigation Systems Survey available through the website (*http://wwdc.state.wy.us/surveys/surveys.html)*.

Important criteria that apply specifically to dam and reservoir projects include the following:

> *The scope specifically…pertains to projects that enlarge existing storage project by 1,000 acre-feet or greater or for proposed new dam and reservoirs with a capacity or 2,000 acre-feet or greater. The WWDC may accept applications related to the construction of dams and reservoirs from applicants that are not public entities. As the evaluations of the feasibility of new dams are complex, this will allow the applicant to know if the proposed reservoir is feasible prior to becoming a public entity. However, the applicant must be a public entity before applying for Level II, Phase III funding. Work included under this phase includes final engineering design, reviews required by the National Environmental Policy Act, consultations required by the Endangered Species Act, and acquisition of state and federal permits.*

### 7.3.2.7 *Financial Plan*

The current standard terms of the Wyoming Water Development Program financial plan are summarized as the following:

- Maximum grant of 75 percent for proposed Level III projects (*Typical grants for Level III projects are 67 percent from the WWDC and 33 percent Sponsor match*)
- Minimum 4 percent loan interest rate (*current rate is 4 percent, but legislature may increase the rate*)
- Maximum 50-year term of loans; term shall not exceed the economic life of project
- Payment of loan interest and principal may be deferred up to 5 years after substantial completion at the WWDC's discretion under special circumstances.

The commission will evaluate whether or not a project will be funded for Level III construction after reviewing the results of Level II studies. If the commission determines that the project should not advance because of high repayment costs (as determined by an analysis of the sponsor's ability to pay and after other funding sources have been considered), the sponsor has the option of making a formal presentation to the WWDC relative to the sponsor's ability and willingness to pay. This presentation must address the need for the project, the direct and indirect benefits of the project, and any other information that the sponsor believes is relevant to the commission's final decision.

The project sponsor shall be a public entity that can legally receive state funds, incur debt, generate revenues to repay a state loan, hold title, and grant a minimum of a parity position mortgage on the existing water system and improvements appurtenant to the project or provide other adequate security for the anticipated state construction loan. The WWDC may waive the requirement that the project sponsor be a public entity under the following exceptions:

1. The WWDC may accept applications for Level I studies from applicants that are not public entities. The applicant may know if a viable project exists before becoming a public entity. However, the applicant must be a public entity before applying for a Level II study. Under these circumstances, the Level I process will have a 2-year duration with the study being completed the first year and the sponsor forming the public entity the second year.
2. The WWDC may accept applications related to constructing dams and reservoirs from applicants that are not public entities. Because evaluating the feasibility of new dams is complex, the applicant will know if the proposed reservoir is feasible before becoming a public entity. However, the applicant must be a public entity before applying for Level II, Phase III funding.

## 7.3.3 Small Water Project Program

The SWPP is intended to be compatible with the conventional WWDC program that was previously described. The following information contains excerpts from Chapter II – Programs of the Operating Criteria of the Wyoming Water Development Program [WWDC, 2018b].

### 7.3.3.1 *Introduction*

The purpose of the Small Water Project Program (SWPP) is to participate with land management agencies and sponsoring entities to provide incentives for the improving the 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 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.

These criteria provide the WWDC and WWDO with general standards for evaluating and prioritizing applications for funding from the SWPP. The criteria also serve as a tool to coordinate with the public and other state and federal agencies.

### 7.3.3.2 *Legal and Institutional Constraints*

1. Sponsoring Entity: Pursuant to W.S. 99-3-1903(k)(i) and W.S. 99-3-1904(m)(i), funding is available only to eligible public entities.
2. Eligible public entities are defined by state statute and include the conservation districts, watershed improvement districts, water conservancy districts, irrigation districts, municipalities, Joint Business Council of the Eastern Shoshone and Northern Arapaho Indian Tribes, Business Council of the Eastern Shoshone Indian tribe, Business Council of the Northern Arapaho Indian tribe, or other approved assessment districts formed in accordance with Wyoming law.
3. Project Description: Pursuant to W.S. 99-3-1903(k)(iii) and W.S. 99-3-1904(m)(iii), the SWPP may provide for construction or rehabilitation and replacement of small dams, windmills, spring development, and pipelines to impound, develop, and convey water for livestock, wildlife, irrigation, environmental, and recreational purposes.

4. Project Funding: Pursuant to W.S. 99-3-1903(k)(vii) and 99-3-1904(m)(vii), a small project is a project where the estimated construction or rehabilitation costs, permit procurement, construction engineering and project land procurement where the maximum financial contribution from the commission is thirty-five thousand dollars ($35,000.00) or less.

#### 7.3.3.3 *Small Water Project Program Definitions*

1. Small Reservoir: Small reservoirs may be eligible for funding through the SWPP.
2. Well: A well may be eligible for funding depending on the depth of the well and scope of the project. Projects that propose to drill into unproven aquifers, as determined by the WWDO, may be eligible for the SWPP at the discretion of the WWDC. Such discretion will be exercised in cases including but not limited to cases where the well does not meet the minimum requirements of the project in terms of quality and quantity.

   The determination of unproven aquifer status will be clearly communicated by the WWDO before issuing a notice to proceed, so the project sponsor may decide to cancel the project before funding is committed. If the sponsor decides to proceed with a well into an unproven aquifer they should be prepared to pay the drilling cost with the understanding that reimbursement for eligible expenses will be contingent upon meeting the minimum water quality and quantity requirements.
3. Solar Platforms: Construction of solar platforms may be eligible for funding through the SWPP.
4. Pipelines and conveyance facilities: Rehabilitation of existing pipelines or conveyance facilities or construction of new pipelines or conveyance facilities may be eligible for funding through the SWPP.
5. Springs: Improving flows of existing springs and installation of collection facilities associated with springs may be eligible for funding through the SWPP.
6. Wetland Development: Development of wetlands where multiple benefits accrue may be eligible for funding through the SWPP.
7. Environmental: Projects that provide for stream bank stability, water quality improvements, or erosion protection may be eligible for funding through the SWPP.
8. Irrigation: Irrigation projects may be eligible for funding through the SWPP.
9. Windmill: Rehabilitation of existing windmills or construction of new windmills may be eligible for funding through the SWPP.
10. Rural Community Fire Suppression: Supply and storage projects for rural community fire suppression may be considered for funding through the SWPP.
11. Recreational: Projects for recreational purposes may be considered for SWPP funding.

#### 7.3.3.4 *Application and Evaluation Process*

1. Small water projects must adequately demonstrate a public benefit. Public benefit may be demonstrated for projects included in WWDC Watershed Studies. Eligible projects may be located on Federal, State, public, or private lands.
2. Applications shall be received by January 1 of each calendar year. Applications meeting criteria requirements will be considered during the regularly scheduled WWDC meeting in March. Applications shall include a project application, detailed project description, description of public

benefit, outline of financial and technical contributions, project location map, project cost estimates and any letters of authorization or commitment of participation that may be available from other funding sources.

3. Projects that improve watershed condition and function, provide multiple benefits, and meet the funding criteria specified in W.S. 99-3-1903(k)(vii) or W.S. 99-3-1904(m)(vii), as described in B.4 herein, are eligible for consideration.
4. The sponsoring entity will be required to address the WWDC and provide testimony and other additional supporting evidence that justifies SWPP funding whenever the public benefit documentation, as required in W.S. 99-3-1903(k)(viii)(c) and W.S. 99-3-1904(m)(viii)(c), submitted with the application is determined to be insufficient by the WWDO.
5. To establish priorities for both New Development and Rehabilitation projects, and to utilize available program funds effectively and efficiently, it is necessary to develop priorities. A project's priority will be assigned based on the project's primary purpose, but secondary benefits may be considered at the Commission's discretion. Project priorities in order of preference, are defined as follows.

   Account I Project Priorities.

   1. Source Water Development
   2. Storage
   3. Pipelines, Conveyance Facilities, Solar Platforms, and Windmills
   4. Irrigation
   5. Environmental
   6. Recreational

   Account II Project Priorities.

   1. Diversion Structures and Spring Developments
   2. Storage
   3. Pipelines, Conveyance Facilities, Solar Platforms, and Windmills
   4. Irrigation other than above
   5. Environmental
   6. Recreational

6. Projects that have completed the following requirements before the application will be classified as "Shovel Ready," and may be considered as a funding priority at the Commission's discretion including the following:
   - Permit procurement
   - State and Federal Agency Notifications
   - Land procurement, Right-of-Way, or Easement Acquisition
   - Have finalized all other financial agreements.

To complete the listed requirements, the project applicant may be asked to submit additional documentation as determined by the Commission at the time of application.

7. In the case of limited funding for this program, the WWDC may only fund a portion of the applications submitted by any one Sponsor.
8. The Commission may take into consideration a Sponsor's existing backlog of previously funded projects that are not completed, when awarding grants for new projects.

### 7.3.3.5 *Project Development*

1. The sponsoring entity shall adhere to appropriate design standards for small water projects. Plans may be provided by the NRCS, an appropriate land management agency or a registered Professional Engineer and/or registered Professional Geologist.
2. Project water rights shall be in good standing with the State of Wyoming before the project's construction.
3. If the sponsoring entity initiates the construction process without previously written notification by the Commission, the sponsoring entity shall bear all costs resulting from said action.

### 7.3.3.6 *Program Expenditures*

1. Project Description: Projects that develop unused and/or unappropriated water will be considered SWPP New Development Projects and will be funded from SWPP Account I, which is funded by appropriations from Water Development Account I [W.S. 41-2-124(a)(i)]. Projects that improve completed water projects, decrease operation and maintenance costs, and/or improve efficiency of use of existing water supplies will be considered SWPP Rehabilitation Projects and will be funded from SWPP Account II , which is funded by appropriations from Water Development Account II [W.S. 41-2-124(a)(ii)].
2. Project Funding: W.S. 99-3-1903(k)(vii) and W.S. 99-3-1904(m)(vii) as described in Section 7.3.3.2 herein, establish the funding limitations for the SWPP.
3. Activities eligible for SWPP funding include design, permit procurement, project land procurement, construction engineering (design and construction inspections), project materials and invoiced contractor expenses. In-kind contributions are only eligible for installation of project materials that were purchased specifically for the project as documented by invoices.
4. Required permits and clearances shall be obtained before construction of the project. Copies of the final permits and clearances must be submitted to the WWDO before the WWDO will issue the notice to proceed for construction. WWDC funds may be used as necessary to secure the technical assistance required to complete permitting activities before construction commences.
5. The sponsoring entity shall provide the WWDO an operation and maintenance plan for the estimated life of the project.
6. SWPP funds shall not be used to refinance projects that have already been completed. SWPP funds shall not be used to augment the operating budget of a sponsor or any other entity. Maintenance costs, as determined by the WWDO, are not eligible expenditures under the SWPP. SWPP funding is limited to a one-time construction of a new project or a single rehabilitation of an existing project.

7. A Project Agreement between the WWDC and the sponsoring entity, which documents the roles and responsibilities of the project participants, must be finalized before expenditure of SWPP funds. Changes, modifications, revisions or amendments to the Project Agreement may be granted by the WWDC.
8. Construction contractors shall be selected using a competitive bid process.
9. Upon project completion, WWDC funds will be disbursed when a certified bill is received from the sponsoring entity including statement of completion, before and after photographs, project longitude/latitude coordinates and the affidavit of publication documenting the required notices of final settlement were published pursuant to W.S. 16-6-116.
10. If the sponsoring entity submits a certified bill, WWDC funds can be disbursed for a component of a project upon receipt of a certification by the project engineer that the component provides a beneficial use and functions in the manner intended. Retainage on the cost of the component may be held until conditions described in paragraph 9 are met.
11. After receiving WWDC funds, the sponsoring entity shall promptly pay the outstanding obligations.
12. Unexpended funds allocated under the Project Agreement will revert to SWPP Account I or SWPP Account II, as appropriate, upon the expiration date of the Project Agreement. Expiration dates may be extended in writing by the WWDC.

### 7.3.4 Wyoming Office of State Lands and Investments

The Wyoming Office of State Lands (OSLI) is the administrative arm of the Board of Land Commissioners and the State Loan and Investment Board. The statutory responsibility of the OSLI is to carry out the policy directives and decisions of these two boards. The organizational structure of OSLI consists of the Office of the Director and four divisions: Administrative Services Division, Trust Land Management Division, Field Service Division, and Wyoming State Forestry. Collectively, these divisions serve as the trust beneficiaries to Wyoming's schoolchildren and state institutions; many clients in agriculture, mineral, timber, transportation, communication, public utility, recreation, tourism and other Wyoming industries; local government entities; state and federal agencies; and the general public.

The Farm Loan Program, was established in 1921, and provides long-term, real-estate loans to Wyoming's agricultural operators. Using this program has been expanded to include loans for purchasing livestock and assist beginning agricultural producers. The Irrigation Loans Program, was established in 1955 and is designed to support small and large agricultural water-development projects. The Legislature has allocated a total of $275 million for loans under the Farm Loan Program and $20 million for the Irrigation Loan Program. Both programs are funded from the Wyoming Permanent Mineral Trust Fund. The Joint Powers Act Loan Program was established in 1974, and the Legislature authorized the Joint Powers Act Loan Program to benefit local communities for infrastructure needs. These loans are approved from funds within the state's Permanent Mineral Trust Fund. These programs aid cities, counties, and special districts in providing needed government services and public facilities. Additional information is also available via the website (*http://lands.wyo.gov/grantsloans/loans/farm).*

### 7.3.5 Wyoming Department of Environmental Quality

The Wyoming Department of Environmental Quality (WDEQ) Water Quality Division (WQD) administers the Nonpoint Source Program, which solicits funding proposals under Section 319(h) of the Clean Water Act (CWA) that address nonpoint sources of pollution within the state of Wyoming. Funded proposals usually address multiple program objectives such as best management practice (BMP) installation, agriculture and urban, information and education, and BMP effectiveness or water quality monitoring. Available nonpoint-sources program funding depends on federal budget appropriations and the annual fund allocation from the US Environmental Protection Agency (EPA) to the State of Wyoming. Section 319 grant funds are available to local, state, and federal agencies; nongovernmental organizations; and private individuals who implement projects that reduce nonpoint-source pollution and improve the quality of surface water and groundwater. Information regarding the program eligibility, priorities, and applications is available on the Wyoming Nonpoint Source Program website (*http://deq.wyoming.gov/wqd/non-point-source*).

### 7.3.6 Wyoming Game and Fish Department

The Wyoming Game and Fish Department (WGFD) may offer technical and funding assistance to help landowners, conservation groups, institutions, land managers, government agencies, industry, and nonprofit organizations develop or maintain water sources for fish and wildlife. Assistance may be provided to protect or improve riparian areas/wetlands, restore streams, and upgrade irrigation infrastructure that provides improved fish passage or diversion screening.

**Habitat Trust Fund:** Funds can be used to acquire, maintain, or improve wildlife habitat or to promote human understanding and enjoyment of the fish and wildlife resource (habitat or information and education projects). Funds can be used for internal projects or paid as grants to an outside entity. All proposals must have a department sponsor and be entered into a department proposal database by early January or early August annually. Project proposals will be prioritized for funding by department staff during January through March and the Wyoming Game and Fish Commission grants preliminary approval in March and final approval in July for funds available in July. No cost-share is required but is strongly recommended. Projects should occur in priority habitats or watersheds. More information can be obtained by contacting any habitat biologist in a regional office nearest the project (*https://wgfd.wyo.gov/About-Us/Offices-and-Facilities*).

**Fish Passage Grants:** All proposals must be submitted by December 15 each year, and coordination with the Fish Passage Coordinator or Regional Aquatic Habitat Biologist is encouraged to begin as early as possible. Proposed projects will be prioritized for funding by WGFD staff during February or March. Applicants will be notified at that time, although the final approval rests with the WGFD at a meeting typically held in July. A draft grant agreement will be developed by the WGFD and presented to the recipient for review and refinement. Funding usually becomes available in July once the WGFD has given final approval to the fiscal year budget. More information can be obtained by contacting the Fish Passage Coordinator at or any Aquatic Habitat Biologist in a regional office nearest the project (*https://wgfd.wyo.gov/About-Us/Offices-and-Facilities*).

The State of Wyoming also provides funding to support the local sage-grouse working groups and fund conservation projects that benefit sage-grouse and their habitat. Implementing projects that are consistent with local sage-grouse conservation plans will reduce the likelihood of sage-grouse being listed under the federal ESA. Project Proposal forms for the Wyoming Sage Grouse Conservation funding can be downloaded by accessing the website (*https://wgfd.wyo.gov/WGFD/media/content/PDF/Habitat/Sage%20Grouse/WSGCF_PROJECTPROPOSAL_FORM.pdf)*.

### 7.3.7 Wyoming Wildlife and Natural Resource Trust

The Wyoming Wildlife and Natural Resource Trust (WWNRT) was created in 2005 and is an independent state agency that is governed by a nine-member citizen board appointed by the governor. Funded by interest earned on a permanent account, donations, and legislative appropriation, the purpose of the program is to enhance and conserve wildlife habitat and natural-resource values throughout the state. Any project designed to improve wildlife habitat or natural-resource values is eligible for funding. The office is located in Cheyenne, Wyoming. The goal of the WWNRT is to assist applicants in enhancing wildlife and natural resources in Wyoming.

WWNRT funding is available for a wide variety of projects throughout the state, including natural-resource programs of other agencies. More information is available at the WWNRT website (*https://wwnrt.wyo.gov/*). Some examples include the following:

- Improving or maintaining existing terrestrial habitat that are necessary to maintain optimum wildlife populations
- Preserving open space by purchasing or acquiring development rights
- Improving and maintaining aquatic habitats, which is necessary to maintain optimum fish populations
- Acquiring terrestrial or aquatic habitat when existing habitat is determined crucial/critical or is present in minimal amounts, and acquisition presents the necessary factor in attaining or preserving preferred wildlife or fish population levels
- Conserving, maintaining, protecting, and developing wildlife resources, the environment, and Wyoming's natural-resource heritage
- Participating in water enhancement projects to benefit aquatic habitat for fish populations and allow for other watershed enhancements that benefit wildlife
- Addressing and mitigating impacts detrimental to the wildlife habitat, environment, and multiple use of renewable natural resources that are attributable to residential, mineral and industrial development
- Mitigating conflicts and reducing potential for disease transmission between wildlife and domestic livestock.

## 7.4 FEDERAL AGENCIES

### 7.4.1 Bureau of Land Management

The Bureau of Land Management's (BLM's) Riparian Habitat Management Program offers the opportunity to coordinate with outside interests on riparian improvement projects. The goal of the BLM's riparian-wetland management is to maintain, restore, improve, protect, and expand these areas so they are in proper functioning condition for their productivity, biological diversity, and sustainability. The overall objective is to achieve an advanced ecological status, except where resource management objectives, including proper functioning condition, would require an earlier successional stage. The goal includes aggressive riparian-wetland information, inventory, and training and research programs and will improve the partnerships and cooperative management processes.

Partnerships have been available for riparian improvement projects and for research into riparian issues. Funding is available on an annual basis subject to budget allocations from Congress. Submitted projects compete for the funds available in the program.

The BLM's Range Improvement Planning and Development Program is a cooperative effort not only with the livestock operator but also with other outside interests, including the various environmental/ conservation groups. Water development, whether it be for better livestock distribution or improved wetland habitats for wildlife, is essential to healthy rangelands and biodiversity. Before actual range-improvement development occurs, an approved management plan must be in place. These plans outline a strategy for an area and identify the type of range improvements needed to accommodate that management. Examples include Coordinated Resource Plans, Allotment Management Plans, and Wildlife Habitat Management Plans.

All rangeland improvement projects on lands administered by the BLM require permit execution. Although a couple of methods are available for authorizing range improvements on public lands, Cooperative Agreement for Range Improvements (Form 4120-6) is the most commonly used method. This method applies equally to range-improvement projects that involve water (such as reservoirs, pits, springs, and wells), including any associated pipelines for distribution. The major funding source for the BLM's share is from the range-improvement fund, which is generated from the collected grazing fees. A limited amount of funding comes from the general rangeland management appropriations. If the cooperator is a livestock operator, their contributions are generally in the form of labor; at times, livestock operators may also provide some of the material costs. Contributions from the conservation/ environmental interest are monetary, are often in the form of grants, and occasionally contribute labor.

The BLM's Watershed and Water Quality Improvement efforts are undertaken in a cooperative approach with the state of Wyoming, conservation districts, livestock operators, and various conservation groups. Wyoming's BLM is collaborating in implementing several Section 319 watershed plans statewide. As the WDEQ continues to inventory state waters and identify impaired and/or threatened waterbodies, the BLM will partner with the WDEQ to improve water quality in waterbodies on public lands. In the course of developing watershed plans or total maximum daily loads (TMDLs) for these watersheds, the BLM will be routinely involved in watershed assessment, planning, implementation, and BMP monitoring.

The goals of cooperative watershed projects will typically be restoring and maintaining healthy watershed functions. These goals will typically be accomplished through approved BMPs (e.g., prescribed burns, vegetation treatments, instream structures to enhance vegetation cover, controlled accelerated soil erosion, increased water infiltration, and enhanced flows and water quality).

The BLM is currently expanding its efforts to address water quality and environmental concerns associated with abandoned mines. This work will also be accomplished in cooperation with the State Abandoned Mine Lands Division (on a priority watershed basis) and will employ appropriate best management practices (BMPs) to address identified acid-mine drainage and runoff problems from mine tailings and waste rock piles.

### 7.4.2 Bureau of Reclamation

The mission of the US Bureau of Reclamation (USBR) mission is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the public. The USBR has a major responsibility (in partnership with states, water users, and other interested parties) to help improve water resources and efficient water use in the western US. After more than 100 years, the USBR's primary role has evolved from one of water-resource development to one of water-resource management. More efficient water use is a key component of the USBR's water resource management strategy.

The Sustain and Manage America's Resources for Tomorrow (WaterSMART) Program establishes a framework to provide federal leadership and assistance on efficient water use, integrating water and energy policies to support the sustainable use of all natural resources, and coordinating the water conservation activities of various department bureaus and offices. Through the WaterSMART Program, the USBR is working to achieve a sustainable water management strategy to meet the nation's water needs through projects that conserve and use water more efficiently, increase the use of renewable energy and improve energy efficiency, protect endangered and threatened species, facilitate water markets, address climate-related impacts on water, or prevent any water-related crisis or conflict.

A major component of WaterSMART is the Water and Energy Efficiency Grant Program, through which the USBR provides funding in two funding groups. In Funding Group I, up to $300,000 in federal funding is available per project, for smaller on-the-ground projects that can be completed within 2 years. In Funding Group II, up to $1 million in funding is available for larger, phased, on-the-ground projects that may take up to 3 years to complete. Water and Energy Efficiency Grants are awarded through a west-wide competitive process that requires a minimum 50 percent cost-share by the recipient.

In contrast, the Water Conservation Field Services Program (WCFSP) provides smaller amounts of funding ($100,000 per project maximum) through local competitions within a region or area. The projects funded are generally smaller in scope than Water and Energy Efficiency Grant projects and focus on fundamental conservation improvements as identified in water conservation plans developed by water users. Financial assistance provided through the WCFSP also requires a minimum 50 percent cost-share by the recipient. Funding opportunity announcements for WaterSMART grants and the WCFSP can be found on the website (*http://www.grants.gov/*).

### 7.4.3 Environmental Protection Agency

The EPA administers several financial assistance programs that provide grants and loans to small, nonprofit organizations to large, state governments for watershed projects. Information about watershed funding can be found by visiting the EPA's website (*http://www.epa.gov/polluted-runoff-nonpoint-source-pollution/watershed-funding*). Additionally, information about EPA grant opportunities are available by visiting the EPA's grants website (*https://www.epa.gov/grants*).

### 7.4.4 US Department of Agriculture

The US Department of Agriculture (USDA) provides leadership on food, agriculture, natural resources, rural development, nutrition, and related issues. The USDA's vision is to provide economic opportunity through innovation and help rural America thrive; promote agriculture production that better nourishes Americans while also helping feed others throughout the world; and preserve US natural resources through conservation, restored forests, improved watersheds, and healthy private working lands. The USDA is made up of 29 agencies and offices with nearly 100,000 employees who serve the American people at more than 4,500 locations across the country and abroad.

The USDA's Farmers.gov website (*www.farmers.gov*) provides farmers, ranchers, private foresters, and agricultural producers with online self-service applications, educational materials, engagement opportunities, and business tools to increase efficiency and productivity while preserving and fostering long-held traditional relationships between local USDA offices and producers. Information about three USDA agencies; the Farm Service Agency (FSA), the Natural Resources Conservation Service (NRCS), and the Rural Utilities Service (RUS), are included since they offer project funding within the study area.

### 7.4.5 Farm Service Agency

The FSA oversees several voluntary conservation-related programs. The FSA administers four different programs that may be applicable to some of the alternative projects identified in Chapter 4.0. Each of these four programs is briefly discussed below. Programs administered through the FSA are offered through local county committees. Available FSA programs include the Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program (CREP), Emergency Conservation Program (ECP), and the Grassland Reserve Program (GRP). Contacting a local FSA office for program eligibility requirements is recommended.

#### 7.4.5.1 *Conservation Reserve Program*

The CRP pays a yearly rental payment in exchange for farmers who remove environmentally sensitive land from production and who plant species that will improve environmental quality. More information is available via the CRP website (*http://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/index*).

#### 7.4.5.2 *Conservation Reserve Enhancement Program*

The CREP, which is an offshoot of CRP, targets high-priority conservation issues identified by government and nongovernmental organizations. Farm land that falls under these conservation issues is removed from production in exchange for annual rental payments. More information is available via the CREP website (*http://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-enhancement/index*).

#### 7.4.5.3 *Emergency Conservation Program*

The ECP provides funding and technical assistance for farmers and ranchers to restore farmland damaged by natural disasters and for emergency water conservation measures in severe droughts. More information is available via the ECP website (*http://www.fsa.usda.gov/programs-and-services/conservation-programs/emergency-conservation/index*).

#### 7.4.5.4 *Grassland Reserve Program*

The GRP works to prevent grazing and pasture land from being converted into cropland or used for urban development. In return for voluntarily limiting the future development of their land, farmers receive a rental payment. More information is available via the GRP website (*http://www.fsa.usda.gov/programs-and-services/conservation-programs/grassland-reserve/index*).

### 7.4.6 Natural Resources Conservation Service

The NRCS administers several funding and technical assistance programs applicable to many of the proposed projects. The NRCS provides leadership in a partnership effort to help people voluntarily conserve, improve, and sustain natural resources on private lands. The purpose and mission of the agency is to help landowners treat every acre of their private property according to its needs and within its capability. The treatment includes a balance between the land use for economic return and protecting its ability to be productive from generation to generation.

Conservation planning is key to successful land stewardship as NRCS employees and landowners work together to tailor-make voluntary conservation plans that meet the specific needs of individual customers. The NRCS workforce has the technical expertise and field experience to help land users solve their natural-resource challenges and maintain and improve their ability to thrive economically. The workforce is highly skilled in many scientific and technical specialties, including soil science, soil conservation, range conservation, engineering, agronomy, biology, geology, hydrology, forestry, cultural resources, GIS, and economics. The NRCS conducts natural-resource inventories and assessments to indicate status, conditions, and trends of natural resources on private lands. This resource information and technology include science-based technical tools, technical guides, and practice specifications and standards ensuring quality and consistency of conservation planning and application across the nation.

Technical and cost-share assistance are available through the NRCS and includes designs, specifications, construction, management, and financial help for practice and system installation. Local people (individually and collectively) decide how to use the NRCS capabilities in the natural-resource conservation planning and application process. The NRCS supports and facilitates these individual and local decisions based on good resource information, whether that is a grazing management plan or layout for an irrigation system.

The NRCS provides technical assistance for the following programs in Wyoming:

- **Grazing Lands Conservation Initiative (GLCI):** Accelerated range-management technical assistance is available to producers in every county to support this initiative.
- **Small Watershed Program (PL-566):** The NRCS works through local government sponsors to help solve natural resources and related economic problems on specific watersheds.
- **Snow, Water, and Climate Services:** Snow survey crews collect information on snowpack conditions to provide water users with forecasts of water supplies. This forecasting helps determine available water to meet agricultural, industrial, recreational, and urban area needs.
- **Soil Surveys:** Soil surveys provide a field-based scientific inventory of soil resources and information on the potentials and limitations of each soil. This information assists in determining the best uses of the land based on soil type.

The NRCS administers the following Landscape Planning Programs:

- **Emergency Watershed Protection (EWP) Program** assists in implementing emergency measures, including purchasing floodplain easements, for runoff retardation and soil-erosion prevention to safeguard lives and property from floods, drought, and erosion on any watershed whenever a natural catastrophe causes a sudden impairment of the watershed.
- **Watershed Protection and Flood Prevention Operations (WFPO) Program** provides technical and financial assistance to entities of state and local governments and tribes (project sponsors) for planning and installing watershed projects.
- **Watershed Surveys and Planning (WSP)** authorizes the NRCS to cooperate with federal, state, and local agencies and tribal governments to protect watersheds from damage caused by erosion, floodwater, and sediment and to conserve and develop water and land resources.

The NRCS will administer the following 2018 Farm Bill programs:

- Through the **Environmental Quality Incentives Program (EQIP)**, technical assistance, cost-share, and incentive payments are available to agricultural producers to implement conservation practices that improve water quality, enhance grazing lands, and/or increase water conservation.
- The **Conservation Stewardship Program (CSP)** encourages land stewards to improve their conservation performance by installing and adopting additional activities, and by improving, maintaining, and managing existing activities on agricultural land and private forest land.
- The **Agricultural Conservation Easement Program (ACEP)** provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits. Under the Agricultural Land Easements (ALE), the NRCS assists tribes, state and local governments, and organizations in protecting working agricultural lands and limiting nonagricultural uses of the land. Under the Wetlands Reserve Easements (WRE) component, the NRCS helps to restore, protect, and enhance enrolled wetlands.
- The **Regional Conservation Partnership Program (RCPP)** promotes coordination between the NRCS and its partners to deliver conservation assistance to producers and landowners. The NRCS helps producers through partnership agreements and through program contracts or easement agreements. Assistance is delivered in accordance with the rules of EQIP, CSP, and ACEP.

### 7.4.7 Rural Utilities Service

The US Department of Agriculture (USDA) Rural Development's Utilities Program is authorized to provide financial assistance for water- and waste-disposal facilities in rural areas in towns of up to 10,000 people. This program is intended for nonprofit corporations and public bodies such as municipalities, counties, and special-purpose districts and authorities.

Funding may be obtained through Rural Development only when the applicant is unable to secure funding from other sources at reasonable rates and terms. The applicant must have legal capacity to borrow and repay loans, pledge security for loans, and operate and maintain the facilities. The applicant must be financially sound and able to manage the facility effectively as well as have a financially sound facility based on taxes, assessments, revenues, fees, or other satisfactory sources of income to pay the costs of operating, debt service, and reserve. Grants are also available and are used to supplement loans to reduce debt service where necessary to achieve reasonable user rates. Assistance is available on how to assemble information regarding engineering, financing, and management of proposed improvements.

Loans and grants may be used to construct, repair, improve, expand, or modify rural water supplies and distribution facilities such as reservoirs, pipelines, wells and pumping stations, waste collection, pumping, treatment, or other disposal facilities. This assistance may also be used to acquire a water supply or water right or to finance facilities in conjunction with funds from other agencies or those provided by the applicant. These funds can be used to pay legal and engineering fees connected with developing a facility or pay other costs related to development, including ROW or easements and relocating roads or utilities. Loan terms are a maximum of 40 years, state statute, or the useful life, whichever is less with interest rates based on current market yields for municipal obligations.

The USDA Rural Development also guarantees loans to eligible commercial lenders to improve, develop, or finance water- or waste-disposal facilities in rural areas. This guarantee is a warrant to protect the lender and may cover up to 90 percent of the principal advanced. The guarantee fee is 1 percent of the loan amount multiplied by the percent of the guarantee. Interest rates will be negotiated between the lender and the borrower.

### 7.4.8 Fish and Wildlife Service

Technical and financial assistance are available to landowners, for profit or nonprofit entities, public agencies, and public-private partnerships under several programs that address managing, conserving, restoring, or enhancing wildlife and aquatic habitat (including riparian areas, streams, wetlands, and grasslands). Some of these programs are identified in the following text with Information available via the US Fish and Wildlife Service (USFWS) website (*http://www.fws.gov/grants/programs.html*).

The Partners for Fish and Wildlife Program serves as the primary tool for conservation delivery on privately owned land for the USFWS. The program provides technical and financial assistance to private landowners and tribes on a voluntary basis to help meet the habitat needs of federal trust species and conservation partner-designated species of interest. The program targets habitats that need to be restored or enhanced, such as riparian areas, streams, wetlands, and grassland. Field biologists work one-on-one with landowners and partners to plan and implement a variety of projects, including grazing lands management, sage steppe enhancement, stream habitat improvement and fish passage, invasive species removal, and wetland establishment.

The Wildlife and Sport Fish Restoration (WSFR) Program works with states, insular areas, and the District of Columbia to conserve, protect, and enhance fish, wildlife, and their habitats, as well as hunting, sport fishing, and recreational boating opportunities. The WSFR Program provides oversight and/or administrative support for the following grant programs: Wildlife Restoration Grant Program, Sport Fish Restoration Grant Program, Boating Infrastructure Grant Program, State Wildlife Grant Program, Tribal Wildlife Grant Program, and Tribal Landowner Incentive Grant Program.

The Cooperative Endangered Species Conservation Fund (Section 6 of the ESA) provides grants to states and territories to participate in a wide array of voluntary conservation projects for candidate, proposed, and listed species. The program provides funding to states and territories for species and habitat conservation actions on nonfederal lands. States and territories must contribute a minimum nonfederal match of 25 percent of the estimated program costs of approved projects or 10 percent when two or more states or territories implement a joint project.

The North American Wetlands Conservation Act (NAWCA) Grant Program promotes long-term conservation of wetlands ecosystems and the waterfowl, migratory birds, fish, and wildlife that depend on such habitat. Supported conservation actions include acquisitioning, enhancing, and restoring wetlands and wetlands-associated habitat. This program encourages voluntary, public-private partnerships. Public or private, for profit or nonprofit entities, or individuals who establish public/private partnerships are eligible. Partners must match grant funds with nonfederal monies.

The **USFWS Challenge Cost-Share Program** started in 1988 as a way to enhance partnerships with state and local governments, individuals, and public and private groups. The program enables the USFWS to manage cooperatively its natural and cultural resources and fulfill stewardship responsibilities to fish and wildlife management. Under this program, projects must occur on a refuge or directly benefit a refuge. The program encourages refuge managers to form partnerships and leverage allocated funds to complete the projects. Appropriated funds may be used to pay for no more than 50 percent of the cost of a project. Nonfederal sources, including state/local governments, private individuals/organizations, business enterprises, and philanthropic and charitable groups provide the matching 50 percent cost-share. The cooperator share may be a nonmonetary contribution. Cooperative agreements are signed with the cost-share partners.

### 7.4.9 US Army Corps of Engineers

The US Army Corp of Engineers (USACE) has civil responsibilities for flood-damage reduction, hydroelectric power generation, and navigational improvement as well as other water and land-resource problems and needs, including environmental preservation and enhancement, ecosystem management, and comprehensive floodplain management.

The USACE is responsible for a worldwide military construction program, an extensive environmental program, and a broad national civil works program. The USACE is authorized to provide technical assistance to local communities, states, and federally recognized Indian tribes to support their efforts to alleviate flooding impacts, reduce erosion, and otherwise plan for the wise and prudent use of the nation's water and related land resources. The USACE also has authority to construct certain water-related projects and respond to water-resource needs.

- **Planning Assistance to States.** This program provides for assistance in preparing plans for developing, using, and conserving water and related land resources. The USACE provides technical planning assistance in all areas related to water resources development such as bank stabilization, sedimentation, water conservation, ecosystem and watershed planning, and water quality. Assistance is limited to $500,000 per state and studies are cost-shared on a 50-50 basis with a nonfederal sponsor such as a state, public entity, or a tribe.
- **Floodplain Management Services.** This program provides technical services and planning guidance to support and promote effective floodplain management. Flood and floodplain data are developed and interpreted with assistance and guidance provided in the form of "Special Studies" on all aspects of floodplain management planning. All services are free to local, regional, state, or nonfederal public agencies. Federal agencies and private entities have to cover 100 percent of costs.
- **Flood-Damage Reduction Projects.** This program provides structural and nonstructural projects to reduce damages caused by flooding and focuses on solving local flood problems in urban areas, towns, and villages. The USACE works with the project sponsor to define the flood problem, evaluate solutions, select a plan, develop the design, and construct a project. A feasibility study is conducted to identify projects with the first $100,000 of the cost funded by federal sources. Any cost above this amount is cost-shared 50-50 with the sponsor in the form of cash and in-kind services. Construction lands, easements, right-of-way (ROW), relocations, and disposal and 5 percent of the projects costs are the sponsor's responsibility. Operation, maintenance, and a maximum of 50 percent of total project cost are the sponsor's responsibility.
- **Project Modification for Improvement of Environment.** The purpose of this program is to modify structures or operation of previously constructed water resources projects to improve environmental quality, especially fish and wildlife values. A study, at federal expense, is initiated followed by a feasibility plan that is cost-shared 25 percent by the sponsor.
- **Aquatic Ecosystem Restoration.** This effort aims to restore habitat conditions to benefit fish and wildlife resources primarily to provide structural or operational changes to improve the environment, such as channel reconnection, wetland creation, or improving water quality. The conditions are similar to the Project Modification Program with cost-share at 35 percent.
- **Water Resources Projects.** The purpose of this program is to construct larger projects for flood-damage reduction and to provide technical assistance in resolving more complex water-resource problems. The program is used to evaluate projects that cost more than $10 million and include the purposes of flood control, water supplies, water quality, environmental protection and restoration, sedimentation, or recreation. Examples include reservoirs, diversions, levees, channels, or floodplain parks. The USACE works with a nonfederal sponsor to define the flood- or water-resource-related problem or opportunity, evaluate flood control or solutions, select a plan, develop a design, and construct a project. Special authorization and funding from Congress is required with a reconnaissance study being federal cost. A feasibility study to establish solutions

is cost-shared 50 percent by the nonfederal sponsor with 35–50 percent of the construction cost being the responsibility of the sponsor.

- **Support for Others Program.** This program provides for environmental protection and restoration of facilities and infrastructure and includes Environmental Planning and Compliance, Economic and Financial Analyses, Floodplain Management, Cultural Resources, and General Planning. All costs for these programs are provided by the customer agency.
- **Regulatory Authority/Responsibility.** The USACE has regulatory authority under the CWA and the River and Harbor Act. These laws aim to restore and maintain the chemical, physical, and biological integrity of waters of the United States. Section 404 of the CWA authorizes the USACE to regulate discharging dredged or fill material into waters, which would include dams and dikes, levees, riprap, bank stabilization, and development fill. Three kinds of permits are issued by the USACE: individual, nationwide, and regional general.

### 7.4.10 Wyoming Landscape Conservation Initiative

The Wyoming Landscape Conservation Initiative (WLCI) is a long-term science-based effort to assess and enhance aquatic and terrestrial habitats at a landscape scale in southwest Wyoming, while facilitating responsible development through local collaboration and partnerships. The WLCI is composed of many committees and teams that consist of representatives from the participating agencies. These agencies include: the BLM, US Geological Survey (USGS), USFWS, USFS, WGFD, Wyoming Department of Agriculture (WDA), Southwest Wyoming County Commissions, Southwest Wyoming Conservation Districts, National Park Service (NPS), NRCS, University of Wyoming, and the USBR.

Information gathered through inventory and assessment of species and habitat is combined with local input and knowledge to develop and implement conservation projects. The WLCI conducts regular Local Project Development Team meetings, where public participation is needed and expected. Ideas for projects can be presented at these meetings or sent to the WLCI Coordination Team through the BLM High Desert District Office (307.352.0227 or *blm_wy_wlci_wymail@blm.gov*). The application form and project tracking checklist are available from the website (*http://www.wlci.gov/lpdt-resources*).

## 7.5 NONPROFIT AND OTHER ORGANIZATIONS

### 7.5.1 Ducks Unlimited

Ducks Unlimited, Inc. (DU) is a funding source for wetlands and waterfowl restoration. DU conducts program development through a partner agency to provide short-term project funding assistance. Money availability is limited to what is within the organizational system. Generally, $20,000–$30,000 is available annually statewide with additional funding support from project-specific donations. More information about DU's Wyoming chapters is available at the (*https://www.ducks.org/Wyoming*).

### 7.5.2 National Fish and Wildlife Foundation

The National Fish and Wildlife Foundation (NFWF) is a private, nonprofit, tax-exempt organization that was chartered by Congress in 1984 to sustain, restore, and enhance the nation's fish, wildlife, plants, and habitats. The NFWF provides competitive grants through their Keystone Initiative Grants and Special

Grant Program. Information about these and other NFWF grants/programs is available at their website (*http://nfwf.org/*). Some of the grants/programs available include but are not limited to, the following:

- The **Pulling Together Initiative** provides support (on a competitive basis) for forming local weed-management area partnerships that engage federal resource agencies, state and local governments, private landowners, and other interested parties in developing long-term weed-management projects within the scope of an integrated pest management strategy; a minimum 1:1 nonfederal match is required.
- The **Bring Back the Natives/More Fish Grant Program** funds projects that restore damaged or degraded riverine habitats and their native aquatic species provided by the BLM, USBR, USFWS, USFS, and NFWF; a minimum 2:1 nonfederal match required.
- The **Five Star and Urban Waters Restoration Grant Program** provides modest financial assistance on a competitive basis to support community-based wetland, riparian, in-stream and/or coastal habitat restoration projects that build diverse partnerships and foster local natural-resource stewardship through education, outreach, and training activities.

### 7.5.3 Trout Unlimited

The Wyoming Council of Trout Unlimited conserves, protects, and restores Wyoming's cold-water (trout) fisheries and their watersheds. The Council consists of 16 chapters that are located throughout the state. While a majority of members are enthusiastic anglers, they do not focus on only maintaining fisheries for the purpose of angling. Healthy trout fisheries indicate well-functioning, sound ecosystems, and work toward restoring trout habitat will ultimately benefit the overall environment.

Of special concern are Wyoming's four subspecies of native cutthroat trout that currently inhabit a tiny fraction of their historic range. Working with federal and state agencies, local officials, and landowners, the Council is actively engaged trying to keep these fish from being listed under the Endangered Species Act. The Council provides funding and volunteer labor for a variety of stream and watershed projects such as erosion control and fish habitat structures, willow and other riparian plantings, and stream-protection fencing. Embrace-A-Stream grants are available for up to $10,000 per project. Partnerships are encouraged and can include local conservation districts and state and federal agencies. Those interested should contact the Council office or visit their website (*http://wyomingtu.org/*).

# 8.0 CONCLUSIONS AND RECOMMENDATIONS

A comprehensive, interdisciplinary study including the inventory and description of the Niobrara–Lower North Platte Rivers Watershed was completed to identify and evaluate land- and water-resource issues and concerns in the study area. An extensive Geographic Information Sciences (GIS) and digital library were also incorporated as part of this Level I watershed study. The GIS includes information that was collected and generated from many sources and serves as a valuable reference for potential projects and future efforts within the watershed.

After the information was gathered and inventory efforts of the watershed study were inventoried, several proposed projects and associated components along with identified opportunities, initial recommendations, and potential resource effects were developed as part of the Watershed Management Plan. The plan's projects, opportunities, and recommendations were formulated based upon field inventory findings; GIS mapping and analysis; landowner feedback during scoping meetings and field visits; and planning conceptual projects with participants, partners, and sponsors during the study. Resource issues and concerns within the watershed were identified and evaluated to develop conceptual proposed project opportunities for the following:

- Irrigation system rehabilitation components
- Livestock/wildlife watering opportunities
- Grazing-management opportunities
- Surface-water storage opportunities
- Channel stabilization opportunities
- Wetland-enhancement opportunities

Each of these opportunities is described in the following sections.

## 8.1 IRRIGATION SYSTEM REHABILITATION OPPORTUNITIES

- A total of 10 proposed projects with 16 associated components were identified during field inventories for irrigation systems.
- Most of the systems that were inventoried during the study involved deteriorated diversion and headgate structures along with laterals and ditches that had seepage issues.
- Five systems were inventoried within Niobrara County and five systems inventoried within Goshen County.
- Irrigation infrastructure improvements on the Lucerne Canal's main diversion and other canal structures should be investigated for securing future potential project funding.
- Recommended improvements to existing irrigation systems mainly involve replacing and/or rehabilitating existing diversion and headgate structures and replacing earthen ditches with buried pipelines to reduce conveyance losses and sedimentation.

- Most of the proposed irrigation system projects would require minor involvement or permitting from regulatory agencies to be completed. However, any proposed project should receive clearance from the Wyoming State Historical Preservation Office (SHPO) regarding cultural resources before commencing any installation activities.

## 8.2 LIVESTOCK/WILDLIFE WATER OPPORTUNITIES

- Livestock grazing, and ranching occurs throughout the watershed with other land uses including grain and hay farming, wildlife habitat, and recreation.
- Opportunities to improve range and riparian conditions require installing and operating well-distributed, reliable water sources and watering facilities for livestock and wildlife.
- Because state lands cover approximately 7.4 percent of the study area and are intermingled with private lands, some of the upland water-development projects would involve coordination with the Wyoming Office of State Lands and Investments (OSLI) before initiating construction.
- When a future project is planned and would occur on federal land, coordinating with the federal agency is necessary when developing proposed livestock/wildlife water supply projects beyond the conceptual-level projects included within the study report.
- All of the proposed projects and pipeline components were conceptually mapped and located on only on private property or state lands within the watershed.
- A total of 23 proposed livestock/wildlife water projects that were identified for development, which resulted from an effort that evaluated available water sources in coordination with participating landowners and state land lessees.
- The 23 proposed livestock/wildlife water projects included conceptual plans and component descriptions along with associated cost estimates for each of the proposed projects.
- The project components included 13 wells; 6 solar pumps; 6 spring developments; 50,800 feet of buried pipelines; 39 stock tanks; 7 storage tanks; and 7 ponds/reservoirs. These components would require additional final planning, design, and permitting to be completed before construction commences.
- The proposed projects and components would need to be installed, operated, and maintained by the landowner or manager according to current standards and specifications to realize the expected benefits within the proposed project areas and to the watershed.

## 8.3 GRAZING MANAGEMENT OPPORTUNITIES

- Reliable water-supply projects need to be developed and constructed in areas with inadequate water sources before grazing management alternatives could be made.
- Developing reliable water sources and associated watering facilities can aid in distribution, timing, and frequency of grazing animals.
- Technical and financial assistance are available from private range consultants, Conservation District, NRCS, and/or UW-CES personnel in order to improve grazing management plans;

evaluate animal and forage balance inventories; generate contingency plan alternatives for drought and/or fire; and monitor field indicators for assessing rangeland health.

- Develop grazing management strategies that assess rangeland health attributes and evaluate range conditions that would optimize rangeland health through grazing plans and practices.

## 8.4 SURFACE-WATER STORAGE OPPORTUNITIES

- Institutional issues and constraints related to the 2001 Modified Decree and/or the Platte River Recovery and Implementation Program (PRRIP) limit the opportunity to create new reservoirs or increase existing reservoirs through enlargement within the watershed.
- Storage evaluations focused on existing pond/reservoir facilities identified by study participants where conditions limited the ability to store water within the study area.
- Investigate potential off stream storage for excess flood water on the North Platte and Laramie Rivers to help minimize downstream flood damage in coordination with SEO, USBR, WWDC, FEMA, Goshen County, and the USACE.
- One existing reservoir (Hoblit Reservoir) was proposed for rehabilitation within the watershed.
- Three existing stock reservoirs (Colters Pond, Smith South, and Bass Ranch No. 1) were proposed for rehabilitation within the watershed.
- Five new small ponds/reservoirs (East Draw, Peterson Draw, Siebken #3, South Draw, and North Draw) are proposed for construction within the watershed.

## 8.5 CHANNEL STABILITY OPPORTUNITIES

- Channels on the North Platte River are affecting diversion, headgate, ditch, and bridge structures within the study area and require further investigation with multiple landowners and agencies.
- Three channel projects – North Platte River Erosion Upstream of Highway 156; North Platte River Erosion Downstream of Highway 157; and North Platte River Erosion Downstream of US Highway 85 were proposed for stabilization within the watershed.
- Site-specific improvements could be developed to alleviate the channel impairments and restore riparian/wetland function as part of the Watershed Management Plan.

## 8.6 WETLANDS ENHANCEMENT OPPORTUNITIES

- No specific wetland projects were identified during the study, however there are wetland and riparian improvements associated with certain irrigation, livestock/wildlife, and surface-storage proposed projects included in this plan.
- Potential wetland enhancement projects within the study area should consider site-specific conditions regarding the contributing surface water, groundwater, soil, and geologic formation.

## 8.7 RECOMMENDATIONS

Several proposed conceptual projects, identified opportunities, and initial conclusions have been presented within this report. The recommendations listed below are also included for consideration:

- The Lucerne Canal's irrigation diversion and distribution system was too large to inventory completely within the scope of this study. Although the study effort did initially evaluate the canal's priority components of the system, the facilities and infrastructure are aged and need to be rehabilitated; therefore, the Lucerne Canal Company is encouraged to investigate potential funding for infrastructure rehabilitation in coordination with the WWDC and the USBR.
- The Lucerne Canal is also encourage to pursue forming an irrigation district in order to apply to the WWDC for consideration to complete an Irrigation Master Plan for the irrigation system.
- Several irrigation system rehabilitation projects and livestock/wildlife water projects could be eligible to apply for funding through the WWDC's Small Water Project Program (SWPP).
- Priority projects should be reviewed and selected, and components should be implemented when the necessary technical and financial requirements are determined.
- Landowners or managers who seek to participate in the SWPP should consult and coordinate with the Niobrara Conservation District (NCD), Lingle-Ft. Laramie Conservation District (LFLCD), North Platte Valley Conservation District (NPVCD), and/or the Platte County Resource District (PRCD), which are eligible sponsors of SWPP applications and project agreements.
- Proposed project narratives, conceptual plans, and cost estimates could be used by local sponsors in developing SWPP applications. Preliminary project benefits were included to also assist in program application submittal.
- Several of the proposed projects require additional planning that would include site-specific engineering, cultural resource, geologic, groundwater, and wetland investigations and surveys.
- Although the study effort attempted to address all of the participants' requests, more projects from additional landowners will probably be identified after the study is completed. These projects are also eligible for SWPP funding because of their location within the watershed but will need additional planning assistance.
- The North Platte River's channel and banks have changed in the past and will continue to change within the study area. A detailed evaluation of the river channel was too vast for this Level I study; however, it is recommended that an effort be initiated locally with assistance from state and federal partners to investigate alternatives to improve channel conditions on the river. There are diversions, bridges, roads, and buildings that are vulnerable along the river and local sponsors are encouraged to consider forming an ad hoc group to evaluate opportunities for addressing channel conditions on the river.
- The study's GIS and digital library should be used as a tool in planning and developing projects and should be updated as necessary from available information sources.
- Innovative strategies for coordinated project funding and financing involving private, local, state, and federal sources such as current partnership efforts between the NCD, LFLCD, NPVCD, PCRD, Natural Resources Conservation Service (NRCS), US Bureau of Reclamation (USBR), US Fish and

Wildlife Service (USFWS), and the Nature Conservancy should be considered in association with WWDC programs to address resource concerns within the watershed.

- A coordinated approach based on local, collaborative endeavors, which integrates more than one watershed issue that results in achieving multiple benefits, is essential.

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