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**Executive Summary
South Platte River Watershed
Level I Study**

**Submitted to the
Wyoming Water Development Commission
And the
Laramie County Conservation District
And the
Laramie Rivers Conservation District**

June 2018

WWDC Contract No. D5SL0296616

South Platte River Watershed Study Executive Summary

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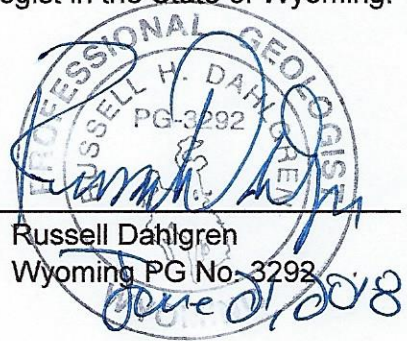
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I hereby certify that this report was prepared by me and/or under my direct supervision and that I am a duly licensed Professional Engineer and Professional Geologist in the State of Wyoming.



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ES.1 Introduction

In 2015 the Laramie County Conservation District requested that the Wyoming Water Development Commission (WWDC) conduct the South Platte River Watershed, Level I Study. In 2016 the WWDC approved funding for the watershed study and following the selection process, contracted with Dahlgren Consulting, Inc. to provide technical and professional services for the South Platte River Watershed Study. Sub-consultants to Dahlgren Consulting, Inc. include WWC Engineering, InfoMaption, Nerbo Hydrology, Ayres Associates, McGrane Water Engineering, and Ecosystems Management.

The South Platte River Watershed Study (the Study) and accompanying report provides information that the local Conservation Districts, landowners, citizens, WWDC, and other agencies can use in developing water resources and implementing conservation practices that address water and land resource issues within the Watershed. This Executive Summary briefly summarizes the information in the full report and results of the Study.

The complete Watershed Study report, accompanied by the digital library and Geographic Information System (GIS) geodatabase, presents the results of the South Platte River Watershed Study.

Chapter 1 of the report provides an introduction to the Study and discusses institutional issues. Chapter 2 of the report documents the public meetings, open houses, website, and other public outreach efforts conducted during the project.

Chapter 3 and Appendix B of the Study provide an inventory and characterization of the South Platte Watershed and its resources. This inventory and characterization effort provides the background data for the Rehabilitation and Management Plan. Specifically, the Study provides information concerning the following issues:

- Land ownership, land use, and cultural resources;
- Land cover and vegetation, including wetlands;
- Climate;
- Surface water hydrology, including data concerning stream gages, estimates of the surface water supply, and discussion of flood events;
- Water quality;
- Wildlife resources;
- Geology and groundwater resources, and;
- Estimates of water use, including irrigation, municipal, industrial, and other water uses. Trans-basin diversions are described in this section of the report.

During the inventory and characterization effort of this study, special emphasis was devoted to:

- The analyses and evaluation of surface water hydrology and water supply in the Crow Creek and Lodgepole Creek sub-basins;
- Mapping and review of the amount of irrigated land within the watershed and determining the source of supply for the irrigated land; and
- Providing updated estimates of the water budgets for the agricultural areas in eastern Laramie County.

During the Study, a geophysical survey pilot project was conducted to investigate whether geophysical tools and methods could be used to define the subsurface characteristics of the White River Formation and thereby assist with water well siting projects. Dahlgren Consulting contracted with the University of Wyoming Near Surface Geophysics Instrument Center to conduct the geo-physical study. This effort is described in Chapter 4 and Appendix C of the report. The geophysical pilot study demonstrated that surface and borehole geophysical tools can help to define subsurface conditions in the White River Formation and help locate zones with higher porosity and permeability that could be favorable well sites.

The Study also developed a list of projects that can improve conditions in the watershed. Meetings with approximately 61 landowners were conducted during the Watershed Study, which resulted in a list of over 100 projects. The projects and the Watershed Management Plan are presented in Chapter 5 and Appendix D of the report.

Chapter 6 of the report outlines funding sources. Permits are discussed in Chapter 7. Cost estimates for the projects are presented in Chapter 8 of the report.

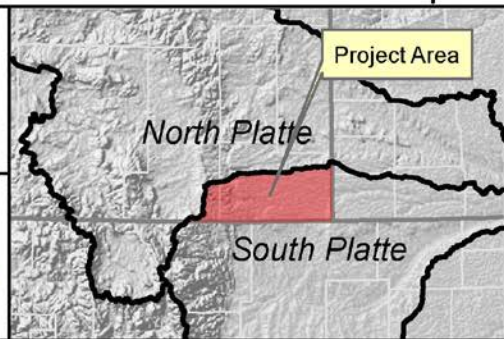
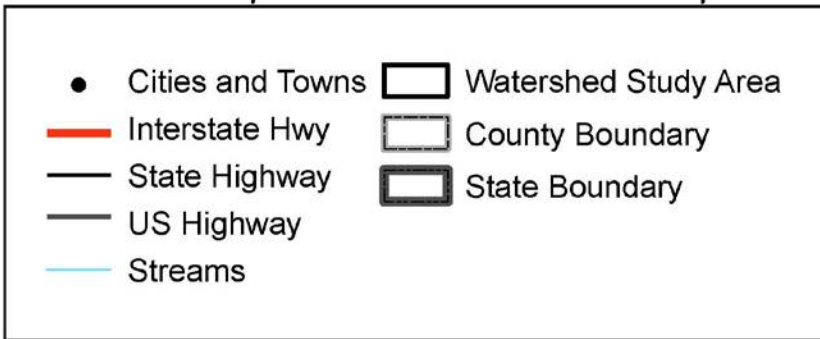
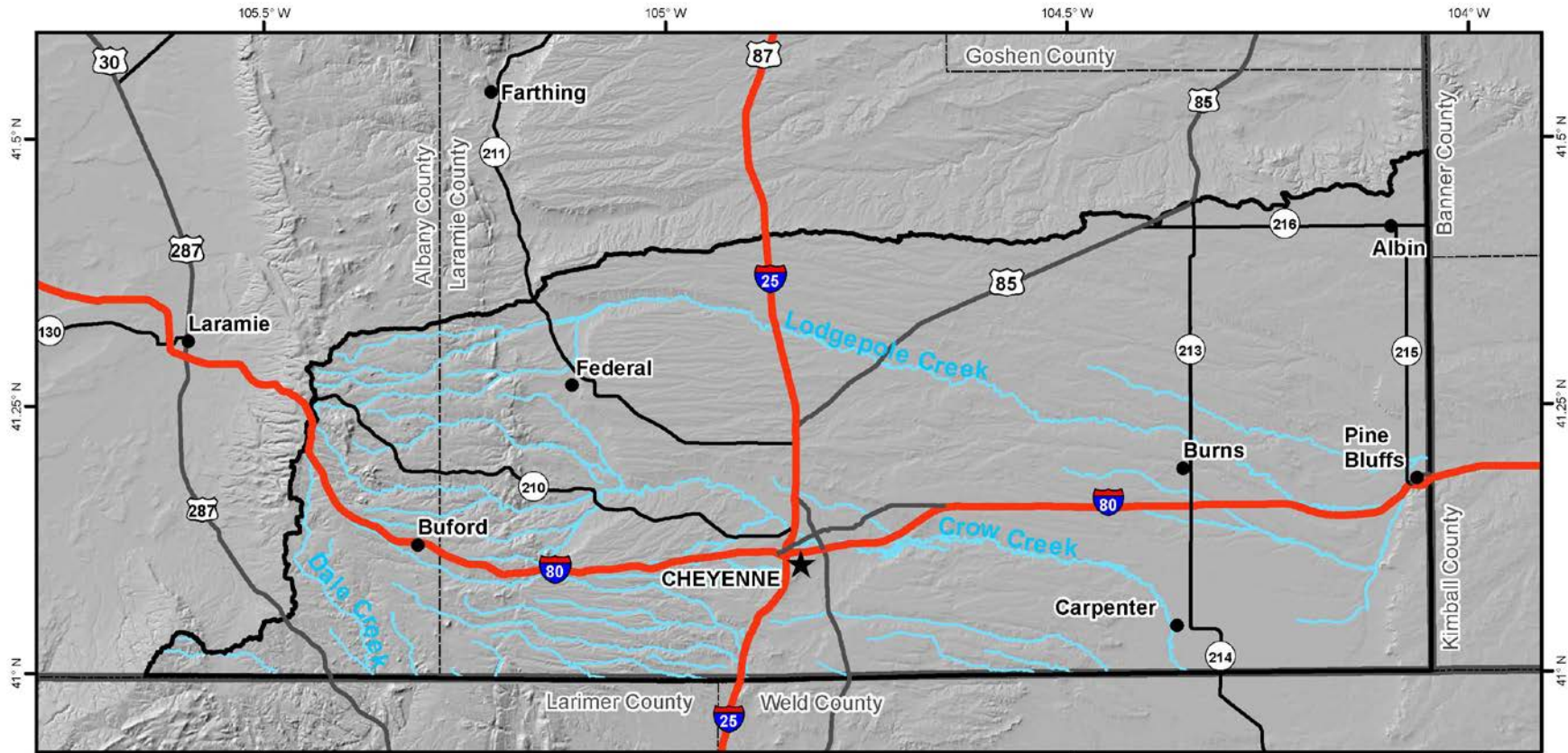
ES.2 Description of the Study Area

A map of the South Platte River Watershed (SPRWS) is shown on Figure ES-1. The watershed is located in southeast Wyoming within Laramie and Albany Counties and includes approximately 2035 square miles or 1,302,400 acres. The watershed is bounded on the north by the divide between the Horse Creek and Lodgepole drainages; the east and south by Nebraska and Colorado, respectively; and the west-southwest by the Dale Creek and Fish Creek drainages. The City of Cheyenne and the Towns and/or communities of Albin, Pine Bluffs, Carpenter, Burns, and Hillsdale lie within the watershed boundary.

The SPRWS includes Lodgepole Creek, Crow Creek, and Lone Tree Creek and their tributaries. These streams originate in the Laramie Range and flow generally east and south into Colorado and Nebraska. On the west side of the Watershed, Dale Creek flows generally south into Colorado, where it joins the Cache La Poudre River. Other smaller creeks, such as Boxelder Creek, Sand Creek and Fish Creek also flow south into Colorado and are tributaries of the Cache La Poudre River.

The South Platte Watershed is not noted for its large surface water flows. Crow Creek and Lodgepole Creek gain and lose water to groundwater along their courses. The headwater areas for Crow Creek and Lodgepole Creek, the two streams with the largest drainage areas within the SPRWS, lie within the Sherman Mountains in the Laramie Range. Dale Creek is perennial. The headwaters of Dale Creek are on the west side of the Laramie Range.

The SPRWS is unique among watersheds in Wyoming since it depends so heavily on groundwater as the water source.



ES.1 Map of the South Platte River Watershed

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ES.3 Institutional Issues in the South Platte River Watershed

Important institutional issues in the South Platte River Watershed are discussed in Chapter 1 of the report. These include the Plate River Recovery Implementation Program (the PRRIP); the Laramie County Control Area; the 2017 Wyoming State Engineer's decisions concerning surface water and groundwater relationships along Crow Creek; and Cheyenne Board of Public Utilities Facilities and Water Rights.

Although the South Platte River Watershed is not part of the 2001 Modified North Platte decree, it is managed as part of the PRRIP with the goal to protect critical habitat for several endangered species located along the central Platte River in Nebraska.

The Laramie County Control Area (LCCA), which was established in 1981, covers the eastern two-thirds of Laramie County, including the Albin, Pine Bluffs and Carpenter areas. The LCCA was established due to declining groundwater levels and to mitigate future potential for conflicts between groundwater users in the LCCA. On April 1, 2015, the Wyoming State Engineer issued an order that imposes additional regulations in the LCCA. A fact sheet and map that summarizes the April 2015 Order is included in Appendix A of this report.

In 2017, the Wyoming State Engineer determined that the "surface waters of Crow Creek, downstream of Cheyenne, are so interconnected with the groundwater supply in the High Plains Aquifer system proximal to Crow Creek as to constitute in fact one source of supply". Future diversions of water from Crow Creek in the area downstream of Cheyenne will be reviewed and considered with the idea that the surface water and groundwater are interconnected.

The City of Cheyenne – Board of Public Utilities (BOPU) is a key entity in the South Platte River Watershed. The BOPU has the senior surface water right for 12,481 cfs from Crow Creek; it owns three major reservoirs with total capacity of 13,750 acre-feet; the BOPU has the ability to bring water into the Watershed via trans-basin diversions; the BOPU obtains groundwater from 5 well fields; and the BOPU operates two wastewater treatment plants. Clearly, the BOPU has the ability to impact the watershed in a profound manner through operation of their facilities and use of their water rights.

ES.4 Climate and Drought

Climate in the South Platte River Watershed ranges from semi-arid within the plains areas to humid-alpine in the Laramie Range. Annual peak flows in the Laramie Mountains are caused by snowmelt runoff, rainfall runoff, and by a combination of both. These mountains often receive late winter or early spring moisture from the south and east. Annual peak floods in the plains areas are usually caused by thunderstorms.

Figure ES.2 shows the Palmer Drought Severity Index (PDSI) for the Wyoming, Climate Division 8, which covers most of southeast Wyoming. The PDSI is an important climatological tool for evaluating the scope, severity, and frequency of prolonged periods of abnormally dry or wet weather. Review of this information indicates that droughts have occurred in the area and will occur again. Likewise, wet cycles have occurred and will occur again. Based on the information presented in Figure ES.2, the period from approximately 2000 - 2008 was perhaps the worst drought in recorded history for the South Platte River Watershed and surrounding areas.

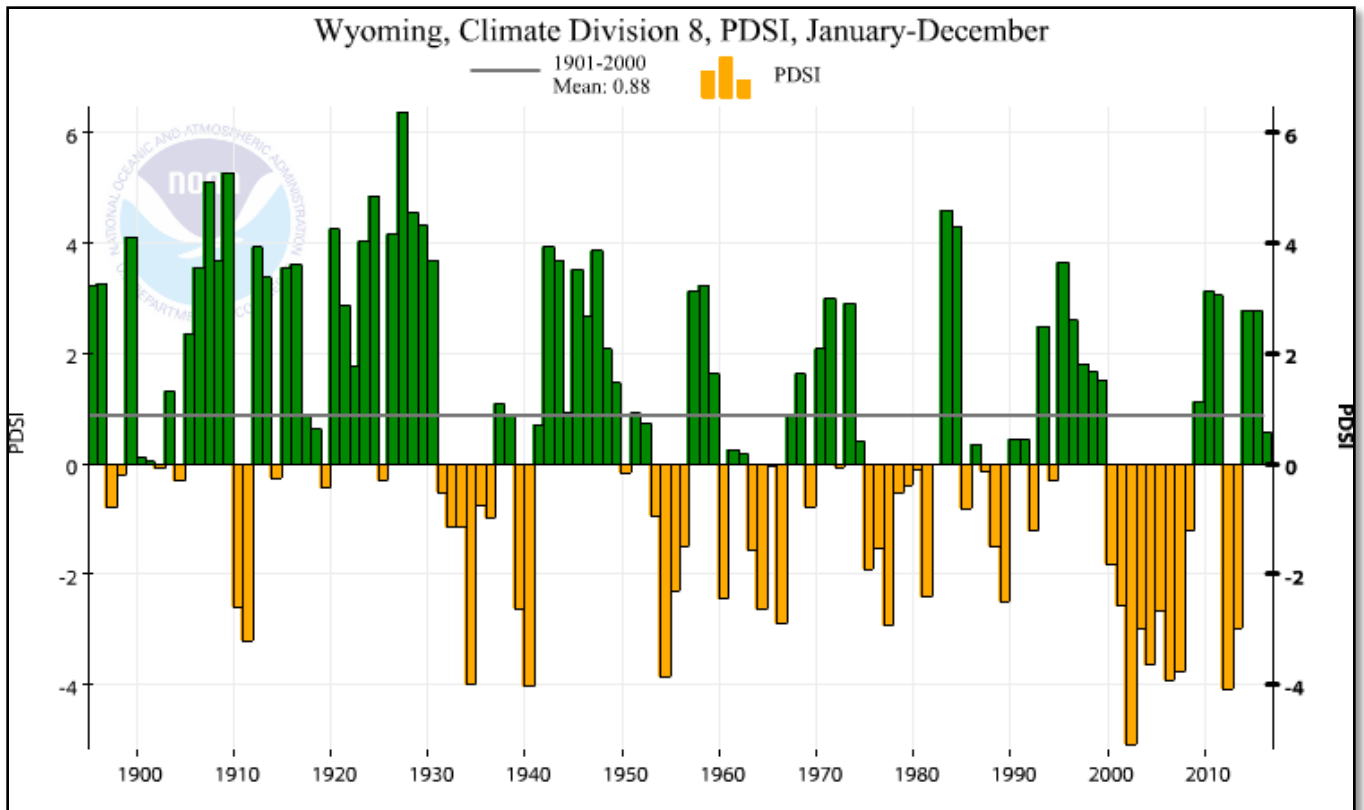


Figure ES.2. Palmer Drought Severity Index for Climate Division 8, which includes the SPRWS

ES.5 Surface Water Hydrology

Chapter 3 and Appendix B of the report describe surface water hydrology, including stream flows and floods. Analyses and evaluation of the stream gage data is presented, including evaluations of the temporary stream gages installed and operated during this Study. There is limited stream flow gage data in the South Platte Watershed. The USGS stream gage Crow Creek at 19th Street, gage No. 6755960, provides data on the flows in Crow Creek near the west side of Cheyenne. Figure ES.3 shows the annual runoff in acre-feet at this gage.

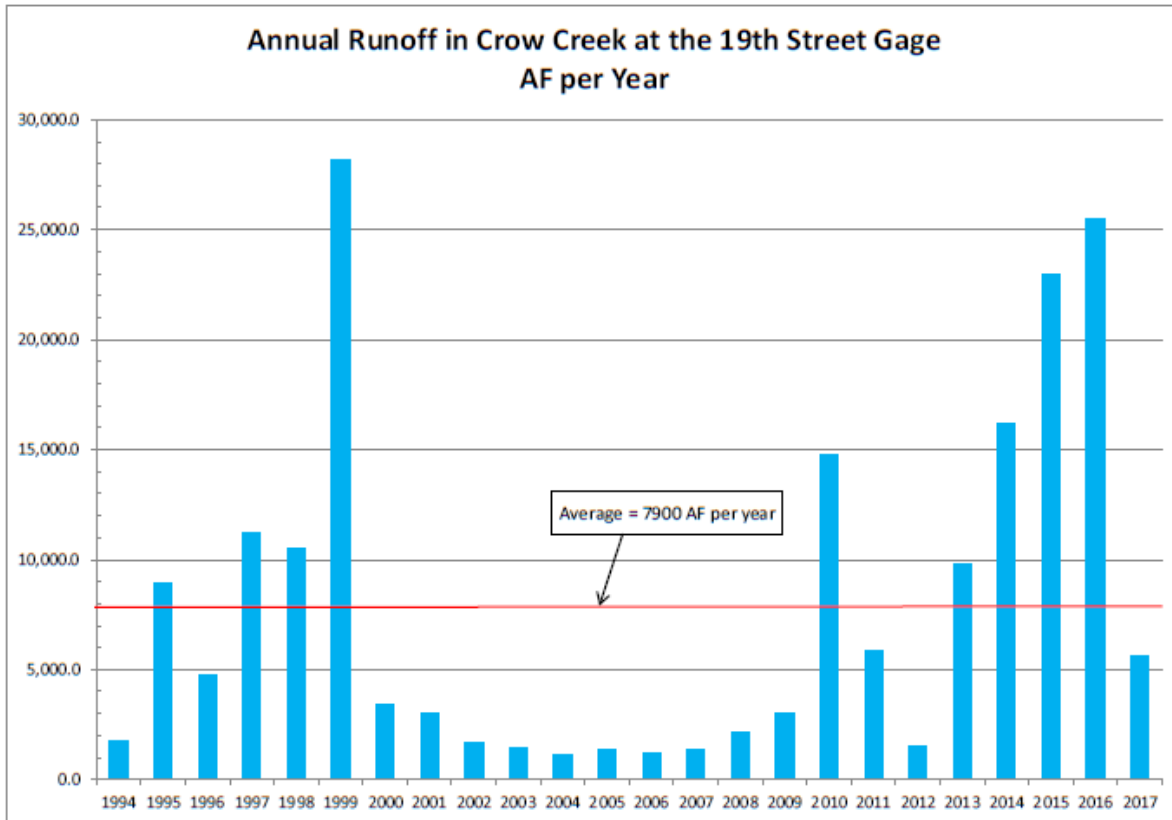


Figure ES.3. Annual Runoff in Crow Creek

ES.6 Irrigation and Water Use

Irrigated Land

A major emphasis of this Study was to review the irrigated lands within the Watershed and to provide an updated estimate of number of acres that are irrigated. This was a key issue for the Laramie County Conservation District. Air photographs taken in 2015 were reviewed and digitized and the irrigated lands were delineated from these photos. Also, the sources of the irrigation water, whether surface water or groundwater, for the irrigated lands were determined during this effort. Table ES.1 summarizes the data concerning the irrigated land within the Watershed. This work is described in detail in Chapter 3 and Appendix B of the report. Twelve (12) maps showing the irrigated land and the source of water are provided in Appendix B. GIS files with this data are submitted with the report.

Table ES.1 SPRWS Irrigated Acreage Estimates

Sub-basin	Groundwater Irrigated Acres	Surface-Water Irrigated Acres	Total
Crow Creek	5,281	4,766	10,047
Lower Lodgepole (Albin)	9,495	0	9,495
Upper Lodgepole (Pine Bluffs)	21,836	2,110	23,946
Cache La Poudre	0	466	466
Lone Tree-Owl	0	1,165	1,165
Total	36,612	8,507	45,119

City of Cheyenne BOPU Supplies and Water Use

Data from the 2013 Cheyenne Board of Public Utilities (BOPU) Master Plan (HDR, 2013) concerning the water use and projected water needs were summarized in the Watershed Study report. The following tables summarize this information.

Table ES.2 – Average Water Supply for the Sherard Water Treatment Plant 2004 - 2012

Ave Water Supply (AF/yr)	Ground-water (AF/yr)	% of Total	Stage I (AF/yr)	% of Total	Stage I (AF/yr)	% of Total	Stage I (AF/yr)	% of Total	Crow Creek (AF/yr)	% of Total
14,310	4140	29 %	3060	29 %	3060	29 %	3060	28%	3080	22

Table ES.3 BOPU Projected Water Needs

Year	Planning Period	Source Water Projected Total Demand (ac-ft/yr)
2013	Existing	18,378
2023	Near-Term	21,056
2033	Mid-Term	24,753

Other Water use

Information concerning water use for the Towns of Burns, Pine Bluffs, and Albin and for other public water supply systems within the Watershed is also presented in Section 3.10 of the report. Other water use, including industrial water use and water that is being used for oil and gas purposes are also presented in Chapter 3 of the report.

ES.7 Water Budgets for the Albin, Pine Bluffs and Carpenter Areas

The report presents water budgets for the key agricultural areas in eastern Laramie County, specifically Albin, Pine Bluffs and Carpenter. The table below summarizes this effort. The approach to the water budget conducted during the Watershed Study needs to be viewed in the context of a Level I study. The Study team believes that the approach presented in the report can be used as a template for other area in the Watershed and can be modified to estimate groundwater availability in other sub-watersheds in the Watershed. The water budget presented in this Study is not the final product. Additional information and refinement is necessary; including basic data about the actual amount of groundwater that is being pumped.

Table ES.4: Water Budgets for the Key Agricultural Areas

Area	Basin Size (acres)	Irrigated Lands (acres)	Estimated Total GW Pumping Rate (AF/yr)	Recharge from Precipitation (AF/yr)	Recharge from Stream Seepage (AF/yr)	Groundwater Pumping Reduction Required for Steady Groundwater levels (% reduction)
Albin	99,205	9,495	9,869	8,267	0 ⁺	16 %
Pine Bluffs	138,729	14,292	15,117	11,561	? ⁺	24 %
Carpenter	28,731	4,796	4,931	2,394	2000 ⁺	11 %

⁺ Values to be refined during future investigations.

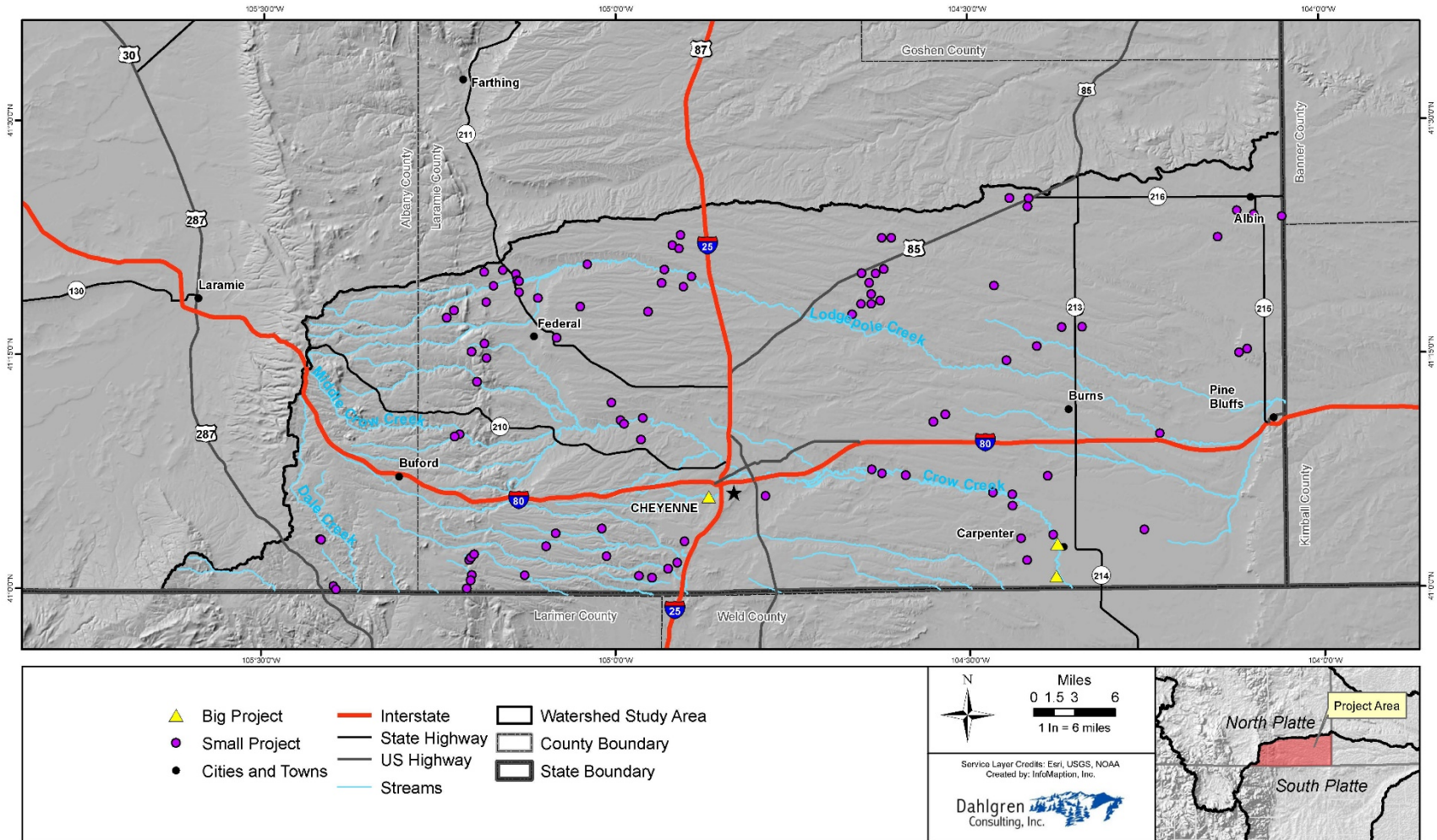
ES.8 Watershed Management and Rehabilitation Plan

One of the key objectives of the South Platte River Watershed Study was to develop a list of projects that can improve conditions in the watershed. As mentioned previously, the project team met with 61 landowners and identified over 100 projects, which will provide public benefits to the Watershed. Many of these projects will qualify for funding through the WWDC Small Water Project Program. Chapter 5 and Appendix D of the report describe these projects.

A brief summary of the projects is presented below:

- 92 projects are located in Laramie County and 15 projects in Albany County.
- The total estimated costs of the projects exceed \$7,000,000.
- There are approximately 20 small reservoir projects; 40 stock well projects, many including new wells, solar platforms, tanks, and/or pipelines; 20 spring developments, with pipelines and tanks; one wetland development; 14 environmental projects; and 11 irrigation projects.

In addition to these projects, the Study identified 3 other projects, which are larger and more complex projects. Figures ES.4 and ES.5 shows the locations of the projects.



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Figure ES.4 South Platte River Watershed Projects

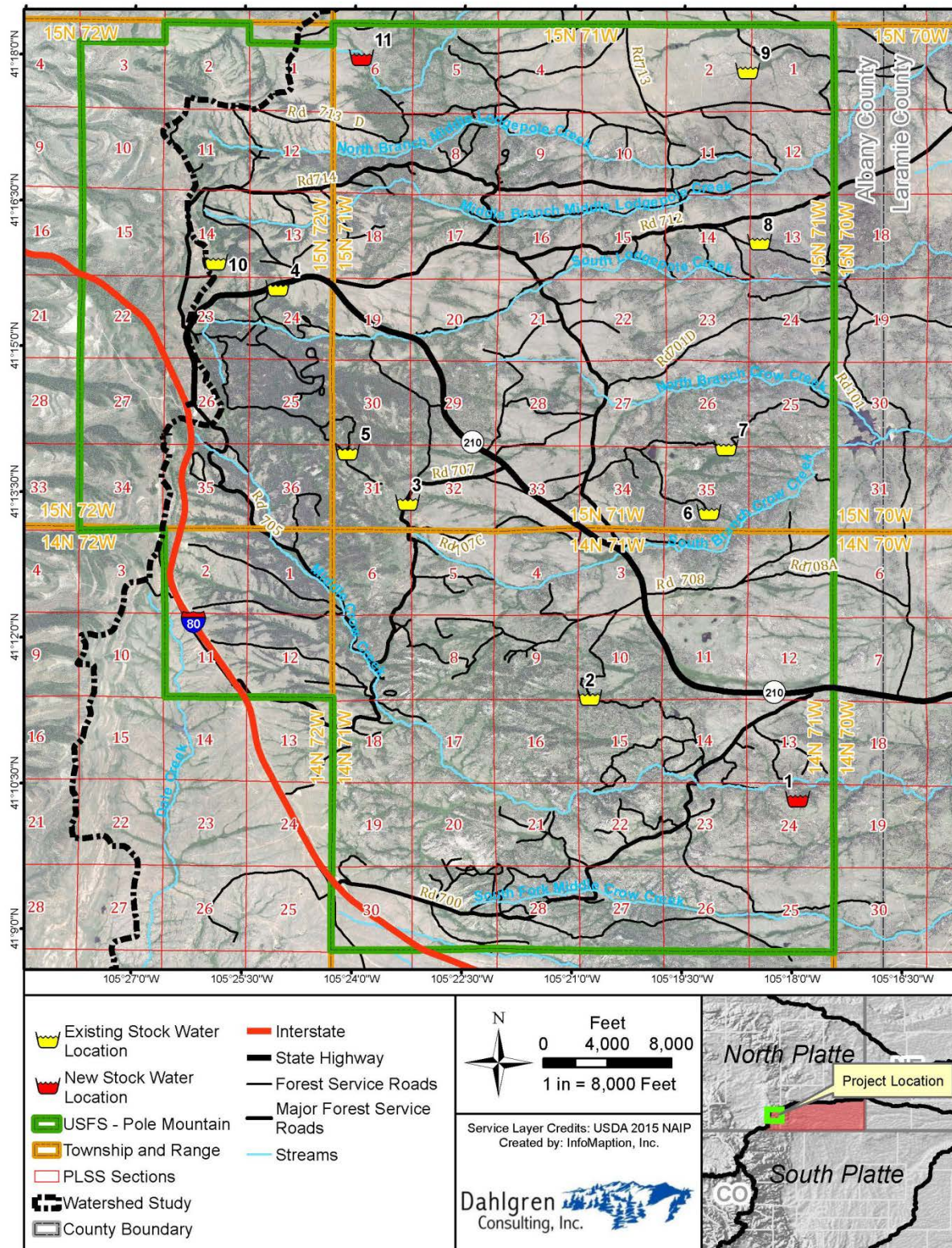


Figure ES.5 USFS Pole Mountain Stock Water Locations

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ES.9 Funding, Permitting and Cost Estimates

Chapter 6 of the report discusses funding sources and options for the types or projects identified during the Watershed Study. A funding flow chart is presented.

Chapter 7 of the report discusses permitting issues.

Cost estimates for most of the projects are presented in Chapter 8 of the report. Some projects are larger and more complex. Additional work to develop detailed cost estimates for these projects will be required.

ES.10 Recommendations

Many of the projects identified in the Watershed Study and report should qualify for WWDC Small Water Project Program funding. Small Water Project funding, with matching grants and/or additional funding as available, should be pursued.

“Shovel ready projects”, i.e. projects with completed designs, permitting and adequate funding, including money provided by landowners, should have high priority.

The GIS database should be used as a tool for additional Watershed planning efforts.

Coordinated efforts with land management agencies, the Conservation Districts, local government entities, landowners, and with wildlife and conservation organizations will create opportunities to implement projects that achieve many benefits to the Watershed. Funding from many different sources can be leveraged to implement projects.

Additional stream gaging efforts will provide necessary data on the surface water resources in the Watershed.

Additional monitoring and refinement of the groundwater budgets presented in the report will result in more accurate estimates and better management tools.