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FINAL REPORT
for
UPPER LARAMIE RIVER
WATERSHED STUDY, LEVEL I

Prepared for:

Wyoming Water Development Commission
6920 Yellowtail Road
Cheyenne, WY 82002

Prepared by:

Anderson Consulting Engineers, Inc.
375 E. Horsetooth Road, Bldg. 5
Fort Collins, CO 80525
(ACE Project No. WYWDC37)

November 1, 2016

ANDERSON CONSULTING ENGINEERS, INC.
Civil • Water Resources • Environmental

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November 1, 2016

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I. INTRODUCTION AND OVERVIEW

I. INTRODUCTION AND OVERVIEW

1.1 Introduction

In 2014 the Laramie Rivers Conservation District (LRCD) requested funding from the Wyoming Water Development Commission (WWDC) for the completion of a watershed management plan for the Upper Laramie River watershed. The intent of the funding request was to have a comprehensive watershed inventory completed which identified issues related to land use and water resources and to then develop a plan addressing those issues The WWDC approved funding for the project and Anderson Consulting Engineers, Inc. (ACE) was ultimately contracted in June, 2015 to complete the project.

1.2 Project Overview

The Upper Laramie River 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 LRCD (the study's local sponsor) and the WWDC 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 recommended water-development projects that could provide economic, ecological, and social benefits to the state of Wyoming and its citizens. The intent of this report is to provide the results of the Study.

1.2.1 Study Area

The project study area lies within the North Platte River basin and is defined as the Upper Laramie River watershed as delineated by the USGS eighth order Hydrologic Unit Code (HUC) 10180010 within the State of Wyoming (Figure 1.1-1). The river system consists primarily of the Laramie River (referred to as the Big Laramie River) and its principal tributary, the Little Laramie River. The Big Laramie River's headwaters are located in the Medicine Bow Range in Colorado. The river flows generally north into Wyoming then northeasterly through the Laramie Valley and into Wheatland Reservoir No. 2 which defines the downstream limit of the study area. From Wheatland Reservoir No. 2, the river flows northeasterly through the Laramie Range and eventually joins the North Platte River near Fort Laramie. Headwaters of the Little Laramie River are located within the Wyoming portion of the Medicine Bow mountains west of the town of Centennial. The Little Laramie joins the Big Laramie about 6.5 miles upstream (southwest) of Bosler, WY.

The study area covers approximately 1,877 square miles or 1,201,324 acres in southeast Wyoming. The watershed is situated almost entirely within a portion of Albany County (96.2 percent) with a small portion on the western fringe lying within Carbon County (3.8 percent). The cities, towns, and communities of Laramie, Centennial, Albany, Bosler and Tie Siding lie within the watershed boundary.

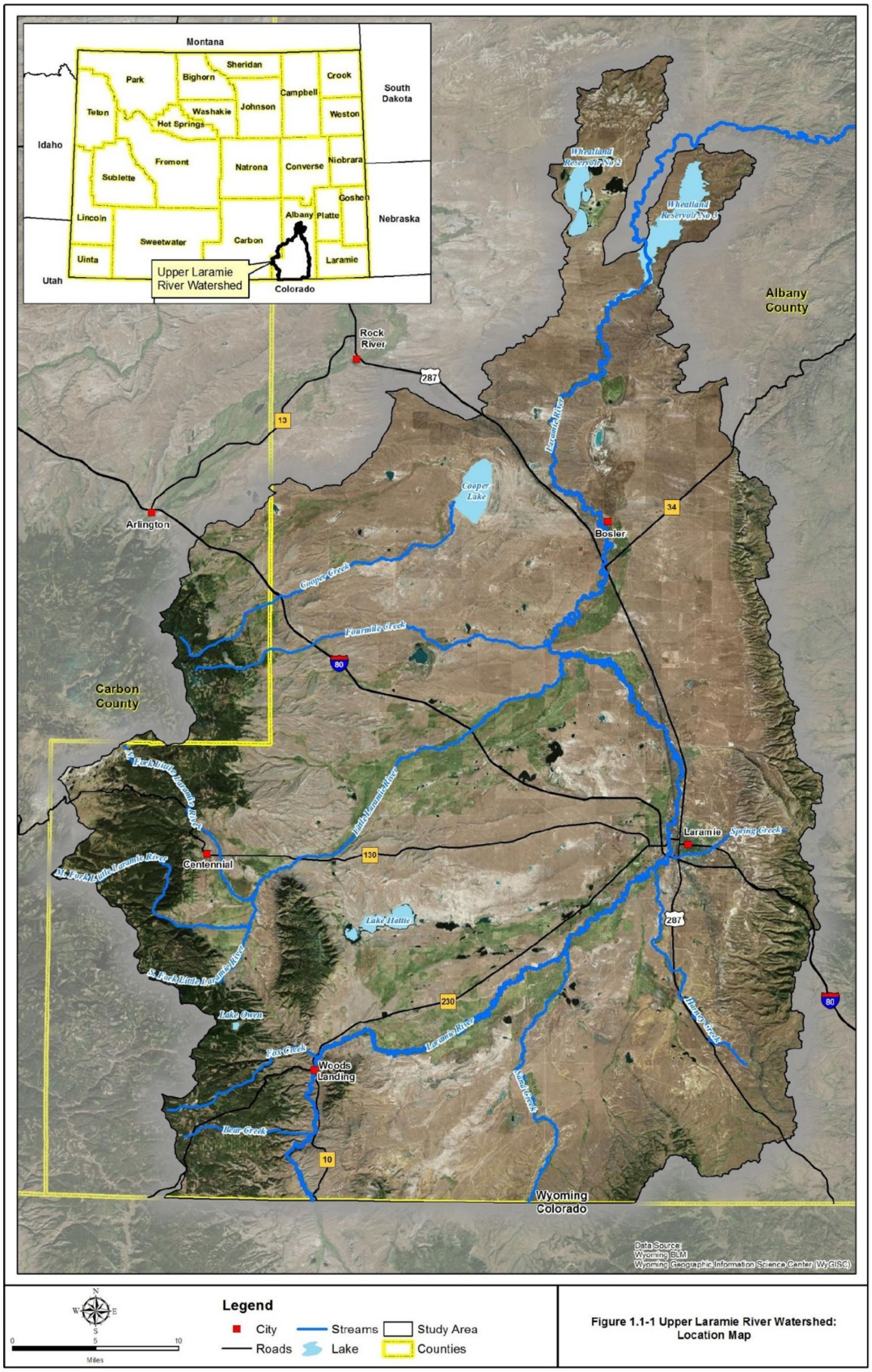


Figure 1.1-1 Upper Laramie River Watershed: Location Map

1.2.2 What is a Watershed Study?

The Operating Criteria of the Wyoming Water Development Program (Wyoming Water Development Commission, 2015) describes Level I watershed studies as preliminary analyses and comparison of development alternatives; although, the designation of 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, (Wyoming Water Development Commission, 2015) 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."*

While the WWDC's definition summarizes a watershed study in terms of their operating criteria, the general philosophy of a watershed study may perhaps be best explained in an article entitled "Conservation and Watershed Studies. What's the Connection?" which appeared in the WWDC's *Water Planning News* Fall 2009 newsletter (Wyoming Water Development Commission, 2009). In this article, a watershed study is described as follows:

> *"Today, conservation by watershed is an old concept with new horizons. Watersheds have long been recognized in the western United 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, fisheries 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 and conservation. 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."

1.2.3 The Small Water Project Program (SWPP)

One of the purposes of this Level I watershed study is to provide the basis upon which the WWDC can make future decisions pertaining to state funding of water development projects. Upon completion of the Level I watershed study, landowners and stakeholders within the geographic boundaries of the project study area become eligible to apply for funding through the WWDC's Small Water Project Program, or SWPP. According to the operating criteria of the SWPP:

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

Small projects are defined as projects where estimated construction of rehabilitation costs, permit procurement, construction engineering and project land procurement are $135,000 or less. Applicants can receive up to $35,000 towards these costs from the SWPP.

The SWPP and its operating criteria are discussed in greater detail in Chapter 6: Funding Opportunities.

1.3 Project Purpose and Objectives

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

- *Facilitate consensus building among the conservation district, landowners and the Wyoming Water Development Commission.*
- *Facilitate public participation through public meetings, open houses/workshops, LRCD contacts, and advertisements.*
- *Conduct an evaluation and description of the Upper Laramie River watershed, including quantity and quality of surface water resources, and riparian/upland conditions.*
- *Inventory and describe Irrigation systems, water storage, and flood control needs present within the watershed.*
- *Conduct a geomorphic assessment of the primary channels within the watershed and identify potential mitigation measures to improve impaired channel reaches.*
- *Conduct an irrigation system inventory and develop a rehabilitation plan for those ditches expressing an interest to participate.*
- *Conduct an evaluation of water storage needs and opportunities to augment water available for livestock and wildlife.*
- *Develop a watershed management plan which identifies water resource related within the watershed and proposes practical economic solutions.*
- *Identify permits, easements, and clearances necessary for plan implementation.*
- *Develop cost estimates for improvements.*
- *Complete an economic analysis and evaluate alternative sources of funding.*

The study culminates in the delivery of a Watershed Management and Rehabilitation Plan (the Plan). It is the goal and objective of the sponsors and the WWDC to generate a plan that is not only technically sound, but also one that is practical and economically feasible. The plan also includes development of a database to facilitate the planning process and the evaluation/implementation of watershed improvements. In order to accomplish this task, the LRCD, WWDC, and ACE addressed several key issues, including the following:

- *Utilization of grazing lands*
- *Water availability*
- *Channel stability/riparian restoration/enhancement*
- *Irrigation system assessment (to promote rehabilitation of existing facilities and provide opportunities for water conservation that would support an increase in water availability)*
- *Public participation and acceptance (intent is to focus on solutions, not compliance issues)*

During the completion of this level I investigation, efforts were made to meet with as many landowners and stakeholders as possible and to provide assistance defining their individual water projects. These projects are then outlined as components of the Plan. Feasible projects not meeting criteria of the SWPP are included as recommendations in the Plan; they simply exceed the cost limitations of the program. For these projects, recommendations for future planning/implementation efforts may include recommendation for Level II funding and/or investigation of alternative funding sources.

1.4 Report Utilization

The remainder of this report is organized in a manner which we believe will provide the greatest utility to the reader, the WWDC, and the LRCD. The major chapters are presented as follows:

Chapter 2 - Project Meetings: This chapter documents the public meetings, open houses, and Final Results Presentations which were conducted in support of the project. In addition, we document individual onsite meetings we completed with individual landowners to discuss their water resources issues.

Chapter 3 - Watershed Description and Inventory: This chapter provides a characterization of the study area and its resources. In this chapter, we provide and discuss the management implications of various watershed attributes and potential impacts upon watershed improvement recommendations. We also provide source references for data utilized so the LRCD and WWDC can easily update information as needed during future planning efforts.

Chapter 4 - Watershed Management Plan: This chapter describes the institutional constraints (Modified North Platte Decree, Laramie River Decree, and the Platte River Recovery and Implementation Program), individual projects which together, comprise the Plan. Projects fall into several broad categories:

- Water Storage Opportunities
- Irrigation System Rehabilitation
- Upland Livestock/Wildlife Water Supply Opportunities
- Stream Rehabilitation / Restoration Opportunities

In addition, we present discussions of potential benefits of the various components to the State of Wyoming and its residents.

Chapter 5 – Permits: Most projects included in the Plan will require some sort of permit in order to be completed. In this section, we provide information to help guide the LRCD through the permitting process and agency contact information.

Chapter 6 - Funding Opportunities: This valuable portion of the report summarizes numerous funding programs provided by various local, state and federal entities as well as private organizations. This information can be used to determine optimized funding strategies including partnering with multiple funding sources

Chapter 7 - Cost Estimates: In this section, we present conceptual level cost estimates of the Watershed Management Plan components and the methods and assumptions supporting them. This information can then be used by the LRCD and project sponsors in future planning efforts.

Chapter 8 – Conclusions and Recommendations: Here we summarize the highlights of the Plan and make concise and feasible recommendations for further action on behalf of the WWDC and the LRCD.

II. PROJECT MEETINGS

II. PROJECT MEETINGS

2.1 Introduction

An integral part of the Upper Laramie River Watershed Study was the public outreach and involvement effort. Meetings were orchestrated by Anderson Consulting Engineers (ACE) and typically included informal presentations conducted by ACE staff and the Wyoming Water Development Office (WWDO). The objectives of the meetings were to:

- 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 about 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

At each of the meetings, ACE representatives were available to discuss the project one on one with landowners/stakeholders and to initiate development of watershed plan alternatives. The project GIS was demonstrated when appropriate to keep landowners up to date on the information which would ultimately be incorporated within it. Table 2.1-1 summarizes the dates, locations and types of meetings.

2.2 Field Trips and "Tailgate Talks"

Field investigations generally occurred in coordination with scheduled meetings for efficiency. Specific field efforts targeted irrigation inventory, upland livestock/wildlife water opportunities, and stream channel conditions observations.

Individual meetings with landowners and leasees were scheduled at their residences and properties where discussions focused on land and water resource concerns and issues specific to the landowner. Usually, the landowner gave a tour of the property. During these property visits, initial planning and conceptual project designs were discussed for upland livestock/wildlife and irrigation water improvements. These informal interviews, often held spontaneously while in the field, have become dubbed "tailgate talks" and provide valuable insight into the overall assessment of the watershed.

Throughout the watershed study, local ranchers, irrigators, and residents who invited the study team to visit their properties and discuss issues and concerns demonstrated extensive knowledge and valuable insight about the watershed. Because of the willingness of landowners to share information, insight, and direction, the study team was able to incorporate this knowledge and experience into the study and provide a more effective evaluation of the watershed.

Table 2.1-1 Project Meetings.

Date	Event
23-Jun-15	LRCD Board Meeting - LRCD Office
28-Jul-15	Scoping Meeting - Hansen Arena
29-Jul-15	Scoping Meeting - Valley View
9-Sep-15	Land Owner Meeting
9-Sep-15	Land Owner Meeting
9-Sep-15	Land Owner Meeting
10-Sep-15	Land Owner Meeting
27-Oct-15	Land Owner Meeting
17-Nov-15	Open House - Hansen Arena
7-Mar-16	Land Owner Meeting
7-Mar-16	Land Owner Meeting
7-Mar-16	Land Owner Meeting
7-Mar-16	Land Owner Meeting
29-Mar-16	Open House -LRCD Office
3/29/2016	Open House -LRCD Office
12-Apr-16	Land Owner Meeting
13-Apr-16	Land Owner Meeting
13-Apr-16	Land Owner Meeting
14-Apr-16	Land Owner Meeting
15-Apr-16	Land Owner Meeting
31-May-16	Land Owner Meeting
31-May-16	Land Owner Meeting
1-Jun-16	Land Owner Meeting
1-Jun-16	Land Owner Meeting
2-Jun-16	Land Owner Meeting
2-Jun-16	Land Owner Meeting
22-Jun-16	Land Owner Meeting
22-Jun-16	Open House -LRCD Office
15-Aug-16	Land Owner Meeting
22-Nov-16	Final Results Presentation

III. WATERSHED DESCRIPTION AND INVENTORY

III. WATERSHED DESCRIPTION AND INVENTORY

3.1 Introduction and Purpose

A considerable amount of information exists pertaining to the Upper Laramie River Study Area and its resources. The data spans a wide variety of disciplines and includes basin hydrology, water quality, land use and ownership, geology and soils, and agricultural practices as typical examples. The primary objective of the watershed inventory phase of this project was to accomplish the following objectives:

1. collect, review, and compile pertinent information regarding the study area;
2. collate the data in a single database; and
3. assess the data to characterize the watershed and facilitate identification of existing issues and development of improvements to the watershed.

Throughout the remainder of this chapter, an overview of existing conditions of natural resources found within the study area are discussed. Included are summaries of numerous individual disciplines: vegetation, soils, wildlife, hydrology, ecologic site descriptions, etc. For each discipline, individual maps delineating the character and extent of that watershed attribute were generated within the project GIS. In conjunction with many of the map figures, summary tables have been prepared which tabulate various attributes of the pertinent watershed characteristics.

3.2 Data Collection and Management

3.2.1 Collection of Existing Information

A significant amount of information and pertinent data were available from existing sources at the time this project was initiated. In an effort to collect and incorporate as much of this information as possible, the following sources were either contacted directly or information and documents procured via websites, libraries, or personal contacts:

- U.S. Bureau of Land Management (BLM)
- U.S. Geological Survey (USGS)
- U.S. Department of Agriculture/Natural Resources Conservation Service (NRCS)
- U.S. Department of Agriculture/Farm Service Agency (FSA)
- U.S. Environmental Protection Agency (EPA)
- U.S. Fish and Wildlife Service (FWS)
- U.S. Department of Interior (DOI)
- Wyoming Water Development Commission (WWDC)
- Wyoming Department of Environmental Quality (WDEQ)
- Wyoming Abandoned Mine Land Program (AML)
- Wyoming Game and Fish Department (WGFD)
- Wyoming State Historic Preservation Office (SHPO)

- Wyoming State Engineer's Office (WSEO)
- Wyoming Oil and Gas Conservation Commission (WOGCC)
- Wyoming State Geological Survey (WSGS)
- Wyoming Geographic Information Science Center (WyGISC)
- Wyoming Natural Diversity Database (WYNDD)
- Water Resources Data System (WRDS)
- Albany County Weed and Pest District
- Albany County Assessor's Office

3.2.2 Geographic Information System

The results of the data collection efforts were incorporated into a comprehensive Geographic Information System (GIS). A GIS can be thought of as a powerful three- dimensional mapping tool that can be used to evaluate and compare spatial data pertaining to a wide range of topics. Numerous maps can be "stacked" to overlay information; each map, or "theme", incorporates data, or "attributes" pertaining to the theme. For instance, a theme showing the location of irrigation ditches could also include numerical data pertaining to each ditch's irrigated acreage, improvements, problems, etc.

The Upper Laramie River watershed GIS was developed with the "clearinghouse" approach in mind. The GIS is intended to incorporate not only the spatial data pertaining to the watershed, but also analytical spreadsheets and documents. Figure 3.2-1 displays this approach graphically. The user can evaluate spatial data with the conventional GIS tools as well as linking to photographs, spreadsheets containing analytical tools, and graphical representation of the various data, and the various documents prepared or collected in the course of this investigation.

Spatial data pertaining to the Study Area was collected from a wide range of sources. A significant amount of information was also specifically developed during the course of this investigation. Table 3.2-1 presents a list of the individual themes, maps, and aerial photographs which have been incorporated into the project GIS. All of the map figures presented in this report were prepared within the project GIS and are representative of the information housed within it.

The project GIS was used in the generation of a majority of the figures included in this report. It will be available as a resource for future investigations and as a tool for watershed stakeholders to use during pursuit of permits, environmental analyses, mapping projects, etc. GIS software (ArcMap 10.x) is required to view and utilize the data to the maximum of its potential. However, free 'shareware' data viewers (ArcGIS Explorer: *http://www.esri.com/software/arcgis/explorer*) are available which enable the user limited capabilities to view the data. It must be kept in mind when using the shareware versions of the GIS software that certain data layers symbology may vary from what is presented in this report.

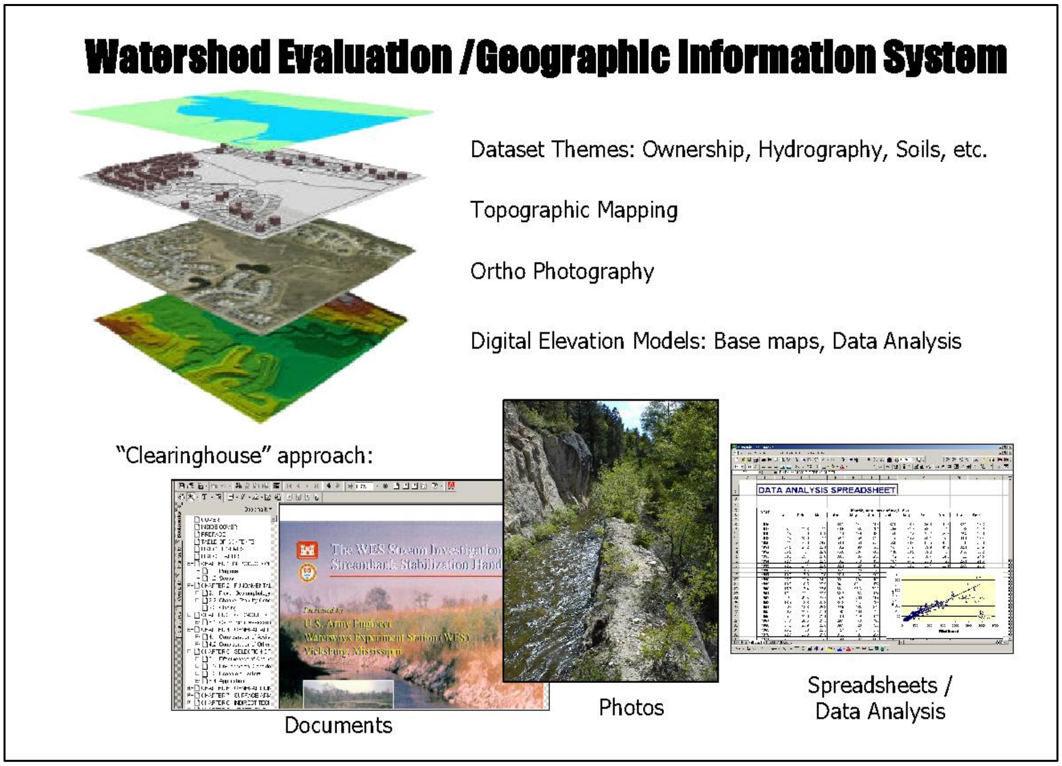


Figure 3.2-1 Example of the Upper Laramie River Watershed Study GIS Structure and "Clearinghouse" Capabilities.

The data in the delivered project GIS is stored in an ArcMap 10.2 File Geodatabase. The File Geodatabase format was chosen for a variety of reasons including; optimizing the GIS performance, customizing the data storage structure, and database compactness and portability. The general structure of the geodatabase is pictured below in Figure 3.2-2. Contained within the ULR_Watershed.gdb (file geodatabase) is a series of feature datasets categorized by the agency who supplied the data (for example, BLM, AML, etc.). Within each feature dataset are feature classes representing the various geographic data supplied by the agency or developed during the project.

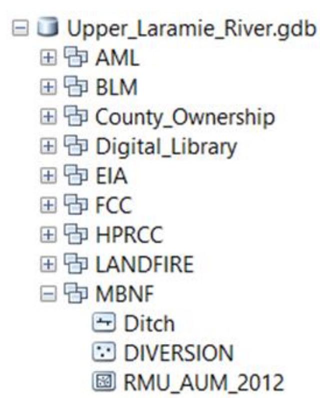


Figure 3.2-2 Upper Laramie River Watershed Study Project GIS Geodatabase Structure.

It is also important to note that data presented in the project GIS and within this report are subject to change with time as the agencies creating them continually update their databases. The user is encouraged to obtain the most current data available to meet the needs of future endeavors utilizing the project GIS.

Table 3.2-1 Generalized GIS Contents.

Category	Feature Class	Summary/Description
Watershed Management Plan	Plan_Component_Locations	General locations of all Plan Component projects related to the Upper Laramie River Watershed Study
	Plan_Component_Detailed_Points	Detailed locations and descriptions of all proposed projects in the Watershed Management Plan
	Plan_Component_Detailed_Lines	Detailed Proposed Projects Lines
	Plan_Component_Detailed_Poly	Detailed Proposed Projects Polygon
Climate	Eco_Site_Precip_Zone	NRCS precipitation zones - statewide
	Observation_Stations	Meterological Stations obtained from the High Plains Regional Climate Center
	precip_a_wy	Average Annual Precipitation 1971-2000- WY
	Precip_a_co	Average Annual Precipitation 1971-2000- CO
	US Drought Monitor 2015_06_02	USDA dataset showing general drought conditions countrywide
Communications	am	AM Radio Tower
	fm	FM Radio Tower
	cellular	Cellular Tower
	lm_comm	Land Mobile Radio Service Antenna- Commercial
	lm_private	Land Mobile Radio Service Antenna - Private
	microwave	Microwave Tower
	TV_NTSC	TV (NTSC) Antenna
	asr	Antenna Structure Registration Location
Fieldwork	Fieldwork_Pts (Various Dates)	Project data collected during fieldwork (various point features collected)
Infrastructure	Wy_Highways	Major Highways in Wyoming - statewide
	WY Roads 100K	Roads 100K scale - statewide
	Railroads	Railroads - statewide
Energy Development	PA_Wells_5_4_16	Permanently Abandoned Well Head within the Upper Laramie River Watershed Study Area attributed with the well pad revegetation analysis results as of 5/4/16
	CBM_Wells_5_4_16	CBM Well Heads as of 5/4/16
	Wellheads_5_4_16	Operative Oil and Gas Wellheads as of 5/4/16
	EPCA1_4basins_gross	Rocky Mtn. Basins Oil/Gas Fields (EPA Source)
	Pipelines_WY_2007	WSGS dataset showing oil/gas pipelines for state of Wyoming
	Power Generation	WSGS dataset showing all electric power generating facilities in Wyoming over 1 megawatt
	wy_transmission	Electric Transmission Corridors
	WY_WindTurbinesLocations_2012	Wyoming wind turbine locations - statewide

Category	Feature Class	Summary/Description
Fish and Wildlife	Crucial Stream Corridors	Crucial stream/river corridors for aquatic species - statewide
	WGF_SWAP_2010	Wyoming Fish and Game State Wildlife Action Plan Data
	WY Sagegrouse_current_distribution	Current range of Sage Grouse
	TerrestrialCrucial_hp15	Terrestrial crucial areas - statewide
	TerrestrialEnhancement_hp15	Terrestrial enhancement areas - statewide
	CombEnhancement_hp15	Combined habitat enhancement areas - statewide
	CombCrucial_hp15	Combined habitat crucial areas - statewide
	AquaticCrucial_hp15	Aquatic crucial areas - statewide
	AquaticEnhancement_hp15	Aquatic enhancement areas - statewide
	WGFD_blue_ribbon_streams	Blue ribbon streams in Wyoming - Statewide
	WHMAs14	Wildlife Habitat Management Areas
	USGS-WY Basin Ecoregional Assesment Data	Series of rasters depicting sage grouse roost site probability occurences and general use abundance statistics provided by USGS
	Antelope Habitat Data	Series of datasets showing WGF antelope data (migration barriers, migration routes, parturition areas, crucial range, seasonal range, hunt area/herd units)
	Elk Habitat Data	Series of datasets showing WGF Elk data (migration barriers, migration routes, parturition areas, crucial range, seasonal range, hunt area/herd units)
	Mule Deer Habitat Data	Series of datasets showing WGF Mule Deer data (migration barriers, migration routes, parturition areas, crucial range, seasonal range, hunt area/herd units)
	Moose Habitat Data	Series of datasets showing WGF Moose data (migration barriers, migration routes, parturition areas, crucial range, seasonal range, hunt area/herd units)
	Big Horn Sheep Data	Series of datasets showing WGF Big Horn Sheep data (migration barriers, migration routes, parturition areas, crucial range, seasonal range, hunt area/herd units)
	White Tail Deer Data	Series of datasets showing WGF White Tail Deer data (migration barriers, migration routes, parturition areas, crucial range, seasonal range, hunt area/herd units)
	WYNDD _original	Wyoming Natural Diversity Database query for study area
	KNWA	Key non-game wildlife areas
Geology and Soils	Faults	Fault Line - statewide
	Landslide_WSGS	Landslide Area - statewide
	Dikes	Geologic Dikes - statewide
	Soils_250K	NRCS 250K Soils Data - statewide
	Albany_24K_soils	Albany County 24K Soils data
	Carbon_24k_soils	Carbon County 24K Soils data
	Surficial_Geology_500K_WYGISC	Surficial Geology 500K scale -statewide
	Bedrock_Geology_500K_WYGISC	Bedrock Geology 500K scale -statewide
	ESD_ULR	Ecological Site Description classifications for study area

Table 3.2-1 Generalized GIS Contents (continued).

Category	Feature Class	Summary/Description
Geomorphology	Rosgen_Streams_UTM	Rosgen analysis for selected streams within study area
	Geomorphology (pts)	points with linked photos of all Rosgen analyzed streams
	USGS_PFCs_Lotic	Proper Functioning Condition data: flowing water
	USGS_PFCs_Lentic	Proper Functioning Condition data: still water
Grazing	Watersources_Pts	Existing Watersources-ACE compiled. Includes springs from various source, reservoirs and reservoir analysis data
	Watersources_Pts_1_Mile_Buffer	Existing Watersource 1 Mile Buffer
	WaterSource_lines	Compiled file of all pipeline projects in the watershed
	SEO_wells_sep29_2014	WY State Engineers Office groundwater wells
	BLM_Allotment_statewide	Bureau of Land Management Grazing Allotments statewide
	RMU_AUM_2012	Rangeland Management Units for Medicine Bow - Routt National Forests and Thunder Basin National Grassland
Historic and Cultural	shpo_cultural_2016_Statewide	State Historic Preservation Office: Eligible Sites per PLSS Section
	Historic_Forts	Historic Forts locatin in Wyoming
	Monuments_Markers	Historic Monuments and Markers (WY)
	historic_pts_NPS	National Registry of Historic Places (US)
	Pioneer_Trails_Clean	Historic Pioneer Trails (WY)
Hydrology	ULR_streams_UTM	Primary streams of importance in Upper Laramie Watershed Study Area
	NHDStreamGageEvents	water related points for National Hydrography Dataset
	BLM_wtr_pts and lines	BLM supplied water points and pipeline projects (springs, reservoirs, tanks)
	USGS_Stream_Gage_2006	USGS Streamgages Locations with links to online gage data
	WYPDES_all_9-19-2016	WYPDES Outfalls as of 9-19-2016
	DEQ_Stream_Class	Wyoming Department of Environmental Quality Surface Water Classifications
	ephemeral_Statewide	ephemeral streams statewide
	rad_303d_line	EPA 303D Streams
	rad_303d_point	EPA 303d Point
	rad_303d_area	EPA 303d Area
	ULR_Study_area	UpperLaramie River Watershed Study Area
	USGS_Springs_statewide	USGS springs
	Lakes	Lakes in the state of wyoming
	HUC 12_statewide	HUC 12 subwatershed boundaries statewide
	HUC12clip	HUC 12 subwatershed boundaries clipped to study area
	HUC10	HUC 10 watershed boundaries
	HUC_250k	HUC 250K watershed boundaries
	miller_regions	Hydrologic Regions of Wyoming (background image)
Irrigation	POD	Irrigation Points of Diversion within the state of wyoming
	Irrigation_districts	Irrigation districts within the state of wyoming
	Irrigated Lands	Irrigated Lands within the state of wyoming
Land Cover and Land Class	WLCI Integrated Assessment-HUC6	Wyoming Landscape Conservation Initiative data analysis results by HUC 6 boundaries
	CONUS wetlands polygon	Wetland Polygons for the conterminous United States
	LANDFIRE EVT	LANDFIRE Existing Vegetation Type (Raster)
	gaplndcv6_2y	Wyoming digital landcover data set (Raster)
	WY_Landcover	Wyoming GAP landcover analysis
	EcoRegions_wy	Wyoming Ecoregions (areas with general similarity in ecosystems)
Land Management	NLCD_CLIP2.img	National Landcover Database raster
	WY_BLM_field_office_boundary	Bureau of Land Management Field Office Boundary
	Stateownership_Surface	Public/Private Land Ownership
	Wild Horse Management Areas	Statewide Wild Horse Management Areas
	Warden_districts13	Game warden districts
	Warden_Regions	Game warden regions
	Wilderness_Boundaries	USFS managed Wilderness Areas - statewide
	WSAs	Wilderness Study Areas-BLM statewide
	State_Conservation10	State Conservation Districts
	State_improvement10	State Improvement Districts
Land Surface Ownership	SpecialMgmtAreas	Special Managemnet Areas-Compiled data
	Albany County Ownership	Albany County Private Ownership
	Carbon County Ownership	Carbon County Ownership
Mining	WYOMING_ACTIVE_COAL_PERMIT_BOUNDARIES	Active Coal Mines in state of wyoming WyDEQ Data
	WDEQ_LQD_mine_permit_locations	WYDEQ Land Quality Division mine permit locations
	mrds_fUS56_1_29_15	USGS Mineral Resource Data System (MRDS) data query - statewide

Table 3.2-1 Generalized GIS Contents (continued).

Category	Feature Class	Summary/Description
Boundaries	counties_wygisc	Wyoming County Boudaries
	qqsection	Publlic Land Survey System (PLSS) Qtr/Qtr sections - statewide
	section	Publlic Land Survey System (PLSS) Sections - statewide
	twnshp	Publlic Land Survey System (PLSS) Township/Range - statewide
	utm	Universal Transverse Mercator Zones - worldwide
	WY_SP_Zones	Wyoming State Plane Coordinate Zones
	city	Statewide city locations

Category	Feature Class	Summary/Description
Background Maps and Aerial Photos	Carbon County NAIP Imagery	2015 True color 1m imagery and 2009 Color Infrared 1m Imagery for Carbon County.
	Albany County NAIP Imagery	2015 True color 1m imagery and 2009 Color Infrared 1m Imagery for Albany County.
	USGS_10M DEM	USGS 10M DEM covering the study area
	Topographic Maps	Countywide 24K USGS topo maps for Lincoln, Uinta and Sweetwater counties.

3.2.3 Digital Library

The Digital Library is a collection of documents, plats, maps, figures, spreadsheets, etc., pertaining to the project. Documents reviewed during the completion of this project were scanned and included in the Digital Library to the extent possible. Copyright protected documents were not included in the Library; however, documents published by public agencies were included where feasible. The Digital Library consists of a spreadsheet listing the available documents and links to each; it can be searched or sorted depending upon the user's needs. Individual document files can be directly accessed via the Digital Library or directly by "browsing" on any IBM based computer. Documents included in the Digital Library were obtained from the agencies listed in Table 3.2-2, among others.

Table 3.2-2 Selected Sources of Information Included in the Digital Library.

USDI Bureau of Land Management
United States Army Corps of Engineers
United States Environmental Protection Agency
United States Fish and Wildlife Service
USDI United States Geologic Survey
Wyoming Department of Environmental Quality
Wyoming Department of Game and Fish
University of Wyoming
Wyoming Water Development Commission
Wyoming Weed and Pest Council
Wyoming State Engineers Office
Wyoming State Geological Survey
United States Forest Service
Miscellaneous

3.3 Land Uses and Activities

3.3.1 Land Ownership

The total land area within the project study area is approximately 1,201,325 acres (1,877 square miles). Figure 3.3-1 presents a map indicating the various land ownership categories within the watershed. The study area spans Albany and Carbon Counties. As indicated in Figure 3.3-2, Albany County comprises 96.2 percent (1,806 square miles) of the study area, while Carbon County comprises the remaining 3.8 percent (71 square miles).

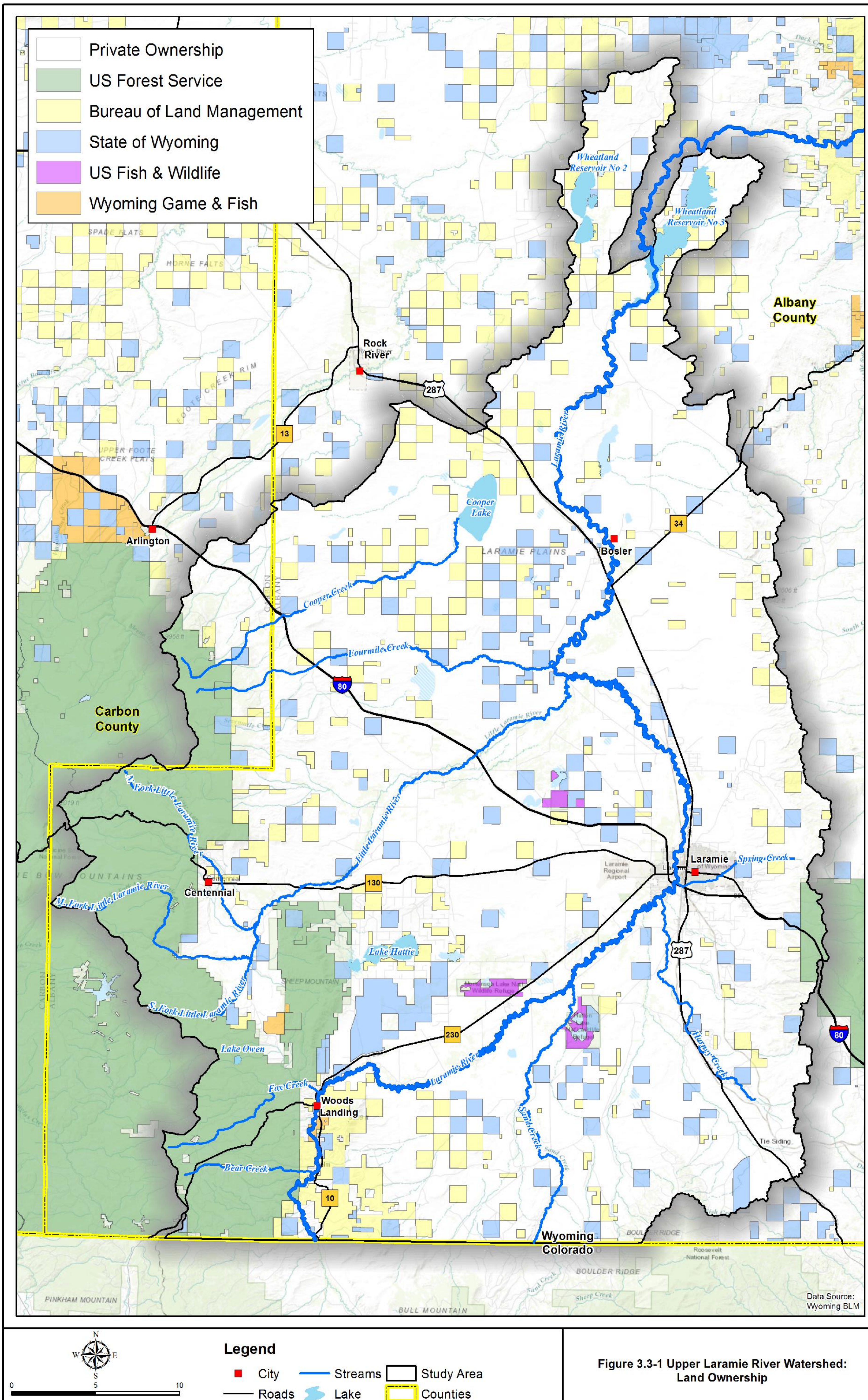


Figure 3.3-1 Upper Laramie River Watershed: Land Ownership

Land ownership information was obtained from the Bureau of Land Management (BLM) and the assessor's offices of the counties involved and incorporated into the project GIS. According to this data, privately owned lands dominate the ownership profile (Figure 3.3-3):

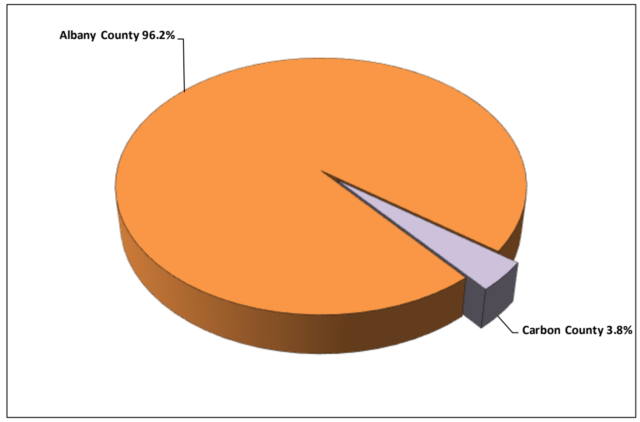


Figure 3.3-2 Distribution of Ownership among Counties.

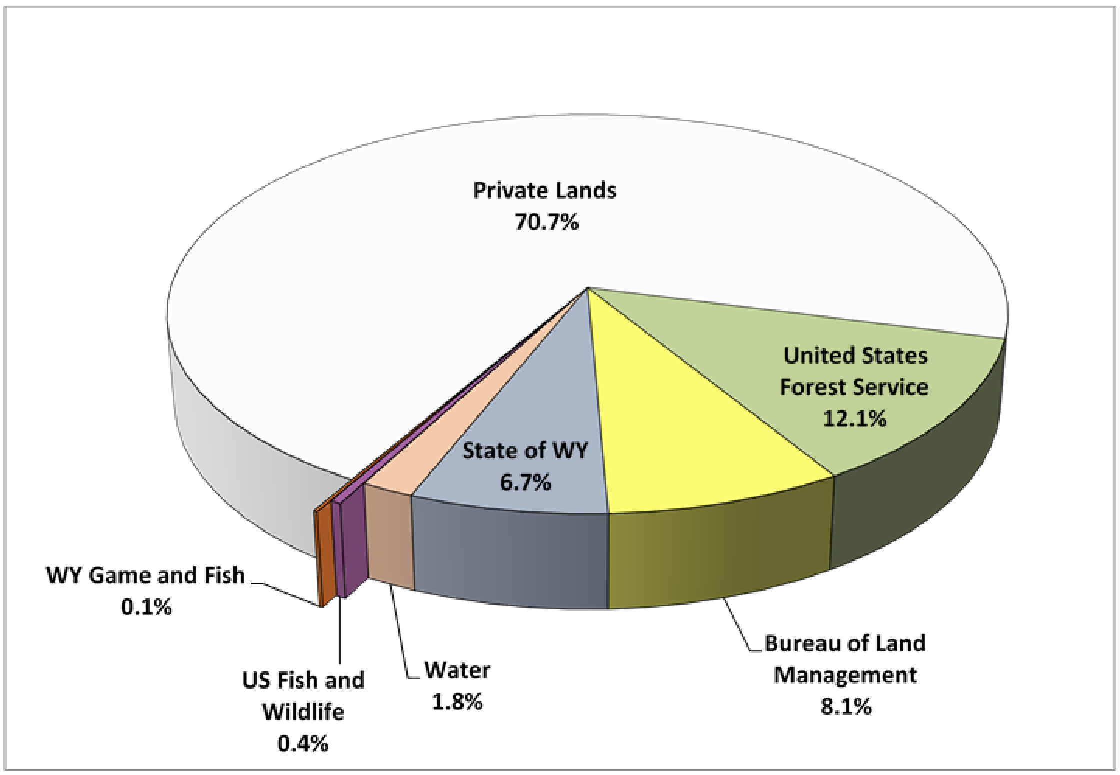


Figure 3.3-3 Distribution of Land Ownership within the Upper Laramie River Study Area.

- Private Lands: 1,328 square miles (70.7 percent of the study area),
- United States Forest Service: 228 square miles (12.1 percent of the study area),
- Bureau of Land Management: 152 square miles (8.1 percent of the study area),
- State of Wyoming: 126 square miles (6.7 percent of the study area),
- United States Fish and Wildlife Service: 7 square miles (0.4 percent of the study area),
- Wyoming Game & Fish: 2 square miles (0.1 percent of the study area).

(Note that the remaining 34 square miles or 1.8 percent of the study area is categorized as water bodies)

The project study area lies at the eastern fringe of what is commonly referred to as the "checkerboard". The "checkerboard" is a pattern of land ownership represented by alternating sections of federal and private properties. This pattern is a remnant of the Union Pacific Act of 1862 with which Congress granted every other section (one square mile) of land within ten miles of the railroad to the Union Pacific, which tried to sell it to raise capital for railroad construction. The strip along the railroad was later extended to twenty miles. The premise was that land values would increase following railroad construction and that the railroad company could then sell the land at a profit (BLM, 2014 at *www.blm.gov*).

Land ownership has direct implications to the watershed study and implementation of proposed watershed improvements. Unlike much of the state, the project study area is dominated by privately owned properties (greater than 70 percent). Consequently, permitting efforts may be greatly simplified on those lands. On federally owned lands, project implementation will require coordination with the BLM, USFS, or USFW for permitting and easements. Depending upon the nature of the proposed project or management activity, the National Environmental Policy Act (NEPA) process may be initiated. Likewise, project implementation on State lands will require permitting through the Wyoming Board of State Lands and Investments. Chapter 7: Permitting provides descriptions of potential permitting requirements, application information, and agency contact tabulations.

Note: The Project GIS includes detailed land ownership information (name, address, etc.) for individual parcels in Albany, and Carbon Counties. The data were obtained directly from the respective county assessor's offices and reflect ownership status as of the dates of their retrieval (Albany Fall of 2015, and Carbon Fall of 2014). This database can be updated by contacting the county Assessor offices and fees may apply. Database queries within the GIS can be used for a variety of purposes including generation of contact information for various projects, determination of zoning characteristics, etc.

Management Implications:

Land ownership has direct implications to the watershed study and implementation of proposed watershed improvements. Unlike much of the State, the project study area is dominated by privately owned properties (greater than 70 percent). Consequently, permitting efforts will be greatly simplified on those lands. On federally owned lands, project implementation will require coordination with the BLM, USFS, or USFW for permitting and easements. Depending upon the nature of the proposed project or management activity, the NEPA process may be initiated. Likewise, project implementation on State lands will require permitting through the Wyoming Board of State Lands and Investments. Chapter 7: Permitting provides descriptions of potential permitting requirements, application information, and agency contact tabulations

Data Sources:

Albany County Assessors Data: http://www.co.albany.wy.us/gis-map-property-data-download.aspx
*Carbon County Assessors Data (Must contact assessor)**:** http://www.carbonwy.com/index.aspx?nid=936*

3.3.2 Transportation, Energy and Communications Infrastructure

Primary paved transportation routes traversing the study area are shown on Figure 3.3-4. Interstate 80 (I-80) bisects the watershed and runs north-westerly through the central portion of the watershed. The primary roads serving the northern half of the watershed are US Route 287 and Wyoming State Route 34. The southern portion of the watershed is serviced primarily by Wyoming State Routes 130, and 230. Wyoming State Route 130 leaves Laramie heading westward through Centennial and over the Medicine Bow Mountains into Saratoga. State Route 230 heads south west out of Laramie, running through Woods Landing, and eventually exits the study area at the Wyoming state boundary.

There are several other improved roads within the watershed but much of the transportation network is made up of unimproved roads of varying quality. Access can be difficult throughout most of the study area during winter or wet conditions. The project GIS contains mapping of improved and unimproved roads in much greater detail than can be displayed at the scale of this figure.

The figure also shows the railroad corridors within the watershed. The main active line is the Union Pacific line that runs parallel to US Highway 287, entering the study area southeast of Laramie and exiting the study area north of Cooper Lake near Rock River WY. The railroad line running west out of Laramie to Centennial, and eventually to Walden CO, was abandoned in the mid 1990's.

Communications towers are located throughout the watershed; however they are clustered around Laramie, which is the major population center within the study area.

While there are no power generation facilities within the study area, the Foote Creek Rim wind project area sits adjacent to the northwestern boundary of the study area. The Foote Creek Rim wind project was Wyoming's first commercial facility to generate electricity from wind. It consists of a total of 183 turbines generating 134.7 megawatts of electricity. (BLM, 2011)

Several electric transmission corridors are located within the study area, primarily located in the central portion of the watershed. Mapping of the lines provided by WyGISC is intentionally coarse in nature with poor accuracy; presumably for security reasons. Consequently, the lines indicated on Figure 3.3-4 are approximations of alignment only.

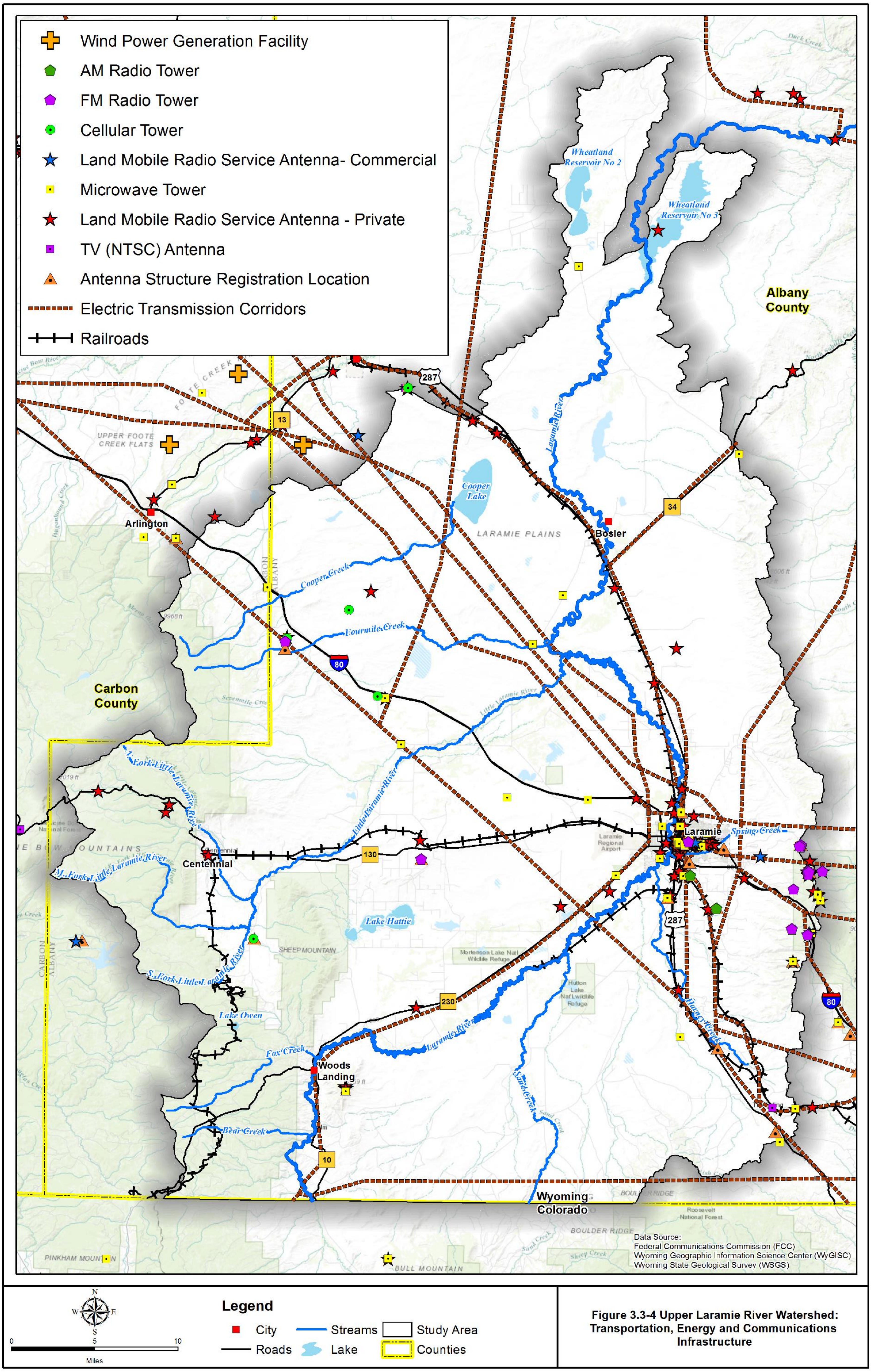


Figure 3.3-4 Upper Laramie River Watershed: Transportation, Energy and Communications Infrastructure

Management Implications:

Coordination with WYDOT and/or Albany County Road and Bridge Department could be required for implementation of many watershed plan components. Crossing existing roads with pipelines or other improvements can be problematic with respect to permitting and can potentially add significant costs to a project. Coordination would be required to determine costs and methods of construction (i.e., trenching, boring, etc).

Whenever possible, project conceptual designs have been developed with the intention of avoiding road and energy transmission line crossings in order to minimize costs and permitting issues. However, there will be cases where the greater effort and costs associated with crossing a road or a pipeline could provide significant benefits to the project owner.

Data Sources:

Federal Communications Commission: *https://catalog.data.gov/dataset/fcc-geographic-information-systems*
Wyoming Geographic Information Science Center (WyGISC- Geospatial Hub): *http://geospatialhub.org/*
Wyoming State Geological Survey (WSGS): *http://www.wsgs.wyo.gov/pubs-maps/gis*

3.3.3 Irrigation

Irrigation activities within the study area are primarily located in the south-central portion of the watershed, as indicated on Figure 3.3-5. The irrigated acres are concentrated along the Laramie River, Little Laramie River, and their tributaries. Smaller irrigated acreages are located along Sevenmile Creek, Cooper Creek, Dutton Creek, and Fourmile Creek. The total irrigated acreage within the study area is approximately 103,468 acres. Points of diversion mapping was obtained from the Wyoming State Engineer's Office (WSEO) and the Medicine Bow National Forest (MBNF). Table 3.3-1 tabulates the irrigated acreage and points of diversion by subwatershed (HUC10).

Table 3.3-1 Irrigated lands (2012) and Point of Diversion by Subwatershed.

Watershed (HUC 10)	Points of Diversion (SEO and MBNF)	Irrigated Acres
Little Laramie River	125	38,652
Laramie River-Harney Creek	47	24,006
Laramie River-Squirrel Creek	28	13,815
Laramie River-Onemile Creek	22	11,033
Laramie River-Spring Creek	2	6,773
Shell Creek	26	5,454
Cooper Creek	18	3,735
Totals	268	103,468

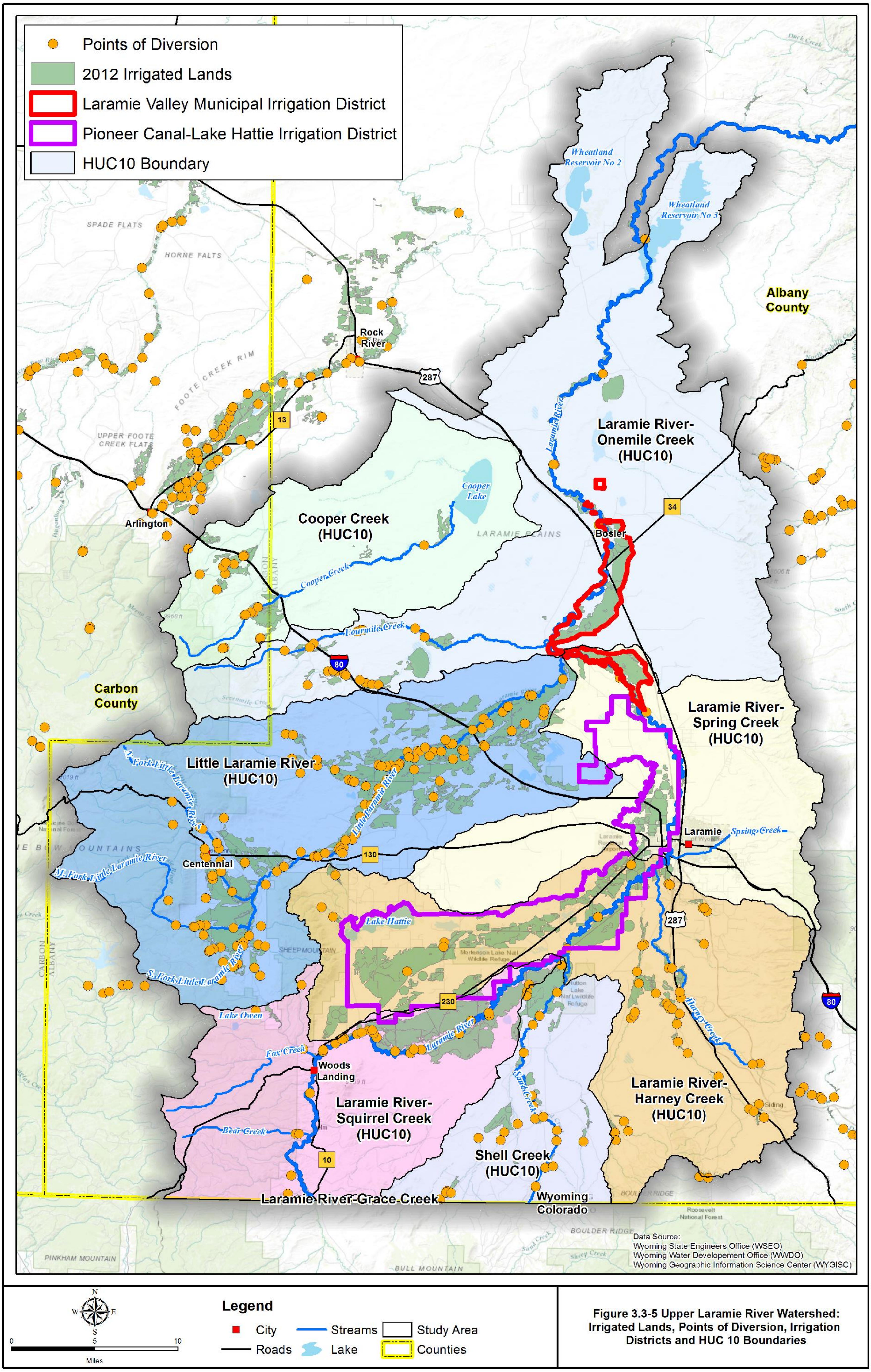


Figure 3.3-5 Upper Laramie River Watershed: Irrigated Lands, Points of Diversion, Irrigation Districts and HUC 10 Boundaries

As indicated in this table, the Laramie River subwatersheds combined comprise the majority of the irrigated lands (55,587 acres and 99 points of diversion) within the study area. Of the Laramie River's tributaries, the Harney Creek and Squirrel Creek HUCs contain the most irrigated lands. The Little Laramie River subwatershed irrigates approximately 38,652 acres of land and has 125 points of diversion.

According to the 2015 Wyoming Irrigation Systems Report provided by the Wyoming Water Development Commission (WWDC), there are two irrigation districts listed within the study area (Table 3.3-2). The larger of the two is the Pioneer Canal-Lake Hattie Irrigation District. This district irrigates approximately 17,920 acres and has 49 individual operators/water users. The district diverts from the Laramie and Little Laramie Rivers, has approximately 75 miles of conveyance, and can store up to 65,265 acre feet in Lake Hattie and 443 acre feet in Sodergreen Lake. The Laramie Valley Municipal Irrigation District irrigates approximately 9,321 acres and has 13 individual operators/water users. This district diverts from the Laramie River via the Oasis Ditch and has approximately 20 miles of conveyance and with no storage capacity.

Table 3.3-2 Irrigation Districts in the Upper Laramie River Watershed.

Subbasin: Upper Laramie	Surface Source	Acres	Number of Users	Storage (ac-ft)	Storage Reservoirs
Laramie Valley Irrigation District	Oasis Ditch	8,636	15	--	--
Pioneer Canal - Lake Hattie Irrigation District	Laramie River	19,000	58	65,000	Lake Hattie

Typically, the full growing season in the majority of the study area extends from mid-May to late September, with the period from mid-July to the end of September defined as late-season when irrigation water shortages frequently occur. Water supplies are more abundant in April, May and June in typical years because of high volumes of snow melt runoff. The supply of irrigation water in the basin is substantially reduced during late July, August, and September as snowmelt slows and ceases. According to WSEO representatives, streams are commonly put into priority regulation within the project study area in response to the Wheatland Irrigation District's call to fill Wheatland Reservoir Numbers 2 and 3 at the downstream limit of the study area.

Wyoming water law normally allows the diversion of 1 cfs per 70 acres of irrigated land, although 2 cfs per 70 acres may be diverted during surplus water conditions subject to priority dates governing surplus water. Of course, there typically is enough water in the river to supply all the diversions. When the water supply is insufficient, water right priorities restrict diversions for junior priority ditches.

Water diverted from a stream for irrigation may:

1) return to the stream as return flow,
2) be lost to the groundwater system through canal and field losses, or
3) be consumptively used by vegetation.

Because of return flows, the total volume of diversions along a stream can actually exceed the stream's natural flow, since the water is being recycled. Irrigation also directly affects a stream’s hydrologic regime by reducing flows at times through diversions and increasing flows at other times with delayed irrigation returns.

This recycling of return flows is much greater along the Little Laramie River than along the Laramie River, because of the location of most irrigated lands in the valley floor and the system of distributary streams which pick up return flows. Along the Laramie River, where some lands - particularly those along the Pioneer and North Canals - drain into deflation hollows, a much lower percentage of the water is returned to the river for reuse (States West, 1991).

As presented in the Platte River Basin Plan in a discussion of irrigation practices in the Upper Laramie River watershed (Trihydro, 2006):

“Based on assessment of data compiled by the USDA National Agricultural Statistics Service (NASS) for years 1972 through 2001:

- *Alfalfa has typically been cultivated on an average of about 3 percent of* [Upper Laramie River] *subbasin irrigated acreage.*
- *Grass hay has typically been cultivated on an average of about 53 percent of* [Upper Laramie River]*subbasin irrigated acreage.*
- *Irrigated pasture has covered an average of about 44 percent of* [Upper Laramie River]*subbasin irrigated acreage.*
- *Other crops have not been cultivated to a significant extent in the* [Upper Laramie River] *subbasin.”*

Furthermore, the Upper Laramie River Basin Planning Study (WWC, 1991) provides the following description of the Pioneer Canal – Lake Hattie Irrigation district:

“The Pioneer Canal – Lake Hattie Irrigation District is the most prominent irrigation system in the upper Laramie subbasin. It is a combination of two districts – the Pioneer Canal Irrigation District and the Lake Hattie Project, also known as the Laramie Rivers Company. The Pioneer Canal Company was formed in 1879 in Albany County as a means of encouraging economic growth in the area. (Wyoming Tales and Trails, 2004). The canal was constructed in 1879 and enlarged both in 1884 and during the period from 1909 to 1912, when Lake Hattie Dam was constructed (Richardson, 2003). The Lake Hattie Project began in 1903 when a group of men acquired Pioneer Canal Company stock and reorganized the company. (Richardson, 2003). Due to water shortages, the Laramie Rivers Company, comprised of local businessmen, purchased the Lake Hattie system and the Pioneer Canal Company in 1922 (Richardson, 2003). The system is currently operated by the Pioneer Canal – Lake Hattie Irrigation District, which was formed by an order of the Albany County Court in 1988.

The Pioneer Canal diverts water from the Laramie River at a point about three miles downstream of Woods Landing, Wyoming. The canal is about 32 miles long, terminating about three miles northwest of the city of Laramie. The canal provides water for irrigation of approximately 18,360 acres.”

An additional, and on-going, issue related to the irrigation ditches within the Medicine Bow National Forest is the pine beetle epidemic and its related effects on ditch functionality and efficiency. Irrigation ditch maintenance is an expected operating cost for local ditch owners and it is required by the USFS in agreements related to ditches that are located on national forest lands. The pine beetle epidemic has drastically increased the amount of maintenance required for the ditches on forest lands. Although the problem is currently not extensive within the study area, the effects of beetle kill on irrigation ditches is much more evident west of the divide within the Platte River watershed. Within the study area there are approximately 5 miles of ditches that are located on Medicine Bow National Forest lands (Figure 3.3-6). Even though this is a relatively small length of ditches, the maintenance necessary will still increase for the operators of these ditches.

As stated in the Medicine Bow-Routt National Forest: 5/10 Year Forest Plan Monitoring Review (2008):

> *Pine beetle mortality is expected to increase the potential for adverse effects to ditch stability and function. Needle loss from dead trees increases overall debris in ditches. Once the trees start to fall over, the potential for debris dam development increases substantially which can inhibit flows, cause ditch failures through saturation of ditch banks, and overtopping of ditches due to loss of flow capacity. Ditch failures and breaches can significantly affect the soil, water, and aquatic resources through surface erosion and gully development, mass failures, delivery of large quantities of sediment to the stream system, and augmented stream flows to the receiving stream that exceeds the natural stream flow level.*

This pine beetle epidemic will also have effects to the local vegetation and hydrology within the study area. These effects are discussed in Sections 3.4 and 3.5, respectively in this report.

Management Implications:

Within the watershed study area, only 27,241 Acres of irrigated ground are within an irrigation district boundary. This represents only 26% of the total irrigated acreage of which two thirds is within the Pioneer Canal – Lake Hattie Irrigation District and one third is within the Laramie Valley Municipal Irrigation District. The remaining 74% of the irrigated lands being served by a significant number of points of diversion and extensive conveyance infrastructure is not represented by a structured entity.

Data Sources:

Wyoming State Engineers Office (WSEO): *http://seo.wyo.gov/home*
Wyoming Water Development: Office (WWDO): *http://wwdc.state.wy.us/*
Medicine Bow National Forest*: http://www.fs.usda.gov/mbr*

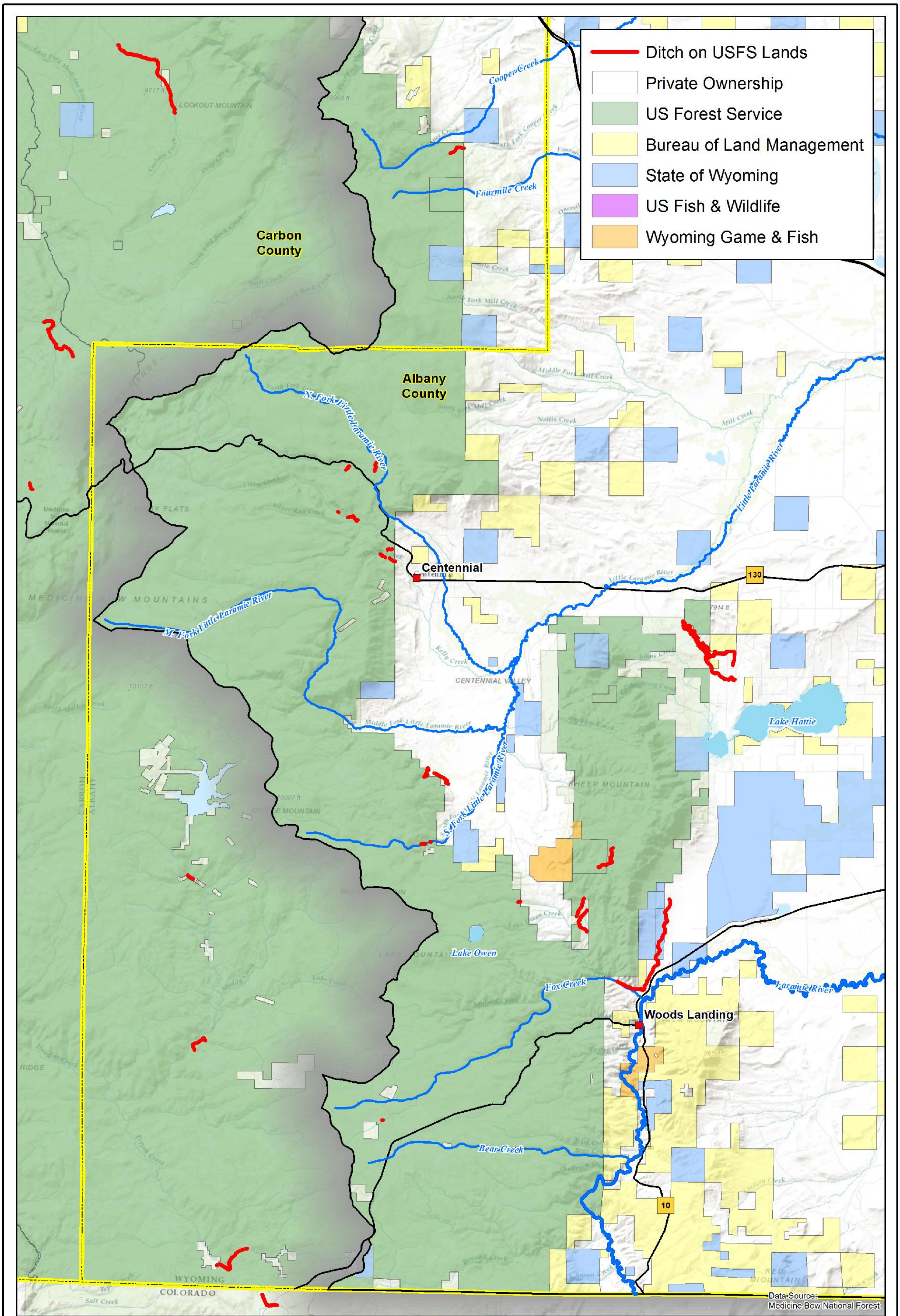


Figure 3.3-6 Upper Laramie River Watershed: US Forest Service Ditches

3.3.4 Range Conditions/Grazing Practices

3.3.4.1 Grazing Allotments Administration

Grazing on federal lands within the Upper Laramie River watershed is administered by the United States Forest Service and the Bureau of Land Management. The USFS-administered allotments (sometimes referred to as rangeland management units or RMUs) are located at higher elevations within the Medicine Bow National Forest on the southeastern and southwestern fringes of the Laramie River valley. There are 14 USFS allotments (RMU) and 86 BLM allotments located within the study area as indicated in Figure 3.3-7. The RMU allotments consist entirely of federal lands as they are located within the Medicine Bow National Forest boundary.

Of the 14 RMU's within the study area, 10 RMU's had Allotment Management Plans (AMPs) available. These were collected, linked to the GIS database, and also incorporated into the Digital Library delivered with this project. The four RMU's without AMP's are either no longer active grazing allotments and are vacant or have no livestock grazing permit and are managed for wildlife (AMP's are long-term operating plans for grazing allotments on public land prepared and agreed to by the permittee and appropriate agency).

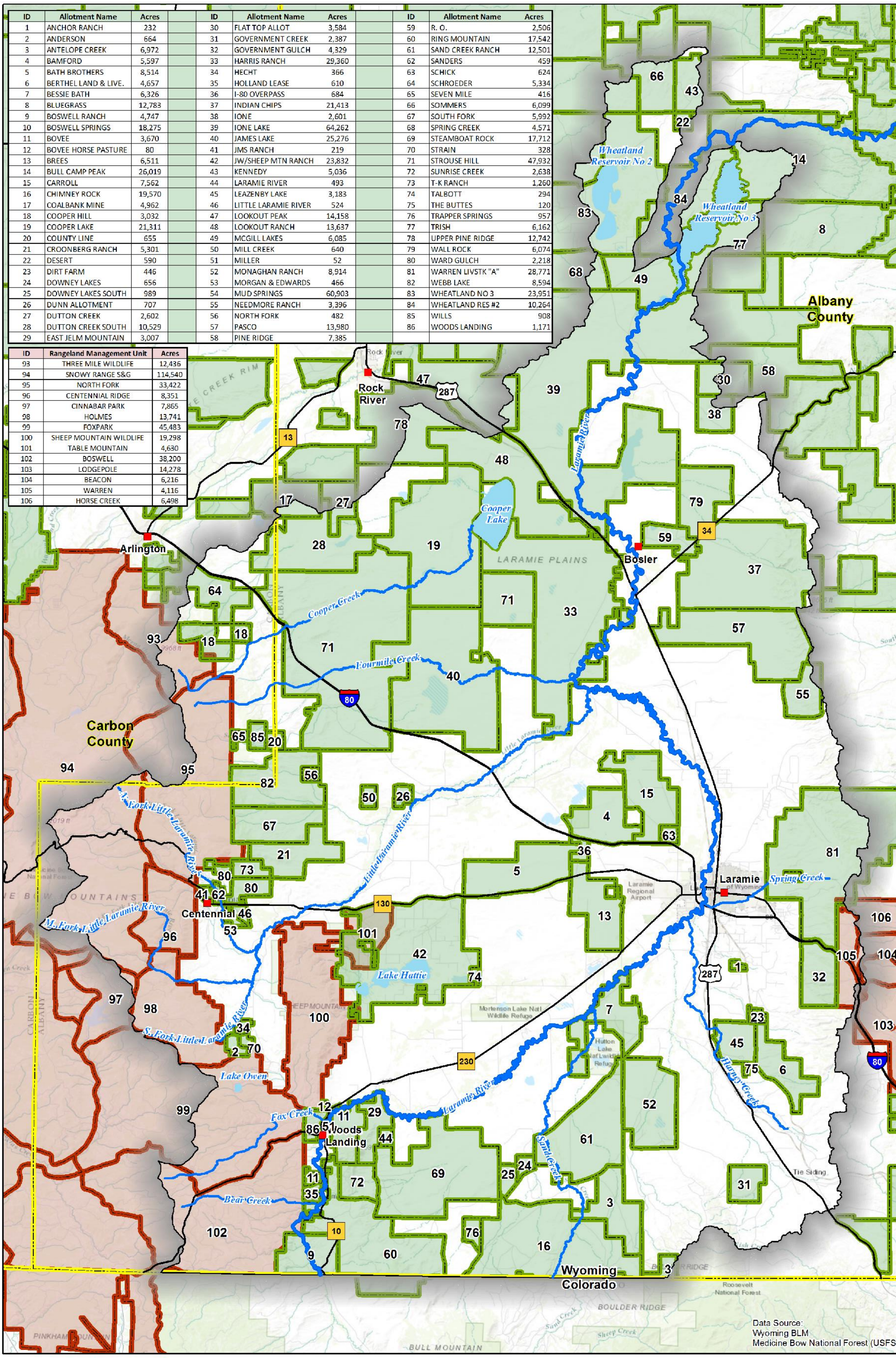
The BLM-administered allotments are administered by the Rawlins Field Office (Rawlins Resource Management Plan approved in 2008). The Rawlins RMP provides a comprehensive framework for managing and allocating use of public lands and resources administered by the BLM in the Rawlins Field Office.

Under the umbrella of this plan, management of BLM grazing allotments is carried out are managed in accordance with the principles of multiple use and sustained yield embodied in the Federal Land Policy and Management Act (1976) and the Taylor Grazing Act (1934). More information describing the BLM's grazing management standards and guidelines can be found online at:

http://www.blm.gov/wy/st/en/programs/grazing.html

The BLM's grazing management guidelines which are pertinent for this watershed study include the following objectives (BLM, 1997):

- Ensure that conditions after grazing use will support infiltration, maintain soil moisture storage, stabilize soils, release sufficient water to maintain overall system function, and maintain soil permeability rates and other appropriate processes;
- Restore, maintain, or improve riparian plant communities to sustain adequate residual plant cover for sediment capture and groundwater recharge.
- Implement riparian improvements to maintain or enhance stream channel morphology.
- Develop springs, seeps, reservoirs, wells or other water development projects in a manner protective of watershed ecological and hydrological functions.



ID	Allotment Name	Acres	ID	Allotment Name	Acres	ID	Allotment Name	Acres
1	ANCHOR RANCH	232	30	FLAT TOP ALLOT	3,584	59	R. O.	2,506
2	ANDERSON	664	31	GOVERNMENT CREEK	2,387	60	RING MOUNTAIN	17,542
3	ANTELOPE CREEK	6,972	32	GOVERNMENT GULCH	4,329	61	SAND CREEK RANCH	12,501
4	BAMFORD	5,597	33	HARRIS RANCH	29,360	62	SANDERS	459
5	BATH BROTHERS	8,514	34	HECHT	366	63	SCHICK	624
6	BERTHEL LAND & LIVE.	4,657	35	HOLLAND LEASE	610	64	SCHROEDER	5,334
7	BESSIE BATH	6,326	36	I-80 OVERPASS	684	65	SEVEN MILE	416
8	BLUEGRASS	12,783	37	INDIAN CHIPS	21,413	66	SOMMERS	6,099
9	BOSWELL RANCH	4,747	38	IONE	2,601	67	SOUTH FORK	5,992
10	BOSWELL SPRINGS	18,275	39	IONE LAKE	64,262	68	SPRING CREEK	4,571
11	BOVEE	3,670	40	JAMES LAKE	25,276	69	STEAMBOAT ROCK	17,712
12	BOVEE HORSE PASTURE	80	41	JMS RANCH	219	70	STRAIN	328
13	BREES	6,511	42	JW/SHEEP MTN RANCH	23,832	71	STROUSE HILL	47,932
14	BULL CAMP PEAK	26,019	43	KENNEDY	5,036	72	SUNRISE CREEK	2,638
15	CARROLL	7,562	44	LARAMIE RIVER	493	73	T-K RANCH	1,260
16	CHIMNEY ROCK	19,570	45	LEAZENBY LAKE	3,183	74	TALBOTT	294
17	COALBANK MINE	4,962	46	LITTLE LARAMIE RIVER	524	75	THE BUTTES	120
18	COOPER HILL	3,032	47	LOOKOUT PEAK	14,158	76	TRAPPER SPRINGS	957
19	COOPER LAKE	21,311	48	LOOKOUT RANCH	13,637	77	TRISH	6,162
20	COUNTY LINE	655	49	MCGILL LAKES	6,085	78	UPPER PINE RIDGE	12,742
21	CROONBERG RANCH	5,301	50	MILL CREEK	640	79	WALL ROCK	6,074
22	DESERT	590	51	MILLER	52	80	WARD GULCH	2,218
23	DIRT FARM	446	52	MONAGHAN RANCH	8,914	81	WARREN LIVSTK "A"	28,771
24	DOWNEY LAKES	656	53	MORGAN & EDWARDS	466	82	WEBB LAKE	8,594
25	DOWNEY LAKES SOUTH	989	54	MUD SPRINGS	60,903	83	WHEATLAND NO 3	23,951
26	DUNN ALLOTMENT	707	55	NEEDMORE RANCH	3,396	84	WHEATLAND RES #2	10,264
27	DUTTON CREEK	2,602	56	NORTH FORK	482	85	WILLS	908
28	DUTTON CREEK SOUTH	10,529	57	PASCO	13,980	86	WOODS LANDING	1,171
29	EAST JELM MOUNTAIN	3,007	58	PINE RIDGE	7,385			

ID	Rangeland Management Unit	Acres
93	THREE MILE WILDLIFE	12,436
94	SNOWY RANGE S&G	114,540
95	NORTH FORK	33,422
96	CENTENNIAL RIDGE	8,351
97	CINNABAR PARK	7,865
98	HOLMES	13,741
99	FOXPARK	45,483
100	SHEEP MOUNTAIN WILDLIFE	19,298
101	TABLE MOUNTAIN	4,630
102	BOSWELL	38,200
103	LODGEPOLE	14,278
104	BEACON	6,216
105	WARREN	4,116
106	HORSE CREEK	6,498

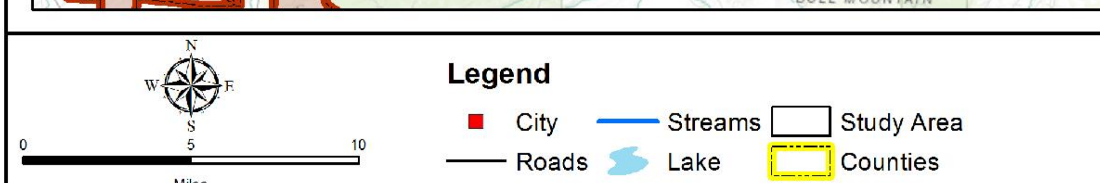


Figure 3.3-7 Upper Laramie River Watershed: BLM Grazing Allotments and USFS Rangeland Management Units

- Implement range improvements away from riparian areas to avoid conflicts in achieving or maintaining riparian function.
- Adopt management practices and implement range improvements that protect vegetative cover and thereby maintain, restore, or enhance water quality.

A set of six standards have been established to meet the above guidelines (BLM, 1997). Each standard sets a specific objective, explains the function and importance of the objective, and provides indicators to assess the attainment of the objective. Detailed information regarding the BLM standards and guidelines is available in the Standards for Healthy Rangelands and Guidelines for Livestock Management document provided in the Digital Library delivered with this report.

BLM allotments typically consist entirely of federal land; however, in the study area, the majority are a mixture of private, state, and federal land ownership. In the study area, of the roughly 527,000 acres of land within BLM allotments, only about 97,000 acres, or 18% of the land is owned by BLM. Because these allotments do not have extensive amounts of federal land, AMP's were not created and the allotments were assigned a "custodial" classification. Consequently, AMP's were not available for any of the 86 allotments in the watershed. Staff with Rawlins BLM office, informed us that many of the custodial allotments within the study area have not been grazed in years and are now managed more as wildlife habitat and will likely stay that way. Further, cattle and sheep numbers have decreased with urbanization and subdivision (BLM, 2007). It is worth noting that the term "custodial" is an antiquated term and is no longer used within the BLM but remains as an attribute within the GIS data available. BLM has recently implemented the Assessment, Inventory, and Monitoring Strategy (AIM Protocol), which is a more landscape-based monitoring strategy that replaces many of the previous methodologies of allotment management.

Assessment of allotments in the study area and comparison to the Standards and Guidelines was conducted in 2007 by staff of the Rawlins Field Office. The results of the assessment are published in the document "Big Laramie River Watershed: Standards and Guidelines Assessment 2007 Field Season" (BLM, 2007). According to that document, cattle operations vary between grazing of cow-calf pairs, yearling steers, and yearling and/or second-year heifers. Grazing use occurs during various portions of the spring/summer/fall seasons, ranging from season-long to deferred and/or rotational use (BLM, 2007).

The document further describes current conditions (as of 2007) and compares them to the Standards and Guidelines. With respect to upland conditions, it describes the overall range conditions in the following extracted text:

> *"In general, varied livestock uses have resulted in assorted impacts to vegetation throughout the watershed. In many grazing allotments, summer grazing by cattle is the best-suited use by domestic livestock due to environmental, topographical, and climatic limitations. Vegetation may be impacted to various extents when grazed during its growing period. This type of use also tends to primarily impact the herbaceous component of the vegetation community, except where young, available, palatable shrub seedlings are abundant. Wildlife use in the watershed, usually seasonal,*

tends to impact different components of the vegetation communities than does domestic livestock use.

Mule deer use concentrates primarily on shrub or "browse" species and is most pronounced on winter ranges where the animals concentrate for extended periods. Elk use impacts both the herbaceous and browse components of the communities, usually at higher elevations throughout the year (dependent on the severity of winter weather).

Pronghorn use impacts tend to be most noticeable in the lower elevation sagebrush, where they may be concentrated during the winter, but more nomadic than other species (somewhat mitigating their impacts). These differences in impacts tend to affect vegetation communities as species are favored or shunned in various management/use scenarios, leading to shifts in overall community make-up. Vegetative traits such as species abundance, vigor, diversity, and age/structure classes are all affected. These trends occur in addition to those which are influenced as a function of natural conditions (e.g., wetter to drier sites, slope, aspect, soil depth, and material).

Like very much of most public lands the high elevation shrub stands, vegetation within the mule deer and elk winter habitat zone have experienced many years of fire suppression. Natural treatment events have been aggressively suppressed, in particular fire, for decades. As with higher elevation vegetation, this has allowed monotypic shrub stands to be dominated by mature-to-decadent, even-age classes of shrubs. Vegetation generally exhibits high vigor, plant density, and diversity where BMPs have been initiated; however, the consequences of fire suppression are beginning to take hold. Increasing urbanization of the assessment area is likely to support more suppression. Lower elevation wind-blown plateaus that are usually available and stay relatively snow free in all but the most severe winters, are used by wintering and/or migrating wildlife as transitional or crucial winter range. Because vegetation communities in these specific areas are used throughout the year by wildlife and become heavily-used by concentrated populations during most, if not all, winter months, the preferred browse species are comprised of even-aged and structured, mature-to-decadent shrub stands.

Low larkspur occurs on a number of allotments in the Upper Laramie watershed and dictates grazing regimes and grazing cycles where present. As low larkspur is highly toxic to cattle in the spring, many upland pastures with adequate forage cannot be utilized until after the growing season. Best management practices recommend no growing season use in riparian areas or areas in need of rest. Not being able to utilize a considerable portion of upland pastures during the growing season constrains the implementation of grazing BMPs in a number of allotments in this watershed.

Death camas and locoweed are also an issue in certain allotments of the Upper Laramie watershed for the same reasons. Death camas is one of the first plants to produce growth in spring. Livestock poisonings usually occur when animals are put on the range in early spring before more palatable *plant species are available. Sheep are most commonly poisoned. Death camas is a native, cool-season, perennial forb. It reproduces from seed, with pollination effected by syrphid flies and solitary bees. It can also reproduce vegetatively by bulb offsets. Death camas grows in dry, loamy to gravelly soils and is commonly found at 4,000 to 7,500 feet (1,300-2,600 m) in elevation throughout its range. It begins its growth in early spring and flowers from May to June. Locoweed causes locoism in all classes of livestock. The toxin in locoweed is an indolizidine alkaloid, swainsonine that causes chronic neurological damage. Livestock must consume large amounts of locoweed for 1 to 3 months before death occurs. Signs of poisoning will appear after 2 to 3 weeks of continuous grazing. Symptoms are rough coats, nervous disorders such as trembling and paralysis, uncoordinated muscle movements, blindness, constipation, and emaciation. Most cattle will readily graze locoweed in the spring when grass is scarce. Sheep and cattle can become chemically addicted to locoweed and will continue to graze it when grass becomes abundant. They are, however, more resistant than horses to its toxic effects.*

Horses never recover once poisoned. Cattle gain weight slowly and often have abortions, while sheep have a high number of abortions after grazing locoweed. Locoweed is poisonous to deer and elk if consumed in large quantities. The concentration of this toxin remains constant in leaves throughout the grazing season.

Overall, vegetation in the Big Laramie River watershed can be considered to be in good condition relative to the seral stage to which it has developed. Desirable species (including herbaceous and browse species important for livestock and wildlife forage, as well as those important for ground cover) are present at worst, usually found in locations where they are less available or vulnerable to grazing animals, and are prevalent at best, found interspersed throughout the various plant communities, with high vigor and density. Although less desirable increaser species are present in varying degrees throughout the watershed, in most cases, their presence does not indicate poor health or nonfunctional vegetation communities. Throughout various portions of the watershed, upland invader and weed species can be found. Additionally, implementation of various BMPs, as well as application of various control methods, can be utilized to manage, if not eliminate, many of these small-scale infestations. On the small amount of BLM administered lands in the assessment area, indications and observations are of properly functioning upland vegetation communities."

On USFS lands, livestock grazing is permitted and governed through a permit system, Allotment Management Plans (AMPs) and Annual Operating Instructions. General grazing management on Medicine Bow National Forest lands is addressed in the Medicine Bow National Forest Final Environmental Impact Statement included in the Digital Library delivered with this report.

State Grazing Leases. Most of the state lands within the study area are leased to private landowners for grazing. These leases are typically issued by the Board of Land Commissioners and administered by the Wyoming OSLI. Management practices and improvements on state lands are usually established and implemented by the lessee. Improvements are typically paid for and owned by the lessee. Upon transfer of the state lease, the new lessee reimburses the previous lessee for improvements.

Grazing on Private Lands. Grazing practices on private lands are established by the landowner, often with technical assistance from the local NRCS staff and/or a range consultant. Range improvement projects implemented under NRCS programs (e.g., EQIP or PL566) follow the guidelines established in the plan of operations developed for the property and/or applicable NRCS technical guidelines as adapted for local conditions.

3.3.4.2 Existing Upland Water Supply

There are numerous upland water supply sources (springs, wells, perennial streams, etc.) within the watershed, and many range improvement projects have been completed which utilize these sources. Typical projects include livestock/wildlife water tanks, livestock/wildlife reservoirs, spring developments with pipelines providing water to remote stock tanks, well construction, etc. Figure 3.3.8 displays a map of viable livestock/wildlife water sources. This GIS dataset shown in the figure was prepared by combining information from several sources:

1. Mapping of stock reservoirs and other watershed improvements (i.e., pipelines, and stock tanks) was obtained from the Rawlins Field Office of the BLM and the USFS.
2. Stock reservoir locations were obtained from the Wyoming State Engineer's Office.
3. Well locations were obtained from the Wyoming State Engineer's Office (SEO). Wells designated for stock watering use were included in the database.
4. Interviews with landowners were conducted during project meetings and in the field. During these interviews, locations of existing sources were documented and the information incorporated into the project GIS.
5. Aerial photography was reviewed within the GIS environment to document visible features (i.e. stock reservoirs, stock tanks), and give an initial assessment of their condition.

Mapping of springs was also obtained from both BLM and the USFS. These data would include springs as yet unpermitted by the WSEO. However, springs were not included in the upland water source dataset because there was insufficient information to determine if the spring provided a location where livestock/wildlife could physically drink or not. These data are, however, available within the Project GIS for later review, use, and analysis.

The combined results of this effort indicated there are 1,216 stock reservoirs/ponds and 239 stock tanks in the watershed. Field inspection of these sites was beyond the scope and budget of this project; however, a reasonable estimate of the viability of the reservoirs and stock tanks was desired.

In order to refine and improve the quality of the stock reservoir features, an evaluation of each reservoir's viability was made by overlaying their locations on aerial photography (July-August 2009, July 2011, July-August 2012, and June-September 2015) and viewing the condition of each. Reservoirs containing water in multiple years of photography or showed no signs of physical breaches or sedimentation were determined to be functional water sources. Physical breaches were visible on several of the reservoirs

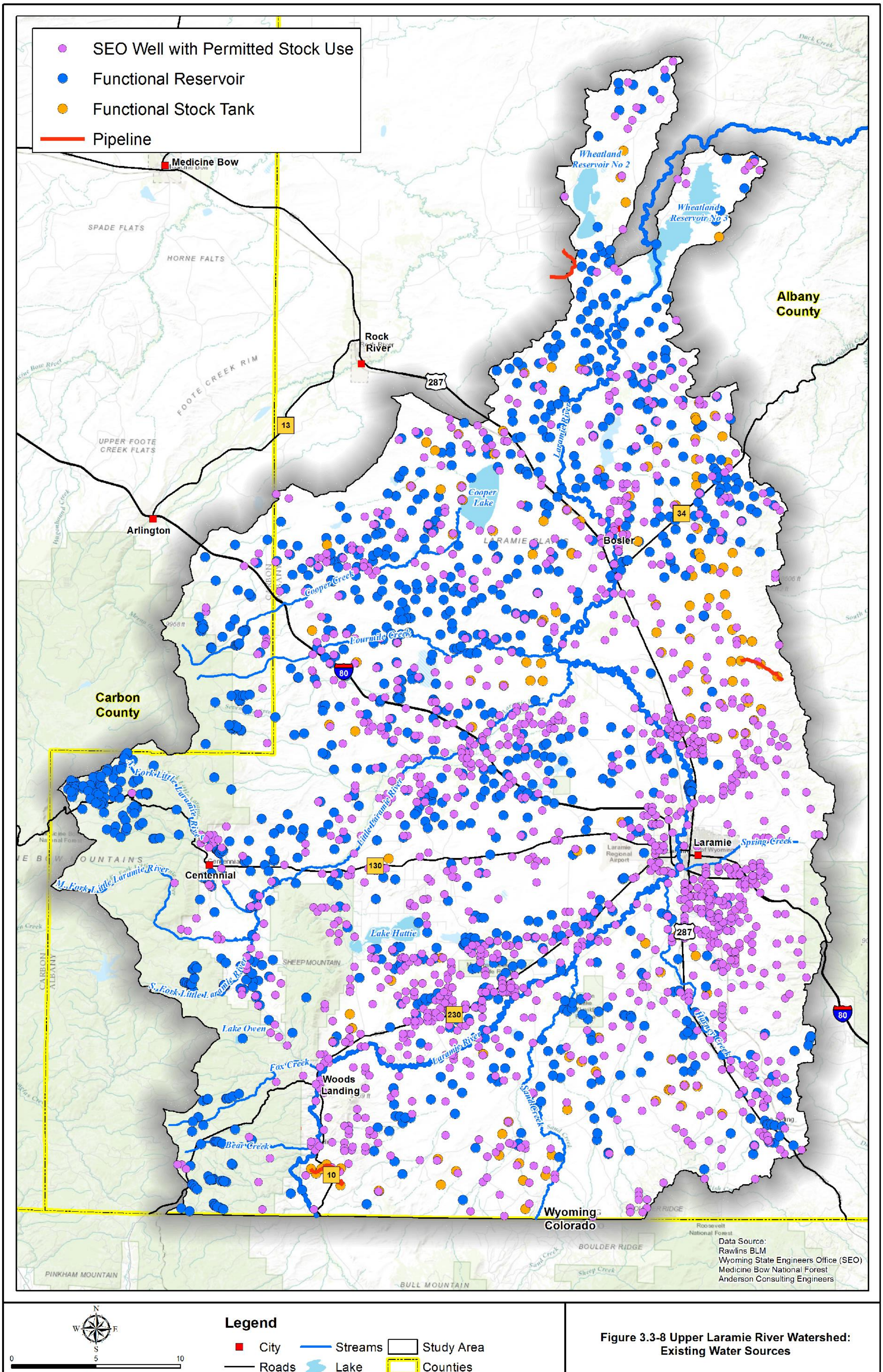


Figure 3.3-8 Upper Laramie River Watershed: Existing Water Sources

resulting in a classification of “non-functional”. Likewise, if a reservoir was visibly filled with sediment it also classified as “non-functional”. Reservoirs containing water in one year of photography or showed no visible signs of damage were classified as “potential” water sources, as firm conclusions on water reliability could not be drawn. Figure 3.3-9 displays an example of this process. Evaluation of the stock tank functionality was again based on multiple years of available imagery. If the tank was visibly wet in several years of imagery and/or was clearly surrounded by cows it was considered functional (Figure 3.3-10). If the tank was clearly present in the imagery but there were no clues as to its functionality, the tank was classified as a “potential” water source. GIS data delivered with this report has more detailed notes related to the status of each point collected.

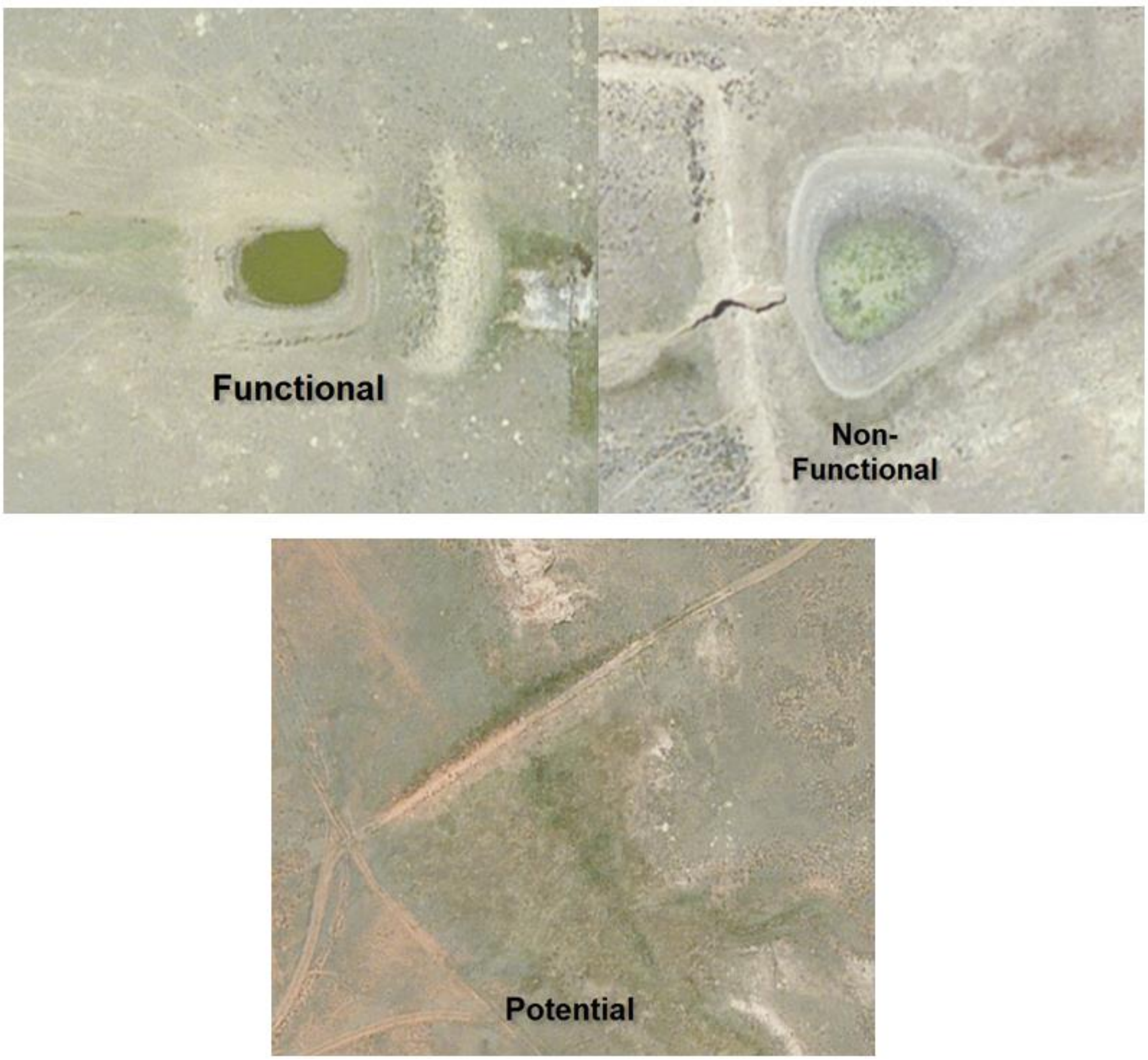


Figure 3.3-9 Evaluation of Stock Reservoirs within the GIS Environment.

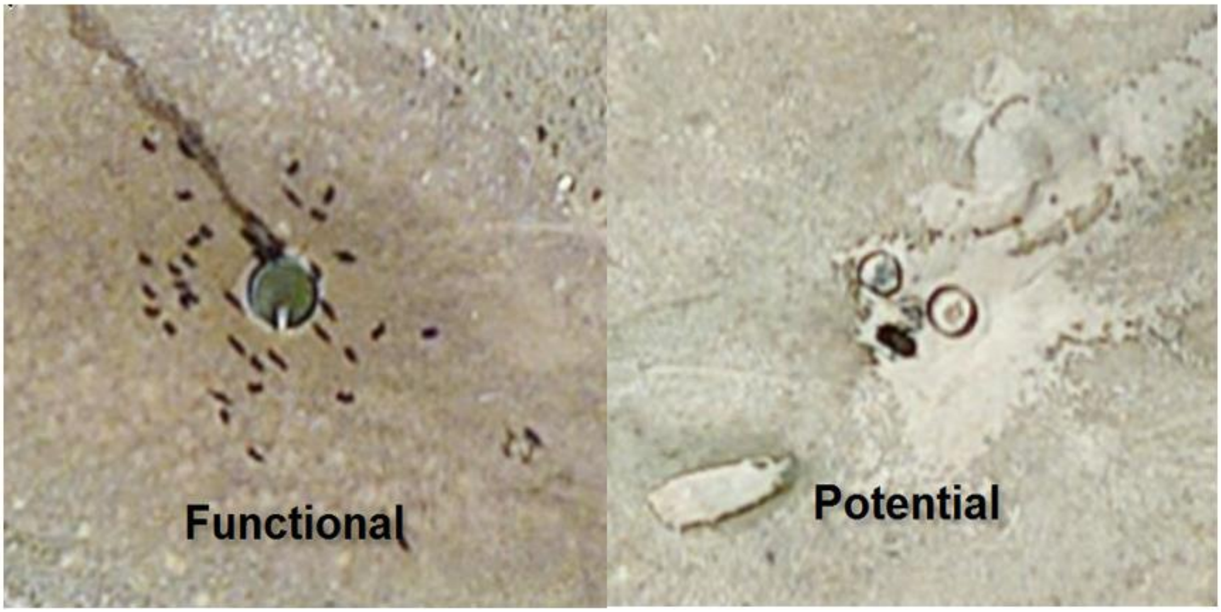


Figure 3.3-10 Evaluation of Stock Tanks within the GIS Environment.

Based upon this analysis, it appears that of the 1,216 reservoirs identified:

- a minimum of 1,078 reservoirs are "functional" water sources,
- 52 are "potential" water sources, and
- 86 reservoirs are "nonfunctional" water sources.

The stock tank analysis indicates that:

- 149 stock tanks were classified as "functional" water sources and
- 90 were classified as "potential" water sources in need of a site visit to truly determine functionality.

Figure 3.3-11 presents the results of this analysis and Appendix 3A presents the results in a tabular format.

Note that the dataset displayed in Figure 3.3-11 does NOT include surface water sources such as perennial streams, intermittent streams, or springs. A primary objective of this study is to evaluate opportunities to provide wildlife and livestock water in addition to those sources. Because they do not presently appear to provide sources of water to livestock or wildlife, reservoirs and stock tanks classified as "potential" or "non-functioning" are also not included in the figure.

This GIS dataset is not expected to be an exhaustive accounting of all available sources. Field mapping and validation of all sources within the watershed was beyond the scope and feasibility of this study.

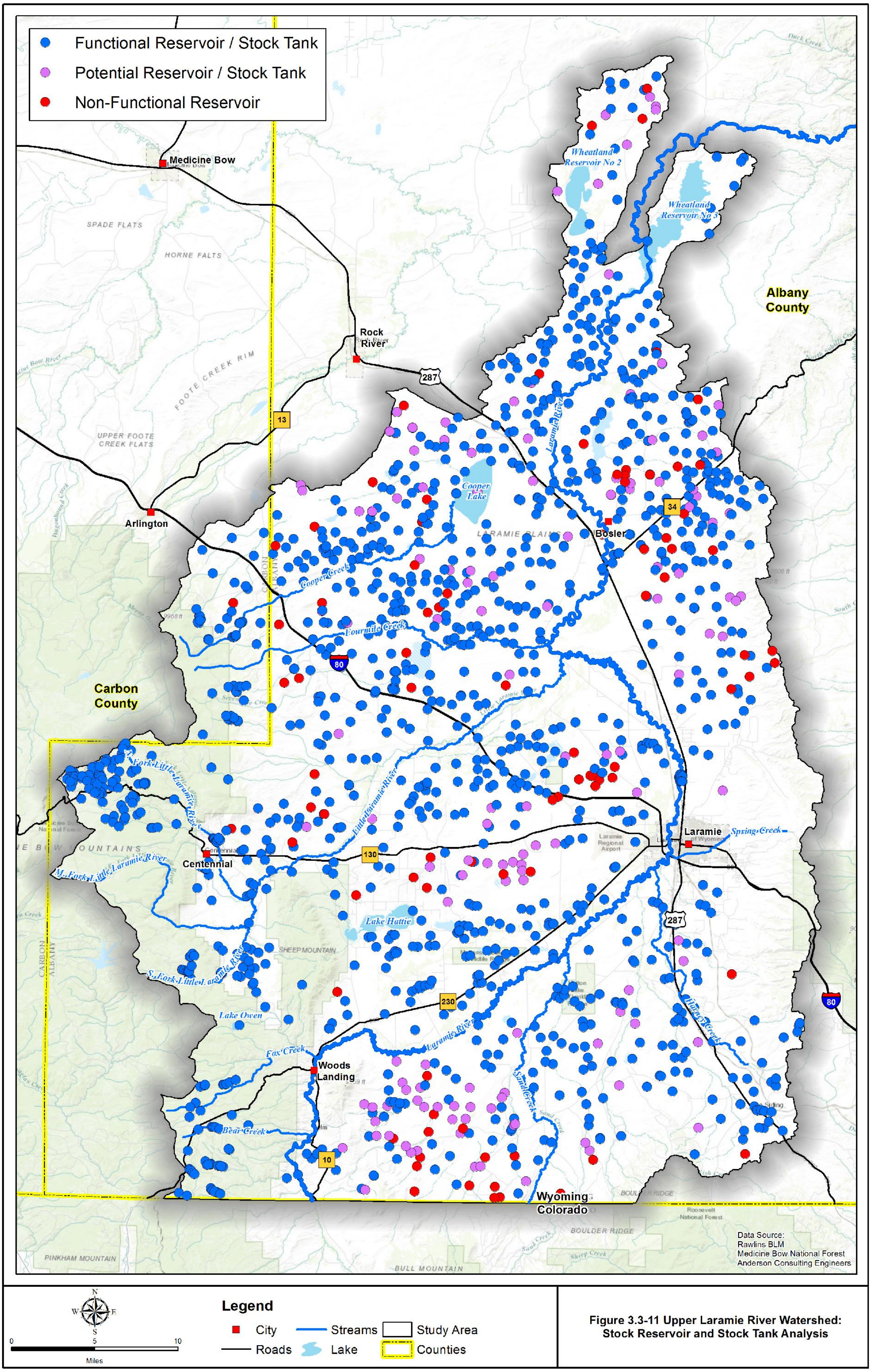


Figure 3.3-11 Upper Laramie River Watershed: Stock Reservoir and Stock Tank Analysis

3.3.4.3 Ecological Site Descriptions

The concept of "Ecological Sites" is described by the NRCS as follows:

"A distinctive kind of land with specific soil and physical characteristics that differs from other kinds of land in its ability to produce distinctive kinds and amounts of vegetation, and in its ability to respond similarly to management actions and natural disturbances."

Ecological sites incorporate environmental factors such as climate, soils, landform, hydrology, vegetation, and natural disturbance regimes that together define the site and its relationships between these factors and how they influence plant community composition (Caudle et al., 2013). The characteristics differentiating ecological sites and their features are documented as an ecological site description (ESD), which includes the following:

- Data used to define the distinctive properties and characteristics of the sites;
- Biotic and abiotic characteristics that differentiate the site (i.e., climate, physiographic, soil characteristics, plant communities); and
- Ecological dynamics including how changes in climate, disturbance processes and management can affect the site.

An ESD includes interpretations about the land uses that a specific ecological site can support and management alternatives for achieving objectives. ESDs are valuable tools that can be used to help landowners and managers make decisions through evaluating the condition or health of a site by comparing the current vegetation composition to the type of plants the site is capable of growing. The ecological sites and associated descriptions were developed over many years of data collection and range site monitoring and are dependent on the location of a site within defined precipitation zones and existing soil characteristics.

ESDs reports are available from the NRCS that describe the following for each Ecological Site:

- Site Characteristics: Identifies the site and describes the physiographic, climate, soil, and water features associated with the site.
- Plant Communities: Describes the ecological dynamics and the common plant communities comprising the various vegetation states of the site. The disturbances that cause a shift from one state to another are also described.
- Site Interpretations: Interpretive information pertinent to the use and management of the site and its related resources.
- Supporting Information: Provides information on sources of information and data utilized in developing the site description and the relationship of the site to other ecological sites (NRCS, 2009).

ESDs are available from the NRCS at:
https://esis.sc.egov.usda.gov/Welcome/pgReportLocation.aspx?type=%20ESD

The ESDs can be used to compare what is growing on the rangeland with what each site is capable of growing. By comparing the present vegetative composition to the potential compositions, the relative health of the range resource can be evaluated. Production of each site is closely related to the ecological condition of the site. Ecological Sites are defined based upon their location within defined Ecological Precipitation Zones and soil characteristics. Figure 3.3-12 displays the ecological precipitation zones found in the watershed.

Using database tools provided by the NRCS, the available soils mapping was evaluated and Ecological Sites defined within the study area. Detailed soils mapping was available for approximately 87% of the study area. The area within the Medicine Bow National Forest did not have detailed soils data available therefore ESD's were not able to be produced for the 13% of the watershed within the National Forest (Please refer to Section 3.4.4 for a discussion of soils mapping availability). Also please note that even if there is soils data available there may not be an associated ESD that can be calculated. For example, the rock outcrop, mines, dumps, urban land, and water are all soil map unit values in the soils data for which ESD's cannot be calculated. Figure 3.3-13 displays the locations of the major ecological sites where the 1:24,000 soils mapping was available.

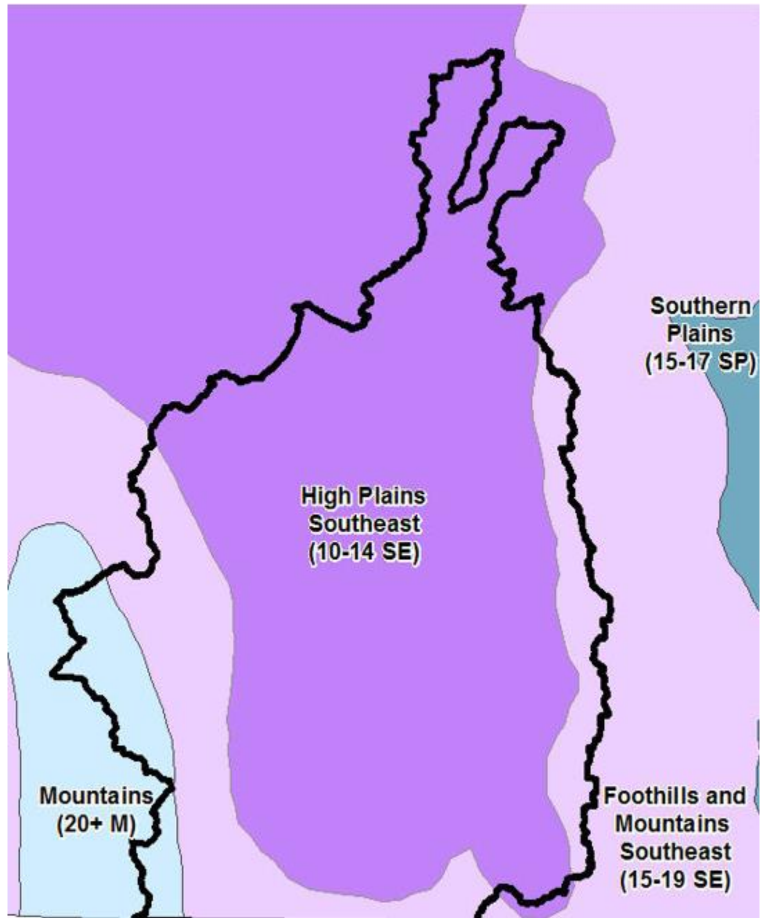


Figure 3.3-12 Ecological Precipitation Zones.

Based upon the mapping which is available, the ecological sites which are predominant are:

- Loamy (Ly) 10-14" P.Z., High Plains Southeast
- Sandy (Sy) 10-14" P.Z., High Plains Southeast
- Saline Loamy (SnLy) 10-14" P.Z., High Plains Southeast

Specific on-site evaluation of local ESD type and condition is required prior to development of site specific management plans. Ecological Site Interpretations associated with these ESDs are extracted from the NRCS descriptions (NRCS, 2014) and included as Appendix 3B. Additionally, every available ESD report has been linked with the GIS data delivered with this report.

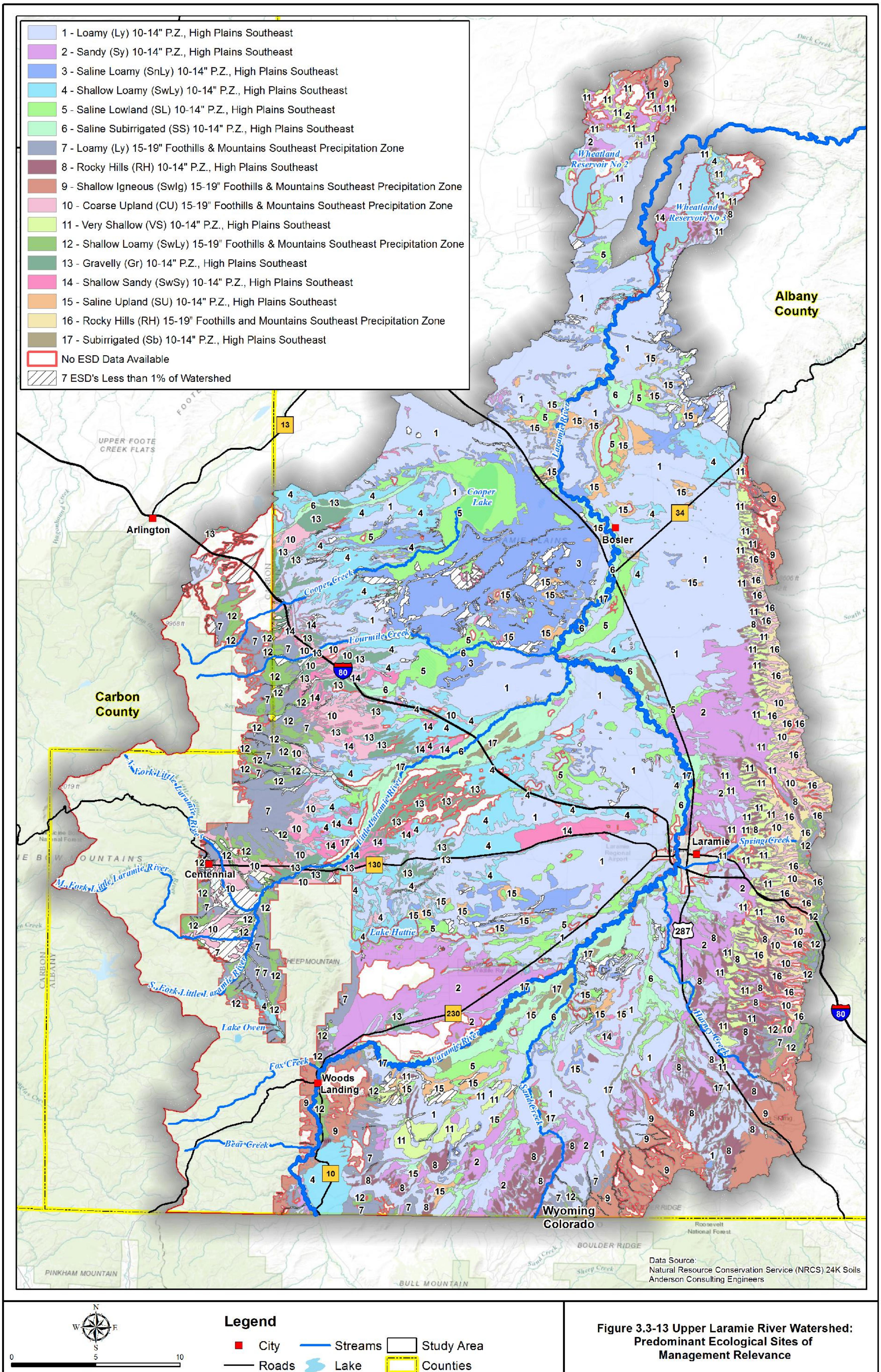


Figure 3.3-13 Upper Laramie River Watershed: Predominant Ecological Sites of Management Relevance

Management Implications:

Grazing management and the overall health of the watershed may benefit substantially with well-distributed, reliable water. Despite the relatively ample water supplies within portions of the watershed, good grazing systems control both the duration (amount of time spent in an area), and the seasonal timing that the livestock / wildlife spend in any given area. Grasses and other plants need to recover from the last livestock / wildlife grazing event before being grazed again because food reserves in the roots must be utilized for new plant growth. If root reserves are not restored, the plants are weakened and may eventually die. Less desirable plants can potentially invade and take over and plant densities decrease. In the absence of well-distributed livestock /wildlife water, areas near water (frequently riparian areas) are potentially grazed heavily while many other areas may be underutilized. As stated above, water sources must also be reliable so that each pasture can be used as needed in a grazing rotation.

Due to the fact that plants grow rapidly during the growing season, re-growth is frequently grazed multiple times during each grazing period, resulting in depleted root reserves. Because of this, it is often desirable to combine herds so livestock can spend shorter time periods in one pasture. This requires adequate quantities of water to accommodate larger herds. Within the central and lower portions of the watershed, conditions are dryer and water supplies are extremely limited.

In addition to restoration of more healthy conditions, continuing adjustments in overall range management will contribute to the maintenance, recovery, or improvement of a variety of interrelated aspects of watershed function, including but not necessarily limited to:

- ***Improved infiltration of snowmelt and rainfall;***
- ***Retention of soil moisture;***
- ***Groundwater recharge;***
- ***Sustained release of soil moisture and groundwater as seeps/springs; and***
- ***Stabilization of soils against erosion into streams.***

In general, most range improvement practices which improve watershed and livestock values also improve wildlife habitat values. With important and sensitive species found within the watershed, such as sage grouse, care must be taken to ensure that practices are beneficial rather than detrimental to their habitat values. Examples of this include the need for mixed age stands of sagebrush, adequate vegetative residues, wildlife escape ramps from livestock tanks, and provisions for wildlife water.

Alternatives to address the need for additional wildlife/livestock watering sites are presented in Section 4.3. Potential management practices and improvements to address other rangeland/grazing related issues are included in Section 4.7. It is important to consider that, to be cost-effective, any range improvement practices/facilities that may be implemented must be followed up with a good grazing system. Otherwise, any short term gains will be lost, and often made worse. The key to any good grazing system is often a good, reliable livestock water system; this usually is the most cost-effective practice to

initiate the process. The best value for the investment of resources frequently occurs on the more productive land. Land that is too steep or shallow can only show limited returns on investments.

Data Sources:

Wyoming Bureau of Land Management (BLM) : http://www.blm.gov/wy/st/en.html
Medicine Bow National Forest (MBNF)*: http://www.fs.usda.gov/mbr*
Natural Resource Conservation Service (NRCS):
http://www.nrcs.usda.gov/wps/portal/nrcs/site/wy/home/

3.3.5 Oil and Gas Production and Resources

There are numerous pipelines within the study area for natural gas and other fuel products. As shown on Figure 3.3-14, most of the pipelines are located along the main transportation route I-80. The lone crude oil pipeline crosses the northernmost portion of the watershed above Wheatland No. 2 reservoir.

Mapping of the pipelines provided by Wyoming State Geological Survey (WSGS) are coarse in nature with poor accuracy; presumably for security reasons. Consequently, the pipelines indicated are approximations of alignment only. This figure also displays WSGS data for the several oil fields located west of Laramie that have been documented within the study area.

The locations of all active and permanently abandoned oil and gas wells were obtained from the Wyoming Oil and Gas Conservation Commission (WOGCC). Active wells and permanently abandoned wells within the study area are shown on Figure 3.3-15.

In an effort to assist the conservation districts in their ongoing efforts to monitor conditions of existing resources, the project team conducted a preliminary screening of reclamation success associated with abandoned oil and gas field wells. Within the project GIS and using available aerial photography, analysts visually evaluated each site to assess its degree of vegetation establishment. Using locations of all abandoned wells in the study area (WOGCC, 2016), each site was designated one of four vegetation categories. The categories are described as follows:

Vegetated:	Obvious vegetation establishment and a lack of discernible erosional features.
Partially Vegetated:	Mixed establishment of vegetation and / or minor erosional features visible.
No Vegetation:	Distinct lack of established vegetation and / or obvious erosional features.
Redeveloped:	Previously abandoned site has been redeveloped with a new well head.

Figure 3.3-16 displays an example of this process. Note that all references to relative extent in vegetative cover are made in relation to the surrounding native ground. In addition, one must keep in mind that the plant species cannot be determined using this process, only the relative cover. Consequently, a fully vegetated abandoned well pad could be covered with undesirable weed species and be classified as vegetated under this procedure. Using these visual classifications, each of the abandoned well sites was evaluated.

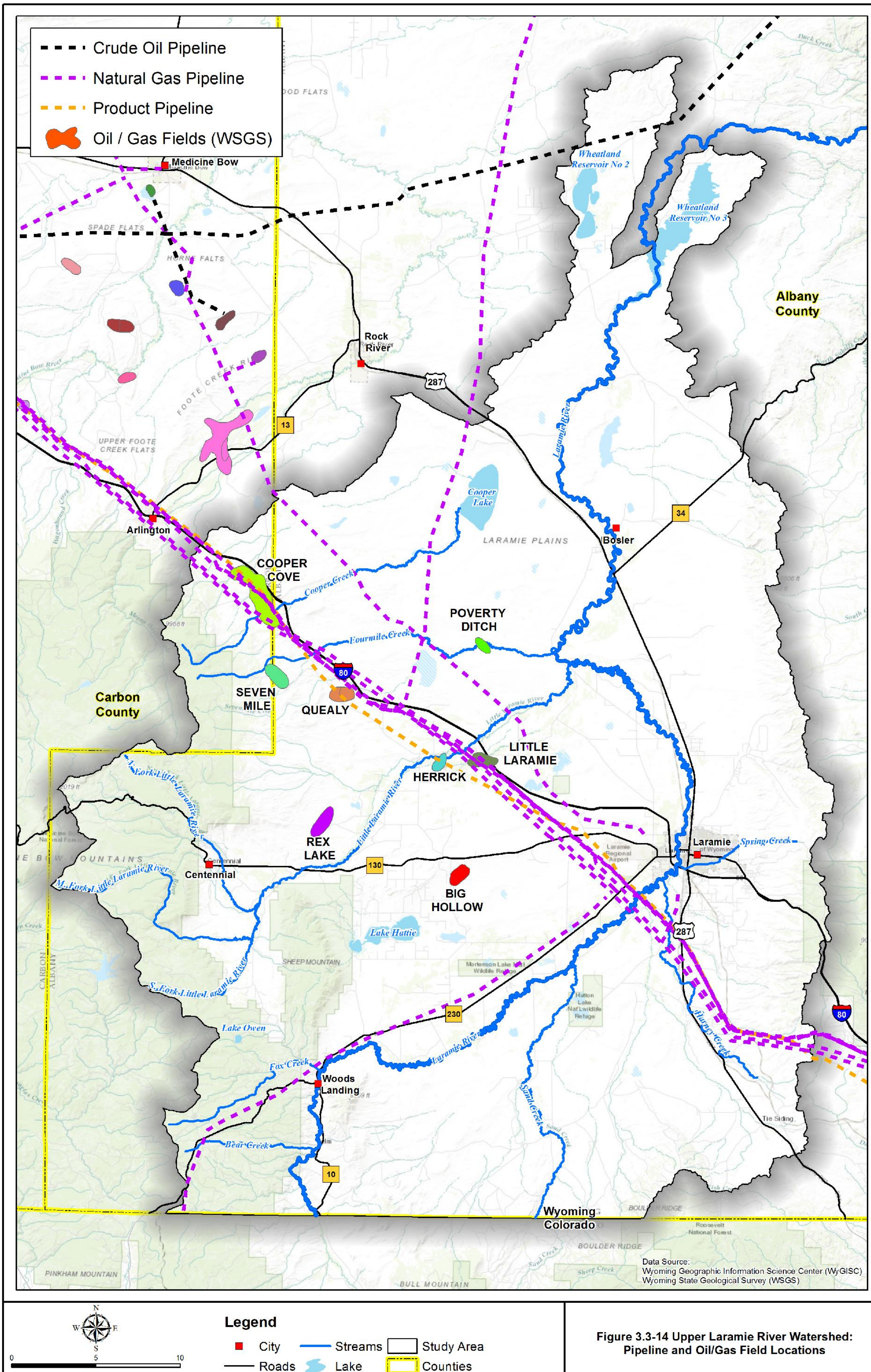


Figure 3.3-14 Upper Laramie River Watershed: Pipeline and Oil/Gas Field Locations

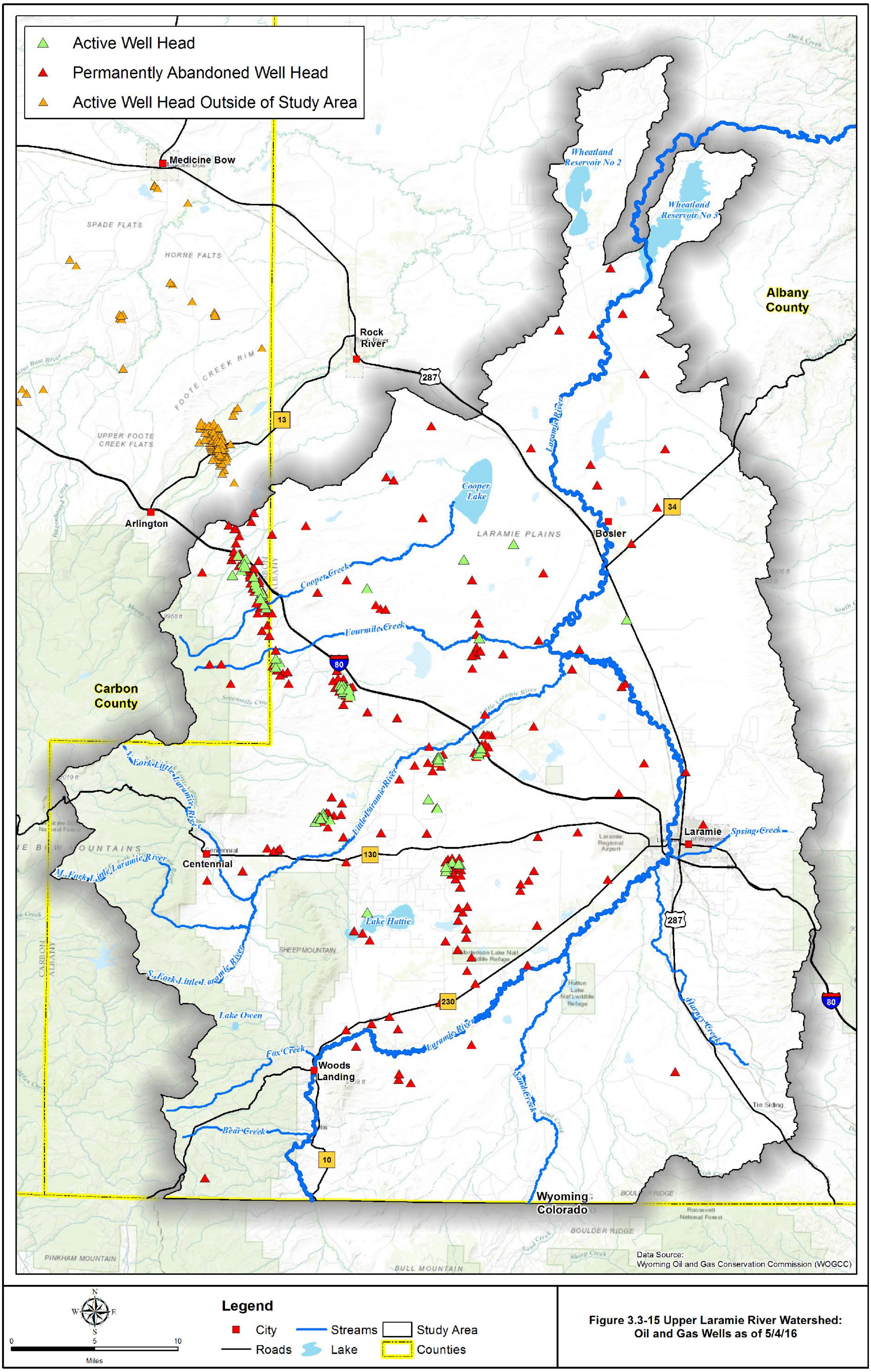


Figure 3.3-15 Upper Laramie River Watershed: Oil and Gas Wells as of 5/4/16

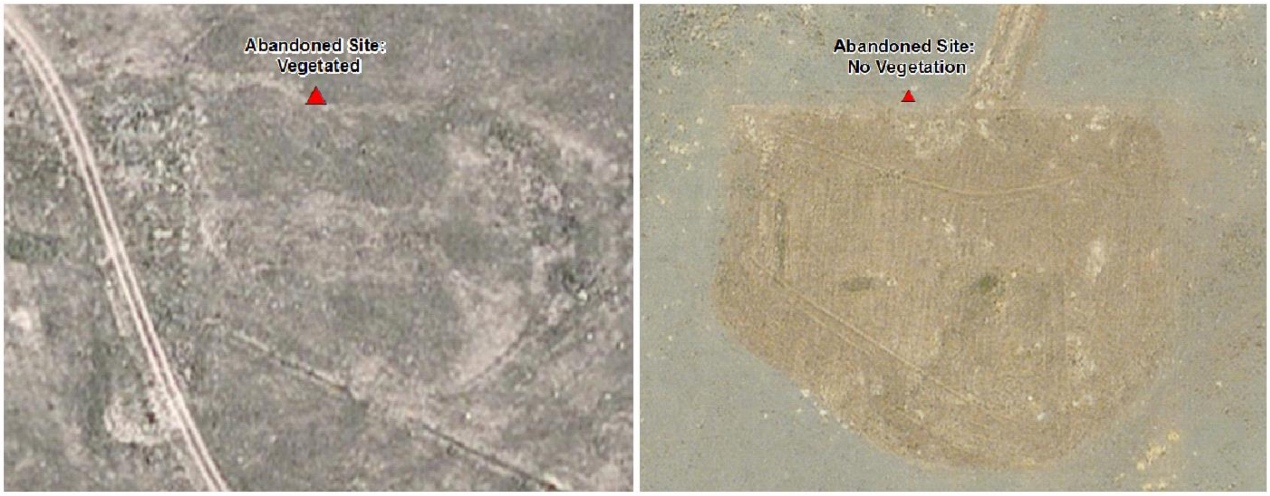


Figure 3.3-16 Example Analysis of Abandoned Oil/Gas Well Site. The site on the left displays vegetation cover equivalent with its surroundings, while the site on the right displays little, if any, vegetation establishment.

As of May 2016, of a total of 233 abandoned sites:

- 188 appeared to have obtained a reasonable level of vegetation cover;
- 32 showed a partial level of cover;
- 5 appeared to be devoid of vegetation and/or exhibiting visual erosional features; and
- 8 have been redeveloped with another well head or some other type of construction.

The 5 classified as "No Vegetation" represent the sites that the conservation district could flag for potential site visits to confirm site-specific conditions. It is worth noting that of the 233 abandoned sites screened, 200 of the sites were abandoned previous to 1990. Many of these sites have had close to 30 years to recover, which contributes to the high number of vegetated sites resulting from this process. Figure 3.3-17 presents the results of this analysis graphically.

Management Implications:
Mapping made available from this watershed study allow for project planning efforts to locate and avoid existing oil and gas pipeline infrastructure. Also, an effort to conduct onsite inspections and field verification of existing exploration and production disturbance rehabilitation and recovery can be enhanced by having available location information available in the GIS environment.

Data Sources:

Wyoming Oil and Gas Conservation Commission: http://wogcc.state.wy.us/
Wyoming State Geological Survey (WSGS): http://www.wsgs.wyo.gov/

3.3.6 Mining and Mineral Resources

At the time of this report, there were twenty active mines within the study area on record with the WDEQ Land Quality Division (Table 3.3-3). The majority of the active permits are associated with sand and/or

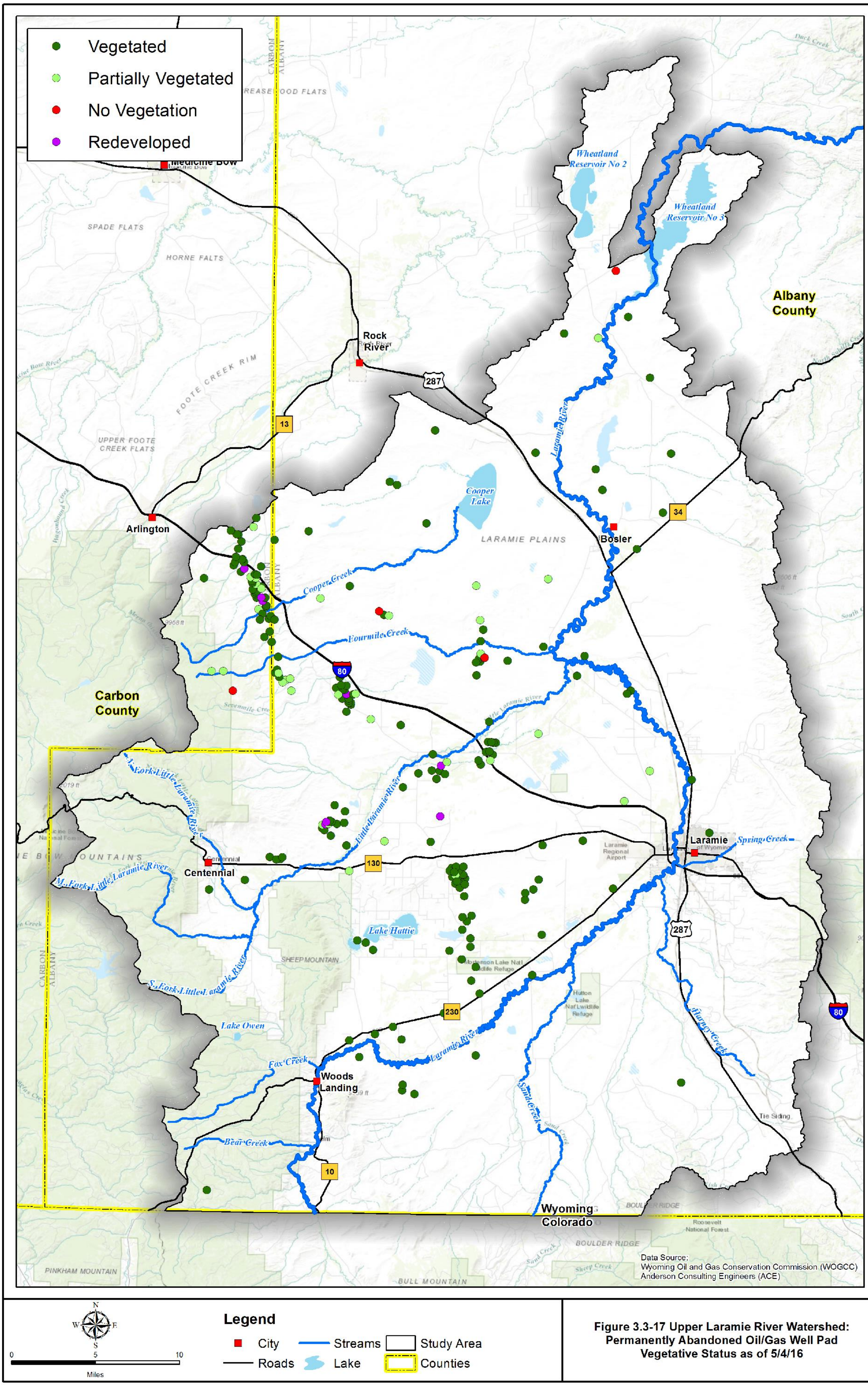


Figure 3.3-17 Upper Laramie River Watershed: Permanently Abandoned Oil/Gas Well Pad Vegetative Status as of 5/4/16

gravel operations (10 permits). In addition to these, three Limestone mines, three Shale mines, two Gypsum mines, a construction fill (i.e., “dirt” as indicated in the permit database) operation, and a gold mine are also currently active within the study area. Figure 3.3-18 displays the locations of these mines.

In addition to current WDEQ records, there are numerous abandoned mine features within the study area also indicated in Figure 3.3-18. These features are related to the area’s historic mining legacy when reclamation standards were either less stringent than today’s regulatory environment or non-existent. The Wyoming Department of Environmental Quality, Abandoned Mine Lands Division’s (AML) mission is *to mitigate safety hazards and repair environmental damage from past mining activities, and to assist communities impacted by mining.* Many of the sites within the study area are eligible for mitigation through the AML program.

Table 3.3-3 Tabulation of Existing Mine Permits (WDEQ, 2016).

Permit Number	Company Name	Mine Name	Mine Type	Mineral	Acres	Status
ET1343	Hamaker Excavation Inc.	Carroll Trust	Limited Mine Operation (ET)	Dirt	10	Active
SP0466	Four Square Mining Inc.	Four Square	Small Mine (SP)	Gold	1	Active
PT0297	Mountain Cement Co.	Red Mountain	Large Mine (PT)	Gypsum	120	Active
PT0605	Mountain Cement Co.	Red Buttes	Large Mine (PT)	Gypsum	162.7	Active
PT0298	Mountain Cement Co.	Piper/Etchepare	Large Mine (PT)	Limestone	3413.31	Active
PT0658	Mountain Cement Co.	Weaver	Large Mine (PT)	Limestone	1372	Active
PT0790	Pete Lien & Sons Inc.	Jonathan Project	Large Mine (PT)	Limestone	1441.2	Active
ET0413	Sanders, William A.	Sanders	Limited Mine Operation (ET)	Sand & Gravel	3	Active
ET1326	Bryan Tronstad	Tronstad	Limited Mine Operation (ET)	Sand & Gravel	1.62	Active
ET1460	Buxton Properties Llc.	Buxton	Limited Mine Operation (ET)	Sand & Gravel	10	Active
PT0299	Mountain Cement Co.	Tuffa	Large Mine (PT)	Sand & Gravel	408	Active
SP0645	Simon Contractors	Simons Pit	Small Mine (SP)	Sand & Gravel	40	Active
PT0752	Flying Z Enterprises Llc.	Talbott Pit	Large Mine (PT)	Sand & Gravel	244	Active
ET1600	Hamaker Excavation Inc.	Nellis Creek Llc	Limited Mine Operation (ET)	Sand & Gravel	17	Active
PT0444	Carbon County Road And Bridge Department	#410 - Silver Spur	Permit	Sand & Gravel	N/A	Active
PT0734	City Of Laramie	Monolith Ranch Pit	Small Mine (SP)	Sand & Gravel	N/A	Active
PT0696	Albany County	Antelope Creek Pit	Small Mine (SP)	Sand & Gravel	N/A	Active
PT0300	Mountain Cement Co.	Monolith	Large Mine (PT)	Shale	226.78	Active
SP0604	Mountain Cement Co.	Hutton Lake Shale	Small Mine (SP)	Shale	185	Active
PT0648	Mountain Cement Co.	Bath Shale	Large Mine (PT)	Shale	735.1	Active

There are a total of 93 AML sites located in the study area. The primary type (44 sites) is associated with metals mining activities (copper, gold, and other metals). These features are located primarily in the mountains of the western portion of the watershed. The remaining sites within the study area are classified as Other (27 sites), Sand & Gravel (21 sites), and Coal (1 site). The AML sites can include a variety of mining-related hazards including open shafts, spoil piles, etc. In addition, environmental impacts associated with the historic mines may still exist. Figure 3.3-19 displays an aerial photo of a typical AML coal mine site. The historic mine data is constantly being updated. If more detailed or updated information is required, please contact the Wyoming Department of Environmental Quality/Abandoned Mine Lands Division.

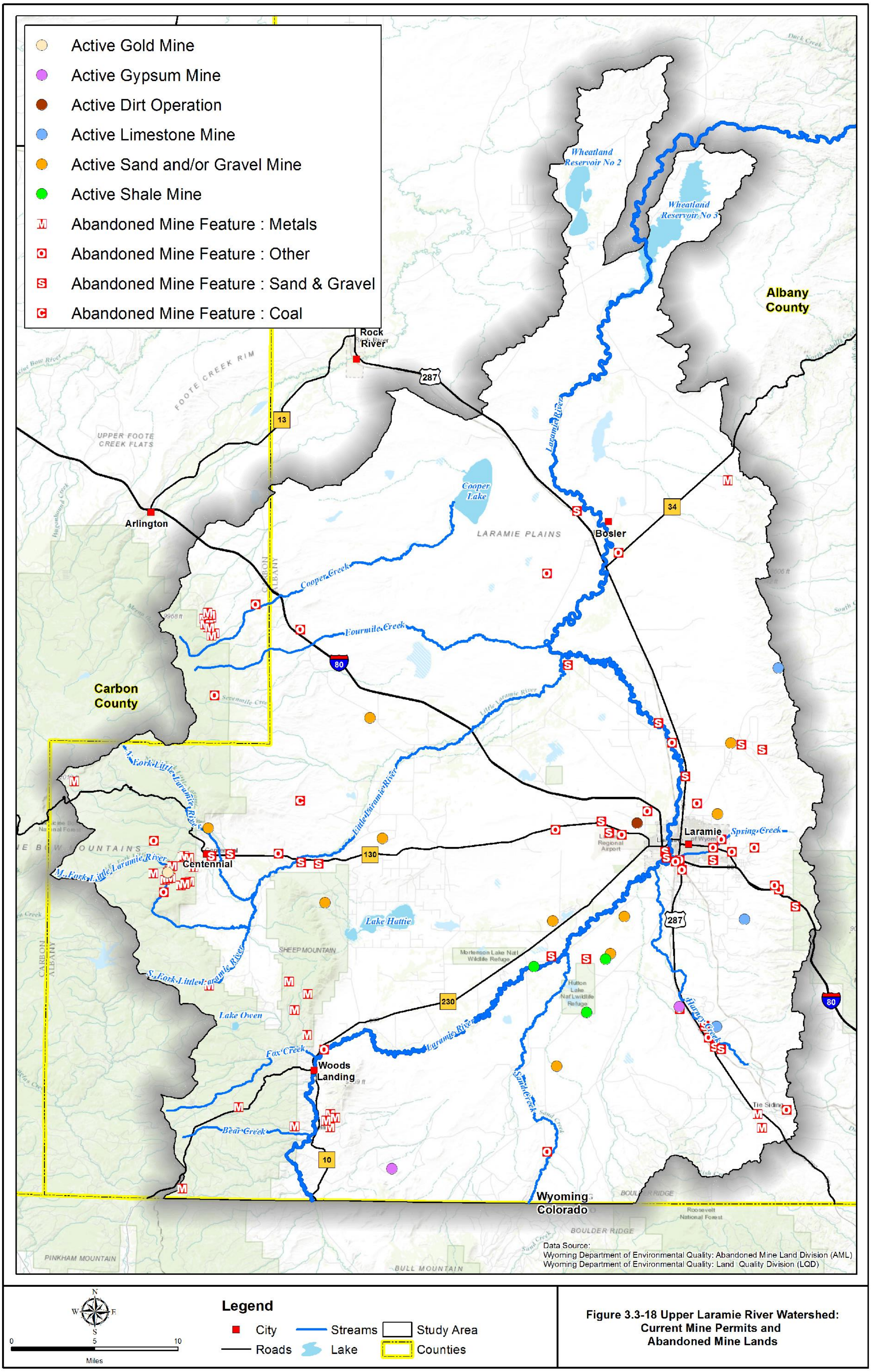


Figure 3.3-18 Upper Laramie River Watershed: Current Mine Permits and Abandoned Mine Lands

Figure 3.3-19 WDEQ Coal Mine Reclamation Site.

Management Implications:

Mining and mineral extraction operations produce economic value to a community and region but can also contribute to ecological and environmental impacts. It is important to consider the locations of such disturbances for assignment of impairment load allocation and when assessing and evaluating current natural resource condition for design and implementation of conservation practices

Data Sources:

Wyoming Department of Environmental Quality Land Quality Division: http://deq.wyoming.gov/lqd/
Wyoming Department of Environmental Quality Abandoned Mine Land Division:
http://deq.wyoming.gov/aml/

3.3.7 Wildlife

3.3.7.1 Refuges

The United States Fish and Wildlife Service (USFWS) manages three National Wildlife Refuges (NWRs) within the basin. The establishment of the refuges is in response to recognition of the area's importance to migratory birds as well as other endemic species. The three refuges are part of the Arapaho National Wildlife Refuge Complex refuge complex which includes:

- Bamforth National Wildlife Refuge (1,666 acres),
- Mortenson Lake National Wildlife Refuge (1,766 acres) and
- Hutton Lake National Wildlife Refuge (23,464 acres).

In addition, the complex includes the Arapaho NWR in Walden, Colorado and the Pathfinder NWR near Casper, Wyoming. Refuges within the watershed are displayed in Figure 3.3-20.

3.3.7.2 Big Game Species

The Wyoming Game and Fish Department (WGFD) maps the seasonal ranges by herd unit for each big game species and makes special note of areas listed as crucial habitat and parturition (birthing areas). WGFD's Crucial habitat, or range, is defined as those seasonal ranges or habitats (mostly winter range) that have been documented as the determining factor in a population's ability to maintain itself at a certain level over a long period of time. In the Upper Laramie River watershed, the primary big game present are pronghorn antelope, elk, and mule deer. Within the watershed, approximately 222,465 acres (roughly 19 percent of the study area) have been determined to be crucial habitat for one or more of antelope, elk, or mule deer. Of the big games species mapped by the WGFD, only elk have parturition areas within the watershed. The elk parturition area totals only 19,957 acres (approximately 1.7% of the study area). According to the Game and Fish data provided, big horn sheep, moose, and white tail deer may utilize the watershed area but only as seasonal range.

Figures 3.3-21 through 3.3-26 display the WGFD seasonal range, crucial range, parturition areas, migration corridors and migration barriers for antelope, elk, mule deer, big horn sheep, moose, and whitetail deer within and immediately adjacent to the study area. Examination of these figures shows that the majority of the watershed is classified as seasonal range for the big game species. The crucial ranges and parturition areas of the primary big game species within the watershed were aggregated individually and are shown in Figure 3.3-27. The figure shows that the crucial range of the three primary species is concentrated in the western portions of the watershed. The crucial ranges are located in the lower elevations surrounding Sheep Mountain and adjacent to the National Forest lands along the western border of the study area. As previously mentioned the crucial ranges tend to be winter range areas where foraging is easier due to lower snow depths, and the landscape provides some sort of thermal cover (BLM, 2008). The parturition areas for elk are located in the western portion of the watershed, immediately adjacent to the National Forest lands. These areas provide particularly good security cover and succulent forage (BLM, 2008).

In an effort to address declining mule deer populations, the WGFD implemented the Sheep Mountain Mule Deer Initiative (SMMDI) in August of 2014. The primary objectives were to increase public involvement in the management direction of the Sheep Mountain mule deer herd and to develop a management recommendations document for this herd unit. This recommendations document was published in July of 2015 and is included with the digital library delivered with this report. The document provides management recommendations related to habitat, mule deer populations, predators, human disturbance (fences, roads), hunter recruitment, and ongoing monitoring.

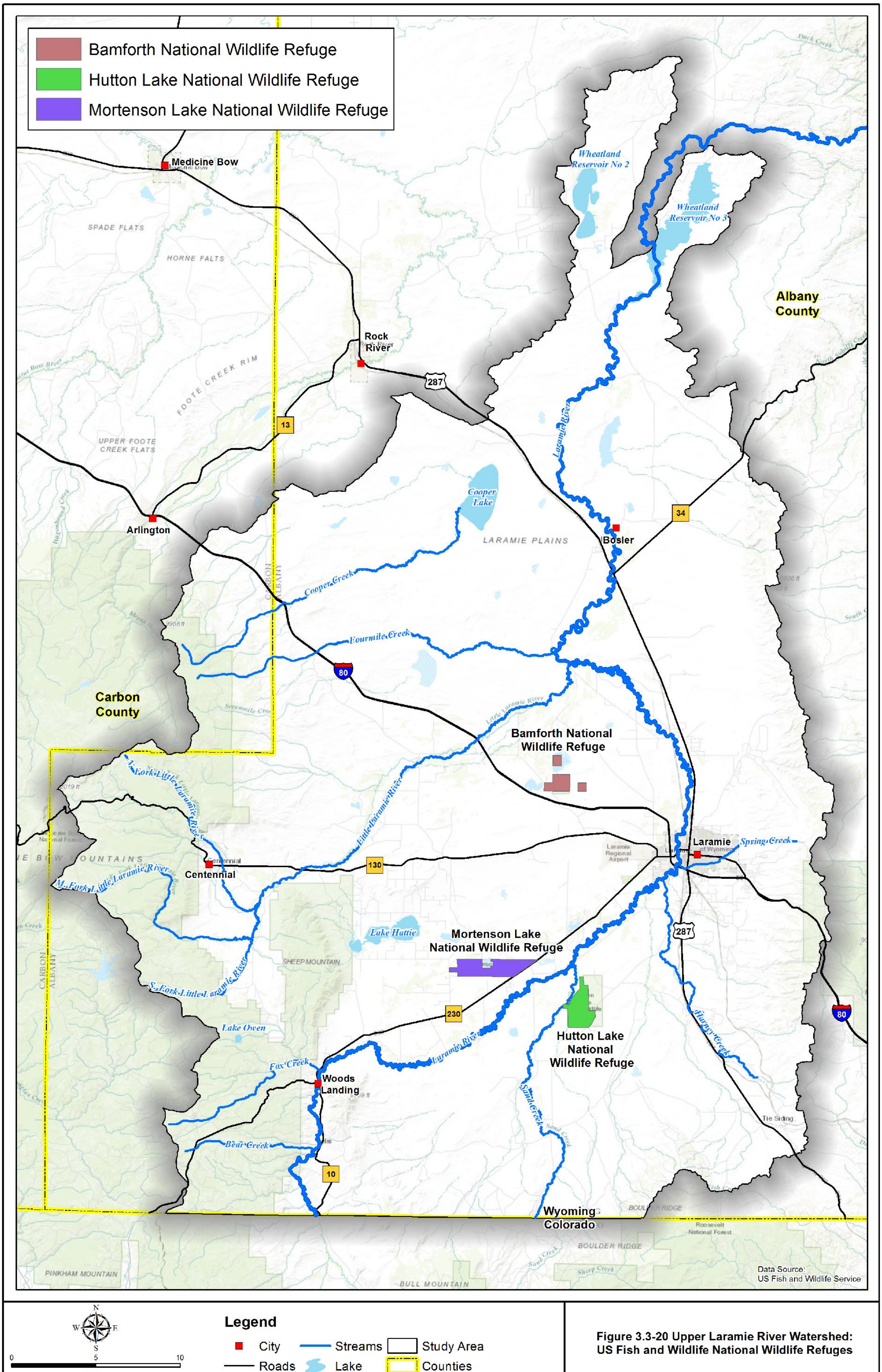


Figure 3.3-20 Upper Laramie River Watershed: US Fish and Wildlife National Wildlife Refuges

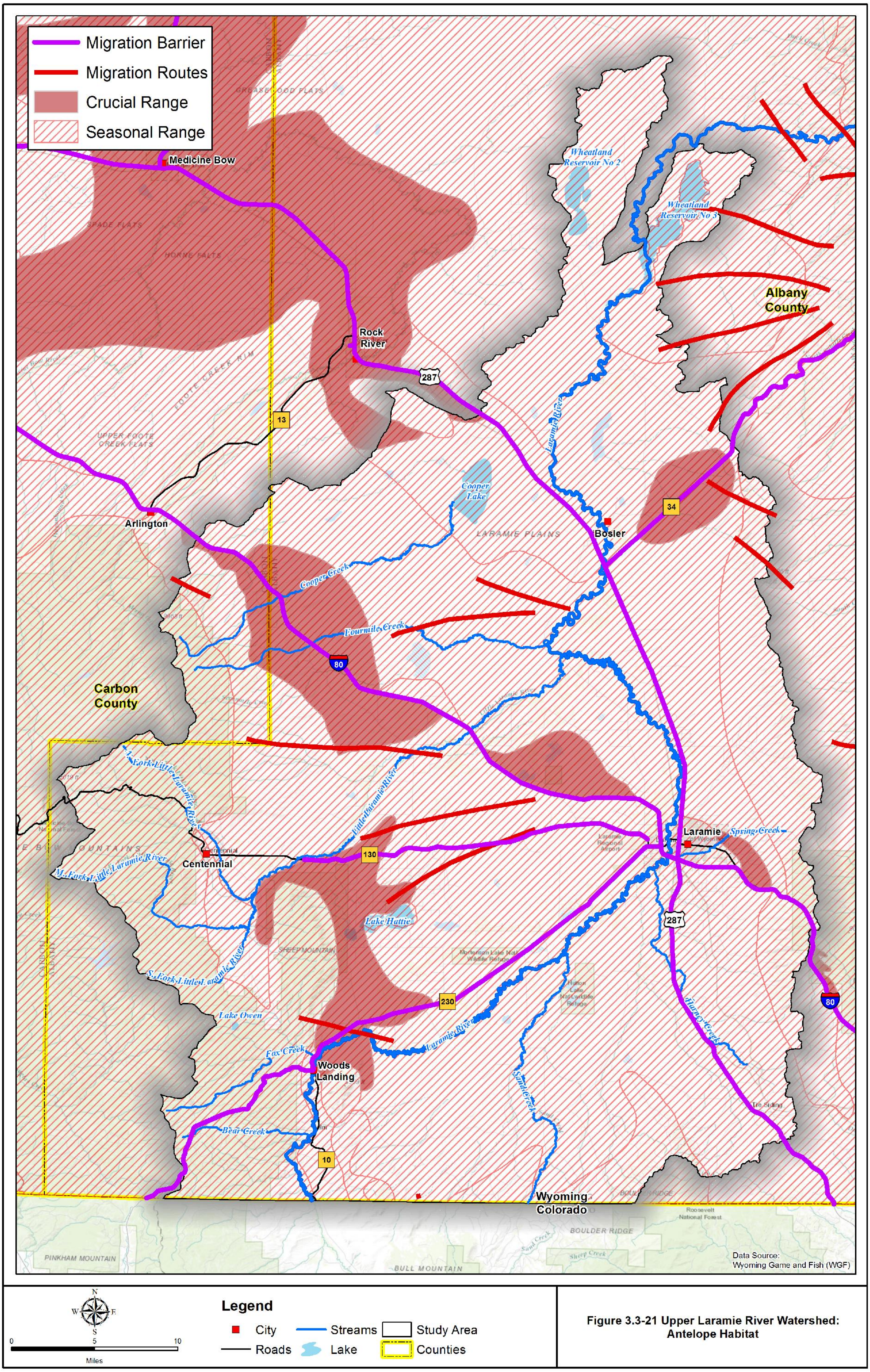


Figure 3.3-21 Upper Laramie River Watershed: Antelope Habitat

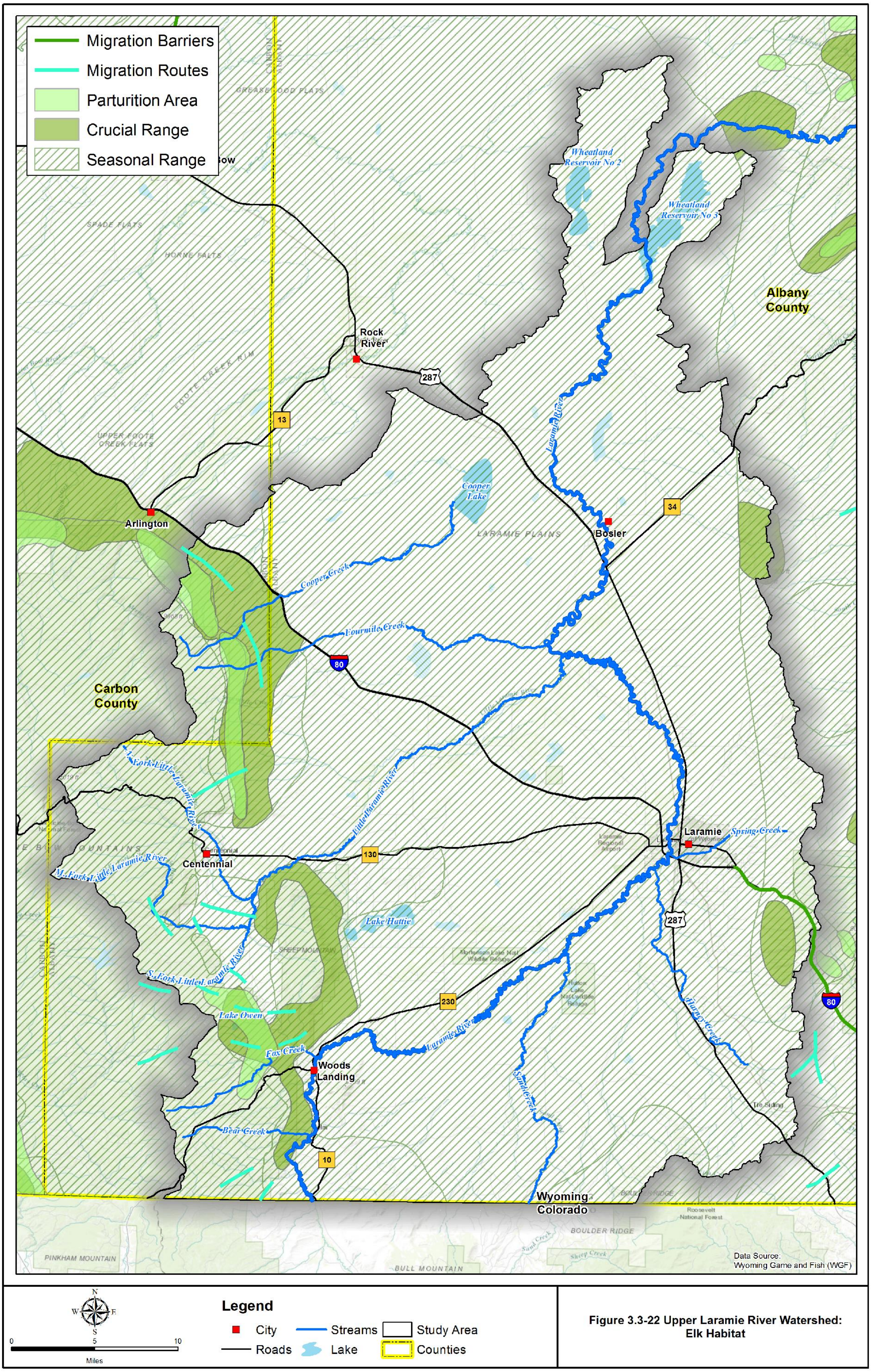


Figure 3.3-22 Upper Laramie River Watershed: Elk Habitat

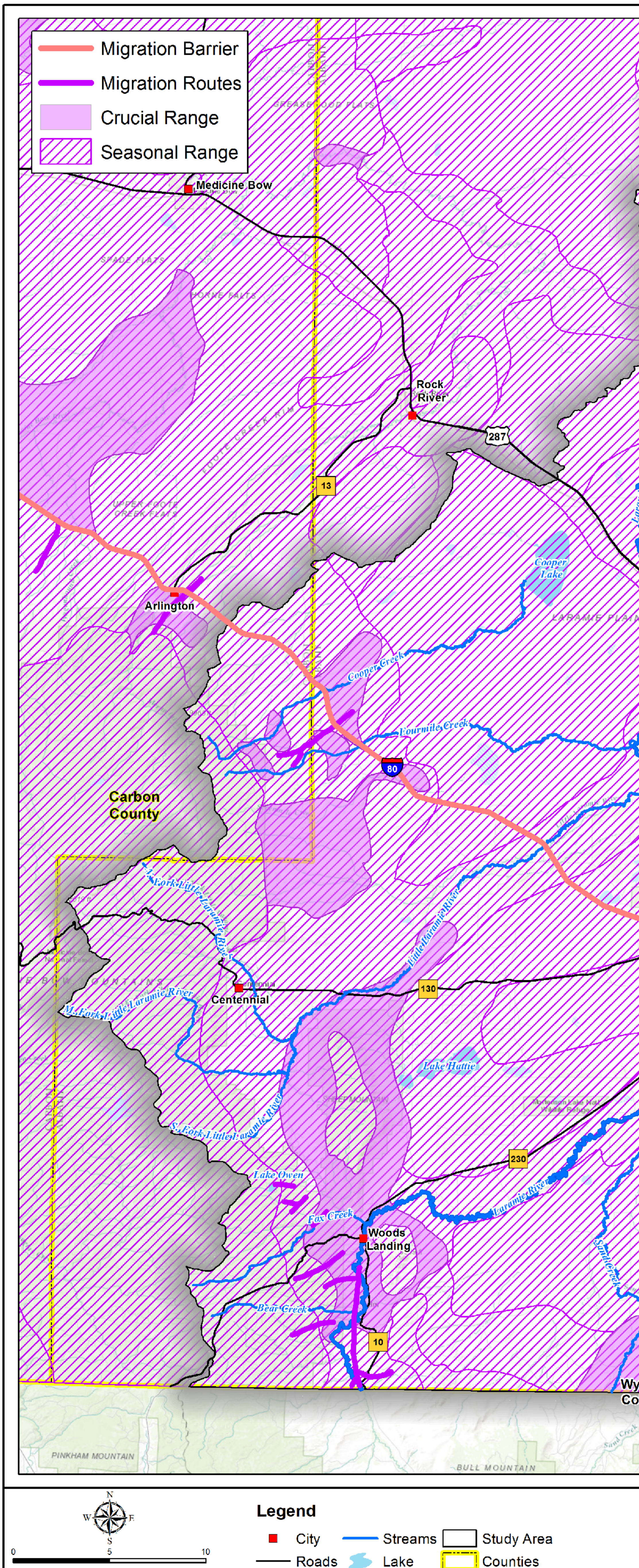


Figure 3.3-23 Upper Laramie River Watershed: Mule Deer Habitat

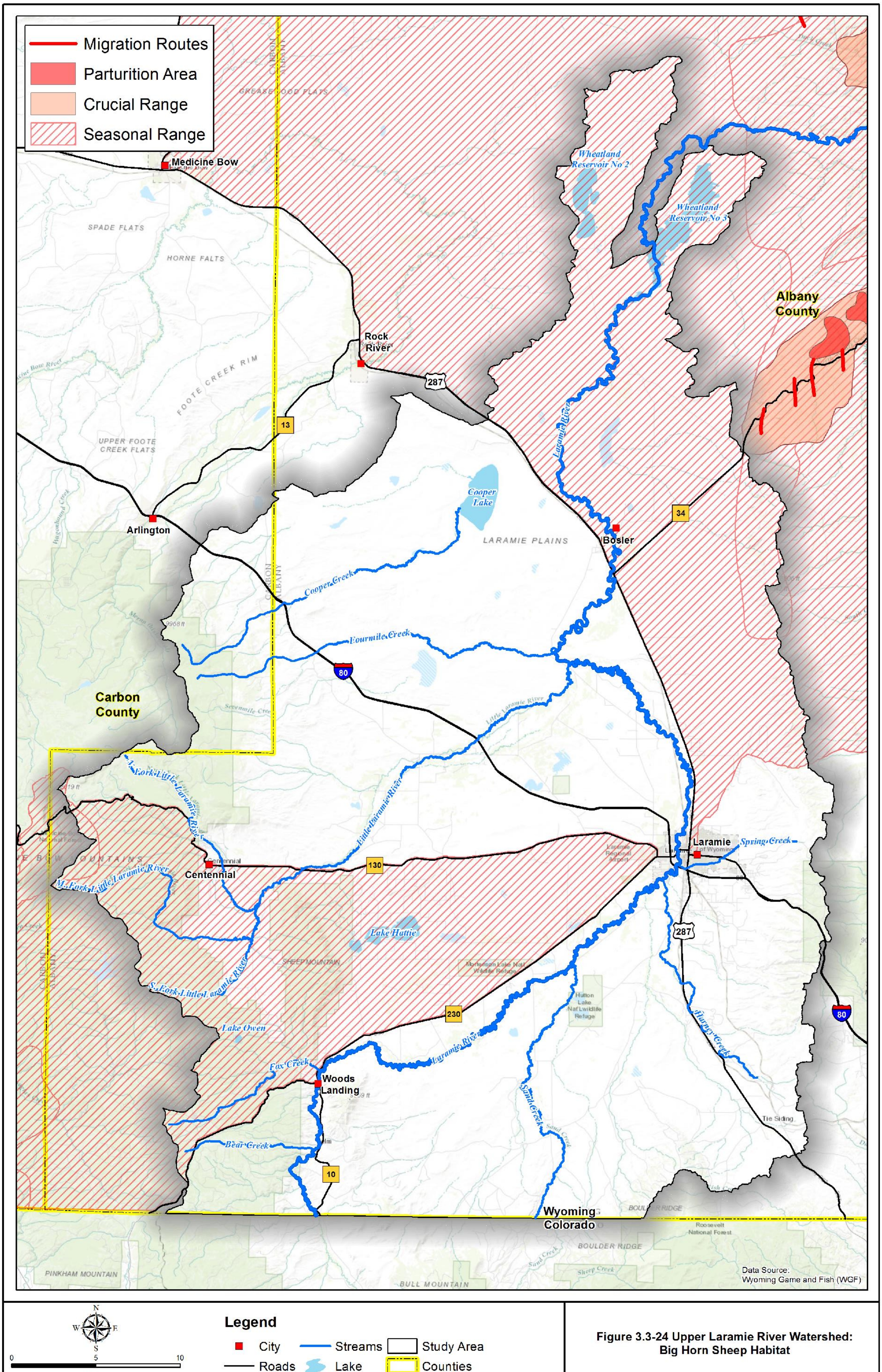


Figure 3.3-24 Upper Laramie River Watershed: Big Horn Sheep Habitat

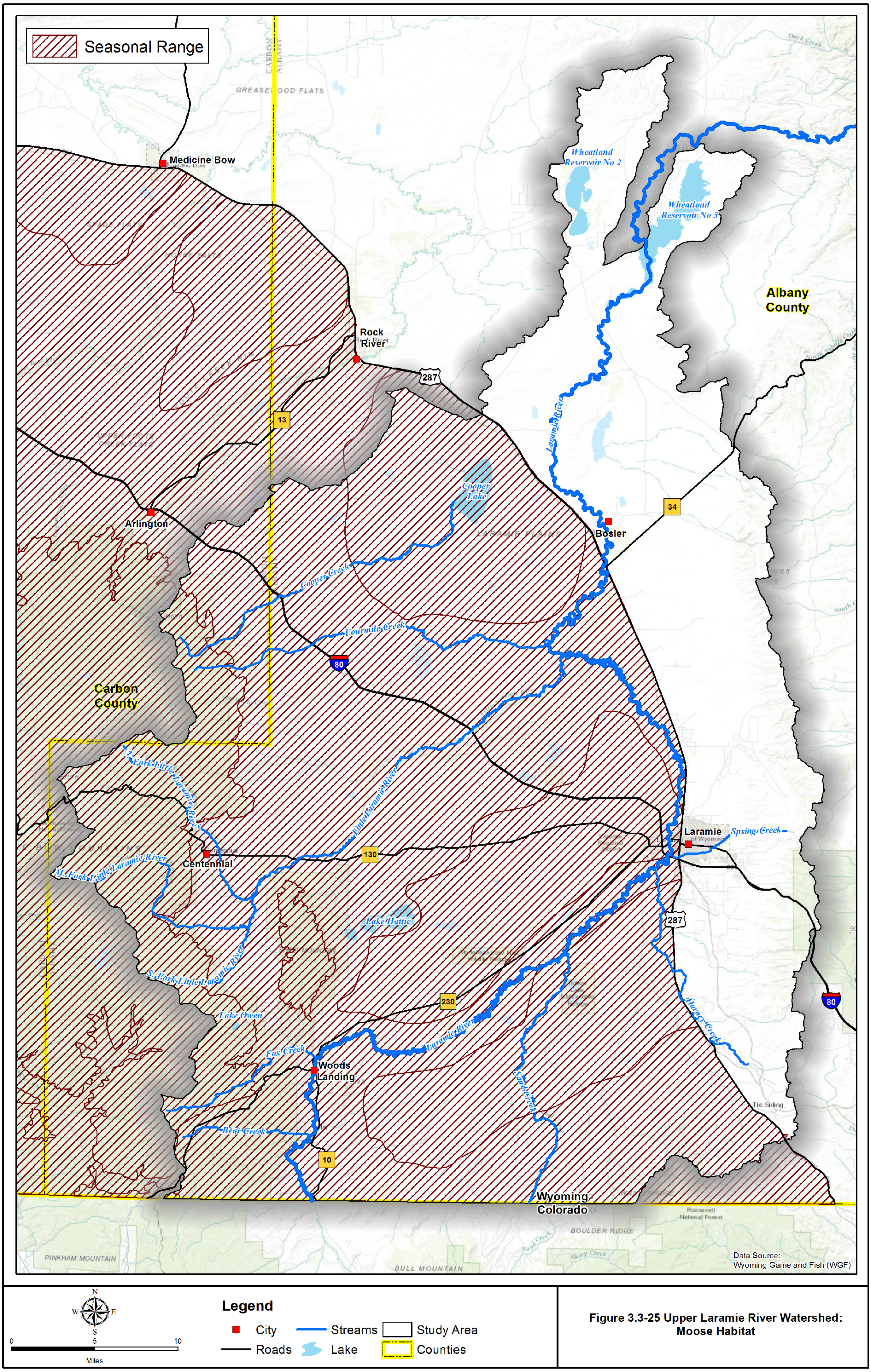


Figure 3.3-25 Upper Laramie River Watershed: Moose Habitat

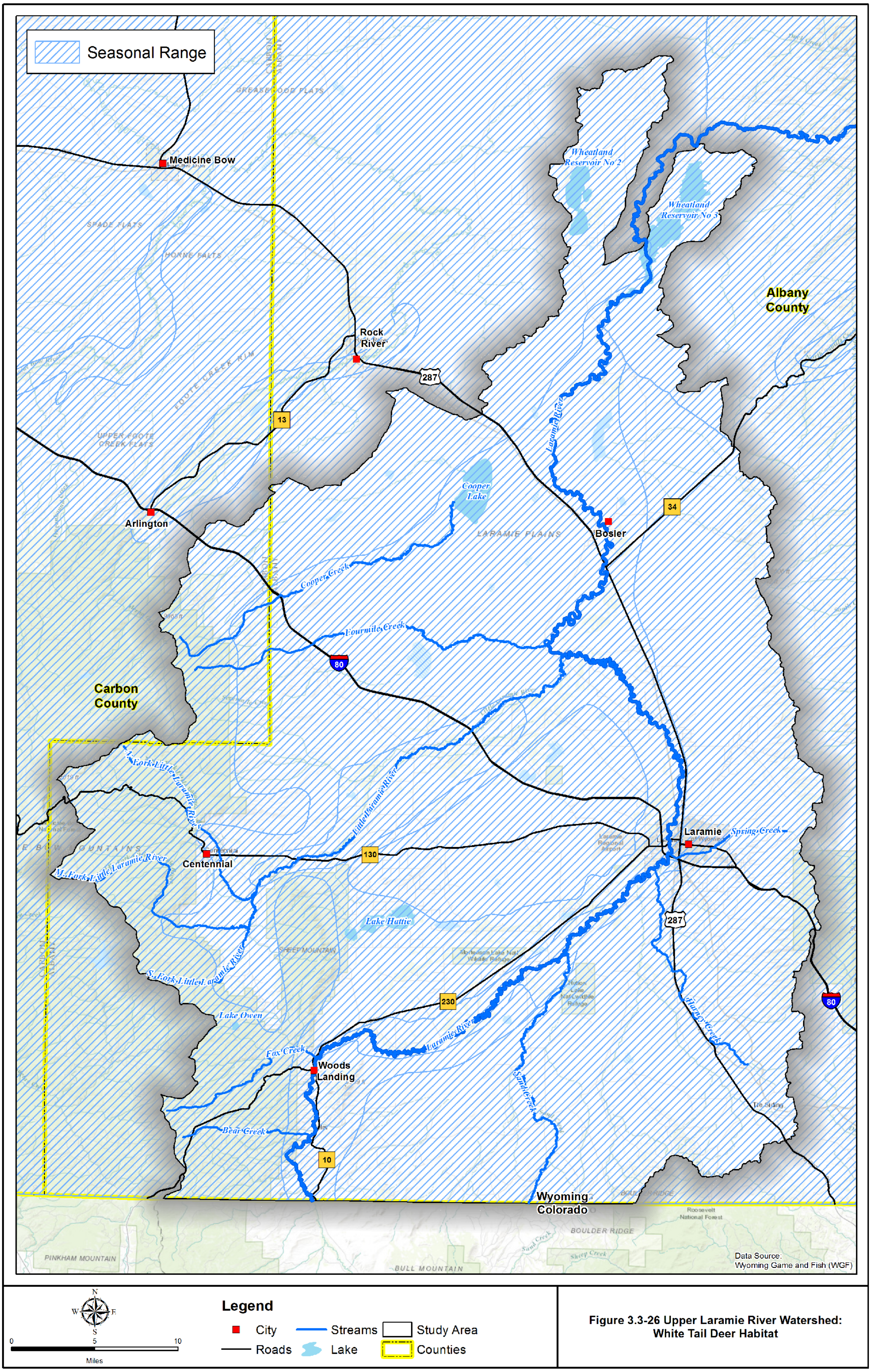


Figure 3.3-26 Upper Laramie River Watershed: White Tail Deer Habitat

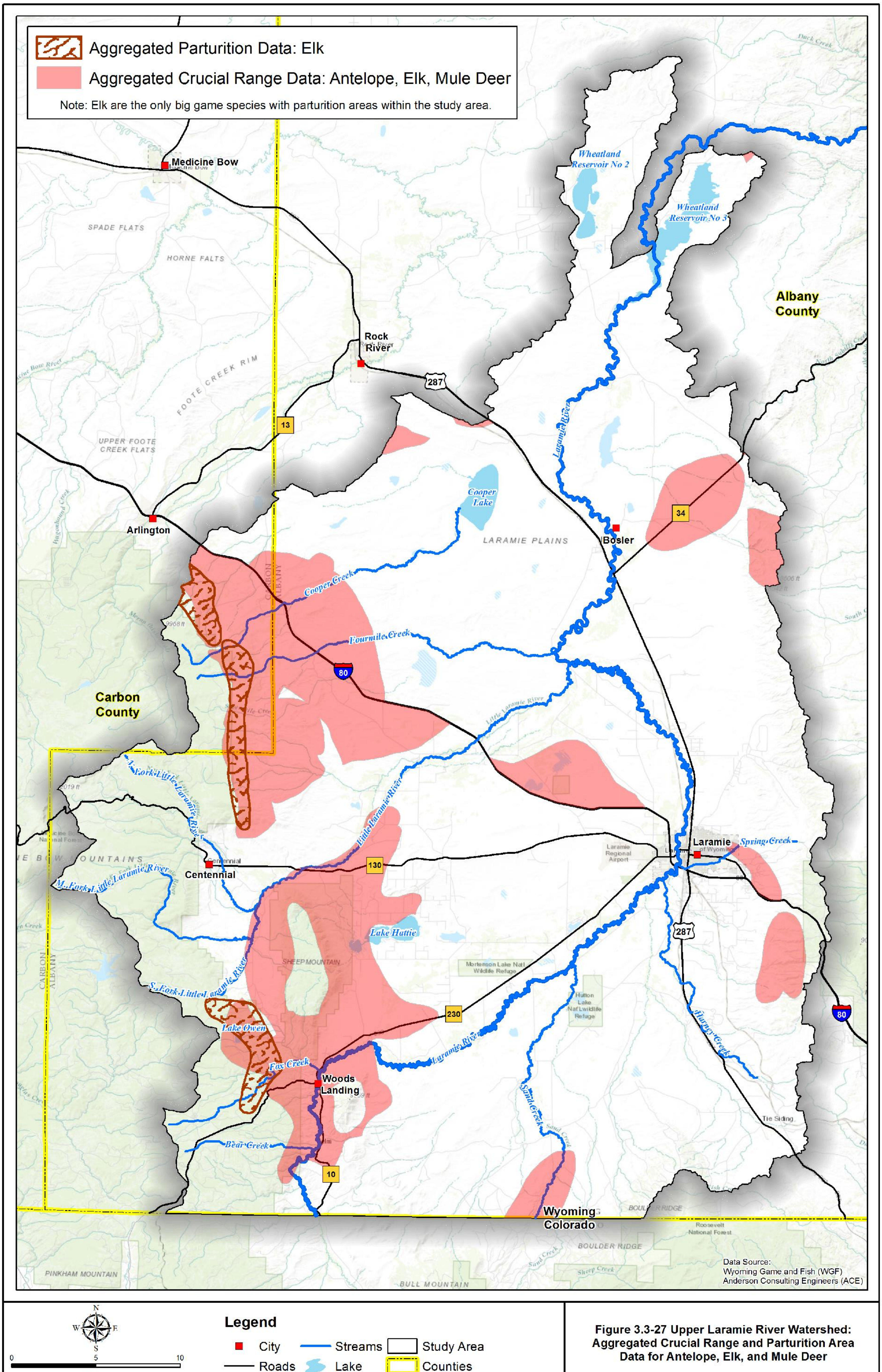


Figure 3.3-27 Upper Laramie River Watershed: Aggregated Crucial Range and Parturition Area Data for Antelope, Elk, and Mule Deer

3.3.7.3 Species of Concern

The Wyoming Natural Diversity Database (WYNDD) lists numerous non-game species of concern within the watershed, including amphibians, birds, crustaceans, fish, insects, mammals, mollusks, and reptiles. Originally initiated by the Nature Conservancy, the WYNDD became a research and service unit of the University of Wyoming in 1998. Appendix 3C presents the results of a database query conducted by the WYNDD for the watershed. Included in this list are all species of concern or species of potential concern which have been documented in the study area. The WYNDD lists several endangered species as being sighted within the watershed. The Wyoming toad, black-footed ferret, and whooping crane have been observed within the watershed. The WYNDD database is a historic accumulation of information related to sightings within the study area. Most of the sightings of the black footed ferret are sourced to literature that documented sightings between 1851 and 1977. The whooping crane sighting occurred in 1983 and is sourced to the WGFD Wildlife Observation System (WOS). According to the WYNDD data collected these two species are also classified as "Listed Endangered – Nonessential Experimental Population (LEXN)". This status is given to species that have been reintroduced at some point at these locations. The regulations related to activities within these areas are less stringent than within areas containing Listed endangered species.

The Wyoming toad sightings are centered around the Mortenson Lake and Hutton Lake National Wildlife Refuges and date from 1939 to 2009. According to the WYNDD conservation efforts for the Wyoming Toad have included annual reintroductions and/or population monitoring at 4 sites in the Laramie Plains since the species was rediscovered in the wild in 1987. Reintroduction efforts since 2006 include the recent release of 900 adult toads, raised in captivity, at three sites in June, 2016 (USFSW, 2016). Despite these reintroduction efforts, the Mortensen Lake National Wildlife Refuge contains the only breeding population of Wyoming toads in the wild (WYNDD, 2010). Please see the WYNDD GIS data included in the project GIS for more information.

3.3.7.4 Sage Grouse

Areas of known Greater Sage Grouse (Centrocercus urophasianus) leks are displayed in Figure 3.3-28. The US Department of Interior decided in September of 2015 that the sage grouse does not require federal protection under the Endangered Species Act. However, it is still recognized as a sensitive species by the BLM and a Species of Greatest Conservation Need (SGCN) by WGFD. The BLM definition of a sensitive species is as follows:

> *Species that could easily become endangered or extinct in the state, including:*
> *(a) species under status review by the FWS/National Marine and Fisheries Service;*
> *(b) species whose numbers are declining so rapidly that Federal listing may become necessary;*
> *(c) species with typically small or fragmented populations; and*
> *(d) species inhabiting specialized refuge or other unique habitats.*

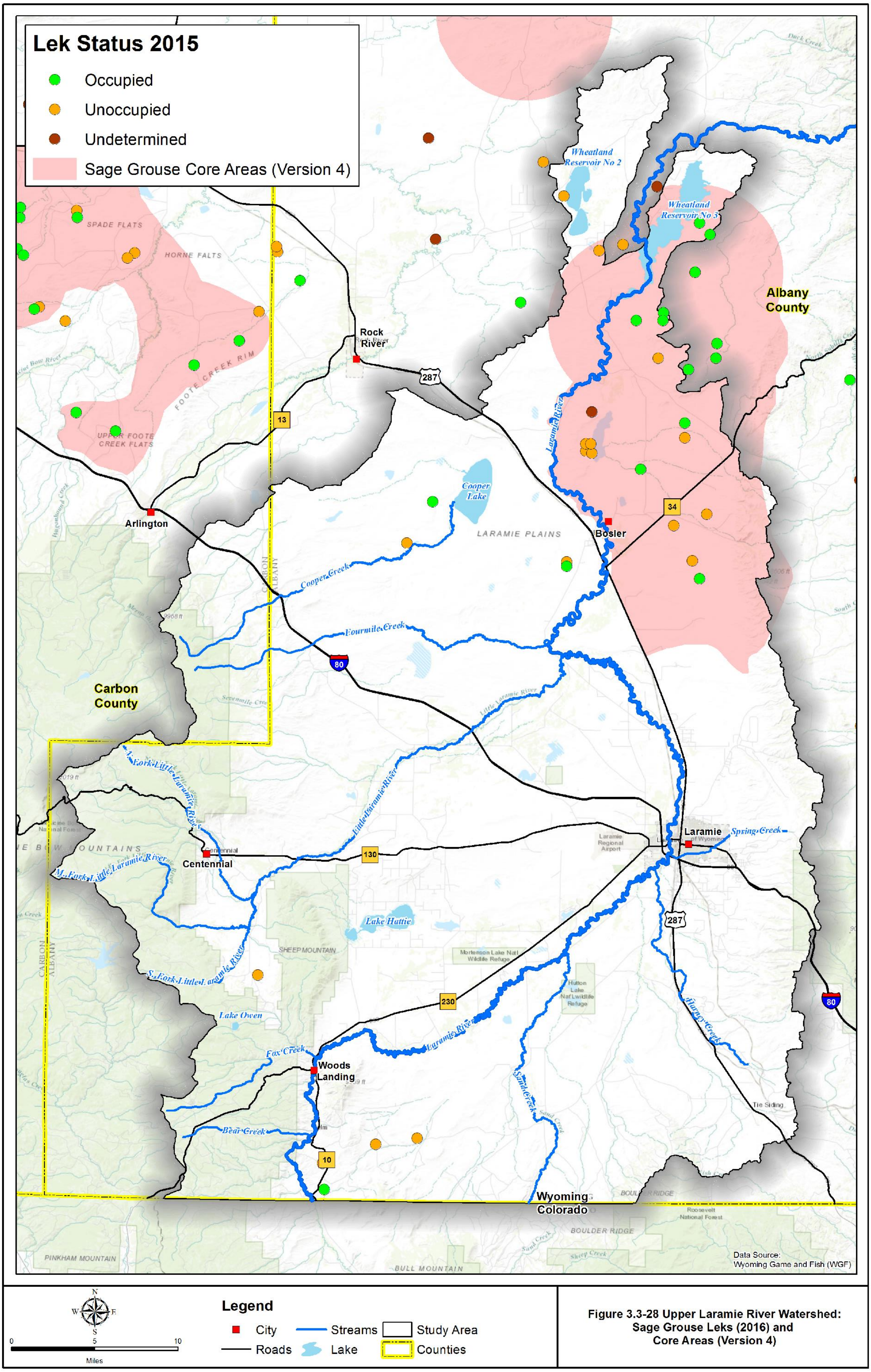


Figure 3.3-28 Upper Laramie River Watershed: Sage Grouse Leks (2016) and Core Areas (Version 4)

The WGFD classification of a Species of Greatest Conservation Need (SGCN) is reserved for species whose conservation status warrants increased management attention, and funding, as well as consideration in conservation, land use, and development planning in Wyoming. The sage grouse is not listed as a Threatened or Endangered species and does not receive any protections from the Endangered Species Act; however, BLM and WGFD have developed restrictions and recommendations to help protect the sage grouse.

In June 2008, Executive Order 2008-2 was signed by Governor Freudenthal which stresses additional management consideration for sage grouse and sage grouse habitat statewide. This original executive order has been extended most recently by Executive Order 2015-4 signed by Governor Mead in July of 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 most recently identified Core Sage Grouse Population Areas within the study area are delineated in Figure 3.3-28. According to WGFD, the overall goal of the Core Area delineations is to protect as many birds as possible while encompassing the least amount of acreage. This can cause occupied leks to fall outside of the identified Core Areas. As is evident in this figure, the Sage Grouse Core Areas affect a portion of the northeastern watershed, from south of Bosler, north east towards Wheatland Reservoir No. 3. In total there are 145,578 acres of Sage Grouse Core Area located within the Upper Laramie River watershed, making up 12% of the total watershed area. According to the 2015 lek data received from WGFD, there are a total of 9 occupied leks, 1 undetermined lek, and 17 unoccupied leks within the Upper Laramie River watershed study area. The regulations related to these leks are explained in Attachment B of Executive Order 2015-4 (included in the digital library of this report).

These regulations do not prevent project development within Core Areas. Core Area project developments could potentially have some restrictions in order to fall within the core area guidelines presented in Executive Order 2015-4, but the areas are not precluded from water development projects. Included in Appendix C of Executive order 2015-4 (included in the digital library delivered with this report) is a list of exemptions to core area regulations. Many of the water projects presented in this report fall under the exempted project types, with only minor seasonal construction restrictions if within close proximity to an occupied lek. Exemptions pertinent to this study were extracted from Executive Order 2015-4 Appendix C and are listed below:

- *Drilling and outfitting of agricultural or residential water wells (including tank installation, pumps, and agricultural water pipelines) more than 0.6 miles from the perimeter of an occupied lek. Construction within 0.6 miles is allowed from July 1 through March 14, after a habitat evaluation has occurred, and provided development does not occur on the lek. New tanks shall have escape ramps.*
- *Construction of agricultural reservoirs, less than 10 surface acres and more than 0.6 miles from the perimeter of an occupied lek. Construction within 0.6 miles is allowed from July 1*

through March 14, after a habitat evaluation has occurred, and provided that development does not occur on the lek.

- *Construction of aquatic habitat improvements, less than ten wetland or water surface acres, more than 0.6 miles from the perimeter of an occupied lek. Construction within 0.6 miles is allowed from July I through March 14, after a habitat evaluation has occurred, and provided development does not occur on the lek.*
- *Irrigation (excluding the conversion of sagebrush habitats to new irrigated lands).*
- *Spring development; if the spring is protected with fencing and enough water remains at the site to provide mesic (wet) vegetation. Fences should be constructed to be highly visible to Greater sage-grouse (i.e., buck-and-rail, steeljack, etc.) and/or marked to minimize collision potential.*

3.3.7.5 Wild Horses

Following passage of the Wild, Free-Roaming Horse and Burro Act in 1971, BLM was charged with management of wild horses and burros in "herd management areas" (HMAs). The BLM's goal is to ensure and maintain healthy wild horse populations on healthy public lands. To do this, the BLM works to achieve what is known as the Appropriate Management Level (AML) – the point at which wild horse and burro herd populations are consistent with the land's capacity to support them. Each Herd Management Area (HMA) has its own AML. When AML is exceeded, the excess animals are to be removed and then prepared for adoption or sent to off-range pastures. Within the project study area, there are no HMAs as indicated in Figure 3.3-29.

3.3.7.6 WGFD Crucial Habitat Areas

As part of the WGFD Strategic Habitat Plan Revision (2015), previously existing priority habitat areas within the state were refined into Goal 1 Crucial Priority Areas and Goal 2 Enhancement Priority Areas for both aquatic and terrestrial terrain (Figure 3.3-30). "Combined" areas were created where significant overlap occurred between aquatic and terrestrial areas. As defined by WGFD at: https://wgfd.wyo.gov/Habitat/Habitat-Plans/Habitat-Priority-Areas.

> *"Goal 1 Crucial Priority Areas are based on significant biological or ecological values. These are areas that need to be protected or managed to maintain viable healthy populations of terrestrial and aquatic wildlife for the present and future. They represent habitat values and identify where those values occur on the landscape. Examples of values include crucial winter range, sage grouse core area seasonal habitats, Species of Greatest Conservation Need (SGCN) diversity and uniqueness, quality and condition of vegetative communities, movement corridors, quality of watershed hydrologic function, etc. The Department will concentrate habitat protection and management activities in these areas."*

> *"Goal 2 Enhancement Habitat Priority Areas represent those with a realistic potential to address wildlife habitat issues and to improve, enhance, or restore wildlife habitats. These areas offer*

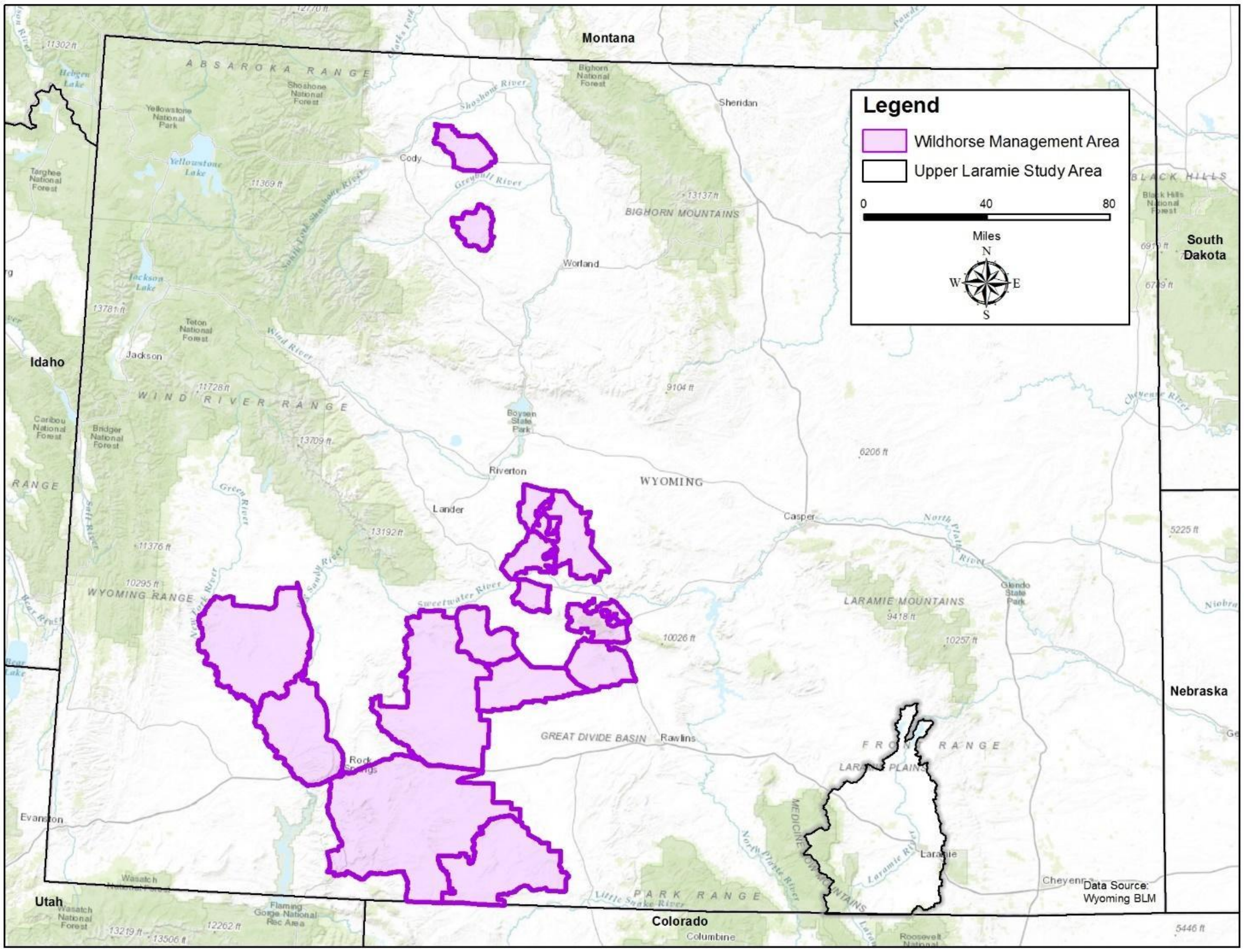


Figure 3.3-29 Upper Laramie River Watershed: Wild Horse Management Areas

potential for improving habitat and focusing Department habitat efforts. They may overlap crucial areas or be distinct from them. Enhancement areas are based on habitat issues. Like crucial areas where values are key, issues were identified by regional personnel and used to select enhancement habitat areas. Examples of issues include loss of aspen communities, habitat fragmentation, development, loss of connectivity, water quality effects, water quantity limitations, beetle killed conifer, lack of fish passage, loss of fish to diversions, degraded habitat, etc."

Review of the WGF Crucial Habitat Area Narratives (available at https://wgfd.wyo.gov/Habitat/Habitat-Priority-Areas/Statewide-Maps/Laramie) provides the following information regarding sensitive habitat within the study area. Full relevant habitat narratives have been downloaded and included with the Digital Library included with this report. The following paragraphs were extracted directly from the narratives provided by WGFD for crucial and enhancement priority areas:

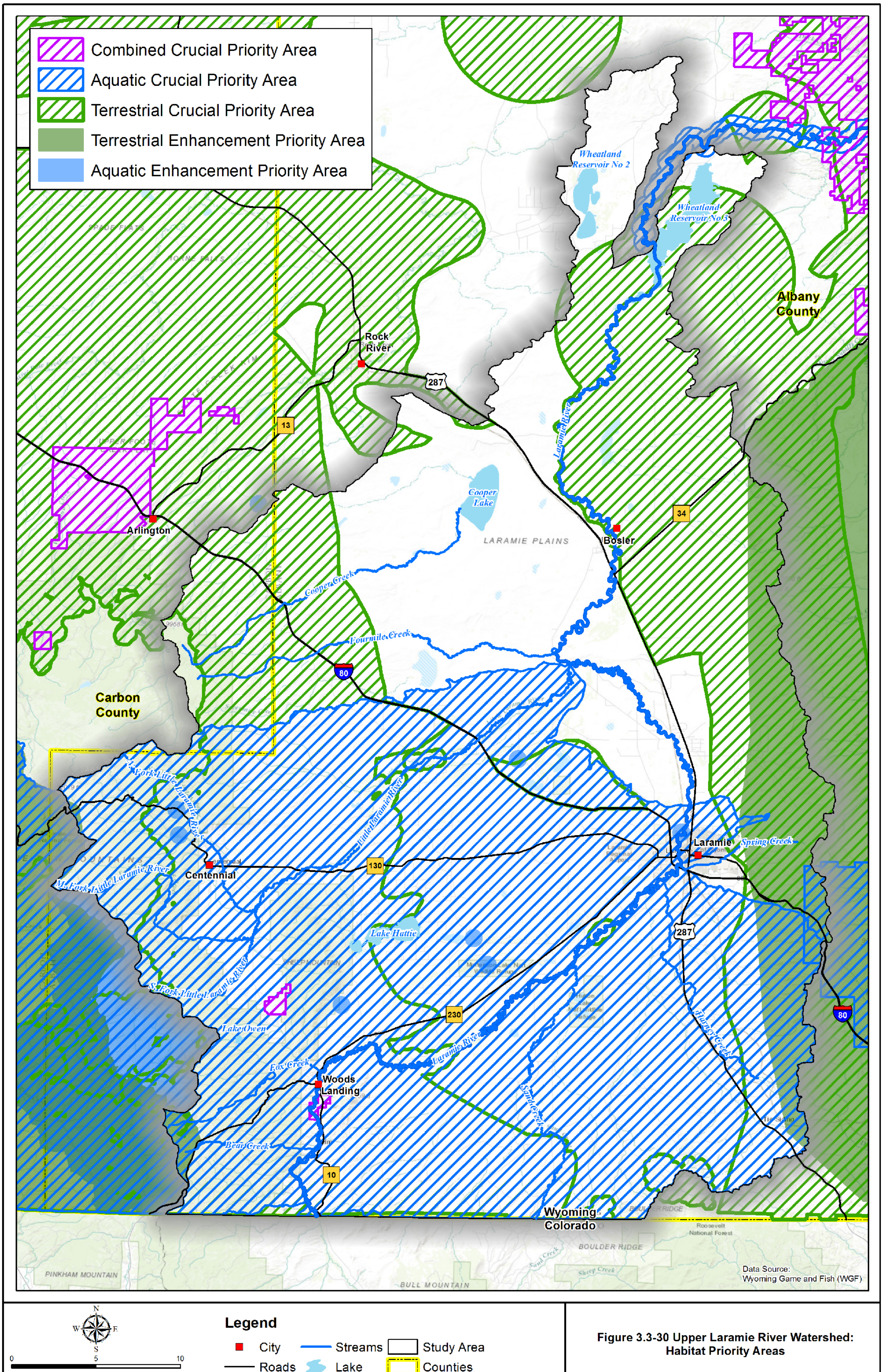


Figure 3.3-30 Upper Laramie River Watershed: Habitat Priority Areas

Upper Laramie and Little Laramie River (Goal 1 Aquatic Crucial Area)

- **Habitat Value:**
  Functioning stream habitat to support wild trout fishery, functioning stream and wetland habitats to support native amphibian, and proper functioning riparian habitats to aid in stream stability and wildlife habitat.
- **Reason Selected:**
  This is the only watershed where the Wyoming toad presently occurs. Boreal toad is also found in portions of the Medicine Bow National Forest in this watershed. The Laramie River and Little Laramie River also provide habitat for wild trout fisheries. The area faces a number of threats including habitat fragmentation and degradation from industrial energy and residential development.
- **Primary species or assemblages of species:**
  Wyoming toad, boreal toad, brown trout, rainbow trout, brassy minnow, Iowa darter.
- **Solutions or actions (partial list):**
  -Seek opportunities for conservation easements to provide protection for stream and riparian corridors.
  -Promote restoring or maintaining beaver. Manage beaver populations to restore riparian habitat function and create wetland habitats.
  -Promote and establish fish passage and screening solutions at irrigation diversions.
  -Promote livestock grazing management practices to maintain or restore riparian habitat function.
- **Additional Information:**
  A stream enhancement project along the Laramie River through Laramie was completed in 2011. The project stabilized banks and enhanced fish habitat and riparian habitat throughout the reach.

Please note that two additional Aquatic Crucial Areas do exist on the margins of the study area. Due to their relatively small overlap with the watershed, they were excluded from this section of the report. The narratives for these areas (Pole Mountain Watersheds, Laramie and North Laramie Rivers) were downloaded and included in the Digital Library delivered with this report and are also available online at the link mentioned above.

Laramie Region Lakes (Goal 2 Aquatic Enhancement Area)

- **Habitat Value:**
  Winter or summer kill events, lack of sufficient water, and inadequate facilities which reduce the public's enjoyment of these waters.
- **Reason Selected:**
  Lakes within the Laramie Region have in the past, presently, and in the future support numerous angler days. Anglers have come to expect quality fisheries in Laramie Region Lakes, as well as quality habitat. There is potential to increase angler days at Laramie Region Lakes and for the benefit of all fish species (native non-game or non-native stocked salmonids).

- **Primary species or assemblages of species:**
  Rainbow trout, various cutthroat trout species, brassy minnow, common shiner, Iowa darter, Johnny darter, boreal toad, Wyoming toad.
- **Solutions or actions: (partial list)**
  - Purchase water for Alsop Lake to prevent winterkill and install aeration system.
  - Install liner, create handicap accessible walkway, improve ditch at Barber Lake.
  - Transfer water to Diamond Lake to recreate what once was a popular fishery.
  - Install additional solar aeration system at Gelatt Lake to prevent winterkill.
  - Improve dam and ditch as well as improve parking and stocking access to Hanging Lake.
  - Improve existing ponds along Laramie River Greenbelt to create new fishing opportunities.

Sage Grouse Core Areas (Goal 1 Terrestrial Crucial Area)

- **Habitat Value:** Sage-grouse core areas.
- **Reason Selected:** Sage-grouse core areas designated by the Governor's Office are described as those areas capable of maintaining habitats and viable populations of sage-grouse where they are most abundant. On a statewide basis, they include habitats and existing populations for at least two-thirds of the sage-grouse in Wyoming.
- **Primary species or assemblages of species:**
  Rainbow trout, various cutthroat trout species, brassy minnow, common shiner, Iowa darter, Johnny darter, boreal toad, Wyoming toad.
- **Solutions or actions: (partial list)**
  - Maintain the functionality and integrity of sage-grouse core areas.
  - Seek opportunities for habitat enhancement, preservation and protection through partnerships and agreements with USFS, BLM, State Land Board and private landowners to maintain these areas. Possible actions include protecting and maintaining core area values through conservation easements, public/private land exchanges and federal land management agency management plans.

There are additional Goal 1 Terrestrial Crucial Areas and Goal 2 Terrestrial Enhancement areas located within the study area. At the time of this report there are no narratives available from WGFD related to the following areas: Moose Crucial, Wildfire Crucial, Land Protection Crucial, Big Game Crucial Range, and Mixed Mountain Shrub Enhancement.

Management Implications:

While there may be regulations related to timing stipulations on activities within habitat priority areas (ex: no human disturbance November 15th to April 30th), the fact that a project proposed in Chapter 4 is within these priority areas does not preclude it from development. The priority areas are not so much a regulatory delineation, but more of a way for WGFD to determine the best locations to spend their money, time and energy. In fact, if a proposed project in a priority area enhances wildlife habitat, funding through WGFD Trust Fund and the Wyoming Wildlife and Natural Resource Trust (WWNRT) might be available.

Data Sources:

Wyoming Game and Fish Department *:* https://wgfd.wyo.gov/
Wyoming Natural Diversity Database : http://www.uwyo.edu/wyndd/
Wyoming BLM : http://www.blm.gov/wy/st/en/field_offices/Rawlins.html

3.3.8 Cultural Resources

The Wyoming State Historic Preservation Office (SHPO) maintains an in-progress database of inventoried historic sites within the state. A determination of each site's eligibility for inclusion in the National Register of Historic Places (Register) is included in the database. SHPO also has created a spatial data file which "generalizes" the cultural resource inventory. This "location fuzzing" of the historically significant data is to protect the sites from unauthorized disturbance. The attributes recorded for each section of the Public Land Survey System include: site count, inventory acres, report numbers, and eligible site number. Figure 3.3-31 displays the results of the database retrieval in a graphical format. Each square mile section within the study area has been color coded based upon the number of sites within it determined to be eligible for inclusion on the Register.

The National Register of Historic Places (National Register) is the nation's official list of cultural resources worthy of preservation. It is administered on a federal level by the National Park Service, and managed locally by the Wyoming State Historic Preservation Office (SHPO). The National Register is part of a program to coordinate and support both public and private efforts to identify, evaluate, and protect historic and archeological resources. The National Register recognizes the accomplishments of those who have contributed to the history and heritage of the United States, the state, and local communities.

Listing a property on the National Register of Historic Places is a form of acknowledgment and prestige, which places no restraints on the property. This classification does not restrict the rights of property owners to use, develop, or sell the property. Although placing a property on the National Register is intended to neither stop alterations to a building nor require owners to provide the public access to the property, it can provide the owner with eligibility for certain financial incentives (NPS, 2016 at *https://www.nps.gov/nr/national_register_fundamentals.htm*).

To date, 33 sites within the study area have been included in the National Register (see Table 3.3-4). Full descriptions of these sites are available from the National Park Service website located at: *http://npgallery.nps.gov/nrhp/*.

In addition to the historic places mentioned in Table 3.3-4, BLM has mapped the historic trails in Wyoming. The Overland Trail enters the watershed from the southeast and traverses the central watershed, intersecting with two other historic trails (Cherokee Trail – Northern Route and Rock Creek-Fort Fetterman

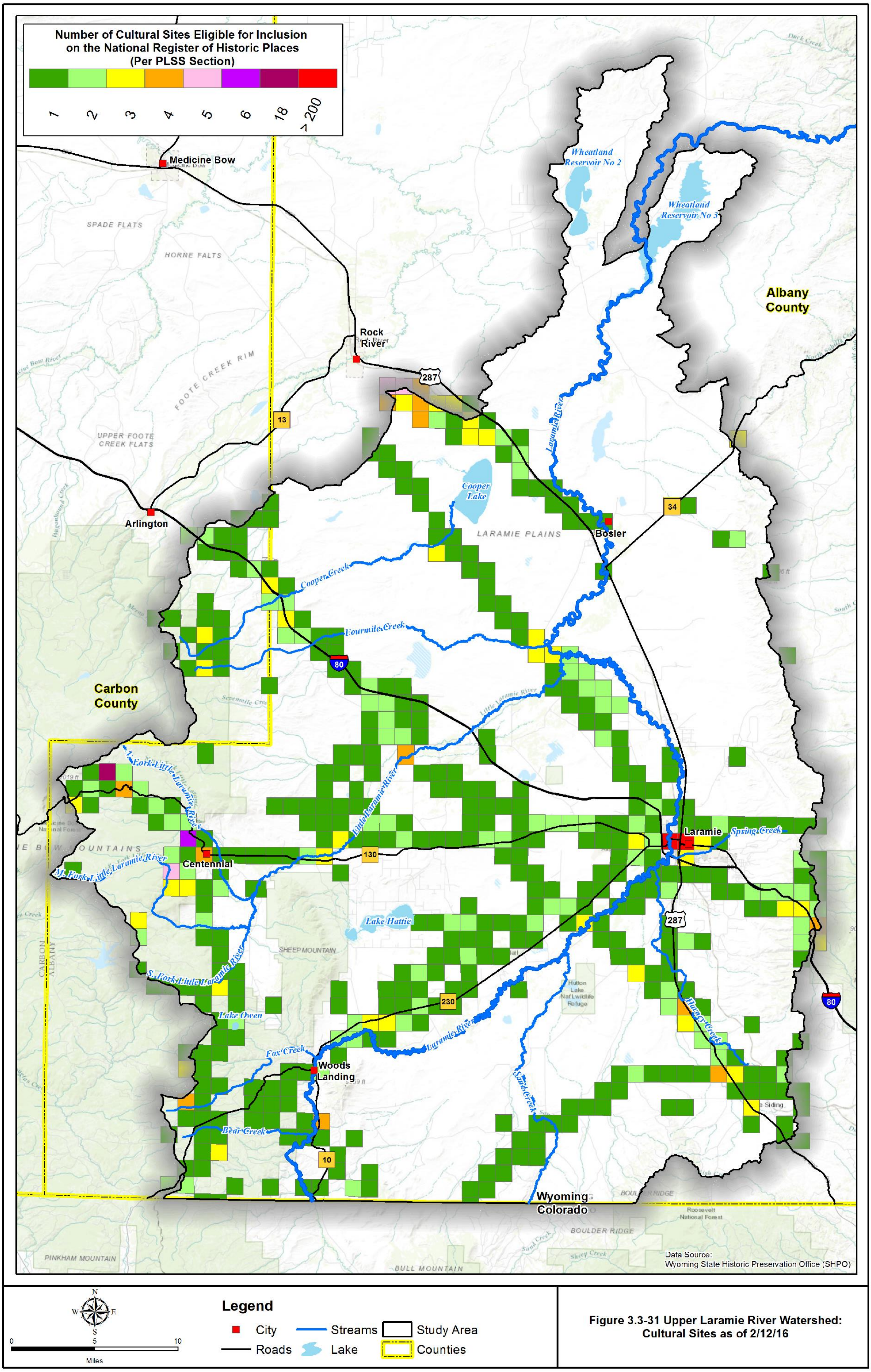


Figure 3.3-31 Upper Laramie River Watershed: Cultural Sites as of 2/12/16

Table 3.3-4 National Register of Historic Places within the Upper Laramie River Watershed.

Historic Place Name	National Registry Reference Number
Barn at Oxford Horse Ranch	86001398
Bath Ranch	85003211
Bath Row	86001015
Blair, Charles E., House	80004298
Boswell, N. K., Ranch	77001381
Brooklyn Lodge	89001068
Centennial Depot	82001828
Centennial Work Center	94000273
Conley, John D., House	80004299
Cooper Mansion	83003359
DOE Bridge over Laramie River	85000411
Durlacher House	11000097
East Side School	81000610
Flying Horseshoe Ranch	1226
Fort Sanders Guardhouse	80004300
Goodale, William, House	91000996
Ivinson Mansion and Grounds	72001295
Jelm-Frank Smith Ranch Historic District	78002816
Laramie Downtown Historic District	88002541
Lehman-Tunnell Mansion	82001829
Libby Lodge aka Snowy Range Lodge	76001947
Lincoln School	3001252
Mountain View Hotel	7000541
Old Main	86001536
Richardson's Overland Trail Ranch	92000122
Snow Train Rolling Stock	13000265
St. Matthew's Cathedral Close	84003622
St. Paulus Kirche (Evangelical Church)	83004266
Union Pacific Athletic Club	78002814
University Neighborhood Historic District	9001109
Vee Bar Ranch Lodge	86001468
Woods Landing Dance Hall	85003210
Wyoming Territorial Penitentiary	78002815

Stage Road) near present day Arlington, WY. Figure 3.3-32 displays the historic trails and sites listed on the National Registry of Historic Places within the study area.

Management Implications:

The data presented above is only the data that is open to the public; there is also "sensitive data" that was not made available for this study. The Wyoming State Historic Preservation Office (SHPO) should be contacted before proceeding with any proposed project to obtain more detailed site-specific information.

If the BLM is involved in any way in a proposed project and the project is within ¼ mile of a historic trail or within the visual horizon of the trail, stipulations put forth in the Rawlins Resource Management Plan (RMP 2008) would be imposed. Most issues related to projects proposed in this report could be mitigated by following best management practices suggested by the BLM, such as low-profile water tanks and low-contrast paint to blend into the surroundings.

Data Sources:

Wyoming Bureau of Land Management (BLM): *http://www.blm.gov/wy/st/en.html*
Wyoming State Historic Preservation Office (SHPO): *http://wyoshpo.state.wy.us/Index.aspx*
National Park Service, National Registry of Historic Places: https://www.nps.gov/nr/

3.4 Natural Environment

3.4.1 Climate

Climate of the study area would be considered a semi-arid continental climate with temperature extremes with. topography being the primary climate influence. Historic climate data for four NOAA Cooperative Weather Stations in watershed was obtained through the Western Regional Climate Center website (*http://www.wrcc.dri.edu/*). Table 3.4-1 presents the average temperature range and average total precipitation while Figure 3.4-1 displays the data graphically as bar charts. As indicated in the bar charts, summers are warm with July high temperatures averaging around 80 °F (26.7 °C) in the vicinity of Laramie. With increasing elevation, this average drops rapidly as indicated at the Foxpark station where the July highs average 71 °F (21.6 °C). Summer nights throughout the assessment area are characterized by a rapid cool down; with mean summer lows averaging 48°F at Laramie and 37°F at Foxpark. Winters are cold, but are variable with periods of sometimes extreme cold interspersed between generally mild periods. Chinook winds can provide unusually warm temperatures in some locations.

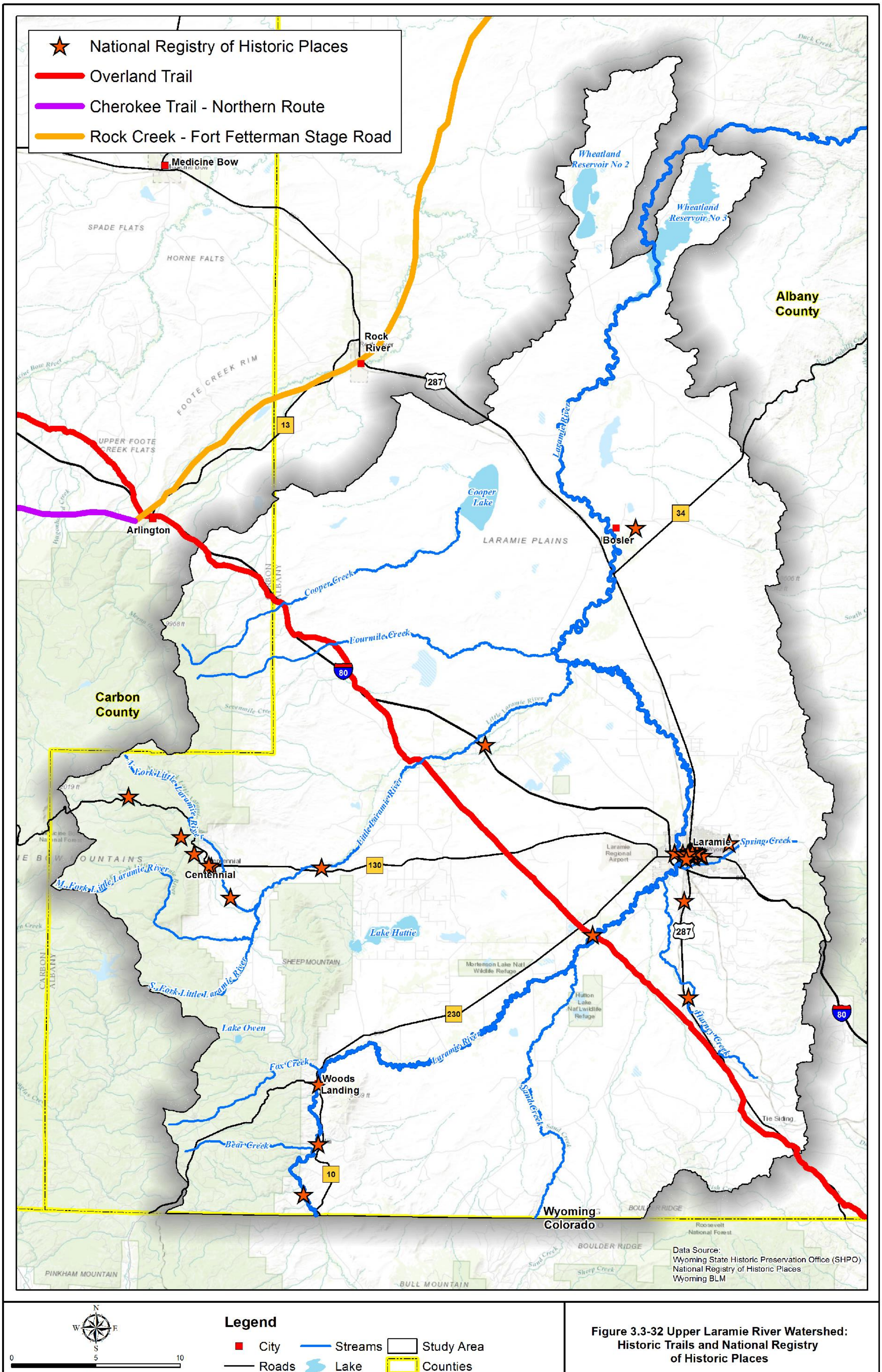


Figure 3.3-32 Upper Laramie River Watershed: Historic Trails and National Registry of Historic Places

Table 3.4-1 Summary of Monthly Climatic Data: Upper Laramie River Watershed.

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Laramie AP, Wyoming 485415: 1/1/1948 to 1/20/15													
Average Max. Temperature (F)	32.6	35.1	41.5	50.9	61.7	73	80.3	78.3	69.2	56.9	41.8	33.7	54.6
Average Min. Temperature (F)	9.2	11.3	17.2	24.5	33.5	41.9	48	46.3	37.7	27.8	17.1	10.4	27.1
Average Total Precipitation (in.)	0.38	0.39	0.65	0.97	1.5	1.33	1.5	1.17	0.98	0.76	0.53	0.36	10.52
Centennial 1 NE, Wyoming 481610: 2/1/1899 to 1/14/2010													
Average Max. Temperature (F)	32	33.8	39	48.7	59.6	70.2	76.8	74.6	66.9	55.5	41.5	33.3	52.6
Average Min. Temperature (F)	12.1	13.1	17	24.4	32.7	40.5	47	45.3	37.7	29.1	19.7	13.8	27.7
Average Total Precipitation (in.)	1.18	1.17	1.29	1.57	1.62	1.29	1.56	1.27	1.28	0.98	0.89	1.04	15.15
Foxpark, Wyoming 483630: 8/1/1948 to 2/28/1979													
Average Max. Temperature (F)	26.1	28.6	33.6	42.6	52.8	64.3	71.5	69.7	61.7	50.8	36.3	28.8	47.2
Average Min. Temperature (F)	4.4	5.7	9.4	17.6	25.7	32.4	37.2	35.7	29.1	22.7	12.4	7.3	20
Average Total Precipitation (in.)	1.36	1.23	1.49	1.5	1.41	1.55	1.54	1.55	1.27	1.01	1.04	1.17	16.12
Lookout 14 NE: 8/1/1948 to 7/31/1965													
Average Max. Temperature (F)	28.7	32.1	37.8	50.5	61.4	72.1	80.6	79	69.6	58	41.5	33.2	53.7
Average Min. Temperature (F)	6	8.9	15.5	25.2	34.5	43.3	49.8	48	38.7	28.7	16.2	11	27.2
Average Total Precipitation (in.)	0.68	0.76	0.98	1.55	1.81	1.47	1.57	0.96	0.91	0.69	0.53	0.47	12.38

Figure 3.4-2 displays the mean annual precipitation throughout the watershed. This figure clearly shows the relationship between elevation and precipitation amounts. The data used to generate this figure were obtained from the Wyoming Geographic Information Center (WyGISC). These data represent the results of PRISM spatial climate data generated at the Oregon Climate Center, Oregon State University. As indicated in this figure, the mean annual precipitation varies from a minimum of about 10-inches at the lower elevations to over 40-inches at the highest elevations, with approximately 60 percent of the watershed receiving 13-inches of precipitation or less annually.

Average frost-free growing season within the watershed ranges from about 50wq days at Foxpark to 100 days around Laramie. Extreme fluctuations in temperatures from day to day and in annual precipitation from year to year are common. These climatic variations have strong effects on vegetation and in determining land capabilities and use. Summers are accompanied by prevailing southwesterly winds that become stronger as fall approaches. Winter winds are often out of the northwest, creating blizzard conditions (BLM, 2008).

It must be kept in mind that this information must be viewed in light of the fact that climate changes are occurring and will likely continue to occur into the future. Causal relationships are open to debate, however, according to a recent publication of the University of Wyoming (Gray, S., C. Anderson, 2009):

> *"There is mounting evidence that the earth is experiencing a warming trend. Climate change has resulted in a 1° F increase in average global temperature in the past century, largely in the past 30 years (IPCC, 2007). The concern now is that climate change may increase the impact of droughts, just as population growth and other factors have greatly increased the West's vulnerability to water shortages. The impacts of these global changes on Wyoming's weather and river systems include altered precipitation patterns and changes to the timing of snowmelt and river flows, which together will significantly alter Wyoming's water supply."*

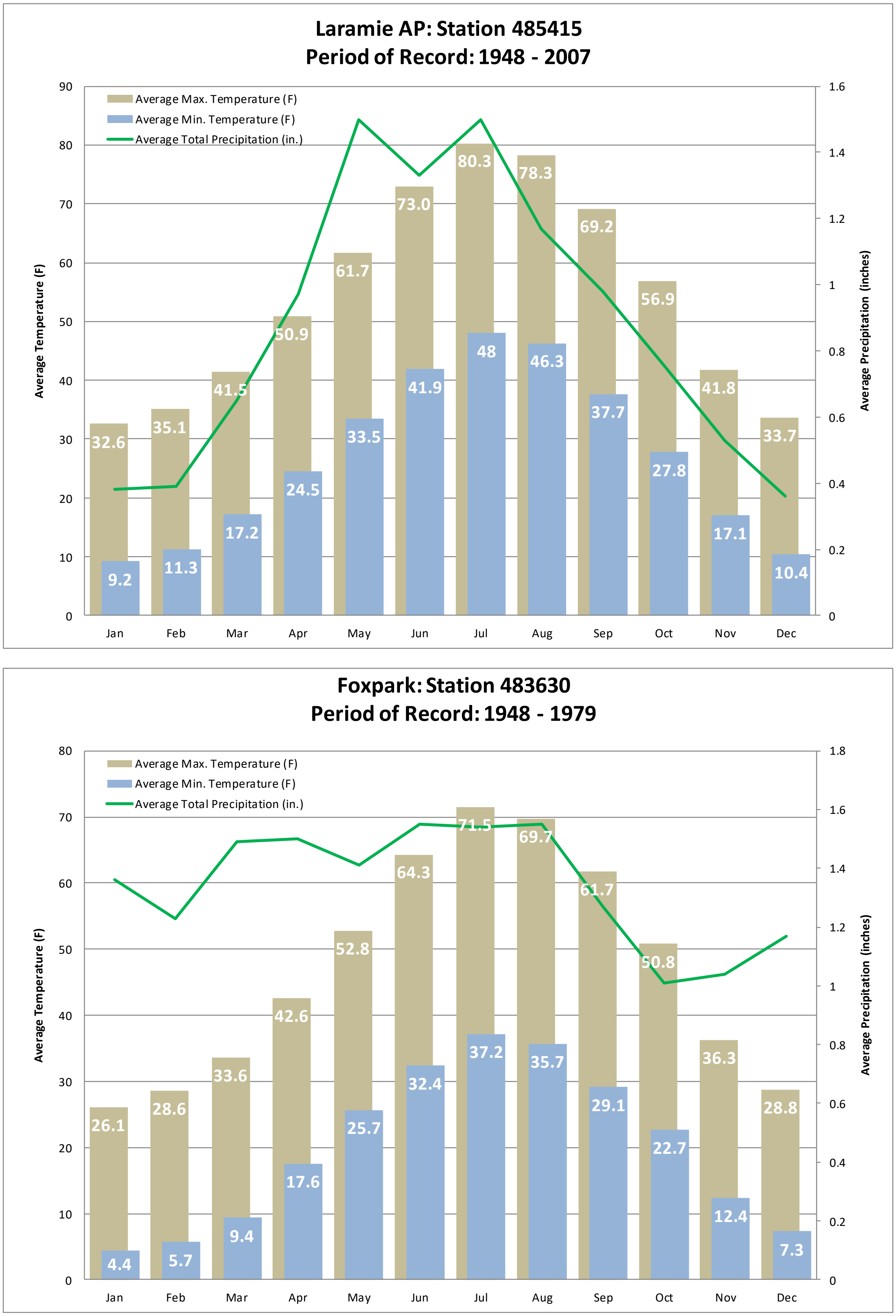
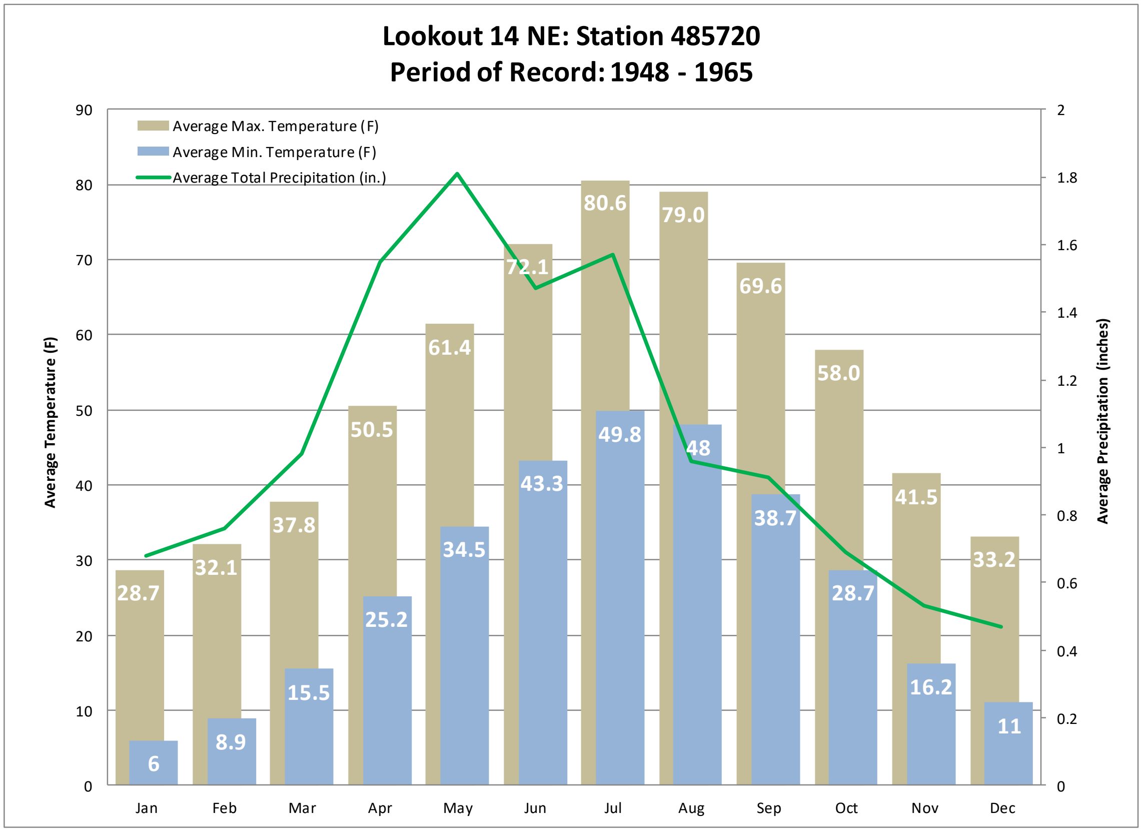


Figure 3.4-1 Mean Monthly Climatic Factors for Upper Laramie River Watershed (1948-2015).



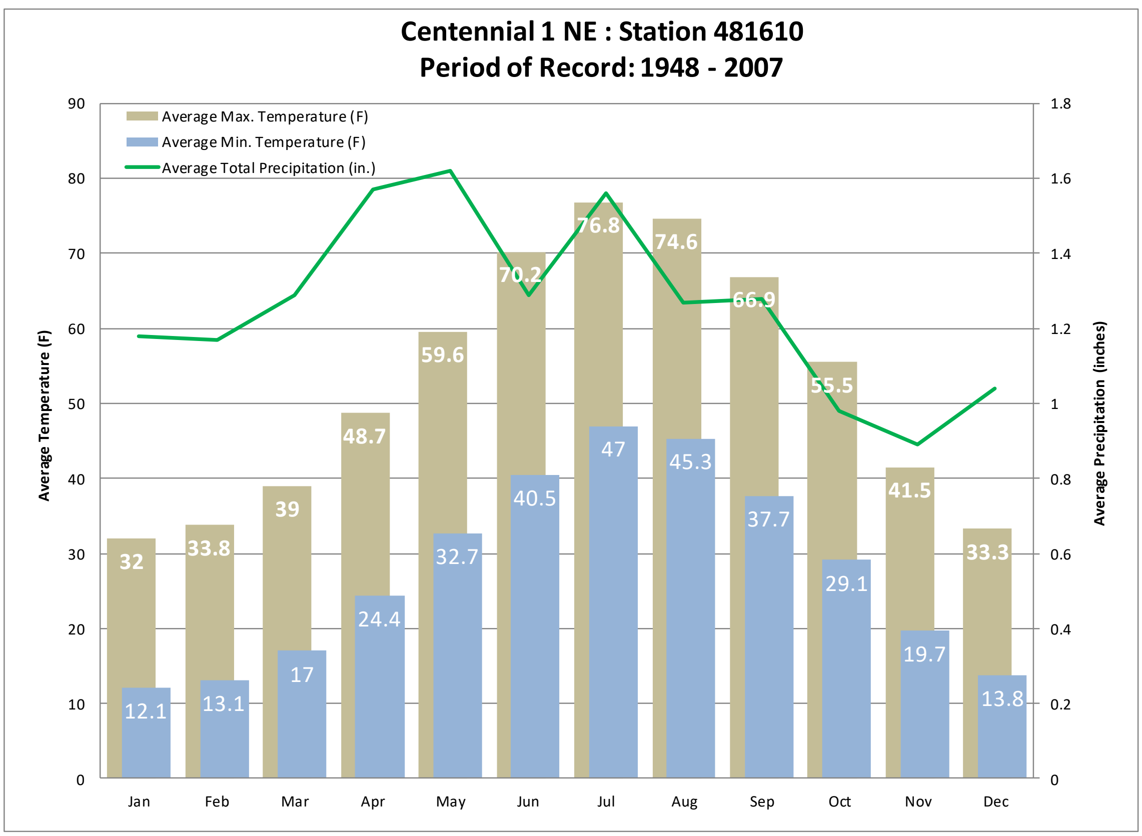


Figure 3.4-1 (continued) Mean Monthly Climatic Factors for Upper Laramie River Watershed (1948 - 2015).

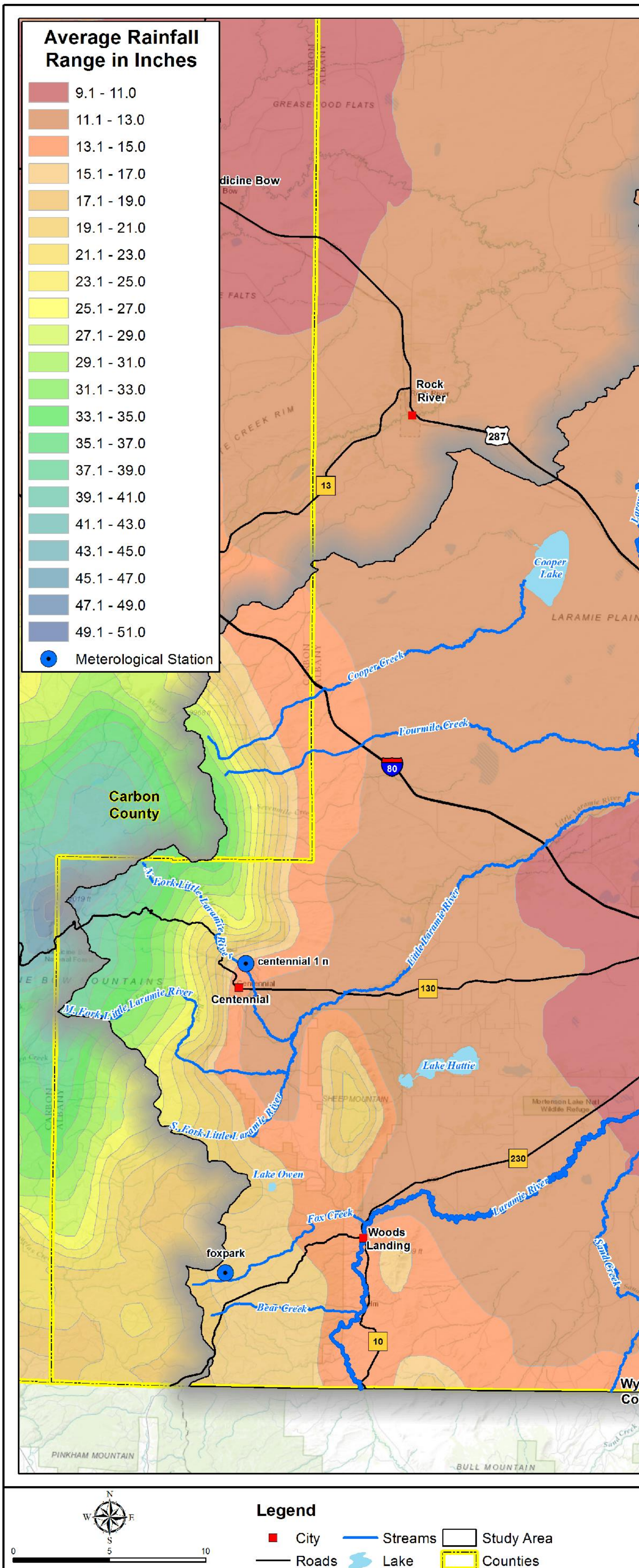


Figure 3.4-2 Upper Laramie River Watershed: Meterological Stations and Precipitation Isohyetals

Management Implications:

Climatic changes will present unpredictable challenges for land managers; impacts of long-term climatic changes cannot be predicted at this time. Numerous guidance documents are available which provide guidance for conducting climate change vulnerability assessments, or CCVA's. The USEPA provides guidance documents worthy of review by land managers that target vulnerability assessment and planning to offset potential impacts. Many of these documents have been incorporated within the project Digital Library.

Data Sources:

Western Regional Climate Center: http://www.wrcc.dri.edu/
Oregon Climate Center, Oregon State University PRISM dataset

3.4.2 Vegetation and Land Cover

There are multiple sources of data describing vegetation and land cover for the Upper Laramie River Watershed Study Area. The principle sources are discussed below.

3.4.2.1 National Land Cover Database (NLCD)

Land cover within the watershed was evaluated using the National Land Cover Database (NLCD). 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 for the Nation. NLCD provides spatial reference and descriptive data for characteristics of the land surface such as thematic class (for example, urban, agriculture, and forest), percent impervious surface, and percent tree canopy cover. NLCD supports a wide variety of Federal, State, local, and nongovernmental applications that seek to assess ecosystem status and health, understand the spatial patterns of biodiversity, predict effects of climate change, and develop land management policy. NLCD products are created by the Multi Resolution Land Characteristics (MRLC) Consortium, a partnership of Federal agencies led by the U.S. Geological Survey. (Homer, C.H., Fry, J.A., and Barnes C.A., 2012, the National Land Cover Database, U.S. Geological Survey FactSheet 2012-3020, 4 p.). Table 3.4-2 presents the results of National Land Cover Database analysis for the study area.

3.4.2.2 LANDFIRE

In order to draw a clearer picture of the land cover within the watershed the vegetative cover within the study area was also evaluated using data obtained through the LANDFIRE project (*www.landfire.gov*). LANDFIRE (Landscape Fire and Resource Management Planning Tools Project) is an interagency vegetation, fire, and fuel characteristics mapping project. It is a shared project between the Department

Table 3.4-2 National Land Cover Database Analysis for the Upper Laramie River Watershed.

Upper Laramie River Watershed : National Land Cover Database (NLCD)			
Classification	**Description**	**Acres**	**Percent of Watershed**
Shrub/Scrub	Areas dominated by shrubs; less than 16 feet tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.	816,186	67.9%
Grassland/Herbaceous	Areas dominated by gramanoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.	134,703	11.2%
Evergreen Forest	Areas dominated by trees generally greater than 16 feet tall, and greater than 20% of total vegetation cover. More than 75% of the tree species maintain their leaves all year. Canopy is never without green foliage.	101,862	8.5%
Emergent Herbaceous Wetlands	Areas where perennial herbaceous vegetation accounts for greater than 80% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.	49,320	4.1%
Pasture/Hay	Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20% of total vegetation.	39,405	3.3%
Open Water	Areas of open water, generally with less than 25% cover of vegetation or soil.	17,394	1.4%
Woody Wetlands	Areas where forest or shrubland vegetation accounts for greater than 20% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.	12,021	1.0%
Other	Classifications with less than 1% of study area	30,411	2.5%
Total		1,201,303	100%

of Interior (DOI) and Forest Service Wildland Fire Management programs. The primary purpose of the LANDFIRE project is to collect the data necessary to develop wildland fire models. The data are generated using remote sensing techniques with on-the-ground truthing. Data products accessed for this project included 30-meter spatial resolution raster data sets describing vegetation type and cover. LANDFIRE vegetation map units are derived from NatureServe's Ecological Systems classification (Comer and others, 2003). While the geographic resolution (30-meter) of the LANDFIRE data is the same as the NLCD data discussed previously, the classification system used by the LANDFIRE dataset is more highly evolved than the NLCD data. This allows for a finer classification of the vegetative cover within the study area.

The LANDFIRE data describes numerous attributes pertinent to this study, including:

- Environmental Site
- Potential Biophysical Settings
- Existing Vegetation Type
- Existing Vegetation Height
- Existing Vegetation Cover

The LANDFIRE "existing vegetation type" (EVT) data were analyzed and the distribution of vegetation classes is summarized in Appendix 3D. The LANDFIRE existing vegetation data indicate a diverse collection of vegetation types totaling 90 different vegetation classes within the Upper Laramie River watershed.

As is clearly indicated in the data, the major sagebrush community (Inter-Mountain Basins Big Sagebrush Shrubland) dominates coverage of the watershed totaling over 42% of the study area. While the fact that the majority of the study area is covered in sagebrush comes as no surprise, the table presents valuable information pertaining to the vegetation types present to a much lesser extent. In order to aid in future analysis and enable the LANDFIRE data to be utilized as a land management/planning tool, the Existing Vegetation Type (EVT) data has been intersected with the sub-watersheds (12 digit hydrologic units) within the study area. The result of this analysis has been included in the project GIS and Digital Library delivered with this report. This data intersection will facilitate a more focused vegetation analysis based on the sub-watersheds within the study area. Analytical tools available within the project GIS facilitate use of the LANDFIRE data for regional watershed planning. For example, areas of the watershed identified as any of several juniper species communities can be identified and evaluated onsite to determine potential encroachment areas. Similar evaluations within the project GIS can be completed for wetland/riparian communities in order to determine areas where the LRCD may concentrate future planning efforts.

While the LANDFIRE data provides valuable insight into watershed conditions, its display is difficult because of the fact the data are represented by a grid with 30-meter spacing. The LANDFIRE data set is included within the project GIS and available for use in subsequent projects and associated efforts.

3.4.2.3 GAP Analysis

A more general vegetative distribution map was created from the Wyoming GAP analysis and is presented in Figure 3.4-3. The Wyoming GAP analysis is discussed below.

The Wyoming GAP dataset was produced "with an intended application at the state or ecoregion level - geographic areas from several hundred thousand to millions of hectares in size. The data provide a coarse-filter approach to vegetation analyses, meaning that not every occurrence of habitat is mapped; only large, generalized distributions are mapped, based on the USGS 1: 100,000 mapping scale in both detail and precision. Therefore, this dataset can be used appropriately for coarse-scale (> 1: 100,000) applications, or to provide context for finer-level maps or applications" (University of Wyoming, Spatial Data Visualization Center, 1996). For the purposes of this project however it is the most "display-friendly" vegetative dataset available and provides generalized distributions of the vegetative land cover located within the Upper Laramie River watershed. Figure 3.4-3 displays the Wyoming Gap Analysis results for the study area. Note that the classifications in the figure are listed in their order of abundance within the watershed. Of the 25 different GAP classifications present in the watershed, two dominate the landscape and make up a combined 64% of the study area. The dominant GAP classifications are Mixed Grass Prairie (54%) and Lodgepole Pine (10%).

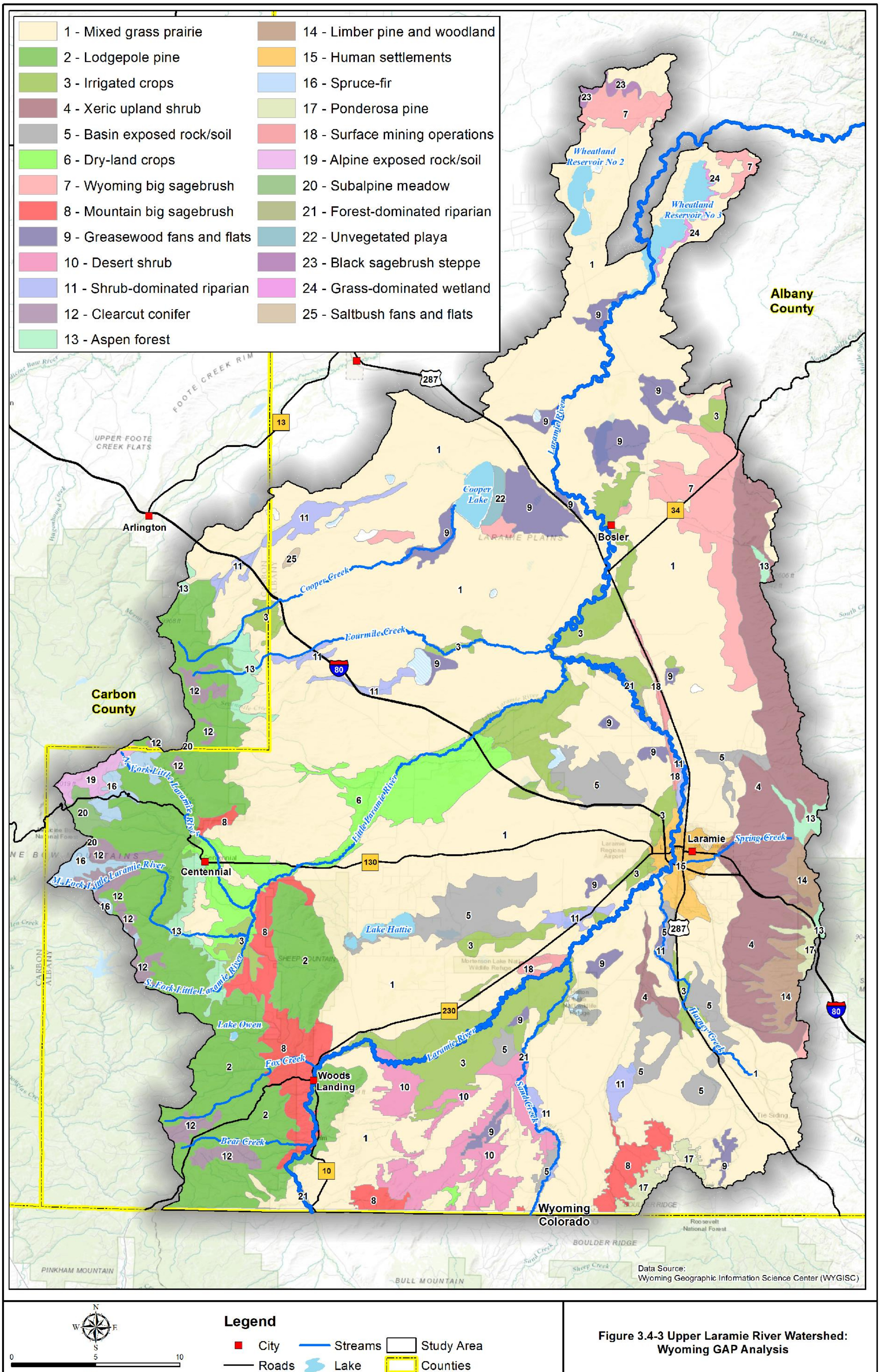


Figure 3.4-3 Upper Laramie River Watershed: Wyoming GAP Analysis

Distinct plant communities within the study area are influenced by characteristics such as soil depth, texture, and salt content; climate variables, particularly temperature, total and seasonal distribution of precipitation, and wind; and topographic features, most importantly elevation, aspect, and slope. Plant communities respond to other environmental influences such as wildlife foraging, rodent burrowing, and ant hills. Plants themselves also influence soil chemistry and soil resistance to wind and water erosion. Vegetation management goals, objectives and actions related to the study area are available in the Rawlins BLM Resource Management Plan (2008) located in the Digital Library delivered with this report.

3.4.2.4 Wyoming Natural Diversity Database (WYNDD)

The Wyoming Natural Diversity Database (WYNDD) lists vegetative species of concern or species of potential concern which have been documented within the study area. The database was queried and the results are presented in Appendix 3E.

3.4.2.5 Pine Beetle Epidemic and Vegetation

The discussion of vegetation and land cover would not be complete without addressing the mountain pine beetle epidemic occurring on the forested lands within the study area. The Medicine Bow National Forest makes up 22% of the landownership within the study area and is located primarily in the southwestern portion of the basin. The following regarding the outbreak and its history is extracted from: Review of the Forest Service Response: The Bark Beetle Outbreak in Northern Colorado and Southern Wyoming (USDA, 2011). This report is also included in the digital library delivered with this report.

A mountain pine beetle outbreak in three national forests in the Rocky Mountain Region (Region 2) of the U.S. Forest Service—the Arapaho-Roosevelt, Medicine Bow-Routt and White River—was initially detected in 1996. By 2010 it had spread to about four million acres.

Factors that helped set the stage for a large-scale outbreak included:

- Consecutive years of severe drought in the late 1990s and through the middle of the first decade of the 2000s, putting already densely populated stands under severe stress.
- Funding for pre-commercial and commercial thinning to reduce stand density during the decade leading up to and including the outbreak did not keep pace with the rate of bark beetle outbreak spread.
- Limited accessibility of terrain (only 25% of the outbreak area was accessible due to steep slopes, lack of existing roads, and land use designations such as Wilderness that precluded treatments needed to reduce susceptibility to insects and disease).
- Decline in public acceptance of large-scale timber management practices in the last part of the 20th century. This lack of public acceptance, compounded by national and international market forces and the relatively low commercial value of Lodgepole Pine, contributed to a corresponding

decline in the timber industry. (The timber industry in the Rocky Mountain Region has declined by 63 percent since 1986).

Historical land uses, involving mining and the railroad construction in the area, also contributed to setting the stage for a large scale epidemic.

The tie hacking industry in the area of Wyoming and Colorado that is now the Medicine Bow National Forest began in 1868 with the construction of the Transcontinental Railroad. During the peak construction years, 1868 to 1870, timber for 3 million railroad ties was removed. Between 1869 and 1902 (the year the Medicine Bow National Forest was established), timber for another 10 million railroad ties were taken, representing 90-95% of the total volume of forest products.

This scale of tree removal, and the clearing of large areas to expose the geology for mining exploration and extraction, resulted in a “regeneration event” in thousands of acres of pine forests—in other words, whole forests started over with seedlings. This contributed to the current stand structure where a mature overstory is the prevalent condition (USDA, 2011).

In order to understand the extent of the change occurring in the forest, Table 3.4-3 presents the summary characteristics related to basal area for 5 watersheds between 2002 and 2012. Note that this table contains watersheds outside of the study area, yet within the Medicine Bow National Forest. The full report (Troendle & Nankervis, 2014) is available in the digital library delivered with this report. The basal area of a tree is defined as the cross-sectional area of a single tree at breast height. This measurement can be used to determine forest stand density and can be linked to timber stand volume and growth. As seen in the table, the watersheds have seen significant basal area reductions between 2002 and 2012. Any analysis of vegetative cover within this watershed must keep in mind that the forests located in the southwestern portion of the watershed are in a transition phase. A mountain pine beetle outbreak of this scope is unprecedented in this area, making accurate predictions regarding the future forest makeup difficult at best.

Table 3.4-3 Summary of Forest Characteristics of Five Watersheds between 2002 and 2012.

Watershed	Watershed Area mi^2	Forested Area mi^2	Percent Area Forested	Percent Change in Basal Area
Laramie River	430.9	314.6	73	-40.7
North Platte River	1430.0	644.0	45	-48.7
North Brush Creek	37.5	37.5	100	-37.0
Encampment River above Hog Park	72.8	72.1	99	-66.5
Encampment River at Mouth	261.8	193.7	74	-59.6

NOTE: This table includes basins outside of the Laramie River study area to exemplify the magnitude of the regional changes in basal area.

At larger scales, Lodgepole Pine forests affected by mountain pine beetles will regenerate naturally and a new forest will emerge with time. While dead trees on a mountain slope may not be visually appealing, the forest has been reset—not destroyed. (USDA, 2011).

The effects of the pine beetle epidemic on irrigation and watershed hydrology are discussed in Sections 3.3 and 3.5 respectively in this report.

3.4.2.6 Noxious Weeds

Vegetation of particular importance with respect to land use and habitat that were identified by the Wyoming Weed and Pest Council include:

Designated Noxious Weeds W.S. 11-5-102 (a) (xi). For more information, see: http://www.wyoweed.org/

- Field bindweed (Convolvulus arvensis L.)
- Canada thistle (Cirsium arvense L.)
- Leafy spurge (Euphorbia esula L.)
- Perennial sowthistle (Sonchus arvensis L.)
- Quackgrass (Elymus repens (L.) Gould.)
- Hoary cress (whitetop) (Cardaria draba & Cardaria pubescens (L.) Desv.)
- Perennial pepperweed (giant whitetop) (Lepidium latifolium L.)
- Ox-eye daisy (Leucanthemum vulgare Lam.)
- Skeletonleaf bursage (Ambrosia tomentosa Nutt.)
- Russian knapweed (Acroptilon repens L.)
- Yellow toadflax (Linaria vulgaris (P.) Mill)
- Dalmatian toadflax (Linaria dalmatica (L.) Mill.)
- Scotch thistle (Onopordum acanthium L.)
- Musk thistle (Carduus nutans L.)
- Common burdock (Arctium minus (Hill) Bernh.)
- Plumeless thistle (Carduus acanthoides L.)
- Dyer's woad (Isatis tinctoria L.)
- Houndstongue (Cynoglossum officinale L.)
- Spotted knapweed (Centaurea stoebe L. ssp. micranthos (Gugler) Hayek)
- Diffuse knapweed (Centaurea diffusa Lam.)
- Purple loosestrife (Lythrum salicaria L.)
- Saltcedar (Tamarix spp.)
- Common St. Johnswort (Hypericum perforatum L.)
- Common Tansy (Tanacetum vulgare)
- Russian olive (Elaeagnus angustifolia L.)
- Black Henban (Hyoscyamus niger)

Additionally, as of February 2016 the Wyoming Weed and Pest Council lists the following weeds as declared weeds by county:

Albany County:

- Plains larkspur/Geyer larkspur (Delphinium geyeri Greene)
- Locoweed (Oxytropis spp.)
- Cheatgrass / downy brome (Bromus tectorum L.)

Carbon County:

- Common cocklebur (Xanthium strumarium L.)
- Halogeton (Halogeton glomeratus (M. Bieb.) C.A. Mey.)
- Plains pricklypear (Opuntia polyacantha Haw.)
- Plains larkspur/Geyer larkspur (Delphinium geyeri Green)
- Wyeth lupine (Lupinus wyethii S. Watson.)

"Designated noxious weed" is defined by the Wyoming Weed & Pest Control Act as follows:

"weeds, seeds or other plant parts that are considered detrimental, destructive, injurious or poisonous, either by virtue of their direct effect or as carriers of diseases or parasites that exist within this state, and are on the designated list, which is formed by joint resolution of the Wyoming Board of Agriculture and the Wyoming Weed and Pest Council. If a plant is listed as a Designated Noxious Weed, that listing provides statewide legal authority to regulate and manage it."

"Declared weed" is defined as follows:

"any plant which the Wyoming Board of Agriculture and the Wyoming Weed and Pest Council have found, either by virtue of its direct effect, or as a carrier of disease or parasites, to be detrimental to the general welfare of persons residing within a district (county).

If a plant is listed as a County Declared Weed, that listing provides that county with legal authority to regulate and manage it."

The county Weed and Pest Districts actively conduct control measures to reduce the spread and reproduction of weed species. Albany County and Carbon County Weed and Pest Districts map areas of weed occurrence within the study area. The mapping was not available to be included in this report due to its sensitive nature and private property concerns. Interested landowners should contact the Albany County or Carbon County Weed and Pest Districts for more information.

Data Sources:

Albany County Weed and Pest District: http://www.albanycountyweedandpest.com/
Carbon County Weed and Pest District: http://www.carboncountyweed.com/

3.4.2.7 Wetlands

Existing mapping of wetlands within the study area consisted of the National Wetlands Inventory (NWI) created by the US Fish and Wildlife Service (USFWS). The NWI mapping was completed using aerial photographs within the GIS environment and digitizing by analysts, however due to the relatively limited extent of mapped wetlands in relation to the size of the watershed, the data does not lend itself to presentation at the watershed scale.

Based upon the NWI mapping, approximately 91,593 acres of wetlands exist within the watershed. Figure 3.4-4 presents a pie chart showing the relative distribution of the general wetland types. The major contiguous wetlands in the watershed are located primarily within the floodplain of the Laramie and Little Laramie Rivers in the central part of the watershed. It is generally understood by users of the NWI mapping that the data are suitable for broad scale planning efforts such as this Level I investigation; however, before design and completion of any project potentially affecting wetlands, detailed onsite delineation should be conducted.

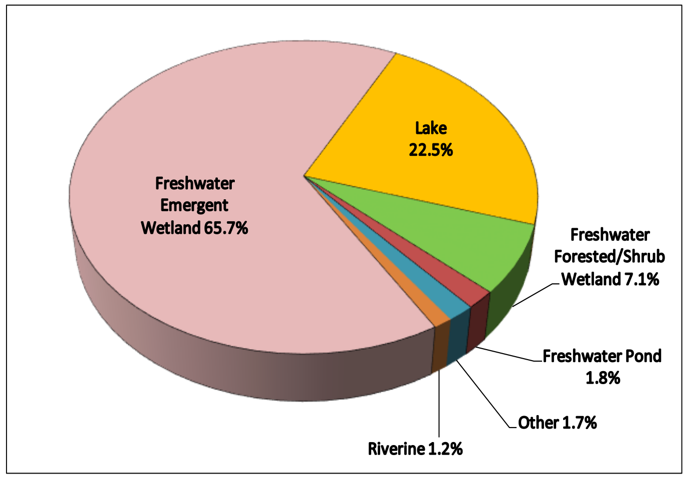


Figure 3.4-4 Percent of NWI Wetlands Types.

The Nature Conservancy utilized the existing NWI data as the basis for development of their 2010 Wetland Complex dataset in which they identified 221 wetland complexes in the State of Wyoming. The Wetland Complex dataset has been included in the project GIS and includes attributes such as:

- Number of Wyoming Species of Greatest Conservation Need (SGCN) in the complex.
- Number of rare species of Greatest Conservation Need (SGCN). See Copeland et al (2010) Ecological Indicators pub for a list of rare species.
- Biological diversity ranking of the complexes.
- Vulnerability of complexes to oil and gas development, residential development, and drought.

There are three named wetland complexes and one unnamed complex exist within the study area (Figure 3.4-5):

- Laramie Plains Wetland Complex (LPWC),
- Laramie Range Wetland Complex (LRWC), and
- Snowy Range Wetland Complex (SRWC).

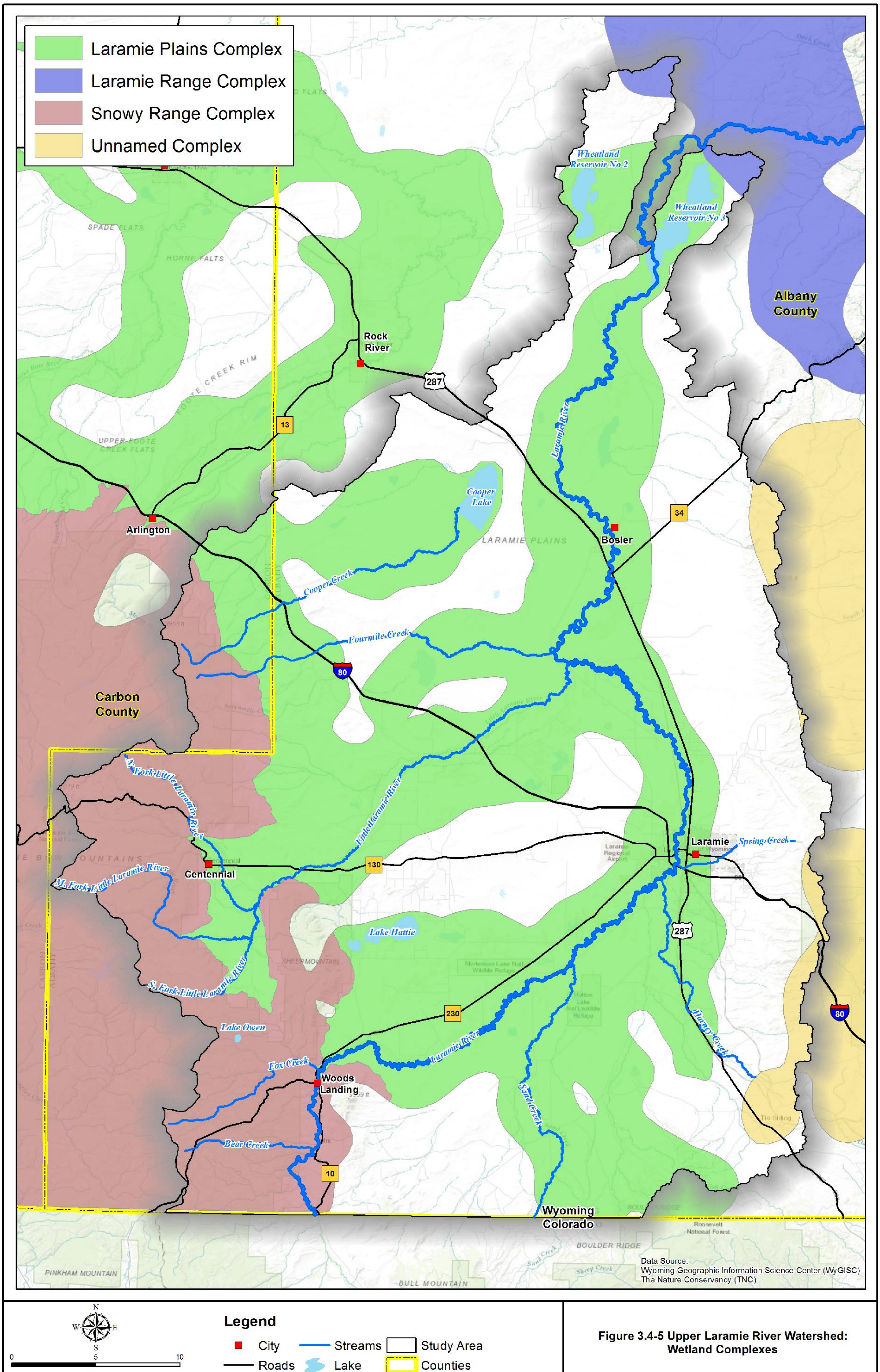


Figure 3.4-5 Upper Laramie River Watershed: Wetland Complexes

The LPWC is the most extensive within the basin; it covers 1,480 square miles. In 2014, the Wyoming Game and Fish department published a conservation plan with numerous recommendations for management and enhancement of wetlands within the LPWC (WGF, 2014).

In 2016, the Nature Conservancy and the WGF published the results of an assessment of the Laramie Plains Complex (WGF, 2016). A summary of the assessment was extracted and is presented below:

- The four wetland subgroups identified were: riparian woodland and shrubland; emergent marsh; wet meadow; and playa and saline depressions.
- All ecological subgroupings were dominated by B-ranked (slightly impacted) wetlands (67%), meaning there was evidence of low levels of disturbance and a slight deviation from reference condition. In addition, 3% of wetlands in the LPWC were A-ranked, 25% C-ranked and 5% D-ranked. The reader is directed to the WGF document for further details pertaining to the results and methods of the assessment.
- Overall, results indicated that approximately 30% of wetlands in the basin are moderately to significantly disturbed.

The LANDFIRE data includes a limited determination of wetlands as well. The LANDFIRE data does not graphically represent well at the watershed scale, therefore the riparian/wetland vegetation communities in the dataset are presented in Table 3.4-4.

Table 3.4-4 LANDFIRE Riparian/Wetlands Classifications.

Upper Laramie River Watershed : LANDFIRE Wetlands				
Existing Vegetation Type	Physiognomy (form/morphological structure of vegetation)	Acres	Percent of Watershed	Cumulative Percent
Western Great Plains Floodplain Forest and Woodland	Riparian	16425.5	1.36728%	1.37%
Western Great Plains Floodplain Herbaceous	Riparian	7189.2	0.59844%	1.97%
Rocky Mountain Montane Riparian Forest and Woodland	Riparian	4260.8	0.35467%	2.32%
Rocky Mountain Subalpine/Upper Montane Riparian Shrubland	Riparian	2825.6	0.23520%	2.56%
Rocky Mountain Wetland-Herbaceous	Riparian	2124.4	0.17684%	2.73%
Western Great Plains Floodplain Shrubland	Riparian	559.8	0.04660%	2.78%
Western Great Plains Depressional Wetland Systems	Riparian	423.6	0.03526%	2.81%
Rocky Mountain Subalpine/Upper Montane Riparian Forest and Woodland	Riparian	358.7	0.02986%	2.84%
Rocky Mountain Montane Riparian Shrubland	Riparian	188.4	0.01568%	2.86%
Western Great Plains Wooded Draw and Ravine	Riparian	0.8	0.00007%	2.86%

3.4.3 Geology

3.4.3.1 Surficial Geology

The surficial deposits mapped within the Upper Laramie watershed are presented on Figure 3.4-6. The figure shows the wide distribution of alluvium, colluvium, alluvial fan, and terrace deposits, etc. within the watershed. These sediment types constitute the dominant exposed geology within the watershed. The remaining exposed geology is composed of bedrock, grus, landslide, and glacial and other minor deposits. Each of these deposits will produce soils and vegetation as a function of its physical and chemical

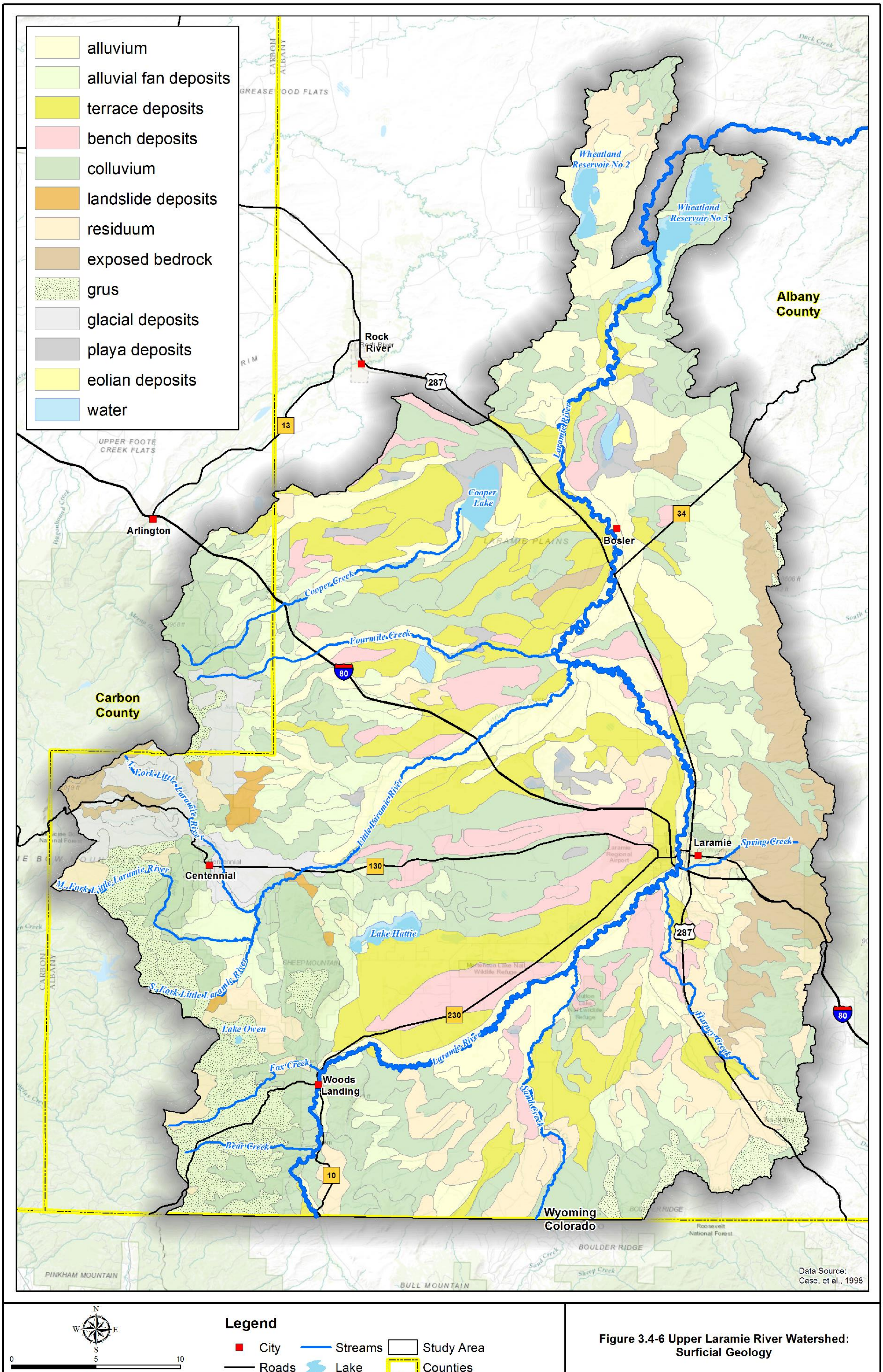


Figure 3.4-6 Upper Laramie River Watershed: Surficial Geology

composition, slope, slope aspect, local precipitation and other climatic factors, age, etc. which vary widely across the study area.

Alluvium is the material associated with surface drainages and is of fluvial origin (produced by the action of a stream or river). The extent of the alluvial deposits varies with the size of the respective fluvial system (present and past). Headwater deposits are typically narrower, shallower, and coarser than deposits in downstream areas in the watershed. Where associated with an active stream, these deposits may be eroding or depositing with the continuing fluvial action. Fluvial deposition includes flooding (vertical deposition) and point-bar migration (lateral deposition).

Closely associated with the mapped “alluvium” are the “alluvial fan deposits”, “terrace deposits”, and “bench deposits”, all of which are the result of moving water spreading erosional debris along stream channels and across the landscape. In aggregate, these alluvial materials cover the 50% of the watershed area.

Colluvium is the rock and soil debris moving downhill, either slowly (“mass wasting”) or suddenly (“landslide”) under the pull of gravity. Thus, colluvial deposits are composed of material derived from whatever bedrock is present upslope.

Where such weathered bedrock has not moved significantly, but remains largely in place, it is termed “residuum”, i.e. the in-situ material formed from the weathering of underlying bedrock. Soluble components of bedrock are partially removed by surface water and groundwater. The insoluble portions of the rock experience mechanical weathering from freeze-thaw and rain-drop impact with little to no transport of the remaining materials. Residuum deposits within the study area may occur over any geologic substrate. As a reflection of ongoing weathering and erosion of underlying materials, these deposits are relatively thin compared to other Quaternary-age deposits. The distinction between “residuum” and “soil” (discussed below) is somewhat arbitrary. “Grus” is basically the coarse residuum associated with granitic bedrock.

In aggregate, colluvium, residuum, and grus cover approximately 40% of the watershed landscape. The remaining 10% is covered by glacial deposits, playa deposits, eolian (wind-blown) deposits, and water.

With respect to water supply, the surficial geology plays little role, with the exception of immediately along perennial streams, where streamflow may keep surficial deposits saturated, providing a natural filter for wells that are basically stream diversions.

3.4.3.2 Bedrock Geology

The following paragraphs outline the basic geology of the Upper Laramie watershed in terms of the geologic formations present (the “stratigraphy”) and the geometry of how those formations are oriented, folded, and faulted (the “structure”). For the purposes of this planning investigation, the watershed geology is presented with respect to its general relevance to the development of useful water projects. A detailed description of the complexities of the study area's geology is beyond the scope of this Level I investigation. A multitude of sources exist which provide site-specific geologic descriptions and mapping. (See Taboga et al., 2013 for copious discussion and bibliography.)

The geologic materials present at the surface and in the near subsurface have an obvious bearing on potentially relevant issues of slope stability, structural integrity (dams, buildings), and infiltration rates and are the foundation for the types and quality of soils present.

The character of geologic materials in the subsurface is primarily of importance with respect to groundwater development opportunities, i.e. the potential quantity and quality of groundwater available at various locations and depths across the watershed.

Figure 3.4-7 provides a bedrock geologic map of the study area developed from standard mapping by the USGS (Love and Christiansen, 1985). Appendix 3F provides basic descriptions of the mapped units, from Taboga et al. (2013). The geologic formations that underlie the study area range in age from Precambrian (>600 million years old) to the alluvial deposits laid down by the most recent flooding of the Laramie River. The hydrogeology of these units is described below (as part of the "Watershed Hydrology" section).

At a very general level: the preCambrian-age rocks (pCr symbol on Figure 3.4-7) exposed in the core of the Medicine Bow and Laramie Ranges are granites, quartzites, schists, and gneisses of local and limited water-development potential; the Paleozoic-age rocks ("P" symbols) exposed on the flanks of the mountains are limestones and relatively clean sandstones, with modest to prolific groundwater-development potential; the Mesozoic and Tertiary-age rocks ("Tr", "K", and "T" symbols) are dominated by shales and fine-grained sandstones with limited groundwater-development potential; and the Quaternary-age deposits ("Q" symbols) tend to be thin and unproductive except in association with live streams or active irrigation.

Figure 3.4-7 (and later, Figure 3.5-3) depict the outcrop areas of the various bedrock formations, i.e. where the indicated formation or aquifer type is exposed at the land surface (beneath soil layers and surficial deposits). Given the layered sequence of these formations, however, any formation older (further down on Appendix 3F) than that mapped at the surface is likely present at depth at that location. "How deep?" depends upon the thickness of the overlying formation(s) and how steeply the formations are dipping, generally toward the center of the basin. The outcrop areas are narrowest where the dips are steepest, i.e. one is seeing the "edge" of the layer. In the Laramie area, for example, the formations dip at approximately 5° to the west. That means a given formation is 90 ft. lower in elevation (deeper) for every 1,000 ft. further west.

3.4.3.3 Geologic Structure

In the case of the Upper Laramie watershed, the hydrologic basin, defined by surface topography, is roughly coincident with the geologic basin, defined by geologic structure. Geologically, the watershed is

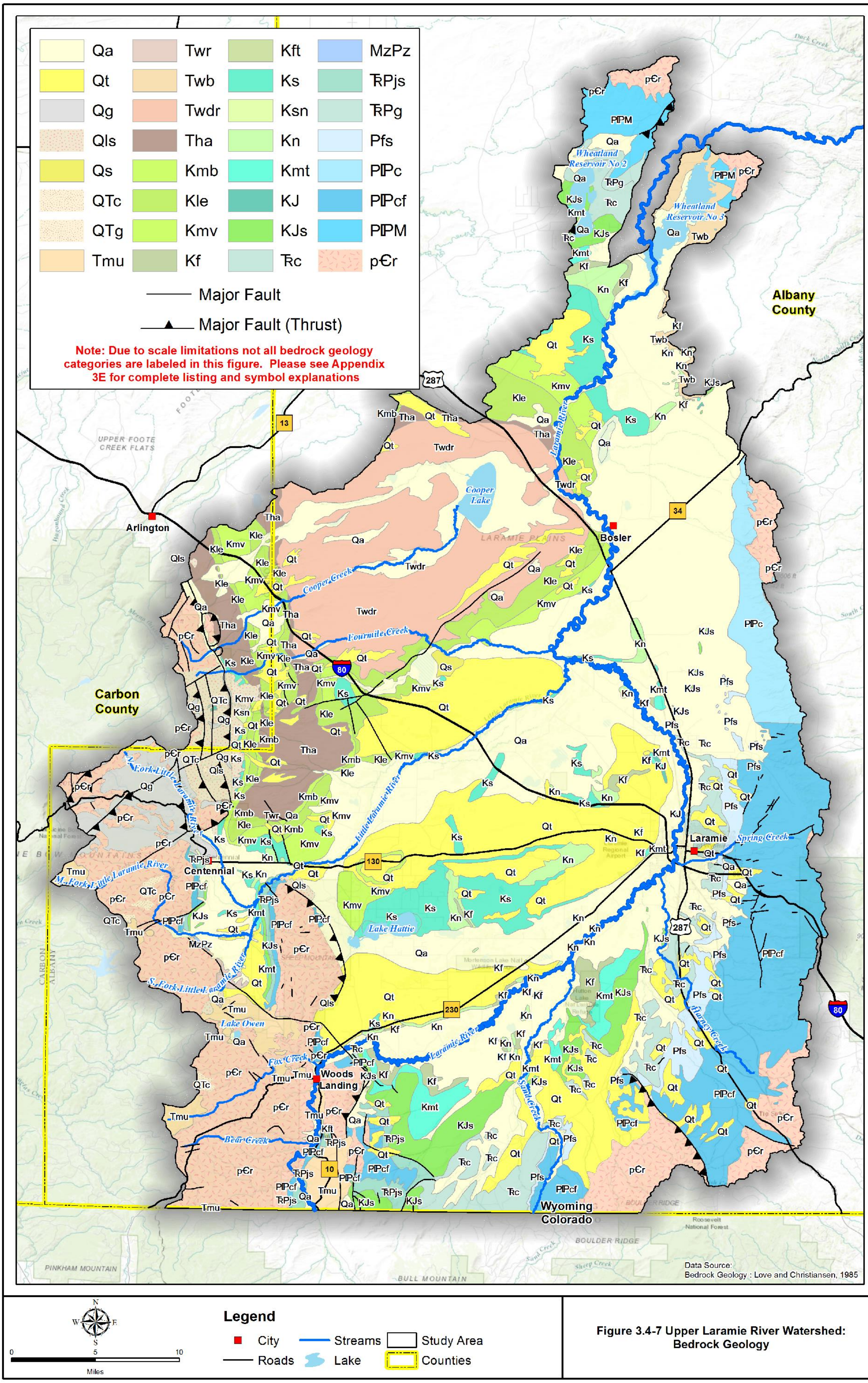


Figure 3.4-7 Upper Laramie River Watershed: Bedrock Geology

a sedimentary basin between the uplifts of the Medicine Bow Mountains (including the Snowy Range), the Laramie Mountains, and a series of less dramatic geologic structures to the northwest (Figure 3.4-8). At this scale, the basin consists of a stack of bowl-shaped sedimentary rock layers, the deepest/oldest of which appear at the surface around the rim of the basin; with the youngest geologic strata in the middle. For example, the Casper Formation (blue on Figure 3.4-7) is present at the surface along the northeast, east, south, and west edges of the basin. It is also present beneath the middle of the basin, but at depths in excess of 10,000 ft. (e.g. Taboga et al., 2013; Plate 1).

Superimposed on this basic bowl-like structure are many local folds in the rock layers that can significantly change the depth to a particular formation locally, bringing different formations to the surface, and creating the complex patterns of outcrop mapped on Figure 3.4-7.

The depth to a particular water-bearing formation is of obvious interest, but as important as depth in terms of groundwater development potential are zones of fracturing that develop where a rock layer is faulted or tightly folded. Such fractures can provide important pathways for groundwater flow to a well, and are commonly critical to the development of large yields. These structural features are present at many scales in the Upper Laramie Watershed. The largest (most extensive) are included on Figure 3.4-8.

With rare exceptions, faulting within the study area is the result of activity in the far-distant past. While the fracturing associated with faults can usefully enhance permeability and groundwater production, or create problems in terms of seepage rates and landslide potential, the faults do not represent a constraint on development activity with respect to earthquakes.

3.4.3.4 Geologic Hazards - Landslides and Earthquakes

Figure 3.4-9 presents landslide information for the study area. Published landslide mapping is available as the "landslide deposits" mapped with bedrock geology (“Qls” on Figure 3.4-7), as the "landslide deposits" mapped with the surficial deposits (Figure 3.4-6), and as "landslides" mapped based on surface morphology, independent of geologic materials (WRDS, 2015). The three approaches produce very similar, although not identical results.

In any case, landslides are relatively rare in this watershed. Almost all are found in the vicinity of Centennial, associated with the inherently unstable situation of older, more-competent pre-Cambrian-age rocks having been thrust faulted eastward, placing them on top of younger, less-competent shales and sandstones (cf. Figure 3.4-7).

The minor, isolated occurrences elsewhere in the study area (e.g. along the Colorado border and in the southwest Centennial valley), appear to be primarily associated with steep slopes and locally unstable materials.

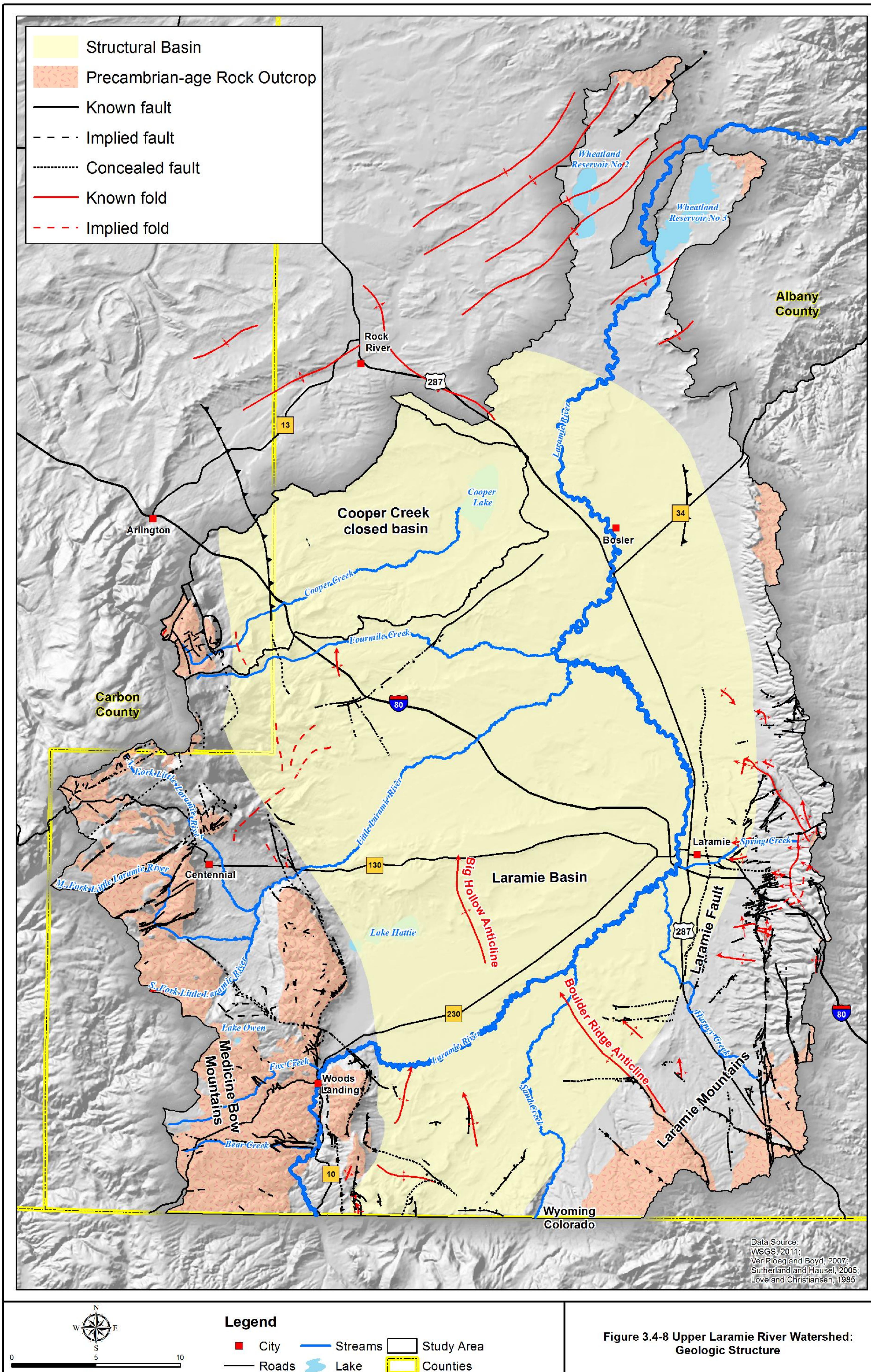


Figure 3.4-8 Upper Laramie River Watershed: Geologic Structure

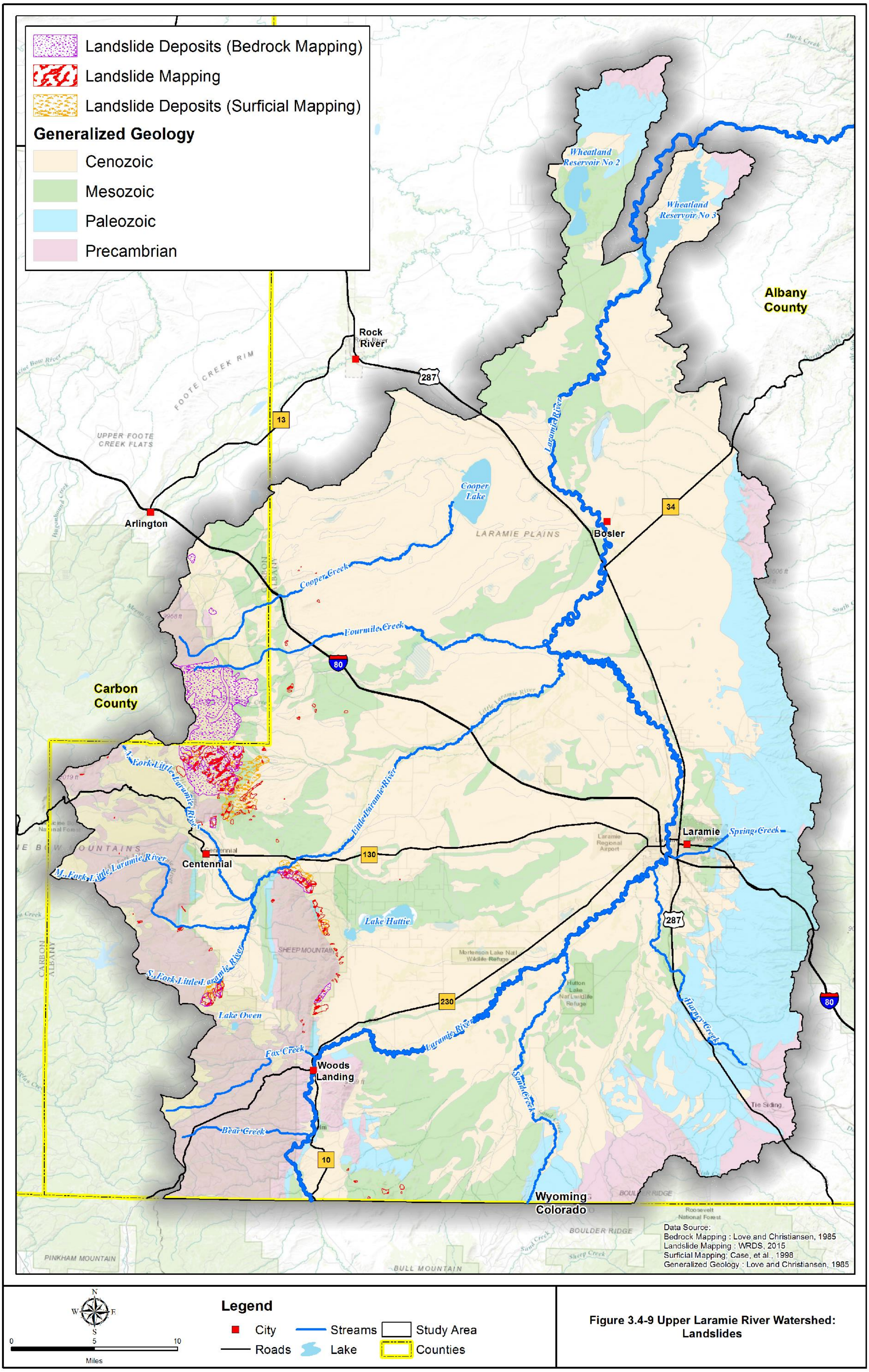


Figure 3.4-9 Upper Laramie River Watershed: Landslides

In any case, landslide activity is the result of local combinations of slope, permeability, pore pressure, and a lack of formation strength creating slope failure. Future landslides are most likely to occur in association with areas of historical slope failure or where water infiltration is locally increased through development activity (e.g. canal construction, irrigation). Thus, while this potential hazard is not confined to the areas mapped, those areas merit heightened concern.

There are no earthquakes recorded in the study area in the National Earthquake Information Center database. Recording started at least as early as 1973. The nearest seismic activity has been in far northern Albany County, 20-30 miles north of the Upper Laramie Watershed, where several small tremors have been recorded, including a 5.3 magnitude earthquake on October 18, 1984 that was felt in Laramie.

Seismic hazard mapping by the USGS (Peterson et al., 2015) concludes a peak horizontal acceleration of 4-6% of gravity has a 10% chance of exceedance in 50 years for the study area. For perspective, this value varies between <1 and >100% for the coterminous United States, and between 2 and 30% for all of Wyoming, placing the study area at the lower end of the scale.

3.4.4 Soils

Soils are diverse within the study area because of the variable characteristics of the watershed's underlying geology, topography and elevation, climate and precipitation, and vegetation. Consequently, soils in the watershed vary considerably.

Available soils information and data were obtained from the NRCS and compiled for the watershed. Complete soils mapping is not available for the entire watershed. For the most current soils information, landowners and managers should access soils data via the Web Soil Survey (WSS) at *http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm*, which provides soil maps and data for almost all counties in the United States and is updated regularly by the NRCS.

Figure 3.4-10 displays a general soils map of the study area prepared using data mapped at the 1:250,000 level of detail and obtained from the NRCS. Detailed soils data (1:24,000 scale) is available for approximately 87% of the watershed. This detailed data does not display well at the watershed scale, therefore Figure 3.4-11 displays the extents of the available detailed soils mapping.

3.5 Watershed Hydrology

3.5.1 Groundwater

The following sections provide an outline of groundwater relationships, the relative productivity of aquifers, the occurrence of springs and wells, and recommendations for site-specific evaluation of groundwater development opportunities in the Upper Laramie River Watershed. For copious data, illustrations, and analysis on a somewhat larger scale, the reader is directed to the 2013 "Platte River Basin Water Plan Update - Groundwater Study" (Taboga et al., 2013).

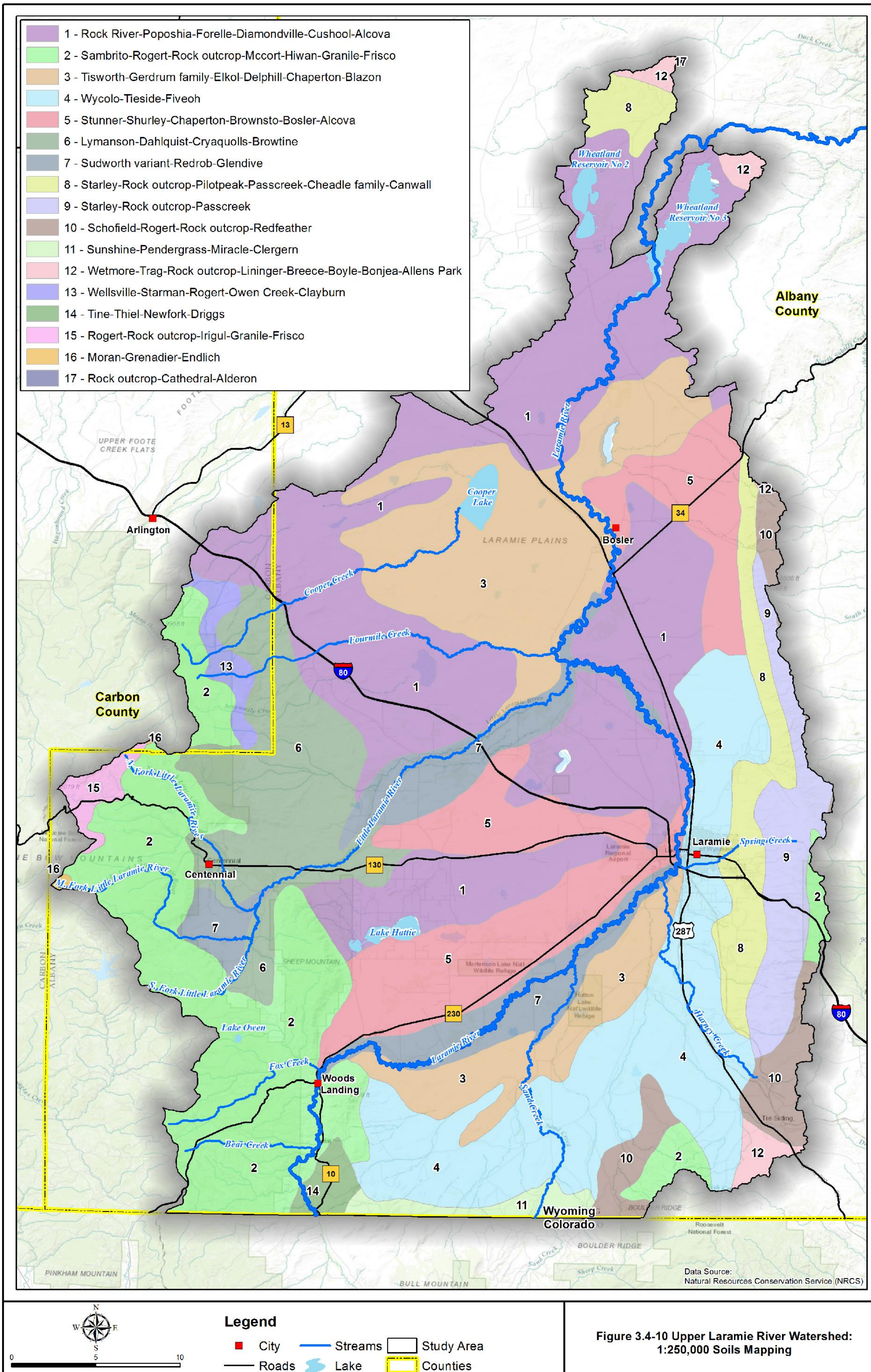


Figure 3.4-10 Upper Laramie River Watershed: 1:250,000 Soils Mapping

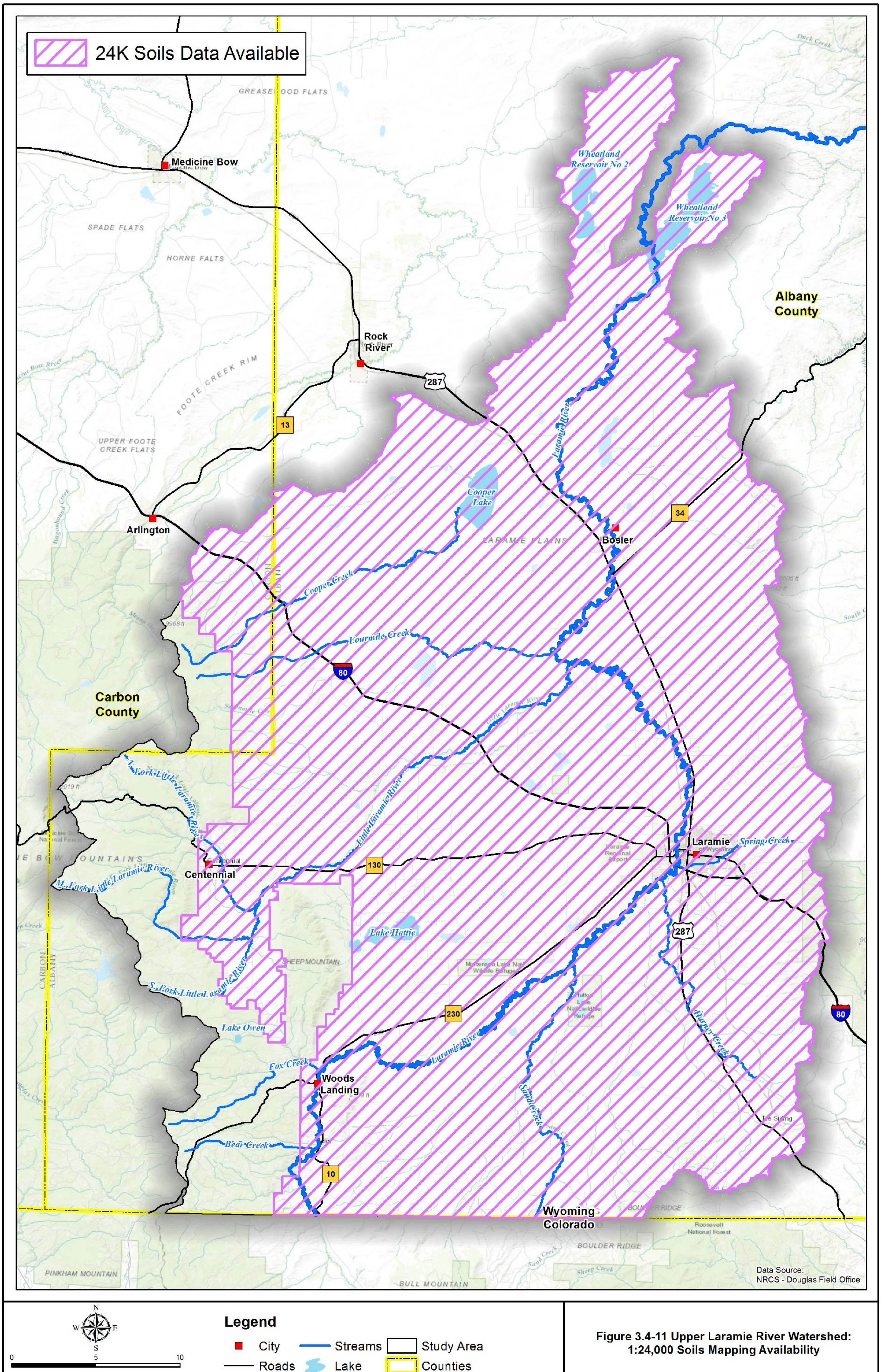


Figure 3.4-11 Upper Laramie River Watershed: 1:24,000 Soils Mapping Availability

Groundwater resources are one component of the overall hydrologic cycle. "Groundwater" is not a source of water separate from "surface water". Rather, groundwater diversions provide an alternative to surface water diversions in the use of a portion of the area's total available water resource. Groundwater diversions differ from surface water diversions in timing, location, rate, volume, and quality. Groundwater originates when rainfall, snowmelt, streamflow, and, in some areas, irrigation water, infiltrate into geologic materials. This constitutes groundwater "recharge".

Figure 3.5-1 presents estimates of the rates of groundwater recharge within the study area developed as part of a groundwater vulnerability study by the University of Wyoming (Hamerlinck and Arneson, 1998). Recharge rates are a function of elevation, i.e. the raw quantity of precipitation increases substantially with elevation in this watershed, and of the infiltration characteristics of the soil and underlying bedrock. Recharge is concentrated on the flanks of the bounding mountain ranges, with the Medicine Bow Mountains (west) receiving substantially more recharge than the Laramie Range (east). The clear majority of the study area averages less than 1 inch of groundwater recharge per year.

Over days, years, centuries, or even millennia where groundwater circulation is long and deep, this recharge travels through the ground and returns to the surface as discharge. Between the points of recharge and discharge, groundwater flow may be straightforward or quite complex. Because groundwater is continually returning to the surface as springs (discussed below) and, more importantly, as diffuse gains to most of Wyoming's perennial streams, streamflow records include large quantities of groundwater. In the absence of storm runoff or snowmelt, most of the flow in Wyoming's streams comes from groundwater discharge at some point upstream.

Like surface water, groundwater flows “downhill”, from areas of high head to areas of lower head. In the case of the Upper Laramie watershed, that means groundwater flow is generally from beneath higher elevations to beneath lower elevations, and the Laramie River serves as the “base” elevation for both the surface and groundwater flow network. Because Wyoming's river basins are generally a reflection of regional geology, even in deep artesian aquifers (e.g. the Casper Formation in this basin) groundwater flow tends to be toward and along major rivers.

(Figure 3.4-8 includes the topographic divide of the Cooper Creek basin, a “closed basin” within the Upper Laramie River watershed. Although “closed” with respect to natural surface drainage, groundwater moves freely beneath the surface-water divides in response to the underlying flow gradients.)

3.5.1.1 Springs

Groundwater is naturally discharged by springs and seeps, by evapotranspiration, and by discharge to streams and other aquifers. Springs and seeps occur when the water table intersects the land surface. This commonly is the result of changes in lithology, faults and fractures, and/or surface topography. For

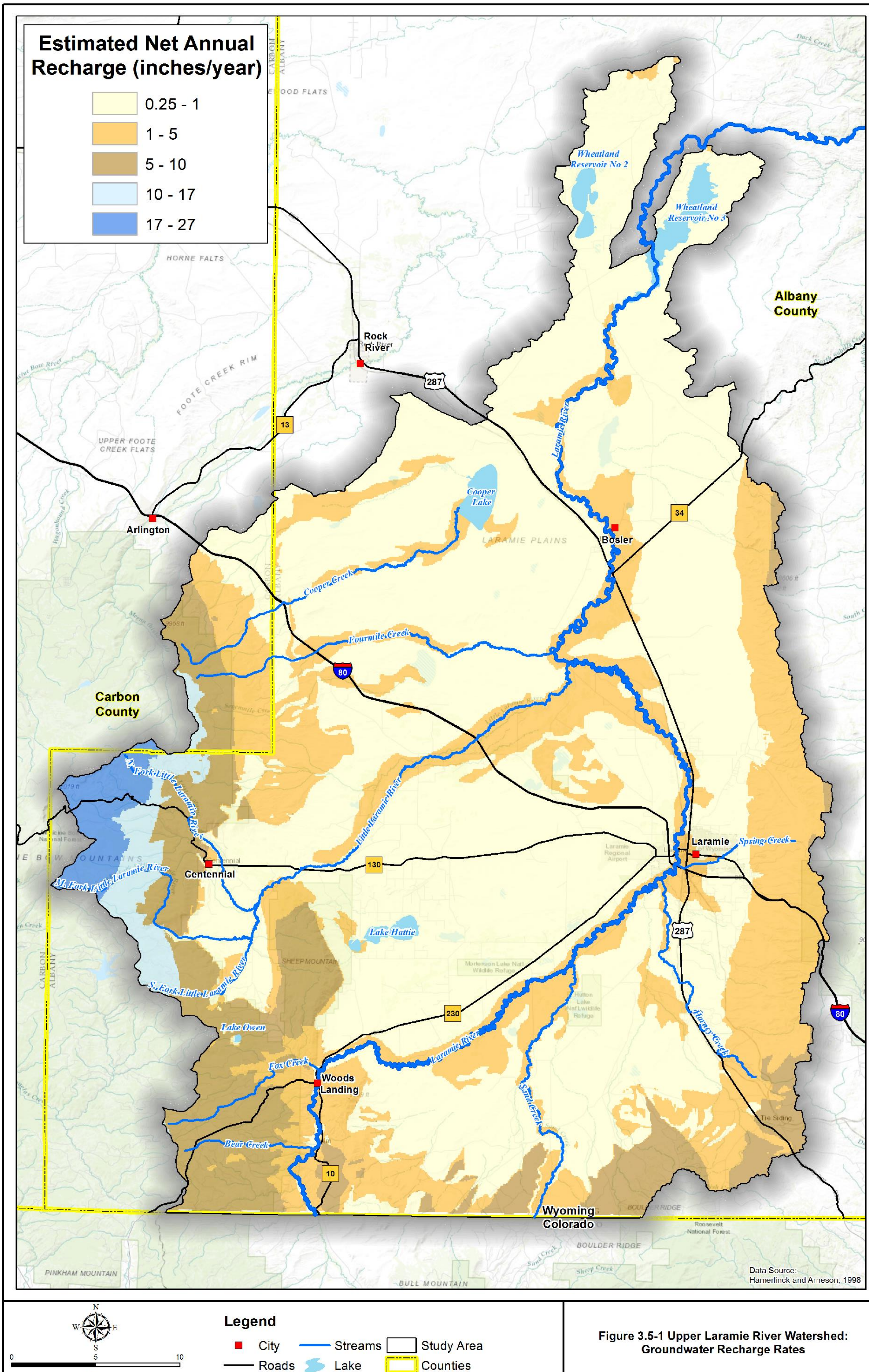


Figure 3.5-1 Upper Laramie River Watershed: Groundwater Recharge Rates

example, where a sufficiently permeable geologic unit (e.g. a poorly-cemented sandstone or conglomerate) crops out in a swale or on a hillside at an elevation below the prevailing groundwater table in the bedrock unit at that location, a spring may develop. Similarly, a permeable geologic structure (e.g., an open joint, fracture or fault zone) may intersect the ground surface and serve as a conduit for the discharge of groundwater from deeper aquifers.

Spring flows vary widely due to the nature of the aquifer/structure discharging, the amount of seasonal recharge from snowmelt and rainfall, depletion of storage during periods of drought, and even evaporation and evapotranspiration near the site of the spring. The flows can be concentrated or diffuse, again depending on the nature of the geologic conditions causing the spring (Susong, et al., 1993).

Figure 3.5-2 presents mapped springs for the Upper Laramie watershed. Those marked as "USGS" were digitized by University of Wyoming personnel from standard USGS 1:24,000-scale topographic mapping, i.e. the word "spring" and a spring symbol on the printed topo map. These do not reflect all existing springs, as the USGS mappers typically worked from air photos and all springs do not express themselves conspicuously. However, the locations of these springs are likely quite accurate due to the manner in which they were compiled. (Detailed inspection of select maps indicates this is correct, although one case in which the word "Spring" in "Spring Creek" was mapped as a spring was corrected.)

Those springs on Figure 3.5-2 marked as "SEO" were extracted from the GIS database of water rights maintained by the Wyoming State Engineer's Office. A groundwater permit was identified as being a spring based on minimal reported "depth", the word "spring" (or "spg", "spng", etc.) in the facility name, and a small reported "depth to water". A surface water permit was identified as being a spring by the word "spring" (or some variation) in the facility name, and "spring" being listed as the "facility type" or in the "stream source" (not including the word "spring" as in "Spring Creek").

The locations of the "SEO" springs are a mix of precise locations based on reported GPS coordinates, and approximate locations based on the center of the permit-reported 1/4 1/4 Section. In the latter case, the actual location could be as much as 900 feet from the posted location. (None of these locations have been field verified for this report.)

Detailed inspection of maps/aerial photos at the locations of select springs of the "SEO" type found many associated with surface irrigation facilities, i.e. likely to be the result of ditch/canal seepage rather than natural conditions. In many cases, it appears the flow of a natural seep or spring has been enhanced through excavation or shallow well construction.

The existence of a water right demonstrates a specific interest in putting a spring to a recognized "beneficial use". Undeveloped natural springs without attached water rights will not be identified through this process, but one might expect a substantial spring to have attracted development interest.

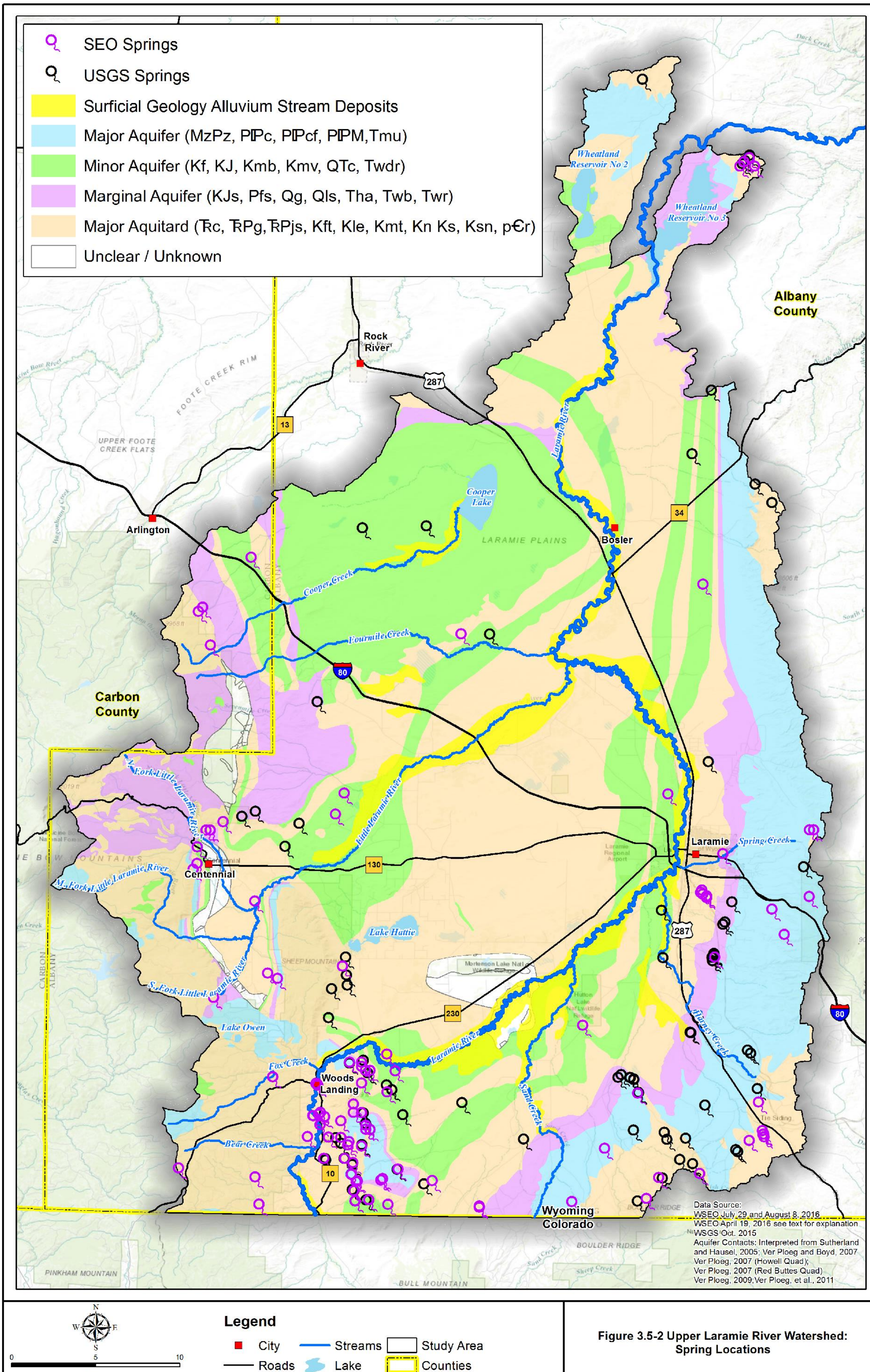


Figure 3.5-2 Upper Laramie River Watershed: Spring Locations

Large springs are necessarily associated with productive aquifers (discussed below), but small springs and seeps occur as a result of sometimes quite local conditions of recharge, topography, and aquifer permeability, in many geologic settings. Springs are most common around the margins of this watershed due to the increased precipitation available for recharge and the juxtaposition of more, and less permeable, bedrock material.

Major springs have been developed from the Casper Formation for the municipal water supply for the City of Laramie, originally as simple spring capture and later through construction of high-yield, near-spring production wells. The City Springs supplying the original municipal water system are labeled on Figure 3.5-2, as is the Soldier #1 Well, drilled to capture the natural Soldier Springs, and routinely flowing 1,200 gallons per minute (gpm) into the Laramie municipal water system.

3.5.1.2 Alluvial Aquifers

Alluvial deposits are the primary component of the Quaternary and Cenozoic age deposits depicted on Figures 3.4-7 and 3.4-9. In many areas of the West, mapped alluvium reflects the presence of relatively coarse sand and gravel deposits which, by virtue of their close association with active streams, have a ready supply of recharge and thus present attractive groundwater development targets. In this case, however, the mapping of alluvial deposits on Figures 3.4-6 and 3.4-7 is a function of widespread, but thin and relatively fine-grained deposits associated with broad flooding of the Laramie River and its tributaries. Across most of the area of mapped alluvium (“Qa”) and terrace deposits (“Qt”), any groundwater-development potential is a function not of the alluvial deposits, but of the underlying bedrock material discussed below.

Exceptions include areas immediately adjacent to perennial streams (or other sources of recharge, like irrigation facilities), particularly in headwater areas where stream deposits are relatively coarse grained and transmit water well.

Where the alluvial aquifer is associated with an active stream, either interception of groundwater headed for the stream or induced infiltration from the stream may provide most of the available groundwater, and stream depletion rates may approach pumping rates over relatively short time periods. Where closely associated with surface streams, alluvial aquifer quality tends to be good due to the low salinity of water in the stream and the filtering effect of the aquifer.

3.5.1.3 Bedrock Aquifers

Groundwater exists in bedrock aquifers under unconfined, water table conditions (at atmospheric pressure) or under confined conditions where the aquifer is present at depth and pressures are sufficient to push water higher than the top of the formation, in some cases, clear to the ground surface to create a flowing well.

Classification of a body of geologic material as an "aquifer" depends on how much water is needed for a specific user or purpose. A hydrogeologic formation capable of adequately supplying the modest water needs of a single rural residence may be entirely inadequate to meet the needs of a large agricultural operation. Similarly, a groundwater quality suitable for livestock watering may be unacceptable for human consumption.

To assist in the assessment of groundwater development opportunities, Figure 3.5-3 presents the formations of Appendix 3F classified with respect to general water-production characteristics following the taxonomy of the 2007 Wyoming Framework Water Plan (WWC, 2007).

The individual formations within each group are keyed to the symbols used on Figure 3.4-7 and Appendix 3F with the major exception that areas of thin alluvial material are classified based on the underlying bedrock. The Upper Laramie watershed is unique with respect to the standard 1:500,000-scale geologic map of Wyoming (Love and Christiansen, 1985) in terms of the extent and lack of hydrogeologic significance of the “Qa” (Quaternary alluvium) unit. Rather than the mapped area (see Figure 3.4-7) identifying significant groundwater-development opportunity, the great majority of these deposits in the Upper Laramie watershed are thin and overlie relatively unproductive shales. Two examples, selected at random from the Wyoming State Engineer’s Office groundwater permit database illustrate the point:

1. Permit 80367 is located in the large area of “Qa” (alluvium) mapped (Figure 3.4-7) along the Little Laramie River in the center of the watershed. Rather than encountering productive sands and gravels, however, this well penetrated 100 ft. of “brown clay” and “gray shale”, was perforated through a 40-ft interval of the latter, and reported short-term production of 8 gpm with 45 ft. of drawdown.

2. Permit 5259P is located in the center of the largest patch of “Qt” (terrace deposits) mapped (Figure 3.4-7) in the center of the watershed. Again, rather than the productive river gravels that “terrace deposits” commonly connote elsewhere in the state, here the well encountered 5 ft. of “sand and large gravel”, then 560 ft. of “brown clay” and “gray shale with a few thin layers of gray sandstone”. The well was perforated through 60 ft. of the latter and reported short-term production of ½ gpm with 200 ft. of drawdown.

The mapping in both of these areas on Figure 3.5-3 falls in the “major aquitard” classification, based on the underlying bedrock formation being the Niobrara or Steele Shale. Our interpretation of what lies below the veneer of mapped Quaternary-age deposits is somewhat speculative in the absence of specific subsurface data, i.e. something of a “connect the dots” exercise, but provides a much more realistic picture of groundwater-development potential than simply keying to the mapped geology of Figure 3.4-7. Lines are increasingly speculative as the distance to a mapped outcrop of the underlying material increases. However, this process was informed by much more detailed geologic mapping than is depicted on Figure 3.4-7, much of it at 1:100,000 and 1:24,000 scales at which isolated outcrops have been identified that were too small for mapping at 1:500,000 scale (see map-listed references). Those original sources should be consulted by readers interested in a particular area.

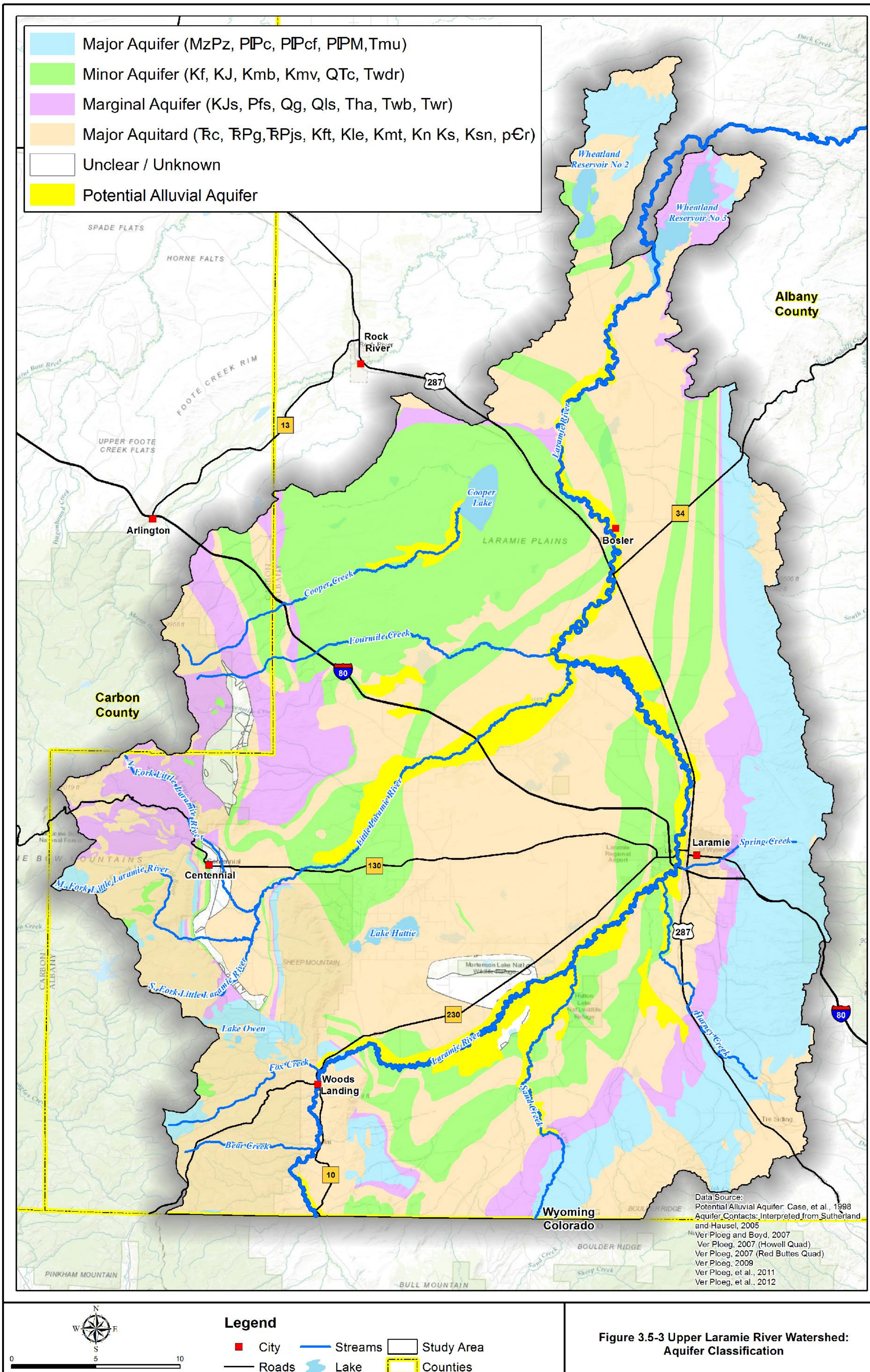


Figure 3.5-3 Upper Laramie River Watershed: Aquifer Classification

Figure 3.5-3 includes an "unclear" classification for areas in which: 1) there are insufficient bedrock outcrops available to inform approximation of what lies beneath the alluvial mantle, or 2) the geology is too variable to classify at this scale. In either case, more detailed, site-specific investigation is warranted prior to water development investment.

As depicted on Figure 3.5-3, most of the Upper Laramie watershed area has relatively poor groundwater development potential. This is due to the prevalence of thick, relatively low-permeability shale formations beneath most of the watershed. This is not to say no groundwater is available; in fact, the historical development of groundwater is widespread (reviewed below). But the availability of large quantities of high-quality groundwater is severely limited in much of this watershed.

Figure 3.5-3 uses the following classifications:

- **Major aquifer -** deposits capable of producing high-capacity wells where saturated. In this watershed, two aquifers are identified in this class, both with the potential for major aquifer status depending on site-specific conditions: 1) the alluvial aquifer, and 2) the Casper aquifer. The alluvial aquifer depicted on Figure 3.5-3 is not taken from bedrock geologic mapping (e.g. Figure 3.4-7), but for this purpose is taken from the surficial geologic mapping, i.e. the classification of "alluvium: stream and river deposits" (Case et al., 1998). The nature of these deposits is likely quite variable, but the chances of finding usefully water-bearing material in this map unit are better than in applying that expectation to the widespread "alluvium" mapped on Figure 3.4-7.

  The only "major aquifer" identified on Figure 3.5-3 in terms of bedrock formations is the Paleozoic-age limestones and sandstones of the Casper, Fountain, Madison, and associated formations. These strata are present throughout the watershed at depth, but are usefully accessible only around the basin margins, within the mapped outcrop areas (where the aquifer is present at the land surface) or adjacent to the outcrop (on the "basinward" side), where the aquifer is present at reasonable drilling depths beneath overlying, less-productive strata.

  Although classified as a major aquifer based on groundwater-bearing potential, absent fracture-enhancement of permeability, these formations provide only modest to poor water production. Along folds and faults (e.g. those shown on Figure 3.4-8), however, these formations can host springs and wells discharging in excess of 1,000 gpm. Recent work in the Casper Formation around Laramie (Hinckley Consulting and Wyoming Groundwater; 2015) has identified the presence of highly-permeable "fractures" parallel to bedding in areas not closely associated with structures that can be mapped based on surface features (e.g. the folds and faults of Figure 3.4-8). These sub-horizontal features can produce groundwater in excess of 400 gpm. Current thinking is that they may be associated with active groundwater circulation along the basin margins. If so, they may be much less common in areas where the aquifer is encountered at depth.

- **Minor aquifer** - deposits less likely to provide high-capacity wells, but commonly providing useful groundwater supplies for local use. In this watershed, this group of aquifers is represented by sandstone strata within the Medicine Bow, Wind River, Mesaverde, and Frontier Formations. Modest supplies of adequate-quality groundwater are most likely to be available near outcrop areas, where there is available recharge. These sandstones are generally fine-grained, so are most productive along structures (folds, faults) where permeability has been enhanced by fracturing.

- **Marginal aquifer** - "Most geologic formations can provide useful groundwater supplies under the right conditions, particularly if the demands are small such as for stock and domestic use. The formations of this group are commonly considered capable of yields on the order of 1-5 gpm, with higher production rates relatively rare. Sandstone beds are the primary source of groundwater, although zones of fractured siltstone or shale can be locally productive" (WWC, 2007). On Figure 3.5-3, this classification is applied to a group of formations of mixed shale, siltstone, and sandstone composition.

  Although not, as a group, noted for groundwater production, individual sandstone strata are locally productive and these formations provide many local opportunities for useful, small-scale groundwater development. Of the classifications of Figure 3.5-3, this group is the most variable and thus, a group requiring localized, site-specific investigation in the evaluation of groundwater development opportunities.

  Most noteworthy in this group are the pervasive sandstone strata (locally conglomerates, sandstones, quartzites) of the Cloverly (Dakota) Formation. This modest aquifer is too thin to be usefully mapped individually at the scale of Figures 3.4-7 or 3.5-3, but is an important groundwater source at many locations in Wyoming and across the western US. (It is included with the "KJ" and "KJs" units of Figure 3.4-7.)

- Major aquitard - These deposits are generally poorly productive of groundwater. (The name refers to their retarding effect on groundwater flow.) Under locally favorable conditions, these formations can produce small, useful quantities of water. In this classification on Figure 3.5-3 are two groups of rocks: 1) the thick, widespread shale-dominated formations with limited permeability and commonly high salinity (the Lewis, Steele, Niobrara, Mowry, and Thermopolis Shales); and 2) the crystalline rocks (granite, gniess, schist, etc.) of the mountain uplifts along the basin margins. As with any brittle geologic material, the latter group provide small supplies of groundwater where fracturing has created permeability in otherwise impermeable rock. (Due to the relatively inert character of these rocks chemically, the limited groundwater available tends to be of high quality.)

3.5.1.4 Groundwater Quality / Sensitivity

The alluvial aquifers primarily receive recharge from an adjacent stream (or from irrigation applications of water diverted from an adjacent stream) and/or the surrounding geologic materials. Where the former dominates, groundwater quality is generally good. The aquifer sands and gravels tend to filter sediment and bacteria from the surface source to produce water that is clean and of low salinity. Where there is substantial inflow to the alluvial aquifer from bedrock, alluvial groundwater quality will reflect that of the surrounding formations. This water will commonly be higher in salinity than the surface water and may render the alluvial aquifer of limited value for many applications.

Bedrock aquifers receive recharge to their outcrop areas through the infiltration of rainfall, snowmelt, and streamflow (although discharge from groundwater to streams is more common than the other way around). Groundwater developed close to the areas of recharge may be of relatively high quality, regardless of the host formation. As water moves deeper, it generally becomes more mineralized.

In general, groundwater quality tends to be better in the more productive aquifers because of the more active groundwater circulation and less soluble minerals. An exception is the crystalline rocks (Precambrian) in which quality is generally good due to the very low solubilities of the constituent minerals, but productivity is low due to the virtual absence of porosity or permeability in the rock.

Bartos et al. (2013) provide extensive compilation of individual groundwater quality analyses for the North Platte River Basin, including samples from many of the geologic units of the Upper Laramie River Watershed. Not surprisingly, most formations post a very wide range of chemical characteristics, depending on depth, location, complex groundwater flow pathways, and the vagaries created by the random availability of chemical analyses.

In very general terms, those units identified as major or minor aquifers on Figure 3.5-3 tend to produce lower salinity groundwater (e.g. median Total Dissolved Solids (TDS) values less than 500 mg/l), whereas those in the major aquitard group commonly produce higher salinity groundwater (e.g. median TDS values in the low thousands mg/l). However, the same formation may provide a TDS of 200 mg/l from an outcrop spring and a TDS of 5,000 mg/l from a deep well.

Depending upon the intended use, different salinity and individual chemical components may be of critical importance. For example, the Bartos et al. (2013) work considers water with TDS < 1,000 mg/l as "fresh" despite the EPA Drinking Water Standard being 500 mg/l. Similarly, for irrigation use, the Sodium Adsorption Ratio (SAR) is important due to impacts on soil infiltration rates, but is irrelevant in terms of drinking water quality.

Where aquifers receive recharge from the surface, they are potentially subject to contamination. In 1998, the University of Wyoming completed a statewide study of groundwater contamination potential that assessed seven factors, including depth to groundwater and recharge rates, to produce 1:100,000 scale county-by-county maps. (The recharge rates of Figure 3.5-1 are from this same study.)

Figure 3.5-4 presents this mapping of "Aquifer Sensitivity" for the Upper Laramie Watershed. Rankings are relative and carry no specific units. The most sensitive lands are those where a contaminant at the surface such as a spill, over-application of agricultural chemicals, or septic system effluent can most easily enter the aquifer. The alluvial aquifers are most sensitive, along with the outcrop areas of the major bedrock aquifers. Least sensitive are bedrock aquifers where they are overlain by substantial thicknesses of low-permeability material.

Wittman (2008) and Albany County (2011) provide detailed “aquifer protection” assessments of the portion of the Casper Formation that provides groundwater to the Laramie municipal wells, and special restrictions on land use in that area.

3.5.1.5 Groundwater Development

All diversions or extractions of water in Wyoming, both surface and groundwater, require permitting through the Wyoming State Engineer's Office. To a significant extent, the distribution of wells is a reflection of the productivity of the local aquifers, i.e. "groundwater is where you find it" and history has outlined the resource. Figures 3.5-5, 3.5-6, 3.5-7 and 3.5-8 provide this empirical mapping of the groundwater resource, in ascending order of the quantity demanded. The base for these figures is the grouping of geologic formations by general productivity discussed above (Figure 3.5-3).

Figures 3.5-5 and 3.5-6 display the least demanding wells. Livestock and domestic wells are typically deemed satisfactory if yields exceed 2 gpm. The distribution of domestic wells is more a function of the desirability of a location for a residence than a reflection of water availability. Point-of-use treatment (e.g. under-sink RO units) are used where groundwater quality is particularly poor, and there are areas of the county where water hauling is the most feasible water-supply alternatives. Domestic well concentrations east of Laramie and around Centennial reflect subdivision development in those areas.

For most of the wells on Figure 3.5-5 for which depths are reported, those depths are less than 100 ft. In many areas, however, it appears drilling to depths in excess of 250 ft. has been required to obtain satisfactory water. The string of shallow wells along the north side of the Laramie River upstream of Laramie likely reflect the access to recharge from the surface-irrigation system (see Figure 3.5-8). The many “incomplete” wells mapped between the Laramie and Little Laramie Rivers may reflect the poor groundwater potential in that area (i.e. the existence of a permit, which is what has been mapped, does not necessarily mean a successful well).

The distribution of stock wells, Figure 3.5-6, provides a better view of the basic availability of at least small quantities of groundwater of a quality suitable for livestock. As with the domestic wells, the success of stock wells along the north side of the Laramie River upstream of Laramie may be a reflection of irrigation-water recharge, whereas the paucity of stock wells further north may reflect natural conditions in these relatively poor formations. Relatively shallow wells are clustered along streams and canals. Successful wells where bedrock formations depend on precipitation for diffuse recharge are generally deeper.

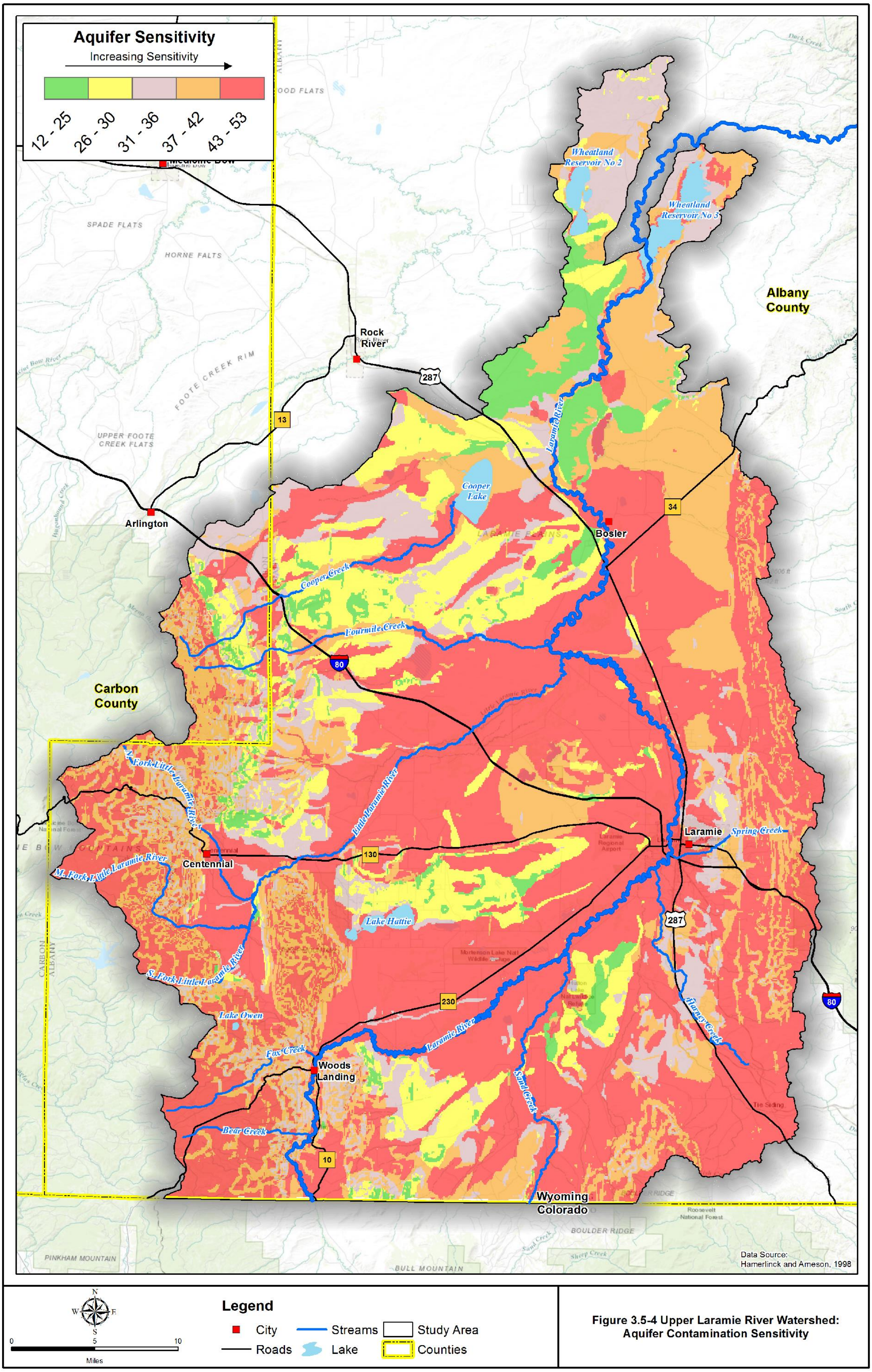


Figure 3.5-4 Upper Laramie River Watershed: Aquifer Contamination Sensitivity

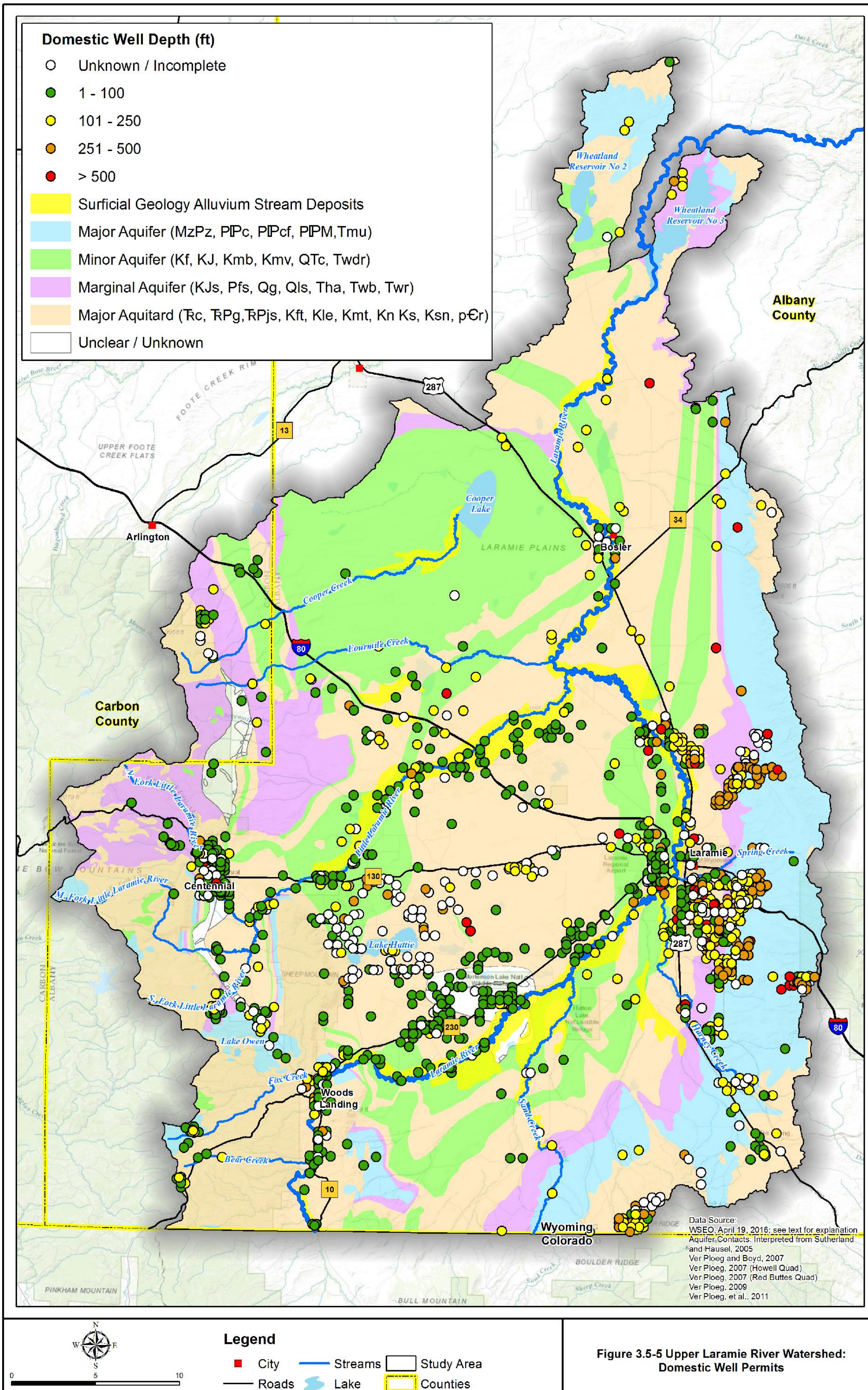


Figure 3.5-5 Upper Laramie River Watershed: Domestic Well Permits

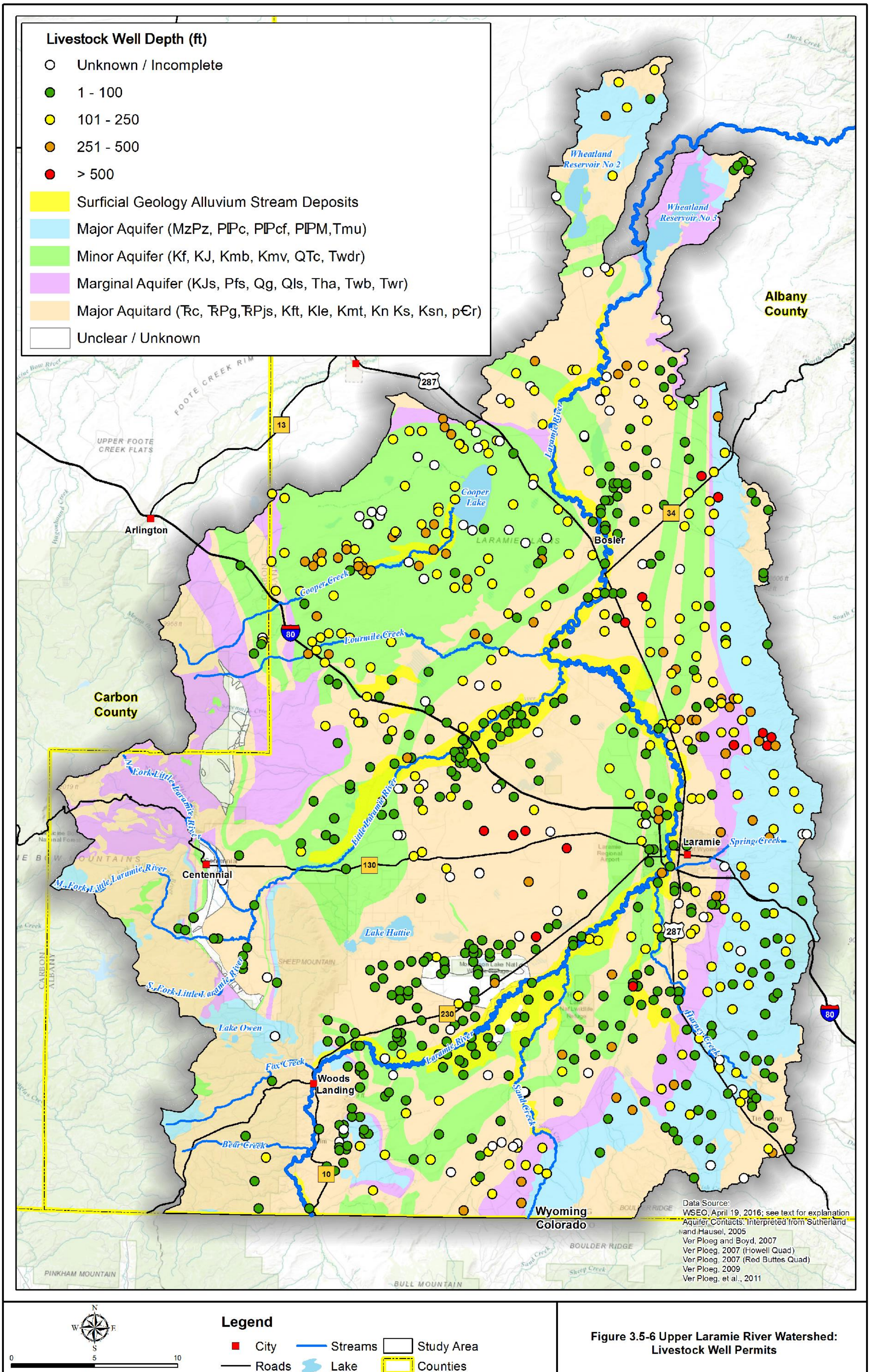


Figure 3.5-6 Upper Laramie River Watershed: Livestock Well Permits

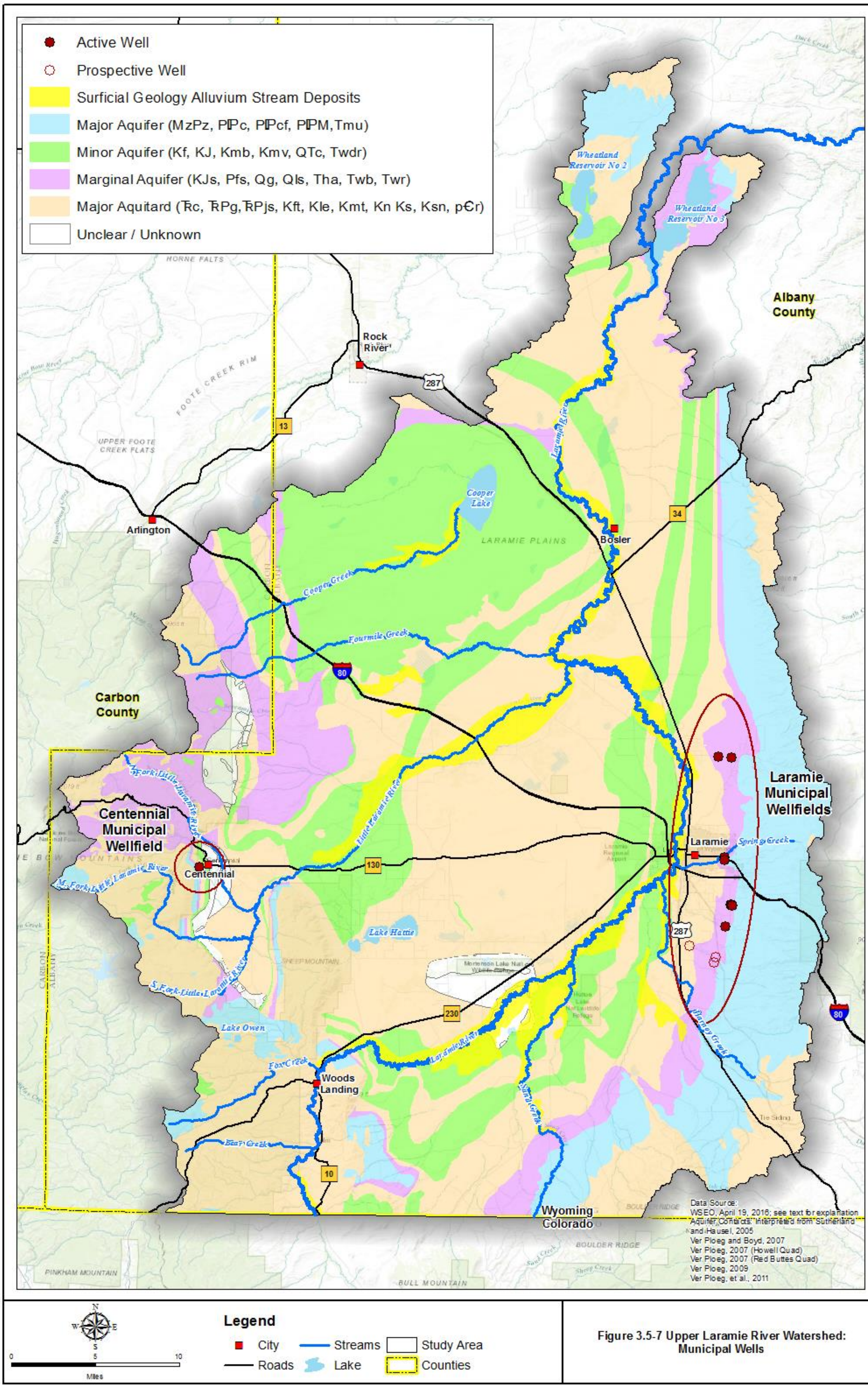


Figure 3.5-7 Upper Laramie River Watershed: Municipal Wells

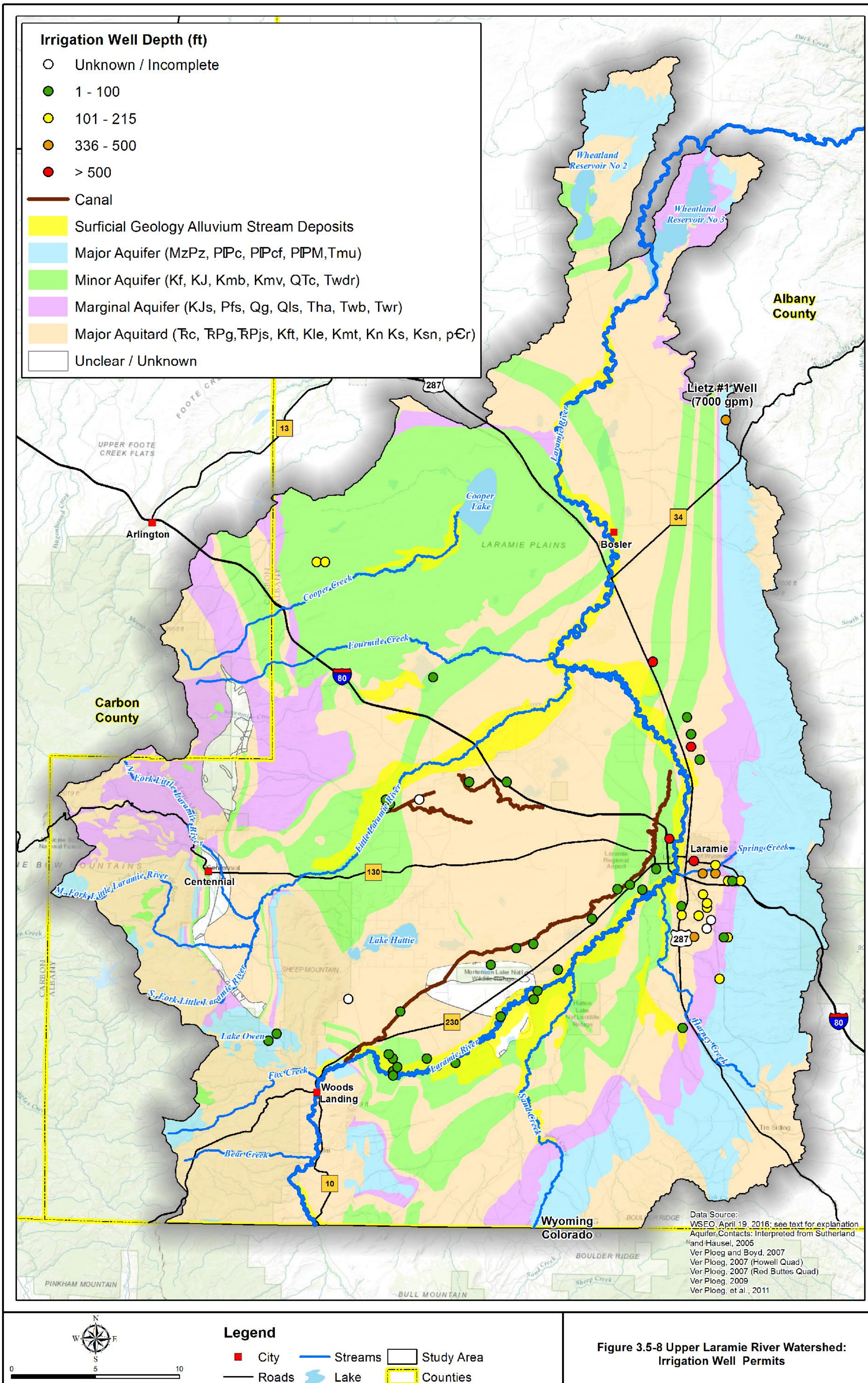


Figure 3.5-8 Upper Laramie River Watershed: Irrigation Well Permits

Between the domestic and stock well groups, there is demonstration that some quantity of useful groundwater is fairly widespread across the landscape. Particularly in those areas identified as marginal aquifers or major aquitards, however, that water may be of low quantity and poor quality and considerable effort may be required to locate, develop, and, potentially, treat groundwater to meet specific needs.

Groundwater of adequate quality and quantity to meet municipal demands has been developed for the City of Laramie and the Town of Centennial, as indicated on Figure 3.5-7. Fortunately for these communities, they are located along the basin margins, where the superior groundwater characteristics of the Casper Formation are available within reasonable depths. Wells north and south of Laramie were developed at particularly favorable locations, based on the occurrence of natural springs or mapped geologic structures. These wells have installed pump capacities in the 500 to 2,300 gpm range (WWC Engineering, 2015). The City of Laramie is currently served by the Spur, Turner, and Pope/Soldier wellfields. The "prospective wells" further south reflect similar development interest at the site of natural springs (Simpson Springs).

Figure 3.5-8 reflects the relative high-quantity demands of most irrigation systems. These include the highest permit yield in the watershed - the 7,000 gpm Leitz No. 1 well northeast of Bosler. This famous well (rumored to have been sited with the assistance of aliens from outer space) encountered a cavern in the Casper Formation, connecting it with nearly unlimited permeability.

High-yield irrigation "wells" along the Laramie River are little more than alternative diversion points for river water, as the names (e.g. Bradford Pit #1 - 4,000 gpm) and depths (e.g. 4 ft.) indicate. Figure 3.5-8 includes major irrigation canals. Their proximity (i.e. provision of recharge) is likely responsible for the presence of high-yield irrigation wells in a bedrock area classified as "major aquitard".

3.5.1.6 Groundwater Rights

Surface water use in Wyoming is administered under the priority system, i.e. "First in time is first in right". While this principle also applies to groundwater rights, the practical administration of groundwater by priority is a "work in progress" in Wyoming. Questions of the adequacy of diversions (i.e. wells), interference within an aquifer, lag times between cause and effect, etc. pose significant problems for routine administration. One arena in which groundwater administration has been codified is reflected on Figure 3.5-9. The green shading on this figure delineates areas which have been determined to be insufficiently connected with surface streamflow to warrant limitation under the specific provisions of the Modified North Platte Decree or the Platte River Recovery Implementation Program (PRRIP). Thus, future groundwater development in these areas is exempt from the special provisions and limitations of those particular agreements.

As is obvious from the figure, this mapping of "hydrologic connection" is basically a stand-back from the Laramie or Little Laramie River - a greater distance where the bedrock is somewhat more permeable and a lesser distance where the bedrock is somewhat less permeable. Groundwater beneath most of the

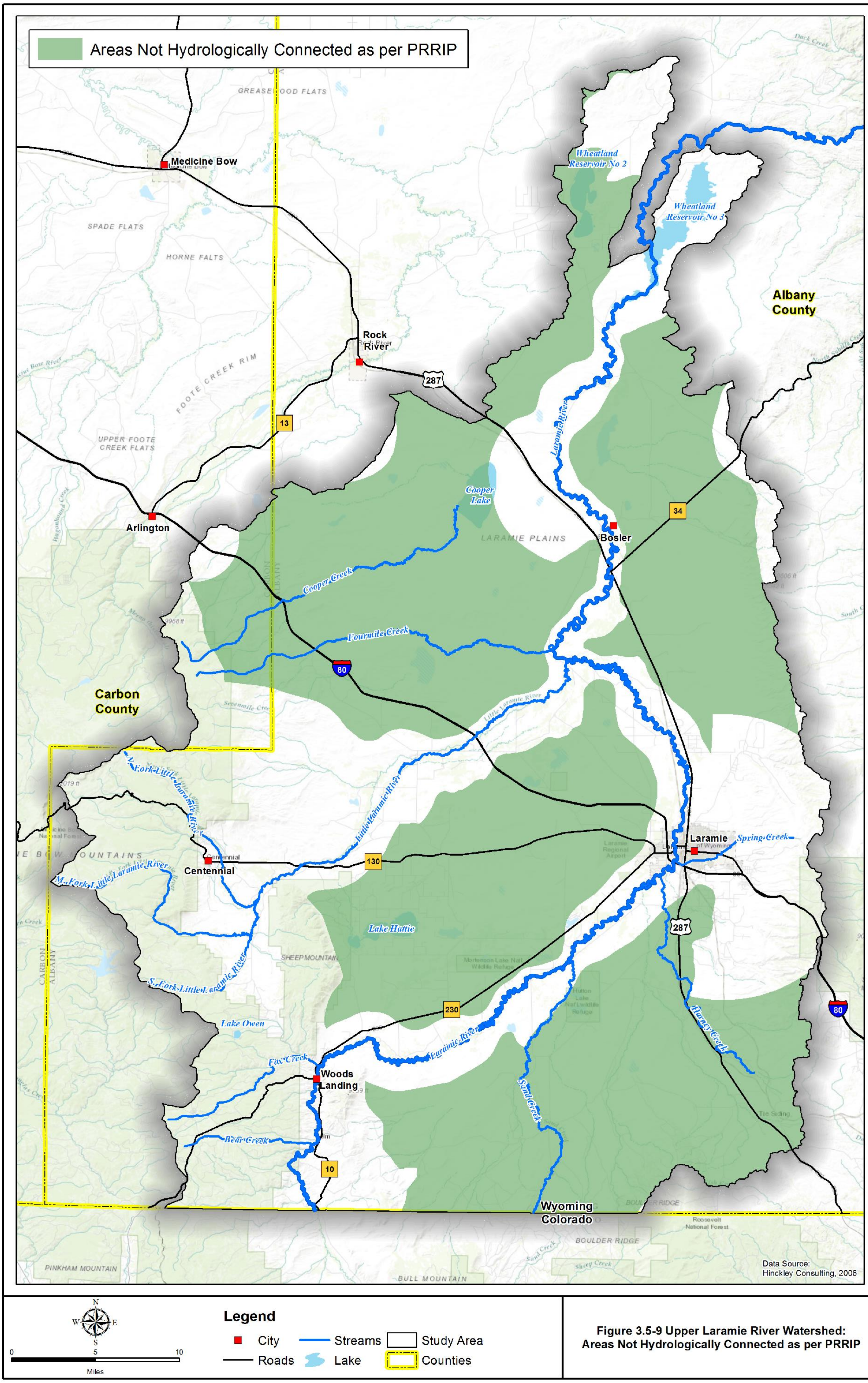


Figure 3.5-9 Upper Laramie River Watershed: Areas Not Hydrologically Connected as per PRRIP

watershed is not considered "connected" under this criterion. (This is more a reflection of the relatively low permeability of the bedrock formations than of the generosity of the "connected" criteria.)

The conspicuous "windshield wiper" area around Laramie is a function of applying a permeability-based stand-off distance to the large spring discharges from the Casper Formation. The "base" of the wiper shape reflects a stand-off from the western edge of the Casper outcrop, i.e. the point beyond which there is no ready avenue of communication between the surface and the aquifer as it dips westward into the basin.

Site Specific Studies:

As outlined above, while one can make generalizations about the availability and quality of groundwater in various formations, groundwater development is inherently both site specific and use specific. For a surface water source, the availability of 5 cfs at point A can be approximately translated, minus intervening diversions, as 5 cfs at downstream point B. In contrast, a well at point A may produce 1500 gpm of high-quality water, whereas a well at point B, in a different formation nearby, may produce less than 10 gpm of poor-quality water. Because both the availability and quality of groundwater, and the specific requirements of a specific project with respect to these parameters, vary widely, generic identification of suitable and unsuitable locations for development are impossible. Any significant commitment of groundwater development funds should be preceded by an appropriate level of site-specific investigation. The following guidelines may be helpful in that process:

- Best performance from the alluvial aquifer will be where the material is coarse and thick, and where saturation is maintained by a ready source of recharge.

- Best performance from any bedrock aquifer will be where whatever intrinsic permeability is present is enhanced by fractures. In many cases, useful levels of fracturing may be associated with folds and faults that can be mapped at the surface (e.g. those on Figure 3.4-8 or in the references listed on Figure 3.5-3). In some aquifers (e.g. the Casper Fm.) large permeabilities may be present in and near outcrop areas due to solution-enhancement of bedding-parallel fractures which may have no surface manifestation.

- Groundwater quality limitations vary widely depending on the intended use; groundwater unsuitable for one use may be perfectly adequate for another. Less productive aquifers tend to have lower overall water quality, but groundwater quality, like quantitative productivity, can be critically site-specific.

- Well siting should always look to take advantage of the experience of those who have gone before. The GIS products associated with this report contain information on permits developed through the Wyoming State Engineer's Office (SEO). Once a well is completed, the owner is required to file a "Statement of Completion", which are now available electronically from the SEO website (https://sites.google.com/a/wyo.gov/seo/). In addition to basic information on owner, use, and depth, many of these statements describe the geologic materials encountered, at what depths groundwater was found, how the well was constructed, basic aquifer productivity test data and, sometimes, limited water-quality data.

- Proximity to successful wells is always a valuable assessment approach, but should be tempered by consideration of whether or not the basic geology changes significantly between the reference and target locations. As can be seen from Figure 3.4-7, formation outcrop changes occur over the shortest distances where the rocks are dipping along the basin margins.

- The classifications of Figure 3.5-3 provide a first-cut on the potential productivity of a specific area. Groundwater development in locations in the "major aquitard" classification should be approached with the most caution. Judgements based on the proximity to successful wells should include careful assessment of whether such wells are anomalous, e.g. the "pit" wells discussed above under irrigation wells, or are otherwise not representative of the underlying geology.

- The geology of both Figures 3.4-7 and 3.5-3 has been generalized to a degree appropriate to the scale at which the referenced maps were published. While digital copies of mapping products are amenable to presentation at much larger scales, doing so cannot create pseudo-detail not supported by the original mapping. Figure 3.5-3 is based on select, more-detailed geologic mapping than is reflected on Figure 3.4-7. Where the underlying geology is unclear, the most detailed sources should be consulted for site-specific evaluations.

- In most areas of the watershed, younger strata are underlain by all older strata in Appendix 3F. For example, the Casper Formation is present at depth beneath the Chugwater Formation. Thus, a major aquifer may be available at a particular location despite the surface occurrence of a major aquitard, and successful groundwater development may be achieved by drilling to sufficient depth. This situation is complicated, however, by the potential deterioration in water-quality with depth and the potential diminution of aquifer permeability absent the active groundwater circulation near outcrop areas.

3.5.2 Surface Water

3.5.2.1 Hydrologic Unit Codes

The USGS has assigned watersheds in the United States with numeric identifiers called Hydrologic Unit Codes, or HUCs. According to the USGS, "The United States is divided and sub divided into successively smaller hydrologic units which are classified into four levels: regions, sub-regions, accounting units, and cataloging units. The hydrologic units are arranged within each other, from the smallest (cataloging units) to the largest (regions). Each hydrologic unit is identified by a unique hydrologic unit code (HUC) consisting of two to eight digits based on the four levels of classification in the hydrologic unit system."

The first level of classification divides the Nation into 21 major geographic areas, or regions. These geographic areas typically contain the drainage area of a major river, such as the Missouri region. Eighteen of the regions make up the land area of the lower forty-eight states. As regions are subdivided, the HUC identifier is extended. At this time, the smallest subdivision is referred to as the Twelfth order HUC due to the fact that the identifier has 12 digits. The following information is provided as an example of the HUC system as it refers to one of the Laramie River tributaries: Dale Creek.

Region:	10 Missouri River	(Second order HUC)
Subregion:	1018 North Platte River	(Fourth Order HUC)
Accounting Unit:	101800 North Platte River	(Sixth Order HUC)
Cataloging Unit:	10180010 Upper Laramie River	(Eighth Order HUC)
Sub-basin:	1018001004 Harney Creek	(Tenth Order HUC)
Sub-basin:	101800100406 Harney Creek – Dale Creek	(Twelfth Order HUC)

The Upper Laramie River watershed study area was defined primarily by the eighth order HUC 10180010 Upper Laramie River. Table 3.5-1 summarizes the HUC system as it pertains to the study area as indicated in Figure 3.5-10.

3.5.2.2 Existing Stream Gaging Stations

There are currently four active USGS stream gaging stations within the watershed (Figure 3.5-10). As indicated in Figure 3.5-11, historically, fourteen gages have been active. However, eight of the gages have been discontinued by the USGS (the last one being discontinued in 2009), leaving the basin with only four active gages. In addition, the Wyoming State Engineers Office maintains gages on streams, irrigation canals/ditches and reservoirs. Table 3.5-2 tabulates the WSEO gages within the study area. Note that some gages appear on both the WSEO and the USGS lists as they are cooperatively managed.

3.5.2.3 Streamflow Characteristics

Mean monthly discharges were computed using the available data from the active USGS gages and are presented in Table 3.5-3. The mean annual hydrographs at these gage locations reflect typical snowmelt

Table 3.5-1 Upper Laramie River Watershed Study: Hydrologic Unit Code Breakdown.

HUC 2 Number / Name	HUC 4 Number / Name	HUC 6 Number / Name	HUC 8 Number / Name	HUC 10		HUC 12	
				Number	Name	Number	Name
Region: Missouri River	Region: Missouri River	Accounting Region 101800: North Platte	10180010: Upper Laramie	1018001001	Laramie River-Grace Creek	101800100106	Laramie River-Stuck Creek
				1018001002	Laramie River-Squirrel Creek	101800100203	Boswell Creek
						101800100202	Johnson Creek
						101800100201	Laramie River-Bear Creek
						101800100205	Laramie River-Sodergreen Lake
						101800100207	Lindsey Creek
						101800100204	Squirrel Creek-Laramie River
				1018001003	Shell Creek	101800100304	Antelope Creek-Shell Creek
						101800100302	Dry Creek-Shell Creek
						101800100303	Sand Creek-Shell Creek
						101800100301	Shell Creek
				1018001004	Laramie River-Harney Creek	101800100406	Harney Creek-Laramie River
						101800100402	Lake Hattie
						101800100401	Laramie River-West Laramie
						101800100404	Lone Tree Creek
						101800100403	Sevenmile Lakes
						101800100407	Soldier Creek-Laramie River
						101800100405	Willow Creek-Laramie River
				1018001005	Laramie River-Spring Creek	101800100501	Laramie River-Laramie
						101800100504	Laramie River-Soap Holes
						101800100505	Rogers Canyon
						101800100502	Spring Creek-Laramie River
						101800100503	The Big Hollow
				1018001006	Little Laramie River	101800100610	Bamforth Lake
						101800100609	Browns Creek
						101800100603	Libby Creek
						101800100604	Little Laramie River-Cenntenial Valley
						101800100601	Little Laramie River-Middle Fork Little Laramie River
						101800100607	Little Laramie River-Sprague River
						101800100605	Little Laramie River-Webb Lake
						101800100606	Mill Creek-Little Laramie River
						101800100602	South Fork Little Laramie River
						101800100608	Table Mountain
				1018001007	Laramie River-Onemile Creek	101800100702	Fourmile Creek-Laramie River
						101800100709	Gates Creek
						101800100711	Gillespie Reservoir
						101800100705	James Lake
						101800100701	Laramie River-Bosler Junction
						101800100707	Laramie River-Dunn Ditch
						101800100710	Long Lake
						101800100704	Oasis Ditch
						101800100706	Oasis Ditch-Laramie River
						101800100703	Sevenmile Creek-Laramie River
						101800100708	Wallrock Creek
						101800100712	Wheatland Reservoir #2
						101800100713	Wheatland Reservoir #3
				1018001008	Cooper Creek	101800100801	Cooper Creek
						101800100805	Cooper Lake
						101800100802	Damm
						101800100804	Lower Dutton Creek
						101800100803	Upper Dutton Creek

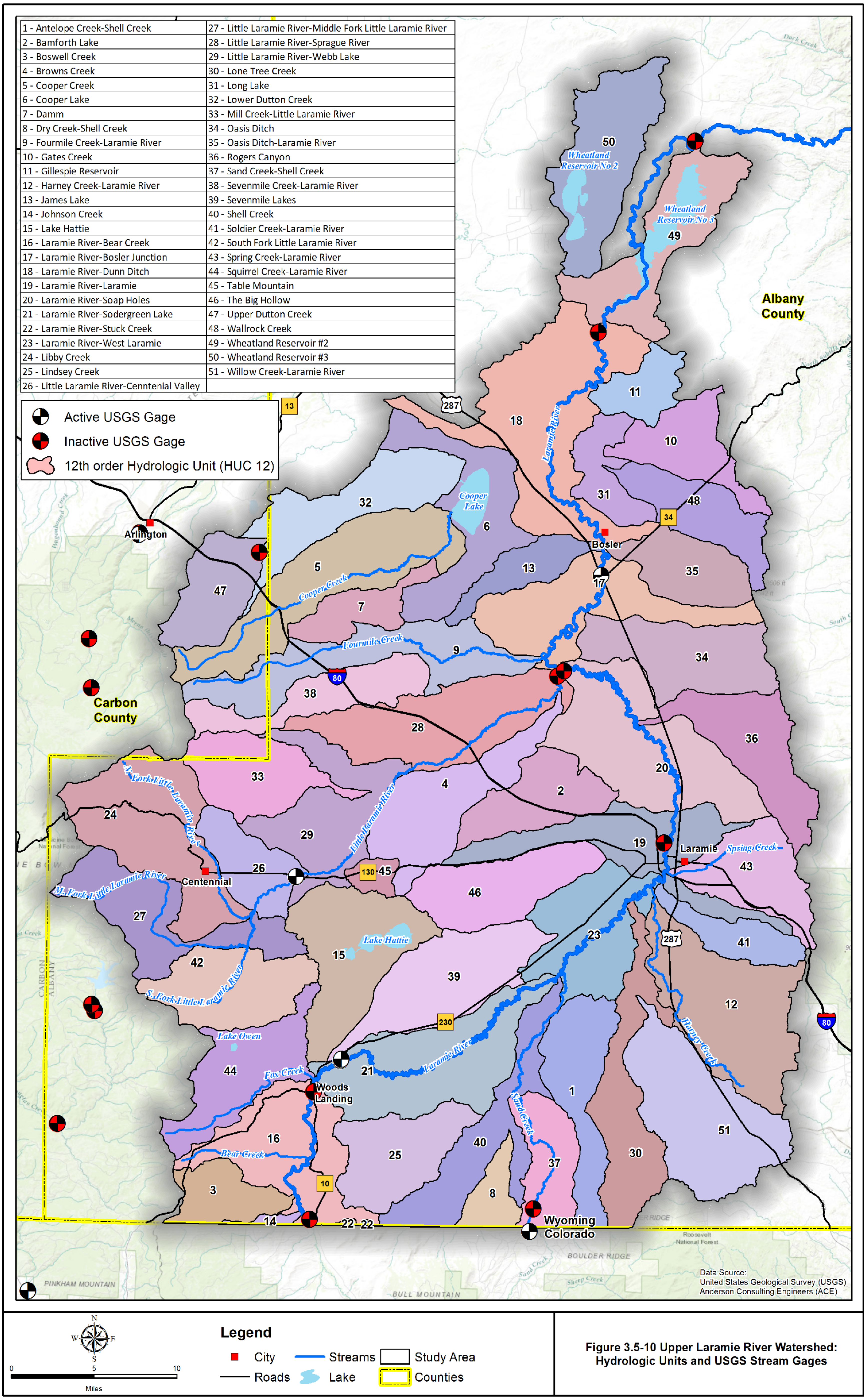
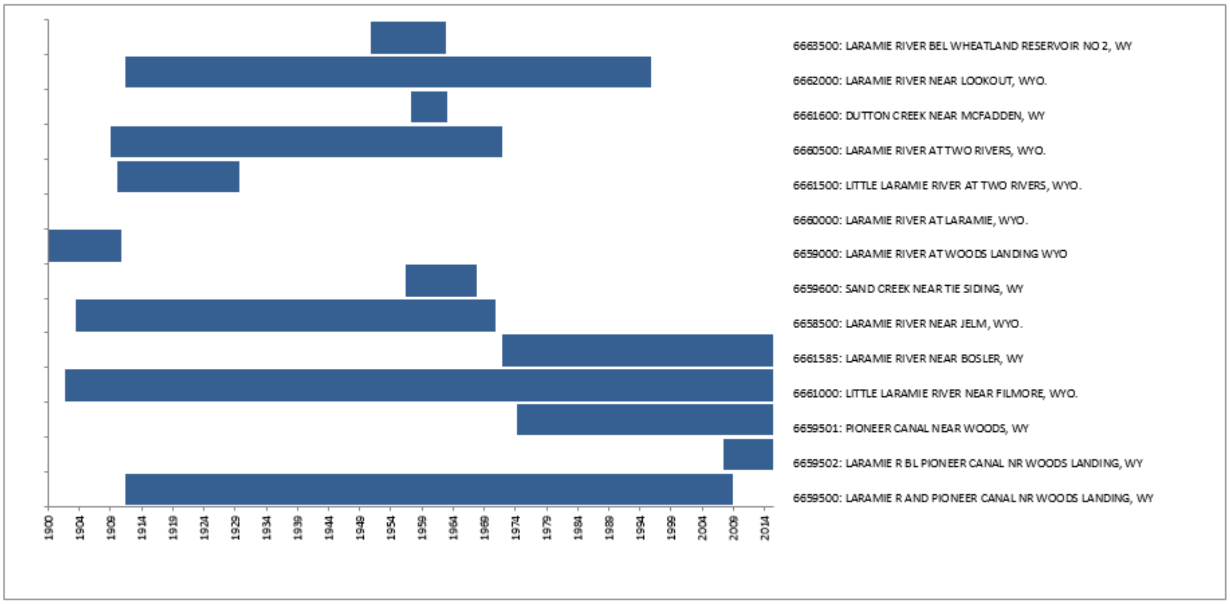


Figure 3.5-10 Upper Laramie River Watershed: Hydrologic Units and USGS Stream Gages



Site Number	Site Name	Site Status	Beginning	End	Drainage Area (sq. miles)	Gauge Elevation (ft, NGVD29)
6659500	LARAMIE R AND PIONEER CANAL NR WOODS	Inactive	5/1/1912	9/30/2009	434	7390
6659502	LARAMIE R BL PIONEER CANAL NR WOODS L	Active	4/19/2008	8/11/2016	434	7390
6659501	PIONEER CANAL NEAR WOODS, WY	Active	4/1/1975	8/10/2016	NA	7390
6661000	LITTLE LARAMIE RIVER NEAR FILMORE, WYO	Active	8/1/1902	8/10/2016	157	7610
6661585	LARAMIE RIVER NEAR BOSLER, WY	Active	10/1/1972	8/10/2016	1790	7030
6658500	LARAMIE RIVER NEAR JELM, WYO.	Inactive	7/1/1904	9/30/1971	294	7683
6659600	SAND CREEK NEAR TIE SIDING, WY	Inactive	4/1/1957	9/30/1968	39.9	7490
6659000	LARAMIE RIVER AT WOODS LANDING WYO	Inactive	1/1/1897	9/30/1911	392	7460
6660000	LARAMIE RIVER AT LARAMIE, WYO.	Inactive	4/1/1933	8/10/1911	1071	7132
6661500	LITTLE LARAMIE RIVER AT TWO RIVERS, WYO	Inactive	1/1/1911	9/30/1930	318	7060
6660500	LARAMIE RIVER AT TWO RIVERS, WYO.	Inactive	1/1/1910	9/30/1972	1224	7059
6661600	DUTTON CREEK NEAR MCFADDEN, WY	Inactive	4/1/1958	12/31/1963	19.9	7451
6662000	LARAMIE RIVER NEAR LOOKOUT, WYO.	Inactive	6/1/1912	9/30/1996	2174	6963
6663500	LARAMIE RIVER BEL WHEATLAND RESERVOI	Inactive	10/1/1951	9/30/1963	2248	6884

Figure 3.5-11 Period of Record for Study Area Stream Gages.

Table 3.5-2 Wyoming State Engineers Office Gages in the Project Study Area.

Station ID	Station Name	WSEO Division / District	Start of Record
014ABO	Laramie River nr. Bosler, WY	Division 1 / District 04A	11/18/2008
014ALO	Laramie River nr. Lookout	Division 1 / District 04A	7/6/2009
014AOC	Oasis Canal	Division 1 / District 04A	4/3/2013
014APC	Pioneer Canal	Division 1 / District 04A	11/19/2008
014AR3O	Wheatland Reservoir No. 3 Outflow	Division 1 / District 04A	4/4/2013
014AR3SC	Wheatland Reservoir No. 3 Supply Canal	Division 1 / District 04A	4/4/2013
014AWL	Laramie River below Pioneer Canal near Woods Landing	Division 1 / District 04A	11/19/2008
014AWLPC	Laramie River and Pioneer Canal near Woods Landing	Division 1 / District 04A	11/19/2008
014AWO	Wheatland Reservoir No. 2 Outflow	Division 1 / District 04A	7/6/2009
6659580	Sand Creek Nr. CO-WY Stateline	Division 1 / District 04A	6/5/2009
014AOC	Oasis Canal	Division 1 / District 04A	4/3/2013
014ABO	Laramie River nr. Bosler, WY	Division 1 / District 04A	5/7/2010
014ALO	Laramie River nr. Lookout	Division 1 / District 04A	6/28/2011
014APC	Pioneer Canal	Division 1 / District 04A	5/26/2010
014AWL	Laramie River below Pioneer Canal near Woods Landing	Division 1 / District 04A	7/2/2010
014AWO	Wheatland Reservoir No. 2 Outflow	Division 1 / District 04A	6/25/2013
6659580	Sand Creek Nr. CO-WY Stateline	Division 1 / District 04A	4/29/2010
014ABO	Laramie River nr. Bosler, WY	Division 1 / District 04A	5/7/2010
014ALO	Laramie River nr. Lookout	Division 1 / District 04A	6/28/2011
014APC	Pioneer Canal	Division 1 / District 04A	5/26/2010
014AWL	Laramie River below Pioneer Canal near Woods Landing	Division 1 / District 04A	7/2/2010
014AWO	Wheatland Reservoir No. 2 Outflow	Division 1 / District 04A	6/28/2011
6659580	Sand Creek Nr. CO-WY Stateline	Division 1 / District 04A	4/29/2010
014ALO	Laramie River nr. Lookout	Division 1 / District 04A	6/28/2011
014ABO	Laramie River nr. Bosler, WY	Division 1 / District 04A	10/1/1972
014ALO	Laramie River nr. Lookout	Division 1 / District 04A	4/1/1996
014AOC	Oasis Canal	Division 1 / District 04A	3/1/1996
014APC	Pioneer Canal	Division 1 / District 04A	4/1/1975
014AR3O	Wheatland Reservoir No. 3 Outflow	Division 1 / District 04A	7/1/1997
014AR3SC	Wheatland Reservoir No. 3 Supply Canal	Division 1 / District 04A	10/1/1995
014AWL	Laramie River below Pioneer Canal near Woods Landing	Division 1 / District 04A	4/1/1975
014AWLPC	Laramie River and Pioneer Canal near Woods Landing	Division 1 / District 04A	4/1/1951
014AWO	Wheatland Reservoir No. 2 Outflow	Division 1 / District 04A	4/1/1996
6659580	Sand Creek Nr. CO-WY Stateline	Division 1 / District 04A	4/1/1975
014BBCBH	Bellamy Canal	Division 1 / District 04B	8/13/2014
014BFM	Little Laramie River nr. Filmore	Division 1 / District 04B	7/6/2009
014BLHS2	Lake Hattie Supply No. 2	Division 1 / District 04B	3/31/2014
014BFM	Little Laramie River nr. Filmore	Division 1 / District 04B	6/1/2010
014BFM	Little Laramie River nr. Filmore	Division 1 / District 04B	6/1/2010
014BBCBH	Bellamy Canal	Division 1 / District 04B	5/11/2009
014BFM	Little Laramie River nr. Filmore	Division 1 / District 04B	10/1/1932
014BLHS2	Lake Hattie Supply No. 2	Division 1 / District 04B	6/5/2009
014AWR	Wheatland Reservoir No. 2 Reservoir	Division 1 / District 04A	10/7/2008

Table 3.5-3 Mean Monthly Discharges for Active Stream Gages.

Month	Mean Stream Discharge	
	LARAMIE RIVER NEAR BOSLER, WY	LITTLE LARAMIE RIVER NEAR FILMORE, WY
USGS Gage	USGS 06661585	USGS 06661000
Period of Record	10/1/1972 to Present	8/1/1902 to Present
Jan	46	20
Feb	55	21
Mar	104	26
Apr	143	54
May	288	236
Jun	733	523
Jul	247	158
Aug	73	49
Sep	34	29
Oct	58	31
Nov	71	28
Dec	54	24

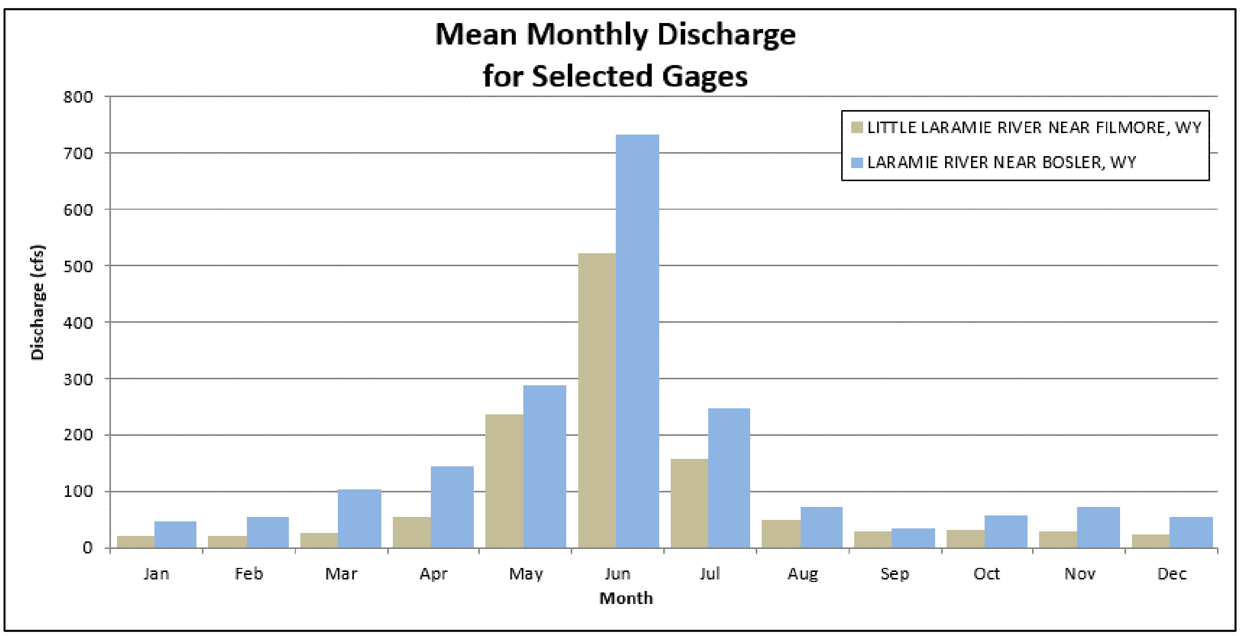


Figure 3.5-12 Mean Monthly Discharge at Selected USGS Stream Gages.

driven runoff patterns. The bulk of the annual runoff occurs between April and July. The late summer through fall months (August through October) see steep declines in streamflow as the streams return to baseflow conditions through the winter. Figure 3.5-12 displays the mean annual hydrograph at the two principal active gages sited within the study area.

The stream reaches and tributaries in the study area range from perennial to ephemeral. Ephemeral streams are defined as those streams/reaches that flow only in response to direct precipitation events, and where any groundwater inflows are insufficient to sustain streamflow due to losses from evaporation, transpiration, and seepage. The hydrologic behavior of intermittent streams/reaches is transitional between perennial and ephemeral stream hydrology. Ephemeral streams tend to be extremely 'flashy', displaying very rapid rise to peak followed by a rapid recession in streamflow. Annual runoff is typically low.

Using regional methods described by the USGS (Miller, 2003), peak flow characteristics were calculated for each of the 51 subwatersheds (HUC12) within the study area. The methodology used to compute these discharges is based upon regressional analyses of gaged data against various basin characteristics.

These estimates are intended to be used for regional planning efforts only. Project-specific estimates would be required before design of future watershed projects (ex. reservoir storage). Appendix 3G presents the results of this effort.

Mean annual discharge was also computed for each of the 51 subwatersheds (HUC12) within the study area using regional methods described by Lowham (1988). The methodology used to compute these discharges relies upon statistical relationships between basin area, mean annual precipitation and measured stream discharge. Results of this analysis are presented in Figure 3.5-13. Appendix 3H presents the results in a tabular format. These data can be used in planning potential water development projects such as stock reservoirs. Using the mean annual yield per square mile for the appropriate sub-basin, approximate yield can be pro-rated for a specific area.

3.5.2.4 Peak Flows

Flood frequency calculations were completed for the USGS stream gages with a sufficient period of record to complete the analysis. The Log-Pearson III methodology (Water Resources Council, 1977) was used to estimate peak discharge associated with the 2-year through the 500-year events. Figure 3.5-14 displays the results of the analysis for the USGS Gage 06661000 Little Laramie River near Filmore, WY. Appendix 3. I contains all of the results.

3.5.2.5 Flooding

Flooding throughout most of the watershed is not considered to be a major problem due to the fact that most of the area consists of unincorporated rural and agricultural land. Damages do occur, however, with flooding of the Laramie River and Little Laramie River. Within the City of Laramie, damages can be more substantial. Figure 3.5-15 displays a mapping generated by the Federal Emergency Management Agency

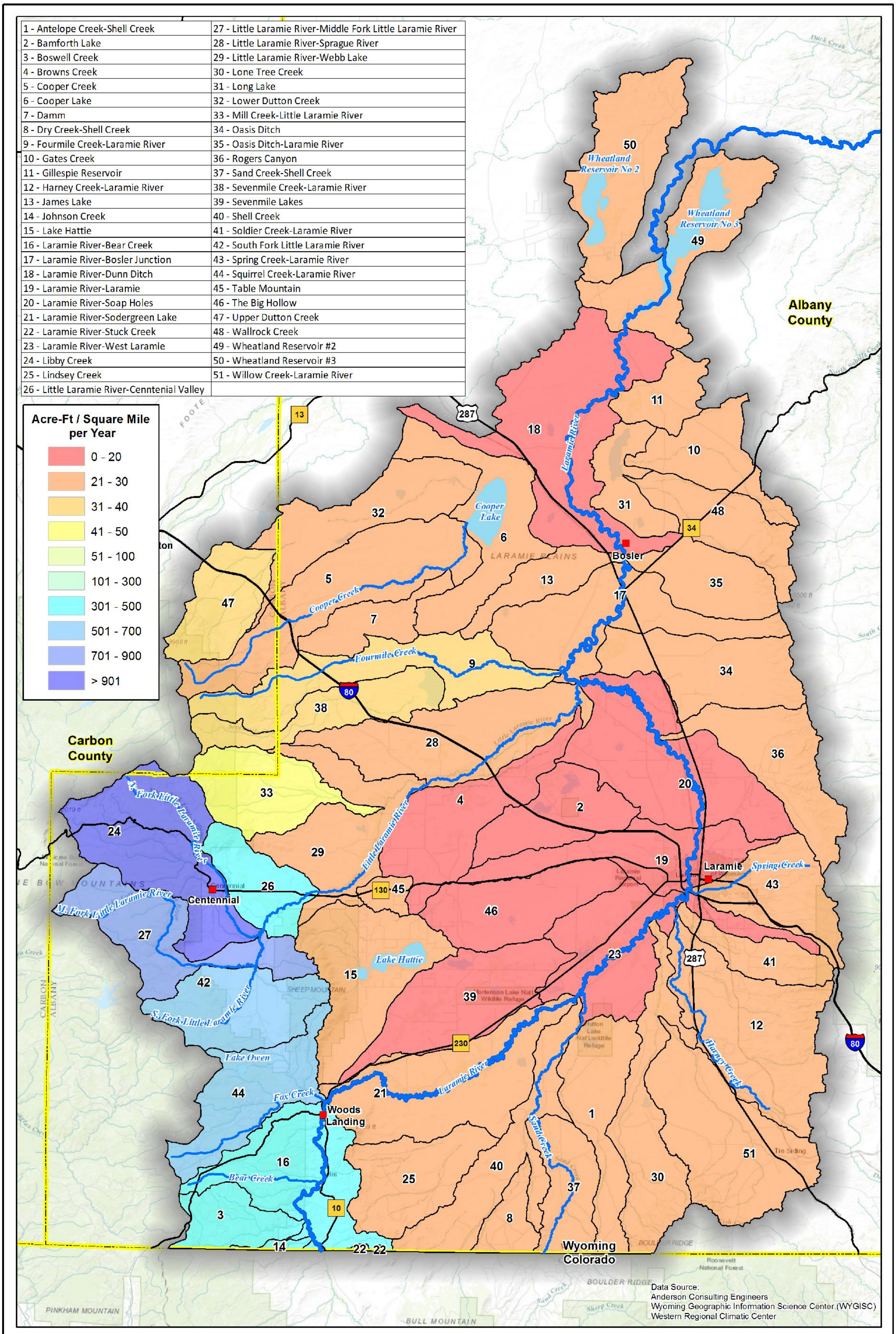
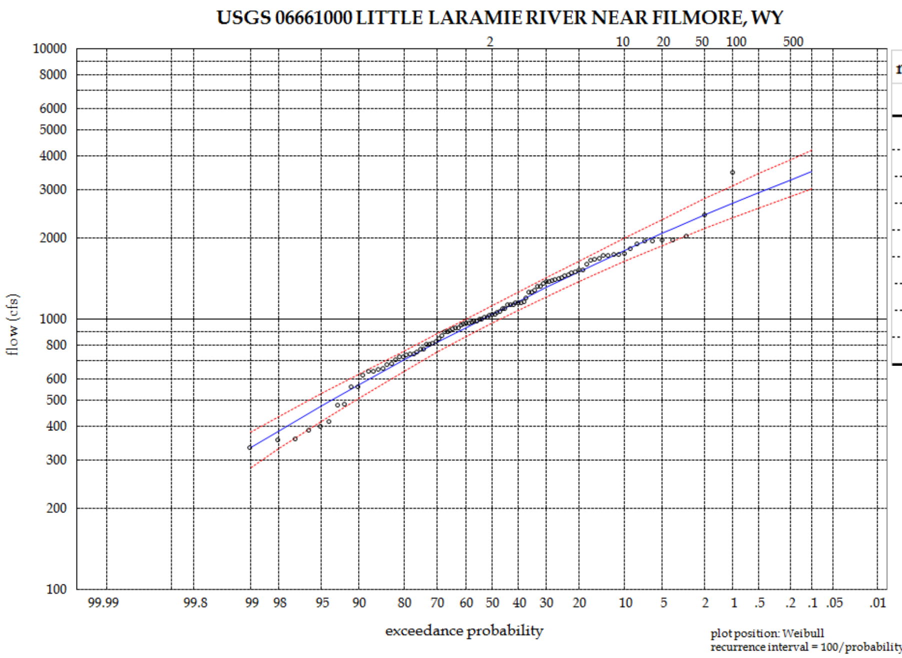


Figure 3.5-13 Upper Laramie River Watershed: Mean Annual Runoff per HUC 12



recurrence (years)	Q (cfs)
500	3,273
200	2,938
100	2,682
50	2,422
25	2,157
20	2,070
10	1,791
5	1,495
2	1,039

Figure 3.5-14 Flood Frequency Analysis: USGS Gage 06661000

Spring Creek is also shown on the FEMA mapping to have a potentially large impact on the city. Portions of Spring Creek have been channelized to increase conveyance capacity and mitigate flooding. However, flooding associated with Spring Creek is still a concern. It is our understanding that engineering contractors to the City of Laramie are completing a storm drainage and assessment study of the area and that the study would include the Spring Creek drainage. At the time this report was prepared, however, the report was not yet available.

3.6 Stream Geomorphology

3.6.1 General

The field of fluvial geomorphology is the study of how land is formed under processes associated with running water. The balance between processes such as erosion, deposition, and sediment transport determines the character and condition of a stream. The objective of the geomorphic evaluation of the study area is to determine the nature of this balance, and where the balance has been upset.

The condition of a stream can be assessed with respect to its basic form (width, depth, slope, etc.), as well as its state of equilibrium, or geomorphic stability (Thorne, et al, 1996; Johnson, et al., 1999). Stable, or equilibrium, channels are generally defined as those that have achieved a balance between flow energy and sediment delivery, such that sediment is transported at the rate at which it is delivered, and the form and pattern of the channel is maintained (Thorne, et al., 1996). Dynamically stable channels are adjustable

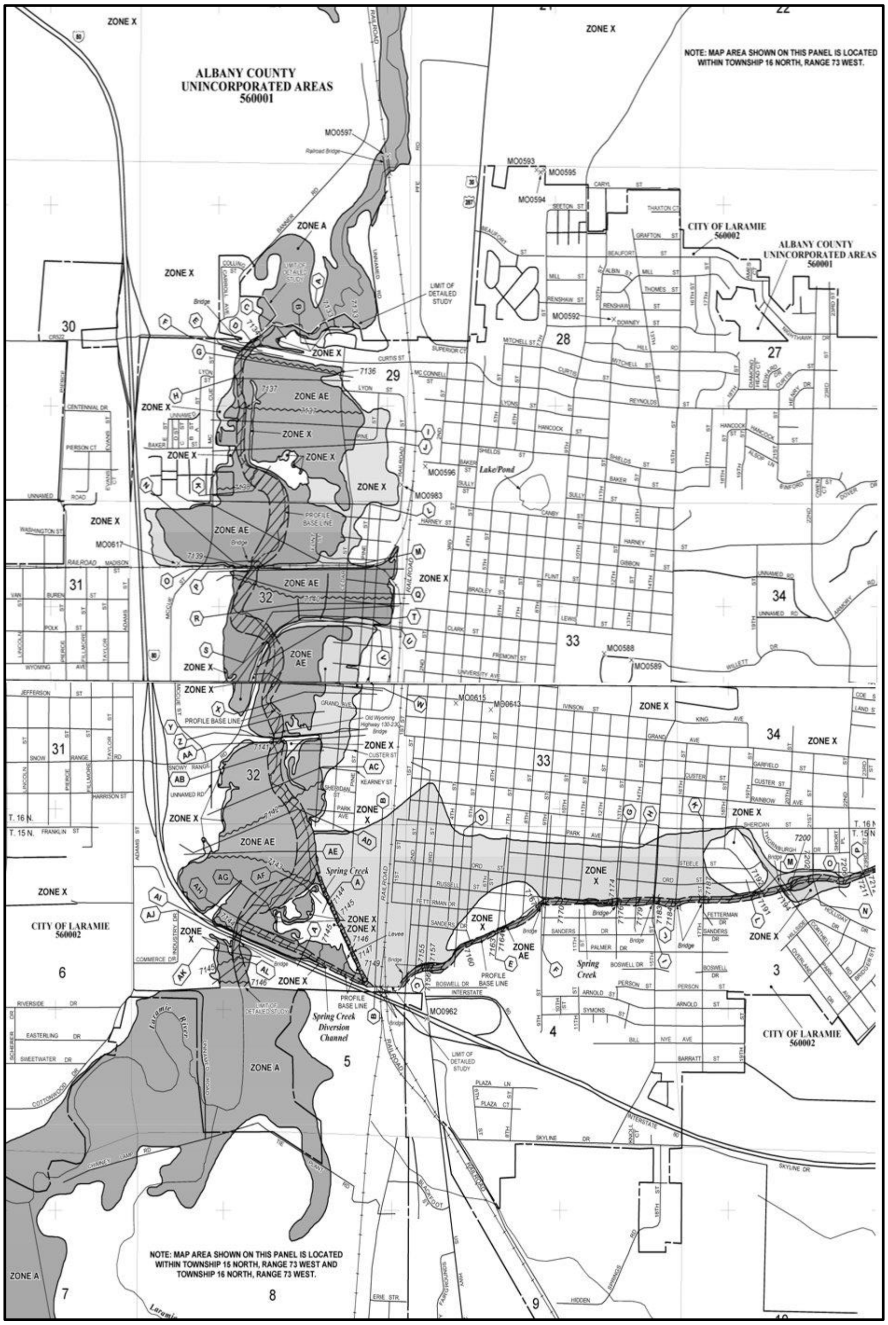


Figure 3.5-15 FEMA Map of the Laramie Vicinity.

(FEMA) of the City of Laramie. The darker grey colored zones indicate the 100-year floodplain and the light grey the 500-year floodplain. As indicated on the map, the Laramie River has access to a wide floodplain upstream (and downstream although not shown on the figure) except within the town limits where it is confined and high flows cause more significant damages to property and infrastructure.

in nature, and “stability” does not preclude lateral migration and associated dynamics such as bank erosion and sediment deposition.

In geomorphically stable conditions, minor changes in either sediment supply or transport energy result in gradual adjustment of channel form to accommodate those changes (Lane, 1955). Channels destabilize when changes in those factors are extreme enough that rapid and dramatic alterations in pattern or form occur. Common indicators of channel instability include active downcutting and accelerated bank erosion, major changes in channel width/depth ratios, and increased flooding due to sediment deposition. Geomorphic function is achieved when a channel is in equilibrium, while undergoing processes such as lateral migration, sediment reworking, and occasional overbank flooding that effectively create and sustain quality aquatic and terrestrial habitat elements, such as bars, pool/riffles, step/pools, and healthy, regenerating riparian corridors.

A commonly used term today for this type of stability is dynamic equilibrium. A stream in dynamic equilibrium has adjusted its width, depth, and slope such that the channel is neither aggrading nor degrading. However, change may be occurring in the stream bank, erosion may result, and bank stabilization may be necessary even on the banks of a stream in dynamic equilibrium.

The equilibrium concept of streams discussed above can also be described by various qualitative relationships. One of the most widely used relationships is the one proposed by Lane (1955) which states that:

$$Q_s \cdot D_{50} \propto Q_w \cdot S$$

Where Qw is the water discharge, S is the slope, Qs is the bed material load, and D50 is the median size of the bed material. This relationship, commonly referred to as Lane's Balance, is illustrated in Figure 3.6-1.

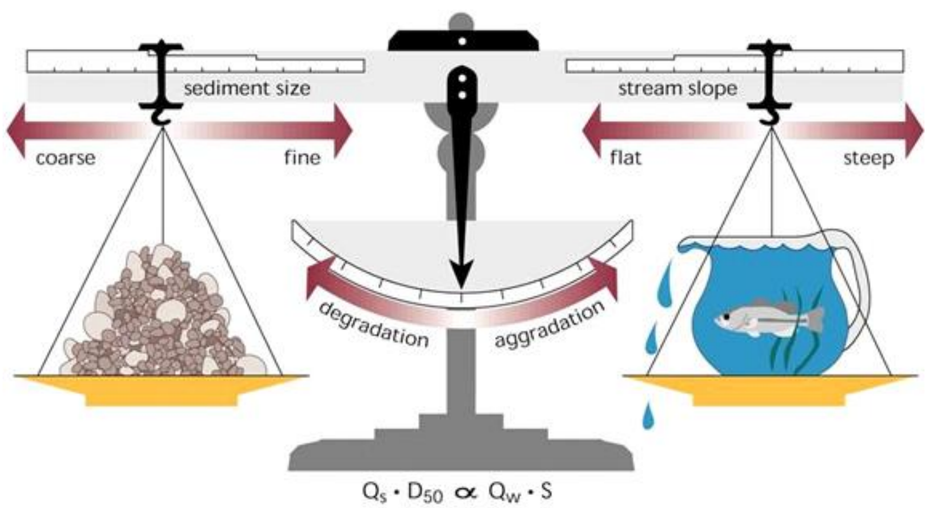


Figure 3.6-1 Lane’s Balance.

This graphic indicates that a change in any of the four variables will cause a change in the others such that equilibrium is restored. When a channel is in equilibrium, it will have adjusted these four variables such that the sediment being transported into the reach is transported out, without significant deposition of sediment in the bed (aggradation), or excessive bed scour (degradation). It should be noted that by this definition of stability, a channel is free to migrate laterally by eroding one of its banks and accreting the one opposite at a similar rate.

In summary, a stable river, from a geomorphic perspective, is one that has adjusted its width, depth, and slope such that there is no significant aggradation or degradation of the stream bed or significant planform changes (meandering to braided, etc.). By this definition, a stable river is not in a static condition but rather is in a state of dynamic equilibrium where it is free to adjust laterally through bank erosion and bar building (Watson, et al, 1999).

Impairments to geomorphic function reflect a significant loss of the functional potential of the river channel segment. These impairments are typically described in general, qualitative, terms and any rehabilitation of impaired channel segments requires a more thorough site-specific assessment of impacts, impairments, and feasible remedies.

3.6.2 Rosgen Classification System

The literature presents descriptions of numerous systems for classifying and evaluating stream systems. Of these, perhaps the most widely used today is the Rosgen classification system (Rosgen, 1996). This system, based upon the stream's existing channel morphology, was utilized in this study. Parameters such as the sinuosity, slope, width/depth ratio, and size of channel materials are evaluated and used to classify the stream into one of the various "types" included in the system.

There are four levels of classification in the Rosgen system, each being more detailed than the previous level. Figure 3.6-2 displays the hierarchy of the assessment levels and the general nature of effort associated with each. Much of the Level I geomorphic characterization is qualitative and utilizes aerial photography and topographic maps. Streams are divided into eight (8) broad types on the basis of their channel and floodplain geometry. Rosgen's classification system stream types can be thought of in their relative location within the watershed from their headwaters through lowlands. The major stream types reflect their location in the watershed. For example, "A" type streams are located in headwaters; "C" & "E" stream types are located in meandering lowlands, etc.

The Level II effort provides a more detailed description of the stream using measurements at selected locations. Stream types are further subdivided into 94 subtypes based upon degree of entrenchment, width-to-depth ratio, water surface slope, streambed materials, and sinuosity (Figure 3.6-3). Consequently, the Level II characterization is more quantitative than the Level I effort. Levels III and IV require more extensive data collection and quantification of stream characteristics. The Upper Laramie River Study included a Level I evaluation of the mainstem streams and their principal tributaries.

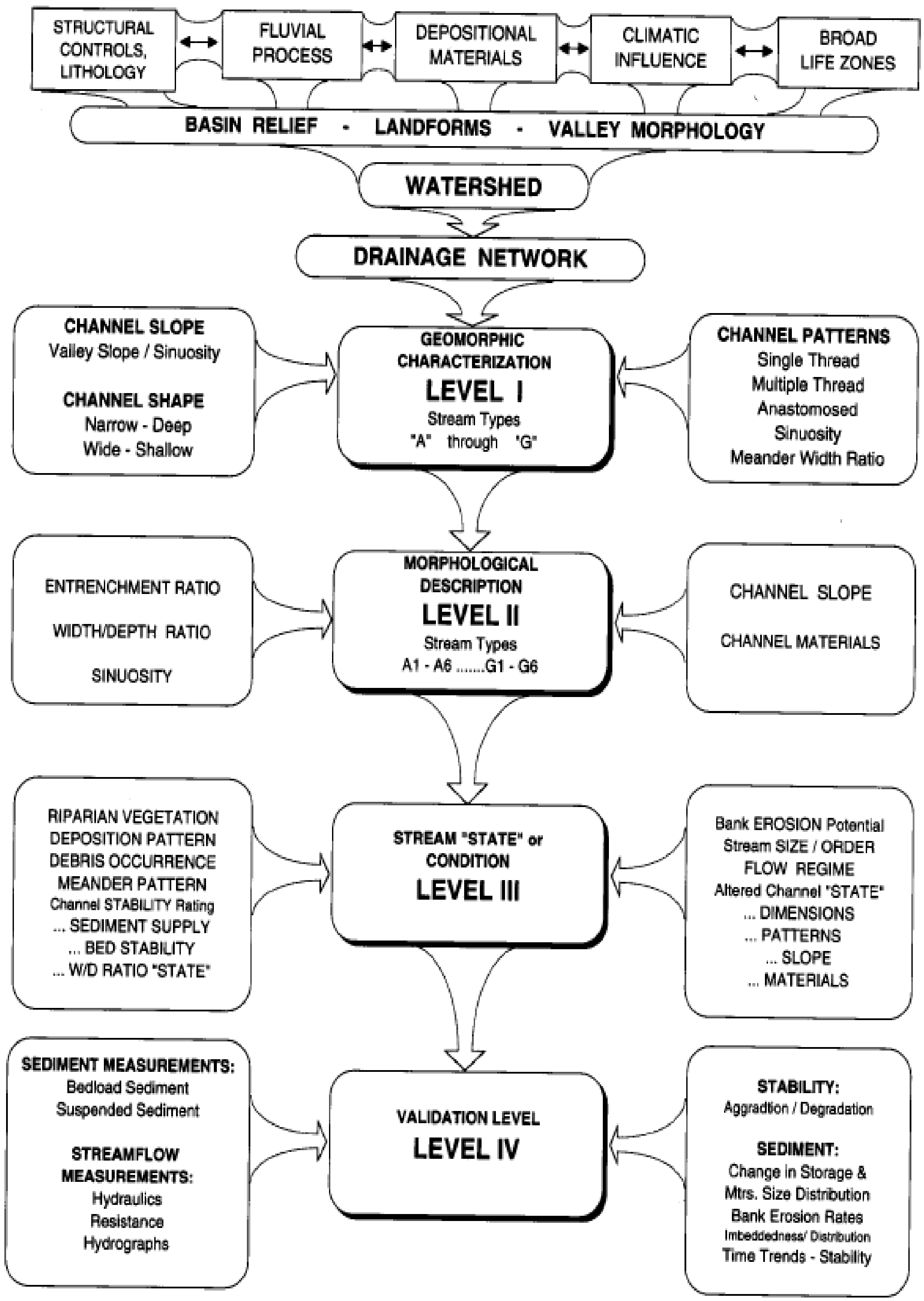


Figure 3.6-2 Hierarchy of the Rosgen Stream Classification System.

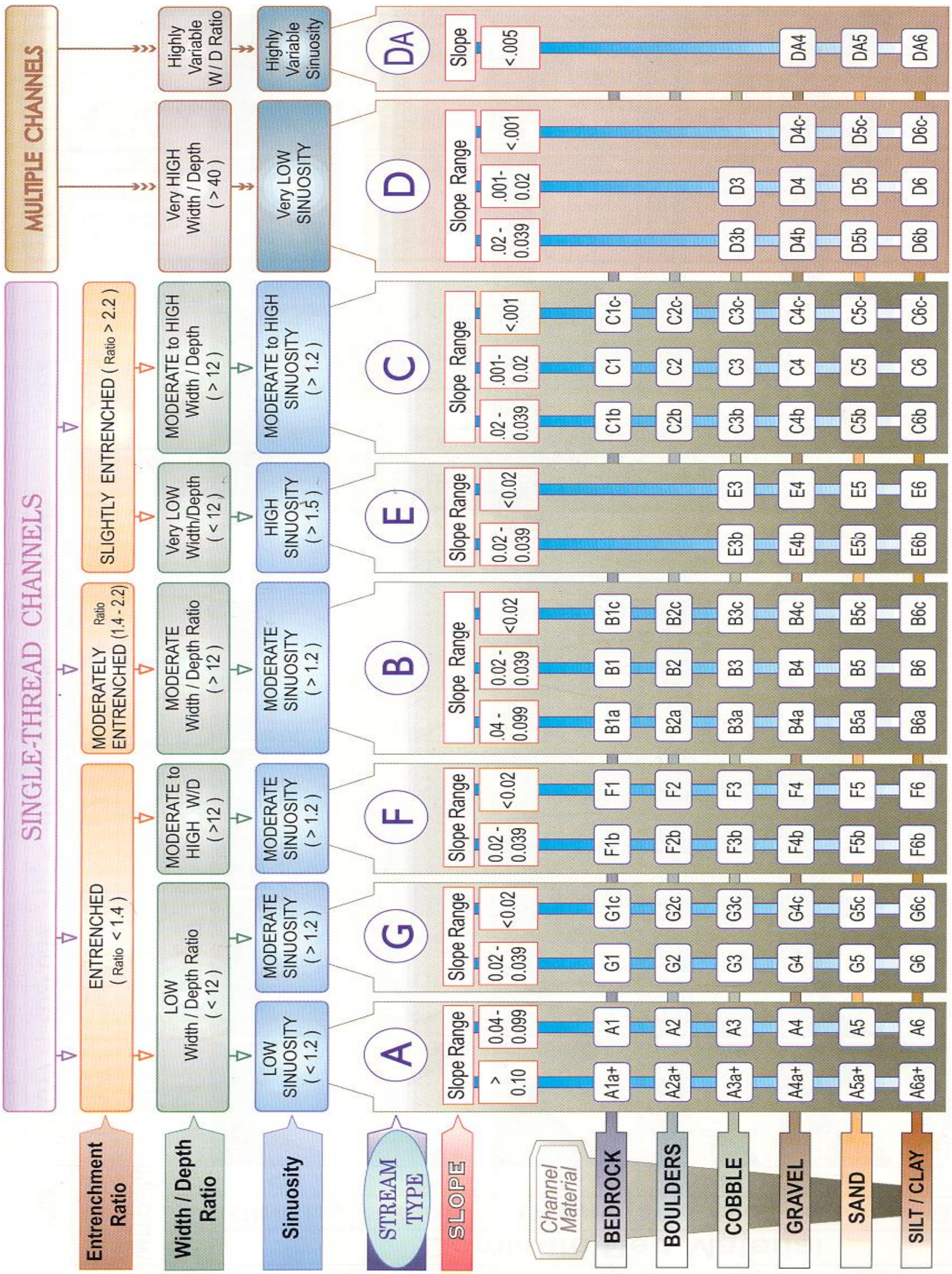


Figure 3.6-3 Rosgen Classification Matrix (Rosgen, 1996).

3.6.2.1 Level I Methods

The purpose of the Level I geomorphic classification is to provide an inventory of the study area's overall stream morphology, character, and condition. It is intended to serve as an initial assessment for use in more detailed assessments and to determine the location and approximate percentage of stream types within the basin. The results of the Level I classification can be integrated directly into the project GIS providing a graphical "snapshot" of the basin. Based upon this initial effort, potential stream reference reaches can be identified for further study in Level II classification efforts. The end product of the Level I classification is the determination of the major stream types, A through G.

Figure 3.6-4 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 encountered in the watershed are presented in the following paragraphs.

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. As the boundaries of A-type channels are typically highly resistant to erosion, these stream types are generally quite resilient with respect to human impacts. The most common cause of geomorphic change within A-type channels is due to large-scale sediment transport events, (landslides, debris flows, debris jam failure) that may result in blockage or deflection of channel flow.

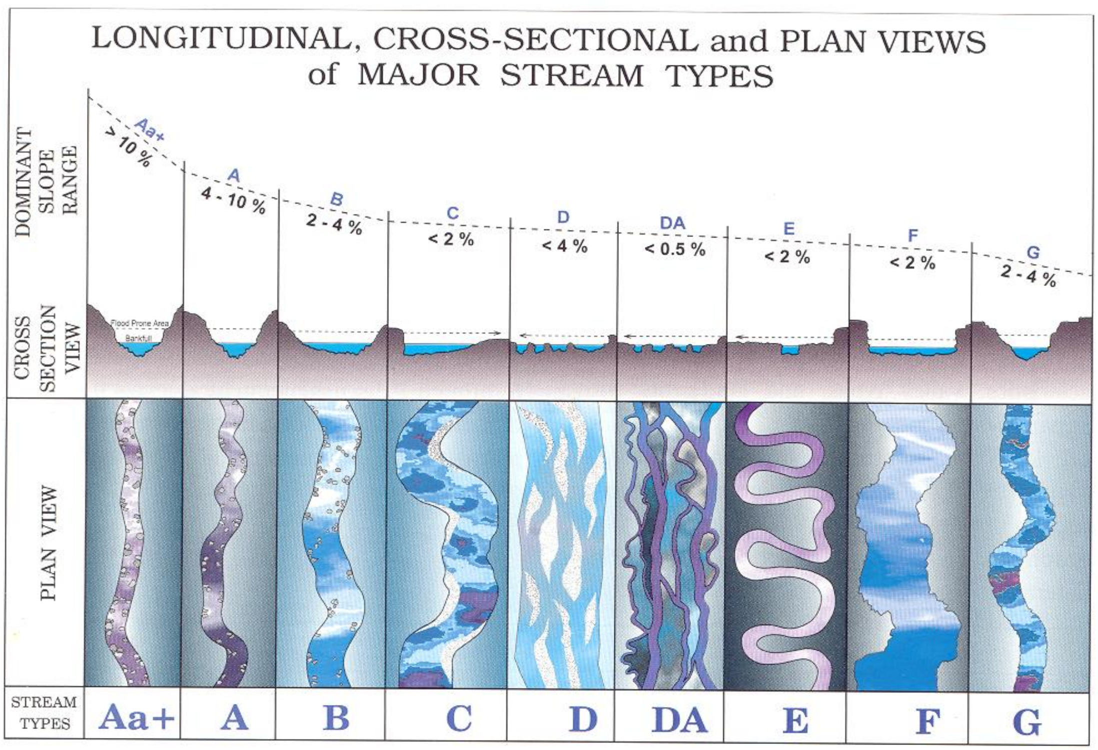


Figure 3.6-4 Major Stream Types within the Rosgen Classification System (Rosgen, 1996).

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 (Figure 3.6-5). B-Type channels are characterized by moderate slopes, moderate entrenchment, and stable channel boundaries. Due to the relatively steep channel slopes and stable channel boundaries, B-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 following a large sediment transport event such as an upstream landslide, debris flow, or flood.

Figure 3.6-5 Example Type B Channel:
North Fork Little Laramie River near Centennial, WY.

C-Type Channels are typically characterized by relatively low slopes, meandering planforms (i.e., the shape one would see if viewing from above, as on a map or aerial photo), and pool/riffle sequences (Figure 3.6-6). The channels tend to occur in broad alluvial valleys, and they are typically associated with broad floodplain areas; they are not entrenched and still have 'access' to their floodplains. C channels tend to be relatively sinuous, as they follow a meandering course within a single channel thread. In stream systems in which the boundaries of C-type channels are composed of alluvial sediments, channels tend to be dynamic in nature, and susceptible to rapid adjustment in response to disturbance.

Figure 3.6-6 Example Type C Channel:
Big Laramie River.

F-Type Channels typically have relatively low slopes (<2%), similar to C and E channel types. The primary difference between C/E channels and F channels is with respect to entrenchment. F channels are entrenched, which means that the floodplain is quite narrow relative to the channel width. The entrenchment of alluvial F-type channels typically is an indicator of a historic downcutting event. F-type channels may form in resistant boundary materials (e.g., U-shaped bedrock canyons) and relatively erodible alluvial materials (e.g., arroyos). When the boundary materials are erodible, the steep valley walls are prone to instability, and channel widening commonly occurs within the entrenched channel cross section (Figure 3.6-7).

Figure 3.6-7 Example Type F Channel: Spring Creek near Laramie, WY.

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.

The Level I classification effort was conducted primarily using existing information incorporated into the project GIS. Several analytical tools were developed and integrated into the GIS which allowed the evaluation of various geomorphic parameters (sinuosity, slope, and stream station determination). The data collated and incorporated in the Project GIS include digital aerial photography, USGS topographic maps, Landsat color infrared imagery, a digital elevation model (DEM), and digitized hydrography information. 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 using 2011 aerial photography and represent the best available estimate of current channel alignment.

The streams evaluated were divided into reaches based upon definable geographic factors (e.g. confluences with tributaries, major road crossings, etc.) or where their geomorphic character displayed changes. Each reach was evaluated in light of the characteristics required at the Level I classification. These parameters, as indicated in Figure 3.6-3, 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”, etc.) is utilized to classify the stream.

3.6.2.2 Geomorphic Characterization

Level I Classification

Results of the Level I classification effort are presented in Table 3.6-1 and graphically in Figure 3.6-8. This figure displays a map of the study area depicting the various stream types as well as the reach designations used in the classification effort.

The headwater reaches of most major streams within the basin are located in steep mountainous terrain comprised of colluvial deposits, bedrock, and forested landscapes. In a manner typical of the Rosgen classification scheme, the dominant stream types in these reaches are A at the higher elevations transitioning to B, with some isolated C and E stream types located in alpine meadows. These stream reaches are generally laterally and vertically stable, and are typically resistant to local anthropogenically caused changes in independent variables.

As the headwater streams enter the lower valley reaches, their character changes. The widening valley floor reduces lateral confinement, sediment size tends to reduce, and boundary conditions typically weaken in conjunction with a change from narrow colluvial valleys to broad riparian alluvial valleys. The common stable stream type within these settings is the C channel type.

The Laramie River enters the project study area from Colorado in a confined steep-walled canyon reach near Jelm where it was classified as a B-Type stream. Steep canyon walls confine the channel laterally and coarse bed materials and bedrock define its bed. Downstream of Woods Landing, the valley widens and the channel transitions to a C-Type channel. The lateral confinement is reduced, the slope lessens, and the boundary materials become less coarse. As a result of these downstream changes in boundary conditions, the lower subreaches tend to display meandering channel dynamics; that is, pool/riffle development and increased lateral channel migration.

Figure 3.6-9 Bank Erosion on Little Laramie River near Confluence with Laramie River

Bank erosion was observed at several locations along the Laramie River and Little Laramie River as would be expected in a meandering system. Figure 3.6-9 displays a photo of the Little Laramie River near its confluence with the Laramie River (Howell Road crossing). As evident in this photo, there is a lack of riparian vegetation and the stream is actively moving laterally to the left. Figure 3.6-10 displays a photo of a section of the Laramie River downstream of Woods Landing where the right bank (as viewed downstream) is actively eroding.

Table 3.6-1 Rosgen Level I Stream Classification

Upper Laramie River Watershed Study, Level I							
Rosgen Level I Stream Classifications							
Stream	Reach Number	Station (Distance from Mouth)		Reach Length (mi)	Sinuosity	Slope	Rosgen
		Station Start (mi)	Station End (mi)				
Bear Creek	1	0.0	8.9	8.9	1.09	0.110	B
Cooper Creek	1	0.0	19.0	19.0	1.70	0.011	E/F
	2	19.0	32.7	13.7	1.23	0.117	B
Fourmile Creek	1	0.0	26.6	26.6	1.98	0.008	E/F
	2	26.6	40.6	14.0	1.29	0.101	B
Fox Creek	1	0.0	13.0	13.0	1.14	0.082	B
Harney Creek	1	0.0	14.2	14.2	1.35	0.008	B
	2	14.2	28.8	14.6	1.24	0.042	E/F
Laramie River	1	0.0	25.4	25.4	1.37	0.001	B
	2	25.4	80.0	54.6	1.82	0.001	C
	3	80.0	130.2	50.2	1.87	0.004	C/F
	4	130.2	144.2	14.0	1.35	0.012	C
Little Laramie River	1	0.0	24.9	24.9	2.12	0.004	C
	2	24.9	46.3	21.4	1.56	0.015	C
Middle Fork Little Laramie River	1	0.0	8.3	8.3	1.47	0.041	B
	2	8.3	21.1	12.8	1.15	0.094	B
North Fork Little Laramie River	1	0.0	9.5	9.5	1.30	0.055	B
	2	9.5	17.9	8.4	1.13	0.156	B
Sand Creek	1	0.0	16.3	16.3	1.84	0.004	E/F
	2	16.3	37.8	21.5	2.05	0.008	E/F
South Fork Little Laramie River	1	0.0	7.5	7.5	1.81	0.009	C
	2	7.5	14.8	7.3	1.12	0.136	B
Spring Creek	1	0.0	3.3	3.3	1.05	0.022	F
	2	3.3	9.1	5.8	1.11	0.131	F

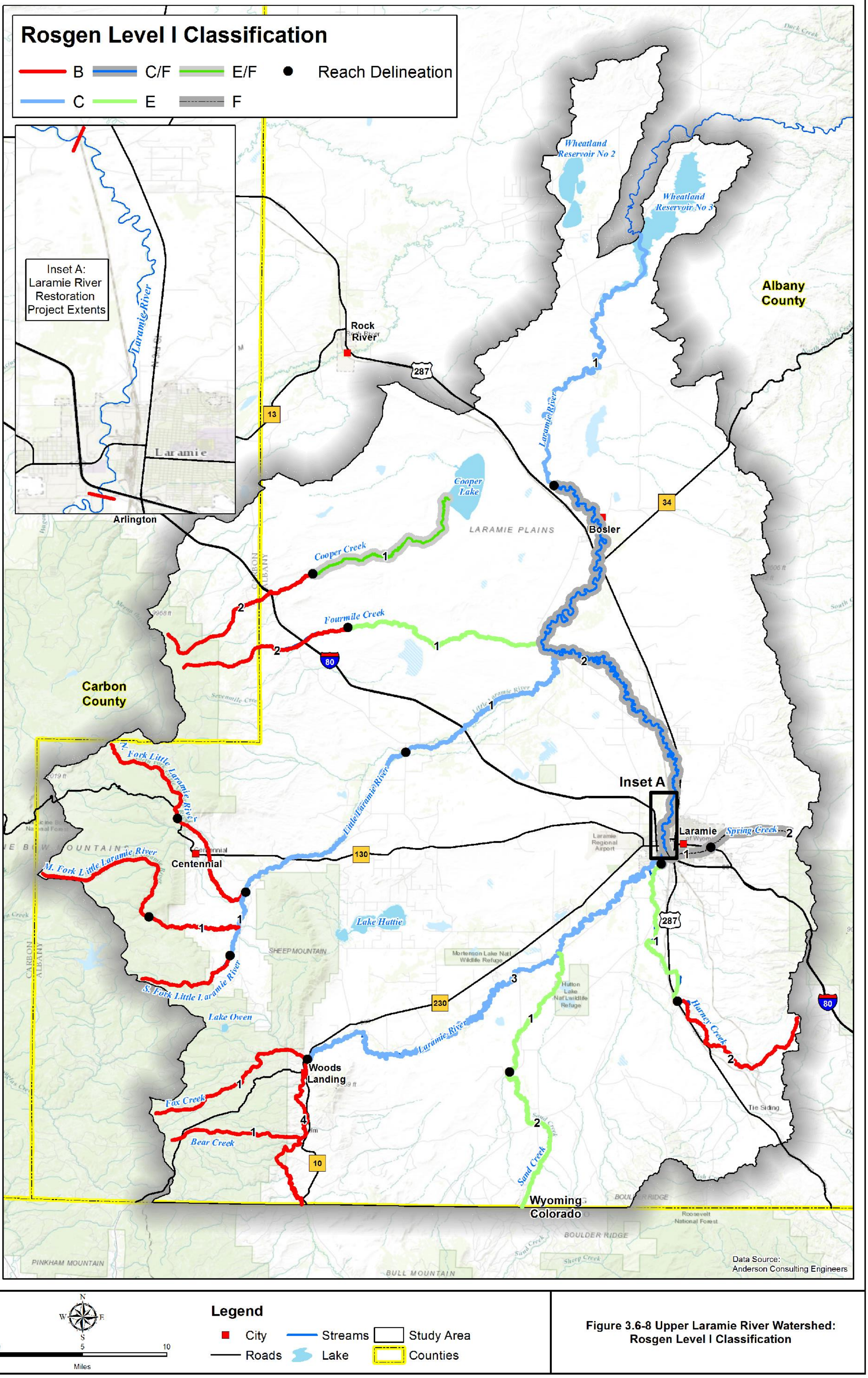


Figure 3.6-8 Upper Laramie River Watershed: Rosgen Level I Classification

Figure 3.6-10 Bank Erosion on the Laramie River Downstream of Woods Landing.

Some channels were classified as either Type F or Type G stream channels in at least portions of their extent. Type F and Type G stream classifications both denote channels which have "disconnected" from their floodplains. These channels are typically erosive, actively downcutting, or widening.

Based upon the GIS classification effort followed by field verification, we concluded that the many of stream channels within the basin are entrenched to some degree. Entrenchment occurs for a variety of reasons including presence of erosive soils coupled with land use practices including road construction, energy development, grazing, etc. Observations of channel conditions within the study revealed entrenchment was generally slight.

Some of the first-order tributaries in the lower portions of the basin can be classified as G-Type channels, or gullies. These channels are highly erosive, generate high sediment volumes, and can result in the loss of productive lands and destabilize upland conditions. These channels could be forming in response to one or more of numerous stimuli including but not necessarily limited to: channel realignment (straightening), road and culvert construction, range management practices, or base-level lowering associated with main channel incision.

Both Spring Creek and the Laramie River have been partially channelized in the vicinity of Laramie. Channelization typically was completed in the past in order to mitigate flooding issues. Channelization was also completed by the Union Pacific Railroad (UPRR) in conjunction with the operation of their Baxter Tie Plant. Between 1876 and 1938, an estimated 87,000 to 350,000 railroad ties were driven down the river (Rosenburg, 1984). Channelization typically results in increased bank erosion and overall instability of the channel. A major stabilization effort, sponsored by the LRCD was completed in 2014. The project entailed stabilization of streambanks and enhancement of aquatic habitat by treating 52 sites in a 12,000-foot stream reach. The project's reach is displayed on Figure 3.6-8.

In 2010 WDEQ completed a two year water quality assessment of the Laramie River associated with the river's placement on Wyoming's 303(d) list of impaired waters. The project's study reach extended approximately 22.8 miles between the Laramie River's confluences with Fivemile Creek and the Little Laramie River. In conjunction with the study was a geomorphic characterization of the reach. The study concluded that instability of the Laramie River within the "altered reach" (referring to the 14 mile reach from the City of Laramie to the confluence with the Little Laramie River) was contributing sediment to the river contributing to degradation of biological conditions. According to the report:

"The available evidence indicates that a majority of the excess sediment in the altered reach, consisting of sand and fine gravel, originates from in-channel sources (i.e., bed and bank erosion) within unstable reaches of the river upstream of the City of Laramie and continuing downstream for several miles. Accelerated bank erosion and lateral channel migration is more prevalent in reaches upstream and downstream of the city. Reaches upstream of the city generate a substantial amount of sediment from accelerated bed and bank erosion that is conveyed downstream. Unable to transport the sediment it receives on an annual basis, the river aggrades, which in turn exacerbates bank erosion through lateral channel migration processes (i.e., development and growth of point bar and mid-channel bar features and creation of divergent and convergent flow patterns that are directed against banks). The continual supply of sediment from bank erosion progressively diminishes the river's sediment transport capacity with distance downstream. Delta bar features observed in the river below the city's stormwater drainage outlets suggest that excess sediment is contributed to the river from urban sources. However, the quantity of sediment generated from urban sources is considered secondary to the amount attributed to the river's in-channel sources."(WDEQ, 2010)

3.6.3 Proper Functioning Condition

The BLM utilizes a procedure for assessing the health of a stream called Proper Functioning Condition assessment or PFC. PFC is described by the BLM as:

> *"A qualitative method for assessing the condition of riparian-wetland areas. The term PFC is used to describe both the assessment process, and a defined, on the-ground condition of a riparian-wetland area. The PFC assessment refers to a consistent approach for considering hydrology, vegetation, and erosion/deposition (soils) attributes and processes to assess the condition of riparian-wetland areas. A checklist is used for the PFC assessment, which synthesizes*

information that is foundational to determining the overall health of a riparian-wetland system" (BLM, 1998).

The PFC assessment terminates with the definition of one of three classes for a given stream segment as described below.

Proper Functioning Condition: A stream is said to be functioning properly when adequate vegetation, landform, or debris is present to:

- dissipate energies associated with wind action, wave action, and overland flow from adjacent sites, thereby reducing erosion and improving water quality;
- filter sediment and aid floodplain development;
- improve flood water retention and groundwater recharge;
- develop root masses that stabilize islands and shoreline features against cutting action;
- restrict water percolation;
- develop diverse ponding characteristics to provide the habitat and water depth, duration, and temperature necessary for fish production, water bird breeding, and other uses; and
- support greater biodiversity.

Functional At Risk: Riparian/wetland areas are classified as *functioning-at-risk* when they are in functioning condition but an existing soil, water, or vegetation attribute makes them susceptible to degradation. These areas are further distinguished based on whether or not they demonstrate an *upward*, *not apparent*, or *downward* trend.

Nonfunctioning: Riparian/wetland areas are classified as *nonfunctioning* when they clearly are not providing adequate riparian vegetation, physical structure, or large woody debris to dissipate stream energy associated with high flows.

At the time of this report PFC data were not available for the watershed. According to Rawlins BLM staff, assessments were being completed but were not expected to be made available until after the completion of this project. When available, the data can be incorporated into the project GIS by the LRCD and used in conjunction with geomorphic evaluations completed during this study for future planning efforts.

3.6.4 Barriers to Fish Passage

Man-made structures such as irrigation diversions and road crossings can create barriers to fish movement within a stream system. According to representatives of Wyoming Game and Fish Department and corroborated by members of the public, there are known barriers within the watershed. Evaluation of these structures and inventory of additional structures was beyond the scope of this project; nor have any inventories been completed by other entities to date. However, using the project GIS and NAIP aerial photography taken in 2014, we were able to make initial determination of the nature of fish barriers on the Laramie and Little Laramie Rivers. Each structure examined was classified based upon information provided by Trout Unlimited:

- **Complete barriers** are defined as those that most or all fish could not pass upstream over at most or all flows.
- **Seasonal barriers** are defined as those that most or all fish could not pass during some time during the year.
- **Partial barriers** are those structures that some fish or some age classes of fish could not pass during some times of year, even if some fish probably could pass the obstruction during the entire year.

Obstructions were considered to not be barriers if it appeared that all fish could pass them at all flows.

Results of this analysis are presented in Figure 3.6-11. A total of twenty-eight (28) potential barriers were noted; ten of which were categorized as “complete barriers”, fourteen (14) were “partial barriers”, and the remaining four (4) were categorized as “seasonal barriers”.

According to the WGF, two of the structures of highest concern are the Pioneer Canal Diversion (Figure 3.6-12) and the Dowlin Ditch Diversion.

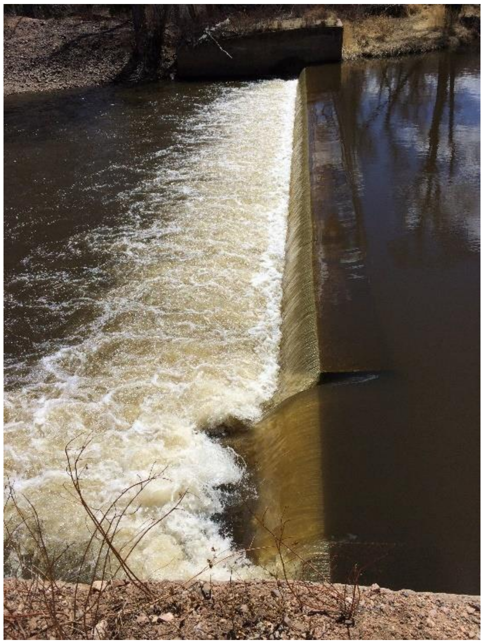


Figure 3.6-12 Pioneer Canal Diversion Structure.

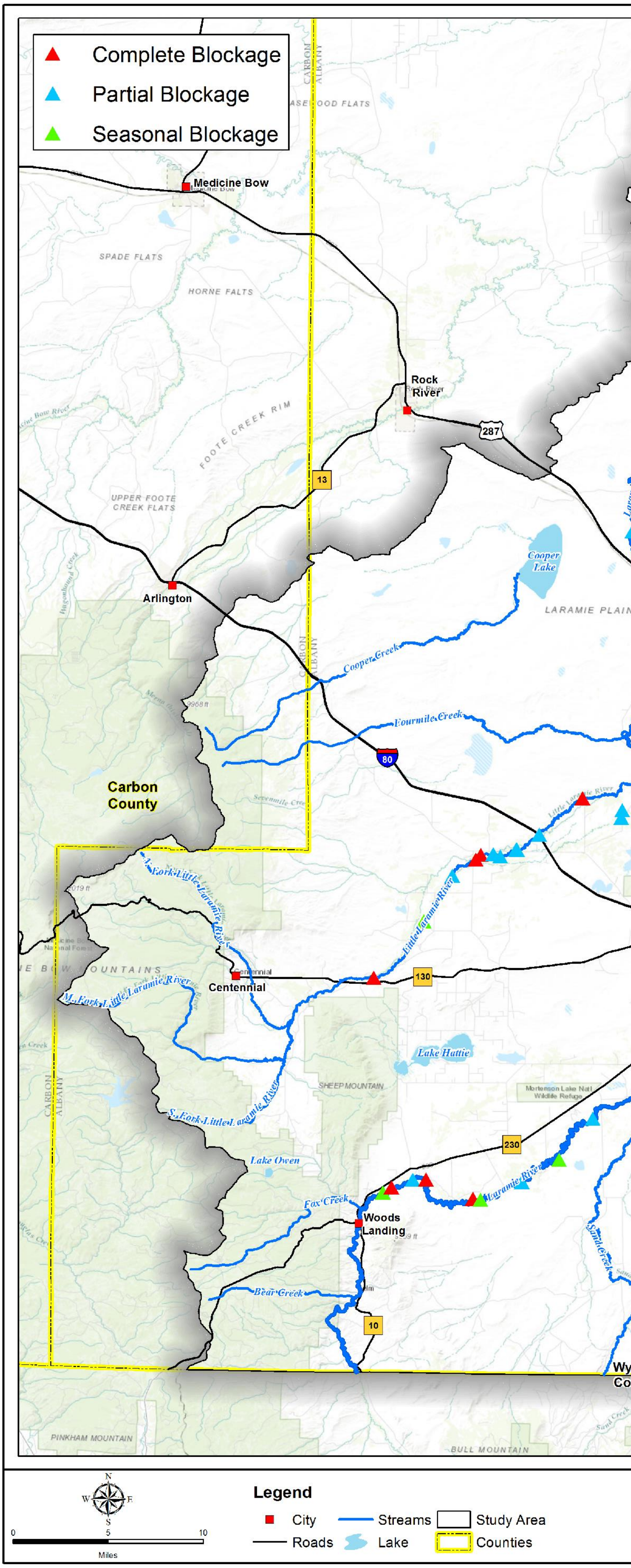


Figure 3.6-11 Upper Laramie River Watershed: Potential Fish Barriers

3.6.5 Impairments

Based upon this basin-wide overall review, study area history and existing or on-going studies, Impairments to stream channels within the study area appear to fall into the following broad and interrelated categories:

- Riparian Vegetation Degradation: Impaired riparian condition and habitat, and
- Riparian Degradation: Generally bank erosion and physical disturbance of stream banks.
- Imbalance of Sediment Supply: Imbalance between stream capacity and sediment supply can lead to channel degradation or aggradation
- Barriers to Fish Passage: Partial or complete obstruction of fish passage

Management Implications:

The objective of a Rosgen classification is to provide insight into the inherent resiliency of the stream and where there may be stability issues. This insight can then be included in future planning efforts or consideration with project-specific designs.

For instance, type A and B channels are typically headwater streams and are inherently resilient to disturbance. Bedrock and valley-type typically contain the channels to a narrow corridor and migration is minimal and they're generally geomorphically stable. Management implications of these types of channels could be how to stabilize culverts, irrigation diversions, etc.

Type C channels (the Laramie river) are non-entrenched and have "access" to their floodplains. These channels migrate, we see oxbow features, bank erosion is a natural feature (within limits), etc. Management implications could include irrigation diversion design, bank stabilization, wetland creation / enhancement (ie. oxbow wetlands), etc.

From a watershed planning perspective, knowing where the various types of channels lie and their extent all adds to the understanding of the watershed health and function. With an abundance of F-type channels (entrenched), systemic issues may be indicated. G channels (gullies) indicate other watershed health issues: over grazing, energy development, roads, etc. These all add to the understanding of sediment loading to the mainstems which affects habitat, receiving stream stability, etc.

Within the project study area, there do not appear to be systemic geomorphic issues associated with channel degradation. In general, streams appear to be relatively stable from a geomorphic standpoint and bank erosion and incision were evident, but not prevalent. There are areas where channel widening is evidenced by active bank erosion and high width depth ratios. For instance, the Laramie River in the vicinity of the City of Laramie has been modified by anthropogenic activities and appears to be in the process of recovering, particularly in consideration of recent channel improvement projects.

Tributaries to the system mainstems were observed to be degrading and would be classified as Type-G channels under the Rosgen system. However, again it is important to keep in mind that these channels do not appear to be associated with widespread systemic watershed rejuvenation as would be expected if the mainstems were degraded. In other words, there was not sufficient evidence of channel degradation in the tributaries to indicate instabilities associated with base-level lowering of the mainstems. The Type-G channels observed through the course of this project were likely caused by local land use practice.

3.7 Water Quality

3.7.1 Stream Classifications

The Water Quality Division of the Wyoming Department of Environmental Quality (WDEQ) has classified water bodies in the state into two parts: primary bodies and secondary bodies. The primary bodies are listed in what is referred to as "Table A" and represent those water bodies either named on the USGS 1:500,000 scale hydrologic map or those specifically classified by the WDEQ. The secondary bodies listed in “Table B” are taken from the WGFD’s “Streams and Lakes Inventory” and are based on the presence or absence of fish species. Where there are differences in classification, "Table A" takes precedence. The water bodies are then classified based upon their use. Table 3.7-1 summarizes the stream classifications and their use designations.

The Upper Laramie River Watershed study area has 911 miles of streams and 59 reservoirs/lakes classified in the WDEQ's "Table A" and “Table B” as displayed in Figure 3.7-1. The definitions of the stream classes applicable to the watershed are quoted from the Water Quality Rules and Regulations, Chapter 1, Wyoming Surface Water Quality Standards (WDEQ, 2013) as follows:

> *Class 2AB waters are those known to support game fish populations or spawning and nursery areas at least seasonally and all their perennial tributaries and adjacent wetlands and where a game fishery and drinking water use is otherwise attainable. Class 2AB waters include all permanent and seasonal game fisheries and can be either “cold water” or “warm water” depending upon the predominance of cold water or warm water species present. All Class 2AB waters are designated as cold water game fisheries unless identified as a warm water game fishery by a “ww” notation in the “Wyoming Surface Water Classification List”. Unless it is shown otherwise, these waters are presumed to have sufficient water quality and quantity to support drinking water supplies and are protected for that use. Class 2AB waters are also protected for nongame fisheries, fish consumption, aquatic life other than fish, recreation, wildlife, industry, agriculture and scenic value uses.*

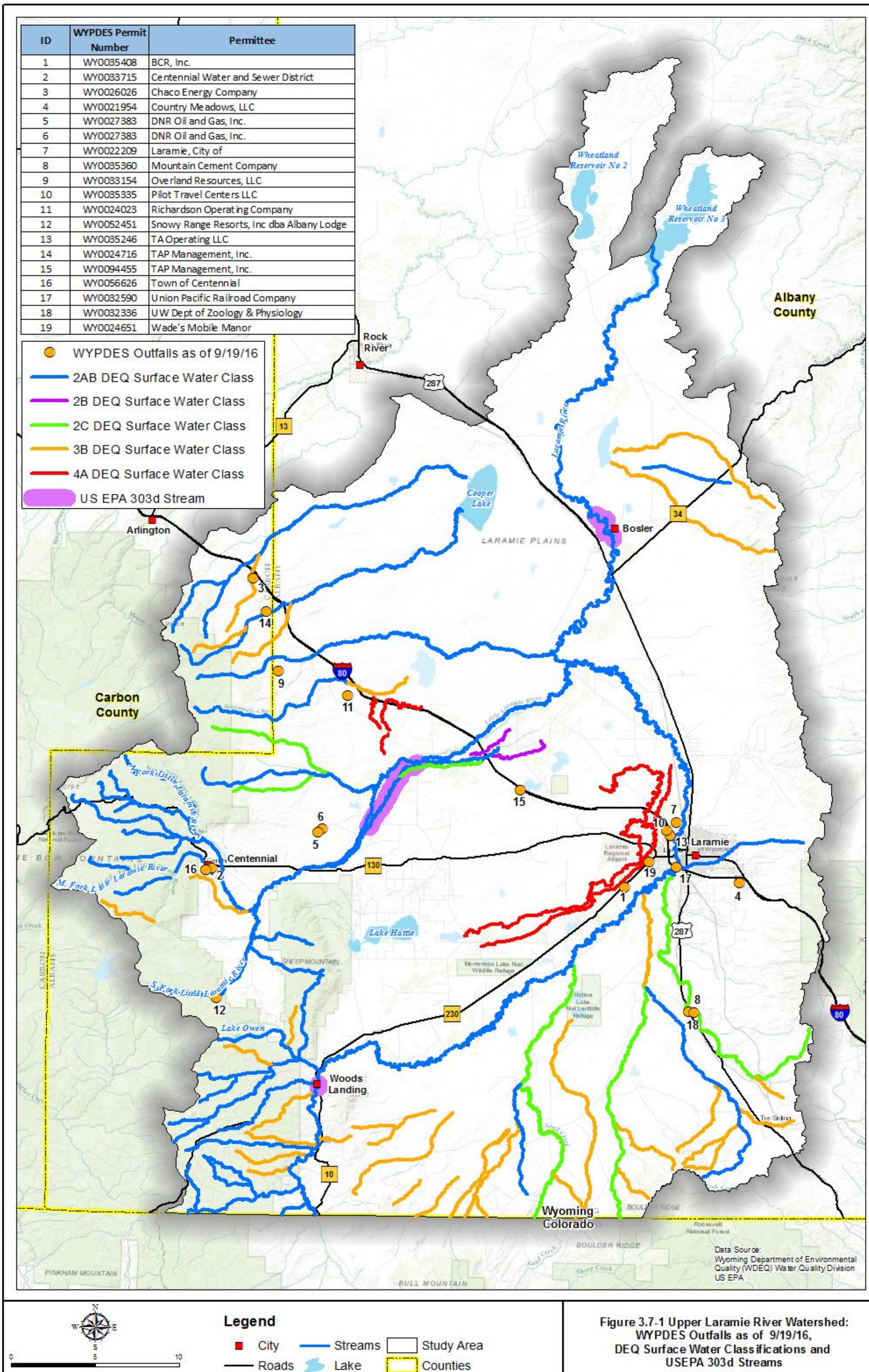
Table 3.7-1 WYDEQ Surface Water Classification and Use Designations.

		Surface Water Classification												
		1	2AB	2A	2B	2C	2D	3A	3B	3C	3D	4A	4B	4C
Designated Use	Drinking Water	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No
	Cold Water game fish	Yes	Yes	No	Yes	No	If Present	No	No	No	No	No	No	No
	Warm Water game fish	Yes	Yes	No	Yes	No	If Present	No	No	No	No	No	No	No
	Nongame Fish	Yes	Yes	No	Yes	Yes	If Present	No	No	No	No	No	No	No
	Fish Consumption	Yes	Yes	No	Yes	Yes	Yes	No	No	No	No	No	No	No
	Aquatic life other than fish	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
	Recreation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Wildlife	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Agriculture	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Scenic Value	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Class 2B waters are those known to support or have the potential to support game fish populations or spawning and nursery areas at least seasonally and all their perennial tributaries and adjacent wetlands and where it has been shown that drinking water uses are not attainable pursuant to the provisions of Section 33. Class 2B waters include permanent and seasonal game fisheries and can be either "cold water" or "warm water" depending upon the predominance of cold water or warm water species present. All Class 2B waters are designated as cold water game fisheries unless identified as a warm water game fishery by a "ww" notation in the Wyoming Surface Water Classification List. Uses designated on Class 2B waters include game and nongame fisheries, fish consumption, aquatic life other than fish, recreation, wildlife, industry, agriculture and scenic value.

Class 2C waters are those known to support or have the potential to support only nongame fish populations or spawning and nursery areas at least seasonally including their perennial tributaries and adjacent wetlands. Class 2C waters include all permanent and seasonal nongame fisheries and are considered "warm water". Uses designated on Class 2C waters include nongame fisheries, fish consumption, aquatic life other than fish, recreation, wildlife, industry, agriculture, and scenic value.

Class 3B waters are tributary waters including adjacent wetlands that are not known to support fish populations or drinking water supplies and where those uses are not attainable. Class 3B waters are intermittent and ephemeral streams with sufficient hydrology to normally support and sustain communities of aquatic life including invertebrates, amphibians, or other flora and fauna



ID	WYPDES Permit Number	Permittee
1	WY0035408	BCR, Inc.
2	WY0033715	Centennial Water and Sewer District
3	WY0026026	Chaco Energy Company
4	WY0021954	Country Meadows, LLC
5	WY0027383	DNR Oil and Gas, Inc.
6	WY0027383	DNR Oil and Gas, Inc.
7	WY0022209	Laramie, City of
8	WY0035360	Mountain Cement Company
9	WY0033154	Overland Resources, LLC
10	WY0035335	Pilot Travel Centers LLC
11	WY0024023	Richardson Operating Company
12	WY0052451	Snowy Range Resorts, Inc dba Albany Lodge
13	WY0035246	TA Operating LLC
14	WY0024716	TAP Management, Inc.
15	WY0094455	TAP Management, Inc.
16	WY0056626	Town of Centennial
17	WY0032590	Union Pacific Railroad Company
18	WY0032336	UW Dept of Zoology & Physiology
19	WY0024651	Wade's Mobile Manor

Figure 3.7-1 Upper Laramie River Watershed: WYPDES Outfalls as of 9/19/16, DEQ Surface Water Classifications and USEPA 303d Streams

which inhabit waters of the state at some stage of their life cycles. In general, 3B waters are characterized by frequent linear wetland occurrences or impoundments within or adjacent to the stream channel over its entire length. Such characteristics will be a primary indicator used in identifying Class 3B waters."

Class 4A. Class 4A waters are artificial canals and ditches that are not known to support fish populations.

3.7.2 WYPDES Permitted Discharges

A database of permitted discharges under the National Pollution Discharge Elimination System (NPDES) was obtained from the Wyoming Department of Environmental Quality. As of the time this report was prepared, there were a total of 19 active (WYPDES) permitted discharges present within the study area. Table 3.7-2 summarizes pertinent information regarding the permits. The locations of these discharges are shown on Figure 3.7-1.

3.7.3 Waters Requiring TMDLs

A Total Maximum Daily Load (TMDL) is the amount of pollutant which a stream can accept and still meet its designated uses. TMDLs must be established for each pollutant which is a source of stream impairment. They must be measurable and must consider both point and nonpoint source pollutant loads, natural background conditions, and a margin of safety.

The term "303(d) list" is short for the list of impaired and threatened waters (stream/river segments, lakes) that the Clean Water Act requires all states to submit for Environmental Protection Agency (EPA) approval every two years on even-numbered years. According to the EPA, most recent data available (2015) from the there are approximately 12 miles of streams within the study area listed as impaired and included on the EPA's 303d list:

- The Laramie River near Woods Landing WY (.25 miles),
- The Laramie River and a section near Bosler WY (2.8 `mile), and
- The Little Laramie River from Mandel Lane upstream to near McGill Ranch (9 miles).

All streams listed on the 303d list within the watershed are impaired due to Escherichia Coli (E. Coli).

3.8 Water Storage and Retention

3.8.1 Existing Facilities

Several major reservoirs are located within the watershed. Table 3.8-1 summarizes information tabulated by the WSEO pertaining to major reservoirs within the watershed (defined as having a storage capacity greater than 1,000 acre-feet). Figure 3.8-1 displays their locations.

Table 3.8-1 Major reservoirs in the Upper Laramie River Watershed.

Structure Number	Permit Number	Reservoir Name	Applicant Name	Priority Date	Source	Use	Size of reservoir	Active Capacity	Year Constructed
1	P1724D	Wyoming Development Company No. 2 Reservoir (Wheatland No. 2)	Wyoming Development Company	1/29/1898	Laramie River	Irrigation , Domestic	98,930	88,930	1901
2	P4978R	Wheatland Irrigation District No. 3 Reservoir	Wheatland Irrigation District	5/31/1929	Laramie River	Irrigation , Stock	71,319	56,319	1941
3	P1372R	Lake Hattie Reservoir	Laramie Water Company	5/11/1908	Laramie River	Irrigation	36,834	36,834	1912
	P9250R	Lake Hattie Reservoir Enl.	Pioneer Canal / Lake Hattie Irrigation District	5/1/1986	Laramie River and Little Laramie River	Irrigation, Municipal, Industrial, Fish Propagation, Flood Control, Power, Domestic			
4	P1279R	James Lake Reservoir	Harris Ranch and Frank Bosler	3/27/1908	Little Laramie River	Irrigation	8,990	8,990	1910
5	P7435R	Twin Buttes Reservoir	Wyoming Game and Fish Commission	2/3/1972	Mortensen Draw	Fish Propagation, Recreation	3,912	937	1972
6	P4156R	Twelve Mile Reservoir	Monolith Portland Midwest Company	1/31/1929	Laramie River	Irrigation	3,421	3,421	ca 1935
7	P528R	Dutton Creek Reservoir	Wheatland Irrigation District	7/1/1904	Dutton Creek	Irrigation	2,566	1,211	1906
	P1215R	Dutton Creek Reservoir Enl.	Wheatland Irrigation District	2/17/1908	Dutton Creek	Irrigation, Stock			
	P2375R	Dutton Creek Reservoir 2nd Enl.	Wheatland Irrigation District	8/2/1912	Dutton Creek	Irrigation, Stock			
8	P3617R	King No. 1 Reservoir	Herbert King et al	2/7/1920	Seepage Creek	Irrigation	2,600	2,216	ca. 1920
9	P5641R	Sportsman Lake Reservoir	Monaghan Farms Inc	10/12/1948	Five Mile Creek	Irrigation, Stock	1,459	1,459	ca. 1950
10	P761R	Willow Creek Reservoir (as changed to Will Creek No. 2 Reservoir)	Monaghan Farms Inc	10/17/1905	Willow Creek	Irrigation, Stock	474	464	ca. 1948
	P5620R	Willow Creek Reservoir 1st Enl. (as changed to Willow Creek No. 2 Reservoir)	Monaghan Farms Inc	9/15/1947	Willow Creek	Irrigation, Stock, Domestic			
	P8026R	Willow Creek No. 2 Reservoir	Monaghan Farms Inc	8/2/1978	Willow Creek	Irrigation			
11	P6537R	Berg (Lake Owen) Reservoir	City of Cheyenne Board of Public Utlitities	5/8/1956	Douglas Creek	Industrial, Irrigation, Municipal	751	751	ca. 1963

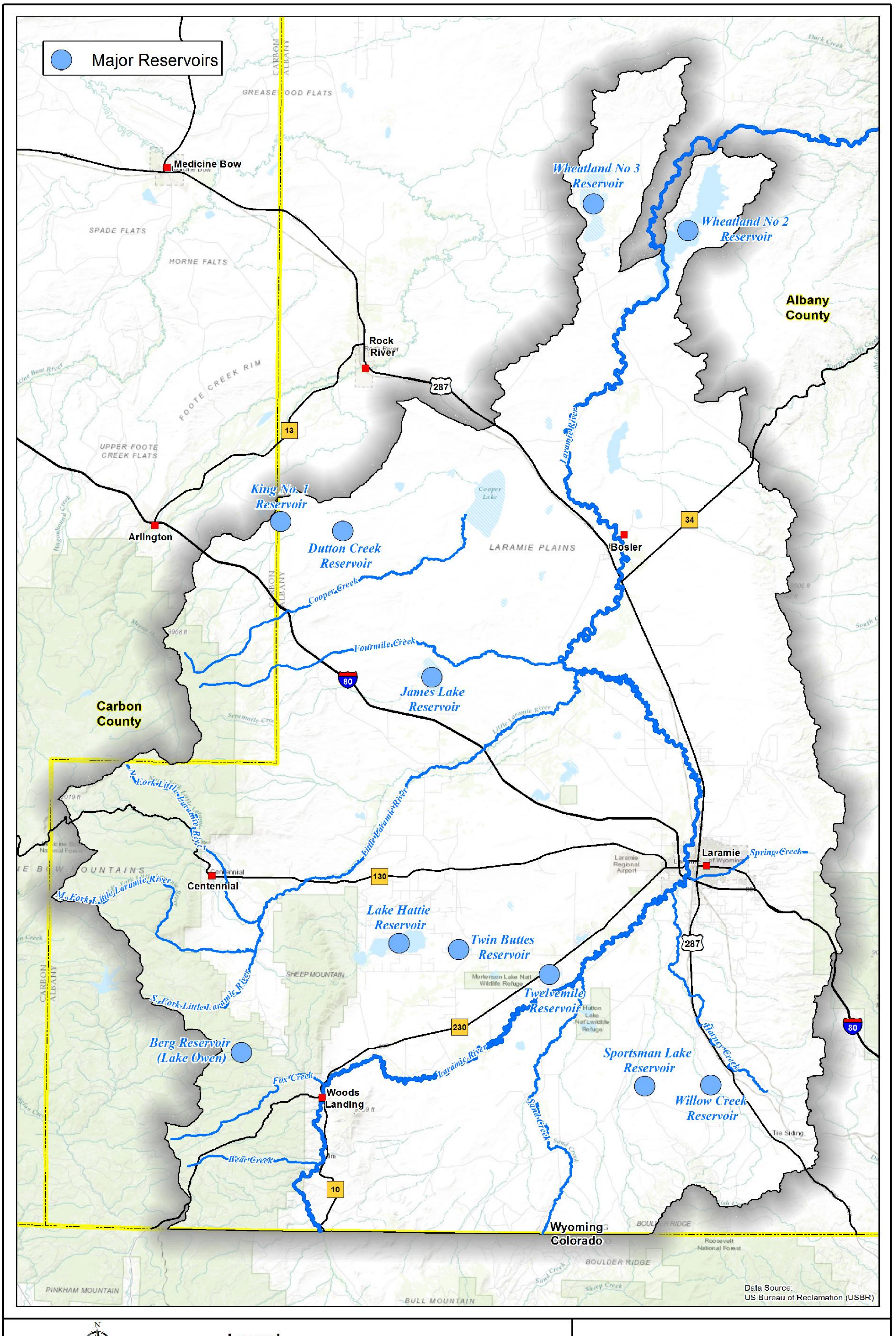


Figure 3.8-1 Upper Laramie River Watershed: Major Reservoirs

Wyoming Development Co. No. 2 Reservoir (Wheatland Irrigation District No. 2 Reservoir)

Wyoming Development Company No. 2 Reservoir is more commonly referred to as Wheatland Irrigation District No. 2 Reservoir. Construction of the reservoir was completed in 1901. This large irrigation reservoir has a permitted storage capacity of 98,934.00 acre-feet and a January 29, 1898 priority date. Permitted uses for the reservoir are irrigation and domestic use.

The dam has a 3H:1V upstream face slope and a 2H:1V downstream face slope. The upstream dam face is armored with 18 inches of riprap and gravel. About 1,200 linear feet of steel sheet piling has been installed along the upstream toe of the dam along the highest portion of the dam. The dam outlet works consists of a masonry drop inlet near the upstream toe of the dam and a masonry discharge tunnel through the dam.

Wheatland Irrigation District No. 3 Reservoir

Wheatland Irrigation District No. 3 Reservoir is located in Albany County, Wyoming. The reservoir was constructed in 1941 and is permitted for irrigation and stock uses. The reservoir is located in the basin adjoining the Laramie River, west of Wyoming Development Company No. 2 Reservoir (Wheatland Irrigation District No. 2 Reservoir). The reservoir has a permitted capacity of 71,318.80 acre-feet with a priority date of May 31, 1929.

Water is taken from the Wheatland Irrigation District No. 2 Reservoir via the Reservoir Canal and Intake-Outlet Canal to fill the Wheatland Irrigation District No. 3 Reservoir. The water flow from Wheatland Irrigation District No. 2 Reservoir to Wheatland Irrigation District No. 3 Reservoir has a maximum rate of 2,118 cubic feet per second, which reduces as the Wheatland Irrigation District No. 3 Reservoir inflow rate reaches 100 cubic feet per second.

Water can be released from the No. 3 Reservoir at a maximum discharge rate of 600 cubic feet per second via the Outlet Canal. After the water flows through the No. 2 Reservoir Outlet Canal, it discharges into the Laramie River and then into the Wheatland Irrigation District distribution system.

Lake Hattie Reservoir

Located in Albany County, Lake Hattie Reservoir is about 15 miles west of Laramie. The reservoir was originally built in 1912. Priority dates of the original storage and enlargement are May 11, 1908 and May 1, 1986.

The original purpose of the reservoir was to provide irrigation storage for water drawn from both the Big and Little Laramie Rivers. Water is released from Lake Hattie Reservoir into Hattie Canal No. 1 through large control gates and outlet pipes (WWC, 2003). Lake Hattie has a permitted capacity of 36,834 acre-feet. The reservoir is permitted for irrigation, municipal use, industrial use, fish propagation, flood control, power, and domestic use. Lake Hattie is supplied by the Lake Hattie Supply Canals Nos. 1 and 2, which have a carrying capacity of 1,500 and 700 cubic feet per second, respectively. Lake Hattie Supply Canal No. 1 water comes from the Laramie River, while Supply Canal No. 2 comes from the Little Laramie River. Lake Hattie is used for hold-over irrigation water storage, and the quantity of water held over in the reservoir varies from year to year. Significant sediment deposition has occurred in the southeastern corner of the lake, where reservoir outlet pipes and control gates are located. Due to this sediment buildup, the outlet control gates could not be opened promulgating investigations conducted on behalf of the WWDC (WWC, 2003). The gates were ultimately replaced and the outlet system rehabilitated using WWDC funding.

Inflow from the Laramie River into Lake Hattie varies from year to year. Senior water rights result in very little inflow into Lake Hattie during dry years. This reservoir also loses about three vertical feet per year of storage water to evaporation (WWC, 2003)

James Lake Reservoir

James Lake was built in 1910 and is permitted for irrigation use. The reservoir is located in the channel of Seven Mile Creek and also receives water from Mill Creek through the James Lake Supply Canal-Mill Creek Diversion. This reservoir also receives water from the Little Laramie River through the Bellamy Ditch at a rate not to exceed 95.0 cubic feet per second (cfs). It has a storage capacity of 8,990 acre-feet and a priority date of March 27, 1908.

Twin Buttes Reservoir

Twin Buttes Reservoir is permitted for both fish propagation and recreation uses. The reservoir was built in 1972 and has a priority date of February 3, 1972. A portion of the water stored in Twin Buttes Reservoir is a result of a change in point of storage of 300 acre-feet annually from Lake Hattie Reservoir. Located in the channel of Mortensen Draw, Twin Buttes Reservoir has a total permitted capacity of 3,912.3 acre-feet, of which 936.9 acre-feet is live storage and 2,975.4 acre-feet is dead storage. The maximum high-water surface elevation for the reservoir is 7,250 feet.

Twelve Mile Reservoir

Twelve Mile Reservoir is permitted for irrigation, domestic use, transportation, power, mechanic, manufacturing, mining, milling, quarrying, and for any and all beneficial uses. It was built circa 1935 and has a priority date of January 31, 1929. The reservoir is filled through the enlargement of the Pioneer Canal and the enlargement of the Lake Hattie Supply Canals No. 1 and No. 2. The permitted capacity of the reservoir is 3,420.5 acre-feet, and the reservoir surface area at the high-water line is 206 acres. The dam is an earth-fill structure with brush riprap to prevent erosion.

Dutton Creek Reservoir

Dutton Creek Reservoir is located near Rock River, Wyoming, in Albany County. The reservoir is used for irrigation and stock watering and also receives water from Rock Creek through the Enlargement of the Canon Ditch. Dutton Creek Reservoir has a permitted capacity of 2,566 acre-feet and a surface area at the reservoir high-water line of 290 acres. The reservoir was built in 1906 and has an original priority date of July 1, 1904 and enlargement priority dates of February 17, 1908 and August 2, 1912. The outlet is an 18-inch cast iron pipe, and a shut-off valve is located at the downstream end of the outlet pipe. The reservoir spillway is 200 feet wide.

The Dutton Creek Reservoir outlet facilities were replaced in 2016 due to their deteriorating condition.

King No. 1 Reservoir

King No. 1 Reservoir was built circa 1920 and has a priority date of February 7, 1920. It has a surface area of 230.2 acres at the reservoir high-water line and a permitted capacity of 2,216 acre-feet. This reservoir also receives water from Rock Creek through the Enlargement of the Canon Ditch and from One Mile Creek through the Enlargement of the Canon Ditch. The dam crest width is 20 feet. In 1977, plans for renovation of the dam outlet works were approved. A 30-inch corrugated metal pipe (CMP) outlet replaced an existing 24-inch outlet pipe. The reservoir is used for irrigation purposes.

In 2014, the reservoir outlet structure failed; it was replaced in 2016

Sportsman Lake Reservoir

Sportsman Lake is a natural reservoir with a permitted capacity of 1,459 acre-feet. The reservoir is supplied through the Sportsman Lake supply ditch, which has a carrying capacity of 86 cubic feet per second. Sportsman Lake discharges water through an open cut ditch equipped with an outlet gate. Construction of the facility was completed circa 1950 and the reservoir has a priority date of October 12, 1948.

Willow Creek Reservoir

Willow Creek Reservoir is located on the channel of Willow Creek. The facility was constructed circa 1948 and has an original priority date of October 17, 1905. It was subsequently enlarged and has an enlargement priority date of September 15, 1947. The permitted uses for the Willow Creek Reservoir are irrigation, stock use, and domestic use. The permitted capacity of the reservoir is 473.71 acre-feet, and the dam has a crest width of 12 feet. Total reservoir capacity at the emergency spillway invert elevation is 1,505.24 acre-feet.

Berg Reservoir (Lake Owen)

Berg Reservoir, also known as Lake Owen, has a permitted storage capacity of 750.68 acre-feet. The reservoir was built circa 1963 and has a priority date of May 8, 1956. This reservoir is included in this section due to the fact that it is an essential component of the City of Cheyenne municipal water supply system. Berg Reservoir is filled through the Douglas Creek Diversion Pipeline and is used for municipal, industrial, and irrigation purposes.

3.8.2 New Storage Opportunities

Development of new storage facilities within the watershed is possible, however, in light of institutional constraints associated with the Laramie River Decree and the Platte River Recovery and Implementation Program (PRRIP), permitting with the WSEO would be extremely difficult. According to the Wyoming State Engineer, new reservoir construction would be subject to the depletion analyses required by the PRRIP. The additional depletions associated with new storage facilities would likely be extremely challenging to offset and successful permitting unlikely (Section 4.2 of this report discusses the legal decrees governing water development within the study area).

A number of potential benefits of additional storage have been identified during the course of this study and are recommended for more detailed evaluation should a storage project(s) advance to the next level of study. The potential benefits of additional storage would vary as a function of the size and cost of the facility, but could include the following:

- Provision of a source of late season irrigation water,
- Enhancement/establishment of late-season stream flows to benefit aquatic and wildlife species, riparian habitat, and livestock,
- Provision of additional direct wildlife/livestock watering opportunities and potential to serve gravity-fed watering systems,
- Reduction of flooding impacts to the aquatic and riparian habitats downstream and potentially downstream municipalities,
- Improvement of stream bank/channel conditions,
- Establishment of a lake fishery,
- Provision of seasonal recreational opportunities (consistent with meeting other needs and achieving other benefits).

3.8.3 Surface Water Availability and Shortages

Development of additional surface water storage within the project study area would be limited based upon the constraints of the Platte River Recovery and Implementation Program (PRRIP) and the Laramie River Decree. Issues associated with development of storage facilities are discussed in Chapter 4: Watershed Management Plan.

Availability of surface waters for development within the basin is defined by both the institutional constraints discussed above AND the amount of water physically available following administration of basin water rights. Despite the limitations and hurdles posed by the institutional constraints, water MAY be available for development, and an entity could have the resources needed to successfully complete a storage project. During high flow periods, water may be physically available for development because the basin water rights are satisfied and excess water remains. Initial quantification of availability and shortages in a system are typically determined in conjunction with the WWDC's basin planning studies.

3.8.3.1 North Platte River Basin Spreadsheet Model

The Upper Laramie River study area lies within the geographic boundaries of the North Platte River Basin Framework Plan, currently being completed on behalf of the WWDC by Wenck Associates. In conjunction with that project, a basin planning spreadsheet model of the North Platte system is being developed in a manner similar that of other river basin planning studies completed on behalf of the WWDC. At the time this report was prepared, construction of the model was in progress but it was not yet completed and available for use. Consequently, estimation of water physically available and within the constraints of Wyoming water law could not be completed. Appendix 3J contains a discussion of the spreadsheet model development, use and limitations.

IV. WATERSHED MANAGEMENT PLAN

IV. WATERSHED MANAGEMENT PLAN

4.1 Overview

The objective of this Level I study is to generate a watershed management and rehabilitation plan that is technically sound, practical in nature, and economically feasible. In conjunction with the development of the study's GIS, the inventory focused on assessment of the watershed and the identification and evaluation of improvements to address those issues described in Chapter 3.0. Potential improvements were developed and categorized into the following:

- **Irrigation System Conservation and Rehabilitation:** The inventory and evaluation of existing infrastructure was completed and improvements were identified.
- **Livestock/Wildlife Upland Watering Opportunities:** Based upon an evaluation of existing water sources and the condition of upland grazing resources, potential upland water source development projects were identified.
- **Surface Water Storage Opportunities:** Results of previous investigations pertaining to development of water storage and opportunities identified during the project inventory phase of this investigation are incorporated.
- **Stream Channel Condition and Stability:** Stream channels within the watershed were characterized with respect to their condition and stability. Impaired channels were identified for further evaluation and alternative improvements developed.
- **Grazing Management Opportunities**: Based upon a review of the pertinent Ecological Site Descriptions (ESDs) and the ambient vegetation and soil conditions, grazing strategies are presented.
- **Other Watershed Management Opportunities:** For each of the categories described above, a series of recommended projects are prescribed in the following portions of this chapter.

These plans have been prepared to provide an overview of potential improvements that can partially or fully address the key issues identified within the watershed.

4.2 Management Implications of Legal Constraints

Any water development projects completed in conjunction with the Watershed Management Plan must be reviewed in light of the three legal constraints governing water use within the basin:

1. The Modified North Platte River Decree (2001),
2. The Laramie River Decree (1922), and
3. The Platte River Recovery and Implementation Program (PRRIP) (2001)

Appendix 4A presents background and discussions of each decree. The management implications of each are presented below.

4.2.1 The Modified North Platte River Decree (2001)

The area affected by the North Platte Decree does not include the Upper Laramie River watershed study area; the Laramie River is excluded from the decree (Discussion of the North Platte Decree is included in Appendix 4A because exclusion of the Laramie River is a critical component).

4.2.2 The Laramie River Decree (1922)

The Laramie River from the Colorado/Wyoming state line to the Wheatland Irrigation District Tunnel Diversion (which encompasses the entire project study area) is controlled under the Laramie River Decree and Wyoming water right priority system.

- Any new projects proposed in the Watershed Management Plan would fall under the priority system. New projects would be assigned a priority date at the time the permitting process is completed.

- The Upper Laramie River is fully appropriated. Consequently, any storage facilities that are constructed should incorporate low-level outlet pipes or by-pass structures which facilitate regulation. This would include stock reservoirs of any capacity.

4.2.3 The Platte River Recovery and Implementation Program (PRRIP) (2001)

The PRRIP was approved in 1997. It set base lines of consumptive use in Wyoming and provided for additional water from Wyoming, Colorado, and Nebraska for the benefit of the endangered species in central Nebraska. It established a process to evaluate all new proposed water right facilities to insure they do not increase consumptive use to further reduce the flow for the critical habitat area. The following items are provided as guidance to be used in project implementation:

- Any proposed new water facility is reviewed to determine the depletions from the proposed project. Prior to a permit being issued, the applicant must prove that implementation of a proposed project results in no net depletions. For example, evaporation from a new stock reservoir would be considered a depletion. If it was built in a location where no depletion was occurring prior to construction (e.g. an ephemeral channel with no vegetation), evaporative losses from the new water surface would result in an increase in depletions when compared to those existing before construction. The applicant would need to offset these losses in some way, such as removing that portion of irrigated lands with a consumptive use equivalent to the new evaporative losses in order to obtain a permit through the WSEO.

- If a new irrigation reservoir is proposed, again the evaporation would be considered a depletion. In addition, if the reservoir provides additional water for irrigation which increases the consumptive use of the crops, then both the evaporative losses and additional consumptive use would be depletions to be offset.

- Enlargement of existing reservoirs would likely increase depletions because the water surface would be increased. Consequently, increased evaporative losses would need to be mitigated. In addition, if consumptive use of crops irrigated from the enlarged reservoir increased, these depletions would need to be mitigated as well prior to a permit being issued to construct the facility.

- Proposed projects such as spring developments and irrigation infrastructure rehabilitation or replacement would likely not be subjected to the consumptive use evaluation. However, the WSEO may require evaluation in order to grant a permit.

- Stock reservoirs resulting in less than 5 acre-feet net depletions would likely be exempt. However, the WSEO may require evaluation in order to grant a permit.

There are additional exemptions to the PRRIP for projects such as those involving domestic use where the consumptive uses would be negligible. However, all new proposed facilities are reviewed and consumptive use determined during the permitting process. Only those facilities that can offset their depletions or result in negligible depletions will receive a permit and be constructed.

4.3 Benefits of Watershed Planning

The Wyoming Water Development Commission's (WWDC) Level I Watershed Study is a fundamental landscape analysis confined to a hydrologically connected drainage area or watershed and is focused on two primary components. The first is an identification of the physical attributes of that analysis area. This is accomplished by conducting a comprehensive inventory of the natural resources and subsequently using that inventory to articulate a description of the current natural resource conditions. The second is a long range plan outlining management and/or rehabilitation opportunities and activities that address ecological enhancement and watershed function.

Best Management Practices (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 mainly used for installing BMPs and conservation practices such as stock ponds, water wells, buried water delivery pipelines, stock tanks, spring developments, solar platforms and pumps, wetland enhancement and restoration, windmills, and irrigation diversion and conveyance improvements.

There can be one or more benefits resulting from the implementation of BMPs and conservation practices. Such benefits can be either quantitative or qualitative or both. Benefits can be local or global and specific or surrogate, depending on multiple factors 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 grazing pressure on riparian areas and create the potential to induce improvements to soil health, plant community diversity, and improved forage production. They allow for grazing deferment in the event that rest is required due to invasive species control efforts, which can also stimulate water release.

Benefits to ecosystem 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 including collection and storage of water along with ecological enhancements such as plant and animal habitat and stream corridor or riverine stability.

Appendix 4B contains more information and detail regarding the benefits of watershed planning,

4.4 Components of the Upper Laramie River Watershed Management Plan

In the remainder of this chapter, the conceptual plans developed within each watershed component are described and evaluated with respect to providing benefits to improving the existing water supply through conservation. For the purposes of tracking individual components of the watershed management plan, each component was designated two unique project or "improvement" identifiers:

- The Component Number denotes the type of project and the portion of the watershed management plan it falls within:
  - Project Components "IRR": Irrigation system rehabilitation components (Section 4.4.1)
  - Project Components "L/W": Livestock/wildlife upland watering opportunities (Section 4.4.2)
  - Project Components "STO": Surface water storage opportunities (Section 4.4.3)
  - Project Components "STR": Stream channel stability components (Section 4.4.4)
  - Project Components "G": Grazing management components (Section 4.4.5)
  - Project Components "O": Other watershed management opportunities (Section 4.4.6).
- The Proponent Number denotes the individual or entity that made the recommendation and may include projects in more than one of the categories listed above.

This method of assigning project identifiers allows us to track the project proponent as well as the type of project being discussed, and will assist the LRCD with the WWDC Small Water Project Program application process.

4.4.1 Irrigation System Components (IRR)

4.4.1.1 Overview: Irrigation

As presented in Chapter 3, the irrigation system inventory effort associated with this project consisted of the evaluation of structures and ditch conditions at the request of interested landowners and stakeholders. No ditch systems were inventoried in their entirety. Instead, and at the request of those individuals who came forward with requests to participate in the study, individual irrigation system components were inspected.

The recommendations included herein are not all-inclusive; there will be additional irrigation structures located throughout the watershed in need of rehabilitation or replacement. By virtue of their location within the geographic boundaries of this study, potential projects involving those structures may still be considered eligible for application funding through the WWDC Small Water Project Program (SWPP).

The improvements that comprise this component of the watershed management plan include:

- Rehabilitation/replacement of existing structures
- Mitigation of seepage losses
- Enhanced delivery of water
- Reduction in annual operation and maintenance costs
- Improvement in ditch management and efficiency through water measurement

In the sections which follow, the specific structures evaluated in the field in the company of landowners and ditch managers are discussed. The projects identified and their respective component identifiers in the watershed management plan are summarized in Table 4.4-1. Figure 4.4-1 displays the general location of all irrigation rehabilitation projects.

Table 4.4-1 Irrigation Rehabilitation Components of the Watershed Management Plan.

Watershed Management Plan Component	Proponent Number	Project Name	Recommendations
IRR-001	Sigel-001	Hecth Ditch Reconstruction	Reconstruct damaged ditch
IRR-002	Rogers-002	Bellamy Ditch Drop-Chute	Replace failing structure
IRR-003	LCD-001	Last Chance Ditch Point of Diversion	Move point of diversion to facilitate diversion and lessen ditch maintenance
IRR-004	Johnson-002	Simon Johnson Ditch Diversion Replacement	Replace failing structure
IRR-005	Johnson-003	Simon Johnson 2 Ditch Diversion Replacement	Replace failing structure
IRR-006	Oasis-001	Oasis Ditch Diversion Replacement	Replace failing structure
IRR-007	Oasis-002	Parshall Flume Evaluation / Replacement	Develop new rating curve and rehabilitate structure if necessary
IRR-008	Oasis-004	Oasis DItch Seepage Evaluation	Conduct seepage investigation and mitigate losses
IRR-009	Edwards-001	Lund Ditch Diversion Reconstruction	Construct stepped rock weir diversion structure
IRR-010	Croonberg-001	Hatton No. 2 DIversion Rehabilitation	Replace failing structure
IRR-011	Croonberg-002	Hatton No. 1 Ditch Diversion Rehabilitation	Replace failing structure
IRR-012	Croonberg-003	McGIll and Crooger Ditch Splitter Construction	Construct new structure
IRR-013	Croonberg-004	Hatton No. 3 and No. 4 Diversion on Dry Creek	Replace failing structure
IRR-014	Croonberg-005	Hatton Ditch Lateral Check Structure	Replace failing structure
IRR-015	USFS-001	Ditch Management / Beetle Kill	develop management plan

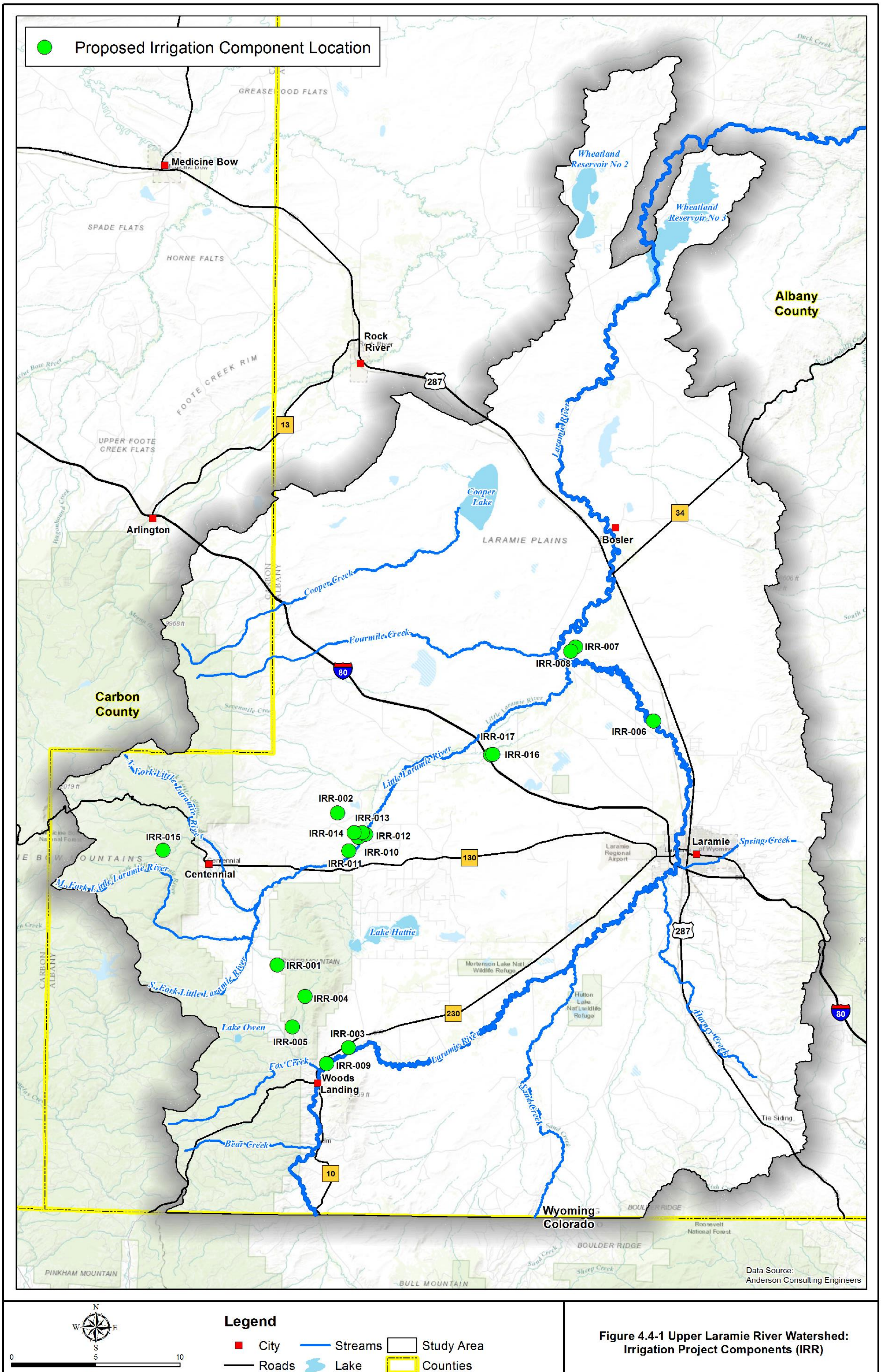


Figure 4.4-1 Upper Laramie River Watershed: Irrigation Project Components (IRR)

4.4.1.2 IRR-001 Hecht Ditch Reconstruction (Sigel-001)

This project would involve installation of a headgate and diversion on a small irrigation ditch which is currently lacking infrastructure. The existing ditch needs complete reconstruction because it has filled with sediment and washed out. The Lena Hecht Ditch (Permit No. T1210) has a priority date of 1892 and diverts from Barkley Creek in Section 5, Township 14 North, Range 77 West. Note that the WSEO Permit records show the name of the creek as Barkley Creek while the USGS topographic quadrangles indicate the name is Hecht Creek. Figure 4.4-2 displays the conceptual layout of the proposed project.

This proposed project would involve the following components:

- Construction of a new diversion structure on Hecht Creek
- Construction of a new headgate structure
- Reconstruction of approximately 2,000 to 3,000 linear feet of irrigation ditch. The ditch would be designed to convey approximately 3 to 4 cfs. The precise alignment would need to be determined during the design phases of the project.
- Associated infrastructure such as check structures and turnouts would need to be determined during the design phases of the project.
- Validation of water rights and permitting through the WSEO.

4.4.1.3 IRR-002 Bellamy Ditch Drop/Chute Replacement (Rogers-002)

The Bellamy Ditch diverts from the Little Laramie River under water rights dating to 1896. The ditch is not part of a form public entity and serves approximately six (6) users. The ditch also serves as a supply canal for James Lake which is one of the major reservoirs within the basin. Infrastructure on the ditch is aged and deteriorating. Of particular concern is a large chute/drop structure located in Section 24 of Township 16 North, Range 77 West. The structure consists of a trapezoidal concrete chute, approximately 12-feet wide at the bottom and 6-feet deep. The structure is approximately 460-feet long and has a vertical drop of approximately 60-feet. Based upon an initial review of water rights associated with the ditch, the ditch conveys approximately 90 cubic feet per second.

As indicated Figures 4.4-3, 4.4-4, and 4.4-5 show that the structure is in poor condition, is failing, and replacement is recommended.

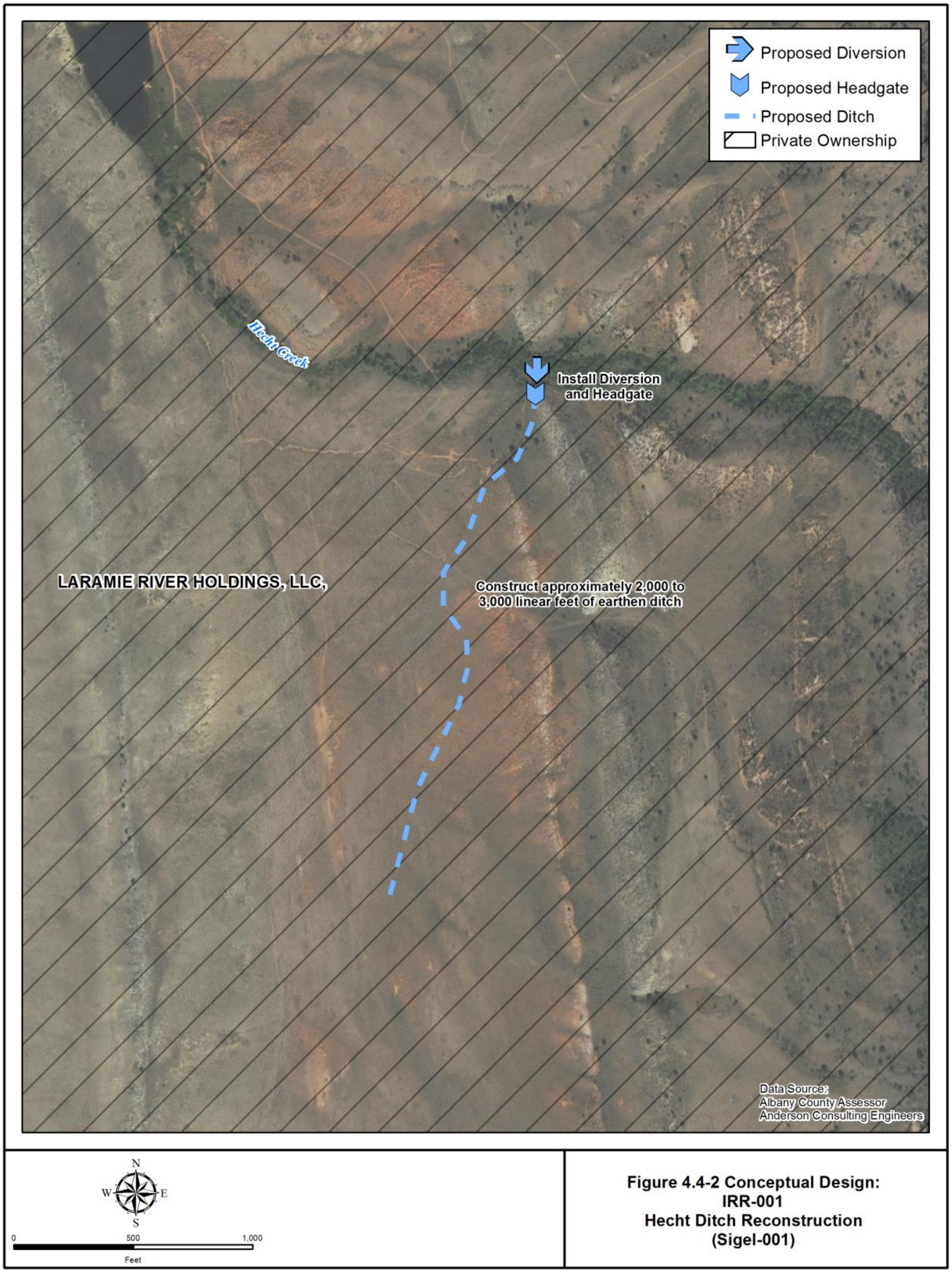


Figure 4.4-2 Conceptual Design: IRR-001 Hecht Ditch Reconstruction (Sigel-001)

Remediation at the site would likely be highly problematic if 'in channel' methods are employed. Given the steep gradient, construction of grade control structures or check dams appears impractical. The solutions which would most likely be successful would be construction of a pipe-drop structure parallel to the channel but offset on undisturbed lands. A similar structure was recently constructed on the Wiant Ditch near Saratoga, Wyoming using WWDC funding. Figure 4.4-6 displays the conceptual drawings associated with that structure. Figure 4.4-7 displays the conceptual design to replace the Bellamy Ditch structure.

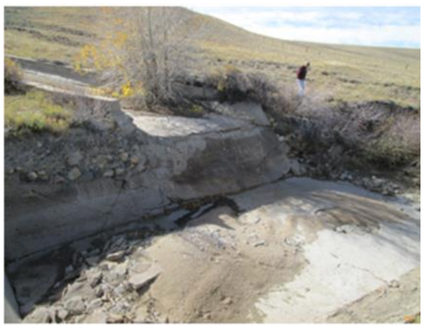


Figure 4.4-3. Bellamy Ditch Drop Chute Outlet.

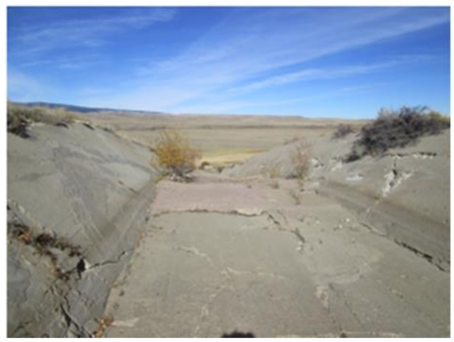


Figure 4.4-4. Bellamy Ditch Drop Chute Inlet.

Figure 4.4-5. Bellamy Ditch Drop Chute Structure Looking Upstream from Outlet.

4.4.1.4 IRR-003 Last Chance Ditch Change of Point of Diversion (LCD-001)

The Last Chance Ditch and the Parker Ditch share a common point of diversion on the Laramie River (Section 36 of Township 14 North, Range 77 West). The Last Chance Ditch diverts under Permit No. P1218 with a priority date of 1896. The Parker Ditch diverts under several water rights and enlargements dating from 1892.

According to ditch representatives, the diversion facility on the river is difficult to maintain and requires frequent maintenance. The Laramie River has migrated away from the structure, bypassed it and rendered it ineffective. A "Push-up" must be built frequently in order to divert during low-flow periods. Figure 4.4-8 shows an aerial photograph of the site.

Reconstruction of a new diversion structure on the Laramie River and protecting it from further channel migration by stabilizing the stream channel was determined to be too costly. An alternative solution could be to change the point of diversion to take advantage of the proximity of the Pioneer Canal and its alignment which roughly parallels that of the Last Chance and Parker Ditches. By changing the point of diversion of the ditches to the Pioneer Canal diversion, flows from either (or both) ditch could be conveyed

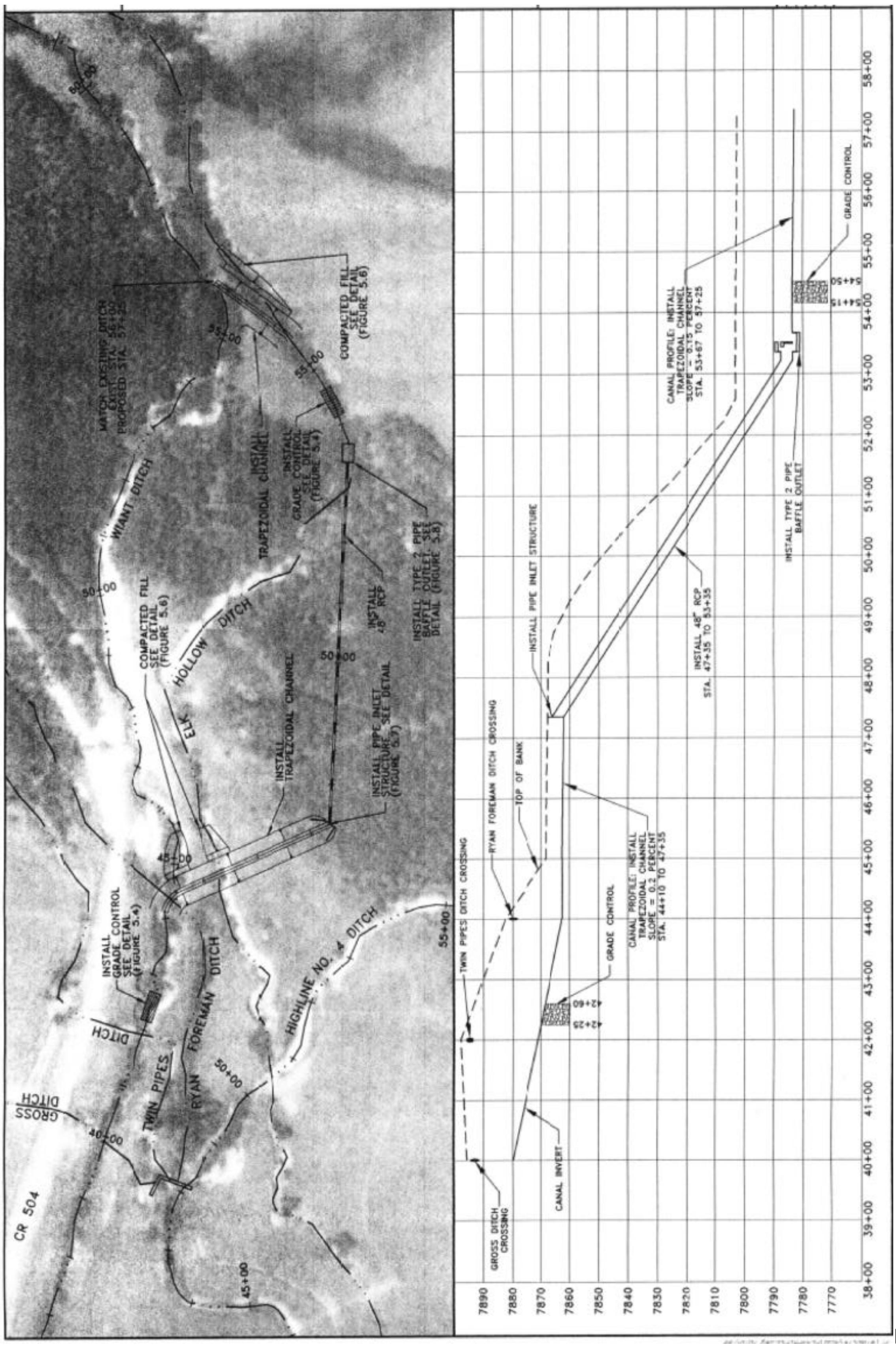


Figure 4.4-6 Wiant Ditch Design.

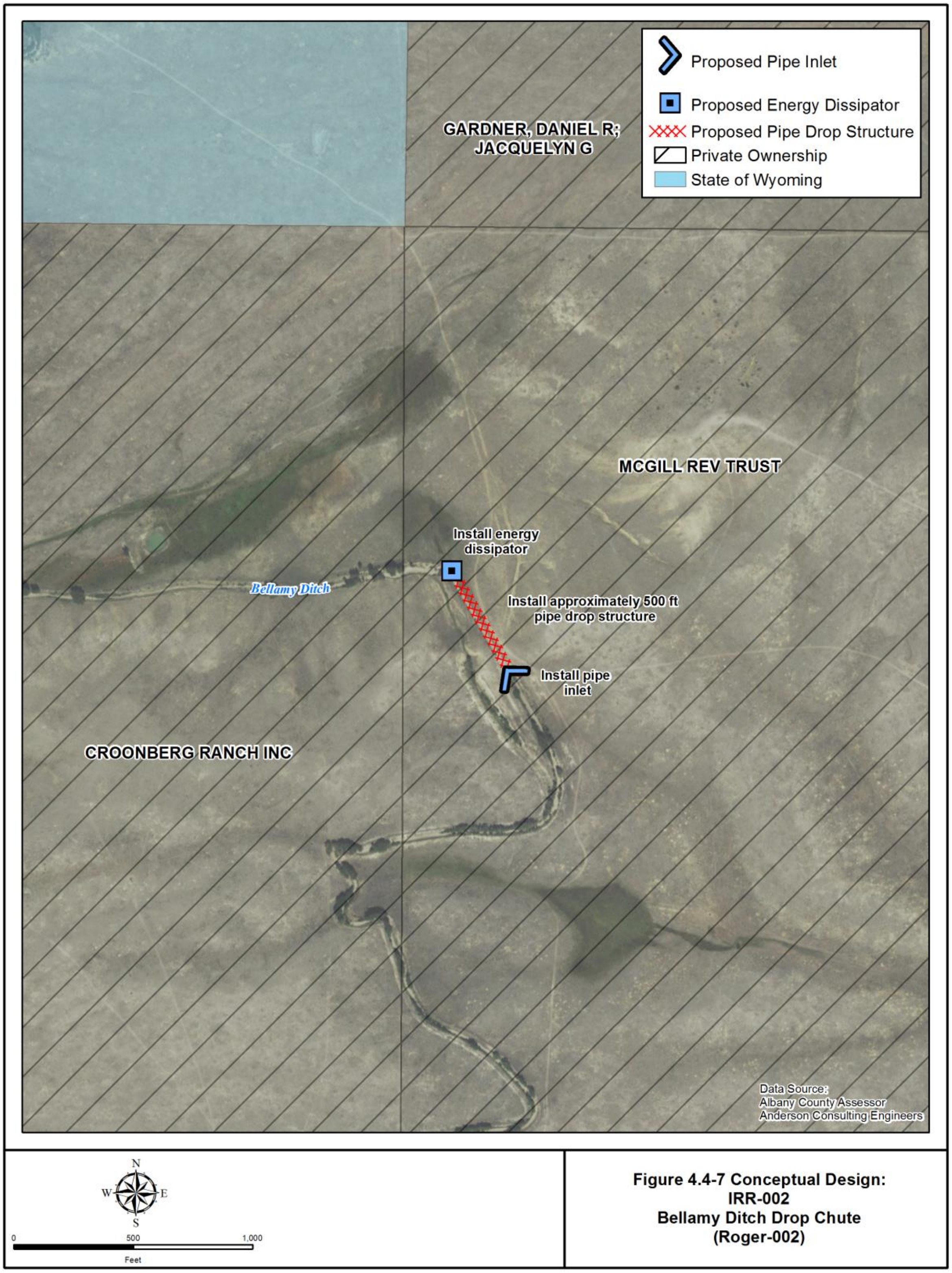


Figure 4.4-7 Conceptual Design:
IRR-002
Bellamy Ditch Drop Chute
(Roger-002)

Figure 4.4-8 Combined Last Chance Ditch and Parker Ditch Diversion Facility.

by the Pioneer Canal for approximately 4 miles. At this location, a headgate could be installed on the Pioneer Canal to facilitate the return of water to their respective ditches.

In addition to mitigating issues associated with the Laramie River diversion structure and a potentially costly new diversion dam, moving the point of diversion to this location would eliminate approximately 10,800 feet of earthen ditch and reduce seepage and evaporative losses associated with it. Figure 4.4-9 presents the conceptual design of this alternative. Figure 4.4-10 displays an aerial photograph of the proposed headgate location for the Last Chance Ditch on the Pioneer Canal.

Under this alternative, either, or both ditch companies would need to petition for a change in point of diversion through the WSEO. In addition, an agreement between the ditch companies and the Pioneer Canal Irrigation District would be required.

This project would involve only privately owned lands.

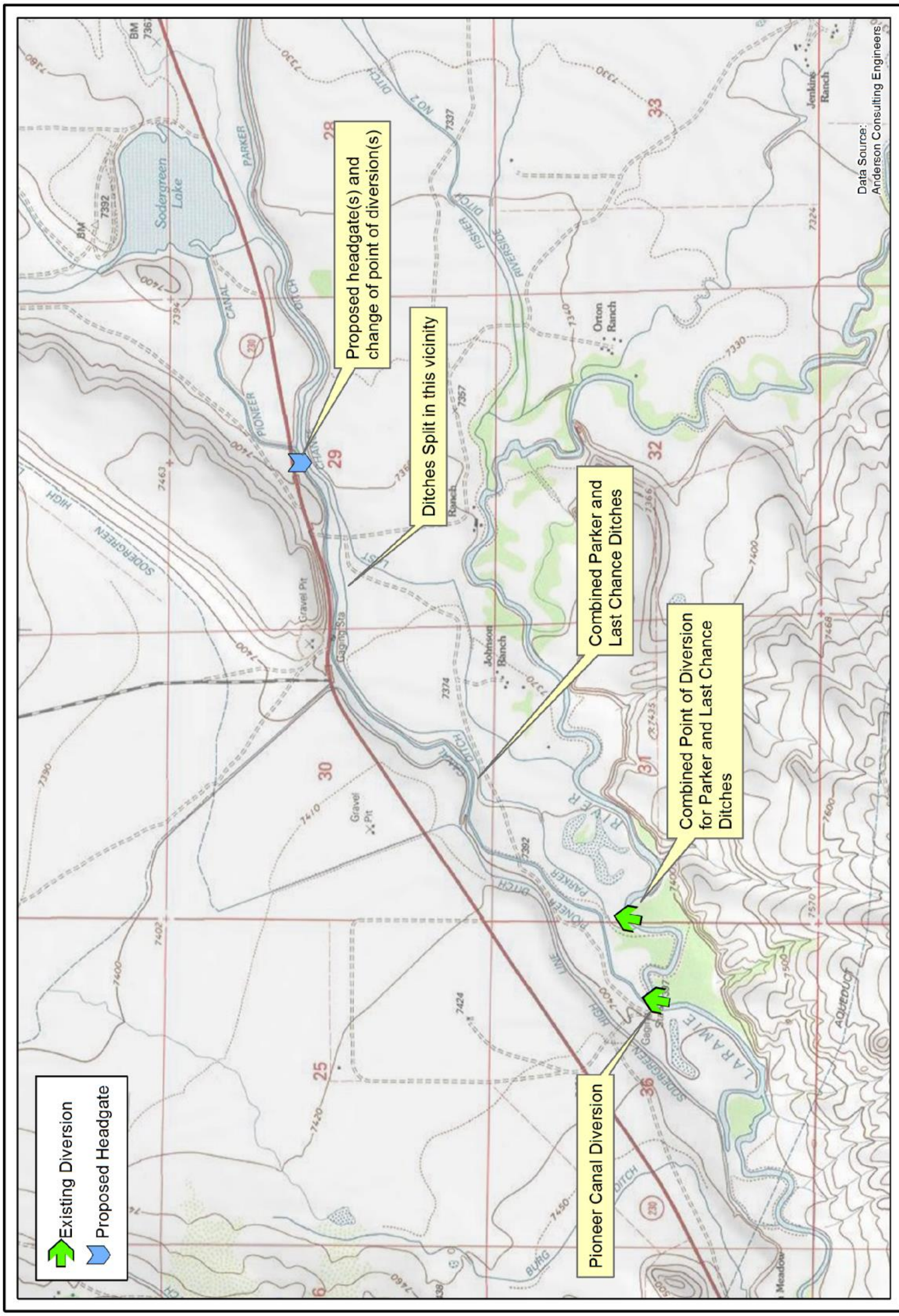


Figure 4.4-9 Conceptual Design:
IRR-003
Last Chance Ditch Point of Diversion
(LCD-001)

Figure 4.4-10 Proposed Headgate Relocation for Parker and/or Last Chance Ditch.

4.4.1.5 IRR-004 Simon Johnson Ditch Diversion Replacement (Johnson-002)

This project would involve reconstruction of an existing irrigation headgate located in Section 15, Township 14 North, Range 77 West on USFS lands within the Medicine Bow National Forest (Figure 4.4-11). The existing diversion is old and inadequate to facilitate diversion from the swampy area (Figure 4.4-12).

Figure 4.4-12 Simon Johnson Ditch Diversion Structure.

The project would include the following components:

- A timber-type structure would be constructed across a portion of the bog area to divert water to its northern edge
- A small diversion headgate, 18-inch diameter (Waterman type) would be installed to control diversions.

Figure 4.4-11 Conceptual Design:
IRR-004
Simon Johnson Ditch Diversion Replacement
(Johnson-002)

4.4.1.6 IRR-005 Simon Johnson 2 Ditch Diversion Replacement (Johnson-003)

The Simon Johnson 2 Ditch diverts water from the Dale Creek in Section 28 of Township 14 North, Range 77 West in Albany County (Figure 4.4-13). Based upon a field evaluation, the Simon Johnson 2 Ditch diversion is only marginally functional and is in need of replacement to ensure that water is diverted. The existing diversion is shown in Figure 4.4-14. The proposed project could involve the following components:

- Replacement of the Simon Johnson 2 Ditch diversion and headgate on the Dale Creek.
- 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 4.4-14 Simon Johnson 2 Ditch Diversion Structure.

Figure 4.4-15 displays a small irrigation diversion and headgate structure located within the Upper North Platte River watershed. This facility represents a low-cost yet highly effective and efficient design alternative that appears appropriate for this location.

Figure 4.4-15 Example of a Cost-Effective Irrigation Diversion Structure.

**Figure 4.4-13 Conceptual Design:
IRR-005
Simon Johnson 2 Ditch Diversion Replacement
(Johnson-003)**

4.4.1.7 IRR-006 Oasis Ditch Diversion Replacement (Oasis-001)

The Oasis Ditch provides irrigation water for the Laramie Valley Municipal Irrigation District. The district consists of approximately 8,636 irrigated acres and 15 individual users (WWDC, 2015). Figure 4.4-16 displays a photo of the existing diversion structure. The ditch diverts under water rights and enlargements dating from 1877.

Figure 4.4-16 Oasis Ditch Diversion Structure on the Laramie River.

According to ditch representatives, the existing diversion structure requires frequent maintenance, induces sediment deposition, and trash accumulation. In addition, the structure poses an impassible barrier to fish.

Replacement of the structure is recommended in order to reduce ditch management requirements with a structure designed to pass sediment and debris. Fish passage could also be facilitated in the design and construction of a new facility. Figure 4.4-17 displays an aerial view of the proposed project location.

Figure 4.4-17.   Oasis Ditch Diversion and Headgate Overview.

The ditch diversion and headgate are located on the Laramie River in Section 19 of Township 17 North, Range 73 West (Figure 4.4-18 and 4.4-19).

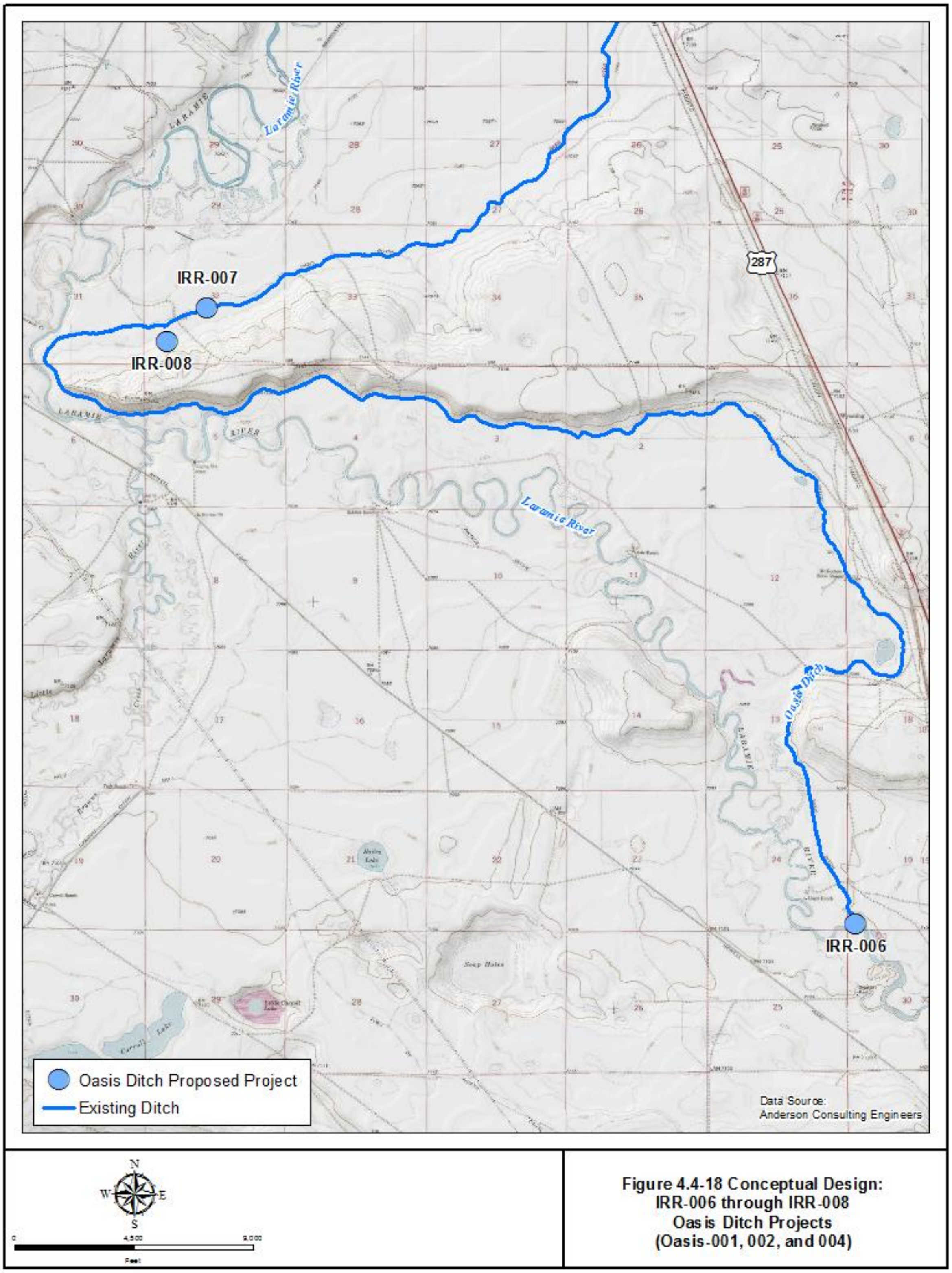


Figure 4.4-18 Conceptual Design: IRR-006 through IRR-008 Oasis Ditch Projects (Oasis-001, 002, and 004)

Figure 4.4-19 Conceptual Design:
IRR-006
Oasis Ditch Diversion Replacement
(Oasis-001)

4.4.1.8 IRR-007 Oasis Ditch Parshall Flume Evaluation / Replacement (Oasis-002)

A 6-ft wide pre-fabricated Parshall flume on the Oasis Ditch is used to measure ditch flows at the approximate middle of the ditch's length (Figure 4.4-18). According to ditch representatives, the accuracy of the flume is questionable. In order for the district to use the flume with confidence and facilitate accurate ditch measurement, recalibration of the flume is recommended. Figure 4.4-20 displays the condition of the flume.

Figure 4.4-20. Existing Parshall Flume on the Oasis Ditch.

This project would entail gaging the ditch discharge at various water levels and simultaneously monitoring water depth at the flume. A depth/discharge rating curve based upon these observations could be prepared and compared to the existing data. Based upon the results of the comparison, the District could decide to either use their existing rating table, develop a new one, or replace the structure.

4.4.1.9 IRR-008 Oasis Ditch Seepage Evaluation (Oasis-004)

Ditch representatives indicated the ditch suffers from excessive seepage at several locations; specific locations and their extents were not indicated. Review of aerial photography shows several areas where seepage may be occurring. Seepage studies are recommended in order to determine the extent and magnitude of the losses.

A seepage study would consist of the following:

- Ditch management would cooperate by maintaining the ditch flow at as constant a level as possible.
- If possible, all farm turnouts would be closed during the study.
- Beginning at the upstream end of the ditch and working in a downstream direction, flows would be measured at various locations.
- Differences in flow measurements would be computed and ditch losses (and gains) estimated.

Based upon the results of the seepage study, mitigation measures, such as ditch lining, would be determined.

4.4.1.10 IRR-009 South Lund Ditch Diversion Construction (Edwards-001)

The South Lund Ditch diverts water from the Laramie River in Section 2 of Township 13 North, Range 77 West (Figure 4.4-21) (Permit L1044 with a priority date of October 31, 1888). There is currently no diversion structure in the river to facilitate diversion of flows; therefore a push-up dam is required. The ditch headgate is in fair condition but is situated relatively high in elevation in relation to the channel bed. Consequently, the ditch is capable of being used only during high discharge events.

The landowner is currently coordinating with the NRCS on the design and implementation of a diversion structure in the river. It is our understanding that the preliminary designs have been completed by the NRCS. Copies of the design drawings were requested for review and inclusion in this report but were not made available by the time it was published. According to the NRCS, the structure would consist of a series of stepped rock vanes capable of providing the water surface elevations needed to facilitate diversion yet not impede fish passage.

The ditch headgate straddles private and BLM lands. The proposed diversion facility would be placed entirely on privately owned land.

4.4.1.11 IRR-010 Hatton No. 2 Diversion Rehabilitation (Croonberg-001)

The Hatton No. 2 Ditch diverts water from the Hatton Ditch in Section 30 of Township 16 North, Range 76 west. Hatton No. 2 Ditch headgate is in fair condition and fully operable according to the landowner (Figure 4.4-22). Diversion of water into the Hatton No. 2 is problematic during low flow conditions; there is no diversion structure on the Hatton Ditch to enable the user to back water up to a suitable elevation to provide the hydraulic head to divert it into the Hatton No. 2 Ditch. Construction of a diversion structure is recommended. Figure 4.4-23 displays the general location of the project.

This project would involve only privately owned lands.

Figure 4.4-22 Hatton No. 2 Ditch Headgate. There is currently no diversion structure on the Hatton Ditch (Hatton Ditch is visible through vegetation on right side of photo).

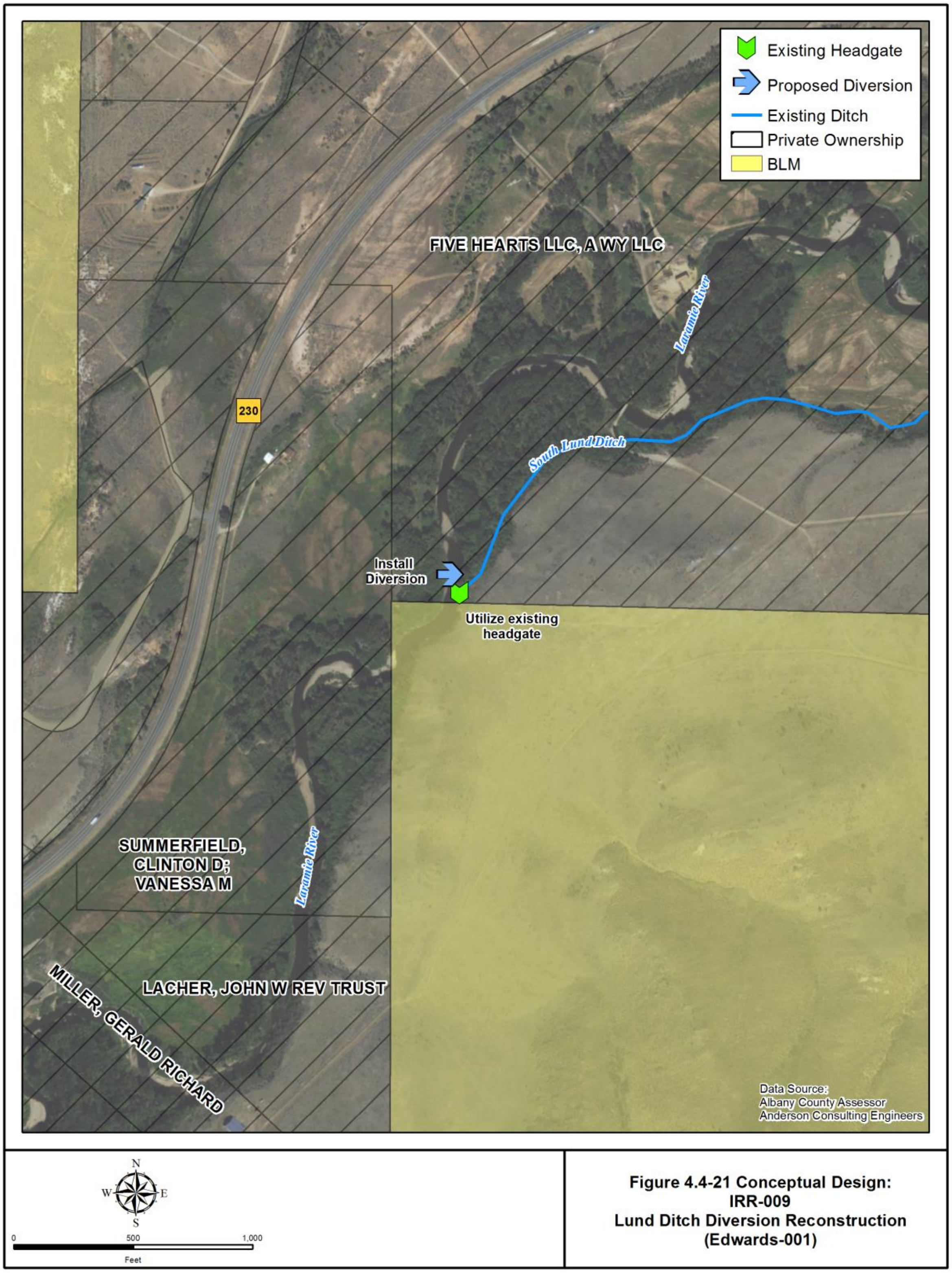


Figure 4.4-21 Conceptual Design:
IRR-009
Lund Ditch Diversion Reconstruction
(Edwards-001)

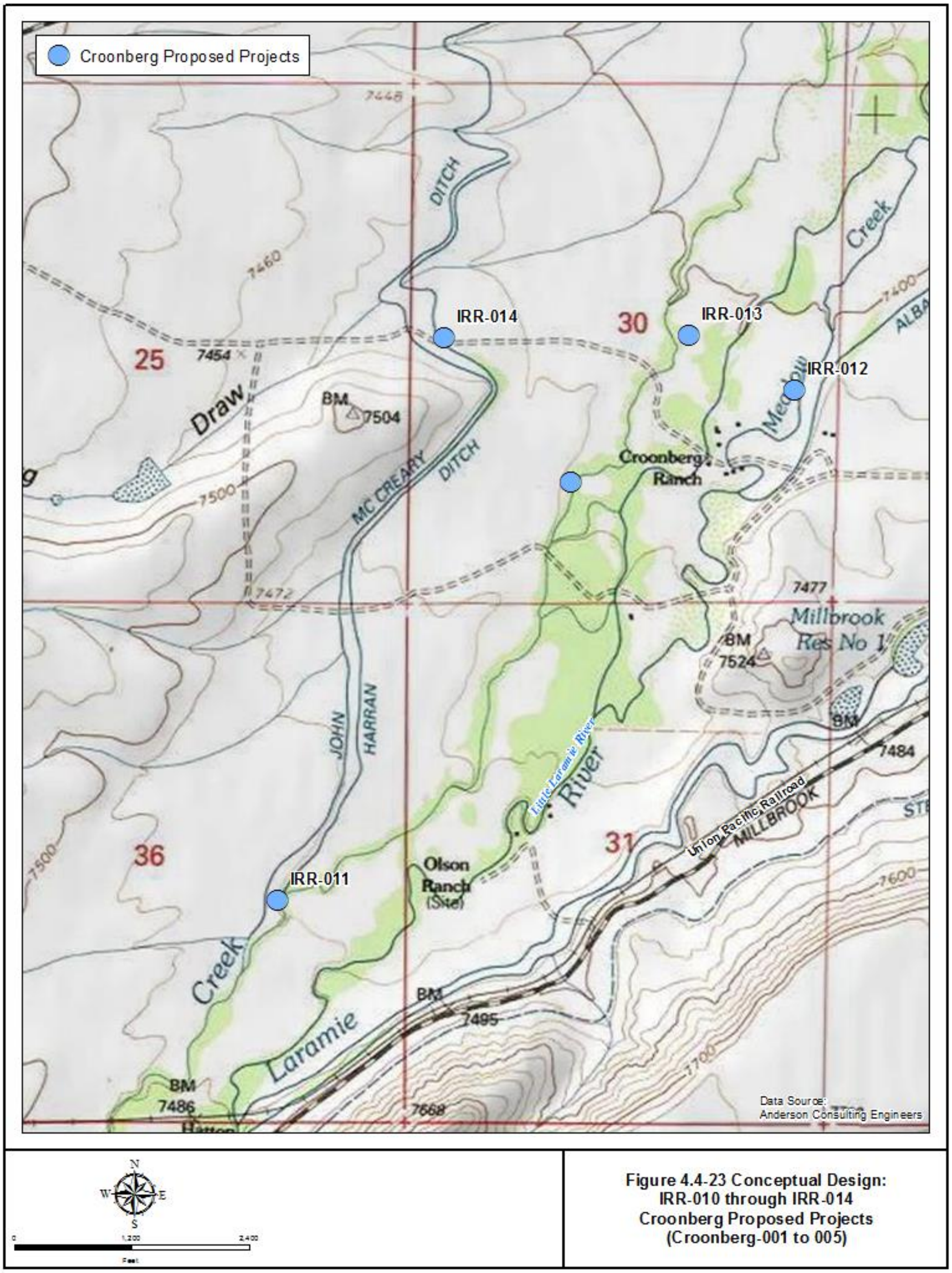


Figure 4.4-23 Conceptual Design: IRR-010 through IRR-014 Croonberg Proposed Projects (Croonberg-001 to 005)

4.4.1.12 IRR-011 Hatton No. 1 Ditch Diversion Rehabilitation (Croonberg-002)

The Hatton No. 1 Ditch diverts water from Dry Creek (a distributary of the Little Laramie River) in Section 36 of Township 16 North, Range 77 West (Figure 4.4-23). Hatton No. 1 Ditch headgate is in fair condition and fully operable according to the landowner (Figure 4.4-24). Diversion of water into the Hatton No. 1 is problematic during low flow conditions; there is no diversion structure on Dry Creek to enable the user to back water up to a suitable elevation to provide the hydraulic head to divert it into the Hatton No. 1 Ditch. Construction of a diversion structure is recommended. In addition, removal of the wooden structure at the ditch mouth is recommended because it appears to impede flows into the Hatton No. 1 Ditch.

Figure 4.4-24. Hatton No. 1 Ditch Headgate.

This project would involve only privately owned lands.

4.4.1.13 IRR-012 McGill and Croonberg Ditch Splitter Construction (Croonberg-003)

The McGill and Croonberg ditches bifurcate in Section 30 of Township 16 North, Range 76 West (Figure 4.4-23). There is currently no means of controlling the division of water between the two ditches; there are also no measurement devices at this location (Figure 4.4-25).

Figure 4.4-25. Location of Recommended Splitter Structure on the Hatton No. 1 Ditch.

A flow-dividing structure similar to the structure displayed in Figure 4.4-26 is recommended at this location. Construction of the division structure would enable the users to equitably share their water and administer water rights. In addition, measurement devices are recommended for installation on both ditches downstream of the new division structure.

This project would involve only privately owned lands.

Figure 4.4-26. Example Pre-Cast Concrete Splitter Structure.

4.4.1.14 IRR-013 Hatton No. 3 and No. 4 Diversion on Dry Creek (Croonberg-004)

The Hatton No. 2 and No. 4 Ditch diversion on Dry Creek is in poor condition and replacement is recommended. The existing structure is located in Section 30 of Township 16 North, Range 76 West (Figure 4.4-23). A flow-dividing structure similar to the structure displayed in Figure 4.4-26 is recommended at this location. Construction of the division structure would enable the landowner to better manage irrigation waters.

This project would involve only privately owned lands.

4.4.1.15 IRR-014 Hatton Ditch Lateral Check Structure (Croonberg-005)

At this location on the Hatton Ditch Lateral (Figure 4.4-23), a small check structure is recommended to facilitate control of ditch water and facilitate diversion to the field. In addition, a small farm turnout headgate is needed to control flows.

This project would involve only privately owned lands.

4.4.1.16 IRR-015 Ditch Management and Beetle Kill on Forest Lands

As discussed previously in Chapter 3, forest lands within the project study area have suffered the effects of pine bark beetle infestation and the associated timber mortality. Subsequent timber fall has direct impacts to irrigation ditches originating on Forest lands. An internal USFS memo (Purchase, Carol, et al, 2008) describes the process:

> "Pine *beetle mortality is expected to increase the potential for adverse effects to ditch stability and function. Needle loss from dead trees increases overall debris in ditches. Once the trees start to fall over, the potential for debris dam development increases substantially which can inhibit flows, cause ditch failures through saturation of ditch banks, and overtopping of ditches due to*

loss of flow capacity. Ditch failures and breaches can significantly affect the soil, water, and aquatic resources through surface erosion and gully development, mass failures, delivery of large quantities of sediment to the stream system, and augmented stream flows to the receiving stream that exceeds the natural stream flow level."

Figure 4.4-27 displays a ditch where timber deadfall has begun to choke the ditch creating a potential for debris dam development. Figure 4.4-28 shows the general location of irrigation ditches within the area of beetle infestation.

The memo included the following recommendations which have been incorporated into the watershed management plan:

Figure 4.4-27 Typical Ditch Originating on Forest Lands Displaying Significant Deadfall.

"This analysis identified four recommendations for addressing the effects of the beetle epidemic on ditches:

1. *Ditch Maintenance: Minimizing the risk of increased impacts to soil, water, and aquatic resources, will require additional ditch maintenance. It is the responsibility of the ditch operator to maintain their ditch in order to prevent resource damage. It is recommended that letters be sent to each ditch owner/operator of ditches within existing or projected beetle kill areas describing the projected beetle mortality, and potential effects to ditch function and increased probability for failures. This letter should strongly recommend that ditch owners plan to maintain their ditches every fall prior to snowfall in order to accommodate spring runoff, again in the spring prior to turning water into their ditches, and after each major windstorm to clear out the accelerated debris input that is expected to occur as a result of the beetle epidemic. Routine maintenance will both reduce resource impacts by preventing breaches and failures while also saving the ditch operator the cost of repairing damaged ditches. This letter should also remind ditch permitees that they are responsible for not only ditch maintenance which will likely be higher over the next decade, but also the cost of resource damages and resource rehabilitation costs associated with their ditches.*

2. *Land Use Authorization Administration: The Forest should expect increased time and costs associated with administering land use authorizations associated with ditches due to the beetle*

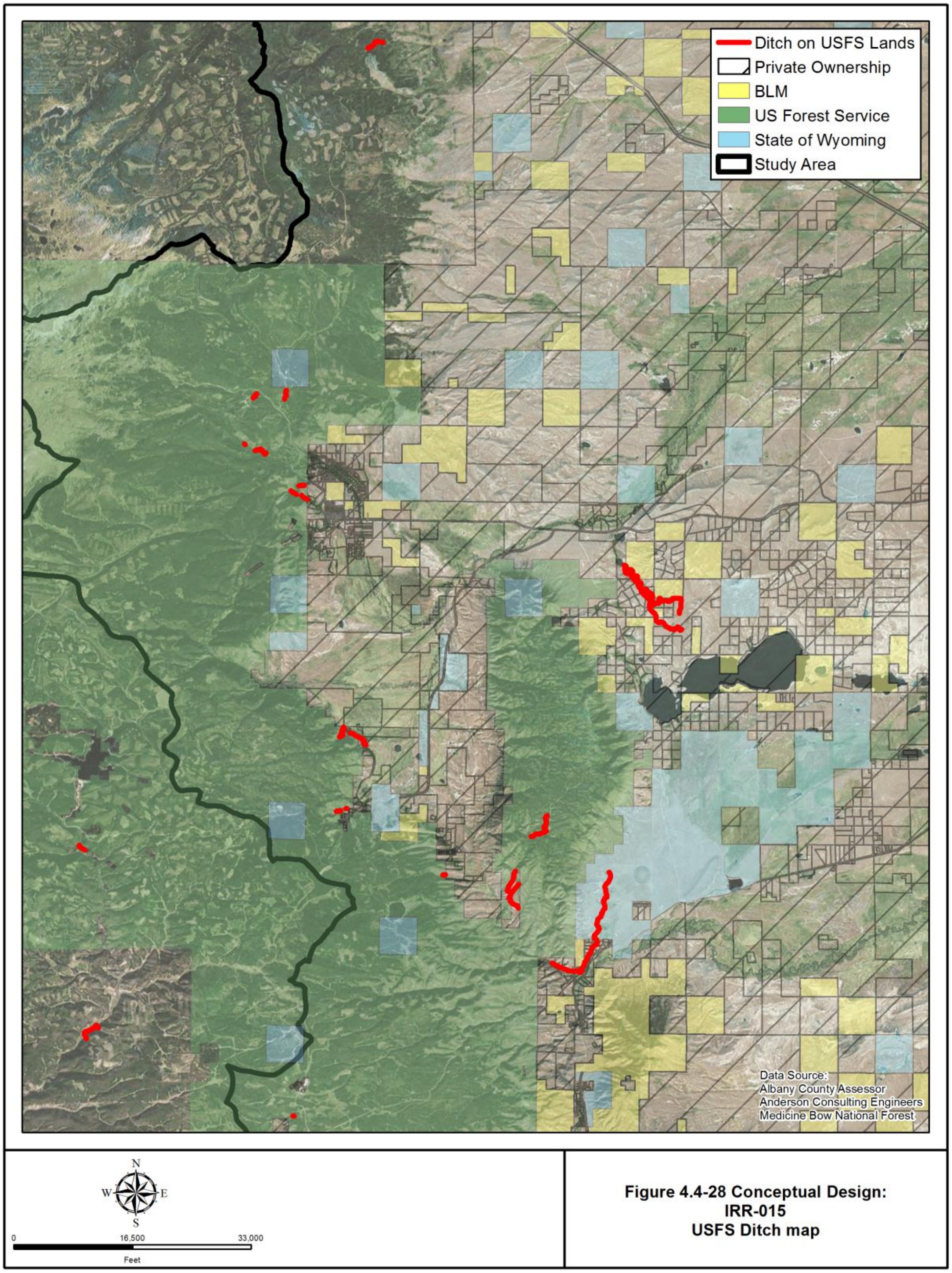


Figure 4.4-28 Conceptual Design: IRR-015 USFS Ditch map

epidemic. This should be recognized and incorporated into the program of work for personnel who administer ditch authorizations.

3. *Timber clearing opportunities: If there are opportunities to remove dead trees adjacent to ditches in areas where other work is already occurring such as salvage logging or roadside clearing, this would help to minimize the potential for dead trees to create debris dams and subsequent ditch failures. These actions are being incorporated into timber sale contracts for beetle salvage sales in the south zone, with specific design criteria to protect ditch integrity and function while removing hazardous dead trees.*

4. *Forestwide assessment: Water facility operators and the Forest may want to consider conducting a Forestwide environmental analysis to analyze the effects of clearing trees adjacent to ditches, similar to other road and powerline assessments conducted on the Forest. Such a planning effort may facilitate early removal of trees likely to fall into ditches and prevent resource problems before they occur."*

4.4.1.17 IRR-016 and IRR-0117 Alsop and Alsop No. 2 Ditch Headgates Replacement (Kaisler-001 and Kaisler-002)

Two small headgate structures associated with the Alsop Ditch and the Alsop No. 2 Ditch are in poor condition and in need of replacement. The structures are located in Section 34 of Township 17 North, Range 75 West. The ditches divert from Browns Creek and Alsop Slough. Replacement of both headgates is recommended.

4.4.2 Livestock/Wildlife Water Components (L/W)

4.4.2.1 Overview

Based upon the premise that existing water sources are capable of providing water to livestock within a one mile radius, buffers were drawn around existing water sources discussed in Chapter 3 (Figure 4.4-29). Note that this figure does not show buffers about perennial/intermittent streams, nor springs. A general objective of this effort was to provide means of providing reliable sources of livestock/wildlife drinking water as alternative water supplies to riparian corridors. As indicated in this figure, much of the study area appears to be adequately supplied with water sources. However, it is important to note that many of these sources are stock reservoirs located on intermittent/ephemeral channels and are consequently reliant upon uncertain runoff. Long-term or season-long utility is not always certain. Based upon this analysis, much of the study area may benefit by the development of upland water sources. In addition, land owners indicated locations where existing sources could benefit from enhanced or improved infrastructure. It must be noted that any water project involving a change in water use or location of water use would require a petition to the Board of Control. Proposals for new appropriations require an application for a permit from the Wyoming State Engineer prior to construction.

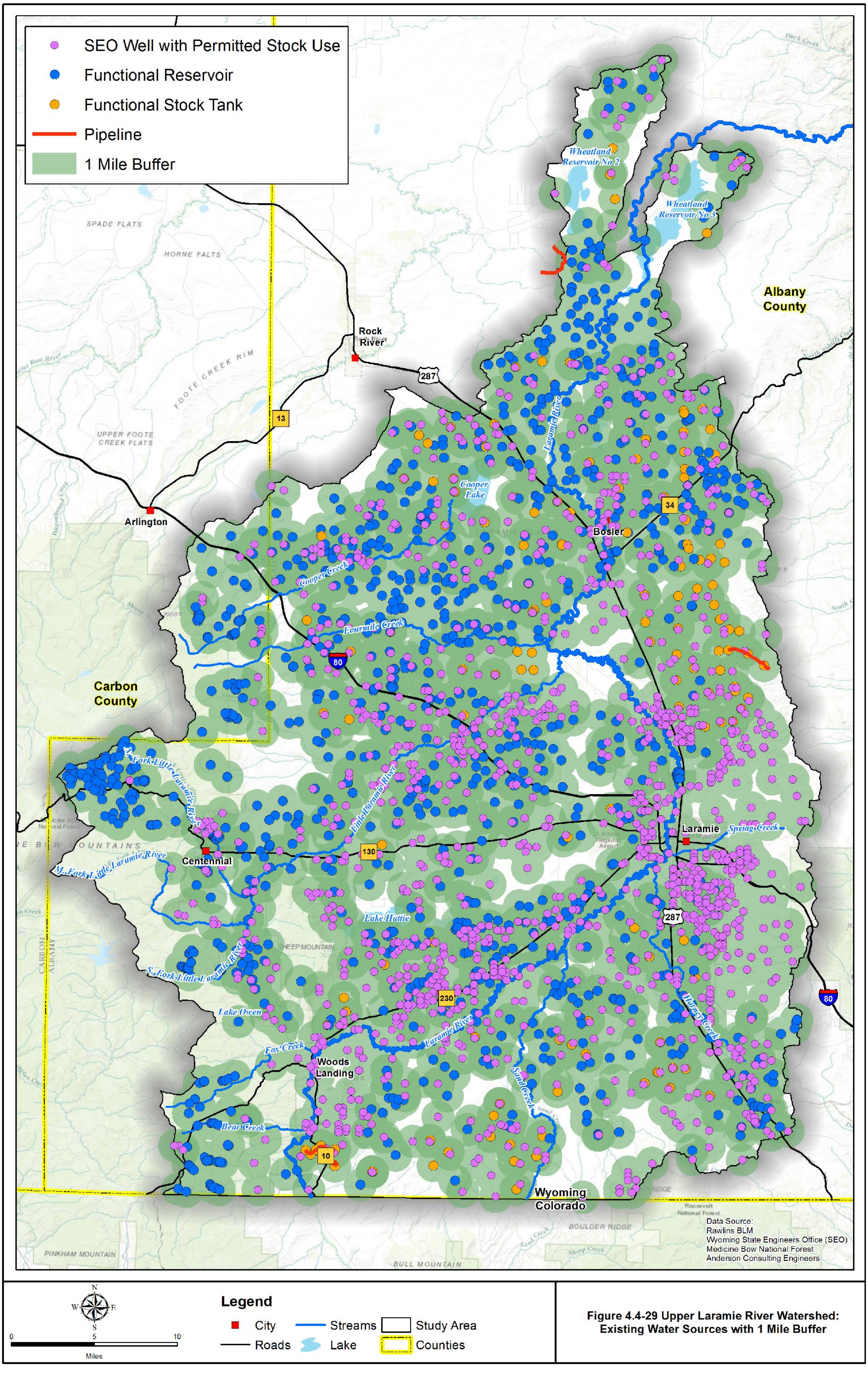


Figure 4.4-29 Upper Laramie River Watershed: Existing Water Sources with 1 Mile Buffer

As presented in Chapter 3, there are numerous springs scattered throughout the study area. Many of these could conceivably be developed as upland water sources for wildlife and livestock. Prior to the design of any project, site-specific evaluation of the water source would be required to ensure adequate water yield and to develop environmental safeguards. Final design of any upland water projects would consequently require consideration of the yield of the water source and the number of animals the project is anticipated to serve.

For the purposes of this project, watering facilities were assumed to consist of rubber tire stock tanks providing approximately 1,200 gallons of storage. This volume would facilitate the water needs of approximately 80 cattle per day assuming a water requirement of 15 gallons per day. A water source capable of providing 1 gallon per minute would be required to supply these facilities. By incorporating closed storage tanks in a project design, greater use of existing water sources could be realized.

It must be kept in mind that designs presented in this report are conceptual only. The indicated alignments of pipelines and placement of livestock / wildlife watering facilities are general and intended to represent the concept behind the alternatives if implemented, detailed design would be required.

A list of interested land owners and allotment permittees was generated based upon input obtained at project meetings and information provided by the LRCD. Individual meetings were scheduled and completed to obtain their input on the water needs of their respective geographical areas of interest. Based upon the results of these interviews and the information presented above pertaining to existing water supplies and areas in need of upland water development, several conceptual water development projects were identified. The general objective of this effort was to create a means of providing reliable sources of livestock / wildlife drinking water in water-short portions of the watershed as well as alternative water supplies to riparian corridors.

In addition, environmental evaluations would be required for the impacts identified with each project. BLM typically conducts these evaluations when BLM lands are involved; however, the NRCS or other agencies may provide input, particularly on archaeological or cultural resources issues. Consequently, implementation would be partially contingent upon BLM scheduling and manpower for their completion of the requisite evaluation and documentation. It is our understanding that the permitting process is simplified for those projects which do not involve placement of above ground facilities pipeline alignment only and thus requiring granting of easement for buried pipelines.

Table 4.4-2 Summarizes the livestock and wildlife water supply projects and Figure 4.4-30 displays their locations.

4.4.2.2 L/W-001 Blake Pipeline Project (Blake-001)

This alternative would involve the modification of an existing pipeline system in Section 28, Township 15 North, Range 75 West. The existing system is supplied by a shallow well and extends approximately 600 feet north to a single rubber tire stock tank. The proposed project would use the existing well and install

Table 4.4-2 Livestock / Wildlife Water Supply Components of the Watershed Management Plan.

Component Number	Sponsor Number	Project Name
L/W-001	Blake-001	Blake Pipeline Project
L/W-002	BLM-001	Windmill Replacement 1
L/W-003	BLM-002	Windmill Replacement 2
L/W-004	BLM-003	WIndmill Replacement 3
L/W-005	Sigel-002	Sigel Spring Development
L/W-006	Sigel-003	Sigel Pipeline and Stock Tank Installation
L/W-007	Rogers-001	Rogers Stock Reservoir
L/W-008	Johnson-001	Johnson Stock Reservoir
L/W-009	Johnson-004	Stock Reservoir Rehabilitation
L/W-010	Johnson-005	Stock Reservoir Construction
L/W-011	Gaddis-001	Mobile Solar Platform and Pipeline Project
L/W-012	Engen-001	Stock Tank and Pipeline Project
L/W-013	Clay-001	Winter Livestock/Wildlife Water Supply
L/W-014	Clark-001	Fox Creek Resevoir
L/W-015	Churches-001	Churches Pipeline Project
L/W-016	Tenbensel-001	Stock Reservoir Rehabilitation
L/W-017	Kaisler-003	Solar Platform Installation

a buried delivery pipeline to an existing stock tank and three new stock tanks. Figure 4.4-31 displays the conceptual design of the proposed project.

The following components would be employed in the construction of this project:

- The existing buried pipeline would be abandoned.
- Approximately 3,400 linear feet of buried 1½ inch HDPE low-pressure pipeline would be installed in the general configuration displayed in the conceptual design. Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Three 1,200 gallon rubber tire stock tanks will be installed.
- Wildlife egress ramps would be installed in the existing and proposed stock tanks.

The project would provide a reliable water supply which would facilitate optimization of grazing management opportunities for the land owner.

The proposed project is located entirely on privately owned lands.

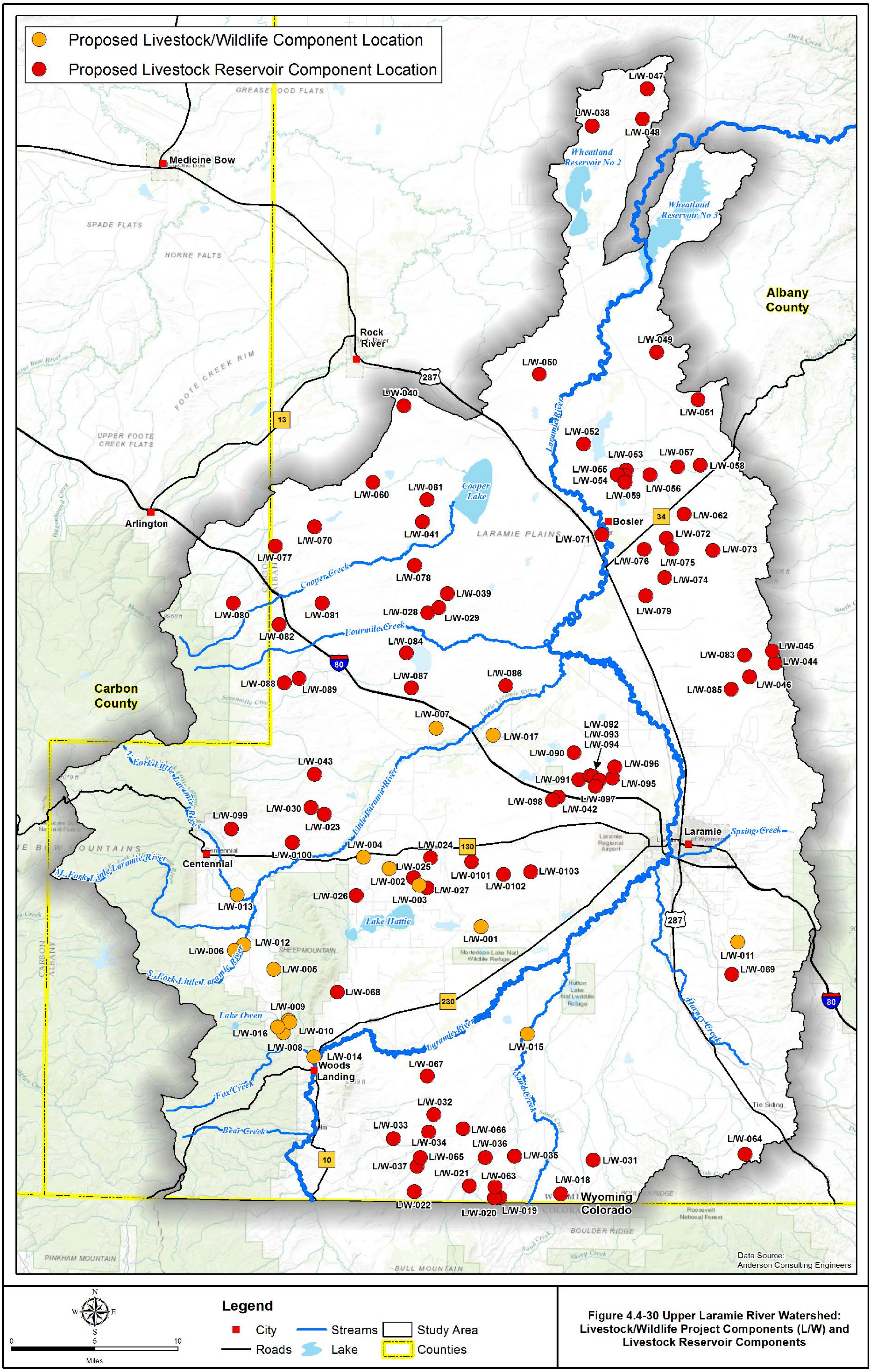


Figure 4.4-30 Upper Laramie River Watershed: Livestock/Wildlife Project Components (L/W) and Livestock Reservoir Components

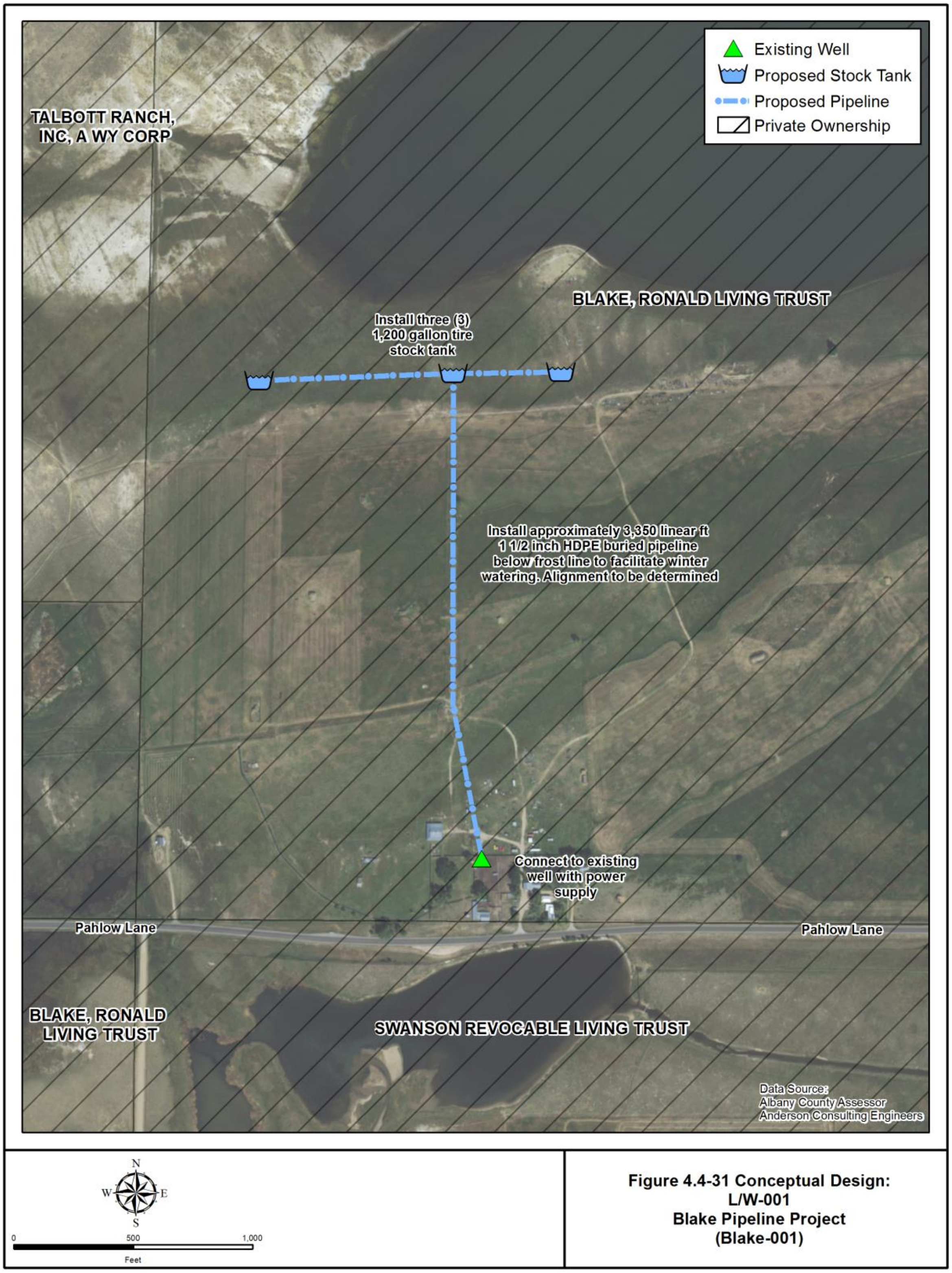


Figure 4.4-31 Conceptual Design: L/W-001 Blake Pipeline Project (Blake-001)

4.4.2.3 L/W-002 through L/W-004 BLM Windmill Replacement Projects

The Bureau of Land Management Rawlins Field Office has recommended renovation of wells at three locations on private lands which would provide reliable sources of water for wildlife in an area where there are otherwise no water sources. Figure 4.4-32 displays the location of the wells.

Each of the wells is currently equipped with a windmill, however, they are all in poor and failing condition.

Renovation of each of the three wells would include the following project components:

- A water quality test to verify the well's suitability.
- A pump test to quantify the well's potential yield and to ascertain the condition of the well.
- Installation of a solar platform including a well pump, solar panels, and requisite controls and circuitry to manage the well.
- Installation of a 1,200 gallon rubber tire stock tank
- Installation of a 4,000 gallon storage tank.

These projects would entail only privately owned lands.

4.4.2.4 L/W-005 Sigel Spring Development (Sigel-002)

This alternative would involve the development and rehabilitation of an existing spring in the Centennial Valley portion of the watershed, Section 8, Township 14 North, Range 77 West. The project would provide a reliable water supply to a portion of the watershed lacking adequate livestock and wildlife upland water sources. Figure 4.4-33 displays the conceptual design of the proposed project. Note that the alignment of the pipeline and placement and number of stock tanks displayed is strictly to exemplify the potential development of the project. Details of the project would be determined at the time of project design.

Under this alternative, the following components would be employed:

- An existing spring would be developed following NRCS spring development designs. A valve would be included for management of pipeline flows.
- Approximately 7,000 to 8,000 linear feet of buried 1 ½ inch HDPE low-pressure pipeline could be installed as displayed. Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Five 1,200 gallon rubber tire stock tanks could be installed
- Wildlife egress ramps would be installed in the proposed stock tank.
- The spring vicinity would be fenced with approximately 500 linear feet of fencing to prevent damage from livestock and wildlife.

The proposed project is located entirely on privately owned lands.

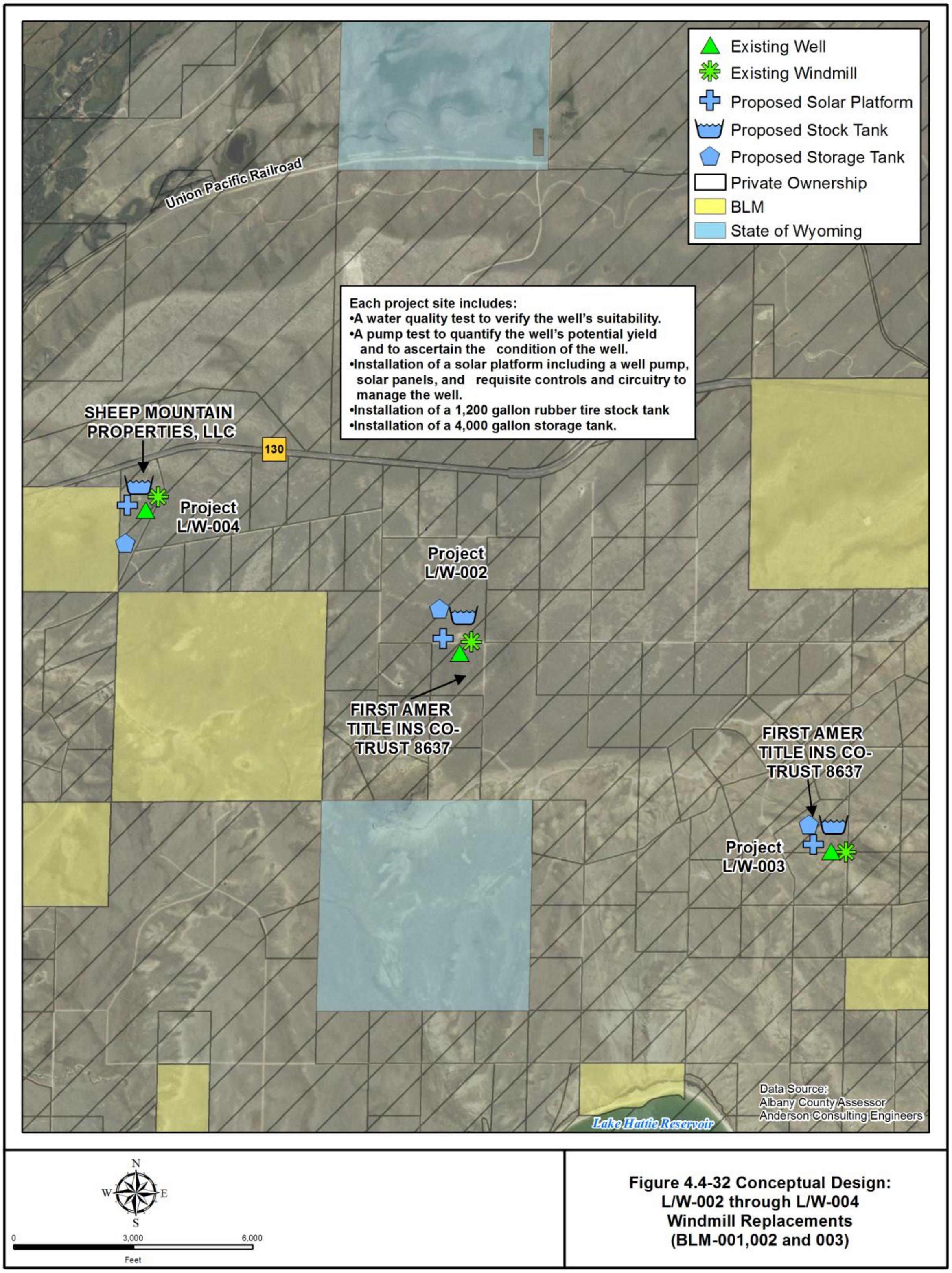


Figure 4.4-32 Conceptual Design: L/W-002 through L/W-004 Windmill Replacements (BLM-001,002 and 003)

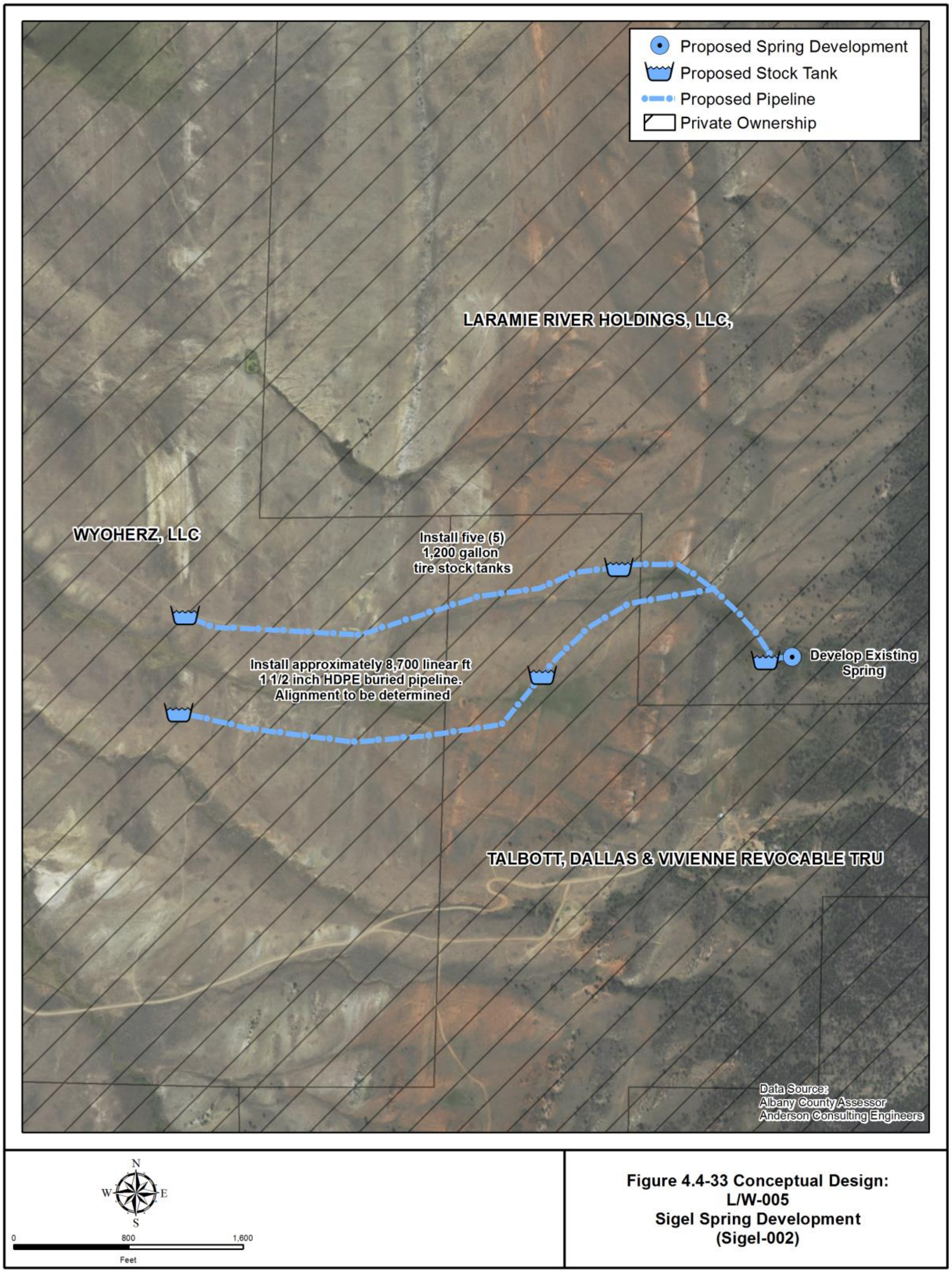


Figure 4.4-33 Conceptual Design:
L/W-005
Sigel Spring Development
(Sigel-002)

4.4.2.5 L/W-006 Sigel Pipeline and Stock Tank Installation (Sigel-003)

This alternative would involve construction of a buried pipeline originating at an existing spring. An electric powered pumping system has been installed at the spring. A buried pipeline would be constructed westerly from the spring to connect to an existing pipeline system that currently supplies several stock tanks. Additional pipeline could be installed if the landowner desires. The spring is located in Section 36, Township 15 North, Range 78 West. Figure 4.4-34 displays the conceptual layout of the project.
Under this alternative, the following components would be employed:

- Approximately 850 linear feet of buried 1 ½ inch HDPE low-pressure pipeline could be installed as displayed. Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- The new pipeline would connect to an existing buried pipeline. The existing pipeline was originally intended to be connected to and supplied by the existing well but was not completed.
- One 1,200 gallon rubber tire stock tank will would be installed at the well location.
- Wildlife egress ramps would be installed in the proposed stock tank.

The proposed project is located entirely on privately owned lands.

4.4.2.6 L/W-007 Rogers Stock Reservoir (Rogers-001)

This project would involve construction of a small stock reservoir on private property in Section 25, Township 17 North, Range 76 West (Figure 4.4-35). The purpose of the project is to provide reliable source of water for livestock and wildlife in an area where other reliable supplies are sparse. The contributing area to the proposed stock pond would be approximately 510 acres. Using the USGS topographic mapping within the project GIS, it appears that the reservoir could have a storage capacity of approximately 10 to 12 acre-feet.

The project would include the following components:

- Installing an outlet control mechanism to control reservoir water levels and allow bypass.
- Due to the gentle topography, the proposed reservoir would likely need to be excavated below the existing ground elevation in order to provide an adequate storage capacity.
- The installed structures would be stabilized with rock riprap.
- Additional engineering design, permits, water rights, clearances, and construction specifications are required before commencing construction on this project.
- Note: Based upon permitting conditions required by the WSEO, the outlet may be required to facilitate draining the reservoir if required for water rights administration.

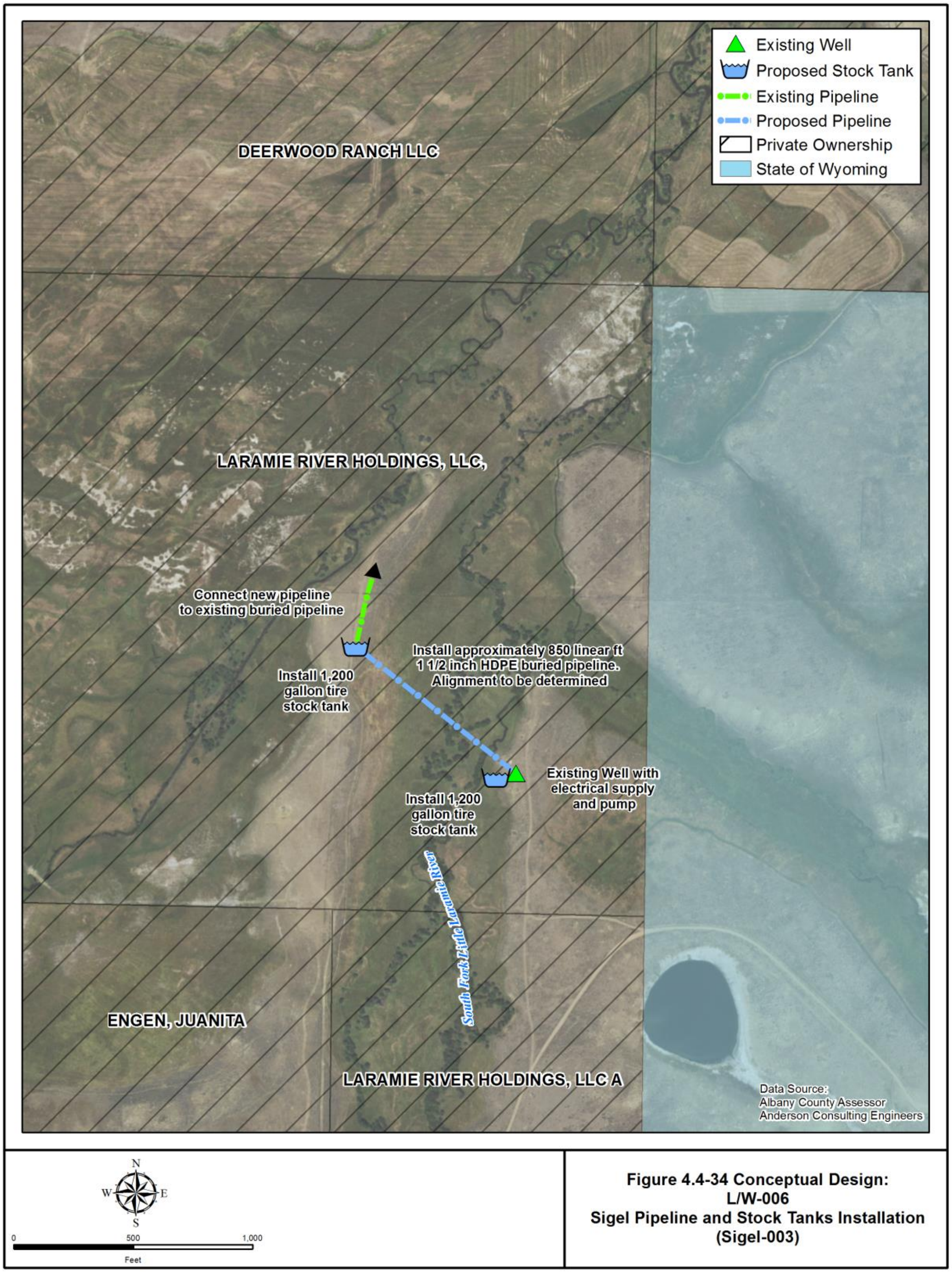


Figure 4.4-34 Conceptual Design: L/W-006 Sigel Pipeline and Stock Tanks Installation (Sigel-003)

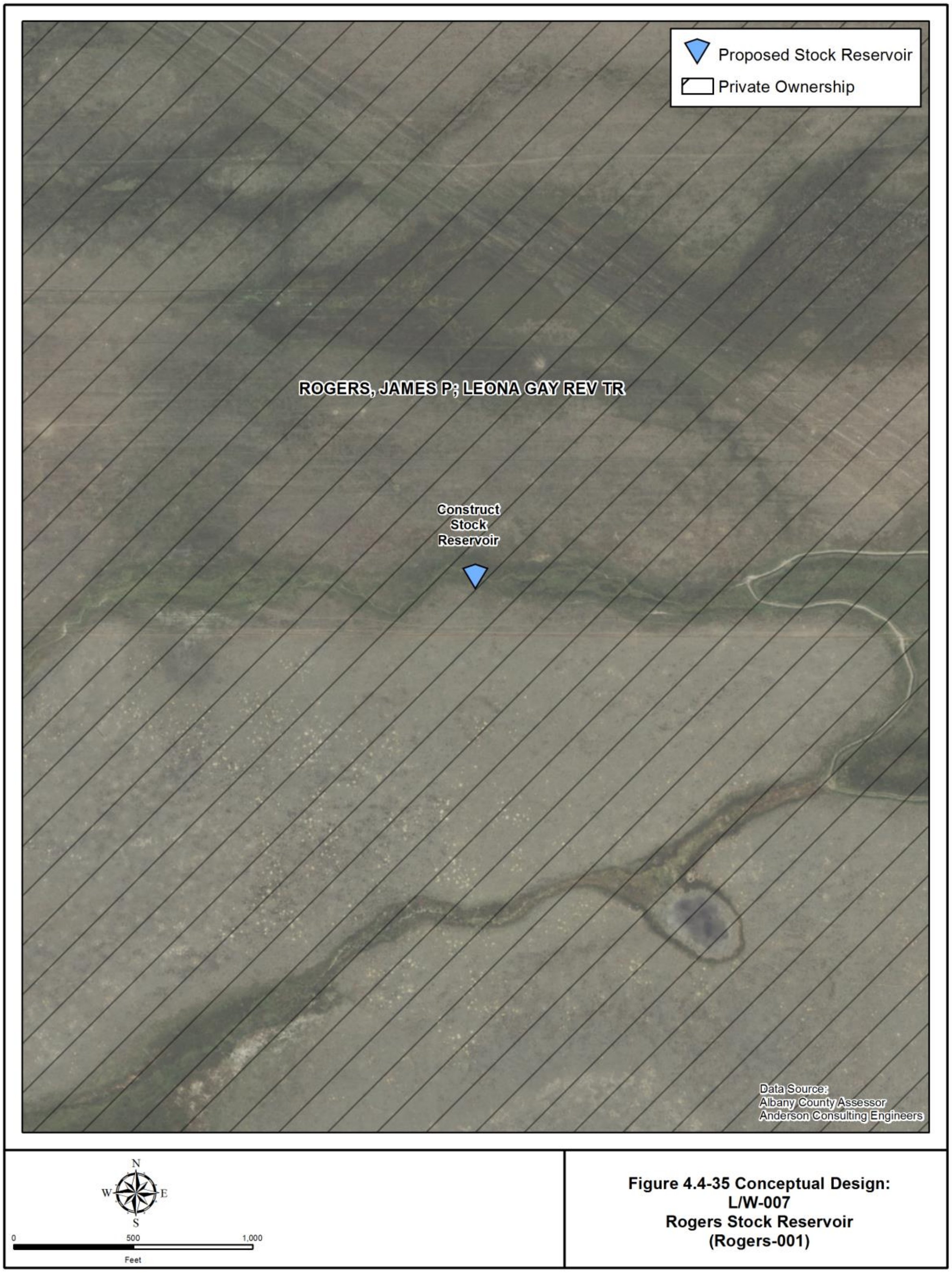


Figure 4.4-35 Conceptual Design: L/W-007 Rogers Stock Reservoir (Rogers-001)

4.4.2.7 L/W-008 Johnson Stock Reservoir (Johnson-001)

This project would involve construction of a small stock reservoir on private property in Section 33, Township 14 North, Range 77 West (Figure 4.4-36). The purpose of the project is to provide a reliable source of water for livestock and wildlife in an area recently burned. The contributing area to the proposed stock pond would be approximately 1,000 acres. Using the USGS topographic mapping within the project GIS, it appears that the reservoir would have a storage capacity of approximately 8 acre-feet.

The project would include the following components:

- Installing an outlet control mechanism to control reservoir water levels and allow bypass.
- The installed structures would be stabilized with rock riprap.
- Additional engineering design, permits, water rights, clearances, and construction specifications are required before commencing construction on this project.
- Note: Based upon permitting conditions required by the WSEO, the outlet may be required to facilitate draining the reservoir if required for water rights administration.

4.4.2.8 L/W-009 Stock Reservoir Rehabilitation (Johnson-004)

This proposed project would involve rehabilitating an existing stock reservoir to supply water to a portion of the watershed lacking adequate livestock/wildlife water sources. The existing reservoir, located in Section 28 of Township 14 North, Range 77 West in Albany County and is situated on Dale Creek, a tributary to the Owen Creek, which is then tributary to the Laramie River (Figure 4.4-37). The land owner has previously treated the lower elevations of the pond with bentonite which has been effective at reducing seepage losses. At this time, the land owner would like to add additional bentonite at elevations above the previously treated area in an effort to increase storage efficiency and reduce seepage losses. The reservoir is located entirely on privately owned land. This stock reservoir could be rehabilitated to provide an additional source of livestock/wildlife water.

Figure 4.4-38 Existing Stock Reservoir in need of Rehabilitation.

Figure 4.4-38 displays a photo of the pond as it exists prior to modification. Improvements would involve:

- Inspecting the embankment and rehabilitation of problem areas as needed.

Figure 4.4-36 Conceptual Design: L/W-008 Johnson Stock Reservoir (Johnson-001)

Figure 4.4-37 Conceptual Design: L/W-009 Stock Reservoir Rehabilitation and L/W-010 Stock Reservoir Construction (Johnson-004 and Johnson-005)

- Installing an inlet and outlet pipe control structure in the reservoir embankment and stabilizing the installed structures and spillway with rock riprap.
- Installing an inlet and outlet control mechanism to control reservoir water levels. The installed structures would be stabilized with rock riprap.
- Placement of bentonite at elevations directed by the landowner and incorporation of the bentonite into existing soil.
- Additional engineering design, permits, water rights, clearances, and constructions specifications are required before commencing construction on this project.
- Note: Based upon permitting conditions required by the WSEO, the outlet may be required to facilitate draining the reservoir if required for water rights administration.

4.4.2.9 L/W-010 Stock Reservoir Construction (Johnson-005)

This project would involve construction of a small stock reservoir on private property in Section 33, Township 14 North, Range 77 West (Figure 4.4-37). The purpose of the project is to provide a small body of water to provide a reliable source of water for livestock and wildlife in an area recently burned. The contributing area to the proposed stock pond would be approximately 1,000 acres. Using the USGS topographic mapping within the project GIS, it appears that the reservoir could have a storage capacity of approximately 8 acre-feet.

- Installing an outlet control mechanism to control reservoir water levels.
- The installed structures would be stabilized with rock riprap.
- Additional engineering design, permits, water rights, clearances, and constructions specifications are required before commencing construction on this project.

Note: Based upon permitting conditions required by the WSEO, the outlet may be required to facilitate draining the reservoir if required for water rights administration

4.4.2.10 L/W-011 Mobile Solar Platform and Pipeline Project (Gaddis-001)

This project would involve construction of a trailer-mounted solar power platform the applicant could use to pump from one of two existing wells as desired. Both wells are located on lands owned by the State of Wyoming (Figure 4.4-39). The westerly well (Permit P17935) is located at a low elevation within the lease and in the vicinity of the applicant's corrals. The easterly well is owned by Mountain Cement Company and is permitted for stock usage (Permit P168948). It is reported to be 240-feet deep and has a depth to water of approximately 180-feet. Currently, the applicant uses a diesel-powered mobile generator which incurs high fuel and maintenance costs. Both wells are currently equipped with electric pumps; consequently new pumps would not be required.

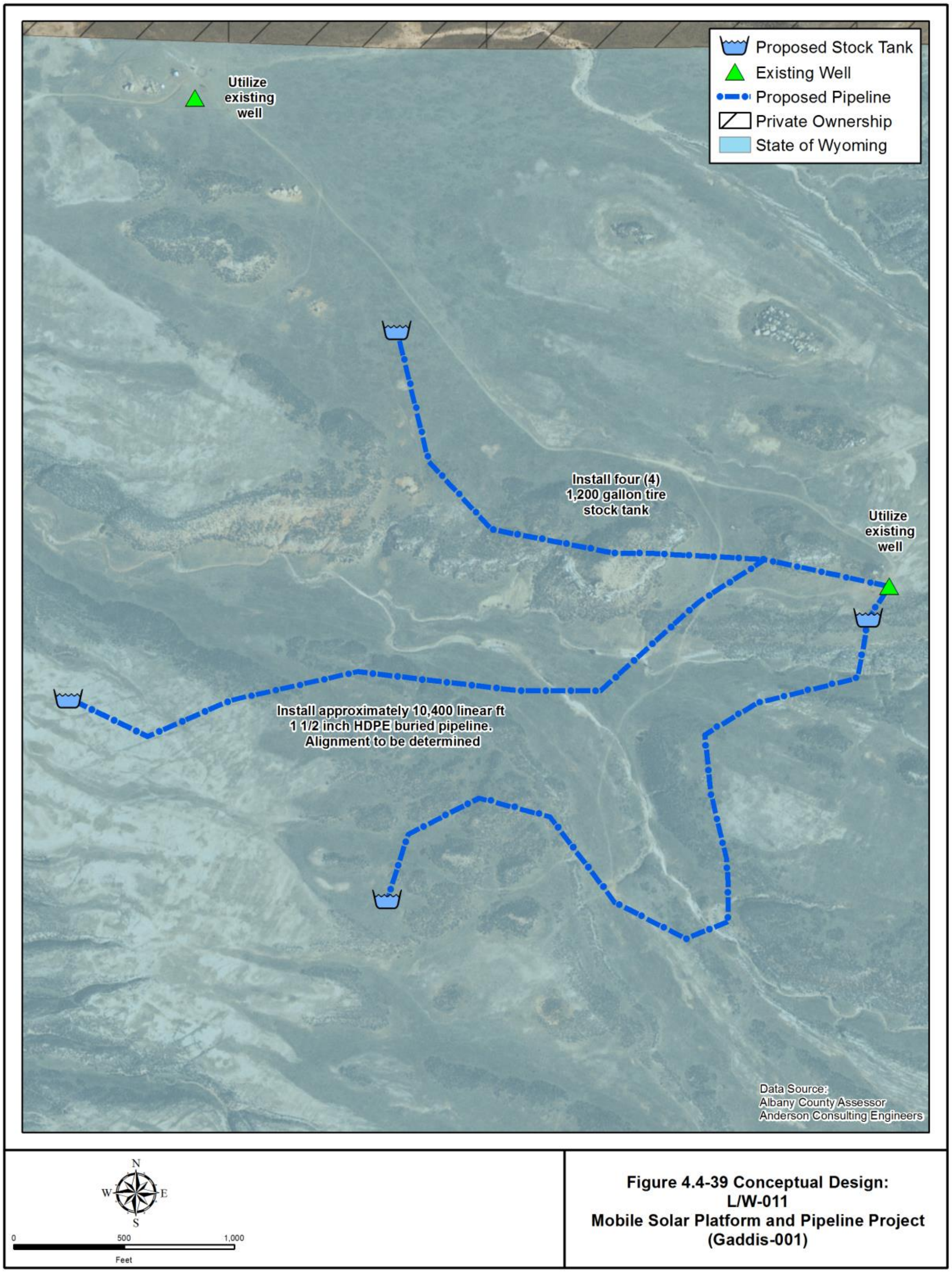


Figure 4.4-39 Conceptual Design: L/W-011 Mobile Solar Platform and Pipeline Project (Gaddis-001)

In addition to the mobile power supply, a gravity-fed pipeline system could be installed which would enable the applicant to provide water to livestock virtually anywhere within the State lease due to the eastern well's location at a high elevation. The conceptual design displayed in Figure 4.4-39 was prepared as an example of potential water development available under this proposed project. The applicant would determine the location and number of stock tanks, and alignment of pipeline during the design phase.

An agreement between the applicant and the Mountain Cement Company would be required. The applicant currently pumps from their well to a stock tank with their consent; a written agreement would be required prior to construction of any additional infrastructure.

As displayed, the project would entail the following elements:

- Written agreement between Mountain Cement Company and the applicant for the continued use of their well.
- Special use agreement with the State of Wyoming Office of State Lands and Investments.
- Construction of a trailer-mounted solar array. Concrete tie-down pads would be constructed at each well-site to secure the trailer in high winds. Livestock panels would be advised to prevent damage to the platform.
- Installation of approximately 10,400 linear feet of buried 1 1/2 inch pipeline.
- Installation of four (4) 1,200-gallon rubber tire stock tanks.

The proposed project is located entirely on publicly owned lands.

4.4.2.11 L/W-012 Stock Tank and Pipeline Project (Engen-001)

This alternative would involve utilization of an existing electrical power supply to pump water from Spring Creek (tributary to the Little Laramie River) in Section 1 of Township 14 North, Range 78 West. The proposed project would create a reliable source of livestock / wildlife water relieving pressures on the existing riparian source. Figure 4.4-40 displays the conceptual design of the proposed project.

The following components would be employed in the construction of this project:

- Approximately 4,000 linear feet of buried 1½ inch HDPE low-pressure pipeline would be installed in the general configuration displayed in the conceptual design. Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- One 1,200 gallon rubber tire stock tanks will be installed
- Wildlife egress ramps would be installed in the existing and proposed stock tank.

The project would provide a reliable supply water which would facilitate optimization of grazing management opportunities for the land owner. The proposed project is located entirely on privately owned lands.

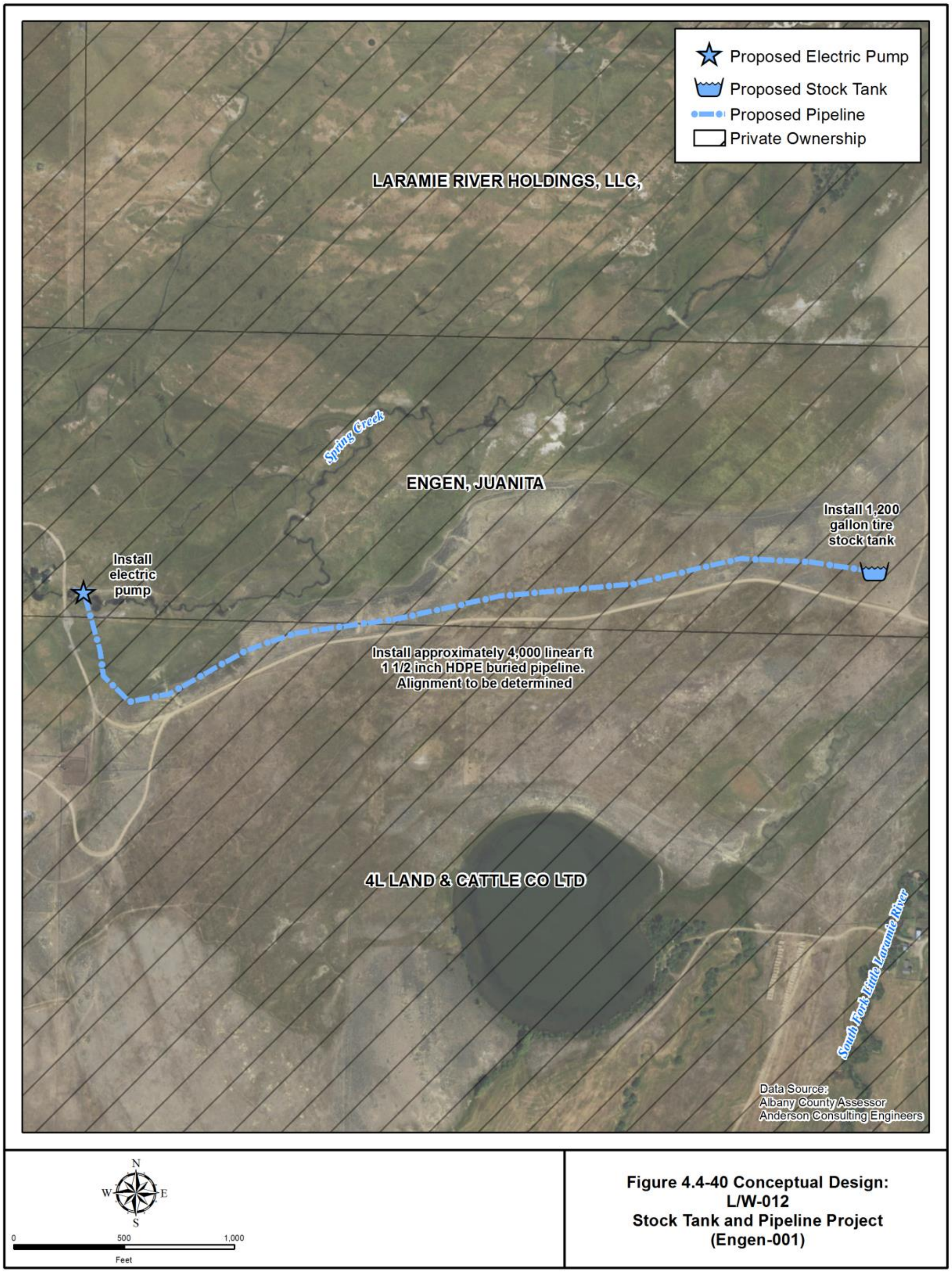


Figure 4.4-40 Conceptual Design: L/W-012 Stock Tank and Pipeline Project (Engen-001)

4.4.2.12 L/W-013 Winter Livestock / Wildlife Water Supply (Clay-001)

This alternative would involve construction of a livestock / wildlife water supply which would serve as a winter source. Completion of the project would relieve pressure on riparian vegetation during the winter months where the Little Laramie River is the only reliable source of water. The project is located in Section 13 of Township 15 North, Range 78 West. The project would consist of a diversion facility on the Little Laramie River and a pipeline to a frost-free water facility (Figure 4.4-41).

Components of the project would include the following:

- Securing a right to divert water by completing an application through the WSEO
- Installation of a buried infiltration pipe diversion facility at the Little Laramie River. The facility would be equipped with a filter sock to prevent sediment from entering the proposed pipeline. The site would be selected during the design phase of the project to facilitate gravity flow to the water facility.
- Installation of a buried 1 1/2 -inch buried pipeline, approximately 2,250-feet long between the diversion and the water facility. The pipeline would be installed below the frost line.
- Installation of a frost-free livestock water unit similar to that shown in Figure 4.4-41. The unit provides water from the pipeline while the animal is drinking. When not drinking, water drains back below grade without freezing in the exposed portion of the unit.

This project would involve only privately owned lands.

4.4.2.13 L/W-014 Fox Creek Reservoir (Clark-001)

This project would involve construction of a small stock reservoir on private property in Sections 2 and 3, Township 13 North, Range 77 West (Figure 4.4-42). The purpose of the project is to provide a reliable source of water for livestock and wildlife and relieve pressures on the Fox Creek riparian zone. The stock reservoir could be supplied by Fox Creek. Using the USGS topographic mapping within the project GIS, it appears that the reservoir would have a storage capacity of approximately 5 acre-feet.

The project would include the following components:

- Installation of a diversion facility on Fox Creek and pipeline to the proposed reservoir.
- Location of the diversion would be determined during the project's design phase and would facilitate gravity flow to the reservoir.
- Installing an outlet control mechanism to control reservoir water levels and allow bypass.
- The installed structures would be stabilized with rock riprap.
- Additional engineering design, permits, water rights, clearances, and construction specifications are required before commencing construction on this project.

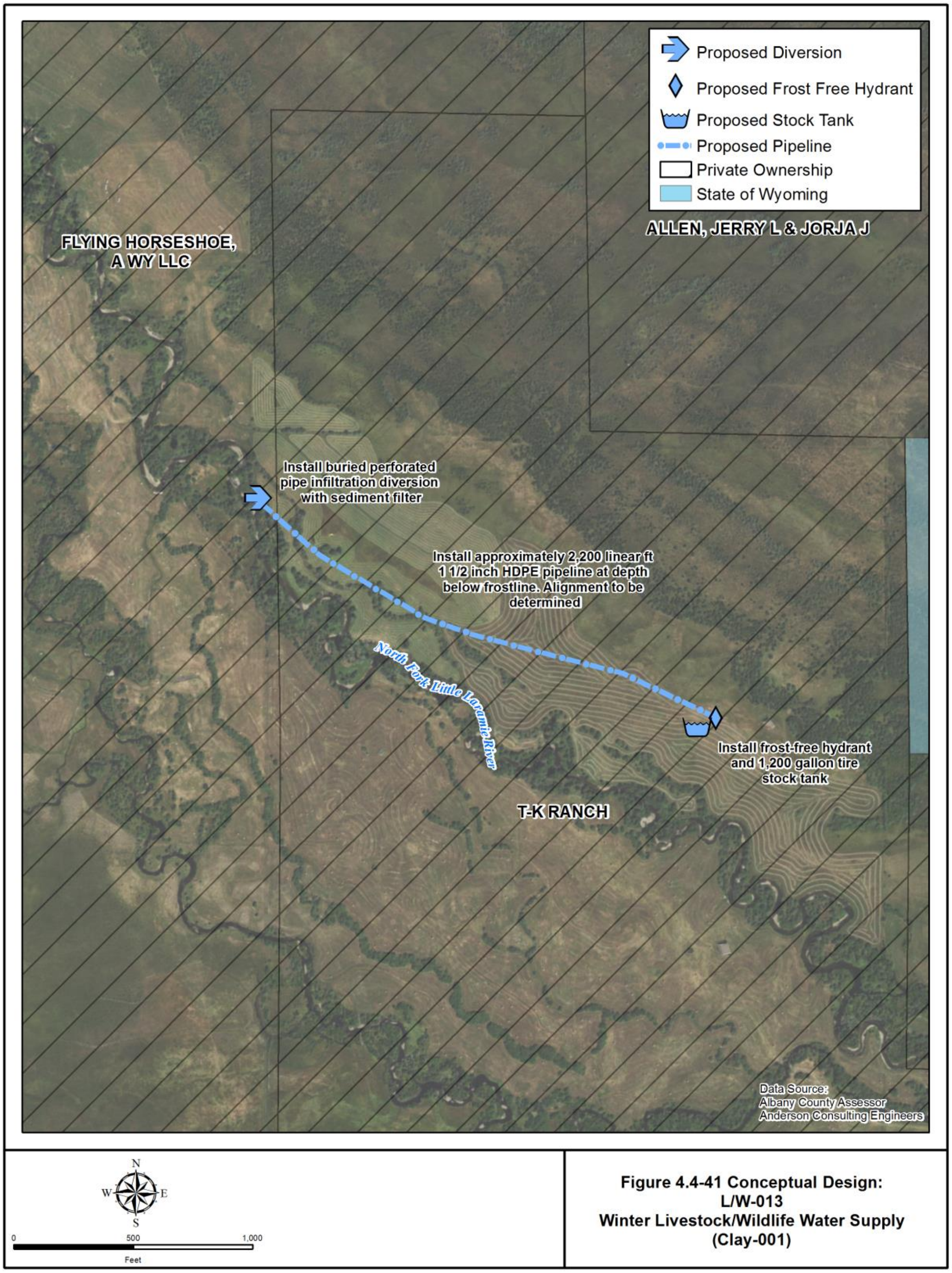


Figure 4.4-41 Conceptual Design: L/W-013 Winter Livestock/Wildlife Water Supply (Clay-001)

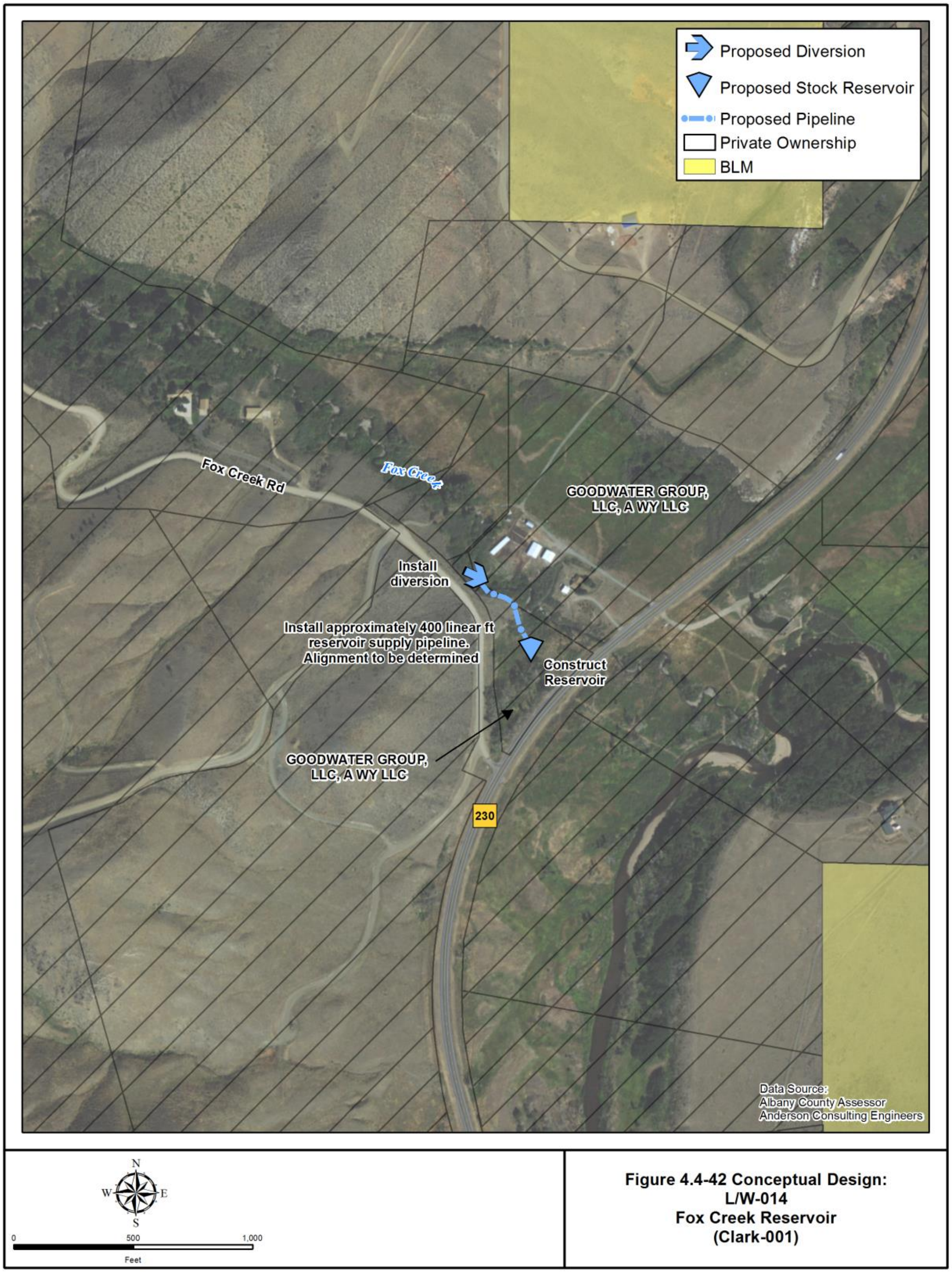


Figure 4.4-42 Conceptual Design:
L/W-014
Fox Creek Reservoir
(Clark-001)

- Application for a new water right through the WSEO to store water in the reservoir.
- Note: Based upon permitting conditions required by the WSEO, the outlet may be required to facilitate draining the reservoir if required for water rights administration.

This project would involve only privately owned lands.

4.4.2.14 L/W-015 Churches Pipeline Project (Churches-001)

This project would entail development of a water distribution system for a ranch where reliable sources of livestock / wildlife water (in lieu of surface water streams) are generally lacking. Outside of the Sand Creek riparian corridor, the area is extremely dry. The property currently obtains water from a shallow well (Permit P94189.0W) approximately 15 feet deep according to records of the WSEO. The well has a reported yield of approximately 15 gallons per minute. The well is located in Section 26 of Township 14 North, Range 75 West. A sample of the well taken during the project site visit showed the well to be very high in total dissolved solids (TDS) at approximately 1,890 mg/L. A sample from the creek, on the other hand, was measured at approximately 786 mg/L TDS.

Given the difference in water quality between the two sources, development of a system utilizing Sand Creek would appear preferable. Due to the fact that a water right application would be limited to stock water use only, the WSEO could likely approve it. Consequently, the conceptual plan presented here assumes a new water right would be obtained from the WSEO for use of Sand Creek for the supply. Figure 4.4-43 displays the conceptual layout of the project.

The following components would be involved:

- An application for diversion of surface water for stock water use would be submitted to the WSEO. Assuming it is approved, the remainder of the project could be completed.
- A diversion facility would be installed on Sand Creek. The structure would facilitate diversion by a pump.
- From the pump, a buried 1 ½ inch HDPE pipeline would be installed below the frost line to a 10,000 gallon storage tank for warm season use.
- The storage tank would be sited on higher ground east of County Road 37.
- Coordination with Albany County Roads Department would be required to install a crossing of the road. Trenching or boring techniques would be employed depending upon the County's requirements.
- From the storage tank, buried 1 ½ inch HDPE pipe would be installed below the frost line to stock tanks as indicated.
- In the vicinity of the storage tank, a frost-free livestock hydrant would be installed to provide water during winter months where the pasture is used for feeding.

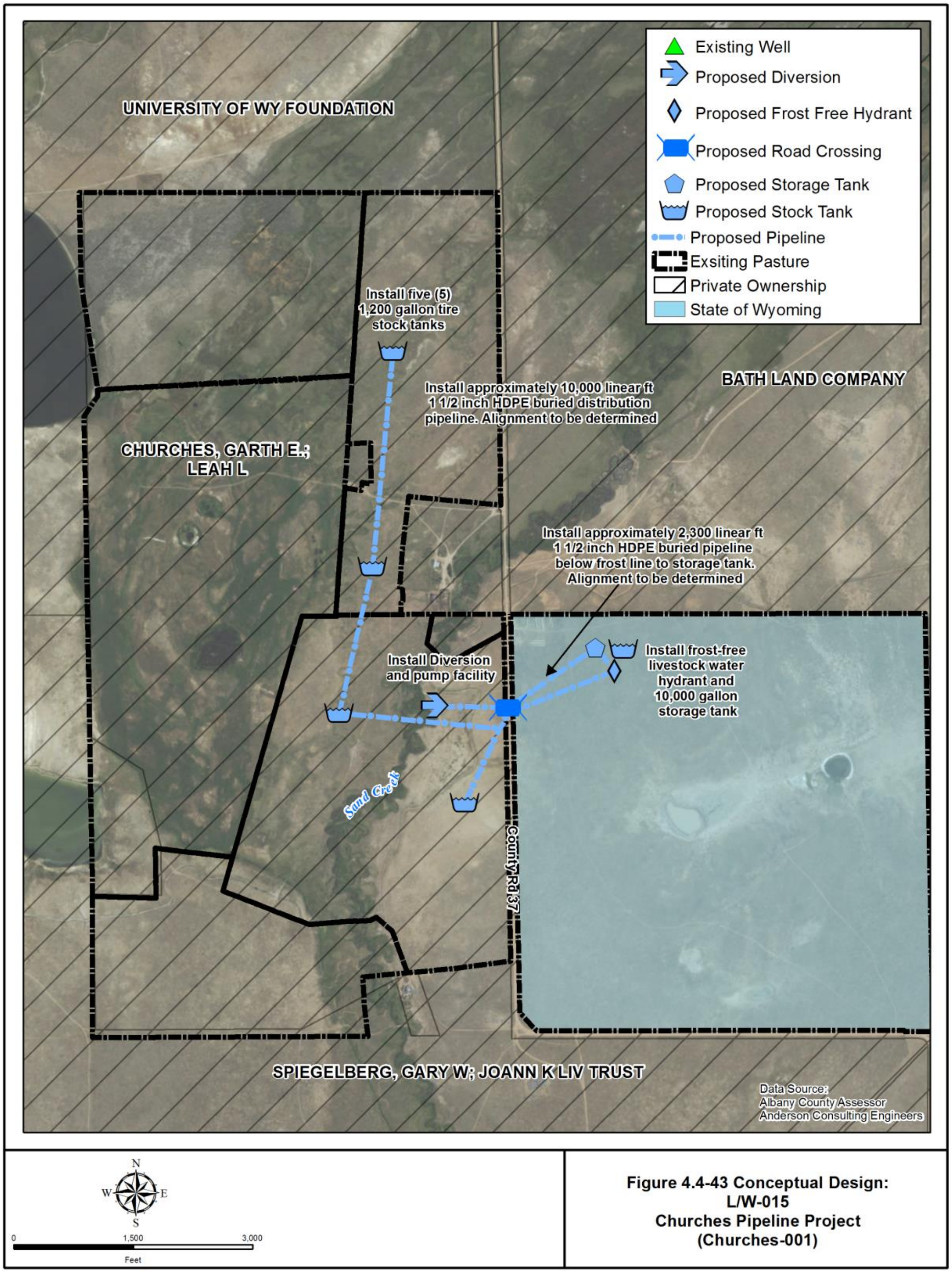


Figure 4.4-43 Conceptual Design: L/W-015 Churches Pipeline Project (Churches-001)

4.4.2.15 L/W-016 Stock Reservoir Rehabilitation (Tenbensel-001)

An existing livestock / wildlife water supply reservoir in Section 29 of Township 14 North, Range 77 West overtopped and formed gullies and headcutting downstream. In recent years, several fires have burned the contributing watershed. Following the fires, runoff has increased and sedimentation of the pond has limited its storage capacity. The reservoir has no outlet or spillway. Rehabilitation of the reservoir is recommended.

Under this alternative, the following improvements would be completed:

- Verification of water rights and permit through the WSEO for the structure.
- Draining the reservoir using a diesel powered pump.
- Sediment would be removed from the reservoir to the extent possible given the existing topography with a backhoe.
- Installation of a prefabricated reservoir outlet to control water surface elevation and reservoir release rates. A facility similar to an Agri-Drain product is commercially available and cost-effective.
- Construction of an emergency spillway and armoring it with rock riprap.

4.4.2.16 L/W-017 Solar Platform Installation (Kaisler-003)

An existing well with windmill is in need of rehabilitation in Section 34 of Township 17 North, Range 75 West. According to records of the WSEO (Permit P75566.0W), the well is approximately 30-feet deep and has a static water level at 20-feet below the ground surface. The reported yield is 20 gallons per minute. Installation of a solar platform at the site would provide reliable sources of water for livestock and wildlife.

Renovation of the well would include the following project components:

- A pump test to quantify the well's potential yield and to ascertain the condition of the well.
- Installation of a solar platform including a well pump, solar panels, and requisite controls and circuitry to manage the well.
- Installation of a 1,200 gallon rubber tire stock tank.

4.4.2.17 L/W-018 through L/W-103 Stock Reservoir Rehabilitation Projects

In Chapter 3, the evaluation of stock reservoirs and the results of their characterization were presented. Of the 1,216 stock reservoirs identified, 86 were flagged as being "non-functional" water sources because they were either breached or appeared to be full of sediment. Figure 4.4-30 displays their locations. Of the 86 reservoirs, 26 appear to have been breached. The remaining 60 appear to be full of sediment. This exercise serves as a starting point for future planning efforts; the assessment is not definitive. Prior to initiating rehabilitation efforts at any given reservoir, a site visit would be required to determine the extent of work required. For the purposes of this level I study, it was assumed that a breached embankment would need replaced and a sediment-filled reservoir could be cleaned with a backhoe.

4.4.3 Storage Components (STO)

4.4.3.1 Overview

Construction of new water storage facilities in the watershed would be ***possible*** to complete within the framework of Wyoming water laws; however, constraints imposed by those laws would present significant and potentially insurmountable hurdles. As discussed previously in Section 4.2, the Modified North Platte Decree (2001), the Laramie River Decree (1922) and the Platte River Recovery and Implementation Program (2001) all impose limits on what can and cannot be done with respect to water use in the basin.

With the potential constraints in mind, the following storage concept was included in the watershed management plan. Figure 4.4-44 shows its location.

Any new storage facility in the Upper Laramie River watershed would be subject to constraints of the Platte River Recovery and Implementation Program (PRRIP) and the Laramie River Decree. Briefly, and as discussed in Section 4.2 and Appendix 4A of this report, the proposed reservoir would require permitting through the WSEO and would include the following efforts:

Issues and Constraints associated with the proposed reservoir:

- Project proponents have suggested transferring existing direct flow rights to storage rights. According to the State Engineer, there are stipulations in Wyoming statutes permitting such transfer, however, there are limitations:

- Change of use from direct flow rights to storage could only be completed for that portion which is lost to consumptive use; not the total amount of the existing direct flow right.

- Areas irrigated with the direct flow right would be abandoned following completion of the transfer of rights.

- The transfer of rights, if completed, would carry the priority date of the original direct flow permit.

- In addition to the transfer, a permit would be required for additional water for storage. The new permit would be assigned a priority date at the time the application was filed. Therefore, it would be junior to all other water rights in a system which is already full adjudicated. Consequently, under the priority system of water rights administration, it would likely be a current day water right with significant limitations to fill the reservoir.

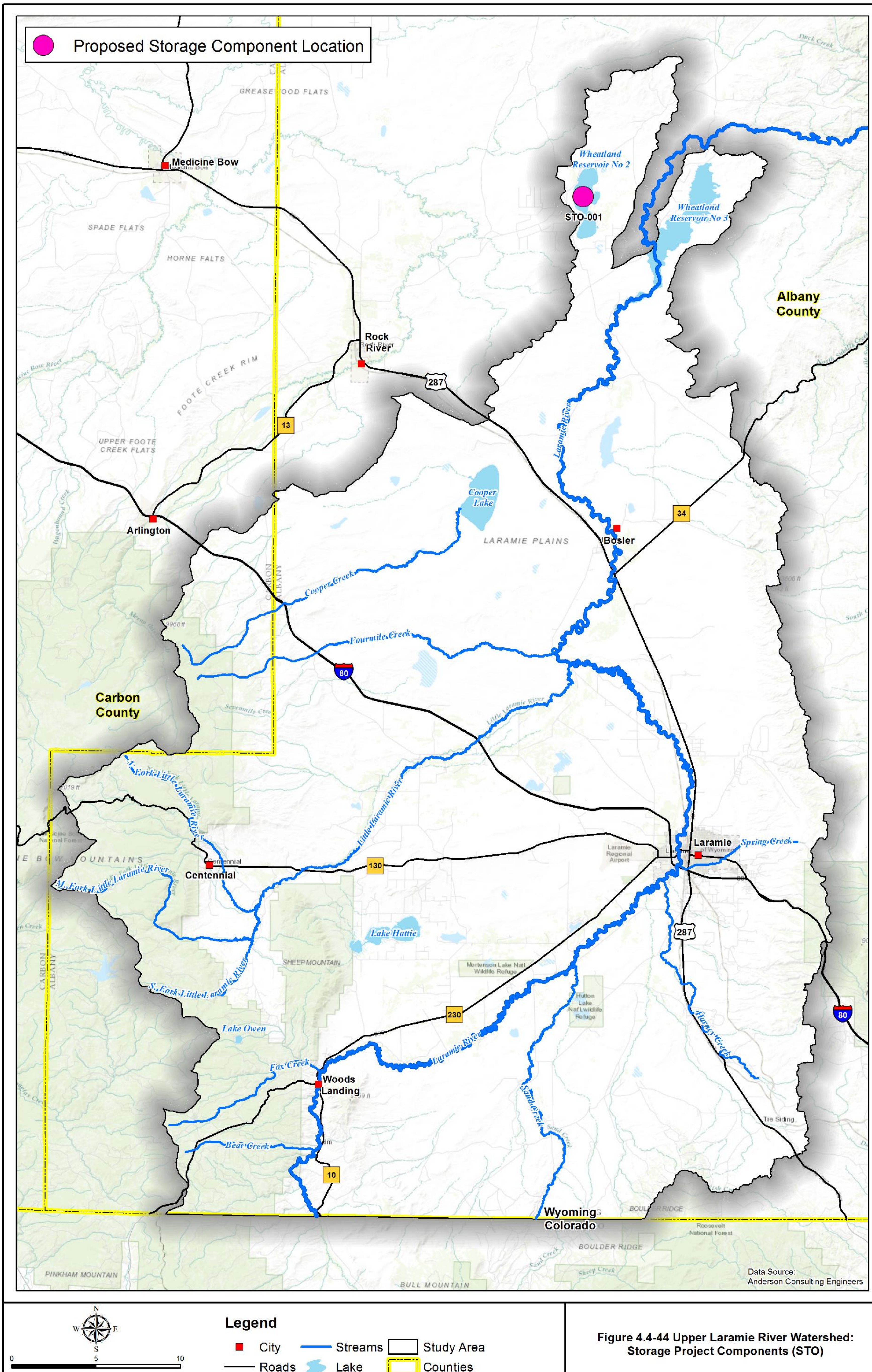


Figure 4.4-44 Upper Laramie River Watershed: Storage Project Components (STO)

- Permitting of any new storage facility in the watershed will require adherence to stipulations of the PRRIP which state that there can be no net increases in basin depletions associated with any new project. Consequently, a depletions analysis would be required entailing evaluation of new depletions (evaporation, seepage, etc.) and development of a means of offsetting these such that there is no net increase in existing depletion losses

4.4.3.2 STO-001 Wheatland Reservoir No. 3 Modifications (WID-001)

The Wheatland Irrigation District (WID) owns Wheatland Reservoir No. 2 and Wheatland Reservoir No. 3 (Figure 4.4-45). While these two facilities physically lie within the geographic limits of this study, all of the beneficial uses associated with them lie downstream in the vicinity of Wheatland (and consequently outside of this study's influence). Wheatland Reservoir No. 3 has been identified by the WID for potential improvements. Due to the configuration of the reservoir and its underlying topography, a large portion of its storage is unavailable and exists as "dead storage".

Improvement concepts discussed by the WID include modification / installation of embankments to essentially 'shift' the reservoir pool and reduce the storage capacity lost to dead storage and sedimentation. Benefits of proposed modifications could potentially include reduced evaporative losses with a modified reservoir surface area (within the confines of the institutional constraints present).

It is important to keep in mind that any modifications made to either Wheatland Reservoir No. 3 or Wheatland Reservoir No. 2 would be subject to critical review by the WSEO in light of constraints imposed by the Modified Platte River Decree (2001), the Laramie River Decree (1922) and the Platte River Recovery and Implementation Program (2001) (See Section 4.2 of this report more information on the constraints imposed upon water development by the Decrees and the PRRIP).

4.4.4 Stream Channel Components (STR)

4.4.4.1 Overview

The general condition of the principal stream channels and primary tributaries were evaluated during the geomorphic investigation which included:

- Classification of approximately 414 miles of stream channel within the GIS environment
- Field reconnaissance to verify the classifications.

These efforts and their results are presented in Chapter 3. During the evaluation of existing channel conditions, several impaired reaches were identified and three general classes of impairments noted. The general categories of impairments were classified as indicated below:

- Channel degradation/incision,
- Bank erosion associated with channel migration and/or widening, and
- Loss or reduction of riparian vegetation.

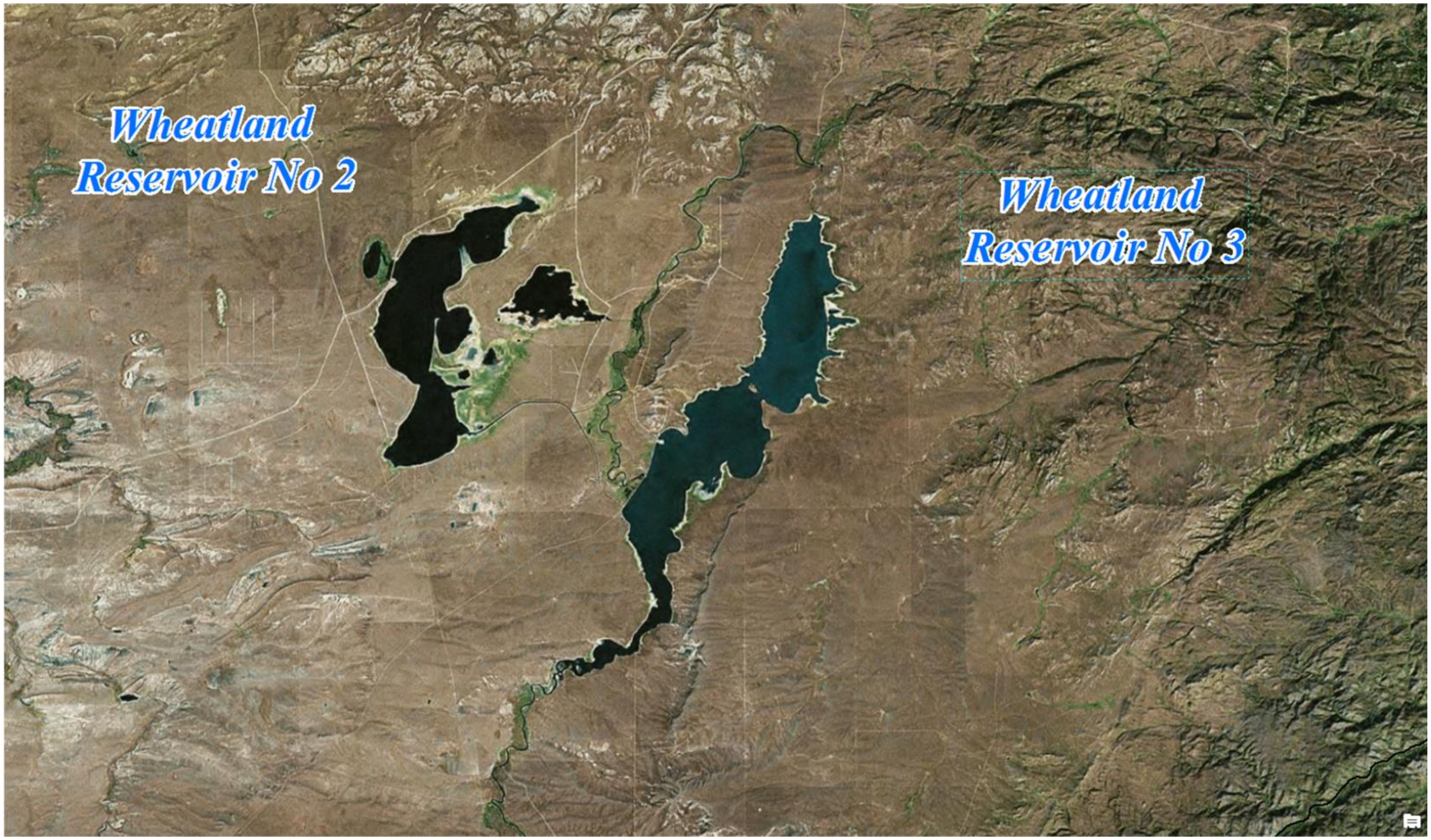


Figure 4.4-45 Wheatland Reservoir No. 2 and Wheatland Reservoir No. 3.

The scope of this Level I investigation precludes an in-depth evaluation of stream channel conditions. Locations where stability issues exist were documented largely through project workshops and word of mouth. Consequently, only a limited number of specific locations where stream channel or bank stabilization projects may be beneficial were noted. Given the magnitude of the extent of the study area, the complexity of the stream system, and the variety of land uses encompassed within it, there are certainly additional locations where further investigation may be warranted. The two specific projects recommended in this watershed management plan, however, serve as examples of the types of local projects which could be completed and provide benefit to landowners and watershed health. In addition, two key locations where irrigation diversions pose barriers to fish passage were identified and incorporated into the watershed management plan. Figure 4.4-46 displays the locations of the stream channel components.

4.4.4.2 STR-001 Laramie River Bank Erosion at Oasis Ditch (STR-001)

In Section 5 of Township 17 North, Range 74 West (Figure 4.4-47), the Laramie River impinges closely upon a hillslope directly below the Oasis Ditch. Ditch representatives state that concern has increased regarding stability of the stream bank and the integrity of the ditch. Previous bank stabilization efforts have slowed the river's erosion but continued migration of the stream will ultimately result in failure of the bank and probably cause a failure of the ditch. At this location, stream bank stabilization is recommended using one of several rock-based structures: j-hook vanes, rock barbs, etc.

Figure 4.4-47. Oasis Ditch and Laramie River Impingement.

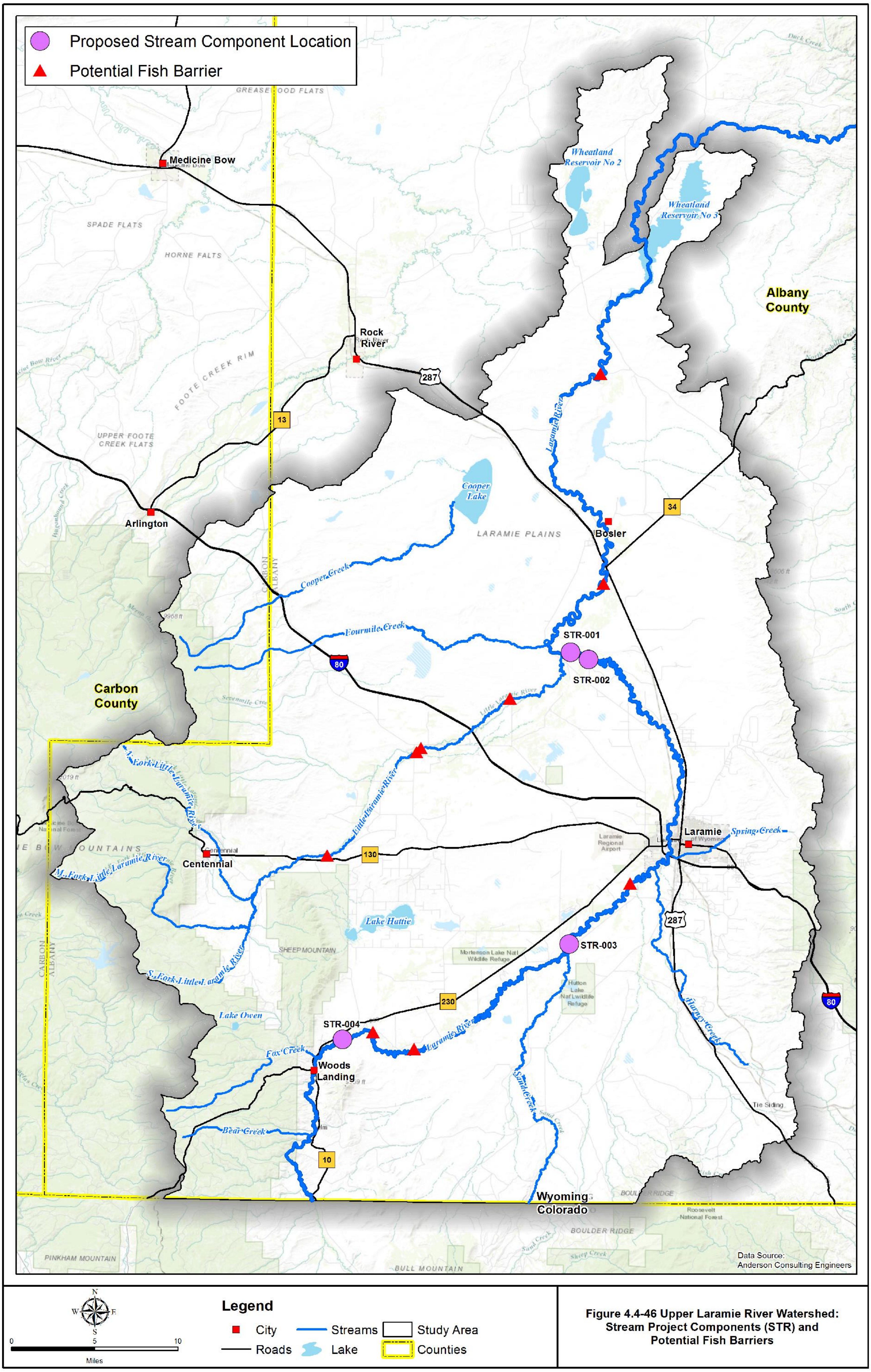


Figure 4.4-46 Upper Laramie River Watershed: Stream Project Components (STR) and Potential Fish Barriers

4.4.4.3 STR-002 Laramie River Bank Erosion at Speiser Corrals (STR-002)

In Section 4 of Township 17 North, Range 74 West, the Laramie River impinges closely upon the left bank at a set of ranch corrals (Figure 4.4-48). Continued erosion will likely result in the ultimate loss of land and ranch infrastructure.

At this location, stream bank stabilization is recommended using one of several rock-based structures: j-hook vanes, rock barbs, etc.

Figure 4.4-48. Laramie River Bank Erosion.

4.4.4.4 Barriers to Fisheries Passage

Several diversion structures were identified in Chapter 3 as being potential barriers to fish passage on the Laramie River and Little Laramie River. They were identified by reviewing aerial photography within the project GIS and classified as "complete" or "partial" barriers based upon the flow patterns observed in the photos. Site-specific information was not collected; field review would be needed prior to initiation of any planning or design process. Specific goals and objectives determined in consultation with fisheries experts would be needed to be incorporated into any project planning. For instance, barriers can be beneficial when incorporated into a fisheries management plan and used to isolate species from intermingling or prevent migration of undesirable species. In addition, design of any structure will be a function of the species involved and include numerous factors such as: flow depth and velocity, jump height and pool length, etc.

The figures flagged as posing potentially 'complete' blockage to fish passage are shown on Figure 4.4-46. Although a complete inventory of barriers in the watershed has not been completed, representatives of the WGF were aware of two structures on the Laramie River where remediation, removal, or replacement of existing structures would be desirable:

1. Pioneer Canal Diversion Structure
2. Dowlin Ditch Diversion Structure

Both structures consist of concrete weirs spanning the entire width of the stream channel with vertical drops surpassing desirable conditions for fish. Numerous remediation options are available, including removal and replacement, modifying the existing structures by incorporating fish ladders (Figure 4.4-49), or construction of a bypass channel or oxbow channel around the structure (Figure 4.4-50).

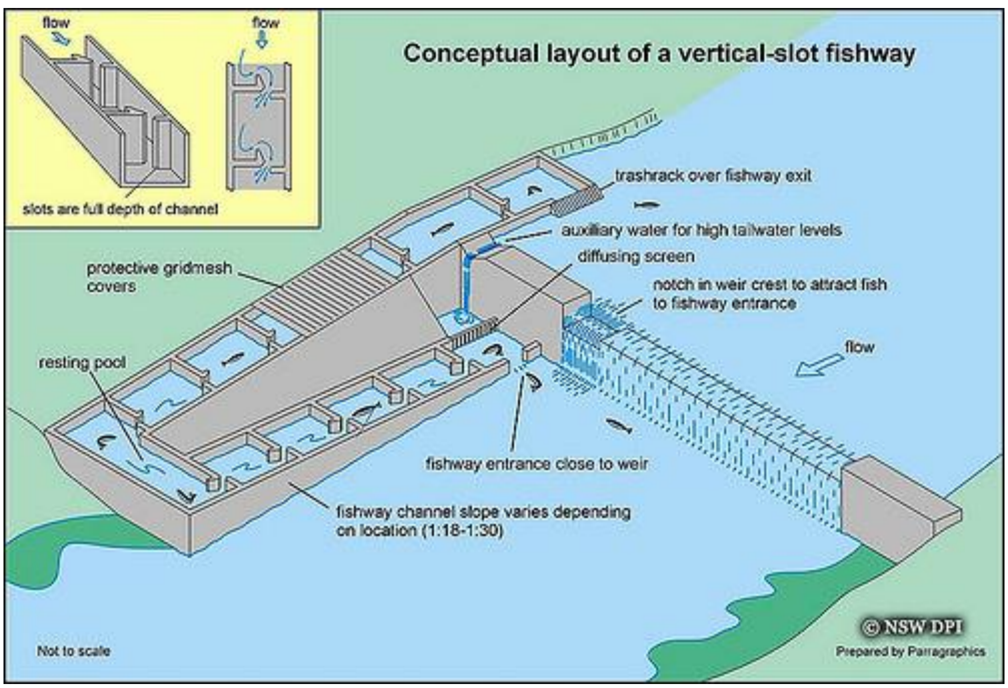


Figure 4.4-49. Conceptual Design of Fishway (Source: NSW DPI, 2016).

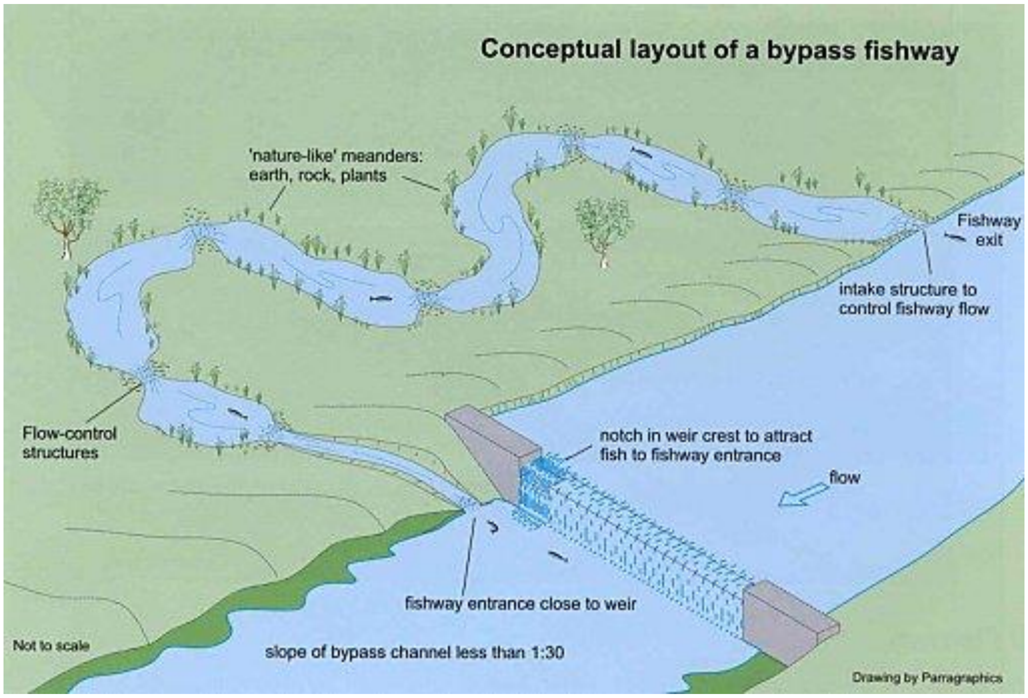


Figure 4.4-50 Conceptual Design of a Bypass Fishway (Source: NSW DPI, 2016).

4.4.4.5 Channel Stabilization Strategies

Various approaches can be taken during channel restoration and stabilization efforts, including both "hard" engineering and "soft" approaches and combinations of the two.

Examples of "hard" approaches would include construction of channel structures or reconstruction of channels themselves. The selection of the appropriate mitigation/restoration technique depends upon site-specific information and critical review of hydrologic and hydraulic data. Installation of an inappropriate type of structure or improper installation could exacerbate conditions.

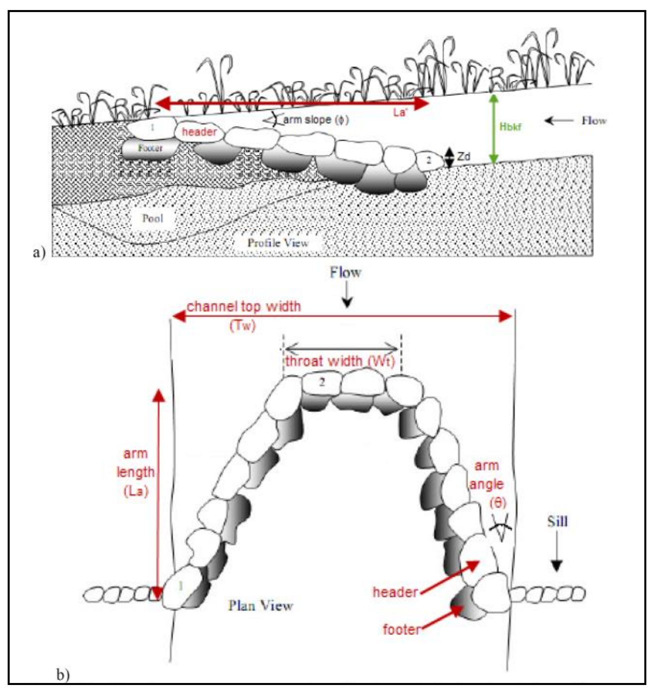


Figure 4.4-51 Rock Vortex Weir Structure Diagram (Adapted from Rosgen, 2006).

For instance, methods of restoring incised channels may include construction of gradient restoration facilities (i.e., drop structures, check structures) within the incised channel. Figure 4.4-51 displays a diagram of a typical stream channel stabilization strategy for a small channel experiencing minor downcutting or bank erosion. A vortex weir can be placed within a problematic reach to serve as a grade control structure as well as directing and centralizing streamflow. Weir configuration can be varied to provide additional functions such as facilitating irrigation diversions. Figure 4.4-52 displays a photograph of a typical installation.

Re-establishment of pre-incision channel elevations can be accomplished by means of check dams. Figure 4.4-53 displays a photo of a large-scale check dam on Muddy Creek in the Little Snake River watershed near Baggs, Wyoming. This structure serves as a good example of how gradient restoration strategies can be utilized to restore diversion capabilities at irrigation headgates rendered inoperable by changes in channel configuration.

Figure 4.4-52 Stream Stabilization Structure: Rock Vortex Weir.

Examples of "soft" approaches include a variety of Best Management Practices (BMPs). Examples of potentially applicable BMPs designed for channel restoration activities include those that result in reducing or, at least temporarily excluding wildlife and livestock from accessing designated riparian zones, establishment of riparian buffers, etc. The proposed wildlife/livestock water developments discussed previously (and others that may be identified in the future) can be considered elements of a range management BMP that will help restore, over time, those areas of channel impairment that have resulted from overutilization of riparian areas or adjacent upland range. Figure 4.4-54 displays a photo of willow fascine installation. This strategy could be employed on many of the perennial channels or intermittent where sufficient flow exists to support the vegetation, in an effort to restore riparian habitat and stabilize streambanks.

Figure 4.4-53 Channel Gradient Restoration Feature on Muddy Creek near Baggs, WY. Photo on left is viewed downstream from the dam at incised channel. Photo on the right is viewed upstream at restored gradient.

These examples of "hard" and "soft" approaches represent both extremes of the continuum of channel restoration strategies that exist. In practice, it must be kept in mind that it is generally a combination of strategies, integrated into a cohesive plan, that provides the most effective solution. Table 4.4-3 presents a summary of some of these channel restoration strategies which can be employed during future restoration efforts. Development of more specific projects and BMPs was beyond the scope of this Level I study. Such projects can be identified and developed on the basis of more detailed geomorphic analysis of impaired stream reaches.

Figure 4.4-54 Stream Stabilization Measure: Willow Fascine Installation.

As would be recommended with any similar project, monitoring of the success of the project(s) is highly recommended. At a minimum, monitoring should include visual inspection of rehabilitation features to determine the effectiveness and ability of the rehabilitation to withstand high flow events. Evidence of existing or induced erosion, movement of rehabilitation features (rock, root wads, etc.), sedimentation, vegetation establishment, etc. should be noted. In addition, long term monitoring of rehabilitation sites should include:

- Photographic documentation
- Cross sections

- Longitudinal profiles
- Bank surveys
- Bank erosion pins
- Scour chains
- Pebble counts

4.4.5 Grazing Management Opportunities (Watershed Management Plan Component G)

Table 4.4-3 Summary of Potential Stream Channel Stabilization/Restoration Techniques.

Flow-Redirection Techniques	**Biotechnical Techniques**
Vanes	Woody Plantings
Groins	Herbaceous Cover
Buried Groins	Soil Reinforcement
Barbs	Coir Logs
Engineered Log Jams	Bank Reshaping
Drop Structures	**Internal Bank-Drainage Techniques**
Porous Weirs	Subsurface Drainage Systems
Structural Techniques	**Avulsion-Prevention Techniques**
Anchor Points	Floodplain Roughness
Roughness Trees	Floodplain Grade Control
Riprap	Floodplain Flow Spreaders
Log Toes	**Other Techniques**
Roughened-Rock Toes	Channel Modifications
Log Cribwalls	Riparian-Buffer Management
Manufactured Retention Systems	Spawning-Habitat Restoration
	Fish Ladders/bypass structures
	Fish Screens/entrainment prevention

4.4.5.1 State and Transition Models

In Chapter 3, the ecological sites found within the watershed were presented and the concept of the ecological site description (ESD) was introduced. The ESD for a given ecological site contains a wealth of information pertaining to the site and its community. Within each ESD is a State and Transition model.

State and transition models describe the patterns, causes, and indicators of transitions between communities within an ecological site based upon the ecological site description (ESD). In a graphical form, they display information obtained from literature supplemented by the knowledge and experience of range scientists and managers. Basically, they display the response of a given ecological site to various range management practices or disturbances. They help to distinguish changes in vegetation and soils that are easily reversible versus changes that are subject to thresholds beyond which reversal is costly or unlikely. By being aware of the predicted response of a given ecological site to a treatment, the land manager can use this knowledge to best prescribe land management practices or treatments to direct the transition in a desirable direction. For instance, land management strategies can be prescribed which could result in restoration of the Historic Climax Plant Community (HCPC) under the right circumstances. Based upon the assumptions presented in Chapter 3, the three dominant ecological sites found within the mapped portions of the Upper Laramie River Watershed study area are likely to be the following:

- Loamy (Ly) 10-14" P.Z., High Plains Southeast
- Sandy (Sy) 10-14" P.Z., High Plains Southeast
- Saline Loamy (SnLy) 10-14" P.Z., High Plains Southeast

It is important to note that other ecological sites will be encountered and that the list above is provided as an initial point for prescription of grazing practices. Prior to prescription of a grazing management plan, local site-specific conditions must be considered and the appropriate ESD determined.

4.4.5.1.1 Loamy (Ly) 10-14" P.Z., High Plains Southeast

"The interpretive plant community for this site is the Historic Climax Plant Community: Rhizomatous Wheatgrass/Needle and Thread Plant Community (HCPC)

Potential vegetation is estimated at 80% grasses or grass-like plants, 10% forbs and 10% woody plants.

The major grasses include rhizomatous wheatgrass, needle and thread, bluebunch wheatgrass, and green needlegrass. Big sagebrush and rubber rabbitbrush are the major woody plants.

A typical plant composition for this state consists of rhizomatous wheatgrass 30-40%, needle and thread 10-20%, bluebunch wheatgrass 5-15%, green needlegrass 5-10%, muttongrass 5-10%, perennial forbs 5-10%, and big sagebrush 5-15%. Ground cover, by ocular estimate, varies from 30-40%.

The total annual production (air-dry weight) of this state is about 1100 pounds per acre, but it can range from about 600lbs./acre in unfavorable years to about 1400 lbs./acre in above average years.

This state is extremely stable and well adapted to the Cool Central Desertic Basins and Plateaus climate. The diversity in plant species allows for high drought resistance. This is a sustainable plant community (site/soil stability, watershed function, and biologic integrity).

Transitions or pathways leading to other plant communities are as follows:

- *Continuous Season-long Grazing will convert the plant community to the Big Sagebrush/Mid Grass Plant Community if big sagebrush is present at 5-10%.*
- *Moderate Continuous Season-long Grazing or Continuous Spring Grazing will convert the plant community to the Blue Grama Sod Plant Community*

- *Heavy Continuous Season Long Grazing with Wild Fire will convert this plant community to the Rabbitbrush/Cheatgrass plant community"* (Figure 4.4-55).

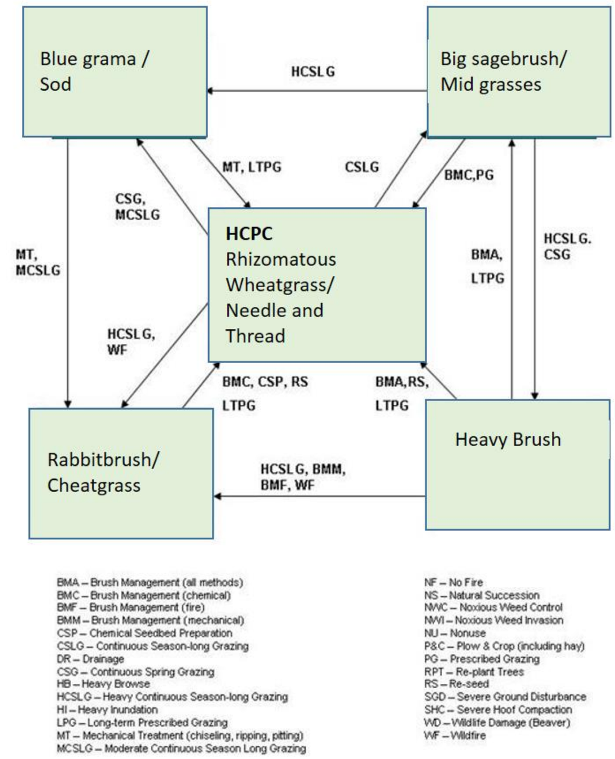


Figure 4.4-55 State and Transition Model: *Loamy (Ly) 10-14" P.Z., High Plains Southeast.*

4.4.5.1.2 Sandy (Sy) 10-14" P.Z., High Plains Southeast

The interpretive plant community for this site is the Reference Plant Community: Needleandthread/ Rhizomatous Wheatgrass Plant Community.

Potential vegetation is estimated at 75% grasses or grass-like plants, 10% forbs and 15% woody plants. The major grasses include needleandthread, Indian ricegrass, and rhizomatous wheatgrass. Big and silver sagebrush are the major woody plants.

A typical plant composition for this state consists of needleandthread 20-50%, rhizomatous wheatgrass 15-25%, Indian ricegrass 10-20%, perennial forbs 5-10%,and shrubs 5-10%. Ground cover, by ocular estimate, varies from 35-45%.

The total annual production (air-dry weight) of this state is about 1200 pounds per acre, but it can range from about 700 lbs/acre in unfavorable years to about 1500 lbs/acre in above average years.

This state is extremely stable and well adapted to the Cool Central Desertic Basins and Plateaus climate. The diversity in plant species allows for high drought resistance. This is a sustainable plant community (site/soil stability, watershed function, and biologic integrity).

Transitions or pathways leading to other plant communities are as follows:

- *Moderate Continuous Season-long Grazing will convert the plant community to the Big Sagebrush/Shortgrass Plant Community if big sagebrush is present at 5-10%.*
- *Moderate Continuous Season-long Grazing or Continuous Spring Grazing with Brush Management (chemical) will convert the plant community to the Threadleaf Sedge/Blue grama Plant Community."* (Figure 4.4-56).

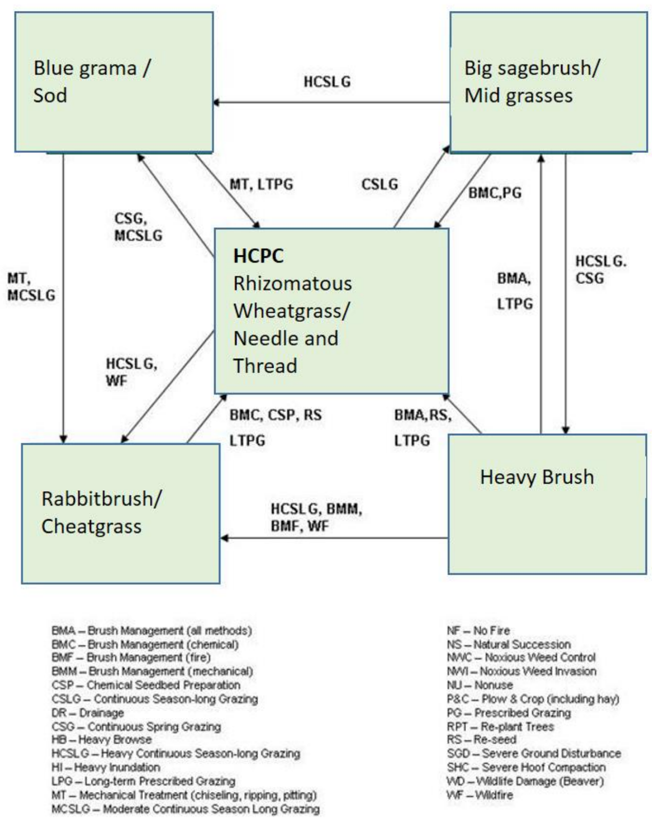


Figure 4.4-56 State and Transition Model: Sandy (Sy) 10-14" P.Z., High Plains Southeast.

4.4.5.1.3 Saline Loamy (SnLy) 10-14" P.Z., High Plains Southeast

"The interpretive plant community for this site is the Historic Climax Plant Community. Potential vegetation is estimated at 60% grasses or grass-like plants, 10% forbs and 30% woody plants. The major grasses include western wheatgrass, needleandthread, and bluebunch wheatgrass. Other grasses include Sandberg bluegrass, prairie junegrass, bottlebrush squirreltail. Birdfoot sagebrush and Gardners saltbush are the major woody plants.

A typical plant composition for this state consists of western wheatgrass 25-35%, needleandthread 5-15%, bluebunch wheatgrass 5-10%, 10-25% other grasses/grasslikes, perennial forbs 5-10%, birdfoot sagebrush 10-20%, and Gardners saltbush 10-20%. Ground cover, by ocular estimate, varies from 15-25%.

The total annual production (air-dry weight) of this state is about 700 pounds per acre, but it can range from about 500 lbs./acre in unfavorable years to about 900 lbs./acre in above average years.

This state is extremely stable and well adapted to the Cool Central Desertic Basins and Plateaus climate. The diversity in plant species allows for high drought resistance. This is a sustainable plant community (site/soil stability, watershed function, and biologic integrity).

Transitions or pathways leading to other plant communities are as follows:

- *Heavy Continuous Season-long Grazing will convert the plant community to the Woody Aster/ Birdfoot Sagebrush Plant Community.*
- *Continuous Season-long Grazing will convert the plant community to the Rhizomatous Birdfoot Sagebrush/Short Grass Plant Community"* (Figure 4.4-57).

4.4.5.2 Range and Grazing Management Components of the Watershed Plan

Based on the information presented above, 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 to areas that do not currently have reliable water. Riparian area plant community condition can be enhanced by development of water 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.

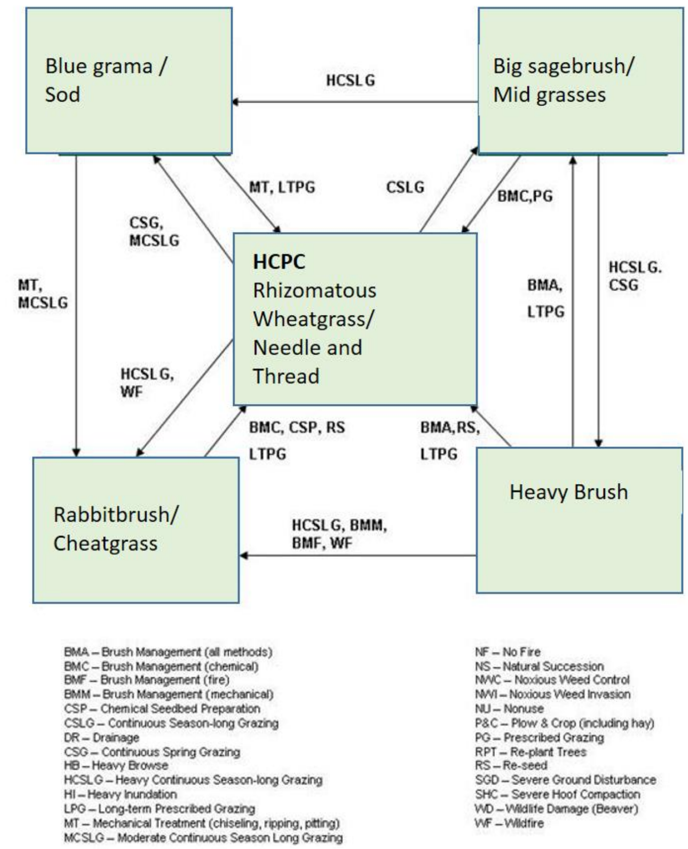


Figure 4.4-57 State and Transition Model: ***Saline Loamy (SnLy) 10-14" P.Z., High Plains Southeast.***

Watershed Plan Component G-4: Most range improvement practices which improve watershed condition, 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.

Watershed Plan Component G-5: Strategies recommended in the state and transition models associated with NRCS descriptions of the ecological sites found within the watershed should be adopted and employed to optimize range conditions through prescribed grazing management and best management practices.

Watershed Plan Component G-6: Prescribed fire may be utilized as a tool to assist in the restoration of range health areas benefitting by this treatment according to the state and transition models. Delineation of specific areas potentially benefitting from this practice was beyond the scope of this Level I project. However, based upon input from landowners and land managers and observations made during the completion of this investigation, it is evident that there are areas which would likely benefit from prescribed fires.

Watershed Plan Component G-7: Application of chemicals may be utilized as a tool to assist in the restoration of range health areas benefitting by this treatment according to the state and transition models. Delineation of specific areas potentially benefitting from this practice was beyond the scope of this Level I project.

These tools can be used to maintain and/or improve watershed function particularly when coupled with implementation of appropriate grazing management strategies.

4.4.6 Other Components (OTH)

4.4.6.1 OTH-001 Spring Creek Flooding (LRCD-001)

This project would involve construction of one or more flood detention structures in the Spring Creek watershed. The purpose of the structures would be to capture flood waters and detain them for later and slower release and thereby reducing peak discharges downstream. Design and optimization of the structures was beyond the scope of this Level I investigation. However, several potential sites were identified, at the conceptual level, on the east side of Laramie where topography and property ownership may make construction of a facility feasible. The facilities would be dry except during or after a rain event or snowmelt. Figure 4.4-58 displays a topographic map of the area in the vicinity of Laramie and three sites where retention facilities could possibly be constructed.
Components of this project would include the following:

- A study would be completed to determine flooding characteristics, capacities of Spring Creek to convey the floodwaters, flood related damages, and mitigation measures, including detention storage.
- Detention storage sites would be evaluated to determine the optimal facility size, location, designs, and costs.

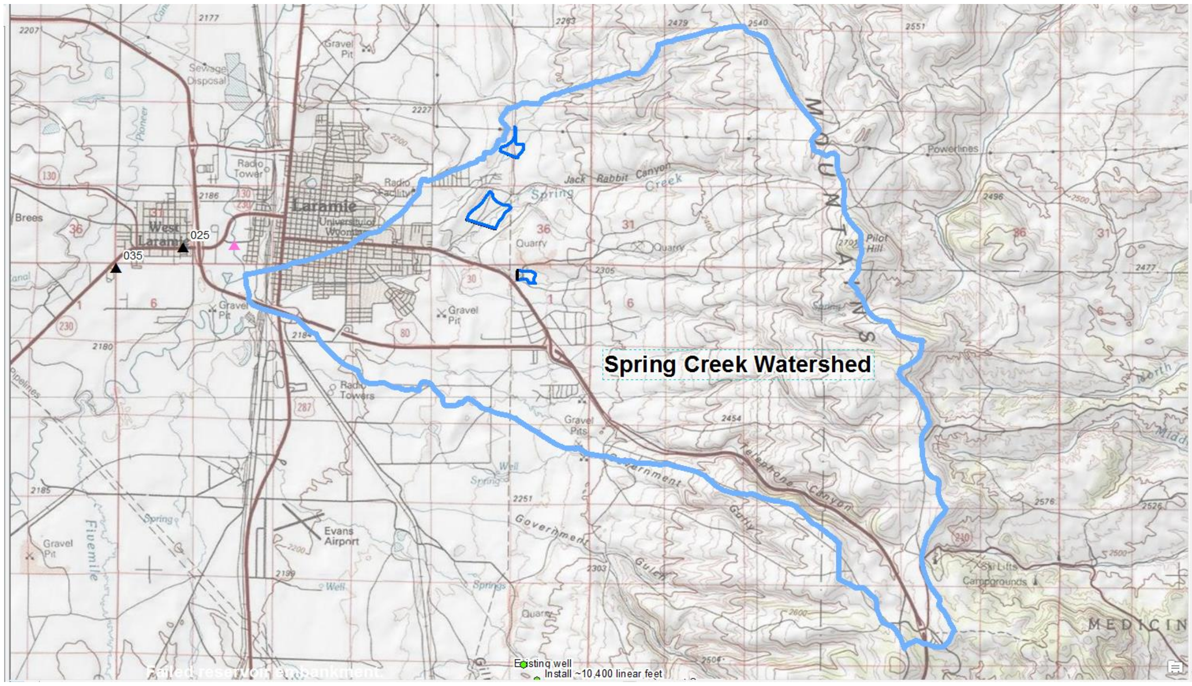


Figure 4.4.58. Potential Flood Mitigation Structures in the Spring Creek Watershed.

4.5 Laramie River Watershed Management Plan

The information presented in this chapter provides recommendations for improvements associated with:

- Irrigation system rehabilitation components
- Livestock / wildlife upland watering opportunities
- Grazing management opportunities
- Storage opportunities
- Stream channel stability components
- Other watershed management plan alternatives

These improvements focus on potential mitigation of several key issues that presently exist within the watershed. For the Upper Laramie River watershed, the watershed management plan consists of a compilation of the recommendations for each category. The plan is summarized in Table 4.5-1.

4.6 Project Prioritization Matrix

In an effort to help the LRCD and the WWDO prioritize projects for completion or funding, a prioritization matrix was prepared. The matrix consists of a tabulation of the individual components of the watershed management plan and various attributes for each. Each component of the plan was assigned a score for each attribute. Table 4.6-1 provides a summary of the attributes and the scoring criteria. Results of the prioritization are presented in Table 4.6-2.

Table 4.5-1 Upper Laramie River Watershed Management Plan.

Watershed Plan Component: Irrigation Rehabilitation Projects (IRR)		
Watershed Management Plan Component	Proponent Number	Project Name
IRR-001	Sigel-001	Hecth Ditch Reconstruction
IRR-002	Rogers-002	Bellamy Ditch Drop-Chute
IRR-003	LCD-001	Last Chance Ditch Point of Diversion
IRR-004	Johnson-002	Simon Johnson Ditch Diversion Replacement
IRR-005	Johnson-003	Simon Johnson 2 Ditch Diversion Replacement
IRR-006	Oasis-001	Oasis Ditch Diversion Replacement
IRR-007	Oasis-002	Parshall Flume Evaluation / Replacement
IRR-008	Oasis-004	Oasis DItch Seepage Evaluation
IRR-009	Edwards-001	Lund Ditch Diversion Reconstruction
IRR-010	Croonberg-001	Hatton No. 2 DIversion Rehabilitation
IRR-011	Croonberg-002	Hatton No. 1 Ditch Diversion Rehabilitation
IRR-012	Croonberg-003	McGIll and Crooger Ditch Splitter Construction
IRR-013	Croonberg-004	Hatton No. 3 and No. 4 Diversion on Dry Creek
IRR-014	Croonberg-005	Hatton Ditch Lateral Check Structure
IRR-015	USFS-001	Ditch Management / Beetle Kill

Watershed Plan Component: Livestock / Wildlife Water Supply Projects (L/W)		
Watershed Management Plan Component	Proponent Number	Project Name
L/W-001	Blake-001	Blake Pipeline Project
L/W-002	BLM-001	Windmill Replacement 1
L/W-003	BLM-002	Windmill Replacement 2
L/W-004	BLM-003	WIndmill Replacement 3
L/W-005	Sigel-002	Sigel Spring Development
L/W-006	Sigel-003	Sigel Pipeline and Stock Tank Installation
L/W-007	Rogers-001	Rogers Stock Reservoir
L/W-008	Johnson-001	Johnson Stock Reservoir
L/W-009	Johnson-004	Stock Reservoir Rehabilitation
L/W-010	Johnson-005	Stock Reservoir Construction
L/W-011	Gaddis-001	Mobile Solar Platform and Pipeline Project
L/W-012	Engen-001	Stock Tank and Pipeline Project
L/W-013	Clay-001	Winter Livestock/Wildlife Water Supply
L/W-014	Clark-001	Fox Creek Resevoir
L/W-015	Churches-001	Churches Pipeline Project
L/W-016	Tenbensel-001	Stock Reservoir Rehabilitation
L/W-017	Kaisler-003	Solar Platform Installation
L/W-18 through L/W-103	ACE-001 through ACE 086	Stock Reservoir Rehabilitation Projects

Watershed Plan Component: Storage Opportunities (STO)		
Watershed Management Plan Component	Proponent Number	Project Name
STO-001	WID-001	Wheatland Reservoir No. 3 Modification

Watershed Plan Component: Stream Channel Opportunities (STR)		
Watershed Plan Component	Proponent Number	Project name
STR-001	Oasis-003	Laramie River at Oasis Ditch
STR-002	Speicer-001	Laramie River at Corrals

Watershed Plan Component: Grazing Opportunities (G)	
Watershed Plan Component	Project name
G-001	Strategic upland livestock / wildlife water sources
G-002	Fencing
G-003	Strategic salting and herding
G-004	Incorporation of wildlife benefits
G-005	State and Transition model strategies
G-006	Prescribed fire
G-007	Chemical application

Watershed Plan Component: Other Opportunities (OTH)		
Watershed Plan Component	Proponent Number	Project name
OTH-001	LRCD-001	Spring Creek Flood Mitigation

Table 4.6-1 Project Prioritization Strategy.

Attribute	Prioritization Matrix Score		
	1	2	3
WWDC Priority [1]	WWDC Priority of 4 or 5	WWDC Priority of 2 or 3	WWDC Priority of 1
Water Rights	Significant permitting effort: ex. PRRIP consumputive use analysis	Routine permitting requirement: ex. WSEO Change in POD, water right	WSEO permit approved or not required
Relative Cost	Estimated project is cost greater than SWPP limit of $135,000	Estimated project cost less than SWPP limit of $135,000	Estimated project cost less than $70,000 (ie SWPP 1:1 match)
Land Ownership	Potentially includes Federal Lands	Potentially includes State Lands but no Federal Lands	Potentially includes Private Lands only
Practical Implementation	Challenging effort	Moderate effort	Routine effort
Ease of Permitting	Federal permits/NEPA	Local or State permits	Permit(s) approved or No permit(s) required
Public Acceptibility	Potential Non-acceptance Anticipated	Moderate Acceptance	Generally Accepted by Public
Ancillary Benefits	Neglible associated benefits	Moderate associated benefits	Mutiple associated benefits
Number of Beneficiaries	1	2 to 8	9 or more

Note [1]

According to the WWDC's recently revised SWPP operating guidelines, project priorities are as follows:

1. Source water development
2. Storage
3. Pipelines, conveyance facilities, solar platforms and windmills
4. Irrigation
5. Environmental

Table 4.6-2 Prioritized Watershed Management Plan Components.

Watershed Plan Component: Irrigation Rehabilitation Projects (IRR)			Prioritization Scoring									
Watershed Management Plan Component	Proponent Number	Project Name	WWDC Priority [1]	Water Rights	Relative Cost	Land Ownership	Practical Implementati	Ease of Permitting	Public Acceptibility	Ancillary Benefits	Number of Beneficiari	Score
IRR-001	Sigel-001	Hecht Ditch Reconstruction	4	2	2	3	2	2	2	1	2	20
IRR-002	Rogers-002	Bellamy Ditch Drop-Chute	4	3	1	3	1	3	2	1	3	21
IRR-003	LCD-001	Last Chance Ditch Point of Diversion	4	1	1	2	1	1	2	1	3	16
IRR-004	Johnson-002	Simon Johnson Ditch Diversion Replacement	4	2	2	1	3	2	2	1	1	18
IRR-005	Johnson-003	Simon Johnson 2 Ditch Diversion Replacement	4	2	2	3	3	2	2	1	1	20
IRR-006	Oasis-001	Oasis Ditch Diversion Replacement	4	1	1	3	1	1	2	3	3	19
IRR-007	Oasis-002	Parshall Flume Evaluation / Replacement	4	3	3	3	3	3	2	1	3	25
IRR-008	Oasis-004	Oasis DItch Seepage Evaluation	4	3	3	2	3	3	2	1	3	24
IRR-009	Edwards-001	Lund Ditch Diversion Reconstruction	4	1	1	2	1	1	2	2	1	15
IRR-010	Croonberg-001	Hatton No. 2 DIversion Rehabilitation	4	2	3	3	2	2	2	1	2	21
IRR-011	Croonberg-002	Hatton No. 1 Ditch Diversion Rehabilitation	4	2	3	3	2	2	2	1	2	21
IRR-012	Croonberg-003	McGIll and Crooger Ditch Splitter Construction	4	2	3	3	2	3	2	1	2	22
IRR-013	Croonberg-004	Hatton No. 3 and No. 4 Diversion on Dry Creek	4	2	3	3	2	2	2	1	2	21
IRR-014	Croonberg-005	Hatton Ditch Lateral Check Structure	4	3	3	3	3	3	2	1	2	24
IRR-015	USFS-001	Ditch Management / Beetle Kill	4	3	2	1	1	3	2	3	3	22

Table 4.6-2 Prioritized Watershed Management Plan Components (continued).

Watershed Plan Component: Livestock / Wildlife Water Supply Projects (L/W)			Prioritization Scoring									
Watershed Management Plan Component	Proponent Number	Project Name										
L/W-001	Blake-001	Blake Pipeline Project	3	2	2	3	3	3	2	2	1	21
L/W-002	BLM-001	Windmill Replacement 1	3	2	3	3	3	3	2	2	1	22
L/W-003	BLM-002	Windmill Replacement 2	3	2	3	3	3	3	2	2	1	22
L/W-004	BLM-003	WIndmill Replacement 3	3	2	3	3	3	3	2	2	1	22
L/W-005	Sigel-002	Sigel Spring Development	1	2	2	3	3	2	2	2	1	18
L/W-006	Sigel-003	Sigel Pipeline and Stock Tank Installation	3	3	3	3	3	3	2	2	1	23
L/W-007	Rogers-001	Rogers Stock Reservoir	2	2	3	3	3	2	2	2	1	20
L/W-008	Johnson-001	Johnson Stock Reservoir	2	2	3	3	3	2	2	2	1	20
L/W-009	Johnson-004	Stock Reservoir Rehabilitation	2	2	3	3	3	2	2	2	1	20
L/W-010	Johnson-005	Stock Reservoir Construction	2	2	3	2	3	2	2	2	1	19
L/W-011	Gaddis-001	Mobile Solar Platform and Pipeline Project	3	2	3	2	3	3	2	2	1	21
L/W-012	Engen-001	Stock Tank and Pipeline Project	3	2	3	3	3	3	2	2	1	22
L/W-013	Clay-001	Winter Livestock/Wildlife Water Supply	1	2	3	3	3	2	2	2	1	19
L/W-014	Clark-001	Fox Creek Resevoir	2	2	3	3	3	2	2	2	1	20
L/W-015	Churches-001	Churches Pipeline Project	3	2	3	3	3	2	2	2	1	21
L/W-016	Tenbensel-001	Stock Reservoir Rehabilitation	2	2	3	3	3	3	2	2	1	21
L/W-017	Kaisler-003	Solar Platform Installation	3	2	3		3	2	2	2	1	18
L/W-18 through L/W-103	ACE-001 through ACE 086	Stock Reservoir Rehabilitation Projects	2	2	3	2	3	2	2	2	1	19

Table 4.6-2 Prioritized Watershed Management Plan Components (continued).

Watershed Plan Component: Storage Opportunities (STO)			Prioritization Scoring									
Watershed Plan Component	Proponent Number	Project name										
STO-001	WID-001	Wheatland Reservoir No. 3 Modification	2	1	1	3	1	1	2	3	3	17
Watershed Plan Component: Stream Channel Opportunities (STR)			**Prioritization Scoring**									
Watershed Plan Component	Proponent Number	Project name										
STR-001	Oasis-003	Laramie River at Oasis Ditch	1	3	3	3	2	2	3	2	3	22
STR-002	Speiser-001	Laramie River at Corrals	1	3	3	3	2	2	3	2	3	22
Watershed Plan Component: Grazing Opportunities (G)			**Prioritization Scoring**									
Watershed Plan Component		Project name										
G-001		Strategic upland livestock / wildlife water sources	n/a: These projects represent general recommendations for incorporation into future planning efforts									
G-002		Fencing										
G-003		Strategic salting and herding										
G-004		Incorporation of wildlife benefits										
G-005		State and Transition model strategies										
G-006		Prescribed fire										
G-007		Chemical application										
Watershed Plan Component: Other Opportunities (OTH)			**Prioritization Scoring**									
Watershed Plan Component	Proponent Number	Project name										
OTH-001	LRCD-001	Spring Creek Flood Mitigation	1	3	1	3	2	2	3	3	3	21

V. PERMITS

V. PERMITS

5.1 Overview

Implementation of any of the projects recommended in the watershed management plan (Chapter 4) will require some form of permit, agency review, easement, or procurement of access consent. Depending on the type of project and the land owner (federal, state, or private), the process can range from a negligible effort to potential road blocks requiring significant efforts to successfully complete. In this chapter, permitting information is provided for a variety of projects as follows:

- Section 5.2: Basic requirements and activities needed to be on the property, collect data and obtain easements are discussed
- Section 5.3: Project-specific permitting requirements are presented for typical projects eligible for funding through the WWDC's Small Water Projects Program (SWPP).
- Section 5.4: Environmental Permitting and Mitigation
- Section 5.5: Information pertaining to online tools and databases to help with the data collection and permitting is presented.

Appendix 5A contains additional information pertaining to each of the federal, state and local agencies.

5.2 Property Access, Easements, and Land Procurement

Permission must be obtained from the landowner, lessee, or management agency prior to any fieldwork on any proposed project area within the watershed. Verbal permission from landowners is sufficient for initial site visits; however, if project specific field data needs collected and potential project alternatives developed then written permission should be acquired. Other negotiations could be necessary for securing easements, rights-of-way (ROW), 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. Permits or right-of-way access are required for the WYDOT and numerous utility and energy entities when project construction involves their properties. 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 Albany County via an online map:

http://www.co.albany.wy.us/map/

or download data:

http://www.co.albany.wy.us/Assessor-maps.aspx

Carbon County parcel data could be accessed via their web map:

http://gis.carbonwy.com/

or order data:

http://www.carbonwy.com/index.aspx?NID=977

5.2.1 Trespassing to Collect Data

In 2015 and 2016, Senate File 12 and Senate File 75 (Trespassing to Collect Data), respectively, were passed by the Wyoming Legislature and signed into law by Governor Mead. These State laws protect landowners' property rights by allowing law enforcement officials to file criminal charges if an individual or entity trespasses onto private property for the purpose of collecting data. The state law also prohibits any information from being used by a government entity if it is collected by someone who trespassed on or across private land. However, if information was illegally collected and provided to a government agency, it will be expunged by the agency, but will be retained to use as evidence against the trespasser.

Because participation in the watershed study is voluntary, the project team worked with the WWDC, local sponsors, and landowners to gain verbal permission before entering private land. Obtaining landowner permission for collecting resource data for the watershed study is required in accordance with Wyoming Statute (W.S.) 6-3-414, Trespassing to Unlawfully Collect Resource Data. Consequently, the project team collected all field data on private lands in the company of the landowner or leasee. Also, global positioning system (GPS) units with 2015 parcel data and a GPS-enabled camera were used to collect field data, which ensures 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. There are a small number of the proposed projects' components that would involve access to rights-of-way along a county road or access to irrigation district infrastructure and would require temporary or conditional use permits 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 NEPA would apply, which is described more in Section 5.5..

5.2.3 Utilities

Permits or right-of-way access are required for numerous utility and energy entities when project construction involves their easements and properties. In the state of Wyoming, the State'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

In the following sections, the permit requirements of specific types of projects within the watershed management plan are presented, including:

- Livestock/wildlife projects
  - Water wells (and spring developments)
  - Stock reservoirs/Ponds
- Irrigation System projects
- Water Storage Projects

Table 5.3-1 presents a tabulation of permits that each of the various agencies may require. Appendix 5A contains additional information regarding the federal, state and local agencies which may require coordination.

5.3.1 Livestock/Wildlife Water Projects

Permits, clearances, and approvals that possibly need to be obtained for typical livestock/wildlife water projects for a typical project component such as a water well, stock reservoir/pond, solar panel and pump, pipeline, and stock tanks are identified in Sections 5.3.1.1 through 5.3.1.4 within this chapter. Additional requirements from various entities may also exist and involve further investigation for some of the proposed projects. The extent of involvement and the nature of coordination would be determined on a project-by-project basis. More detailed discussions of those requirements are included in Appendix 5A.

Table 5.3-1 Tabulation of Agencies and Pertinent Permit Requirements.

Agency	Potential Permit and/or Clearance
Federal	
U.S. Army Corps of Engineers (USACE)	Authorization of Permit for Discharge of Dredged or Fill Material (Section 404 permit) Requires further delineation of jurisdictional wetlands and a wetland mitigation plan.
U.S. Fish and Wildlife Service (USFWS)	Platte River Recovery Implementation Program (PRRIP) Endangered Species Act, Section 7 and 10 consultations
Bureau of Land Management (BLM)	BLM clearance necessary if located or crossing BLM lands, NEPA review required
Forest Service (USFS)	USFS clearance necessary if located or crossing USFS lands, NEPA review required
Natural Resource Conservation Service (NRCS)	NRCS approval necessary if funded by Farm Bill or USDA, NEPA review may be required
State	
Wyoming State Engineer's Office (SEO)	Ground Water Division approval of Water Well Permits Ground or Surface Water Division approval of Spring Development Permits Surface Water Division Approval of Ditches, Pipelines, and Changes in Points of Diversion Surface Water Division Approval of Diversion or Headgates carrying 50 cfs Surface Water Division approval of Reservoir Permits Safety of Dams Approval of Dam Modifications Platte River Recovery Implementation Program (PRRIP)
Wyoming State Historical Preservation Office (SHPO)	SHPO compliance letter for projects on federal land or that include a federal action
Wyoming Game and Fish Department (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 Greater Sage-Grouse Core Area Protection
Wyoming Department of Environmental Quality (WDEQ)	401 Certification for 404 Permits under the federal Clean Water Act WYPDES Construction General Permit (CGP) for Large Construction Activity (> 5 acres) or Small Construction Activity (between 1 acre and 5 acres) Applicable Water Quality Standards for Wells, Reservoirs, and Streams
Wyoming Office of State Lands and Investments (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

	Electrical installations must be performed by licensed electricians unless exempted
Local	
Albany County	Permits for building structures, wind energy systems, aquifer protection, and floodplain development
Carbon County	Permits for building structures, wind and solar energy systems, and floodplain development
Special Districts	Permits or clearances from special districts including water and sewer, sanitary and improvement, flood control, irrigation, road, and improvement/service districts

5.3.1.1 Water Well

Drilling a water well or rehabilitating an existing water well to provide a source of livestock/wildlife water are typical projects in the watershed management plan. In the state of Wyoming, any person drilling a water well must obtain a water right permit prior to constructing any well by making 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 in accordance with Title 41 Water, Chapter 3 Water Rights; Administration and Control (W.S. 41-3-930). Necessary 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

Also, the drilling and/or pump contactor and the well owner must comply with the requirements pursuant to 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:

https://sites.google.com/a/wyo.gov/seo/ground-water/water-well-construction

Additionally, the water quality of the completed well must be suitable for livestock and cannot exceed suitability constituents for any of the Class III Groundwater standards (Table I) of Chapter 8, Quality Standards for Wyoming Groundwaters (W.S. 35-11-302), which can be accessed at the website:

http://deq.wyoming.gov/wqd/groundwater/resources/rules-regs/

Spring developments (which can be technically considered wells) also need to be permitted by the SEO in accordance with either their ground water 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 (i.e., no machinery used), and is identifiable as ground water, then the spring is permitted by making 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 in accordance with Title 41 Water, Chapter 3 Water Rights;

Administration and Control (W.S. 41-3-930). If a spring development doesn't meet of the described conditions, then the spring is permitted by completing 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 involving the storage or impoundment of water. Stock reservoirs must not exceed 20 acre-feet in capacity, cannot have a dam height greater than 20 feet, and the use of the stored water should be for stock purposes only pursuant with Title 41 Water, Chapter 3 Water Rights; Administration and Control, Article 3 Reservoirs (W.S. 41-3-301). Any individual or entity intending 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 in accordance with 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. Additionally, the water quality of a completed stock reservoir or pond must be suitable for 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) found at the website:

http://deq.wyoming.gov/wqd/surface-water-quality-standards/

In addition, the construction or rehabilitation of a reservoir would typically involve the discharge 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). Because numerous waterbodies and wetlands are considered waters of the United States, they are subject to the United States Army Corps of Engineers' (USACE) regulatory authority. 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 pre-construction notification (PCN) to the USACE, the PCN is forwarded to the WDEQ for review under Section 401 of the CWA. 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

Rehabilitation of existing diversions, ditches, or pipelines for diverting irrigation water from a river, creek, or reservoir to irrigated lands are also typical projects in the watershed management plan. This type of a project requires verifying the applicable water rights to ensure 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 proposed project does not involve a change in the point of use, point of diversion, or an enlargement, additional approval from the SEO is not likely to be required. Before initiating any irrigation structure project, however, the SEO should be consulted for a final determination of their requirements.***

However, any enlargement or change in point of use of the structure or facility would require the submittal of an application and/or petition to the SEO and the Board of Control (BOC) 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 intending to construct a new diversion structure, ditch, or pipeline from a stream that does not use an existing, permitted structure or facility must make 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). It is recommended that coordination with the SEO occur with any proposed project before rehabilitating an existing structure or constructing a new one. Moreover, there may be additional permission or approval necessary if the structure or facility supplies water to any other irrigators or water users.

In addition to the SEO requirements, the construction or rehabilitation of a diversion structure including a headgate, weir, or diversion dam along with any associated in-stream or streambank work would involve the discharge of dredged or fill material into a waters of the United States and could require permitting under Section 404 of the CWA. It is recommended that coordination with the USACE occur to determine any agricultural exemptions from Section 404 regarding the construction or maintenance of 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 via the website:

http://www.nwo.usace.army.mil/Missions/Regulatory-Program/Wyoming/

Again, 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 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

As discussed in Section 4.2, construction of dams and reservoirs greater than 20 acre-feet in size face a multitude of legal constraints. The reader is directed to Section 4.2 and Appendix 4B for a review of these issues. In the remainder of this section, additional permit requirements associated with dams and reservoirs are presented.

Any individual or entity intending to construct a new reservoir or enlarge an existing reservoir exceeding 20 acre-feet in capacity or having a dam height greater than 20 feet must make application to the SEO using their Application for Permit to Appropriate Surface Water (S.W.3 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 3 Reservoirs (W.S. 41-3-301). Applications and instructions for 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 proposing 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 diversion system with headgates or diversion structures carrying 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, the construction or rehabilitation of a reservoir or pond typically involves the discharge of dredged or fill material into waters of the United States and could require permitting under Section 404 of the federal Clean Water Act (CWA). Because numerous waterbodies and wetlands within the study area are considered waters of the United States, they are subject to the USACE' Section 404 regulatory authority. Section 404 applications and instructions can be obtained by contacting the USACE's Wyoming Regulatory Office by telephone (307) 772-2300 or can be obtained by visiting the website:

http://www.nwo.usace.army.mil/Missions/Regulatory-Program/Wyoming/

Again, 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 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 for securing permits under the federal CWA and Section 7 consultation under the federal ESA. The timeframe 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. The issuance of a 404 permit for discharge must only be for the least environmentally damaging practicable alternative to the aquatic ecosystem and does not have other significant adverse environmental consequences.

Generally, the effort to comply with the 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 while the NRCS would likely be the lead agency for any reservoir project funded by USDA on private lands. For proposed reservoirs on private lands funded privately or by state programs, the permitting process still requires that NEPA be addressed and would be led by the appropriate local or state agency or landowner. Coordination with the USACE would be required prior to initiation of any water storage project. 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 along the Central Platte River in Nebraska resulted in the signing of a cooperative agreement in 1997 for the Platte River Recovery Implementation Program (PRRIP) between the United States Department of Interior (USDI), 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 along the Central Platte River in compliance with the ESA. The state of Wyoming has adopted their Wyoming 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 visiting the SEO's website:

https://sites.google.com/a/wyo.gov/seo/interstate-streams/know-your-basin/platte-river-basin or accessed via the USFWS' website:

https://www.fws.gov/platteriver/

5.3.4 Other Project Types

Permit and clearance approvals for any the proposed projects ultimately depend on the site-specific project and its location. Generally, the permits, clearances, and approvals discussed in Sections 5.3 through 5.5 could also be applicable for any proposed municipal, rural domestic water, groundwater exploration, weather modification, pipelines and conveyance facilities, wetland development, environmental (streambank, water quality, 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 possibly 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; avoiding the need for mitigating significant impacts. Avoiding potential impacts to species of concern and their associated habitats could typically be accomplished by scheduling construction activities outside of the relevant nesting, parturition, breeding, or migration seasons. Sage grouse core area needs are discussed in Section 5.4.3.

5.4 Environmental Evaluation

5.4.1 National Environmental Policy Act Compliance

Compliance with the NEPA typically applies whenever a proposed project 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 or USFS lands or would be a recipient of U.S. Department of Agriculture (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, in regards to the NRCS providing technical assistance to conservation districts and landowners on any proposed project funded by the WWDC's Small Water Project Program (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.*

5.4.2 Proposed, Threatened, and Endangered Species

The following species have the potential to occur within the proposed project areas within the watershed study area [Wyoming Natural Diversity Database, 2016]:

Endangered:	Black-footed ferret (Mustela nigripes)
	Wyoming toad (Anaxyrus baxteri)
	Whooping Crane (Grus Americana)
Threatened:	Greenback cutthroat trout (Oncorhynchus clarkii stomias)
	Canada lynx (Lynx canadensis)
	Grizzly Bear (Ursus arctos arctos).

(It is important to note the although the grizzly bear sightings appear to be pre-1900, the species is still included in the WYNDD database as a threatened species which could be encountered within the study area.)

5.4.3 Other Species of Concern

The Wyoming Natural Diversity Database (WYNDD) records and maintains a list of plant species in Wyoming that are thought to be rare or sensitive, as discussed in Section 3.3.4.2. Table 3.7 lists the tracked or watched status of 39 plant species of concern that potentially occur within the study area. Tracked species are those that are vulnerable to extirpation because of rarity, inherent vulnerability, or habitat threats. Watched species are those that appear to be presently secure but have limited distribution. Although some of these plant species could occur on a proposed project area, none of the species are currently protected by state or federal regulation but still deserve appropriate planning and implementation considerations.

Also, the WYNDD records and maintains a list of species for amphibians, birds, crustaceans, fish, insects, mammals, mollusks, and reptiles in Wyoming that are thought to be rare or sensitive, as discussed in Section 3.3.7.3. Appendix 3C lists the tracked or watched status of 6 amphibians, 73 birds, 4 crustaceans, 4 fish, 7 insects, 30 mammals, 8 mollusks, and 3 reptiles [WYNDD, 2016]. Appendix 3C also shows that the Greater sage-grouse is classified as "Not Warranted for Listing," which reflects the U.S. Department of Interior's decision in September 2015 to withdraw the sage-grouse from the USFWS's candidate species list, which is discussed in Section 3.3.7.4.

The Greater sage-grouse is still recognized as a sensitive species/species of concern by the BLM and a species of concern by the WGFD. In June 2008, Executive Order 2008-2 was signed by the Governor which stresses additional management consideration to sage-grouse and sage-grouse habitat statewide. In July 2015, Executive Order 2015-4, Greater Sage-Grouse Core Area Protection, was signed by Governor Mead, which requires 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. 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 website:

https://wgfd.wyo.gov/Habitat/Sage-Grouse-Management

Sponsors for a proposed project within the watershed should contact the WGFD at least 60 days prior to submitting an application for a permit or project so any sage-grouse related issues could be identified and any stipulations could be incorporated before commencing project activities.

5.4.4 Fish Distribution, Wildlife Habitat Distribution, 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) will be obtained, described, mapped, and incorporated into the study's ArcGIS geodatabase and digital library. Fish habitats within the study area could include perennial and intermittent streams, springs, lakes, ponds, and reservoirs that support fish through at least a portion of the year. Available fish survey and habitat investigations would be obtained from the WGFD, UW, and USFS and included as part of the study effort.

The WGFD geodata that shows hunt areas, herd units, seasonal range, crucial ranges, parturition areas, and migration routes and barriers for antelope, elk, mule deer, moose, and white-tailed deer within the watershed has already been collected. The project team would coordinate with the WWDO in requesting sensitive and threatened/endangered species information and data for the watershed from the Wyoming Natural Diversity Database (WYNDD). The WYNDD records and maintains a list of species in Wyoming that are thought to be rare or sensitive. Tracked species are those that are vulnerable to extirpation because of rarity, inherent vulnerability, or habitat threats. Watched species are those that appear to be presently secure but have limited distribution. The WGFD also maintains geodata for the Greater sage-grouse, including core areas, distribution, and habitat connectivity and corridors.

5.4.5 Fish Species

The Upper Laramie River and its tributaries (Seven Mile Creek, Fourmile Creek, Cooper Creek, Mill Creek, Middle Fork Laramie River, Spring Creek, and Libby Creek), along with Lake Hattie, Meeboer Reservoir, Twin Buttes Lake, Wheatland No 3 reservoir, and small ponds or reservoirs, provide fish habitat and sport fishing opportunities. The alternatives for rehabilitating reservoirs, dam embankments, and inlet/outlet ditches may have impacts to the streams and reservoirs and associated fishery resources; therefore, coordination with the WGFD is recommended before proceeding with any of the proposed alternatives. Most of the other proposed projects such as livestock/wildlife water developments are expected to have no direct effect on fishery resources because they are off channel/upland projects.

5.4.6 Big-Game Species

The watershed contains portions of crucial big-game habitat for antelope, elk and mule deer managed by the WGFD and seasonal ranges for several big-game species as described in Section 3.3.7.2. Additionally, WGFD Crucial Habitat Priority Areas exist within the watershed that contains big-game crucial winter ranges and year-long ranges. Crucial habitats have biologically important features that need to be protected or managed to maintain viable, healthy wildlife populations and are where the WGFD concentrates their habitat protection and management activities. Typically, the proposed projects included in the Watershed Management Plan are implemented in a manner that improves or maintains these habitat features.

5.4.7 Wetlands Delineation

Site-specific wetland delineation and inventories were not part of the scope of the watershed study. Geospatial data for the mapped National Wetlands Inventory (NWI) areas are listed in Table 3.13 and shown in Figure 3.10. This mapping was used in preparing conceptual proposed project plans listed in Section 4.3.1 for irrigation systems and in Section 4.4.2 for livestock/wildlife water 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 with 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 determined by certified wetland delineations.

5.5 Planning Resources and Tools

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

5.5.1 Wyoming Department of Enterprise Technology Services (ETS)

The Wyoming Department of ETS was established to increase the ability of state agencies to deliver quality cost-effective services to the Wyoming citizens. The ETS' "State Agency Map Portal", which can be accessed via the website (gis.wyo.gov), provides links for GIS web applications with publicly accessible maps, as shown in Table 5.5-1.

Table 5.5-1 Wyoming Department of Enterprise Technology Services State Agency Map Portal GIS Web Applications.

Agency	Address	Description
Enterprise Technology Services (ETS)	*http://gis.wyo.gov/parcels/*	Wyoming Statewide Parcels
	http://gis.wyo.gov/Wyofires/	Wyoming Current Fire Map
State Parks and Historic Trails	*http://gis.wyo.gov/WYOutsideResourceGuide/*	State Parks Events Info
Office of State Lands and Investment (OSLI)	*http://www.onanypc.com/statelandaccess/*	Public Access to State Lands
	http://www.onanypc.com/osligis/oilandgas/	State 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 Map
	http://psc.state.wy.us/htdocs/Dwnload/CertMaps/Gas.pdf	Gas Utilities Certificate Area Map
State Engineer's Office (SEO)	*http://seo.maps.arcgis.com/home/index.html*	State Engineer's Office Information
Wyoming Department of Environmental Quality (WDEQ)	*http://deq.state.wy.us/lqd_permit_public/*	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.uwyo.edu/data/maps/published.html*	Geologic Maps
	http://www.wsgs.uwyo.edu/Data/GIS/IMS-Projects.aspx	Various geologic mapping projects
	http://www.wsgs.uwyo.edu/Data/GIS/	Digital data by theme

Wyoming Geographic Information Science Center (WyGISC)	*http://www.uwyo.edu/wygisc/*	Home page for WyGISC
Wyoming Climate Office	*http://www.wrds.uwyo.edu/sco/data/PRISM/PRISM.html*	PRISM Climate Data Server
	http://ims2.wrds.uwyo.edu/Website/Statewide/	Water/Climate Map Server

5.5.2 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 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 district boards and employees and WACD Directors, staff, and advisors. Requests for access to SuiteWater must be submitted to the WACD for approval.

http://suitewater.wygisc.org/

5.5.3 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 soils 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.

5.5.4 Wyoming Cultural Resource Information System

The Wyoming State Historic Preservation Office (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:

https://nrex.wyo.gov/

and the Cultural Resource Management Tracker (CRMTracker) via:

http://www.gnomon.com/CRMTracker/CRMTracker_AllOrg/CRMTrackerHome.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 State Historic Preservation Office by telephone (307) 777-7697or via the website:

http://wyoshpo.state.wy.us/OLResources/Index.aspx

5.5.5 Natural Resource and Energy Explorer

The Natural Resource and Energy Explorer (NREX) is a web GIS-based software tool that supports pre-planning development considerations by enabling discovery; energy analysis and assessment, environmental, cultural, socioeconomic, and infrastructural assets for user-defined, project-scale areas of interest in the state. 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. NREX could be used by developers, conservationists, consultants, planners, policy makers, and managers for resource assessment. NREX can be accessed via the website:

https://nrex.wyo.gov

5.5.6 Wyoming State Engineer's Office e-Permit System

The Wyoming State Engineer's Office (SEO) e-Permit system facilitates the supervision and protection of 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 right 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/

5.5.7 Wyoming Interagency Spatial Database and Online Management System

The Wyoming Interagency Spatial Database and Online Management (WISDOM) System is another online planning tool that allows individuals to access data about 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, the Nature Conservancy, 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. WISDOM is available online at:

http://wisdom.wygisc.org/

5.5.8 Wyoming Density and Disturbance Calculation Tool for Greater Sage-Grouse

The Wyoming Geographic Information Science Center (WyGISC), in partnership with the Wyoming Game and Fish Department (WGFD), the BLM, and the USFS created the Greater Sage-Grouse Online Density and Disturbance Calculation Tool (DDCT), which is a web-based application tool that calculates both the number of disruptive activities averaged per square mile and total surface disturbance within the DDCT assessment area for proposed projects in protected sage-grouse core areas. The DDCT web application is used by individuals in preparation of required permits for a development activities. Users must register before the web application can be used. The DDCT is available online at:

http://ddct.wygisc.org/

5.5.9 U.S. Fish and Wildlife Service Information for Planning and Conservation (IPaC)

The U.S. Fish and Wildlife Service's (USFWS) Information for Planning and Conservation (IPaC) is a web-based application that is available to anyone needing 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 and could help improve the efficiency of project planning, discussions, and recommendations.

IPaC is available online at:

https://ecos.fws.gov/ipac/

Additional assistance regarding IPaC or USFWS requirements 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

VI. FUNDING OPPORTUNITIES

VI. FUNDING OPPORTUNITIES

6.1 Overview

Sources of funding and financing for proposed projects within the watershed and the associated technical support and assistance are available from various local, private, state, and federal entities. The widespread opportunities described in this Level I watershed study, watershed management plan, and 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 Upper Laramie River Watershed. Land and water users and managers interested in voluntarily implementing conservation projects and programs should be aware of the partnership opportunities and program incentives available in 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 with a smaller group of these entities also providing financial assistance. Private contributions, such as in-kind provisions, are vital in 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 project and program 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://ofmpub.epa.gov/apex/watershedfunding/f?p=fedfund:1*)

- **Habitat Extension Bulletin No. 50 – Fisheries and Wildlife Habitat Cost Share Programs and Grants** *is* published by the Wyoming Game and Fish Department and provides a very comprehensive listing of potential funding sources for fisheries and wildlife habitat projects. The document is available at the following website:
  http://wgfcms.wyo.gov/WGFD/media/content/PDF/Habitat/Extension%20Bulletins/B50-Fisheries-and-Wildlife-Habitat-Cost-Sharing-Programs-and-Grants.pdf

Additional information about potential funding sources were reviewed and incorporated from previous watershed studies completed on behalf of the WWDC and specifically included excerpts from the *Upper North Platte River Watershed Study Watershed Management Plan* [Anderson Consulting Engineers, 2015] and the *Middle North Platte River Watershed Management Plan, Level I Watershed Study* [RESPEC, 2014]. These potential sources 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 private organizations. Additionally, the contact information for these sources can and does change occasionally. Important contact information for local conservation organizations include, but are certainly not limited to, the following contacts:

- Laramie Rivers Conservation District (307-721-0072)
- Medicine Bow Conservation District (307-379-2221)
- Laramie NRCS Field Office (307-223-3271)
- Medicine Bow NRCS Office (307-326-5657)
- Bureau of Land Management/Rawlins District Office (307-328-4200)
- USFS Medicine Bow National Forest: Laramie Ranger District (307-326-5258)
- WGFD Laramie Regional Office (307-745-4046)

Table 6.1-1 summarizes the potential funding sources mentioned in this section.

6.2 Local Agencies

6.2.1 Conservation Districts

The Laramie Rivers Conservation District will be the primary point of contact for information contained within this report. However, approximately 46,000 acres of the study area do fall within Medicine Bow Conservation District boundary. The portion of the watershed within Colorado is within the Fort Collins Conservation District and lies outside of the study area. Conservation districts are locally led, locally elected county government entities. They function as representatives of local people with responsibility for 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 are providers of information and education at the local level. Districts also provide technical assistance as local resources, capacity, and expertise allow. They can assist in developing and implementing program and project design and funding through assistance in proposal preparation, presentation, and pursuit of grant assistance. Conservation districts can provide funding assistance, often through in-kind contributions such as staff time and technical aid. They can administer programs, projects, and grants on behalf of recipients of state and federal natural resource programs. Districts can assist with developing leveraged, partnered programs and projects. Additional information can be found on their website (*http://www.conservewy.com*) or through the contacts below:

Table 6.1-1 Summary of Potential Funding Sources.

Agency/Entity	Program Name	Project Type(s)	Internet Site	Telephone	Email
Local					
Laramie Rivers Conservation District	n/a	Liaison, in-kind administrative and technical assistance, program coordination/partnering	http://www.lrcd.net/	307-721-0072	tony.hoch@lrcd.net
Medicine Bow Conservation District	n/a		http://www.nrcs.usda.gov/wps/portal/nrcs/detail/wy/contact/local/?cid=nrcs142p2_027318	307-379-2221	justin@medbowcd.org
NRCS Laramie Office	n/a	See Federal NRCS	http://www.nrcs.usda.gov/wps/portal/nrcs/site/wy/home/	307-223-3271	ruben.vasquez@wy.usda.gov
NRCS Medicine Bow Office	n/a		http://www.nrcs.usda.gov/wps/portal/nrcs/site/wy/home/	307-326-5657 Ext. 101	mark.shirley@wy.usda.gov
Carbon County Weed and Pest	n/a	Technical assistance, Cost-share programs, inspection service	http://www.carboncountyweed.com/	307-324-6584	ccwpsupervisor@gmail.com
Albany County Weed and Pest	n/a		http://www.albanycountyweedandpest.com/	307-742-4469	acwpcd1@wildblue.net
State					
Wyoming Department of Environmental Quality	Nonpoint Source Implementation Grants (319 Program)	Water quality BMPs	http://deq.wyoming.gov/wqd/non-point-source/resources/grant-resources/	307-777-6080	jennifer.zygmunt@wyo.gov
Wyoming Game and Fish Department	Habitat Trust Fund	improving wildlife habitat, promote human understanding and enjoyment of fish and wildlife	https://wgfd.wyo.gov/	Paul Dey (307)777-4505	paul.dey@wyo.gov
	Fish Passage Grants	create and improve upstream and downstream passage of all life stages of fish		Nick Scribner (307)332-7723 Ext 277	nick.scribner@wyo.gov
Wyoming Office of State Lands and Investments	Farm Loan Program	Projects involving most agricultural purposes	http://lands.wyo.gov/	Bridget Hill Director 307-777-6629	bridget.hill1@wyo.gov
	Joint Powers Act Loan Program	Aids cities, counties, and special districts in providing needed services			
Wyoming Water Development Commission	Wyoming Water Development Program	New development, dams and reservoirs, rehabilitation, water resources planning	http://wwdc.state.wy.us/	307-777-7626	harry.labonde@wyo.gov
	Small Water Project Program	Small reservoirs and stock ponds, wells, pipelines/conveyance, spring developments, windmills, wetland			jodie.pavlica@wyo.gov
Wyoming Wildlife and Natural Resource Trust	n/a	Aquatic and wildlife habitat improvement, including water developments, prescribed burns, invasive plant control, etc.	http://wwnrt.state.wy.us	Mike Massie (District 2) 307-742-5383	n/a
Federal					
Bureau of Land Management	Riparian Habitat Management Program	Projects to maintain, restore, improve, protect and expand riparian/wetland areas	http://www.blm.gov/wy/st/en.html	307-3328-4200 or 4256 (Rawlins FO)	Rawlins_WYMail@blm.gov
	Range Improvement Planning and Development	Reservoirs, pits, spring developments, wells, and associated distribution pipelines	http://www.blm.gov/wy/st/en/info/offices.html		
	Watershed and Water Quality Improvement	Watershed health assessments, BMP implementation			
Bureau of Reclamation	WaterSMART Grants Program	Water conservation, efficiency and marketing	http://www.usbr.gov/WaterSMART/grants.html	Carlie Ronca (Area Manager) 307-261-5671	http://www.usbr.gov/gp/contact.html
Environmental Protection Agency	Urban Waters Program	Helps communities restore urban waters	https://www.epa.gov/urbanwaters/urban-waters-small-grants	800-227-8917 (Region 8 EPA)	r8eisc@epa.gov
	Healthy Watersheds Program	Consortium to support individual waterhsed protection projects	https://www.epa.gov/hwp/what-epa-doing-healthy-watersheds		
Farm Service Agency	Conservation Reserve Program (CRP)	Removal of highly erobible lands from production	https://www.fsa.usda.gov/programs-and-services/conservation-programs/index	307-261-5231	gregor.goertz@wy.usda.gov
	Farmable Wetlands Program	Restores wetlands and wetland buffer zones that are farmed			
	Grassland Reserve Program	Prevents grazing and pasture land from becoming cropland/urban			
	Emergency Conservation Program (ECP)	Emergency livestock watering conservation during severe drought			
Fish and Wildlife Service	Partners for Wildlife Habitat Restoration	Various fish and wildlife habitat restoration projects	http://www.fws.gov/partners/?viewPage=home	307-332-8719	Mark_J_Hogan@fws.gov
	Wildlife and Sport Fish Restoration (WSFR) Program	provides oversight and/or administrative support for projects related to conservation, enhancing fish/wildlife habitat	http://wsfrprograms.fws.gov/home.html	303-236-4411	david_mcgillivary@fws.gov
	Cooperative Endangered Species Conservation Fund	Grants for voluntary conservation projects related to candidate,listed and proposed endangered species	http://www.fws.gov/endangered/grants/	303-236-4252	Michael_Thabault@fws.gov
	North American Wetlands Conservation Act Program	Various wetlands conservation projects	http://www.fws.gov/birds/grants/north-american-wetland-conservation-act.php	406-549-0732 (Intermountain West Joint Venture)	info@iwjv.org
	Fish and Wildlife Service's (FWS) Challenge Cost Share Program	Projects and partnerships benefitting refuges	http://www.fws.gov/refuges/policiesandbudget/challengecostshareprogram.html	Mountain-Prarie Region 303- 236-8102	mountainprairie@fws.gov
United States National Forest Service	Secure Rural Schools Program: Title II Funds	Protection, restoration and enhancement of fish/wildlife habitat	http://www.fs.usda.gov/main/pts/specialprojects	307-745-2323 (Aaron Voos	atvoos@fs.fed.us
Natural Resources Conservation Service	Grazing Lands Conservation Initiative (GLCI) Grants	See websites and/or local contacts for detailed information on these programs	http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/technical/?cid=nrcs143_008456	307-233-6750 (State Office) 307-223-3271 (Laramie Office) 307-326-5657 Ext. 101 (Medicine Bow Office)	astrid.martinez@wy.usda.gov
	Emergency Watershed Protection (EWP)		http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp/		
	Watershed Protection and Flood Prevention Operations Program (WFPO)		http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/wfpo/		
	Watershed Surverys and Planning		http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/wsp/		
	Environmental Quality Incentives Program (EQIP)		http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/		
	Conservation Stewardship Program (CSP)		http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/csp/		
	Regional Conservation Partnership Program (RCPP)		http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/farmbill/rcpp/		
	Agricultural Management Assistance (AMA)		http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/financial/ama/?cid=stelprdb1242818		
	Conservation Innovation Grants (CIG) Program		http://www.nrcs.usda.gov/wps/portal/nrcs/detail/mo/home/?cid=stelprdb1242734		
	Agricultural Conservation Easement Program (ACEP)		http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/acep/		
	Sage Grouse Initiative (SGI)		http://www.sagegrouseinitiative.com/	Brian Jensen WY State Biologist, 307-233-6740	brian.m.jensen@wy.usda.gov
US Army Corps of Engineers	See website for program names	Planning, Floodplain Mangement, Flood Damage, Aquatic Ecosystem Restoration	http://www.usace.army.mil/	202-761-0011	hq-publicaffairs@usace.army.mil
USDA Rural Development Utilities	See website for program names	Water/Wastewater disposal facilities	http://www.rd.usda.gov/about-rd/agencies/rural-utilities-service	Connie Baker Wolfe (WY State Director) 307-233-6700	
Wyoming Landscape Conservation Initiative (WLCI)	See website for program names	habitat projects to improve aquatic habitats and terrain	http://www.wlci.gov/	307-352-0227	blm_wy_wlci_wymail@blm.gov
Private					
Ducks Unlimited	See website for program names	Waterfowl aquatic and upland habitat protection, restoration and enhancement	http://www.ducks.org/conservation/du-regional-offices	Great Plains Regional Office: 701-355-3500	http://www.ducks.org/about-du/contact-du-onlin
National Fish and Wildlife Foundation	Acres For America	Conserves lands of national significance, protects fish and wildlife habitat	http://www.nfwf.org/whatwedo/programs/Pages/home.aspx	202-857-0166 (Rocky Mtn Region)	seth.gallagher@nfwf.org
	Bring Back the Natives Grant Program	Riverine habitat and aquatic species restoration projects			
	Conservation Partners Program	Targets Farm Bill funds toward top priority conservation objectives			
	Five-Star Urban Waters Restoration Grant Program	Supports community-based wetland and riparian restoration			
	Pulling Together Initiative	Long-term weed management projects			
	Environmental Solutions for Communities Initiative	Supports projects that link economic development to stewardship of the environment			
Trout Unlimited	See website for program names	Erosion control, fish habitat structures, willow and other riparian plantings, etc.	http://www.tu.org/	1-800-834-2419 (National Office)	trout@tu.org

Laramie Rivers Conservation District
5015 Stone Road
Laramie, WY 82070
(307) 721-0072

Medicine Bow Conservation District
510 Utah Street
Medicine Bow, WY 82324
(307) 379-2221

6.2.2 County Weed and Pest Districts

County Weed and Pest Districts in Albany and Carbon 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:

- Albany County Weed and Pest (307-742-4469)
- Carbon County Weed and Pest (307-324-6584)

Statewide weed and pest information can be obtained from: *http://www.wyoweed.org/*

6.3 State Programs

6.3.1 Wyoming Department of Environmental Quality

The WDEQ Water Quality Division administers the Nonpoint Source Program, which solicits funding proposals under Sections 319 and 205(j) of the Clean Water Act that address nonpoint sources of pollution within the state of Wyoming. Program funding depends upon federal budget appropriations and the annual fund allocation from the EPA to the state of Wyoming. Funded proposals usually address multiple program objectives such as BMP installation, agriculture and urban, information and education, and BMP effectiveness or water quality monitoring.

- **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.

- **Section 205(j)** funds are available to cities, towns, counties, and conservation districts for water quality management planning projects. These funds are not intended for construction or implementation of water quality controls, but rather, are to be targeted for water quality planning and assessment.

Information regarding program eligibility, priorities, and applications is available at the WDEQ Non-point Source Grant Resources website: *http://deq.wyoming.gov/wqd/non-point-source/resources/grant-resources/*

6.3.2 Wyoming Game and Fish Department

The following summary of funding assistance available from the Wyoming Game and Fish Department (WGFD) is quoted from the Water Management & Conservation Assistance Program Directory (WWDC, 2014). The full document can be accessed here:

http://wwdc.state.wy.us/wconsprog/2014WtrMgntConsDirectory.html

"The Wyoming Game and Fish Department may offer technical and funding assistance to help landowners, conservation groups, institutions, land managers, government agencies, industry, and non-profit organizations develop or maintain water sources for fish and wildlife. Assistance may also be provided for protecting or improving riparian areas/wetlands, restoring streams, and upgrading irrigation infrastructure in a manner that provides improved fish passage or diversion screening."

- **Habitat Trust Fund:** Funds can be used for acquiring, maintaining, or improving wildlife habitat; or for promoting 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 WGFD 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. Approximately $600,000 to $1,200,000 is allocated annually to projects across Wyoming. For more information related to this fund, contact Paul Dey at Wyoming Game and Fish (*paul.dey@wyo.gov*).

- **Fish Passage Grants:** Funds can be used for creating or improving upstream or downstream passage fish in Wyoming waterways and for screening diversions. Examples include developing fishways or fish ladders, assisting with the replacement of traditional push-up diversion dams with more fish-friendly options, and installing various screening technologies to keep fish from becoming entrained into irrigation ditches. All proposals must have a WGFD sponsor and be entered into a WGFD? proposal database by early January 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. Approximately $25,000 to $90,000 is allocated annually to projects across Wyoming. The project information and application sheet is included with the digital library delivered with this report.

Additionally, during its 2014 session, the Wyoming Legislature approved the Governor's budget request to support the local sage grouse working groups and fund conservation projects benefiting sage grouse and their habitat. Implementation of projects consistent with local sage-grouse conservation plans will assist in keeping the sage grouse from being listed under the federal Endangered Species Act. A detailed listing of sage grouse funding opportunities is available from the Wyoming Game and Fish department: *http://wgfcms.wyo.gov/WGFD/media/content/PDF/Habitat/Sage%20Grouse/SGC_FUNDINGOPPS_REVISED0414.pdf*. Requests for Wyoming Sage Grouse Conservation funding directly through WGFD must be made on a separate project proposal form that has been included in the Digital Library delivered with this report. The project proposal form and more information related to sage grouse conservation is also available from the WGFD website located at: *http://wgfcms.wyo.gov/Habitat/Sage-Grouse-Management*

6.3.3 Wyoming Office of State Lands and Investments (OSLI)

The OSLI is the administrative arm of the Board of Land Commissioners and the State Loan and Investment Board. It is the statutory responsibility of the OSLI 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 the trust beneficiaries–Wyoming's school children and state institutions; numerous clients in agriculture, mineral, timber, transportation, communication, public utility, recreation, tourism and other Wyoming industries; local government entities; state and federal agencies; and the resident and nonresident general public.

- The Farm Loan Program, established in 1921, provides long-term real estate loans to Wyoming's agricultural operators. The use of this program has been expanded over the years to also include irrigation loans, beginning agricultural producer and livestock enhancement loans, and most recently, hydropower development loans. These loans are made for a wide range of agricultural purposes, including as most applicable to the potential projects identified in Chapter 5, purchasing, constructing or installing equipment and/or improvements necessary to maintain or improve the earning capacity of the farming operation. Eligible applicants include individuals whose primary residence is in Wyoming and legal entities with a majority of the ownership meeting the individual residency requirements.

- 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. Funding for this program is set at $60 million and is provided from the Wyoming Permanent Fund. These programs are an aid to cities, counties and special districts in providing needed government services and public facilities.

A summary of Wyoming State Loan Programs available through the Office of State Lands and Investments is included in the Digital Library delivered with this report. More information is also available at: *https://sites.google.com/a/wyo.gov/osli/grantsloans*

6.3.4 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. Clients served by the Commission include irrigation districts, conservancy districts, municipalities, water and sewer districts, joint powers boards, improvement and service districts, counties, and state agencies.

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.*

6.3.4.1 Wyoming Water Development Program

The primary Wyoming Water Development Program encompasses new development, rehabilitation, dams and reservoirs, small water projects, and water resources planning. Information described below was abstracted from the Operating Criteria of the Wyoming Water Development Program (*http://wwdc.state.wy.us/opcrit/WWDPopCriteria.html*). Additional project application information is available at: *http://wwdc.state.wy.us/project_application_info/project_app_info.html* and also from the form titled *Information for New Applicants* included in the digital library delivered with this report.

New Development Program: This program provides technical assistance and funding to develop waters of Wyoming that are currently unused and/or unappropriated. It provides an opportunity for sponsors to develop supplies for existing and anticipated future needs to ensure that lack of water supply will not inhibit economic growth. New development projects can proceed as Sponsored projects of State projects. Sponsored projects are projects where the sponsor is a public entity that can legally receive state funds (i.e. irrigation districts, watershed improvement districts, municipalities, conservation districts). State projects are projects that benefit more than one entity and are multipurpose in nature.

Rehabilitation Program: The Rehabilitation Program addresses the improvement of water projects completed and in use for at least 15 years to assist in keeping existing water supplies effective and viable for the future. Rehabilitation projects are initiated by an application from a project sponsor (i.e. irrigation districts, watershed improvement districts, municipalities, conservation districts, etc.). The Rehabilitation Program can improve existing agricultural storage facilities or conveyance/distribution systems to ensure safety, decrease operation and maintenance costs, and increase the efficiency of agricultural water use. **On-farm improvements (e.g., gated pipe, side rolls, center pivots, and related facilities and/or equipment such as pumps and power lines) are excluded from WWDC funding under both the New Development and Rehabilitation Programs.**

Dam and Reservoir Program: Proposed new dams with storage capacity of 2,000 acre-feet or more and proposed expansions of existing dams of 1,000 acre-feet or more qualify for the Dam and Reservoir Program. Dams and reservoirs typically provide opportunities for many potential uses. While water supply is emphasized in developing reservoir operating plans, recreation, environmental enhancement, flood control, erosion control and hydropower uses should be explored as secondary purposes.

Small Water Project Program: A small water project is a project in which the estimated construction or rehabilitation costs, permit procurement, construction engineering and project land procurement are $135,000 or less and the maximum WWDC contribution is $35,000 or less. Small water projects are addressed further in section 6.3.4.2.

Water Resource Planning: The Wyoming Water Development Commission serves as the water planning agency for the state of Wyoming. In this capacity, the WWDC can provide the following assistance to project sponsors:

- **River Basin Plans:** The program serves to develop basin-wide plans for each of the state's major drainage basins.

- **Watershed Studies:** These studies provide a detailed evaluation of an individual watershed. The studies identify water development and system rehabilitation needs within a specific watershed. Watershed improvement studies are an integral part of the Small Water Project Program, which has its own specific criteria. These studies may identify projects eligible for new development, rehabilitation, or the dam and reservoir programs discussed above.

- **Master Plans:** The program provides a service to municipalities, districts, and other entities to assist in preparing planning documents that serve as master plans for future water supply systems and improvements. The plans are a framework for the entities to establish project priorities and to perform the financial planning necessary to meet those priorities. These plans can assist entities in preparing the reports necessary to achieve federal funding assistance for water development and other water-related projects.

Groundwater Grant Program: The primary purpose of the program is to inventory the available groundwater resources in the state. The program also serves to assist communities in developing sufficient water supplies. Municipalities and special districts that purvey drinking water are eligible to receive up to $400,000 in grant funds if 25 percent of the total project costs will be paid by local matching funds.

Funding available from the programs listed above is administered by the project priority listing presented in the WWDC Operating Criteria document. The following is a list of eligible projects in the order of preference from highest to lowest:

- Multiple Purpose – projects that serve two or more functions (agriculture, municipal, industrial, rural, domestic, recreation, environmental, flood control, erosion control, hydropower). Priority will be given to projects that serve more than one entity or purpose.

- Storage Projects – Proposed new dams with storage capacity of 2,000 acre feet or more and proposed expansions of existing dams of 1,000 acre feet or more qualify for the Dam and Reservoir Program. Smaller storage projects qualify for funding under the New Development Program and repairs/improvements to existing storage projects qualify for funding under the Rehabilitation Program.

- Supply Projects (Irrigation/Municipal) – These projects include groundwater wells, alluvial wells, diversion dams, and other structures which put un-appropriated water to beneficial use or supplement existing uses.

- Supply Systems (Irrigation/Municipal) – Supply projects (listed above) make water available at the source, supply systems bring this source water closer to the point of use through pipelines and canal systems.

- Watershed Improvement (for components whose primary function or benefit is water development).

- Rural Domestic Projects Obtaining Water from Another Existing Public Water Supply – These projects centralize growth around existing service areas which provides effective and efficient use of available water resources. They can lead to regional systems that are more cost effective than building numerous independent systems.

- Rural Domestic Projects with Independent Water Supplies – These projects occur when there are isolated developments which require independent water supplies and supply systems. Technical assistance can be obtained but funding may be necessary from alternative sources.

- Hydropower Projects (Feasibility Studies) – These projects include retrofitting existing facilities of constructing new facilities capable of developing marketable hydropower.

- Purchase of Existing Storage – This investment may be made if the storage is uncommitted or not being used for a specific purpose. The purchase shall be project specific and assurances made that it will lead to the ultimate use of the water. Secondary benefits such as recreational or environmental will also be considered. There could be situations where these projects are considered Storage and therefore rank higher in priority.

- Municipal and Rural Raw Water Projects – Projects develop raw water supplies to irrigate parks and lawns. Difficult to justify these investments with limited financial resource.

Key Criteria and Procedures. An application for funding under the New Development and Rehabilitation Programs must meet the following key criteria most applicable 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 2,000 or more acres of irrigated cropland, or must rehabilitate watershed infrastructure, which will develop or preserve the beneficial use of water in a watershed. The watershed rehabilitation projects must possess an estimated minimum useful life span of twenty-five (25) years and demonstrate that sufficient public benefits will accrue to justify construction of the anticipated improvement.*

Important procedures, deadlines and requirements for applications to the New Development, Rehabilitation, and Dam and Reservoir 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 apply to projects advanced to the next level of study or to construction.

- A certified resolution passed by the governing body of the sponsoring entity must accompany an application for a Level II study or Level III construction. This requirement may be deferred if the applicant is in the process of forming a public entity.

- A public entity must be in place before a Level II study or Level III construction can commence, with certain exceptions discussed below.

- The due date for new project applications is August 15 of each year; the due date for applications for advancing to the next study level or construction funding is October 1 of each year.

Two important criteria that apply specifically to dam and reservoir projects include the following:

- *For projects that enlarge existing storage projects by 1,000 acre-feet or greater or for proposed new dam and reservoirs with a capacity of 2,000 acre-feet or greater, expenses associated with final engineering design and required National Environmental Policy Act reviews, including but not limited to environmental assessments and environmental Impact statements, are eligible components of a Water Development Program Level II, Phase III Study Project.*

- *For dam and reservoir projects, the Commission may waive sponsor eligibility requirements through Level II, Phase II. However, the eligible entity requirements shall be met prior to initiation of Level II, Phase III activities described herein.*

Financial Plan. The current standard terms of the Wyoming Water Development Program financial plan are summarized as follows:

- A 67 percent grant to 33 percent loan mix.

- 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 WWDC's discretion under special circumstances.

In the document titled *Information for New Applicants*, the following additional relevant information is provided regarding financial terms:

- *The best available project financial terms include a grant for Level I and Level II expenses, a grand total of 75% of the Level III costs, a loan of 25% of the Level III costs with an interest rate of four percent (4%) and a term equal to the economic life of the project/improvements or fifty (50) years, whichever is less. Principal and interest payments may be deferred for five (5) years after project completion. However, these favorable terms will be granted when a project is essential and the project sponsor has a very limited ability to pay.*

- *Those sponsors who feel more favorable terms are warranted due to a limited ability to pay must make a formal presentation to the Commission documenting their case. Sponsors electing to pursue this option should be aware that the Commission is reluctant to deviate from this standard and such requests will be denied unless they are clearly documented and justified.*

The Commission will evaluate whether or not a project will be funded for Level III construction following review of 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 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. Applicant may then know if there is a viable project 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 the construction of 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.

6.3.4.2 Small Water Project Program (SWPP)

The SWPP is intended to be compatible with the conventional WWDC program described above. Small water projects are defined as providing multiple benefits, and where the total estimated project costs (including construction, permitting, construction engineering, and land procurement) are less than $135,000 and WWDC's maximum financial contribution is 50 percent of project costs or $35,000, whichever is less. SWPP funding is a "one-time" grant so that operation and maintenance costs are not included. Loans are not available under the SWPP.

Eligibility:

According to the WWDC's operating criteria, the following types of projects are eligible for funding through the SWPP:

1. Small Reservoir: A small reservoir is any water storage facility up to twenty feet (20') of dam height and twenty acre-feet (20 AF) of capacity.

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 unproved aquifers, as determined by the WWDC, may be eligible for the SWPP at the discretion of the WWDC. Discretion of the WWDC will be exercised in cases including but not limited to cases where the applicant is willing to reimburse the WWDC if the well does not meet the minimum requirements of the project in terms of quality and quantity.

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.

Funding can only be provided to eligible public entities including but not necessarily limited to conservation districts, watershed improvement districts, water conservancy districts, and irrigation districts.

Application, Evaluation and Administration. Details of the application and evaluation process and program administrative procedures are provided in the Small Water Project Program Operating Criteria available online at: *http://wwdc.state.wy.us/small_water_projects/SWPPopCriteria.html* . Some key aspects of the process and procedures applicable to the potential projects identified in Chapter 5 include the following:

- Planning for small water projects will be generated by a WWDC watershed study or equivalent as determined by the WWDO. A watershed study will incorporate, at a minimum, available technical information that describes conditions and assessments of the watershed including hydrology, geology, geomorphology, geography, soils, vegetation, water conveyance, infrastructure, and stream system data. A plan outlining the site-specific activities that may remediate existing impairments or address opportunities beneficial to the watershed shall also be included. A watershed study may identify one or more projects that may qualify for SWPP funding. A professional engineer and/or geologist (as appropriate) shall certify any analysis submitted unless generated by a federal agency.

- 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, sponsor project referral, project location map, project cost estimates, and any letters of authorization or commitment of participation that may be available from other funding sources.

- Projects that improve watershed condition and function, provide multiple benefits, and meet the funding criteria specified in W.S. 99-3-703(j)(vii) or W.S. 99-3-704(g)(vii), as described in B.4 herein, are eligible for consideration.

- 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, submitted with the application, is deemed to be insufficient by the WWDC.

6.3.5 Wyoming Wildlife and Natural Resource Trust

The Wildlife and Natural Resource Trust, created in 2005, is an independent state agency 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 may be considered for funding.

Wildlife and Natural Resource Trust funding is available for a wide variety of projects throughout the state, 31including natural resource programs of other agencies. Some examples include the following:

- Projects that improve or maintain existing terrestrial habitat necessary to maintain optimum wildlife populations may include grassland restoration, changes in management, prescribed fire, or treatment of invasive plants.

- Preservation of open space by purchase or acquisition of development rights, contractual obligations, or other means of maintaining open space.

- Improvement and maintenance of aquatic habitats, including wetland creation or enhancement, stream restoration, water management or other methods.

- Acquisition of 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.

- Mitigation of impacts detrimental to wildlife habitat, the environment, and the multiple use of renewable natural resources, or mitigation of conflicts and reduction of potential for disease transmission between wildlife and domestic livestock.

Allowable projects under this program that are potentially relevant to this watershed management plan study include:

- Improvement and maintenance of existing aquatic habitat necessary to maintain optimum fish populations.

- Conservation, maintenance, protection and development of wildlife resources, the environment, and Wyoming's natural resource heritage.

- Participation in water enhancement projects to benefit aquatic habitat for fish populations and allow for other watershed enhancements that benefit wildlife.

Non-profit and governmental organizations (including watershed improvement districts, conservation districts, etc.) are eligible for funding by WWNRT. The application form has been included in the digital library and more information on the application process is available here: *https://sites.google.com/a/wyo.gov/wwnrt/how-to-apply*

6.4 Federal Agencies

6.4.1 Bureau of Land Management (BLM)

- **Range Improvement Planning and Development** 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 key to healthy rangelands and biodiversity. Before actual range improvement development occurs, an approved management plan must be in place. These plans outline a management strategy for an area and identify the type of range improvements needed to accommodate that management. Examples of these plans are Coordinated Resource Plans, Allotment Management Plans, and Wildlife Habitat Management Plans.

  All rangeland improvement projects on lands administered by the Bureau of Land Management require the execution of a permit. Although there are a couple of methods for authorizing range improvements on the public lands, Cooperative Agreement for Range Improvements form 4120-6 is the method most commonly used. This applies equally to range improvement projects involving water such as reservoirs, pits, springs, and wells including any associated pipelines for distribution. The major funding source for the Bureau of Land Management's share comes from the Range Improvement Fund which is generated from the grazing fees collected. There, too, is a limited amount of funding from the general rangeland management appropriations. If the cooperator is a livestock operator, their matching contributions come generally in the form of labor. There are times they also provide some of the material costs as well. Contributions from the conservation/environmental interests is monetary and often come in the form of grants.

- **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 partnering in the implementation of several Section 319 (EPA Clean Water Act) watershed plans state-wide.

  It is anticipated that as the Wyoming Department of Environmental Quality (WDEQ) continues the inventory of waters of the State and the identification of impaired and/or threatened water bodies, BLM will be partnering with the WDEQ to improve water quality in water bodies on public lands. In the course of developing watershed plans or Total Maximum Daily Loads (TMDL's) for these watersheds, BLM will be routinely involved in watershed health assessments, planning, project implementation and Best Management Practice (BMP) monitoring.

  The goals of cooperative watershed projects is the restoration and maintenance of healthy watershed function. These goals will typically be accomplished through approved BMP's, e.g. prescribed burns, vegetation treatments, instream structures, enhancement of vegetation cover, controlling accelerated soil erosion, increasing water infiltration, and enhancement of stream flows and water quality.

  Additionally, in response to the Clean Water and Watershed Restoration initiative and associated funding increases, BLM is 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 BMP's to address identified acid mine drainage and runoff problems from mine tailings and waste rock piles.

6.4.2 United States Bureau of Reclamation (USBR)

The 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 the water use efficiency in the western United States.

The USBR Sustain and Manage America's Resources for Tomorrow (WaterSMART) Program establishes a framework to provide federal leadership and assistance on the efficient use of water, 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 department 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, or carry out other activities to 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 USBR provides funding in two groups. In Funding Group I, up to $300,000 in federal funding is available per project, for smaller on-the-ground projects. 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.

The Water Conservation Field Services Program (WCFSP), by contrast, 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 are focused 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. At the time of this report the Bureau of Reclamation is stating that beginning in fiscal year 2017, on the ground projects (i.e., implementation projects) will no longer be funded by the WCFSP. On the ground projects will be funded through a new grant category under WaterSMART Grants which will provided a new dedicated funding source. Draft framework of this new funding source is due out in August 2016. Please visit *http://www.usbr.gov/watersmart/grants.html* for more information.

6.4.3 Environmental Protection Agency (EPA)

The EPA has several grant programs that could potentially provide funding opportunities for projects described in this report.

- **Urban Waters Program:** This program was established in 2012 to help local residents and their organizations, particularly those in underserved communities, restore their urban waters in ways that also benefit community and economic revitalization. The two types of grants available through this program are listed below:

- **The Five Star/Urban Waters Restoration Grant Program** projects include on-the-ground activities (for example: wetland or river habitat restoration), integrated education, outreach and training, measurable ecological and community benefits, and community partnership building emphasis.

- **The Urban Waters Small Grants** are competed and awarded every two years. Since its inception in 2012, the program has awarded approximately $5.3 million in Urban Waters Small Grants to 92 organizations across the country, with individual award amounts of up to $60,000. Urban Waters Small Grants Program projects must address local water quality issues related to urban runoff pollution, provide additional community benefits, actively engage underserved communities, and foster partnerships. Specific information pertaining to the types of projects funded was not available.

- **Section 319** was added to the Clean Water Act (CWA) in 1987 to establish a national program to address nonpoint sources of water pollution. Section 319(h) specifically authorizes EPA to award grants to states with approved Nonpoint Source Assessment Reports and Nonpoint Source Management Programs. The funds are to be used to implement programs and projects designed to reduce nonpoint source pollution.

- **Healthy Watersheds Program:** After decades of focusing almost exclusively on restoring impaired waters, EPA created the Healthy Watersheds Program to help address the "maintain" component of the "restore and maintain" goal intended by Congress in the 1972 Federal Water Pollution Control Act amendments. Through a multi-year cooperative agreement awarded in 2015, EPA is helping to support watershed protection via a healthy watershed grants consortium. This consortium brings together like-minded partners from all levels of government, private organizations and industry to support individual watershed protection projects through grants, using leveraged funding from government and non-government sources together. Details and contact information on healthy watersheds grants can be found at: *https://www.epa.gov/hwp/what-epa-doing-healthy-watersheds*

6.4.4 Farm Service Agency

The FSA administers a variety of different programs that may be applicable to some of the alternative projects identified in Chapter 5. The FSA is a member agency of the USDA. Programs administered through the FSA are offered through local county committees. Technical assistance needed for implementing FSA programs is provided through the NRCS.

Several of the available programs are briefly discussed below and more information can be obtained from the FSA conservation program website (*https://www.fsa.usda.gov/programs-and-services/conservation-programs/index*):

- **Conservation Reserve Program (CRP)**: The CRP is the country's largest private-land conservation program that offers agricultural producers annual rental payments to remove highly erodible cropland from production. Through the CRP, farmers and ranchers establish long-term conservation practices on erodible and environmentally sensitive land. In exchange, they receive 10–15 years of annual rental payments and cost-share assistance. The CRP is a voluntary program specifically for highly erodible lands currently in active production planted two of the five most recent crop years. Land offered for CRP is ranked according to environmental benefit for wildlife habitat, erosion control, water quality, and air quality. Land must meet the requirements of CRP and be determined by the NRCS to be eligible and suitable for the following:

  Riparian buffers Shelter belts Salt tolerant vegetation

Filter strips	Living snow fences	Shallow water areas for wildlife
Grass waterways	Contour grass strips	Buffers for Wildlife Habitat
Wetlands Buffer	Wetland Restoration	

- **Emergency Conservation Program (ECP):** The ECP provides emergency funding and technical assistance for farmers and ranchers to rehabilitate farmland damaged by natural disasters and for carrying out emergency water conservation measures for livestock during periods of severe drought. Participants receive cost-share assistance of up to 75 percent of the cost to implement approved emergency conservation practices, as determined by county FSA committees. The FSA County Committee is able to approve applications up to $50,000 while $50,001 to $100,000 requires state committee approval. Some of the conservation practices included are removing debris, restoring fences and conservation structures, and providing water for livestock in drought situations.

- **Farmable Wetlands Program**: The Farmable Wetlands Program is designed to restore previously farmed wetlands and wetland buffer zones to improve both vegetation and water flow. FWP provides annual rental payments in return for restoring wetlands and establishing plant cover. Eligible land must have been used for agricultural purposes for 3 of the past 10 crop years.

- **Grassland Reserve Program**: The Grassland Reserve Program is designed to prevent grazing and pasture land from being converted to cropland, urban development, or other non-grazing uses. Participants in the program voluntarily limit future development of their grazing and pasture land, while still being able to use the land for livestock grazing and activities related to forage and seed production.

6.4.5 U.S. Fish and Wildlife Service

Technical and financial assistance are available to private landowners, for profit or nonprofit entities, public agencies and public-private partnerships under several programs addressing the management, conservation, restoration or enhancement of wildlife and aquatic habitat (including riparian areas, streams, wetlands and grasslands). These programs include, but are not necessarily limited to:

- **Partners for Fish and Wildlife Program:** 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 are in need of restoration or enhancement 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.

- **Wildlife and Sport Fish Restoration (WSFR) Program** works with states, and the District of Columbia to conserve, protect, and enhance fish, wildlife, their habitats, and the hunting, sport fishing, and recreational boating opportunities they provide. 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.

- **Cooperative Endangered Species Conservation Fund:** 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.

- **North American Wetlands Conservation Act (NAWCA) Grant Program:** This program promotes long-term conservation of wetlands ecosystems and the waterfowl, migratory birds, fish and wildlife that depend upon such habitat. Conservation actions supported are acquisitioning, enhancing, and restoring wetlands and wetlands-associated habitat. This program encourages voluntary, public-private partnerships. Public or private, profit or nonprofit entities, or individuals establishing public/private sector partnerships are eligible. Cost-share partners must at least match grant funds with non-federal monies.

- **Fish and Wildlife Service's (FWS) Challenge Cost Share Program:** This 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 FWS 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

More information regarding these programs and others is available at: *http://www.fws.gov/grants/programs.html*

6.4.6 U.S. Forest Service

A number of federal laws direct or authorize watershed management on U.S. Forest Service (U.S.F.S) lands. Some of these laws provide broad authority while others deal more narrowly with specific watershed management activities. The objectives of the Forest Service watershed management program are to protect and enhance soil productivity, water quality, water quantity, and timing of water flows and to maintain favorable conditions of streamflow and continuous production of resources from National Forest System watersheds. The policy of the Forest Service is to implement watershed management activities on National Forest System lands in accordance with general objectives of multiple use and the specific objectives in the forest land management plans for the area involved. It is also the intent to design management activities of other resources to minimize short-term impacts on soil and water resources and to maintain or enhance long-term productivity, water quality, and water quantity.

Specific direction for water quality is contained in the Land and Resource Management Plan for each national forest. The Medicine Bow National Forest Revised Land and Resource Management Plan (2003) is included in the digital library delivered with this report.

Funding for projects mentioned in this report could potentially be available via the Secure Rural Schools Program Title II mechanism. Title II funds may be used for the for protection, restoration, and enhancement of fish and wildlife habitat, and other resource objectives consistent with the Act on Federal land and on non-Federal land where projects would benefit the resources on Federal land. Projects that implement stewardship objectives to enhance forest ecosystems, or restore and improve land health and water quality would be eligible. Projects shall have broad-based support with objectives that may include, but are not limited to: road, trail, and infrastructure maintenance or obliteration; soil productivity improvement; improvements in forest ecosystem health; watershed restoration and maintenance; restoration, maintenance and improvement of wildlife and fish habitat; control of noxious and exotic weeds; and reestablishment of native species. Information pertaining to funding amounts was not readily available nor was application guidance information. For more information related to Title II funding please visit: *http://www.fs.usda.gov/main/pts/specialprojects*.

6.4.7 Natural Resources Conservation Service(NRCS)

The NRCS administers a number of funding and technical assistance programs applicable to many of the alternative projects, described below. 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 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.

Technical and cost-share assistance is available through the NRCS. This assistance includes designs, specifications, construction, and management and financial help for practice and system installation. Local people, individually and collectively, decide how to use NRCS capabilities in the natural resource conservation planning and application process. The role of NRCS is to support and facilitate 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.

- **Snow, Water and Climate Services:** Snow survey crews collect information on snowpack conditions to provide Wyoming water users with forecasts of seasonal water supplies. This 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.

- **Plant Materials:** Wyoming NRCS is serviced by the Plant Materials Center (PMC) at Bridger, Montana. The Plant Materials Program identifies, selects, and releases superior performing plant collections for a variety of conservation uses.

NRCS administers the following Landscape Planning Programs:

- **Emergency Watershed Protection (EWP) Program:** This program assists in implementing emergency measures, including the purchase of floodplain easements, for runoff retardation and soil erosion prevention to safeguard lives and property from floods, drought, and the products of erosion on any watershed whenever fire, flood, or any other natural occurrence is causing or has caused a sudden impairment of the watershed.

- **Watershed Protection and Flood Prevention Operations (WFPO) Program:** This program provides technical and financial assistance to entities of state and local governments and tribes for planning and installing watershed projects.

- **Watershed Surveys and Planning (WSP):** The WSP authorizes the NRCS to cooperate with federal, state, and local agencies and tribal governments to protect watersheds from damage caused by erosion, floodwater, sediment, and to conserve and develop water and land resources.

NRCS administers the following 2014 Farm Bill programs:

- **EQIP:** Through 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.

- **Conservation Stewardship Program (CSP):** The CSP encourages land stewards to improve their conservation performance by installing and adopting additional activities, and improving, maintaining, and managing existing activities on agricultural land and non-industrial private forest land.

- **Regional Conservation Partnership Program (RCPP):** The RCPP promotes coordination between the NRCS and its partners to deliver conservation assistance to producers and landowners. The NRCS provides assistance to producers through partnership agreements and through program contracts or easement agreements. Assistance is delivered in accordance with the rules of EQIP, CSP, Agricultural Conservation Easement Program (ACEP), and HFRP and in certain areas the Watershed Operations and Flood Prevention Program.

- **Agricultural Management Assistance (AMA):** The AMA provides financial assistance to agricultural producers to address resource issues such as water management, water quality, invasive species control, and erosion control by incorporating conservation into their farming or ranching operations. The purpose of the AMA is to assist producers in reducing risk to their operation.

- **Conservation Innovation Grants (CIG) Program:** The CIG is intended to stimulate the development and adoption of innovative conservation approaches and technologies while leveraging federal investment in environmental enhancement and protection, in conjunction with agricultural production. Under CIG, EQIP funds are used to award competitive grants to nonfederal governmental or nongovernmental organizations, tribes, or individuals.

- **ACEP:** The ACEP provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits. Under the Agricultural Land Easements (ALE) component, NRCS helps tribes, state and local governments, and nongovernmental organizations protect working agricultural lands and limit non-agricultural uses of the land. Under the Wetlands Reserve Easements (WRE) component, the NRCS helps to restore, protect and enhance enrolled wetlands.

- **Sage Grouse Initiative:** The Sage Grouse Initiative is an organization of public and private entities conserving at-risk wildlife through voluntary cooperation, incentives, and community support. The Natural Resources Conservation Service launched SGI in 2010, applying the power of the Farm Bill to target lands where habitats are intact and sage grouse numbers are highest – covering 78 million acres across 11 western states. While private lands are the primary focus, the Initiative serves as a catalyst for public land enhancements. The Sage Grouse Initiative applies Farm Bill dollars and certifies conservation projects in the core areas for sage grouse with a dual goal of sustaining rangelands and sage grouse. In addition to directing dollars to private lands where 40 percent of sage grouse live, SGI dollars can be applied on public lands where ranchers have grazing leases. For more details related to funding opportunities, please contact your local NRCS office. Detailed information related to the Sage Grouse Initiative can be found at the following website: *http://www.sagegrouseinitiative.com/*

Information on all NRCS programs is available from the local contacts listed in Table 6.1-1.

6.4.8 US Army Corps of Engineers (USACE)

The 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 Corps is responsible for a worldwide military construction program, an extensive environmental program and a broad national civil works program.

The Corps of Engineers is authorized to provide technical assistance to local communities, States and federally recognized Indian Tribes in support of 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. They also have authority to construct certain water resources related projects and respond to water resource needs.

- **Planning Assistance to States:** This program provides for assistance in preparation of plans for the development, utilization and conservation of water and related land resources. The Corps provide 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 non-federal sponsor such as a state, public entity or an Indian Tribe.

- **Floodplain Management Services:** This program provides technical services and planning guidance for support and promotion of effective floodplain management. Flood and flood plain 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 provided free of charge to local, regional, state, or non-federal public agencies. Federal agencies and private entities have to cover 100% of costs.

- **Flood Damage Reduction Projects:** This program provides structural and non-structural projects to reduce damages caused by flooding and focuses on solving local flood problems in urban areas, towns and villages. The Corps 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 potential projects with the first $100,000 of the cost Federal. 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, rights-of-way, relocations and disposal and 5% of the projects costs are the sponsor's responsibility. Operation and maintenance and a maximum of 50% 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. An initial study is 100% federally funded up to $100,000. All planning costs after the first $100,000 are cost shared 50/50. All design and construction costs are cost shared 75% Federal and 25% non-Federal. The Federal cost limit is $5,000,000. The non-Federal sponsor cost share can be a contribution of cash, Lands, Easements, Rights-of-way, Relocations, and Disposal areas (LERRDs), or work-in-kind. Work-in-kind may be provided subsequent to the execution of a Project Partnership Agreement (PPA), and the value may not exceed 80% of the non-Federal share.

- **Aquatic Ecosystem Restoration:** This effort is for restoration of historic habitat conditions to benefit fish and wildlife resources. This is primarily to provide structural or operational changes to improve the environment such as? river channel reconnection, wetland creation or improving water quality. Conditions are similar to the Project Modification program with sponsor cost-share being 35%.

- **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. It is used to evaluate projects costing more than $10 million that include purposes of flood control, water supplies, water quality, environmental protection and restoration, sedimentation or recreation. This would include reservoirs, diversions, levees, channels or flood plain parks as examples. The Corps works with a non-federal 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. This requires special authorization and funding from Congress with a reconnaissance study being federal cost. A feasibility study to establish solutions is cost-shared 50% by the non-federal sponsor with 35 to 50% of construction cost the responsibility of the sponsor.

- **Support for Others Program:** This program provides for environmental protection and restoration or facilities and infrastructure. This includes Environmental Planning and Compliance, Economic and Financial Analyses, Flood Plain Management, Cultural Resources and General Planning. All costs for these programs are provided by the customer agency.

- **Regulatory Authority/Responsibility.** The Corps of Engineers has regulatory authority under the Clean Water Act and the River and Harbor Act. The purpose of these laws is to restore and maintain the chemical, physical and biological integrity of waters of the United States. Section 404 of the Clean Water Act authorizes the Corps to regulate the discharge of dredged or fill material into waters of the U.S. This would include dams and dikes, levees, riprap, bank stabilization and development fill.

The local contact for the USACE is:

Wyoming Regulatory Office
2232 Dell Range Blvd,
Suite 210
Cheyenne, Wyoming 82009
Ph: 307-772-2300

6.4.9 United States Department of Agriculture (USDA) Rural Development

The USDA Rural Development's Water & Environmental Program (WEP) is authorized to provide financial assistance for water and waste disposal facilities in rural areas and towns of up to 10,000 people. This program is intended for non-profit corporations and public bodies such as municipalities, counties, and special purpose districts and authorities.

The applicant must have legal capacity to borrow and repay loans, to pledge security for loans and to 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 upon taxes, assessments, revenues, fees or other satisfactory sources of income to pay 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 also available on how to assemble information concerning 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 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 associated with the development of a facility or pay other costs related to development including rights-of-way or easements and relocation of 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. More information can be found at: *http://www.rd.usda.gov/about-rd/agencies/rural-utilities-service.*

6.4.10 Wyoming Landscape Conservation Initiative (WLCI)

The 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 numerous committees and teams made up of representatives from the participating agencies. These agencies include: BLM, USGS, US Fish and Wildlife Service, US Forest Service, Wyoming Game and Fish Department, Wyoming Department of Agriculture, Southwest Wyoming County Commissions, Southwest Wyoming Conservation Districts, US National Park Service, NRCS, University of Wyoming, and the US Bureau of Reclamation.

Information gathered through scientific 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. If you have ideas for projects, they can be presented at these meetings or sent to the WLCI Coordination Team through the BLM High Desert District Office at (307) 352-0227 or *blm_wy_wlci_wymail@blm.gov.*

The project application form, project tracking and project ranking score sheet are available from the following website, and have been included in the digital library delivered with this report (*http://www.wlci.gov/lpdt-resources*).

6.5 Non-Profit and Other Organizations

6.5.1 Ducks Unlimited

Ducks Unlimited, Inc. (DU) is a potential funding source for wetlands and waterfowl restoration projects. Although direct grant funding is limited (to the extent that there is generally about $20,000 to $30,000 available annually statewide), in-kind assistance may be available from the local chapter of DU. Additional information on DU's funding programs and opportunities is available in the Water Management & Conservation Assistance Program Directory referenced previously.

DU offers a waterfowl habitat development and protection program called Matching Aid to Restore States Habitat (MARSH). This is a reimbursement program that provides matching funds for restoring, protecting, or enhancing wetlands. The financial extent of this program is dependent on DU's income within the state. MARSH projects must significantly benefit waterfowl. Projects receiving funding support must be on lands that can demonstrate at least a 30-year project life at a minimum. Groups requesting assistance must be able to demonstrate capacity to execute long-term habitat agreements, deliver and manage projects, and be willing to assume project liability. DU's goal is to match MARSH funds equally with private, state, or federal sources. Their objective is to obtain maximum leverage possible to maximize benefit to waterfowl. Therefore, leveraged projects have a greater likelihood of being approved. Specifics for proposal submission, budget preparation, project development, and receipt of funding can be further explained by the DU local coordinator.

The DU regional director can be reached at:
Robert Hathaway (301) 221.2061 or rhathaway@ducks.org

6.5.2 National Fish and Wildlife Foundation (NFWF)

The National Fish and Wildlife Foundation (NFWF) is a private, non-profit, tax exempt organization chartered by Congress in 1984 to sustain, restore and enhance the Nation's fish, wildlife, plants and habitats. NFWF provides funding on a competitive basis to projects that sustain, restore, and enhance our nation's fish, wildlife, and plants and their habitats. The available programs and initiatives are listed and detailed here: *http://www.nfwf.org/whatwedo/programs/Pages/home.aspx*. The programs listed, support diverse projects for wildlife and habitat conservation across the county. The initiatives provided in this listing, each have a Board of Directors approved business plan developed by scientists and other experts. Grants are available to support the actions identified in the business plan.

Some of the grants/programs that may be applicable to potential projects in the Upper Laramie Watershed Study Area include, but are not limited to the following:

- **Acres for America:** Acres for America is one of the most effective public-private partnerships in the history of U.S. conservation efforts. The Acres for America program conserves lands of national significance, protects critical fish and wildlife habitat and benefits people and local economies.

- **Bring Back the Natives Grant Program:** This program invests in conservation activities that restore, protect, and enhance native populations of sensitive or listed fish species across the United States, especially in areas on or adjacent to federal lands. The program emphasizes coordination between private landowners and federal agencies, tribes, corporations, and states to improve the ecosystem functions and health of watersheds. The end result is conservation of aquatic ecosystems, increase of in-stream flows, and partnerships that benefit native fish species throughout the U.S. This funding opportunity also provides grants to implement the goals of the National Fish Habitat Action Plan.

- **Conservation Partners Program:** The primary goals of this program are targeting funds made available by the federal Farm Bill toward priority conservation objectives and maximizing the funds benefits. Through these regional grants, this conservation program has begun to place expert staff ("boots-on-the-ground") where they can maximize outreach to the private landowner.

- **Five-Star Urban Waters Restoration Grant Program:** This program provides modest financial assistance on a competitive basis to support community-based wetland, riparian, and coastal habitat restoration projects that build diverse partnerships and foster local natural resource stewardship through education, outreach and training activities. Projects seek to address water quality issues in priority watersheds, such as erosion due to unstable streambanks, pollution from stormwater runoff, and degraded shorelines caused by development.

- **Pulling Together Initiative:** This program provides support on a competitive basis for the formation of local Weed Management Area (WMA) 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; minimum 1:1 nonfederal match is required.

- **Environmental Solutions for Communities Initiative:** This program was designed to support projects that link economic development and community well-being to the stewardship and health of the environment. Funding is available for projects that conserve critical land and water resources or improve local water quality. Another priority of this initiative is restoring and managing natural habitat, species and ecosystems that are important to community livelihoods.

Information about all of these and other NFWF grants/programs is available at their website: *http://www.nfwf.org/whatwedo/grants/pages/home.aspx*.

6.5.3 Trout Unlimited

The mission of the Wyoming Council of Trout Unlimited is to conserve, protect, and restore Wyoming's cold-water (trout) fisheries and their watersheds. The (TU) Council is made up of 11 chapters located throughout the state. While a majority of Trout Unlimited members are indeed enthusiastic anglers, their focus is not only on maintaining fisheries for the purpose of angling. Healthy trout fisheries are indicative of well-functioning, sound ecosystems and the work done towards restoring good 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, Wyoming Trout Unlimited is actively engaged in a battle to keep these fish from being listed under the Endangered Species Act. Trout Unlimited 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.

VII. COST ESTIMATES

VII. COST ESTIMATES

Conceptual-level costs have been developed for each of the alternative potential projects identified and described in Chapter 4. The basis for these costs are described in the following subsections for each of the overall project categories. Cost estimates presented represent 2016 dollars. NRCS Fiscal Year (2015) Practice Payment Rates for EQIP Program costs data were used where feasible for typical design items and inflated to represent 2016 dollars assuming a 3% inflation rate. These values represent the amount of money typically paid to individuals for EQIP projects and not necessarily the actual cost of construction. Consequently, in order to best represent actual construction costs, the EQIP Payment Rates were inflated 25% for livestock projects and 33% for irrigation projects to better reflect actual construction costs; not reimbursement values.

7.1 Irrigation System Components

Costs associated with irrigation system components of the watershed management plan were estimated based upon current itemized unit costs for individual improvements. NRCS Fiscal Year (2015) Practice Payment Rates for EQIP Program costs cost data were used where feasible for typical design items and updated to represent 2016 costs. In Table 7.1-1 summarizes conceptual cost estimates for irrigation system components of the watershed management plan. Where feasible, NRCS EQIP components are itemized for most structures.

7.2 Upland Wildlife/Livestock Water Components

The anticipated costs associated with these components of the watershed management plan were based upon previous experience completing similar projects in the study area, current NRCS EQIP cost tables, and current costs of various other system components obtained from reliable sources.

Table 7.2-1 presents the estimated costs associated with each of the upland wildlife / livestock water source components of the watershed management plan. The following components are common to most of the systems and are itemized below for general reference.

Spring Developments: Typical costs range from $1,000 to $5,000 depending on size and yield of the spring. For the purposes of this Level I investigation a cost of $3,600 was used as a median value because site-specific information was not available.

Wells*:* Well construction costs were assumed to be approximately $50 to $60 per foot of depth. This value was determined based upon input from local stakeholders, conservation districts, and the NRCS.

Solar Pump Facility*:* A cost of $8,500 per solar pump facility was used. This cost was assumed to include the pump, solar arrays, and requisite controls and regulators. Actual price would vary based upon depth to water.

Table 7.1-1 Conceptual Cost Estimates: Irrigation System Components.

		Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component
		IRR-001	IRR-002	IRR-003	IRR-004	IRR-005	IRR-006	IRR-007	IRR-008	IRR-009	IRR-010	IRR-011	IRR-012	IRR-013	IRR-014	IRR-015
Sponsor Identifier:		Sigel-001	Rogers-002	LCD-001	Johnson-002	Johnson-003	Oasis-001	Oasis-002	Oasis-004	Edwards-001	Croonberg-001	Croonberg-002	Croonberg-003	Croonberg-004	Croonberg-005	USFS-001
Project Name:		Hecth Ditch Reconstruction	Bellamy Ditch Drop-Chute	Last Chance Ditch Point of Diversion	Simon Johnson Ditch Diversion	Simon Johnson 2 Ditch Diversion	Oasis Ditch Diversion	Parshall Flume Evaluation /	Oasis Ditch Seepage	Lund Ditch Diversion	Hatton No. 2 DIversion	Hatton No. 1 Ditch Diversion	McGill and Crooger Ditch	Hatton No. 3 and No. 4 Diversion	Hatton Ditch Lateral Check	Ditch Management /
Mobilization		$3,000		$1,000	$1,000	$1,000		$500			$500	$500	$500	$500	$500	
Pipeline	< 12 inches															
	> 12 inches															
Water Control Structures	Extra Small														1	
	Small				1			1				1	1			
	Medium	1		1		1					1			1		
	Large	1														
Other Components	Structural Concrete															
	Rock Riprap															
Construction Subtotal		$28,300		$17,300	$6,000	$17,300		$6,000	$50,000		$17,300	$6,000	$6,000	$17,300	$3,100	**TBD**
Engineering (10%)		$2,830		$1,730	$600	$1,730		$600	$5,000		$1,730	$600	$600	$1,730	$310	
Constuction and Engineering Subtotal		$31,130		$19,030	$6,600	$19,030		$6,600	$55,000		$19,030	$6,600	$6,600	$19,030	$3,410	
Contingency (15%)		$4,670		$2,855	$990	$2,855		$990	$8,250		$2,855	$990	$990	$2,855	$512	
Total Construction Cost		$35,800		$21,885	$7,590	$21,885		$7,590	$63,250		$21,885	$7,590	$7,590	$21,885	$3,922	
Final Plans and Specs		$4,000		$4,000	$2,000	$1,500		$500	$0		$1,000	$1,000	$1,000	$10,000	$2,000	
Additional		$0		$0	$0	$0		$0	$0		$0	$0	$0	$0	$0	
Permitting / Legal Fees / Access and		$2,500		$5,000	$1,000	$1,500		$500	$0		$1,500	$1,000	$1,000	$3,000	$500	
Total Project Cost		**$45,300**	**>250,000**	**$31,885**	**$11,590**	**$25,885**	**>250,000**	**$9,090**	**$63,250**	**>250,000**	**$24,885**	**$10,090**	**$10,090**	**$35,385**	**$6,922**	**TBD**

Table 7.2-1 Summary of Conceptual Costs: Livestock / Wildlife Components

		Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component	Watershed Component
		L/W-001	L/W-002	L/W-003	L/W-004	L/W-005	L/W-006	L/W-007	L/W-008	L/W-009	L/W-010	L/W-011	L/W-012	L/W-013	L/W-014	L/W-015	L/W-016	L/W-017
Sponsor Identifier:		BCR-001	BLM-001	BLM-002	BLM-003	Sigel-001	Sigel-003	Rogers-001	Johnson-001	Johnson-004	GC-005	Gaddis-001	Engen-001	Clay-001	Clark-001	Churches-001	Tenbensel-001	Kaisler-001
Description:		Well / Stock Tank / Pipeline Construction / existing well with pump	Replace existing non-functioning windmill with solar platform / pump	Replace existing non-functioning windmill with solar platform / pump	Replace existing non-functioning windmill with solar platform / pump	Spring Development / Pipeline / Stock Tank Construction	Spring Development / Pipeline / Stock Tank Construction	Stock Reservoir Construction	Stock Reservoir Construction	Stock Reservoir Rehabilitation	Stock Reservoir Construction	Construct trailer-mounted solar platform to use for pumping at multiple wells with pumps in them	Stock tank and pipeline project	Winter wildlife and livestock water facility	Stock reservoir construction	Pipeline and stock tank installation with storage	Stock reservoir rehabilitation	Solar Platform Installation
Project Name:		Blake Pipeline	BLM Windmill Replacement	BLM Windmill Replacement	BLM Windmill Replacement	Sigel Spring Development	Sigel Pipeline and Stock Tank Installation	Rogers Stock Reservoir	Johnson Stock Reservoir	Stock Reservoir Rehabilitation	Johnson Stock Reservoir	Mobile Solar Platform and Pipeline	Engen stock tank / pipeline	Clay Winter Water Supply Project	Fox Creek Reservoir	Churches Pipeline Project	Tenbensel stock reservoir rehabilitation	Kaisler Solar Platform
Water Source:		Existing well	Existing well	Existing well	Existing well	Existing Spring	Existing Well	Proposed Stock Reservoir	Proposed Stock Reservoir	Existing Stock Reservoir	Proposed Stock Reservoir	Existing Wells	Surface Water	Surface Water	Surface Water	Existing Well	Existing stock reservoir	Existing well
Mobilization		$500	$500	$500	$500	$500	$500	$1,000	$1,000	$1,000	$1,000	$500	$500	$1,000	$1,000	$1,000	$1,000	$50
Well Construction / Spring Development / Surface Diversion	Source:	Existing well	Existing well	Existing well	Existing well	Existing Spring	Existing Well						Surface diversion	Surface diversion	Surface diversion	Existing Spring	Existing stock reservoir	Existing well
	Units (each)	1				1							1	1	1	1		
	Depth Each	0				NA							NA	NA	NA	NA		
	Unit Cost ($/LF wells or $/EA springs	$38	NA	NA	NA	$3,600	NA	NA	NA	NA	NA	NA	$4,500	$4,500	$4,500	$3,600		
	Well Screen (LF each well)	NA				NA							NA	NA	NA	NA		
	Well Screen ($/LF)	NA				NA							NA	NA	NA	NA		
	Component Subtotal	$0				$3,600							$4,500	$4,500	$4,500	$3,600		
Stock Pond / Guzzler Construction / Rehabilitation	Units (each)							1	1		1						1	
	Earthwork (Stock Pond)							$16,500	$16,500		$16,500						$16,500	
	Agri-Drain Installation (Stock Pond)							$4,800	$4,800		$4,800						$4,800	
	Rock Stabilization (Stock Pond)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Bentonite Lining (Stock Pond)							NA	NA		NA						$0	
	Guzzler Installation (Materials and Labor)							NA	NA		NA						NA	
	Pond/ Guzzler Component Subtotal							$21,300	$21,300		$21,300						$21,300	
Pump	Units (EA)	0	1	1	1							1	1			1		1
	Type	Solar Pump / Platform	Solar Pump / Platform	Solar Pump / Platform	Solar Pump / Platform	NA	NA	NA	NA	NA	NA	Solar Pump / Platform	Electric Pump and connections	NA	NA	Electric Pump and connections	NA	Solar Pump / Platform
	Unit Cost (EA)	$8,755	$8,755	$8,755	$8,755							$8,755	$1,200			$1,200		$8,755
	Component Subtotal	$0	$8,755	$8,755	$8,755							$8,755	$1,200			$1,200		$8,755
Pipeline	Low Pressure 1 1/2 in Pipe Diameter:	1.5				1.5 (non-winter)	1.5 (non-winter)					1.5 (non-winter)	1.5 (non-winter)	1.5 (winter)		.5 (non-winter and winte		1.5 (non-winter)
	Units (LF)	3,400	NA	NA	1.5	8,000	850	NA	NA	NA	NA	10,400	4,000	2,250	NA	10,000 / 2300	NA	200
	Unit Cost (EA)	$3.44				$3.44	$3.44					$3.44	$3.44	$5.00		$3.44 / $5.00		$3.44
	Component Subtotal	$11,697				$27,520	$2,924					$35,776	$13,760	$11,250		$44,900		$688
Livestock / Wildlife Water Tanks	Units (EA)	3	1	1	1	5	1					4	1	Frost Free water facility		5		1
	Size (gal)	1,200	1,200	1,200	1,200	1,200	1,200	NA	NA	NA	NA	1,200	1,200	1	NA	1,200	NA	1,200
	Unit Cost	$3,200	$3,200	$3,200	$3,200	$3,200	$3,200					$3,200	$3,200	$5,000		$3,200		$3,200
	Component	$9,600	$3,200	$3,200	$3,200	$16,000	$3,200					$12,800	$3,200	$5,000		$16,000		$3,200
Miscellaneous	Item		Pump test and Water quality test	Pump test and Water quality test	Pump test and Water quality test	Fencing						Trailer				Storage		
	Units (Each)	NA	1	1	1	500	NA	NA	NA	NA	NA	1	NA	NA	NA	10000 gal	NA	NA
	Unit Cost ($/ea)		$1,000.00	$1,000.00	$1,000.00	$5.04						$4,000.00				$1.00		
	Component Subtotal		$1,000.00	$1,000.00	$1,000.00	$2,518.35						$4,000.00				$10,000.00		
Construction Subtotal		$21,797	$13,455	$13,455	$13,455	$50,138	$6,624	$22,300	$22,300	$1,000	$22,300	$61,831	$23,160	$21,750	$5,500	$76,700	$22,300	$12,693
Engineering (10%)		$2,180	$1,346	$1,346	$1,346	$5,014	$662	$2,230	$2,230	$100	$2,230	$6,183	$2,316	$2,175	$550	$7,670	$2,230	$1,269
Constuction and Engineering Subtotal		$23,976	$14,801	$14,801	$14,801	$55,152	$7,286	$24,530	$24,530	$1,100	$24,530	$68,014	$25,476	$23,925	$6,050	$84,370	$24,530	$13,962
Contingency (15%)		$3,596	$2,220	$2,220	$2,220	$8,273	$1,093	$3,680	$3,680	$165	$3,680	$10,202	$3,821	$3,589	$908	$12,656	$3,680	$2,094
Total Construction Cost		$27,573	$17,021	$17,021	$17,021	$63,425	$8,379	$28,210	$28,210	$1,265	$28,210	$78,216	$29,297	$27,514	$6,958	$97,026	$28,210	$16,057
Final Plans and Specs		$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000	$1,500	$1,500	$1,500	$1,000	$1,000	$1,500	$1,500	$1,000	$1,000	$1,000
Additional		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Permitting / Legal Fees / Access and Rights of Way		$0	$500	$500	$500	$500	$500	$1,000	$1,000	$1,000	$1,000	$500	$1,000	$1,000	$1,000	$1,000	$500	$500
Total Project Cost		**$28,573**	**$18,521**	**$18,521**	**$18,521**	**$64,925**	**$9,879**	**$30,210**	**$30,710**	**$3,765**	**$30,710**	**$79,716**	**$31,297**	**$30,014**	**$9,458**	**$99,026**	**$29,710**	**$17,557**

Pipelines*:* A cost of approximately $3.44 / lineal foot (installed) for 1.5-inch diameter pipe was used and is based upon information provided by the NRCS for "easily" installed pipeline. Areas where installation is more difficult (i.e, rough terrain, rocky, etc.) could result in higher costs. A cost of $5.15 per linear foot for pipeline installed below the frost line was assumed. Length of pipe associated with each project was approximated within the GIS environment.

Water Tanks (Stock and Storage): A cost of $3,200 per stock tank was used for a typical rubber-tire type tank. Cost of storage tanks were assumed to be approximately $1 per gallon of storage.

Stock Pond Construction. A cost of $16,500 per stock reservoir was used based upon summation of NRCS unit costs associated with a typical facilities:

- Assumed embankment of approximately 2,800 cy (10 ft high, 10 crest width, 250 feet crest length) applied to a unit cost of approximately $4/cy earthwork
- Agridrain outlet facility: $4,800 installed

Fencing. A cost of $2.30 per linear foot was utilized for general fencing requirements (barbed or smooth wire). For sensitive areas / protected areas, a cost of $5.04 per linear foot was used.

Stock Pond Sealant**.** Unit cost of $10,000 per acre of inundated area was used based upon information presented in previous Level I watershed studies previous. This cost assumes incorporation of bentonite at appropriate application rates.

Guzzler Installation. Based upon information obtained from BLM, a unit cost of $5,500 per installation was utilized.

7.3 Other Management Practices and Improvements

The costs of other potential management practices and improvements such as:

- Stream channel restoration,
- Range/grazing management,
- Prescribed burning, and
- Removal/control of invasive plants and noxious weeds are very project and site dependent.

Normally, all but some of the range/grazing management practices or improvements would be implemented by the appropriate agency (NRCS, BLM, Weed and Pest Districts, etc.).

Local staff of those agencies should be consulted regarding the costs of these practices and improvements. The cost of range/grazing practices and improvements (other than wildlife/livestock watering addressed in Section 7.2 above) mostly involve the rancher's time for planning, herding, salting, noxious weed and plant control/removal (where not otherwise covered by cooperative efforts managed by the Weed and Pest Districts), and possibly installation of local fencing in critical areas.

VIII. CONCLUSIONS AND RECOMMENDATIONS

VIII. CONCLUSIONS AND RECOMMENDATIONS

A multidisciplinary inventory of the Upper Laramie River watershed was conducted in an effort to identify and evaluate key resource issues and concerns related to watershed function and condition. A comprehensive Geographic Information System (GIS) was completed in conjunction with the inventory. The GIS incorporates the data collected and results generated during the study and collates it with information collected from a wide variety of sources. The GIS will be a valuable resource for the community and future studies which will likely be conducted in the watershed.

8.1 Conclusions

Upon completion of the watershed inventory phase of the project, the project team developed the watershed management plan. The plan was developed based upon findings of the inventory phase, a series of public meetings, questionnaires, and interaction with the project steering committee. In previous chapters, the key issues and problems were identified and ultimately, project goals and objectives were formulated to address them. Specifically, plans were developed to address issues associated with the following broad categories:

- *Irrigation System Conservation and Rehabilitation,*
- *Livestock/Wildlife Upland Watering Opportunities,*
- *Surface Water Storage Opportunities,*
- *Stream Channel Condition and Stability,*
- *Grazing Management Opportunities, and*
- *Other Management Opportunities.*

In summary, the following conclusions are provided.

8.1.1 Irrigation System Components

1. Potential solutions to the primary issues and problems associated with irrigation system infrastructure were identified. Consequently, fifteen (15) individual projects were incorporated into the watershed management plan. Conceptual level cost estimates were completed for the recommended improvements.

2. Individual improvements range from installation of simple structures on ditch systems providing water to one user to replacement of a diversion structure for a ditch serving many users (Oasis Ditch).

3. The recommended improvements to each irrigation system can be implemented individually, in combination, or as a complete package depending on the needs, preferences, and financial ability of the owner. Funding assistance is available from a number of sources, especially the WWDC Small Water Project Program and various programs administered by the NRCS.

4. Partnering opportunities may exist for construction of in-stream structures such as irrigation diversions. For example, Trout Unlimited (TU) recently provided partial funding for projects within the Upper Laramie River watershed in an effort to minimize their impacts upon fisheries and fish passage.

5. Many of the proposed irrigation system improvements would require minor involvement or permitting from regulatory agencies to be completed. However, work completed within stream channels (waters of the US) would require coordination with the USACE. Rehabilitation activities would likely be exempted from Section 404 permitting due to the USACE's exclusion of irrigation system maintenance efforts. Construction of new facilities would likely require Section 404 permitting.

8.1.2 Livestock/Wildlife Upland Watering Opportunities

1. There appears to be numerous opportunities to improve range and riparian conditions by means of increasing the availability of upland water sources for wildlife and livestock use.

2. Opportunities to improve range and riparian conditions require installing and operating well-distributed, reliable upland water sources and watering facilities for wildlife and livestock. Installing pipelines and stock tanks is the foundation of effective grazing management and can be an economical way to improve rangeland conditions. Strategic fencing is frequently required to optimize these benefits.

3. Pipeline/tank systems appear to offer the most efficient and cost-effective means to provide adequate watering to large areas of rangeland. Water sources for these systems will depend on the location of the rangeland to be served and the available alternative sources. The most likely sources are wells or spring developments.

4. Through discussion with local landowners and stakeholders, a total of 17 potential livestock / wildlife water supply projects were identified. Conceptual plans and conceptual level cost estimates were prepared for each project. Projects ranged from installation of stock tanks to well spring development and pipeline construction.

5. Most of the livestock / wildlife projects could be completed entirely on private lands. Consequently permitting issues are greatly simplified. However, some could involve coordination with the Bureau of Land Management (BLM) through the Rawlins Office. BLM consultation will be necessary in order to obtain the requisite permits and cultural clearances.

8.1.3 Surface Water Storage Opportunities

1. Development of new storage facilities or modification of existing facilities were not highly recommended by water users in the basin. Restrictions and constraints imposed by the Modified

North Platte Decree (2001) and the Platte River Recovery and Implementation Program (PRRIP) (2001) make completion of new projects highly problematic.

2. Potential modifications to Wheatland Reservoir No. 3 were also identified by the Wheatland Irrigation District (WID). Further study of this and other projects lying outside of the study area are needed. Since all beneficial uses of Wheatland Reservoir No. 3 lie in the Lower Laramie River basin, and consequently, outside of the current study area, the project was identified but not fully investigated at this time.

8.1.4 Stream Channel Condition and Stability

1. Based on the geomorphic assessment and input from the project Sponsor, the project team concluded that channel degradation does not appear to be systemic, yet impaired streams do exist. The categories of impairments identified include, but are not limited to, degradation of riparian vegetation and degradation of riparian condition in the form of stream bank erosion and channel degradation.

2. Site-specific solutions should be developed to mitigate the channel impairment and ultimately included in the watershed management rehabilitation plan.

3. Community-sponsored stream channel and habitat improvement projects could provide numerous benefits to the watershed. The LRCD has proven experience completing stream channel improvements including the recently completed project on the Laramie River within the City of Laramie. Community involvement provided numerous benefits to the project.

4. Potential projects would include efforts such as bank stabilization efforts using techniques such as willow plantings. In addition to providing direct benefits to the specific stream, ancillary benefits include education and community involvement.

8.1.5 Grazing Management Opportunities

1. Construction and operation of reliable water supply projects must be developed and implemented in areas with inadequate water sources before adjustments or alternatives in grazing management could be made on a particular area or allotment.

2. Development of reliable water sources and associated watering facilities can aid in distribution, timing, and frequency of grazing animals. However, additional measures such as cross-fencing, low-stress herding, mineral/salting, and grazing density should be evaluated as part of the site-specific, grazing management inventory and plan.

3. Available tools such as the ESD and the STM can be used by landowners and managers to become aware of the growth potential of desirable vegetation and predicted responses on a particular range site.

4. These tools could be used in developing appropriate rangeland treatments and grazing practices to begin the transition from an undesirable to a desirable plant community

8.2 Recommendations

Based upon the information presented throughout this report, and the conclusions presented above, the recommendations listed below are presented for consideration:

1. Many of the irrigation rehabilitation alternatives and the livestock / wildlife upland watering alternatives fall within the constraints for funding eligibility of the WWDC's Small Water Project Program (SWPP). These projects should be reviewed and selected alternatives should be implemented as soon as is practical. Completion of one or more of these projects in the near future would serve to benefit those directly involved in the project and increase interest and awareness of the benefits associated with the watershed planning process.

   Funding through the SWPP does not require formation of a public entity as defined by WWDC criteria. Consequently, individuals can seek funding through this program by applying through a conservation district as their sponsor. As discussed in Chapter 7, projects providing multiple benefits and for which total project cost are less than $135,000 are eligible for funding under this program. Grants are available for up to 50 percent of the total project cost or $35,000, whichever is less.

   Several alternative sources exist for funding of improvements within the watershed including on-farm improvements, irrigation rehabilitation projects, stream enhancements/restoration projects, and conservation and flood control projects. Creative strategies for funding/financing of projects should be more fully investigated following identification of projects worthy of additional evaluation and potential implementation. As an example, replacement of a failing ditch headgate and diversion which are also identified by WGFD as barriers to fish passage, could potentially be eligible for funding through SWPP (if total project cost meets SWPP criteria). Additional funding could also be attained through WGFD, Trout Unlimited, and other sources because of the fisheries and stream habitat benefits achievable with completion of the project. *By combining funding sources, the owner could conceivably obtain grants for most, if not all, of the project costs.*

2. Several of the irrigation projects identified involved costly repairs or replacement of existing facilities and would not be eligible for funding through the SWPP. For the projects listed below, landowners and ditch owners should consider district formation (where applicable) and application to the WWDC for level II evaluation and potential project funding:

a. IRR-006: Oasis Ditch Diversion
b. IRR-009: South Lund Ditch Diversion
c. IRR-002: Bellamy Ditch Drop/Chute Structure

3. The Laramie Valley Irrigation District is served by the Oasis Ditch. District representatives presented several issues associated with the ditch which were ultimately included in the Upper Laramie River Watershed Management Plan. The Oasis Ditch system, however, would benefit from more in-depth evaluation than could be completed during the completion of this Level I study. Potential considerations would include system automation, evaluation of annual assessments, and operations and maintenance funding. Consequently, it is recommended that the Laramie Valley Irrigation District apply to the WWDC for Level II funding of an irrigation systems master plan investigation at which time, these and other management issues could be evaluated.

4. Landowners or managers seeking to participate in the SWPP should consult and coordinate with the LRCD, which is the eligible sponsor of SWPP applications and project agreements.

5. The study's GIS and digital library should be used as a tool in planning and developing potential projects and should be updated as necessary from available information sources.

6. Potential funding opportunities exist for proposed and future improvement projects within the watershed including ranch and farm improvements, irrigation system rehabilitation, riparian/wetland enhancements, river corridor and stream channel restoration, and urban drainage and flood control projects. For example, the Saratoga Encampment Rawlins Conservation District (SERCD) was recently granted funding through the USDA ***Regional Conservation Partnership Program (RCPP)***. The funding is intended for achieving resource management goals from improving water quality and wildlife habitat to streambank restoration. Where appropriate, partnering SWPP funding with RCPP funded projects could provide multiple benefits.

7. Innovative strategies for coordinated project funding and financing should be investigated and focus on local, collaborative endeavors that integrate more than one watershed issue or concern that could potentially result in achievement of multiple benefits.

8. Every effort was made to provide information within this document to support the application for SWPP funding from the WWDC with LRCD sponsorship. Project narratives, conceptual designs, cost estimates, and discussion of project benefits can all be incorporated directly into the SWPP application by the LRCD.

9. The public outreach portion of this project attempted to accommodate all interested parties. To the best of the project team's knowledge, all who expressed interested in participating were

contacted. However, our experience has shown that additional "new" individuals will come forward wishing to participate after this Level I study is completed. These individuals must be made aware that they are eligible to apply for SWPP funding if they are within the geographic boundaries of the study area. They simply have not had the benefit of having met with the project team and having a portion of their application needs provided to them. They would be subject to the same application requirements and deadlines as those who did participate.

10. The Upper Laramie River Watershed Management plan was completed based primarily upon input obtained from the LRCD and participating landowners/stakeholders. Many of the project recommendations involved rehabilitation or replacement of irrigation structures (IRR components) with a total of fifteen (15) projects. Twelve of these would be eligible for Small Water Project Program Funding as their total costs are estimated to be less than $135,000 each. Construction of all project eligible for SWPP funding would require approximately $275,000. The remaining three projects would likely require Level II investigations and would potentially add over $750,000 to complete.

    A total of seventeen (17) livestock and wildlife water supply projects (L/W components) were included in the plan. Construction of all projects would require approximately $522,000 to complete.

11. Barriers to fish passage were identified using the project GIS and consultation with WGF. Two structures were identified by WGF staff as important structures where modifications could be made to facilitate fish passage:

    a. Pioneer Ditch Diversion Structure (STR-003)
    b. Dowlin Ditch Diversion Structure (STR-004)

    These two structures do not represent all of the structures posing partial or complete barriers. They are recommended, however, for further investigation. Potential partnering with agencies such as WGF and private entities such as TU could result in successful completion.

IX. REFERENCES

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APPENDIX 3A

STOCK RESERVOIR EVALUATION

APPENDIX 3A: STOCK RESERVOIR EVALUATION

ACE_ID	Improvement Type	Source	Notes	Status	Water Source	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
1	Pond	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.73	-105.82	Laramie River-Dunn Ditch	LOOKOUT PEAK	20N	75W	9
2	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.66	-105.88	Lower Dutton Creek	COOPER LAKE	19N	76W	1
	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.66	-105.87	Lower Dutton Creek	COOPER LAKE	19N	76W	1
4	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.64	-105.92	Lower Dutton Creek	COOPER LAKE	19N	76W	10
5	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.64	-105.78	Laramie River-Dunn Ditch	N/A	19N	75W	11
6	Pond	ACE Mapscan	Depression, but it is wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.64	-105.77	Laramie River-Dunn Ditch	IONE LAKE	19N	75W	12
7	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.62	-105.74	Laramie River-Dunn Ditch	IONE LAKE	19N	74W	18
8	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.62	-105.90	Lower Dutton Creek	COOPER LAKE	19N	76W	14
9	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.00	-106.17	Boswell Creek	BOSWELL (RMU)	12N	78W	21
10	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.01	-106.13	Boswell Creek	BOSWELL (RMU)	12N	78W	14
11	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.01	-106.13	Boswell Creek	BOSWELL (RMU)	12N	78W	14
12	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.01	-106.13	Boswell Creek	BOSWELL (RMU)	12N	78W	14
13	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.00	-106.13	Boswell Creek	BOSWELL (RMU)	12N	78W	14
14	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.00	-106.12	Boswell Creek	BOSWELL (RMU)	12N	78W	14
15	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.00	-106.12	Boswell Creek	BOSWELL (RMU)	12N	78W	14
16	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.00	-106.13	Boswell Creek	BOSWELL (RMU)	12N	78W	14
17	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.00	-106.12	Boswell Creek	BOSWELL (RMU)	12N	78W	14
18	Pond	ACE Mapscan	series of ponds, wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.02	-106.16	Boswell Creek	BOSWELL (RMU)	12N	78W	9
19	Pond	ACE Mapscan	series of ponds, wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.02	-106.15	Boswell Creek	BOSWELL (RMU)	12N	78W	9
20	Pond	ACE Mapscan	series of ponds, wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.02	-106.15	Boswell Creek	BOSWELL (RMU)	12N	78W	9
21	Pond	ACE Mapscan	series of ponds, wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.02	-106.15	Boswell Creek	BOSWELL (RMU)	12N	78W	9
22	Pond	ACE Mapscan	series of ponds, wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.02	-106.15	Boswell Creek	BOSWELL (RMU)	12N	78W	10
23	Pond	ACE Mapscan	pond wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.03	-106.14	Boswell Creek	BOSWELL (RMU)	12N	78W	10
24	Pond	ACE Mapscan	pond wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.03	-106.13	Boswell Creek	BOSWELL (RMU)	12N	78W	11
25	Pond	ACE Mapscan	pond wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.03	-106.13	Boswell Creek	BOSWELL (RMU)	12N	78W	10
26	Pond	ACE Mapscan	pond wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.03	-106.13	Boswell Creek	BOSWELL (RMU)	12N	78W	10
27	Pond	ACE Mapscan	pond wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.03	-106.14	Boswell Creek	BOSWELL (RMU)	12N	78W	10
28	Pond	ACE Mapscan	pond wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.03	-106.13	Boswell Creek	BOSWELL (RMU)	12N	78W	10
29	Pond	ACE Mapscan	pond wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.03	-106.12	Boswell Creek	BOSWELL (RMU)	12N	78W	11
30	Pond	ACE Mapscan	pond wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.03	-106.12	Boswell Creek	BOSWELL (RMU)	12N	78W	11
31	Pond	ACE Mapscan	pond wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.03	-106.12	Boswell Creek	BOSWELL (RMU)	12N	78W	11
32	Pond	ACE Mapscan	pond wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.03	-106.12	Boswell Creek	BOSWELL (RMU)	12N	78W	11
33	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.02	-106.03	Laramie River-Bear Creek	BOSWELL RANCH	12N	77W	10
34	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015 series of ponds.	Existing	Yes	US Forest Service	41.04	-106.11	Boswell Creek	BOSWELL (RMU)	12N	78W	1
35	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015, Pond	Existing	Yes	US Forest Service	41.04	-106.16	Boswell Creek	BOSWELL (RMU)	12N	78W	4
36	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015, series of ponds	Existing	Yes	US Forest Service	41.06	-106.13	Laramie River-Bear Creek	BOSWELL (RMU)	13N	78W	26
37	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015, series of ponds	Existing	Yes	US Forest Service	41.06	-106.13	Laramie River-Bear Creek	BOSWELL (RMU)	13N	78W	26
38	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015, series of ponds	Existing	Yes	US Forest Service	41.06	-106.13	Laramie River-Bear Creek	BOSWELL (RMU)	13N	78W	26
39	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015, series of ponds	Existing	Yes	US Forest Service	41.06	-106.13	Laramie River-Bear Creek	BOSWELL (RMU)	13N	78W	26
40	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015, series of ponds	Existing	Yes	Private	41.06	-106.12	Laramie River-Bear Creek	BOSWELL (RMU)	13N	78W	35
41	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.05	-105.74	Sand Creek-Shell Creek	ANTELOPE CREEK	13N	74W	31
42	Pond	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.06	-105.79	Dry Creek-Shell Creek	N/A	13N	75W	27
43	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.06	-105.78	Dry Creek-Shell Creek	N/A	13N	75W	27
44	Pond	ACE Mapscan	Wet in 2011, 2015. seasonal ponds	Existing	Potential	Private	41.06	-105.78	Dry Creek-Shell Creek	N/A	13N	75W	26
45	Pond	ACE Mapscan	Wet in 2011, 2015. seasonal ponds	Existing	Potential	Private	41.07	-105.78	Dry Creek-Shell Creek	N/A	13N	75W	26
46	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.06	-106.09	Laramie River-Bear Creek	BOSWELL (RMU)	13N	77W	30
47	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.08	-106.15	Squirrel Creek-Laramie River	FOXPARK (RMU)	13N	78W	22
48	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.08	-105.92	Lindsey Creek	STEAMBOAT ROCK	13N	76W	22
49	Pond	ACE Mapscan	Wet in 2009, 2012, 2015	Existing	Yes	Bureau of Land Management	41.10	-105.89	Laramie River-Sodergreen Lake	STEAMBOAT ROCK	13N	76W	14
50	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.09	-105.93	Laramie River-Sodergreen Lake	N/A	13N	76W	16
51	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.10	-106.12	Squirrel Creek-Laramie River	FOXPARK (RMU)	13N	78W	14
52	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.10	-106.12	Squirrel Creek-Laramie River	FOXPARK (RMU)	13N	78W	14
53	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.10	-106.11	Squirrel Creek-Laramie River	FOXPARK (RMU)	13N	78W	14
54	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.10	-106.11	Squirrel Creek-Laramie River	FOXPARK (RMU)	13N	78W	13
55	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.10	-106.10	Squirrel Creek-Laramie River	FOXPARK (RMU)	13N	78W	13
56	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.10	-106.14	Squirrel Creek-Laramie River	FOXPARK (RMU)	13N	78W	15
57	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.10	-106.14	Squirrel Creek-Laramie River	FOXPARK (RMU)	13N	78W	15
58	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.10	-106.14	Squirrel Creek-Laramie River	FOXPARK (RMU)	13N	78W	15
59	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.12	-105.60	Willow Creek-Laramie River	N/A	13N	73W	5
60	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	State of Wyoming	41.12	-105.59	Willow Creek-Laramie River	N/A	13N	73W	4
61	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.12	-105.75	Shell Creek	SAND CREEK RANCH	13N	74W	6
62	Pond	ACE Mapscan	Wet in 2011, 2012, 2015, seasonal water	Existing	Potential	Private	41.15	-105.78	Laramie River-Sodergreen Lake	N/A	14N	75W	35
63	Pond	ACE Mapscan	Wet in 2009, 2015, seasonal water	Potential	Yes	State of Wyoming	41.14	-105.75	Shell Creek	N/A	14N	75W	36
64	Pond	ACE Mapscan	Wet in 2009, 2015	Existing	Yes	Private	41.14	-105.74	Antelope Creek-Shell Creek	N/A	14N	74W	31
65	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.13	-105.70	Antelope Creek-Shell Creek	SAND CREEK RANCH	14N	74W	33
66	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.14	-105.60	Willow Creek-Laramie River	N/A	14N	73W	32
67	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.16	-105.59	Willow Creek-Laramie River	N/A	14N	73W	21
68	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.17	-105.67	Antelope Creek-Shell Creek	MONAGHAN RANCH	14N	74W	23
69	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.17	-105.66	Antelope Creek-Shell Creek	MONAGHAN RANCH	14N	74W	23
70	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.17	-105.66	Lone Tree Creek	MONAGHAN RANCH	14N	74W	23
71	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.17	-105.66	Lone Tree Creek	MONAGHAN RANCH	14N	74W	23
72	Pond	ACE Mapscan	Wet in 2009, 2015	Existing	Yes	Private	41.18	-105.69	Antelope Creek-Shell Creek	N/A	14N	74W	15
73	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.15	-105.99	Lake Hattie	N/A	14N	77W	25

ACE_ID	Improvement Type	Source	Notes	Status	Water Source	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
74	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.15	-106.00	Lake Hattie	N/A	14N	77W	26
75	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.16	-105.83	Laramie River-Sodergreen Lake	N/A	14N	75W	29
76	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.15	-105.82	Laramie River-Sodergreen Lake	N/A	14N	75W	29
77	Pond	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.15	-105.70	Antelope Creek-Shell Creek	SAND CREEK RANCH	14N	74W	28
78	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.17	-105.84	Laramie River-Sodergreen Lake	N/A	14N	75W	20
79	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.19	-106.03	Squirrel Creek-Laramie River	SHEEP MOUNTAIN WILDLIFE (RMU)	14N	77W	15
80	Pond	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	State of Wyoming	41.18	-105.90	Sevenmile Lakes	N/A	14N	76W	14
81	Pond	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	State of Wyoming	41.18	-105.89	Sevenmile Lakes	N/A	14N	76W	14
82	Pond	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	State of Wyoming	41.19	-105.89	Sevenmile Lakes	N/A	14N	76W	14
83	Pond	ACE Mapscan	Wet in 2011, 2015	Existing	Yes	State of Wyoming	41.19	-105.89	Sevenmile Lakes	N/A	14N	76W	14
84	Pond	ACE Mapscan	Wet in 2011, 2015	Existing	Yes	Private	41.19	-105.88	Sevenmile Lakes	N/A	14N	76W	13
85	Pond	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.19	-105.88	Sevenmile Lakes	N/A	14N	76W	12
86	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.19	-105.83	Sevenmile Lakes	N/A	14N	75W	16
87	Pond	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.19	-105.82	Sevenmile Lakes	N/A	14N	75W	16
88	Pond	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.19	-105.81	Laramie River-Sodergreen Lake	N/A	14N	75W	16
89	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.18	-105.73	Shell Creek	BESSIE BATH	14N	74W	18
90	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.19	-105.61	Harney Creek-Laramie River	N/A	14N	73W	8
91	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.19	-105.60	Harney Creek-Laramie River	N/A	14N	73W	8
92	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.19	-105.83	Sevenmile Lakes	N/A	14N	75W	8
93	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.19	-106.10	South Fork Little Laramie River	HECHT	14N	78W	12
94	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	Private	41.19	-106.12	South Fork Little Laramie River	N/A	14N	78W	11
95	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	Private	41.19	-106.12	South Fork Little Laramie River	N/A	14N	78W	11
96	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	Private	41.20	-106.12	South Fork Little Laramie River	N/A	14N	78W	11
97	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	Private	41.20	-106.12	South Fork Little Laramie River	N/A	14N	78W	11
98	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.19	-106.16	South Fork Little Laramie River	HOLMES (RMU)	14N	78W	9
99	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.19	-106.16	South Fork Little Laramie River	HOLMES (RMU)	14N	78W	9
100	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.19	-106.16	South Fork Little Laramie River	HOLMES (RMU)	14N	78W	9
101	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.20	-106.17	South Fork Little Laramie River	HOLMES (RMU)	14N	78W	9
102	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.20	-106.17	South Fork Little Laramie River	HOLMES (RMU)	14N	78W	9
103	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.20	-106.16	South Fork Little Laramie River	HOLMES (RMU)	14N	78W	9
104	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.20	-106.16	South Fork Little Laramie River	HOLMES (RMU)	14N	78W	9
105	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.20	-106.16	South Fork Little Laramie River	HOLMES (RMU)	14N	78W	9
106	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.20	-106.16	South Fork Little Laramie River	HOLMES (RMU)	14N	78W	9
107	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.20	-106.16	South Fork Little Laramie River	HOLMES (RMU)	14N	78W	9
108	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.20	-106.16	South Fork Little Laramie River	HOLMES (RMU)	14N	78W	9
109	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.21	-106.16	South Fork Little Laramie River	HOLMES (RMU)	14N	78W	4
110	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.21	-106.16	South Fork Little Laramie River	HOLMES (RMU)	14N	78W	4
111	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.21	-106.16	South Fork Little Laramie River	HOLMES (RMU)	14N	78W	4
112	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. series of ponds	Existing	Yes	US Forest Service	41.21	-106.15	South Fork Little Laramie River	HOLMES (RMU)	14N	78W	4
113	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.22	-106.13	South Fork Little Laramie River	N/A	14N	78W	2
114	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.21	-106.12	South Fork Little Laramie River	N/A	14N	78W	2
115	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	State of Wyoming	41.22	-106.09	South Fork Little Laramie River	N/A	14N	77W	6
116	Pond	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	State of Wyoming	41.21	-105.93	Sevenmile Lakes	N/A	14N	76W	4
117	Pond	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	State of Wyoming	41.21	-105.92	Sevenmile Lakes	N/A	14N	76W	4
118	Pond	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.22	-105.92	Sevenmile Lakes	N/A	14N	76W	
119	Pond	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.21	-105.92	Sevenmile Lakes	N/A	14N	76W	
120	Pond	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.21	-105.92	Sevenmile Lakes	N/A	14N	76W	
121	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	US Fish & Wildlife	41.21	-105.83	Sevenmile Lakes	N/A	14N	75W	5
122	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.22	-105.70	Laramie River-West Laramie	BESSIE BATH	14N	74W	4
123	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.22	-105.61	Harney Creek-Laramie River	N/A	15N	73W	32
124	Pond	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	State of Wyoming	41.23	-105.65	Laramie River-West Laramie	N/A	15N	74W	36
125	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Nelson Pond	Existing	Yes	Private	41.23	-105.83	Sevenmile Lakes	N/A	15N	75W	32
126	Pond	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.24	-105.84	Sevenmile Lakes	N/A	15N	75W	29
127	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	State of Wyoming	41.23	-105.88	Sevenmile Lakes	N/A	15N	76W	36
128	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.22	-105.90	Sevenmile Lakes	JW/SHEEP MTN RANCH	15N	76W	35
129	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.22	-105.90	Sevenmile Lakes	JW/SHEEP MTN RANCH	15N	76W	35
130	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.23	-105.93	Lake Hattie	JW/SHEEP MTN RANCH	15N	76W	33
131	Pond	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.23	-105.95	Lake Hattie	JW/SHEEP MTN RANCH	15N	76W	32
132	Pond	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.23	-105.95	Lake Hattie	JW/SHEEP MTN RANCH	15N	76W	32
133	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.24	-105.80	Sevenmile Lakes	N/A	15N	75W	27
134	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.24	-105.74	Laramie River-West Laramie	N/A	15N	74W	30
135	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.59	-105.95	Cooper Creek	COOPER LAKE	19N	76W	29
136	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.58	-105.95	Cooper Creek	STROUSE HILL	19N	76W	29
137	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.58	-106.08	Upper Dutton Creek	DUTTON CREEK SOUTH	19N	77W	32
138	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.58	-106.00	Cooper Creek	DUTTON CREEK SOUTH	19N	77W	36
139	Pond	ACE Mapscan	Wet in 2009, 2011,2015	Existing	Yes	Private	41.56	-105.67	Laramie River-Bosler Junction	N/A	18N	74W	2
140	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.56	-105.67	Laramie River-Bosler Junction	N/A	18N	74W	2
141	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.56	-105.67	Laramie River-Bosler Junction	N/A	18N	74W	2
142	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.56	-105.76	James Lake	HARRIS RANCH	18N	75W	1
143	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.55	-105.75	James Lake	HARRIS RANCH	18N	74W	7
144	Pond	ACE Mapscan	Wet in 2009, 2015, seasonally holds water	Existing	Yes	State of Wyoming	41.57	-105.75	James Lake	HARRIS RANCH	18N	74W	6
145	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.56	-105.77	James Lake	HARRIS RANCH	18N	75W	1
146	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Bureau of Land Management	41.57	-105.94	Cooper Creek	STROUSE HILL	18N	76W	4

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147	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.56	-106.03	Cooper Creek	STROUSE HILL	18N	77W	
148	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.55	-105.69	Laramie River-Bosler Junction	N/A	18N	74W	10
149	Pond	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	State of Wyoming	41.53	-105.81	Laramie River-Bosler Junction	STROUSE HILL	18N	75W	16
150	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.53	-105.99	Damm	STROUSE HILL	18N	77W	13
151	Pond	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.52	-105.77	Laramie River-Bosler Junction	HARRIS RANCH	18N	75W	23
152	Pond	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.51	-105.78	Laramie River-Bosler Junction	HARRIS RANCH	18N	75W	23
153	Pond	ACE Mapscan	Wet in 2009, 2015	Existing	Yes	Private	41.50	-105.79	Laramie River-Bosler Junction	HARRIS RANCH	18N	75W	26
154	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.50	-105.82	Fourmile Creek-Laramie River	N/A	18N	75W	33
155	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.50	-105.80	Laramie River-Bosler Junction	N/A	18N	75W	34
156	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.50	-105.84	Fourmile Creek-Laramie River	JAMES LAKE	18N	75W	29
157	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.50	-105.83	Fourmile Creek-Laramie River	N/A	18N	75W	29
158	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.50	-105.88	Fourmile Creek-Laramie River	JAMES LAKE	18N	76W	25
159	Pond	ACE Mapscan	Wet in 2009, 2015	Existing	Potential	Private	41.50	-105.98	Damm	STROUSE HILL	18N	76W	30
160	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.50	-106.11	Cooper Creek	N/A	18N	78W	25
161	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.50	-106.10	Cooper Creek	N/A	18N	78W	25
162	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.50	-106.10	Cooper Creek	N/A	18N	78W	25
163	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.50	-106.10	Cooper Creek	N/A	18N	78W	25
164	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.50	-106.10	Cooper Creek	N/A	18N	78W	25
165	Pond	ACE Mapscan	new pond in 2015	Existing	Yes	Private	41.50	-106.15	Upper Dutton Creek	N/A	18N	78W	27
166	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.49	-106.14	Cooper Creek	THREE MILE WILDLIFE (RMU)	18N	78W	34
167	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.49	-106.14	Cooper Creek	THREE MILE WILDLIFE (RMU)	18N	78W	34
168	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.49	-106.14	Cooper Creek	NORTH FORK (RMU)	18N	78W	34
169	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.49	-106.11	Cooper Creek	N/A	18N	78W	36
170	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.49	-106.11	Cooper Creek	N/A	18N	78W	36
171	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.49	-106.11	Cooper Creek	N/A	18N	78W	36
172	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.49	-106.11	Cooper Creek	N/A	18N	78W	36
173	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.49	-106.11	Cooper Creek	N/A	18N	78W	36
174	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.49	-105.86	Fourmile Creek-Laramie River	JAMES LAKE	18N	75W	31
175	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.49	-105.86	Fourmile Creek-Laramie River	JAMES LAKE	18N	75W	31
176	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.49	-105.86	Fourmile Creek-Laramie River	JAMES LAKE	18N	75W	31
177	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.48	-105.85	Fourmile Creek-Laramie River	JAMES LAKE	18N	75W	32
178	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.48	-105.85	Fourmile Creek-Laramie River	JAMES LAKE	17N	75W	5
179	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.46	-105.94	Sevenmile Creek-Laramie River	JAMES LAKE	17N	76W	9
180	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.46	-105.93	Sevenmile Creek-Laramie River	JAMES LAKE	17N	76W	9
181	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.46	-105.92	Sevenmile Creek-Laramie River	JAMES LAKE	17N	76W	10
182	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.46	-105.92	Sevenmile Creek-Laramie River	JAMES LAKE	17N	76W	10
183	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.47	-105.91	Sevenmile Creek-Laramie River	JAMES LAKE	17N	76W	10
184	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.47	-105.64	Laramie River-Soap Holes	N/A	17N	74W	12
185	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Watt Lake	Existing	Yes	Private	41.44	-105.77	Little Laramie River-Sprague River	HARRIS RANCH	17N	75W	14
186	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.44	-105.93	Sevenmile Creek-Laramie River	JAMES LAKE	17N	76W	16
187	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.44	-106.11	Fourmile Creek-Laramie River	N/A	17N	78W	13
188	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.44	-106.11	Sevenmile Creek-Laramie River	N/A	17N	78W	13
189	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.45	-106.11	Fourmile Creek-Laramie River	N/A	17N	78W	13
190	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.44	-106.10	Fourmile Creek-Laramie River	N/A	17N	78W	13
191	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.44	-106.10	Fourmile Creek-Laramie River	N/A	17N	78W	13
192	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Bureau of Land Management	41.45	-106.10	Fourmile Creek-Laramie River	WILLS	17N	77W	18
193	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.44	-106.12	Fourmile Creek-Laramie River	NORTH FORK (RMU)	17N	78W	14
194	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.44	-106.14	Sevenmile Creek-Laramie River	NORTH FORK (RMU)	17N	78W	15
195	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.43	-105.88	Little Laramie River-Sprague River	N/A	17N	76W	24
196	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.43	-105.87	Little Laramie River-Sprague River	N/A	17N	76W	24
197	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.43	-105.86	Little Laramie River-Sprague River	JAMES LAKE	17N	75W	19
198	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.42	-105.67	Laramie River-Soap Holes	CARROLL	17N	74W	26
199	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.42	-105.68	Laramie River-Soap Holes	CARROLL	17N	74W	27
200	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Little Carroll Lake	Existing	Yes	Private	41.42	-105.72	Laramie River-Soap Holes	CARROLL	17N	74W	29
201	Pond	ACE Mapscan	Wet in 2011, 2012, 2015. Carroll Lake	Existing	Yes	Water	41.41	-105.73	Laramie River-Soap Holes	N/A	17N	74W	30
202	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Carroll Lake	Existing	Yes	Water	41.41	-105.74	Laramie River-Soap Holes	N/A	17N	74W	30
203	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.42	-106.12	Mill Creek-Little Laramie River	N/A	17N	78W	25
204	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.41	-106.11	Mill Creek-Little Laramie River	N/A	17N	78W	25
205	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.41	-106.11	Mill Creek-Little Laramie River	N/A	17N	78W	25
206	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.42	-106.12	Mill Creek-Little Laramie River	N/A	17N	78W	25
207	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.42	-106.12	Mill Creek-Little Laramie River	NORTH FORK (RMU)	17N	78W	26
208	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.42	-106.11	Sevenmile Creek-Laramie River	N/A	17N	78W	25
209	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.42	-106.11	Sevenmile Creek-Laramie River	N/A	17N	78W	25
210	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.42	-106.11	Mill Creek-Little Laramie River	N/A	17N	78W	25
211	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.42	-106.12	Sevenmile Creek-Laramie River	NORTH FORK (RMU)	17N	78W	26
212	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.40	-106.15	Mill Creek-Little Laramie River	NORTH FORK (RMU)	17N	78W	34
213	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.40	-105.83	Little Laramie River-Sprague River	N/A	17N	75W	32
214	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.40	-105.79	Browns Creek	N/A	17N	75W	34
215	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Lori Lake	Existing	Yes	State of Wyoming	41.39	-105.78	Browns Creek	N/A	16N	75W	2
216	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Teri Lake	Existing	Yes	Private	41.40	-105.78	Browns Creek	N/A	17N	75W	35
217	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.40	-105.76	Browns Creek	N/A	17N	75W	36
218	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.41	-105.76	Browns Creek	N/A	17N	75W	36
219	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Bamforth Lake	Existing	Yes	Water	41.39	-105.74	Bamforth Lake	N/A	16N	74W	6

ACE_ID	Improvement Type	Source	Notes	Status	Water Source	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
220	Pond	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.40	-105.68	Laramie River-Soap Holes	CARROLL	16N	74W	
221	Pond	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.40	-105.66	Laramie River-Soap Holes	CARROLL	17N	74W	35
222	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.40	-105.64	Laramie River-Soap Holes	N/A	17N	74W	36
223	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.40	-105.63	Laramie River-Soap Holes	N/A	17N	73W	31
224	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.40	-105.63	Laramie River-Soap Holes	N/A	17N	73W	31
225	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.40	-105.62	Laramie River-Soap Holes	N/A	17N	73W	31
226	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.39	-105.62	Laramie River-Soap Holes	N/A	16N	73W	6
227	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.39	-105.58	Laramie River-Soap Holes	N/A	16N	73W	4
228	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Rhodes Lake	Existing	Yes	Private	41.39	-105.66	Laramie River-Soap Holes	CARROLL	16N	74W	2
229	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Alsop Lake	Existing	Yes	Private	41.39	-105.79	Browns Creek	N/A	16N	75W	
230	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.39	-105.80	Browns Creek	N/A	16N	75W	
231	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.38	-105.83	Browns Creek	N/A	16N	75W	5
232	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.38	-105.82	Browns Creek	N/A	16N	75W	4
233	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.38	-105.85	Browns Creek	N/A	16N	75W	6
234	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.38	-106.21	Libby Creek	NORTH FORK (RMU)	16N	78W	6
235	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.38	-106.24	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	2
236	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.39	-106.23	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	2
237	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.39	-106.24	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	2
238	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.39	-106.24	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	2
239	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.39	-106.24	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	2
240	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.38	-106.26	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	
241	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.38	-106.25	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	
242	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.38	-106.26	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	
243	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.38	-106.24	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	2
244	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.38	-106.26	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	
245	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Lost Lake	Existing	Yes	US Forest Service	41.37	-106.27	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	9
246	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Brooklyn Lake	Existing	Yes	US Forest Service	41.37	-106.25	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	10
247	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.37	-106.27	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	9
248	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.37	-106.27	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	9
249	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.37	-106.27	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	9
250	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.37	-106.28	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	9
251	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Lost Lake	Existing	Yes	US Forest Service	41.37	-106.30	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	8
252	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.37	-106.30	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	8
253	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.36	-106.29	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	8
254	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.37	-106.27	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	10
255	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.36	-106.30	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	8
256	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Lost Lake	Existing	Yes	US Forest Service	41.36	-106.30	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	8
257	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.36	-106.29	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	8
258	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.36	-106.29	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	8
259	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Klondike Lake	Existing	Yes	US Forest Service	41.36	-106.30	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	8
260	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.36	-106.30	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	8
261	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.36	-106.29	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	8
262	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.36	-106.28	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	16
263	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.36	-106.27	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	9
264	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.36	-106.27	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	9
265	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.36	-106.26	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	10
266	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.36	-106.26	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	10
267	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Brooklyn Lake	Existing	Yes	US Forest Service	41.37	-106.24	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	11
268	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Brooklyn Lake	Existing	Yes	US Forest Service	41.36	-106.25	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	10
269	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Brooklyn Lake	Existing	Yes	US Forest Service	41.37	-106.23	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	12
270	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Brooklyn Lake	Existing	Yes	US Forest Service	41.37	-106.23	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	12
271	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Brooklyn Lake	Existing	Yes	US Forest Service	41.37	-106.23	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	11
272	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Brooklyn Lake	Existing	Yes	US Forest Service	41.37	-106.22	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	12
273	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.37	-106.14	Mill Creek-Little Laramie River	NORTH FORK (RMU)	16N	78W	10
274	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.36	-106.12	Mill Creek-Little Laramie River	NORTH FORK (RMU)	16N	78W	11
275	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Pilger Lake	Existing	Yes	Private	41.37	-105.83	Browns Creek	N/A	16N	75W	8
276	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.37	-105.82	Browns Creek	N/A	16N	75W	9
277	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.38	-105.80	Browns Creek	N/A	16N	75W	10
278	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Knadler Lake	Existing	Yes	Private	41.37	-105.77	Bamforth Lake	N/A	16N	75W	11
279	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Gravel Pits	Existing	Yes	Private	41.37	-105.60	Laramie River-Soap Holes	N/A	16N	73W	9
280	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Gravel Pits	Existing	Yes	Private	41.37	-105.60	Laramie River-Soap Holes	N/A	16N	73W	9
281	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Gravel Pits	Existing	Yes	Private	41.37	-105.59	Laramie River-Soap Holes	N/A	16N	73W	9
282	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Gravel Pits	Existing	Yes	Private	41.37	-105.59	Laramie River-Soap Holes	N/A	16N	73W	9
283	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Gravel Pits	Existing	Yes	Private	41.37	-105.59	Laramie River-Soap Holes	N/A	16N	73W	9
284	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Gravel Pits	Existing	Yes	Private	41.37	-105.59	Laramie River-Soap Holes	N/A	16N	73W	9
285	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Gravel Pits	Existing	Yes	Private	41.37	-105.59	Laramie River-Soap Holes	N/A	16N	73W	9
286	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Gravel Pits	Existing	Yes	Private	41.37	-105.59	Laramie River-Soap Holes	N/A	16N	73W	9
287	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Gravel Pits	Existing	Yes	Private	41.37	-105.59	Laramie River-Soap Holes	N/A	16N	73W	9
288	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Gravel Pits	Existing	Yes	Private	41.37	-105.59	Laramie River-Soap Holes	N/A	16N	73W	9
289	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Gravel Pits	Existing	Yes	Private	41.37	-105.59	Laramie River-Soap Holes	N/A	16N	73W	9
290	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Gravel Pits	Existing	Yes	Private	41.37	-105.59	Laramie River-Soap Holes	N/A	16N	73W	9
291	Pond	ACE Mapscan	Dry in all imagery, no visible damage	Existing	Potential	Private	41.36	-105.54	Laramie River-Soap Holes	N/A	16N	73W	14
292	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.36	-105.79	Bamforth Lake	N/A	16N	75W	15

ACE_ID	Improvement Type	Source	Notes	Status	Water Source	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
293	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.36	-105.83	Browns Creek	N/A	16N	75W	17
294	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.36	-105.83	Browns Creek	N/A	16N	75W	17
295	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.36	-105.89	Browns Creek	N/A	16N	76W	14
296	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.36	-105.89	Browns Creek	N/A	16N	76W	14
297	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.36	-105.89	Browns Creek	N/A	16N	76W	14
298	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Webb Lake	Existing	Yes	Water	41.35	-105.97	Little Laramie River-Webb Lake	N/A	16N	76W	18
299	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.36	-106.22	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	13
300	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.36	-106.21	Libby Creek	NORTH FORK (RMU)	16N	79W	13
301	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.36	-106.21	Libby Creek	NORTH FORK (RMU)	16N	79W	13
302	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.36	-106.21	Libby Creek	NORTH FORK (RMU)	16N	79W	13
303	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.36	-106.21	Libby Creek	NORTH FORK (RMU)	16N	79W	13
304	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.34	-106.23	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	23
305	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.35	-106.22	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	24
306	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.35	-106.23	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	13
307	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.36	-106.25	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	15
308	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.35	-106.24	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	14
309	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.36	-106.25	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	15
310	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.35	-106.26	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	15
311	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.35	-106.26	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	15
312	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.35	-106.26	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	15
313	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.35	-106.27	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	15
314	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.36	-106.27	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	16
315	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.36	-106.27	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	16
316	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.36	-106.27	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	16
317	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.35	-106.28	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	16
318	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.35	-106.27	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	16
319	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.35	-106.27	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	16
320	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Lewis Lake	Existing	Yes	US Forest Service	41.36	-106.30	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	17
321	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Libby Lake	Existing	Yes	US Forest Service	41.36	-106.30	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	17
322	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.36	-106.30	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	17
323	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.34	-106.29	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	20
324	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.34	-106.26	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	22
325	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.34	-106.24	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	23
326	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.34	-106.24	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	23
327	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.33	-106.22	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	25
328	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.33	-106.22	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	24
329	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.34	-106.23	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	24
330	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.35	-106.18	Libby Creek	NORTH FORK (RMU)	16N	78W	20
331	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.35	-105.90	Browns Creek	N/A	16N	76W	22
332	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.34	-105.90	Browns Creek	N/A	16N	76W	23
333	Pond	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.34	-105.91	Browns Creek	N/A	16N	76W	22
334	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.34	-105.88	Browns Creek	N/A	16N	76W	23
335	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Swedes Cabin Lake	Existing	Yes	Private	41.33	-105.87	Browns Creek	N/A	16N	76W	25
336	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.33	-105.65	Laramie River-Laramie	N/A	16N	74W	25
337	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.33	-105.65	Laramie River-Laramie	N/A	16N	74W	26
338	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Rex Lake	Existing	Yes	Private	41.33	-106.01	Little Laramie River-Webb Lake	N/A	16N	77W	26
339	Pond	ACE Mapscan	Wet in 2011, 2015	Existing	Yes	US Forest Service	41.32	-106.18	Libby Creek	NORTH FORK (RMU)	16N	78W	29
340	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.32	-106.20	Libby Creek	CENTENNIAL RIDGE (RMU)	16N	78W	30
341	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.32	-106.20	Libby Creek	CENTENNIAL RIDGE (RMU)	16N	78W	30
342	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	US Forest Service	41.32	-106.20	Libby Creek	CENTENNIAL RIDGE (RMU)	16N	78W	30
343	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Silver Run Lake	Existing	Yes	US Forest Service	41.33	-106.24	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	26
344	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Upper Silver Run Lake	Existing	Yes	US Forest Service	41.33	-106.24	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	26
345	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Bear Lake	Existing	Yes	US Forest Service	41.33	-106.25	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	27
346	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.33	-106.26	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	27
347	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.32	-106.25	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	27
348	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.32	-106.24	Libby Creek	SNOWY RANGE S&G (RMU)	16N	79W	26
349	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.31	-106.13	Libby Creek	SANDERS	16N	78W	35
350	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.31	-106.13	Libby Creek	SANDERS	16N	78W	35
351	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.31	-106.13	Libby Creek	SANDERS	16N	78W	35
352	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.31	-106.13	Libby Creek	SANDERS	16N	78W	35
353	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.31	-106.13	Libby Creek	SANDERS	16N	78W	35
354	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.31	-106.13	Libby Creek	SANDERS	16N	78W	35
355	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.31	-106.13	Libby Creek	SANDERS	16N	78W	35
356	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.31	-106.13	Libby Creek	SANDERS	16N	78W	35
357	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.31	-106.13	Libby Creek	SANDERS	16N	78W	35
358	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.31	-106.13	Little Laramie River-Cenntenial Valley	SANDERS	16N	78W	35
359	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.31	-106.13	Little Laramie River-Cenntenial Valley	N/A	16N	78W	35
360	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.31	-106.13	Little Laramie River-Cenntenial Valley	SANDERS	16N	78W	35
361	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.31	-106.13	Little Laramie River-Cenntenial Valley	N/A	16N	78W	35
362	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Porter Lake	Existing	Yes	Private	41.29	-105.99	Little Laramie River-Webb Lake	JW/SHEEP MTN RANCH	15N	77W	1
363	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.28	-106.14	Libby Creek	N/A	15N	78W	10
364	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.29	-106.14	Libby Creek	N/A	15N	78W	10
365	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.29	-106.14	Libby Creek	N/A	15N	78W	10

ACE_ID	Improvement Type	Source	Notes	Status	Water Source	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
366	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.29	-106.14	Libby Creek	N/A	15N	78W	10
367	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.29	-106.15	Libby Creek	N/A	15N	78W	10
368	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.29	-106.00	Lake Hattie	N/A	15N	77W	11
369	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Hardigan Lake	Existing	Yes	Private	41.28	-105.99	Lake Hattie	N/A	15N	77W	12
370	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.26	-105.70	Laramie River-West Laramie	BREES	15N	74W	16
371	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.27	-105.70	Laramie River-West Laramie	BREES	15N	74W	16
372	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.26	-106.09	Libby Creek	N/A	15N	77W	18
373	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.26	-106.13	Libby Creek	N/A	15N	78W	22
374	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.25	-105.78	Sevenmile Lakes	N/A	15N	75W	23
375	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.25	-105.77	Sevenmile Lakes	N/A	15N	75W	24
376	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.26	-105.75	Laramie River-West Laramie	N/A	15N	74W	19
377	Pond	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.26	-105.68	Laramie River-West Laramie	N/A	15N	74W	22
378	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.26	-105.62	Harney Creek-Laramie River	N/A	15N	73W	19
379	Pond	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.26	-105.62	Harney Creek-Laramie River	N/A	15N	73W	19
380	Pond	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.25	-105.66	Laramie River-West Laramie	N/A	15N	74W	26
381	Reservoir	BLM Rawlins	Wet in 2009, 2011,2015	Existing	Yes	Private	41.02	-106.04	Boswell Creek	BOSWELL RANCH	12N	77W	9
382	Reservoir	BLM Rawlins	sediment	Existing	No	Private	41.01	-105.73	Sand Creek-Shell Creek	CHIMNEY ROCK	12N	74W	18
383	Reservoir	BLM Rawlins	sediment	Existing	No	Private	41.00	-105.80	Dry Creek-Shell Creek	CHIMNEY ROCK	12N	75W	15
384	Reservoir	BLM Rawlins	sediment	Existing	No	Private	41.00	-105.80	Dry Creek-Shell Creek	CHIMNEY ROCK	12N	75W	21
385	Reservoir	BLM Rawlins	Breached	Existing	No	Private	41.01	-105.83	Dry Creek-Shell Creek	CHIMNEY ROCK	12N	75W	17
386	Reservoir	BLM Rawlins	sediment	Existing	No	Bureau of Land Management	41.01	-105.90	Shell Creek	RING MOUNTAIN	12N	76W	14
387	Reservoir	BLM Rawlins	Wet in 2009, 2011,2015	Existing	Yes	State of Wyoming	41.01	-105.96	Laramie River-Bear Creek	RING MOUNTAIN	12N	76W	17
388	Reservoir	BLM Rawlins	Wet in 2009, 2011,2015	Existing	Yes	Private	41.33	-106.01	Little Laramie River-Webb Lake	CROONBERG RANCH	16N	77W	23
389	Reservoir	BLM Rawlins	removed in 2011 photo	Existing	No	Private	41.33	-106.00	Little Laramie River-Webb Lake	CROONBERG RANCH	16N	77W	23
390	Reservoir	BLM Rawlins	Wet in 2009, 2011,2015	Existing	Yes	Bureau of Land Management	41.55	-105.95	Cooper Creek	STROUSE HILL	18N	76W	8
391	Reservoir	BLM Rawlins	sediment	Existing	No	Private	41.30	-105.88	The Big Hollow	JW/SHEEP MTN RANCH	15N	76W	1
392	Reservoir	BLM Rawlins	sediment	Existing	No	Private	41.28	-105.90	The Big Hollow	JW/SHEEP MTN RANCH	15N	76W	11
393	Reservoir	BLM Rawlins	Wet in 2009, 2011,2015	Existing	Yes	Bureau of Land Management	41.29	-105.94	Table Mountain	TABLE MOUNTAIN (RMU)	15N	76W	8
394	Reservoir	BLM Rawlins	sediment	Existing	No	Private	41.26	-105.97	Lake Hattie	TABLE MOUNTAIN (RMU)	15N	76W	18
395	Reservoir	BLM Rawlins	sediment	Existing	No	Private	41.27	-105.89	The Big Hollow	JW/SHEEP MTN RANCH	15N	76W	14
396	Reservoir	BLM Rawlins	Wet in 2009, 2011,2015	Existing	Yes	Private	41.27	-105.87	The Big Hollow	JW/SHEEP MTN RANCH	15N	76W	13
397	Reservoir	BLM Rawlins	More of a depression that may collect water, no visible embankment	Existing	Potential	Private	41.26	-105.86	The Big Hollow	JW/SHEEP MTN RANCH	15N	75W	19
398	Reservoir	BLM Rawlins	Wet in 2009, 2011,2015	Existing	Yes	Private	41.29	-105.93	Table Mountain	JW/SHEEP MTN RANCH	15N	76W	9
399	Reservoir	BLM Rawlins	Wet in 2009,2012, 2015	Existing	Yes	Bureau of Land Management	41.59	-105.90	Cooper Creek	COOPER LAKE	19N	76W	26
400	Reservoir	BLM Rawlins	Wet in 2009, 2011,2015, Note erosion related to spillway	Existing	Yes	Bureau of Land Management	41.54	-105.91	Cooper Lake	JAMES LAKE	18N	76W	14
401	Reservoir	BLM Rawlins	Wet in 2011, dry in 2009, 2012, 2015 no visible damage	Existing	Potential	Bureau of Land Management	41.04	-105.70	Antelope Creek-Shell Creek	ANTELOPE CREEK	12N	74W	4
402	Reservoir	BLM Rawlins	Wet in 2009, 2011,2015	Existing	Yes	Bureau of Land Management	41.32	-106.10	Little Laramie River-Cenntenial Valley	T-K RANCH	16N	78W	25
403	Reservoir	BLM Rawlins	Wet in 2009, 2011,2015	Existing	Yes	Bureau of Land Management	41.50	-105.87	Fourmile Creek-Laramie River	JAMES LAKE	18N	75W	30
404	Reservoir	BLM Rawlins	Wet in 2009, 2011,2015	Existing	Yes	Bureau of Land Management	41.51	-105.87	Fourmile Creek-Laramie River	JAMES LAKE	18N	75W	30
405	Reservoir	BLM Rawlins	Wet in 2009, 2011,2015	Existing	Yes	Bureau of Land Management	41.52	-105.92	Damm	JAMES LAKE	18N	76W	22
406	Reservoir	BLM Rawlins	Wet in 2009, 2011,2015	Existing	Yes	Bureau of Land Management	41.51	-105.92	Damm	JAMES LAKE	18N	76W	22
407	Reservoir	BLM Rawlins	Wet in 2009, 2011,2015	Existing	Yes	Bureau of Land Management	41.51	-105.91	Damm	JAMES LAKE	18N	76W	22
408	Reservoir	BLM Rawlins	Breached	Existing	No	Bureau of Land Management	41.51	-105.89	Fourmile Creek-Laramie River	JAMES LAKE	18N	76W	26
409	Reservoir	BLM Rawlins	Wet in 2009, 2015	Existing	Yes	Bureau of Land Management	41.52	-105.87	Cooper Lake	JAMES LAKE	18N	76W	24
410	Reservoir	BLM Rawlins	sediment	Existing	No	Bureau of Land Management	41.52	-105.87	Cooper Lake	JAMES LAKE	18N	76W	24
411	Reservoir	BLM Rawlins	Wet in 2009, 2011,2015	Existing	Yes	Bureau of Land Management	41.52	-105.87	Cooper Lake	JAMES LAKE	18N	76W	24
412	Reservoir	BLM Rawlins	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.34	-106.08	Little Laramie River-Webb Lake	CROONBERG RANCH	16N	77W	19
413	Reservoir	BLM Rawlins	sediment	Existing	No	Bureau of Land Management	41.34	-106.02	Little Laramie River-Webb Lake	CROONBERG RANCH	16N	77W	22
414	Reservoir	BLM Rawlins	Breached around spillway	Existing	No	Bureau of Land Management	41.04	-105.69	Antelope Creek-Shell Creek	ANTELOPE CREEK	12N	74W	4
415	Reservoir	BLM Rawlins	Wet in 2009, 2011, 2015	Existing	Yes	State of Wyoming	41.12	-105.74	Antelope Creek-Shell Creek	SAND CREEK RANCH	13N	74W	6
416	Reservoir	BLM Rawlins	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.13	-105.75	Antelope Creek-Shell Creek	SAND CREEK RANCH	13N	74W	6
417	Reservoir	BLM Rawlins	Dry 2009, 2011, wet 2015 but no visible damage	Existing	Potential	Private	41.10	-105.91	Laramie River-Sodergreen Lake	STEAMBOAT ROCK	13N	76W	15
418	Reservoir	BLM Rawlins	Dry 2009, 2011, Wet in 2012 possibly catches overflow from upstream pond	Existing	Potential	Private	41.08	-105.95	Lindsey Creek	STEAMBOAT ROCK	13N	76W	20
419	Reservoir	BLM Rawlins	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.07	-105.95	Lindsey Creek	STEAMBOAT ROCK	13N	76W	20
420	Reservoir	BLM Rawlins	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.08	-105.91	Lindsey Creek	STEAMBOAT ROCK	13N	76W	22
421	Reservoir	BLM Rawlins	Dry 2009, 2011, 2015 but no visible damage	Existing	Potential	Private	41.09	-105.89	Lindsey Creek	STEAMBOAT ROCK	13N	76W	23
422	Reservoir	BLM Rawlins	sediment	Existing	No	Private	41.07	-105.87	Lindsey Creek	STEAMBOAT ROCK	13N	76W	25
423	Reservoir	BLM Rawlins	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.09	-105.86	Lindsey Creek	STEAMBOAT ROCK	13N	75W	19
424	Reservoir	BLM Rawlins	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.07	-105.93	Lindsey Creek	STEAMBOAT ROCK	13N	76W	28
425	Reservoir	BLM Rawlins	sediment	Existing	No	Private	41.05	-105.92	Lindsey Creek	STEAMBOAT ROCK	13N	76W	33
426	Reservoir	BLM Rawlins	Wet in 2011, 2015	Existing	Yes	Private	41.04	-105.93	Lindsey Creek	STEAMBOAT ROCK	13N	76W	33
427	Reservoir	BLM Rawlins	sediment	Existing	No	Private	41.06	-105.88	Lindsey Creek	STEAMBOAT ROCK	13N	76W	35
428	Reservoir	BLM Rawlins	sediment	Existing	No	Private	41.04	-105.78	Shell Creek	CHIMNEY ROCK	12N	75W	2
429	Reservoir	BLM Rawlins	Breached around spillway	Existing	No	Private	41.04	-105.82	Dry Creek-Shell Creek	CHIMNEY ROCK	12N	75W	4
430	Reservoir	BLM Rawlins	sediment	Existing	No	Private	41.03	-105.89	Lindsey Creek	RING MOUNTAIN	12N	76W	11
431	Reservoir	BLM Rawlins	Wet in 2009, 2011, 2015	Existing	Yes	Bureau of Land Management	41.97	-105.66	Wheatland Reservoir #3	SOMMERS	23N	74W	14
432	Reservoir	BLM Rawlins	Wet in 2011, 2015	Existing	Yes	Bureau of Land Management	41.97	-105.68	Wheatland Reservoir #3	SOMMERS	23N	74W	14
433	Reservoir	BLM Rawlins	Breached	Existing	No	Bureau of Land Management	41.94	-105.70	Wheatland Reservoir #3	WHEATLAND NO 3	23N	74W	28
434	Reservoir	BLM Rawlins	Wet in 2009, 2011, 2015	Existing	Yes	Bureau of Land Management	41.54	-105.86	Cooper Lake	JAMES LAKE	18N	75W	18
435	Reservoir	BLM Rawlins	Wet in 2009, 2011, 2015	Existing	Yes	Bureau of Land Management	41.54	-105.87	Cooper Lake	JAMES LAKE	18N	75W	18
436	Reservoir	BLM Rawlins	wet in 2009, 2011, 2015, Windmill source	Existing	Yes	Bureau of Land Management	41.54	-105.86	Cooper Lake	JAMES LAKE	18N	75W	18
437	Reservoir	BLM Rawlins	Breached in 2011 photo, no water in 2012	Existing	No	Bureau of Land Management	41.53	-105.87	Cooper Lake	JAMES LAKE	18N	75W	18
438	Reservoir	BLM Rawlins	Wet in 2009, 2011, 2015	Existing	Yes	Bureau of Land Management	41.57	-105.97	Cooper Creek	STROUSE HILL	18N	76W	6

ACE_ID	Improvement Type	Source	Notes	Status	Water Source	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
439	Reservoir	BLM Rawlins	Wet in 2009, 2011, 2015	Existing	Yes	Bureau of Land Management	41.56	-105.98	Cooper Creek	STROUSE HILL	18N	76W	6
440	Reservoir	BLM Rawlins	Wet in 2009, 2011, 2015	Existing	Yes	Bureau of Land Management	41.54	-105.89	Cooper Lake	JAMES LAKE	18N	76W	14
441	Reservoir	BLM Rawlins	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Bureau of Land Management	41.54	-105.98	Damm	STROUSE HILL	18N	76W	18
442	Reservoir	BLM Rawlins	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Bureau of Land Management	41.53	-105.97	Damm	STROUSE HILL	18N	76W	18
443	Reservoir	BLM Rawlins	Wet in 2009, 2011, 2015	Existing	Yes	Bureau of Land Management	41.76	-105.75	Laramie River-Dunn Ditch	IONE LAKE	21N	74W	30
444	Reservoir	BLM Rawlins	sediment	Existing	No	Bureau of Land Management	41.69	-105.92	Cooper Lake	UPPER PINE RIDGE	20N	76W	22
445	Reservoir	BLM Rawlins	Two points on one reservoir, this point not considered a reservoir point	No Visible Reservoir	No	Bureau of Land Management	41.59	-105.89	Cooper Creek	COOPER LAKE	19N	76W	26
446	Reservoir	BLM Rawlins	Wet in 2009,2011,2015	Existing	Yes	Bureau of Land Management	41.59	-105.94	Cooper Creek	COOPER LAKE	19N	76W	28
447	Reservoir	BLM Rawlins	Wet in 2009,2011,2015	Existing	Yes	Bureau of Land Management	41.58	-105.92	Cooper Creek	COOPER LAKE	19N	76W	34
448	Reservoir	BLM Rawlins	sediment	Existing	No	Bureau of Land Management	41.35	-105.73	Bamforth Lake	I-80 OVERPASS	16N	74W	18
449	Reservoir	BLM Rawlins	Wet in 2011, 2012, 2015	Existing	Yes	Bureau of Land Management	41.35	-105.75	Bamforth Lake	I-80 OVERPASS	16N	74W	18
450	Reservoir	BLM Rawlins	Wet in 2009, 2011	Existing	Yes	Bureau of Land Management	41.33	-105.85	Browns Creek	BATH BROTHERS	16N	75W	30
451	Reservoir	BLM Rawlins	Wet in 2009, 2011, 2015, collects upstream spring	Existing	Yes	Bureau of Land Management	41.05	-105.95	Lindsey Creek	STEAMBOAT ROCK	13N	76W	32
452	Reservoir	BLM Rawlins	Wet in 2009, 2011, 2015 Note erosion on spillway	Existing	Yes	Bureau of Land Management	41.56	-105.86	Cooper Lake	COOPER LAKE	18N	75W	6
453	Reservoir	BLM Rawlins	Wet in 2009, 2011, 2015	Existing	Yes	Bureau of Land Management	41.57	-105.93	Cooper Creek	STROUSE HILL	18N	76W	4
454	Reservoir	BLM Rawlins	Wet in 2009,2011,2015	Existing	Yes	Bureau of Land Management	41.64	-105.82	Cooper Lake	LOOKOUT RANCH	19N	75W	4
455	Reservoir	BLM Rawlins	Wet in 2009, 2011	Existing	Yes	Bureau of Land Management	41.51	-105.92	Damm	JAMES LAKE	18N	76W	22
456	Reservoir	BLM Rawlins	Wet in 2009, 2011	Existing	Yes	Bureau of Land Management	41.52	-105.92	Damm	JAMES LAKE	18N	76W	22
457	Reservoir	BLM Rawlins	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Bureau of Land Management	41.53	-105.92	Damm	JAMES LAKE	18N	76W	22
458	Reservoir	BLM Rawlins	sediment	Existing	No	Bureau of Land Management	41.37	-106.02	Little Laramie River-Webb Lake	SOUTH FORK	16N	77W	10
459	Reservoir	BLM Rawlins	Breached	Existing	No	Private	41.47	-105.49	Oasis Ditch	NEEDMORE RANCH	17N	72W	5
460	Reservoir	BLM Rawlins	sediment	Existing	No	Private	41.48	-105.49	Oasis Ditch	NEEDMORE RANCH	17N	72W	5
461	Reservoir	BLM Rawlins	sediment and possibly breached	Existing	No	Private	41.46	-105.51	Oasis Ditch	NEEDMORE RANCH	17N	72W	7
462	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.97	-105.68	Wheatland Reservoir #3	SOMMERS	23N	74W	11
463	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.98	-105.63	Wheatland Reservoir #3	KENNEDY	23N	73W	7
464	Reservoir	ACE Mapscan	Wet in 2009,2011,2015	Existing	Yes	Private	41.97	-105.64	Wheatland Reservoir #3	KENNEDY	23N	73W	18
465	Reservoir	ACE Mapscan	Breached	Existing	No	Private	41.97	-105.64	Wheatland Reservoir #3	KENNEDY	23N	73W	18
466	Reservoir	ACE Mapscan	Wet in 2011, 2015	Existing	Potential	Private	41.96	-105.63	Wheatland Reservoir #3	KENNEDY	23N	73W	18
467	Reservoir	ACE Mapscan	wet in 2011, dry in 2009, 2012, collects overflow from windmill and stock tank upstream	Existing	Potential	Private	41.95	-105.69	Wheatland Reservoir #3	MUD SPRINGS	23N	74W	22
468	Reservoir	ACE Mapscan	Wet in 2009,2011, 2015	Existing	Yes	Private	41.95	-105.68	Wheatland Reservoir #3	SOMMERS	23N	74W	23
469	Reservoir	ACE Mapscan	Wet in 2009,2011, 2015	Existing	Yes	Private	41.95	-105.66	Wheatland Reservoir #3	SOMMERS	23N	74W	24
470	Reservoir	ACE Mapscan	dry in 2009,2011,2012 but no visible damage	Existing	Potential	Private	41.95	-105.63	Wheatland Reservoir #3	KENNEDY	23N	73W	19
471	Reservoir	ACE Mapscan	dry in 2009,2011,2012 but no visible damage	Existing	Potential	Private	41.95	-105.63	Wheatland Reservoir #3	KENNEDY	23N	73W	19
472	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.94	-105.64	Wheatland Reservoir #3	N/A	23N	73W	30
473	Reservoir	ACE Mapscan	Wet in 2009,2011,2015, tanks present and windmill indicated on topo	Existing	Yes	Private	41.93	-105.70	Wheatland Reservoir #3	WHEATLAND NO 3	23N	74W	33
474	Reservoir	ACE Mapscan	Wet in 2009,2011,2015, McGill Lakes	Existing	Yes	Private	41.82	-105.69	Wheatland Reservoir #3	MCGILL LAKES	21N	74W	
475	Reservoir	ACE Mapscan	Wet in 2009,2011, 2015 McGill Lakes	Existing	Yes	Private	41.82	-105.69	Wheatland Reservoir #3	MCGILL LAKES	21N	74W	
476	Reservoir	ACE Mapscan	Wet in 2009,2011,2015	Existing	Yes	Bureau of Land Management	41.82	-105.71	Wheatland Reservoir #3	MCGILL LAKES	21N	74W	4
477	Reservoir	ACE Mapscan	Wet in 2009,2011, 2015 McGill Lakes	Existing	Yes	Private	41.83	-105.69	Wheatland Reservoir #3	MCGILL LAKES	21N	74W	
478	Reservoir	ACE Mapscan	Wet in 2009,2011, 2015 ,McGill Lakes	Existing	Yes	Private	41.83	-105.70	Wheatland Reservoir #3	WHEATLAND NO 3	22N	74W	34
479	Reservoir	ACE Mapscan	Wet in 2009,2011, 2015, McGill Lakes	Existing	Yes	Private	41.83	-105.70	Wheatland Reservoir #3	WHEATLAND NO 3	22N	74W	33
480	Reservoir	ACE Mapscan	Wet in 2009,2011, 2015, McGill Lakes	Existing	Yes	Private	41.83	-105.69	Wheatland Reservoir #3	WHEATLAND NO 3	22N	74W	34
481	Reservoir	ACE Mapscan	Wheatland Reservoir No. 2	Existing	Yes	Water	41.84	-105.64	Wheatland Reservoir #2	N/A	22N	73W	31
482	Reservoir	ACE Mapscan	Wheatland Reservoir No. 3	Existing	Yes	Water	41.85	-105.70	Wheatland Reservoir #3	WHEATLAND NO 3	22N	74W	28
483	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.81	-105.71	Wheatland Reservoir #3	MCGILL LAKES	21N	74W	9
484	Reservoir	ACE Mapscan	Wet in 2009, 2015	Existing	Yes	Private	41.82	-105.72	Wheatland Reservoir #3	SPRING CREEK	21N	74W	5
485	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.83	-105.72	Wheatland Reservoir #3	SPRING CREEK	21N	74W	5
486	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.91	-105.56	Wheatland Reservoir #2	BULL CAMP PEAK	22N	73W	2
487	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.91	-105.52	Wheatland Reservoir #2	BULL CAMP PEAK	22N	72W	6
488	Reservoir	ACE Mapscan	Wet in 2009, 2015	Existing	Yes	Private	41.89	-105.54	Wheatland Reservoir #2	BULL CAMP PEAK	22N	73W	13
489	Reservoir	ACE Mapscan	Wet in 2009, 2011,2015	Existing	Yes	Private	41.87	-105.56	Wheatland Reservoir #2	TRISH	22N	73W	23
490	Reservoir	ACE Mapscan	Wet in 2009, 2011	Existing	Yes	Private	41.86	-105.57	Wheatland Reservoir #2	TRISH	22N	73W	27
491	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.80	-105.71	Wheatland Reservoir #2	SPRING CREEK	21N	74W	9
492	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.81	-105.67	Wheatland Reservoir #2	MCGILL LAKES	21N	74W	11
493	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Bureau of Land Management	41.79	-105.62	Wheatland Reservoir #2	IONE LAKE	21N	73W	18
494	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.79	-105.70	Wheatland Reservoir #2	IONE LAKE	21N	74W	15
495	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.79	-105.68	Wheatland Reservoir #2	IONE LAKE	21N	74W	15
496	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.79	-105.72	Wheatland Reservoir #2	IONE LAKE	21N	74W	17
497	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.79	-105.72	Wheatland Reservoir #2	IONE LAKE	21N	74W	17
498	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.78	-105.71	Laramie River-Dunn Ditch	IONE LAKE	21N	74W	21
499	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Bureau of Land Management	41.77	-105.72	Laramie River-Dunn Ditch	IONE LAKE	21N	74W	20
500	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.78	-105.71	Laramie River-Dunn Ditch	IONE LAKE	21N	74W	21
501	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.78	-105.69	Wheatland Reservoir #2	IONE LAKE	21N	74W	22
502	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.78	-105.64	Wheatland Reservoir #2	IONE LAKE	21N	73W	19
503	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Bureau of Land Management	41.76	-105.63	Wheatland Reservoir #2	IONE LAKE	21N	73W	30
504	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.76	-105.65	Laramie River-Dunn Ditch	IONE LAKE	21N	74W	25
505	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.77	-105.64	Wheatland Reservoir #2	IONE LAKE	21N	74W	25
506	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.77	-105.68	Laramie River-Dunn Ditch	IONE LAKE	21N	74W	26
507	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.77	-105.67	Laramie River-Dunn Ditch	IONE LAKE	21N	74W	26
508	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.76	-105.68	Laramie River-Dunn Ditch	IONE LAKE	21N	74W	26
509	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.77	-105.70	Laramie River-Dunn Ditch	IONE LAKE	21N	74W	27
510	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.76	-105.70	Laramie River-Dunn Ditch	IONE LAKE	21N	74W	28
511	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015, Twin Lakes	Existing	Yes	Private	41.76	-105.71	Laramie River-Dunn Ditch	IONE LAKE	21N	74W	28

ACE_ID	Improvement Type	Source	Notes	Status	Water Source	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
512	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015, Twin Lakes	Existing	Yes	Private	41.76	-105.71	Laramie River-Dunn Ditch	IONE LAKE	21N	74W	28
513	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015, Twin Lakes	Existing	Yes	Private	41.76	-105.73	Laramie River-Dunn Ditch	IONE LAKE	21N	74W	29
514	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.75	-105.76	Laramie River-Dunn Ditch	IONE LAKE	21N	74W	31
515	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.75	-105.76	Laramie River-Dunn Ditch	IONE LAKE	21N	74W	31
516	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.75	-105.75	Laramie River-Dunn Ditch	IONE LAKE	21N	74W	31
517	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.75	-105.75	Laramie River-Dunn Ditch	IONE LAKE	21N	74W	31
518	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.75	-105.72	Laramie River-Dunn Ditch	IONE LAKE	21N	74W	33
519	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.74	-105.70	Laramie River-Dunn Ditch	IONE LAKE	21N	74W	34
520	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.75	-105.68	Laramie River-Dunn Ditch	IONE LAKE	21N	74W	35
521	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.74	-105.63	Gillespie Reservoir	IONE LAKE	21N	73W	31
522	Reservoir	ACE Mapscan	Wet in 2009, 2011	Existing	Yes	Private	41.75	-105.62	Gillespie Reservoir	IONE LAKE	21N	73W	31
523	Reservoir	ACE Mapscan	Breached	Existing	No	Private	41.74	-105.62	Gillespie Reservoir	N/A	20N	73W	6
524	Reservoir	ACE Mapscan	Wet in 2009, 2011	Existing	Yes	Private	41.74	-105.63	Gillespie Reservoir	N/A	20N	73W	6
525	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.73	-105.62	Gillespie Reservoir	N/A	20N	73W	7
526	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.74	-105.64	Laramie River-Dunn Ditch	N/A	20N	74W	1
527	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.74	-105.71	Laramie River-Dunn Ditch	IONE LAKE	20N	74W	4
528	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.73	-105.70	Laramie River-Dunn Ditch	N/A	20N	74W	4
529	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.74	-105.72	Laramie River-Dunn Ditch	N/A	20N	74W	5
530	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.73	-105.77	Laramie River-Dunn Ditch	IONE LAKE	20N	75W	1
531	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.74	-105.75	Laramie River-Dunn Ditch	IONE LAKE	20N	75W	1
532	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.73	-105.79	Laramie River-Dunn Ditch	IONE LAKE	20N	75W	2
533	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.73	-105.79	Laramie River-Dunn Ditch	IONE LAKE	20N	75W	
534	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.73	-105.80	Laramie River-Dunn Ditch	IONE LAKE	20N	75W	10
535	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.72	-105.80	Laramie River-Dunn Ditch	IONE LAKE	20N	75W	10
536	Reservoir	ACE Mapscan	Breached	Existing	No	Private	41.72	-105.76	Laramie River-Dunn Ditch	IONE LAKE	20N	75W	12
537	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.73	-105.71	Laramie River-Dunn Ditch	N/A	20N	74W	8
538	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.73	-105.70	Laramie River-Dunn Ditch	N/A	20N	74W	9
539	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.72	-105.66	Gillespie Reservoir	N/A	20N	74W	11
540	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.72	-105.66	Gillespie Reservoir	N/A	20N	74W	11
541	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.72	-105.66	Gillespie Reservoir	N/A	20N	74W	11
542	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.73	-105.65	Laramie River-Dunn Ditch	N/A	20N	74W	12
543	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015, Gillepspie Reservoir	Existing	Yes	Private	41.72	-105.65	Gillespie Reservoir	N/A	20N	74W	12
544	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.71	-105.65	Gillespie Reservoir	N/A	20N	74W	13
545	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.72	-105.64	Gillespie Reservoir	N/A	20N	74W	12
546	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.72	-105.63	Gillespie Reservoir	N/A	20N	73W	7
547	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.71	-105.57	Gates Creek	N/A	20N	73W	15
548	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.70	-105.61	Gillespie Reservoir	IONE	20N	73W	17
549	Reservoir	ACE Mapscan	Wet in 2011	Existing	Potential	Private	41.70	-105.65	Gillespie Reservoir	N/A	20N	74W	13
550	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015, Dunn Lake	Existing	Yes	Private	41.70	-105.74	Laramie River-Dunn Ditch	IONE LAKE	20N	74W	18
551	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.71	-105.74	Laramie River-Dunn Ditch	IONE LAKE	20N	74W	18
552	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Bureau of Land Management	41.71	-105.77	Laramie River-Dunn Ditch	IONE LAKE	20N	75W	14
553	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.71	-105.77	Laramie River-Dunn Ditch	IONE LAKE	20N	75W	13
554	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Bureau of Land Management	41.69	-105.80	Laramie River-Dunn Ditch	IONE LAKE	20N	75W	22
555	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Bureau of Land Management	41.70	-105.77	Laramie River-Dunn Ditch	IONE LAKE	20N	75W	24
556	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Bureau of Land Management	41.69	-105.76	Laramie River-Dunn Ditch	IONE LAKE	20N	75W	24
557	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Bureau of Land Management	41.70	-105.76	Laramie River-Dunn Ditch	IONE LAKE	20N	75W	24
558	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Bureau of Land Management	41.69	-105.76	Laramie River-Dunn Ditch	IONE LAKE	20N	75W	24
559	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.70	-105.75	Laramie River-Dunn Ditch	IONE LAKE	20N	74W	19
560	Reservoir	ACE Mapscan	Wet in 2009, 2011	Existing	Yes	Private	41.69	-105.73	Laramie River-Dunn Ditch	N/A	20N	74W	20
561	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.69	-105.69	Long Lake	IONE LAKE	20N	74W	22
562	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015 Lake Ione	Existing	Yes	Water	41.70	-105.68	Gillespie Reservoir	IONE LAKE	20N	74W	22
563	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.70	-105.66	Gillespie Reservoir	IONE LAKE	20N	74W	23
564	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.70	-105.65	Gillespie Reservoir	N/A	20N	74W	24
565	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.70	-105.65	Gillespie Reservoir	N/A	20N	74W	24
566	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.69	-105.64	Gillespie Reservoir	N/A	20N	74W	24
567	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.70	-105.64	Gillespie Reservoir	N/A	20N	74W	24
568	Reservoir	ACE Mapscan	Wet in 2009, 2015	Existing	Yes	Private	41.70	-105.63	Gillespie Reservoir	N/A	20N	73W	19
569	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.70	-105.58	Gates Creek	N/A	20N	73W	22
570	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.69	-105.55	Gates Creek	N/A	20N	73W	26
571	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.68	-105.59	Gates Creek	N/A	20N	73W	28
572	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.68	-105.59	Gates Creek	N/A	20N	73W	28
573	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.68	-105.58	Gates Creek	N/A	20N	73W	28
574	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.68	-105.58	Gates Creek	N/A	20N	73W	28
575	Reservoir	ACE Mapscan	Wet in 2011, 2015, catches overflow from stock tank	Existing	Yes	Private	41.69	-105.59	Gates Creek	N/A	20N	73W	28
576	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.68	-105.62	Gates Creek	N/A	20N	73W	30
577	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.68	-105.64	Gates Creek	N/A	20N	73W	30
578	Reservoir	ACE Mapscan	Wet i n2009, 2011, 2015	Existing	Yes	Private	41.68	-105.65	Gates Creek	IONE LAKE	20N	74W	25
579	Reservoir	ACE Mapscan	Wet in 2009, 2011	Existing	Yes	Private	41.68	-105.69	Long Lake	IONE LAKE	20N	74W	27
580	Reservoir	ACE Mapscan	Wet in 2009, 2011,2015, Long Lake	Existing	Yes	Water	41.66	-105.69	Long Lake	IONE LAKE	20N	74W	34
581	Reservoir	ACE Mapscan	Wet in 2009, 2011	Existing	Yes	Private	41.68	-105.70	Long Lake	N/A	20N	74W	28
582	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.68	-105.77	Laramie River-Dunn Ditch	IONE LAKE	20N	75W	25
583	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Bureau of Land Management	41.68	-105.77	Laramie River-Dunn Ditch	IONE LAKE	20N	75W	26
584	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.68	-105.80	Laramie River-Dunn Ditch	IONE LAKE	20N	75W	27

ACE_ID	Improvement Type	Source	Notes	Status	Water Source	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
585	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015 associated with nearby wel	Existing	Yes	Bureau of Land Management	41.68	-105.85	Laramie River-Dunn Ditch	LOOKOUT RANCH	20N	75W	30
586	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015 associated with nearby wel	Existing	Yes	Bureau of Land Management	41.67	-105.91	Cooper Lake	UPPER PINE RIDGE	20N	76W	26
587	Reservoir	ACE Mapscan	Wet in 2009, 2011	Existing	Yes	Bureau of Land Management	41.67	-105.93	Cooper Lake	UPPER PINE RIDGE	20N	76W	34
588	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	State of Wyoming	41.66	-105.87	Cooper Lake	LOOKOUT RANCH	20N	76W	36
589	Reservoir	ACE Mapscan	Wet in 2009, 2011	Existing	Yes	Private	41.67	-105.83	Laramie River-Dunn Ditch	LOOKOUT RANCH	20N	75W	33
590	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.67	-105.80	Laramie River-Dunn Ditch	IONE LAKE	20N	75W	34
591	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.67	-105.79	Laramie River-Dunn Ditch	IONE LAKE	20N	75W	35
592	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	State of Wyoming	41.67	-105.76	Laramie River-Dunn Ditch	IONE LAKE	20N	75W	36
593	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	State of Wyoming	41.67	-105.76	Laramie River-Dunn Ditch	IONE LAKE	20N	75W	36
594	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.66	-105.71	Long Lake	N/A	20N	74W	33
595	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.67	-105.71	Long Lake	N/A	20N	74W	33
596	Reservoir	ACE Mapscan	Wet in 2009, 2011	Existing	Yes	Private	41.66	-105.66	Gates Creek	IONE LAKE	20N	74W	35
597	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.66	-105.66	Gates Creek	IONE LAKE	20N	74W	35
598	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	State of Wyoming	41.67	-105.64	Gates Creek	IONE LAKE	20N	74W	36
599	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.66	-105.63	Gates Creek	N/A	20N	73W	31
600	Reservoir	ACE Mapscan	Wet in 2009, Dry 2011, 2015, no visible damage	Existing	Potential	Private	41.66	-105.63	Gates Creek	N/A	20N	73W	31
601	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.67	-105.62	Gates Creek	N/A	20N	73W	32
602	Reservoir	ACE Mapscan	Wet in 2009, Dry in 2011, 2015, no visible damage	Existing	Potential	Private	41.67	-105.57	Gates Creek	N/A	20N	73W	34
603	Reservoir	ACE Mapscan	Wet in 2009, Dry in 2011, 2015 no visible damage	Existing	Potential	Private	41.65	-105.55	Gates Creek	N/A	19N	73W	2
604	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012	Existing	Yes	Private	41.65	-105.57	Gates Creek	N/A	19N	73W	3
605	Reservoir	ACE Mapscan	Wet in 2009, 2015	Existing	Yes	Private	41.65	-105.56	Gates Creek	N/A	19N	73W	3
606	Reservoir	ACE Mapscan	Wet in 2009, 2012, 2015	Existing	Yes	Private	41.64	-105.57	Gates Creek	N/A	19N	73W	3
607	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.65	-105.60	Gates Creek	WALL ROCK	19N	73W	5
608	Reservoir	ACE Mapscan	Wet in 2015, 2009	Existing	Yes	Private	41.64	-105.67	Wallrock Creek	IONE LAKE	19N	74W	2
609	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.65	-105.73	Laramie River-Dunn Ditch	IONE LAKE	19N	74W	5
610	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.65	-105.73	Laramie River-Dunn Ditch	IONE LAKE	19N	74W	5
611	Reservoir	ACE Mapscan	Wet in 2009, 2015	Existing	Yes	Private	41.65	-105.77	Laramie River-Dunn Ditch	IONE LAKE	19N	75W	1
612	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.65	-105.80	Cooper Lake	LOOKOUT RANCH	19N	75W	3
613	Reservoir	ACE Mapscan	Wet in 2015, 2012	Existing	Yes	Bureau of Land Management	41.65	-105.83	Cooper Lake	LOOKOUT RANCH	19N	75W	4
614	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.66	-105.85	Cooper Lake	LOOKOUT RANCH	19N	75W	5
615	Reservoir	ACE Mapscan	Wet in 2015, dry in all other years, potentially rebuilt	Existing	Potential	Private	41.65	-105.84	Cooper Lake	LOOKOUT RANCH	19N	75W	5
616	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015, note that this point includes waterbody south of location, Dutton Reservoi	Existing	Yes	Private	41.64	-105.87	Lower Dutton Creek	COOPER LAKE	19N	76W	1
617	Reservoir	ACE Mapscan	Wet in 2009, dry in other years, no visible damage	Existing	Potential	Private	41.65	-105.91	Lower Dutton Creek	N/A	19N	76W	2
618	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015 Rainey Lake	Existing	Yes	Private	41.63	-105.93	Lower Dutton Creek	N/A	19N	76W	9
619	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.64	-105.93	Lower Dutton Creek	N/A	19N	76W	9
620	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.64	-105.90	Lower Dutton Creek	COOPER LAKE	19N	76W	11
621	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Water	41.63	-105.85	Cooper Lake	N/A	19N	75W	8
622	Reservoir	ACE Mapscan	Cooper Lake, not full time watersource, seasonal	Existing	Potential	Water	41.62	-105.83	Cooper Lake	N/A	19N	75W	17
623	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.64	-105.79	Cooper Lake	LOOKOUT RANCH	19N	75W	11
624	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.64	-105.78	Laramie River-Dunn Ditch	N/A	19N	75W	11
625	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.63	-105.72	Laramie River-Dunn Ditch	IONE LAKE	19N	74W	8
626	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.64	-105.69	Long Lake	IONE LAKE	19N	74W	9
627	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.63	-105.70	Long Lake	IONE LAKE	19N	74W	9
628	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.63	-105.69	Long Lake	N/A	19N	74W	10
629	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.64	-105.66	Wallrock Creek	N/A	19N	74W	11
630	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.63	-105.66	Wallrock Creek	N/A	19N	74W	11
631	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.63	-105.67	Long Lake	N/A	19N	74W	11
632	Reservoir	ACE Mapscan	Large reservoir may be non-fucntional, but small watersource available in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.63	-105.63	Wallrock Creek	WALL ROCK	19N	73W	7
633	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.63	-105.63	Wallrock Creek	WALL ROCK	19N	73W	7
634	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.63	-105.61	Wallrock Creek	WALL ROCK	19N	73W	8
635	Reservoir	ACE Mapscan	Breached around on spillway, possibly on purpose	Existing	No	Private	41.64	-105.60	Wallrock Creek	WALL ROCK	19N	73W	8
636	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.64	-105.58	Wallrock Creek	WALL ROCK	19N	73W	9
637	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.64	-105.57	Gates Creek	N/A	19N	73W	10
638	Reservoir	ACE Mapscan	Sediment	Existing	No	Private	41.64	-105.57	Gates Creek	N/A	19N	73W	10
639	Reservoir	ACE Mapscan	Wet in 2012, 2015	Existing	Yes	Private	41.63	-105.57	Wallrock Creek	N/A	19N	73W	10
640	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015, fed by nearby spring	Existing	Yes	Private	41.64	-105.56	Gates Creek	N/A	19N	73W	10
641	Reservoir	ACE Mapscan	Wet in 2012, 2015	Existing	Yes	Private	41.64	-105.54	Gates Creek	N/A	19N	73W	11
642	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015, fed by nearby spring	Existing	Yes	Private	41.64	-105.55	Gates Creek	N/A	19N	73W	11
643	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015, fed by nearby spring	Existing	Yes	Private	41.63	-105.54	Wallrock Creek	N/A	19N	73W	11
644	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.63	-105.53	Gates Creek	N/A	19N	73W	12
645	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.62	-105.50	Gates Creek	N/A	19N	72W	18
646	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.62	-105.52	Gates Creek	N/A	19N	73W	13
647	Reservoir	ACE Mapscan	Wet in 2015, 2009, fed by nearby windmil	Existing	Yes	Private	41.63	-105.55	Wallrock Creek	N/A	19N	73W	14
648	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015, fed by nearby spring	Existing	Yes	Private	41.63	-105.54	Wallrock Creek	N/A	19N	73W	14
649	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.62	-105.55	Wallrock Creek	N/A	19N	73W	14
650	Reservoir	ACE Mapscan	Wet in 2009, 2012, 2015	Existing	Yes	Private	41.63	-105.56	Wallrock Creek	N/A	19N	73W	15
651	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012	Existing	Yes	Private	41.62	-105.56	Wallrock Creek	N/A	19N	73W	15
652	Reservoir	ACE Mapscan	Wet 2009, 2011, 2012, 2015 fed by windmill nearby	Existing	Yes	Private	41.62	-105.56	Wallrock Creek	N/A	19N	73W	15
653	Reservoir	ACE Mapscan	Wet in 2009, dry in 2011, 2012, 2015 no visible damage	Existing	Potential	Private	41.61	-105.58	Wallrock Creek	N/A	19N	73W	15
654	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	State of Wyoming	41.61	-105.59	Wallrock Creek	N/A	19N	73W	16
655	Reservoir	ACE Mapscan	Wet in 2009, dry in 2011, 2012, 2015 no visible damage	Existing	Potential	State of Wyoming	41.62	-105.58	Wallrock Creek	N/A	19N	73W	16
656	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012	Existing	Yes	State of Wyoming	41.62	-105.58	Wallrock Creek	N/A	19N	73W	16
657	Reservoir	ACE Mapscan	Wet in 2009, 2015 fed from nearby stock tank with windmil	Existing	Yes	Private	41.61	-105.63	Long Lake	WALL ROCK	19N	73W	18

ACE_ID	Improvement Type	Source	Notes	Status	Water Source	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
658	Reservoir	ACE Mapscan	Wet in 2009, dry in 2011,2012,2015 no visible damage	Existing	Potential	Private	41.63	-105.62	Wallrock Creek	WALL ROCK	19N	73W	18
659	Reservoir	ACE Mapscan	Dry but no visible damage	Existing	Potential	Private	41.62	-105.66	Long Lake	N/A	19N	74W	13
660	Reservoir	ACE Mapscan	Dry but no visible damage	Existing	Potential	Private	41.63	-105.65	Long Lake	N/A	19N	74W	13
661	Reservoir	ACE Mapscan	Sediment	Existing	No	Private	41.63	-105.66	Long Lake	N/A	19N	74W	14
662	Reservoir	ACE Mapscan	Wet in 2009, dry in all other years, no visible damage	Existing	Potential	Private	41.62	-105.68	Long Lake	N/A	19N	74W	15
663	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.63	-105.73	Laramie River-Dunn Ditch	IONE LAKE	19N	74W	17
664	Reservoir	ACE Mapscan	Wet in 2009, 2011	Existing	Yes	Private	41.63	-105.72	Long Lake	IONE LAKE	19N	74W	17
665	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.62	-105.75	Laramie River-Dunn Ditch	IONE LAKE	19N	74W	18
666	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015. two constructed ponds inside larger fluctuating pond to keep water when larger pond is low (compare 2009 and 2015 imagery	Existing	Yes	State of Wyoming	41.61	-105.76	Laramie River-Dunn Ditch	LOOKOUT RANCH	19N	75W	24
667	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015. two constructed ponds can become inundated by larger pond in high water. Look at 2015 imagery	Existing	Yes	State of Wyoming	41.61	-105.76	Laramie River-Dunn Ditch	LOOKOUT RANCH	19N	75W	24
668	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015, looks like smaller pond constructed inside larger fluctuating pond to keep water when larger pond is low	Existing	Yes	State of Wyoming	41.61	-105.76	Laramie River-Dunn Ditch	LOOKOUT RANCH	19N	75W	24
669	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015. Receives overflow from nearby stock tank/stock pond	Existing	Yes	Private	41.62	-105.86	Cooper Lake	COOPER LAKE	19N	75W	18
670	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.62	-105.88	Lower Dutton Creek	COOPER LAKE	19N	76W	13
671	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.62	-105.91	Lower Dutton Creek	COOPER LAKE	19N	76W	15
672	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	State of Wyoming	41.62	-105.93	Lower Dutton Creek	COOPER LAKE	19N	76W	16
673	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	State of Wyoming	41.62	-105.94	Lower Dutton Creek	COOPER LAKE	19N	76W	16
674	Reservoir	ACE Mapscan	Breached between 2009 and 2011	Existing	No	Private	41.62	-105.95	Lower Dutton Creek	N/A	19N	76W	17
675	Reservoir	ACE Mapscan	Dry in 2009, 2011, 2012, wet in 2015, no visible damage	Existing	Potential	Private	41.62	-106.03	Lower Dutton Creek	COALBANK MINE	19N	77W	15
676	Reservoir	ACE Mapscan	King Reservoir, water levels fluctuate	Existing	Yes	Private	41.59	-106.06	Lower Dutton Creek	DUTTON CREEK SOUTH	19N	77W	29
677	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.61	-106.00	Lower Dutton Creek	DUTTON CREEK SOUTH	19N	77W	24
678	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.60	-105.95	Cooper Creek	N/A	19N	76W	20
679	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.61	-105.91	Cooper Creek	COOPER LAKE	19N	76W	22
680	Reservoir	ACE Mapscan	Sediment	Existing	No	Private	41.61	-105.89	Cooper Creek	COOPER LAKE	19N	76W	23
681	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015. two ponds fed by nearby windmill?	Existing	Yes	Private	41.60	-105.88	Cooper Creek	COOPER LAKE	19N	76W	24
682	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.61	-105.78	Laramie River-Dunn Ditch	LOOKOUT RANCH	19N	75W	23
683	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. looks like smaller pond constructed inside larger fluctuating pond to keep water when larger pond is low	Existing	Yes	State of Wyoming	41.60	-105.76	Laramie River-Dunn Ditch	LOOKOUT RANCH	19N	75W	24
684	Reservoir	ACE Mapscan	Diamond Lake	Existing	Yes	Water	41.61	-105.66	Long Lake	N/A	19N	74W	23
685	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012. windmill present	Existing	Yes	Private	41.60	-105.66	Long Lake	R. O.	19N	74W	23
686	Reservoir	ACE Mapscan	Wet in 2009, 2015	Existing	Yes	Private	41.60	-105.63	Long Lake	R. O.	19N	73W	19
687	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.60	-105.62	Wallrock Creek	WALL ROCK	19N	73W	19
688	Reservoir	ACE Mapscan	Wet in 2009, 2011,2015	Existing	Yes	Private	41.60	-105.59	Wallrock Creek	INDIAN CHIPS	19N	73W	21
689	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.61	-105.58	Wallrock Creek	INDIAN CHIPS	19N	73W	21
690	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.60	-105.58	Wallrock Creek	INDIAN CHIPS	19N	73W	22
691	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.61	-105.54	Wallrock Creek	INDIAN CHIPS	19N	73W	23
692	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.61	-105.53	Wallrock Creek	INDIAN CHIPS	19N	73W	24
693	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.61	-105.52	Wallrock Creek	INDIAN CHIPS	19N	72W	19
694	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.61	-105.50	Gates Creek	N/A	19N	72W	19
695	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.60	-105.54	Wallrock Creek	INDIAN CHIPS	19N	73W	25
696	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.59	-105.56	Wallrock Creek	INDIAN CHIPS	19N	73W	27
697	Reservoir	ACE Mapscan	Wet in 2009, 2012	Existing	Yes	Private	41.59	-105.57	Wallrock Creek	INDIAN CHIPS	19N	73W	27
698	Reservoir	ACE Mapscan	Wet in 2009, 2012, 2015	Existing	Yes	Private	41.60	-105.57	Wallrock Creek	INDIAN CHIPS	19N	73W	27
699	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.60	-105.59	Wallrock Creek	INDIAN CHIPS	19N	73W	28
700	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.59	-105.61	Oasis Ditch-Laramie River	INDIAN CHIPS	19N	73W	29
701	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.60	-105.61	Oasis Ditch-Laramie River	INDIAN CHIPS	19N	73W	29
702	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.59	-105.63	Oasis Ditch-Laramie River	R. O.	19N	73W	30
703	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.58	-105.62	Oasis Ditch-Laramie River	INDIAN CHIPS	19N	73W	31
704	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.00	-106.16	Boswell Creek	BOSWELL (RMU)	12N	78W	21
705	Reservoir	ACE Mapscan	Dry in all imagery, sediment, note erosion on contributing tributary	Existing	No	State of Wyoming	41.01	-105.80	Dry Creek-Shell Creek	CHIMNEY ROCK	12N	75W	16
706	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.01	-105.85	Shell Creek	N/A	12N	75W	18
707	Reservoir	ACE Mapscan	Breached	Existing	No	Private	41.04	-105.52	Willow Creek-Laramie River	N/A	12N	72W	6
708	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.04	-105.89	Lindsey Creek	N/A	12N	76W	2
709	Reservoir	ACE Mapscan	Dry in 2009, 2011, 2012, Wet in 2015. No visible damage,	Existing	Potential	Private	41.04	-105.90	Lindsey Creek	N/A	12N	76W	
710	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.03	-105.92	Lindsey Creek	N/A	12N	76W	
711	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.06	-106.15	Laramie River-Bear Creek	BOSWELL (RMU)	13N	78W	34
712	Reservoir	ACE Mapscan	steamboat lake	Existing	Yes	Private	41.06	-105.83	Shell Creek	N/A	13N	75W	32
713	Reservoir	ACE Mapscan	Wet in 2011, no visible damage	Existing	Potential	Private	41.05	-105.70	Antelope Creek-Shell Creek	ANTELOPE CREEK	13N	74W	33
714	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.05	-105.68	Antelope Creek-Shell Creek	ANTELOPE CREEK	13N	74W	34
715	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.05	-105.68	Antelope Creek-Shell Creek	ANTELOPE CREEK	13N	74W	34
716	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.06	-105.66	Lone Tree Creek	N/A	13N	74W	35
717	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012	Existing	Yes	Private	41.05	-105.52	Willow Creek-Laramie River	N/A	13N	72W	31
718	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.06	-105.47	Willow Creek-Laramie River	N/A	13N	72W	28
719	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.06	-105.50	Willow Creek-Laramie River	N/A	13N	72W	29
720	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.07	-105.49	Willow Creek-Laramie River	N/A	13N	72W	29
721	Reservoir	ACE Mapscan	Wet IN 2011, 2012, 2015	Existing	Yes	Private	41.06	-105.50	Willow Creek-Laramie River	N/A	13N	72W	30
722	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.06	-105.52	Willow Creek-Laramie River	N/A	13N	72W	30
723	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.07	-105.54	Willow Creek-Laramie River	GOVERNMENT CREEK	13N	73W	26
724	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.07	-105.70	Antelope Creek-Shell Creek	ANTELOPE CREEK	13N	74W	28
725	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.07	-105.70	Antelope Creek-Shell Creek	ANTELOPE CREEK	13N	74W	28
726	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015, Rice Reservoir	Existing	Yes	Private	41.07	-105.78	Dry Creek-Shell Creek	N/A	13N	75W	26
727	Reservoir	ACE Mapscan	Breached	Existing	No	Private	41.06	-105.84	Shell Creek	STEAMBOAT ROCK	13N	75W	29
728	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.07	-106.11	Laramie River-Bear Creek	BOSWELL (RMU)	13N	78W	25
729	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.07	-106.14	Squirrel Creek-Laramie River	FOXPARK (RMU)	13N	78W	27
730	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.07	-106.16	Squirrel Creek-Laramie River	BOSWELL (RMU)	13N	78W	28

ACE_ID	Improvement Type	Source	Notes	Status	Water Source	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
731	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	US Forest Service	41.08	-106.16	Squirrel Creek-Laramie River	BOSWELL (RMU)	13N	78W	21
732	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.08	-105.93	Lindsey Creek	STEAMBOAT ROCK	13N	76W	21
733	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.08	-105.92	Lindsey Creek	STEAMBOAT ROCK	13N	76W	21
734	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.08	-105.91	Lindsey Creek	STEAMBOAT ROCK	13N	76W	22
735	Reservoir	ACE Mapscan	difficult to determine viability from imagery	Existing	Potential	Private	41.08	-105.81	Shell Creek	DOWNEY LAKES SOUTH	13N	75W	21
736	Reservoir	ACE Mapscan	difficult to determine viability from imagery	Existing	Potential	Private	41.09	-105.79	Shell Creek	DOWNEY LAKES	13N	75W	15
737	Reservoir	ACE Mapscan	difficult to determine viability from imagery	Existing	Potential	Private	41.09	-105.80	Shell Creek	DOWNEY LAKES	13N	75W	15
738	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.08	-105.70	Antelope Creek-Shell Creek	ANTELOPE CREEK	13N	74W	21
739	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.09	-105.68	Lone Tree Creek	N/A	13N	74W	15
740	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.08	-105.52	Willow Creek-Laramie River	N/A	13N	73W	24
741	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.08	-105.51	Willow Creek-Laramie River	N/A	13N	72W	19
742	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.08	-105.50	Willow Creek-Laramie River	N/A	13N	72W	19
743	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.08	-105.50	Willow Creek-Laramie River	N/A	13N	72W	19
744	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.08	-105.50	Willow Creek-Laramie River	N/A	13N	72W	20
745	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.08	-105.49	Willow Creek-Laramie River	N/A	13N	72W	20
746	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.08	-105.49	Willow Creek-Laramie River	N/A	13N	72W	20
747	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.10	-105.49	Harney Creek-Laramie River	N/A	13N	72W	8
748	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.10	-105.48	Harney Creek-Laramie River	N/A	13N	72W	17
749	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.10	-105.51	Willow Creek-Laramie River	N/A	13N	72W	18
750	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	State of Wyoming	41.09	-105.70	Antelope Creek-Shell Creek	SAND CREEK RANCH	13N	74W	16
751	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.09	-105.76	Sand Creek-Shell Creek	SAND CREEK RANCH	13N	75W	13
752	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.10	-105.76	Sand Creek-Shell Creek	SAND CREEK RANCH	13N	75W	13
753	Reservoir	ACE Mapscan	Wet in 2009, 2015	Existing	Yes	Private	41.11	-105.93	Laramie River-Sodergreen Lake	N/A	13N	76W	9
754	Reservoir	ACE Mapscan	Wet in 2015, dry in others. no visible damage	Existing	Potential	Private	41.12	-105.88	Laramie River-Sodergreen Lake	STEAMBOAT ROCK	13N	76W	11
755	Reservoir	ACE Mapscan	Breached around spillway	Existing	No	Private	41.11	-105.88	Laramie River-Sodergreen Lake	STEAMBOAT ROCK	13N	76W	11
756	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.11	-105.86	Laramie River-Sodergreen Lake	STEAMBOAT ROCK	13N	75W	7
757	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.10	-105.85	Lindsey Creek	STEAMBOAT ROCK	13N	75W	7
758	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.11	-105.81	Laramie River-Sodergreen Lake	N/A	13N	75W	9
759	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.12	-105.82	Laramie River-Sodergreen Lake	N/A	13N	75W	9
760	Reservoir	ACE Mapscan	Wet in 2011, 2015	Existing	Yes	Private	41.11	-105.76	Sand Creek-Shell Creek	SAND CREEK RANCH	13N	75W	12
761	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.11	-105.70	Antelope Creek-Shell Creek	SAND CREEK RANCH	13N	74W	9
762	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.12	-105.69	Antelope Creek-Shell Creek	SAND CREEK RANCH	13N	74W	9
763	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.11	-105.53	Willow Creek-Laramie River	N/A	13N	73W	12
764	Reservoir	ACE Mapscan	Wet in 2011, 2015	Existing	Yes	Private	41.11	-105.51	Willow Creek-Laramie River	N/A	13N	72W	7
765	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.11	-105.48	Harney Creek-Laramie River	N/A	13N	72W	8
766	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.12	-105.50	Harney Creek-Laramie River	N/A	13N	72W	5
767	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Willow Creek Reservoir	Existing	Yes	State of Wyoming	41.13	-105.59	Willow Creek-Laramie River	N/A	13N	73W	4
768	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Sportsman Lake	Existing	Yes	Private	41.12	-105.65	Lone Tree Creek	MONAGHAN RANCH	13N	74W	1
769	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.12	-105.67	Lone Tree Creek	MONAGHAN RANCH	13N	74W	2
770	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.13	-105.80	Laramie River-Sodergreen Lake	N/A	13N	75W	
771	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015 series of ponds.	Existing	Yes	US Forest Service	41.04	-106.11	Boswell Creek	BOSWELL (RMU)	12N	78W	1
772	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.13	-105.81	Laramie River-Sodergreen Lake	N/A	13N	75W	4
773	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.12	-105.87	Laramie River-Sodergreen Lake	N/A	13N	76W	1
774	Reservoir	ACE Mapscan	embankment present, no visible damage, dry in all imagery	Existing	Potential	Private	41.12	-105.92	Laramie River-Sodergreen Lake	N/A	13N	76W	
775	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Lake Owen	Existing	Yes	US Forest Service	41.15	-106.10	Squirrel Creek-Laramie River	FOXPARK (RMU)	14N	78W	25
776	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.14	-105.80	Laramie River-Sodergreen Lake	N/A	14N	75W	34
777	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	State of Wyoming	41.14	-105.64	Willow Creek-Laramie River	MONAGHAN RANCH	14N	74W	36
778	Reservoir	ACE Mapscan	Wet in 2011, 2015	Existing	Yes	Private	41.14	-105.55	Harney Creek-Laramie River	N/A	14N	73W	35
779	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	State of Wyoming	41.14	-105.52	Harney Creek-Laramie River	N/A	14N	73W	36
780	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.14	-105.47	Harney Creek-Laramie River	N/A	14N	72W	33
781	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.15	-105.46	Harney Creek-Laramie River	N/A	14N	72W	27
782	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.16	-105.45	Harney Creek-Laramie River	N/A	14N	72W	27
783	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.15	-105.46	Harney Creek-Laramie River	N/A	14N	72W	27
784	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.17	-105.58	Harney Creek-Laramie River	N/A	14N	73W	21
785	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.17	-105.60	Willow Creek-Laramie River	N/A	14N	73W	20
786	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Leazenby Lake	Existing	Yes	Private	41.18	-105.59	Harney Creek-Laramie River	LEAZENBY LAKE	14N	73W	21
787	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.16	-105.64	Lone Tree Creek	MONAGHAN RANCH	14N	74W	24
788	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	US Fish & Wildlife	41.17	-105.71	Antelope Creek-Shell Creek	N/A	14N	74W	21
789	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.18	-105.74	Antelope Creek-Shell Creek	BESSIE BATH	14N	74W	18
790	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.18	-105.73	Antelope Creek-Shell Creek	BESSIE BATH	14N	74W	19
791	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Hutton Lake	Existing	Yes	Water	41.17	-105.71	Antelope Creek-Shell Creek	N/A	14N	74W	20
792	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Rush Lake	Existing	Yes	Water	41.18	-105.73	Antelope Creek-Shell Creek	N/A	14N	74W	17
793	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Lake George	Existing	Yes	Water	41.18	-105.73	Antelope Creek-Shell Creek	N/A	14N	74W	17
794	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Creighton Lake	Existing	Yes	Water	41.19	-105.72	Antelope Creek-Shell Creek	N/A	14N	74W	17
795	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.17	-105.86	Laramie River-Sodergreen Lake	N/A	14N	75W	19
796	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.17	-105.90	Sevenmile Lakes	N/A	14N	76W	22
797	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.15	-106.04	Squirrel Creek-Laramie River	SHEEP MOUNTAIN WILDLIFE (RMU)	14N	77W	28
798	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Sodergreen Lake	Existing	Yes	Water	41.16	-105.93	Laramie River-Sodergreen Lake	N/A	14N	76W	21
799	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.15	-105.90	Laramie River-Sodergreen Lake	N/A	14N	76W	26
800	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.16	-105.86	Laramie River-Sodergreen Lake	N/A	14N	76W	25
801	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Caldwell Lake	Existing	Yes	Private	41.15	-105.79	Laramie River-Sodergreen Lake	N/A	14N	75W	26
802	Reservoir	ACE Mapscan	Wet in 2009, 2015	Existing	Yes	Private	41.15	-105.76	Shell Creek	N/A	14N	75W	25
803	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.16	-105.70	Antelope Creek-Shell Creek	SAND CREEK RANCH	14N	74W	28

ACE_ID	Improvement Type	Source	Notes	Status	Water Source	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
804	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.16	-105.60	Willow Creek-Laramie River	N/A	14N	73W	29
805	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.16	-105.59	Willow Creek-Laramie River	N/A	14N	73W	28
806	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012	Existing	Yes	Private	41.16	-105.59	Willow Creek-Laramie River	N/A	14N	73W	28
807	Reservoir	ACE Mapscan	Breached	Existing	Yes	Private	41.16	-105.56	Harney Creek-Laramie River	N/A	14N	73W	27
808	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.16	-105.51	Harney Creek-Laramie River	BERTHEL LAND & LIVE.	14N	72W	30
809	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.17	-106.07	Squirrel Creek-Laramie River	N/A	14N	77W	19
810	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.18	-106.09	South Fork Little Laramie River	N/A	14N	77W	18
811	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.19	-106.08	South Fork Little Laramie River	N/A	14N	77W	18
812	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.18	-106.08	South Fork Little Laramie River	N/A	14N	77W	18
813	Reservoir	ACE Mapscan	Breached	Existing	No	Private	41.18	-105.99	Lake Hattie	N/A	14N	77W	13
814	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	State of Wyoming	41.18	-105.92	Sevenmile Lakes	N/A	14N	76W	15
815	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.18	-105.90	Sevenmile Lakes	N/A	14N	76W	14
816	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.18	-105.83	Sevenmile Lakes	N/A	14N	75W	17
817	Reservoir	ACE Mapscan	Wet in 2009, 2015	Existing	Yes	Private	41.18	-105.70	Antelope Creek-Shell Creek	SAND CREEK RANCH	14N	74W	21
818	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.20	-105.53	Harney Creek-Laramie River	N/A	14N	73W	12
819	Reservoir	ACE Mapscan	Wet in 2009, 2015	Existing	Yes	Private	41.20	-105.57	Harney Creek-Laramie River	LEAZENBY LAKE	14N	73W	10
820	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.20	-105.81	Sevenmile Lakes	N/A	14N	75W	10
821	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.20	-105.82	Sevenmile Lakes	N/A	14N	75W	9
822	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	State of Wyoming	41.20	-105.97	Lake Hattie	N/A	14N	76W	7
823	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.20	-106.07	South Fork Little Laramie River	N/A	14N	77W	7
824	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.20	-106.08	South Fork Little Laramie River	N/A	14N	77W	7
825	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.20	-106.09	South Fork Little Laramie River	N/A	14N	77W	7
826	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.19	-106.09	South Fork Little Laramie River	N/A	14N	77W	7
827	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.20	-106.10	South Fork Little Laramie River	HECHT	14N	78W	12
828	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.19	-106.10	South Fork Little Laramie River	STRAIN	14N	78W	12
829	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.21	-106.10	South Fork Little Laramie River	N/A	14N	78W	1
830	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.21	-106.10	South Fork Little Laramie River	N/A	14N	78W	1
831	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	State of Wyoming	41.21	-106.09	South Fork Little Laramie River	N/A	14N	77W	6
832	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.22	-106.09	South Fork Little Laramie River	N/A	14N	77W	6
833	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.21	-106.08	South Fork Little Laramie River	N/A	14N	77W	6
834	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.22	-106.07	South Fork Little Laramie River	N/A	14N	77W	5
835	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Mortenson Lake	Existing	Yes	US Fish & Wildlife	41.21	-105.84	Sevenmile Lakes	N/A	14N	75W	5
836	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Meeboer Lake	Existing	Yes	US Fish & Wildlife	41.22	-105.82	Sevenmile Lakes	N/A	14N	75W	4
837	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	US Fish & Wildlife	41.21	-105.80	Sevenmile Lakes	N/A	14N	75W	3
838	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Soda Lake	Existing	Yes	US Fish & Wildlife	41.21	-105.79	Sevenmile Lakes	N/A	14N	75W	3
839	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Gibbs Pond	Existing	Yes	US Fish & Wildlife	41.22	-105.78	Sevenmile Lakes	N/A	14N	75W	2
840	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	US Fish & Wildlife	41.22	-105.81	Sevenmile Lakes	N/A	14N	75W	3
841	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Twelve Mile Lake	Existing	Yes	Private	41.22	-105.76	Laramie River-West Laramie	N/A	14N	75W	1
842	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.21	-105.74	Laramie River-Sodergreen Lake	N/A	14N	74W	6
843	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.21	-105.74	Laramie River-Sodergreen Lake	N/A	14N	74W	6
844	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.21	-105.65	Lone Tree Creek	N/A	14N	74W	1
845	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.21	-105.65	Lone Tree Creek	N/A	14N	74W	1
846	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.22	-105.56	Harney Creek-Laramie River	N/A	14N	73W	3
847	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.22	-105.57	Harney Creek-Laramie River	N/A	15N	73W	34
848	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	State of Wyoming	41.23	-105.76	Laramie River-West Laramie	N/A	15N	75W	36
849	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Osterman Lake	Existing	Yes	Private	41.23	-105.82	Sevenmile Lakes	N/A	15N	75W	33
850	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Phillips Reservoir	Existing	Yes	Private	41.23	-105.84	Sevenmile Lakes	N/A	15N	75W	32
851	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015, Twin Buttes Lake	Existing	Yes	Water	41.24	-105.85	Sevenmile Lakes	TALBOTT	15N	75W	30
852	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Gelatt Lake	Existing	Yes	Private	41.24	-105.84	Sevenmile Lakes	N/A	15N	75W	29
853	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.23	-105.85	Sevenmile Lakes	N/A	15N	75W	31
854	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.23	-105.85	Sevenmile Lakes	N/A	15N	75W	31
855	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.23	-105.85	Sevenmile Lakes	N/A	15N	75W	31
856	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.23	-105.85	Sevenmile Lakes	TALBOTT	15N	75W	30
857	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	State of Wyoming	41.22	-105.88	Sevenmile Lakes	N/A	15N	76W	36
858	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Lake Hattie	Existing	Yes	Private	41.25	-105.90	Lake Hattie	JW/SHEEP MTN RANCH	15N	76W	23
859	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.23	-105.93	Lake Hattie	JW/SHEEP MTN RANCH	15N	76W	33
860	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Bureau of Land Management	41.23	-105.92	Lake Hattie	JW/SHEEP MTN RANCH	15N	76W	34
861	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.22	-105.94	Lake Hattie	JW/SHEEP MTN RANCH	15N	76W	32
862	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.24	-106.09	Little Laramie River-Middle Fork Little Laramie River	N/A	15N	77W	30
863	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.25	-105.98	Lake Hattie	JW/SHEEP MTN RANCH	15N	77W	25
864	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Bureau of Land Management	41.24	-105.89	Lake Hattie	JW/SHEEP MTN RANCH	15N	76W	26
865	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.24	-105.81	Sevenmile Lakes	N/A	15N	75W	28
866	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.24	-105.79	Sevenmile Lakes	N/A	15N	75W	26
867	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.24	-105.77	Sevenmile Lakes	N/A	15N	75W	25
868	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.24	-105.74	Sevenmile Lakes	N/A	15N	74W	30
869	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.24	-105.74	Laramie River-West Laramie	N/A	15N	74W	30
870	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.24	-105.72	Laramie River-West Laramie	N/A	15N	74W	29
871	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Sevenmile Lakes	Existing	Yes	Private	41.25	-105.72	Laramie River-West Laramie	N/A	15N	74W	29
872	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.26	-105.57	Soldier Creek-Laramie River	N/A	15N	73W	22
873	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.26	-105.56	Soldier Creek-Laramie River	N/A	15N	73W	22
874	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.04	-105.57	Willow Creek-Laramie River	N/A	12N	73W	3
875	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.60	-105.64	Laramie River-Dunn Ditch	R. O.	19N	73W	30
876	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.59	-105.67	Laramie River-Dunn Ditch	R. O.	19N	74W	26

ACE_ID	Improvement Type	Source	Notes	Status	Water Source	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
877	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.59	-105.89	Cooper Creek	COOPER LAKE	19N	76W	26
878	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.59	-105.89	Cooper Creek	COOPER LAKE	19N	76W	26
879	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.60	-105.89	Cooper Creek	COOPER LAKE	19N	76W	25
880	Reservoir	ACE Mapscan	Wet in 2009, 2011. windmill and well nearby	Existing	Yes	Bureau of Land Management	41.59	-105.89	Cooper Creek	COOPER LAKE	19N	76W	26
881	Reservoir	ACE Mapscan	wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.59	-105.96	Cooper Creek	COOPER LAKE	19N	76W	29
882	Reservoir	ACE Mapscan	Wet in 2009, 2011. Dutton Creek Reservoir. water levels fluctuate	Existing	Yes	Water	41.60	-105.99	Lower Dutton Creek	DUTTON CREEK SOUTH	19N	77W	24
883	Reservoir	ACE Mapscan	Breached	Existing	No	Private	41.58	-106.02	Lower Dutton Creek	DUTTON CREEK SOUTH	19N	77W	26
884	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	State of Wyoming	41.57	-106.12	Upper Dutton Creek	N/A	19N	78W	36
885	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.57	-106.06	Lower Dutton Creek	DUTTON CREEK SOUTH	19N	77W	32
886	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.57	-106.04	Lower Dutton Creek	DUTTON CREEK SOUTH	19N	77W	33
887	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012,2015. possibly spring fed	Existing	Yes	Private	41.58	-106.01	Cooper Creek	DUTTON CREEK SOUTH	19N	77W	35
888	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.57	-105.99	Cooper Creek	DUTTON CREEK SOUTH	19N	77W	36
889	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.57	-105.98	Cooper Creek	STROUSE HILL	19N	76W	31
890	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.58	-105.97	Cooper Creek	STROUSE HILL	19N	76W	31
891	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.57	-105.94	Cooper Creek	STROUSE HILL	19N	76W	33
892	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.58	-105.90	Cooper Creek	COOPER LAKE	19N	76W	35
893	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.57	-105.90	Cooper Creek	COOPER LAKE	19N	76W	35
894	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.58	-105.86	Cooper Creek	COOPER LAKE	19N	75W	31
895	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.58	-105.82	Cooper Lake	HARRIS RANCH	19N	75W	33
896	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.58	-105.77	James Lake	HARRIS RANCH	19N	75W	35
897	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015. Spillway erosion	Existing	Yes	Private	41.58	-105.74	James Lake	HARRIS RANCH	19N	74W	31
898	Reservoir	ACE Mapscan	Wet in 2009, 2015, damage along embankment	Existing	Potential	Private	41.58	-105.73	James Lake	HARRIS RANCH	19N	74W	32
899	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. note spillway erosion	Existing	Yes	Private	41.58	-105.71	James Lake	HARRIS RANCH	19N	74W	33
900	Reservoir	ACE Mapscan	Breached	Existing	No	Private	41.58	-105.69	James Lake	N/A	19N	74W	34
901	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.58	-105.65	Oasis Ditch-Laramie River	N/A	19N	74W	36
902	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.57	-105.64	Oasis Ditch-Laramie River	N/A	19N	74W	36
903	Reservoir	ACE Mapscan	Breached, holding water	Existing	No	Private	41.58	-105.61	Oasis Ditch-Laramie River	INDIAN CHIPS	19N	73W	32
904	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.58	-105.59	Oasis Ditch-Laramie River	INDIAN CHIPS	19N	73W	33
905	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.57	-105.59	Oasis Ditch-Laramie River	INDIAN CHIPS	19N	73W	33
906	Reservoir	ACE Mapscan	Wet in 2009, 2012, 2015.	Existing	Yes	Private	41.58	-105.57	Oasis Ditch-Laramie River	INDIAN CHIPS	19N	73W	34
907	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.58	-105.54	Wallrock Creek	INDIAN CHIPS	19N	73W	36
908	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.57	-105.52	Wallrock Creek	INDIAN CHIPS	19N	72W	31
909	Reservoir	ACE Mapscan	Dry in 2011, 2012, 2015, unreliable	Existing	No	Private	41.57	-105.56	Oasis Ditch-Laramie River	INDIAN CHIPS	18N	73W	
910	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.56	-105.61	Oasis Ditch-Laramie River	INDIAN CHIPS	18N	73W	5
911	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.55	-105.62	Oasis Ditch-Laramie River	INDIAN CHIPS	18N	73W	7
912	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.54	-105.61	Oasis Ditch-Laramie River	INDIAN CHIPS	18N	73W	8
913	Reservoir	ACE Mapscan	Breached in 2011, holds some water	Existing	No	Private	41.57	-105.61	Oasis Ditch-Laramie River	INDIAN CHIPS	18N	73W	5
914	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015. possibly fed by nearby spring	Existing	Yes	Private	41.58	-105.56	Oasis Ditch-Laramie River	INDIAN CHIPS	19N	73W	34
915	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.56	-105.58	Oasis Ditch-Laramie River	INDIAN CHIPS	18N	73W	
916	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.56	-105.62	Oasis Ditch-Laramie River	INDIAN CHIPS	18N	73W	6
917	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Functional. overflow to stock pond. Windmill present	Existing	Yes	Private	41.57	-105.62	Oasis Ditch-Laramie River	INDIAN CHIPS	18N	73W	6
918	Reservoir	ACE Mapscan	sediment, dry in all photography	Existing	No	Private	41.57	-105.64	Oasis Ditch-Laramie River	N/A	18N	74W	1
919	Reservoir	ACE Mapscan	Wet in 2009, 2012, 2015	Existing	Yes	Private	41.56	-105.67	Laramie River-Bosler Junction	N/A	18N	74W	11
920	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.56	-105.79	James Lake	STROUSE HILL	18N	75W	
921	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015 small stock pond fed by nearby windmill	Existing	Yes	State of Wyoming	41.57	-105.82	Cooper Lake	STROUSE HILL	18N	75W	4
922	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.56	-105.82	Cooper Lake	STROUSE HILL	18N	75W	4
923	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.56	-105.84	Cooper Lake	STROUSE HILL	18N	75W	5
924	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Catching water from upstream spring, well nearby	Existing	Yes	Private	41.56	-105.97	Cooper Creek	STROUSE HILL	18N	76W	6
925	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.56	-105.96	Cooper Creek	STROUSE HILL	18N	76W	5
926	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.57	-105.96	Cooper Creek	STROUSE HILL	18N	76W	5
927	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. fed by nearby windmill	Existing	Yes	Private	41.57	-105.95	Cooper Creek	STROUSE HILL	18N	76W	5
928	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.56	-106.00	Cooper Creek	STROUSE HILL	18N	77W	1
929	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.56	-106.00	Cooper Creek	STROUSE HILL	18N	77W	1
930	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.56	-105.99	Cooper Creek	STROUSE HILL	18N	77W	1
931	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. windmill fed stock pond	Existing	Yes	Private	41.56	-106.02	Cooper Creek	STROUSE HILL	18N	77W	2
932	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. windmill fed stock pond	Existing	Yes	Private	41.56	-106.01	Cooper Creek	STROUSE HILL	18N	77W	2
933	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.57	-106.01	Cooper Creek	STROUSE HILL	18N	77W	2
934	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.57	-106.01	Cooper Creek	STROUSE HILL	18N	77W	2
935	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.57	-106.01	Cooper Creek	STROUSE HILL	18N	77W	2
936	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.55	-106.04	Cooper Creek	STROUSE HILL	18N	77W	10
937	Reservoir	ACE Mapscan	Wet in 2009, 2012, 2015. windmill fed stock pond	Existing	Yes	Bureau of Land Management	41.57	-106.05	Lower Dutton Creek	STROUSE HILL	18N	77W	4
938	Reservoir	ACE Mapscan	Wet in 2009, 2012, 2015. windmill fed stock pond	Existing	Yes	Private	41.56	-106.07	Lower Dutton Creek	STROUSE HILL	18N	77W	5
939	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.57	-106.07	Lower Dutton Creek	STROUSE HILL	18N	77W	5
940	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.56	-106.09	Upper Dutton Creek	N/A	18N	77W	6
941	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.56	-106.15	Upper Dutton Creek	SCHROEDER	18N	78W	
942	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.54	-106.14	Upper Dutton Creek	SCHROEDER	18N	78W	10
943	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.55	-106.05	Cooper Creek	STROUSE HILL	18N	77W	9
944	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012	Existing	Yes	Private	41.55	-106.03	Cooper Creek	STROUSE HILL	18N	77W	10
945	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.54	-106.01	Cooper Creek	STROUSE HILL	18N	77W	11
946	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.54	-106.00	Cooper Creek	STROUSE HILL	18N	77W	12
947	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.55	-105.98	Cooper Creek	STROUSE HILL	18N	76W	7
948	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.54	-105.93	Damm	STROUSE HILL	18N	76W	9
949	Reservoir	ACE Mapscan	Dry in all photography	Existing	No	Private	41.55	-105.90	Damm	COOPER LAKE	18N	76W	11

ACE_ID	Improvement Type	Source	Notes	Status	Water Source	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
950	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.54	-105.91	Cooper Lake	COOPER LAKE	18N	76W	10
951	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.54	-105.89	Cooper Lake	COOPER LAKE	18N	76W	11
952	Reservoir	ACE Mapscan	Wet in 2009, dry in others, no visible damage	Existing	Potential	Private	41.55	-105.86	Cooper Lake	COOPER LAKE	18N	75W	7
953	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. fed from nearby wel	Existing	Yes	Bureau of Land Management	41.55	-105.84	Cooper Lake	STROUSE HILL	18N	75W	8
954	Reservoir	ACE Mapscan	Wet in 2009, dry in others. no visible damage	Existing	Potential	Bureau of Land Management	41.55	-105.84	Cooper Lake	STROUSE HILL	18N	75W	8
955	Reservoir	ACE Mapscan	Wet in 2009, dry in other years. no visible damage. windmill nearby	Existing	Potential	Private	41.54	-105.81	James Lake	STROUSE HILL	18N	75W	9
956	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.55	-105.80	James Lake	STROUSE HILL	18N	75W	10
957	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.55	-105.79	James Lake	STROUSE HILL	18N	75W	10
958	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.55	-105.60	Oasis Ditch-Laramie River	INDIAN CHIPS	18N	73W	8
959	Reservoir	ACE Mapscan	Dry but no visible damage	Existing	Potential	Private	41.55	-105.60	Oasis Ditch-Laramie River	INDIAN CHIPS	18N	73W	8
960	Reservoir	ACE Mapscan	Breachedaround spillway	Existing	No	Private	41.53	-105.64	Laramie River-Bosler Junction	PASCO	18N	73W	18
961	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.53	-105.72	Laramie River-Bosler Junction	HARRIS RANCH	18N	74W	17
962	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.54	-105.72	Laramie River-Bosler Junction	HARRIS RANCH	18N	74W	17
963	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. windmill present	Existing	Yes	Private	41.54	-105.77	Laramie River-Bosler Junction	HARRIS RANCH	18N	75W	13
964	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.54	-105.82	James Lake	STROUSE HILL	18N	75W	16
965	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.53	-105.83	James Lake	STROUSE HILL	18N	75W	17
966	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.53	-105.84	James Lake	STROUSE HILL	18N	75W	17
967	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.53	-105.88	Cooper Lake	JAMES LAKE	18N	76W	13
968	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.54	-105.88	Cooper Lake	JAMES LAKE	18N	76W	13
969	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.53	-105.91	Cooper Lake	JAMES LAKE	18N	76W	15
970	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. erosion on spillway channe	Existing	Yes	Private	41.54	-105.92	Damm	JAMES LAKE	18N	76W	15
971	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.53	-105.95	Damm	STROUSE HILL	18N	76W	17
972	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.54	-105.95	Damm	STROUSE HILL	18N	76W	17
973	Reservoir	ACE Mapscan	WEt in 2009, 2011, 2012, 2015. windmill to stock ponc	Existing	Yes	Private	41.54	-106.03	Cooper Creek	STROUSE HILL	18N	77W	15
974	Reservoir	ACE Mapscan	WEt in 2009, 2011, 2012, 2015. windmill to stock ponc	Existing	Yes	State of Wyoming	41.54	-106.06	Cooper Creek	STROUSE HILL	18N	77W	16
975	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.53	-106.10	Upper Dutton Creek	N/A	18N	77W	18
976	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.53	-106.10	Upper Dutton Creek	N/A	18N	78W	13
977	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.53	-106.11	Upper Dutton Creek	N/A	18N	78W	13
978	Reservoir	ACE Mapscan	Breached, but does hold some water	Existing	No	Private	41.52	-106.11	Upper Dutton Creek	COOPER HILL	18N	78W	24
979	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.52	-106.01	Damm	STROUSE HILL	18N	77W	23
980	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.51	-105.93	Damm	JAMES LAKE	18N	76W	28
981	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.52	-105.93	Damm	STROUSE HILL	18N	76W	21
982	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.52	-105.94	Damm	STROUSE HILL	18N	76W	21
983	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.51	-105.92	Damm	JAMES LAKE	18N	76W	27
984	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.52	-105.89	Cooper Lake	JAMES LAKE	18N	76W	23
985	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.53	-105.84	James Lake	N/A	18N	75W	20
986	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.52	-105.85	James Lake	JAMES LAKE	18N	75W	19
987	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.52	-105.81	Laramie River-Bosler Junction	N/A	18N	75W	22
988	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.52	-105.79	Laramie River-Bosler Junction	N/A	18N	75W	22
989	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.52	-105.78	Laramie River-Bosler Junction	HARRIS RANCH	18N	75W	23
990	Reservoir	ACE Mapscan	Wet in 2009, dry in other years. no visible damage	Existing	Potential	Private	41.52	-105.75	Laramie River-Bosler Junction	HARRIS RANCH	18N	74W	19
991	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.51	-105.74	Laramie River-Bosler Junction	HARRIS RANCH	18N	74W	19
992	Reservoir	ACE Mapscan	Wet in 2011, dry in others . no visible damage	Existing	Potential	Private	41.52	-105.62	Laramie River-Bosler Junction	PASCO	18N	73W	19
993	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.52	-105.58	Laramie River-Bosler Junction	PASCO	18N	73W	21
994	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.52	-105.58	Laramie River-Bosler Junction	PASCO	18N	73W	21
995	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.51	-105.61	Oasis Ditch	N/A	18N	73W	29
996	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.50	-105.85	Fourmile Creek-Laramie River	N/A	18N	75W	30
997	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012. Heavy erosion on spillway channel, needs investigatior	Existing	Potential	Private	41.51	-105.88	Fourmile Creek-Laramie River	JAMES LAKE	18N	76W	25
998	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.50	-105.92	Fourmile Creek-Laramie River	JAMES LAKE	18N	76W	27
999	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.50	-105.94	Fourmile Creek-Laramie River	JAMES LAKE	18N	76W	28
1000	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.50	-105.92	Fourmile Creek-Laramie River	JAMES LAKE	18N	76W	27
1001	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.50	-105.94	Fourmile Creek-Laramie River	JAMES LAKE	18N	76W	28
1002	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.50	-105.95	Fourmile Creek-Laramie River	JAMES LAKE	18N	76W	29
1003	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.50	-105.95	Fourmile Creek-Laramie River	JAMES LAKE	18N	76W	29
1004	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. fed my nearby windmil	Existing	Yes	Private	41.50	-105.99	Damm	STROUSE HILL	18N	77W	25
1005	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.50	-105.98	Damm	STROUSE HILL	18N	76W	30
1006	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. fed by nearby windmill, two ponds present on each side of fence. Windmill presen	Existing	Yes	Private	41.50	-106.00	Damm	STROUSE HILL	18N	77W	25
1007	Reservoir	ACE Mapscan	sediment	Existing	Yes	Bureau of Land Management	41.50	-106.01	Damm	STROUSE HILL	18N	77W	26
1008	Reservoir	ACE Mapscan	Sediment	Existing	No	Private	41.50	-106.06	Cooper Creek	STROUSE HILL	18N	77W	28
1009	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.50	-106.08	Cooper Creek	N/A	18N	77W	30
1010	Reservoir	ACE Mapscan	Wet in 2011, 2015	Existing	Yes	Private	41.50	-106.12	Upper Dutton Creek	COOPER HILL	18N	78W	26
1011	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.51	-106.11	Upper Dutton Creek	N/A	18N	78W	25
1012	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.50	-106.15	Upper Dutton Creek	THREE MILE WILDLIFE (RMU)	18N	78W	27
1013	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.50	-106.15	Upper Dutton Creek	N/A	18N	78W	27
1014	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.50	-106.15	Upper Dutton Creek	N/A	18N	78W	27
1015	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.51	-106.15	Upper Dutton Creek	N/A	18N	78W	27
1016	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.51	-106.15	Upper Dutton Creek	N/A	18N	78W	27
1017	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.51	-106.16	Upper Dutton Creek	N/A	18N	78W	21
1018	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.49	-106.13	Upper Dutton Creek	N/A	18N	78W	35
1019	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.48	-106.09	Cooper Creek	N/A	17N	77W	6
1020	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.49	-106.02	Fourmile Creek-Laramie River	STROUSE HILL	18N	77W	35
1021	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	State of Wyoming	41.49	-105.99	Fourmile Creek-Laramie River	STROUSE HILL	18N	77W	36
1022	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.49	-105.96	Fourmile Creek-Laramie River	STROUSE HILL	18N	76W	32

ACE_ID	Improvement Type	Source	Notes	Status	Water Source	Land Owner	Lat	Long	HUC 12 Name	Allotment / RMU Name	T	R	S
1023	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. possibly fed by nearby windmil	Existing	Yes	Private	41.49	-105.95	Fourmile Creek-Laramie River	STROUSE HILL	18N	76W	33
1024	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. possibly fed by nearby windmil	Existing	Yes	Private	41.49	-105.93	Fourmile Creek-Laramie River	STROUSE HILL	18N	76W	33
1025	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Water	41.48	-105.89	Sevenmile Creek-Laramie River	JAMES LAKE	17N	76W	2
1026	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.50	-105.85	Fourmile Creek-Laramie River	JAMES LAKE	18N	75W	31
1027	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.48	-105.84	Fourmile Creek-Laramie River	JAMES LAKE	18N	75W	32
1028	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.49	-105.83	Fourmile Creek-Laramie River	N/A	18N	75W	33
1029	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.49	-105.82	Fourmile Creek-Laramie River	N/A	18N	75W	33
1030	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015. fed by nearby windmil	Existing	Yes	Private	41.49	-105.80	Fourmile Creek-Laramie River	N/A	18N	75W	34
1031	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.48	-105.79	Fourmile Creek-Laramie River	HARRIS RANCH	18N	75W	35
1032	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.49	-105.76	Laramie River-Bosler Junction	HARRIS RANCH	18N	75W	36
1033	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.49	-105.76	Laramie River-Bosler Junction	HARRIS RANCH	18N	75W	36
1034	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.48	-105.52	Oasis Ditch	NEEDMORE RANCH	17N	73W	1
1035	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.48	-105.89	Fourmile Creek-Laramie River	JAMES LAKE	17N	76W	2
1036	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.48	-105.91	Sevenmile Creek-Laramie River	JAMES LAKE	17N	76W	3
1037	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.47	-105.93	Sevenmile Creek-Laramie River	JAMES LAKE	17N	76W	4
1038	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Windmill nearby	Existing	Yes	Private	41.47	-105.95	Sevenmile Creek-Laramie River	STROUSE HILL	17N	76W	5
1039	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015. windmill present	Existing	Yes	Private	41.47	-106.01	Fourmile Creek-Laramie River	STROUSE HILL	17N	77W	2
1040	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.48	-106.00	Fourmile Creek-Laramie River	STROUSE HILL	17N	77W	1
1041	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.48	-106.01	Fourmile Creek-Laramie River	STROUSE HILL	17N	77W	2
1042	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.47	-106.05	Fourmile Creek-Laramie River	STROUSE HILL	17N	77W	4
1043	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.46	-106.04	Fourmile Creek-Laramie River	N/A	17N	77W	9
1044	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.46	-106.04	Fourmile Creek-Laramie River	N/A	17N	77W	10
1045	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.46	-106.02	Sevenmile Creek-Laramie River	STROUSE HILL	17N	77W	10
1046	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Bureau of Land Management	41.46	-105.99	Sevenmile Creek-Laramie River	STROUSE HILL	17N	77W	12
1047	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.46	-105.91	Sevenmile Creek-Laramie River	JAMES LAKE	17N	76W	10
1048	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.46	-105.90	Sevenmile Creek-Laramie River	JAMES LAKE	17N	76W	11
1049	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.46	-105.88	Fourmile Creek-Laramie River	JAMES LAKE	17N	76W	12
1050	Reservoir	ACE Mapscan	sediment	Existing	Potential	State of Wyoming	41.46	-105.79	Little Laramie River-Sprague River	N/A	17N	75W	10
1051	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.45	-105.54	Rogers Canyon	N/A	17N	73W	13
1052	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.45	-105.57	Rogers Canyon	N/A	17N	73W	15
1053	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.45	-105.80	Little Laramie River-Sprague River	N/A	17N	75W	15
1054	Reservoir	ACE Mapscan	Wet in 2009, 2012, 2015	Existing	Yes	Private	41.44	-105.83	Little Laramie River-Sprague River	JAMES LAKE	17N	75W	17
1055	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. fed by nearby windmil	Existing	Yes	Private	41.44	-105.85	Little Laramie River-Sprague River	JAMES LAKE	17N	75W	19
1056	Reservoir	ACE Mapscan	Wet in 2011, 2015. fed by nearby windmill	Existing	Yes	Bureau of Land Management	41.44	-105.89	Little Laramie River-Sprague River	JAMES LAKE	17N	76W	14
1057	Reservoir	ACE Mapscan	Wet in 2011, 2015. fed by nearby windmill	Existing	Yes	Private	41.44	-105.89	Little Laramie River-Sprague River	JAMES LAKE	17N	76W	13
1058	Reservoir	ACE Mapscan	sediment	Existing	No	Bureau of Land Management	41.45	-105.91	Little Laramie River-Sprague River	JAMES LAKE	17N	76W	14
1059	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.45	-105.92	Sevenmile Creek-Laramie River	JAMES LAKE	17N	76W	15
1060	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.44	-105.93	Sevenmile Creek-Laramie River	JAMES LAKE	17N	76W	16
1061	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.45	-105.93	Sevenmile Creek-Laramie River	JAMES LAKE	17N	76W	16
1062	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.44	-105.92	Sevenmile Creek-Laramie River	JAMES LAKE	17N	76W	15
1063	Reservoir	ACE Mapscan	Wet in 2011, 2015	Existing	Yes	Private	41.44	-105.95	Sevenmile Creek-Laramie River	STROUSE HILL	17N	76W	17
1064	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.44	-105.95	Sevenmile Creek-Laramie River	STROUSE HILL	17N	76W	17
1065	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.44	-106.01	Sevenmile Creek-Laramie River	STROUSE HILL	17N	77W	23
1066	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.44	-106.01	Sevenmile Creek-Laramie River	STROUSE HILL	17N	77W	23
1067	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.45	-106.04	Sevenmile Creek-Laramie River	N/A	17N	77W	15
1068	Reservoir	ACE Mapscan	sediment	Existing	No	State of Wyoming	41.45	-106.05	Fourmile Creek-Laramie River	N/A	17N	77W	16
1069	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Bureau of Land Management	41.43	-106.10	Fourmile Creek-Laramie River	SEVEN MILE	17N	78W	24
1070	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.43	-106.07	Sevenmile Creek-Laramie River	COUNTY LINE	17N	77W	20
1071	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.43	-106.01	Little Laramie River-Sprague River	STROUSE HILL	17N	77W	23
1072	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Bureau of Land Management	41.44	-105.99	Little Laramie River-Sprague River	STROUSE HILL	17N	77W	24
1073	Reservoir	ACE Mapscan	Wet in 2009, 2012, 2015. fed by nearby windmil	Existing	Yes	Private	41.43	-105.96	Little Laramie River-Sprague River	STROUSE HILL	17N	76W	19
1074	Reservoir	ACE Mapscan	Wet in 2009, 2012, 2015. fed by nearby windmil	Existing	Yes	State of Wyoming	41.43	-105.96	Little Laramie River-Sprague River	STROUSE HILL	17N	76W	20
1075	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. fed from nearby windmil	Existing	Yes	Private	41.43	-105.93	Little Laramie River-Sprague River	N/A	17N	76W	21
1076	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.43	-105.89	Little Laramie River-Sprague River	N/A	17N	76W	23
1077	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.44	-105.85	Little Laramie River-Sprague River	JAMES LAKE	17N	75W	19
1078	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.43	-105.83	Little Laramie River-Sprague River	JAMES LAKE	17N	75W	20
1079	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.43	-105.82	Little Laramie River-Sprague River	N/A	17N	75W	21
1080	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. windmill present. overflow to pond downstream	Existing	Yes	Private	41.44	-105.58	Rogers Canyon	N/A	17N	73W	22
1081	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.41	-105.78	Browns Creek	N/A	17N	75W	26
1082	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.41	-105.85	Little Laramie River-Sprague River	N/A	17N	75W	30
1083	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.41	-105.92	Little Laramie River-Sprague River	N/A	17N	76W	27
1084	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.42	-105.94	Little Laramie River-Sprague River	N/A	17N	76W	28
1085	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.41	-106.03	Little Laramie River-Webb Lake	WEBB LAKE	17N	77W	27
1086	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.41	-106.05	Little Laramie River-Webb Lake	WEBB LAKE	17N	77W	28
1087	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.39	-106.01	Little Laramie River-Webb Lake	N/A	16N	77W	2
1088	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.40	-106.01	Little Laramie River-Webb Lake	N/A	17N	77W	35
1089	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.40	-106.00	Little Laramie River-Webb Lake	N/A	17N	77W	35
1090	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.41	-105.93	Little Laramie River-Sprague River	N/A	17N	76W	33
1091	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.41	-105.91	Little Laramie River-Sprague River	N/A	17N	76W	34
1092	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015.	Existing	Yes	Private	41.40	-105.89	Little Laramie River-Sprague River	N/A	17N	76W	35
1093	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.40	-105.77	Bamforth Lake	N/A	17N	75W	36
1094	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.39	-105.76	Bamforth Lake	N/A	16N	75W	1
1095	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.39	-105.75	Bamforth Lake	N/A	16N	75W	1

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1096	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.39	-105.64	Laramie River-Soap Holes	CARROLL	16N	74W	1
1097	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.39	-105.56	Laramie River-Soap Holes	N/A	16N	73W	
1098	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.38	-105.61	Laramie River-Soap Holes	N/A	16N	73W	5
1099	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.38	-105.68	Bamforth Lake	CARROLL	16N	74W	
1100	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.39	-105.72	Bamforth Lake	BAMFORD	16N	74W	5
1101	Reservoir	ACE Mapscan	Wet in 2009, dry in other years. No visible damage	Existing	Potential	Private	41.39	-105.73	Bamforth Lake	BAMFORD	16N	74W	5
1102	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.38	-105.73	Bamforth Lake	BAMFORD	16N	74W	5
1103	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.38	-105.75	Bamforth Lake	N/A	16N	75W	1
1104	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.38	-105.96	Little Laramie River-Webb Lake	N/A	16N	76W	5
1105	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.38	-105.95	Little Laramie River-Webb Lake	N/A	16N	76W	5
1106	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.38	-105.97	Little Laramie River-Webb Lake	MILL CREEK	16N	76W	6
1107	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.38	-106.00	Mill Creek-Little Laramie River	N/A	16N	77W	2
1108	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.36	-105.92	Browns Creek	N/A	16N	76W	10
1109	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.38	-105.88	Browns Creek	N/A	16N	76W	12
1110	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.37	-105.79	Bamforth Lake	N/A	16N	75W	11
1111	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. fed by nearby windmil	Existing	Yes	Private	41.37	-105.80	Browns Creek	N/A	16N	75W	10
1112	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	US Fish & Wildlife	41.37	-105.75	Bamforth Lake	BAMFORD	16N	75W	12
1113	Reservoir	ACE Mapscan	sediment	Existing	No	US Fish & Wildlife	41.37	-105.71	Bamforth Lake	BAMFORD	16N	74W	8
1114	Reservoir	ACE Mapscan	Breached	Existing	No	Private	41.37	-105.70	Bamforth Lake	BAMFORD	16N	74W	9
1115	Reservoir	ACE Mapscan	Breached	Existing	No	Private	41.37	-105.69	Bamforth Lake	BAMFORD	16N	74W	9
1116	Reservoir	ACE Mapscan	Breached	Existing	No	Private	41.37	-105.69	Bamforth Lake	N/A	16N	74W	10
1117	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.38	-105.69	Bamforth Lake	BAMFORD	16N	74W	9
1118	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.37	-105.68	Bamforth Lake	N/A	16N	74W	10
1119	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.37	-105.67	Bamforth Lake	CARROLL	16N	74W	11
1120	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.38	-105.67	Laramie River-Soap Holes	CARROLL	16N	74W	11
1121	Reservoir	ACE Mapscan	Wet in 2009, 2015.	Existing	Yes	Private	41.36	-105.63	Laramie River-Soap Holes	SCHICK	16N	74W	13
1122	Reservoir	ACE Mapscan	Wet in 2009, dry in other imagery. No visible damage	Existing	Potential	Private	41.36	-105.64	Laramie River-Laramie	SCHICK	16N	74W	13
1123	Reservoir	ACE Mapscan	sediment	Existing	No	State of Wyoming	41.36	-105.69	Bamforth Lake	BAMFORD	16N	74W	16
1124	Reservoir	ACE Mapscan	Wet in 2009, 2011	Existing	Yes	Private	41.36	-105.73	Bamforth Lake	BAMFORD	16N	74W	17
1125	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.36	-105.76	Bamforth Lake	N/A	16N	75W	13
1126	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.36	-105.77	Bamforth Lake	N/A	16N	75W	14
1127	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.36	-105.78	Bamforth Lake	N/A	16N	75W	14
1128	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.36	-105.78	Bamforth Lake	N/A	16N	75W	14
1129	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	State of Wyoming	41.36	-105.81	Bamforth Lake	N/A	16N	75W	16
1130	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	State of Wyoming	41.36	-105.81	Bamforth Lake	N/A	16N	75W	16
1131	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.36	-105.85	Browns Creek	N/A	16N	75W	18
1132	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.35	-105.88	Browns Creek	N/A	16N	76W	13
1133	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.36	-105.89	Browns Creek	N/A	16N	76W	14
1134	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.36	-105.90	Browns Creek	N/A	16N	76W	14
1135	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.35	-105.90	Browns Creek	N/A	16N	76W	14
1136	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.36	-105.98	Little Laramie River-Webb Lake	N/A	16N	77W	13
1137	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.36	-105.98	Little Laramie River-Webb Lake	N/A	16N	77W	13
1138	Reservoir	ACE Mapscan	Wet in 2011,2015	Existing	Yes	Private	41.35	-106.01	Little Laramie River-Webb Lake	CROONBERG RANCH	16N	77W	15
1139	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.34	-106.05	Little Laramie River-Webb Lake	CROONBERG RANCH	16N	77W	21
1140	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.34	-106.00	Little Laramie River-Webb Lake	CROONBERG RANCH	16N	77W	23
1141	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.34	-105.84	Bamforth Lake	N/A	16N	75W	20
1142	Reservoir	ACE Mapscan	Wet in 2015. Dry in all other imagery. no visible damage	Existing	Potential	Private	41.34	-105.81	Bamforth Lake	N/A	16N	75W	21
1143	Reservoir	ACE Mapscan	Wet in 2009, 2011. fed from nearby spring	Existing	Yes	Private	41.34	-105.81	Bamforth Lake	BATH BROTHERS	16N	75W	22
1144	Reservoir	ACE Mapscan	Wet in 2012, 2015. windmill present. tanks present but apper non functional.	Existing	Yes	Private	41.34	-105.78	Bamforth Lake	BATH BROTHERS	16N	75W	23
1145	Reservoir	ACE Mapscan	Dry in all imagery, but no visible damge	Existing	Potential	Private	41.34	-105.77	Bamforth Lake	BATH BROTHERS	16N	75W	23
1146	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.35	-105.74	Bamforth Lake	BATH BROTHERS	16N	74W	19
1147	Reservoir	ACE Mapscan	Wet in 2011, 2012	Existing	Yes	Private	41.34	-105.71	Laramie River-Laramie	N/A	16N	74W	21
1148	Reservoir	ACE Mapscan	Wet in 2009, 2015	Existing	Yes	Private	41.34	-105.66	Laramie River-Laramie	N/A	16N	74W	23
1149	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.34	-105.64	Laramie River-Laramie	N/A	16N	74W	24
1150	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012	Existing	Yes	Private	41.33	-105.71	Laramie River-Laramie	N/A	16N	74W	29
1151	Reservoir	ACE Mapscan	Wet in 2009, 2012, 2015. Windmill/well present	Existing	Yes	Bureau of Land Management	41.33	-105.78	Laramie River-Laramie	BATH BROTHERS	16N	75W	26
1152	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.32	-105.81	Laramie River-Laramie	BATH BROTHERS	16N	75W	28
1153	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.33	-105.89	Browns Creek	N/A	16N	76W	26
1154	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.32	-105.92	Browns Creek	N/A	16N	76W	27
1155	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.33	-105.92	Browns Creek	N/A	16N	76W	27
1156	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Millbrook Res. No 2	Existing	Yes	Private	41.32	-105.95	Browns Creek	N/A	16N	76W	29
1157	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.32	-105.99	Little Laramie River-Webb Lake	N/A	16N	77W	25
1158	Reservoir	ACE Mapscan	Wet in 2011, 2015	Existing	Yes	Private	41.32	-105.99	Little Laramie River-Webb Lake	N/A	16N	77W	25
1159	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.33	-106.03	Little Laramie River-Webb Lake	N/A	16N	77W	28
1160	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.32	-106.04	Little Laramie River-Webb Lake	CROONBERG RANCH	16N	77W	28
1161	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.33	-106.05	Little Laramie River-Webb Lake	CROONBERG RANCH	16N	77W	28
1162	Reservoir	ACE Mapscan	Wet in 2011, 2012, 2015	Existing	Yes	Private	41.33	-106.03	Little Laramie River-Webb Lake	N/A	16N	77W	28
1163	Reservoir	ACE Mapscan	Wet in 2015, dry in other all other imager. no visible damage	Existing	Potential	Private	41.32	-106.03	Little Laramie River-Webb Lake	N/A	16N	77W	27
1164	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.33	-106.06	Little Laramie River-Webb Lake	CROONBERG RANCH	16N	77W	29
1165	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.33	-106.07	Little Laramie River-Webb Lake	CROONBERG RANCH	16N	77W	29
1166	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.32	-106.11	Little Laramie River-Cenntenial Valley	T-K RANCH	16N	78W	25
1167	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.32	-106.12	Little Laramie River-Cenntenial Valley	N/A	16N	78W	35
1168	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.30	-106.07	Little Laramie River-Cenntenial Valley	N/A	15N	77W	5

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1169	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.30	-106.07	Little Laramie River-Cenntenial Valley	N/A	15N	77W	5
1170	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.31	-106.07	Little Laramie River-Cenntenial Valley	N/A	16N	77W	32
1171	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.31	-106.04	Little Laramie River-Cenntenial Valley	N/A	16N	77W	33
1172	Reservoir	ACE Mapscan	sediment	Existing	No	Private	41.31	-106.04	Little Laramie River-Cenntenial Valley	N/A	16N	77W	33
1173	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.31	-106.00	Little Laramie River-Webb Lake	N/A	16N	77W	35
1174	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.31	-105.82	Laramie River-Laramie	BATH BROTHERS	16N	75W	33
1175	Reservoir	ACE Mapscan	Dry in all photography, no visible damage	Existing	Potential	State of Wyoming	41.31	-105.76	The Big Hollow	N/A	16N	75W	36
1176	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.31	-105.73	The Big Hollow	BREES	16N	74W	32
1177	Reservoir	ACE Mapscan	Dry in all photography, no visible damage	Existing	Potential	Private	41.31	-105.74	The Big Hollow	BREES	16N	74W	31
1178	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.32	-105.71	The Big Hollow	N/A	16N	74W	33
1179	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.31	-105.65	Laramie River-Laramie	N/A	16N	74W	36
1180	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2015	Existing	Yes	Private	41.29	-105.83	The Big Hollow	N/A	15N	75W	5
1181	Reservoir	ACE Mapscan	Sediment	Existing	No	Private	41.29	-105.83	The Big Hollow	N/A	15N	75W	5
1182	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.30	-105.86	The Big Hollow	JW/SHEEP MTN RANCH	15N	76W	1
1183	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.30	-106.08	Little Laramie River-Cenntenial Valley	N/A	15N	77W	6
1184	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.29	-106.09	Little Laramie River-Cenntenial Valley	N/A	15N	77W	6
1185	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.29	-106.07	Little Laramie River-Cenntenial Valley	N/A	15N	77W	6
1186	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.30	-106.10	Little Laramie River-Cenntenial Valley	WARD GULCH	15N	78W	1
1187	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.30	-106.10	Little Laramie River-Cenntenial Valley	N/A	15N	78W	1
1188	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.29	-106.14	Libby Creek	N/A	15N	78W	
1189	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.28	-106.07	Little Laramie River-Cenntenial Valley	N/A	15N	77W	8
1190	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.28	-106.04	Little Laramie River-Cenntenial Valley	N/A	15N	77W	9
1191	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.28	-105.85	The Big Hollow	N/A	15N	75W	7
1192	Reservoir	ACE Mapscan	Dry in all imagery but no visible damage	Existing	Potential	Private	41.28	-105.84	The Big Hollow	N/A	15N	75W	8
1193	Reservoir	ACE Mapscan	sediment, embankment damage	Existing	No	Private	41.28	-105.80	The Big Hollow	N/A	15N	75W	10
1194	Reservoir	ACE Mapscan	Breached	Existing	No	Private	41.29	-105.77	The Big Hollow	N/A	15N	75W	12
1195	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.29	-105.67	Laramie River-West Laramie	N/A	15N	74W	11
1196	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.29	-105.67	Laramie River-West Laramie	N/A	15N	74W	11
1197	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.27	-105.55	Laramie River-Laramie	N/A	15N	73W	14
1198	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.28	-105.57	Laramie River-Laramie	N/A	15N	73W	15
1199	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.27	-105.95	Lake Hattie	TABLE MOUNTAIN (RMU)	15N	76W	17
1200	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.26	-105.99	Lake Hattie	TABLE MOUNTAIN (RMU)	15N	77W	13
1201	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.27	-106.07	Little Laramie River-Cenntenial Valley	N/A	15N	77W	18
1202	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.26	-106.09	Libby Creek	N/A	15N	77W	18
1203	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.26	-106.09	Libby Creek	N/A	15N	77W	18
1204	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.27	-106.09	Little Laramie River-Cenntenial Valley	N/A	15N	77W	18
1205	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.27	-106.09	Little Laramie River-Cenntenial Valley	N/A	15N	77W	18
1206	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.27	-106.15	Libby Creek	N/A	15N	78W	15
1207	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.26	-105.84	The Big Hollow	N/A	15N	75W	20
1208	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.26	-105.83	The Big Hollow	N/A	15N	75W	20
1209	Reservoir	ACE Mapscan	Wet in 2009. 2011, 2015	Existing	Yes	Private	41.26	-105.83	The Big Hollow	N/A	15N	75W	21
1210	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Sevenmile Lakes	Existing	Yes	Private	41.26	-105.71	Laramie River-West Laramie	N/A	15N	74W	21
1211	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Sevenmile Lakes	Existing	Yes	Private	41.26	-105.70	Laramie River-West Laramie	N/A	15N	74W	21
1212	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015. Sevenmile Lakes	Existing	Yes	Private	41.25	-105.71	Laramie River-West Laramie	N/A	15N	74W	21
1213	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.26	-105.61	Harney Creek-Laramie River	N/A	15N	73W	20
1214	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015.	Existing	Yes	Private	41.25	-105.56	Soldier Creek-Laramie River	N/A	15N	73W	22
1215	Reservoir	ACE Mapscan	Wet in 2009, 2011, 2012, 2015	Existing	Yes	Private	41.55	-105.87	Cooper Lake	COOPER LAKE	18N	76W	12
1216	Reservoir	ACE Mapscan	Wet in 2012, 2015	Existing	Yes	Private	41.51	-106.01	Damm	STROUSE HILL	18N	77W	23

APPENDIX 3B

ECOLOGICAL SITE DESCRIPTIONS

United States Department of Agriculture
NRCS Natural Resources Conservation Service

Ecological Site Description

Data Access
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Report Selections
> General
> Physiographic Features
> Climate Features
> Water Features
> Soil Features
> Plant Communities
Site Interpretations
> Supporting Information
Rangeland Health Reference Sheet
Complete Report
> HTML Printable Format

United States Department of Agriculture
Natural Resources Conservation Service
Ecological Site Description

Section I: Ecological Site Characteristics

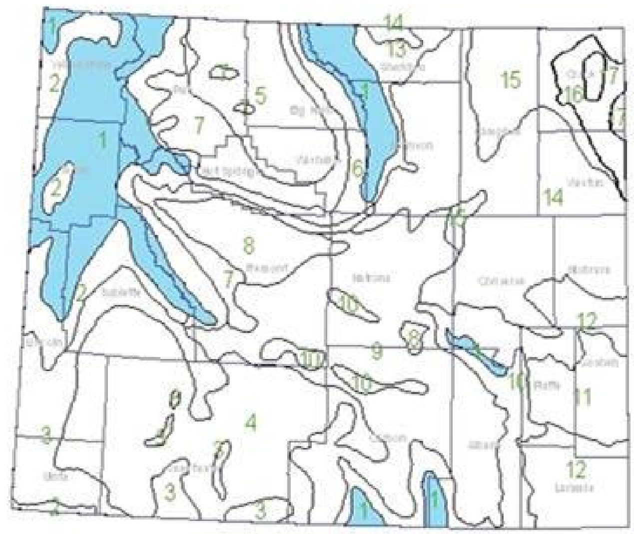
Ecological Site Identification and Concept

Site stage: **Provisional**

Provisional: an ESD at the provisional status represents the lowest tier of documentation that is releasable to the public. It contains a grouping of soil units that respond similarly to ecological processes. The ESD contains 1) enough information to distinguish it from similar and associated ecological sites and 2) a draft state and transition model capturing the ecological processes and vegetative states and community phases as they are currently conceptualized. The provisional ESD has undergone both quality control and quality assurance protocols. It is expected that the provisional ESD will continue refinement towards an approved status.

Site name: **Loamy (Ly) 20"+ P.Z., High Mountains**
Site type: Rangeland
Site ID: R043BY122WY
Major land resource area (MLRA): 043B-Central Rocky Mountains

Precipitation Zones for Rangeland Ecological Site Descriptions



Physiographic Features

This site occurs on gentle to steep mountain slopes.

Landform: (1) Hill
(2) Alluvial fan
(3) Stream terrace

	Minimum	Maximum
Elevation (feet):	6500	12000
Slope (percent):	2	30
Flooding		
Frequency:	None	None
Ponding		
Depth (inches):	0	0
Frequency:	None	None
Runoff class:	Negligible	Low

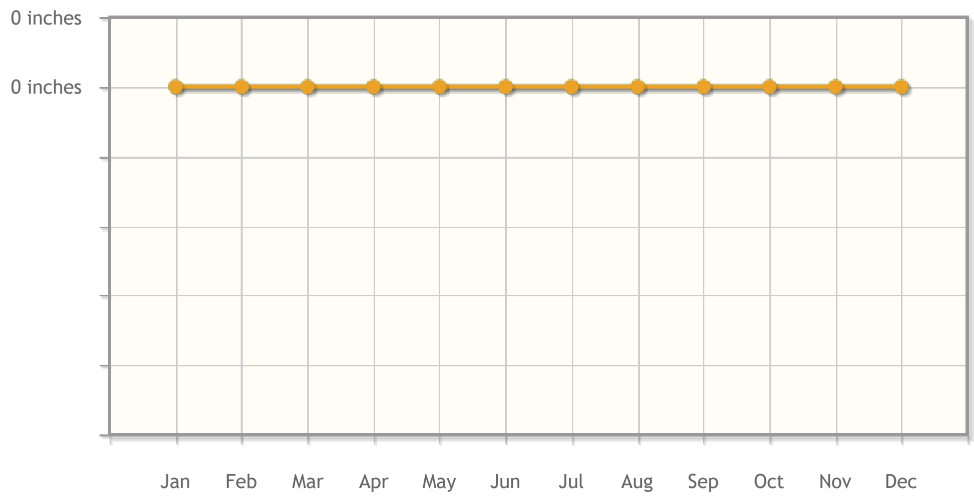
Climatic Features

Annual precipitation is fairly evenly distributed through the year and averages over 20 inches. Snows are heavy and usually remain in place during the winter. Annual snowfall averages 150 to 200 inches per year. Wide fluctuations may occur in yearly precipitation and result in more dry years than those with more than normal precipitation. Temperatures show a wide range between summer and winter and between daily maximums and minimums. This is predominantly due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air outbreaks in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Prevailing winds are from the southwest, and strong winds are less frequent than over other areas of Wyoming. Occasional storms, however, can bring brief periods of high winds with gusts exceeding 50 mph. Growth of native cool season plants begins about June 1 at lower elevations, as late as July 15 at higher elevations, and continues until the beginning of September. The following information is from the “Moran 5 WNW” climate station:

	Averaged
Frost-free period (days):	54
Freeze-free period (days):	91
Mean annual precipitation (inches):	29.35

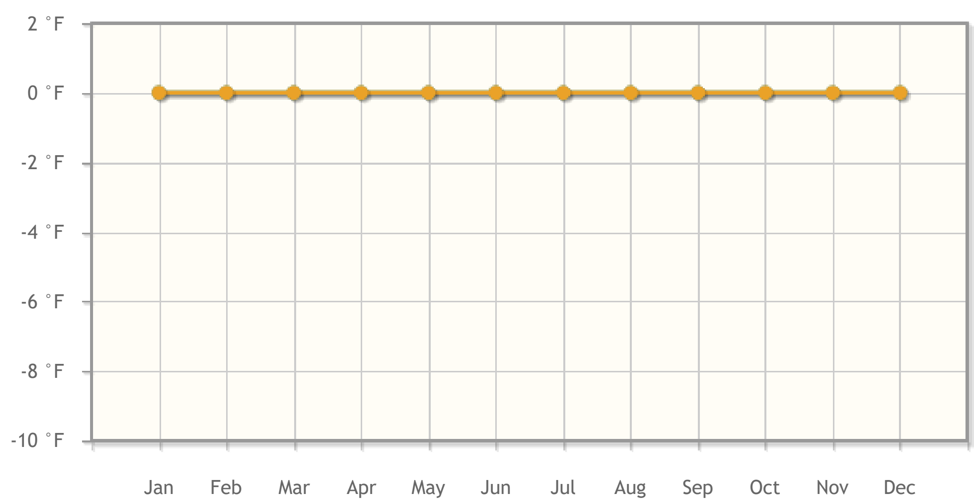
Monthly Precipitation (Inches):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Low	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



Monthly Temperature (°F):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Low	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Influencing Water Features

Representative Soil Features

The soils of this site are moderately deep (greater than 20" to bedrock) to very deep and well-drained with textures ranging from very fine sandy loams through clay loams. Some soils have a lime horizon below 3 feet. The overlying soil is usually noncalcareous.

Surface texture: (1)Gravelly Loam
(2) Clay loam
(3) Fine sandy loam

Subsurface texture group: Loamy

	Minimum	Maximum
Surface fragments <=3" (% cover):	0	20
Surface fragments >3" (% cover):	0	0
Subsurface fragments <=3" (% volume):	0	10
Subsurface fragments >3" (% volume):	0	5

Drainage class: Moderately well drained to well drained

Permeability class: Moderately slow to moderate

	Minimum	Maximum
Depth (inches):	20	60
Available water capacity (inches):	2.50	6.00
Electrical conductivity (mmhos/cm):	0	8
Sodium adsorption ratio:	0	5
Calcium carbonate equivalent (percent):	0	15
Soil reaction (1:1 water):	6.6	8.4

Plant Communities

Ecological Dynamics of the Site

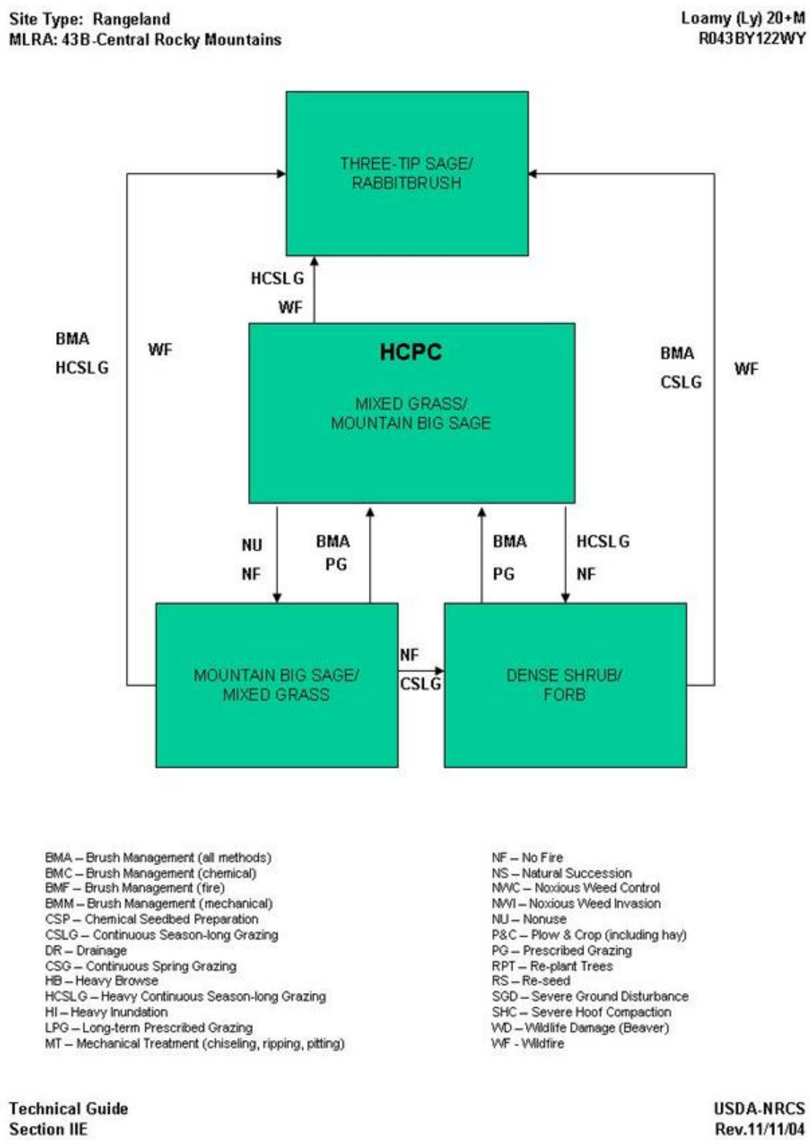
As this site deteriorates due to a combination of frequent and severe grazing, species such as three-tip and mountain big sagebrush, buckwheat, and yarrow will increase. Rhizomatous wheatgrass and less palatable grasses such as Letterman needlegrass increase. Kentucky bluegrass may invade. Cool-season grasses such as bluebunch wheatgrass and Columbia needlegrass will decrease in frequency and production.

Mountain big sagebrush will become dominant with the absence of fire. Wildfires are often actively controlled so chemical control using herbicides has replaced the historic role of fire on this site. Recently, prescribed burning has regained some popularity.

The Historic Climax Plant Community (description follows the plant community diagram) has been determined by study of rangeland relic areas, or areas protected from excessive disturbance. Trends in plant communities going from heavily grazed areas to lightly grazed areas, seasonal use pastures, and historical accounts have also been used.

The following is a State and Transition Model Diagram that illustrates the common plant communities (states) that can occur on the site and the transitions between these communities. The ecological processes will be discussed in more detail in the plant community narratives following the diagram.

State-and-Transition Diagram



Mixed Grass/Mountain Big Sage Plant Community (HCPC)

The interpretive plant community for this site is the Historic Climax Plant Community. This state evolved with grazing by large herbivores and is well suited for grazing by domestic livestock. Potential vegetation is estimated at 70% grasses or grass-like plants, 20% forbs, and 10% woody plants.

The major grasses include Idaho fescue, Columbia needlegrass, slender wheatgrass, and bluebunch wheatgrass. Other grasses may include mutton and Cusick bluegrass, bentgrass, prairie junegrass, Letterman, Richardson, and western needlegrass, sun and dunehead sedge, one-spike and timber oatgrass, thickspike wheatgrass, mountain and nodding brome, tufted hairgrass, spike trisetum, and oniongrass. Mountain big sagebrush is the dominant woody plant. Other woody species may include snowberry, serviceberry, silver and three-tip sagebrush, and green rabbitbrush.

A typical plant composition for this state consists of Idaho fescue 15-25%, Columbia needlegrass 15-25%, slender wheatgrass 10-20%, bluebunch wheatgrass 10-15%, other grasses and grass-like plants 10-20%, perennial forbs 10-20%, mountain big sagebrush 5-10%, and 5-10% other woody species. Ground cover, by ocular estimate, varies from 70-75%.

The total annual production (air-dry weight) of this state is about 2500 lbs./acre, but it can range from about 1800 lbs./acre in unfavorable years to about 3000 lbs./acre in above average years.

The following is the growth curve of this plant community expected during a normal year:
Growth curve number: WY0101
Growth curve name: 20+M, UPLAND SITES
Growth curve description: ALL UPLAND SITES
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
0 0 0 0 5 30 40 20 5 0 0 0
(Monthly percentages of total annual growth)

This plant community is extremely stable and well adapted to the Central Rocky Mountains climatic conditions. The diversity in plant species allows for high drought tolerance. This is a sustainable plant community (site/soil stability, watershed function, and biologic integrity).

Transitions or pathways leading to other plant communities are as follows:
• Nonuse and No Fire will convert this plant community to the Mountain Big Sage/Mixed Grass State.
• Heavy Continuous Season-long Grazing and No Fire will convert this plant community to the Dense Shrub/Forb State.
• Wildfire with Heavy Continuous Season-long Grazing will convert this plant community to the Three-tip Sage/Rabbitbrush State.

Mixed Grass/Mountain Big Sage Plant Community (HCPC) Plant Species Composition

Grass/Grasslike

Group	Group name	Common name	Symbol	Scientific name	Annual Production (pounds per acre) Low	High
1					375	625
		Idaho fescue	FEID	*Festuca idahoensis*	375	625
2					375	625
		Columbia needlegrass	ACNE9	*Achnatherum nelsonii*	375	625
3					250	500
		slender wheatgrass	ELTR7	*Elymus trachycaulus*	250	500
4					250	375
		bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	250	375
5					250	500
		Grass, perennial	2GP		0	125
		Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	0	125
			ACOC	*Achillea occidentalis*	0	125
		Richardson's needlegrass	ACRI8	*Achnatherum richardsonii*	0	125
		bentgrass	AGROS2	*Agrostis*	0	125
		mountain brome	BRMA4	*Bromus marginatus*	0	125
		nodding brome	BRPO2	*Bromus porteri*	0	125

		needleleaf sedge	CADU6	Carex duriuscula	0	125
		threadleaf sedge	CAFI	Carex filifolia	0	125
		sun sedge	CAINH2	Carex inops subsp. heliophila	0	125
		dunehead sedge	CAPH2	Carex phaeocephala	0	125
		California danthonia	DACA3	Danthonia californica	0	125
		timber danthonia	DAIN	Danthonia intermedia	0	125
		onespike danthonia	DAUN	Danthonia unispicata	0	125
		tufted hairgrass	DECA18	Deschampsia caespitosa	0	125
		bottlebrush squirreltail	ELELE	Elymus elymoides subsp. elymoides	0	125
		streambank wheatgrass	ELLAL	Elymus lanceolatus subsp. lanceolatus	0	125
		prairie Junegrass	KOMA	Koeleria macrantha	0	125
		basin wildrye	LECI4	Leymus cinereus	0	125
		onion melic	MEBU	Melica bulbosa	0	125
			POAM	Poa ampla	0	125
			POCA	Poa canbyi	0	125
		Cusick bluegrass	POCU3	Poa cusickii	0	125
		mutton bluegrass	POFE	Poa fendleriana	0	125
		spike trisetum	TRSP2	Trisetum spicatum	0	125

Forb

Group	Group name	Common name	Symbol	Scientific name	Annual Production (pounds per acre) Low	High
6 -null					250	500
		Forb, perennial	2FP		0	125
		common yarrow	ACMI2	Achillea millefolium	0	125
		giant hyssop	AGAST	Agastache	0	125
		agoseris	AGOSE	Agoseris	0	125
		onion	ALLIU	Allium	0	125
		pussytoes	ANTEN	Antennaria	0	125
		milkvetch	ASTRA	Astragalus	0	125
		balsamroot	BALSA	Balsamorhiza	0	125
		Indian paintbrush	CASTI2	Castilleja	0	125
		hawksbeard	CREPI	Crepis	0	125
		larkspur	DELPH	Delphinium	0	125
		buckwheat	ERIOG	Eriogonum	0	125
		aster	EUCEP2	Eucephalus	0	125
		elkweed	FRSP	Frasera speciosa	0	125
		geranium	GERAN	Geranium	0	125
		avens	GEUM	Geum	0	125
		common sneezeweed	HEAU	Helenium autumnale	0	125
		sunflower	HELIA3	Helianthus	0	125
		pea	LATHY	Lathyrus	0	125
		flax	LINUM	Linum	0	125
		gromwell	LITHO3	Lithospermum	0	125
		biscuitroot	LOMAT	Lomatium	0	125
		lupine	LUPIN	Lupinus	0	125
		creeping barberry	MARE11	Mahonia repens	0	125
		bluebells	MERTE	Mertensia	0	125
		locoweed	OXYTR	Oxytropis	0	125
		groundsel	PACKE	Packera	0	125
		beardtongue	PENST	Penstemon	0	125
		phacelia	PHACE	Phacelia	0	125
		phlox	PHLOX	Phlox	0	125
		buttercup	RANUN	Ranunculus	0	125
		western coneflower	RUOC2	Rudbeckia occidentalis	0	125

		ragwort	SENEC	*Senecio*	0	125
		meadow-rue	THALI2	*Thalictrum*	0	125
		clover	TRIFO	*Trifolium*	0	125
		American vetch	VIAM	*Vicia americana*	0	125
		violet	VIOLA	*Viola*	0	125
		mule-ears	WYAM	*Wyethia amplexicaulis*	0	125
		mountain deathcamas	ZIEL2	*Zigadenus elegans*	0	125

Shrub/Vine

Group	Group name	Common name	Symbol	Scientific name	Annual Production (pounds per acre) Low	High
7					125	250
		mountain big sagebrush	ARTRV	*Artemisia tridentata subsp. vaseyana*	125	250
8					0	125
		Shrub, deciduous	2SD		0	125
		Shrub, evergreen	2SE		0	125
		Tree, deciduous	2TD		0	125
		Tree, evergreen	2TE		0	125
		Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	0	125
		silver sagebrush	ARCA13	*Artemisia cana*	0	125
		threetip sagebrush	ARTR4	*Artemisia tripartita*	0	125
		Douglas rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0	125
		snowberry	SYMPH	*Symphoricarpos*	0	125

Plant Growth Curve

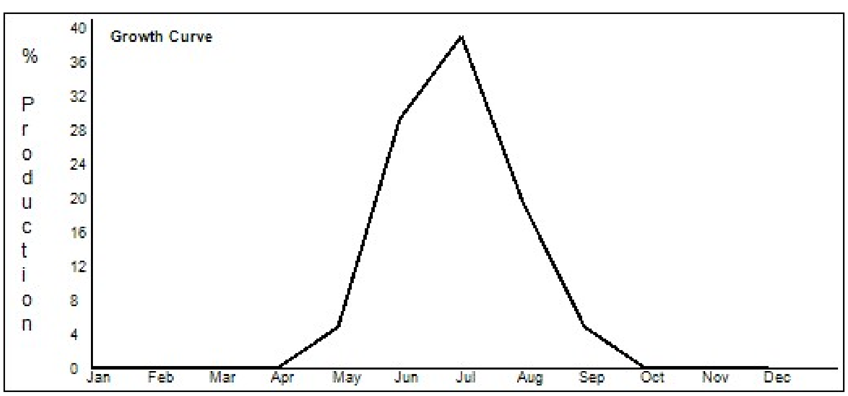
Growth curve number: WY0101

Growth curve name: 20+ upland sites

Growth curve description:

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	0	5	30	40	20	5	0	0	0



Supporting Information

Associated Sites

Site name	Site ID	Site narrative
Overflow (High Mountains)	R043BY130WY	Overflow
Shallow Loamy (High Mountains)	R043BY162WY	Shallow Loamy

Similar Sites

Site name	Site ID	Site narrative
Loamy (Foothills And Mountains West)	R043BY222WY	Loamy (Ly) 15-19W has lower production.

Inventory Data References

Inventory Data References (narrative)
Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range trained personnel were also used. Those involved in developing this site include: Bill Christensen, Range Management Specialist, NRCS; Karen Clause, Range Management Specialist, NRCS; and Everet Bainter, Range Management Specialist, NRCS. Other sources used as references include: USDA NRCS Water and Climate Center, USDA NRCS National Range and Pasture Handbook, and USDA NRCS Soil Surveys from various counties.

Inventory Data References
Data Source Number of Records Sample Period State County

Site Authors

K. Clause

Quality Assurance

Provisional Status Verified in Legacy System

United States Department of Agriculture
Natural Resources Conservation Service
Ecological Site Description

<u>Section I: Ecological Site Characteristics</u>

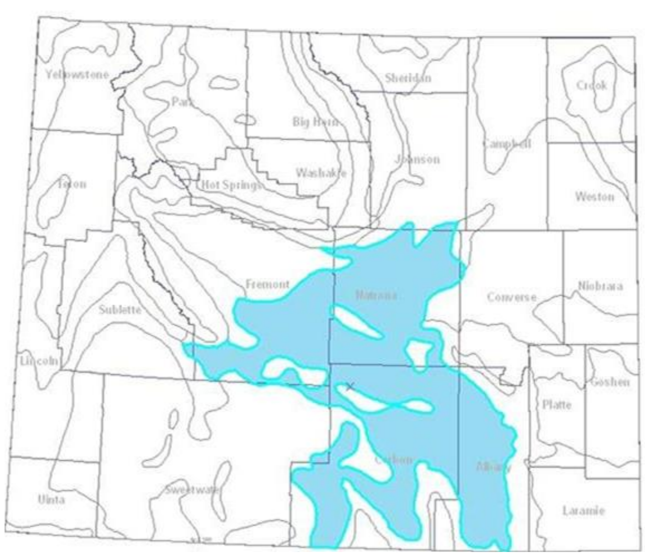
Ecological Site Identification and Concept

Site stage: **Provisional**

Provisional: an ESD at the provisional status represents the lowest tier of documentation that is releasable to the public. It contains a grouping of soil units that respond similarly to ecological processes. The ESD contains 1) enough information to distinguish it from similar and associated ecological sites and 2) a draft state and transition model capturing the ecological processes and vegetative states and community phases as they are currently conceptualized. The provisional ESD has undergone both quality control and quality assurance protocols. It is expected that the provisional ESD will continue refinement towards an approved status.

Site name: **Saline Loamy (SnLy) 10-14" P.Z., High Plains Southeast**
Site type: Rangeland
Site ID: R034AY336WY
Major land resource area (MLRA): 034A-Cool Central Desertic Basins and Plateaus

Precipitation Zones for Rangeland Ecological Site Descriptions



Physiographic Features

This site will usually occur in a lowland position, on flat to gently sloping land, but can occur in all positions.

Landform: (1) Alluvial fan
(2) Stream terrace

	Minimum	Maximum
Elevation (feet):	5500	7500
Slope (percent):	0	40
Flooding		
Frequency:	None	None
Ponding		
Depth (inches):	0	0
Frequency:	None	None
Runoff class:	Negligible	High
Aspect:	No Influence on this site	

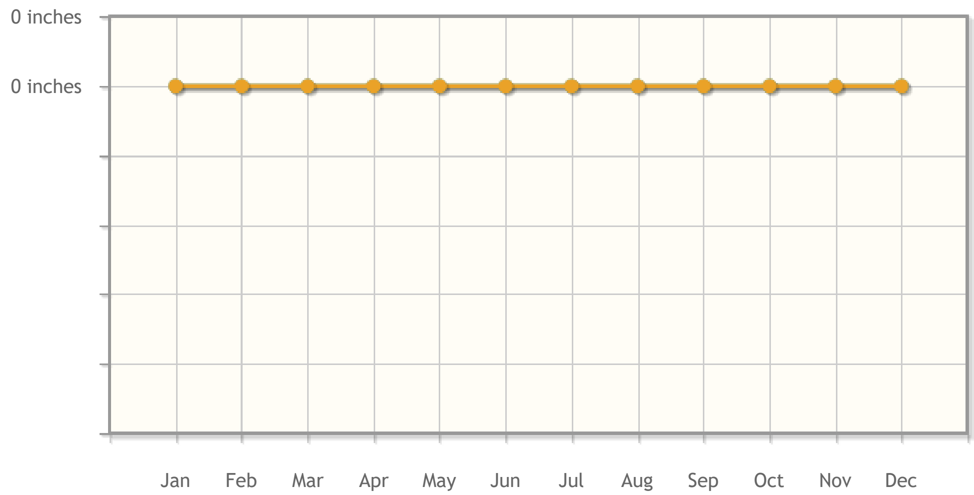
Climatic Features

Climatic Features Annual precipitation ranges from 10-14 inches per year. Wide fluctuations may occur in yearly precipitation and result in more dry years than those with more than normal precipitation. Temperatures show a wide range between summer and winter and between daily maximums and minimums. This is predominantly due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air outbreaks in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Extreme storms may occur during the winter, but most severely affect ranch operations during late winter and spring. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 50 mph. Growth of native cool season plants begins about April 15 and continues to about June 15. Some green up of cool season plants usually occurs in September. The following information is from the "Laramie" climate station: Minimum Maximum 5 yrs. out of 10 between Frost-free period (days): 57 149 June 1 – September 16 Freeze-free period (days): 94 183 May 15 – September 28 Annual Precipitation (inches): 5.8 17.34 Mean annual precipitation: 11.53 inches Mean annual air temperature: 42.2 F (30.4 F Avg. Min. to 53.9 F Avg. Max.) For detailed information visit the Natural Resources Conservation Service National Water and Climate Center at http://www.wcc.nrcs.usda.gov/ website. Other climate station(s) representative of this precipitation zone include "Dixon " and "Medicine Bow".

	Averaged
Frost-free period (days):	103
Freeze-free period (days):	138
Mean annual precipitation (inches):	14.00

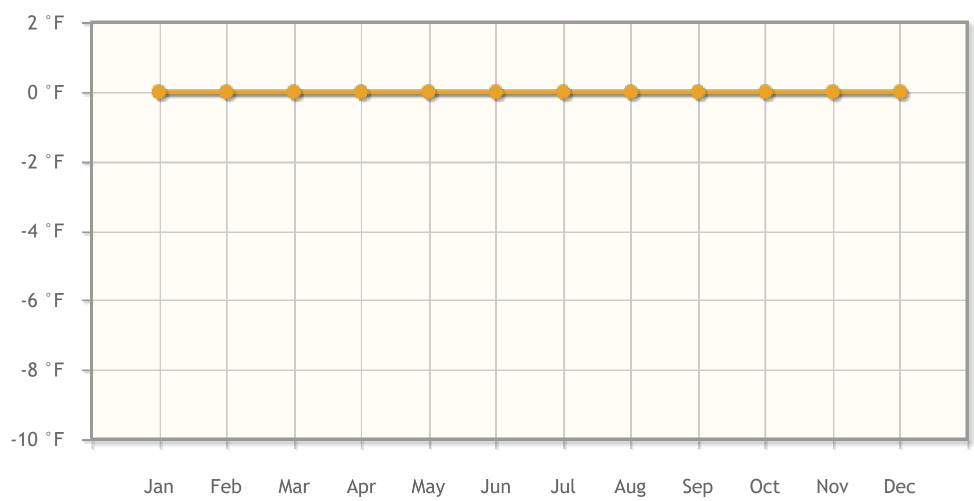
Monthly Precipitation (Inches):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Low	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



Monthly Temperature (°F):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Low	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Influencing Water Features

Stream type: None

Representative Soil Features

The soils of this site are moderately deep (greater than 20” to bedrock) to very deep. Permeability is moderately slow to slow due to excess sodium in the substratum. Depth to horizons with excessive amounts of sodium and strongly alkaline reactions ranges from 10 to 20 inches. These horizons restrict deep root penetration by all but alkali tolerant species. These soils are typically calcareous throughout and have salts which, although low at the surface and upper subsoil, increase with depth.

Surface texture: (1) Loam
(2) Fine sandy loam
(3) Sandy clay loam

Subsurface texture group: Loamy

	Minimum	Maximum
Surface fragments <=3" (% cover):	0	0
Surface fragments >3" (% cover):	0	0
Subsurface fragments <=3" (% volume):	0	0
Subsurface fragments >3" (% volume):	0	0

Drainage class: Well drained

Permeability class: Moderate to very slow

	Minimum	Maximum
Depth (inches):	15	60
Available water capacity (inches):	3.00	4.50
Electrical conductivity (mmhos/cm):	0	16
Sodium adsorption ratio:	5	40
Calcium carbonate equivalent (percent):	0	15
Soil reaction (1:1 water):	6.6	9.6

Plant Communities

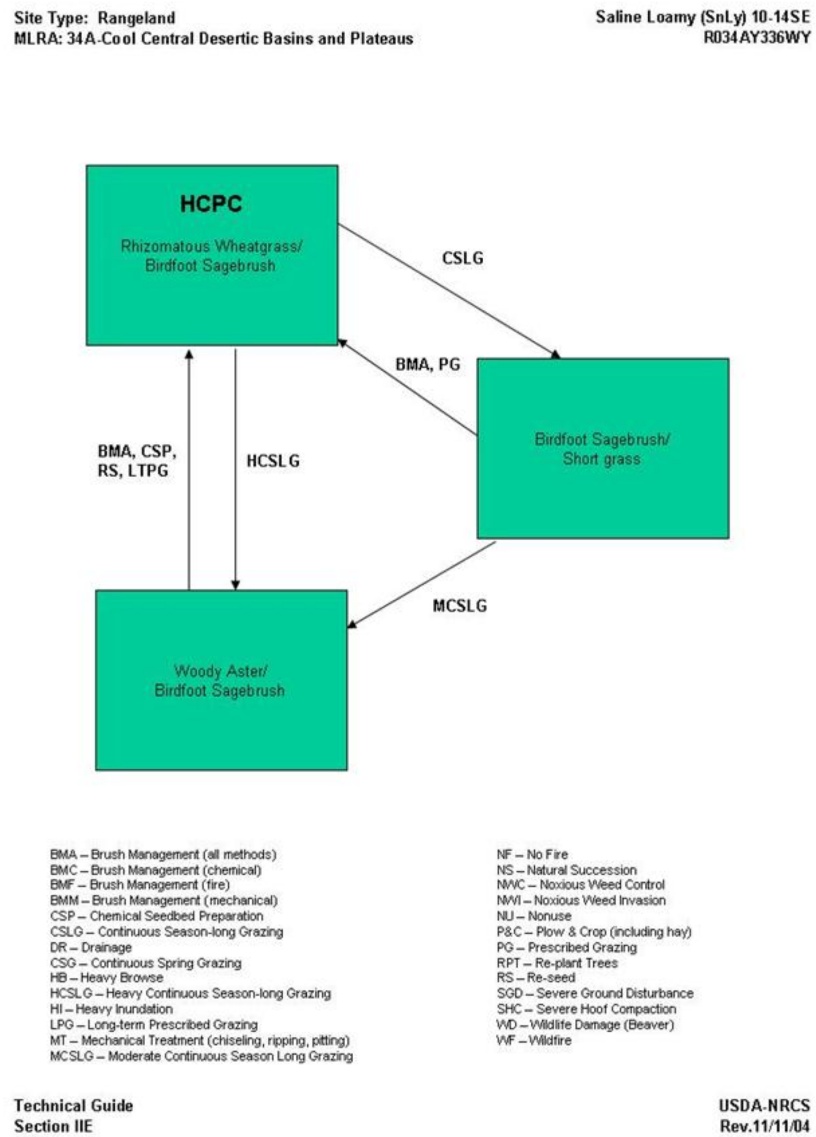
Ecological Dynamics of the Site

As this site deteriorates from improper grazing management, species such as birdfoot sage and unpalatable forbs will increase. Western wheatgrass and needleandthread will decrease in frequency and production.

The Historic Climax Plant Community (description follows the plant community diagram) has been determined by study of rangeland relic areas, or areas protected from excessive disturbance. Trends in plant communities going from heavily grazed areas to lightly grazed areas, seasonal use pastures, and historical accounts have also been used.

The following is a State and Transition Model Diagram that illustrates the common plant communities (states) that can occur on the site and the transitions between these communities. The ecological processes will be discussed in more detail in the plant community narratives following the diagram.

State-and-Transition Diagram



Rhizomatous Wheatgrass/ Birdfoot Sage Plant Community (HCPC)

The interpretive plant community for this site is the Historic Climax Plant Community. Potential vegetation is estimated at 60% grasses or grass-like plants, 10% forbs and 30% woody plants.
The major grasses include western wheatgrass, needleandthread, and bluebunch wheatgrass. Other grasses include Sandberg bluegrass, prairie junegrass, bottlebrush squirreltail. Birdfoot sagebrush and Gardners saltbush are the major woody plants.

A typical plant composition for this state consists of western wheatgrass 25-35%, needleandthread 5-15%, bluebunch wheatgrass 5-10%, 10-25% other grasses/grasslikes, perennial forbs 5-10%, birdfoot sagebrush 10-20%, and Gardners saltbush 10-20%. Ground cover, by ocular estimate, varies from 15-25%.

The total annual production (air-dry weight) of this state is about 700 pounds per acre, but it can range from about 500 lbs./acre in unfavorable years to about 900 lbs./acre in above average years.

This state is extremely stable and well adapted to the Cool Central Desertic Basins and Plateaus climate. The diversity in plant species allows for high drought resistance. This is a sustainable plant community (site/soil stability, watershed function, and biologic integrity).

Transitions or pathways leading to other plant communities are as follows:

• Heavy Continuous Season-long Grazing will convert the plant community to the Woody Aster/ Birdfoot Sagebrush Plant Community.

• Continuous Season-long Grazing will convert the plant community to the Rhizomatous Birdfoot Sagebrush/Short Grass Plant Community.

Rhizomatous Wheatgrass/ Birdfoot Sage Plant Community (HCPC) Plant Species Composition

Grass/Grasslike

Group	Group name	Common name	Symbol	Scientific name	Annual Production (pounds per acre) Low	High
1					175	245
		western wheatgrass	PASM	*Pascopyrum smithii*	175	245
2					35	105
		needle and thread	HECO26	*Hesperostipa comata*	35	105
3					35	70
		bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	35	70
4					70	175
		Grass, perennial	2GP		0	35
		Indian ricegrass	ACHY	*Achnatherum hymenoides*	0	35
		blue grama	BOGR2	*Bouteloua gracilis*	0	35
		threadleaf sedge	CAFI	*Carex filifolia*	0	35
		plains reedgrass	CAMO	*Calamagrostis montanensis*	0	35
		bottlebrush squirreltail	ELEL5	*Elymus elymoides*	0	35
		prairie Junegrass	KOMA	*Koeleria macrantha*	0	35
		mutton bluegrass	POFE	*Poa fendleriana*	0	35
		alkali bluegrass	POSE	*Poa secunda*	0	35
5					35	70
		Forb, perennial	2FP		0	35
		sandwort	ARENA	*Arenaria*	0	35
		fringed sagewort	ARFR4	*Artemisia frigida*	0	35
		nailwort	PARON	*Paronychia*	0	35
		Hood's phlox	PHHO	*Phlox hoodii*	0	35
		scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0	35
		stemless mock goldenweed	STAC	*Stenotus acaulis*	0	35
		woodyaster	XYLOR	*Xylorhiza*	0	35

Shrub/Vine

Group	Group name	Common name	Symbol	Scientific name	Annual Production (pounds per acre) Low	High
6					70	140

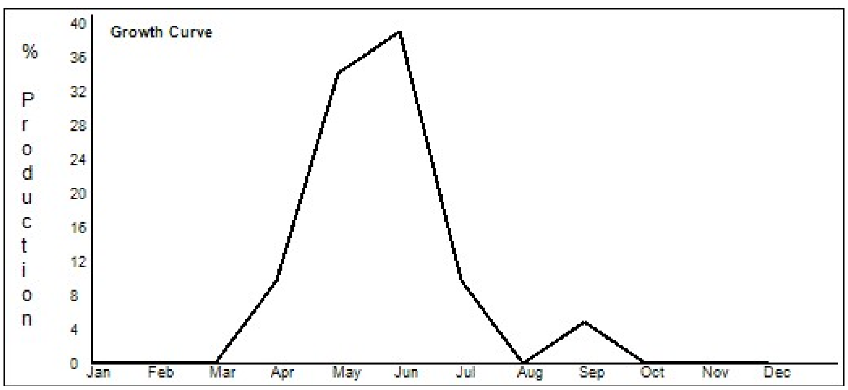
	birdfoot sagebrush	ARPE6	Artemisia pedatifida	70	140
7				70	140
	Gardner's saltbush	ATGA	Atriplex gardneri	70	140
8				35	70
	Shrub (>.5m)	2SHRUB		0	35
	big sagebrush	ARTR2	Artemisia tridentata	0	35
	Douglas rabbitbrush	CHVI8	Chrysothamnus viscidiflorus	0	35
	winterfat	KRLA2	Krascheninnikovia lanata	0	35

Plant Growth Curve

Growth curve number:	WY0901
Growth curve name:	34AI, Upland Sites
Growth curve description:	All Upland Sites

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10	35	40	10	0	5	0	0	0



Supporting Information

State Correlation

This site has been correlated with the following states: WY

Inventory Data References

Inventory Data References (narrative)
Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range trained personnel were also used. Other sources used as references include: USDA NRCS Water and Climate Center, USDA NRCS National Range and Pasture Handbook, and USDA NRCS Soil Surveys from various counties.

Inventory Data References
Data Source Number of Records Sample Period State County
SCS-RANGE-417 69 1967-1988 WY Carbon
& others

Site Authors

B. Brazee

Quality Assurance

Provisional Status Verified in Legacy System

Data Access

> Return to Reports Selection Screen

Report Selections

> General
> Physiographic Features
> Climate Features
> Water Features
> Soil Features
> Plant Communities
Site Interpretations
> Supporting Information
Rangeland Health Reference Sheet
Complete Report
> HTML Printable Format

United States Department of Agriculture
Natural Resources Conservation Service
Ecological Site Description

Section I: Ecological Site Characteristics

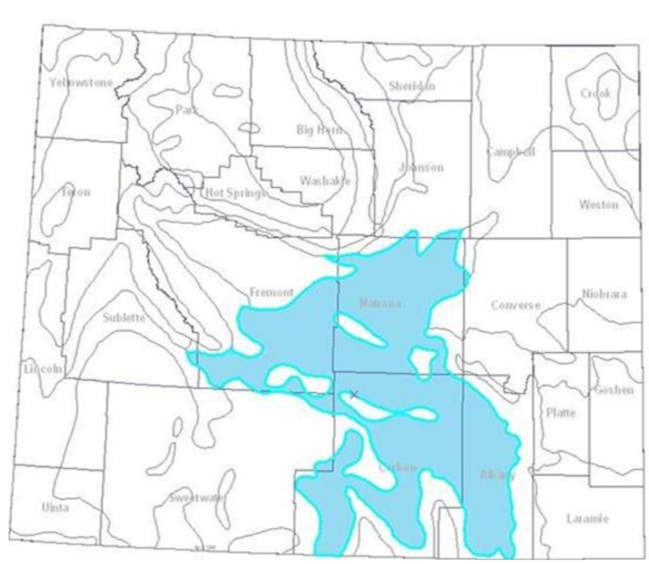
Ecological Site Identification and Concept

Site stage: **Provisional**

Provisional: an ESD at the provisional status represents the lowest tier of documentation that is releasable to the public. It contains a grouping of soil units that respond similarly to ecological processes. The ESD contains 1) enough information to distinguish it from similar and associated ecological sites and 2) a draft state and transition model capturing the ecological processes and vegetative states and community phases as they are currently conceptualized. The provisional ESD has undergone both quality control and quality assurance protocols. It is expected that the provisional ESD will continue refinement towards an approved status.

Site name: **Sandy (Sy) 10-14" P.Z., High Plains Southeast**
Site type: Rangeland
Site ID: R034AY350WY
Major land resource area (MLRA): 034A-Cool Central Desertic Basins and Plateaus

Precipitation Zones for Rangeland Ecological Site Descriptions



Physiographic Features

This site usually occurs in an upland position on relatively flat to moderately sloping land. Slopes commonly range from 1 to 15%.

Landform: (1) Alluvial fan
(2) Hill
(3) Plateau

	Minimum	Maximum
Elevation (feet):	5500	7500
Slope (percent):	0	30
Flooding		
Frequency:	None	None
Ponding		
Depth (inches):	0	0
Frequency:	None	None
Runoff class:	Negligible	High
Aspect:	No Influence on this site	

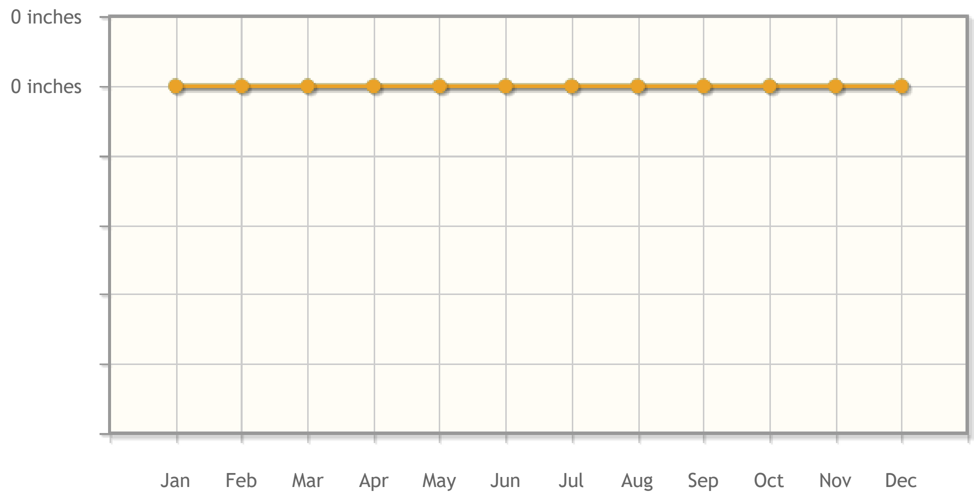
Climatic Features

Annual precipitation ranges from 10-14 inches per year. Wide fluctuations may occur in yearly precipitation and result in more dry years than those with more than normal precipitation. Temperatures show a wide range between summer and winter and between daily maximums and minimums. This is predominantly due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air outbreaks in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Extreme storms may occur during the winter, but most severely affect ranch operations during late winter and spring. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 50 mph. Growth of native cool season plants begins about April 15 and continues to about June 15. Some green up of cool season plants usually occurs in September. The following information is from the “Laramie” climate station: Minimum Maximum 5 yrs. out of 10 between Frost-free period (days): 57 149 June 1 – September 16 Freeze-free period (days): 94 183 May 15 – September 28 Annual Precipitation (inches): 5.8 17.34 Mean annual precipitation: 11.53 inches Mean annual air temperature: 42.2 F (30.4 F Avg. Min. to 53.9 F Avg. Max.) For detailed information visit the Natural Resources Conservation Service National Water and Climate Center at http://www.wcc.nrcs.usda.gov/ website. Other climate station(s) representative of this precipitation zone include ”Dixon ” and “Medicine Bow”.

	Averaged
Frost-free period (days):	103
Freeze-free period (days):	138
Mean annual precipitation (inches):	14.00

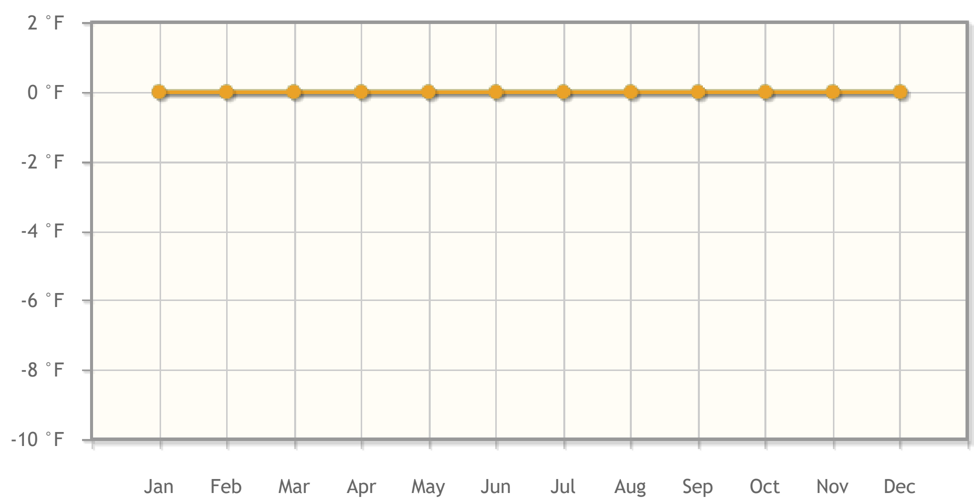
Monthly Precipitation (Inches):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Low	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



Monthly Temperature (°F):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Low	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Influencing Water Features

Stream type: None

Representative Soil Features

These soils are mostly deep (greater than 20 inches) and well drained. Surface layers are 5 inches or more thick with sandy loam to sandy clay loam subsoils.

Surface texture: (1) Fine sandy loam

(2) Sandy loam
(3) Loamy fine sand

Subsurface texture group: Sandy

	Minimum	Maximum
Surface fragments <=3" (% cover):	0	15
Surface fragments >3" (% cover):	0	5
Subsurface fragments <=3" (% volume):	0	15
Subsurface fragments >3" (% volume):	0	10

Drainage class: Well drained to somewhat excessively drained

Permeability class: Moderate to rapid

	Minimum	Maximum
Depth (inches):	20	60
Available water capacity (inches):	2.50	4.50
Electrical conductivity (mmhos/cm):	0	40
Sodium adsorption ratio:	0	5
Calcium carbonate equivalent (percent):	0	5
Soil reaction (1:1 water):	6.6	8.4

Plant Communities

Ecological Dynamics of the Site

Ecological Dynamics of the Site:

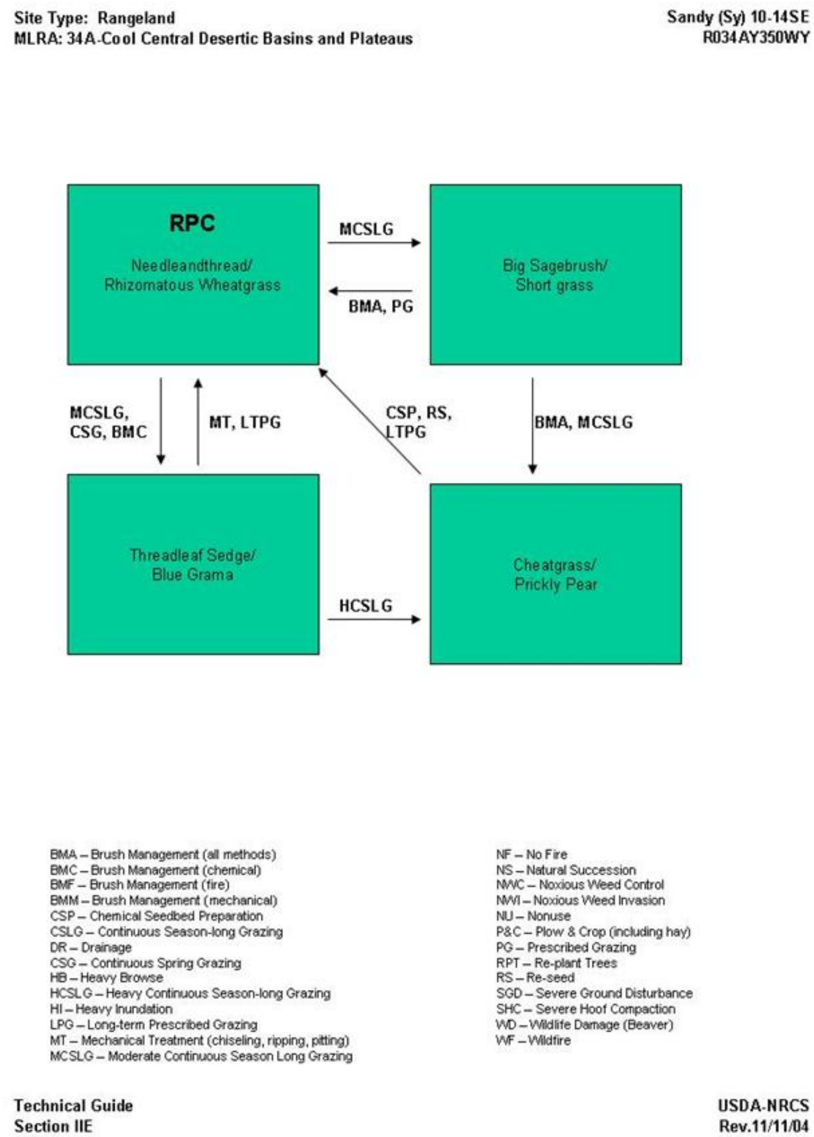
As this site deteriorates from improper grazing management, woody species such as big sagebrush and silver sagebrush will increase. Bunchgrasses such as Indian ricegrass and needleandthread will decrease in frequency and production.

Big sagebrush will become dominant on some areas with an absence of fire. Wildfires are often actively controlled so chemical control using herbicides has replaced the historic role of fire on this site. Recently, prescribed burning has regained some popularity.

The Reference Plant Community (RPC) (description follows the plant community diagram) has been determined by study of rangeland relic areas, or areas protected from excessive disturbance. Trends in plant communities going from heavily grazed areas to lightly grazed areas, seasonal use pastures, and historical accounts have also been used.

The following is a State and Transition Model Diagram that illustrates the common plant communities (states) that can occur on the site and the transitions between these communities. The ecological processes will be discussed in more detail in the plant community narratives following the diagram.

State-and-Transition Diagram



Needleandthread/Rhizomatous Wheatgrass Plant Community (RPC)

The interpretive plant community for this site is the Reference Plant Community. Potential vegetation is estimated at 75% grasses or grass-like plants, 10% forbs and 15% woody plants. The major grasses include needleandthread, Indian ricegrass, and rhizomatous wheatgrass. Big and silver sagebrush are the major woody plants. A typical plant composition for this state consists of needleandthread 20-50%, rhizomatous wheatgrass 15-25%, Indian ricegrass 10-20%, perennial forbs 5-10%,and shrubs 5-10%. Ground cover, by ocular estimate, varies from 35-45%.The total annual production (air-dry weight) of this state is about 1200 pounds per acre, but it can range from about 700 lbs/acre in unfavorable years to about 1500 lbs/acre in above average years.This state is extremely stable and well adapted to the Cool Central Desertic Basins and Plateaus climate. The diversity in plant species allows for high drought resistance. This is a sustainable plant community (site/soil stability, watershed function, and biologic integrity). Transitions or pathways leading to other plant communities are as follows:• Moderate Continuous Season-long Grazing will convert the plant community to the Big Sagebrush/Shortgrass

Plant Community if big sagebrush is present at 5-10%.• Moderate Continuous Season-long Grazing or Continuous Spring Grazing with Brush Management (chemical) will convert the plant community to the Threadleaf Sedge/Blue grama Plant Community.

Needleandthread/Rhizomatous Wheatgrass Plant Community (RPC) Plant Species Composition

Grass/Grasslike

Group	Group name	Common name	Symbol	Scientific name	Annual Production (pounds per acre) Low	High
1					240	600
		needle and thread	HECO26	*Hesperostipa comata*	240	600
2					180	300
		streambank wheatgrass	ELLAL	*Elymus lanceolatus subsp. lanceolatus*	180	300
3					120	240
		Indian ricegrass	ACHY	*Achnatherum hymenoides*	120	240
4					60	120
		bottlebrush squirreltail	ELEL5	*Elymus elymoides*	60	120
5					60	120
		threadleaf sedge	CAFI	*Carex filifolia*	60	120
6					60	180
		Grass, perennial	2GP		0	60
		Bloomer's ricegrass	ACBL	*Achnatherum ×bloomeri [hymenoides × occidentale]*	0	60
		blue grama	BOGR2	*Bouteloua gracilis*	0	60
		prairie sandreed	CALO	*Calamovilfa longifolia*	0	60
		plains reedgrass	CAMO	*Calamagrostis montanensis*	0	60
		prairie Junegrass	KOMA	*Koeleria macrantha*	0	60
		mountain muhly	MUMO	*Muhlenbergia montana*	0	60
			POCA	*Poa canbyi*	0	60
		mutton bluegrass	POFE	*Poa fendleriana*	0	60
		alkali bluegrass	POSE	*Poa secunda*	0	60
		bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	0	60
		sand dropseed	SPCR	*Sporobolus cryptandrus*	0	60

Forb

Group	Group name	Common name	Symbol	Scientific name	Annual Production (pounds per acre) Low	High
7					60	120
		Forb, perennial	2FP		0	60
		fringed sagewort	ARFR4	*Artemisia frigida*	0	60
		bastard toadflax	COUM	*Comandra umbellata*	0	60
		buckwheat	ERIOG	*Eriogonum*	0	60
		aster	EUCEP2	*Eucephalus*	0	60
		granite prickly phlox	LEPU	*Leptodactylon pungens*	0	60

		Common name	Symbol	Scientific name	Low	High
		rush skeletonplant	LYJU	Lygodesmia juncea	0	60
		beardtongue	PENST	Penstemon	0	60
		Hood's phlox	PHHO	Phlox hoodii	0	60
		scurfpea	PSORA2	Psoralidium	0	60
		scarlet globemallow	SPCO	Sphaeralcea coccinea	0	60
		deathcamas	ZIGAD	Zigadenus	0	60

Shrub/Vine

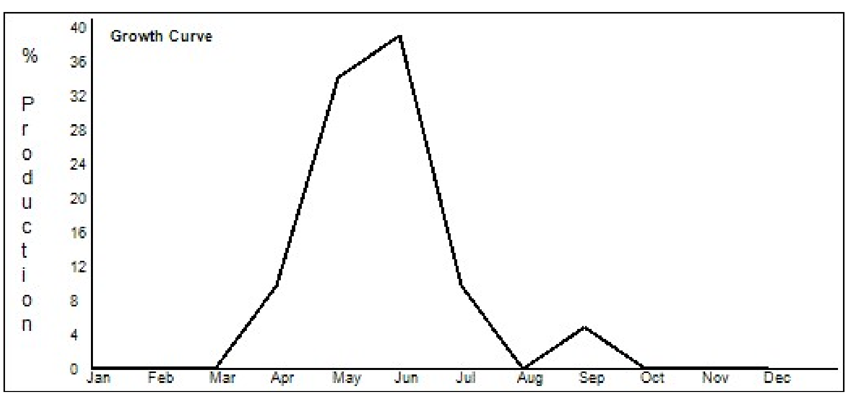
Group	Group name	Common name	Symbol	Scientific name	Annual Production (pounds per acre) Low	High
8					60	120
		silver sagebrush	ARCA13	Artemisia cana	60	120
		Wyoming big sagebrush	ARTRW8	Artemisia tridentata subsp. wyomingensis	60	120
9					60	120
		Shrub (>.5m)	2SHRUB		0	60
		black sagebrush	ARNO4	Artemisia nova	0	60
		shadscale saltbush	ATCO	Atriplex confertifolia	0	60
		Douglas rabbitbrush	CHVI8	Chrysothamnus viscidiflorus	0	60
		winterfat	KRLA2	Krascheninnikovia lanata	0	60
		antelope bitterbrush	PUTR2	Purshia tridentata	0	60
		gray horsebrush	TECA2	Tetradymia canescens	0	60

Plant Growth Curve

Growth curve number:	WY0901
Growth curve name:	34AI, Upland Sites
Growth curve description:	All Upland Sites

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	10	35	40	10	0	5	0	0	0



Supporting Information

State Correlation

This site has been correlated with the following states: WY

Inventory Data References

Inventory Data References (narrative)
Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range trained personnel were also used. Other sources used as references include: USDA NRCS Water and Climate Center, USDA NRCS National Range and Pasture Handbook, and USDA NRCS Soil Surveys from various counties.

Inventory Data References
Data Source Number of Records Sample Period State County
SCS-RANGE-417 69 1967-1988 WY Carbon
& others

Site Authors

B. Brazee

Quality Assurance

Provisional Status Verified in Legacy System

APPENDIX 3C

WYOMING NATURAL DIVERSITY DATABASE: WILDLIFE

Wyoming Natural Diversity Database: Wildlife Species of Concern in the Upper Laramie River Watershed								
Common Name	Scientific Name	USFWS Listing Status	WYBLM Sensitive Species list	USFS Sensitive Species	WGFD Native Species Status	Global Heritage Rank	State Heritage Rank	WYNDD Status
Amphibians								
Eastern Clade Western Toad	Anaxyrus boreas - Eastern Clade	Petition Under Review (UR)	Sensitive	S-USFS R2, S-USFS R4	NSS1 (Aa), Tier 1	G4T2T3	S1	Species of Concern (SOC)
Northern Leopard Frog	Lithobates pipiens	Not Warranted for Listing (NW)	Sensitive	S-USFS R2	NSSU (U), Tier 3	G5	S3	Species of Concern (SOC)
Plains Spadefoot	Spea bombifrons				NSSU (U), Tier 3	G5	S4	Species of Concern (SOC)
Southern Rockies Wood Frog	Lithobates sylvaticus - Southern Rockies			S-USFS R2	NSS2 (Ba), Tier 2	G5T3Q	S1	Species of Concern (SOC)
Tiger Salamander	Ambystoma mavortium					G5	S4	Species of Potential Concern (SOPC)
Wyoming Toad	Anaxyrus baxteri	Listed Endangered (LE)			NSS1 (Aa), Tier 1	G1	S1	Species of Concern (SOC)
Birds								
American Avocet	Recurvirostra americana					G5	S3B	Species of Potential Concern (SOPC)
American Bittern	Botaurus lentiginosus			S-USFS R2	NSS3 (Bb), Tier 2	G4	S3B	Species of Concern (SOC)
American Dipper	Cinclus mexicanus					G5	S4	Species of Potential Concern (SOPC)
American Three-toed Woodpecker	Picoides dorsalis			S-USFS R4	NSSU (U), Tier 2	G5	S3	Species of Concern (SOC)
American White Pelican	Pelecanus erythrorhynchos					G4	S1B	Species of Concern (SOC)
Bald Eagle	Haliaeetus leucocephalus	Delisted, formally monitored (DM)	Sensitive	S-USFS R2, S-USFS R4	NSS2 (Ba), Tier 1	G5	S3B,S5N	Species of Concern (SOC)
Barn Owl	Tyto alba					G5	S2	Species of Potential Concern (SOPC)
Black Rosy-Finch	Leucosticte atrata				NSSU (U), Tier 2	G4	S1B,S2N	Species of Concern (SOC)
Black Tern	Chlidonias niger			S-USFS R2	NSS3 (Bb), Tier 2	G4	S1	Species of Concern (SOC)
Black-billed Cuckoo	Coccyzus erythropthalmus					G5	S2	Species of Concern (SOC)
Black-crowned Night-Heron	Nycticorax nycticorax				NSS3 (Bb), Tier 2	G5	S3B	Species of Potential Concern (SOPC)
Black-necked Stilt	Himantopus mexicanus					G5	S3B	Species of Potential Concern (SOPC)
Black-throated Gray Warbler	Setophaga nigrescens					G5	S2	Species of Concern (SOC)
Blue Grosbeak	Passerina caerulea					G5	S3B	Species of Potential Concern (SOPC)
Boreal Owl	Aegolius funereus			S-USFS R2, S-USFS R4	NSS3 (Bb), Tier 2	G5	S2	Species of Concern (SOC)
Brewer's Sparrow	Spizella breweri		Sensitive	S-USFS R2	NSS4 (Bc), Tier 2	G5	S5	Species of Potential Concern (SOPC)
Brown-capped Rosy-Finch	Leucosticte australis				NSSU (U), Tier 2	G4	S1	Species of Concern (SOC)
Bufflehead	Bucephala albeola					G5	S2B	Species of Potential Concern (SOPC)
Burrowing Owl	Athene cunicularia		Sensitive	S-USFS R2	NSSU (U), Tier 1	G4	S4B	Species of Concern (SOC)
California Gull	Larus californicus					G5	S2B	Species of Potential Concern (SOPC)
Calliope Hummingbird	Selasphorus calliope					G5	S3	Species of Concern (SOC)
Canyon Wren	Catherpes mexicanus					G5	S2S3	Species of Potential Concern (SOPC)
Caspian Tern	Hydroprogne caspia				NSS3 (Bb), Tier 2	G5	S1	Species of Concern (SOC)
Chestnut-collared Longspur	Calcarius ornatus			S-USFS R2	NSS4 (Bc), Tier 2	G5	S1	Species of Concern (SOC)
Clark's Grebe	Aechmophorus clarkii				NSSU (U), Tier 2	G5	S1B	Species of Concern (SOC)
Clay-colored Sparrow	Spizella pallida					G5	S3B	Species of Potential Concern (SOPC)
Common Goldeneye	Bucephala clangula					G5	S3B	Species of Potential Concern (SOPC)
Common Loon	Gavia immer			S-USFS R4	NSS1 (Aa), Tier 1	G5	S1B,S2N	Species of Concern (SOC)
Common Tern	Sterna hirundo					G5	S1	Species of Potential Concern (SOPC)
Dark-eyed Junco	Junco hyemalis					G5	S5B,S5N	Species of Concern (SOC)
Eastern Bluebird	Sialia sialis					G5	S2	Species of Potential Concern (SOPC)
Eastern Screech-Owl	Megascops asio					G5	S3	Species of Potential Concern (SOPC)
Ferruginous Hawk	Buteo regalis		Sensitive	S-USFS R2	NSSU (U), Tier 1	G4	S4B,S5N	Species of Concern (SOC)
Forster's Tern	Sterna forsteri				NSS3 (Bb), Tier 2	G5	S1	Species of Concern (SOC)
Golden Eagle	Aquila chrysaetos					G5	S4B,S4N	Species of Potential Concern (SOPC)

Wyoming Natural Diversity Database: Wildlife Species of Concern in the Upper Laramie River Watershed								
Common Name	Scientific Name	USFWS Listing Status	WYBLM Sensitive Species list	USFS Sensitive Species	WGFD Native Species Status	Global Heritage Rank	State Heritage Rank	WYNDD Status
Golden-crowned Kinglet	Regulus satrapa					G5	S3B,S4N	Species of Potential Concern (SOPC)
Grasshopper Sparrow	Ammodramus savannarum			S-USFS R2	NSS4 (Bc), Tier 2	G5	S4	Species of Potential Concern (SOPC)
Greater Sage-Grouse	Centrocercus urophasianus	Not Warranted for Listing (NW)	Sensitive	S-USFS R2, S-USFS R4	NSS2 (Ba), Tier 1	G3G4	S4	Species of Concern (SOC)
Hammond's Flycatcher	Empidonax hammondii					G5	S4	Species of Potential Concern (SOPC)
Herring Gull	Larus argentatus					G5	SNA	Species of Potential Concern (SOPC)
Lesser Black-backed Gull	Larus fuscus					G5	SNR	Species of Potential Concern (SOPC)
Lewis's Woodpecker	Melanerpes lewis			S-USFS R2	NSSU (U), Tier 2	G4	S2	Species of Concern (SOC)
Loggerhead Shrike	Lanius ludovicianus		Sensitive	S-USFS R2		G4	S3	Species of Concern (SOC)
Long-billed Curlew	Numenius americanus		Sensitive	S-USFS R2	NSS3 (Bb), Tier 2	G5	S3B	Species of Concern (SOC)
McCown's Longspur	Rhynchophanes mccownii			S-USFS R2	NSS4 (Bc), Tier 2	G4	S2	Species of Concern (SOC)
Merlin	Falco columbarius				NSSU (U), Tier 3	G5	S3B,S4N	Species of Potential Concern (SOPC)
Mountain Plover	Charadrius montanus	Not Warranted for Listing (NW)	Sensitive	S-USFS R2	NSSU (U), Tier 1	G3	S2B,S3B	Species of Concern (SOC)
Northern Goshawk	Accipiter gentilis	Not Warranted for Listing (NW)	Sensitive	S-USFS R2, S-USFS R4	NSSU (U), Tier 1	G5	S2B,S3N	Species of Concern (SOC)
Northern Pygmy-Owl	Glaucidium gnoma				NSSU (U), Tier 2	G4G5	S1	Species of Concern (SOC)
Olive-sided Flycatcher	Contopus cooperi			S-USFS R2		G4	S4B	Species of Potential Concern (SOPC)
Osprey	Pandion haliaetus					G5	S3B	Species of Potential Concern (SOPC)
Peregrine Falcon	Falco peregrinus	Delisted, formally monitored (DM)	Sensitive	S-USFS R2, S-USFS R4	NSS3 (Bb), Tier 2	G4	S2	Species of Concern (SOC)
Pygmy Nuthatch	Sitta pygmaea				NSSU (U), Tier 2	G5	S2	Species of Concern (SOC)
Red-necked Phalarope	Phalaropus lobatus					G4G5	S3N	Species of Potential Concern (SOPC)
Ring-billed Gull	Larus delawarensis					G5	S2	Species of Potential Concern (SOPC)
Ring-necked Duck	Aythya collaris					G5	S4B	Species of Potential Concern (SOPC)
Rose-breasted Grosbeak	Pheucticus ludovicianus					G5	S1	Species of Potential Concern (SOPC)
Sage Thrasher	Oreoscoptes montanus		Sensitive		NSS4 (Bc), Tier 2	G5	S5	Species of Potential Concern (SOPC)
Sagebrush Sparrow	Artemisiospiza nevadensis		Sensitive	S-USFS R2	NSS4 (Bc), Tier 2	G5	S3	Species of Concern (SOC)
Sandhill Crane	Grus canadensis				NSS4 (Bc), Tier 3	G5	S3B,S5N	Species of Potential Concern (SOPC)
Short-eared Owl	Asio flammeus			S-USFS R2	NSS4 (Bc), Tier 2	G5	S2	Species of Concern (SOC)
Snowy Egret	Egretta thula				NSS3 (Bb), Tier 2	G5	S3B	Species of Potential Concern (SOPC)
Townsend's Warbler	Setophaga townsendi					G5	SNA	Species of Potential Concern (SOPC)
Trumpeter Swan	Cygnus buccinator	Not Warranted for Listing (NW)	Sensitive	S-USFS R2, S-USFS R4	NSS2 (Ba), Tier 2	G4	S3B,S3N	Species of Concern (SOC)
Tundra Swan	Cygnus columbianus					G5	S2N	Species of Potential Concern (SOPC)
Virginia's Warbler	Oreothlypis virginiae					G5	S1	Species of Concern (SOC)
Western Scrub-Jay	Aphelocoma californica				NSS3 (Bb), Tier 2	G5	S1	Species of Concern (SOC)
White-faced Ibis	Plegadis chihi		Sensitive		NSS3 (Bb), Tier 2	G5	S1B	Species of Concern (SOC)
White-tailed Ptarmigan	Lagopus leucura	Petition Under Review (UR)		S-USFS R2		G5	S1	Species of Concern (SOC)
White-winged Crossbill	Loxia leucoptera					G5	S2	Species of Potential Concern (SOPC)
Whooping Crane	Grus americana	Listed Endangered (LE), and Endangered - Nonessential Experimental Population (LEXN)				G1	S1N	Species of Concern (SOC)
Williamson's Sapsucker	Sphyrapicus thyroideus					G5	S2	Species of Concern (SOC)
Yellow-billed Cuckoo	Coccyzus americanus		Sensitive	S-USFS R2, S-USFS R4	NSSU (U), Tier 3	G5	S1	Species of Concern (SOC)
Crustaceans								
Circumpolar Fairy Shrimp	Branchinecta paludosa				NSSU (U), Tier 3	G5	S4	Species of Concern (SOC)
Couse tadpole shrimp	Lepidurus couesii				NSSU (U), Tier 3	G4	S3	Species of Concern (SOC)
Longtail Tadpole Shrimp	Triops longicaudatus				NSSU (U), Tier 3	G5	S4	Species of Concern (SOC)

Wyoming Natural Diversity Database: Wildlife Species of Concern in the Upper Laramie River Watershed								
Common Name	**Scientific Name**	**USFWS Listing Status**	**WYBLM Sensitive Species list**	**USFS Sensitive Species**	**WGFD Native Species Status**	**Global Heritage Rank**	**State Heritage Rank**	**WYNDD Status**
Pocket Pouch Fairy Shrimp	Branchinecta lateralis				NSSU (U), Tier 3	G4	S5	Species of Concern (SOC)
Fish								
Colorado River Cutthroat Trout	Oncorhynchus clarkii pleuriticus	Not Warranted for Listing (NW)	Sensitive	S-USFS R2, S-USFS R4	NSS2 (Ba), Tier 1	G4T3	S1	Species of Concern (SOC)
Greenback Cutthroat Trout	Oncorhynchus clarkii stomias	Listed Threatened (LT)				G4T2T3	SX	Species of Concern (SOC)
Hornyhead Chub	Nocomis biguttatus		Sensitive	S-USFS R2	NSS2 (Ab), Tier 2	G5	S1	Species of Concern (SOC)
Iowa Darter	Etheostoma exile				NSS3 (Bb), Tier 2	G5	S3S4	Species of Potential Concern (SOPC)
Insects								
A Caddisfly	Allomyia chama					G2G4	SH	Species of Concern (SOC)
A Mason Bee	Osmia tanneri					G3G5	SH	Species of Concern (SOC)
A Rita Dotted-Blue subspecies	Euphilotes rita coloradensis					G3G4T2T3	S3	Species of Concern (SOC)
Hudsonian Emerald	Somatochlora hudsonica			S-USFS R2		G5	S3	Species of Concern (SOC)
Monarch Butterfly	Danaus plexippus plexippus	Petition Under Review (UR)				G5T3T4	SNR	Species of Concern (SOC)
Snow Scorpionfly	Boreus bomari					GNR	S4	Species of Concern (SOC)
Tawny Crescent	Phyciodes batesii					G4	SNR	Species of Concern (SOC)
Mammals								
Abert's Squirrel	Sciurus aberti					G5	S1	Species of Potential Concern (SOPC)
Bighorn Sheep	Ovis canadensis			S-USFS R2, S-USFS R4	NSS4 (Bc), Tier 2	G4	S3S4	Species of Potential Concern (SOPC)
Black-footed Ferret	Mustela nigripes	Listed Endangered (LE), and Endangered - Nonessential Experimental Population (LEXN)			NSS1 (Aa), Tier 1	G1	S1	Species of Concern (SOC)
Canada Lynx	Lynx canadensis	Listed Threatened (LT)			NSS1 (Aa), Tier 1	G5	S1	Species of Concern (SOC)
Dwarf Shrew	Sorex nanus				NSS3 (Bb), Tier 2	G4	S4	Species of Potential Concern (SOPC)
Eastern Cottontail	Sylvilagus floridanus					G5	S3	Species of Potential Concern (SOPC)
Fisher	Pekania pennanti	Not Warranted for Listing (NW)		S-USFS R4	NSSU (U), Tier 3	G5	S1	Species of Concern (SOC)
Fringed Myotis	Myotis thysanodes		Sensitive	S-USFS R2	NSS3 (Bb), Tier 2	G4	S2	Species of Concern (SOC)
Gray Wolf	Canis lupus	Proposed for Delisting (PD)		S-USFS R2, S-USFS R4		G4G5	S1	Species of Concern (SOC)
Grizzly Bear	Ursus arctos arctos	Listed Threatened (LT)				G4T4	S1	Species of Concern (SOC)
Hoary Bat	Lasiurus cinereus			S-USFS R2		G5	S4	Species of Potential Concern (SOPC)
Little Brown Myotis	Myotis lucifugus	Petition Under Review (UR)			NSS4 (Cb), Tier 2	G3	S5	Species of Potential Concern (SOPC)
Long-eared Myotis	Myotis evotis		Sensitive		NSS3 (Bb), Tier 2	G5	S4	Species of Potential Concern (SOPC)
Long-legged Myotis	Myotis volans				NSS3 (Bb), Tier 2	G5	S3B	Species of Potential Concern (SOPC)
Medicine Bow Mountain Pika	Ochotona princeps princeps - Medicine Bow Mountains	Not Warranted for Listing (NW)				G5T5Q	S1	Species of Potential Concern (SOPC)
North American Wolverine	Gulo gulo luscus	Not Warranted for Listing (NW)			NSS3 (Bb), Tier 2	G4T4	S2	Species of Concern (SOC)
Northern River Otter	Lontra canadensis			S-USFS R2	NSSU (U), Tier 2	G5	S3	Species of Concern (SOC)
Pacific Marten	Martes caurina			S-USFS R2	NSS4 (Cb), Tier 2	G4G5	S3	Species of Potential Concern (SOPC)
Plains Bison	Bos bison bison	Not Warranted for Listing (NW)				G4TU	S1	Species of Concern (SOC)
Pygmy Rabbit	Brachylagus idahoensis	Not Warranted for Listing (NW)	Sensitive	S-USFS R4	NSS3 (Bb), Tier 2	G4	S1	Species of Concern (SOC)
Ringtail	Bassariscus astutus					G5	S1	Species of Potential Concern (SOPC)
Silver-haired Bat	Lasionycteris noctivagans					G5	S3B	Species of Potential Concern (SOPC)
Southern Rocky Mountain Pygmy Shrew	Sorex hoyi montanus			S-USFS R2	NSS2 (Ab), Tier 2	G5T2T3	S1	Species of Concern (SOC)
Swift Fox	Vulpes velox	Not Warranted for Listing (NW)	Sensitive	S-USFS R2	NSS4 (Cb), Tier 2	G3	S2	Species of Concern (SOC)
Thirteen-lined Ground Squirrel	Ictidomys tridecemlineatus					G5	S5	Species of Concern (SOC)
Townsend's Big-eared Bat	Corynorhinus townsendii		Sensitive	S-USFS R2, S-USFS R4	NSS2 (Ba), Tier 1	G3G4	S2	Species of Concern (SOC)

Wyoming Natural Diversity Database: Wildlife Species of Concern in the Upper Laramie River Watershed								
Common Name	**Scientific Name**	**USFWS Listing Status**	**WYBLM Sensitive Species list**	**USFS Sensitive Species**	**WGFD Native Species Status**	**Global Heritage Rank**	**State Heritage Rank**	**WYNDD Status**
Uinta Ground Squirrel	Urocitellus armatus					G5	S3S4	Species of Potential Concern (SOPC)
Western Small-footed Myotis	Myotis ciliolabrum				NSS4 (Cb), Tier 2	G5	S3B	Species of Potential Concern (SOPC)
White-tailed Prairie Dog	Cynomys leucurus	Petition Under Review (UR)	Sensitive	S-USFS R2		G4	S3	Species of Concern (SOC)
Wyoming Ground Squirrel	Urocitellus elegans					G5	S3S4	Species of Potential Concern (SOPC)
Mollusks								
A Mountainsnail	Oreohelix				NSSU (U), Tier 1	GNR	SNR	Species of Concern (SOC)
A Mountainsnail	Oreohelix subrudis				NSSU (U), Tier 1	G5	SNR	Species of Concern (SOC)
Ash Gyro	Gyraulus parvus				NSSU (U), Tier 2	G5	S4	Species of Concern (SOC)
Indecisive Vallonia	Vallonia albula				NSSU (U), Tier 2	G4Q	SNR	Species of Concern (SOC)
Lance Aplexa	Aplexa elongata				NSSU (U), Tier 2	G5	S3	Species of Concern (SOC)
Marsh Rams-horn	Planorbella trivolvis				NSSU (U), Tier 2	G5	S4	Species of Concern (SOC)
Pewter Physa	Physa acuta				NSSU (U), Tier 2	G5Q	S4	Species of Concern (SOC)
Umbilicate Sprite	Promenetus umbilicatellus				NSSU (U), Tier 2	G4	S3	Species of Concern (SOC)
Reptiles								
Eastern Spiny Softshell	Apalone spinifera spinifera				NSS4 (Bc), Tier 3	G5T5	S4	Species of Potential Concern (SOPC)
Plains Box Turtle	Terrapene ornata ornata				NSSU (U), Tier 3	G5T5	S1	Species of Concern (SOC)
Plateau Fence Lizard	Sceloporus tristichus					G5	S1	Species of Concern (SOC)

APPENDIX 3D

LANDFIRE DATABASE

APPENDIX 3D: LANDFIRE DATABASE

Upper Laramie River Watershed : LANDFIRE				
Existing Vegetation Type	Physiognomy (form/morphological structure of vegetation)	Acres	Percent of Watershed	Cumulative Percent
Inter-Mountain Basins Big Sagebrush Shrubland	Shrubland	507026.4817	42.20560%	42.206%
Inter-Mountain Basins Big Sagebrush Steppe	Shrubland	128806.6594	10.72205%	52.928%
Artemisia tridentata ssp. vaseyana Shrubland Alliance	Shrubland	58168.22261	4.84201%	57.770%
Inter-Mountain Basins Semi-Desert Shrub-Steppe	Shrubland	56621.27505	4.71324%	62.483%
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	Conifer	53864.84104	4.48379%	66.967%
Rocky Mountain Lodgepole Pine Forest	Conifer	46404.93853	3.86281%	70.829%
Wyoming Basins Dwarf Sagebrush Shrubland and Steppe	Shrubland	41765.54903	3.47662%	74.306%
Western Cool Temperate Pasture and Hayland	Agricultural	37760.5505	3.14324%	77.449%
Inter-Mountain Basins Montane Sagebrush Steppe	Shrubland	35533.59469	2.95787%	80.407%
Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland	Conifer-Hardwood	26794.29056	2.23039%	82.638%
Inter-Mountain Basins Mat Saltbush Shrubland	Shrubland	24765.30016	2.06150%	84.699%
Western Great Plains Floodplain Forest and Woodland	Riparian	16425.46891	1.36728%	86.066%
Rocky Mountain Lower Montane-Foothill Shrubland	Shrubland	15795.32357	1.31483%	87.381%
Open Water	Open Water	13074.70303	1.08836%	88.470%
Southern Rocky Mountain Ponderosa Pine Woodland	Conifer	12884.33599	1.07251%	89.542%
Western Cool Temperate Developed Ruderal Shrubland	Developed	9919.069527	0.82568%	90.368%
Western Cool Temperate Developed Ruderal Grassland	Developed	9228.602001	0.76820%	91.136%
Inter-Mountain Basins Semi-Desert Grassland	Grassland	8280.682178	0.68930%	91.825%
Developed-Roads	Developed-Roads	7913.241776	0.65871%	92.484%
Western Great Plains Floodplain Herbaceous	Riparian	7189.23453	0.59844%	93.082%
Northwestern Great Plains Mixedgrass Prairie	Grassland	6879.829297	0.57269%	93.655%
Rocky Mountain Aspen Forest and Woodland	Hardwood	6459.018995	0.53766%	94.193%
Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	Conifer	5825.628631	0.48493%	94.678%
Northern Rocky Mountain Lower Montane-Foothill-Valley Grassland	Grassland	5616.900009	0.46756%	95.145%
Northern Rocky Mountain Subalpine-Upper Montane Grassland	Grassland	5023.573046	0.41817%	95.563%
Rocky Mountain Foothill Limber Pine-Juniper Woodland	Conifer	4400.539868	0.36631%	95.930%
Rocky Mountain Montane Riparian Forest and Woodland	Riparian	4260.790429	0.35467%	96.284%
Western Cool Temperate Urban Shrubland	Developed	3871.947922	0.32231%	96.607%
Barren	Barren	3061.895092	0.25488%	96.862%
Inter-Mountain Basins Greasewood Flat	Shrubland	3000.320161	0.24975%	97.111%
Introduced Upland Vegetation-Annual and Biennial Forbland	Exotic Herbaceous	2985.97625	0.24856%	97.360%
Rocky Mountain Subalpine-Montane Mesic Meadow	Grassland	2860.140204	0.23808%	97.598%
Rocky Mountain Subalpine/Upper Montane Riparian Shrubland	Riparian	2825.562901	0.23520%	97.833%
Southern Rocky Mountain Montane-Subalpine Grassland	Grassland	2679.560634	0.22305%	98.056%
Developed-Low Intensity	Developed-Low Intensity	2230.493756	0.18567%	98.242%
Rocky Mountain Wetland-Herbaceous	Riparian	2124.421265	0.17684%	98.419%
Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland	Conifer	1212.425548	0.10092%	98.520%
Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland	Conifer	1204.852333	0.10029%	98.620%
Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	Conifer	1149.667977	0.09570%	98.716%
Western Cool Temperate Urban Herbaceous	Developed	1149.306948	0.09567%	98.811%
Rocky Mountain Alpine Turf	Grassland	1132.18126	0.09424%	98.906%
Introduced Upland Vegetation-Perennial Grassland and Forbland	Exotic Herbaceous	1128.598106	0.09395%	99.000%
Middle Rocky Mountain Montane Douglas-fir Forest and Woodland	Conifer	1127.277987	0.09384%	99.093%
Introduced Upland Vegetation-Annual Grassland	Exotic Herbaceous	1092.659261	0.09095%	99.184%
Inter-Mountain Basins Sparsely Vegetated Systems	Sparsely Vegetated	1051.69878	0.08754%	99.272%
Developed-Medium Intensity	Developed-Medium Intensity	819.596036	0.06822%	99.340%
Southern Rocky Mountain Ponderosa Pine Savanna	Conifer	813.416623	0.06771%	99.408%
Northern Rocky Mountain Montane-Foothill Deciduous Shrubland	Shrubland	781.088437	0.06502%	99.473%
Quarries-Strip Mines-Gravel Pits	Quarries-Strip Mines-Gravel Pits	666.916663	0.05552%	99.528%
Inter-Mountain Basins Curl-leaf Mountain Mahogany Shrubland	Shrubland	662.045465	0.05511%	99.583%
Western Great Plains Floodplain Shrubland	Riparian	559.782841	0.04660%	99.630%
Western Great Plains Depressional Wetland Systems	Riparian	423.597318	0.03526%	99.665%
Unknown	Unknown	372.596993	0.03102%	99.696%
Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland	Conifer	365.812717	0.03045%	99.727%
Rocky Mountain Subalpine/Upper Montane Riparian Forest and Woodland	Riparian	358.748403	0.02986%	99.757%
Rocky Mountain Alpine/Montane Sparsely Vegetated Systems	Sparsely Vegetated	323.707664	0.02695%	99.784%
Quercus gambelii Shrubland Alliance	Shrubland	290.40046	0.02417%	99.808%
Northern Rocky Mountain Subalpine Deciduous Shrubland	Shrubland	277.672565	0.02311%	99.831%
Western Cool Temperate Undeveloped Ruderal Shrubland	Developed	248.648027	0.02070%	99.852%
Western Cool Temperate Close Grown Crop	Agricultural	240.737937	0.02004%	99.872%
Western Cool Temperate Urban Evergreen Forest	Developed	222.82168	0.01855%	99.890%
Rocky Mountain Montane Riparian Shrubland	Riparian	188.38516	0.01568%	99.906%
Western Cool Temperate Developed Ruderal Deciduous Forest	Developed	145.203312	0.01209%	99.918%
Western Cool Temperate Urban Deciduous Forest	Developed	140.292619	0.01168%	99.930%
Colorado Plateau Pinyon-Juniper Woodland	Conifer	112.646074	0.00938%	99.939%
Western Cool Temperate Developed Ruderal Evergreen Forest	Developed	109.323353	0.00910%	99.948%
Western Cool Temperate Undeveloped Ruderal Grassland	Developed	90.868806	0.00756%	99.956%
Western Great Plains Sparsely Vegetated Systems	Sparsely Vegetated	81.935724	0.00682%	99.962%
Developed-High Intensity	Developed-High Intensity	68.162626	0.00567%	99.968%
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Shrubland	45.323996	0.00377%	99.972%
Western Cool Temperate Wheat	Agricultural	38.674543	0.00322%	99.975%
Western Cool Temperate Row Crop	Agricultural	37.483746	0.00312%	99.978%
Western Cool Temperate Urban Mixed Forest	Developed	34.798549	0.00290%	99.981%
Northern Rocky Mountain Subalpine Woodland and Parkland	Conifer	34.342389	0.00286%	99.984%
Snow-Ice	Snow-Ice	33.12157	0.00276%	99.987%
Western Cool Temperate Fallow/Idle Cropland	Agricultural	29.409429	0.00245%	99.989%
Introduced Riparian Forest and Woodland	Exotic Tree-Shrub	28.357539	0.00236%	99.992%

Existing Vegetation Type	Physiognomy (form/morphological structure of vegetation)	Acres	Percent of Watershed	Cumulative Percent
Colorado Plateau Mixed Low Sagebrush Shrubland	Shrubland	22.736281	0.00189%	99.993%
Southern Colorado Plateau Sand Shrubland	Shrubland	22.287412	0.00186%	99.995%
Inter-Mountain Basins Juniper Savanna	Conifer	15.85518	0.00132%	99.997%
Inter-Mountain Basins Mixed Salt Desert Scrub	Shrubland	14.040199	0.00117%	99.998%
Southern Rocky Mountain Pinyon-Juniper Woodland	Conifer	8.937895	0.00074%	99.9985%
Rocky Mountain Alpine Dwarf-Shrubland	Grassland	7.486916	0.00062%	99.9992%
Northwestern Great Plains Shrubland	Shrubland	3.2658	0.00027%	99.9994%
Northwestern Great Plains-Black Hills Ponderosa Pine Woodland and Savanna	Conifer	1.254392	0.00010%	99.9995%
Western Cool Temperate Undeveloped Ruderal Deciduous Forest	Developed	1.254392	0.00010%	99.9996%
Western Cool Temperate Undeveloped Ruderal Evergreen Forest	Developed	1.184268	0.00010%	99.9997%
Southern Rocky Mountain Juniper Woodland and Savanna	Conifer	1.111974	0.00009%	99.9998%
Western Great Plains Wooded Draw and Ravine	Riparian	0.819456	0.00007%	99.9999%
Western Cool Temperate Developed Ruderal Mixed Forest	Developed	0.587207	0.00005%	99.9999%
Northwestern Great Plains Highland White Spruce Woodland	Conifer	0.222395	0.00002%	100.0000%

Upper Laramie River Watershed : LANDFIRE Wetlands				
Existing Vegetation Type	Physiognomy (form/morphological structure of vegetation)	Acres	Percent of Watershed	Cumulative Percent
Western Great Plains Floodplain Forest and Woodland	Riparian	16425.5	1.36728%	1.37%
Western Great Plains Floodplain Herbaceous	Riparian	7189.2	0.59844%	1.97%
Rocky Mountain Montane Riparian Forest and Woodland	Riparian	4260.8	0.35467%	2.32%
Rocky Mountain Subalpine/Upper Montane Riparian Shrubland	Riparian	2825.6	0.23520%	2.56%
Rocky Mountain Wetland-Herbaceous	Riparian	2124.4	0.17684%	2.73%
Western Great Plains Floodplain Shrubland	Riparian	559.8	0.04660%	2.78%
Western Great Plains Depressional Wetland Systems	Riparian	423.6	0.03526%	2.81%
Rocky Mountain Subalpine/Upper Montane Riparian Forest and Woodland	Riparian	358.7	0.02986%	2.84%
Rocky Mountain Montane Riparian Shrubland	Riparian	188.4	0.01568%	2.86%
Western Great Plains Wooded Draw and Ravine	Riparian	0.8	0.00007%	2.86%

APPENDIX 3E

WYOMING NATURAL DIVERSITY DATABASE: VEGETATION

Wyoming Natural Diversity Database: Vegetative Species of Concern in the Upper Laramie River Watershed								
Common Name	Scientific Name	USFWS Listing Status	WYBLM Sensitive Species list	USFS Sensitive Species	WGFD Native Species Status	Global Heritage Rank	State Heritage Rank	WYNDD Status
Fern and Fern Ally								
Green spleenwort	Asplenium trichomanes-ramosum					G4	S2	Species of Concern (SOC)
Underwood's spike-moss	Selaginella underwoodii					G5?	S1	Species of Concern (SOC)
Flowering Plants								
Alpine kittentails	Besseya alpina			SOLC-Med Bow NFR2-Thunder		G4	S1	Species of Concern (SOC)
Alpine oreoxis	Cymopterus alpinus					G4G5	S1	Species of Concern (SOC)
Bigelow's groundsel	Ligularia bigelovii var. hallii			SOLC-Med Bow NFR2-Thunder		G4?T3T4	S1	Species of Concern (SOC)
Bigelow's prairie gentian	Gentiana affinis var. bigelovii			SOLC-Med Bow NFR2-Thunder		G5T4	S1	Species of Concern (SOC)
Bigelow's spiny aster	Machaeranthera bigelovii var. bigelovii					G4G5T3T4	S2	Species of Concern (SOC)
Broadleaf arrowhead	Sagittaria latifolia					G5	S1	Species of Concern (SOC)
Broad-leaved twayblade	Listera convallarioides			SOLC-Bighorn NFR2, SOLC-Black Hills NFR2, SOLC-Med		G5	S2	Species of Concern (SOC)
Clustered Lady's-slipper	Cypripedium fasciculatum			S-USFS R4, SOLC-Med Bow NFR2-Thunder Basin NGR2		G4	S3	Species of Potential Concern (SOPC)
Colorado spiny aster	Machaeranthera coloradoensis			S-USFS R2		G3	S2	Species of Concern (SOC)
Creeping wildrye	Elymus triticoides					G4G5	SH	Species of Concern (SOC)
Daggett rockcress	Boechera pendulina var. russeola					G5T3?	S3	Species of Potential Concern (SOPC)
Eggleston's sedge	Carex egglestonii					G4	S1	Species of Concern (SOC)
Grassyslope sedge	Carex oreocharis					G3	S2	Species of Concern (SOC)
Great basin downingia	Downingia laeta					G5	S1	Species of Concern (SOC)
Hall's milkweed	Asclepias hallii					G3	SH	Species of Concern (SOC)
Halls sedge	Carex parryana var. unica					G4?Q	S2	Species of Concern (SOC)
Hoary willow	Salix candida			S-USFS R2		G5	S2	Species of Concern (SOC)
Illinois pondweed	Potamogeton illinoensis					G5	S1	Species of Concern (SOC)
Laramie false sagebrush	Sphaeromeria simplex		Sensitive			G2	S2	Species of Concern (SOC)
Large-flower triteleia	Triteleia grandiflora			S-USFS R2		G4G5	S2	Species of Concern (SOC)
Leech-leaf mentzelia	Mentzelia sinuata					G3	S2	Species of Concern (SOC)
Lesser bladderwort	Utricularia minor			S-USFS R2		G5	S3	Species of Potential Concern (SOPC)
Lesser panicled sedge	Carex diandra			S-USFS R2		G5	S2	Species of Concern (SOC)
Little golden-aster	Heterotheca pumila					G4	S1	Species of Concern (SOC)
Marsh felwort	Lomatogonium rotatum			SOLC-Med Bow NFR2-Thunder Basin NGR2		G5	S2	Species of Concern (SOC)
Moschatel	Adoxa moschatellina			SOLC-Bighorn NFR2, SOLC-Med Bow NFR2-Thunder Basin NGR2		G5	S2	Species of Concern (SOC)
Nelson's sedge	Carex nelsonii					G3	S2	Species of Concern (SOC)
Northern white rush	Juncus triglumis var. albescens			SOLC-Med Bow NFR2-Thunder Basin NGR2		G5T5	S2	Species of Concern (SOC)
Pale blue-eye-grass	Sisyrinchium pallidum					G3	S2S3	Species of Potential Concern (SOPC)
Park milkvetch	Astragalus leptaleus			S-USFS R2, SOLC-Targhee NFR4		G4	S1	Species of Concern (SOC)
Perennial rockcress	Boechera perennans					G5	S1	Species of Concern (SOC)
Persistent sepal yellowcress	Rorippa calycina		Sensitive			G3	S3	Species of Potential Concern (SOPC)

Wyoming Natural Diversity Database: Vegetative Species of Concern in the Upper Laramie River Watershed								
Common Name	Scientific Name	USFWS Listing Status	WYBLM Sensitive Species list	USFS Sensitive Species	WGFD Native Species Status	Global Heritage Rank	State Heritage Rank	WYNDD Status
Pinnate fleabane	Erigeron pinnatisectus					G4	S2	Species of Concern (SOC)
Pygmy bulrush	Trichophorum pumilum					G5	S2	Species of Concern (SOC)
Pygmy goldenweed	Tonestus pygmaeus					G4	S1	Species of Concern (SOC)
Rockcress whitlow-grass	Draba globosa			S-USFS R4		G3	S2S3	Species of Concern (SOC)
Rocky Mountain nailwort	Paronychia pulvinata					G3?	S1	Species of Concern (SOC)
Rocky Mountain phacelia	Phacelia denticulata			SOLC-Med Bow NFR2-Thunder Basin NGR2		G3	S2	Species of Concern (SOC)
Rocky Mountain snowlover	Chionophila jamesii					G4?	S1	Species of Concern (SOC)
Rusby's blazing star	Mentzelia rusbyi					G4?	S1	Species of Concern (SOC)
Saffron groundsel	Packera crocata			SOLC-Med Bow NFR2-Thunder Basin NGR2		G4	S1?	Species of Concern (SOC)
Slender cottongrass	Eriophorum gracile			S-USFS R2		G5	S3	Species of Potential Concern (SOPC)
Slender-leaved wild buckwheat	Eriogonum exilifolium			S-USFS R2		G3	S2	Species of Concern (SOC)
Streambank groundsel	Packera pseudaurea var. flavula			SOLC-Med Bow NFR2-Thunder Basin NGR2		G5T2T4	S1	Species of Concern (SOC)
Strict-leaved pondweed	Potamogeton strictifolius					G5	S1?	Species of Concern (SOC)
Tall fleabane	Erigeron elatior					G4	S2	Species of Concern (SOC)
Three-fingered milkvetch	Astragalus tridactylicus					G4	S2	Species of Potential Concern (SOPC)
Ward's goldenweed	Oonopsis wardii					G3	S3	Species of Potential Concern (SOPC)
Western sedge	Carex occidentalis					G4	S1	Species of Concern (SOC)
White phacelia	Phacelia alba			SOLC-Med Bow NFR2-Thunder Basin NGR2		G4G5	S1	Species of Concern (SOC)
White-stem pondweed	Potamogeton praelongus			SOLC-Med Bow NFR2-Thunder Basin NGR2		G5	S2	Species of Concern (SOC)

APPENDIX 3F

GEOLOGIC UNITS

APPENDIX 3F
Geologic Units in the Upper Laramie Watershed
(condensed from Taboga et al, 2013)

CENOZOIC GEOLOGIC UNITS
Quaternary geologic units

Qa	Alluvium and colluvium (Holocene-Pleistocene) – Clay, silt, sand, and gravel in flood plains, fans, terraces, and slopes.
Qt	Gravel, pediment, and fan deposits (Holocene-Pleistocene) – Mostly locally derived clasts; locally includes some Tertiary gravels.
Qg	Glacial deposits (Holocene-Pleistocene) – Till and outwash of sand, gravel, and boulders.
Qls	Landslide deposits (Holocene-Pleistocene) – Local intermixed landslide and glacial deposits, talus, and rock-glacier deposits.
Qs	Dune sand and loess (Holocene-Pleistocene) – Active and dormant sand dunes.
QTc	Conglomerate (Pleistocene to Miocene) – Giant granite boulders in arkose matrix.
QTg	Terrace gravel (Pleistocene and (or) Pliocene) – Partly consolidated gravel above and flanking some major streams.

Upper Tertiary geologic units

Tmu	Upper Miocene rocks (undivided) – Light-colored tuffaceous claystone, sandstone, and conglomerate.

Lower Tertiary geologic units

Twr	White River Formation (Oligocene) – White to pale-pink, blocky, tuffaceous claystone and lenticular arkosic conglomerate.
Twb	Wagon Bed Formation (Eocene) – Dull-green, siliceous, bentonitic claystone and tuff; giant granite boulder conglomerate in tuffaceous matrix.
Twdr	Wind River Formation (Eocene) – Variegated claystone and sandstone; lenticular conglomerate. Age of tuff at top 49 Ma.
Tha	Hanna Formation (Paleocene) – Brown and gray sandstone, shale, conglomerate, and coal; giant quartzite boulders near Medicine Bow Mountains.

MESOZOIC GEOLOGIC UNITS
Upper Cretaceous geologic units

Kmb — Medicine Bow Formation (Upper Cretaceous) – Brown and gray sandstone and shale; thin coal and carbonaceous shale beds.

Kle — Lewis Shale (Upper Cretaceous) – Gray marine shale containing abundant interbedded gray and brown lenticular concretion-rich sandstone beds.

Kmv — Mesaverde Formation or Group (Upper Cretaceous) – Light-colored, massive to thinbedded sandstone, gray sandy shale, and coal beds.

> <u>Pine Ridge Sandstone</u> – Light gray sandstone and thin coal beds.
> <u>Rock River Formation</u> – Soft sandstone and sandy shale.

Kf — Frontier Formation (Upper Cretaceous) – Gray sandstone and sandy shale.

Kft — Frontier Formation and Mowry and Thermopolis Shales (Upper Cretaceous)

> <u>Frontier Formation</u> – Gray sandstone and sandy shale.
> <u>Mowry Shale</u> (Upper Cretaceous) – Silvery-gray, hard, and siliceous shale containing abundant fish scales and bentonite beds.
> <u>Thermopolis Shale</u> (Lower Cretaceous) – Black, soft, and fissile shale with Muddy Sandstone Member at top of unit.

Ks — Steele Shale (Upper Cretaceous) – Gray, soft, marine shale containing numerous bentonite beds and thin lenticular sandstone.

Ksn — Steele Shale and Niobrara Formation (Upper Cretaceous)

> <u>Steele Shale</u> (Upper Cretaceous) – Gray, soft, marine shale containing numerous bentonite beds and thin lenticular sandstone.
> <u>Niobrara Formation</u> (Upper Cretaceous) – Light-colored limestone and gray to yellow speckled limy shale.

Kn — Niobrara Formation (Upper Cretaceous) – Light-colored limestone and gray to yellow speckled limy shale.

Lower Cretaceous geologic units

Kmt — Mowry and Thermopolis Shales (Upper to Lower Cretaceous)

> <u>Mowry Shale</u> (Upper Cretaceous) – Silvery-gray, hard, siliceous shale containing abundant fish scales and bentonite beds.
> <u>Thermopolis Shale</u> (Lower Cretaceous) – Black soft fissile shale with Muddy Sandstone Member at top of unit.

Cretaceous and Jurassic geologic units

KJ — Cloverly and Morrison Formations (Lower Cretaceous to Jurassic)

Cloverly Formation – Rusty-color sandstone at top, underlain by brightly variegated bentonitic claystone; chert-pebble conglomerate locally at base.
Morrison Formation – Dully variegated, siliceous claystone, nodular white limestone, and gray silty sandstone.

KJs Cloverly, Morrison, and Sundance Formations (Lower Cretaceous to Jurassic)
Cloverly Formation – Rusty-color sandstone at top, which overlies brightly variegated bentonitic claystone; chert-pebble conglomerate locally at the base.
Morrison Formation – Dully variegated, siliceous claystone, nodular white limestone, and gray silty sandstone.
Sundance Formation – Greenish-gray glauconitic sandstone and shale, underlain by red and gray non-glauconitic sandstone and shale.

Triassic geologic units

ȾRc Chugwater Formation (Upper and Lower Triassic) – Red siltstone and shale.

MESOZOIC AND PALEOZOIC GEOLOGIC UNITS

MzPz Mesozoic and Paleozoic rocks (Mesozoic to Paleozoic) – Mapped in small local areas of complex structure.

Triassic and Permian geologic units

ȾRPjs Chugwater and Goose Egg Formations (Upper Triassic-Permian)
Chugwater Formation (Upper and Lower Triassic) – Red siltstone and shale.
Goose Egg Formation – Red sandstone and siltstone, white gypsum, halite, and purple to white dolomite and limestone.

ȾRPg

PALEOZOIC GEOLOGIC UNITS

Permian geologic units

Pfs Forelle Limestone and Satanka Shale (Permian)
Forelle Limestone – Thin-bedded limestone. Locally a member of the Goose Egg Formation.
Satanka Shale – Red shale.

Permian and Pennsylvanian geologic units

PPc Casper Formation (Lower Permian-Upper and Middle Pennsylvanian) – Gray, tan, and red thick-bedded sandstone underlain by interbedded sandstone and pink and gray limestone. May include some Devonian (?) sandstone along east flank of Laramie Mountains.

PIPcf Casper and Fountain Formations (Lower Permian-Upper and Middle Pennsylvanian)

Casper Formation – Gray, tan, and red thick-bedded sandstone underlain by interbedded sandstone and pink and gray limestone. May include some Devonian (?) sandstone along east flank of Laramie Mountains.

Fountain Formation – Arkose and red sandstone.

Permian and Mississippian geologic units

PIPM Tensleep Sandstone and Amsden Formation (lower Permian to Upper Mississippian)

Tensleep Sandstone (Lower Permian to Upper Mississippian) – White to gray sandstone containing thin limestone and dolomite beds.

Amsden Formation (lower Permian to Middle Pennsylvanian) – Red and green shale and dolomite with a persistent red to brown sandstone at base.

PRECAMBRIAN GEOLOGIC UNITS

p€r Precambrian rocks – Middle Proterozoic through middle Archean granitic, metasedimentary, metavolcanic, and mafic intrusive rocks.

APPENDIX 3G

HYDROLOGY: USGS METHOD FOR UNGAGED WATERSHEDS (MILLER)

Peak Flow Characteristics : Published Regression Coefficients

Region 1 : Rocky Mountains Region		
Recurrence Interval	**A**	**B**
1.5 yr	0.126	0.885
2 yr	0.313	0.866
2.33 yr	0.458	0.858
5 yr	1.89	0.829
10 yr	4.71	0.81
25 yr	12.1	0.79
50 yr	22.3	0.776
100 yr	38.6	0.764
200 yr	64.3	0.752
500 yr	120	0.738

Peak flows in cfs for various return periods												
HUC12 Basin Name	**A (mi2)**	**1.5 yr**	**2 yr**	**2.33 yr**	**5 yr**	**10 yr**	**25 yr**	**50 yr**	**100 yr**	**200 yr**	**500 yr**	**NOTES**
1 - Antelope Creek-Shell Creek	34.676173	2.91	6.75	9.60	35.74	83.26	199.26	349.44	579.66	925.37	1643.33	Partial area, HUC 12 clipped to watershed boundary
2 - Bamforth Lake	29.43633	2.51	5.86	8.34	31.20	72.91	175.07	307.72	511.46	818.11	1456.19	
3 - Boswell Creek	18.540582	1.67	3.92	5.61	21.27	50.14	121.51	214.97	359.28	577.88	1035.28	Partial area, HUC 12 clipped to watershed boundary
4 - Browns Creek	41.966318	3.44	7.96	11.31	41.86	97.18	231.67	405.21	670.63	1068.15	1891.83	
5 - Cooper Creek	61.081167	4.80	11.02	15.60	57.15	131.71	311.64	542.21	893.35	1416.49	2495.63	
6 - Cooper Lake	42.52346	3.48	8.05	11.43	42.32	98.22	234.10	409.37	677.42	1078.80	1910.33	
7 - Damm	17.201633	1.56	3.68	5.26	19.99	47.19	114.52	202.82	339.28	546.21	979.56	
8 - Dry Creek-Shell Creek	11.229728	1.07	2.54	3.65	14.04	33.41	81.77	145.68	244.95	396.36	715.08	Partial area, HUC 12 clipped to watershed boundary
9 - Fourmile Creek-Laramie River	48.206268	3.89	8.98	12.73	46.96	108.73	258.49	451.23	745.55	1185.51	2095.62	
10 - Gates Creek	27.215424	2.35	5.47	7.80	29.24	68.43	164.55	289.55	481.71	771.24	1374.28	
11 - Gillespie Reservoir	15.371825	1.41	3.34	4.78	18.21	43.08	104.78	185.87	311.35	501.91	901.54	
12 - Harney Creek-Laramie River	62.759869	4.91	11.28	15.97	58.44	134.63	318.39	553.74	912.05	1445.67	2546.07	
13 - James Lake	16.308859	1.49	3.51	5.02	19.12	45.19	109.80	194.60	325.75	524.75	941.78	
14 - Johnson Creek	1.941804	0.23	0.56	0.81	3.28	8.06	20.44	37.32	64.09	105.91	195.83	Partial area, HUC 12 clipped to watershed boundary
15 - Lake Hattie	49.446084	3.98	9.18	13.01	47.96	110.99	263.72	460.20	760.16	1208.37	2135.26	
16 - Laramie River-Bear Creek	49.062507	3.95	9.11	12.93	47.65	110.29	262.11	457.43	755.65	1201.31	2123.02	
17 - Laramie River-Bosler Junction	48.948933	3.94	9.10	12.90	47.56	110.08	261.63	456.61	754.31	1199.22	2119.39	
18 - Laramie River-Dunn Ditch	83.798758	6.35	14.49	20.46	74.27	170.15	400.08	693.01	1137.47	1796.74	3151.60	
19 - Laramie River-Laramie	44.250964	3.61	8.34	11.83	43.75	101.44	241.58	422.22	698.35	1111.59	1967.31	
20 - Laramie River-Soap Holes	67.418774	5.23	12.00	16.98	62.02	142.67	336.92	585.38	963.33	1525.65	2684.24	
21 - Laramie River-Sodergreen Lake	60.773886	4.77	10.97	15.53	56.91	131.17	310.40	540.09	889.91	1411.13	2486.36	
22 - Laramie River-Stuck Creek	0.57984	0.08	0.20	0.29	1.20	3.03	7.87	14.61	25.45	42.68	80.26	
23 - Laramie River-West Laramie	41.925621	3.44	7.95	11.30	41.83	97.10	231.50	404.90	670.13	1067.37	1890.48	
24 - Libby Creek	59.789376	4.71	10.82	15.32	56.14	129.45	306.42	533.29	878.88	1393.90	2456.57	
25 - Lindsey Creek	34.076957	2.86	6.65	9.46	35.23	82.09	196.53	344.74	571.99	913.32	1622.32	
26 - Little Laramie River-Cenntenial Valley	22.810013	2.01	4.70	6.70	25.26	59.31	143.12	252.47	420.92	675.34	1206.36	
27 - Little Laramie River-Middle Fork Little Laramie River	41.003349	3.37	7.80	11.08	41.07	95.37	227.46	397.97	658.84	1049.67	1859.70	
28 - Little Laramie River-Sprague River	55.191541	4.38	10.09	14.30	52.54	121.32	287.65	501.18	826.76	1312.50	2315.70	
29 - Little Laramie River-Webb Lake	42.744695	3.50	8.09	11.49	42.51	98.64	235.06	411.03	680.11	1083.01	1917.66	
30 - Lone Tree Creek	40.786472	3.35	7.77	11.03	40.89	94.96	226.51	396.34	656.18	1045.49	1852.43	
31 - Long Lake	17.849581	1.61	3.80	5.43	20.61	48.62	117.92	208.72	349.00	561.61	1006.66	
32 - Lower Dutton Creek	39.513682	3.26	7.56	10.74	39.83	92.55	220.91	386.71	640.48	1020.86	1809.59	

Peak flows in cfs for various return periods												
HUC12 Basin Name	**A (mi2)**	**1.5 yr**	**2 yr**	**2.33 yr**	**5 yr**	**10 yr**	**25 yr**	**50 yr**	**100 yr**	**200 yr**	**500 yr**	**NOTES**
33 - Mill Creek-Little Laramie River	32.365563	2.73	6.36	9.05	33.75	78.74	188.69	331.23	549.91	878.60	1561.79	
34 - Oasis Ditch	41.332035	3.39	7.86	11.16	41.34	95.99	228.90	400.45	662.87	1055.99	1870.69	
35 - Oasis Ditch-Laramie River	26.033251	2.25	5.26	7.51	28.18	66.01	158.87	279.74	465.64	745.91	1329.97	
36 - Rogers Canyon	37.522359	3.12	7.23	10.27	38.15	88.76	212.07	371.50	615.67	981.92	1741.84	
37 - Sand Creek-Shell Creek	24.562149	2.14	5.01	7.14	26.85	62.97	151.74	267.39	445.40	713.99	1274.08	Partial area, HUC 12 clipped to watershed boundary
38 - Sevenmile Creek-Laramie River	28.403713	2.44	5.68	8.09	30.29	70.84	170.20	299.31	497.70	796.43	1418.31	
39 - Sevenmile Lakes	45.696824	3.71	8.57	12.16	44.93	104.12	247.80	432.89	715.72	1138.79	2014.55	
40 - Shell Creek	38.494575	3.19	7.39	10.50	38.97	90.61	216.40	378.94	627.82	1000.99	1775.03	Partial area, HUC 12 clipped to watershed boundary
41 - Soldier Creek-Laramie River	16.863106	1.54	3.61	5.17	19.66	46.43	112.74	199.71	334.17	538.11	965.30	
42 - South Fork Little Laramie River	37.04361	3.08	7.15	10.16	37.75	87.84	209.93	367.81	609.66	972.49	1725.41	
43 - Spring Creek-Laramie River	31.949027	2.70	6.29	8.95	33.39	77.92	186.77	327.92	544.49	870.09	1546.93	
44 - Squirrel Creek-Laramie River	37.485174	3.11	7.22	10.26	38.12	88.68	211.90	371.21	615.20	981.19	1740.56	
45 - Table Mountain	5.373784	0.56	1.34	1.94	7.62	18.39	45.68	82.22	139.48	227.71	415.08	
46 - The Big Hollow	36.184646	3.02	7.00	9.96	37.02	86.18	206.07	361.18	598.82	955.48	1695.79	
47 - Upper Dutton Creek	27.316319	2.35	5.49	7.82	29.33	68.63	165.03	290.38	483.07	773.39	1378.04	
48 - Wallrock Creek	27.98541	2.40	5.61	7.99	29.92	69.99	168.21	295.89	492.09	787.60	1402.87	
49 - Wheatland Reservoir #2	45.362705	3.69	8.52	12.09	44.65	103.50	246.36	430.43	711.71	1132.53	2003.66	
50 - Wheatland Reservoir #3	48.741215	3.93	9.06	12.86	47.39	109.70	260.75	455.11	751.87	1195.39	2112.75	
51 - Willow Creek-Laramie River	59.924372	4.72	10.84	15.35	56.25	129.68	306.97	534.23	880.39	1396.27	2460.67	

APPENDIX 3H

HYDROLOGY: MEAN ANNUAL RUNOFF ESTIMATES (LOWHAM)

Label	Lowham Hydrologic Region	Area_SqMi	Mean Annual Precipitation (In)	Annual Runoff CFS (Spread Calc)	Cfs per Sq mile	Acre-Ft/year	Acre-Ft/year/sq mile	Notes
1 - Antelope Creek-Shell Creek	High Desert Region	34.676173	13.781819	1.079497153	0.031130804	788.0329217	22.72548709	Partial watershed area, clipped to watershed boundary
2 - Bamforth Lake	High Desert Region	29.43633	12.054968	0.796937993	0.02707328	581.764735	19.76349412	
4 - Browns Creek	High Desert Region	41.966318	12.435913	1.129896052	0.026923879	824.8241181	19.6544314	
5 - Cooper Creek	High Desert Region	61.081167	15.271741	2.007451753	0.032865314	1465.439779	23.99167945	
6 - Cooper Lake	High Desert Region	42.52346	13.312764	1.239628794	0.029151645	904.9290194	21.28070057	
7 - Damm	High Desert Region	17.201633	14.855519	0.636893956	0.037025203	464.9325881	27.0283983	
8 - Dry Creek-Shell Creek	High Desert Region	11.229728	13.474811	0.389651377	0.034698203	284.4455053	25.32968789	Partial watershed area, clipped to watershed boundary
9 - Fourmile Creek-Laramie River	High Desert Region	48.206268	18.526546	2.051283991	0.042552226	1497.437313	31.06312468	
10 - Gates Creek	High Desert Region	27.215424	13.590165	0.857815749	0.03151947	626.2054964	23.00921332	
11 - Gillespie Reservoir	High Desert Region	15.371825	13.451975	0.512617084	0.033347835	374.2104713	24.34391956	
12 - Harney Creek-Laramie River	High Desert Region	62.759869	14.66363	1.958875603	0.031212232	1429.97919	22.78492949	
13 - James Lake	High Desert Region	16.308859	13.062999	0.52148652	0.031975659	380.6851596	23.34223134	
15 - Lake Hattie	High Desert Region	49.446084	15.375127	1.680233486	0.033981123	1226.570445	24.80622015	
17 - Laramie River-Bosler Junction	High Desert Region	48.948933	12.954141	1.358187078	0.027747021	991.476567	20.25532542	
18 - Laramie River-Dunn Ditch	High Desert Region	83.798758	13.301149	2.249554221	0.02684472	1642.174581	19.59664583	
19 - Laramie River-Laramie	High Desert Region	44.250964	12.194219	1.156523738	0.02613556	844.2623286	19.07895902	
20 - Laramie River-Soap Holes	High Desert Region	67.418774	12.360007	1.702349456	0.025250377	1242.715103	18.43277516	
21 - Laramie River-Sodergreen Lake	High Desert Region	60.773886	13.117172	1.667708394	0.027441201	1217.427127	20.0320764	
22 - Laramie River-Stuck Creek	High Desert Region	0.57984	16.964536	0.037764649	0.06512943	27.56819353	47.54448387	
23 - Laramie River-West Laramie	High Desert Region	41.925621	12.006227	1.082667383	0.025823526	790.3471894	18.85117431	
25 - Lindsey Creek	High Desert Region	34.076957	14.445362	1.124246737	0.032991406	820.7001177	24.08372666	
28 - Little Laramie River-Sprague River	High Desert Region	55.191541	13.212094	1.545337636	0.027999538	1128.096474	20.43966256	
29 - Little Laramie River-Webb Lake	High Desert Region	42.744695	13.885638	1.309329639	0.030631395	955.8106364	22.36091839	
30 - Lone Tree Creek	High Desert Region	40.786472	14.814103	1.356991655	0.033270631	990.6039081	24.28756055	
31 - Long Lake	High Desert Region	17.849581	13.207685	0.572052297	0.0320485	417.5981767	23.395405	
32 - Lower Dutton Creek	High Desert Region	39.513682	14.34989	1.27059428	0.032155806	927.5338241	23.47373814	
33 - Mill Creek-Little Laramie River	High Desert Region	32.365563	25.117415	2.075212912	0.06411793	1514.905426	46.8060891	
34 - Oasis Ditch	High Desert Region	41.332035	12.721778	1.145416845	0.027712568	836.1542968	20.23017489	
35 - Oasis Ditch-Laramie River	High Desert Region	26.033251	13.098905	0.789575988	0.030329519	576.3904716	22.14054908	
36 - Rogers Canyon	High Desert Region	37.522359	13.745441	1.153462394	0.030740668	842.0275474	22.44068789	
37 - Sand Creek-Shell Creek	High Desert Region	24.562149	13.438708	0.773391044	0.031487108	564.5754625	22.98558902	Partial watershed area, clipped to watershed boundary
38 - Sevenmile Creek-Laramie River	High Desert Region	28.403713	20.543318	1.45635549	0.051273419	1063.139508	37.42959619	
39 - Sevenmile Lakes	High Desert Region	45.696824	12.626464	1.240064475	0.027136776	905.2470665	19.80984645	
40 - Shell Creek	High Desert Region	38.494575	13.302487	1.134621382	0.029474839	828.2736092	21.51663213	Partial watershed area, clipped to watershed boundary
41 - Soldier Creek-Laramie River	High Desert Region	16.863106	14.439575	0.605053957	0.035880339	441.6893883	26.19264732	
43 - Spring Creek-Laramie River	High Desert Region	31.949027	14.826543	1.095669311	0.034294294	799.838597	25.0348343	
45 - Table Mountain	High Desert Region	5.373784	13.097724	0.196937726	0.036647868	143.76454	26.75294356	
46 - The Big Hollow	High Desert Region	36.184646	12.09481	0.959430617	0.026514854	700.3843505	19.35584365	
47 - Upper Dutton Creek	High Desert Region	27.316319	19.992648	1.362405819	0.049875161	994.5562477	36.40886782	
48 - Wallrock Creek	High Desert Region	27.98541	13.502881	0.872422046	0.031174174	636.8680937	22.75714716	
49 - Wheatland Reservoir #2	High Desert Region	45.362705	13.346582	1.316148023	0.029013879	960.7880565	21.18013149	
50 - Wheatland Reservoir #3	High Desert Region	48.741215	13.265991	1.391965029	0.028558275	1016.134471	20.84754086	
51 - Willow Creek-Laramie River	High Desert Region	59.924372	14.890677	1.915484114	0.031965026	1398.303404	23.33446905	

3 - Boswell Creek	Mountainous Region	18.540582	18.198042	12.44896792	0.67144429	9087.746582	490.1543318	Partial watershed area, clipped to watershed boundary
14 - Johnson Creek	Mountainous Region	1.941804	16.44871	1.321426168	0.680514701	964.6411029	496.7757317	Partial watershed area, clipped to watershed boundary
16 - Laramie River-Bear Creek	Mountainous Region	49.062507	16.900127	27.68364436	0.564252543	20209.06038	411.9043567	
24 - Libby Creek	Mountainous Region	59.789376	31.406709	80.7134233	1.34996263	58920.79901	985.4727202	
26 - Little Laramie River-Cenntenial Valley	Mountainous Region	22.810013	17.781782	14.60376213	0.640234713	10660.74636	467.3713407	
27 - Little Laramie River-Middle Fork Little Laramie River	Mountainous Region	41.003349	27.660763	47.39484109	1.155877318	34598.234	843.7904425	
42 - South Fork Little Laramie River	Mountainous Region	37.04361	22.374421	31.84137447	0.859564564	23244.20336	627.4821315	
44 - Squirrel Creek-Laramie River	Mountainous Region	37.485174	19.182412	25.83356325	0.689167489	18858.50117	503.0922672	

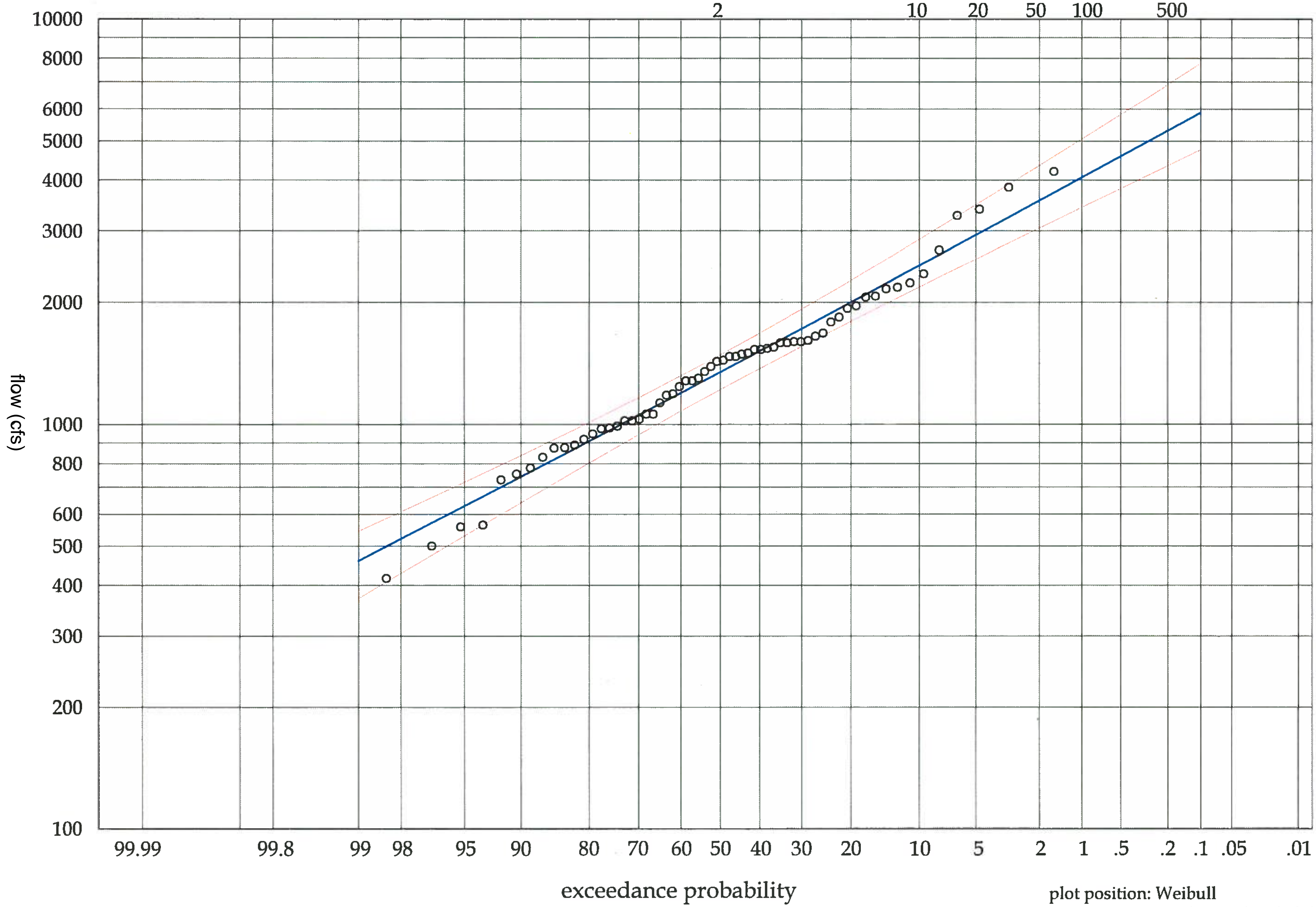
APPENDIX 3I

HYDROLOGY: PEAK FLOW ANALYSIS

USGS 06658500 LARAMIE RIVER NEAR JELM, WY

recurrence (years)	Q (cfs)	Q_5 (cfs)	Q_{95} (cfs)
1000	5,885	7,773	4,762
500	5,309	6,897	4,348
200	4,586	5,821	3,819
100	4,066	5,065	3,431
50	3,566	4,355	3,051
25	3,084	3,687	2,678
20	2,932	3,481	2,558
10	2,466	2,860	2,184
5	2,001	2,267	1,799
3.333	1,723	1,926	1,559
2.5	1,517	1,681	1,375
2	1,347	1,487	1,220
1.667	1,197	1,320	1,079
1.429	1,055	1,166	943
1.250	910	1,013	804
1.111	743	838	641
1.053	629	720	530
1.020	521	608	428
1.010	460	544	371

USGS 06658500 LARAMIE RIVER NEAR JELM, WY



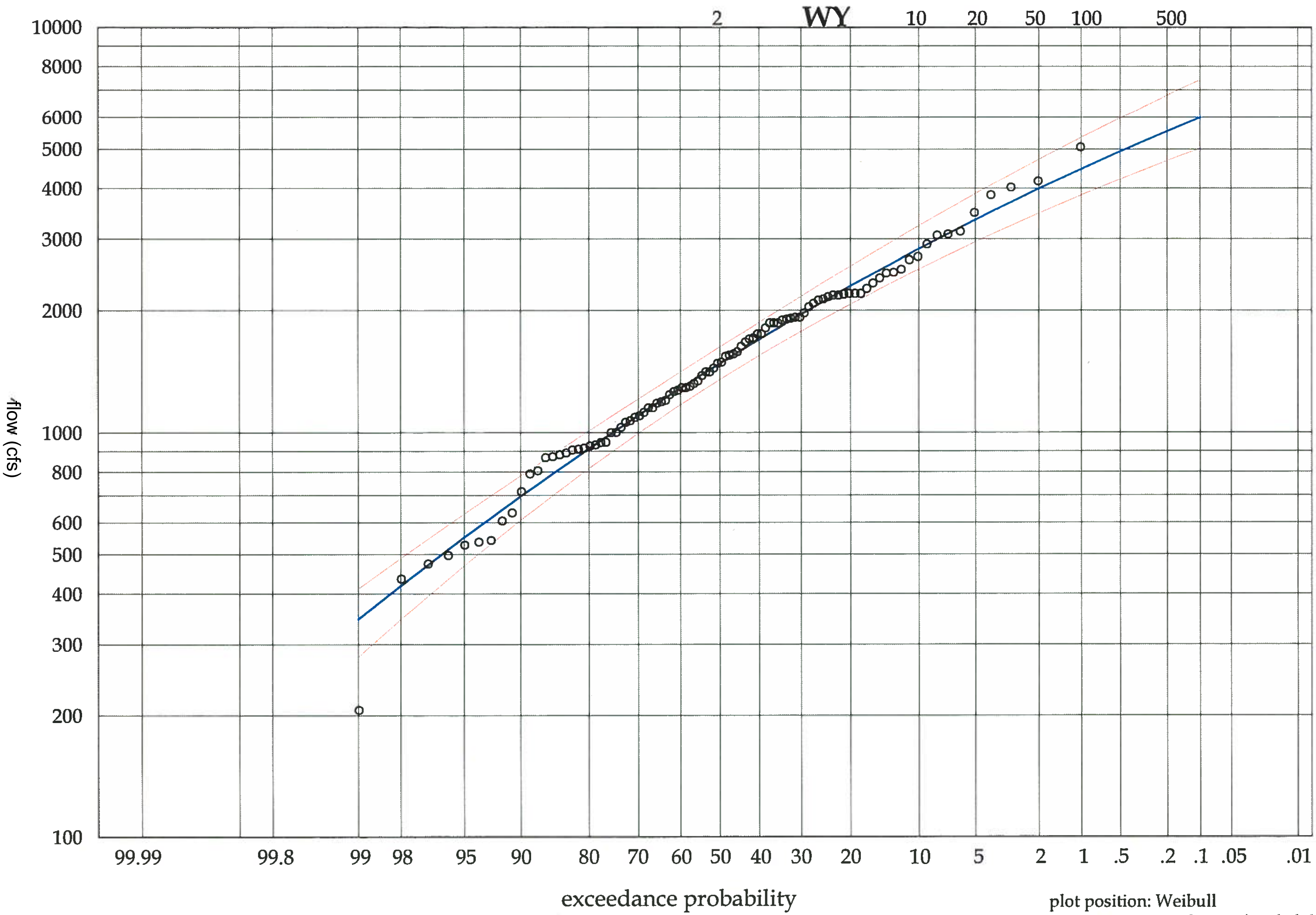
plot position: Weibull
recurrence interval = 100/probability

plot date: 9/26/2016
file: 06658500 Flood Frequency.xlsm

USGS 06659500 LARAMIE R AND PIONEER CANAL NR WOODS LANI

recurrence (years)	Q (cfs)	Q_5 (cfs)	Q_{95} (cfs)
1000	5,991	7,426	5,034
500	5,542	6,805	4,689
200	4,937	5,981	4,220
100	4,471	5,355	3,855
50	3,995	4,726	3,477
25	3,508	4,091	3,084
20	3,348	3,886	2,954
10	2,837	3,240	2,533
5	2,297	2,576	2,075
3.333	1,958	2,172	1,780
2.5	1,699	1,872	1,550
2	1,482	1,626	1,352
1.667	1,288	1,411	1,171
1.429	1,103	1,211	996
1.250	914	1,010	816
1.111	696	782	607
1.053	551	629	469
1.020	418	489	345
1.010	346	412	279

USGS 06659500 LARAMIE R AND PIONEER CANAL NR WOODS LANDING



31-4

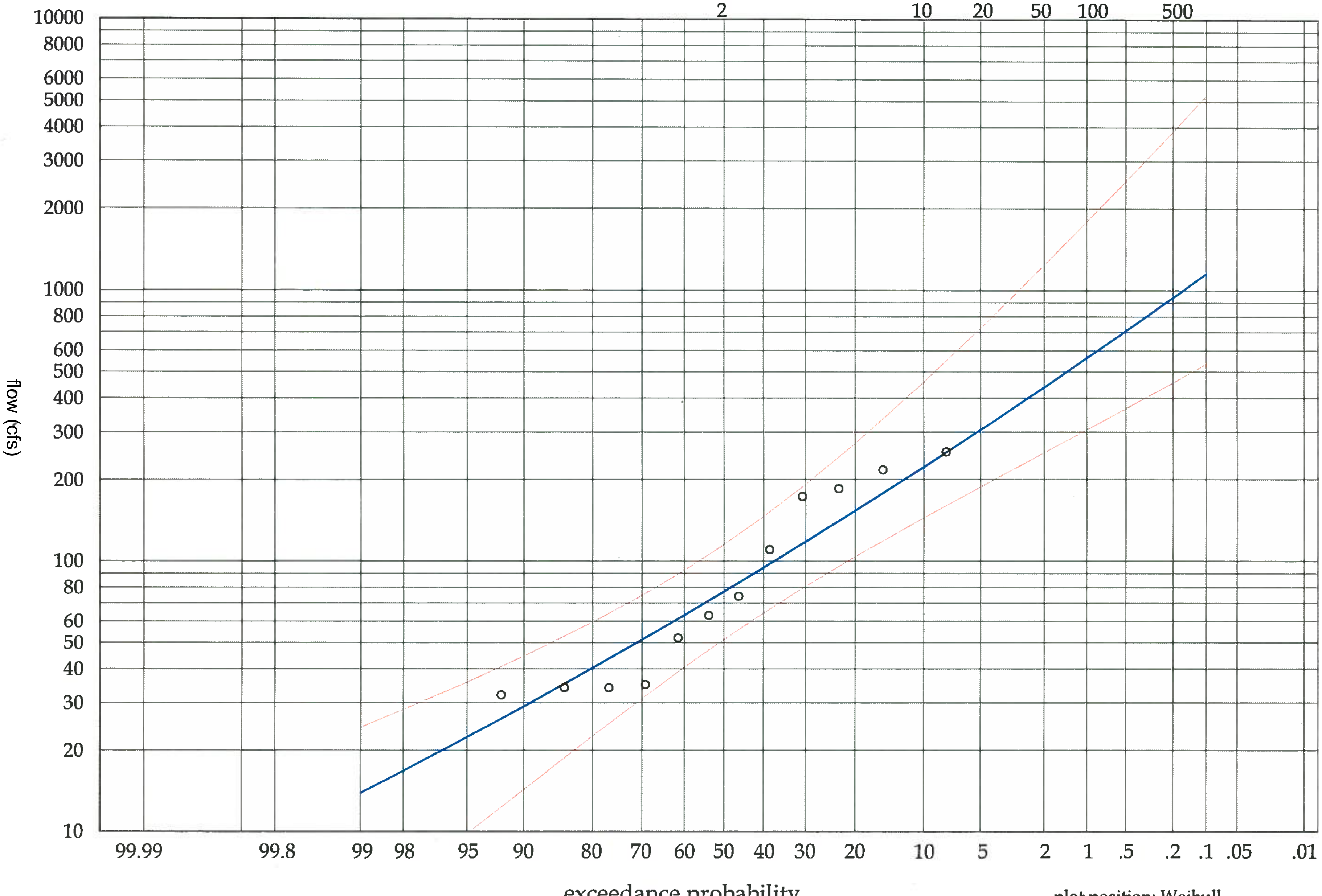
plot position: Weibull
recurrence interval = 100/probability

plot date: 9/26/2016
file: 06659500 Flood Frequency.xlsm

USGS 06659600 SAND CREEK NEAR TIE SIDING, WY

recurrence (years)	Q (cfs)	Q_5 (cfs)	Q_{95} (cfs)
1000	1,148	5,239	533
500	939	3,864	456
200	708	2,522	367
100	562	1,787	307
50	439	1,236	252
25	335	829	203
20	305	723	188
10	223	458	144
5	153	272	104
3.333	118	192	81
2.5	95	146	64
2	77	115	51
1.667	63	93	41
1.429	51	75	31
1.250	40	60	23
1.111	29	45	14
1.053	22	36	10
1.020	17	28	6
1.010	14	24	5

USGS 06659600 SAND CREEK NEAR TIE SIDING, WY



plot position: Weibull
recurrence interval = 100/probability

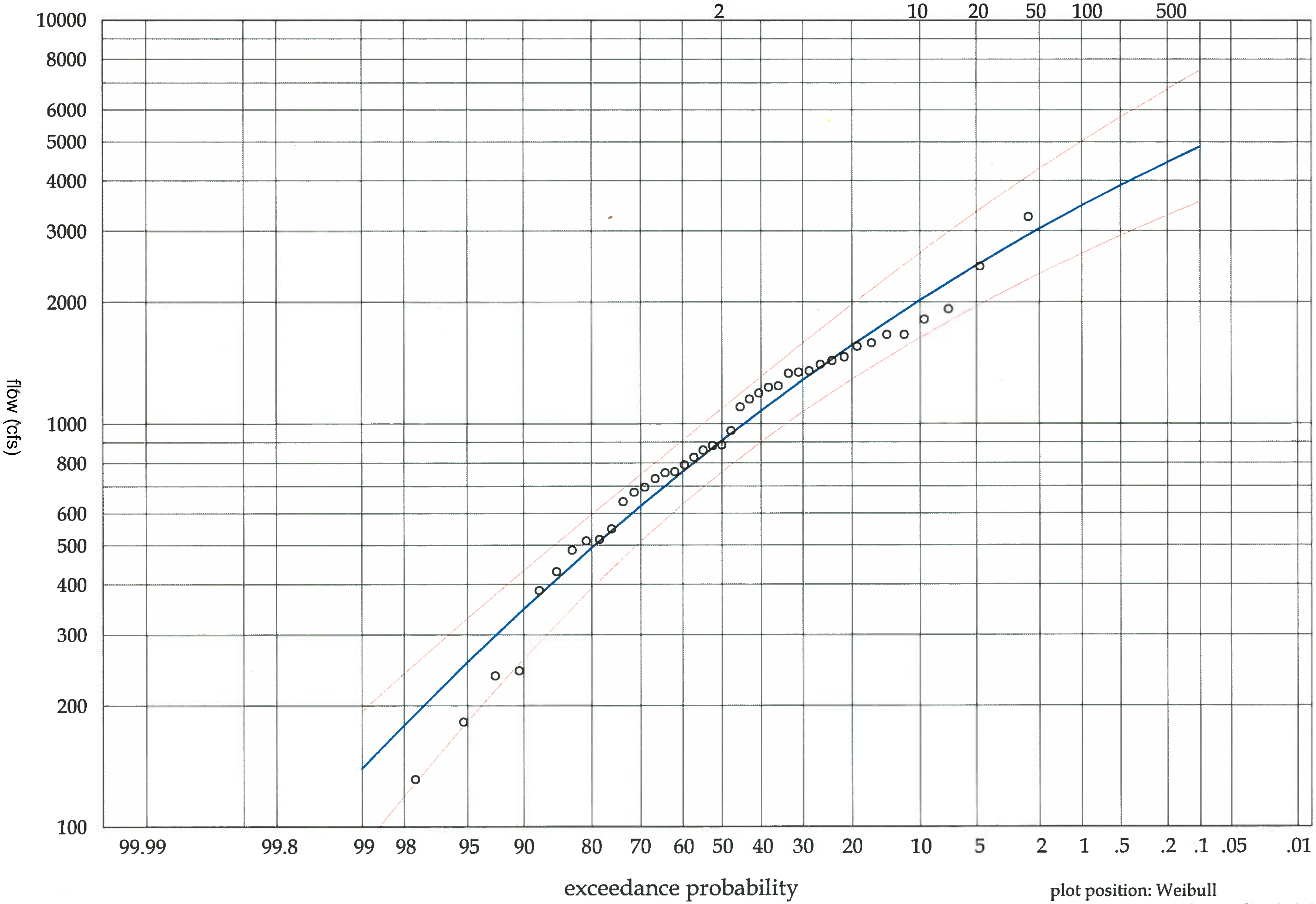
plot date: 9/26/2016
file: 06659600 Flood Frequency.xlsm

31-6

USGS 06660000 LARAMIE RIVER AT LARAMIE, WY

recurrence (years)	Q (cfs)	Q_5 (cfs)	Q_{95} (cfs)
1000	4,865	7,522	3,551
500	4,452	6,761	3,287
200	3,898	5,767	2,928
100	3,473	5,025	2,646
50	3,044	4,295	2,356
25	2,609	3,578	2,055
20	2,467	3,351	1,955
10	2,022	2,655	1,634
5	1,563	1,975	1,290
3.333	1,284	1,584	1,070
2.5	1,077	1,307	902
2	908	1,091	759
1.667	761	909	631
1.429	625	748	511
1.250	492	595	391
1.111	347	432	262
1.053	256	329	183
1.020	179	240	119
1.010	139	194	88

USGS 06660000 LARAMIE RIVER AT LARAMIE, WY



31-8

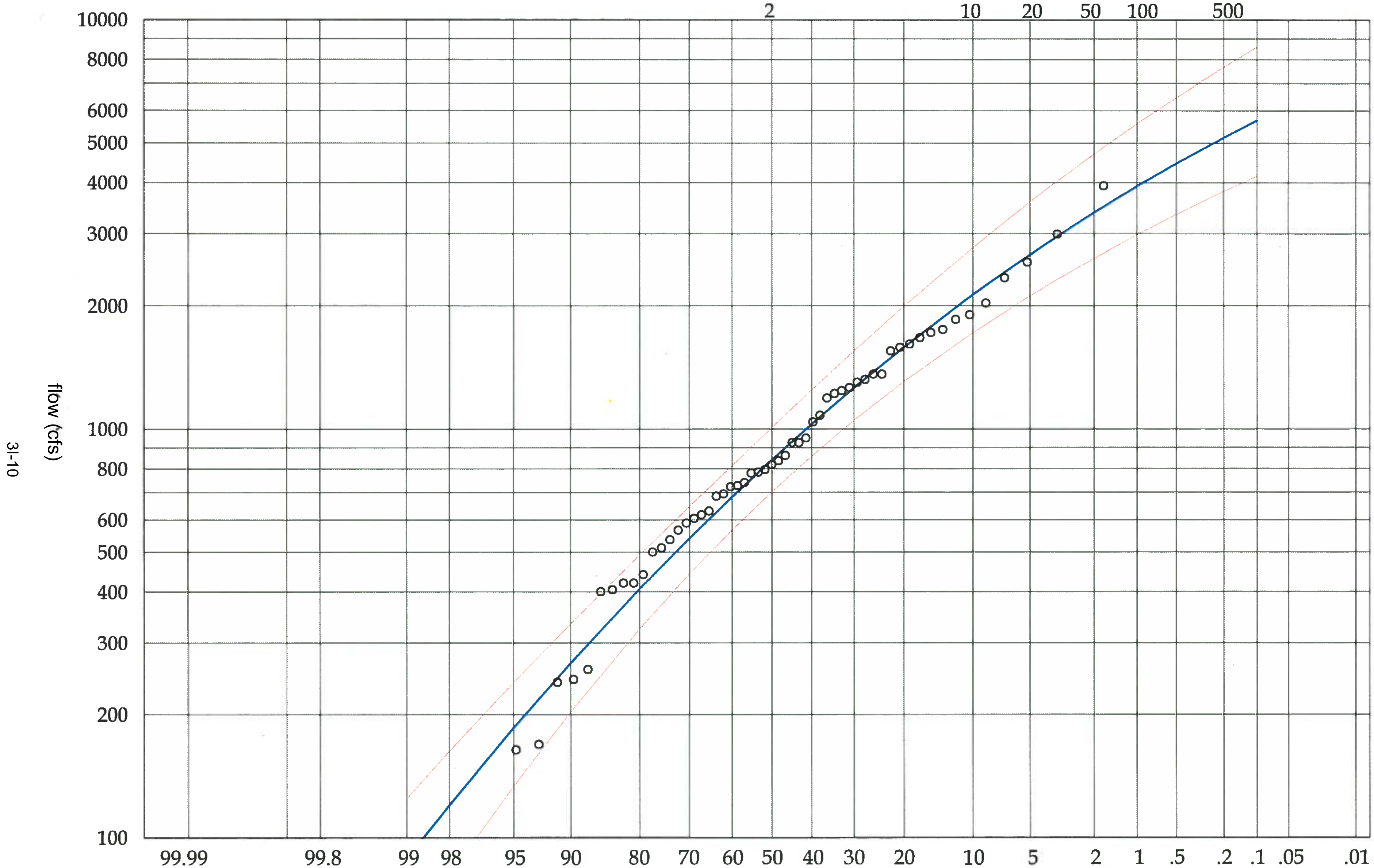
plot position: Weibull
recurrence interval = 100/probability

plot date: 9/26/2016
file: 06660000 Flood Frequency.xlsm

USGS 06660500 LARAMIE RIVER AT TWO RIVERS, WYO.

recurrence (years)	Q (cfs)	Q_5 (cfs)	Q_{95} (cfs)
1000	5,691	8,590	4,158
500	5,165	7,675	3,815
200	4,462	6,477	3,350
100	3,926	5,586	2,988
50	3,387	4,712	2,617
25	2,846	3,859	2,237
20	2,672	3,590	2,113
10	2,130	2,774	1,717
5	1,584	1,991	1,304
3.333	1,261	1,550	1,050
2.5	1,027	1,244	859
2	841	1,008	703
1.667	682	815	567
1.429	541	648	443
1.250	407	493	325
1.111	268	334	203
1.053	186	240	134
1.020	120	163	81
1.010	89	125	57

USGS 06660500 LARAMIE RIVER AT TWO RIVERS, WYO.



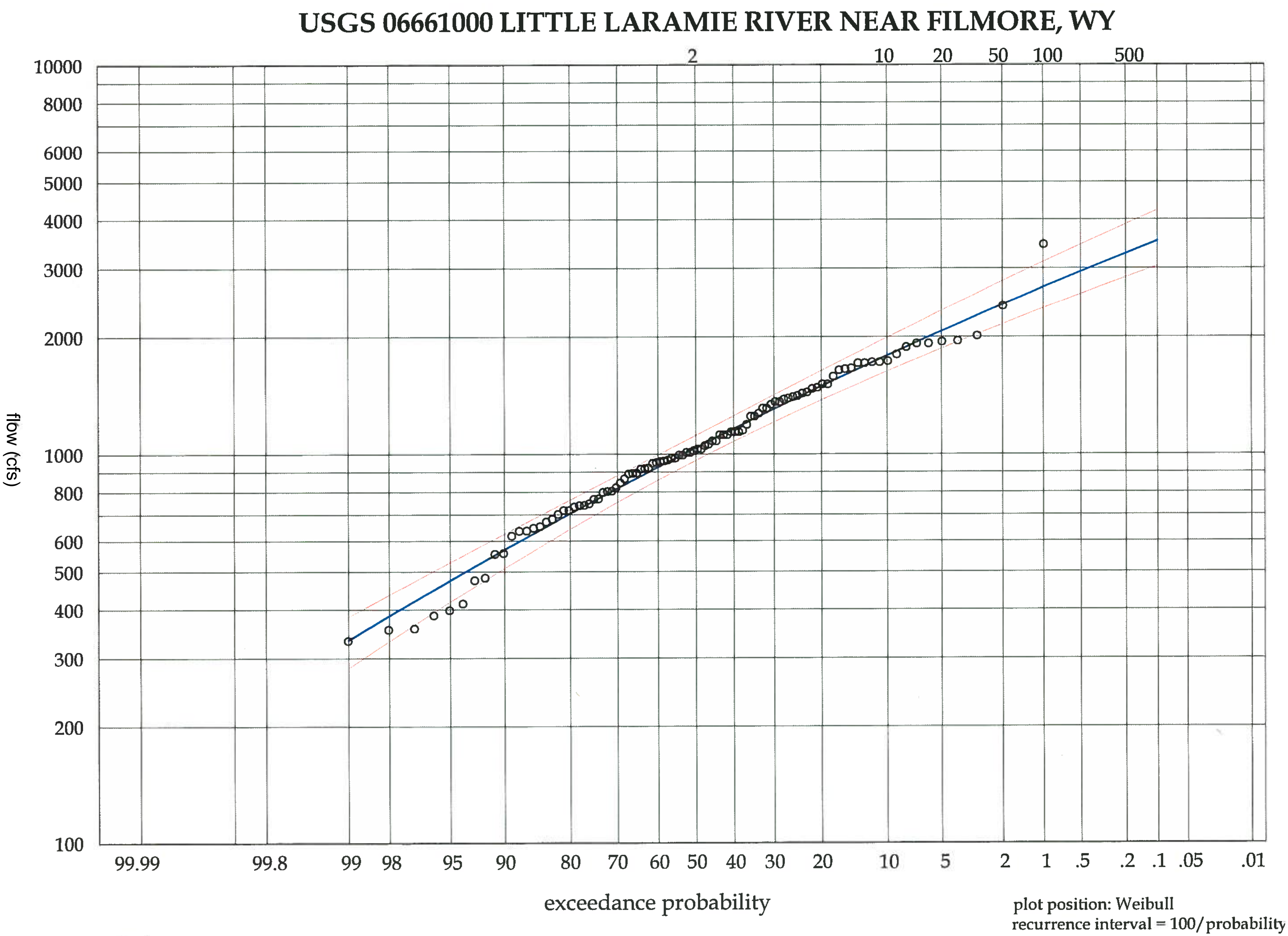
plot position: Weibull
recurrence interval = 100/probability

plot date: 9/26/2016
file: 06660500 Flood Frequency.xlsm

31-10

USGS 06661000 LITTLE LARAMIE RIVER NEAR FILMORE, WY

recurrence (years)	Q (cfs)	Q_5 (cfs)	Q_{95} (cfs)
1000	3,524	4,226	3,041
500	3,273	3,891	2,844
200	2,938	3,449	2,578
100	2,682	3,116	2,372
50	2,422	2,782	2,160
25	2,157	2,446	1,941
20	2,070	2,337	1,869
10	1,791	1,995	1,634
5	1,495	1,639	1,378
3.333	1,307	1,421	1,211
2.5	1,162	1,256	1,079
2	1,039	1,119	965
1.667	927	998	858
1.429	818	882	754
1.250	704	764	643
1.111	569	625	510
1.053	475	528	418
1.020	385	436	331
1.010	334	383	282



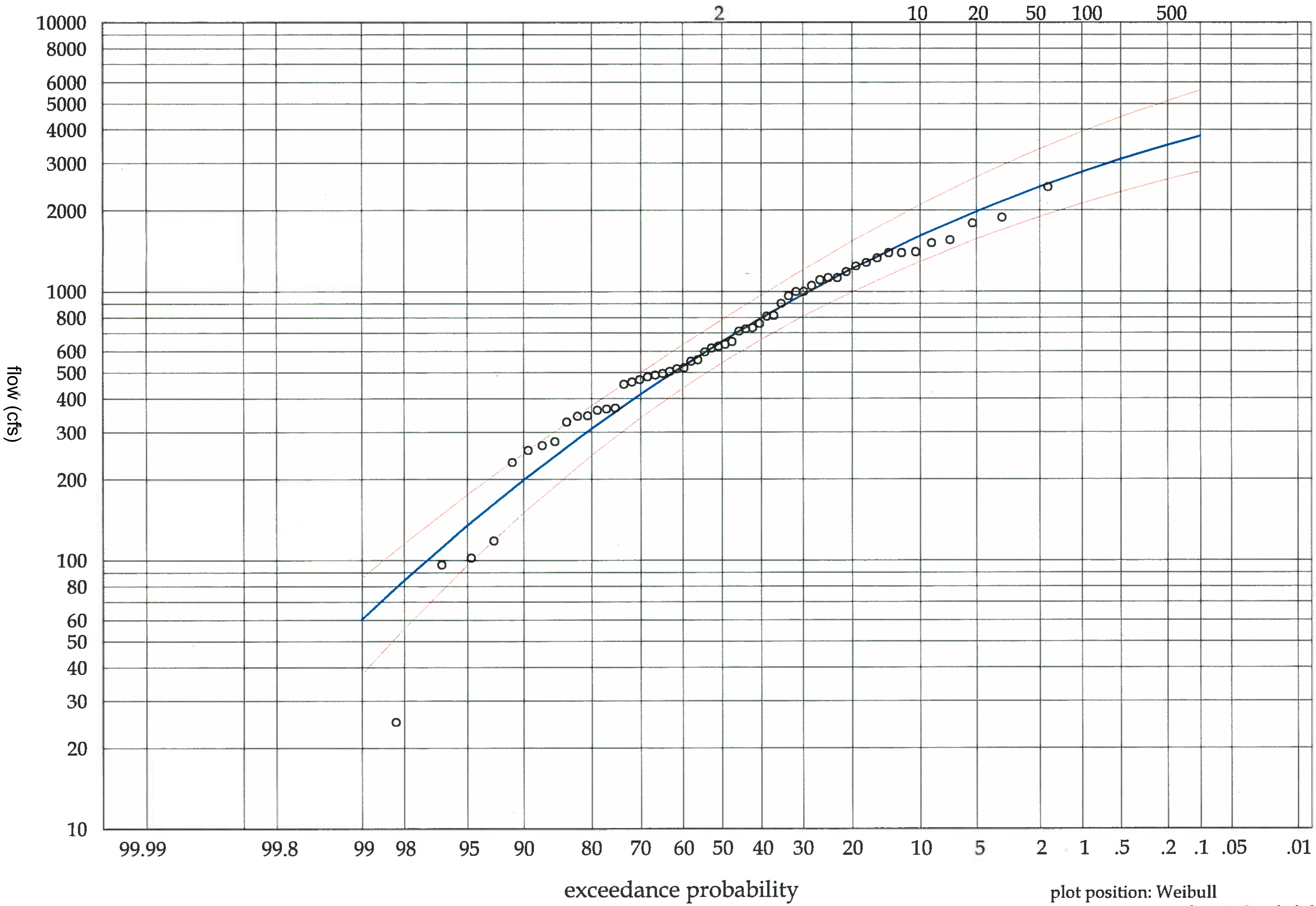
3I-12

plot date: 9/26/2016
file: 06661000 Flood Frequency.xlsm

USGS 06661500 LITTLE LARAMIE RIVER
AT TWO RIVERS, WYO

recurrence (years)	Q (cfs)	Q_5 (cfs)	Q_{95} (cfs)
1000	3,787	5,625	2,799
500	3,502	5,136	2,610
200	3,102	4,463	2,343
100	2,782	3,936	2,125
50	2,447	3,394	1,894
25	2,096	2,842	1,647
20	1,980	2,662	1,563
10	1,607	2,100	1,292
5	1,214	1,535	996
3.333	974	1,204	807
2.5	796	969	663
2	652	785	543
1.667	528	633	437
1.429	416	500	340
1.250	310	377	246
1.111	199	250	150
1.053	135	176	96
1.020	84	116	56
1.010	60	86	38

USGS 06661500 LITTLE LARAMIE RIVER AT TWO RIVERS, WYO.



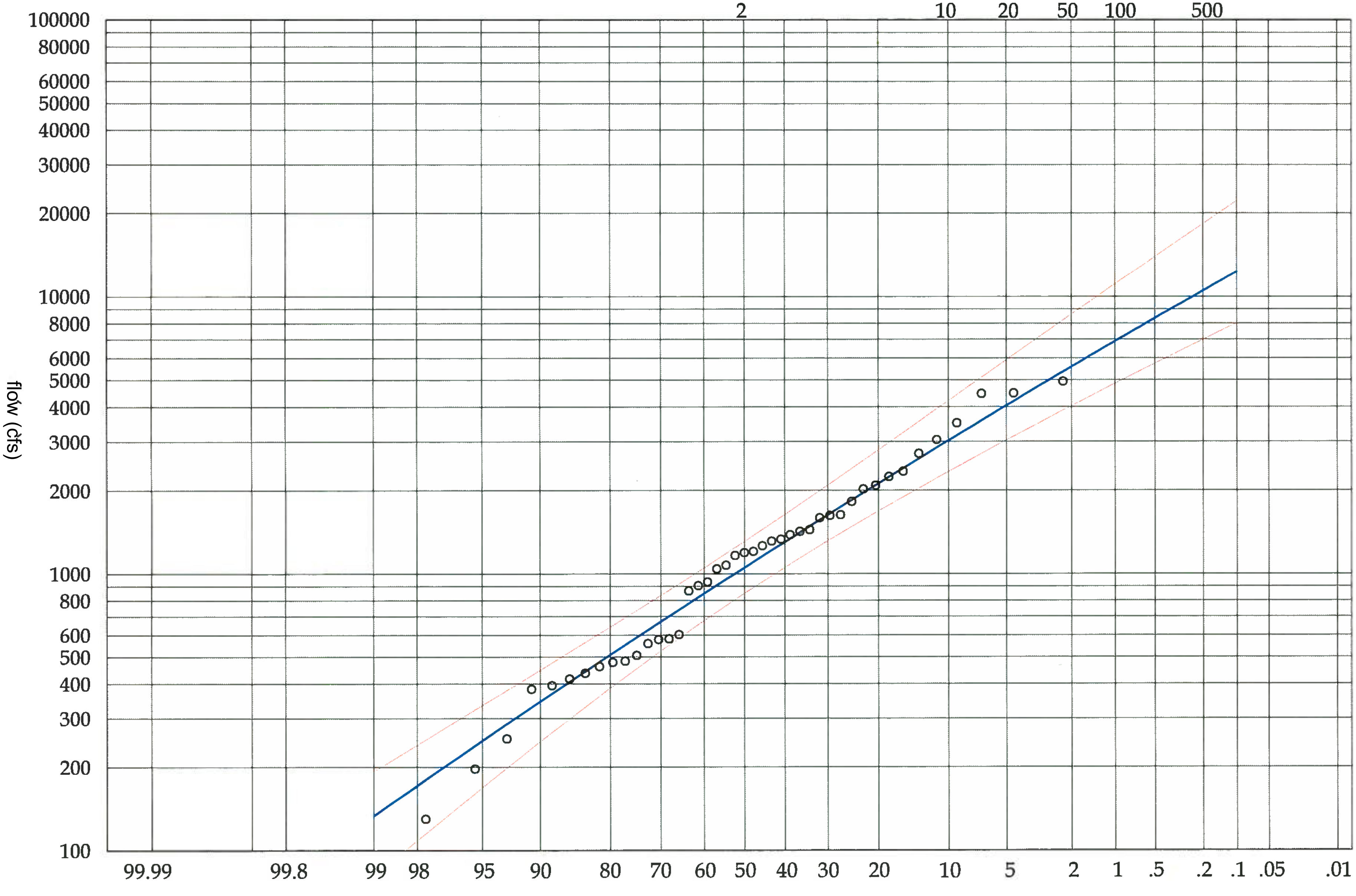
plot position: Weibull
recurrence interval = 100/probability

plot date: 9/26/2016
file: 06661500 Flood Frequency.xlsm

USGS 06661585 LARAMIE RIVER NEAR BOSLER, WY

recurrence (years)	Q (cfs)	Q_5 (cfs)	Q_{95} (cfs)
1000	12,309	22,205	8,046
500	10,501	18,352	7,011
200	8,353	13,953	5,746
100	6,899	11,107	4,863
50	5,586	8,642	4,040
25	4,405	6,526	3,274
20	4,051	5,914	3,039
10	3,031	4,216	2,341
5	2,121	2,800	1,685
3.333	1,633	2,091	1,314
2.5	1,303	1,636	1,053
2	1,052	1,307	848
1.667	848	1,049	676
1.429	671	834	526
1.250	509	641	386
1.111	345	448	247
1.053	249	334	169
1.020	172	241	109
1.010	134	193	81

USGS 06661585 LARAMIE RIVER NEAR BOSLER, WY



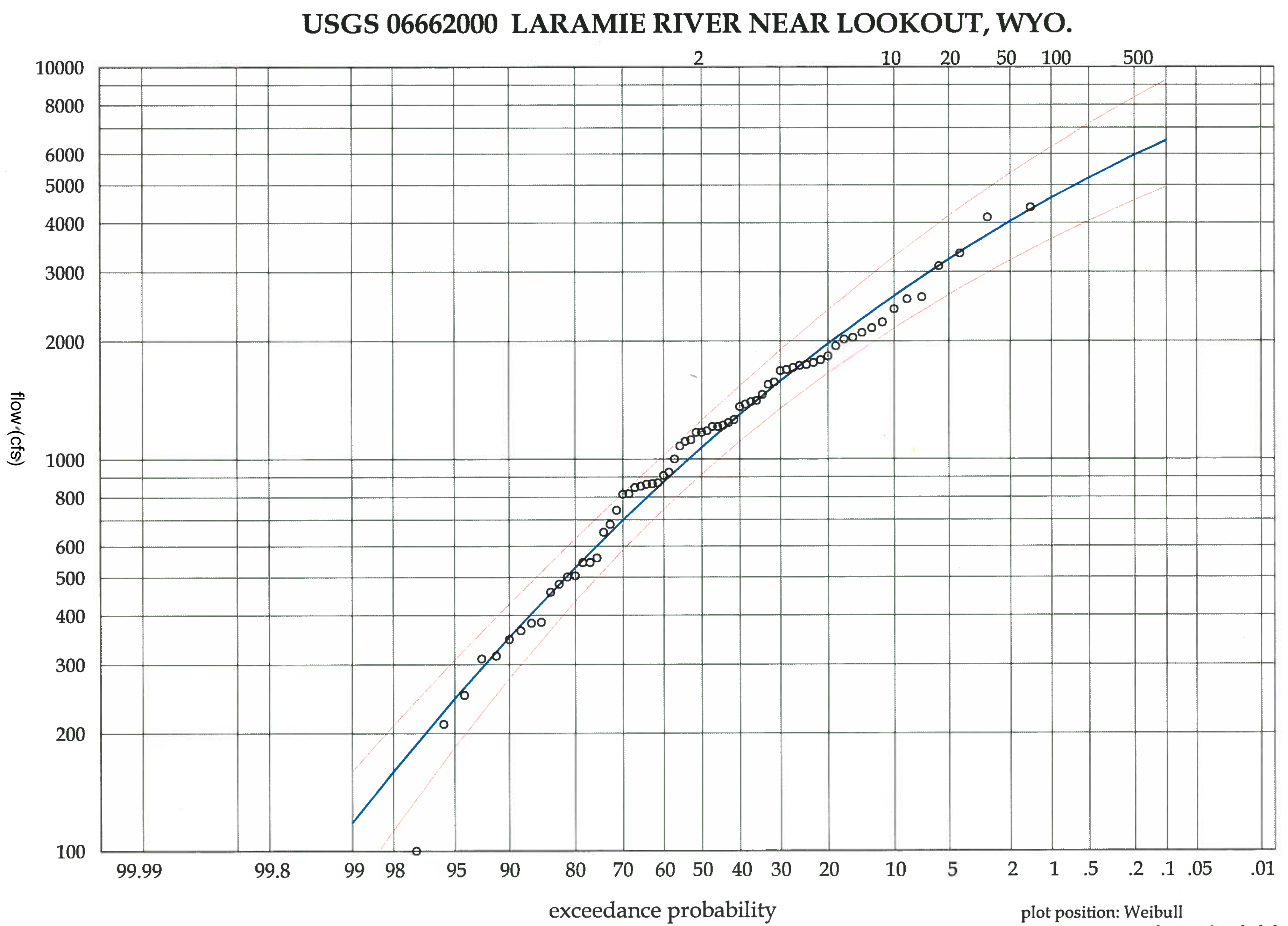
31-16

plot position: Weibull
recurrence interval = 100/probability

plot date: 9/26/2016
file: 06661585 Flood Frequency.xlsm

USGS 06662000 LARAMIE RIVER NEAR LOOKOUT, WYO

recurrence (years)	Q (cfs)	Q_5 (cfs)	Q_{95} (cfs)
1000	6,515	9,251	4,951
500	5,964	8,361	4,574
200	5,215	7,174	4,054
100	4,633	6,270	3,644
50	4,039	5,365	3,218
25	3,433	4,464	2,775
20	3,235	4,175	2,629
10	2,611	3,284	2,158
5	1,971	2,406	1,659
3.333	1,584	1,898	1,347
2.5	1,301	1,538	1,111
2	1,072	1,258	916
1.667	876	1,024	745
1.429	699	819	587
1.250	529	627	435
1.111	351	428	276
1.053	245	308	184
1.020	160	209	113
1.010	118	160	80

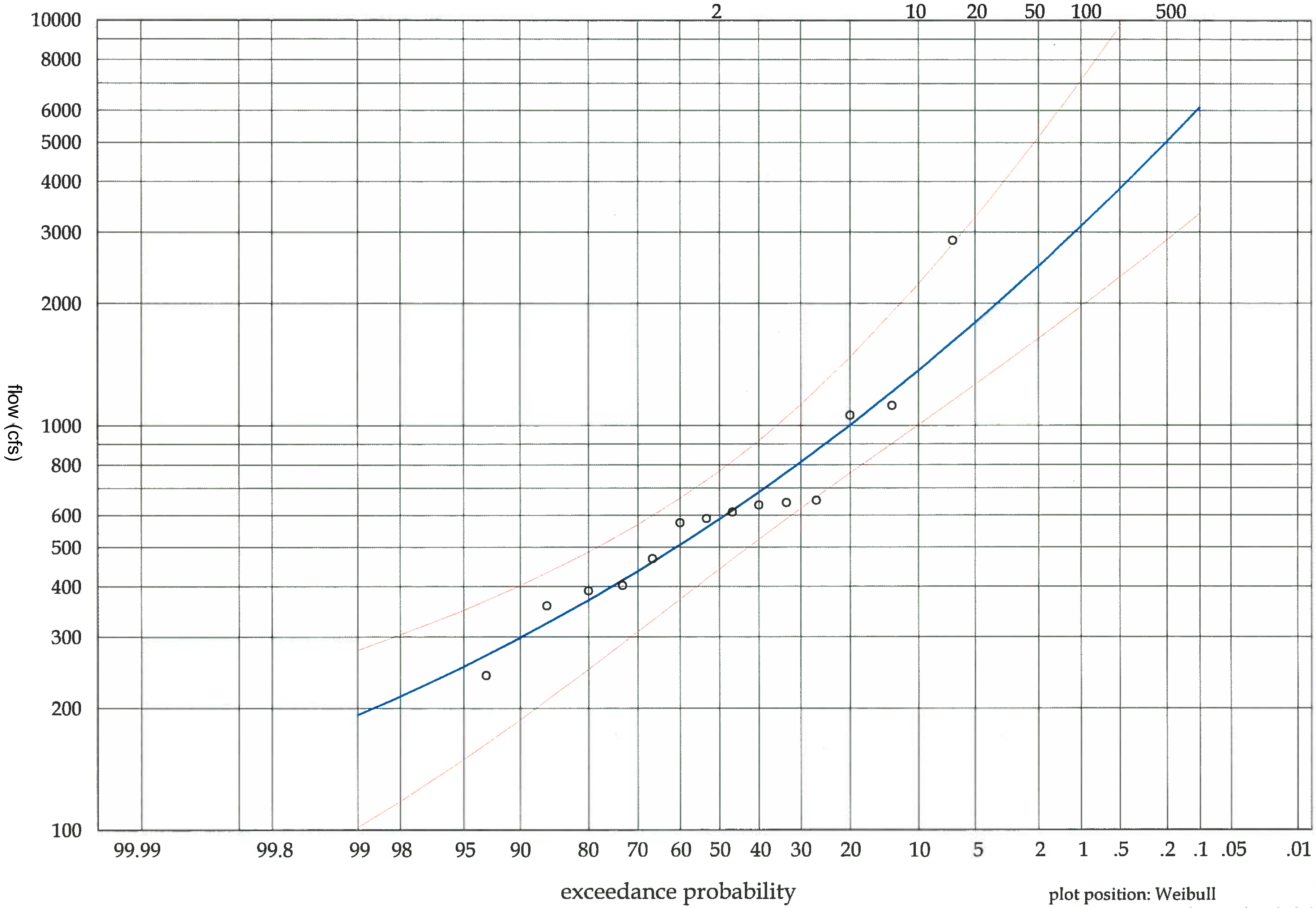


plot date: 9/26/2016
file: 06662000 Flood Frequency.xlsm

USGS 06663500 LARAMIE RIVER BEL WHEATLAND RESERVOIR NO 2, WY

recurrence (years)	Q (cfs)	Q_5 (cfs)	Q_{95} (cfs)
1000	6,112	19,053	3,339
500	5,028	14,339	2,869
200	3,841	9,701	2,325
100	3,100	7,120	1,964
50	2,474	5,147	1,641
25	1,943	3,652	1,350
20	1,791	3,254	1,262
10	1,365	2,230	1,005
5	1,002	1,472	763
3.333	812	1,126	624
2.5	684	917	523
2	587	771	442
1.667	507	661	372
1.429	437	569	309
1.250	370	487	250
1.111	298	402	187
1.053	253	349	149
1.020	214	303	118
1.010	192	278	102

USGS 06663500 LARAMIE RIVER BEL WHEATLAND RESERVOIR NO 2, WY



31-20

plot position: Weibull
recurrence interval = 100/probability

plot date: 9/26/2016
file: 06663500 Flood Frequency.xlsm

APPENDIX 3J

HYDROLOGY: WWDC BASIN PLANNING SPREADSHEET MODEL BACKGROUND

APPENDIX 3J: HYDROLOGY: WWDC BASIN PLANNING SPREADSHEET MODEL BACKGROUND

3J.1 North Platte River Basin Spreadsheet Model

The Upper North Platte River study area lies within the geographic boundaries of the North Platte River Basin Framework Plan, currently being completed on behalf of the WWDC by Wenck Associates (Trihydro, 2006). In conjunction with that project, a basin planning spreadsheet model of the North Platte system is being developed in a manner similar that of other river basin planning studies completed on behalf of the WWDC. At the time this report was prepared, construction of the model was in progress but it was not yet completed and available for use. Consequently, estimation of water physically available and within the constraints of Wyoming water law could not be completed. However, the following brief overview of the spreadsheet model and its usage is included.

The spreadsheet model was originally developed on behalf of the WWDC during the completion of the Bear River Basin and the Upper Green River Basin Studies in 2001). The model consists of an Excel spreadsheet programmed to incorporate multiple diversions, gaging stations, and other water resources data within the basin being studied. One of the primary purposes of the model is to provide a planning tool for river basin water users and the State of Wyoming for use in determining those river reaches in which flows may be available to Wyoming water users for future development. For river basin studies already completed, Individual models have been generated to reflect each of three hydrologic conditions: dry, normal, and wet year water supply.

The spreadsheets each represent one calendar year of streamflow data, on a monthly time step. Each spreadsheet relies on a calibration model that reflects available historical data from a 30 to 40 year period to estimate the hydrologic conditions. Streamflow, consumptive use, diversions, and irrigation return flows are the basic input data to the model. For all of these data, average values drawn from the dry, normal, or wet subset of the study period were computed for use in the spreadsheets. The model does not explicitly account for water rights, reservoir operations, compact allocations, or the management of the basin water supply based on these legal constraints. It is assumed that the historic discharge data reflect effects of any limitations that may have been placed upon water users by water rights or compact restrictions as well as reservoir operations.

To mathematically represent a river system, subbasins are first divided into reaches based primarily upon the location of USGS gaging stations. Each reach was then sub-divided by identifying a series of individual nodes representing locations where diversions occur, basin imports are added, tributaries converge, or other significant water resource features are located.

At each node, a water budget computation is completed to determine the amount of water that flows out of the node. Total flow into the node and diversions or other losses from the node are calculated. The difference between total inflow and diversions/losses is the amount of flow available to the next node downstream. Mass balance, or water budget calculations, are repeated for all nodes in a reach, with the outflow of the last node being the inflow to the beginning node in the next reach. Figure 3.9-1 displays a graphical representation of the water balance approach. For each reach, ungaged stream gains (e.g., ungaged tributaries, groundwater inflow, and return flows from unspecified diversions) and losses (e.g., seepage, evaporation, and unspecified diversions) are taken as the difference between average historical gage flows (or outflows) and model-predicted outflow from the reach. Stream gains are input at the top of a reach to be available for diversion throughout the reach and losses are subtracted at the bottom of each reach.

3J.2 Model Limitations

There are several limitations to the model, which must be considered when reviewing the model and results generated by its use. These limitations and their implications with respect to a determination of water availability are discussed below:

- Use of a monthly time step in the river simulation may result in the exclusion of peak flows on 'flashier' systems. These peaks would be incorporated within the monthly average streamflows within the model; however, in instances where peaks exceed demand, the monthly time step could result in underestimation of available flows.

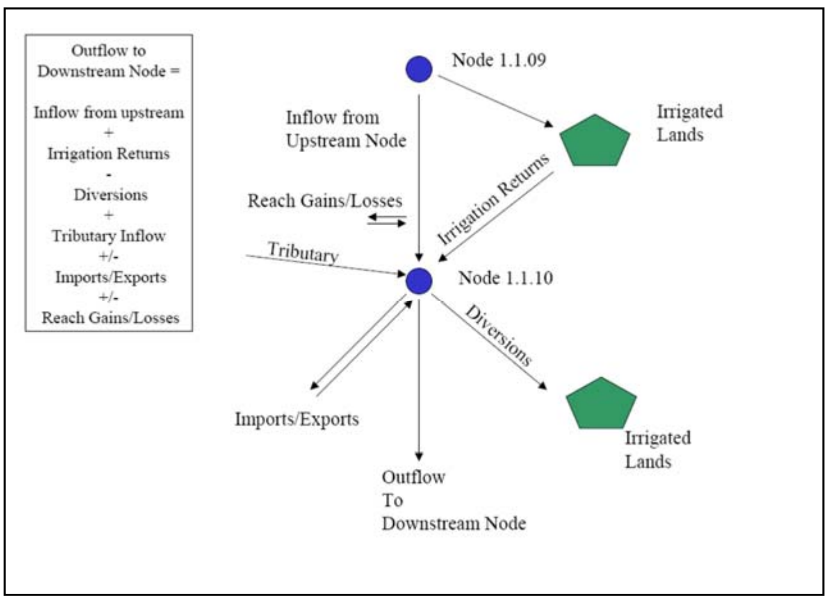


Figure 3.J-1 Diagram of Model Water Budget Computations.

- The spreadsheet model does not explicitly account for diversions from the river in accordance with Wyoming water law and is not operated on these legal principals. Simply stated, this means that the model cannot forego a diversion to an upstream junior water appropriator to satisfy a downstream senior water right.

- The basin planning model was originally developed under the assumption that if this situation occurred historically, the diversion data would reflect this occurrence and the junior appropriator would incur a shortage.
- Models completed to date do not incorporate reservoir operational rules for release or storage of water. Consequently, evaluation of changes in practices that accompany reservoirs is problematic. For each simulation condition (normal-, dry- and wet-year conditions), reservoir releases do not deviate from historic releases.
- The model uses data generated outside of the program in several instances. Consequently, evaluation of different water usage scenarios involving this data is cumbersome. For example, the model does not directly facilitate evaluation of effects of improvements to farm irrigation practices resulting in increased irrigation efficiency without recalculation of input data outside of the model environment.
- Comparison of historic data with full supply diversion estimates indicates that irrigators typically operate under supply-limited conditions. The model simulates diversion data related to a multitude of uses (irrigation, municipal, industrial, etc.). Given the magnitude of the irrigation diversions, however, special attention is devoted to the water requirements associated with irrigated lands. To fully understand this potential limitation, it is important to know that the spreadsheet model can be run in three different modes.
- *Calibration (Historical):* This mode simulates the historical diversions where data are available. This mode is typically used for model calibration because historic diversion data are utilized.
- *Full Supply for Existing Irrigated Lands:* This mode reflects full supply diversions, based on computed diversion requirements for existing irrigated lands (lands presently irrigated and mapped during the planning process).
- *Full Supply for Existing Irrigated Lands and Futures Projects:* This mode simulates full supply, based on computed diversion requirements, for existing irrigated lands and Tribal futures projects.

3J.3 Available Flows Analysis

To determine how much of the physical supply is actually available for storage at any given model node, "available water" was defined as that portion of the physically available streamflow that could be stored without causing a shortage to existing water users in any downstream river reach on the modeled river. *In other words, the water available at any node is determined as the minimum of the physically available flow at that point or the minimum available flow at any node downstream in the system.* As noted previously, this evaluation is made on a water budget basis (inherent to the Basin Plan model) and does not directly incorporate individual water rights.

As previously discussed, a model of the North Platte River is currently under construction in conjunction with ongoing river basin planning efforts being completed on behalf of the WWDC. At the time this report was completed, the model was not completed and available for use.

APPENDIX 4A

INSTITUTIONAL ISSUES IN THE UPPER LARAMIE WATERSHED

APPENDIX 4A
INSTITUTIONAL ISSUES IN THE LARAMIE RIVER WATERSHED

There are three important legal decrees which govern water use within the Upper Laramie River Watershed:

1. The Modified North Platte River Decree (2001),
2. The Laramie River Decree (1922), and
3. The Platte River Recover and Implementation Program (PRRIP) (2001).

In the following sections, the history and limitations imposed by each is presented. This information has been extracted from previous reports prepared on behalf of the Wyoming Water Development Commission and is presented here as background information. Management implications of each decree are presented within the body of this report at Section 4.3 Management Implications of Legal Decrees

Appendix 4A.1 The Modified North Platte River Decree

The following discussion of the Modified North Platte River Decree was extracted from the Medicine Bow River Watershed Study, Level I (RESPEC and Anderson Consulting Engineers, 2014):

In Wyoming, the State Engineer's Office (SEO) is responsible for regulating and administrating the state's water resources and administers all matters involving 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 U.S. 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 U.S. Supreme Court over the flows of the North Platte River claiming that priority rights in Nebraska were not being honored [SEO, 2006a; Trihydro, 2006]. In 1945, the U.S. Supreme Court handed down a decree apportioning the waters of the North Platte among the states that set limitations on water appropriations in Wyoming and included the following provisions [Supreme Court of the United States, 2001; SEO, 2006a]:

a. 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.

b. 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.

c. The storage rights of the Pathfinder, Guernsey, Seminoe, and Alcova Reservoirs are junior to 1,165 cubic feet per second 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.

d. 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.

The 1945 decree also limited the amount 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 U.S. 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 U.S. Supreme Court alleging that Wyoming had violated the 1945 Decree therefore, reopening the decree, which resulted in the U.S. Supreme Court approving the Final Settlement Stipulation and ordering 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]. The provisions in the 1945 North Platte Decree and the 2001 Modified North Platte Decree includes, but are not limited to the following [SEO, 2006a; WWDC, 2014]:

a. Exclusive of 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 following 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 shall not exceed 226,000 acres.

b. 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.

c. 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 2001 Decree’s provision for splitting the 226,000 acreage limitation between the area above Pathfinder Reservoir and the area between Pathfinder Reservoir and Guernsey Reservoir has been completed. The “split” of the 226,000 acres of intentionally irrigated acreage was determined to be 169,100 acres for the area above Pathfinder Reservoir and 56,900 acres for the area from Pathfinder Reservoir to Guernsey Reservoir and was approved by the U.S. Supreme Court in 2011 [WWDC, 2014].

The 2001 Decree's acreage limitations include water from hydrologically connected groundwater wells, which are defined as a well that is so 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 Final Settlement Stipulation and the 2001 Modified North Platte Decree contains numerous provisions and several articles pertaining 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/*). Additionally, the SEO's Interstate Streams Division compiled documents regarding interstate streams into a report titled *Wyoming's Compacts, Treaties, and Court Decrees,* (available online at:

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-right 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 non-irrigation season [WWDC, 2014]. The water users formally protested the U.S. Bureau of Reclamation's (USBR) application to the Wyoming Board of Control for the partial change of use of the storage right for Pathfinder Reservoir needed to implement the PMP [WWDC, 2014]. However, this matter was resolved in a "Stipulation and Settlement Agreement," dated October 16, 2008, between the Upper North Platte Valley Water Users, the Upper North Platte Valley Water Conservation Association, the USBR, and the Wyoming Water Development Office (WWDO) [WWDC, 2014].

Appendix 4A.2 Laramie River Decree

In 1911, Wyoming sued Colorado in the Supreme Court to limit Colorado diversions from the Laramie River. In 1922, the Supreme Court handed down its decree, which allowed Colorado to annually divert 4,250 acre-feet for the meadow lands and 33,500 acre-feet by trans-mountain diversion plus "the relatively small amount of water appropriated..." from the headwaters of Deadman Creek, through the Wilson Supply Ditch. In 1936, the Supreme Court of the United States stated that the record showed that the "relatively small amount of water" referred to actually amounted to 2,000 acre-feet of water per year. Therefore, the total annual diversion allowed Colorado was 39,750 acre-feet. In 1939, Wyoming secured an order from the Supreme Court of the United States restraining Colorado from diverting more than the 39,750 acre-feet annually that the state had been allotted. The Supreme Court stated that this amount should be administered according to Colorado laws. By stipulation between Colorado and Wyoming in 1957, the Supreme Court vacated all former decrees and decreed that only 19,875 acre-feet of water per year could be diverted from the Laramie River Basin and that 29,500 acre-feet per year could be diverted by the meadow land users for the irrigation of certain lands described by map in the decree.

Appendix 4A.3 Platte River Recovery Implementation Program

This section was authored in 2012 by Mr. Michael K. Purcell, Director of the WWDC, as part of the Middle North Platte Watershed Level I Study and adapted for this report [Purcell, 2014; RESPEC and Anderson Consulting Engineers, Inc., 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 U.S. Department of Interior (USDI) [USDI, 2006; SEO, 2006b; Purcell, 2014; RESPEC and Anderson Consulting Engineers, Inc., 2014]. The states became interested in the Program when it became apparent that the ESA provided the U.S. Fish and Wildlife Service (USFWS) the authority to require replacing existing depletions until it achieved its water-supply goal of 417,000 acre-feet per year for the critical habitat in the Central Platte River in Nebraska [Purcell, 2014; RESPEC and Anderson Consulting Engineers, Inc., 2014]. Also, the USFWS could assess depletion fees to acquire 29,000 acres of habitat in the Central Platte River [Purcell, 2014; RESPEC and Anderson Consulting Engineers, Inc., 2014].

The Program serves as the reasonable and prudent alternative under the ESA for irrigation, municipal, industrial, and other water uses in place on or before July 1, 1997 [Purcell, 2014; RESPEC and Anderson Consulting Engineers, Inc., 2014]. Without the Program, the USFWS would use the ESA consultations required for future federal actions (permits including renewals, funding, contracts, easements, and others) to require water users (irrigators, municipalities, industries, and others) to replace existing and proposed new depletions until the water goals were met [Purcell, 2014; RESPEC and Anderson Consulting Engineers, Inc., 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 Anderson Consulting Engineers, Inc., 2014]. In addition, the states agreed to curtail new depletions that would impact the Program’s goals. In Wyoming, the North Platte River 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 Anderson Consulting Engineers, Inc., 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 Anderson Consulting Engineers, Inc., 2014].

Each state wrote a depletion plan that explained existing and future water-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 authorized by existing, valid Wyoming water rights with a priority date before July 1, 1997, which is the date negotiations began to formulate the Program. In addition, the Plan addresses new depletions if they do not exceed 20 acre-feet per year [Purcell, 2014; RESPEC and Anderson Consulting Engineers, Inc., 2014]. The SEO North Platte River Coordinator is responsible for determining the depletions that can be covered by the Plan, identifying new depletions that require mitigation, and approving mitigation plans required for new depletions [Purcell, 2014; RESPEC and Anderson Consulting Engineers, Inc., 2014].

APPENDIX 4B

BENEFITS OF WATERSHED PLANNING

APPENDIX 4B
BENEFITS OF WATERSHED MANAGEMENT PLANNING

Appendix 4B.1 Overview

Appendix 4B.2 Natural Resources Conservation Service Conservation Effects Assessment Program

In 2003, in the interest of government accountability, Congress and the Office of Management and Budget requested information from the U.S. Department of Agriculture (USDA) about the effectiveness of its conservation programs. In response, the Conservation Effects Assessment Project (CEAP) was initiated by NRCS to provide quantitative information about the environmental impacts of its conservation practices on agricultural lands within the contiguous 48 United 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 programs and develop the science base for managing the agricultural landscape for environmental quality. Initially focused on croplands, the CEAP effort has been expanded to include wildlife, wetlands, pastures, and rangelands.

Project findings have been used to guide USDA conservation policy and program development that will 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 collation of information from hundreds of published scientific papers, journals, and additional references. Consequently, the CEAP documents provides a valuable source of information pertaining to various BMPs incorporated in this plan and is referenced throughout the remainder of this section.

Appendix 4B.3 Watershed Function

Identifying improvement opportunities for hydrologic and watershed function, including water quantity, yield and use, is an essential element of the Level I Watershed Study. Hydrologically, there are three fundamental watershed functions: (1) collection of the water from rainfall, snowmelt, and storage that becomes runoff, (2) storage of various amounts and durations, and (3) discharge of water as runoff [Black, 1997]. Watershed characteristics such as geologic structure, soils, landform, topography, vegetation, and climate influence the capture or collection of precipitation, infiltration and storage of surface and ground water, and the runoff or discharge of water.

Appendix 4B.3.1 Water Quantity

Implementation of BMPs and conservation practices can affect water resource quantity through improvement of plant communities, vegetative diversity, and ecological site health achieved from water development and the creation of reliable water sources in areas devoid of such allows for the establishment of grazing systems and changes in grazing distribution.

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 having greater hydrological function, including infiltration rate, than shortgrass-dominated communities [Wood and Blackburn 1981b; Thurow 1991; Natural Resources Conservation Service, 2011]. Poor water distribution has been the primary cause of poor livestock distribution [Holecheck, 1997]. Livestock distribution and grazing behavior can be modified by adjusting the location of supplemental feed and water, implementation of patch burns, and herding in addition to the traditional practice of fencing [Williams 1954; Ganskopp 2001; Fuhlendorf and Engle 2004; Bailey 2005]. Natural Resources Conservation Service [2011] reviewed many studies and found that water distribution, steep slopes, and high elevations unequivocally influenced livestock distribution. Also sufficient evidence existed to recommend that NRCS increase the role of herding and supplement placement along with water development and fences for managing livestock distribution [Natural Resources Conservation Service, 2011].

Soil vegetative cover is widely recognized as a critical factor in maintaining soil surface hydrologic condition and reducing soil erosion [Gifford, 1985; Natural Resources Conservation Service, 2011]. Stocking rates, regardless of grazing system, that reduce soil surface vegetative cover below a site-specific threshold increases detachment and mobilization of soil particles due to raindrop impact, decreases soil organic matter and soil aggregate stability, increases soil surface crusting and reduces soil surface porosity, and thus decreasing infiltration and increasing soil erosion and sediment transport [Blackburn, 1984]. Sufficient vegetative cover, critical soil cover, or residual biomass must remain during and following 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 the long-term reduction of organic matter additions to soil detrimentally affect numerous soil properties, including the increase of bulk density, disruption of biotic crusts, reduced aggregate stability, and organic matter content, which collectively reduce infiltration rate and increase sediment yield and runoff [Natural Resources Conservation Service, 2011].

The rehabilitation efforts described in the following sections can increase water infiltration/percolation, stimulate spring flows and increase flow volume and duration. An example of restoring watershed function and water quantity was in a 74,000 acre watershed in West Texas near San Angelo where West Rocky Creek, a dry, intermittent stream for decades, started flowing again [Moseley, 1983; Wiedenfeld, 1986]. In the early part of the 20th century, West Rocky Creek was a yearlong flowing stream until the late 1910s, when it became an intermittent stream and by 1935, the springs feeding the creek had been dried up by mesquite and other invading woody plants [Moseley, 1983; Wiedenfeld, 1986].

During the 1950s and 1960s, ranchers and landowners on five ranches, covering about half the watershed, began conservation work including root-plowing, reseeding, tree-dozing, aerial spraying, and chaining of mainly mesquite and juniper brush, which limited water availability for native grasses such as sideoats grama, buffalograss, curly mesquite, and tobosa [Moseley, 1983]. About 30,000 acres or 70 percent of the mesquite was removed from the watershed, and the original prairie was restored [Moseley, 1983;

Wiedenfeld, 1986]. In the mid to late 1960s, one of the 5 ranchers noticed that a spring, which was dry since 1935, had started flowing again and by replacing the water-hungry brush with a good grass cover, more rainfall soaked into the aquifer, recharging the dormant springs which began flowing on all 5 ranches by 1970 [Moseley, 1983]. Ongoing grazing management on each ranch enhanced the cover of grasses in the watershed with soils producing an estimated 2,000 to 2,500 pounds of forage per acre which helps retard brush succession; the ranchers periodically must do maintenance brush control to keep the desired vegetation balance [Moseley, 1983].

In southeast Arizona, long-term data on soils, vegetation, hydrology, and climate have been collected for over five decades on the Walnut Gulch Experimental Watershed, which is operated by the USDA's Agricultural Research Service (ARS). The Walnut Gulch Experimental Watershed is one of the most intensively instrumented semiarid experimental watersheds in the world, with a 10 to 100-year record of abiotic and biotic measurements and photographs [Moran et al, 2008]. Researchers studied the interaction between rainfall intensity and soils and vegetation by comparing the frequency of runoff producing summer events between a shrub-dominated watershed and a grass-dominated watershed and found that it takes higher rainfall intensities to produce runoff on the grassed watershed [U.S. Department of Agriculture, 2013]. Results also indicate that the grassland plant community is producing more plant material than the shrubland, with close to the same amount of precipitation input, making the grassland ecosystem more water use efficient [U.S. Department of Agriculture, 2013]. The researchers found that runoff quantities at the watershed scale are controlled more by infiltration of water into alluvial channels and spatial distribution of thunderstorm rainfall [U.S. Department of Agriculture, 2013].

Appendix 4B.4 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. Ecological sites are complex and varied within the study area as described in Section 3.4.5.5 and Figure 3.3-12. And so are the potential benefits achieved from project activities and implementations that influence the condition of those ecological sites and characteristics.

Conjunctive to soil function is plant community diversity, health and productivity and subsequent forage diversity, production and wildlife habitat. Benefits accrued to water quality are significant as improvements to the chemical, physical, and biological constituents of a water body produce both local site enhancements and those transferred downstream. Wetland enhancement and restoration provides benefits to ecological stabilization as well as contributions to water quality and quantity. Ecologically, watersheds function by providing diverse sites and pathways along which vital chemical reactions occur and furnishing habitat for the flora and fauna that constitute the biological elements of ecosystems [Black, 1997].

Appendix 4B.4.1 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 the locations of fences, watering points, and feeders that are used to modify patterns of animal movement and forage utilization, taking into account livestock behavior and the template of topography and plant communities to which livestock respond [Laca, 2009; Natural Resources Conservation Service, 2011]. The use of rangelands for sustainable livestock production has the potential to ensure the maintenance of wildlife habitat which will ensure that wildlife habitat will persist into the future [Natural Resources Conservation Service, 2011]. Livestock grazing can have negative or positive impacts on game bird habitat, depending on timing and intensity of grazing and the habitat being influenced [Beck and Mitchell, 2000]. Wildlife responses to conservation practices are usually species and even species-habitat specific, meaning not only that each species may respond differently to any specific practice but also that a single species may respond differently to the same practice in different vegetation associations or conditions [Natural Resources Conservation Service, 2011].

Free-stranding water has been considered to be a resource that limits distribution and abundance of many species of wildlife in arid regions of the United States, and water developments have been used since the 1940s to improve wildlife habitat [Simpson et al, 2011]. Simpson et al [2011] compiled and evaluated available literature for evidence of effects of water sources on wildlife populations. Positive effects of water developments on wildlife have been documented, and species thought previously not to use free-standing water developments do so when it is available [Simpson et al, 2011]. Additionally, researchers studied 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, a number of nongame species [Rosenstock et al, 2004].

Appendix 4B.4.2 Stream Corridors and Riparian/Wetland Areas

Reducing impact to riparian plant communities through the development of upland water resources can result in stream corridor benefits. Riparian plant community diversity and regeneration of desirable important woody species can help restore local water tables, trap sediments, increase wildlife habitat and migration corridors, and stabilize stream banks which can affect localized land loss. In addition, aquatic population benefits can accrue and recreation potential can be realized.

Livestock distribution practices such as water developments, supplement placement, and herding are effective means of managing the intensity and season of livestock grazing in riparian areas [Natural Resources Conservation Service, 2011]. Season of grazing also determines livestock grazing effects on riparian plant communities, particularly woody plants, and can be managed to conserve riparian habitats and their associated services [Natural Resources Conservation Service, 2011]. Sufficient evidence in peer-reviewed studies existed that Natural Resources Conservation Service [2011] suggested riparian grazing management that maintains or enhances key riparian vegetation attributes (i.e., species composition, root mass and root density, cover, and biomass) will enhance stream channel and riparian soil stability, which will in turn support ecosystem services, such as flood and pollutant attenuation and high-quality riparian habitat. Peer-reviewed literature generally supports the effectiveness of water developments, supplement placement and herding for reducing riparian vegetation utilization, or time spent in riparian areas [Natural Resources Conservation Service, 2011].

Appendix 4B.5 Societal Value

Natural resource stewardship not only has economic value in terms of forage, livestock, and wildlife production relationships, but also can have non-economic value placed on those conservation practices by society. Those values can even influence the perception of those implementing conservation practices and can be as much an influence in the decision process to implement conservation as is an economic value. Additionally, it is possible for a BMP or conservation practice that provides an ecological service to accrue more value to society in general than to a local landowner. Ecosystem services are defined as those things or experiences produced by natural systems on which humans place value [Natural Resources Conservation Service, 2011]. Ecosystem services benefit society in numerous and diverse ways while each of the conservation practices can potentially produce different kinds, qualities, and amounts of these goods and services, depending on location, natural potentials, current states, and other factors.

Non-economic values can and should be considered in determining watershed enhancement programs, particularly when considering public investment in conservation. Natural Resources Conservation Service [2011] found little to no research exists showing the direct noneconomic effects of BMPs and conservation practices on individuals, households, or social systems but acknowledged it was likely that producers do realize psychological benefits from conservation because stewardship typically ranks high among the management goals of livestock producers [Huntsinger and Fortmann, 1990; Sayre, 2004]. Moreover, livestock producers who believe strongly in a responsibility to society are more likely to engage in environmentally desirable management practices, such as invasive weed control and riparian protection [Kreuter et al, 2006].

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

In addition to other social values and ecological enhancements, open spaces have long been held with high value to Wyoming and other western region states. From a ranching industry perspective, tourism interest, outdoor recreationist activity, or a real estate value, open space is significant. Preservation of our custom and culture has been and continues to be a focal point of consideration. Open spaces are critical for upland/riparian conductivity, wildlife migrations and habitat, and recreational opportunity.

Open space is valued for preservation of cultural resources and for the reduction or prevention of land conversion to a condition that can be stewarded to an improved ecological condition.

Appendix 4B.6 Potential Effects and Benefits of Upper North Platte Watershed Management Plan Components

In the following sections, the potential effects and benefits associated with key BMPs and conservation practices are discussed in relation to the various plan components: Livestock/Wildlife water supply (Components LW), irrigation system rehabilitation (Components I), and storage (Components S). The intent of this discussion is to provide the decision makers with the background necessary to make informed decisions regarding future planning efforts.

The NRCS prepares NEDs of conservation practices or BMPs which act together to achieve desired purposes. The NEDs "are flow charts of direct, indirect and cumulative effects resulting from installation of the practices. Completed network diagrams are an overview of expert consensus on the direct, indirect and cumulative effects of installing proposed practice installation. They show the potential positive and negative outcomes of practice installation, and are useful as a reference point for next steps, and as a communication tool with partners and the public" [Natural Resources Conservation Service, 2014].

Benefits associated with a particular conservation practice or BMP can be classified as direct, indirect or cumulative. Direct and indirect benefits would be considered measureable or tangible benefits. For example, construction of a reservoir designed to augment late season irrigation water supplies provides the direct or measurable benefit, of providing a supply of water 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 previously discussed, such benefits can be either quantitative or qualitative or both. Benefits can be local or global and specific or surrogate, depending on multiple factors unique and specific to the BMP, ecological site, 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. Where appropriate, the NRCS NED for the conservation practice is presented within this document.

Appendix 4B.6.1 Irrigation Rehabilitation Projects

The Watershed Management Plan includes fifteen recommendations. These projects include various forms of irrigation improvements and rehabilitation projects.

Irrigation Water Conveyance—Pipeline

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

Strategies defining placement of irrigation water conveyance pipelines typically involve:

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

Effects and benefits of rehabilitating and improving water conveyance for irrigation systems are numerous and are displayed in the NRCS's NED in Figure 4.10-1. As shown in this figure, direct and indirect benefits associated with this BMP include:

- 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

Cumulative effects/benefits of provision of reliable water supplies are described as:

- 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.

Appendix 4B.6.2 Livestock/Wildlife Water Supply Projects

The Watershed Management Plan includes 114 livestock/wildlife water supply projects. These projects include various forms of water facilities, water wells, spring developments, pipelines, and stock ponds.

Water Facilities

The development of reliable watering facilities in areas otherwise lacking reliable sources of water 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 involving distribution of livestock.***

Strategies defining placement of water facilities typically involve:

- Facilitation of prescribed grazing management plans
- Alternative water supplies to riparian sources
- Provision of a reliable source where no other sources may exist
- Optimization of upland range resources.

Benefits of providing reliable water facilities for livestock and wildlife are numerous and are displayed in the NRCS's NED in Figure 4.10-2. As shown in this figure, direct and indirect benefits associated with this BMP include:

- 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 are described as:

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

Appendix 4B.6.3 Grazing Management Alternatives

These alternatives include conservation practices and BMPs such as water developments, fencing, salting and herding, ecological sites and state and transition models, prescribed fire, and application of chemicals along with 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 with grazing animals 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 allotments, pastures to be grazed. Removal of vegetation by the grazing animals is in conformity with realistic yield goals, plant growth needs, and management goals. Duration and intensity of grazing is 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 by:

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

Benefits of implementing prescribed grazing and associated BMPs and conservation practices are numerous and are displayed in the NRCS's NED in Figure 4.10-3. As shown in this figure, direct and indirect benefits associated with this BMP include:

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

Cumulative benefits of implementing prescribing grazing could include:

- 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

Appendix 4B.6.4 Stream Channel Restoration Projects

These alternatives include conservation practices and BMPs such as installation of stream channel degradation/incision and streambank erosion mitigation measures based upon site-specific evaluation of conditions along with routine monitoring of completed stream projects to identify necessary 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 the stabilization and protection of streambanks, constructed channels, and shorelines of lakes and reservoirs. Strategies for applying streambank and shoreline protection involve:

- Streambanks of natural or constructed channels and shorelines of lakes and reservoirs where they are susceptible to erosion.
- Various materials may be used for protection of streambanks and shorelines,
- A site-specific assessment should be conducted to determine if the causes are local or systemic and used to select appropriate treatment to achieve the desired objective,
- Functional and stable treatments for design flows and sustainable for 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 offsite or downstream effects of sediment resulting from bank erosion
- Improving the stream corridor for fish and wildlife habitat, aesthetics, and recreation

Benefits of implementing streambank and shoreline protection and associated BMPs and conservation practices are numerous and are displayed in the NRCS's NED in Figure 4.10-4. As shown in this figure, direct and indirect benefits associated with this BMP include:

- 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

Cumulative benefits of implementing streambank and shoreline protection could include:

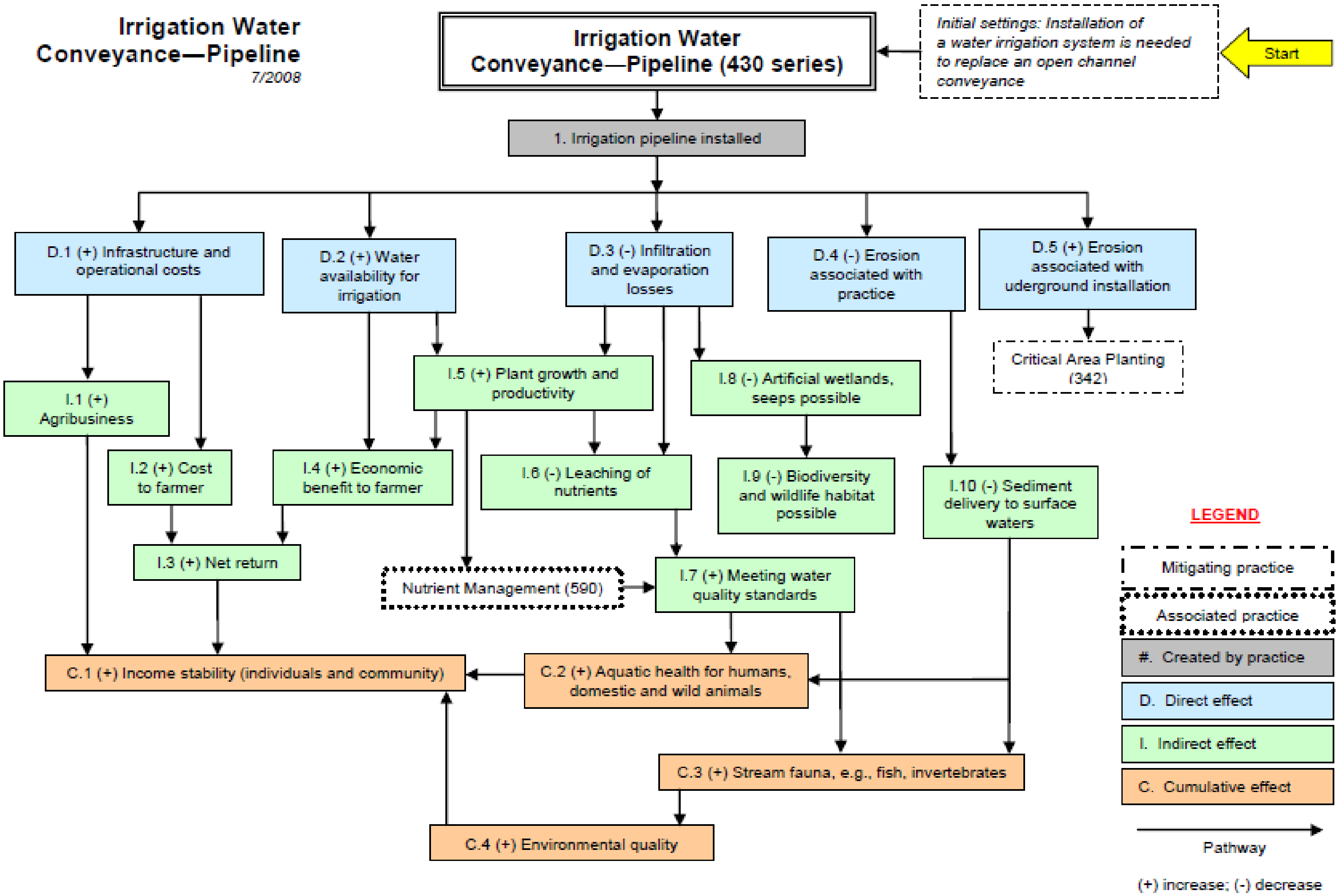
- Positive impacts to income and stability of individual producers and the community,
- Improved water quality and aquatic and/or terrestrial habitat,
- Improved recreational opportunities

Appendix 4B.6.5 Water Storage Facilities / Irrigation Reservoir

Benefits of storage facilities and associated BMPs and conservation practices are numerous and are displayed in the NRCS's NED in Figure 4.10-5. As shown in this figure, direct and indirect benefits associated with this BMP include:

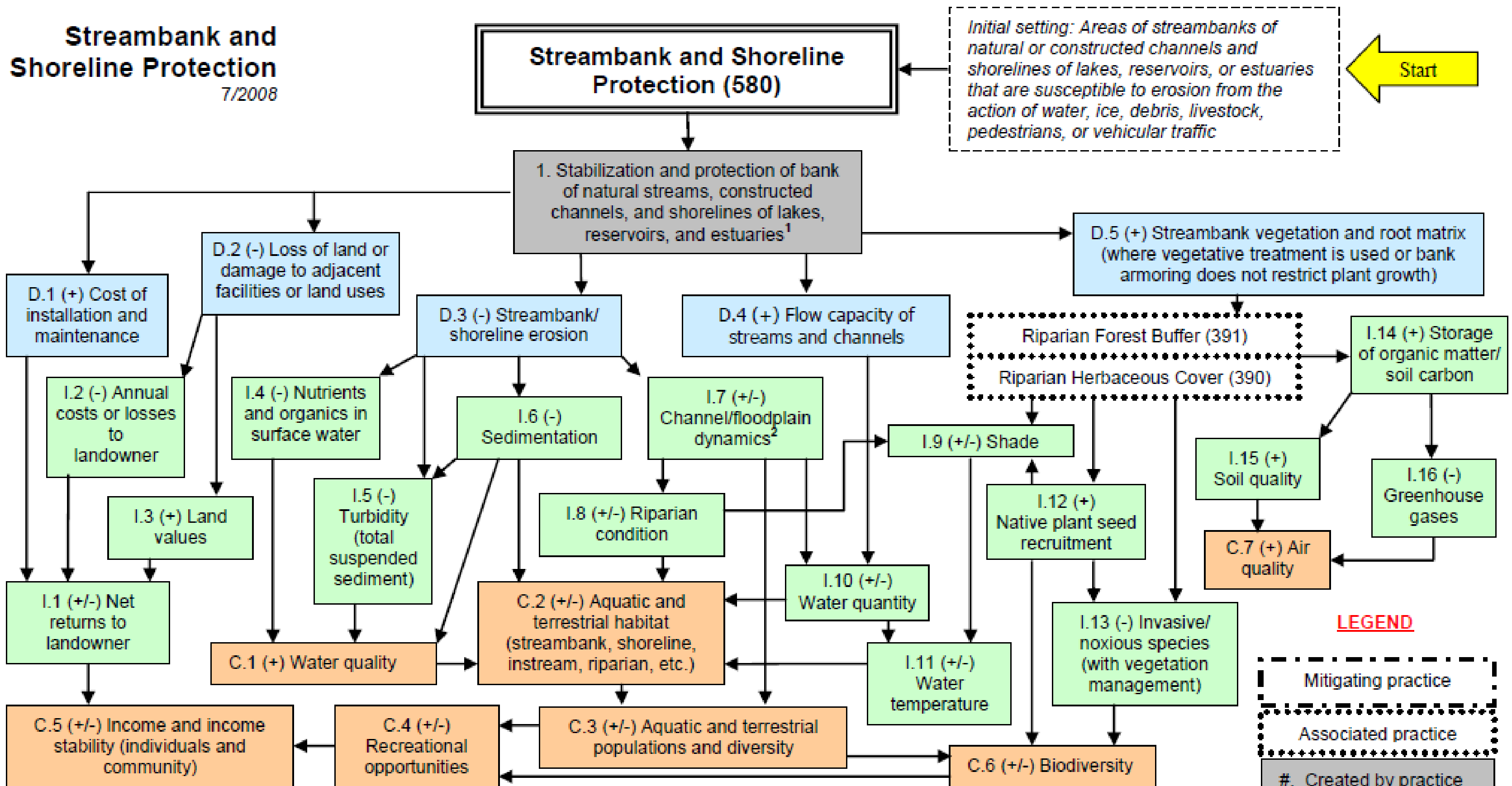
- Storage of water for late season irrigation supply
- Storage of water for municipal and industrial use
- Supply of flow augmentation
- Flood control and attenuation of peak flows downstream
- Wetland enhancement and development
- Sediment management
- Aquatic habitat
- Recreation opportunities

Figure 4B.6-1 Network Effects Diagram for Irrigation Conveyance –



Note: Effects are qualified with a plus (+) or minus (-). These symbols indicate only an increase (+) or a decrease (-) in the effect upon the resource, not whether the effect is beneficial or adverse.

Figure 4B.6-2 Network Effects Diagram for Streambank and Shoreline Protection.



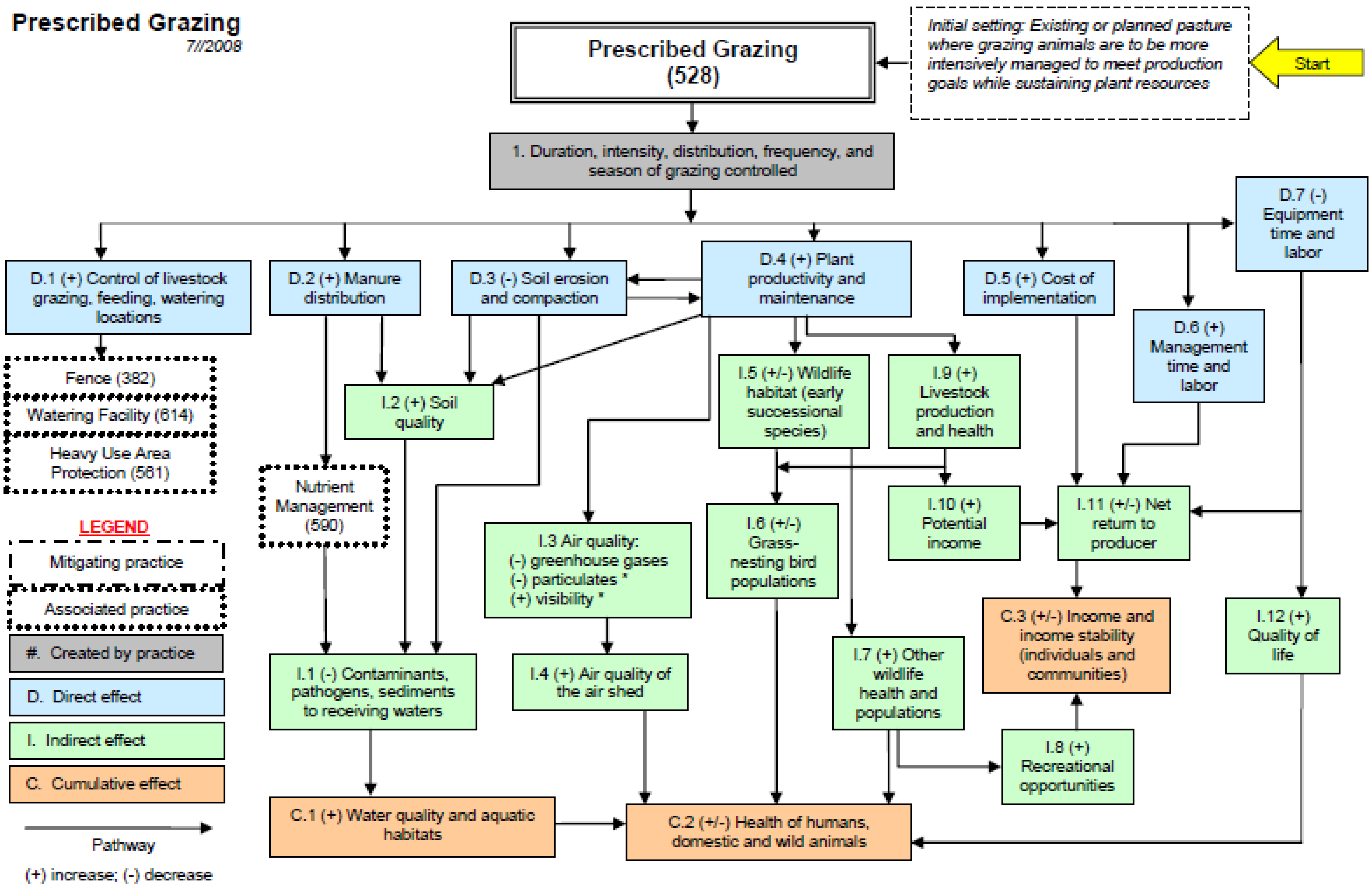
Notes: Effects are qualified with a plus (+) or minus (-). These symbols indicate only an increase (+) or a decrease (-) in the effect upon the resource, not whether the effect is beneficial or adverse.

Projects involving long lengths of bank or shoreline, structural controls, substantial earth moving and/or fill, or sensitive waters may need to be evaluated in a site-specific EA or EIS.

[1] Additional information about potential protection measures and their impacts is available in the EIS for the Emergency Watershed Protection (EWP) Program.

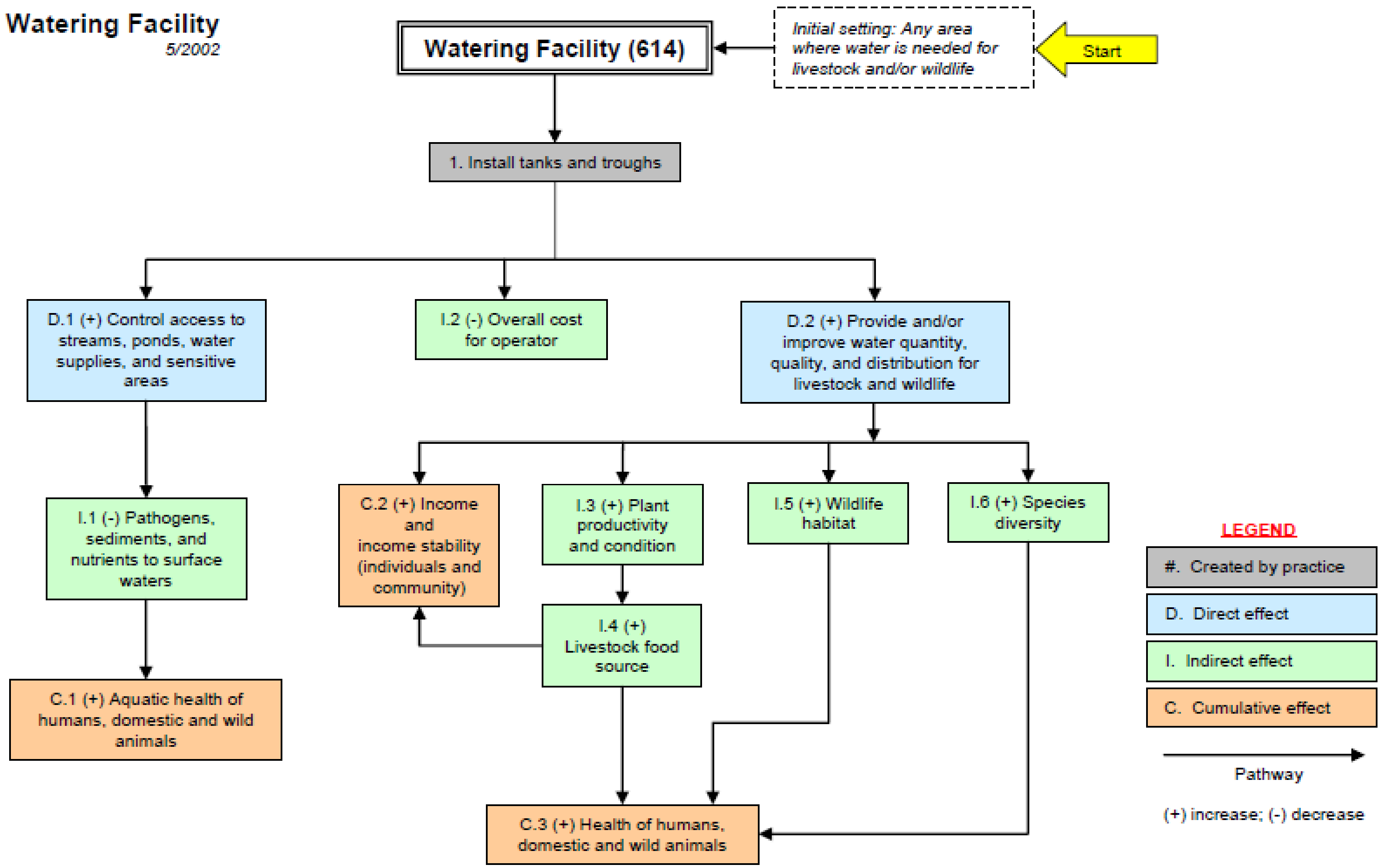
[2] Conventional bank armoring (e.g., rip rap, gabions) may result in decreased (-) channel/flood plain dynamics, and associated impacts, while other less intrusive methods (e.g., stream barbs, stone toes with sloped, vegetated banks) may result in increased (+) channel/flood plain dynamics.

Figure 4B.6-3 Network Effects Diagram for Prescribed Grazing.



Note: Effects are qualified with a plus (+) or minus (-). These symbols indicate only an increase (+) or a decrease (-) in the effect upon the resource, not whether the effect is beneficial or adverse.

Figure 4B.6-4 Network Effects Diagram for Watering Facility.



Note: Effects are qualified with a plus (+) or minus (-). These symbols indicate only an increase (+) or a decrease (-) in the effect upon the resource, not whether the effect is beneficial or adverse.

APPENDIX 5A

AGENCY REQUIREMENTS AND NOTIFICATIONS

Appendix 5A AGENCY REQUIREMENTS AND NOTIFICATIONS

Several permits and clearances would need to be submitted to and approved by federal, state, and local agencies prior to the construction and/or installation of 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 5.4-1.

Appendix 5A.1 U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers' (USACE) 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 the discharge of dredged or fill material into waters of the United States. Because many waterbodies and wetlands are considered waters of the United States, they are subject to the USACE's regulatory authority. Permit applications can be obtained by contacting the USACE Wyoming Regulatory Office in Cheyenne by telephone (307) 772-2300 or via the website (http://www.nwo.usace.army.mil/Missions/Regulatory-Program/Wyoming/). Numerous nationwide permits have been developed as of 2012; the applicable permit depends upon the nature of the proposed activity.

Appendix 5A.2 U.S. Fish and Wildlife Service

The Endangered Species Act's (ESA) Section 7 requires federal agencies to conserve threatened and endangered species and ensure their 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 the 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 fi the agency's proposed project or program may affect the listed species. Normally, the federal agency 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, then 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.

Also, a non-federal agency can be approved by the USFWS for an incidental take permit of threatened or endangered species under Section 10 of the ESA. However, the USFWS's approval is usually dependent upon a habitat conservation plan (HCP), which when followed would minimize the taking of the listed species to the maximum extent practicable. Information can be obtained by contacting the USFWS's Wyoming Ecological Services Field Office in Cheyenne by telephone (307) 772-2374 or website (https://www.fws.gov/wyominges/index.php). Additionally, the USFWS's Information for Planning and Conservation (IPaC) is web-based application and planning tool available to anyone who needs assistance in determining how their activity or project may affect migratory birds, ESA proposed or listed species, other sensitive resource. The IPaC can be accessed via the website (https://ecos.fws.gov/ipac/).

Appendix 5A.3 Wyoming State Engineer's Office

The majority of proposed projects included in this watershed study would require a permit from the Wyoming State Engineer's Office (WSEO). Proposed livestock/wildlife water, irrigation rehabilitation, and water storage projects would 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 construction of a new dam and reservoir or the rehabilitation of an existing dam and reservoir exceeding 20 acre-feet in capacity or having 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).

The SEO also administers Wyoming's Safety of Dams program (W.S. 41-3-307 through 41-3-318), which applies to reservoirs when the dam height is more than 20 feet high and reservoir capacity is more than 50 acre-feet. Any proposed construction, enlargement, major repair, alteration or removal of a dam or diversion system with headgates or diversion structures carrying 50 cfs must have plans and specifications prepared a Wyoming licensed registered 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). Necessary water right applications, regulatory information, and instructions can be accessed via the website (https://sites.google.com/a/wyo.gov/seo/regulations-instructions). SEO permits can also be accessed via the e-Permit website (http://seoweb.wyo.gov/e-Permit/).

Appendix 5A.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 Wyoming State Historic Preservation Office (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 Wyoming State Historic Preservation Office reviews cultural resource reports, issues compliance letters for proposed projects, provides comments on activities potentially affecting historic properties or cultural resources, and recommends additional investigations if necessary. Additional SHPO compliance and review information can be obtained by contacting the State Historic Preservation Office by telephone (307) 777-6311 or via the website (http://wyoshpo.state.wy.us/Section106/Index.aspx).

Appendix 5A.5 Wyoming Game and Fish Department

The Wyoming Game and Fish Commission encourage 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 Commission adopted a mitigation policy in 2016 to provide an approach in avoiding impacts when possible and formulating mitigation measures when necessary. The Commission has directed the WGFD to resolve conflicts between land use activities and 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 federal CWA, and the Federal Fish and Wildlife Coordination Act. WGFD's habitat information can be obtained via the website (https://wgfd.wyo.gov/habitat/habitat-information).

In July 2015, Executive Order 2015-4, Greater Sage-Grouse Core Area Protection, was signed by the Governor Mead, which requires 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. 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 website (https://wgfd.wyo.gov/Habitat/Sage-Grouse-Management). Sponsors for a proposed project within the watershed should contact the WGFD at least 60 days prior to submitting an application for a permit or project so any sage-grouse related issues can be identified and any stipulations could be incorporated before commencing project activities.

Appendix 5A.6 Wyoming Department of Environmental Quality

Appendix 5A.6.1 Section 401 Water Quality Certification

For a proposed project requiring a USACE Section 404 permit, a pre-construction notification (PCN) is submitted by the applicant to the USACE. The PCN is then 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 in order to guarantee compliance with surface water quality standards or TMDLs. Information about the WDEQ's 401 Certification process can be obtained by visiting their website (http://deq.wyoming.gov/wqd/401-certification/).

Appendix 5A.6.2 Permit to Construct

Storm water discharges are regulated under the federal CWA by the WDEQ's Wyoming Pollutant Discharge Elimination System (WYPDES) Program. For any proposed project within the watershed, the project sponsor should contact the WDEQ to determine if a Large or Small Construction General Permit (CGP) is needed to construct the project components. WYPDES requires that construction activities disturbing 5 or more acres to obtain a Large Construction General Permit (LCGP) or construction activities disturbing at least one acre, but less than five acres to obtain a Small Construction General Permit (SCGP). In order to obtain a LCGP, the applicant must also complete a Storm Water Pollution Prevention Plan (SWPPP). Additionally, the WDEQ may 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/).

Appendix 5A.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 is on State land a grazing and agricultural lessee is required to obtain permission from the Board of Land Commissioners prior to construction in accordance with Title 36 State Lands, Chapter 2, Board of Land Commissioners Article 1, In General (W.S. 36-2-107). The lessee must submit an Application for Construction of Improvements on State Land to the Wyoming Office of State Lands and Investments (OSLI), which would include the location, value, construction date, type of improvement, federal aid received, and applicable water rights for the improvement. Applications can be obtained by contacting the OSLI by telephone (307) 777-7331 or via the website (http://lands.wyo.gov/lands/leasing/agricultural).

Appendix 5A.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 installing electrical equipment in new construction or remodeling of a building, mobile home or premises and 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). There may be applicable exemptions to these 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) 777-7119 or via the website (http://wsfm.wyo.gov/electrical-safety/wiring-permits).

Appendix 5A.9 Albany County

Albany County has adopted regulations for land use zoning, aquifer protection, wastewater, and floodplain development within the project area. The Albany County Planning Department issues permits for activities in the unincorporated areas of the county including but not limited to building structures, wastewater systems, wind energy systems, and aquifer protection. The project sponsor should contact the planning department 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 Albany County Planning Department by telephone (307) 721-2568 or via the website (http://www.co.albany.wy.us/planning.aspx).

Appendix 5A.10 Carbon County

Carbon County has also adopted regulations for land use zoning and floodplain development within the project area. The Carbon County Planning and Development Department issues permits for activities in the unincorporated areas of the county including but not limited to building structures, wind and solar energy systems, and floodplain development. The project sponsor should contact the department 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 Carbon County Planning and Development Department by telephone (307) 328-2651 or via the website (http://www.carbonwy.com/).

Appendix 5A.11 Special Districts

There are 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. Some of the special districts located within the project area are listed below.

- Wheatland Irrigation District
- Laramie Valley Irrigation District
- Pioneer Canal-Lake Hattie Irrigation District
- Rainbow Valley Special Road District
- Sage Drive Community Improvement and Service District
- Sherman Hill Road Improvement and Service District
- South Knoll Road Improvement District
- The Paddocks Improvement District
- Valley View Drive Community Improvement and Service District
- Wold Improvement and Service District
- Centennial Water and Sewer District
- Nine Mile Water and Sewer District
- South of Laramie Water and Sewer District