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FINAL REPORT
BADWATER / POISON CREEK
WATERSHED LEVEL I STUDY

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. WYWDC33)

February 21, 2014

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

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Professional Engineer (Civil)
Bradley Alan Anderson
5150
Date
WYOMING

February 21, 2014

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I. INTRODUCTION AND OVERVIEW

1.1 Introduction

On June 7, 2012, Anderson Consulting Engineers, Inc. (ACE) entered into a contract with the Wyoming Water Development Commission (WWDC) to provide professional services for the Badwater / Poison Creek Watershed Level I Study. ACE was retained to evaluate and describe the study area and specifically develop a watershed management plan. Opportunities and issues within the watershed are to be identified and practical economic solutions proposed. The plan was prepared on behalf of the project sponsor, the Lower Wind River Conservation District (LWRCD).

This report documents the results of all tasks associated with this effort.

1.2 Project Overview

The term "watershed" may have been best defined by John Wesley Powell, scientist geographer, when he said that a watershed is:

> *"that area of land, a bounded hydrologic system, within which all living things are inextricably linked by their common water course and where, as humans settled, simple logic demanded that they become part of a community."*

The State of Wyoming recognizes the benefits of basin planning efforts on the basis of watershed areas which do not necessarily adhere to political boundaries such as counties or states. The WWDC describes the watershed planning process 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."

The Badwater / Poison Creek Watershed Study is one of several watershed planning studies completed on behalf of the WWDC and the Wyoming Water Development Office (WWDO). Watershed investigations either completed or in the process of being completed include the following:

Prairie Dog Creek Watershed Study
Popo Agie River Watershed Study
Cottonwood Creek / Grass Creek Watershed Study
Sweetwater River Watershed Study
Thunder Basin Watershed Study
Clear Creek Watershed Study
Kirby Creek Watershed Study
Shell Valley Watershed Study
Buffalo Creek Watershed Study
Nowood River Watershed Study

Middle North Platte Watershed Study
Belle Fourche River Watershed Study
Blacks Fork Watershed Study

As a direct result of these efforts, numerous additional studies have been initiated and multiple projects have been constructed.

1.3 Background

The project study area is the Badwater / Poison Creek watershed located in the Wind River basin near the town of Shoshoni in Fremont County (Figure 1.1). The project study area includes the Badwater Creek and Poison Creek watershed plus the adjacent Gold Creek and Cottonwood Creek watersheds. The total area encompassed by these watersheds is approximately 1,435 square miles.

The study area is primarily only sparsely populated. The Town of Shoshoni is the largest with a population of approximately 635. Other towns and town sites include Lost Cabin, Moneta, Lysite, Bonneville, Hiland, and Arminto. Elevations range from less than 4,740 feet above mean sea level at Boysen Reservoir to over 8,300 feet on Copper Mountain, resulting in overall relief of over 3,560 feet. The majority of the study area is extremely dry. Annual precipitation typically averages 7 to 9 inches throughout most of the watershed with much of the precipitation derived from summer thunderstorms.

The majority of the basin (approximately 55.0 percent) is federally owned and managed by the BLM. The remainder of the study area is either owned by the State of Wyoming (10.3 percent) or is deeded (33.3 percent). The remaining 1.4 percent is divided between the Bureau of Reclamation (1.1 percent) and the Bureau of Indian Affairs (0.3 percent).

Some of the issues facing the LWRCD which will direct their future planning efforts include the following:

- Information and Data Management
- Water Quantity, Location and Timing
- Impacts Associated with Energy Development
- Utilization of Grazing Allotments and Range Management
- Stream Channel Stability/Riparian Restoration/Wetlands Enhancement
- Irrigation System Rehabilitation Needs and Opportunities
- Water Storage Needs and Opportunities

1.4 Purpose and Scope

In view of the previous discussions, the goal of this Level I Study is to combine all existing data with data collected and generated from this study to form a comprehensive Watershed Management Plan. The purpose and objectives of the proposed project are itemized below:

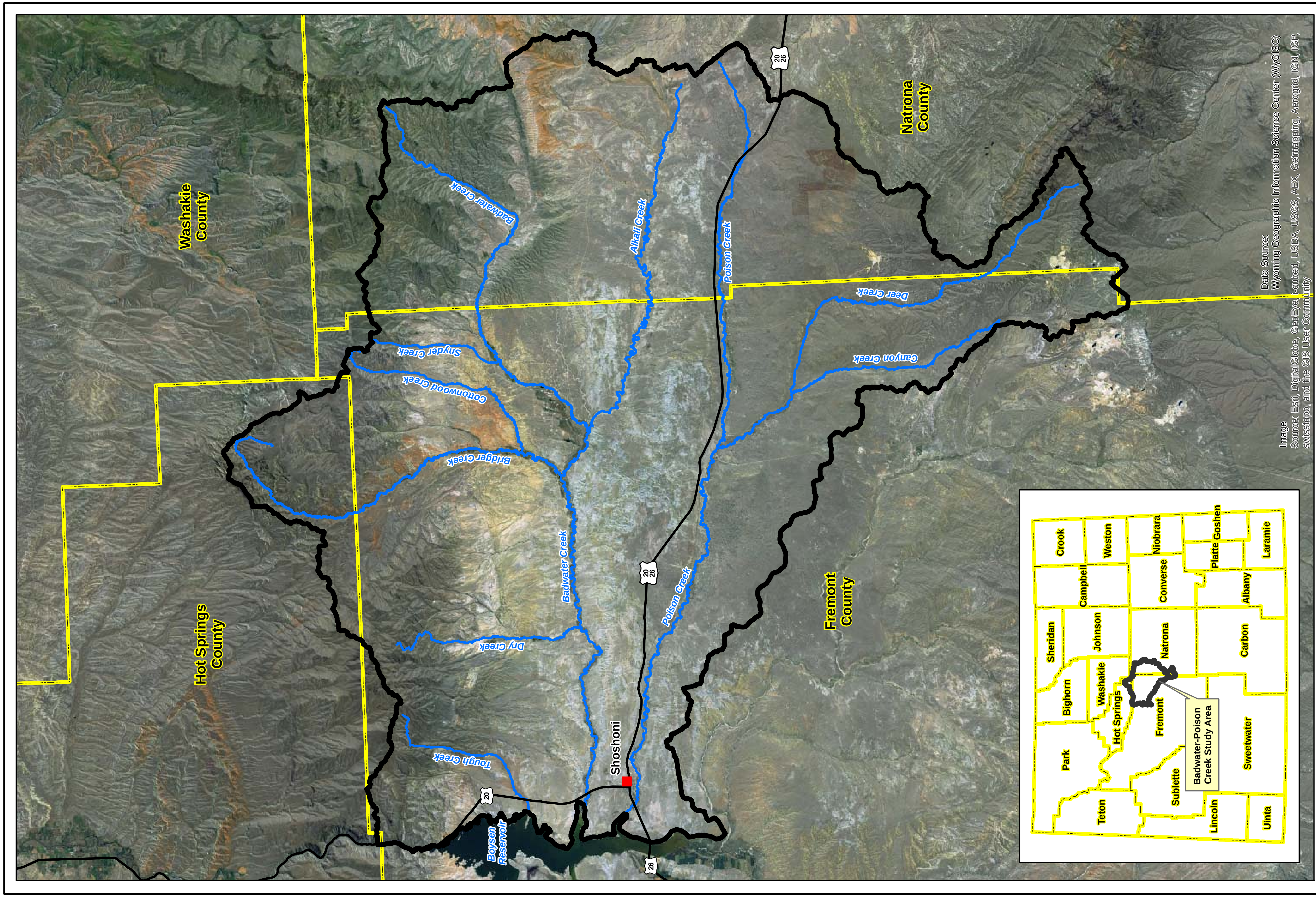


Figure 1.1 Badwater-Poison Creek Watershed: Location Map

- *Facilitate consensus building among the LWRCD, landowners and the Wyoming Water Development Commission.*
- *Facilitate public participation.*
- *Develop a comprehensive Geographic Information System (GIS) encompassing the vast amount of spatial data, background mapping, and aerial photography (including the legacy of historic aerial imagery,*
- *Construct a Digital Library with which the user can access the extensive amount of existing literature and data. The Digital Library should also be seamlessly available through the GIS environment.*
- *Conduct an evaluation and description of the* Badwater / Poison Creek *watershed (and associated watersheds) based to a large degree on the wealth of available information. Included in the summary should be the discussion of quantity and quality of surface water resources and riparian/upland conditions.*
- *Augment existing baseline geomorphic data by conducting a geomorphic investigation of the primary channels within the watershed and identify potential mitigation measures to improve impaired channel reaches.*
- *Conduct an irrigation system inventory and develop an enhancement / rehabilitation plan for those ditches where landowners expressed 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 problem areas within the watershed and proposes practical economic solutions.*
- *Develop cost estimates for improvements.*

In summary, the Badwater / Poison Creek Watershed Plan (Plan) represents a unique opportunity for the conservation district and the landowners to continue to provide direction related to the future of their watershed. This plan essentially represents a road map that will guide the conservation district and landowners in the selection and implementation of projects. This Plan will enable the conservation districts to apply for additional funding through the WWDC's Small Water Project Program and to allow for implementation of small projects in the short-term while planning the implementation of larger projects, such as reservoirs, for the long-term. In so doing, the Plan will guide the conservation districts and landowners in project implementation while optimizing potential funding opportunities and minimizing the time associated with potential NEPA/permitting requirements. Finally, the Plan will identify potential benefits to each project and will support formation of improvement districts, as necessary.

II. PROJECT MEETINGS

2.1 Introduction

An integral part of the Badwater / Poison Creek River Watershed Study was the public outreach and involvement effort. This effort was initiated by the WWDO prior to Anderson Consulting Engineers, Inc. (ACE) being awarded the contract in June, 2012.

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:

- Obtain direction from landowners pertaining to the project;
- Obtain information and opinions of the public regarding their perspective on the watershed planning process;
- Provide guidance to landowners with respect to setting of goals; and
- Keep landowners informed of initial results and project progress.

Five project meetings were held and included the following:

• Initial Scoping Meeting:	August 7, 2012
• Project Open House /workshop	November 28, 2012
• Project Open House/workshop	April 11, 2013
• Project Open House/workshop	December 9, 2013
• Final Results Presentation	February 12, 2014

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. Presentations summarizing the status of the project and the next steps to be accomplished were also completed. The project GIS was demonstrated when appropriate to keep landowners up to date on the information which would ultimately be incorporated within it. Following each meeting, discussions and question and answer sessions were held.

2.2 Field Trips and "Tailgate Talks"

Field investigation efforts generally were held in coordination with scheduled meetings for efficiency. Specific field efforts targeted irrigation inventory, upland livestock/wildlife water opportunities, stream channel conditions, hydrologic investigations (including establishment of temporary stream gages), and storage site investigations.

“Tailgate Talks” were informal discussions held whenever the opportunity arose. It is apparent that regardless of our familiarity with the area, local ranchers, irrigators, and residents generally have extensive knowledge of the watershed. Through the interviewing process, the project team incorporated this knowledge and experience directly into the study. 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.

III. WATERSHED DESCRIPTION AND INVENTORY

3.1 Introduction and Purpose

A considerable amount of information exists pertaining to the Badwater/Poison Creek 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 characteristic.

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)
- Fremont County Weed and Pest District
- Fremont County Assessor’s Office
- Hot Springs County Assessor's Office
- Natrona 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 Badwater / Poison Creek 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 Badwater / Poison Creek Study Area was collected from a wide range of sources. Agencies providing information included the State of Wyoming, USDI Bureau of Land Management, United States Geological Survey, Natural Resources Conservation Service, Wyoming Game and Fish Department, Freemont, Hot Springs and Natrona Counties, the USDA Natural Resources Conservation Service, and others. 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.

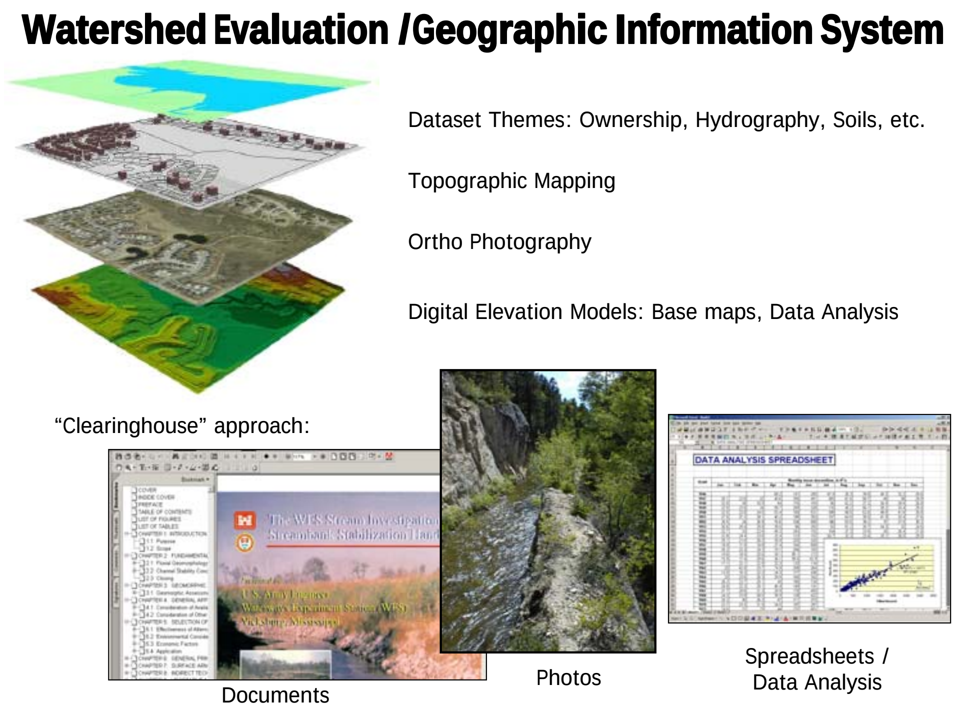


Figure 3.2-1 Example of the Badwater / Poison Creek Watershed Study GIS Structure and "Clearinghouse" Capabilities.

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 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 will vary from what is presented in this report.

The data in the delivered project GIS is stored in an ArcMap 10.1 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 BPC.gdb (file geodatabase) is a series of feature datasets categorized by the agency who supplied the data (BLM, AML). Within each feature dataset are feature classes representing the various geographic data supplied by the agency or developed during the project.

Table 3.2-1 Generalized GIS Contents.

Watershed Management Plan	**Communications**
BLM Proposed Improvements	FCC Antenna
Badwater/Poison Creek Watershed Management Plan Points - Proposed Improvements	FCC Cellular Tower
Badwater/Poison Creek Watershed Management Plan Linear - Proposed Improvements	FCC Microwave Tower
Political	**Historic and Cultural**
City	Historic Forts
Counties	Historic Monuments and Markers
PLSS (Township, Range, Section)	National Registry of Historic Places
UTM Zones	Pioneer Trails
Hydrology	Cultural Sites - State Historic Preservation Office (SHPO)
State Engineers Office Wells	**Fish and Wildlife**
Reservoirs evaluated by ACE	Sage Grouse Leks
Functional Reservoirs - 1 Mile Buffer	Sage Grouse Core Areas
PFC Data Lentic and Lotic (Lander, Worland, Casper Field Offices)	USGS Sagebrush ecosystem conservation and management: WY Basins Data
Stream Gages: USGS & Temporary Project	Migration Routes (Antelope, Elk, Moose, Mule Deer, White Tail Deer)
Streams (NHD high resolution, USGS/BLM, Rosgen Classification)	Migration Barriers (Antelope, Elk, Moose, Mule Deer, White Tail Deer)
Study Area	Crucial Range (Antelope, Elk, Moose, Mule Deer, White Tail Deer)
Springs	Seasonal Range (Antelope, Elk, Moose, Mule Deer, White Tail Deer)
Subwatersheds (HUC 12)	Parturition Areas (Antelope, Elk, Moose, Mule Deer, White Tail Deer)
HUC 250	Hunt Areas Herd Unit Boundaries (Antelope, Elk, Moose, Mule Deer, White Tail Deer)
Infrastructure	Black Bear Hunt and Management Areas
Roads (100K, roads with names)	Mountain Lion Hunt and Management Areas
Railroads	Aquatic Habitat Priorities
Irrigation	Terrestrial Habitat Priorities
Points of Diversion	Combined Habitat Priorities
Irrigation Ditches	Wyoming Game and Fish SWAP 2010 data (Fish, Mollusks, conservation areas)
Irrigated Lands	Fish Regional Boundaries
Irrigation Districts	Critical Stream Corridors
Fieldwork	**Climate**
Fieldwork Pts	Ecological Site Precipitation Zone
Fieldwork Track	NWS weather Stations
Land Management	Annual Average Precipitation
Wild Horse Management Areas	USGS Geographic Factors
Mine Permit Locations and Boundaries	**Land Cover and Land Class**
AML Sites (Bentonite, Coal, Hardrock, Industrial, Uranium, etc…)	WY Landcover - GAP Analysis
BLM Surface Ownership	LANDFIRE and National Wetlands Inventory
BLM Field Office Boundary	**Geology and Soils**
Grazing Allotments	Dikes
State Conservation Areas	Fault Lines
State Improvement Areas	Wyoming State Geologic Survey Earthquake Database
Ownership	Bedrock Geology
Private Ownership - Fremont, Natrona, and Hot Springs Counties	Surficial Geology
Energy Development	Landslides
Electric Transmission Corridors	250K Soils and 24K Soils (where available)
WY Wind Turbines	Ecological Site Descriptions : Dominant Component
Oil and Gas Wells	**Backgrounds**
Oil and Gas Pipelines	National Agriculture Imagery Program (NAIP)- 2012
EPA Oil and Gas Fields	USGS 10 Meter DEM
	USGS Topographic Maps

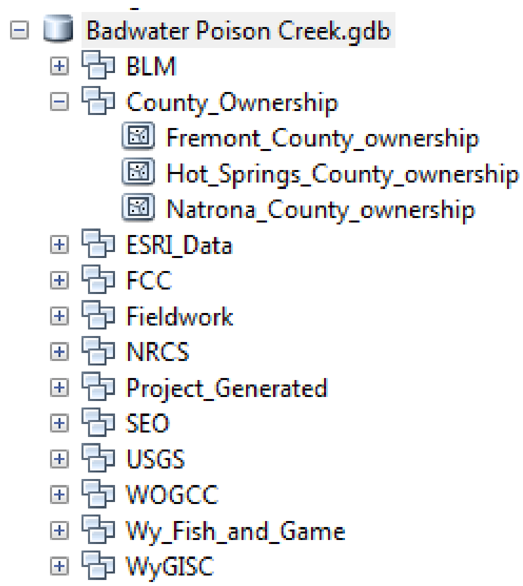


Figure 3.2-2 Badwater / Poison Creek Watershed Study Project GIS Geodatabase Structure.

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.

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 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
Miscellaneous

3.3 Land Uses and Activities

3.3.1 Land Ownership

The total land area within the project study area is approximately 918,000 acres (1,434.5 square miles). Figure 3.3-1 presents a map indicating the various land ownership categories within the watershed. The study area spans three counties; primarily Fremont and Natrona Counties and to a lesser extent Hot Springs County. As indicated in Figure 3.3-2, Fremont County comprises the majority of the area (905.3 square miles or 63.1 percent of the study area. Natrona County comprises approximately 465.2 square miles (32.4 percent) and Hot Springs County comprises the remaining 64 square miles (4.5 percent).

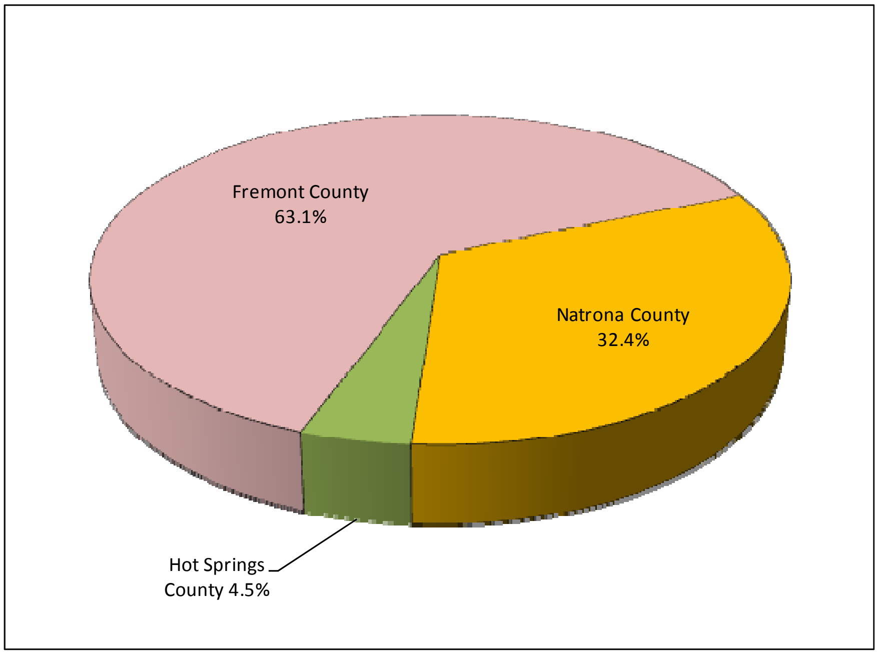


Figure 3.3-2 Distribution of Study Area among Counties and Study Area Subregions.

Land ownership information was obtained from the Bureau of Land Management (BLM) and the assessor's offices of the three counties involved and incorporated into the project GIS. According to this data, approximately 787.2 square miles (54.9 percent) of the study area is federally owned and administered by the Bureau of Land Management (BLM). The second largest land owner category is private individuals with approximately 479.1 square miles (33.4 percent). The State of Wyoming (146.5 square miles or 10.2 percent), US Bureau of Reclamation (15.6 square miles or 1.1 percent) and the Bureau of Indian Affairs (6.1 square miles or 0.4 percent) round out the surface ownership within the study area. A pie chart displaying the relative percentage of land ownership within the watershed is presented as Figure 3.3-3.

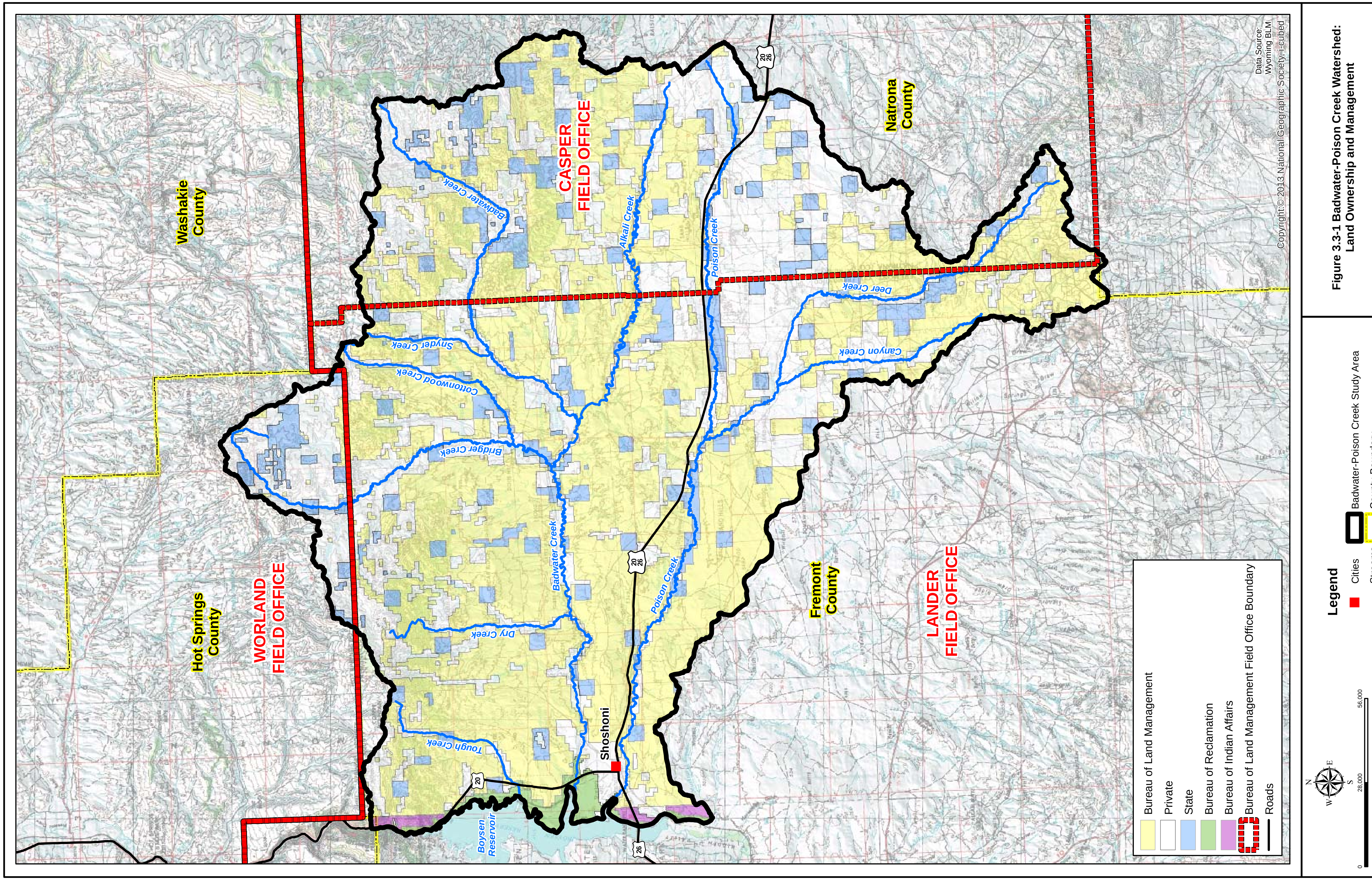


Figure 3.3-1 Badwater-Poison Creek Watershed:
Land Ownership and Management
Data Source:
Wyoming BLM
Copyright:© 2013 National Geographic Society, i-cubed
Legend
Cities
Streams
Badwater-Poison Creek Study Area
County Boundary
Bureau of Land Management
Private
State
Bureau of Reclamation
Bureau of Indian Affairs
Bureau of Land Management Field Office Boundary
Roads
0
28,000
56,000
Feet
N
S
E
W
CASPER
FIELD OFFICE
WORLAND
FIELD OFFICE
LANDER
FIELD OFFICE
Washakie
County
Hot Springs
County
Natrona
County
Fremont
County
Shoshoni
Boysen
Reservoir
Badwater Creek
Alkali Creek
Poison Creek
Deer Creek
Canyon Creek
Snyder Creek
Cottonwood Creek
Bridger Creek
Dry Creek
Tough Creek
20
26

Note: The Project GIS includes detailed land ownership information (name, address, etc) for individual parcels in Fremont, Natrona, and Hot Springs Counties. The data were obtained directly from the respective county assessor's offices and reflect ownership status as of the dates of their retrieval (Summer of 2013).

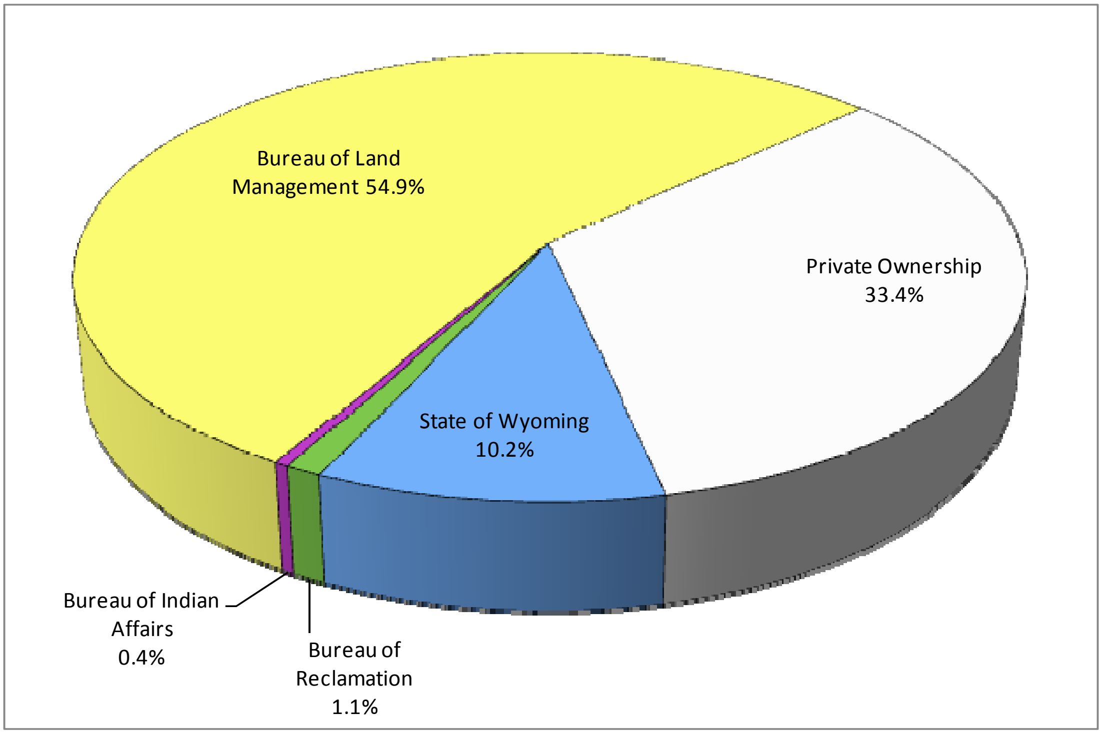


Figure 3.3-3 Distribution of Land Ownership within the Badwater / Poison Creek Study Area.

3.3.2 Transportation, Energy and Communications Infrastructure

Primary paved transportation routes traversing the study area are shown on Figure 3.3-4. State Highway 20/26 is the primary east/west transportation route. It is the only major route between Casper and Shoshoni. In Shoshoni State Highway 20/26 splits with highway 20 heading north out of Shoshoni towards Thermopolis and highway 26 heading southwest to Riverton. There are several other improved roads within the watershed but much of the transportation network is made up of unimproved roads of varying quality. On-going development and expansion of the energy industry has resulted in construction of numerous additional roads within the study area. Many of these are newer than the digital data and are consequently, not included in the GIS. Access is difficult throughout most of the study area during winter or wet conditions.

Several electric transmission lines cross the area. Mapping of the lines provided by WyGISC is coarse in nature with poor accuracy; presumably for security reasons. Consequently, the lines indicated on Figure 3.3-4 are approximations of alignment only.

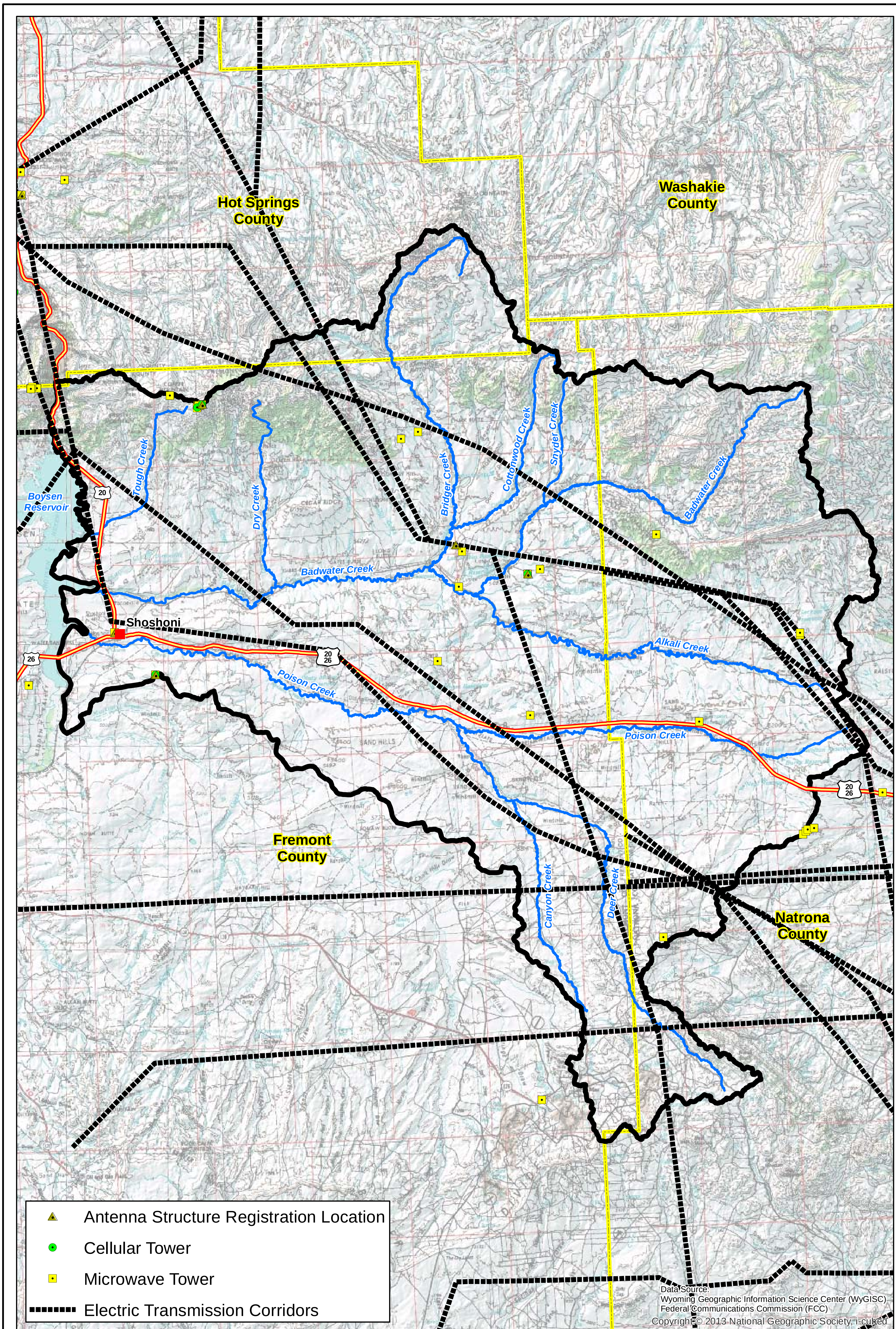


Figure 3.3-4 Badwater-Poison Creek Watershed: Communications and Transportation

3.3.3 Irrigation

Irrigation activities are limited primarily to the Badwater Creek floodplain as indicated on Figure 3.3-5. Smaller irrigated acreages are located on Dry Creek and Bridger Creek and its tributaries; however, these are isolated and less extensive than the irrigated areas on Badwater Creek. Irrigated pastures and grass hay/alfalfa dominate the irrigated lands usage.

Typically, the full growing season in the majority of the study area extends from early-May to late September, with the period from mid-July to the end of September defined as late-season when shortages frequently occur. Water supplies are more abundant in April, May and June because of high volumes of snow melt runoff. During these months, water supplies frequently exceed the demand. However, the supply of irrigation water in the basin is substantially reduced during late July, August, and September as snowmelt slows and ceases.

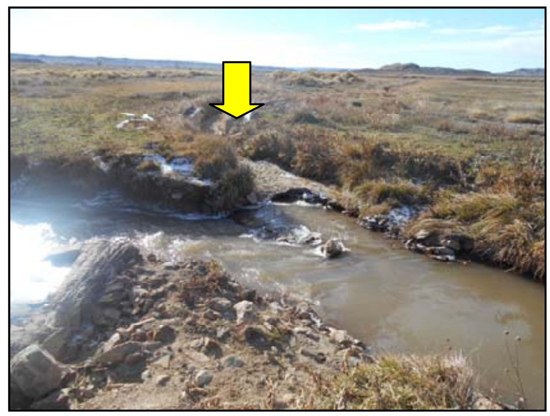


Figure 3.3-6 Inoperable Irrigation Headgate on Bridger Creek.

Based upon evaluation of delineated irrigated acreage provided by the WWDO, there are approximately 9,620 acres within the study area. Tabulated water rights provided by the WSEO are provided in Appendix 3A. Review of aerial photography with respect to the permitted headgate locations indicates that the majority of irrigated acres consist of narrow strips of irrigated pasture within riparian corridors. Some headgates appear to have been rendered unusable due to channel incision. Figure 3.3-6 displays a headgate located on Dry Creek which is no longer capable of diverting flows due to the significant magnitude of channel incision.

3.3.4 Range Conditions/Grazing Practices

3.3.4.1 Grazing Allotments Administration

Grazing on federal lands within the Badwater / Poison Creek watershed is administered by the Bureau of Land Management.

The BLM-administered allotments are administered by the Lander, Casper, and Worland Field Offices. The Lander Field Office is currently revising the existing 1987 Lander Field Office RMP (BLM, 1987) to reflect changes in land management issues, policies and circumstances that have occurred during the approximately 25 years since the Record of Decision for the existing plan was signed. At the time this report was written, the Final Environmental Impact Statement (FEIS) had been prepared (BLM, 2013). The following extract from the Lander Field Office website describes the current status of the process:

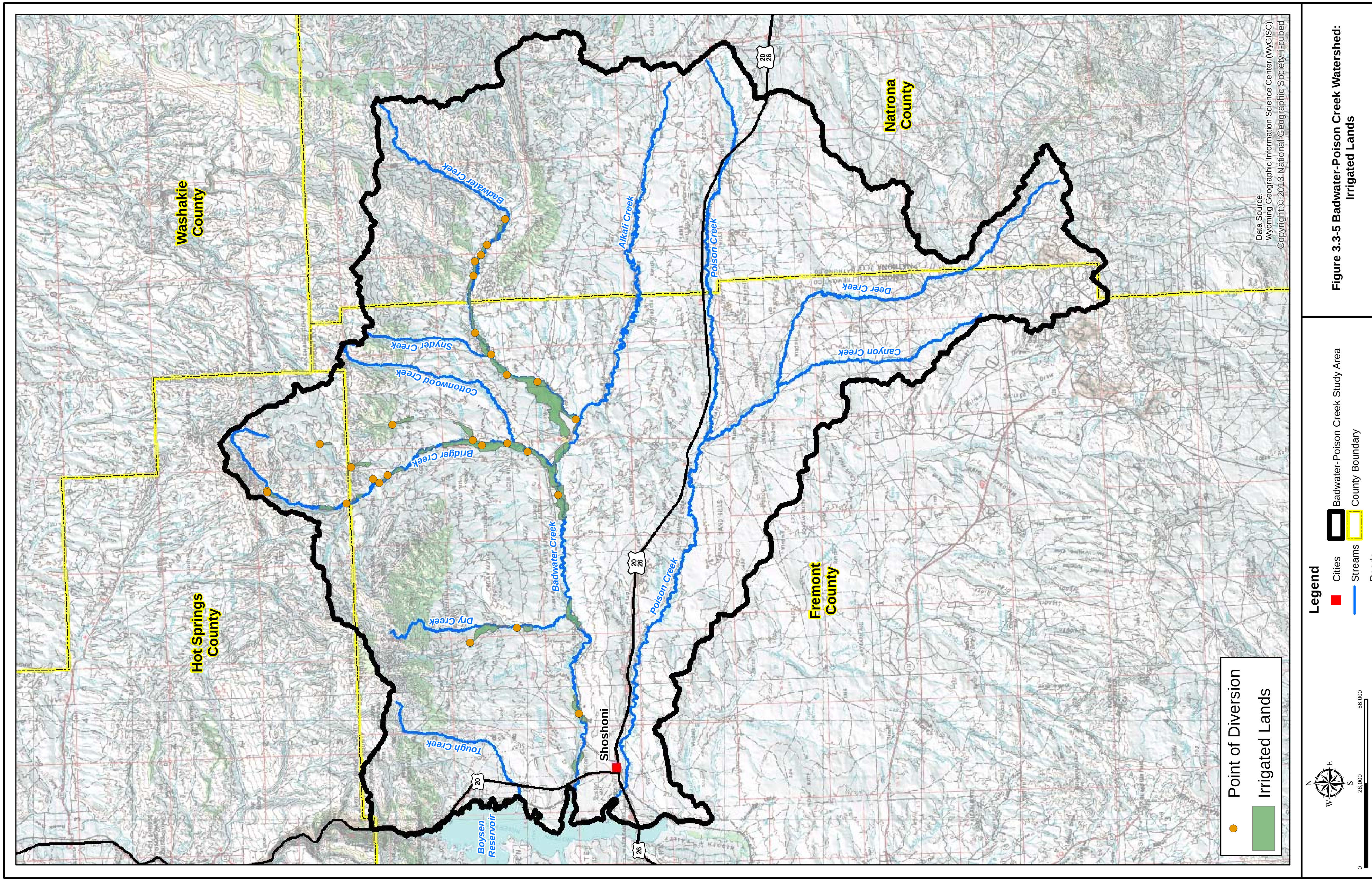


Figure 3.3-5 Badwater-Poison Creek Watershed: Irrigated Lands

On February 22, 2013 the notice of availability (NOA) of the proposed RMP and final EIS was published in the Federal Register*, initiating a 30-day protest period which closed March 25, 2013. During the 30-day protest period members of the public with standing had the opportunity to protest the content of the proposed RMP and final EIS.*

Following the resolution of protests and a 60-day Governor's consistency review and a determination a supplemental proposed RMP and final EIS is not warranted, the BLM will prepare the record of decision (ROD) and the approved RMP, which will document the BLM's decision.

Available at: http://www.blm.gov/wy/st/en/programs/Planning/rmps/lander.html

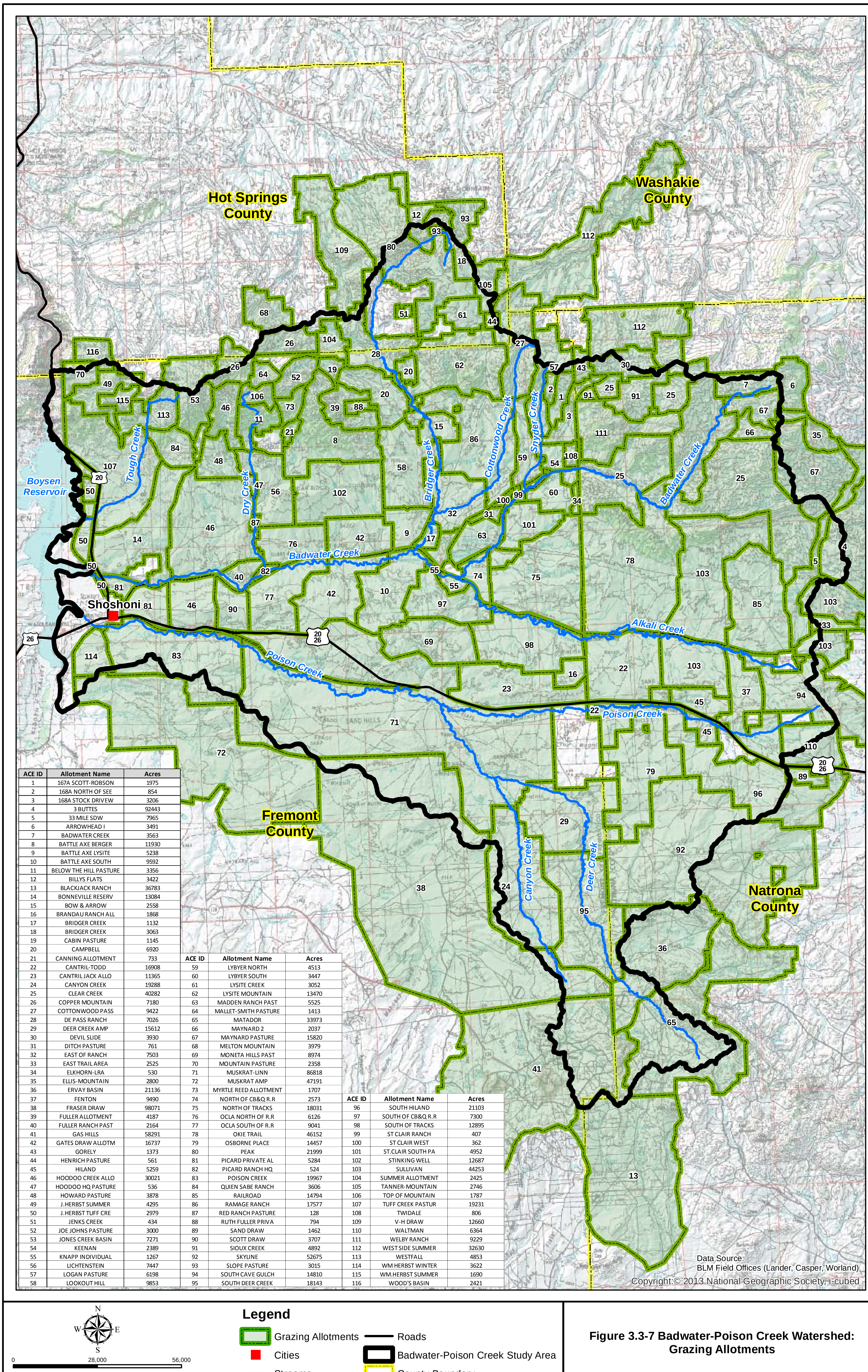
The Casper Field Office administers lands in the eastern portion of the study area within Natrona County. The Casper RMP was approved in December, 2007 (BLM, 2007). The Worland Field Office manages lands in the northern portion of the study area and is currently in the process of developing the Bighorn Basin (BB) Resource Management Plan Revision Project and associated Environmental Impact Statement. The resulting RMP will provide a single document which guides land management decisions. Currently the Worland Field Office operates under the Washakie RMP (1988) and the Grass Creek RMP (1998). For more information: http://www.blm.gov/wy/st/en/programs/Planning/rmps/bighorn.html

Based upon information collected from the BLM, there are approximately 116 individual allotments as indicated in Figure 3.3-7. Note that some of these allotments may be located primarily in adjacent watersheds and "spill" over the watershed divide. Appendix 3B lists the allotments and pertinent data associated with them.

Livestock grazing is 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). BLM's specific objectives and procedures for managing livestock grazing are contained in the agency's grazing regulations. BLM's grazing regulations were revised in 1995 to ensure that livestock grazing is conducted in a manner that will sustain or improve the fundamental ecological health of public rangelands.

Grazing on BLM lands to meet these requirements is managed under the Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management for the Public Lands Administered by the BLM in the State of Wyoming (BLM, 2013). Among the full suite of grazing management guidelines, those most applicable to this watershed study are summarized as follows:

- 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;



ACE ID	Allotment Name	Acres
1	167A SCOTT-ROBSON	1975
2	168A NORTH OF SEE	854
3	168A STOCK DRIVEW	3206
4	3 BUTTES	92443
5	33 MILE SDW	7965
6	ARROWHEAD I	3491
7	BADWATER CREEK	3563
8	BATTLE AXE BERGER	11930
9	BATTLE AXE LYSITE	5238
10	BATTLE AXE SOUTH	9592
11	BELOW THE HILL PASTURE	3356
12	BILLYS FLATS	3422
13	BLACKJACK RANCH	36783
14	BONNEVILLE RESERV	13084
15	BOW & ARROW	2558
16	BRANDAU RANCH ALL	1868
17	BRIDGER CREEK	1132
18	BRIDGER CREEK	3063
19	CABIN PASTURE	1145
20	CAMPBELL	6920
21	CANNING ALLOTMENT	733
22	CANTRIL-TODD	16908
23	CANTRIL JACK ALLO	11365
24	CANYON CREEK	19288
25	CLEAR CREEK	40282
26	COPPER MOUNTAIN	7180
27	COTTONWOOD PASS	9422
28	DE PASS RANCH	7026
29	DEER CREEK AMP	15612
30	DEVIL SLIDE	3930
31	DITCH PASTURE	761
32	EAST OF RANCH	7503
33	EAST TRAIL AREA	2525
34	ELKHORN-LRA	530
35	ELLIS-MOUNTAIN	2800
36	ERVAY BASIN	21136
37	FENTON	9490
38	FRASER DRAW	98071
39	FULLER ALLOTMENT	4187
40	FULLER RANCH PAST	2164
41	GAS HILLS	58291
42	GATES DRAW ALLOTM	16737
43	GORELY	1373
44	HENRICH PASTURE	561
45	HILAND	5259
46	HOODOO CREEK ALLO	30021
47	HOODOO HQ PASTURE	536
48	HOWARD PASTURE	3878
49	J.HERBST SUMMER	4295
50	J.HERBST TUFF CRE	2979
51	JENKS CREEK	434
52	JOE JOHNS PASTURE	3000
53	JONES CREEK BASIN	7271
54	KEENAN	2389
55	KNAPP INDIVIDUAL	1267
56	LICHTENSTEIN	7447
57	LOGAN PASTURE	6198
58	LOOKOUT HILL	9853

ACE ID	Allotment Name	Acres
59	LYBYER NORTH	4513
60	LYBYER SOUTH	3447
61	LYSITE CREEK	3052
62	LYSITE MOUNTAIN	13470
63	MADDEN RANCH PAST	5525
64	MALLET-SMITH PASTURE	1413
65	MATADOR	33973
66	MAYNARD 2	2037
67	MAYNARD PASTURE	15820
68	MELTON MOUNTAIN	3979
69	MONETA HILLS PAST	8974
70	MOUNTAIN PASTURE	2358
71	MUSKRAT-LINN	86818
72	MUSKRAT AMP	47191
73	MYRTLE REED ALLOTMENT	1707
74	NORTH OF CB&Q R.R	2573
75	NORTH OF TRACKS	18031
76	OCLA NORTH OF R.R	6126
77	OCLA SOUTH OF R.R	9041
78	OKIE TRAIL	46152
79	OSBORNE PLACE	14457
80	PEAK	21999
81	PICARD PRIVATE AL	5284
82	PICARD RANCH HQ	524
83	POISON CREEK	19967
84	QUIEN SABE RANCH	3606
85	RAILROAD	14794
86	RAMAGE RANCH	17577
87	RED RANCH PASTURE	128
88	RUTH FULLER PRIVA	794
89	SAND DRAW	1462
90	SCOTT DRAW	3707
91	SIOUX CREEK	4892
92	SKYLINE	52675
93	SLOPE PASTURE	3015
94	SOUTH CAVE GULCH	14810
95	SOUTH DEER CREEK	18143

ACE ID	Allotment Name	Acres
96	SOUTH HILAND	21103
97	SOUTH OF CB&Q R.R	7300
98	SOUTH OF TRACKS	12895
99	ST CLAIR RANCH	407
100	ST CLAIR WEST	362
101	ST.CLAIR SOUTH PA	4952
102	STINKING WELL	12687
103	SULLIVAN	44253
104	SUMMER ALLOTMENT	2425
105	TANNER-MOUNTAIN	2746
106	TOP OF MOUNTAIN	1787
107	TUFF CREEK PASTUR	19231
108	TWIDALE	806
109	V-H DRAW	12660
110	WALTMAN	6364
111	WELBY RANCH	9229
112	WEST SIDE SUMMER	32630
113	WESTFALL	4853
114	WM HERBST WINTER	3622
115	WM.HERBST SUMMER	1690
116	WOOD'S BASIN	2421

Figure 3.3-7 Badwater-Poison Creek Watershed: Grazing Allotments

- Restore, maintain, or improve riparian plant communities to sustain adequate residual plant cover for sediment capture and groundwater recharge;
- Implement riparian improvements (e.g., instream structures, water troughs, etc.) to maintain or enhance appropriate stream channel morphology; develop springs, seeps, reservoirs, wells or other water development projects in a manner protective of watershed ecological and hydrological functions; and implement range improvements away from riparian areas to avoid conflicts in achieving or maintaining riparian function; and
- 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, 2013). 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 at:

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

State Grazing Leases. Most of the state lands within the Badwater / Poison Creek watershed are leased to private landowners for grazing. These leases are typically issued by the Board of Land Commissioners and administered by the Office of State Lands and Investments (OSLI). Grazing management, practices and improvements on state lands are usually established and implemented by the lessee. Improvements are normally paid for and owned by the lessee with reimbursement by the new lessee upon transfer of the lease.

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 Water Supply

Numerous upland water supply sources currently exist within the study area. Within the project study area, numerous range improvement projects have been completed which utilize existing water sources (springs, wells, perennial streams, etc). Typical projects include livestock/wildlife water tanks and/or livestock/wildlife reservoirs, spring developments with pipelines providing water to remote stock tanks, well construction, etc.

Mapping of existing sources was completed to provide valuable information for completion of the watershed management plan:

- Mapping of stock reservoirs and springs was initially obtained from the Lander, Worland and Casper Field Offices of the BLM (Figure 3.3-8).
- Mapping of wells with a designated stock use was obtained from the Wyoming State Engineers Office (SEO).
- 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.
- In addition, aerial photography was reviewed within the GIS environment to document visible features (i.e. stock reservoirs), and give an initial assessment of their condition.

Not all landowners participated in the project; consequently, the mapping is not expected to be an exhaustive accounting of all available sources. However, the information provides a starting point upon which to evaluate the watershed.

The results of this effort indicated the presence of 549 stock reservoirs/ponds. Mapping of springs was augmented with digitized locations from USGS topographic mapping. Field inspection of the sites was beyond the scope and budget of this project, however, a reasonable estimate of the viability of the reservoirs was desired. Based upon field observations and interviews with landowners, it is obvious that many of the reservoirs have either failed or have filled with sediment and are no longer viable sources of livestock and wildlife water.

Using the project GIS, mapping of the reservoirs sites was overlain on recent high resolution aerial photography. Each reservoir was examined in the GIS to determine its status at the time of the photography (2009). Those containing water or showed no signs of physical breaches or sedimentation were determined to be functional water sources. Physical breaches were visible on many of the reservoirs resulting in a classification of “non-functional”. Likewise, many were visibly filled with sediment and also classified as “non-functional”. Others were simply empty and firm conclusions could not be drawn. These sites could have been dry at the time of the photography but remain viable sources following precipitation events. Figure 3.3-9 displays an example of this process.

Figure 3.3-10 displays a map of the study area showing the results of this classification. Based upon this analysis, it appears that a minimum of 380 remain viable water sources. This analysis also indicates that 169 are either breached, sediment filled, or in need of site visits to determine their status. (Appendix 3C presents the results in a tabular format).

Note that this feature does NOT include surface water sources such as perennial streams, intermittent streams, or undeveloped springs because a primary objective of this study is to reduce reliance upon these sources. Because they do not presently appear to provide sources of water to livestock or wildlife, reservoirs which appeared to be either breached, filled with sediment, or otherwise nonviable, are not included in this figure.

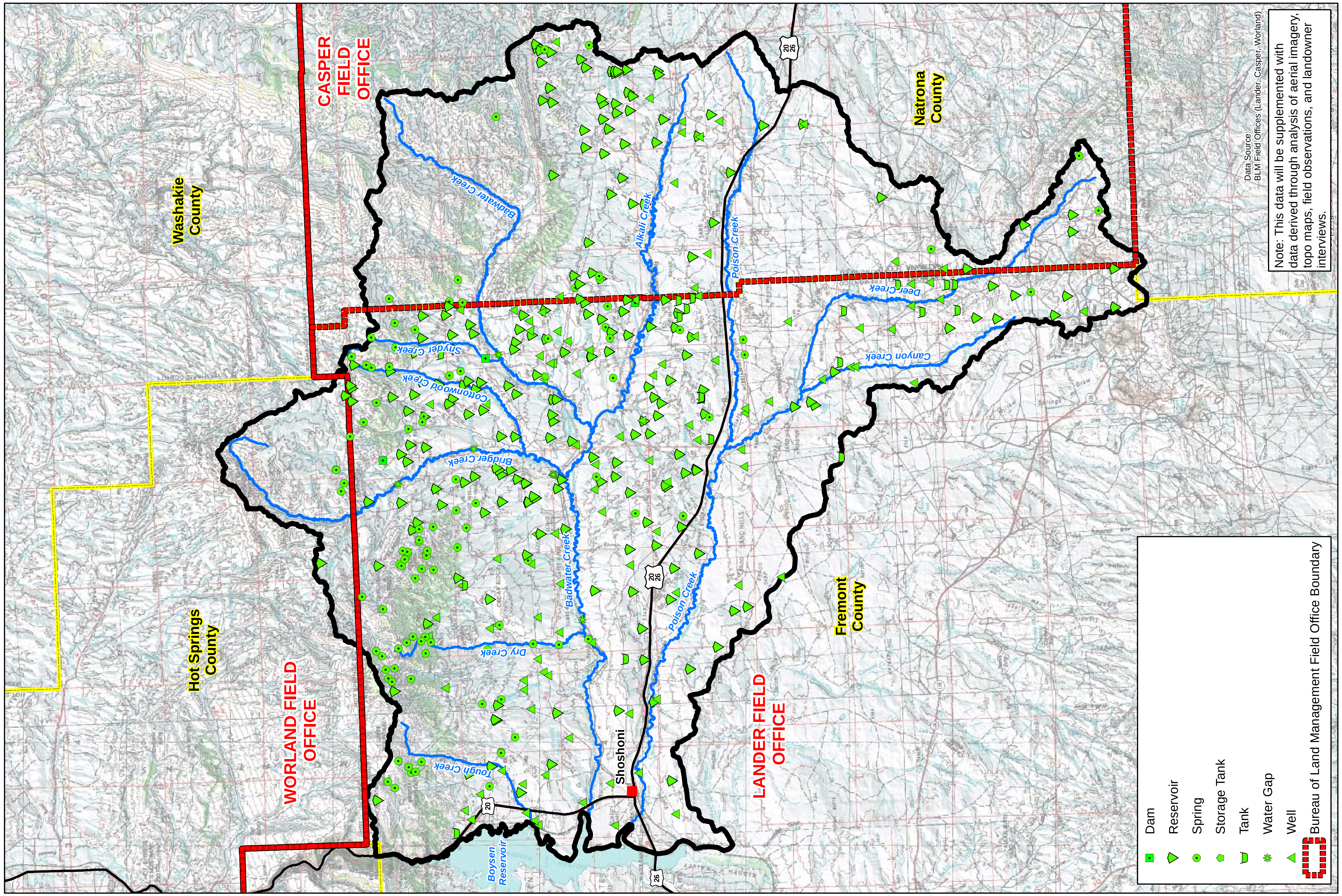


Figure 3.3-8 Badwater-Poison Creek Watershed: BLM Range Improvement Projects (Lander, Casper and Worland Field Offices)

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

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 Site Descriptions (ESDs) are reports 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).

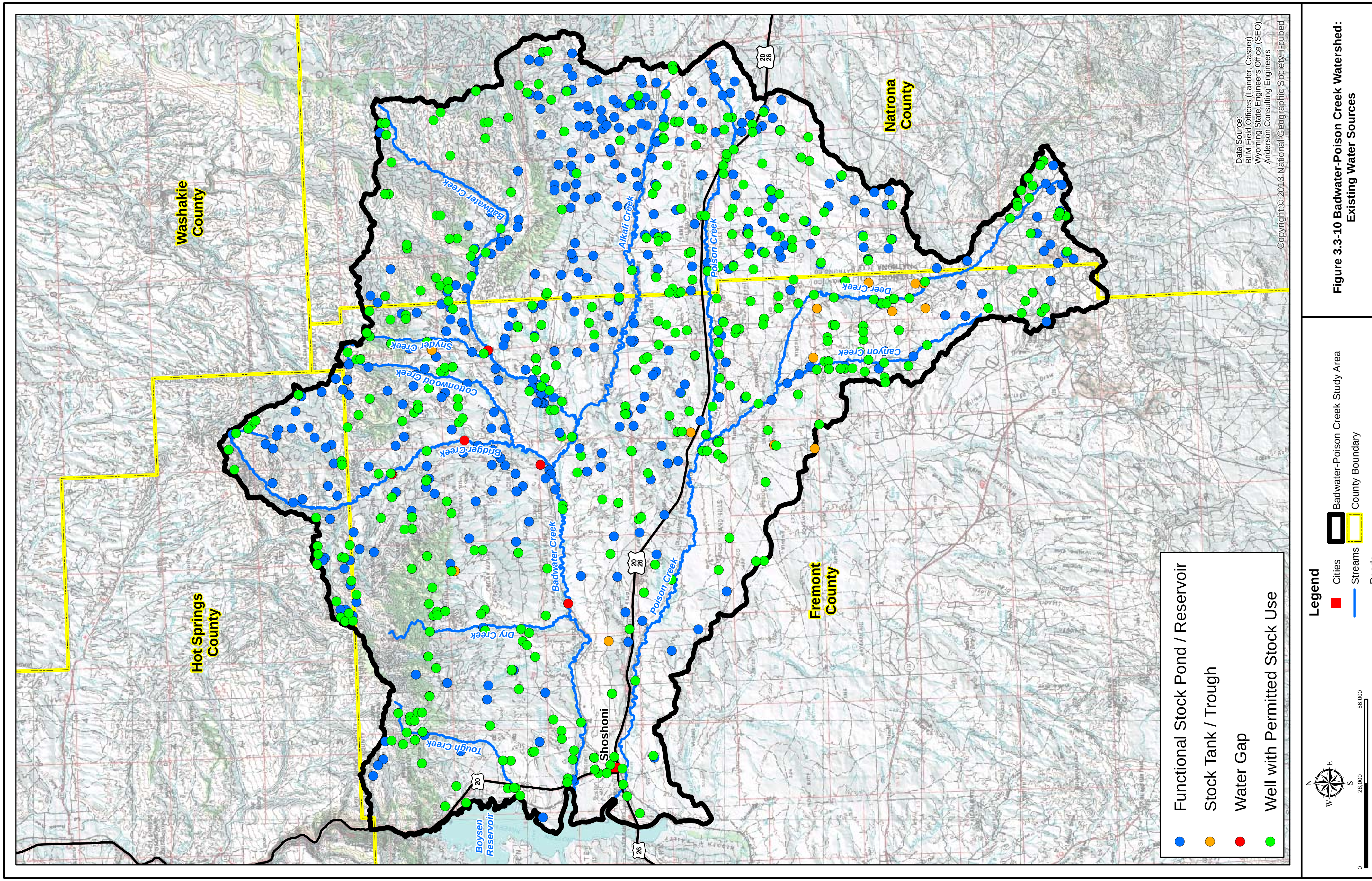


Figure 3.3-10 Badwater-Poison Creek Watershed:
Existing Water Sources
Washakie County
Hot Springs County
Natrona County
Fremont County
Badwater Creek
Alkali Creek
Poison Creek
Deer Creek
Canyon Creek
Snyder Creek
Cottonwood Creek
Bridger Creek
Dry Creek
Tough Creek
Boysen Reservoir
Shoshoni
20
26
Functional Stock Pond / Reservoir
Stock Tank / Trough
Water Gap
Well with Permitted Stock Use
Legend
Cities
Streams
Roads
Badwater-Poison Creek Study Area
County Boundary
0
28,000
56,000
Feet
Data Source:
BLM Field Offices (Lander, Casper)
Wyoming State Engineers Office (SEO)
Anderson Consulting Engineers
Copyright:© 2013 National Geographic Society, i-cubed

More information regarding ESDs and their application is available at: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/ecoscience/desc/.

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 3.3-11 displays the ecological precipitation zones found in the Study Area.

Ecological Sites are defined based upon their location within defined Ecological Precipitation Zones and soil characteristics. 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

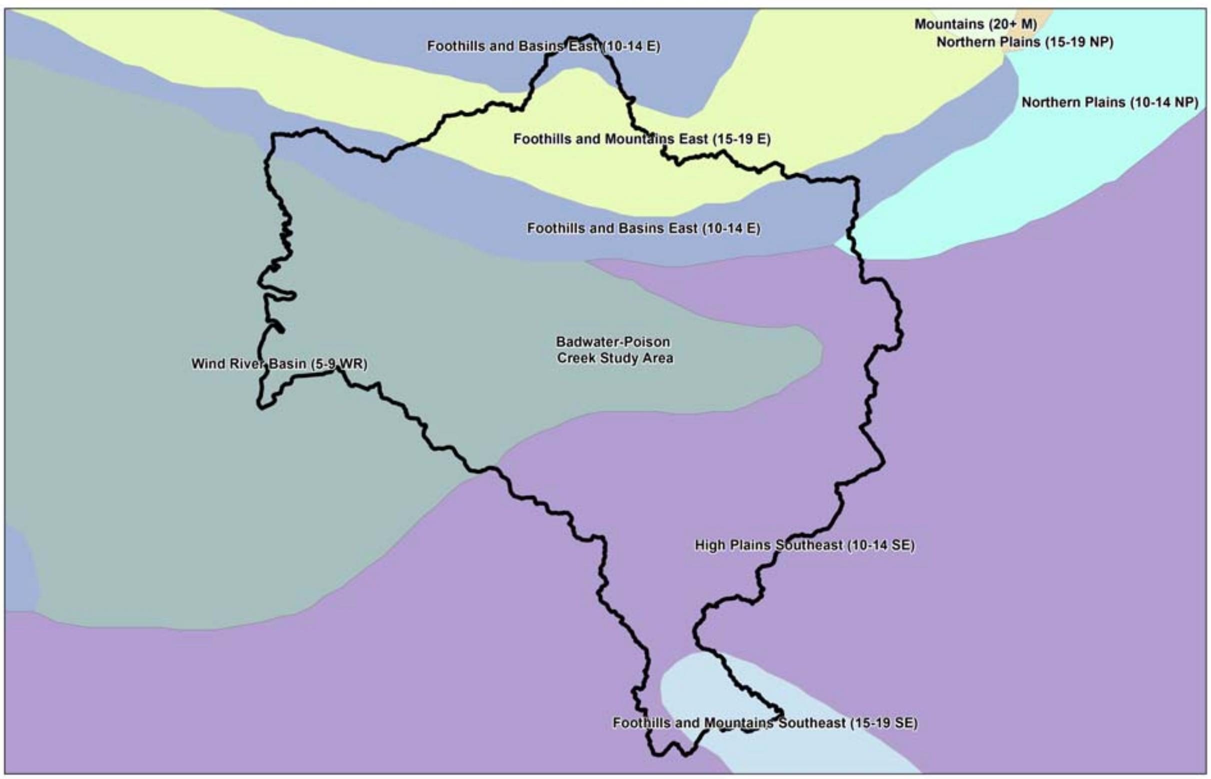


Figure 3.3-11 Ecological Precipitation Zones.

approximately 94% of the study area. ESD's were not able to be produced for the remaining 6% of the watershed due to lack of available soils data (Please refer to Section 3.4.4 for a discussion of soils mapping availability). Figure 3.3-12 displays the locations of the major ecological sites where the 1:24,000 mapping was available.

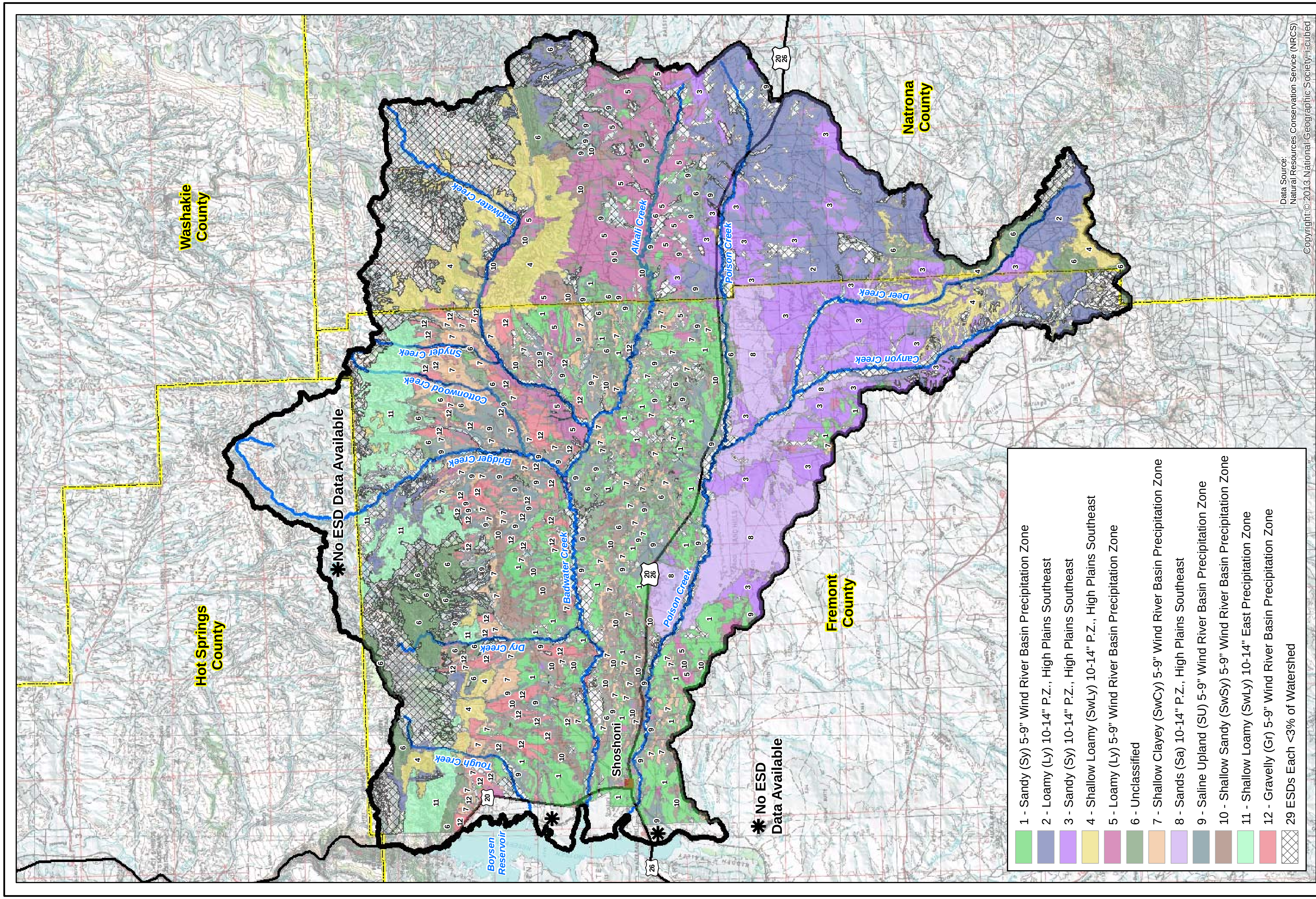


Figure 3.3-12 Badwater-Poison Creek Watershed: Predominant Ecological Sites of Management Relevance

Based upon the mapping which is available, there are several ecological sites which are predominant. These ecological sites are:

- Sandy (Sy) 5-9” Wind River Basin Precipitation Zone
- Loamy (Ly) 10-14" P.Z., High Plains Southeast
- Sandy (Sy) 10-14" P.Z., High Plains Southeast

The following descriptions of the Historic Climax Plant Communities (HCPC) associated with these ESDs are extracted from the NRCS descriptions (NRCS, 2008).

<u>Sandy (Sy) 5-9” Wind River Basin Precipitation Zone</u>

The interpretive plant community for this site is the Historic Climax Plant Community. This state evolved with grazing by large herbivores and periodic fires. The cyclical natural of the fire regime in this community prevented big sagebrush from being the dominant landscape. This plant community can be found on areas that are properly managed with grazing and/or prescribed burning, and on areas receiving occasional short periods of rest. The state is mostly cool season mid-grasses and a variety of forbs and woody species. Potential vegetation is about 70% grasses or grass-like plants, 15% forbs, and 15% woody plants.

The major grasses include needleandthread, Indian ricegrass and rhizomatous wheatgrasses. Other grasses and grass-likes occurring in the state include prairie sandreed, Sandberg bluegrass, blue grama, threadleaf sedge, and threeawns. Big sagebrush and winterfat are conspicuous components of this state. A variety of forbs also occurs in this state and plant diversity is high (see Plant Composition Table).

The total annual production (air-dry weight) of this state is about 400 lbs./acre, but it can range from about 225 lbs./acre in unfavorable years to about 600 lbs./acre in above average years.

The state is stable and well adapted to the Northern Great Plains climatic conditions. 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 Perennial Grass/Big Sagebrush Plant Community. Prolonged Drought will exacerbate this transition.

Loamy (Ly) 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 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.

Sandy (Sy) 10-14" P.Z., High Plains Southeast

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.

3.3.4.4 Range Conditions and Needs

As previously discussed, the study area lies within the boundaries of the Lander, Casper, and Worland Field Offices of the BLM. The Lander and Worland Districts are each currently in the process of revising their existing Resource Management Plan (RMP). The Casper District completed its revision in 2007.

An important factor needed to facilitate improved grazing management and thereby achieve the associated benefits to the watershed is well-distributed, reliable water. Despite the relatively ample water supplies within upper portions of the watershed, good grazing systems control both the time (amount of time spent in an area), and the timing (the time of the year) that the livestock spend in a pasture. Grasses and other plants need to recover from the last 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 eventually take over and plant densities decrease. In the absence of well-distributed livestock water, areas near water (frequently riparian areas) are grazed heavily while many other areas are under-utilized. Livestock water must also be reliable so that each pasture can be used as needed in a grazing rotation. Otherwise, the same pastures with reliable water get grazed repeatedly at the same crucial time of the year.

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 4.6. 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.

3.3.5 Oil and Gas Production and Resources

The locations of all active and permanently abandoned oil and gas wells were obtained from the Wyoming Oil and Gas Conservation Commission (WOGCC) website: http://wogcc.state.wy.us/. Active wells and permanently abandoned wells within the study area are shown on Figure 3.3-13. Annual oil and gas production for 2012 for the well fields encountered is summarized in Table 3.3-2 (It must be kept in mind that the well fields may extend beyond the boundaries of the current study area). Figure 3.3-14 displays mapped pipelines. Total oil production was approximately 5.3 million barrels. Natural gas production was approximately 189 million cubic feet.

At the time this report was prepared, a major oil and gas development was under review. The Moneta Divide Project proposed by Encana Oil and Gas Inc. and Burlington Resources Oil & Gas Company LP could result in the construction of numerous additional wells and associated infrastructure within the study area.

At this time, the BLM is preparing the Draft Environmental Impact Statement (DEIS) pertaining to the project and many of the specific details have yet to be determined. According to the Lander BLM office, the DEIS is not scheduled for completion until the end of 2016.

The extensive number of oil and gas wells and the associated infrastructures has made a considerable mark on the landscape especially in the central portion of the study area. In recent years this is where the oil and gas development has been concentrated. The two primary fields located in this area are the Madden Field (located northeast of the confluence of Badwater Creek and Alkali Creek) and the Frenchie Draw field (located due south of the Madden field between Alkali Creek and Poison Creek).In an effort to monitor conditions of existing resources, the project team conducted a preliminary screening of reclamation success associated with abandoned oilfield wells. Within the project GIS and using the best available aerial photography, analysts visually evaluated each site to assess its reclamation success in terms of vegetation establishment. Using locations of all abandoned wells in the study area (WOGCC, 2012), each site was designated one of five vegetation categories. The categories are described as follows:

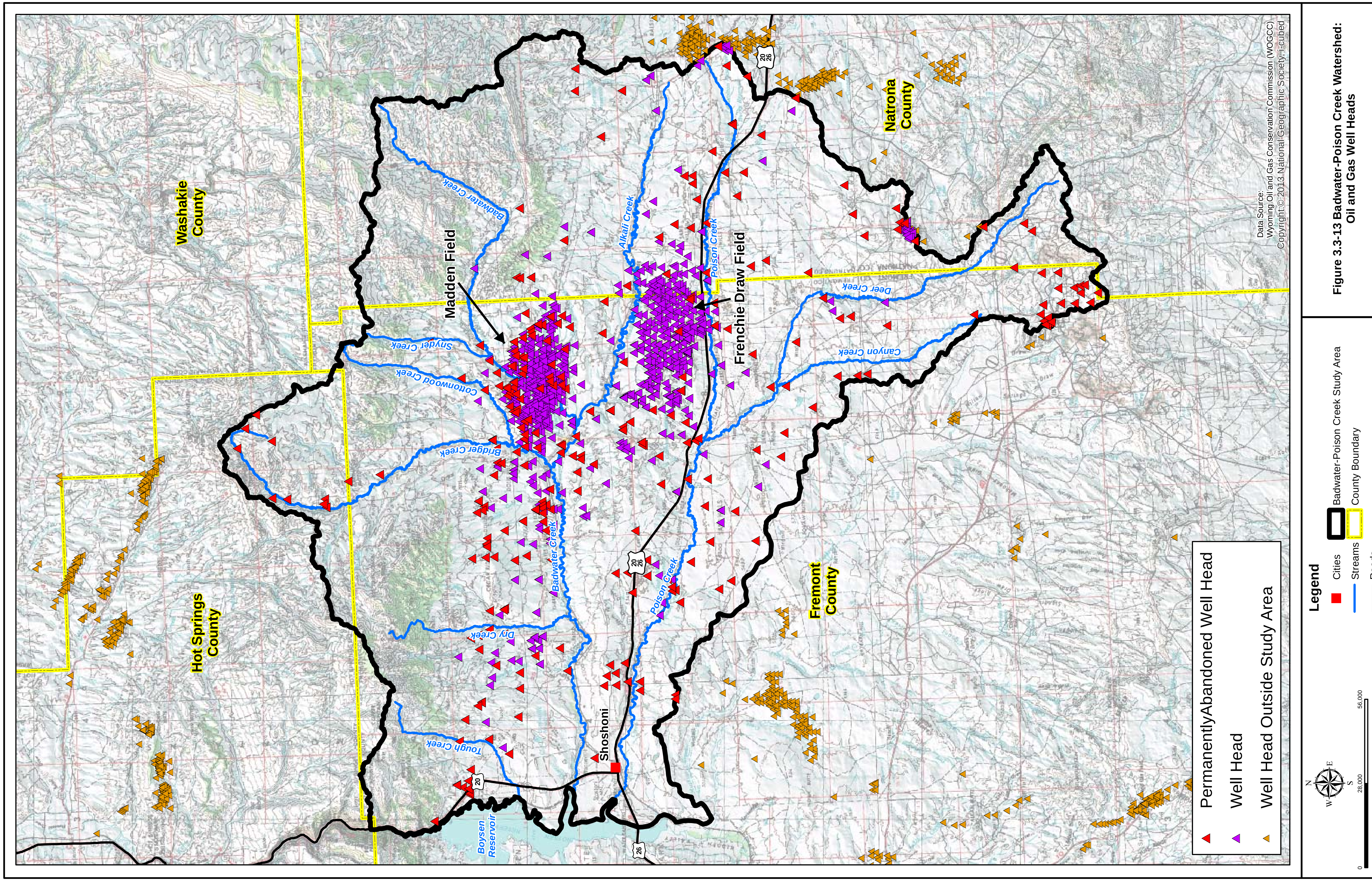


Figure 3.3-13 Badwater-Poison Creek Watershed:
Oil and Gas Well Heads
Data Source:
Wyoming Oil and Gas Conservation Commission (WOGCC)
Copyright:© 2013 National Geographic Society, i-cubed
Legend
Cities
Streams
Roads
Badwater-Poison Creek Study Area
County Boundary
Permanently Abandoned Well Head
Well Head
Well Head Outside Study Area
0
28,000
56,000
Feet
Washakie County
Hot Springs County
Natrona County
Fremont County
Madden Field
Frenchie Draw Field
Badwater Creek
Snyder Creek
Cottonwood Creek
Bridger Creek
Badwater Creek
Dry Creek
Tough Creek
Alkali Creek
Poison Creek
Deer Creek
Canyon Creek
Shoshoni
Boysen Reservoir
20
26

Table 3.3-2 Tabulation of 2012 Oil, Gas, and Water Production.

Field	Discovery Year	Total Wells	Producing Wells	Idle Wells	2012 Oil BBLS	2012 Gas MCF	Total Cumlative Oil BBLS	Total Cumlative Gas MCF
BONNEVILLE	1971	10	8	2	2,488	68,074	198,819	3,730,877
CEDAR GAP	1985	1	0	1	0	0	1,282	312,315
DAY BUTTE	1986	1	1	0	70	12,410	1,911	181,918
DEER CREEK II	1986	0	0	0	0	0	691	186,243
FRENCHIE DRAW	1961	240	214	26	459,806	29,295,792	5,407,281	260,775,427
GATES BUTTE	2006	1	1	0	58	60,167	4,666	786,297
HOODOO HILLS	2006	1	0	1	0	0	0	18,347
HOWARD RANCH	1961	1	1	0	455	21,598	29,616	2,993,983
KANSON DRAW	1974	4	1	3	2,979	118,643	7,742	1,339,514
LONG BUTTE	1983	1	0	1	0	0	0	2,554
LOST CABIN	1957	10	5	5	5,472	0	556,701	3,791,149
LYSITE	1963	16	14	2	27	872,162	58,921	161,994,523
MADDEN	1969	309	189	120	13,493	103,191,064	1,520,918	2,178,624,658
MEIGH RANCH	1995	0	0	0	0	0	142	92,314
MONETA HILLS	1962	41	30	11	27,869	1,145,709	364,135	9,184,711
OWL CREEK VALLEY	2006	1	1	0	136	59,331	10,765	1,468,171
PAVILLION	1960	141	109	32	123	2,877,402	27,999	296,620,095
RADERVILLE	1955	28	20	8	14,531	4,023	819,722	440,351
SQUAW BUTTE	1960	2	2	0	58	409	18,781	414,856
STEFFEN HILL	1982	2	1	1	0	1,961	0	478,808
TRAVIS	1967	0	0	0	0	0	0	0
WALTMAN	1959	139	133	6	29,414	8,449,485	2,171,465	575,974,879
WC	2000	1,000	613	387	4,746,796	42,863,308	9,983,984	222,651,929
	Total	**1,949**	**1,343**	**606**	**5,303,775**	**189,041,538**	**21,185,541**	**3,722,063,919**

Source: WOGCC, 2013

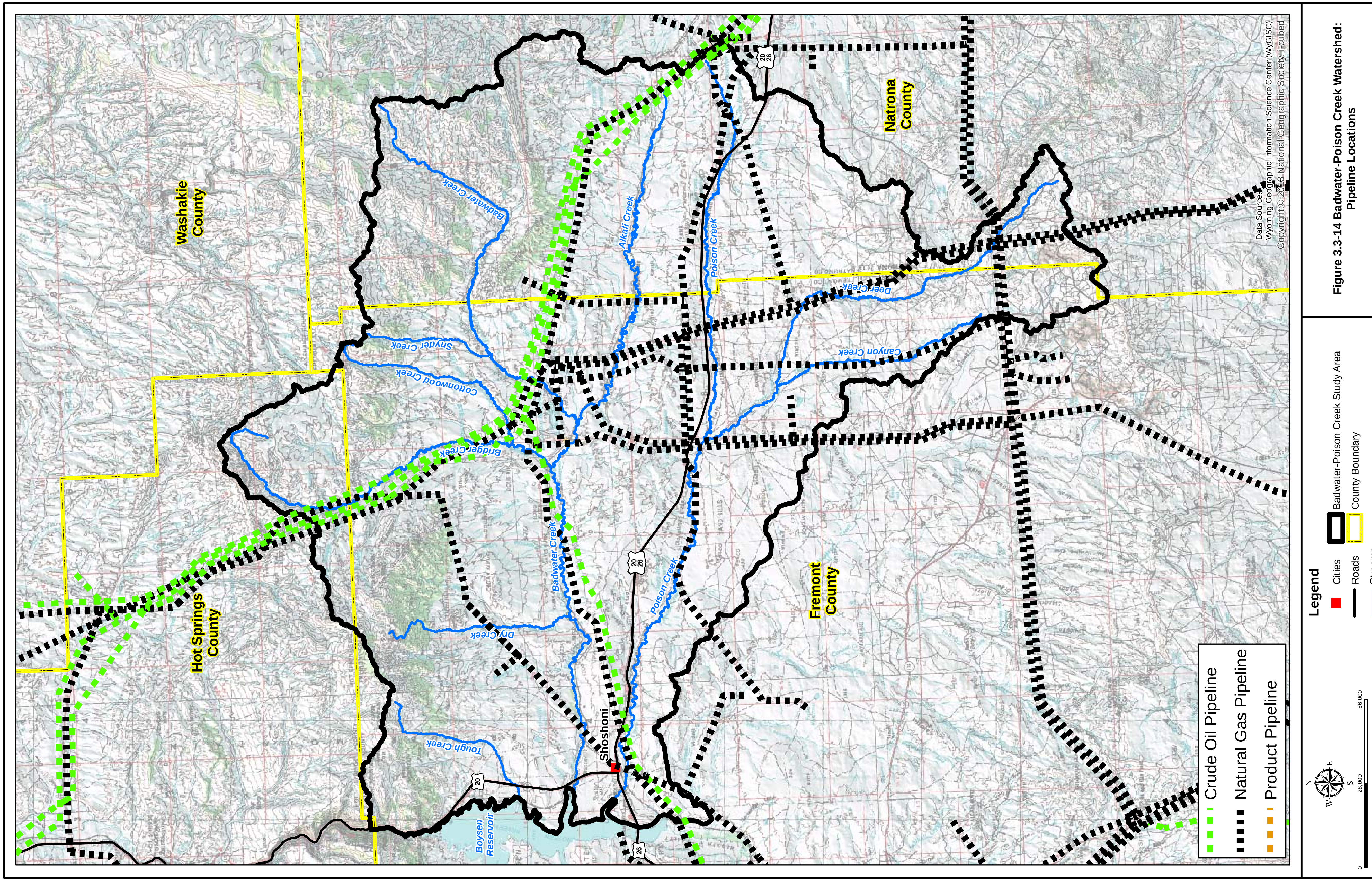


Figure 3.3-14 Badwater-Poison Creek Watershed: Pipeline Locations

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.
Unknown: Well site could not be verified or located.

Figure 3.3-15 displays and 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 non-desirable weed species and be classified as vegetated under this procedure. Using these visual classifications, each of the abandoned well sites was evaluated. As of March, 2012, of a total of 296 sites, 175 appeared to have obtained a reasonably successful level of vegetation cover; 70 showed a partial level of success; 32 appeared to be devoid of vegetation and/or exhibiting visual erosional features and 17 have been redeveloped with another well head. The remaining 2 could not be verified or located. The 32 classified as “No Vegetation” represent the sites that the conservation districts could flag for potential site visits to confirm site-specific conditions. Figure 3.3-16 presents the results of this analysis graphically.

Figure 3.3-15 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.

3.3.6 Mining and Mineral Resources

At the time of this report, there were thirteen active mines on record with the WDEQ within the study area (Table 3.3-3). The majority of the active permits were associated with sand and/or gravel operations (9 permits). Two uranium mines, a bentonite mine and a quartzite mine are also currently active within the study area. Figure 3.3-17 displays the locations of these mines.

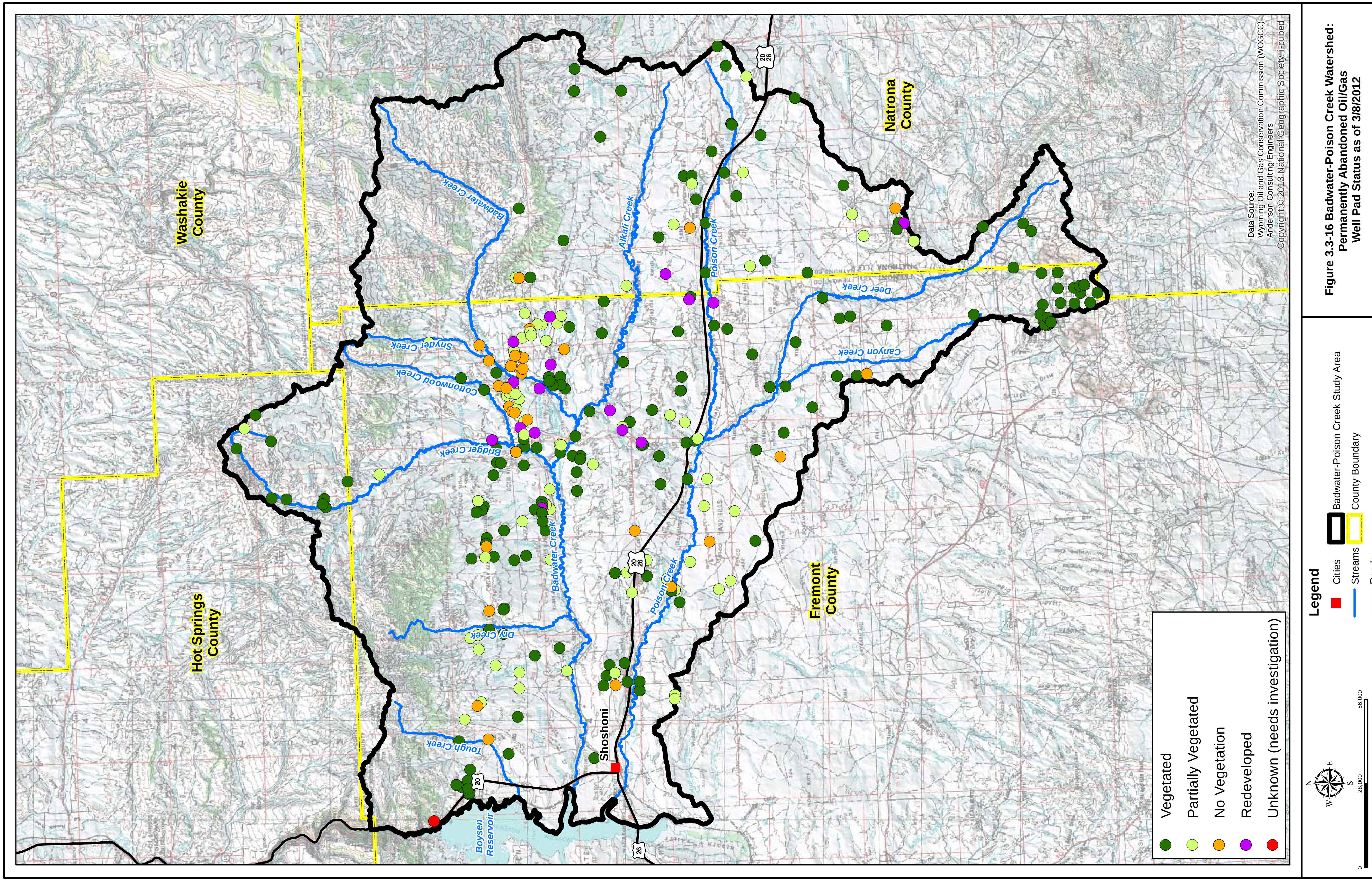


Figure 3.3-16 Badwater-Poison Creek Watershed: Permanently Abandoned Oil/Gas Well Pad Status as of 3/8/2012

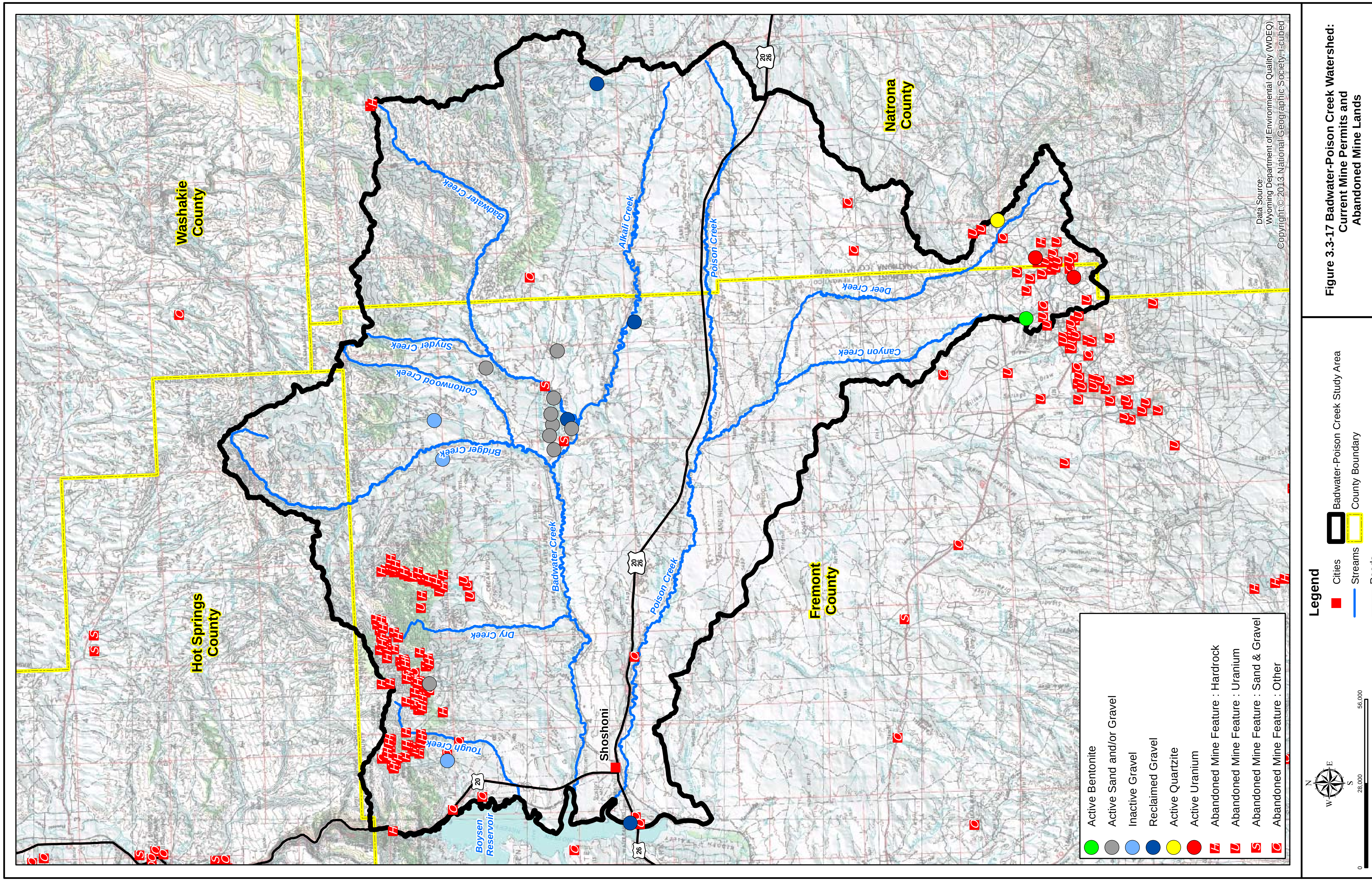


Figure 3.3-17 Badwater-Poison Creek Watershed: Current Mine Permits and Abandoned Mine Lands

In addition to current WDEQ records , there are numerous abandoned mine features within the study area; also indicated in Figure 3.3-17. 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 (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 (Figure 3.3-18).

Figure 3.3-18 WDEQ AML uranium mine reclamation project.

Most of the abandoned mine sites in the study area are associated with uranium mining activities. These features include a variety of mining-related hazards including open pits, spoil piles, etc. In addition, environmental impacts associated with the historic mines may still exist.

Table 3.3-3 Tabulation of Existing Mine Permits (WDEQ, 2012).

Permit Number	Company Name	Mine Name	Mine Description	Mineral	Status
SP0721	MOBILE CONCRETE INC	KNAPP	Small Mine, 10 Acre and smaller	Sand and Gravel	Active
ET0827	STAR TRUCKING INC	HOODOO	10 Acre Exemption, small surface disturbance	Gravel	Active
SP0674	STAR TRUCKING A WY CORP	BURLINGTON	Small Mine, 10 Acre and smaller	Sand and Gravel	Active
SP0743	STAR TRUCKING INC	LOUISIANA LAND & EXPL	Small Mine, 10 Acre and smaller	Sand and Gravel	Active
ET1259	BURLINGTON RESOIRCES OIL & GAS LP		10 Acre Exemption, small surface disturbance	Gravel	Active
ET0372	STAR TRUCKING INC	SPRATT	10 Acre Exemption, small surface disturbance	Gravel	Active
PT0723	ROCK SPRINGS MINERAL PROCESSING	BLM LANDER	Large Mine	Bentonite	Active
PT0682	UMETCO MINERALS CORP	RATTLESNAKE HILLS	Large Mine	Quartzite	Active
PT0687	CAMECO RESOURCES (POWER RESOURCES INC DBA)	GAS HILLS PROJECT	Large Mine	Uranium	Active
PT0349	UMETCO MINERALS CORP		Large Mine	Uranium	Active
577	FREMONT COUNTY	LYSITE NORTH OF RAILROAD	County gravel mine	Gravel	Active
577	FREMONT COUNTY	LYSITE CREEK	County gravel mine	Gravel	Active
577	FREMONT COUNTY	LOST CABIN	County gravel mine	Gravel	Active
577	FREMONT COUNTY	BOYSEN	County gravel mine	Gravel	Inactive
577	FREMONT COUNTY	LYSITE STATE OF WYOMING	County gravel mine	Gravel	Inactive
577	FREMONT COUNTY	BRADDOCK	County gravel mine	Gravel	Inactive
577	FREMONT COUNTY	CAUSEWAY	County gravel mine	Gravel	Reclaimed
ET1340	MCGARVIN MOBERLY CONST CO	CLEAR CREEK CATTLE CO PIT	10 Acre Exemption, small surface disturbance	Gravel	Reclaimed
ET0385	STAR TRUCKING INC		10 Acre Exemption, small surface disturbance	Gravel	Reclaimed
ET1173	L & L PRODUCTION SERVICE, INC		10 Acre Exemption, small surface disturbance	Gravel	Reclaimed

3.3.7 Wildlife

3.3.7.1 General

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). WGF'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 Badwater/Poison Creek watershed the primary big game present are Mule Deer, Elk and Antelope. According to the Game and Fish data provided, Moose and White Tail Deer will utilize the exterior fringes of the watershed but only as seasonal range. Within the watershed, approximately 306,651 acres (roughly 33 percent of the study area) have been determined to be crucial habitat for one or more of elk, antelope, or mule deer. Most of this crucial range is concentrated in northern half of the watershed along Badwater Creek and its tributaries. In the southern portion of the watershed there is one corridor of crucial range running east/west along Poison Creek.

Figures 3.3-19 through 3.3-23 display the WGF seasonal range, crucial range, parturition areas, migration corridors and migration barriers for antelope, elk, moose, mule deer, and whitetail deer within and immediately adjacent to the study area. Examination of these figures shows that while the majority of the watershed is classified as seasonal range for the big game species, the crucial habitat for these species is limited to the two previously mentioned areas along Badwater Creek and its tributaries and along the Poison Creek corridor in the southern part of the watershed.

The Wyoming Natural Diversity Database (WYNDD) lists numerous non-game species of concern within the watershed, including amphibians, birds, 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. Table 3.3-4 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.

3.3.7.2 Sage Grouse

Areas of known greater sage grouse (*Centrocercus urophasianus*) leks are displayed in Figure 3.3-24. The sage grouse does not receive federal or state protection at this time; however, it is recognized as a sensitive species / species of concern by the BLM and a species of concern by WGFD. In August 2008, Executive Order 2008-2 was signed by the Governor which stresses additional management consideration to sage grouse and sage grouse habitat statewide. The Order includes requirements of state agencies to encourage development outside of the Core areas and to focus management to the greatest extent possible on the maintenance and enhancements of habitat within them. The Core Sage Grouse Population Areas within the study area are delineated in Figure 3.3-24. As is evident in this figure, the Sage Grouse Core areas affect primarily the land located in the north central and south central portions of the watershed. The core areas in the north central portion of the watershed are primarily located in the upper reaches of the Bridger Creek and Lysite Creek drainages. The core areas in the south central portion of the watershed enter the watershed from the southwest and encompass parts of the Deer Creek and Canyon Creek drainages. While there are occupied Sage Grouse Leks located in the central portion of the watershed (as seen in Figure 3.3-24), these are not considered part of the core areas by the Wyoming Game and Fish Department.

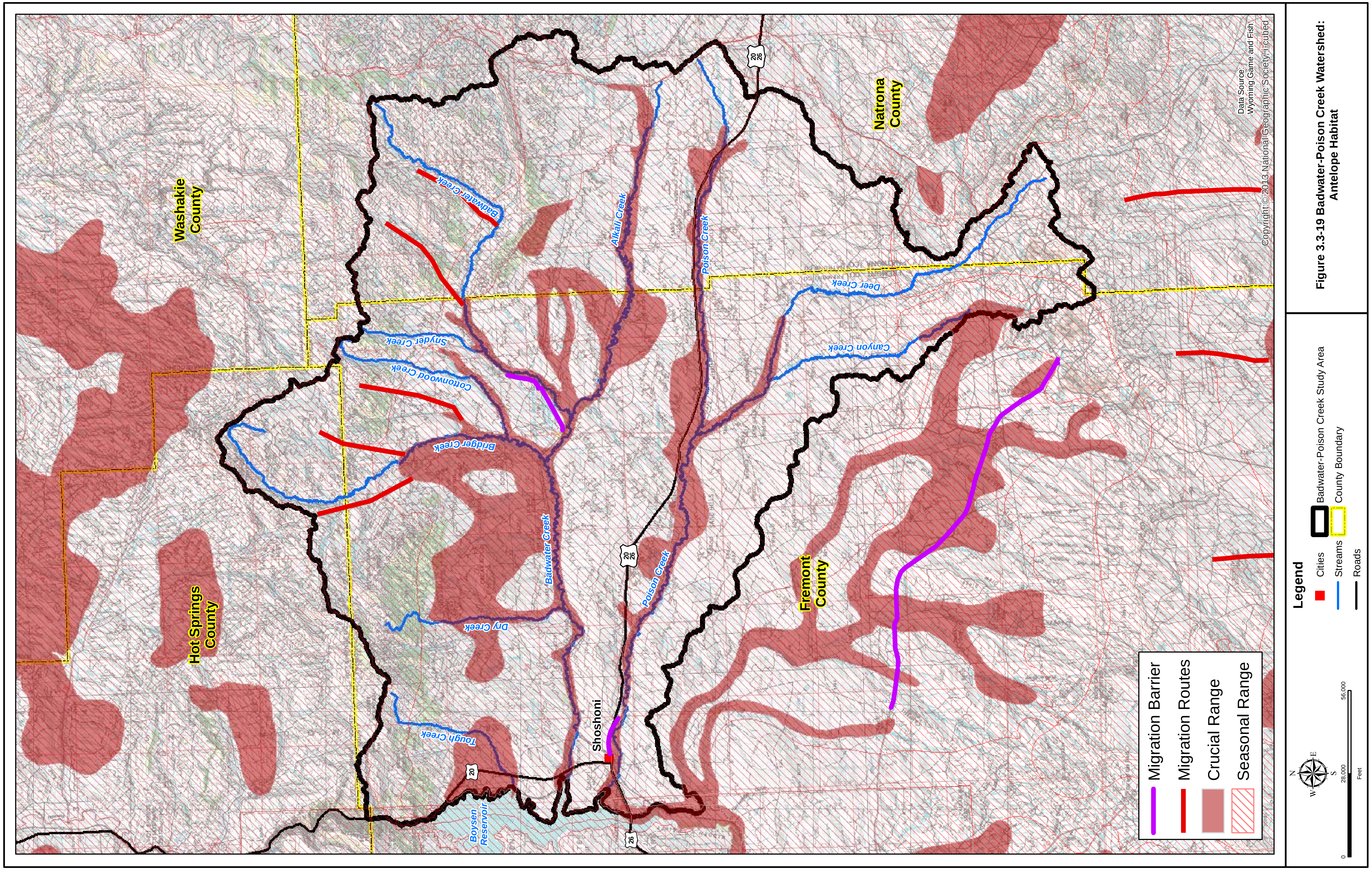


Figure 3.3-19 Badwater-Poison Creek Watershed: Antelope Habitat

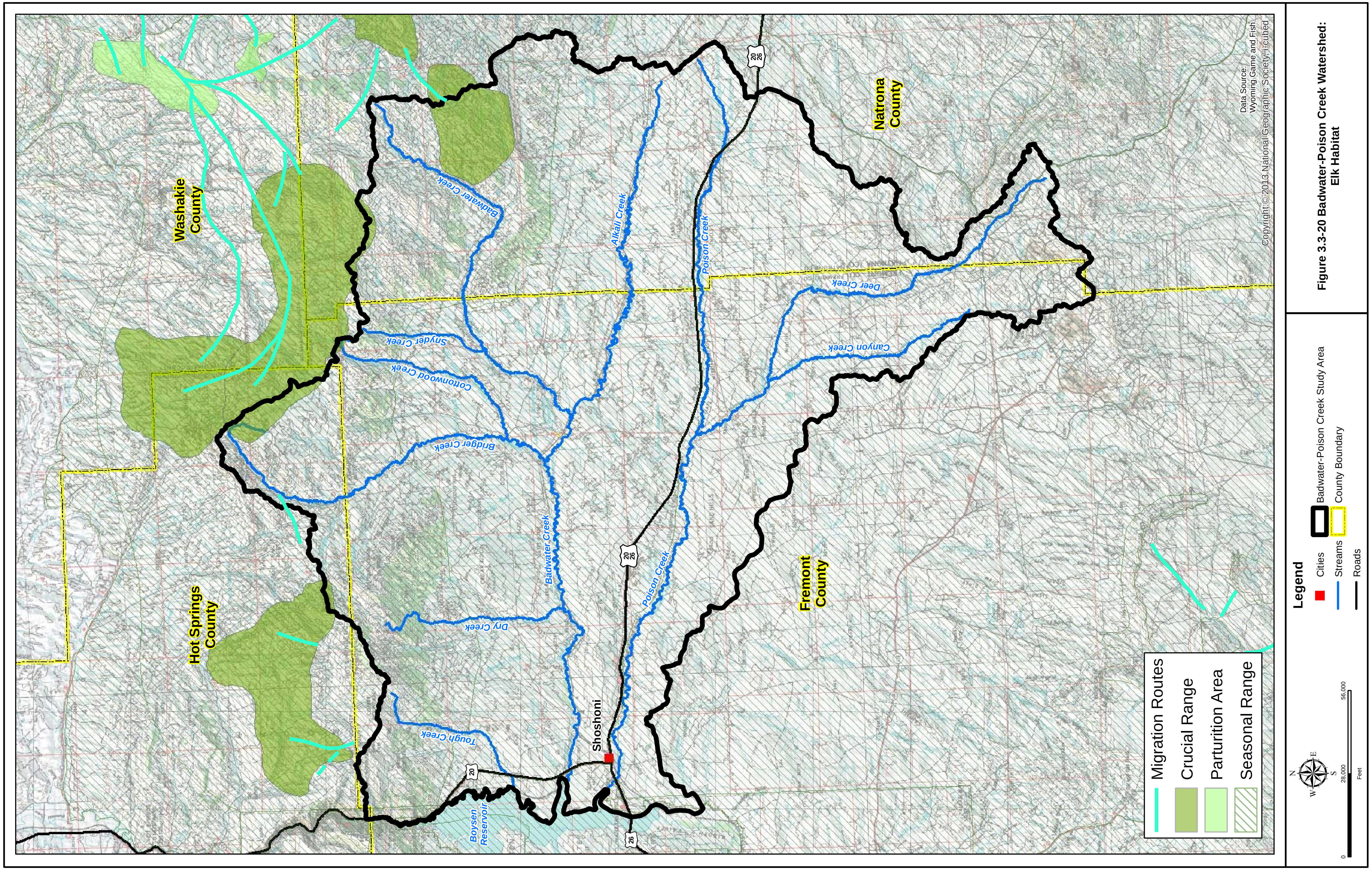


Figure 3.3-20 Badwater-Poison Creek Watershed: Elk Habitat

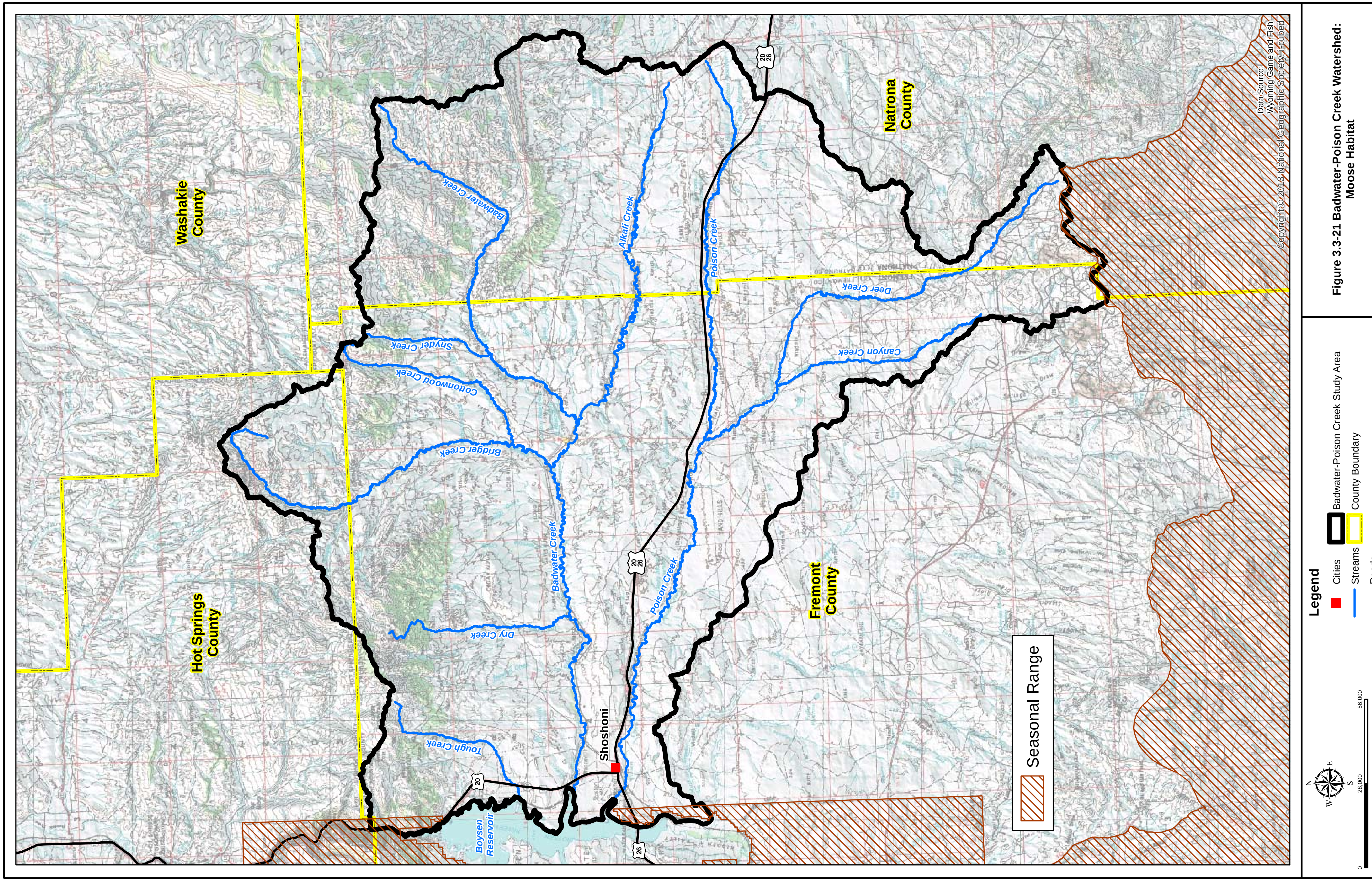


Figure 3.3-21 Badwater-Poison Creek Watershed:
Moose Habitat
Legend
Cities
Streams
Roads
Badwater-Poison Creek Study Area
County Boundary
Seasonal Range
Data Source:
Wyoming Game and Fish
Copyright © 2013 National Geographic Society, i-cubed
Feet
0
28,000
56,000
N
S
E
W
Washakie County
Natrona County
Hot Springs County
Fremont County
Shoshoni
Boysen Reservoir
Badwater Creek
Alkali Creek
Poison Creek
Deer Creek
Canyon Creek
Snyder Creek
Cottonwood Creek
Bridger Creek
Dry Creek
Tough Creek
20
26

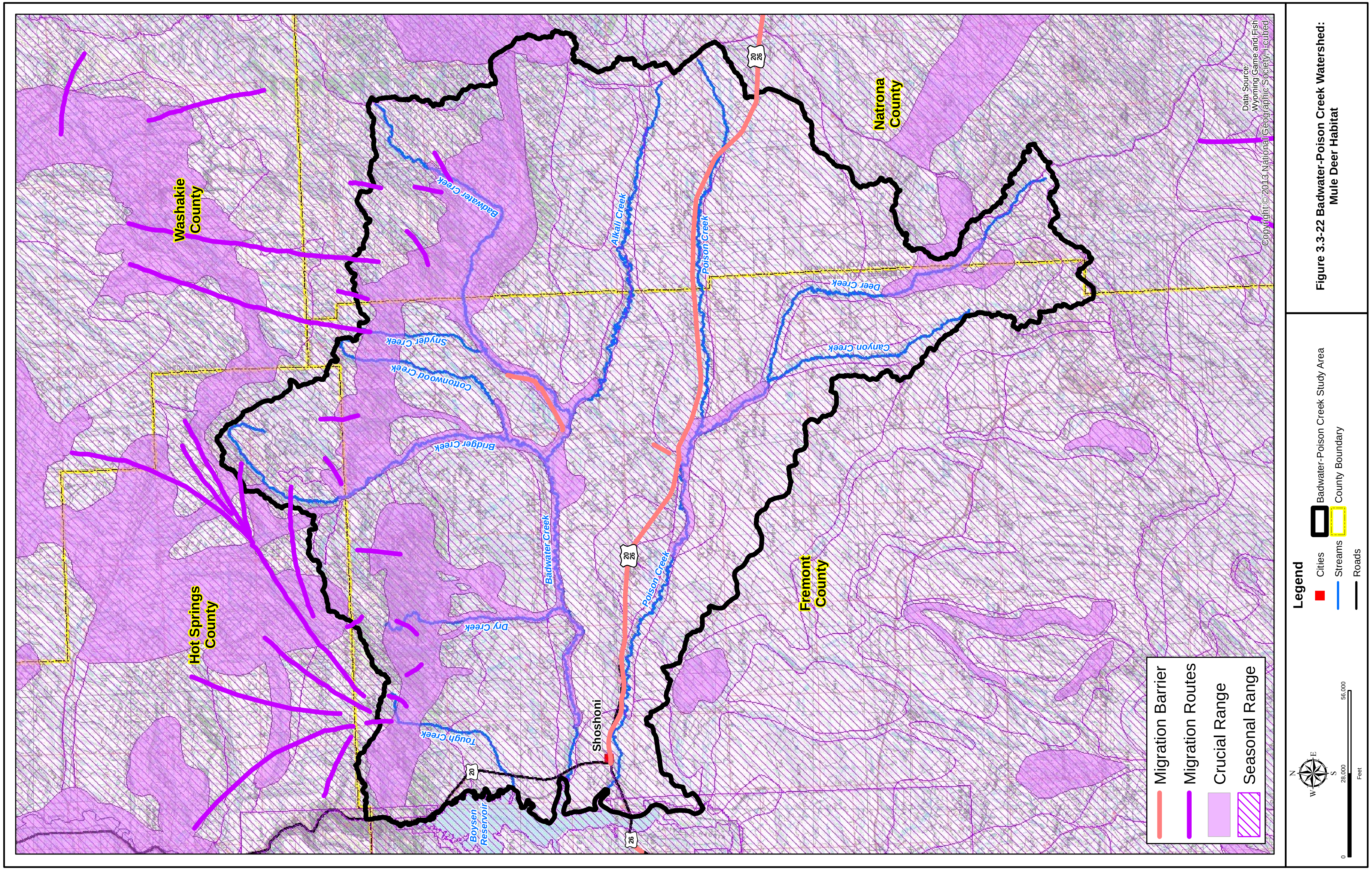


Figure 3.3-22 Badwater-Poison Creek Watershed: Mule Deer Habitat

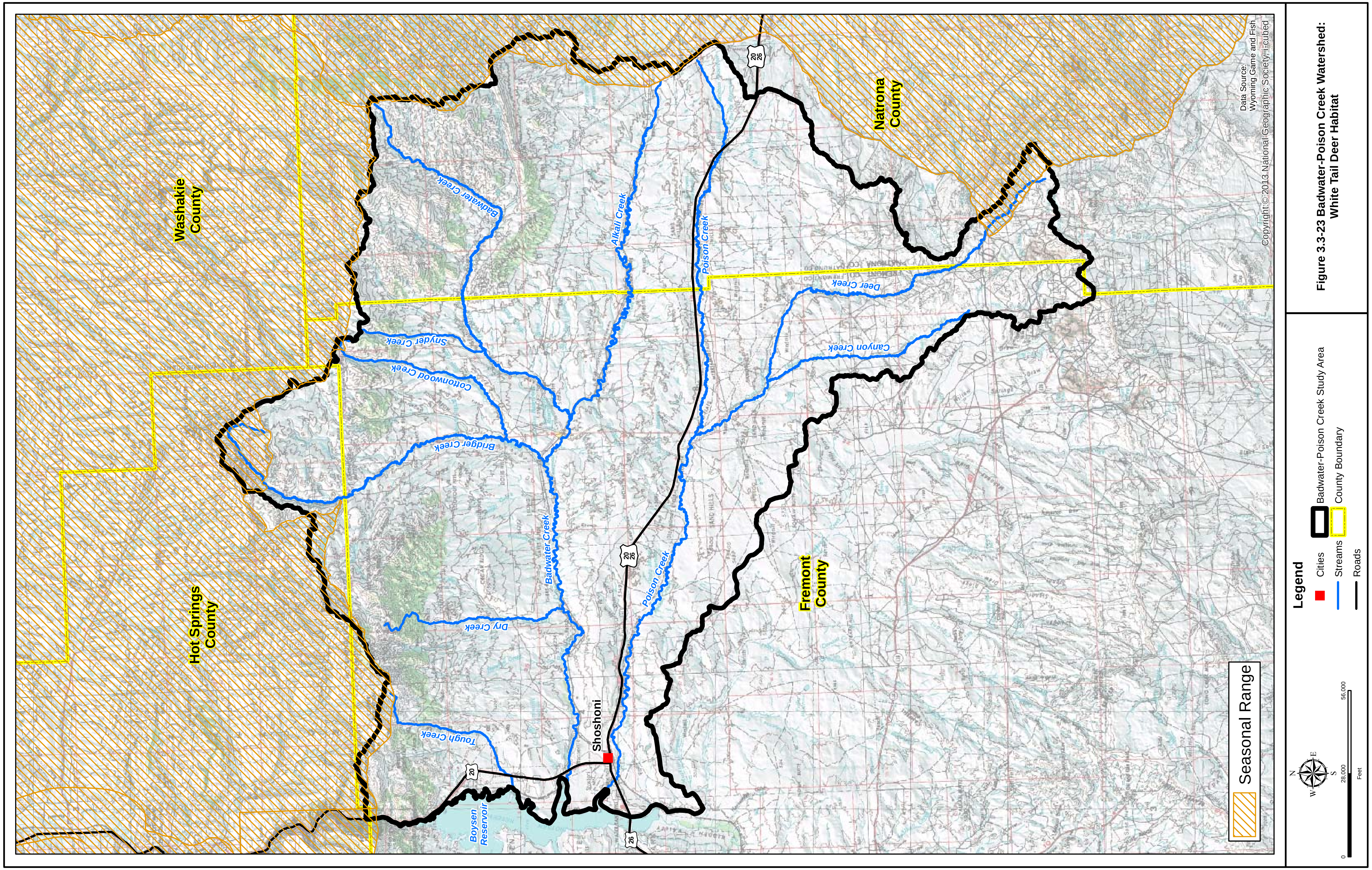


Figure 3.3-23 Badwater-Poison Creek Watershed:
White Tail Deer Habitat

Table 3.3-4 Wyoming Natural Diversity Database: Wildlife Species in the Badwater/Poison Creek Watershed.

Common Name	Scientific Name	Listing Status	Tracked/Watched
Amphibians			
Tiger Salamander	Ambystoma mavortium		Watched
Northern Leopard Frog	Lithobates pipiens	Not Warranted for Listing (NW)	Tracked
Birds			
Northern Goshawk	Accipiter gentilis	Not Warranted for Listing (NW)	Tracked
Clark's Grebe	Aechmophorus clarkii		Tracked
Grasshopper Sparrow	Ammodramus savannarum		Watched
Golden Eagle	Aquila chrysaetos		Watched
Sagebrush Sparrow	Artemisiospiza nevadensis		Tracked
Short-eared Owl	Asio flammeus		Tracked
Burrowing Owl	Athene cunicularia		Tracked
Common Goldeneye	Bucephala clangula		Watched
Ferruginous Hawk	Buteo regalis		Tracked
Canyon Wren	Catherpes mexicanus		Watched
Greater Sage-Grouse	Centrocercus urophasianus	Candidate; Warranted but Precluded (C)	Tracked
Mountain Plover	Charadrius montanus	Not Warranted for Listing (NW)	Tracked
Yellow-billed Cuckoo	Coccyzus americanus		Tracked
Bobolink	Dolichonyx oryzivorus		Tracked
Merlin	Falco columbarius		Watched
Peregrine Falcon	Falco peregrinus	Delisted, formally monitored (DM)	Tracked
Common Loon	Gavia immer		Tracked
Sandhill Crane	Grus canadensis		Watched
Bald Eagle	Haliaeetus leucocephalus	Delisted, formally monitored (DM)	Tracked
Loggerhead Shrike	Lanius ludovicianus		Tracked
Lewis Woodpecker	Melanerpes lewis		Tracked
Long-billed Curlew	Numenius americanus		Tracked
Sage Thrasher	Oreoscoptes montanus		Watched
Osprey	Pandion haliaetus		Watched
Indigo Bunting	Passerina cyanea		Watched
American White Pelican	Pelecanus erythrorhynchos		Tracked
Red-necked Phalarope	Phalaropus lobatus		Watched
Rose-breasted Grosbeak	Pheucticus ludovicianus		Watched
White-faced Ibis	Plegadis chihi		Tracked
American Avocet	Recurvirostra americana		Watched
McCown's Longspur	Rhynchophanes mccownii		Tracked
Calliope Hummingbird	Selasphorus calliope		Tracked
Black-throated Gray Warbler	Setophaga nigrescens		Tracked
Brewer's Sparrow	Spizella breweri		Watched
Clay-colored Sparrow	Spizella pallida		Watched
Forster's Tern	Sterna forsteri		Tracked
Crustaceans			
Colorado Fairy Shrimp	Branchinecta coloradensis		Tracked
Mammals			
Pallid Bat	Antrozous pallidus		Tracked
Plains Bison	Bos bison bison	Not Warranted for Listing (NW)	Tracked
Pygmy Rabbit	Brachylagus idahoensis	Not Warranted for Listing (NW)	Tracked
Gray Wolf	Canis lupus	Proposed for Delisting (PD)	Tracked
Townsend's Big-eared Bat	Corynorhinus townsendii		Tracked
White-tailed Prairie Dog	Cynomys leucurus	Not Warranted for Listing (NW)	Tracked
Black-tailed Prairie Dog	Cynomys ludovicianus	Not Warranted for Listing (NW)	Tracked
Spotted Bat	Euderma maculatum		Tracked
Hoary Bat	Lasiurus cinereus		Watched
Black-footed Ferret	Mustela nigripes	Listed Endangered (LE), and Endangered - Nonessential Experimental Population (LEXN)	Tracked
Western Small-footed Myotis	Myotis ciliolabrum		Watched
Long-eared Myotis	Myotis evotis		Watched
Fringed Myotis	Myotis thysanodes		Tracked
Long-legged Myotis	Myotis volans		Watched
Bighorn Sheep	Ovis canadensis		Watched
Olive-backed Pocket Mouse	Perognathus fasciatus		Watched
Eastern Cottontail	Sylvilagus floridanus		Watched

Note: the sole listing of an endangered species (Black Footed Ferret in 1973/1977) was “vague and unsubstantiated; reliability of observer is unclear” according to the WYNDD database (WYNDD, 2013).

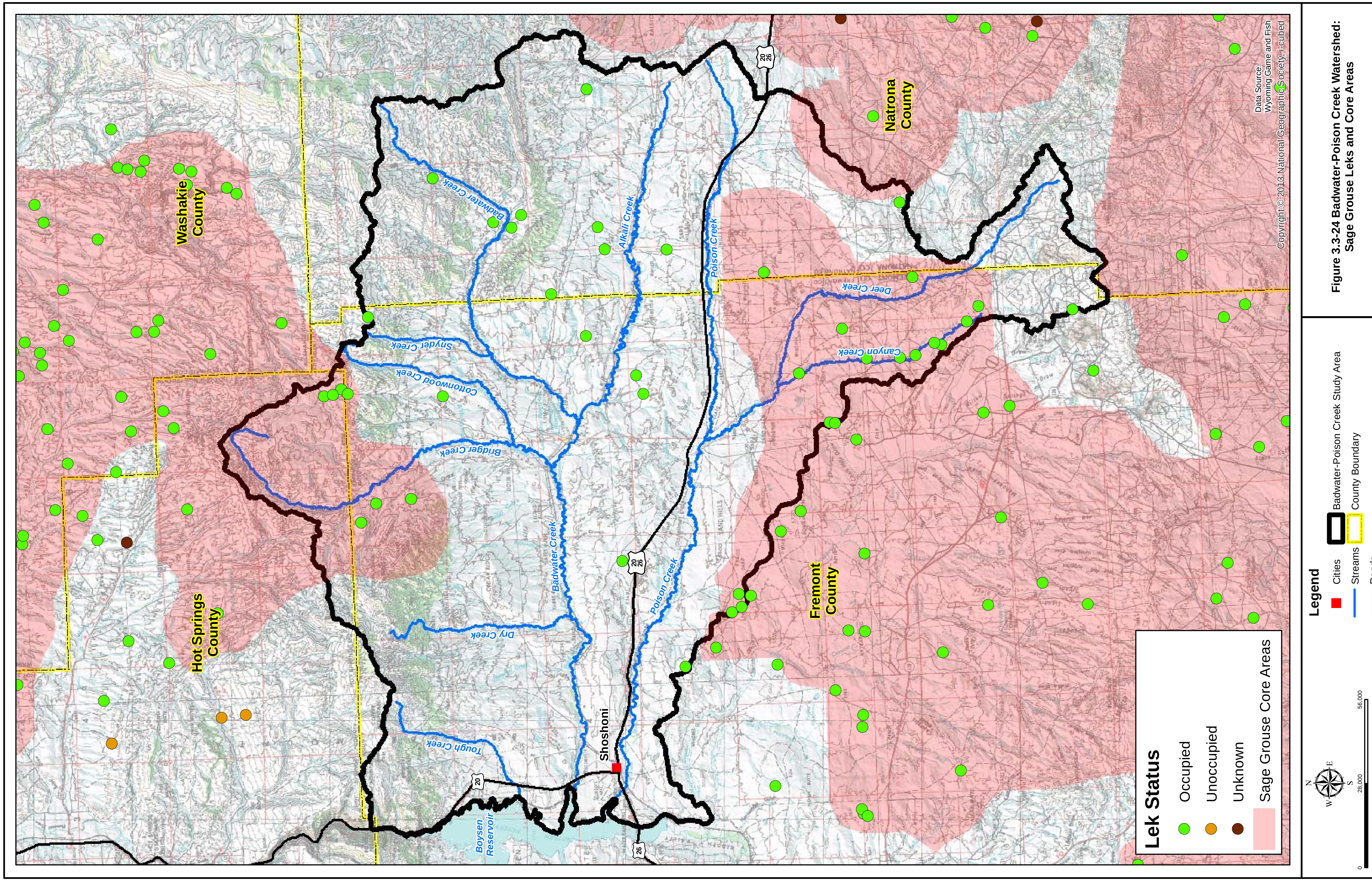


Figure 3.3-24 Badwater-Poison Creek Watershed: Sage Grouse Leks and Core Areas

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.

WGFD lists the greater sage grouse as: species that are widely distributed, with population status or trends unknown but suspected to be stable; habitat restricted or vulnerable but no recent or on-going significant loss; species likely sensitive to human disturbance. *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/recommendations to help protect the sage grouse.*

3.3.7.3 Wild Horses

Following passage of the Wild, Free-Roaming Horse and Burro Act in 1971, BLM was charged with management of wild horses or burros in "herd management areas" (HMAs). The BLM establishes an "appropriate management level" (AML) for each HMA. The AML is the population objective for the HMA that will ensure a "thriving ecological balance among all the users and resources of the HMA". For example, wildlife, livestock, wild horses, vegetation, water, and soil. Wyoming has no wild burros (BLM, 2012). Should any wild horses be found within this study area, they would be removed by BLM.

Within the project study area, there are no HMAs as indicated in Figure 3.3-25.

3.3.7.4 WGF Crucial Habitat Areas

As part of the WGFD Strategic Habitat Plan (2009), areas within the State which have been determined to be Crucial Priority Areas or Enhancement Priority Areas for both riparian and terrestrial terrain were delineated (Figure 3.3-26). As defined by WGFD at: http://wgfd.wyo.gov/web2011/wildlife-1000405.aspx

*"**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."*

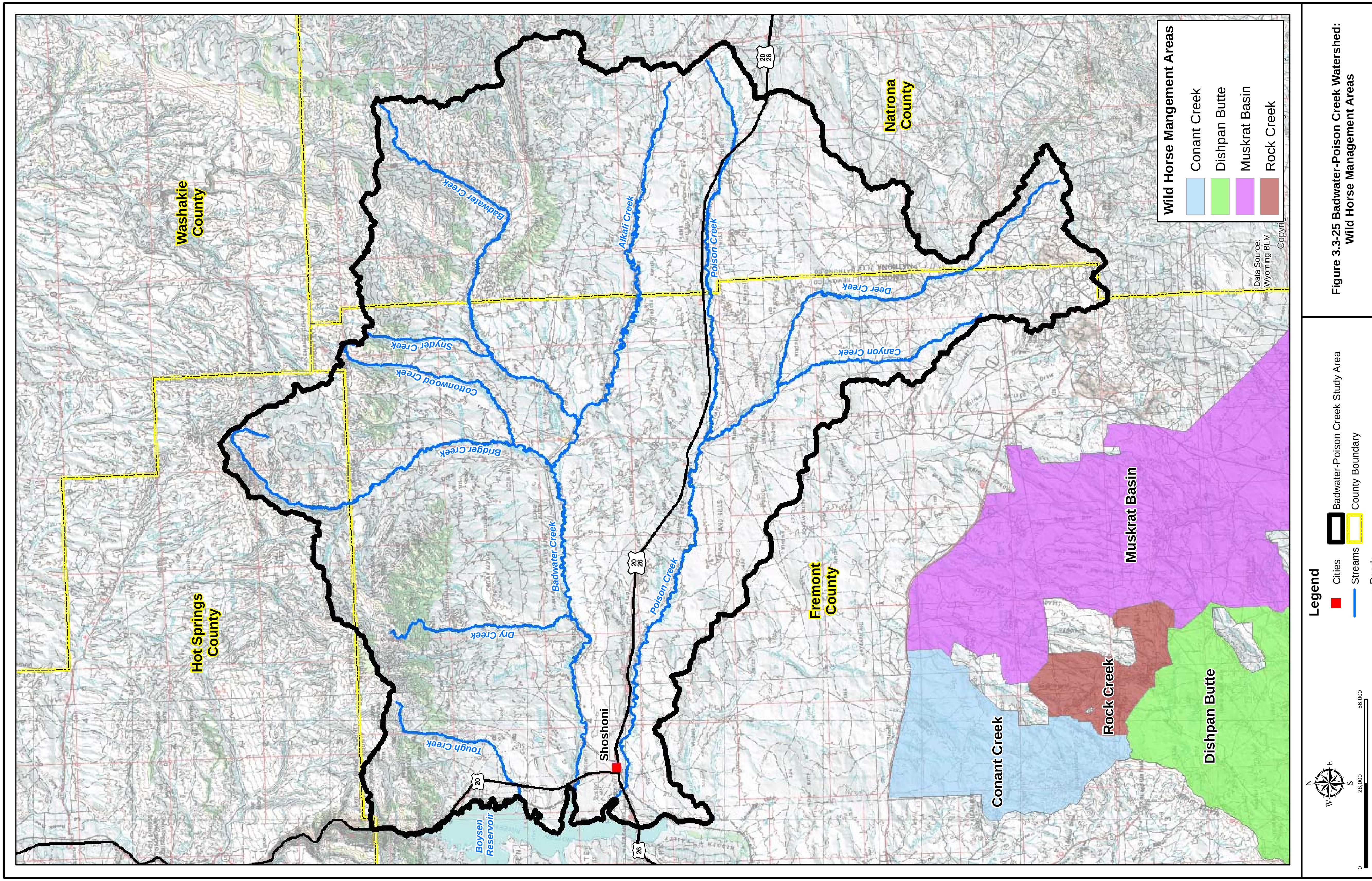


Figure 3.3-25 Badwater-Poison Creek Watershed: Wild Horse Management Areas

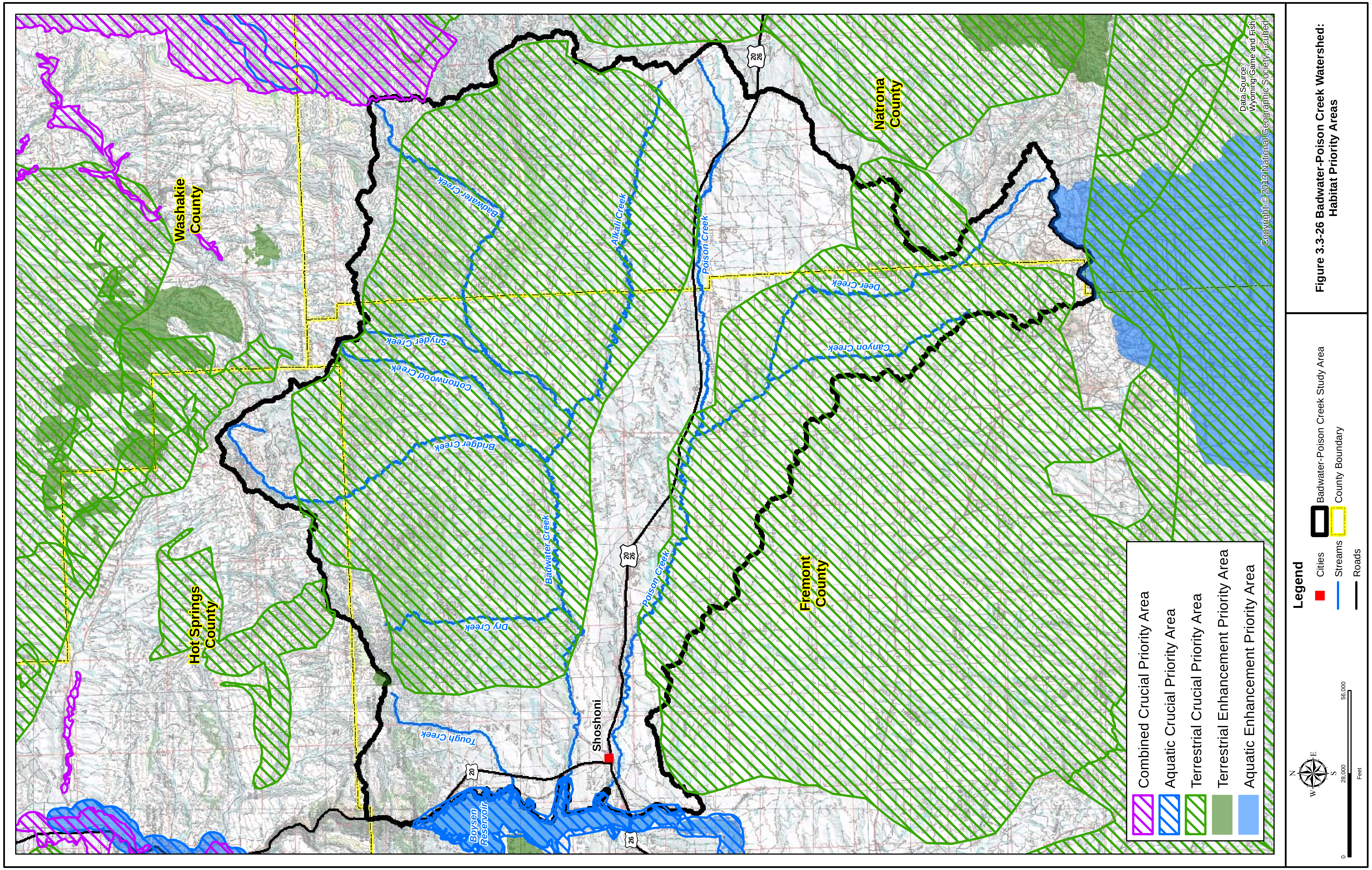


Figure 3.3-26 Badwater-Poison Creek Watershed: Habitat Priority Areas

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 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." (*http://wgfd.wyo.gov/web2011/wildlife-1000055.aspx*).*

Review of the *WGF* Crucial Habitat Area Narratives (available at http://wgfd.wyo.gov/web2011/wildlife-1000426.aspx) provides the following information regarding sensitive fisheries species within the study area. The paragraphs were extracted directly from the narratives for Crucial Habitat Areas found within the project study area:

Badwater Creek Watershed:

- *Reason Selected:*

  Supports crucial winter range for elk, mule deer and pronghorn and core sage grouse breeding, nesting and brood rearing habitat. Area is subject to intense energy developments resulting in habitat loss and fragmentation and protective measures need to be implemented to maintain wildlife populations and their habitats.
- *Primary species or assemblages of species: elk, mule deer, pronghorn, sage-grouse, sage sparrow and sage thrasher*
- *Solutions or actions:*

  Develop cooperative management agreements with BLM, State Land Board, private landowners, and other interests to maintain open spaces and healthy ecosystem functions.
- *Additional Information:*

  A number of issues will need to be addressed to maintain wildlife habitats within this crucial area. Intense gas development has caused habitat loss and fragmentation in big game winter range and sage-grouse breeding and nesting habitat. This has increased utilization of adjacent habitats resulting in a decline in conditions on some of these areas.

Poison Creek Watershed:

- *Reason Selected:*

  Supports crucial winter range for mule deer and pronghorn and Governor's core sage grouse areas. Riparian areas are very important for maintaining populations of mule deer and sage-grouse.
- *Primary Species or assemblages of species:*

  Mule deer, pronghorn, sage-grouse, mountain plover and burrowing owl*.*

- *Solutions or actions:*

  Develop cooperative management agreements with BLM, State Land Board, private landowners, and other interests to maintain open spaces and healthy ecosystem functions. Seek conservation easements with willing private landowners.

- *Additional Information:*

  A number of issues will need to be addressed to maintain wildlife habitats within this crucial area. The area is generally intact, however riparian areas are becoming infested with saltcedar, which out competes native species such as willow and cottonwood. These riparian areas are very important for mule deer winter habitat and sage-grouse brood rearing habitat.

  Work with ranchers to improve grazing management, particularly in riparian areas, by implementing rest-rotation and deferment. Improve the diversity of sagebrush age classes and densities, which is critical for different mule deer, pronghorn and sage-grouse life stages. Control weed infestations, primarily saltcedar, which are competing

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 makes available a spatial data file which generalizes the cultural resource inventory to the section level. This "location fuzzing" of the archaeological data is to protect the sites from unauthorized disturbance. The attributes recorded for each section include: site count, inventory acres, report numbers, and eligible site number. Figure 3.3-27 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.

In addition, the historic Bridger Trail traverses the study area. The trail enters from the east near where present day Highway 20/26 enters the watershed. The trail runs northwest through the central portion of the watershed, along Bridger Creek then exits the watershed in the north and heads on to Kirby, WY. Figure 3.3-28 displays the Bridger Trail, sites listed on the National Registry of Historic Places, and historic monuments and markers.

The National Register of Historic Places is the nation's official list of cultural resources worthy of preservation. Administered on a federal level by the National Park Service and managed locally by the State Historic Preservation Office, 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.

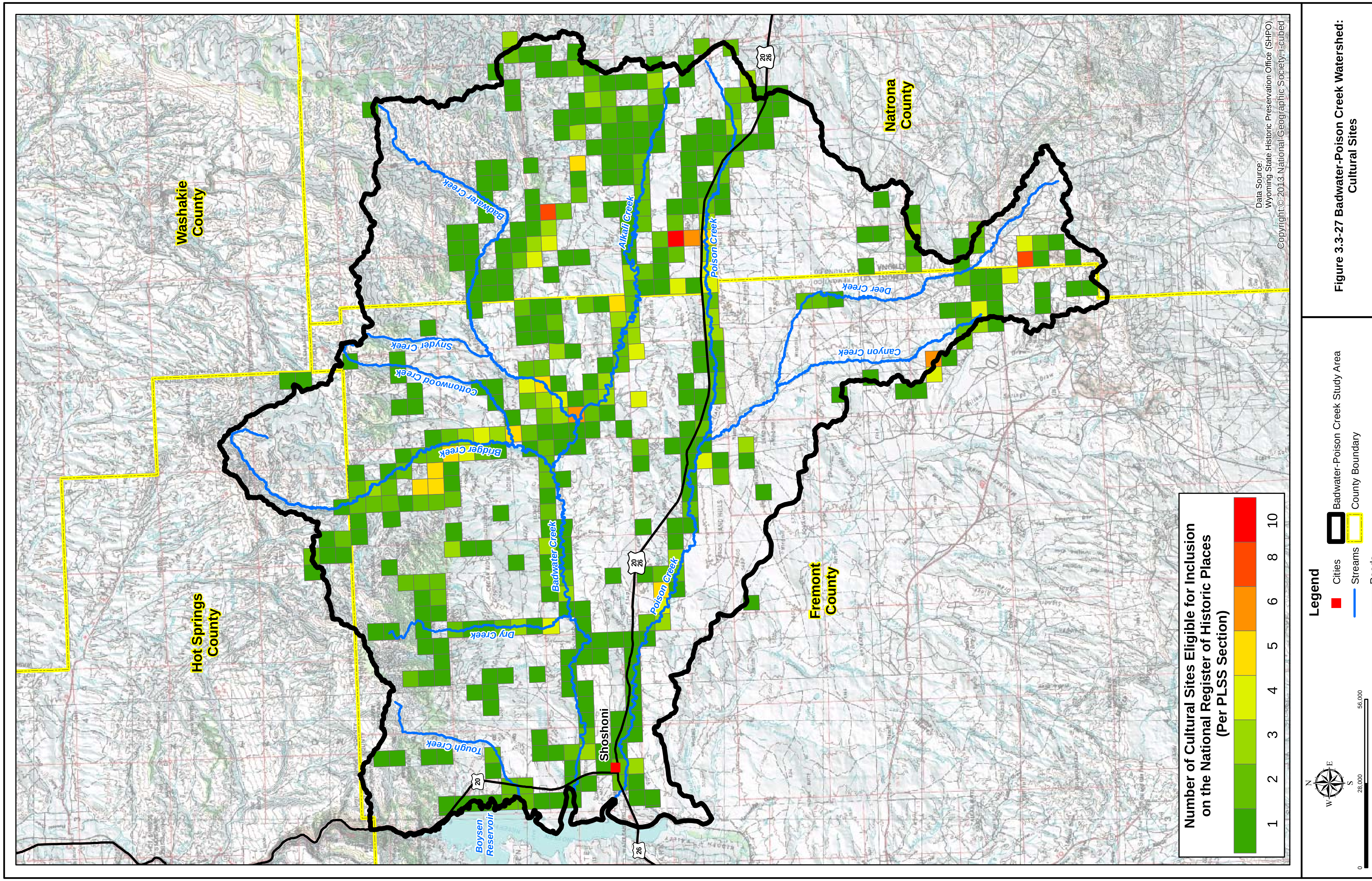


Figure 3.3-27 Badwater-Poison Creek Watershed: Cultural Sites

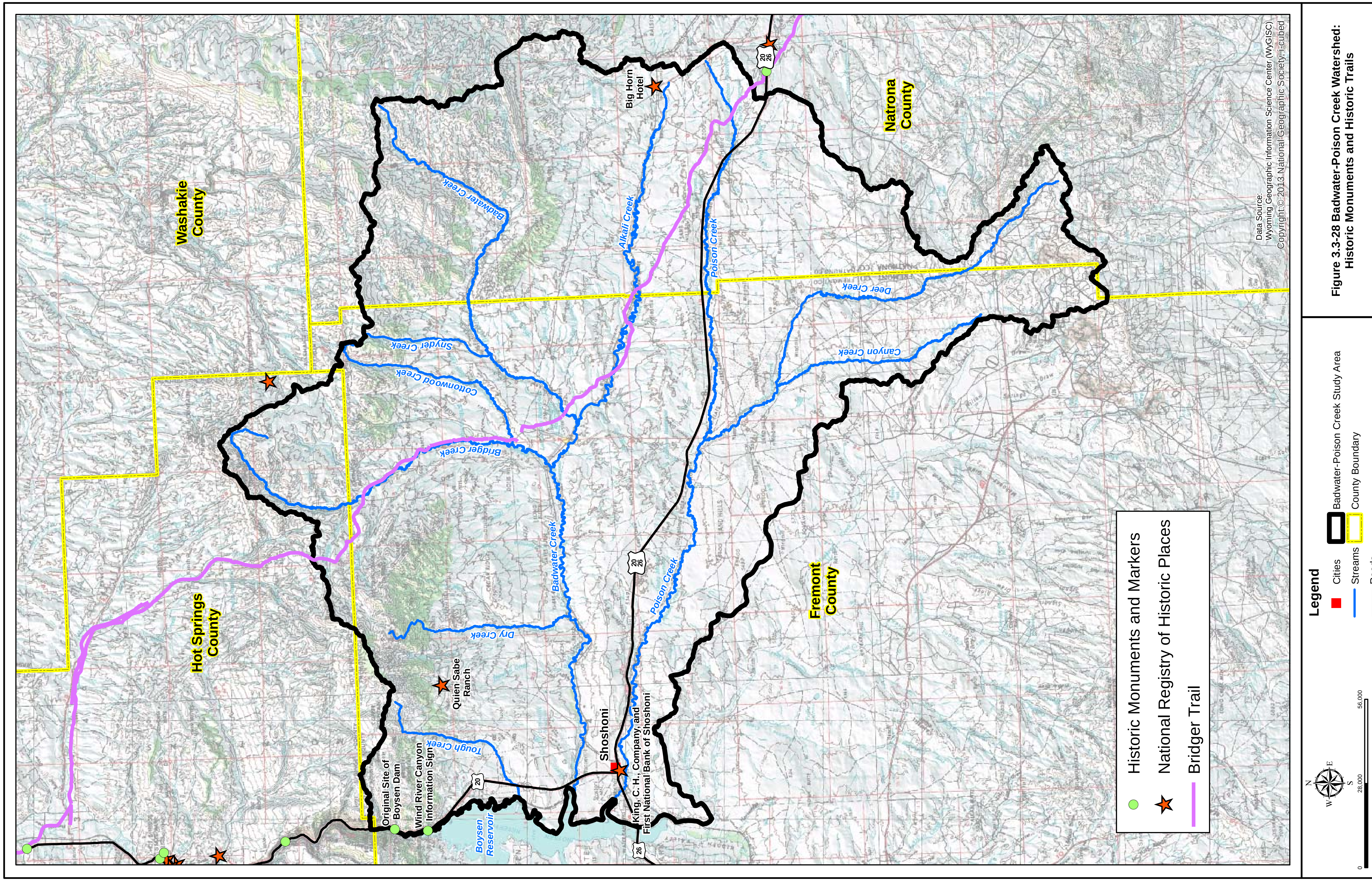


Figure 3.3-28 Badwater-Poison Creek Watershed: Historic Monuments and Historic Trails

Listing a property on the National Register of Historic Places is a form of acknowledgment and prestige, which places no restraints on the property. The National Register does not restrict the rights of property owners to use, develop, or sell the property. Although placing a property on the National Register neither stops alterations to a building nor requires owners to provide the public access to the property, it can provide the owner with eligibility for certain financial incentives (NPS, 2009 at http://www.nps.gov/history/nr/).

To date, two sites within the study area have been included in the Register. The following descriptions of the sites were obtained from the Wyoming State Preservation Office website at: http://wyoshpo.state.wy.us/NationalRegister/.

Bridger Immigrant Road - Waltman Crossing (Smithsonian Number ***48NA561)*** was certified as a historic location on Friday, January 17, 1975.

"The Bridger Road ran across the northwestern quadrant of Wyoming from near the present day city of Casper for a distance of about 225 miles into Montana, where it turned in a due westerly course leading up the Yellowstone River Valley continuing for another 200 miles to its destination at Bozeman. It was a wagon road primarily formed by the shod hoofs of teams--oxen, mules or horses--and the imprints of iron-banded wheels rolling under heavy loads. The road was established by Jim Bridger in 1864 to reach the bustling gold fields of western Montana. The Waltman Crossing of the Bridger Immigrant Road is located approximately 45 miles west of Casper, Wyoming where it crosses U.S. Highway 20/26."

Quien Sabe Ranch (Smithsonian Number 48FR2608) was certified as a historic location on Tuesday, April 16, 1991(Figure 3.3-29).

Figure 3.3-29 Quien Sabe Ranch.

"The Quien Sabe Ranch has a long and colorful history beginning with the English cattle barons of the 1880s, a shadowy period as a headquarters for outlaws and cattle rustlers in the 1890s and early 1900s, and a prolonged period of single family ownership beginning in 1907. It represents one of the earliest stockraising operations in northern Fremont County. It has operated continuously as a livestock ranch for over one hundred years, yet still retains the original ranch house and several important early or original outbuildings."

3.4 Natural Environment

3.4.1 Climate

The Badwater / Poison Creek Study Area contains topography ranging in elevation from 4,570 msl feet on the western edge of the watershed near Boysen Reservoir to over 9,100 msl feet in the headwaters of Badwater Creek on the southern edge of the Bighorn Mountains. Generally, climatic conditions for the study area are classified as an Intermountain Semi-Desert. The climate is typified by dry, windy conditions with limited precipitation and long cold winters.

Figure 3.4-1 displays the isohyetals (lines of equal precipitation) within the study area. 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 7 inches at the lower elevations to over 25 inches at the highest elevations, with approximately 70 percent of the watershed receiving only 7 to 9 inches of precipitation annually.

Historic climate data for five NOAA Cooperative Weather Stations in the study area was obtained through the Western Regional Climate Center website (http://www.wrcc.dri.edu/). The recorded temperatures at all stations are typically cool, with average daily temperatures ranging between 4°F and 30°F in midwinter and 55°F to 88°F during midsummer. The annual average total precipitation for the study area is 8.16 inches. Table 3.4-1 presents the average temperature range and average total precipitation while Figure 3.4-2 presents the average climatic conditions recorded by the weather stations located within the study area.

Table 3.4-1 Summary of Monthly Climatic Data: Badwater/Poison Creek Watershed.

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Shoshoni, Wyoming 488209: 3/ 7/1931 to 5/31/2012													
Average Max. Temperature (F)	29.5	35.6	51.6	61.4	72.1	82.6	92.2	89.1	78.4	63	45.1	31.6	61
Average Min. Temperature (F)	1.1	7	23.5	32.1	43.3	50.6	57.4	53.6	44	32.4	17.1	5.1	30.6
Average Total Precipitation (in.)	0.16	0.14	0.25	0.91	1.52	1.09	0.59	0.53	0.68	0.57	0.24	0.16	6.86
Lost Cabin,Wyoming 485734: 10/12/1961 to 9/30/1982													
Average Max. Temperature (F)	30.5	37.5	46.1	57.4	67.5	76.9	87.5	85.4	74.8	61.9	44.2	33.9	58.6
Average Min. Temperature (F)	1.9	9.3	18	28	36.9	44.5	51	48.4	38.5	28.7	16	5.7	27.2
Average Total Precipitation (in.)	0.2	0.11	0.45	0.94	1.6	1.49	0.6	0.75	0.79	0.85	0.3	0.3	8.39
Arminto,Wyoming 480324:10/22/1949 to 11/30/1966													
Average Max. Temperature (F)	31.4	34.1	40.4	55.3	67.4	75	87.8	82.9	72.1	65.1	48.2	36.2	58
Average Min. Temperature (F)	0.7	8.3	14	27.4	36.5	43.9	52	47.3	38.2	30.8	20.3	10.2	27.5
Average Total Precipitation (in.)	0.29	0.24	0.24	0.71	1.61	1.13	0.75	0.58	0.71	0.57	0.27	0.12	7.23
Gas Hills 4E, Wyoming 483801: 9/10/1962 to 4/30/2007													
Average Max. Temperature (F)	28.4	32.4	40.2	51	62.5	73.3	82.2	80.2	69.4	57	39.1	30.4	53.8
Average Min. Temperature (F)	11	13.8	19.5	28.4	37.4	46.7	53.6	52.5	42.8	33.1	20.8	13.2	31.1
Average Total Precipitation (in.)	0.38	0.38	0.72	1.2	1.59	1.33	0.86	0.64	0.74	0.68	0.42	0.35	9.28
Boysen Dam, Wyoming 481000: 8/1/1948 to 5/31/2012													
Average Max. Temperature (F)	29.6	37.9	49.4	59.7	70.1	81	90.2	88.1	76.4	62.2	44	31.3	60
Average Min. Temperature (F)	6.4	12.9	23.8	33.8	43.6	52.7	60	58.3	47.7	36.3	23.1	10.8	34.1
Average Total Precipitation (in.)	0.25	0.28	0.56	1.28	1.82	1.37	0.73	0.52	0.8	0.81	0.33	0.28	9.03

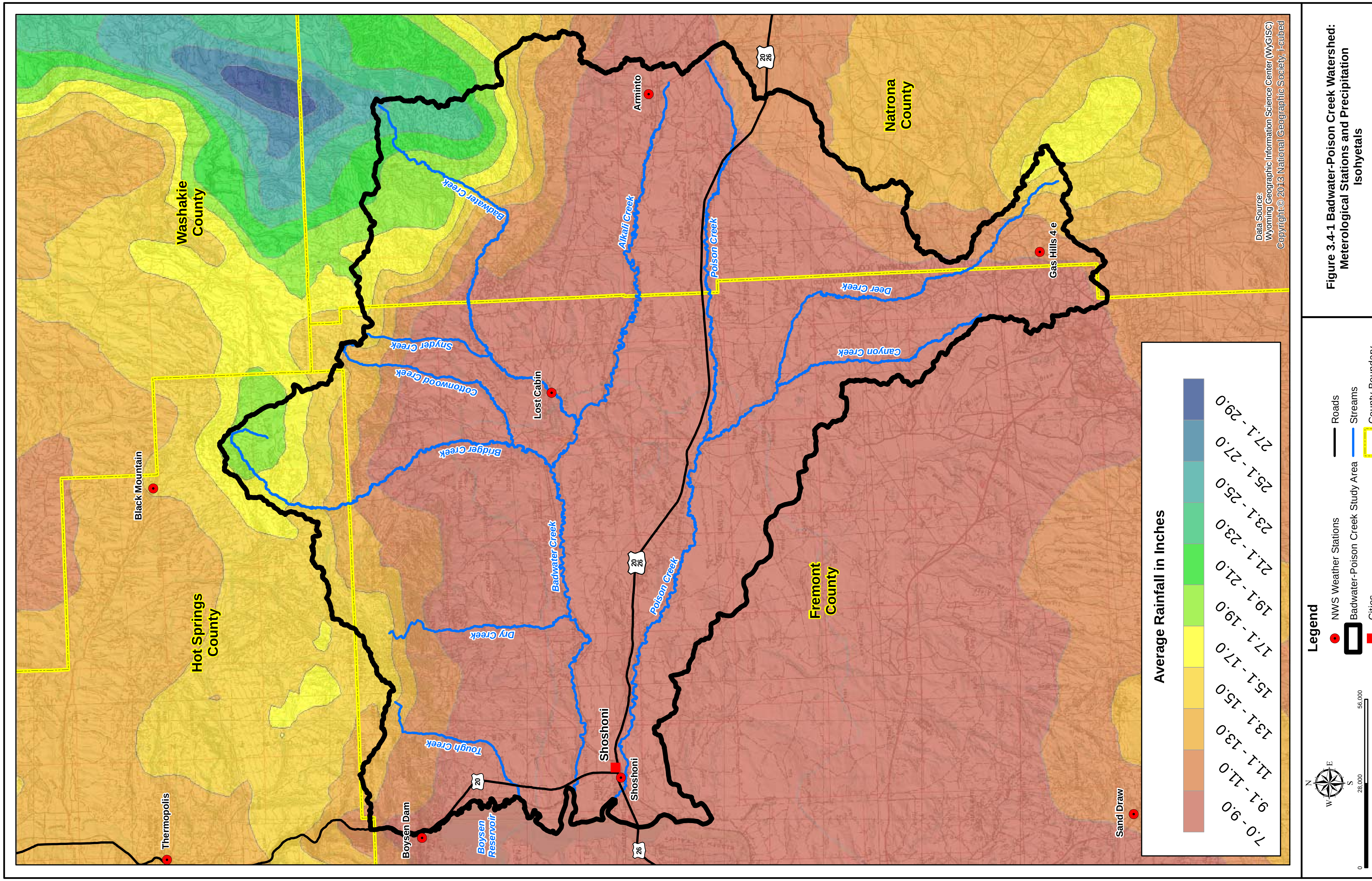
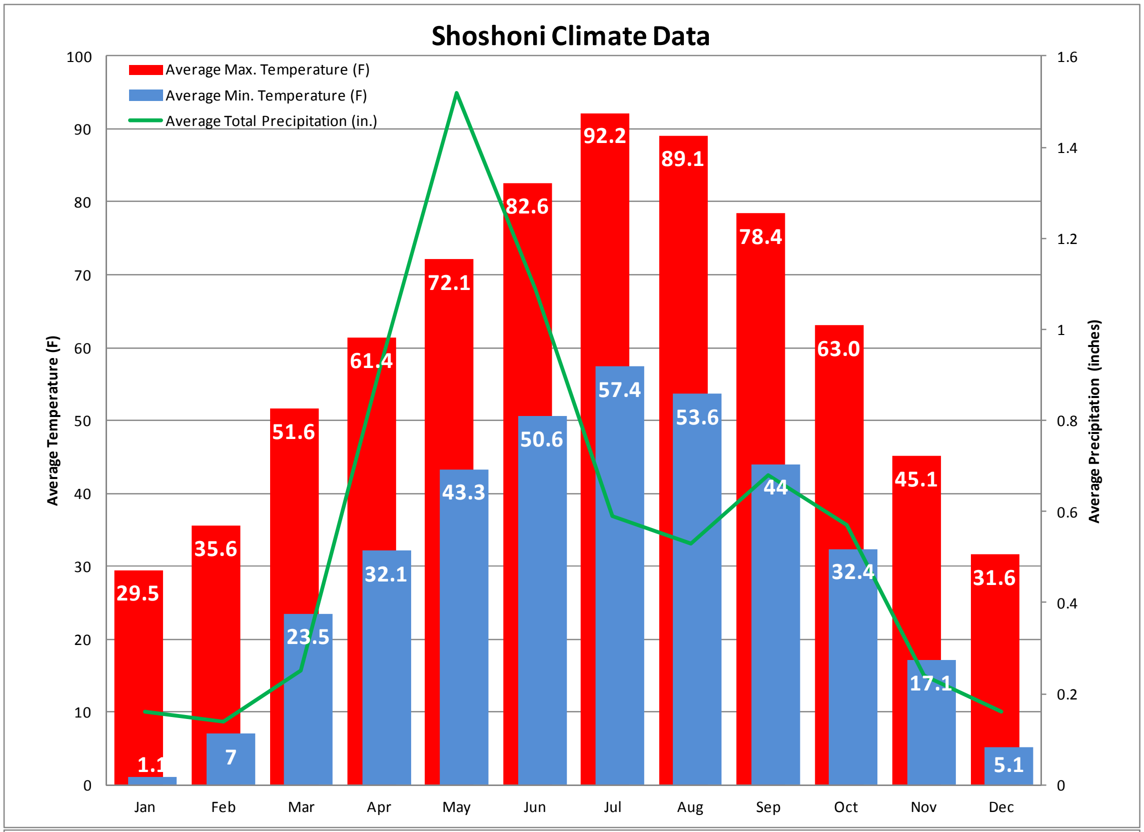


Figure 3.4-1 Badwater-Poison Creek Watershed: Meterological Stations and Precipitation Isohyetals



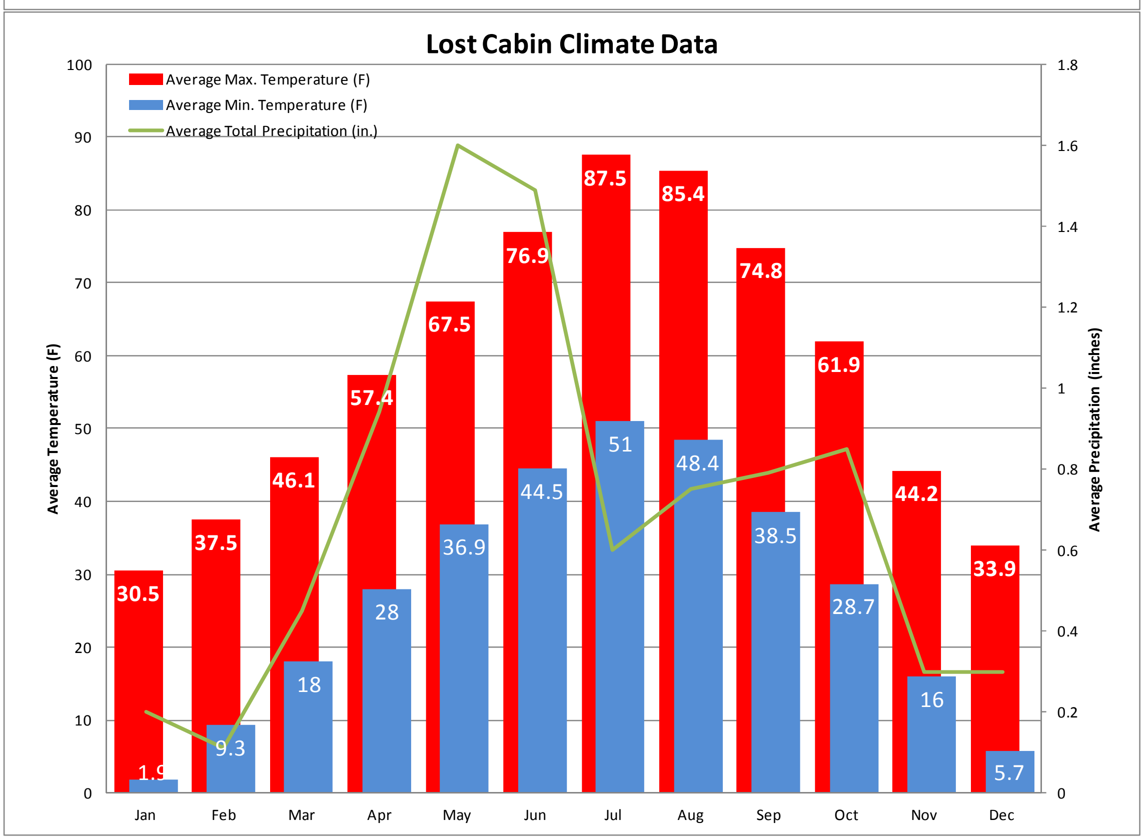
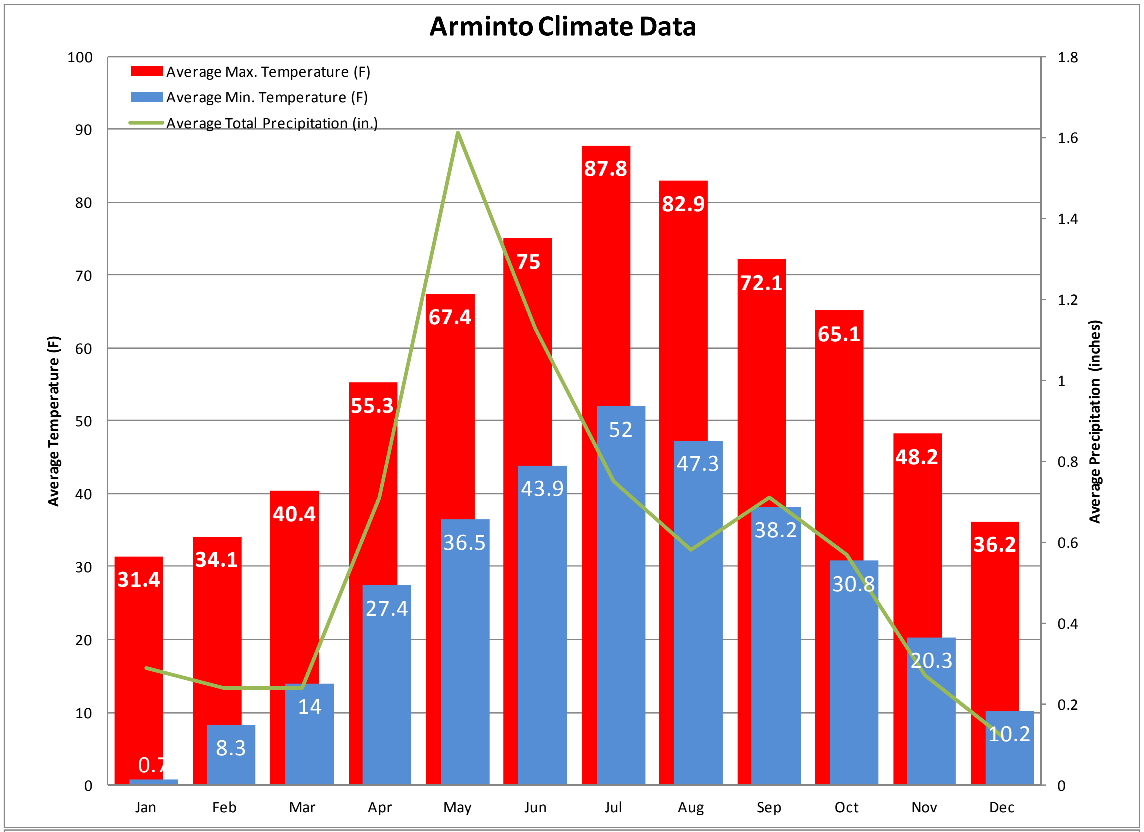


Figure 3.4-2 Mean Monthly Climatic Factors for Badwater/Poison Creek Watershed (1931 – 2012).



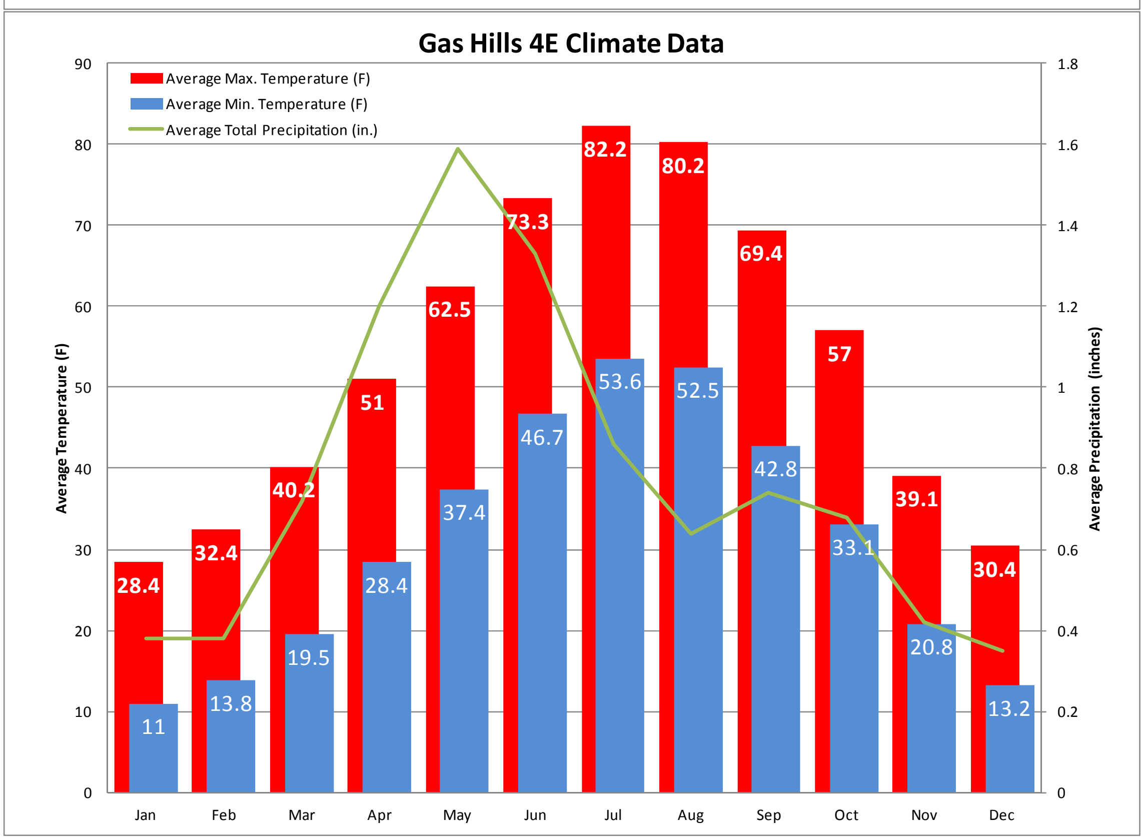


Figure 3.4-2 (continued) Mean Monthly Climatic Factors for Badwater/Poison Creek Watershed (1931 – 2012).

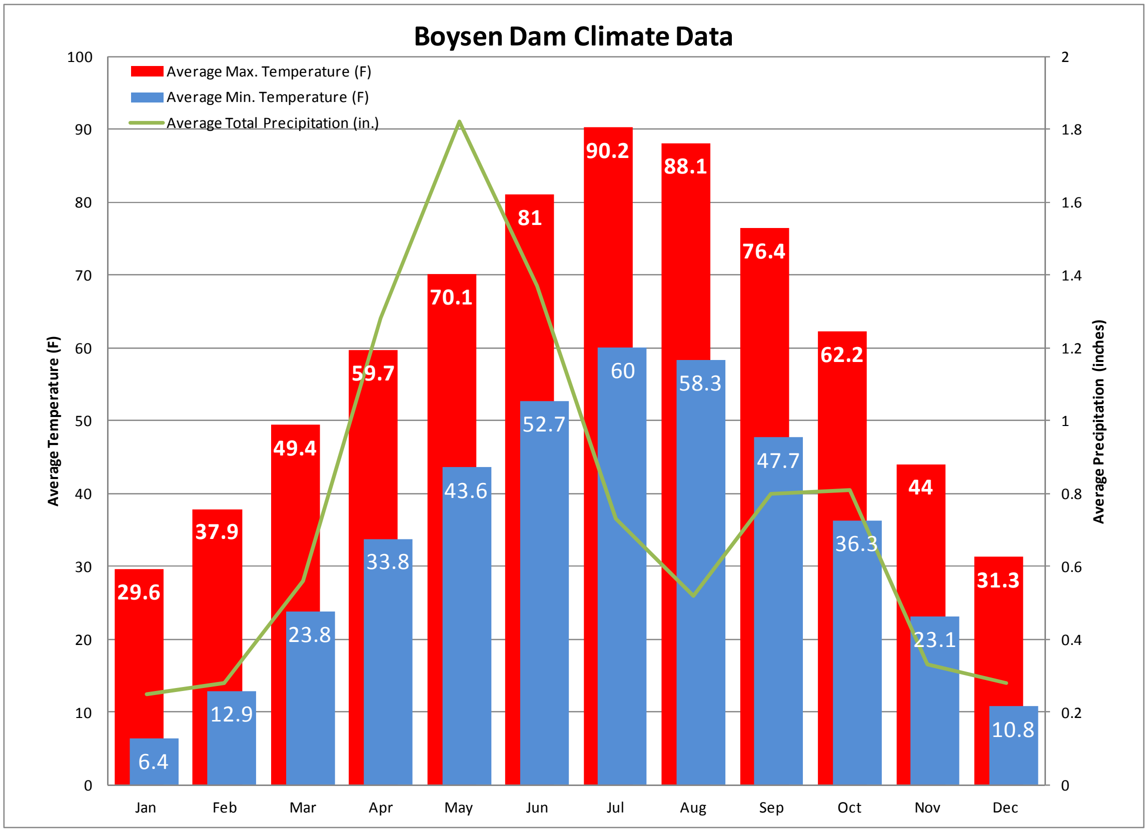


Figure 3.4-2 (continued) Mean Monthly Climatic Factors for Badwater/Poison Creek Watershed (1931 – 2012).

3.4.2 Vegetation and Land Cover

3.4.2.1 Overview

Vegetative cover within the watershed was 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 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).

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 57 different vegetation classes within the Badwater Creek watershed and 40 different vegetation classes in the Poison Creek watershed.

As is clearly indicated in the data, the major sagebrush community (Inter-Mountain Basins Big Sagebrush Shrubland) dominates coverage of both watersheds totaling over 35% in the Badwater Creek watershed and over 58% in the Poison Creek watershed. 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. Table 3.4-2 summarizes the distribution of the wetland and riparian vegetation communities within each watershed (Western Great Plains Floodplain Systems, Introduced Riparian Vegetation, Rocky Mountain Subalpine/Upper Montane Riparian Systems, Rocky Mountain Montane Riparian Systems, Western Great Plains Depressional Wetland Systems).

Table 3.4-2 Tabulation of LANDFIRE Wetlands Data.

Badwater Creek Watershed : LANDFIRE Wetlands			
Existing Vegetation Type	**Acres**	**Percent of Watershed**	**Cumulative Percent**
Western Great Plains Floodplain Systems	8379.60	1.43%	1.43%
Introduced Riparian Vegetation	4009.77	0.68%	2.11%
Rocky Mountain Subalpine/Upper Montane Riparian Systems	1828.75	0.31%	2.42%
Rocky Mountain Montane Riparian Systems	1596.79	0.27%	2.69%
Western Great Plains Depressional Wetland Systems	30.25	0.01%	2.70%
Poison Creek Watershed : LANDFIRE Wetlands			
Existing Vegetation Type	**Acres**	**Percent of Watershed**	**Cumulative Percent**
Western Great Plains Floodplain Systems	3966.628	1.20%	1.20%
Introduced Riparian Vegetation	1124.649	0.34%	1.54%
Rocky Mountain Montane Riparian Systems	567.3284	0.17%	1.71%
Rocky Mountain Subalpine/Upper Montane Riparian Systems	521.7375	0.16%	1.87%
Western Great Plains Depressional Wetland Systems	154.5642	0.05%	1.92%

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. For graphical purposes, data obtained through the Wyoming Gap Analysis program are shown on Figure 3.4-3 (http://www.wygisc.uwyo.edu/wbn/gap.html). However, this data set is included within the project GIS and available for use in subsequent projects and associated efforts.

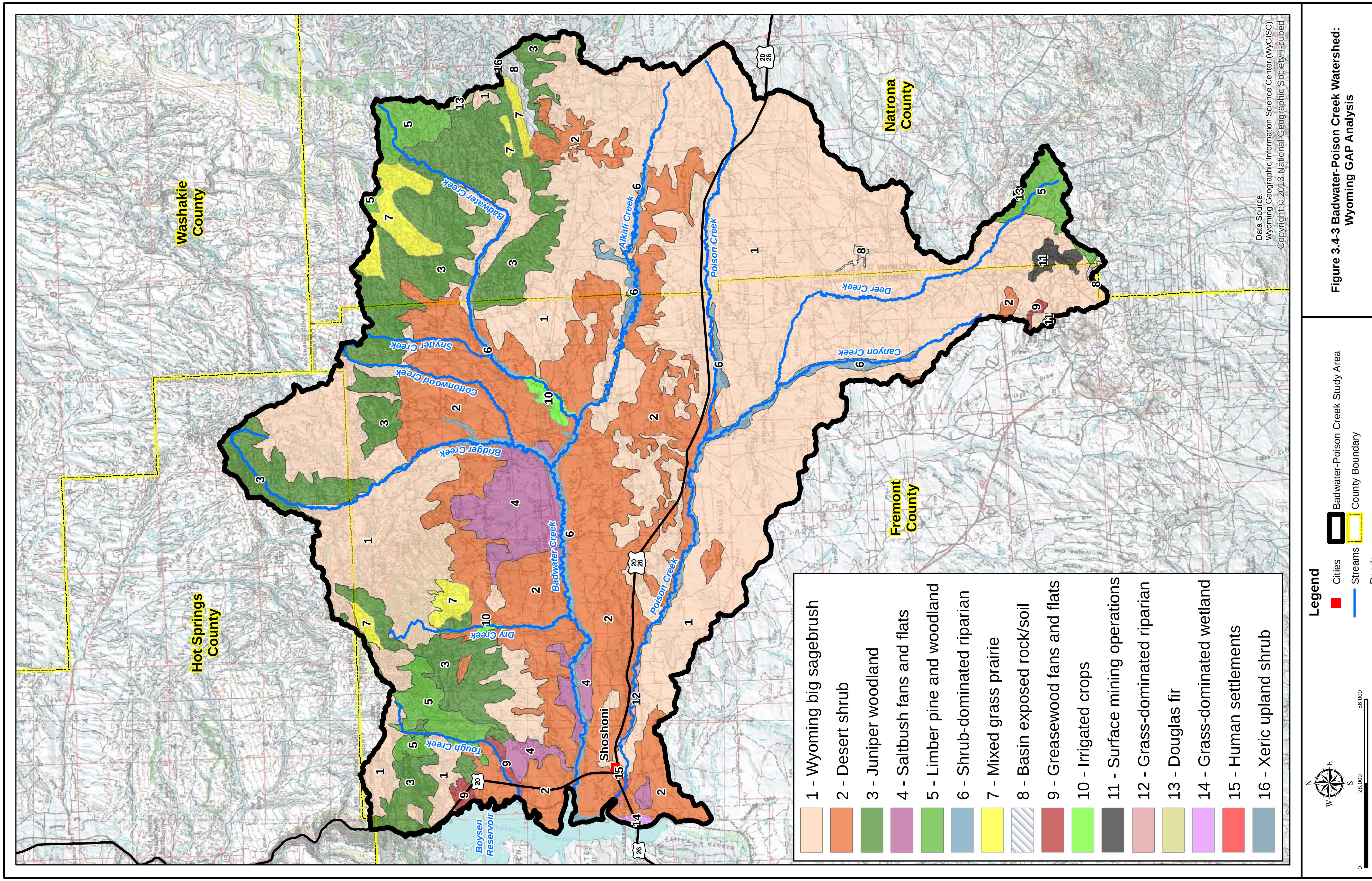


Figure 3.4-3 Badwater-Poison Creek Watershed: Wyoming GAP Analysis

The 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 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).

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. Plant community overviews are available in the Lander and Casper RMPs as well as the EIS documents supporting them (BLM, 2007; BLM, 2013).

3.4.2.2 Targeted Vegetation

Vegetation of particular importance with respect to land use and habitat that were identified by Fremont County Weed and Pest District, Natrona County Weed and Pest District, Hot Springs County Weed and Pest District and local landowners include:

Designated Noxious Weeds .S. 11-5-102 (a) (xi) and Prohibited Noxious Weeds W.S. 11-12-104. For more information see: http://www.wyoweed.org/weeds/state-designated-weeds.

- 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.)

Additionally as of February 2013 the Wyoming Weed and Pest Council lists the following weeds as declared weeds by county:

Fremont County:

- Puncturevine (Tribulus terrestris L.)
- Swainsonpea (Sphaerophysa salsula (Pallas) DC.)

Natrona County:

- Black henbane (Hyoscyamus niger L.)
- Buffalobur (Solanum rostratum Dunal)
- Curlycup gumweed (Grindelia squarrosa (Pursh) Dunal)
- Foxtail barley (Hordeum jubatum L.)
- Halogeton (Halogeton glomeratus (M. Bieb.) C.A. Mey.)
- Puncturevine (Tribulus terrestris L.)
- Showy milkweed (Asclepias speciosa Torr)
- Wild licorice (Glycyrrhiza lepidota Pursh)
- Cheatgrass / downy brome (Bromus tectorum L)
- Yellow starthistle (Centaurea solstitialis)
- Black medic (Medicago lupulina)

Hot Springs County:

- Puncturevine (Tribulus terrestris L.)
- Wild oat (Avena fatua L.)

The county Weed and Pest Districts actively conducts control measures to reduce the spread and reproduction of weed species. Fremont County Weed and Pest District maps areas of weed occurrence; the project GIS contains mapping available at the time this report was prepared.

3.4.2.3 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 this scale. Based upon the NWI mapping, approximately 5,217 acres of wetlands exist within the watershed. The major contiguous wetlands in the watershed are located along the lower portions of Badwater Creek, Alkali Creek and Poison Creek. Bridger Creek has wetlands delineated for most of its 50 mile length from the confluence with Badwater Creek to the headwaters in the upper parts of the drainage. There are also significant pockets of wetlands located in the upper reaches of Badwater Creek and along Poison Creek in an area labeled on the USGS quad as Merriam Meadows. 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.

In addition to the NWI mapping and as previously discussed and presented in Table 3.4-2, the LANDFIRE data includes limited determination of wetlands as well. Figure 3.4-4 displays the location of all riparian/wetland vegetation communities included in the LANDFIRE analysis.

The US Army Corps of Engineers has adopted a 'watershed approach' to wetland classification which includes consideration of the 'hydrogeomorphic character' of the various wetland types. According to the USACE manual (USACE, 1995):

> *"The hydrogeomorphic classification is based on three fundamental factors that influence how wetlands function, including geomorphic setting, water source, and hydrodynamics. Geomorphic setting refers to the landform of a wetland, its geologic evolution, and its topographic position in the landscape. For example, a wetland may occur in a depressional landform or a valley landform and may occur at the top, middle, or bottom of a watershed."*

Seven wetland types have been defined using the classification system adopted by the USACE: Riverine, Slopes, Lacustrine Fringe, Depressional, Tidal Fringe, Mineral Flats, and Organic Flats. Within the study area, the following three types are likely to be encountered: slope wetlands, depressional wetlands, and riverine wetlands. In the paragraphs that follow, extracts from the USACE (http://el.erdc.usace.army.mil/wetlands/class.html) are presented which describe the nature and function of each.

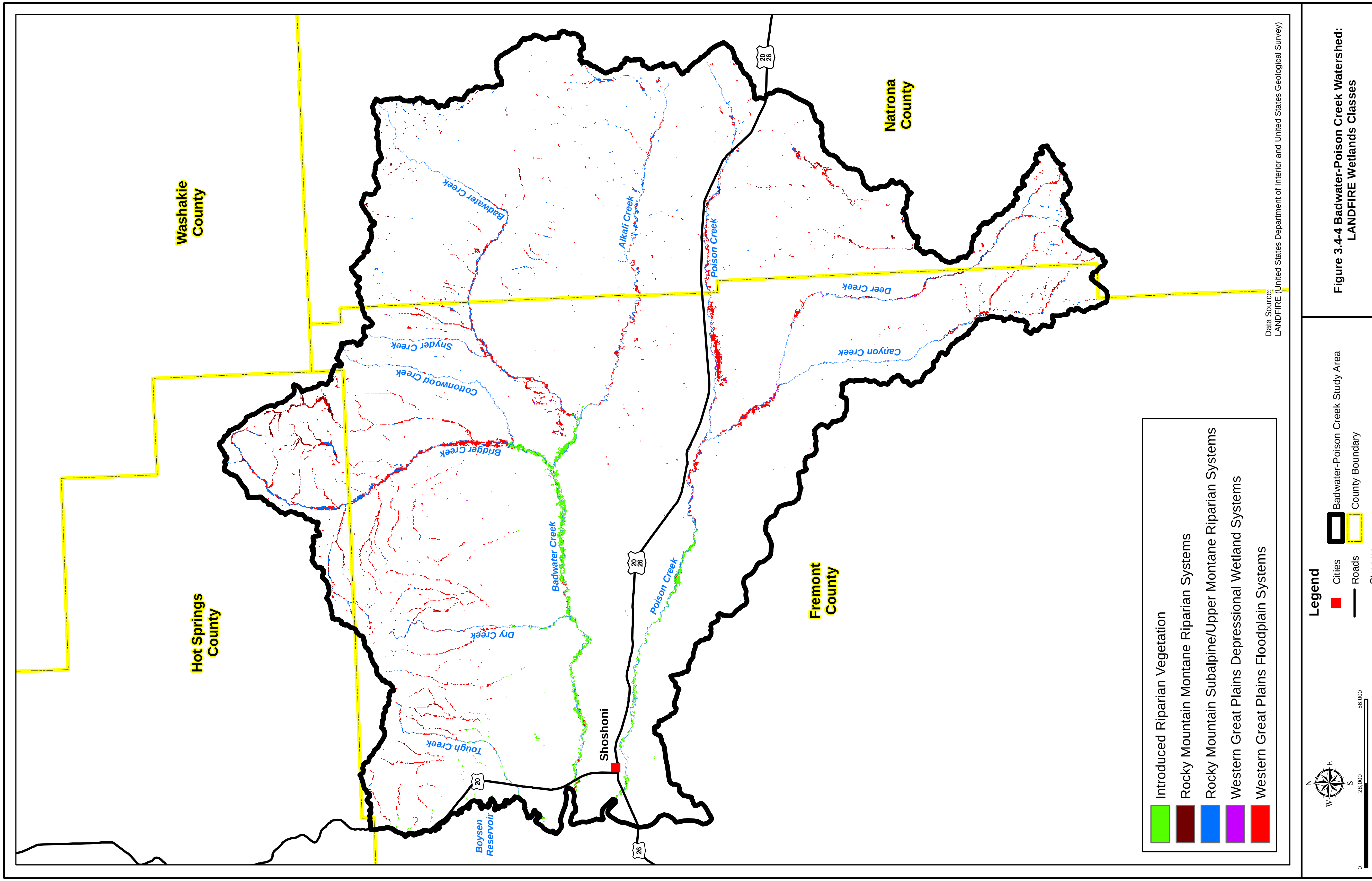


Figure 3.4-4 Badwater-Poison Creek Watershed:
LANDFIRE Wetlands Classes

“Slope Wetlands

Slope wetlands are found in association with the discharge of groundwater to the land surface or sites with saturated overflow with no channel formation. They normally occur on sloping land ranging from slight to steep. The predominant source of water is groundwater or interflow discharging at the land surface. Precipitation is often a secondary contributing source of water. Hydrodynamics are dominated by downslope unidirectional water flow. Slope wetlands can occur in nearly flat landscapes if groundwater discharge is a dominant source to the wetland surface. Slope wetlands lose water primarily by saturated subsurface flows, and by evapotranspiration. Slope wetlands may develop channels, but the channels serve only to convey water away from the slope wetland. Slope wetlands are distinguished from depressional wetlands by the lack of a closed topographic depression and the predominance of the groundwater/interflow water source. Fens are a common example of slope wetlands.

Depressional Wetlands

Depression wetlands occur in topographic depressions (i.e., closed elevation contours) that allow the accumulation of surface water. Depression wetlands may have any combination of inlets and outlets or lack them completely. Potential water sources are precipitation, overland flow, streams, or groundwater/interflow from adjacent uplands. The predominant direction of flow is from the higher elevations toward the center of the depression. The predominant hydrodynamics are vertical fluctuations that range from diurnal to seasonal. Depression wetlands may lose water through evapotranspiration, intermittent or perennial outlets, or recharge to groundwater. Prairie potholes, playa lakes, vernal pools, and cypress domes are common examples of depression wetlands.

Riverine Wetlands

Riverine wetlands occur in floodplains and riparian corridors in association with stream channels. Dominant water sources are overbank flow from the channel or subsurface hydraulic connections between the stream channel and wetlands. Additional sources may be interflow, overland flow from adjacent uplands, tributary inflow, and precipitation. When overbank flow occurs, surface flows down the floodplain may dominate hydrodynamics. In headwaters, riverine wetlands often intergrade with slope wetlands, depressions, poorly drained flats, or uplands as the channel (bed) and bank disappear. Perennial flow is not required. Riverine wetlands lose surface water via the return of floodwater to the channel after flooding and through surface flow to the channel during rainfall events. They lose subsurface water by discharge to the channel, movement to deeper groundwater (for losing streams), and evaporation. Peat may accumulate in off-channel depressions (oxbows) that have become isolated from riverine *processes and subjected to long periods of saturation from groundwater sources. Bottomland hardwoods on floodplains are an example of riverine wetlands.*

The classification system discussed by the USACE also incorporates consideration of the various 'functions' of the wetland types:

"Wetland functions are defined as the normal or characteristic activities that take place in wetland ecosystems or simply the things that wetlands do. Wetlands perform a wide variety of functions in a hierarchy from simple to complex as a result of their physical, chemical, and biological attributes. For example, the reduction of nitrate to gaseous nitrogen is a relatively simple function performed by wetlands when aerobic and anaerobic conditions exist in the presence of denitrifying bacteria. Nitrogen cycling and nutrient cycling represent increasingly more complex wetland functions that involve a greater number of structural components and processes. At the highest level of this hierarchy is the maintenance of ecological integrity, the function that encompasses all of the structural components and processes in a wetland ecosystem."

Figure 3.4-5 provides a figure extracted from the USACE manual depicting the hierarchy of wetland functions associated with the example cited above regarding the nitrogen cycle. Additional information regarding the wetlands classification scheme is contained in the USACE document included in the digital library delivered with this report and also available at: http://el.erdc.usace.army.mil/elpubs/pdf/wrpde9.pdf.

Delineation of wetlands and classification by function was beyond the scope of this study. However, based upon the project team's familiarity of the basin and the hydrologic regime of the watershed, it can be assumed that the majority of the wetlands in the study area consist primarily of riverine and slope wetlands found along the water courses and associated with springs outside of the riparian zones.

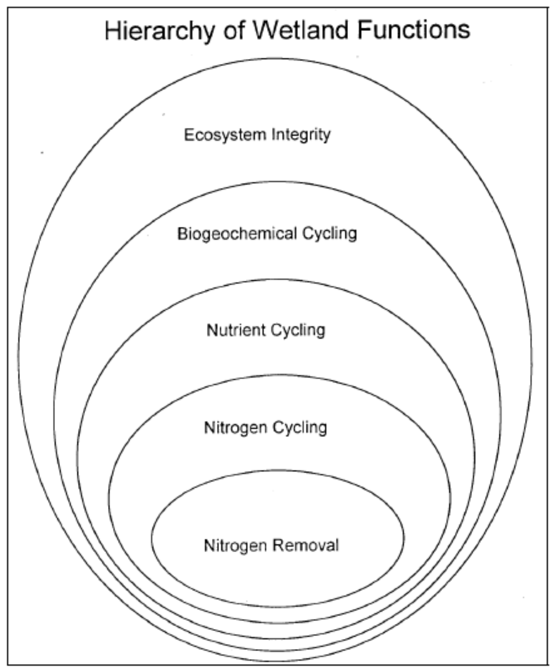


Figure 3.4-5 Hierarchy of Wetland Functions (USACE, 1995).

3.4.3 Geology

3.4.3.1 Surficial Geology

The surficial deposits found within the Badwater/Poison Creek watershed are presented on Figure 3.4-6. The figure shows the wide distribution of alluvium, eolian mixed, residuum, slope wash and

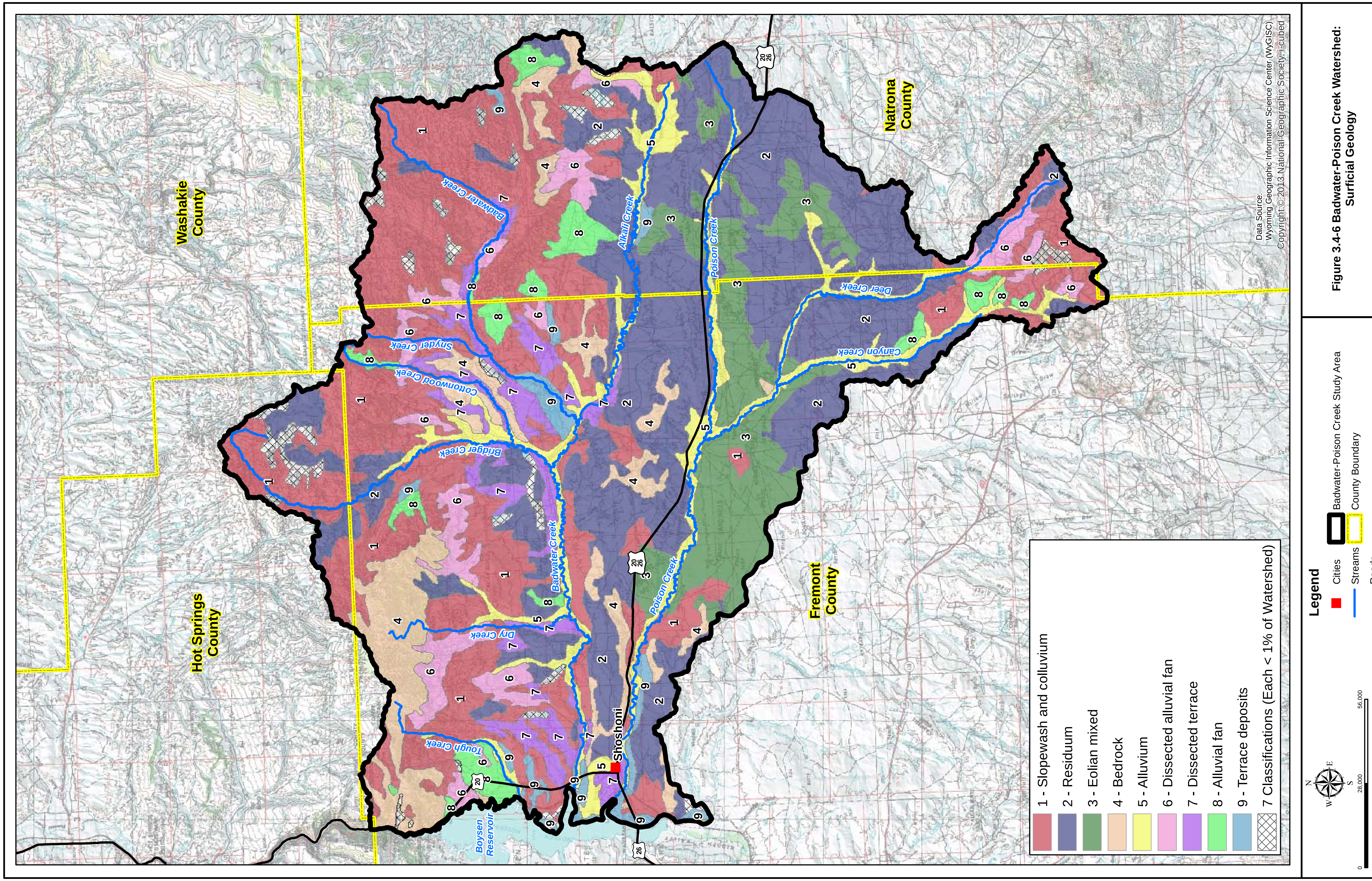


Figure 3.4-6 Badwater-Poison Creek Watershed: Surficial Geology
Legend
Cities
Streams
Roads
Badwater-Poison Creek Study Area
County Boundary
1 - Slopewash and colluvium
2 - Residuum
3 - Eolian mixed
4 - Bedrock
5 - Alluvium
6 - Dissected alluvial fan
7 - Dissected terrace
8 - Alluvial fan
9 - Terrace deposits
7 Classifications (Each < 1% of Watershed)
Data Source:
Wyoming Geographic Information Science Center (WyGISC)
Copyright:© 2013 National Geographic Society, i-cubed
0
28,000
56,000
Feet
Washakie County
Hot Springs County
Fremont County
Natrona County
Shoshoni
Boysen Reservoir
Badwater Creek
Alkali Creek
Poison Creek
Deer Creek
Canyon Creek
Snyder Creek
Cottonwood Creek
Bridger Creek
Dry Creek
Tough Creek

colluvium 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 terrace deposits.

Each of these deposits will produce soils and vegetation as a function of its physical and chemical composition, slope, slope aspect, local precipitation and other climatic factors, age, etc. which vary widely across the study area.

Residuum is an in-situ deposit formed from the weathering of bedrock. Soluble components of the bedrock were transported from the area by fluvial, fluvioglacial, and groundwater processes. The insoluble portions of the rock experienced some mechanical weathering from freeze-thaw and rain-drop impact with little to no transport of the remaining materials. The residuum deposits within the study area are primarily derived from late Paleozoic to Mesozoic rocks. The deposits are relatively young and are therefore thin compared to other quaternary deposits.

Colluvium exists throughout the watershed and has a genetic origin related to mass wasting mechanisms. These sediments were derived from the movement of material down slope under the influence of gravity. The colluvial deposits are composed of material derived from bedrock at higher elevations. Grain sizes range from silt to gravel, and grain shape is predominantly angular to subangular.

Alluvium is found adjacent to 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. Headwater deposits are typically narrower and shallower compared to downstream areas in the watershed. These deposits are actively growing with the fluvial action of existing surface drainages. Fluvial action includes flooding (vertical deposition) and point-bar migration (lateral deposition).

3.4.3.2 Bedrock Units

The geologic formations that underlie the study area range in age from Precambrian to Recent. Figure 3.4-7 provides a generalized geologic map of the study area extracted from the 1:500,000-scale geologic map compilation by Love and Christiansen (1985). Figure 3.4-8 provides a geologic column for the study area, modified from the Ricther (1981) report on the occurrence and characteristics of groundwater in the Wind River Basin.

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. For the purposes of this planning investigation, the general geologic maps and column are presented in order to define the formations present which could potentially affect development of potential watershed improvement projects, reservoir storage, etc. Descriptions of key formations as they relate to groundwater availability and development are discussed in Section 3.5 of this report.

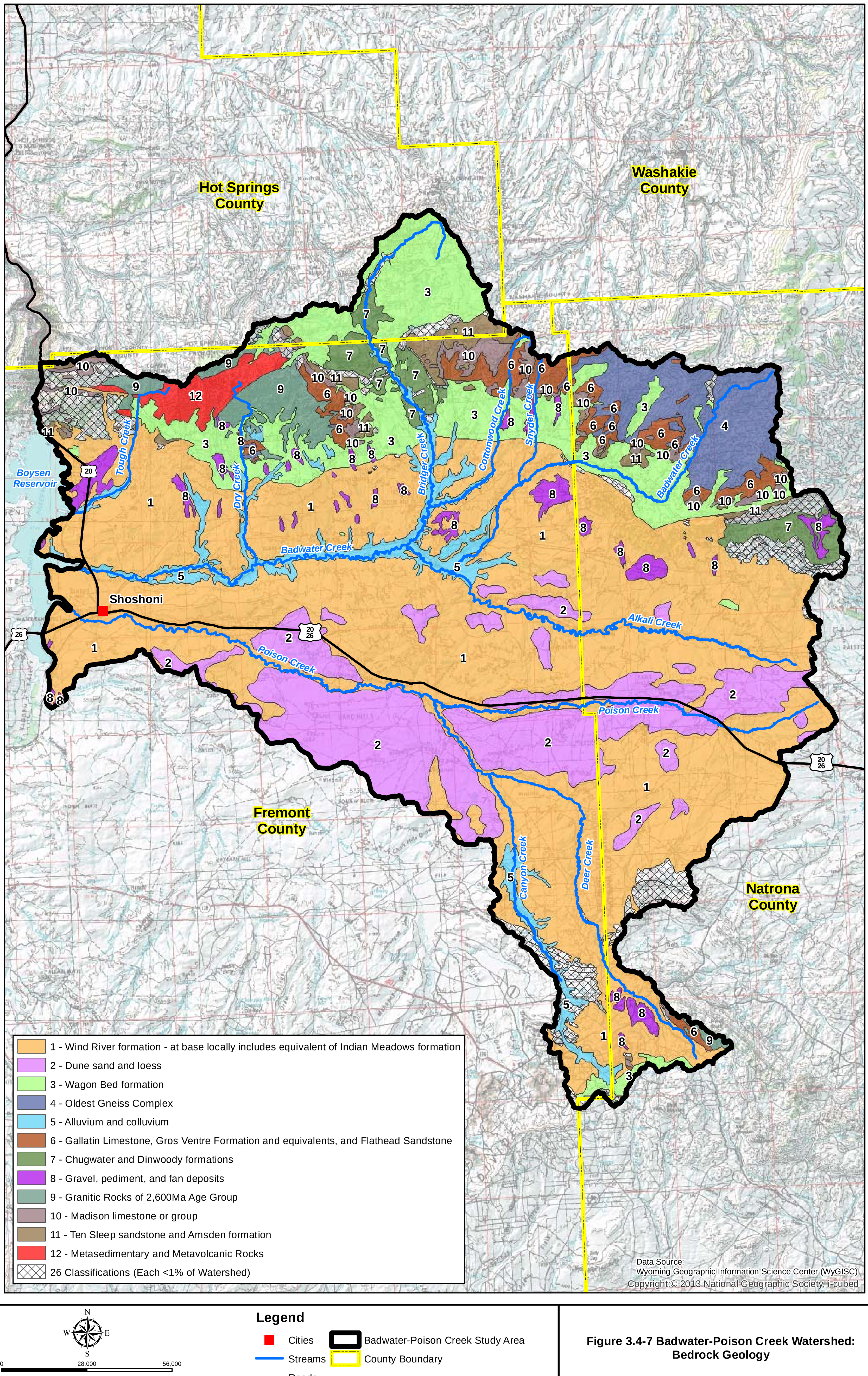


Figure 3.4-7 Badwater-Poison Creek Watershed: Bedrock Geology

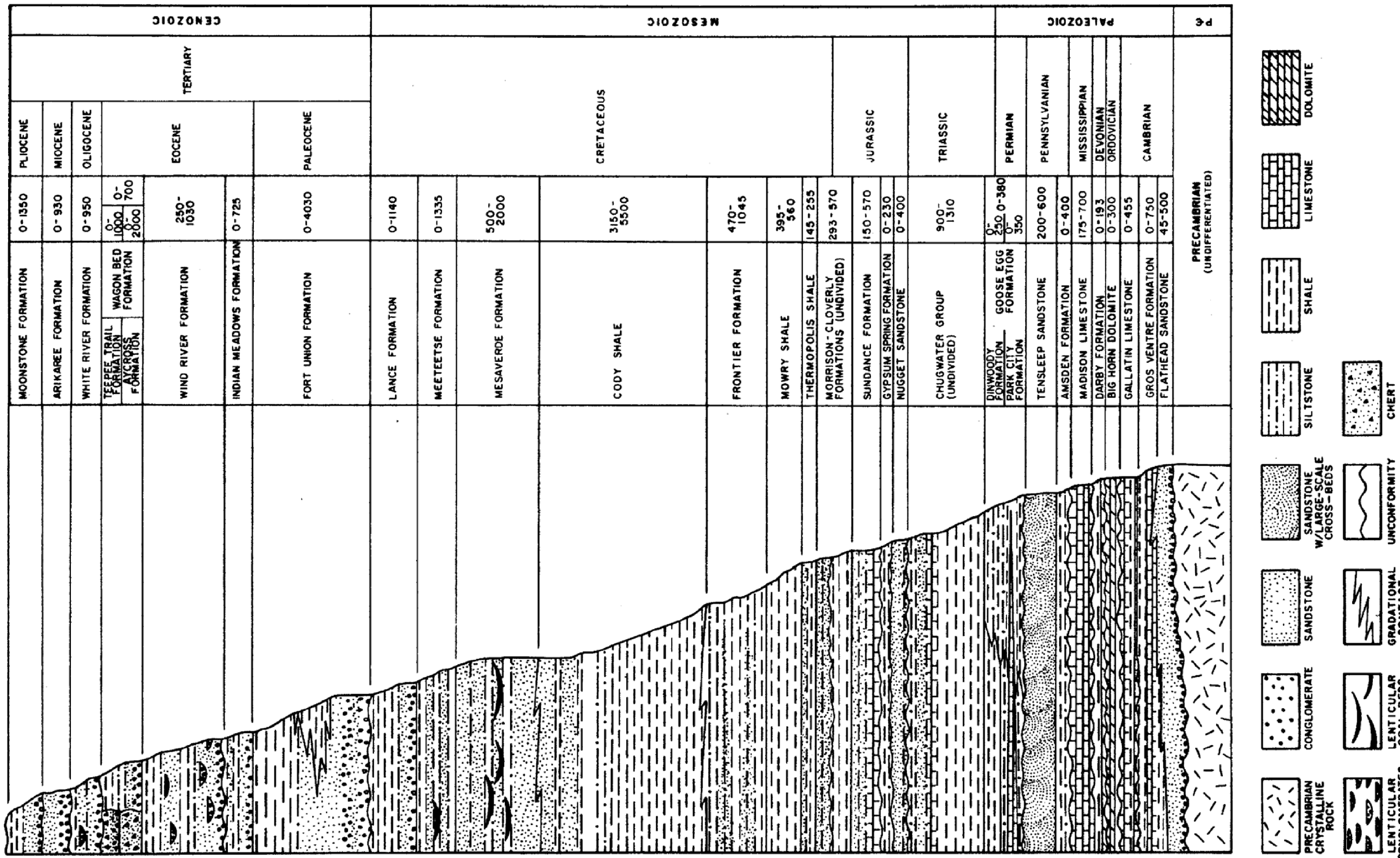


Figure 3.4-8 Generalized Geologic Column, Wind River Basin (Richter, 1981).

3.4.3.3 Geologic Hazards

Conventional "geologic hazards" are minor in the Badwater / Poison Creek Study Area (Figure 3.4-9).

Landslide deposits are included with the mapping of general surficial geology. Landslide activity in the study area is relatively minor in any case, marking local occurrences where slope, permeability, pore pressure, and formation strength have combined to create slope failure. Future landslides are most likely to occur in association with areas of historical slope failure. Thus, while this potential hazard is not restricted to the areas mapped, those areas merit heightened concern.

Using the Wyoming State Geological Surveys (WSGS) earthquake databases, (http://ims.wsgs.uwyo.edu/Earthquakes/) the study area was searched for significant historical earthquakes. The Advanced National Seismic System (ANSS) database returned only one earthquake located in the study area. On November 8th 2000, a magnitude 3 earthquake was recorded near the base of Lysite Mountain east of Meadow Creek. Two other earthquakes were recorded just outside the boundaries of the study area. A magnitude 2.3 earthquake was recorded in 2008 in the upper reaches of Kirby Creek, and a 3.1 magnitude earthquake was recorded in the Lone Tree Creek drainage north of the study area. Results are mapped on Figure 3.4.9.

As indicated in the figure, there are numerous fault lines located primarily in the northern portion of the watershed. However the watershed appears to be a relatively seismically stable area due to the infrequency of recordable seismic events. The study area falls in zone 1 according to seismic risk mapping by the Uniform Building Code Seismic Zone Map. This zone is defined by the probability of having a ground shaking (horizontal acceleration) between 5% and 10% of gravity in 50 years.

3.4.4 Soils

Many of the physical and chemical properties of the soils in the study area are strongly influenced by the nature of the parent materials. Very young soils are influenced more by parent material than by vegetation. The soils in the watershed area formed from limestone and sandstone on mountainsides and from interbedded sandstone. Soils within the study area vary greatly as would be anticipated given the areal extent of the basin and the variety of parent materials, precipitation, and other soil forming factors. 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. This level of detail is valuable for regional planning efforts such as this investigation; however, more detailed mapping is required for site-specific investigations and evaluation of specific projects.

Within the study area, detailed soils mapping was available for Fremont County and Natrona County. At the time of this report Hot Springs County detailed soils data was unavailable. The 1:24,000 scale soils mapping is incorporated within the project GIS.

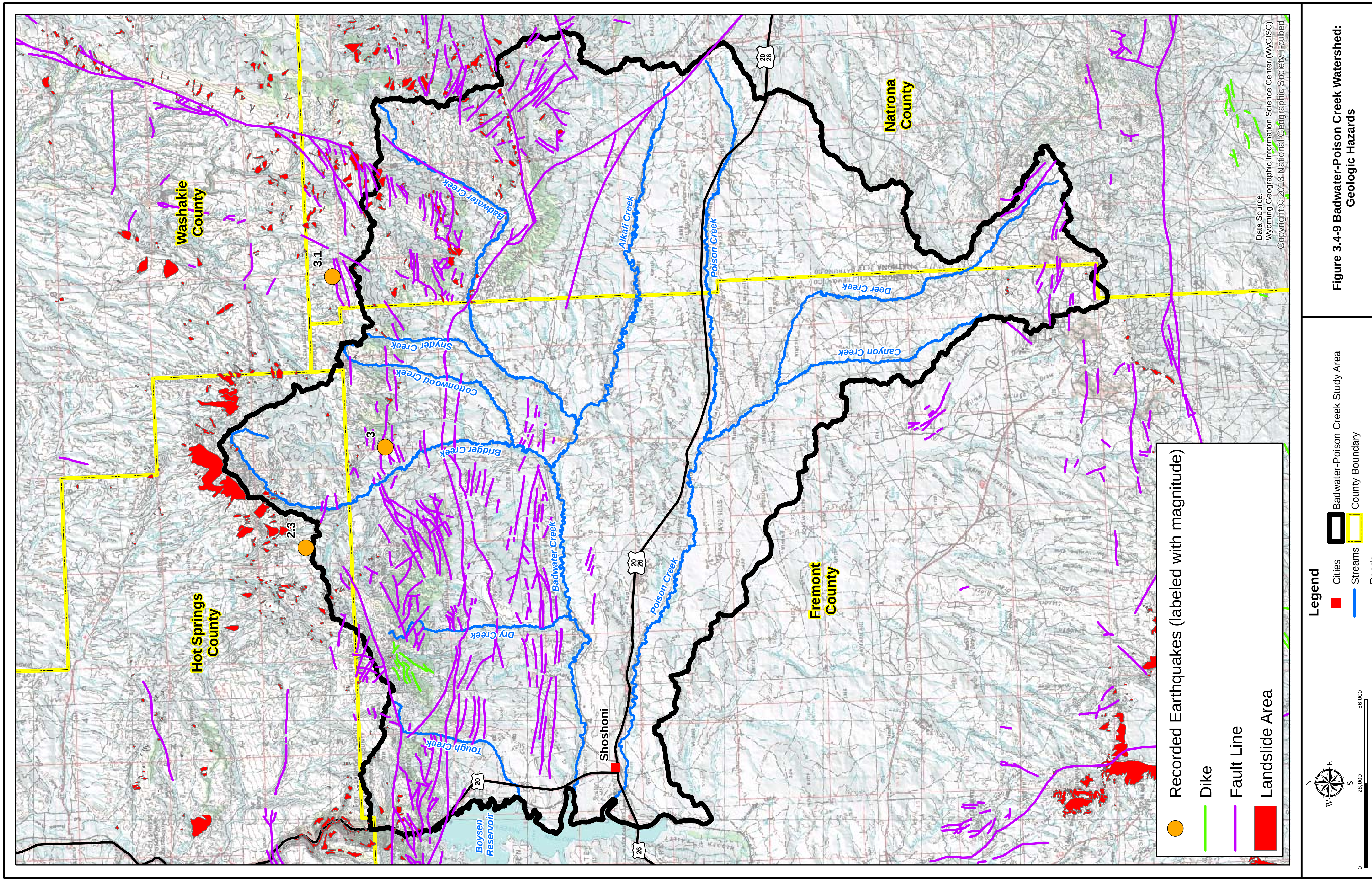


Figure 3.4-9 Badwater-Poison Creek Watershed: Geologic Hazards

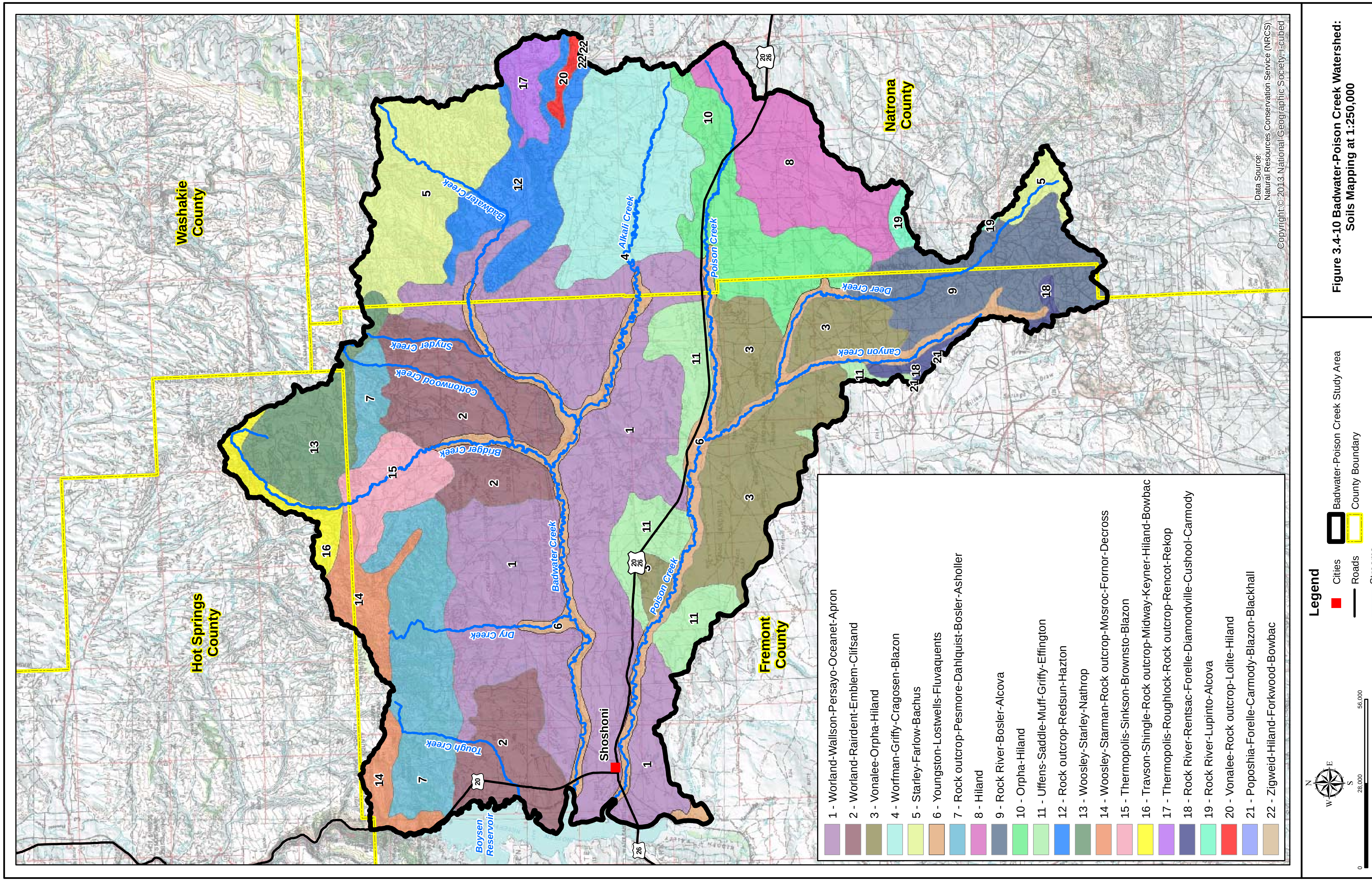


Figure 3.4-10 Badwater-Poison Creek Watershed:
Soils Mapping at 1:250,000

3.5 Watershed Hydrology

3.5.1 Groundwater

Groundwater is simply the underground component of the hydrologic cycle. Water enters the subsurface as rainfall, snowmelt, streamflow, irrigation water, etc. infiltrates, in a process called "recharge". Groundwater moves beneath the surface in response to groundwater gradients, much as surface water flows "downhill". Groundwater leaves the subsurface as "discharge" via springs, wells, baseflow into streams, uptake by deep-rooted vegetation, and evaporation from the ground surface.

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 topography. For example, where a sufficiently permeable geologic unit (e.g., uncemented sandstone or conglomerate) crops out in a swale or on a hillside at an elevation below the ambient 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. 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 at 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).

USGS quads were scanned for mapped spring locations and spring location data was collected from the Lander and Casper BLM field offices (spring locations from Worland Field office were unavailable at the time of this report). Spring locations were not considered as existing water sources due to the fact that the viability of the spring could not be determined remotely. They were mapped in order to provide data for further investigation, if deemed necessary. Figure 3.5-1 displays the location of springs mapped by the USGS and the BLM.

3.5.1.2 Alluvial Aquifers

A large number of existing stock and domestic wells within the study area are shallow wells completed in alluvial aquifers associated with Badwater Creek, Poison Creek, and their tributaries. The following description extracted from Richter (1981) provides a general description:

> *"Unconsolidated alluvium, colluvium and terrace deposits of Recent age underlie all major flood plains in the Wind River basin. The unconsolidated material consists mainly of thin to medium beds of clay, silt, fint- to coarse-grained sand, fine- to coarse-pebble conglomerate, gravel, and boulders. The deposits range from 5 to 200 feet thick, but are*

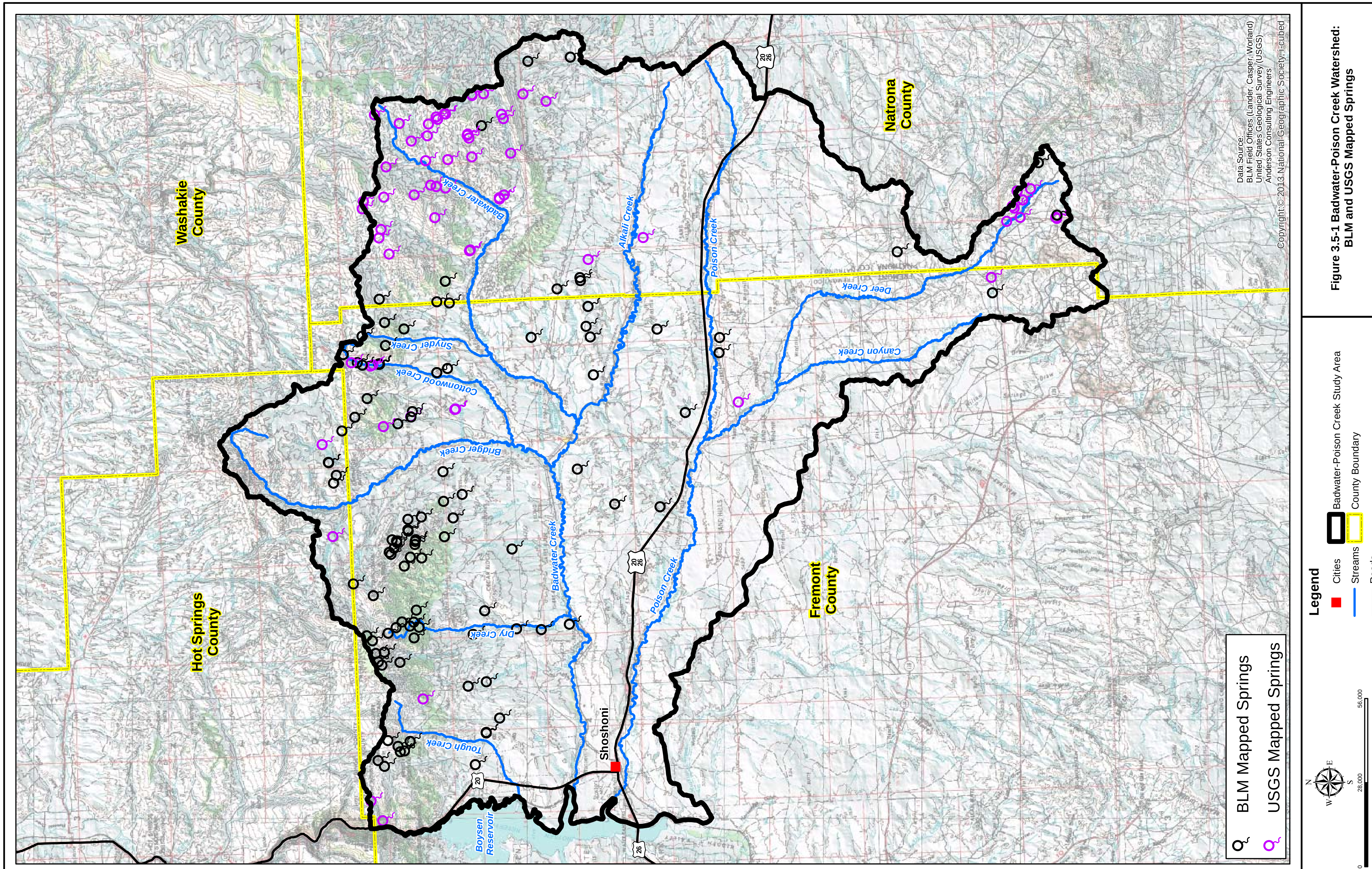


Figure 3.5-1 Badwater-Poison Creek Watershed: BLM and USGS Mapped Springs

generally less than 40 feet thick (McGreevy and others, 1969, Morris and others 1959). They have excellent development potential as productive aquifers because permeabilities are large and because in many places the entire thickness is saturated.

Groundwater in the Quaternary deposits is unconfined. Water table conditions are dependent on seasonal recharge and vary widely throughout the year. Recharge to the deposits occurs by (1) infiltration of precipitation into outcrops, (2) discharge from bedrock units, (3) stream loss, and (4) irrigation. Maximum recharge occurs in March and July."

3.5.1.3 Bedrock Aquifers

Groundwater exists in both unconfined water table conditions (at atmospheric pressure) or under confined conditions where pressures are greater than atmospheric. Table 3.5-1, extracted from Richter (1981), tabulates the lithology and water yielding characteristics of these and other members of the stratigraphic sequence. Figure 3.5-2, also extracted from Richter, presents the generalized hydostratigraphic column of the Wind River Basin.

A database of permitted well information was obtained from the Wyoming State Engineers Office (WSEO). Within the database are attributes for each well including: permit number, applicant name, well name, location, well depth, depth to water, well yield, and appropriated uses. Figure 3.5-3 displays the locations of the wells. This figure also indicates the general depth of each well.

3.5.2 Surface Water

The USGS has designated watersheds within 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 occupy the land area of the conterminous United 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 Badwater Creek tributaries: Lysite Creek.

Table 3.5-1 Generalized stratigraphy lithology and water-bearing characteristics of geologic formations in the Wind River Basin (From Richter, 1981)

Era	Period	Geologic Unit	Thickness (feet)	Lithologic Description	Hydrologic Properties
Cenozoic	Quaternary	alluvium and terrace deposits	0-100+	Unconsolidated, interbedded, silt, sand, and gravel.	Highly permeable and productive water-bearing deposits. Possible yields from 1 to greater than 1,000 gpm. Total dissolved solids generally range between 100 to 1,000 mg/l.
	Tertiary	White River Formation	0-950	Calcareous, argillaceous, fine-grained sandstone with interbedded tuff and bentonite. Discontinuous, thin lenses of arkose and very coarse, poorly sorted conglomerate. Unaltered uitric ash layers common. Unit exposed only in southern part of basin.	Highly permeable and productive water-bearing unit. Good intergranular permeability and porosity. Well yields generally range between 1 to 300 gpm, with maximum reported production 850 gpm. Saturated thickness ranges between 200 to 350 feet. Comprises basal part of Arikaree aquifer.
	Tertiary	Wagon Bed Formation		Tuffaceous and bentonitic sandstone, siltstone, and mudstone. Poorly sorted coarse-pebble conglomerate and arkose at top and base of unit. Chert lenses and silicified mudstone lenses in upper 100 feet. Unit exposed only along southern margin of basin.	Yields water locally to springs and shallow wells. Yields less than 10 gpm. Saturated zones include sandstone and conglomerate lenses. Water qualities are poor with total dissolved solids between 1,500 to 2,500 mg/l. Not considered an aquifer.
	Tertiary	Wind River Formation	250-1,030	Variegated siltstone, shale, claystone, and argillaceous sandstone with interbedded fine-grained sandstone, arkose, snd arkosic sandstone. Tuff5ceous and bentonitic mudstone lenses in upper 500 feet.	Major aquifer. Yields water to wells and springs throughout basin. Yields range between 1 to 3,000 gpm. Locally contains artesian zones with sufficient head to produce 200 gpm. Principal source of domestic and stock water on Wind River reservation. Principal source of industrial water in southern part of basin. Water qualities are highly variable with total dissolved solids between 100 to 5,000 mg/l.
	Tertiary	Indian Meadows Format ion		Series of variegated claystone, agrillaceous sandstone, massive limestone, and poorly sorted conglomerate.	Confihing layer.
	Tertiary	Fort Union Formation	0-8,000	Conglomerate, sandstone, shale, siltstone, and carbonaceous shale in basal part of unit; grades upward to very fine-grained clas tics.	Conglomerate and sandstone zones yield water to wells. Highly productive and permeable where fractured. Water is semi-confined to confined with sufficient head to produce 10 gpm. Water qualities are poor with total dissolved solids greater than 1,000 mg/l. Basal part of unit is considered a regional confining unit. Upper part of unit contains complex series of permeable and confining layers.
Mesozoic	Cretaceous	Lance Formation	0-6,000	Massive to thin bedded sandstone, poorly sorted shale pebble conglomerate; grades upward to carbonaceous shale, siltstone, with thin lenses of bentonite and coarse-grained sandstone. Thin coal lenses in uppermost part of unit.	No known wells produce water solely from unit. Wells completed in Fort Union and Lance. Unit is highly productive and permeable in Big Horn basin (yields range between 1 to 100 gpm); water qualities are general-ly poor with total dissolved solids greater than 1,000 mg/l. Large development potential in Wind River basin.

Table 3.5-1 (continued) Generalized stratigraphy lithology and water-bearing characteristics of geologic formations in the Wind River Basin (From Richter, 1981)

Era	Period	Geologic Unit	Thickness (feet)	Lithologic Description	Hydrologic Properties
	Cretaceous	Meeteetse Formation	0-1,335	Massive to thin bedded, friable sandstone, shale, siltstone, and claystone, with thin coal and bentonite interbeds. Grades to shale, siltstone, and sandy shale eastward.	Regional confining layer.
	Cretaceous	Mesaverde Formation	550-2,000	Upper: very fine to coarse grain, massive to cross-bedded, friable sandstone. Few shale, claystone, and carbonaceous shale interbeds. Middle: interbedded carbonaceous shale, siltstone, and sandstone. Some lenticular coal beds up to 13 feet thick. Basal: very fine to medium grain, irregularly bedded to massive sandstone.	Permeable and productive water-bearing unit. Regional aquifer. Well yield data not available; however, artesian flows reported in numerous interbedded carbonaceous shale, Yields water to shallow stock wells in eastern basin. Water qualities poor with total dissolved solids usually greater than 1,500 mgll.
Cretaceous		Frontier Formation	470-1,045	Alternating sequence of sandstone and shale. Upper 2/3 of unit is regional aquifer; 'Sandstone: fine to medium grain, thin bedded to massive, locally glauconitic. Shale: fissile, silty and sandy,locally carbonaceous.	Upper 2/3 of unit is regional aquifer; lower 1/3 of unit is confining layer. Water is under confined conditions with sufficient head to produce flows of 10 to 25 gpm at selected petroleum tests. Yields 5 to 150 gpm to shallow stock and domestic wells. Water qualities vary from less than 500 to greater than 3,000 mg/l total dissolved solids.
Cretaceous-Jurassic		Cloverly-Morrison forma	300-570	Cloverly: Upper-sandstone, clean with lenticular chert-pebble conglomerate and thin variegated shale. Middle: variegated shale. Basal: sandstone, fine to coarse grain. Morrison: variegated claystone and shale, with thinbedded to lenticular, fine to medium grain, friable sandstone.	Cloverly: permeable and productive upper and basal sandstones. Water is under artesian conditions with sufficient head to produce flows of 1 to 25 gpm at selected petroleum tests. Yields water to stock wells along outcrops. Water qualities are generally poor with total dissolved solids greater than 1,500 mgll. Morrison: regional confining layer. Locally contains permeable sandstone lenses. Water is under confined conditions. Yields less than 5 gpm.
Jurassic		Sundance Formation	150-570	Upper: fine to coarse grain glauconitic sandstone with few thin shale and fossiliferous limestone interbeds. Basal: siltstone and sandstone; grade downward to oolitic limestone, dolomite, and chert pebble conglomerate.	Regional aquifer. Large intergranular permeability in sandstone and chert lenses. Yields water to shallow stock and domestic wells along outcrops (1 to 25 gpm). Water is under confined conditions. Selected petroleum tests yield-flows of 25 to 50 gpm. Water qualities are good along outcrops with 'total dissolved solids less than 500 mg/l. Water qualities deteriorate basinward with total dissolved solids greater than 2,000 mgll.

Table 3.5-1 (continued) Generalized stratigraphy lithology and water-bearing characteristics of geologic formations in the Wind River Basin (From Richter, 1981)

Era	Period	Geologic Unit	Thickness (feet)	Lithologic Description	Hydrologic Properties
Pennsylvanian		Tensleep Sands tone	200-600	Sandstone, resistant, massive to cross-bedded, fine grain, friable, with irregular chert layers and thin limestone and domilite abili near base.	Uppermost unit of the Tensleep aquifer system. Good intergranular permeability, excellent permeabilities where fractured. Saturated throughout basin. Water is under confined conditions with sufficient head to produce flows of 1 to several hundred gpm from selected wells. Water qualities along outcrops are good with total dissolved solids less than 500 mgfl. Water qualities decrease basinward with total dissolved solids greater than 2,000 mgll.
Mississippian		Madison Limestone	200-700	Upper: limestone and dolomite, irregular, thin to massive, dense, locally cavernous, cherty. Basal: alternating sequence of limestone, dolomite, thin bedded sandstone, cherty; limestone breccia at base.	Part of Tensleep aquifer system. Poor permeabilities except where fractured. Some saturated caverns. Water-bearing throughout basin. Water is confined. Well yields range between 1 to several hundred gpm. Water qualities are good along outcrop with total dissolved solids less than 500 mg/l.
Cambrian		Gallatin Limestone	0-450	Limestone, dense, thinly laminated to massive, glauconitic and oolitic, shale, silty shale, and thin sandstone interbeds.	Confining layer. Permeable along joints and fractures. Yields small quantities (less than 5 gpm) to springs along the Wind River Mountains.
Precambrian		undifferentiated		Complex of igneous and metamorphic rocks. Predominantly granite, granite gniess, schist, hornblende schist, aplite and basic dikes.	Permeable along joints, fractures and faults. Locally yields water to shallow wells along outcrops.

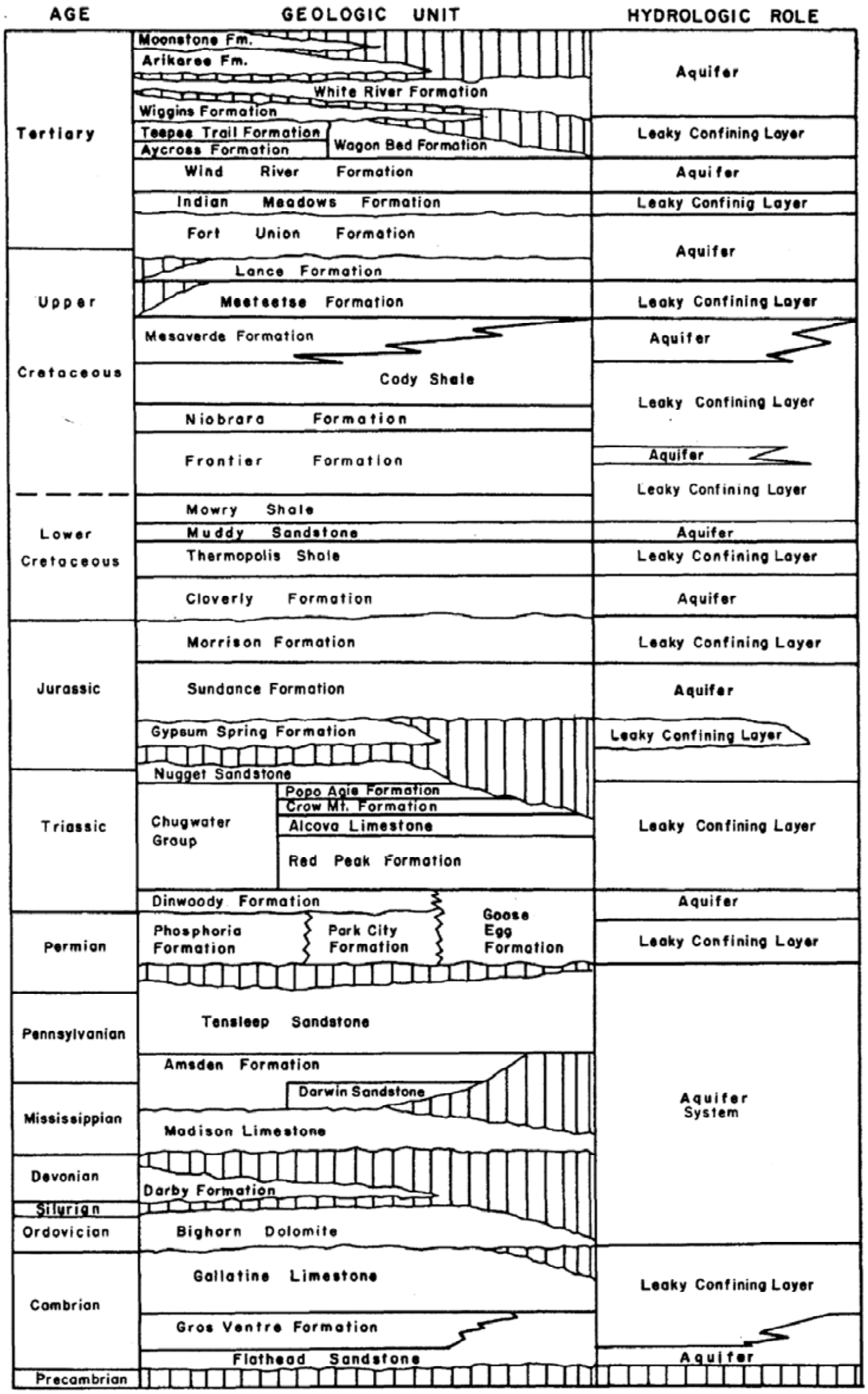


Figure 3.5-2 Generalized hydrostatic column of the Wind River Basin (Richter, 1981).

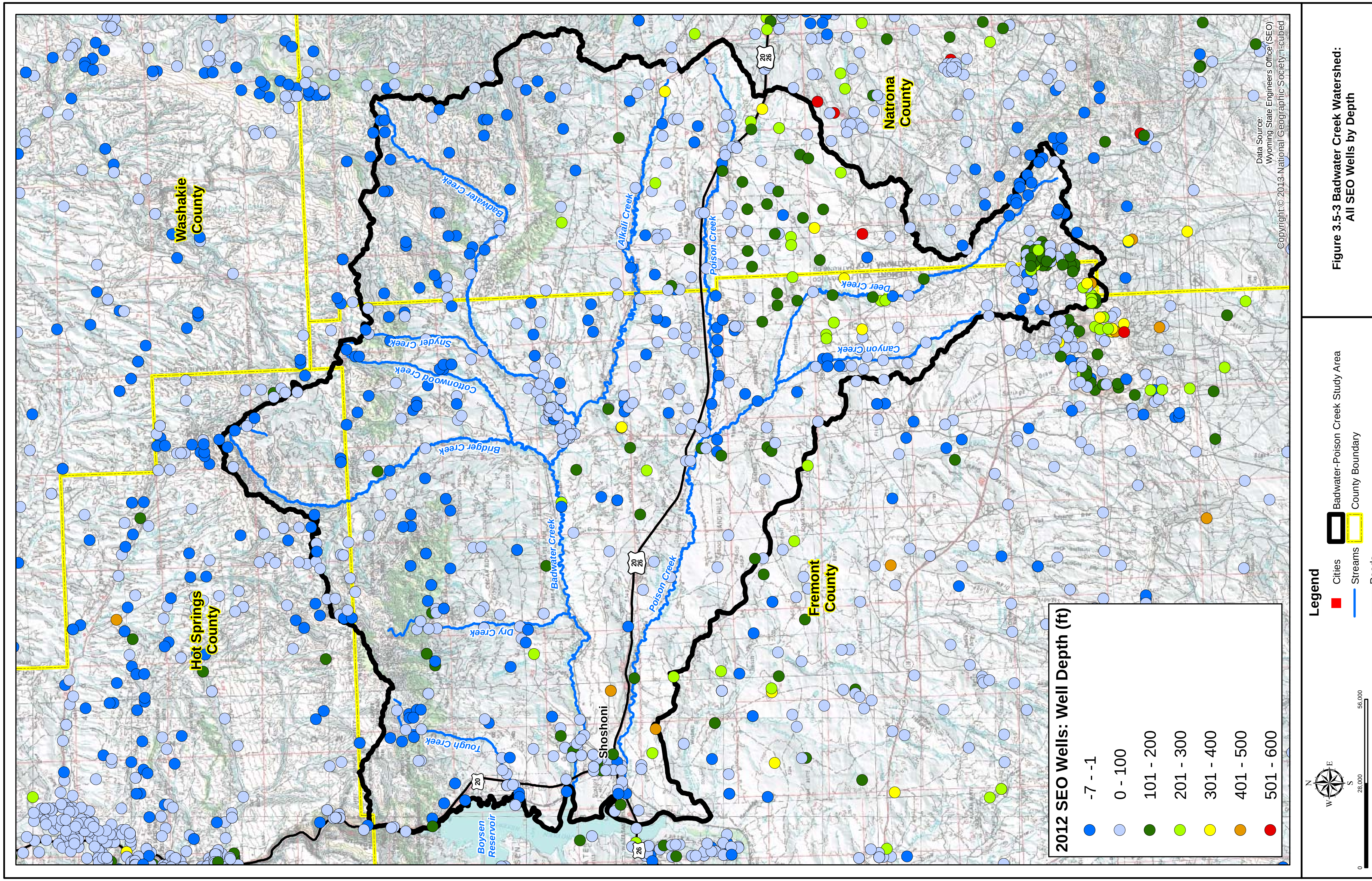


Figure 3.5-3 Badwater Creek Watershed: All SEO Wells by Depth

Region:	10 Missouri River	(Second order HUC)
Subregion:	1008 Big Horn River	(Fourth Order HUC)
Accounting Unit:	100800 Big Horn River	(Sixth Order HUC)
Cataloging Unit:	10080006 Badwater Creek	(Eighth Order HUC)
Eight subbasins:	1008000603 Bridger Creek	(Tenth Order HUC)
37 Sub-basins:	100800060303 Lysite Creek	(Twelfth Order HUC)

The Badwater/Poison Creek watershed study area was defined by the eighth order HUC 10080006 Badwater Creek combined with the tenth order HUCs 1008000503 Upper Poison Creek and 1008000504 Lower Poison Creek. Table 3.5-2 summarizes the HUC system as it pertains to the study area as indicated in Figure 3.5-4.

USGS Gaging Stations

There are currently no active USGS stream gaging stations within the watershed (Figure 3.5-4). As indicated in Figure 3.5-5, historically, seven gages have been active with up to five active at one time (mid-1960's). However all of the gages have been discontinued by the USGS (the last one being discontinued in 1980), leaving the basin with no active gages.

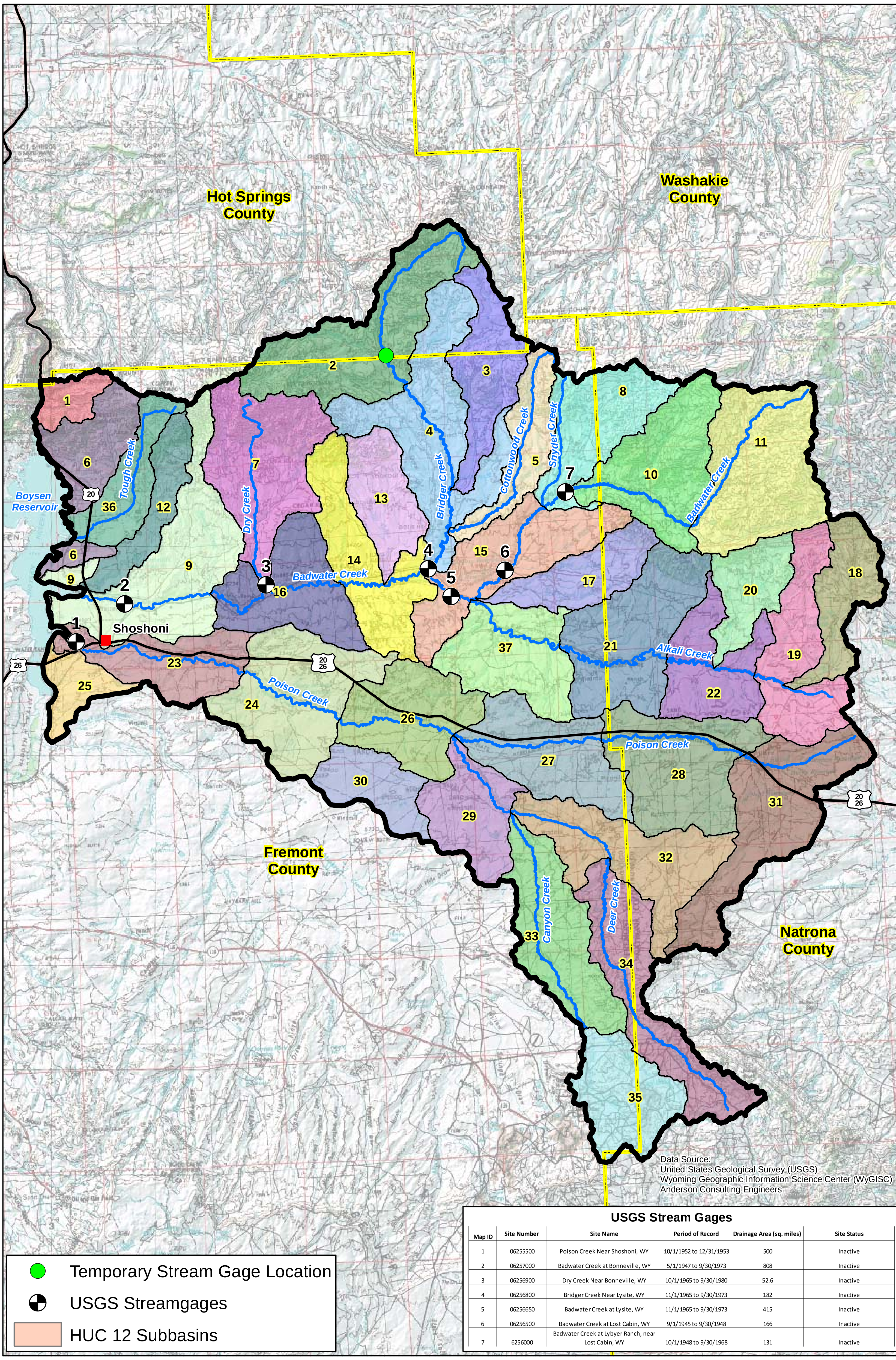
Mean monthly discharges were computed using the available data from the gages with significant periods of record (10 years or more) and are presented in Table 3.5-3. The mean annual hydrographs at these gage locations reflect typical snowmelt driven runoff patterns. The bulk of the annual runoff occurs between April and July at all of the gages. 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 3.5-6 displays the mean annual hydrograph at the three gages with significant periods of record (10 years or more) 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. Figure 3.5-7 displays the approximate extent of intermittent, ephemeral and perennial stream reaches.

Using regional methods described by the USGS (Miller, 2003), peak flow characteristics were calculated for each of the 37 subwatersheds (HUC12) within the study area. The methodology used to compute these discharges is based upon regressional analyses of gaged data against basin characteristics for similar watersheds. Because anthropogenic influences can have significant influences upon peak

Table 3.5-2 Badwater / Poison Creek Watershed Study: Hydrologic Units.

HUC 2 Name / Number	HUC 4 Name / Number	HUC 6 Name / Number	HUC 8 Name / Number	HUC 10		
				Number	Name	Number
Region 10: Missouri River	Subregion 1008: Big Horn	Accounting Unit 100800: Big Horn	Cataloging Unit 10080006: Badwater	1008000601	Upper Badwater Creek	100800060101
						100800060102
						100800060103
						100800060104
						100800060105
				1008000602	Alkali Creek	100800060201
						100800060202
						100800060203
						100800060204
						100800060205
						100800060206
				1008000603	Bridger Creek	100800060301
						100800060302
						100800060303
						100800060304
				1008000604	Lower Badwater Creek	100800060401
						100800060402
						100800060403
						100800060404
						100800060405
						100800060406
			Cataloging Unit 10080005: Lower Wind	1008000501	Fivemile Creek	100800050101
				1008000503	Upper Poison Creek	100800050301
						100800050302
						100800050303
						100800050304
						100800050305
						100800050306
						100800050307
						100800050308
				1008000504	Lower Poison Creek	100800050401
						100800050402
						100800050403
						100800050404
				1008000505	Wind River	100800050501
						100800050502
						100800050508



USGS Stream Gages

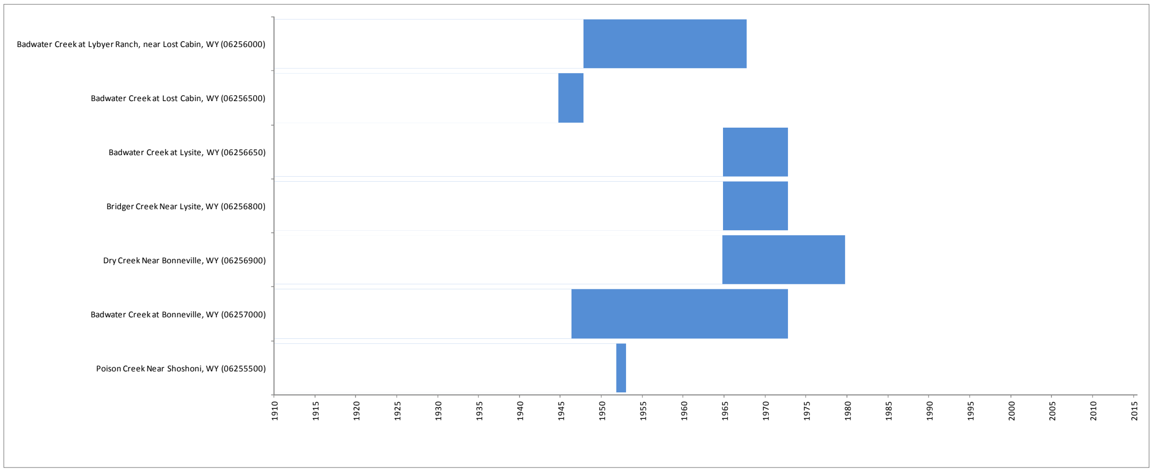
Map ID	Site Number	Site Name	Period of Record	Drainage Area (sq. miles)	Site Status
1	06255500	Poison Creek Near Shoshoni, WY	10/1/1952 to 12/31/1953	500	Inactive
2	06257000	Badwater Creek at Bonneville, WY	5/1/1947 to 9/30/1973	808	Inactive
3	06256900	Dry Creek Near Bonneville, WY	10/1/1965 to 9/30/1980	52.6	Inactive
4	06256800	Bridger Creek Near Lysite, WY	11/1/1965 to 9/30/1973	182	Inactive
5	06256650	Badwater Creek at Lysite, WY	11/1/1965 to 9/30/1973	415	Inactive
6	06256500	Badwater Creek at Lost Cabin, WY	9/1/1945 to 9/30/1948	166	Inactive
7	6256000	Badwater Creek at Lybyer Ranch, near Lost Cabin, WY	10/1/1948 to 9/30/1968	131	Inactive

N W E S
0 28,000 56,000
Feet

Legend

Cities
Streams
Roads
Badwater-Poison Creek Study Area
County Boundary

Figure 3.5-4 Badwater-Poison Creek Watershed: Hydrologic Unit Codes and USGS Streamgage Locations



Site Number	Site Name	Period of Record	Drainage Area (sq. miles)	Gauge Elevation (ft, NGVD29)	Natural Flow
06255500	Poison Creek Near Shoshoni, WY	10/1/1952 to 12/31/1953	500	4750	Yes
06257000	Badwater Creek at Bonneville, WY	5/1/1947 to 9/30/1973	808	4774	Yes
06256900	Dry Creek Near Bonneville, WY	10/1/1965 to 9/30/1980	52.6	5010	Yes
06256800	Bridger Creek Near Lysite, WY	11/1/1965 to 9/30/1973	182	5200	Yes
06256650	Badwater Creek at Lysite, WY	11/1/1965 to 9/30/1973	415	5240	Yes
06256500	Badwater Creek at Lost Cabin, WY	9/1/1945 to 9/30/1948	166	UNK	Yes
06256000	Badwater Creek at Lybyer Ranch, near Lost Cabin, WY	10/1/1948 to 9/30/1968	131	5715	Yes

Figure 3.5-5 Period of Record for Study Area Stream Gages.

Table 3.5-3 Mean Monthly Streamflow for USGS Gages within the Study Area.

Month	Mean Stream Discharge		
	Badwater Creek at Bonneville, WY	Badwater Creek at Lyber Ranch, near Lost Cabin, WY	Dry Creek near Bonneville, WY
	(cfs)	(cfs)	(cfs)
USGS Gage	06257000	06256000	06256900
Period of Record	5/1/1947 to 9/30/1973	10/1/1948 to 9/30/1968	10/1/1965 to 9/30/1980
Jan	0.93	1.5	0
Feb	15	1.6	0.08
Mar	37	4.6	0.41
Apr	39	20	5.1
May	74	37	19
Jun	66	25	8.6
Jul	18	6.2	0.22
Aug	7.1	1.7	0.56
Sep	7.7	1.2	0.12
Oct	6.6	2	0.02
Nov	3.9	2.6	0.01
Dec	0.95	1.9	0
Annual	23.0	8.8	2.8

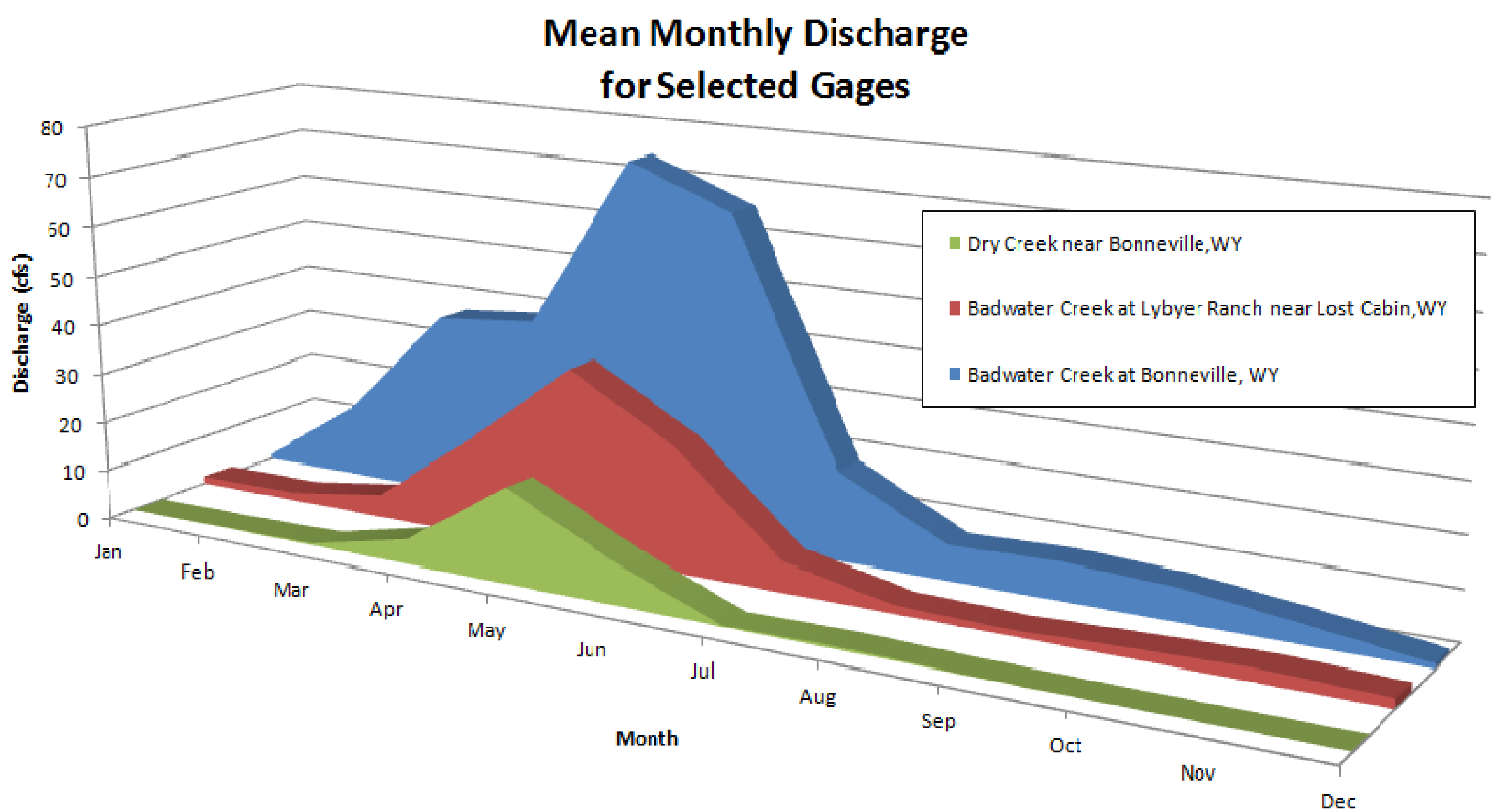


Figure 3.5-6 Mean Monthly Discharge at Selected USGS Stream Gages.

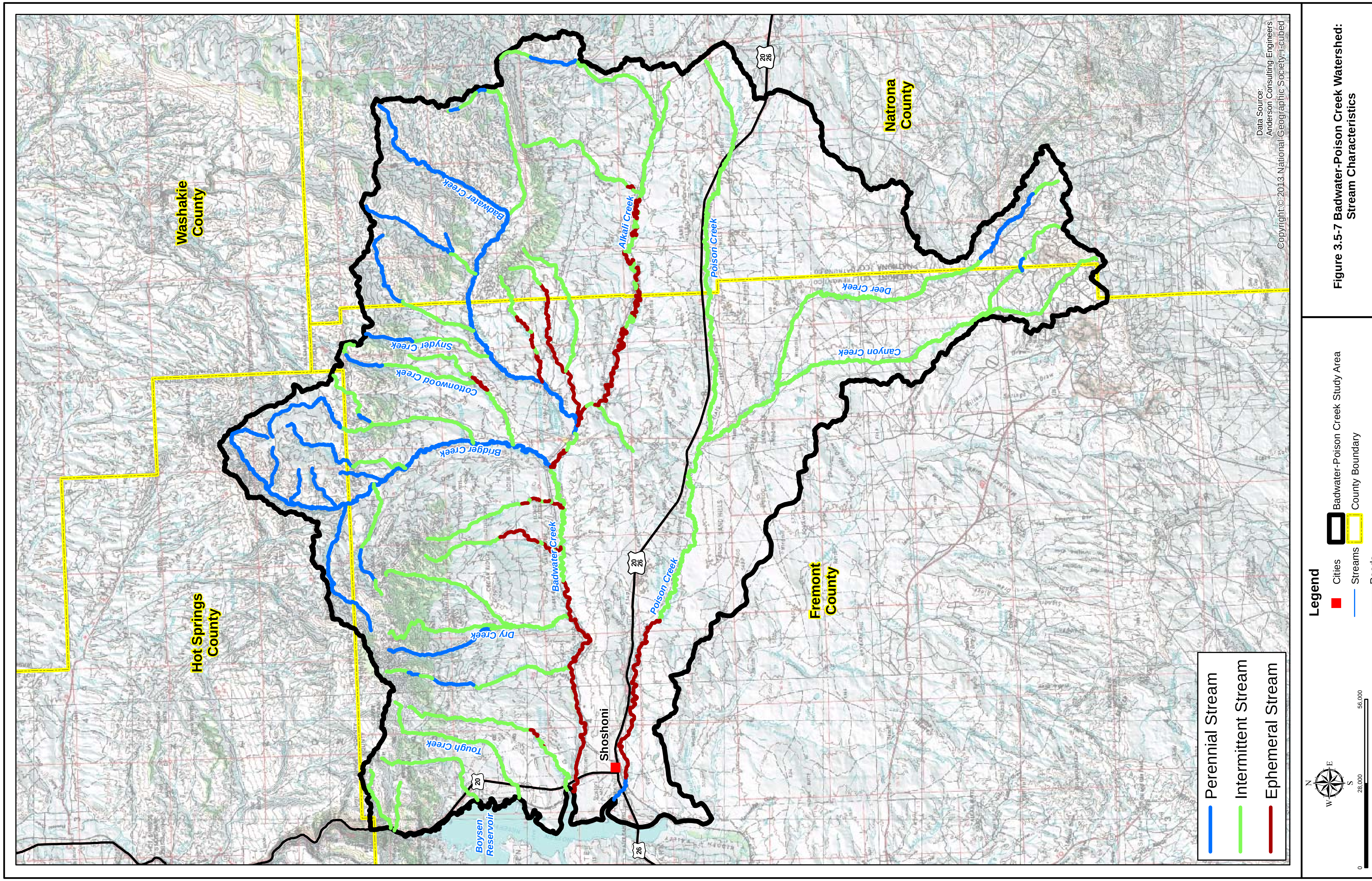


Figure 3.5-7 Badwater-Poison Creek Watershed:
Stream Characteristics
Legend
Cities
Streams
Roads
Badwater-Poison Creek Study Area
County Boundary
Perennial Stream
Intermittent Stream
Ephemeral Stream
Data Source:
Anderson Consulting Engineers
Copyright © 2013 National Geographic Society, i-cubed
Washakie County
Hot Springs County
Natrona County
Fremont County
Shoshoni
Boysen Reservoir
Badwater Creek
Alkali Creek
Poison Creek
Deer Creek
Canyon Creek
Snyder Creek
Cottonwood Creek
Bridger Creek
Dry Creek
Tough Creek

discharge values (irrigation, diversion, reservoirs, etc), these values 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 3E presents the results of this effort.

3.5.2.1 Temporary WWDC Gaging Stations

In an effort to gather additional streamflow data on the ungaged stream network, a temporary stream gage was installed in conjunction with this study on Bridger Creek.

The gage consists of a pressure transducer and data logger protected in a PVC housing fabricated onsite (Figure 3.5-8). The data logger was programmed to collect depth of water data at fifteen minute intervals throughout the investigation period.

Figure 3.5-8 Temporary Stream Gage Installed in Bridger Creek.

Figure 3.5-4 displays its location.

An initial rating curve was developed for the gage by completing hydraulic modeling flow conditions at each gage. Stream stage/discharge relationships were used to convert the depth data to stream discharge. Cross section surveys, channel slope, and observations of bed and overbank conditions were made for model input. Stream gaging data measured at each site also provided information with respect to flow depth and velocities for model calibration. The initial rating curve provided a basis upon which to evaluate the depth data recorded by the pressure transducers. During the completion of the study, stream measurements were completed at the gage as it was serviced (battery replacement, data download, etc). These "real data" were then compared to the results of the hydraulic models and adjustment made as necessary. Table 3.5-4 summarizes the results of the temporary stream gaging effort. Figure 3.5-9 displays the recorded hydrograph.

Table 3.5-4 Summary of Temporary Stream Gage Hydrology.

Bridger Creek (2013)	
Minimum (cfs)	0.03
Peak (cfs)	15.12
Date of Peak	25-Mar
Average (cfs)	5.01
Yield (ac-ft)	1,477

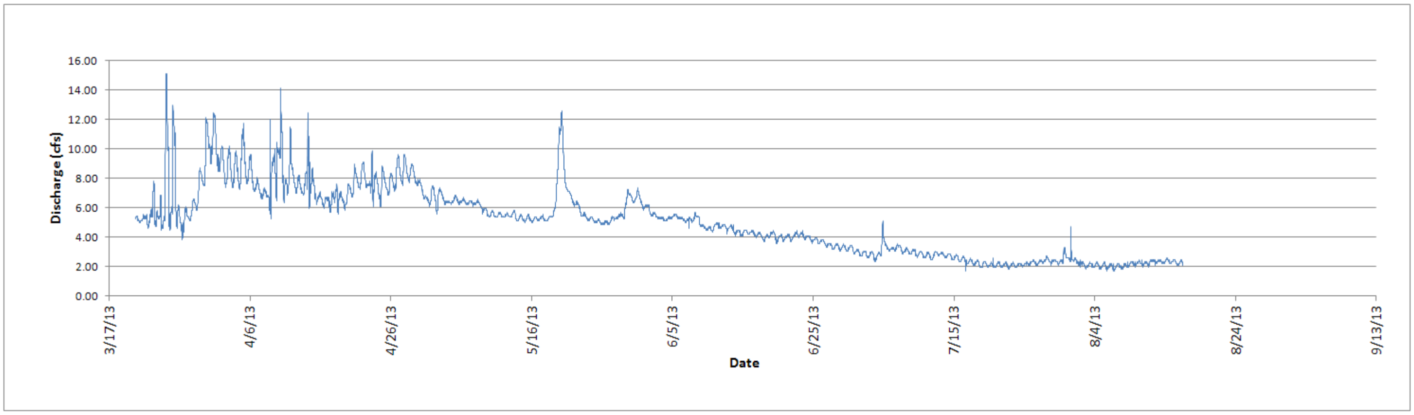


Figure 3.5-9 Bridger Creek Temporary Stream Gage.

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 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 habitat elements, such as bars, pool/riffles, step/pools, and healthy, regenerating riparian corridors.

Impairments to geomorphic function reflect a significant loss of the functional potential of the green 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 3.6-1 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 3.6-2). 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 Badwater/Poison Creek Study included Level I evaluation of the mainstem streams and their principal tributaries.

3.6.2.1 Level I Methods

The purpose of the Level I geomorphic classification is to provide an inventory of the Badwater/Poison Creek 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 Geographic Information System (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.

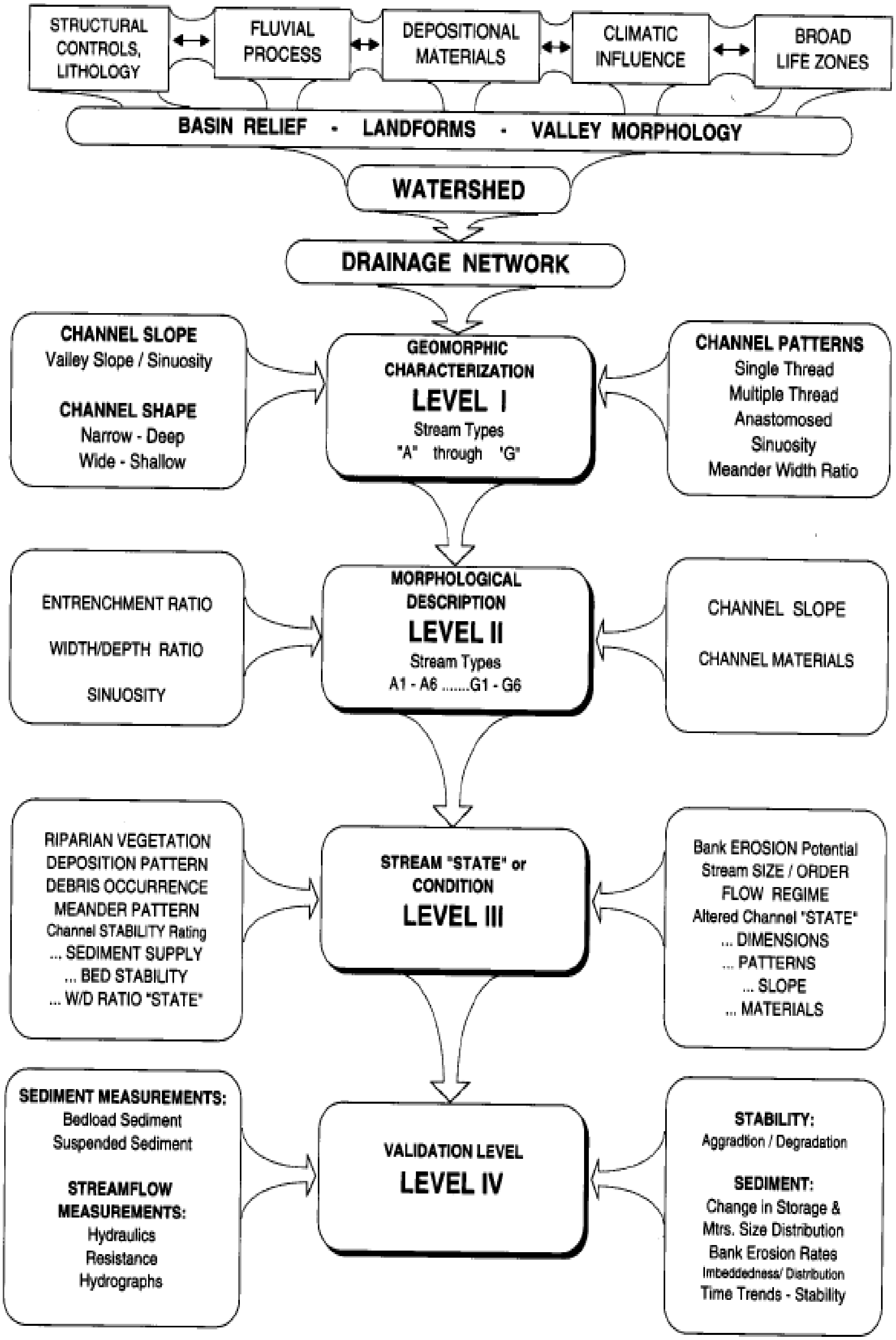


Figure 3.6-1 Hierarchy of the Rosgen Stream Classification System.

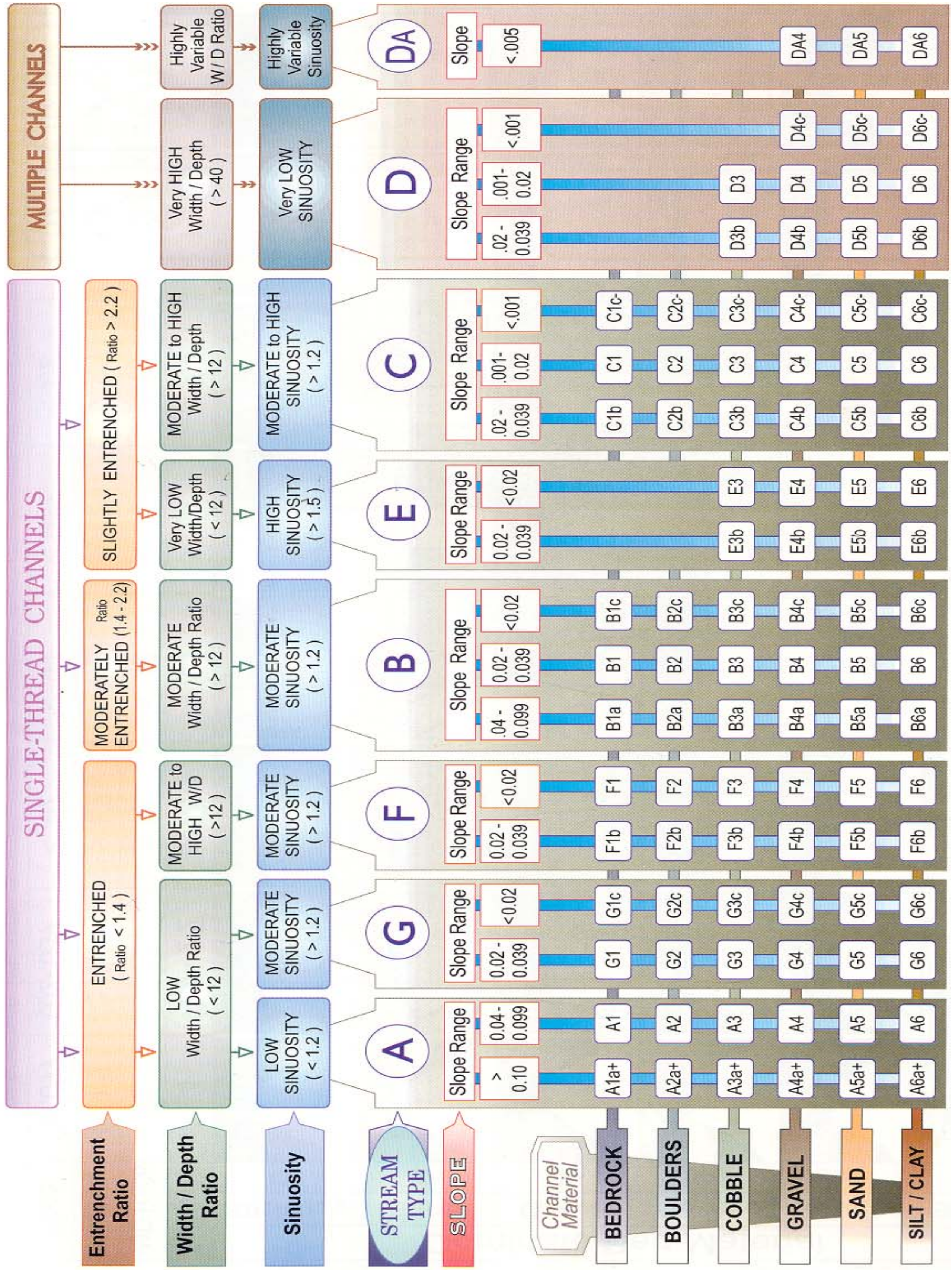


Figure 3.6-2 Rosgen Classification Matrix (Rosgen, 1996).

Figure 3.6-3 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.

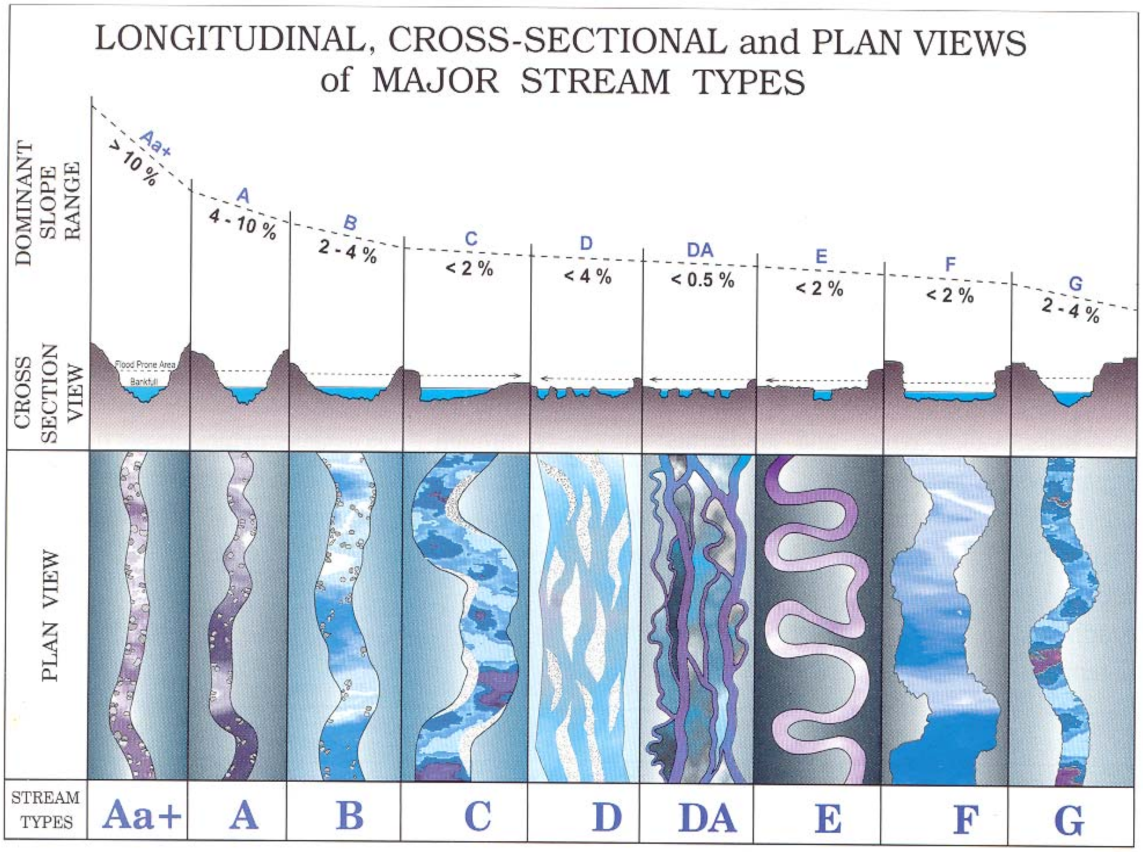


Figure 3.6-3 Major Stream Types within the Rosgen Classification System (Rosgen, 1996).

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.

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 3.6-4). 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.

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 3.6-5). 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 3.6-4 Example Type B Channel: Upper Reaches of Bridger Creek.

E-Type Channels are somewhat similar to C channels, as they form as single threads with defined, accessible floodplain areas. However, E channels are different in that they tend to have fine-grained channel margins, which provide cohesion and support dense bankline vegetation. The fine-grained, vegetation-reinforced banklines allow for the development of steep banks, very sinuous planforms, and relatively deep, U-shaped channel cross sections. E-type channels commonly form in low gradient areas with fine-grained source areas, mountain meadows, and in beaver-dominated environments. E-channels tend to have very stable planforms, and efficient sediment transport capacities due to low width/depth ratios.

Figure 3.6-5 Example Type C Channel: Lower Badwater Creek.

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 an 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 3.6-6).

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 (Figure 3.6-7).

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, 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.

Figure 3.6-6 Example Type F Channel: Lower Reaches of Bridger Creek.

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 3.6-2, 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.

Figure 3.6-7 Example Type G Channel: Unnamed Tributary to Frenchie Draw.

3.6.2.2 Level I Classification Results

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 are depicting the various stream types as well as the reach designations used in the classification effort.

Badwater Creek and its primary tributaries originate in the steeper slopes of Copper Mountain. Within the mountainous areas, the channels are steep and bounded by very coarse, resistant materials that include hillslope colluvium and bedrock. Rocks here are harder igneous and metamorphic Precambrian rocks. Poison Creek, Deer Creek, and Canyon Creek, on the other hand, originate in sedimentary rocks of Tertiary age. As a result, the channels are laterally stable, and geomorphically resilient with respect to human impacts. Channel change in these upper subreaches typically results from punctuated hillslope processes rather than gradual channel migration. The channels are A-type or B-type channels which reflects their steep slope and stable boundaries.

As the major stream channels descend into the lower basin, 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. The channels transition from B-type channels, which are located in transition zones at the foot of the mountains, to C-type channels, which are gravel bed meandering streams that dominate the lower basin.

The lower reaches of Badwater Creek were classified as a C-type channel. This classification is based upon the ‘processes’ observed and not strict adherence to classification based solely upon sinuosity, entrenchment, and slope. Throughout most of its extent, Badwater Creek appears to have access to its floodplain on at least one of its banks. Review of existing aerial photography distinctly shows evidence of the naturally occurring meandering pattern within an entrenched floodplain. Likewise, throughout most of its extent, Poison Creek appears to alternate between a C-type channel and an entrenched F-type channel.

Table 3.6-1 Rosgen Level I Stream Classification Results

Stream	Reach Number	Station (Distance from Mouth)		Reach Length (ft)	Sinuosity	Slope	Rosgen
		Station Start (ft)	Staion End (ft)				
Alkali Creek	1	0	154,327	154,327	1.79	0.003	F
	2	154,327	213,871	59,544	1.52	0.004	F
Badwater Creek	1	0	80,886	80,886	1.26	0.003	C
	2	80,886	183,404	102,518	1.53	0.003	C/F
	3	183,404	351,434	168,030	1.81	0.007	F
	4	351,434	429,831	78,397	1.25	0.031	B
Bridger Creek	1	0	54,167	54,167	1.92	0.003	F
	2	54,167	120,164	65,997	1.96	0.003	F
	3	120,164	196,163	75,999	2.30	0.004	F
	4	196,163	270,520	74,357	1.63	0.014	B
Canyon Creek	1	0	54,287	54,287	1.35	0.005	C/F
	2	54,287	107,245	52,958	1.55	0.005	C/F
Cottonwood Creek	1	0	38,180	38,180	1.52	0.006	F
	2	38,180	70,328	32,148	1.15	0.017	F
	3	70,328	97,363	27,035	1.09	0.041	A
Deer Creek	1	0	43,193	43,193	1.37	0.005	C/F
	2	43,193	84,756	41,563	1.20	0.006	B
	3	84,756	145,853	61,097	1.55	0.007	B
	4	145,853	222,263	76,410	1.31	0.013	A
Dry Creek	1	0	34,516	34,516	1.33	0.009	F
	2	34,516	61,983	27,467	1.16	0.023	F
	3	61,983	84,186	22,203	1.08	0.081	A
Gold Creek	1	0	11,888	11,888	1.11	0.530	B
	2	11,888	24,991	13,103	1.10	0.055	B
Poison Creek	1	0	101,244	101,244	1.33	0.051	C/F
	2	101,244	186,905	85,661	1.56	0.004	C/F
	3	186,905	262,987	76,082	1.57	0.003	C/F
	4	262,987	338,179	75,192	1.48	0.004	C/F
	5	338,179	379,568	41,389	1.26	0.004	B
Snyder Creek	1	0	26,467	26,467	1.12	0.014	F
	2	26,467	48,852	22,385	1.07	0.047	A
Tough Creek	1	0	30,027	30,027	1.15	0.169	F
	2	30,027	69,766	39,739	1.11	0.057	A

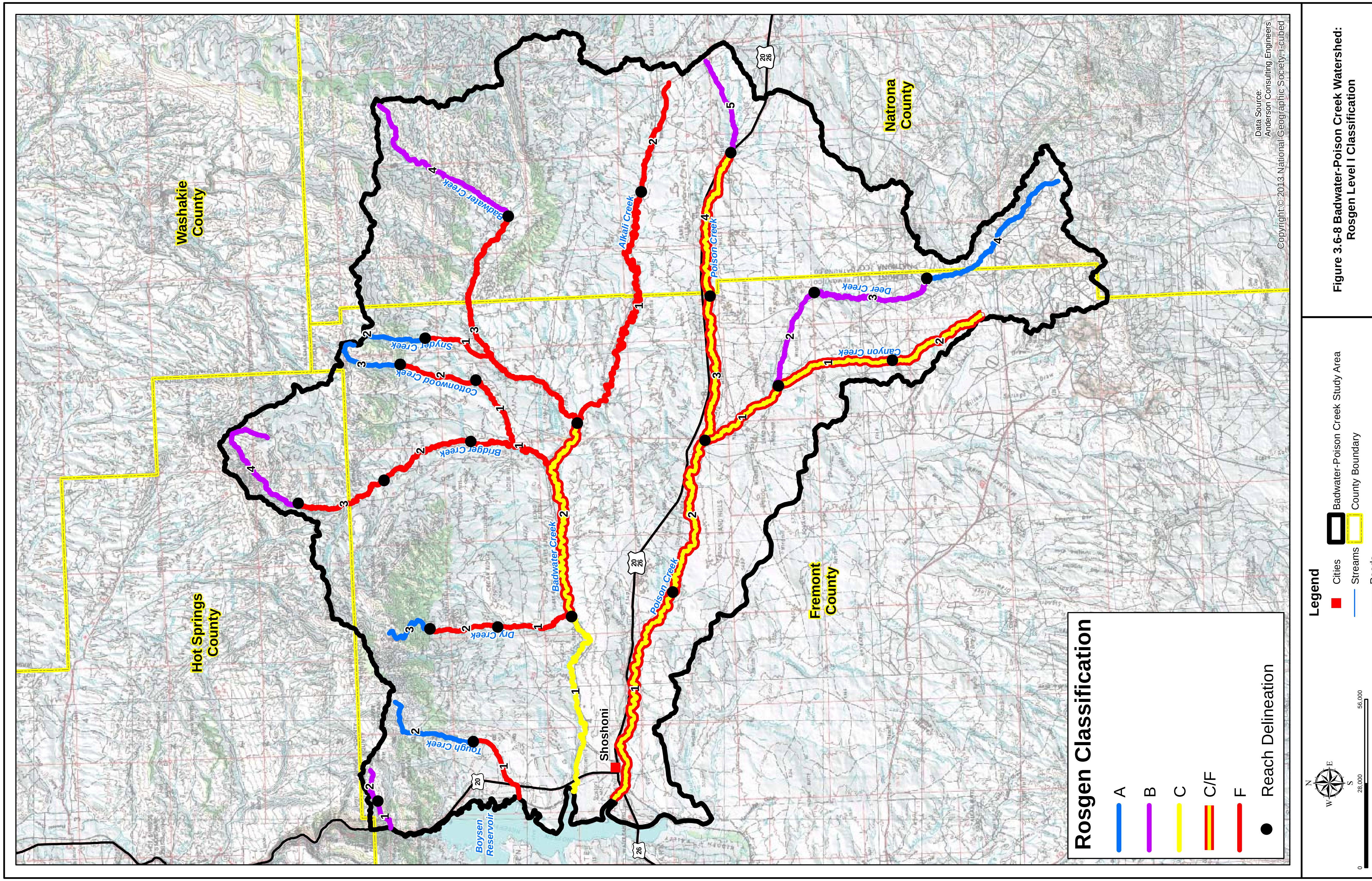


Figure 3.6-8 Badwater-Poison Creek Watershed: Rosgen Level I Classification

Figure 3.6-9 Entrenched reach of Dry Creek.

As is clearly evident upon review of the table, many of the 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, it was concluded that the majority of stream channels within the study area 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 ranging from slight to severe. Figure 3.6-9 displays an entrenched reach of Dry Creek. Figure 3.6-10 displays a photo of one of several active headcuts located on Bridger Creek.

Figure 3.6-10 Active headcut located on Bridger Creek.

Many 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. Observation of many of these channels indicates that while the major stream channels appear to have achieved a level of stability, the upper reaches of the watershed are still suffering a level of destabilization. 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.

3.6.3 Proper Functioning Condition

The condition of approximately 77 miles of stream channel on federal lands has been evaluated by BLM staff and the results incorporated herein. 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.

Within the project study area, the three BLM field offices (Lander, Worland, and Casper) have conducted PFC assessments on selected stream segments intermittently since 1989. Results of the BLM PFC assessment are shown on Figure 3.6-11. As evidenced in this figure, the PFC assessment results in evaluation of specific and frequently isolated stream reaches.

3.6.4 Impairments

Impairments to stream channels within the study area appear to fall into two broad and interrelated categories:

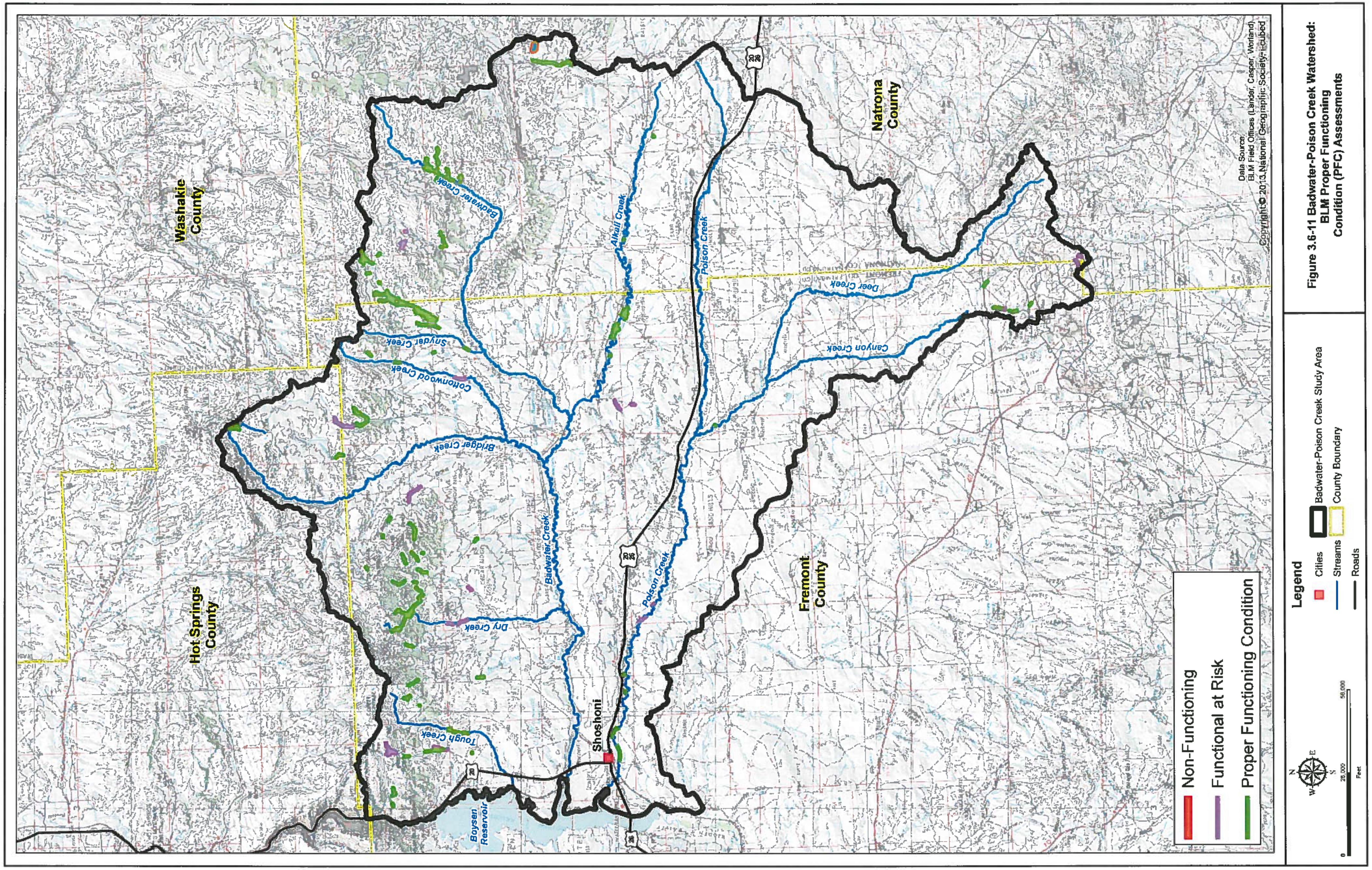


Figure 3.6-11 Badwater-Poison Creek Watershed: BLM Proper Functioning Condition (PFC) Assessments

- Riparian Vegetation Degradation: Impaired riparian condition and habitat, and
- Riparian Degradation: Generally bank erosion and physical disturbance of stream banks.

Figure 3.6-12 Channel degradation associated with discharge of oil and gas process water.

Development of the oil and gas industry within the study area has resulted in permitted discharges of process water to surface waters. Frequently, receiving channels experience incision due to the additional waters (Figure 3.6-12).

Reaches of perennial streams commonly displayed indications of riparian degradation as evidenced by bank erosion, loss of riparian habitat, channel widening, channel degradation, etc. Figure 3.6-13 displays a photo of upper Badwater Creek where land use For example, upper Badwater Creek.

Figure 3.6-13 Loss of riparian vegetation on Badwater Creek.

Channels classified as F-type channels, common in the lower portions of the study area reaches of these streams, are entrenched and consequently have lost connection with their floodplains. Some streams are heavily incised and restoration could be problematic (Figure 3.6-14).

Multiple approaches to restoration can be applied to incised river channels (Rotar and Boyd, 1999). Common objectives in such restoration efforts are to promote channel stability, as well as to connect the channel to its historic floodplain. The reconnection of the channel to its historic floodplain requires raising the channel bed, which can be achieved through grade controls and channel infilling, or even reconstruction of a new channel. These approaches can have difficult and costly challenges, however, such as tying in the project end points to the incised channel grade, or preventing post-project channel relocation (avulsion).

Another approach to incised channel stabilization is to completely armor the channel banks and add grade control structures. This process will reduce sediment inputs, but will not provide a dynamic, functional channel configuration. Perhaps the most geomorphically beneficial approach to incised channel restoration is to promote the natural recovery process of channel widening and incised floodplain development. This can be achieved by encouraging the development of a new floodplain surface adjacent to the channel to provide an area for flood energy dissipation and new riparian corridor establishment.

Figure 3.6-14 Incised channel on Bridger Creek.

Any work in incised channel restoration requires an assessment of the status of the current channel stability, so that the potential for further downcutting is known and accommodated for in the channel restoration design.

3.7 Water Quality

3.7.1 Stream Classifications

All streams named on the U.S. Geological Survey 1:500,000 scale hydrologic map of Wyoming and other selected streams have been classified for protection of one or more designated uses by the Water Quality Division of the WDEQ. This list is included in the project Digital Library for reference. Figure 3.7-1 displays the classifications within the Badwater/Poison Creek watershed study area. 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.*
>
> C*lass 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 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 4B waters are intermittent and ephemeral stream channels that have been determined to lack the hydrologic potential to normally support and sustain aquatic life pursuant to the provisions of Section 33(b)(ii) of these regulations. In general, 4B streams are characterized by only infrequent 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 4B waters.

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 21 active (WYPDES) permitted discharges present within the study area. These 21 discharges are filed under only 5 separate permits. Table 3.7-1 summarizes pertinent information regarding the permits. The locations of these discharges are shown on Figure 3.-7-1.

Table 3.7-1 Summary of WYPDES Permitted Discharge Locations.

WYPDES Permit Number	Permittee	Facility Name	Number of Outfalls	Permit Issued	Permit Expires	Permit Type	Receiving Waters
WY0002062	EnCana Oil and Gas Company	Frenchie Draw Permit #1	15	10/21/2013	12/31/2017	Oil Treaters	Alkali Creek via an unnamed drainage (all 3B), Wind River Basin
WY0021890	Shoshoni, Town of	Shoshoni Wastewater Lagoons	1	6/28/2011	6/30/2016	Sanitary Wastewater	Poison Creek (2AB), via an unnamed ephemeral tributary (class 3B), tributaries to Boysen Reservoir (class 2AB), Wind River Basin
WY0036196	Burlington Resources Oil and Gas Company, Inc.	Lost Cabin Gas Plant	2	4/17/2013	3/31/2018	Industrial	Sand Creek (4B), tributary to Badwater Creek (2AB). Wind River Basin.
WY0056227	Tallgrass Midstream, LLC	West Frenchie Draw Amine Plant	1	5/20/2013	4/30/2018	Industrial	unnamed tributary of Alkali Creek (3B), Wind River Basin
WY0056791	Encana Oil & Gas (USA) Inc.	N. Merriam State 44-36	2	In process at time of report	In process at time of report	Oil Treaters	Badwater Creek (2AB), via Reservoir Creek (3B), Wind River Basin

ID	WYPDES Permit Number	Permittee	Facility Name	Number of Outfalls	Permit Issued	Permit Expires	Permit Type	Receiving Water Description
1	WY0002062	EnCana Oil and Gas Company	Frenchie Draw Permit #1	15	10/21/2013	12/31/2017	Oil Treaters	Alkali Creek via an unnamed drainage (all 3B), Wind River Basin
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4	WY0056227	Tallgrass Midstream, LLC	West Frenchie Draw Amine Plant	1	5/20/2013	4/30/2018	Industrial	unnamed tributary of Alkali Creek (3B), Wind River Basin
5	WY0056791	Encana Oil & Gas (USA) Inc.	N. Merriam State 44-36	2	In process at time of report	In process at time of report	Oil Treaters	Badwater Creek (2AB), via an unnamed ephemeral tributary of Alkali Creek (3B)

*Note: Multiple outfalls possible under single permit number

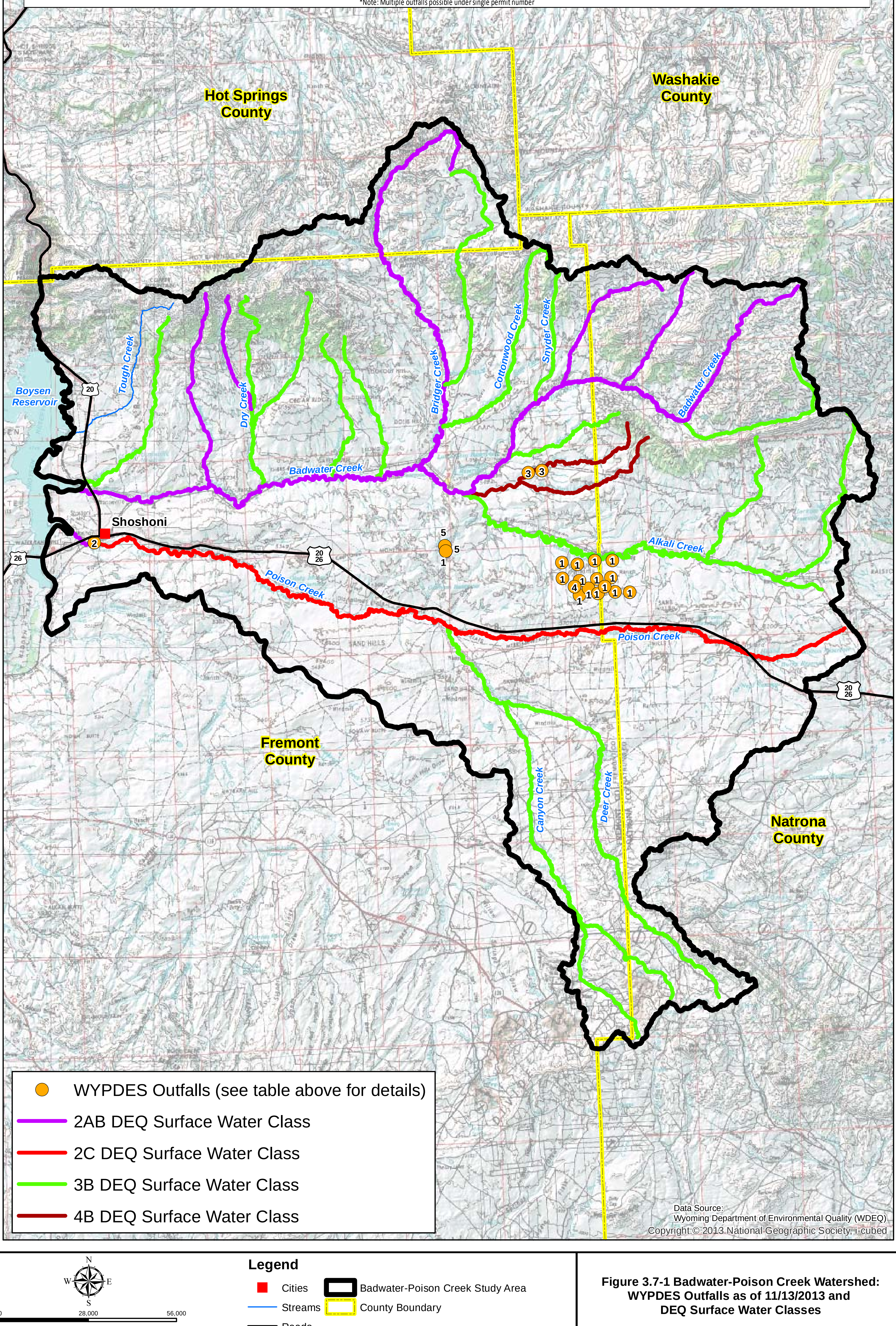


Figure 3.7-1 Badwater-Poison Creek Watershed: WYPDES Outfalls as of 11/13/2013 and DEQ Surface Water Classes

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 EPA approval every two years on even-numbered years. At the time of this report, there is one 2 mile section of Poison Creek listed on the US EPA 303(d) list. The impaired reach extends from Boysen Reservoir to two miles upstream. At this time the local conservation district is coordinating with the Wyoming Department of Environmental Quality regarding this 303(d) listing.

Section 303(d) of the Clean Water Act requires States to:

1) Identify all waters of the state which are impaired--i.e. they contain pollutants which adversely affect the designated use of the water.
2) prioritize all impaired waterbodies for development of TMDLs. Prioritization is to take into consideration public health and environmental risk. Therefore, point source discharges generally are a higher priority than nonpoint sources of clean sediment.
3) Establish and adopt TMDLs for all impaired waterbodies or for waterbodies which would be impaired if a TMDL was not established.

If a state does not comply with Section 303(d), the Environmental Protection Agency is required to perform these activities.

3.8 Irrigation System Inventory

3.8.1 Overview

For the purposes of this study, specific irrigation structure inventories and evaluations were conducted at the request of irrigators/stakeholders at locations identified by them.

Specific tasks completed during this effort included the following:

- interviewing ditch representatives and users;
- field inventory of ditch structures;
- inventory of physical ditch conditions;
- assessment of hydraulic efficiency of existing ditch structures;
- photographic documentation of structures and an assessment of their condition;

- location of the structures using GPS technology; and
- incorporation of data into the project GIS.

Possible improvements include rehabilitation or replacement of existing infrastructure, bank stabilization (particularly near structures), and installation of new structures. Many of the ditch system components inspected are significantly deteriorated and have exceeded their design life. Several ditches were built prior to statehood and have been nursed along over the years through the efforts of private landowners.

Due to the fact that only problematic structures were visited, results of the irrigation structure inventories are incorporated directly into the watershed management plan (Chapter 4).

3.8.2 Dry Creek Ditch No. 2 Diversion (Frank)

The Dry Creek Ditch No. 2 is permitted with the Wyoming State Engineers Office under permit number P2227.0D with a priority date of August 4, 1899. The appropriation with the original water right is for 0.396 cubic feet per second.

Figure 3.8-1 Dry Creek No. 2 Ditch Diversion.

The headgate of the ditch is in poor condition and consists of a simple wood and tarpaulin structure requiring frequent maintenance (Figure 3.8-1). Due to downcutting of Dry Creek in the vicinity of the diversion, a significant amount of rock has been placed in the creek bed in order to facilitate diversion.

3.8.3 Woodruff Ditch Diversion and Sand Trap (Frank)

The Woodruff Ditch is permitted with the Wyoming State Engineers Office under permit number P12950D with a priority date of December 22, 1914. The original appropriation associated with the water right is for 2.060 cubic feet per second.

According to the landowner, the headgate is difficult to operate during low flow periods due to incision of Dry Creek. In addition, due to the extensive sediment load in the creek, a sand-flushing wasteway would be desirable.

3.8.4 Elsass Ditch Diversion Structure (Philp)

The Elsass Ditch is permitted with the Wyoming State Engineers Office under permit number P2691 and P5840 with a priority date of July 3, 1900. The appropriations associated with the original water rights are 1.23 cubic feet per second and 0.9 cubic feet per second.

Bridger Creek is presently experiencing active headcutting and channel degradation. Headcuts located downstream of the diversion threaten the integrity of the diversion and will render the facility useless when they migrate upstream to the structure. Figure 3.8-2 displays a photo of a headcut located downstream of an irrigation diversion.

Figure 3.8-2 Headcut located downstream of the Elsass Ditch Headgate on Bridger Creek.

3.8.5 Moore Ditch Diversion Structure

The Moore Ditch is permitted under permit numbers P2021E and P2635E with priority dates of February 4, 1909 and October 2, 1911, respectively. The appropriated diversion is 1.99 cubic feet per second.

Bridger Creek is presently experiencing active headcutting and channel degradation. Headcuts located downstream of the diversion threaten the integrity of the diversion and will render the facility useless when they migrate upstream to the structure. Figure 3.8-3 displays a photo of the degraded channel located immediately downstream of the diversion.

3.9 Water Storage and Retention

Figure 3.8-3 Channel Degradation in vicinity of Moore Ditch Diversion.

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).

In the sections which follow, results from previous water resources investigations and the hydrologic modeling conducted in support of them are presented. It was beyond the scope of this project to update or develop hydrologic models associated with the project study area. Consequently, not all streams or subwatersheds within the Badwater/Poison Creek project study area are included in the results.

3.9.1 Surface Water Availability and Shortages

3.9.1.1 Wind/Bighorn River Basin Model

The Badwater/Poison Creek Study area lies within the geographic boundaries of the Wind/Bighorn River Basin Planning Study, completed on behalf of the WWDC in 2010 (MWH,2010). In conjunction with that project, the Wind/Bighorn River Basin Planning Model was developed.

The Wind/Bighorn River Basin Planning Model is a water accounting spreadsheet that incorporates multiple diversions, gaging stations, and other water resources data within the Wind/Bighorn River Basin. One of the primary purposes of the model is to provide a planning tool for Wind/Bighorn 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 the purposes of this study, the spreadsheet model was utilized without modification. The Wind/Bighorn River model consists of four individual spreadsheet models, each representing a specific subbasin of the watershed. One reach within the Lower Wind River model focused on the Badwater Creek watershed (Reach 800) and another on the Poison Creek (Reach 660). The individual spreadsheet models are linked to enable data generated in one model to be "passed along" to subsequent models. Furthermore, models were 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 the 1971 to 2007 study 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 the Wind/Bighorn River system subbasins, each basin was 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.

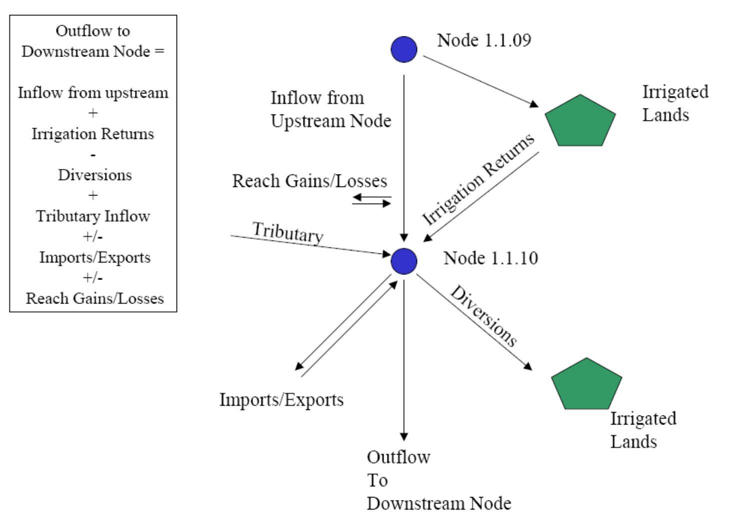


Figure 3.9-1 Diagram of Model Water Budget Computations.

3.9.1.2 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.

- 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.
- The model does 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. For example, releases from Boysen Reservoir remain consistent with historic patterns despite changes to reservoir inflow and storage. The implication of this limitation is that Boysen Reservoir behaves as a "buffer" between the upper and lower portions of the basin.
- 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.
- The spreadsheet model does not contain logic to evaluate impacts upon the state's obligations under the Bighorn River Compact (Compact).
- 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.

3.9.1.3 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 Bighorn River. *In other words, the water available at any node was 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.

Results of the availability analyses indicate that there is flow available for storage within the Badwater watershed without incurring a shortage in downstream reaches as summarized in Table 3.9-2 for modeled stream reach 800: Badwater Creek. Note that the Wind-Bighorn Basin study did not report results of availability for Reach 660: Poison Spider. The total annual available flow for the entire Badwater Creek basin was estimated to be almost 14,000 ac-ft for the dry (2 out of 10 years) condition and over 20,000 ac-ft for a normal (6 out of 10 years) condition. The model results show that the large majority of available flows occur in April, May and June as would be expected in this hydrologic setting and consistent with the pattern of gaged flows as previously described.

Table 3.9-2 Results of the Wind / Bighorn River Watershed Available Flow Analysis.

Reach 800: Badwater Creek	Dry Year	Normal Year	Wet Year
Full Supply Existing Irrigated Lands	13,938	20,059	25,180
Full Supply with All Futures Projects	13,938	20,059	25,180

IV. WATERSHED MANAGEMENT AND REHABILITATION 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. Potential improvements were developed and categorized into the following:

- **<u>Livestock / Wildlife Upland Watering Opportunities</u>**. Based upon an evaluation of existing water sources and the condition of upland grazing resources, potential upland water source development projects were identified.
- **<u>Irrigation System Conservation and Rehabilitation</u>.** The inventory and evaluation of the existing infrastructure was completed and improvements identified for the rehabilitation of existing structures and the potential conservation of existing irrigation diversions.
- **<u>Grazing Management Opportunities</u>**. Based upon a review of the pertinent Ecological Site Descriptions (ESDs) and the ambient vegetation and soil conditions, grazing management strategies are presented.
- **<u>Storage Opportunities</u>.** Results of previous investigations pertaining to development of water storage opportunities within the watershed are incorporated.
- **<u>Stream Channel Condition and Stability</u>**. 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.

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 a unique project or 'improvement' number. The prefixes used for each improvement describe the category of the watershed management plan it falls under. The prefixes are as follows:

- Project Components "L/W": Livestock / wildlife upland watering opportunities Section 4.3
- Project Components "I": Irrigation system rehabilitation components Section 4.4
- Project Components "G": Grazing management opportunities Section 4.5
- Project Components "S": Storage opportunities Section 4.6
- Project Components "C": Stream channel stability components Section 4.7

4.2 Potential Effects and Benefits of Watershed Management Plan Components

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.

Such activities, in the conservation community, are commonly referred to as best management practices (BMPs) or conservation practices. These BMPs and conservation practices are eligible for grant funding assistance through the WWDC's Small Water Project Program (SWPP). The WWDC's SWPP funds are 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 as well as societal values including economic stability and open space maintenance. Multiple benefits can result from improvement opportunities for water resources, which are critical to meet the daily water demands of the resident population of man and beast, develop, increase or extend irrigation water availability, and improve fishery habitat and potential recreational benefits.

4.2.1 NRCS Conservation Effects Assessment Program (CEAP)

"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.

4.2.2 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.

4.2.2.1 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; Briske, 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]. Briske [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 [Briske, 2011].

Soil vegetative cover is widely recognized as a critical factor in maintaining soil surface hydrologic condition and reducing soil erosion [Gifford, 1985; Briske, 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 [Briske, 2011].

These efforts 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 [USDA Agricultural Research Service, 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 [USDA Agricultural Research Service, 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 [USDA Agricultural Research Service, 2013].

4.2.3 Ecological Enhancement

An ecological enhancement is any activity that improves an ecosystem such as stabilizing erosive soils, increasing soil quality, planting or maintaining native grasses, shrubs, or trees, removing and controlling invasive species, and improving or maintaining riparian/wetland areas. Ecological sites are complex and varied within the study area as described in Section 3.4.5.5 and Figure 3.10. 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].

4.2.3.1 Plant and Animal Habitat

Locations of conservation practices and rangeland infrastructure can have a large, indirect impact on overall vegetation change with the spatial design of infrastructure including the locations of fences, watering points, and feeders 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; Briske, 2011]. The use of rangelands for sustainable livestock production has the potential to ensure the maintenance of wildlife habitat, especially when compared to energy development and urbanization, which will ensure that wildlife habitat will persist into the future [Briske, 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 [Briske, 2011].

Positive effects of water developments on wildlife have been documented while the negative effects of water developments are not supported by available data and remain highly speculative [Simpson et al, 2011]. From 1999 to 2003, researchers studied direct and indirect 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, and at least one species previously reported not to need free water [Rosenstock et al, 2004]. Based upon a comprehensive review of scientific literature, Rosenstock et al, [1999] concluded that water developments have likely benefitted many game and non-game wildlife species, but not all water development projects have yielded expected increases in animal distribution and abundance while negative impacts of water developments on wildlife are not supported by data but the understanding of both positive and negative effects of wildlife water developments is incomplete because of limitations of previous research.

Peer-reviewed literature evaluating how conservation practices influence upland wildlife habitat has not received high priority, and their complex influences on wildlife and its habitat are unknown [Briske, 2011]. However, the use of rangelands for livestock production has the potential to ensure the maintenance of wildlife habitat, especially when compared to energy development and urbanization, which will ensure that wildlife habitat will persist into the future [Briske, 2011]. The only empirical evidence of the influence of prescribed grazing on game birds that Briske [2011] found in the literature was a 5-yr study by Rice and Carter [1982] of plains sharp-tailed grouse and greater prairie chicken at Fort Pierre National Grassland in central South Dakota. Deferred rotation, rest–rotation, and winter-only grazing was compared and found rest–rotation pastures produced approximately 10 times more nest-broods than did deferred rotation system with grouse following the grazing rotation seeking the best herbaceous cover for nesting and rearing broods [Rice and Carter, 1982]. Studies evaluating effects of range management on improving nongame bird habitat are rare but some trends that emerged from the peer-reviewed literature are that continuously grazed pastures appear to have fewer nongame birds and species than areas grazed using a rotational system, grazed after the breeding season, or where cattle were removed entirely [Briske, 2011].

4.2.3.2 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 [Briske, 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 [Briske, 2011]. Sufficient evidence in peer-reviewed studies existed that Briske [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 [Briske, 2011].

4.2.4 Societal Value

Natural resource stewardship not only has economic value in terms of forage, livestock, and wildlife production relationships, but also can have 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 [Briske, 2011]. Ecosystem services benefit society in numerous and diverse ways with 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. Briske [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; Wyoming Livestock Roundup, 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; Wyoming Livestock Roundup, 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.

4.3 Upland Wildlife/Livestock Watering Sources (Watershed Management Plan Component LW)

4.3.1 Alternative New Watering Opportunities

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 4.3-1). Note that this figure does not show buffers about perennial/intermittent streams, nor springs. When viewing this figure, it should be kept in mind that stock reservoirs represent ephemeral sources of water; the majority of them rely upon rainfall runoff for their water supply. Also, although all wells with stock use as a permitted use are shown, not all may in actuality be equipped to provide livestock water.

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.

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. Sizing of water facilities cannot be determined at this time due to the uncertainties associated with the grazing management plan proposed by the BLM. 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.

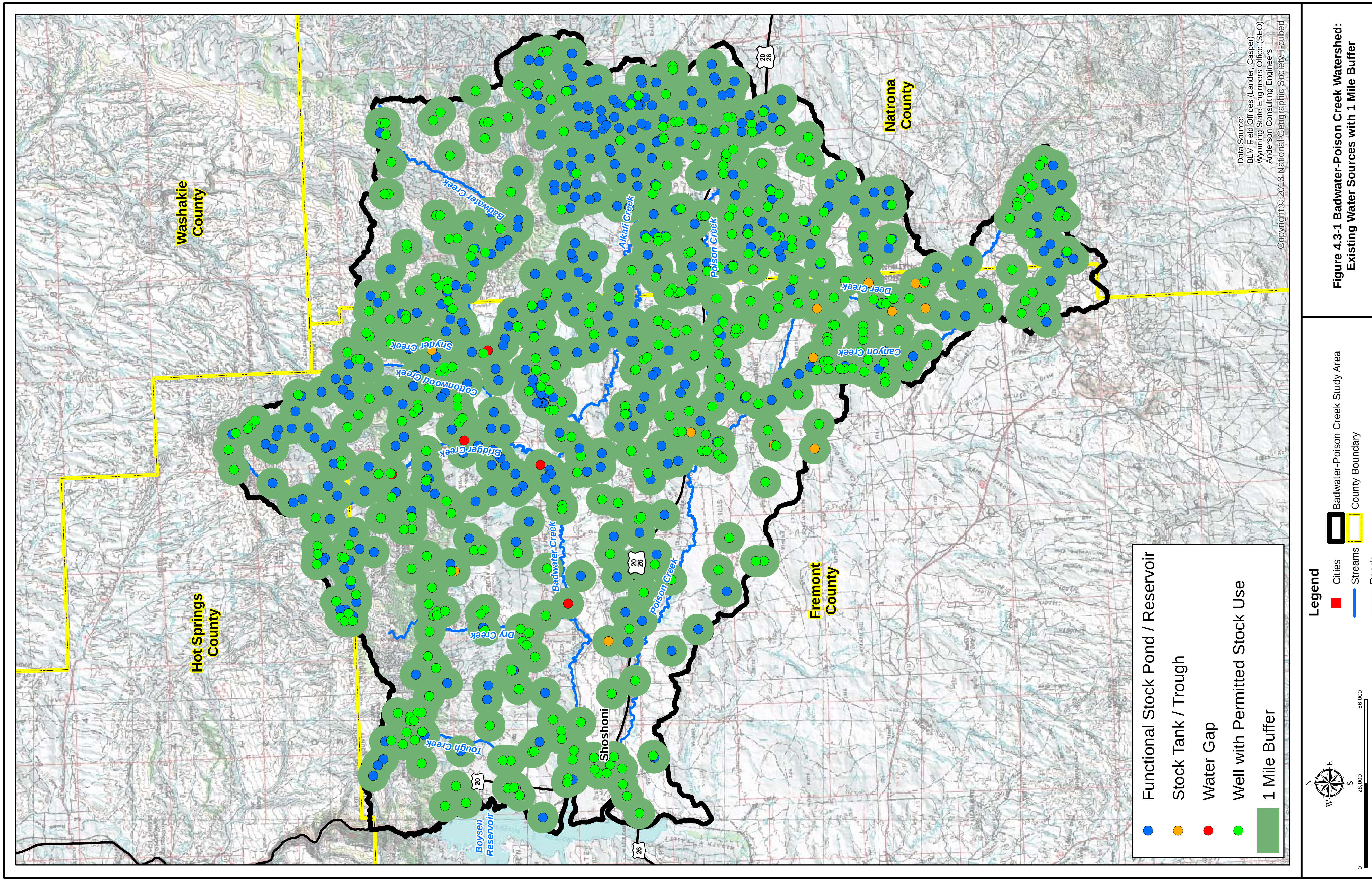


Figure 4.3-1 Badwater-Poison Creek Watershed: Existing Water Sources with 1 Mile Buffer

4.3.2 Upland Wildlife/Livestock Water Development Projects

A list of interested land owners and allotment permittees was generated based upon input obtained at project meetings. Individual meetings were scheduled and completed to gain 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 the following paragraphs, several alternatives are presented at the conceptual level. For each project, a conceptual design is also presented. It must be kept in mind that these designs are conceptual only and if implemented, detailed design would be required. The projects and their respective component identifiers in the watershed management plan are summarized in Table 4.3-1. Figure 4.3-2 displays the general location of all livestock/wildlife water opportunity projects.

Representatives of both the BLM District Offices servicing the area (Lander and Casper Field Offices) were contacted and information pertaining to planned water development and range improvement projects was requested. The Casper Field Office had no projects identified within the study area. The Lander Field Office identified two projects involving improvements to existing wells. These projects were incorporated as items in the watershed management plan.

Federal lands are significant in extent within the project area. Consequently, many of the upland water development projects could involve coordination with the BLM in order for construction to occur. Additionally, pipeline projects have the potential to require cooperation among multiple landowners. Written agreements would be required which define the maintenance responsibility and ownership liability associated with each project. In addition, environmental evaluations would be required for the impacts identified with each project. BLM typically conducts these evaluations; 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.

In the following sections, identified projects are presented individually. Based upon current guidelines associated with the WWDC's Small Water Project Program (SWPP), may be eligible for application for funding through the program. It is important to keep in mind that there may be additional funding resources available for these projects in addition to the SWPP. By partnering funds from additional resources, the financial burden to design and build any of these projects can potentially be reduced substantially.

Table 4.3.1 Tabulation of Proposed Livestock / Wildlife Supply Projects (L/W).

Watershed Plan Component: Livestock / Wildlife Water Supply Projects (L/W)										
Plan Component	Project Name	Field Notes Reference	Solar Pump / Windmill	Well Construction	Spring Development / Infiltration Gallery	Pipeline (ft)	Stock Tank	Storage Tank	Stock Reservoir Rehabilitation / Reconstruction
L/W-01	Franks Upland Project #1	Franks 2	1		1	150	1		
L/W-02	Franks Upland Project #2	Franks 3	1		1	75	1		
L/W-03	Franks Upland Project #3	Franks 4	1			300	1		
L/W-04	L/W-04 Franks Upland Project #4	Franks 5				100	1	1	
L/W-05	Franks Upland Project #5	Franks 6				100	1	1	
L/W-06	Franks Upland Project #6	Franks 7				10,560	2	1	
L/W-07	Franks Upland Project #7	Franks 8				300	1		
L/W-08	Cameron Upland Project #	Cameron 1			1	100	1		
L/W-09	Cameron Upland Project #2	Cameron 2							1
L/W-10	Cameron Upland Project #3	Cameron 3			1	2,900	1		
L/W-11	Cameron Upland Project #4	Cameron 4					1		
L/W-12	Humphreys Upland Project #1	Humphreys 1				200	1		
L/W-13	Humphreys Upland Project #2	Humphreys 2	1			500	2		
L/W-14	Cady Upland Project #1	Cady 1				300	1	1	
L/W-15	Cady Upland Project #2	Cady 2			1	300	2		
L/W-16	Cady Upland Project #3	Cady 3			1	600	1		
L/W-17	Cady Upland Project #3	Cady 4			1	300	1		
L/W-18	Cady Upland Project #5	Cady 5			1		1		
L/W-19	Allen Upland Project #1	Allen 1			1	200	1		
L/W-20	Allen Upland Project #2	Allen 2		1		1,400	1		
L/W-21	Allen Upland Project #3	Allen 3		1					
L/W-22	Thoren Upland Project #1	Thoren 1							1
L/W-23	Thoren Upland Project #2	Thoren 2				400	1		
L/W-24	Thoren Upland Project #3	Thoren 3			1	300	1		
L/W-25	Thoren Upland Project #4	Thoren 4	1			4,600	1		
L/W-26	Thoren Upland Project #6	Thoren 6							1
L/W-27	Bloomquist/McCoy Upland Project #1	Bloomquist / McCoy 1	1		1	900	1		
L/W-28	Bloomquist/McCoy Upland Project #2	Bloomquist / McCoy 2			1	300	1		
L/W-29	Bloomquist/McCoy Upland Project #3	Bloomquist / McCoy 3			1	1,500	1		
L/W-30	Hendry Upland Project #1	Hendry 6			1	21,000	6	1	
L/W-31	Campbell Upland Project #1	Jock 2 and 3			1	900			
L/W-32	Campbell Upland Project #2	Jock 5			1	600	1		
L/W-33	Campbell Upland Project #3	Jock 6			1	400	2		
L/W-34	Bloomquist/McCoy Upland Project #4	Bloomquist / Mccoy 4			1	2,800	1		

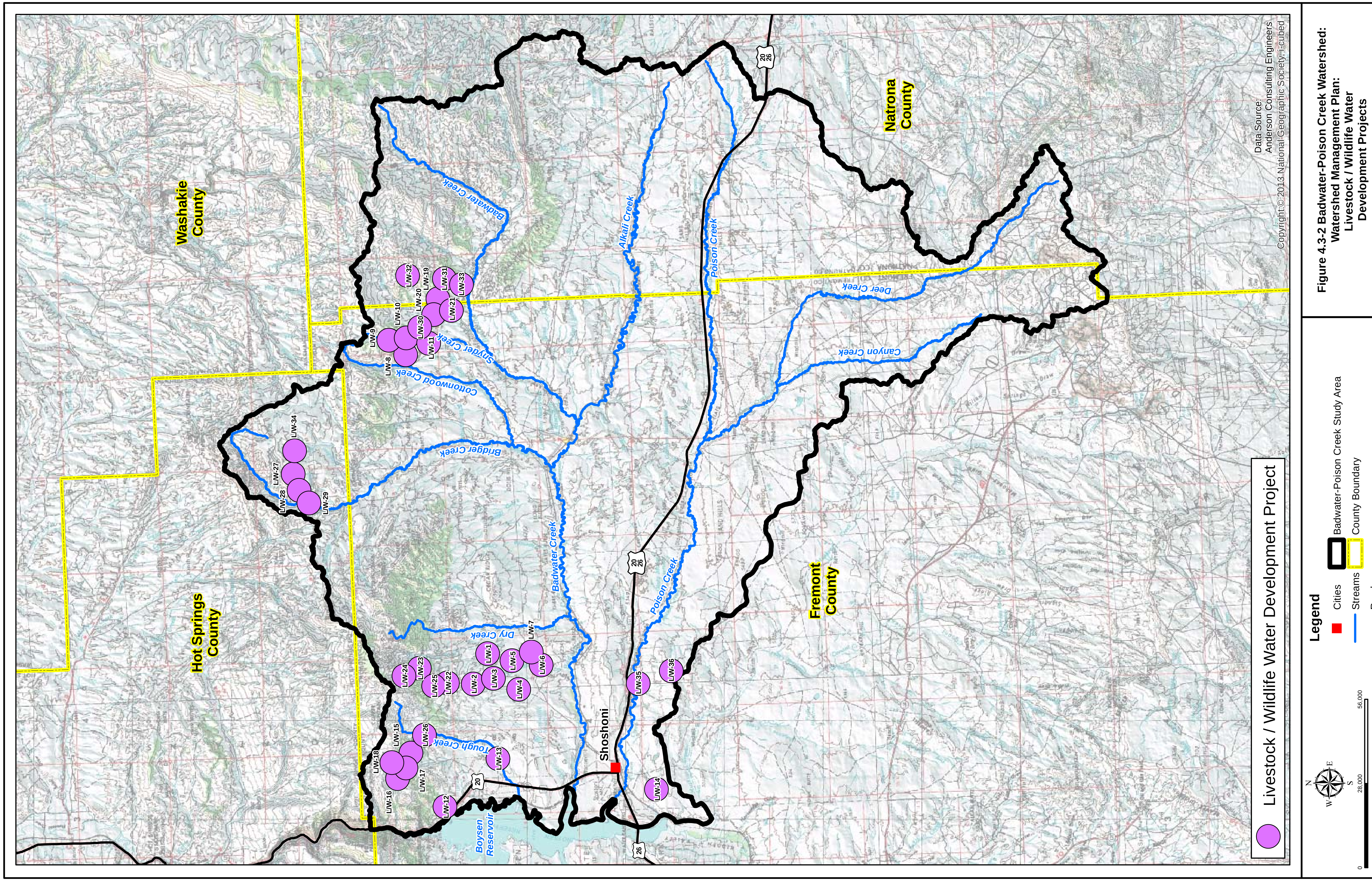


Figure 4.3-2 Badwater-Poison Creek Watershed: Watershed Management Plan: Livestock / Wildlife Water Development Projects

4.3.2.1 L/W-01: Frank Upland Project 1

This alternative would involve the development of an existing spring in the Dry Creek subwatershed located entirely on Bureau of Land Management Lands. The alternative would supply water to a portion of the watershed lacking adequate alternative livestock and wildlife upland water sources. Figure 4.3-3 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- An existing spring would be developed in Section 14, Township 39N, Range 93W. A valve would be included for management of pipeline flows.
- The facility would be equipped with a solar platform consisting of solar panels, solar powered pump, batteries, and all requisite regulators, connections and housings.
- From the spring, water would be pumped westerly and upslope to a 1,200 gallon stock tank.
- Approximately 150 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be required.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tank.
- The spring vicinity would be fenced to prevent spring development damage from livestock and wildlife.

Note that the proposed project as delineated would involve only federally owned (BLM) lands for pipeline alignment and stock tank placement.

4.3.2.2 L/W-02: Frank Upland Project 2

This alternative would involve the development of an existing spring adjacent to Hoodoo Creek and located on Diamond X Ranch properties. This alternative would provide a source of water which would be an alternative to riparian sources. Figure 4.3-4 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- An existing spring would be developed in Section 10, Township 39N, Range 93W. A valve would be included for management of pipeline flows.
- The buried 1 ½ inch HDPE low-pressure pipeline (approx. 75 feet) would be routed easterly from the spring to a stock tank located upslope and away from the riparian corridor.
- The spring development would be equipped with a solar platform consisting of solar panels, solar powered pump, batteries, and all requisite regulators, connections and housings.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tank.

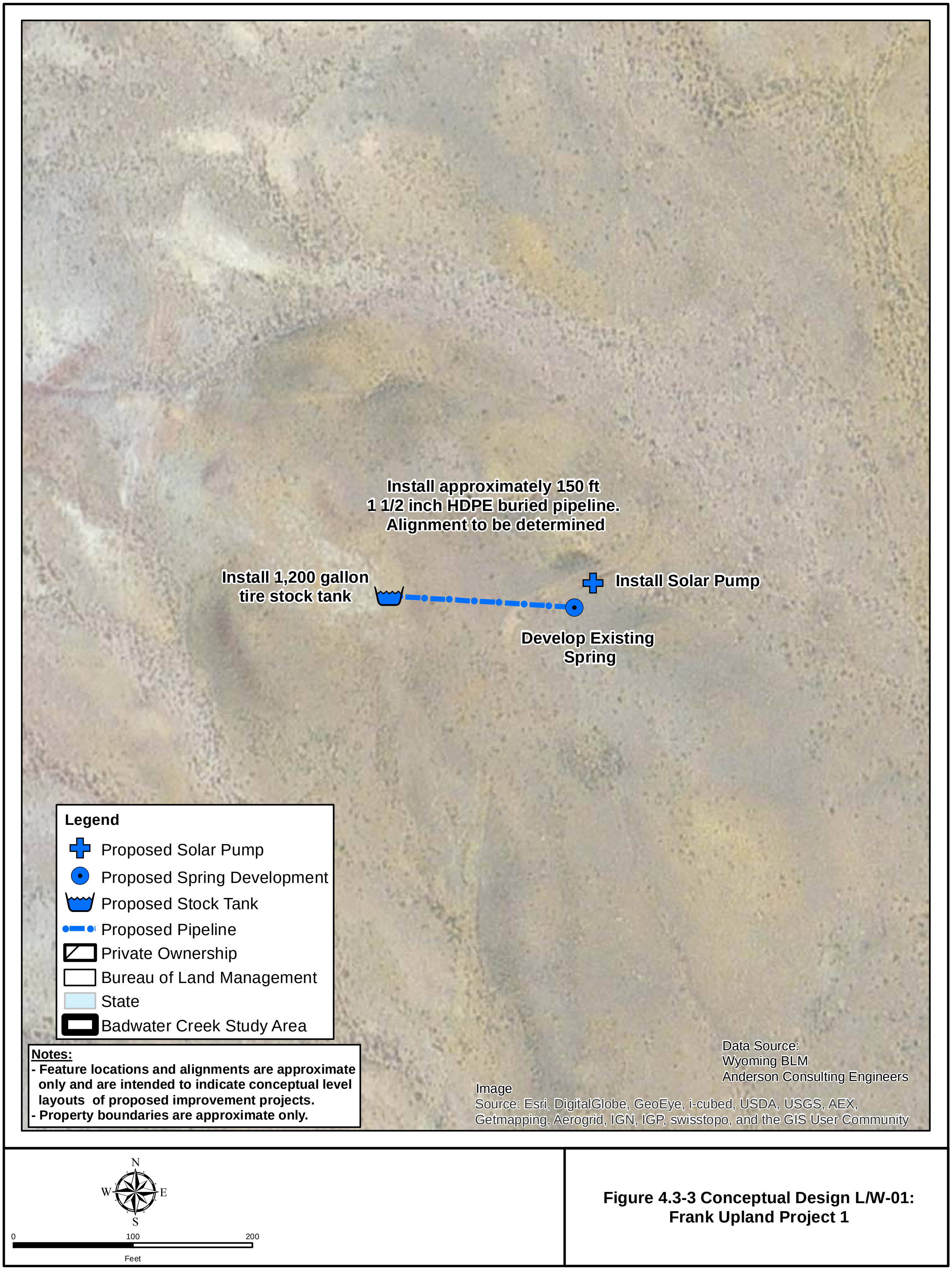


Figure 4.3-3 Conceptual Design L/W-01: Frank Upland Project 1

Figure 4.3-4 Conceptual Design L/W-02: Frank Upland Project 2

- The spring vicinity would be fenced to prevent spring development damage from livestock and wildlife.

Note that the proposed project as delineated would involve only privately owned lands.

4.3.2.3 L/W-03: Frank Upland Project 3

This alternative would involve the modification of facilities associated with an existing well located within the Hoodoo Creek subwatershed (Section 15, Township 39N, Range 93W). The well would be equipped with a solar pump, pipeline (300ft), and 1,200 gallon stock tank. The alternative would supply water to a portion of the watershed lacking adequate alternative livestock and wildlife upland water sources. Figure 4.3-5 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- The existing well would be equipped with a solar platform consisting of solar panels, solar powered pump, batteries, and all requisite regulators, connections and housings.
- Approximately 300 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be routed south to a 1,200 gallon stock tank.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tank.

Note that the project as delineated would involve only private lands.

4.3.2.4 L/W-04: Frank Upland Project 4

This project involves modifications to an existing well previously equipped with a solar pump. The well is located in the Hoodoo Creek subwatershed (Section 28, Township 39N, Range 93W). The modifications would supply water to a portion of the watershed lacking adequate alternative livestock and wildlife upland water sources. Figure 4.3-6 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- A 10,000 gallon storage tank would be installed adjacent to the existing well.
- Approximately 100 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be routed southwesterly to a 1,200 gallon stock tank.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tank.

Note that the proposed project as delineated would involve only federally owned land (BLM).

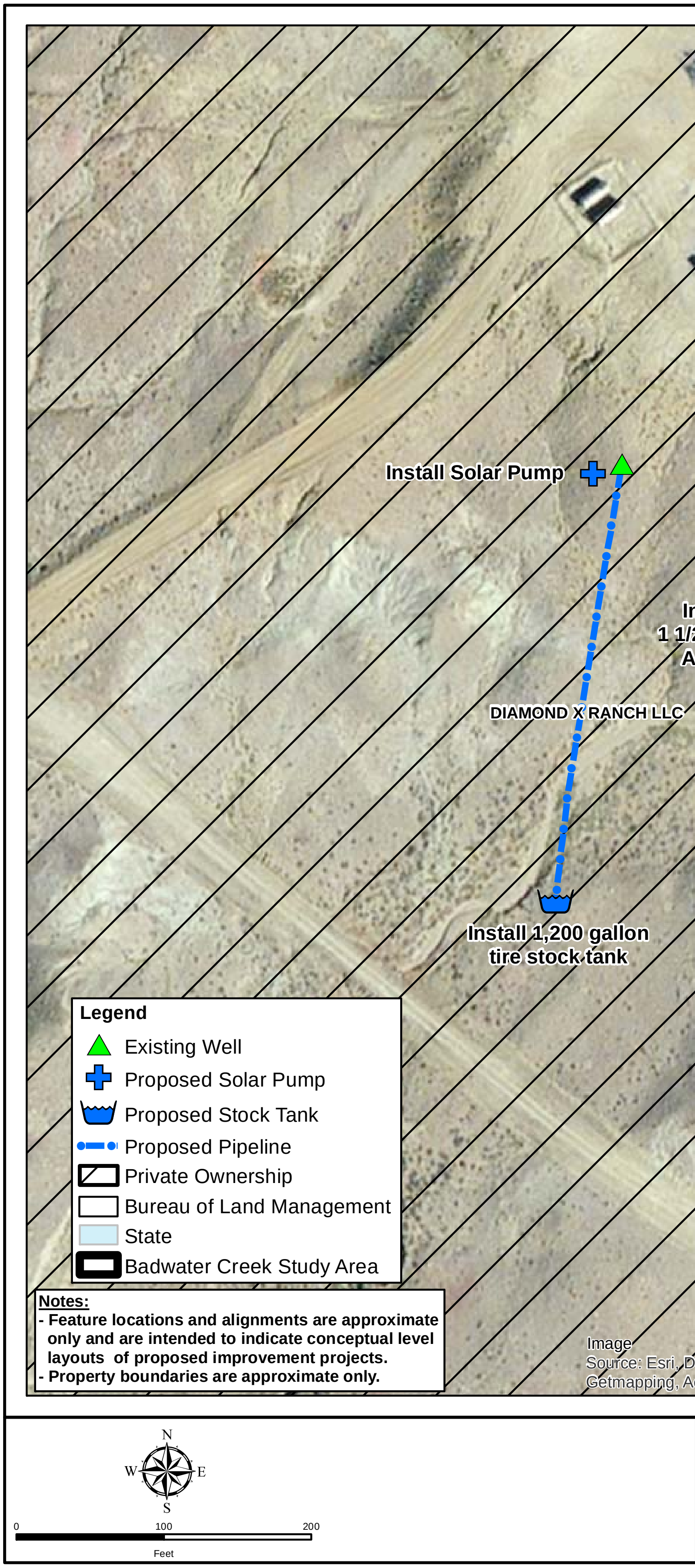
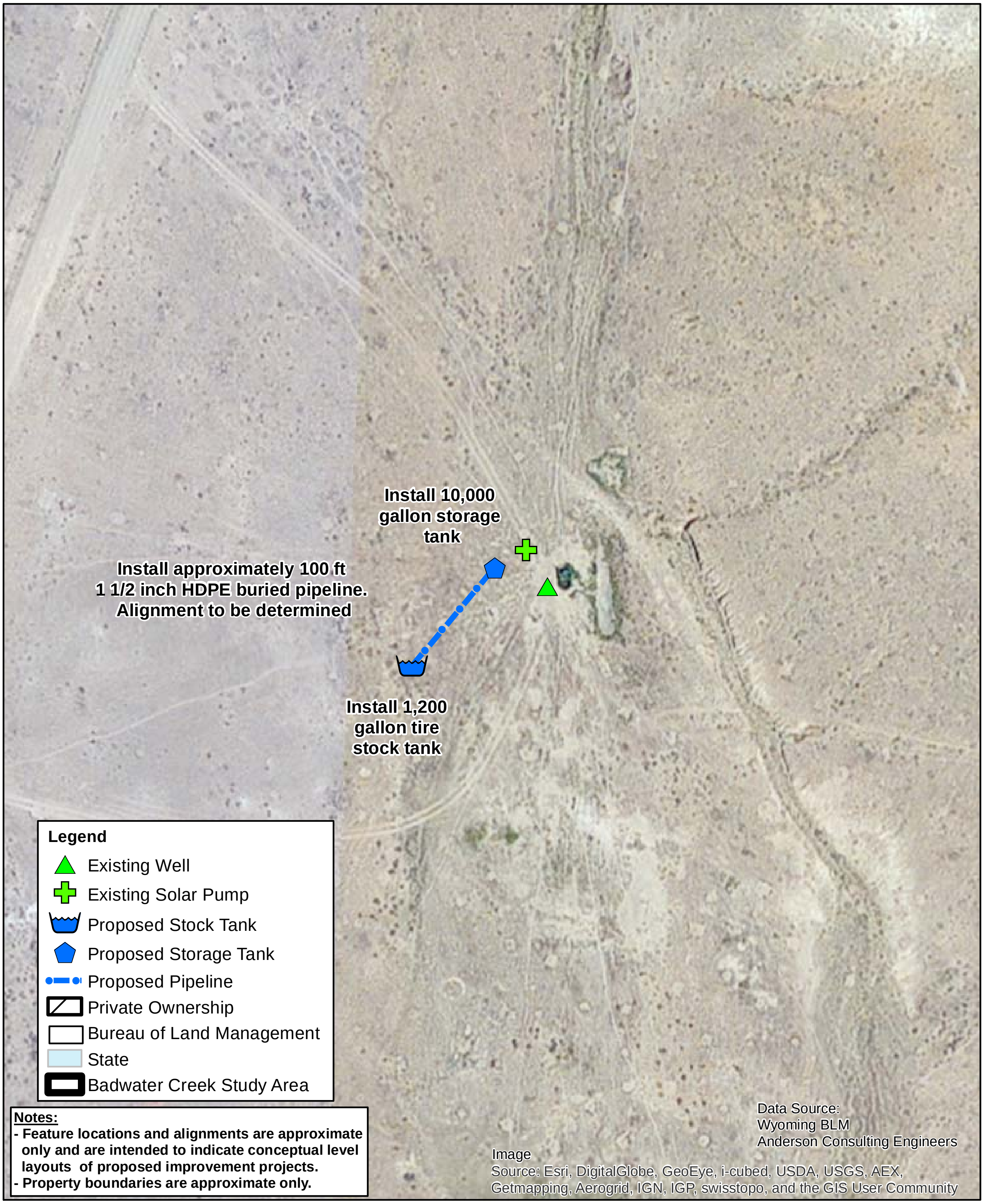


Figure 4.3-5 Conceptual Design L/W-03: Frank Upland Project 3



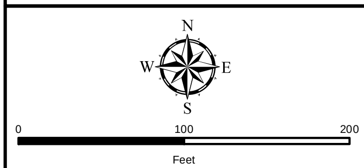


Figure 4.3-6 Conceptual Design: L/W-04
Frank Upland Project 4

4.3.2.5 L/W-05: Frank Upland Project 5

This project involves modifications to an existing artesian well. The well is located in the Hoodoo Creek subwatershed (Section 23, Township 39N, Range 93W). The alternative would supply water to a portion of the watershed lacking adequate alternative livestock and wildlife upland water sources. Figure 4.3-7 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- A 10,000 gallon storage tank would be installed adjacent to the existing artesian well.
- Approximately 100 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be routed southwesterly to a 1,200 gallon stock tank.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tank.

Note that the proposed project as delineated would involve only federally owned land (BLM).

4.3.2.6 L/W-06: Frank Upland Project 6

This alternative consists of improvements to an existing well located in Section 35, Township 39N, Range 93W. The project is entirely on federally owned land (BLM) and located in the Hoodoo Creek subwatershed. The improvements will provide a reliable source of water in an otherwise dry area where existing water sources are sparse. Figure 4.3-8 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- A 10,000 gallon storage tank would be installed adjacent to the existing well.
- Two 1,200 gallon stock tanks would be installed. One stock tank will be installed adjacent to the storage tank to replace the existing undersized tank. The other would be installed at the terminus of the pipeline.
- Approximately 2 miles (10,560 ft) of buried 1 ½ inch HDPE low-pressure pipeline would be routed southwesterly to the second 1,200 gallon stock tank.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tank.

Note that the proposed project as delineated would involve only federally owned land (BLM).

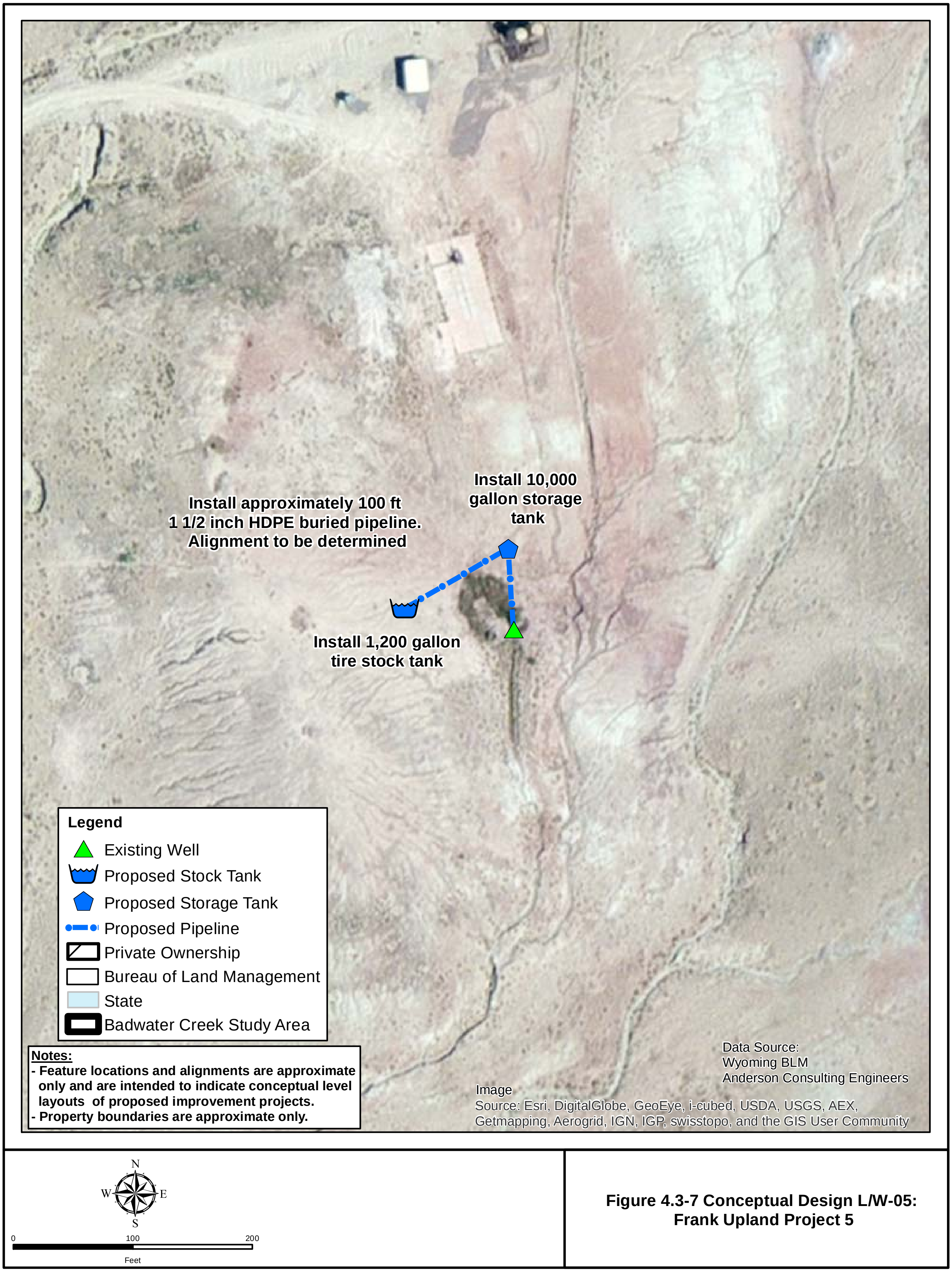
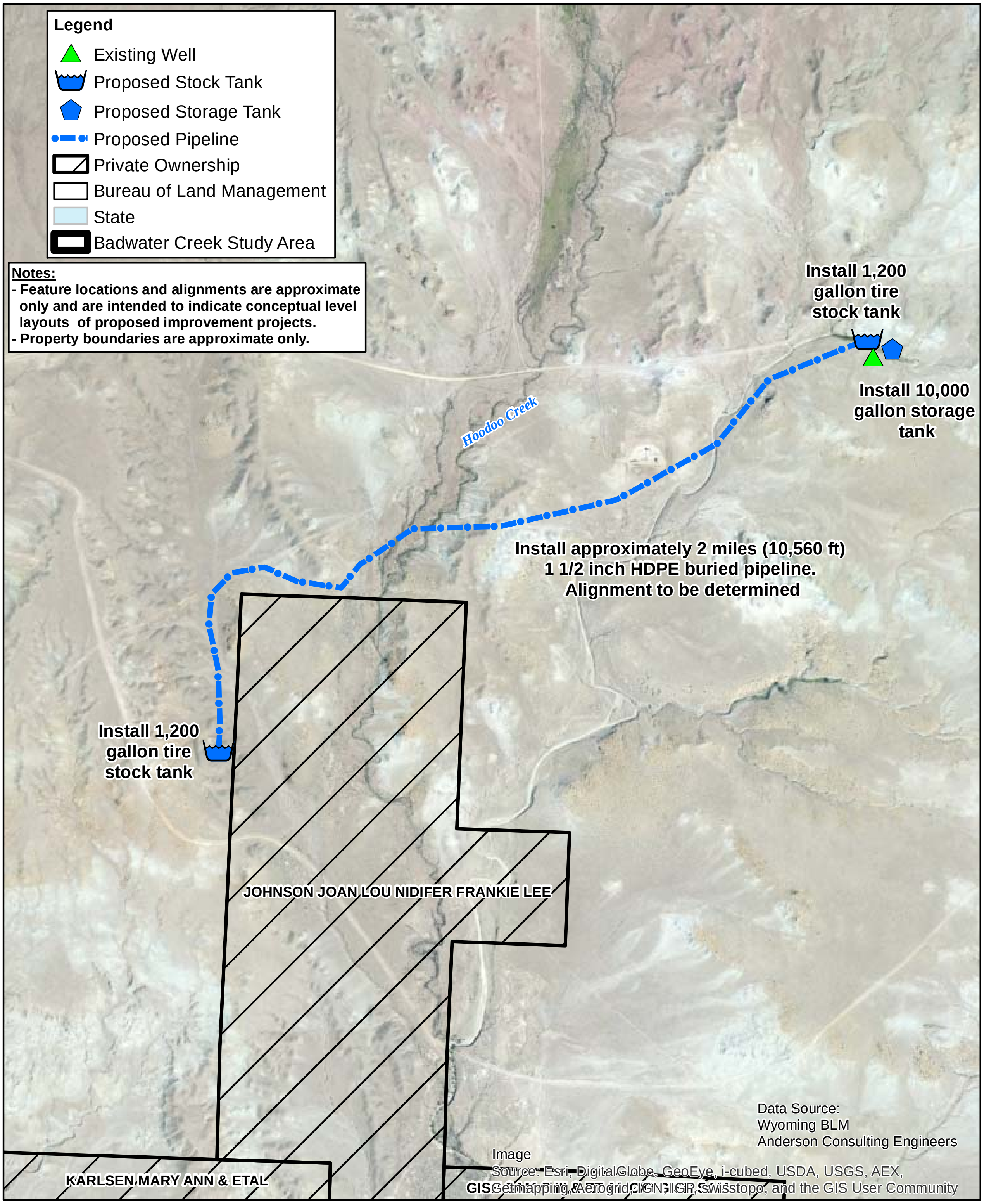


Figure 4.3-7 Conceptual Design L/W-05: Frank Upland Project 5



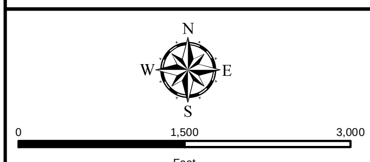


Figure 4.3-8 Conceptual Design L/W-06: Frank Upland Project 6

4.3.2.7 L/W-07: Frank Upland Project 7

This project involves modifications to an existing well located in the Hoodoo Creek subwatershed (Section 35, Township 39N, Range 93W). The project is located entirely on federally owned land (BLM). The alternative would supply water to a portion of the watershed lacking adequate alternative livestock and wildlife upland water sources. Figure 4.3-9 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- Approximately 300 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be routed from the existing well south to a 1,200 gallon stock tank.
- Overflow from the stock tank would be routed to the existing reservoir located east of the proposed stock tank location.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tank.

Note that the proposed project as delineated would involve only federally owned land (BLM).

4.3.2.8 L/W-08: Cameron Upland Project 1

This alternative would involve the development of an existing spring in the Snyder Creek subwatershed (Section 30, Township 40N, Range 89W). The spring development would provide a source of water which would be an alternative to riparian sources. Figure 4.3-10 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- An existing spring would be developed and a valve would be included for management of pipeline flows.
- The spring vicinity would be fenced to prevent the spring development damage from livestock and wildlife.
- Approximately 100 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be routed south to a 1,200 gallon stock tank.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tank.

Note that the proposed project as delineated would involve only lands owned by State of Wyoming.

Figure 4.3-9 Conceptual Design: L/W-07
Frank Upland Project 7

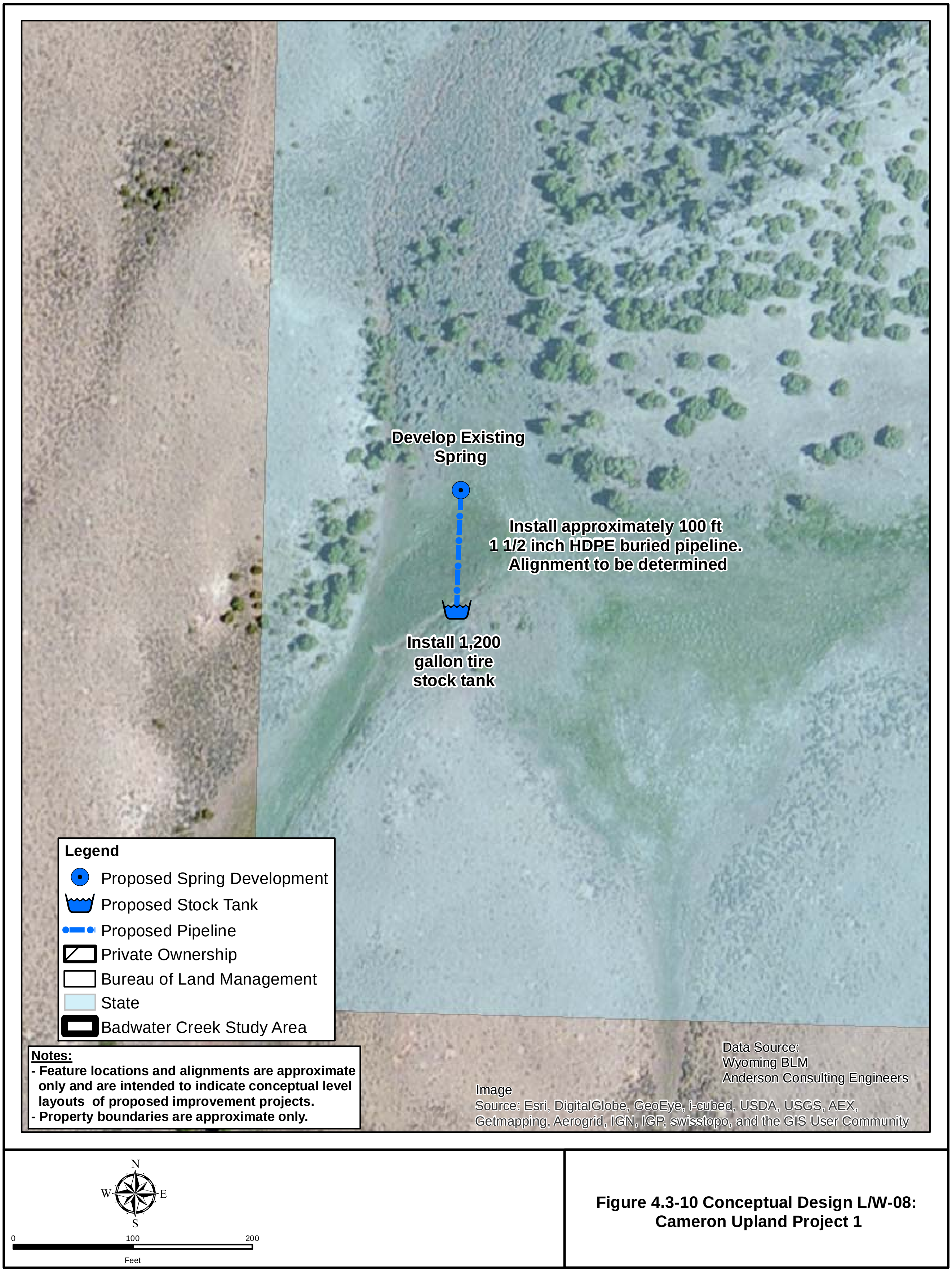


Figure 4.3-10 Conceptual Design L/W-08: Cameron Upland Project 1

4.3.2.9 L/W-09: Cameron Upland Project 2

This project involves the rebuilding of a stock reservoir located on Cameron Ranch property in Section 19, Township 40N, Range 89W. The reservoir is located on Snyder Creek. This project would entail inspection of the embankment, making necessary repairs if needed, removing sediment and installing an Agri-drain outlet to facilitate irrigation. Figure 4.3-11 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- Existing sediment would be excavated from the existing pond.
- Agri-drain outlet would be installed to facilitate irrigation

As delineated, the projects involve privately-owned lands only.

4.3.2.10 L/W-10: Cameron Upland Project 3

This alternative would involve the development of an existing spring in the Snyder Creek subwatershed (Section 18, Township 40N, Range 89W). The spring development would provide a source of water which would be an alternative to riparian sources. Figure 4.3-12 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- An existing spring would be developed and a valve would be included for management of pipeline flows.
- The spring vicinity would be fenced to prevent the spring development damage from livestock and wildlife.
- Approximately 100 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be routed south to a 1,200 gallon stock tank.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tank.

Note that the proposed project as delineated would involve only lands owned by State of Wyoming.

4.3.2.11 L/W-11: Cameron Upland Project 4

This project involves rehabilitation of an existing artesian well located in Section 31, Township 40N, Range 89W. Currently, the well is uncapped and there is no means of controlling well discharge. Water flows downslope to a small wetland which has subsequently developed. An existing pipeline extends southwesterly from the well but is currently not connected to the well. Rehabilitation efforts would

Figure 4.3-11 Conceptual Design L/W-09: Cameron Upland Project 2

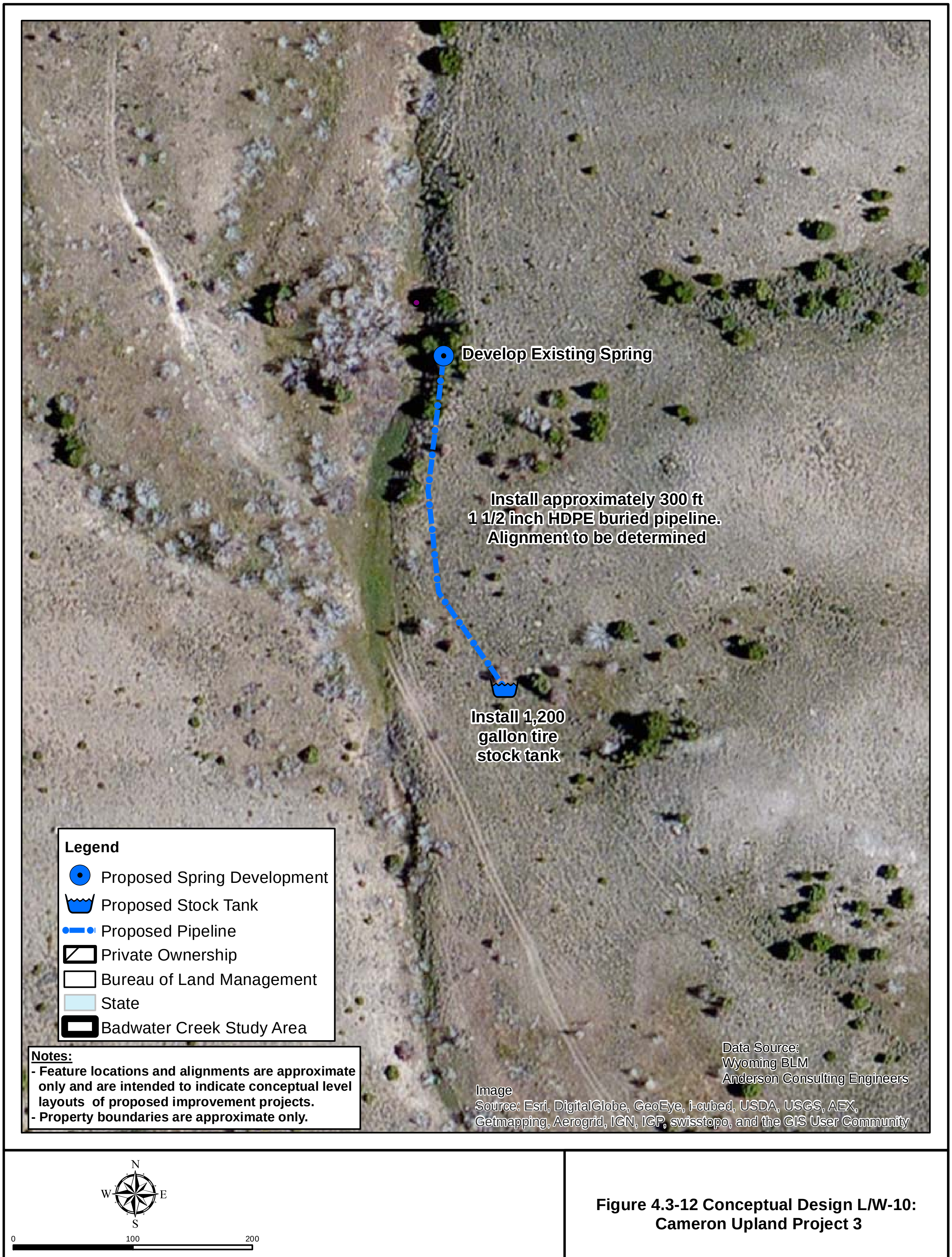


Figure 4.3-12 Conceptual Design L/W-10: Cameron Upland Project 3

require inspection of the well at a detail which is greater than the scope of this Level I investigation in order to determine the proper means of repair. Figure 4.3-13 displays the conceptual design of the project.

Assuming the well can be adequately rehabilitated, the following components would be included in the project:

- Rehabilitate and repair the existing well casing
- Reconnection of the well to the existing pipeline
- Install 1,200 gallon stock tank adjacent the well at a location approximately ½ mile downstream of the well
- Wildlife egress ramps would be installed in the proposed stock tank.

Note that the proposed project as delineated would involve only privately owned lands.

4.3.2.12 L/W-12: Humphreys Upland Project 1

This alternative involves installing a pipeline and a stock tank which would be fed by an existing well in order to provide a source of water in an area where existing water sources are sparse. The project is located entirely on Humphreys Ranch property in the western portion of the study area near Boysen Reservoir (Section 32, Township 40N, Range 94W). Figure 4.3-14 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- Approximately 200 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be routed southwesterly from the well to a 1,200 gallon stock tank.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tank.

Note that as delineated, the project involves privately owned lands only.

4.3.2.13 L/W-13: Humphreys Upland Project 2

This alternative would involve the modification of facilities associated with an existing well located on deeded property within the Tough Creek subwatershed (Section 14, Township 39N, Range 94W). The well would be equipped with a solar pump, pipeline (500 ft), and two 1,200 gallon stock tanks. The alternative would provide a reliable source of water to an area where existing sources are sparse. Figure 4.3-15 displays the conceptual design of the project.

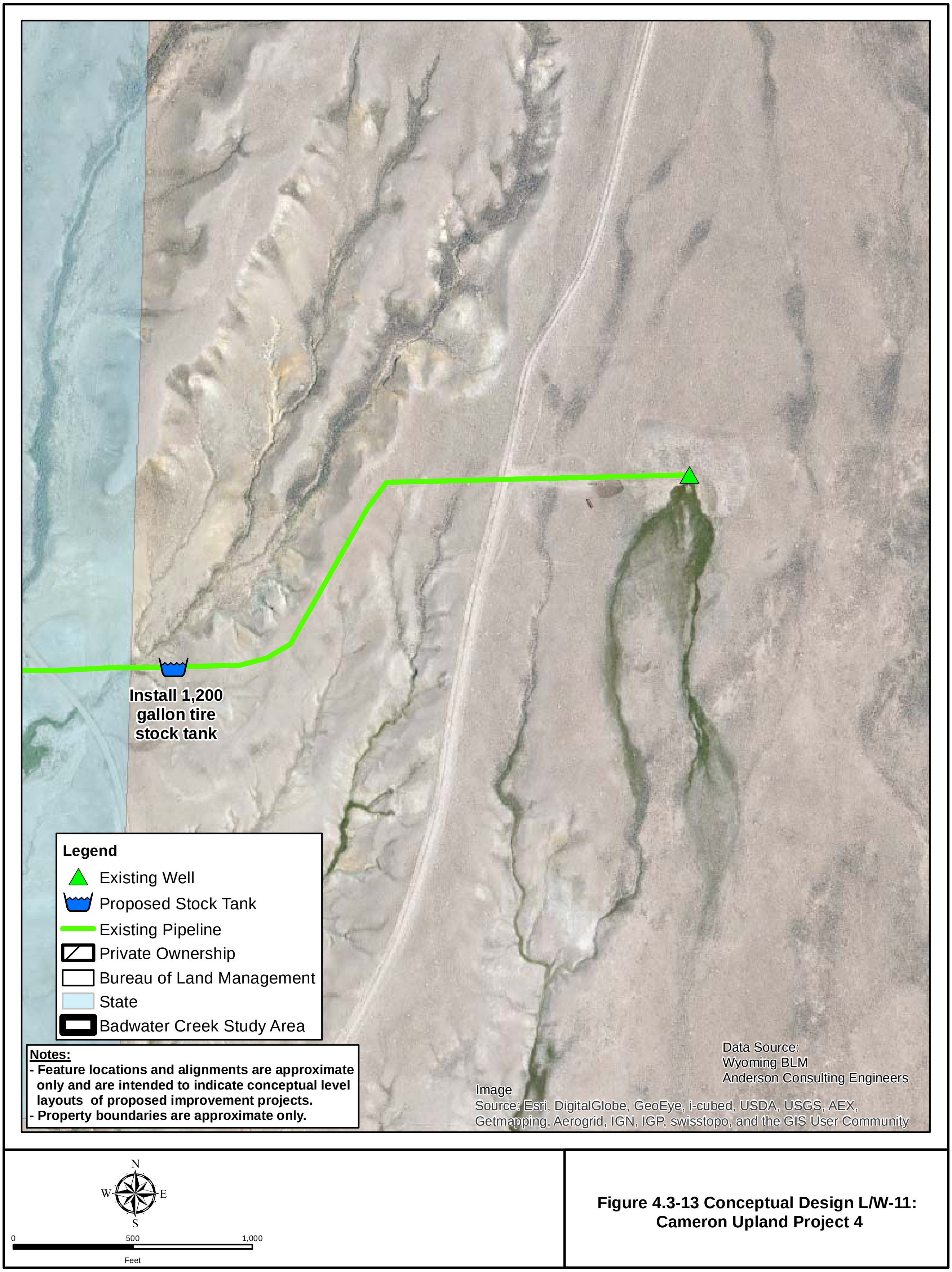


Figure 4.3-13 Conceptual Design L/W-11: Cameron Upland Project 4

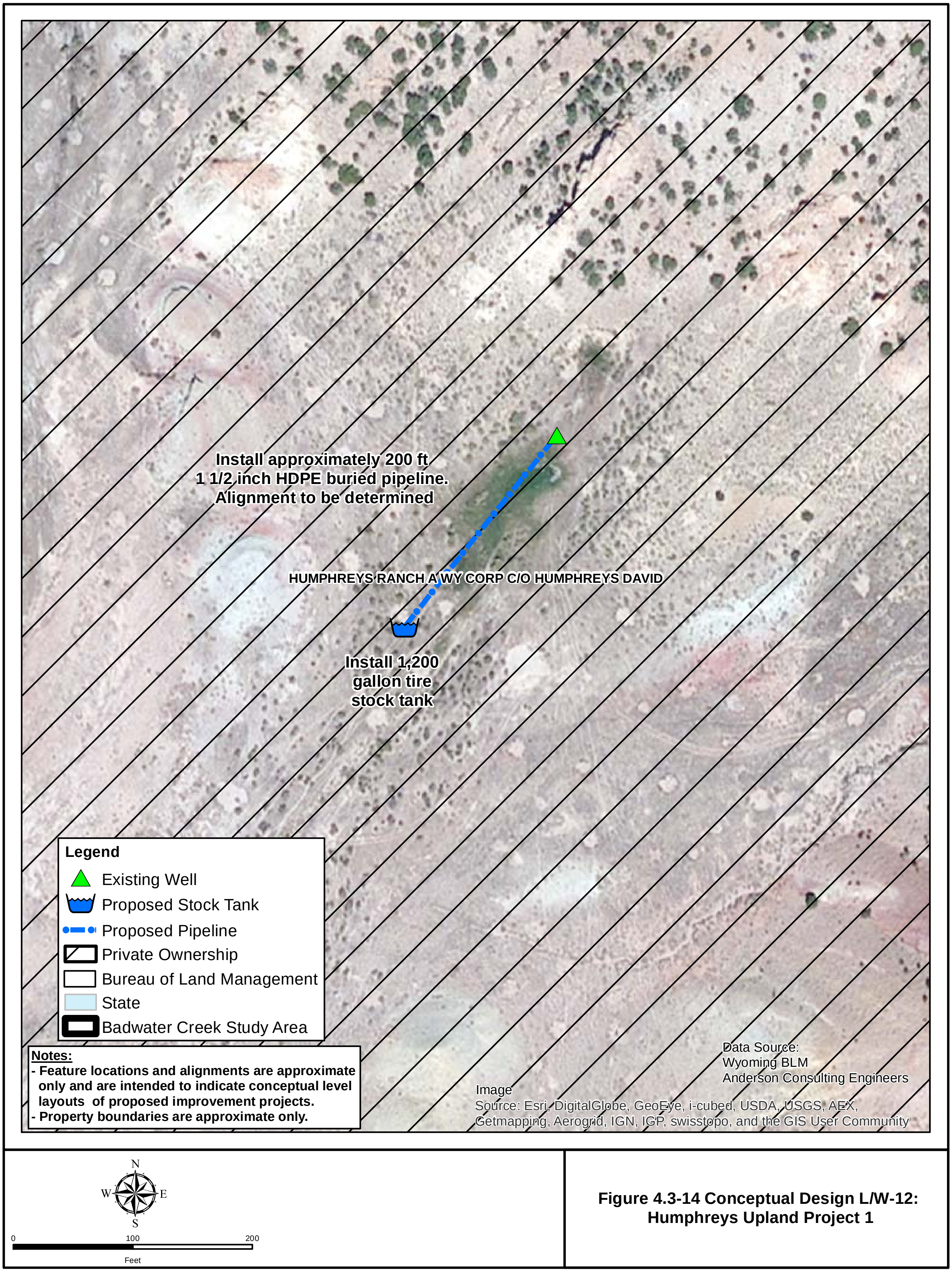


Figure 4.3-14 Conceptual Design L/W-12: Humphreys Upland Project 1

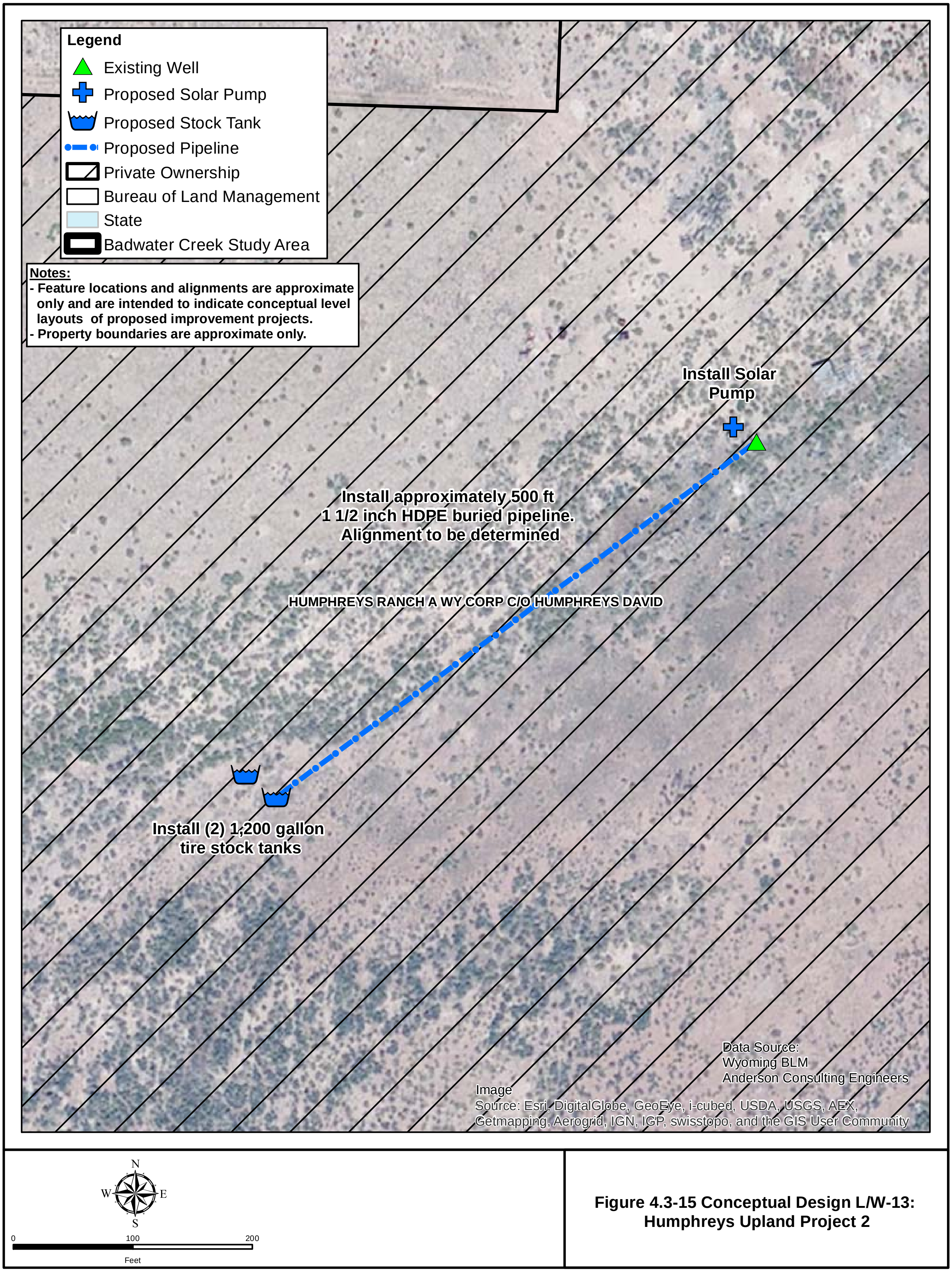


Figure 4.3-15 Conceptual Design L/W-13: Humphreys Upland Project 2

Under this alternative, the following components would be employed:

- The existing well would be equipped with a solar platform consisting of solar panels, solar powered pump, batteries, and all requisite regulators, connections and housings.
- Approximately 500 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be routed southwesterly to two 1,200 gallon stock tanks.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tanks.

Note that the project as delineated would involve only private lands.

4.3.2.14 L/W-14: Cady Upland Project 1

This project involves modifications to an existing well located in the southwest portion of the study area near Boysen Reservoir (Section 5, Township 37N, Range 94W). The well is located on federally owned land (BLM),however the stock tank and portions of the pipeline would be located on deeded lands. The alternative would supply water to a portion of the watershed lacking adequate alternative livestock and wildlife upland water sources. Figure 4.3-16 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- A 10,000 gallon storage tank would be installed adjacent to the existing well.
- Approximately 300 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be routed from the existing well northwest to a 1,200 gallon stock tank.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tank.

Note that the proposed project as delineated would involve both federally (BLM) and privately owned lands.

4.3.2.15 L/W-15: Cady Upland Project 2

This project involves replacing an infrastructure associated with an existing developed spring located on deeded property Section 23, Township 40N, Range 94W. The spring flow is estimated to be approximately 15 gallons per minute. The 15 gpm spring would be redeveloped and a new stock tank would be installed next to the spring to replace the existing undersized tank. A pipeline would be run to provide water to second stock tank located down slope. This alternative would provide a source of water which would be an alternative to riparian sources. Figure 4.3-17 displays the conceptual design of the project.

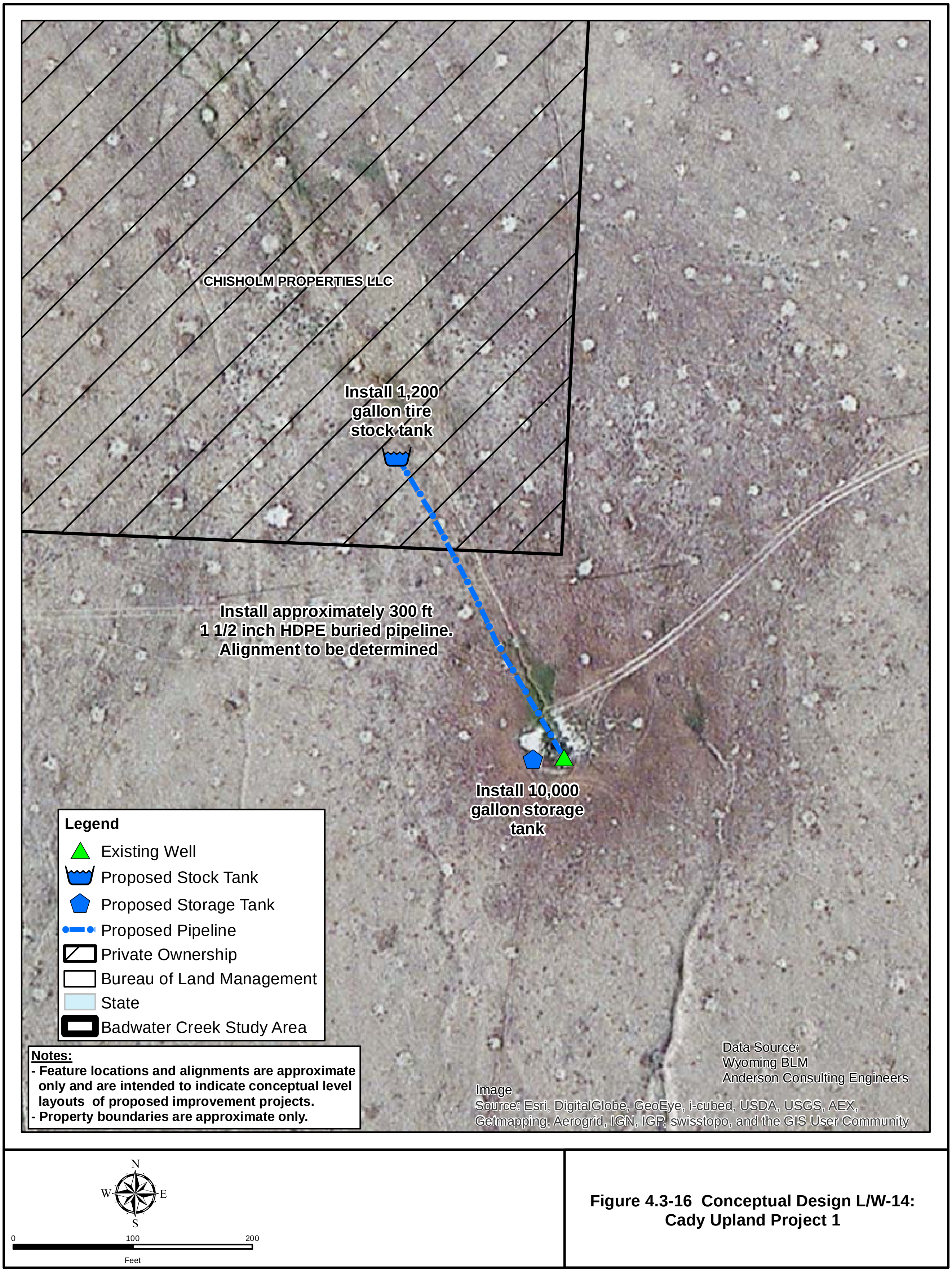


Figure 4.3-16 Conceptual Design L/W-14: Cady Upland Project 1

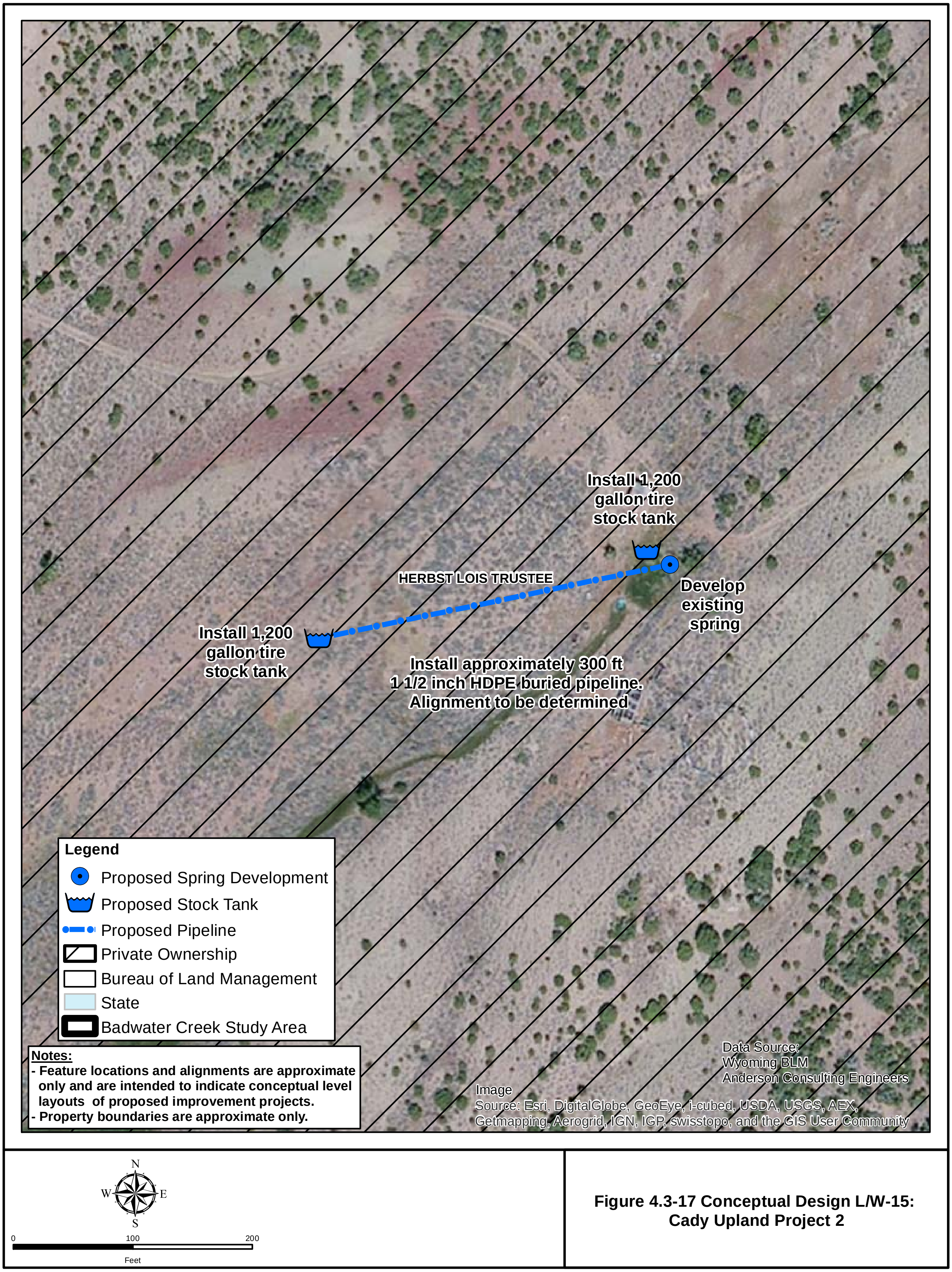


Figure 4.3-17 Conceptual Design L/W-15: Cady Upland Project 2

Under this alternative, the following components would be employed:

- The buried 1 ½ inch HDPE low-pressure pipeline (approx. 300 feet) would be routed southwesterly from the spring to a stock tank located away from the riparian corridor.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tanks.
- The spring vicinity would be fenced to prevent spring development damage from livestock and wildlife.

Note that the proposed project as delineated would involve only privately owned lands.

4.3.2.16 L/W-16: Cady Upland Project 3

This alternative would involve the development of an existing spring in Section 15, Township 40N, Range 94W. The project is located entirely on private property and it would provide a source of water which would be an alternative to riparian sources. Figure 4.3-18 displays the conceptual design of the project.

Prior to initiation of this project, a more detailed review of the spring and its development potential should be conducted to confirm its viability.

Assuming an adequate water supply exists, the following components would be employed:

- An existing spring would be developed and a valve would be included for management of pipeline flows.
- The buried 1 ½ inch HDPE low-pressure pipeline (approx. 600 feet) would be routed southeasterly from the spring to a 1,200 gallon stock tank located away from the riparian corridor.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tanks.
- The spring vicinity would be fenced to prevent spring development damage from livestock and wildlife.

Note that the proposed project as delineated would involve only privately owned lands.

4.3.2.17 L/W-17: Cady Upland Project 4

This project would involve the development of an existing spring near Birdseye Creek (Section 14, Township 40N, Range 94W). The entire project would be located on private lands and would provide a source of water which would be an alternative to riparian sources. Figure 4.3-19 displays the conceptual design of the project.

Figure 4.3-18 Conceptual Design L/W-16: Cady Upland Water Supply Project 3

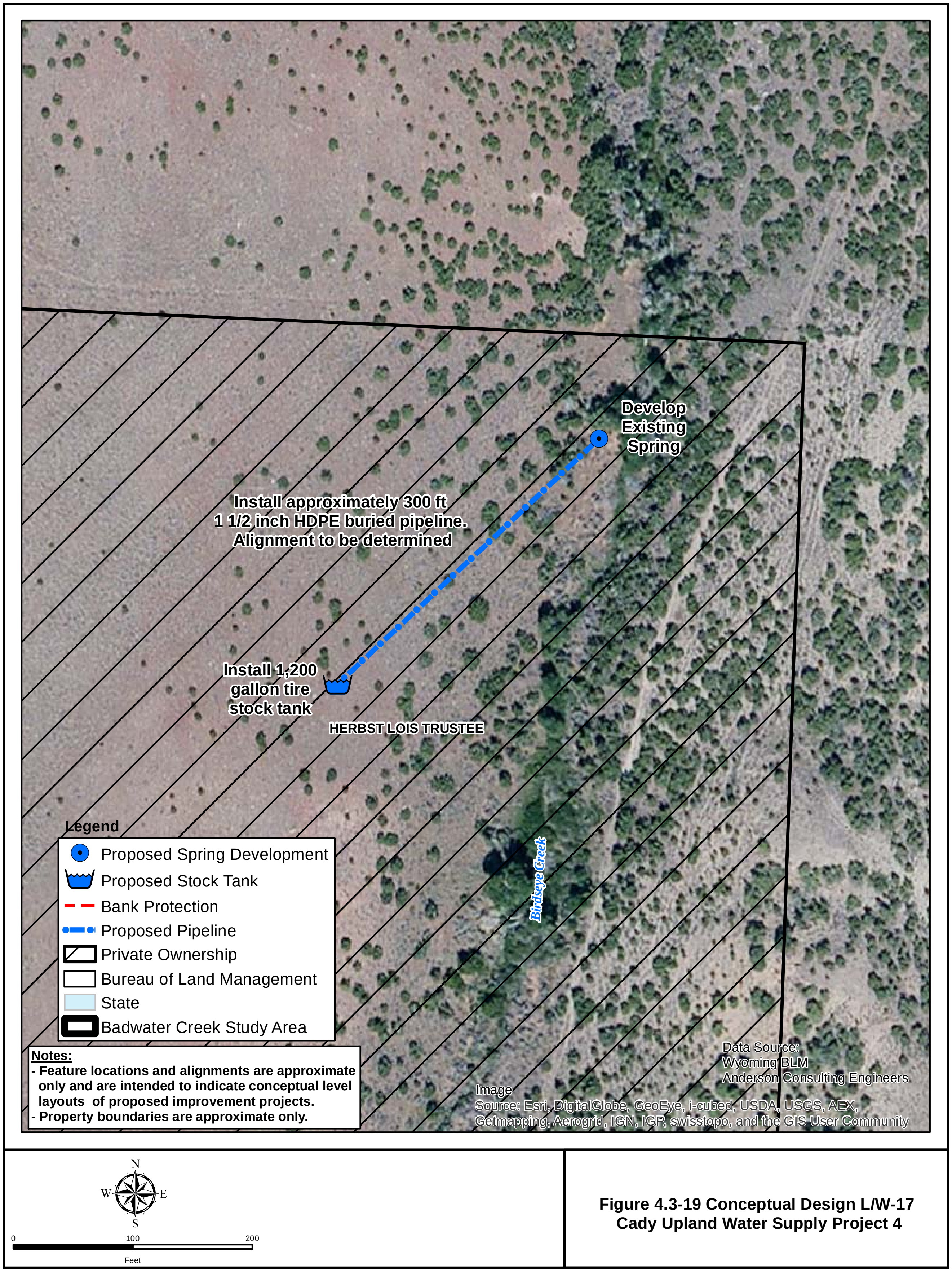


Figure 4.3-19 Conceptual Design L/W-17
Cady Upland Water Supply Project 4

Under this alternative, the following components would be employed:

- An existing spring would be developed and a valve would be included for management of pipeline flows.
- Approximately 300 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be routed southwesterly to a 1,200 gallon stock tank.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tank.
- The spring vicinity would be fenced to prevent spring development damage from livestock and wildlife.

Note that the proposed project as delineated would involve only private lands.

4.3.2.18 L/W-18: Cady Upland Project 5

This project would involve the development of an existing spring near Birdseye Creek (Section 14, Township 40N, Range 94W). The entire project would be located on federally owned lands (BLM) and would provide a source of water which would be an alternative to riparian sources. Figure 4.3-20 displays the conceptual design of the project. It must be noted that accessibility to this site is extremely difficult and construction could be problematic.

Under this alternative, the following components would be employed:

- An existing spring would be developed and the spring vicinity would be fenced to prevent spring development damage from livestock and wildlife.
- A 1,200 gallon stock tank would be installed directly adjacent to the new spring development.
- Wildlife egress ramps would be installed in the proposed stock tank.

Note that the proposed project as delineated would involve only federally owned land (BLM).

4.3.2.19 L/W-19: Allen Upland Project 1

This alternative would involve the development of an existing spring in the Section 3, Township 39N, Range 89W. The majority of the project would be located on Campbell Livestock land, however it would include a 6" pipeline routed to an unnamed reservoir on the Allen property to the west. This project would provide a source of water which would be an alternative to riparian sources as well as augmenting irrigation water supplies from the reservoir. Figure 4.3-21 displays the conceptual design of the project.

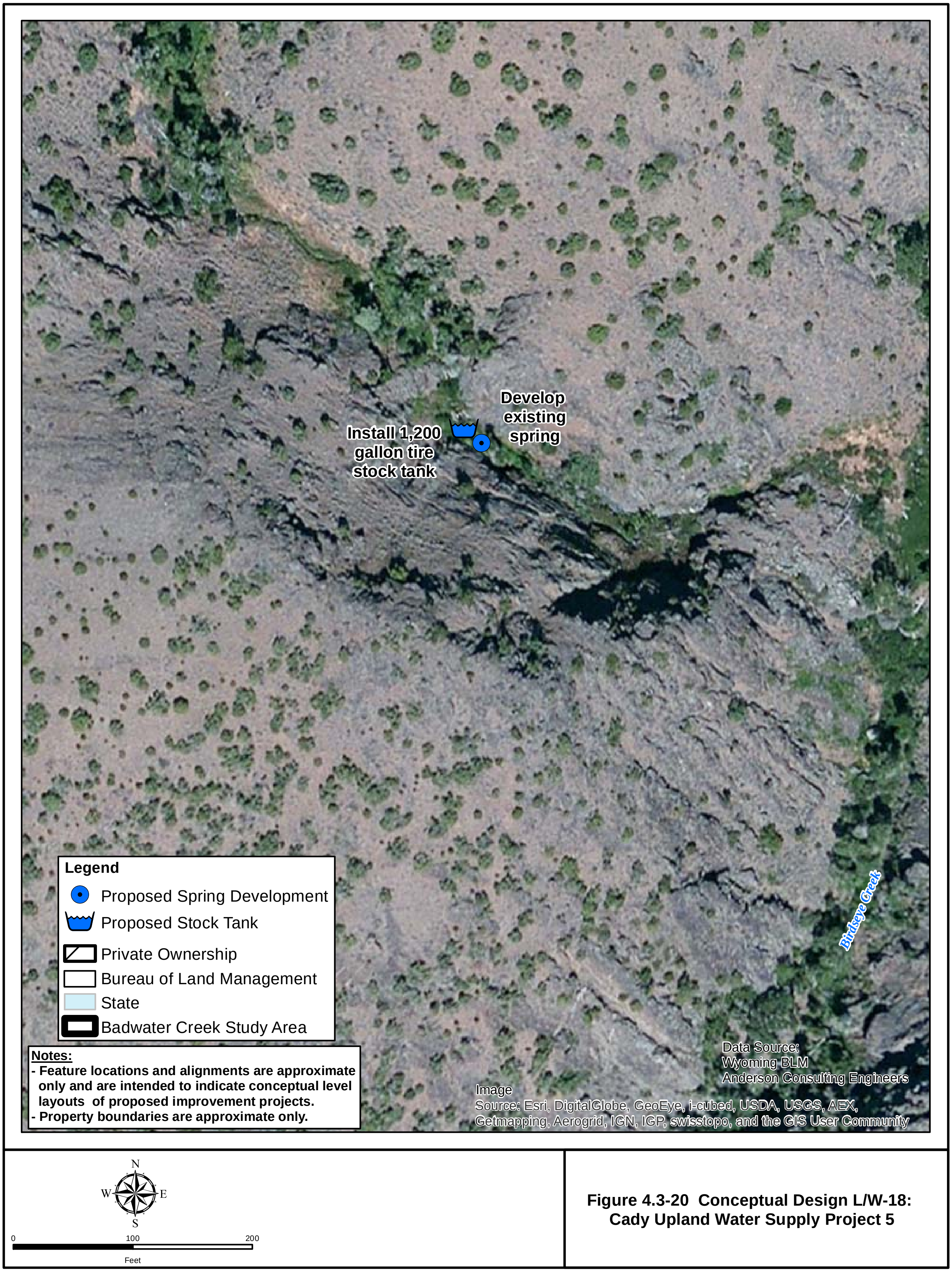


Figure 4.3-20 Conceptual Design L/W-18: Cady Upland Water Supply Project 5

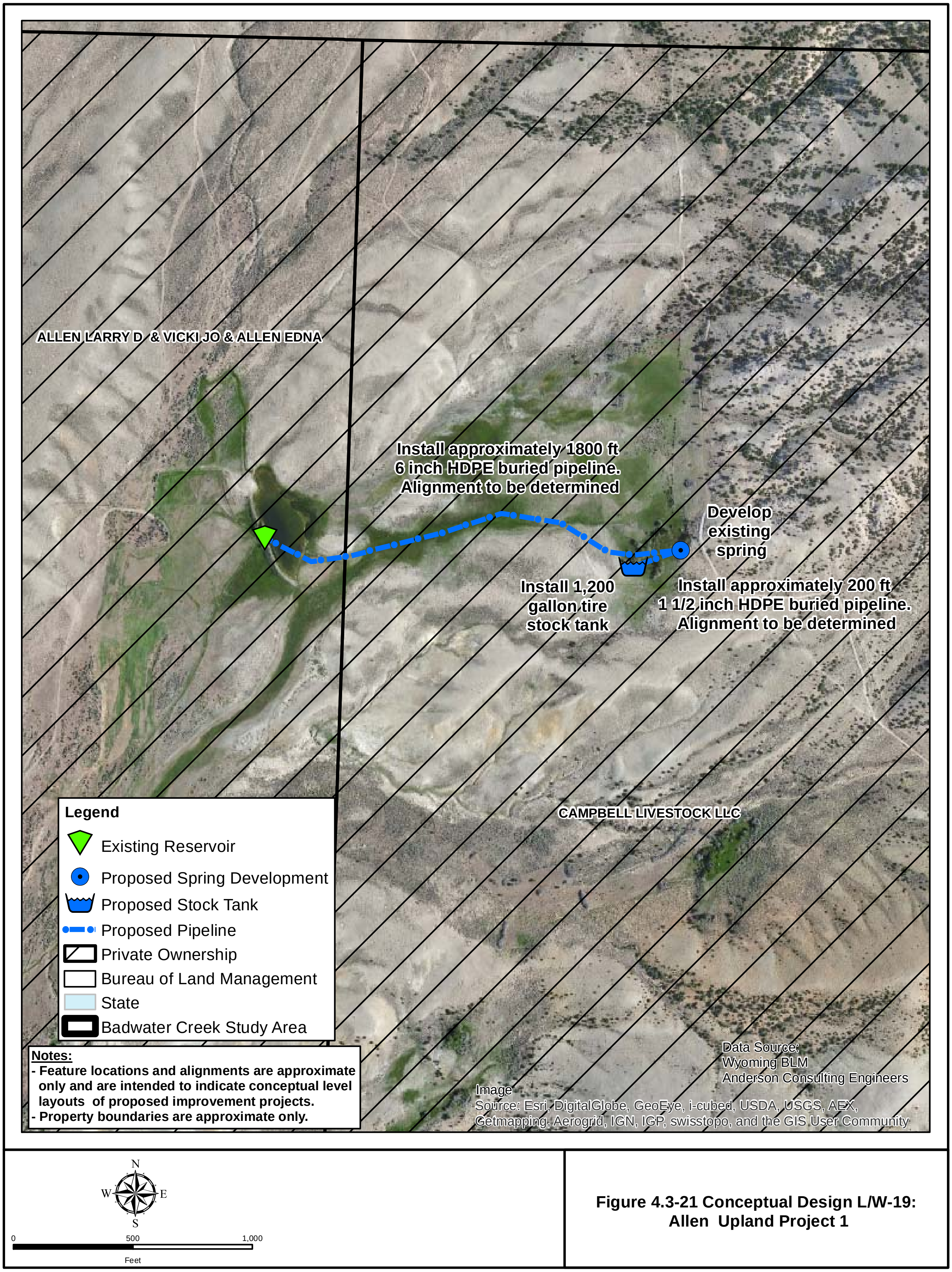


Figure 4.3-21 Conceptual Design L/W-19: Allen Upland Project 1

Under this alternative, the following components would be employed:

- An existing spring would be developed and a valve would be included for management of pipeline flows.
- The spring vicinity would be fenced to prevent spring development damage from livestock and wildlife.
- A buried 1 ½ inch HDPE low-pressure pipeline (approx. 200 feet) would be routed southwesterly from the spring to a 1,200 gallon stock tank located away from the riparian corridor.
- Wildlife egress ramps would be installed in the proposed stock tank.
- A second buried 6 inch HDPE pipeline (approx. 1,800 feet) would be routed west to an unnamed reservoir located on the Allen property.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.

Note that the proposed project as delineated would involve only private lands. Because this project would involve multiple private owners, coordination and agreements pertaining to operation, costs and maintenance would be necessary

4.3.2.20 L/W-20: Allen Upland Project 2

This project involves drilling a new well, installing a stock tank, and routing a pipeline approximately 1,400 feet to an existing unnamed reservoir. The project is located in the Section 4, Township 39N, Range 89W and is entirely on deeded property. The alternative would supply water to a portion of the watershed lacking adequate alternative livestock and wildlife upland water sources. Figure 4.3-22 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- The existing reservoir reportedly does not hold water for sustained periods. Consequently, sediment would be excavated and a bentonite layer installed in an effort to reduce seepage losses.
- The current landowner reports that historically an artesian well existed in this vicinity which was constructed in association with energy development activities. However, no evidence or record of the well could be located. Consequently a new well is recommended. Based upon a preliminary review of surrounding well depths, the anticipated depth would likely be 400 to 500 feet.
- Should artesian conditions not be encountered, a solar pump facility would be incorporated.
- A new well would be drilled and a 1,200 gallon stock tank would be installed.
- A buried 1 ½ inch HDPE low-pressure pipeline (approx. 1,400 feet) would be routed southwesterly from the well to an unnamed reservoir.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tank.

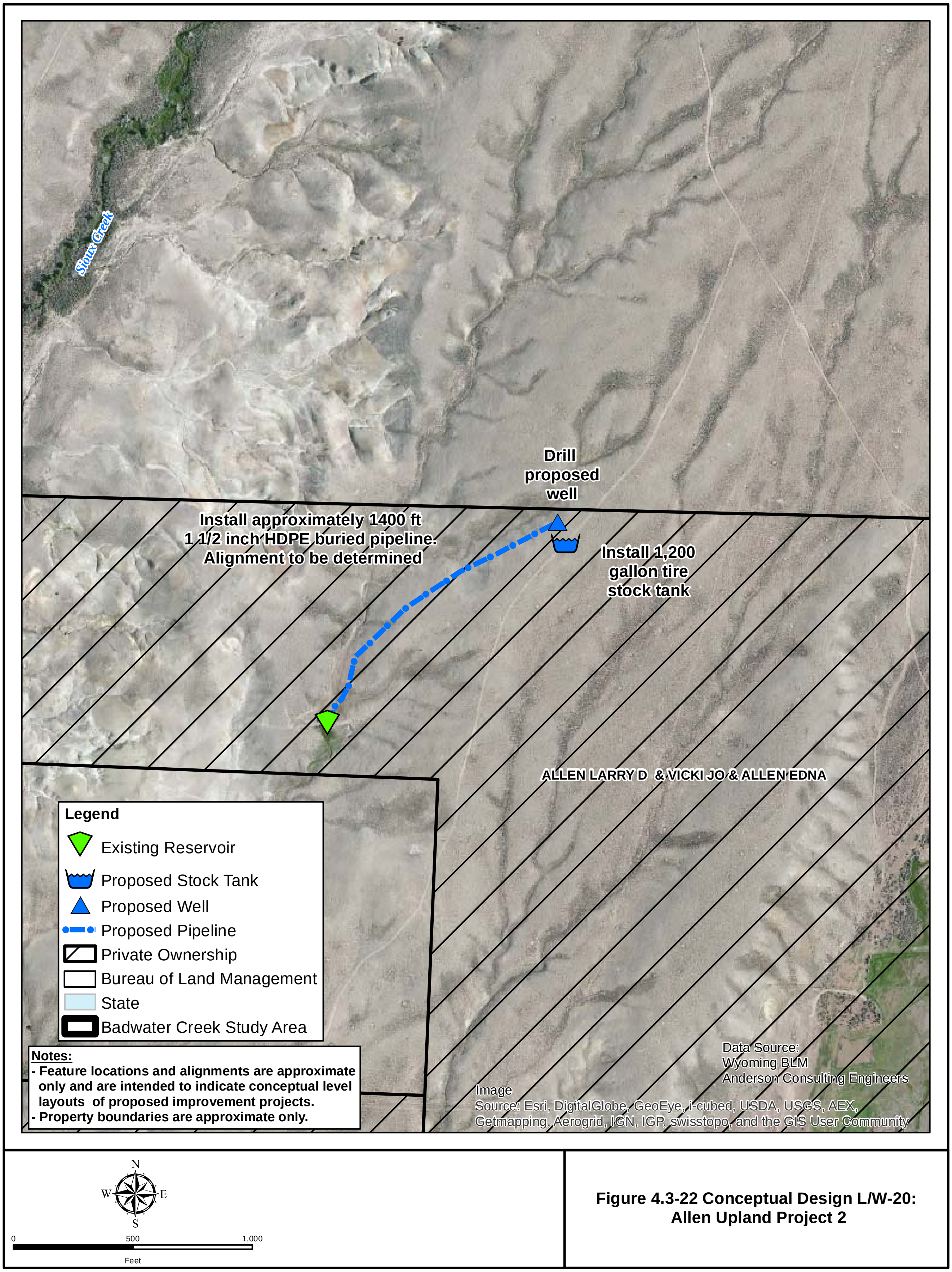


Figure 4.3-22 Conceptual Design L/W-20: Allen Upland Project 2

Note that the proposed project as delineated would involve only private lands.

4.3.2.21 L/W-21: Allen Upland Project 3

This project involves drilling a new well located in the Sioux Creek subwatershed (Section 4, Township 39N, Range 89W). The new well would be located on deeded property. Figure 4.3-23 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- A new well would be drilled to a depth of 400 to 500 feet based upon depths of existing wells in the surrounding area.
- A buried 1 ½ inch HDPE low-pressure pipeline (approx. 200 feet) would be routed southwesterly from the well to an unnamed reservoir.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tank.

Note that the proposed project as delineated would involve only deeded lands.

4.3.2.22 L/W-22: Thoren Upland Project 1

This project involves the rehabilitation of an existing reservoir located on the Quien Sabe Ranch property (Section 34, Township 40N, Range 93W). The reservoir is currently used for livestock and wildlife water supply as well as a source of irrigation water for an irrigated pasture downstream. The existing outlet infrastructure is in disrepair and replacement is recommended. Prior to initiation of work at this site, an in-depth investigation of the embankment and its materials is necessary, this effort was beyond the scope and budget of the current Level I investigation. Figure 4.3-24 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- A detailed investigation of existing conditions would be completed to confirm the assumptions regarding competency of the embankment
- Assuming the existing embankment is competent, an Agri-Drain outlet facility (or similar installation) would be installed to provide more efficient control of water releases from the reservoir. Installation would require penetration of the existing embankment in order to install the outlet.

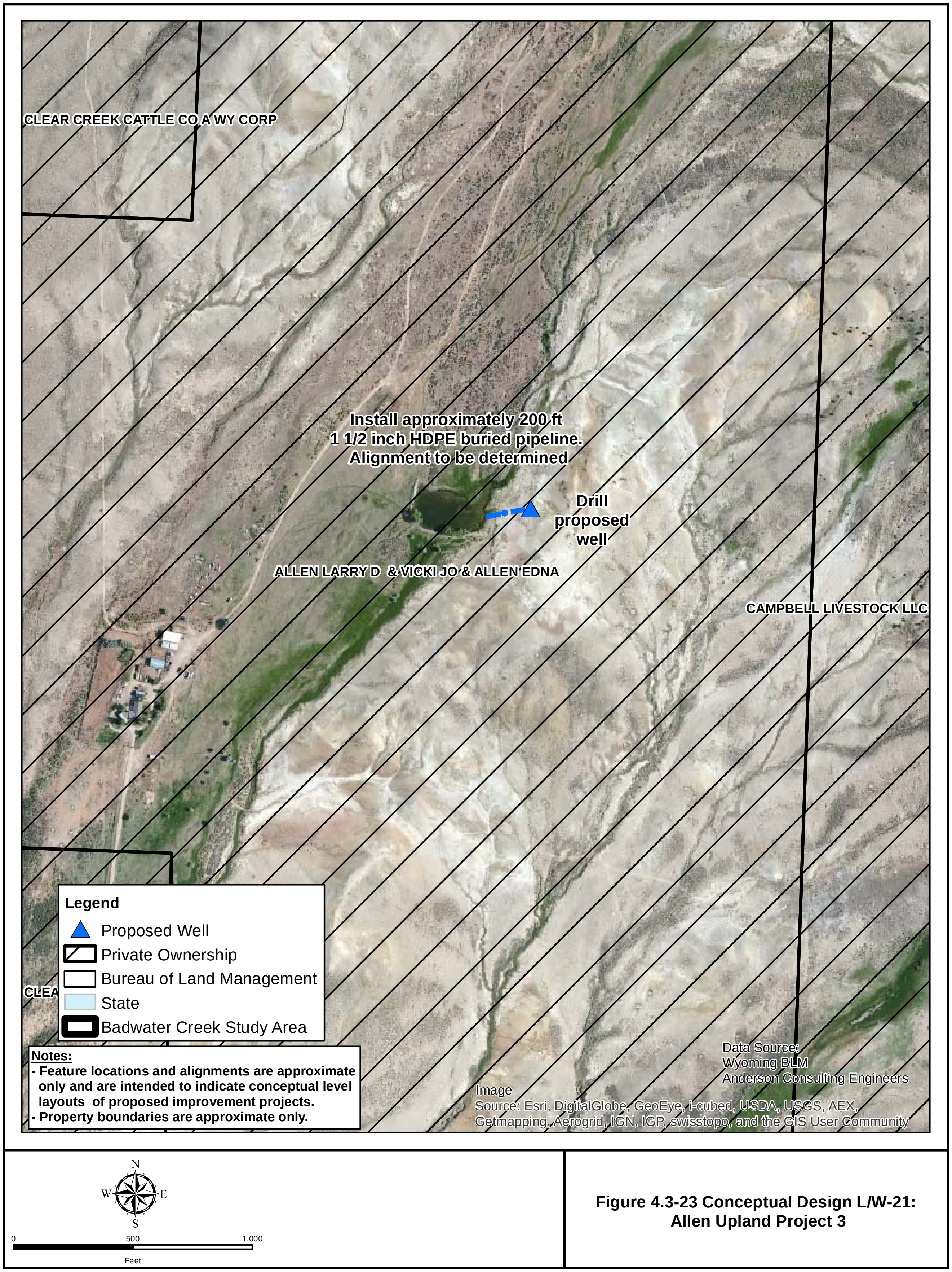


Figure 4.3-23 Conceptual Design L/W-21: Allen Upland Project 3

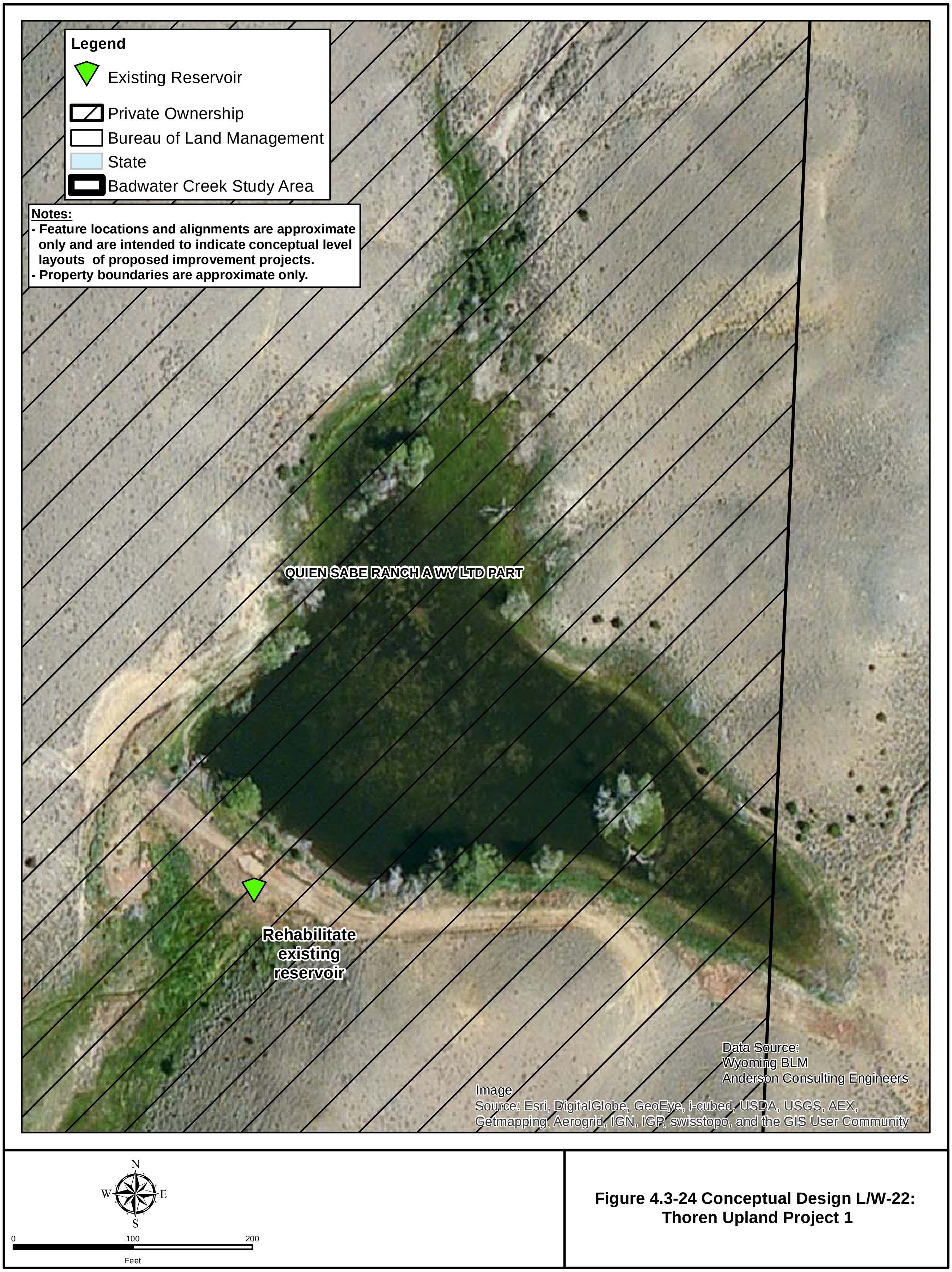


Figure 4.3-24 Conceptual Design L/W-22: Thoren Upland Project 1

4.3.2.23 L/W-23: Thoren Upland Project 2

This alternative would involve the installation of a pipeline (approx. 400 feet) running from an existing reservoir to a 1,200 gallon stock tank located down slope. The project is located in the Hoodoo Creek subwatershed, and entirely on deeded property (Section 22, Township 40N, Range 93W). This project would provide a source of water which would be an alternative to riparian sources. Figure 4.3-25 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- An Agri-Drain reservoir outlet (or similar product) would be installed to facilitate control of the reservoir levels and releases.
- A buried 1 ½ inch HDPE low-pressure pipeline (approx. 400 feet) would be routed southwesterly from an existing unnamed reservoir to a 1,200 gallon stock tank.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tank.

Note that the proposed project as delineated would involve only private lands.

4.3.2.24 L/W-24: Thoren Upland Project 3

This alternative would involve the development of an existing spring in the Hoodoo Creek subwatershed and is located entirely on deeded property. This project would provide a source of water which would be an alternative to riparian sources. Figure 4.3-26 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- An existing spring would be developed in Section 22, Township 40N, Range 93W. A valve would be included for management of pipeline flows.
- The spring vicinity would be fenced to prevent spring development damage from livestock and wildlife.
- A buried 1 ½ inch HDPE low-pressure pipeline (approx. 300 feet) would be routed southeasterly from the spring development to a 1,200 gallon stock tank.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tanks.

Note that the proposed project as delineated would involve only privately owned lands for pipeline alignment and stock tank placement.

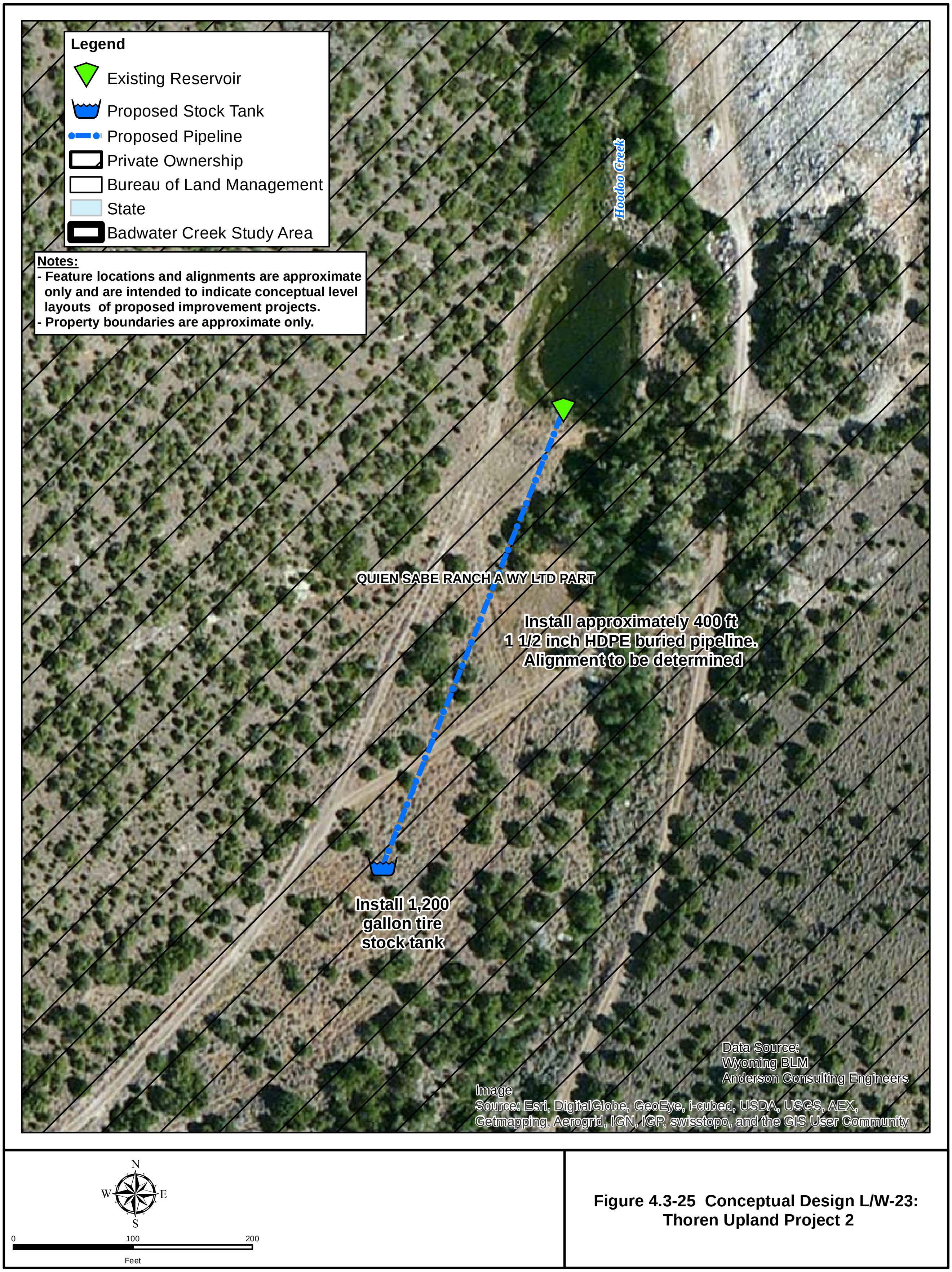


Figure 4.3-25 Conceptual Design L/W-23: Thoren Upland Project 2

Figure 4.3-26 Conceptual Design L/W-24: Thoren Upland Water Supply Project 3

4.3.2.25 L/W-25: Thoren Upland Project 4

This alternative would involve the modification of existing facilities associated with an existing well located in the Hoodoo Creek subwatershed (Section 27, Township 40N, Range 93W). The well would be equipped with a solar pump, pipeline (4,600 ft), and a 1,200 gallon stock tank. This project would provide a reliable source of water which would be an alternative to riparian sources. Figure 4.3-27 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- The existing well would be equipped with a solar platform consisting of solar panels, solar powered pump, batters, and all requisite regulators, connections and housings.
- Approximately 4,600 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be routed southwesterly to a 1,200 gallon stock tank.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tank.

Note that the project as delineated would involve only federally owned (BLM) lands.

4.3.2.26 L/W-26: Thoren Upland Project 5

Currently the existing embankment appears to be failing: slope failure was noted on the downstream face. Prior to initiation of work at this site, an in-depth investigation of the embankment and its materials is necessary. This effort was beyond the scope and budget of the current Level I investigation. Figure 4.3-28 displays the location of the proposed project.

Based upon preliminary observations, the following project components would likely be recommended:

- The existing embankment could be buttressed on the downslope face with suitable materials (a local source would be required as haulage from offsite would likely be cost prohibitive).
- The upstream face of the embankment should be protected against erosion from wind generated waves with riprap or Geotextile fabric.
- An outlet facility consisting of an Agri-Drain outlet, or similar product, should be installed to control water levels and reservoir releases. This effort will require trenching the embankment in order to properly install the drain.
- The emergency spillway located on the eastern end of the embankment should be reinforced with rock riprap.

Note that the proposed project as delineated would involve only private lands.

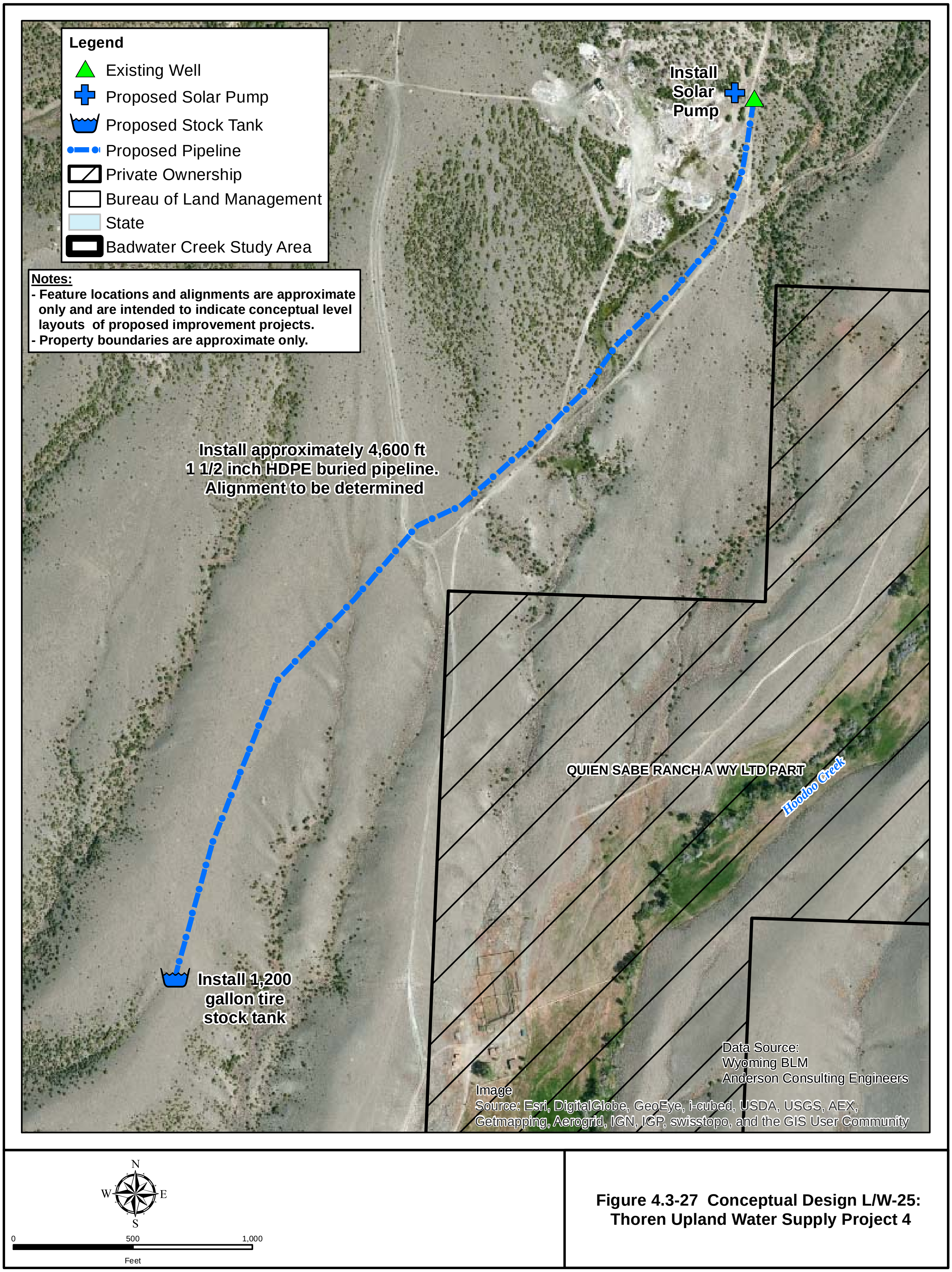


Figure 4.3-27 Conceptual Design L/W-25: Thoren Upland Water Supply Project 4

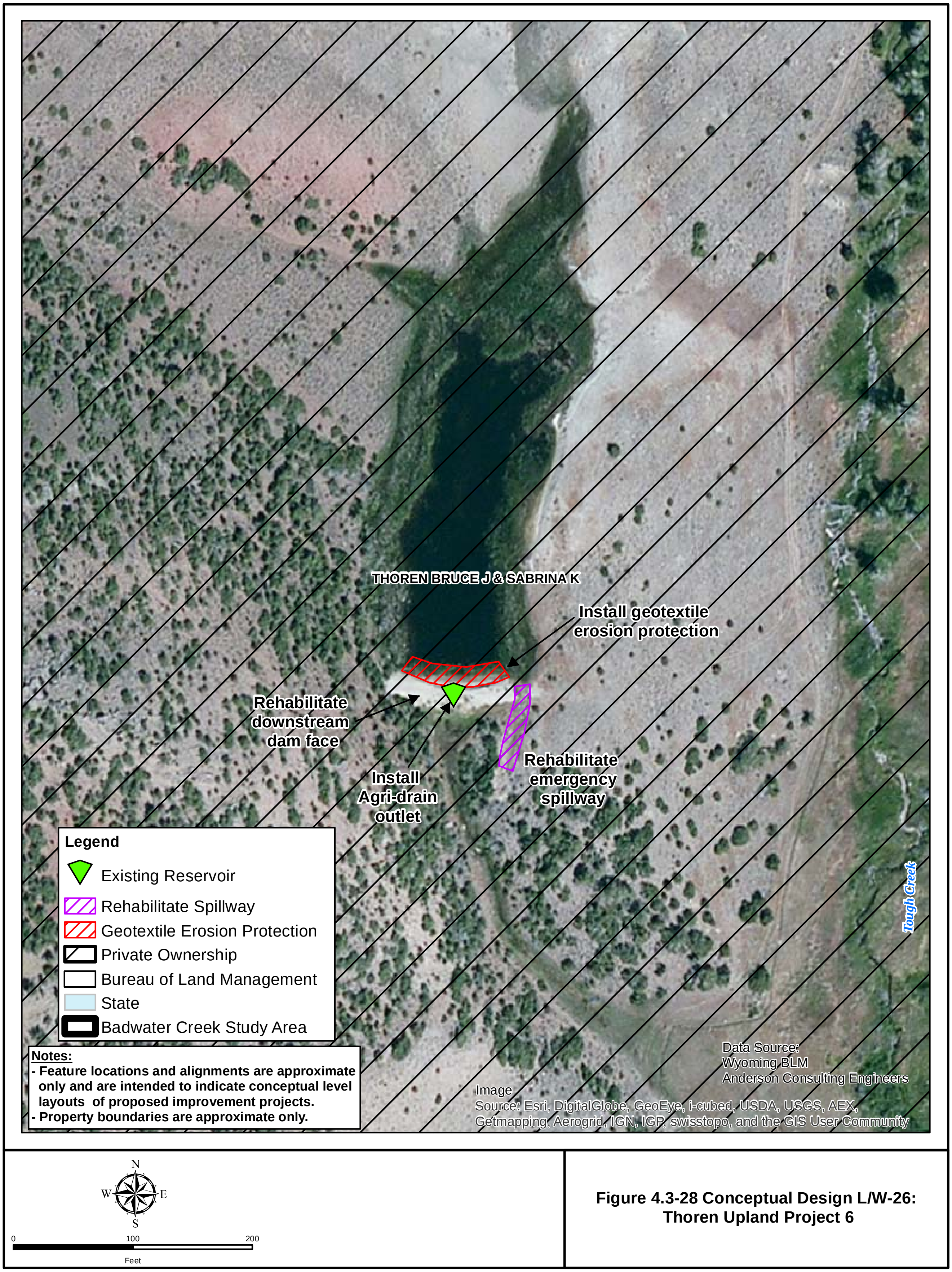


Figure 4.3-28 Conceptual Design L/W-26: Thoren Upland Project 6

4.3.2.27 L/W-27: Bloomquist/McCoy Upland Project 1

This project would involve the development of an existing spring in the West Bridger Creek subwatershed (Section 13, Township 41N, Range 91W). The alternative would supply water to a portion of the watershed lacking adequate alternative livestock and wildlife upland water sources. Figure 4.3-29 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- An existing spring would be developed and a valve would be included for management of pipeline flows.
- The spring vicinity would be fenced to prevent spring development damage from livestock and wildlife.
- The spring development would be equipped with a solar platform consisting of solar panels, solar powered pump, batteries, and all requisite regulators, connections and housings.
- From the spring, water would be pumped north and upslope to a 1,200 gallon stock tank.
- Approximately 900 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be required.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tanks.

Note that the proposed project as delineated would involve only privately owned land for pipeline alignment and stock tank placement.

4.3.2.28 L/W-28: Bloomquist/McCoy Upland Project 2

This alternative involves the development of an existing spring in the West Bridger Creek subwatershed (Section 23, Township 41N, Range 91W). This project would provide a source of water which would be an alternative to riparian sources and is located entirely on private lands. Figure 4.3-30 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- An existing spring would be developed and a valve would be included for management of pipeline flows.
- The spring vicinity would be fenced to prevent spring development damage from livestock and wildlife.
- A buried 1 ½ inch HDPE low-pressure pipeline (approx. 300 feet) would be routed southwesterly from the spring development to a 1,200 gallon stock tank located away from the riparian area.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tanks.

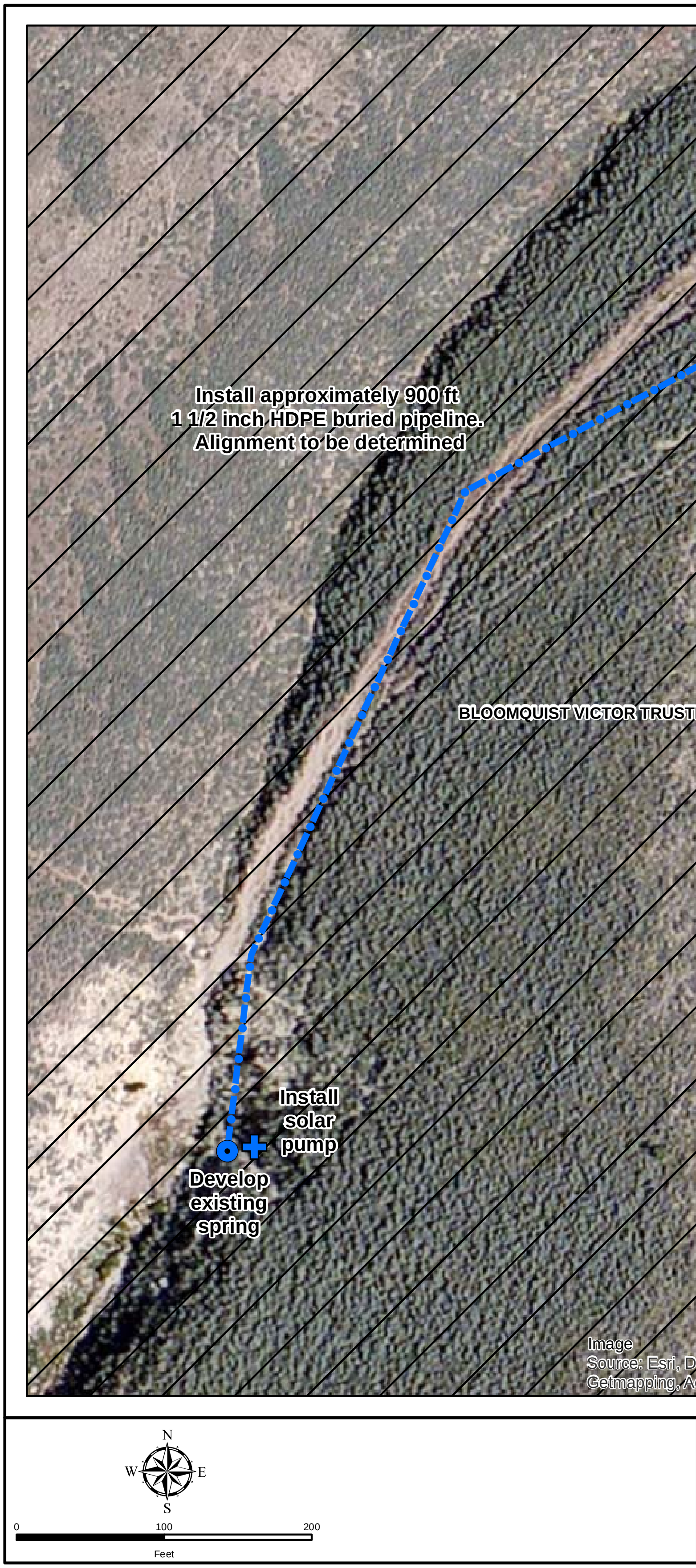


Figure 4.3-29 Conceptual Design L/W-27: Bloomquist/McCoy Upland Project 1

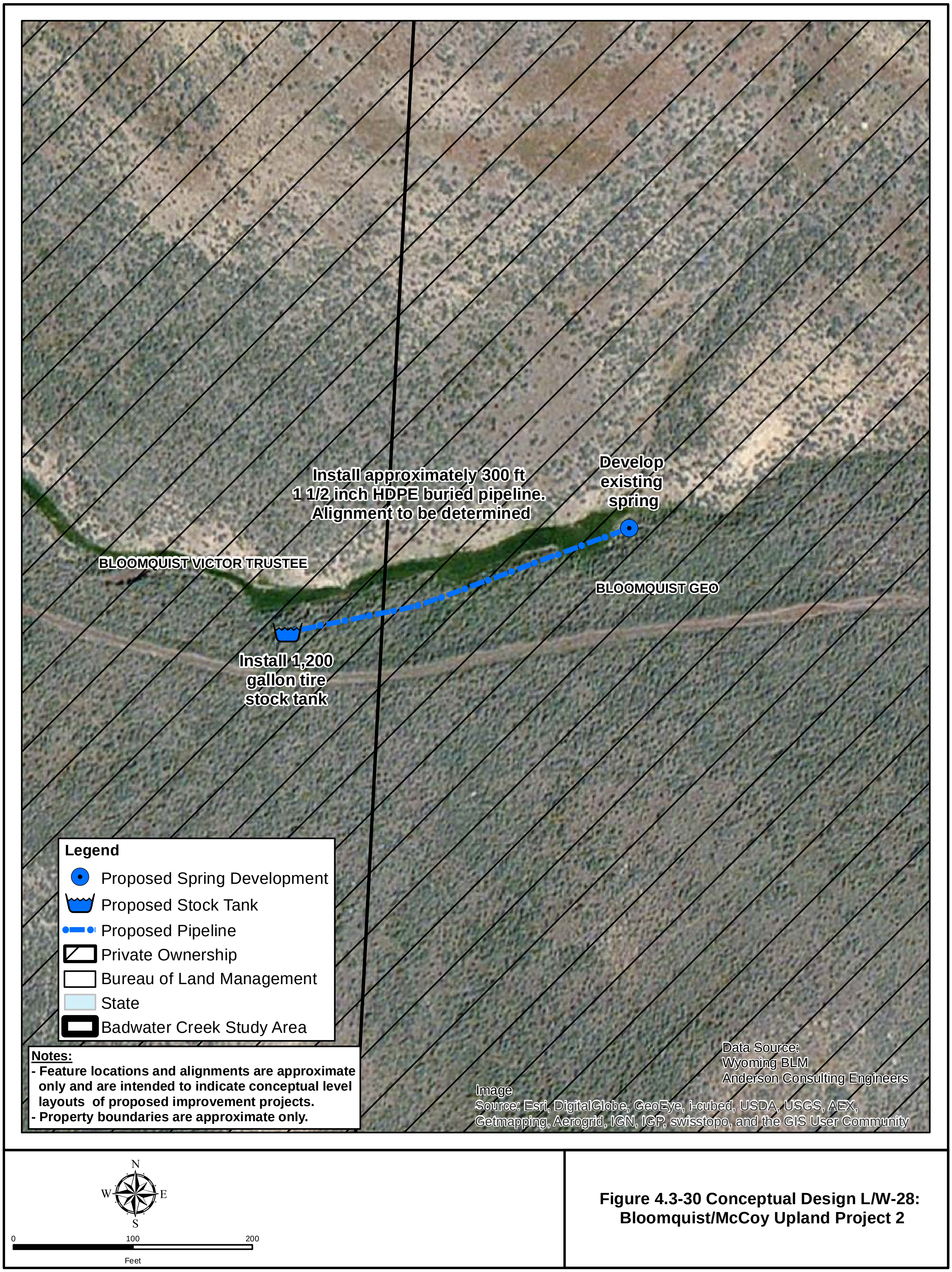


Figure 4.3-30 Conceptual Design L/W-28: Bloomquist/McCoy Upland Project 2

Note that the proposed project as delineated would involve only privately owned land for pipeline alignment and stock tank placement.

4.3.2.29 L/W-29: Bloomquist/McCoy Upland Project 3

This project would involve the development of an existing spring in the Bridger Creek-West Bridger Creek subwatershed (Section 22, Township 41N, Range 91W). The alternative would supply water to a portion of the watershed lacking adequate alternative livestock and wildlife upland water sources. Figure 4.3-31 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- An existing spring would be developed and a valve would be included for management of pipeline flows.
- The spring vicinity would be fenced to prevent spring development damage from livestock and wildlife.
- Approximately 1,500 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be routed northwesterly to a 1,200 gallon stock tank.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tanks.

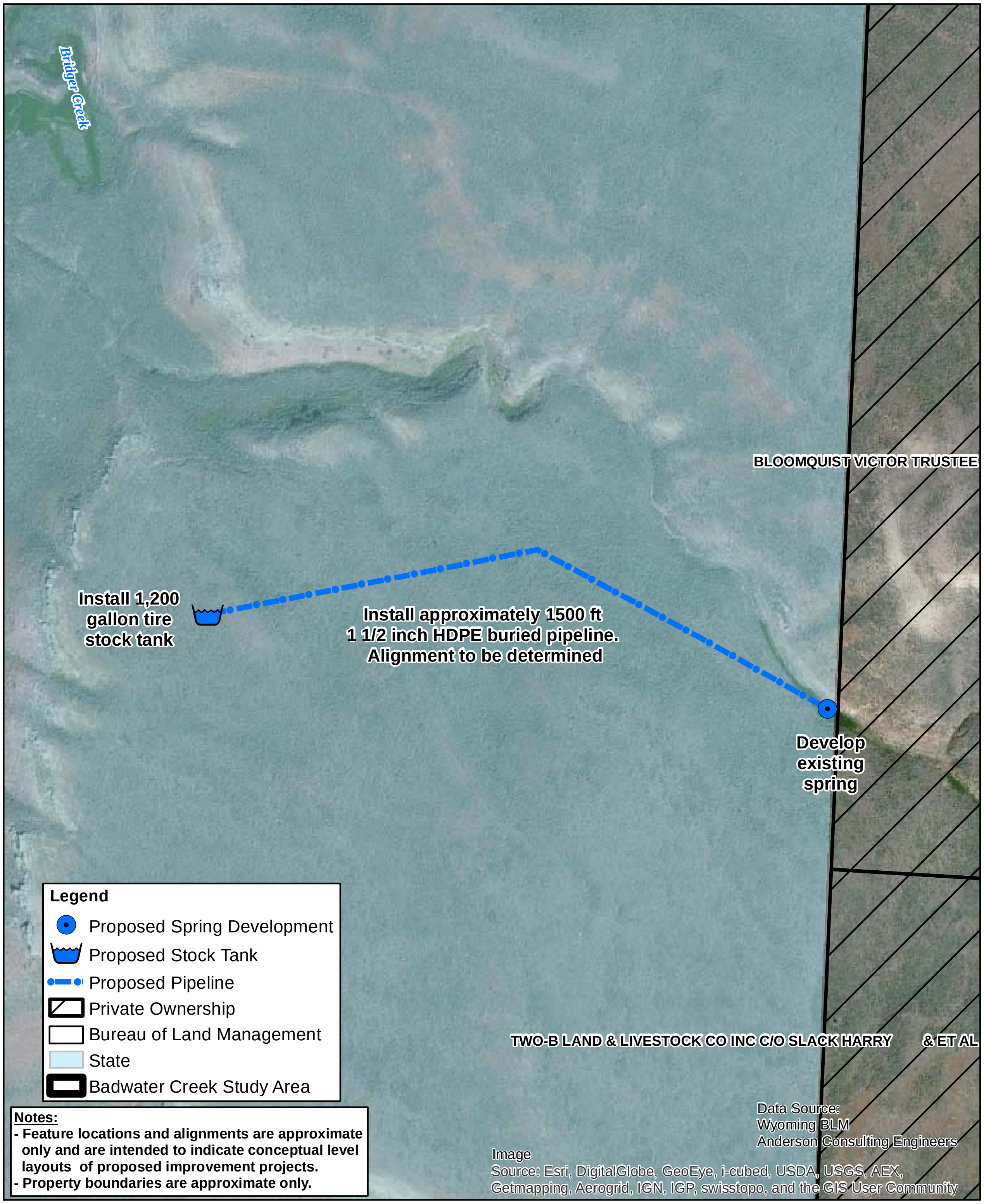
Note that the proposed project as delineated would only involve lands owned by the State of Wyoming.

4.3.2.30 L/W-30: Hendry Upland Project 1

This alternative would involve the development of an existing spring, placement of a storage tank, routing of approximately 21,000 linear feet of pipeline, and the installation of 6 stock tanks. The project would originate near the Shelly Seeps on deeded property (Section 29, Township 40N, Range 89W). The pipeline would run south crossing approximately 1.5 miles of federally owned land (BLM) and terminate on deeded land (Section 7, Township 39N, Range 89W). The 5 stock tanks would be dispersed over the entire length of the pipeline. This alternative would supply water to a portion of the watershed lacking adequate alternative livestock and wildlife upland water sources. Figure 4.3-32 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- An existing spring would be developed and a valve would be included for management of pipeline flows.
- The spring vicinity would be fenced to prevent spring development damage from livestock and wildlife.
- A 10,000 gallon storage tank would be installed adjacent to the developed spring.



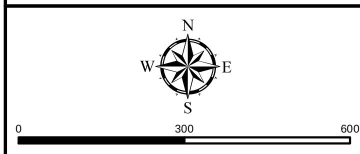


Figure 4.3-31 Conceptual Design L/W-29: Bloomquist/McCoy Upland Project 3

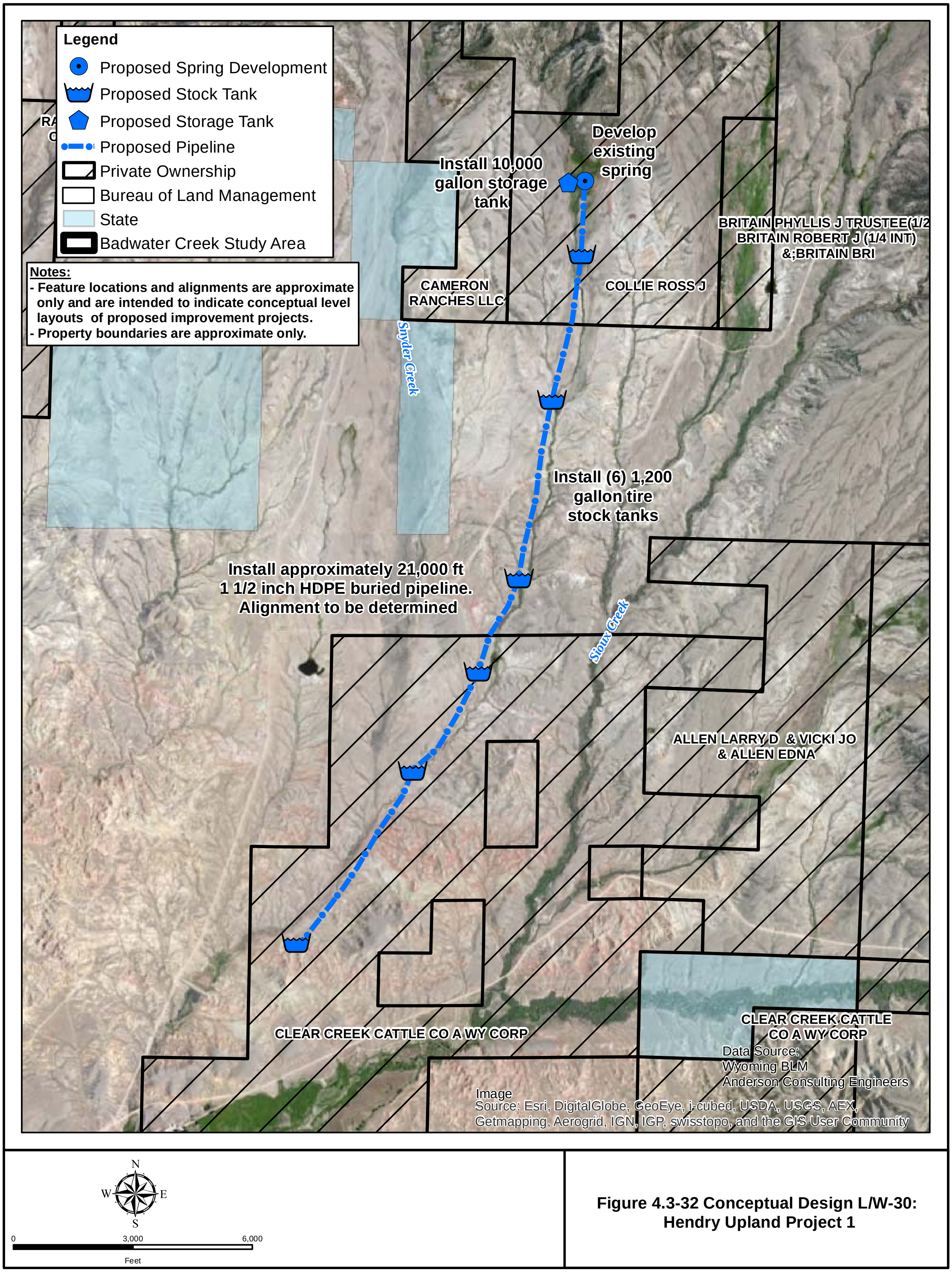


Figure 4.3-32 Conceptual Design L/W-30: Hendry Upland Project 1

- Approximately 21,000 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be routed south to six 1,200 gallon stock tanks.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tanks.

Note that the proposed project as delineated would involve privately and federally owned lands (BLM). Because this project would involve multiple private owners, coordination and agreements pertaining to operation, costs and maintenance would be necessary.

4.3.2.31 L/W-31: Campbell Upland Project 1

This project would involve development of an existing spring and routing of a pipeline to an existing stock tank. The project is located on deeded lands in the Clear Creek subwatershed (Section 2, Township 39N, Range 89W). This alternative would supply water to a portion of the watershed lacking adequate alternative livestock and wildlife upland water sources. Figure 4.3-33 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- An existing spring would be developed and a valve would be included for management of pipeline flows.
- Approximately 900 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be routed south to an existing stock tank.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the existing stock tank.
- The spring vicinity would be fenced to prevent spring development damage from livestock and wildlife.

Note that the proposed project as delineated would only involve privately owned lands.

4.3.2.32 L/W-32: Campbell Upland Project 2

This project would involve the development of an existing spring in the Badwater Creek-Sioux Creek subwatershed (Section 26, Township 40N, Range 89W). This alternative would supply water to a portion of the watershed lacking adequate alternative livestock and wildlife upland water sources. Figure 4.3-34 displays the conceptual design of the project.

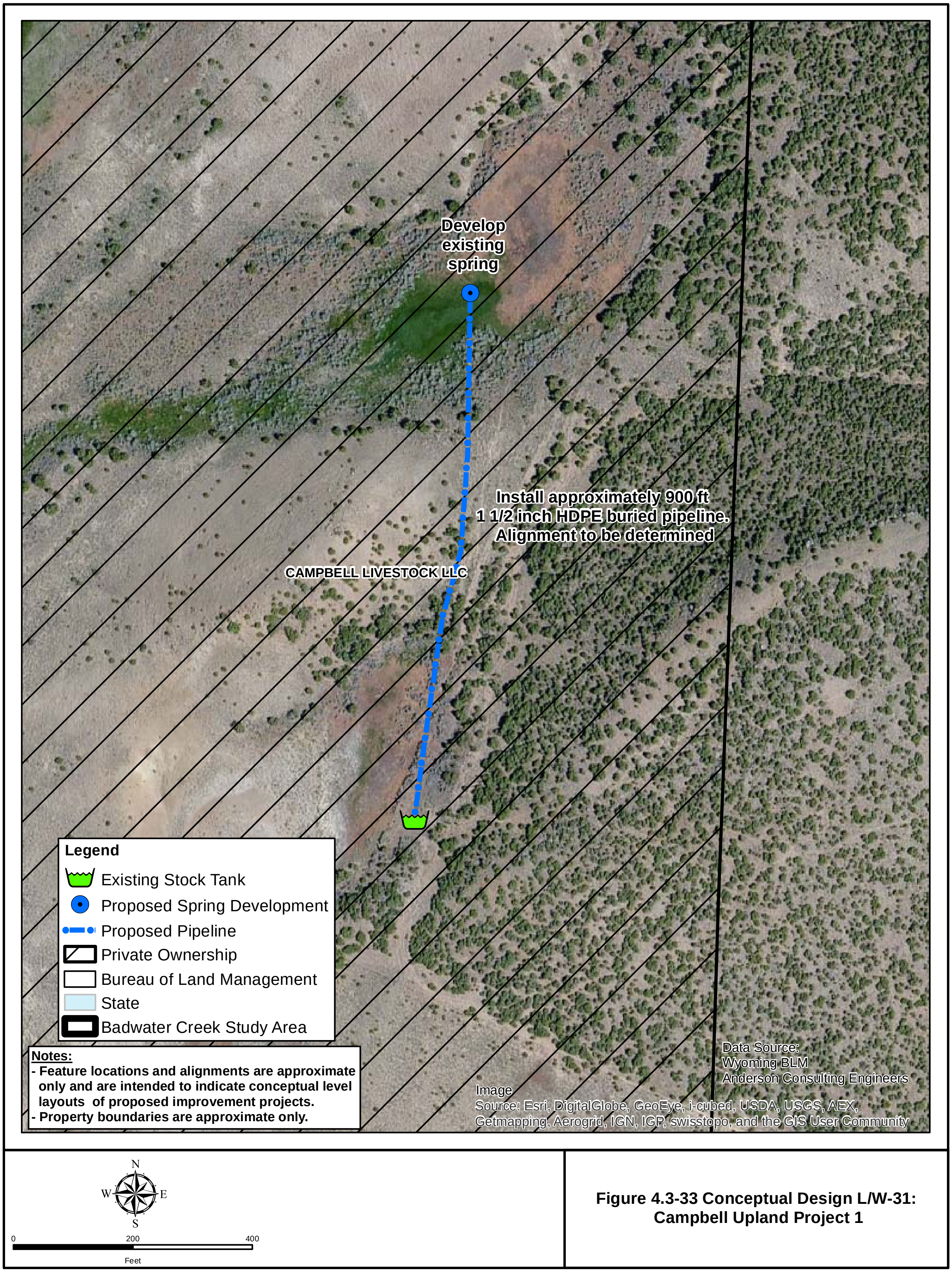


Figure 4.3-33 Conceptual Design L/W-31: Campbell Upland Project 1

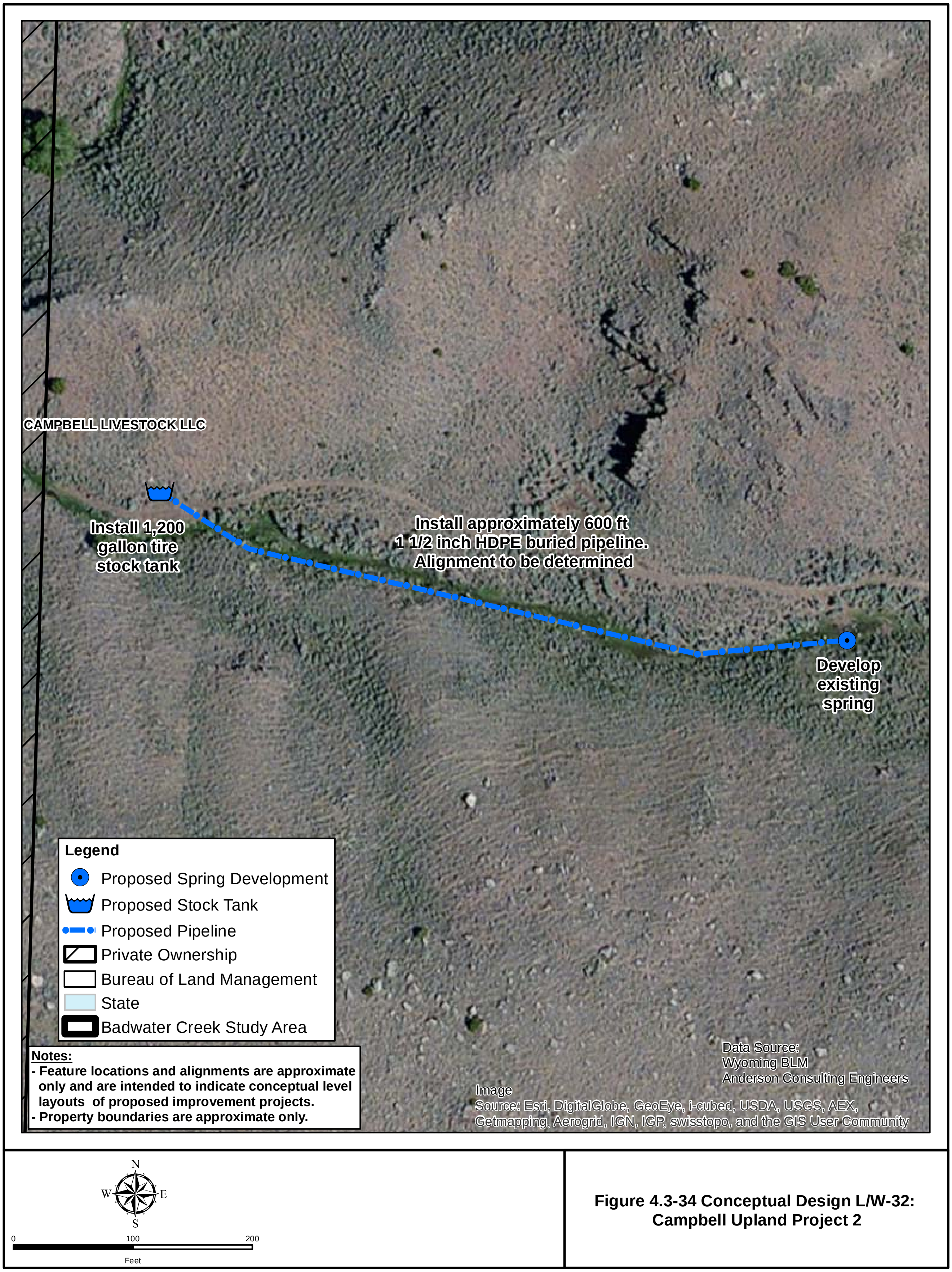


Figure 4.3-34 Conceptual Design L/W-32: Campbell Upland Project 2

Under this alternative, the following components would be employed:

- An existing spring would be developed and a valve would be included for management of pipeline flows.
- Approximately 600 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be routed west to a 1,200 gallon stock tank.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tank.
- The spring vicinity would be fenced to prevent spring development damage from livestock and wildlife.

Note that the proposed project as delineated would only involve federally owned (BLM) lands.

4.3.2.33 L/W-33: Campbell Upland Project 3

This alternative would involve the development of an existing spring located on Campbell Livestock property (Section 11, Township 39N, Range 89W). A pipeline would be installed that runs northwest to a stock tank on the Campbell Livestock property. A second pipeline would be installed that runs southwest to a stock tank located on Clear Creek Cattle property. This alternative would supply water to a portion of the watershed lacking adequate alternative livestock and wildlife upland water sources. Figure 4.3-35 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- An existing spring would be developed and a valve would be included for management of pipeline flows.
- The spring vicinity would be fenced to prevent spring development damage from livestock and wildlife.
- A total of approximately 400 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be routed to two 1,200 gallon stock tanks, one located to the northwest of the spring, the other located to the southwest.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tanks.

Note that the proposed project as delineated would only involve privately owned lands. Because this project would involve multiple private owners, coordination and agreements pertaining to operation, costs and maintenance would be necessary.

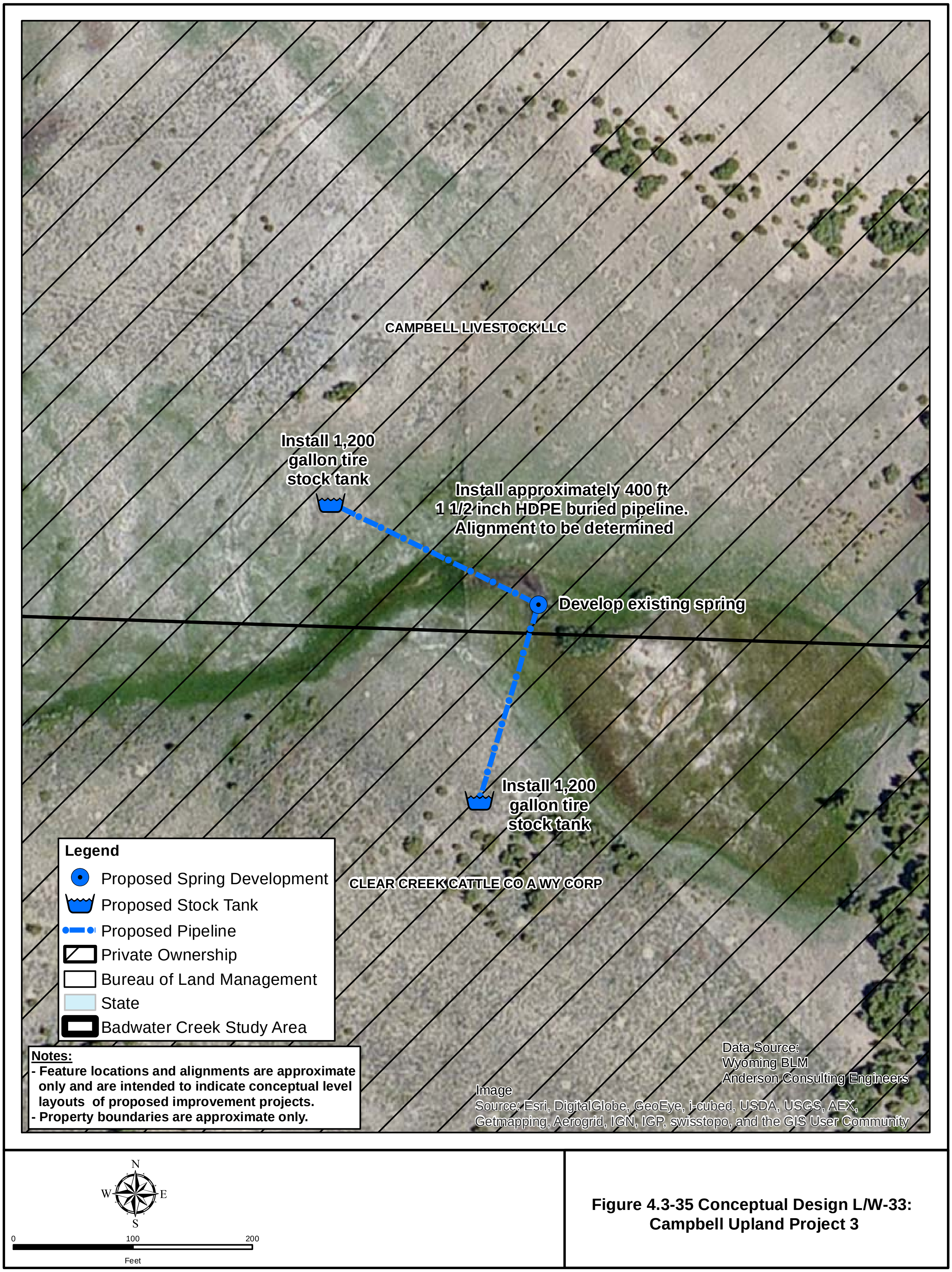


Figure 4.3-35 Conceptual Design L/W-33: Campbell Upland Project 3

4.3.2.34 L/W-34: Bloomquist/McCoy Upland Project 4

This alternative would involve the development of an existing spring in the Meadow Creek subwatershed (Section 17, Township 41N, Range 90W). The spring development would provide a source of water which would be an alternative to riparian sources as well as providing a reliable source of livestock/wildlife water to an area where existing sources are sparse. Figure 4.3-36 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- An existing spring would be developed and a valve would be included for management of pipeline flows.
- The spring vicinity would be fenced to prevent the spring development damage from livestock and wildlife.
- Approximately 2,800 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be routed south to a 1,200 gallon stock tank.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tank.

Note that the proposed project as delineated would involve only privately owned lands.

4.3.2.35 L/W-35: Pingetzer Project 1

This alternative would involve the modification of existing facilities associated with an existing well located in the Poison Creek subwatershed (Section 34, Township 38N, Range 93W). Currently, a pipeline from the well extends westerly approximately ½ mile and terminates at a stock thank. This alternative would involve extending the pipeline westward and replacing the existing pipeline with a line buried below the frost line. This project would provide a reliable source of water which would be an alternative to riparian sources. Figure 4.3-37 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- The existing well would be equipped with a solar platform consisting of solar panels, solar powered pump, batters, and all requisite regulators, connections and housings.
- Approximately 6,300 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be routed westerly to two 1,200 gallon stock tanks. The line would be buried below the frost line.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tank.

Note that the project as delineated would involve only privately owned lands.

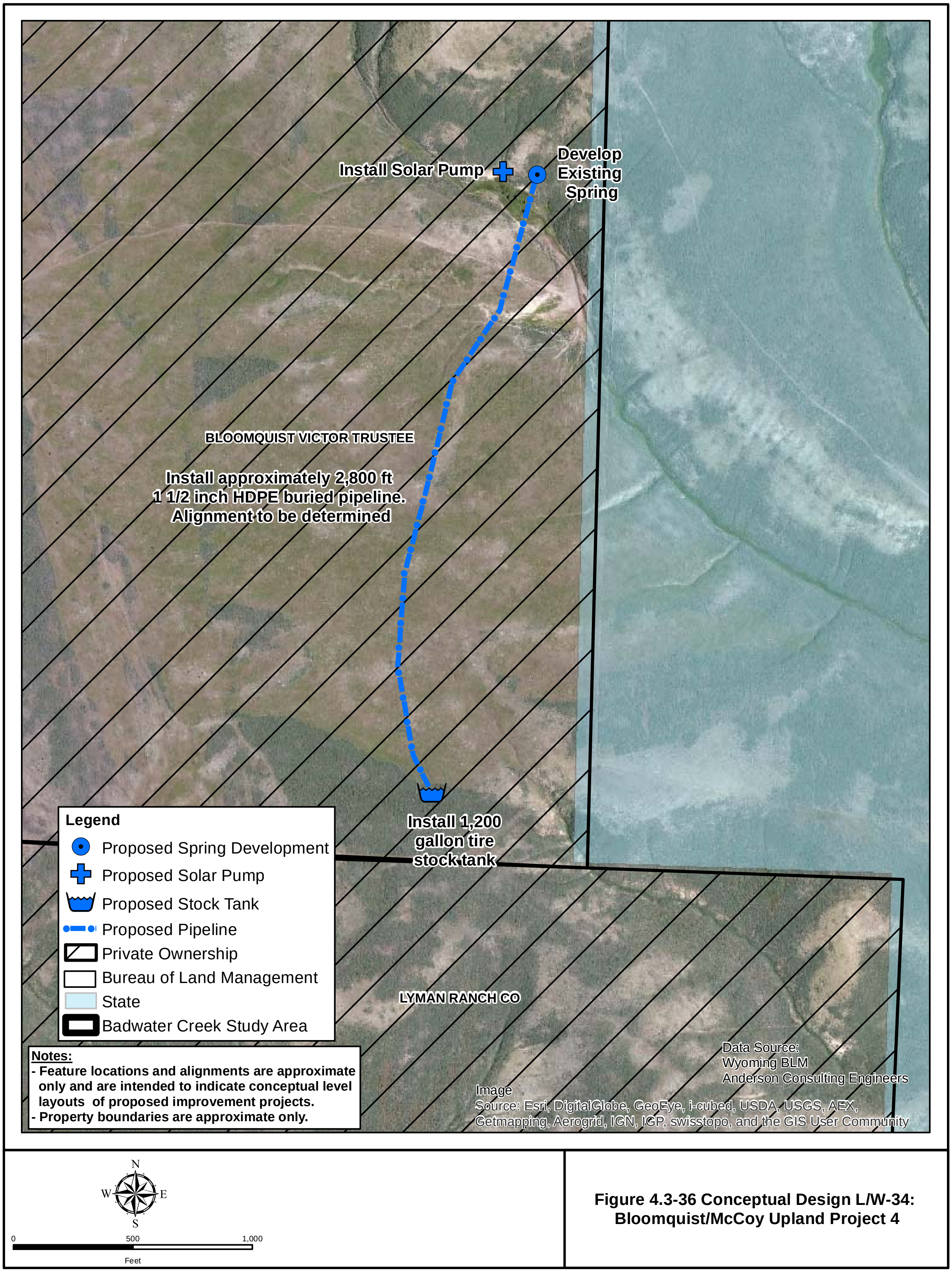


Figure 4.3-36 Conceptual Design L/W-34: Bloomquist/McCoy Upland Project 4

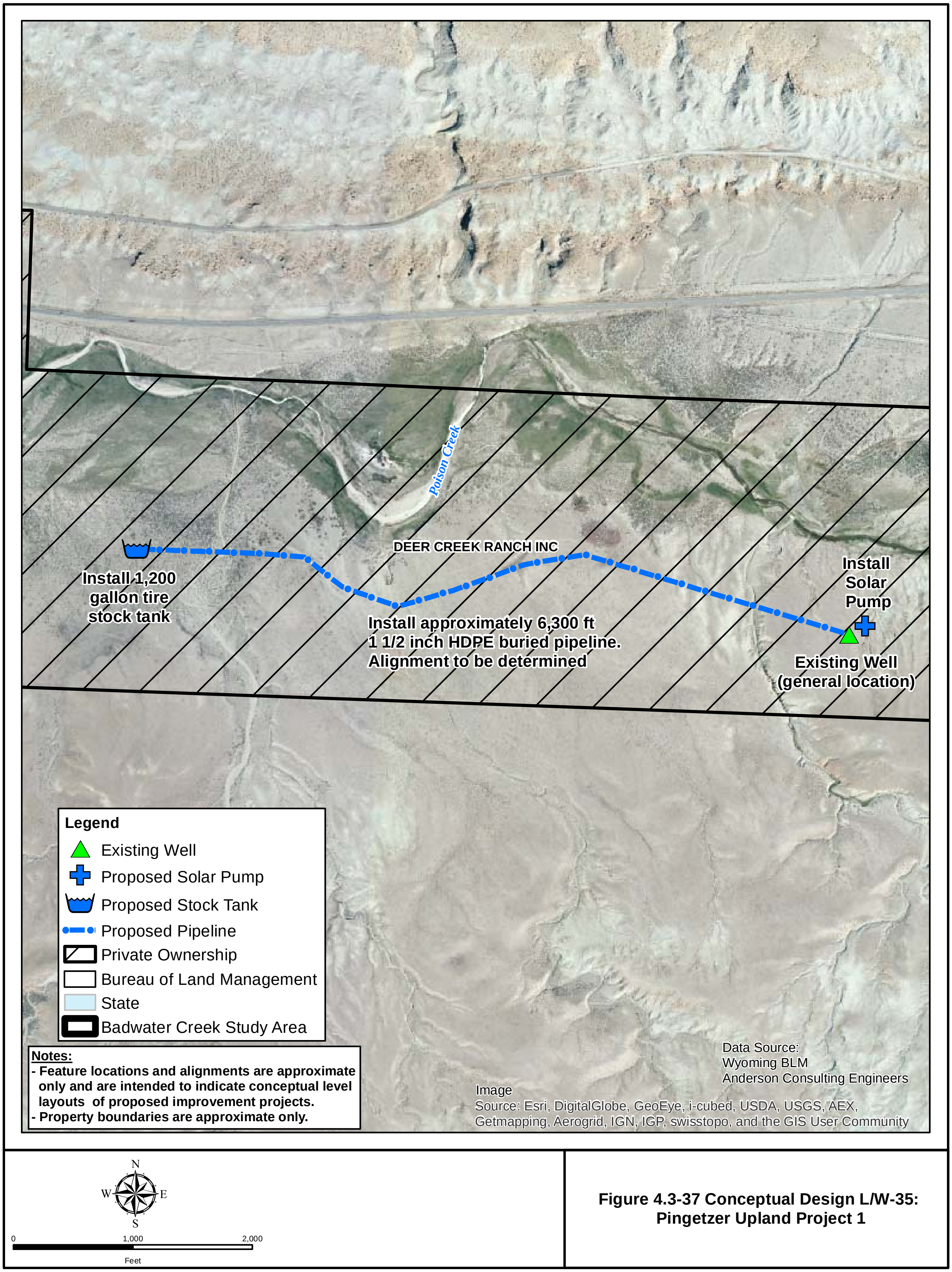


Figure 4.3-37 Conceptual Design L/W-35: Pingetzer Upland Project 1

4.3.2.36 L/W-36: Pingetzer Project 2

This alternative would involve the modification of existing facilities associated with an existing well located in the Poison Creek subwatershed (Section 16, Township 37N, Range 93W). The well was drilled circa 2005 to a depth of 575 feet below the ground surface. At this time, the well has not yet been utilized; consequently completion of this project would provide a reliable source of water to an area where water sources are limited. Figure 4.3-38 displays the conceptual design of the project.

Under this alternative, the following components would be employed:

- The existing well would be equipped with a solar platform consisting of solar panels, solar powered pump, batters, and all requisite regulators, connections and housings.
- Approximately 5,300 linear feet of buried 1 ½ inch HDPE low-pressure pipeline would be routed westerly to one 1,200 gallon stock tank. The line would be buried below the frost line.
- Requisite valves and fittings would be incorporated to facilitate management of flows and water levels.
- Wildlife egress ramps would be installed in the proposed stock tank.

The well was constructed on lands owned by the State of Wyoming. The pipeline and stock tank project as delineated would involve only federally owned (BLM) lands.

4.3.2.37 Additional Upland Management Opportunities

Guzzlers are artificial catchments providing sources of water in remote areas for wildlife. Larger systems could be employed for livestock watering purposes. They rely entirely upon direct precipitation; therefore, their reliability is only as good as can be expected in a water short region. Figure 4.3-39 displays a photo of a guzzler installed in the Cottonwood Creek watershed near Thermopolis, Wyoming. The option of installing a guzzler type water collection system with watering facilities may be considered in areas where wildlife water is needed, and alternative options are not available.

Figure 4.2-39 Wildlife Guzzler.

Guzzler watering systems utilize direct precipitation as a source of supply, with a storage tank of capacity suitable to the watering need. Wildlife guzzlers are typically designed to maximize use by wildlife and discourage use by livestock. A complete guzzler system is comprised of the following components:

- Catchment apron – typically made of textured HDPE; secured with rocks placed on a suitable grid spacing, and protected by suitable fencing from trampling by wildlife or livestock,
- Catchment outlet - pipe boot, clamps and well screen section,

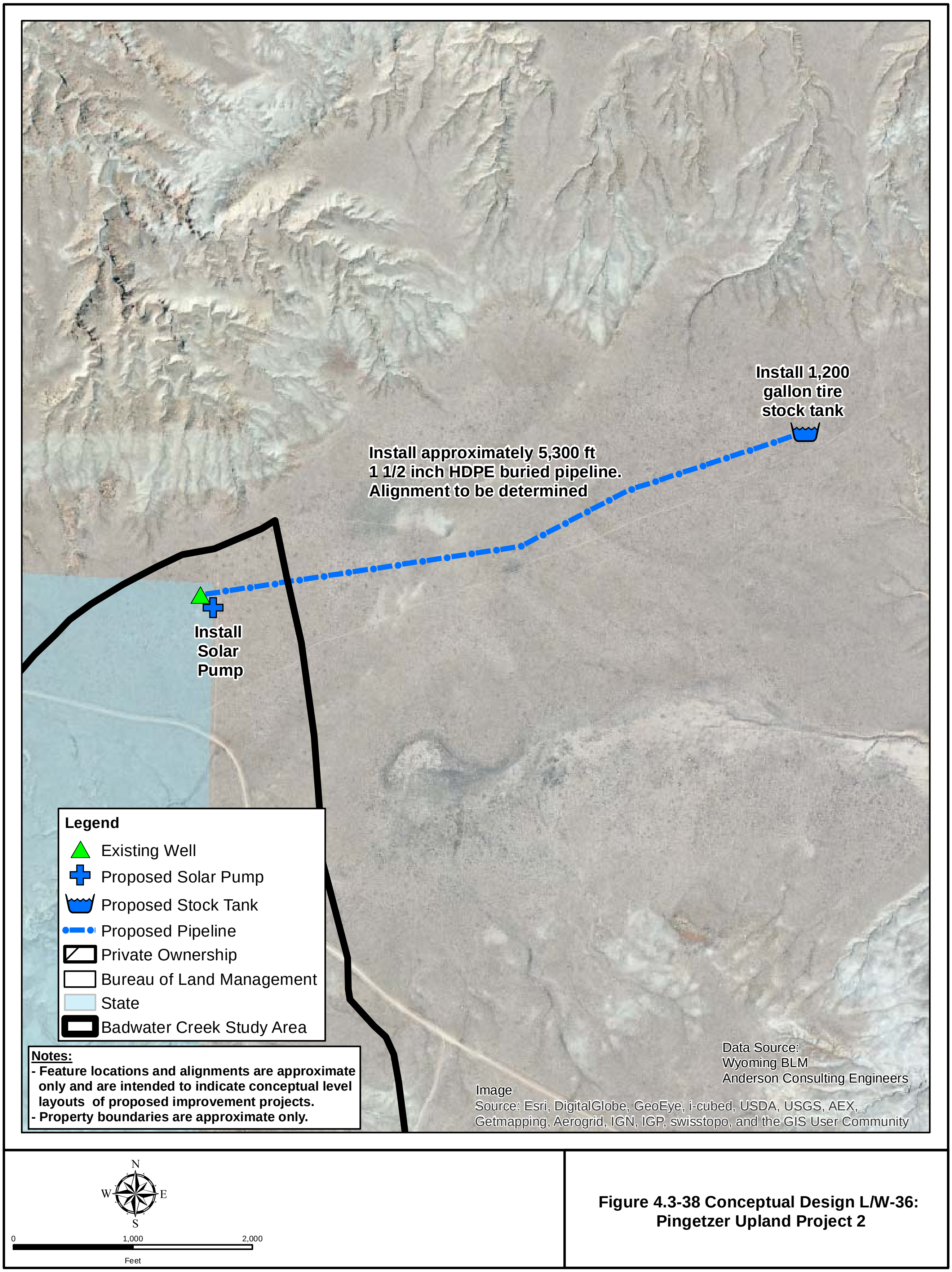


Figure 4.3-38 Conceptual Design L/W-36: Pingetzer Upland Project 2

- HDPE pipe – typically 1.5-2-inch, 160 psi, SDR 11,
- Catchment tank – HDPE tank sized to accommodate wildlife or livestock watering needs, with integral drinker (ideally with no float valve required), small animal escape ladder and overflow adapter, and
- Overflow pipe – with erosion protection at discharge.

These guzzlers would be installed at locations to be determined. The guzzler operates by intercepting direct rainfall or snowmelt on the catchment, routing the captured water via a pipe to the tank, and controlling the tank level via a simple overflow outlet pipe. Complete guzzler systems are commercially available.

4.4 Irrigation System Recommendations (Watershed Management Plan Component I)

As presented in Chapter 3, the irrigation system inventory effort associated with this project consisted of 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 inventoried. 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, those potential projects involving those structures would 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
- Economic practicality
- Physical feasibility

The plan is intended to provide the ditch owners an assessment of conditions associated with the ditch and its associated hydraulic structures. The ditch owner / manager can use the plan as a "resource or wish list" from which they can select projects for potential future funding assistance from sources such as the WWDC Small Water Project Program or NRCS EQIP.

4.4.1 Irrigation System Projects

Based upon the results of the field inventory, conceptual rehabilitation plans were developed for each structure. In an effort to assist the ditch owner and the LWRCD in prioritizing potential improvements to each ditch, relative priorities were defined as follows:

Priority 1: Install, replace, or rehabilitate aging infrastructure critical to the diversion and delivery of water.

Priority 2: Install, replace, or rehabilitate aging infrastructure critical to the operation, measurement, and management of the irrigation diversions.

Priority 3: Install, replace, or rehabilitate aging infrastructure to provide improvements in on-farm efficiency and conservation.

In the following paragraphs, the individual structures inventoried and assessed are discussed. Each irrigation system improvement was assigned a unique identifier which identifies it within the watershed management plan. Within the rehabilitation plan, each line item is given a subsequent item number. The structures inventoried and their respective component identifiers in the watershed management plan summarized in Table 4.4-1. The locations of these components of the Badwater Creek / Poison Creek Watershed Management Plan are indicated on Figure 4.4-1. This information has been incorporated within the Project GIS.

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

Watershed Plan Component: Irrigation Infrastructure Projects (I)				
Plan Component	**Ditch**	**Owner**	**Structure Type**	**Priority**
I-01	Dry Creek Ditch No. 2	Frank	Grade Control / Headgate	2
I-02	Woodruff Ditch	Frank	Grade Control / Sand Trap Wasteway / Siphon	2
I-03	Elsass Ditch	Philp	Grade Control	1
I-04	Moore Ditch	Philp	Grade COntrol	1

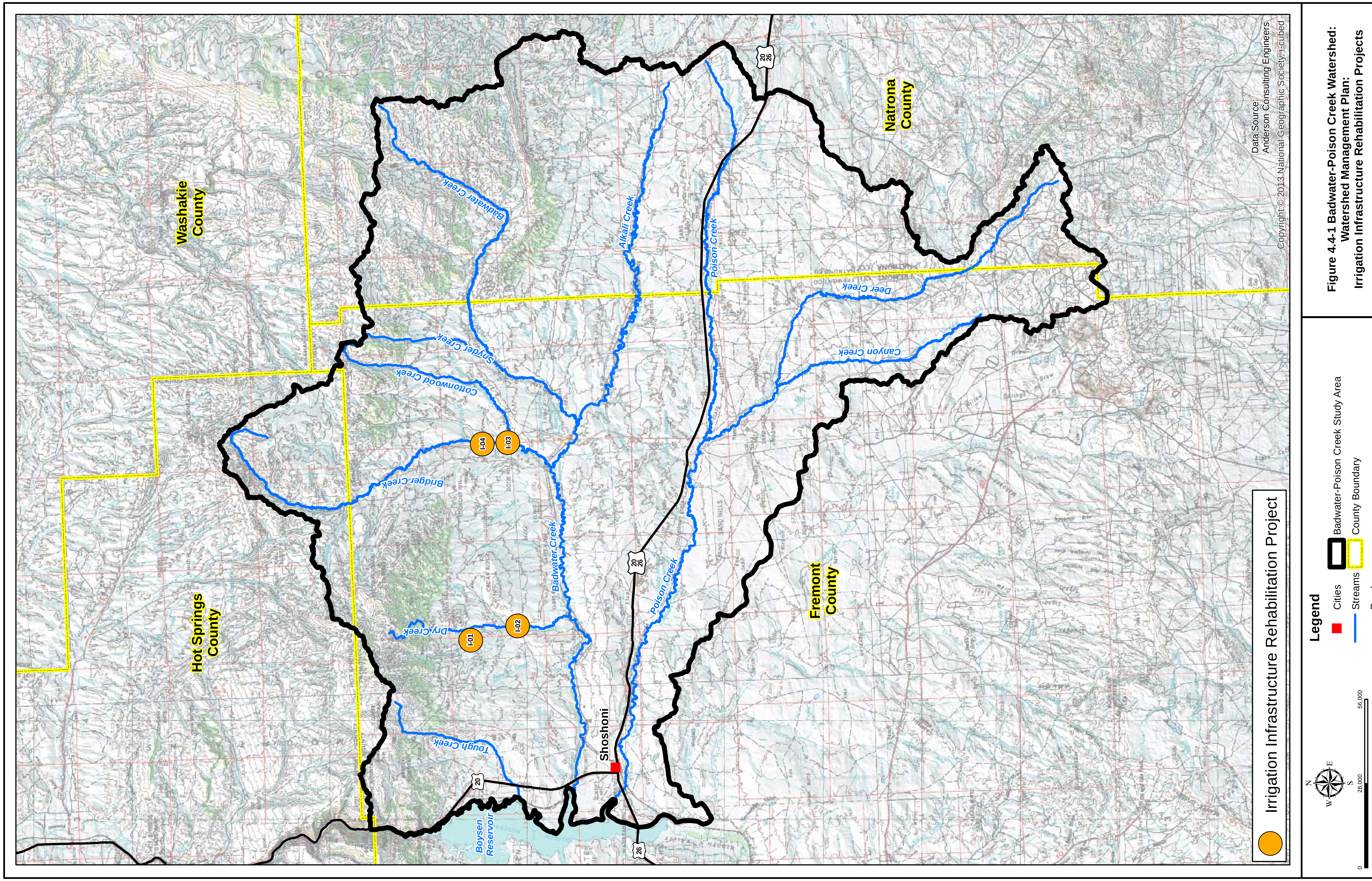


Figure 4.4-1 Badwater-Poison Creek Watershed: Watershed Management Plan: Irrigation Infrastructure Rehabilitation Projects

4.4.1.1 Item I-01: West Fork Dry Creek No. 2 Ditch

As discussed in Chapter 3, the existing headgate of the Dry Creek No. 2 Ditch is in poor condition and the diversion dam requires frequent repair by the land owner. At this location, the following project components are recommended:

- A sheet pile diversion dam would be constructed to facilitate diversion of flows at a range of streamflow levels and reduce the amount of effort required to maintain the existing rock dam.
- An 18-inch slide gate (Waterman type) would be installed.
- An 18 inch Parshall flume would be installed.

4.4.1.2 Item I-02: Woodruff Ditch

As discussed in Chapter 3, the headgate and associated facilities of the Woodruff Ditch are in need of replacement and repair in order to facilitate diversion and control of ditch flows as well as to provide a means of removing sediment from the ditch. At this location, the following components are recommended. Figure 4.4-2 displays a conceptual design of the proposed improvements.

- A sheet pile diversion structure would be constructed on Dry Creek to control the grade of the creek and to facilitate diversion of water during low-flow periods.
- The existing headgate would be replaced with an 18-inch Waterman slide gate.
- A sand trap wasteway would be installed in the immediate vicinity of the headgate with a bottom-opening orifice to enable entrained sediment to be released back into Dry Creek.
- The existing sand trap wasteway located approximately 1,000 feet downstream of the headgate would be rehabilitated and repaired as necessary to provide a secondary means of releasing entrained sediment back to Dry Creek if necessary.
- The existing 18-inch flume would be replaced with a 24-inch flume, 200-feet long to improve ditch capacity.

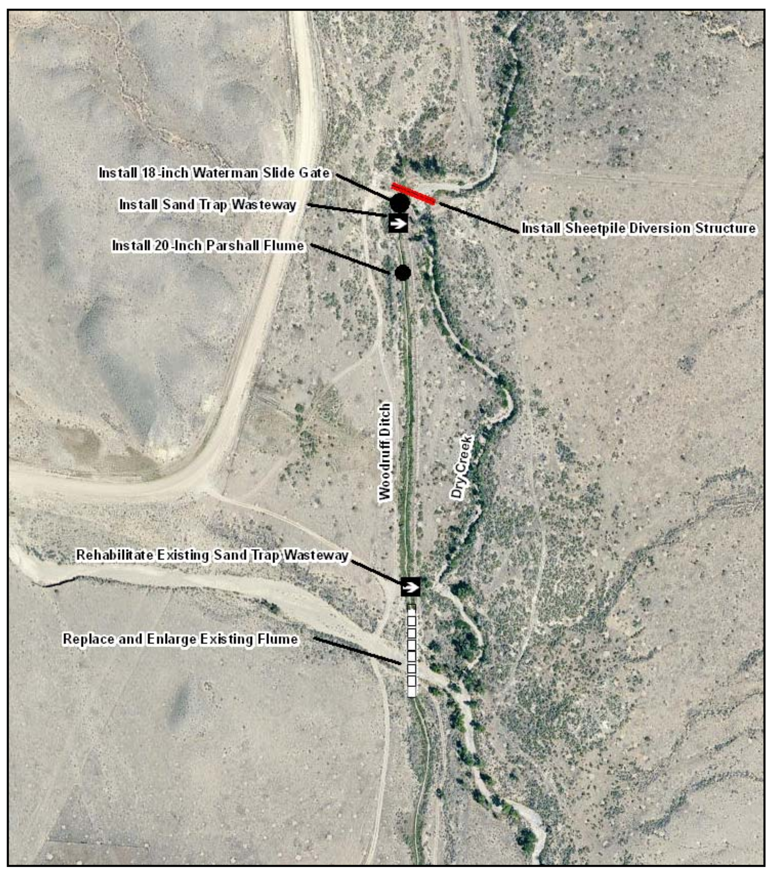


Figure 4.4-2 Woodruff Ditch Improvements

4.4.1.3 Item I-03: Elsass Ditch Headgate Stabilization

As discussed in Chapter 3, active headcutting on Bridger Creek in the vicinity of the Elsass Ditch headgate threatens to render the diversion inoperable. At this location, a gradient restoration facility would be constructed under this project. Detailed evaluation of stream conditions and dimensions would be required prior to design in order to select the proper method of stabilizing the channel. At this point, the most cost-effective method would most likely consist of sheet pile driven vertically into the stream channel and backfilled with rock riprap. The sheet pile would be configured to form a trapezoidal cross section, the bottom of which would be established at the appropriate elevation to ensure diversion of low flows into the ditch.

4.4.1.4 Item I-04: Moore Ditch Headgate Stabilization

As discussed in Chapter 3, active headcutting on Bridger Creek in the vicinity of the Moore Ditch headgate threatens to render the diversion inoperable. At this location, a gradient restoration facility would be constructed under this project. Detailed evaluation of stream conditions and dimensions would be required prior to design in order to select the proper method of stabilizing the channel. At this point, the most cost-effective method would most likely consist of sheet pile driven vertically into the stream channel and backfilled with rock riprap. The sheet pile would be configured to form a trapezoidal cross section, the bottom of which would be established at the appropriate elevation to ensure diversion of low flows into the ditch.

4.5 Grazing Management Opportunities (Watershed Management Plan Component G)

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 Badwater Creek / Poison Creek Watershed study area are likely to be the following:

- Sandy (Sy) 5-9” Wind River Basin Precipitation Zone
- Loamy (Ly) 10-14" P.Z., High Plains Southeast
- Sandy (Sy) 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.

4.5.1.1 ESD: • Sandy (Sy) 5-9” Wind River Basin Precipitation Zone

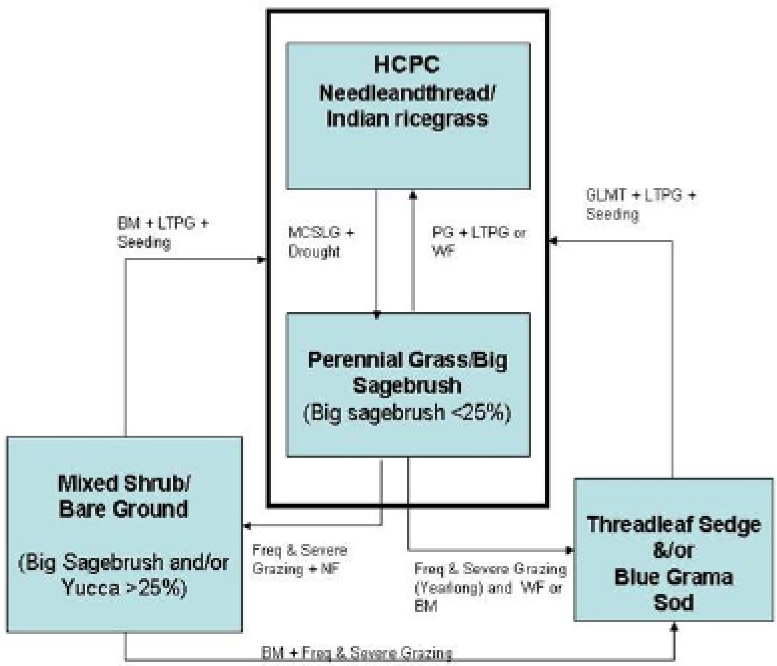
One of the most prevalent ecological sites within the mapped portions of the study area is the Sandy (Sy) 5-9” Wind River Basin Precipitation Zone. Figure 4.5-1 displays the state and transition model for this site.

The following description of the ecological site’s HCPC and transitions to and from it was extracted from the NRCS ESD for the site:

> *The interpretive plant community for this site is the Historic Climax Plant Community. This state evolved with grazing by large herbivores and periodic fires. The cyclical natural of the fire regime in this community prevented big sagebrush from being the dominant landscape. This plant community can be found on areas that are properly managed with grazing and/or prescribed burning, and on areas receiving occasional short periods of rest. The state is mostly cool season mid-grasses and a variety of forbs and woody species. Potential vegetation is about 70% grasses or grass-like plants, 15% forbs, and 15% woody plants.*
>
> *The major grasses include needleandthread, Indian ricegrass and rhizomatous wheatgrasses. Other grasses and grass-likes occurring in the state include prairie sandreed, Sandberg bluegrass, blue grama, threadleaf sedge, and threeawns. Big sagebrush and winterfat are conspicuous components of this state. A variety of forbs also occurs in this state and plant diversity is high (see Plant Composition Table).*
>
> *The total annual production (air-dry weight) of this state is about 400 lbs./acre, but it can range from about 225 lbs./acre in unfavorable years to about 600 lbs./acre in above average years.*
>
> *The state is stable and well adapted to the Northern Great Plains climatic conditions. 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 Perennial Grass/Big Sagebrush Plant Community. Prolonged Drought will exacerbate this transition.*



BMA - Brush Management (all methods)	NF - No Fire
BMC - Brush Management (chemical)	NS - Natural Succession
BMF - Brush Management (fire)	NWC - Noxious Weed Control
BMM - Brush Management (Mechanical)	NWI - Noxious Weed Invasion
CSP - Chemical Seedbed Preparation	NU - Nonuse
DR - Drainage	P&C Plow & Crop (including hay)
CSG - Continuous Spring Grazing	PG - Prescribed Grazing
HB - Heavy Browse	RPT - Replant Trees
HCSLG - Heavy Continuous Season-Long Grazing	RS - Re-Seed
HI - heavy Inundation	SGD - Severe Ground Disturbance
LPG - Oong Term Prescribed Grazing	SHC - Severe Hoof Compaction
MT - Mechanical Treatment (chiseling, ripping, pitting)	WD - Wildlife Damage (Beaver)
	WF - WIldfire

Figure 4.5-1 State and Transition Model: *Sandy (Sy) 5-9" Wind River Basin Precipitation Zone*.

4.5.1.2 ESD: Loamy (Ly) 10-14" P.Z., High Plains Southeast

A prevalent ecological site within the lower portions of the study area is the Loamy (Ly) 10-14" P.Z., High Plains Southeast site. Figure 4.5-2 displays the state and transition model for this site. The following description of the ecological site's HCPC and transitions to and from it was extracted from the NRCS ESD for the site:

The interpretive plant community for this site is the Historic Climax Plant Community. 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).

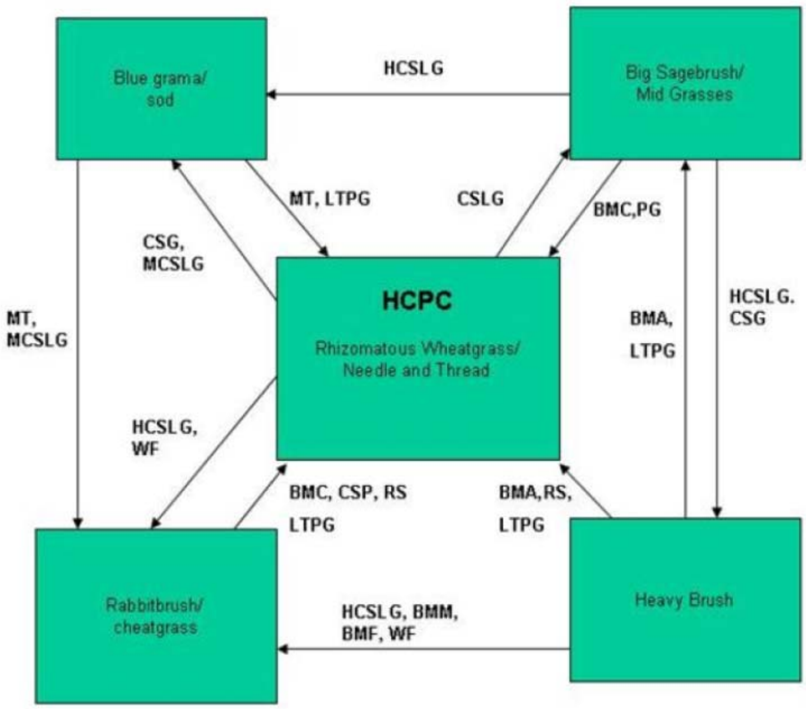
Transitions or pathways leading to other plant communities are as follows:

- 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.

This state is fragile, but well adapted to the Cool Central Desertic Basins and Plateaus climatic conditions. The diversity in plant species allows for some drought resistance. This is a sustainable plant community, but is difficult to reestablish when damaged. (Site/soil stability, watershed function, and biologic integrity).



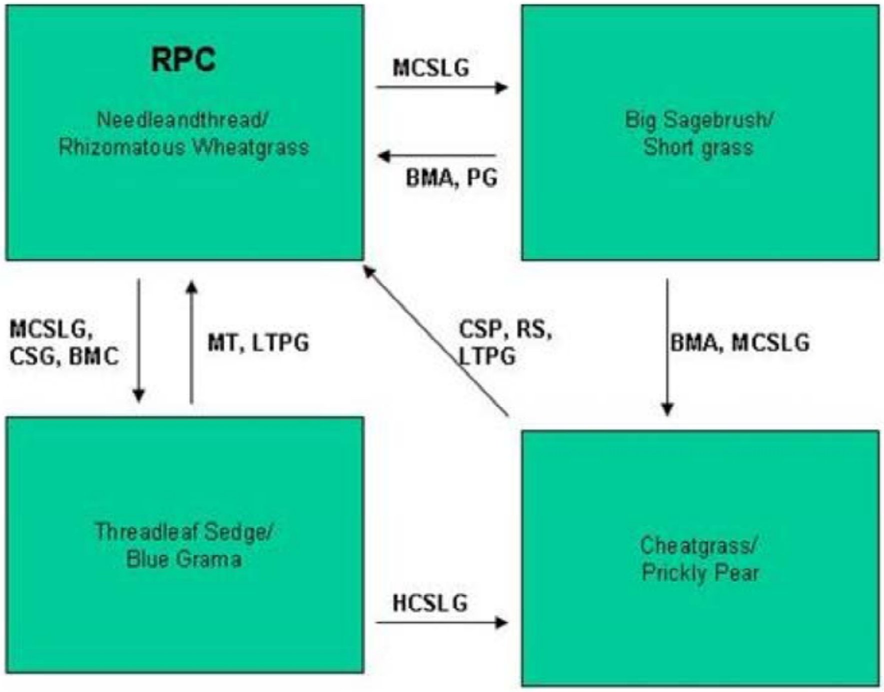
BMA - Brush Management (all methods)
BMC - Brush Management (chemical)
BMF - Brush Management (fire)
BMM - Brush Management (Mechanical)
CSP - Chemical Seedbed Preparation
DR - Drainage
CSG - Continuous Spring Grazing
HB - Heavy Browse
HCSLG - Heavy Continuous Season-Long Grazing
HI - heavy Inundation
LPG - Oong Term Prescribed Grazing
MT - Mechanical Treatment (chiseling, ripping, pitting)

NF - No Fire
NS - Natural Succession
NWC - Noxious Weed Control
NWI - Noxious Weed Invasion
NU - Nonuse
P&C Plow & Crop (including hay)
PG - Prescribed Grazing
RPT - Replant Trees
RS - Re-Seed
SGD - Severe Ground Disturbance
SHC - Severe Hoof Compaction
WD - Wildlife Damage (Beaver)
WF - WIldfire

Figure 4.5-2 State and Transition Model: *Loamy (Ly) 10-14" P.Z., High Plains Southeast*.

4.5.1.3 ESD: Sandy (Sy) 10-14" P.Z., High Plains Southeast

A third prevalent ecological site within the lower portions of the study area is the Sandy (Sy) 10-14" P.Z., High Plains Southeast. Figure 4.5-3 displays the state and transition model for this site. The following description of the ecological site's HCPC and transitions to and from it was extracted from the NRCS ESD for the site:



BMA - Brush Management (all methods)
BMC - Brush Management (chemical)
BMF - Brush Management (fire)
BMM - Brush Management (Mechanical)
CSP - Chemical Seedbed Preparation
DR - Drainage
CSG - Continuous Spring Grazing
HB - Heavy Browse
HCSLG - Heavy Continuous Season-Long Grazing
HI - heavy Inundation
LPG - Oong Term Prescribed Grazing
MT - Mechanical Treatment (chiseling, ripping, pitting)

NF - No Fire
NS - Natural Succession
NWC - Noxious Weed Control
NWI - Noxious Weed Invasion
NU - Nonuse
P&C Plow & Crop (including hay)
PG - Prescribed Grazing
RPT - Replant Trees
RS - Re-Seed
SGD - Severe Ground Disturbance
SHC - Severe Hoof Compaction
WD - Wildlife Damage (Beaver)
WF - WIldfire

Figure 4.5-3 State and Transition Model: 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 (RPC).

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*

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.

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. 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 chemical application for control of range (e.g. Big Sagebrush).

These tools can be used to maintain and/or improve watershed function particularly when coupled with implementation of appropriate grazing management strategies.

4.6 Storage Opportunities (Watershed Management Plan Component S)

Identification and evaluation of opportunities to develop surface water storage in the Badwater Creek / Poison Creek Watershed was one objective of this investigation. As discussed previously in Chapter 3, a limited number of sites were identified. The two identified potential sites for new reservoir construction are presented in the paragraphs which follow. Figure 4.6-1 displays the locations of the sites. Table 4.6-1 tabulates pertinent data for each of the two sites. Specifically, the sites are:

- Clear Creek Reservoir
- Dry Fork Badwater Creek Reservoir

Table 4.6-1 Tabulation of Potential Reservoir Data.

Watershed Plan Components: Storage (S)						
Plan Component	Reservoir Site	Basin Contributing Area (square miles)	Storage Capacity (acre feet)	Surface Area (acres)	Embankment Height (feet)	Embankment Length (feet)
S-01	Clear Creek Reservoir	10,734	1,000	33	60	430
S-02	Dry Fork Badwater Creek Reservoir	38,025	480	27	40	930

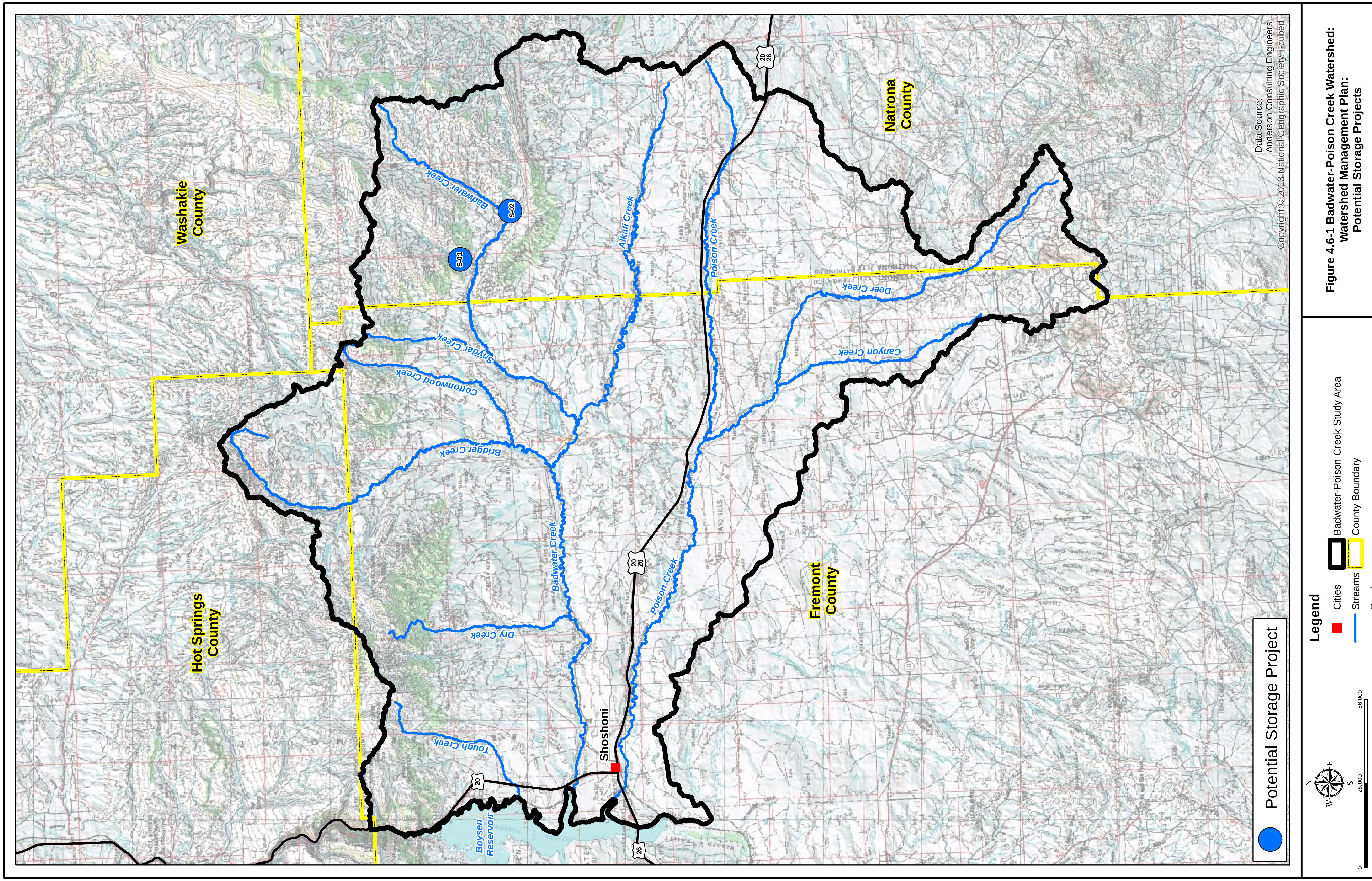


Figure 4.6-1 Badwater-Poison Creek Watershed:
Watershed Management Plan:
Potential Storage Projects
Data Source:
Anderson Consulting Engineers
Copyright:© 2013 National Geographic Society, i-cubed
Legend
Cities
Streams
Roads
Badwater-Poison Creek Study Area
County Boundary
Potential Storage Project
0
28,000
56,000
Feet
N
S
E
W
Washakie County
Hot Springs County
Natrona County
Fremont County
Shoshoni
Boysen Reservoir
S-01
S-02
Badwater Creek
Alkali Creek
Poison Creek
Deer Creek
Canyon Creek
Snyder Creek
Cottonwood Creek
Bridger Creek
Dry Creek
Tough Creek
20
26

4.6.1 Watershed Management Plan Component S-01: Clear Creek Reservoir

This reservoir, as configured at this conceptual level, would be an on-channel reservoir situated on Clear Creek in Section 12, Township 39, Range 89. The reservoir would store native flows of Clear Creek for the principal purpose of providing a source of late season irrigation water to irrigated lands located downstream. Figure 4.6-2 displays the location and general layout of the proposed reservoir.

As configured, the reservoir embankment would be approximately 60 feet high and 430 feet long. The surface area of the reservoir at this elevation would be approximately 33 acres and the storage capacity would be approximately 1,000 acre feet.

4.6.2 Watershed Management Plan Component S-02: Dry Fork Badwater Creek Reservoir Site 1

This reservoir, as configured at this conceptual level, would be an off-channel reservoir situated on Dry Fork Badwater Creek in Section 33, Township 39, Range 88. The reservoir would be filled via a supply canal, approximately 5,200 feet long, conveying water from Badwater Creek to the proposed reservoir. The reservoir would also store native flows from Dry Fork Badwater Creek. Figure 4.6-3 displays the location and general layout of the proposed reservoir and the supply canal.

As configured, the reservoir embankment would be approximately 40 feet high and 930 feet long. The surface area of the reservoir at this elevation would be approximately 27 acres and the storage capacity would be approximately 480 acre-feet.

The primary purpose of the reservoir would be to provide late season irrigation supply to irrigated lands downstream.

4.7 Stream Channel Condition and Stability (Watershed Management Plan Component C)

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

- classification of approximately 300 miles of stream channel within the GIS environment,
- review of BLM Proper Functioning Condition assessments,
- field reconnaissance,
- landowner / stakeholder input.

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:

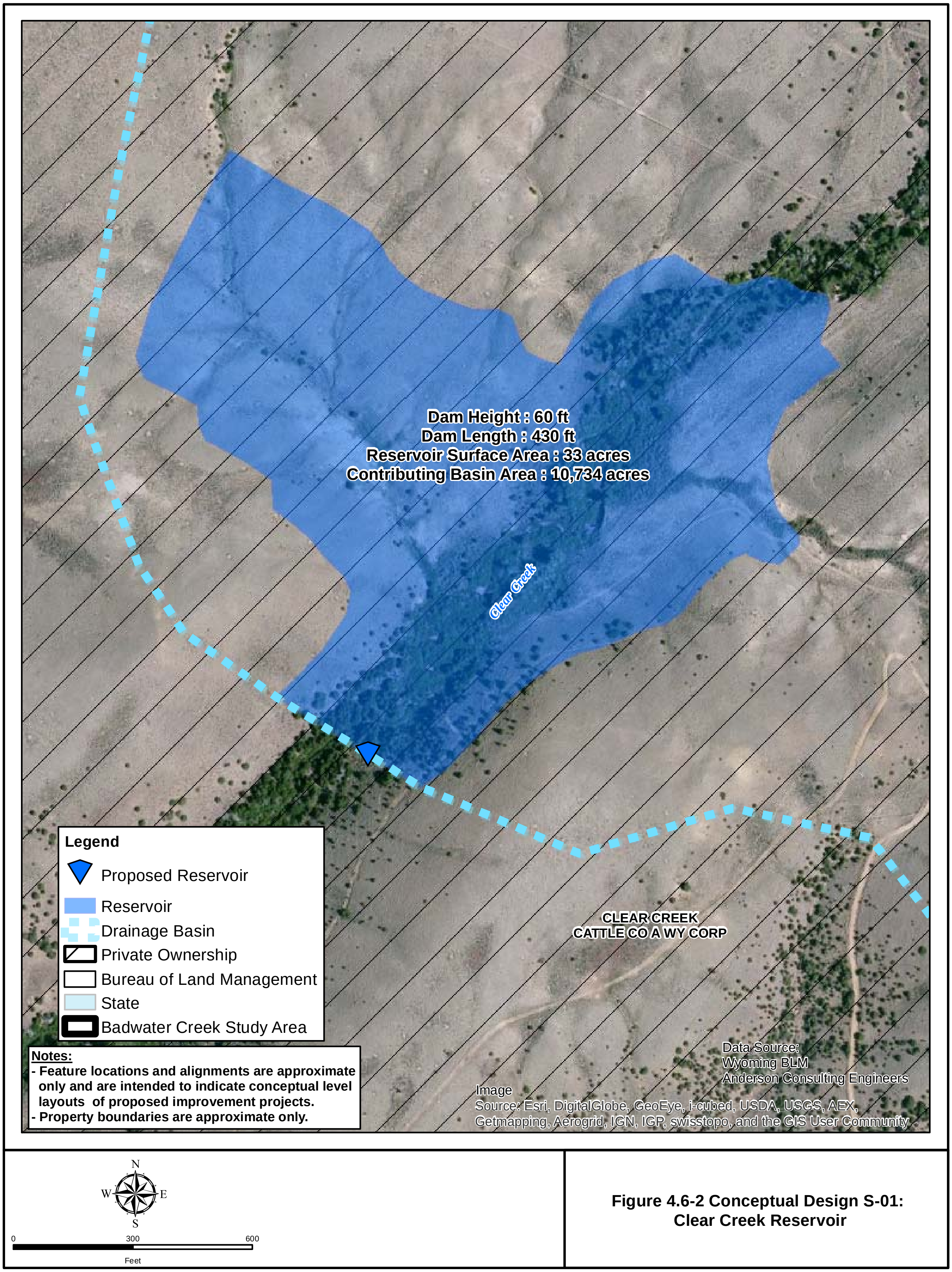


Figure 4.6-2 Conceptual Design S-01: Clear Creek Reservoir

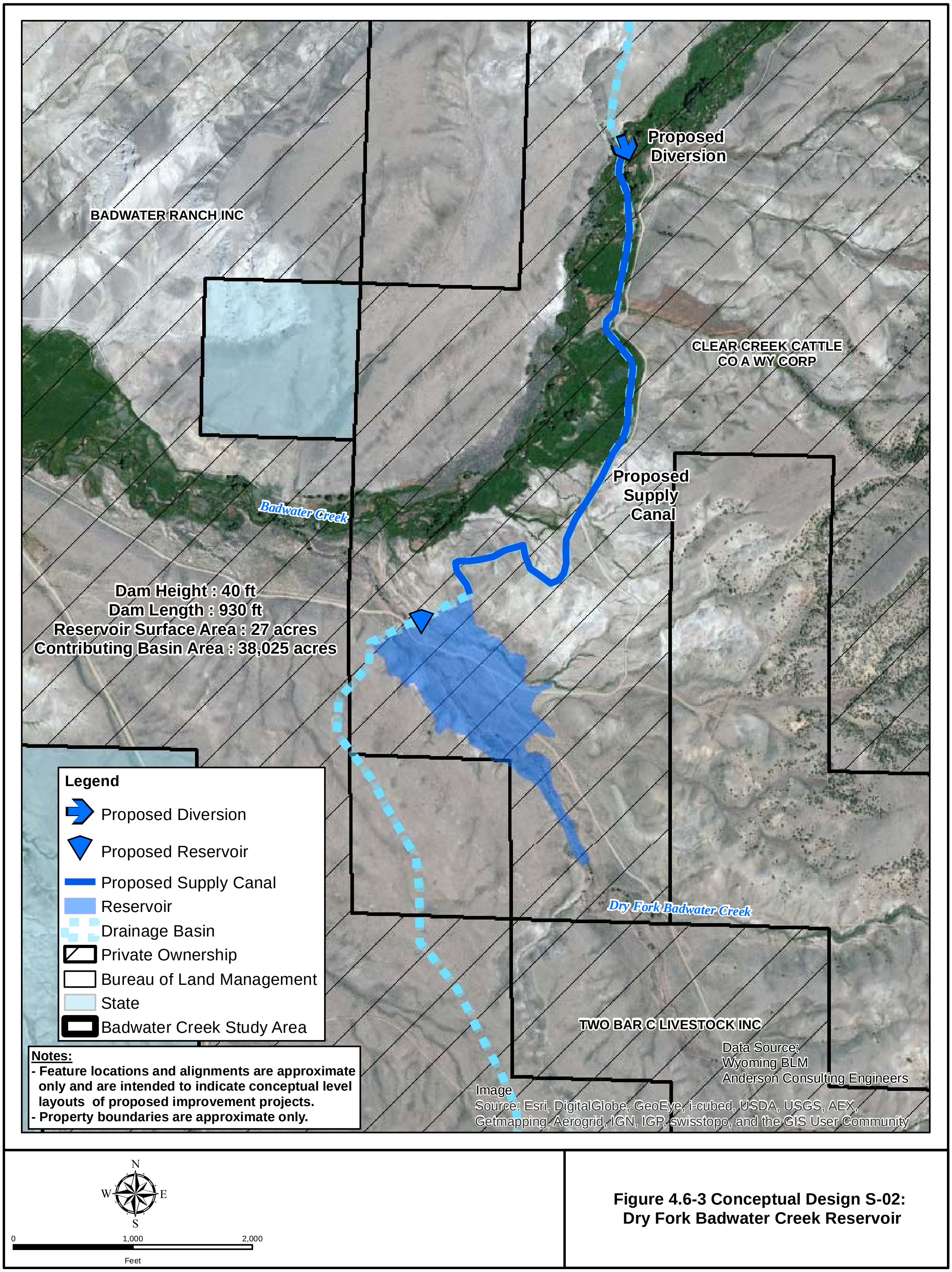


Figure 4.6-3 Conceptual Design S-02: Dry Fork Badwater Creek Reservoir

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

4.7.1 Stream Channel Rehabilitation

With respect to overall stream stabilization efforts, 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.

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 4.7-1 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 4.7-2 displays a photograph of a typical installation.

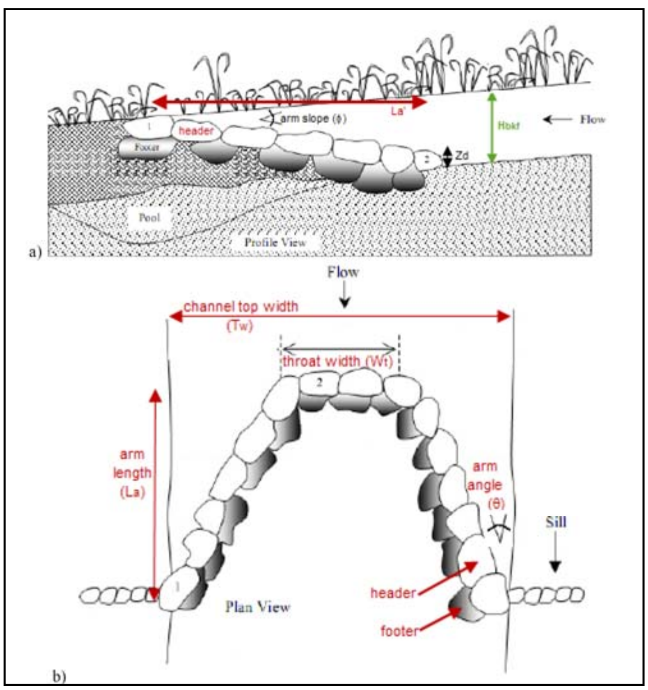


Figure 4.7-1 Rock Vortex Weir Structure Diagram (Adapted from Rosgen, 2006).

Figure 4.7-2 Stream Stabilization Structure: Rock Vortex Weir.

Re-establishment of pre-incision channel elevations can be accomplished by means of check dams. Figure 4.7-3 displays a photo of a large-scale check dam on Muddy Creek near Baggs, Wyoming in the Little Snake River watershed. 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 4.7-3 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.

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 4.7-4 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 4.7-4 Stream Stabilization Measure: Willow Fascine Installation.

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 4.7-1 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.

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

Several stream reaches were identified which would benefit from site-specific stream restoration strategies. These stream segments were either classified as F-type channels in the stream channel characterization phase of the project (see Chapter 3) or were brought to the attention of the project team during completion of field investigations or project meetings. This list is not intended to be all-inclusive. It is understood that there will be stream segments throughout the watershed that could benefit from stream restoration activities.

- Badwater Creek
- Bridger Creek
- Dry Creek
- Deer Creek

Based on the information presented above, the following items are presented for inclusion in the Badwater/Poison Creek Watershed Management Plan:

Table 4.7-1 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

Watershed Plan Component C-26: Installation of stream channel degradation/incision mitigation measures based upon site-specific evaluation of conditions. Appropriate mitigation measures could be ‘hard’ engineering, ‘soft’ approaches, or combinations of both.

Watershed Plan Component C-27: Installation of stream bank erosion mitigation measures based upon site-specific evaluation of conditions. Appropriate mitigation measures could be ‘hard’ engineering, ‘soft’ approaches, or combinations of both.

Watershed Plan Component C-28: Initiation of routine monitoring of completed stream restoration projects to determine their effectiveness and viability. Repairs should be made as necessary as soon as is practical.

4.8 Other Upland Management Opportunities (Watershed Management Plan Component O)

4.8.1 Noxious Weed and Undesirable Plant Control

The Fremont County and Natrona County Weed and Pest Districts are implementing aggressive, well planned, and cost-effective treatment measures for saltcedar, Russian olive and other noxious and other weeds as available staffing and funding allow. Both districts have been successful in enlisting broadly based participation in various control programs, work days and workshops. The most effective overall strategy going forward would appear to be to assist the Districts in applying for additional grant funding, participate with in-kind efforts on work days and attend/support workshops and planning sessions.

A general management implication to bear in mind with development of any water resources related project would be the associated affects on weed infestation. Typical of an arid environment such as the Badwater / Poison Creek watershed study area, weed infestations are exacerbated when water is available; development of water supply projects may inadvertently exacerbate existing weed issues. For example, irrigation in the study area is typically conducted when water is available in the streams, which is generally short-lived. Irrigated crops and pastures likely do not get the full supply of water needed to thrive and out-compete weed species. Weed species can then benefit from a limited water supply associated with a less than vigorous crop/pasture. Similarly, upland pipeline / stock tank projects can also encourage weed infestations if not properly maintained.

4.9 Moneta Divide Natural Gas and Oil Development Project

As previously discussed in Chapter 3, the Moneta Divide Project proposed by Encana Oil and Gas Inc. and Burlington Resources Oil & Gas Company LP could potentially result in impacts to the study area's landscape, and water resources. At this time, the BLM is preparing the Draft Environmental Impact Statement (DEIS) pertaining to the project and many of the specific details have yet to be determined. According to the Lander BLM office, the DEIS is not scheduled for completion until the end of 2016.

According to the BLM, the amount of process water generated in the well field could peak at approximately 1 million barrels per day (or roughly 65 cubic feet per second). Assuming a treatment efficiency of 70% to 90%, this could ultimately translate to between 45 and 58 cubic feet per second of treated process water being conveyed to the reservoir at peak well field operation. Given the realities of the construction process, the amount of water processed would initially be limited and eventually rise to the peak as the number of wells increase and also the treatment facilities capacity. After the peak is reached, it is anticipated that the quantity of produced water would lessen as older wells are removed from production. As part of the EIS process, BLM will evaluate alternatives involving management of this water. One alternative being evaluated, among others, consists of a pipeline to convey treated process water from the well field to Boysen Reservoir. Pipeline route and design details are not available at this time, however, it is understood that the water would be treated using reverse osmosis technologies and presumed to meet drinking water standards.

During the course of this study, the prospects of using this water within the watershed were raised on numerous occasions by study area stakeholders. Concepts presented included:

- Reservoir construction and storage of the process water for irrigation supply,
- Reservoir construction and storage of the process water of domestic / municipal supply in Lysite and Lost Cabin,
- Stock reservoir supply augmentation, and
- Livestock / wildlife water facility supply.

Given the current uncertainties associated with the project, combined with the fact that the EIS process and BLM's Record of Decision (ROD) will not be completed for another two years, evaluation of alternatives involving this water is beyond the scope of this Level I investigation. However, it is worth noting that numerous issues and constraints must be considered should the Moneta Divide Project be completed and should interested parties seek alternative uses of the treated process waters. These issues include, but are not limited to. permitting constraints through the WSEO, environmental impact of the water use, costs associated with associated infrastructure, etc. It is also important to keep in mind that such a source of water would be an ephemeral source: the lifespan of the Moneta Divide Project would be limited.

4.10 The Badwater Creek / Poison Creek Watershed Management Plan

4.10.1 Overview

The information presented in this chapter provides recommendations for improvements associated with:

- Livestock / wildlife upland watering opportunities
- Irrigation system rehabilitation components
- Grazing management opportunities
- Storage opportunities
- Stream channel stability components
- Wetland Enhancement opportunities
- Other watershed management plan alternatives

These improvements focus on potential mitigation of several key issues that presently exist within the watershed. For the Badwater Creek / Poison Creek Watershed, the watershed management plan consists of a compilation of the recommendations for each category. The plan is summarized in Table 4.10-1.

Table 4.10-1 Badwater/Poison Creek Watershed Management Plan.

Watershed Plan Component: Livestock / Wildlife Water Supply Projects (L/W)

Plan Component	Project Name	Field Notes Reference	Solar Pump / Windmill	Well Construction	Spring Development / Infiltration Gallery	Pipeline (ft)	Stock Tank	Storage Tank	Stock Reservoir Rehabilitation / Reconstruction	Land Ownership
L/W-01	Franks Upland Project #1	Franks 2	1		1	150	1			BLM
L/W-02	Franks Upland Project #2	Franks 3	1		1	75	1			P
L/W-03	Franks Upland Project #3	Franks 4	1			300	1			P
L/W-04	L/W-04 Franks Upland Project #4	Franks 5				100	1	1		BLM
L/W-05	Franks Upland Project #5	Franks 6				100	1	1		BLM
L/W-06	Franks Upland Project #6	Franks 7				10,560	2	1		BLM
L/W-07	Franks Upland Project #7	Franks 8				300	1			BLM
L/W-08	Cameron Upland Project #	Cameron 1			1	100	1			STATE
L/W-09	Cameron Upland Project #2	Cameron 2							1	P
L/W-10	Cameron Upland Project #3	Cameron 3			1	2,900	1			P
L/W-11	Cameron Upland Project #4	Cameron 4					1			BLM
L/W-12	Humphreys Upland Project #1	Humphreys 1				200	1			P
L/W-13	Humphreys Upland Project #2	Humphreys 2	1			500	2			P
L/W-14	Cady Upland Project #1	Cady 1				300	1	1		P, BLM
L/W-15	Cady Upland Project #2	Cady 2			1	300	2			P
L/W-16	Cady Upland Project #3	Cady 3			1	600	1			P
L/W-17	Cady Upland Project #3	Cady 4			1	300	1			P
L/W-18	Cady Upland Project #5	Cady 5			1		1			BLM
L/W-19	Allen Upland Project #1	Allen 1			1	200	1			P
L/W-20	Allen Upland Project #2	Allen 2		1		1,400	1			P
L/W-21	Allen Upland Project #3	Allen 3		1						P
L/W-22	Thoren Upland Project #1	Thoren 1							1	P, BLM
L/W-23	Thoren Upland Project #2	Thoren 2				400	1			P
L/W-24	Thoren Upland Project #3	Thoren 3			1	300	1			P
L/W-25	Thoren Upland Project #4	Thoren 4	1			4,600	1			BLM
L/W-26	Thoren Upland Project #6	Thoren 6							1	P
L/W-27	Bloomquist/McCoy Upland Project #1	Bloomquist / McCoy 1	1		1	900	1			P
L/W-28	Bloomquist/McCoy Upland Project #2	Bloomquist / McCoy 2			1	300	1			P
L/W-29	Bloomquist/McCoy Upland Project #3	Bloomquist / McCoy 3			1	1,500	1			STATE
L/W-30	Hendry Upland Project #1	Hendry 6			1	21,000	6	1		P, BLM
L/W-31	Campbell Upland Project #1	Jock 2 and 3			1	900				P
L/W-32	Campbell Upland Project #2	Jock 5			1	600	1			BLM
L/W-33	Campbell Upland Project #3	Jock 6			1	400	2			P
L/W-34	Bloomquist/McCoy Upland Project #4	Bloomquist / Mccoy 4			1	2,800	1			P
L/W-35	Pingetzer Upland Project #1	Pingetzer 1	1			6,300	2			P
L/W-36	Pingetzer Upland Project #2	Pingetzer 2	1			5,300	1			STATE, BLM
	Totals:		8	2	18	63,685	41	5	3	

Watershed Plan Component: Grazing Management Opportunities (G)

G-1	Expansion of grazing distribution / limited reliance on riparian areas.
G-2	Fencing to create pastures of similar ecological condition to enable a rest-rotation grazing system.
G-3	Strategic salting and herding are other tools that can be used to enhance grazing distribution.
G-4	Consideration of wildlife needs in upland water source development (escape ramps, wildlife watering facilities, etc).
G-5	Utilization of Ecological Site Description State and Transition Modeling to optimize range conditions.
G-6	Use of prescribed fire to assist in the restoration of range health areas benefitting by this treatment according to the state and transition models.
G-7	Application of chemicals may be utilized in the restoration of range health areas benefitting by this treatment according to the state/transition models.

Watershed Plan Component: Irrigation Infrastructure Projects (I)

Plan Component	Ditch	Owner	Structure Type	Priority
I-01	Dry Creek Ditch No. 2	Frank	Grade Control / Headgate	2
I-02	Woodruff Ditch	Frank	Grade Control / Sand Trap Wasteway / Siphon	2
I-03	Elsass Ditch	Philp	Grade Control	1
I-04	Moore Ditch	Philp	Grade COntrol	1

Watershed Plan Component: Storage (S)

Plan Component	Reservoir Site	Basin Contributing Area (acres)	Storage Capacity (acre feet)	Surface Area (acres)	Embankment Height (feet)	Embankment Length (feet)
S-01	Clear Creek Reservoir	10,734	1,000	33	60	430
S-02	Dry Fork Badwater Creek Reservoir	38,025	480	27	40	930

Watershed Plan Component: Other Watershed Management Opportunities (O)

Plan Component	Action / Recommendation
O-1	Continuaton of eradication efforts targeting noxious weeds and undesirable vegetation
O-2	Prescribed burns planned and executed in an effort to control juniper encroachment.
O-3	Mechanical treatment of infestation should be completed in areas where prescribed burns are not feasible or practical.

In the preceding sections of this report, various proposed watershed and range improvement projects and components, along with BMPs and conservation practices have been presented. The BMPs and conservation practices that have been presented and are eligible for grant funding assistance through the WWDC's Small Water Project Program include:

- stock ponds,
- wells,
- pipelines,
- tanks,
- spring developments,
- solar platforms,
- wetland restoration,
- windmills, and
- irrigation diversion/conveyance projects.

In addition, several BMPs which are not eligible for grant funding through the SWPP have been presented. These include:

- stream channel restoration,
- reservoir storage,
- prescribed grazing practices, and
- prescribed burning.

4.10.2 Potential Effects and Benefits of Watershed Management Plan Components

In the following sections of the Badwater / Poison Creek Watershed Management Plan, 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 L/W), irrigation system rehabilitation (Components I), storage (Components S), etc. 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 Network Effects Diagrams (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. The Digital Library contains the NED and associated project description of these and additional pertinent conservation practices and BMPs.

4.10.2.1 Irrigation Rehabilitation Projects

The Watershed Management Plan includes 4 recommendations in this category. 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 graphically in the NRCS's NED displayed in Figure 4.10-1. As displayed 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, and
- Improved stream fauna and environmental quality.

4.10.2.2 Livestock/Wildlife Water Supply Projects

The Watershed Management Plan includes 36 recommendations in this category. 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, and
- Optimization of upland range resources.

Benefits of providing reliable water facilities for livestock and wildlife are numerous and are displayed graphically in the NRCS's NED displayed in Figure 4.10-2. As displayed in this figure, direct and indirect benefits associated with this BMP include:

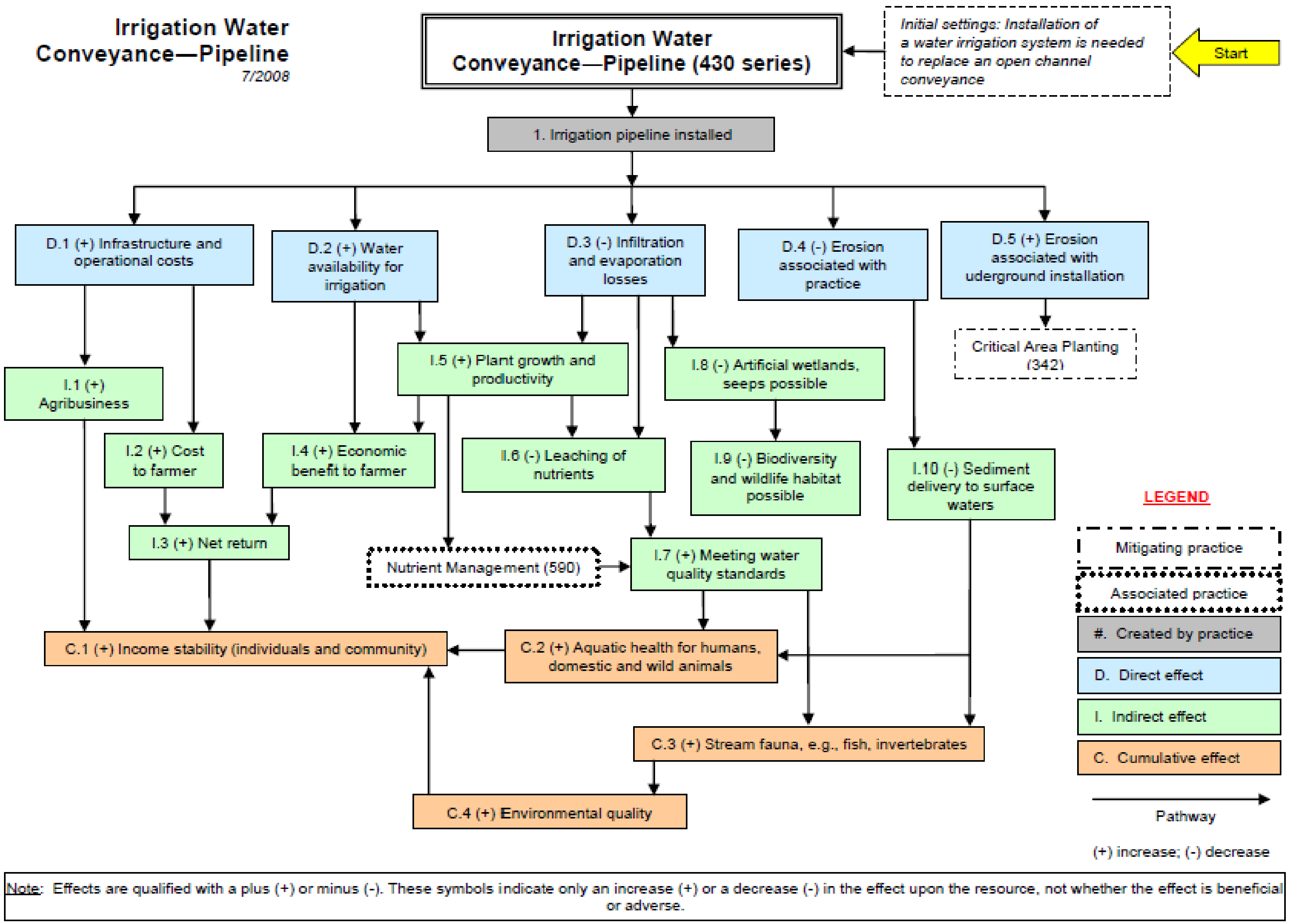
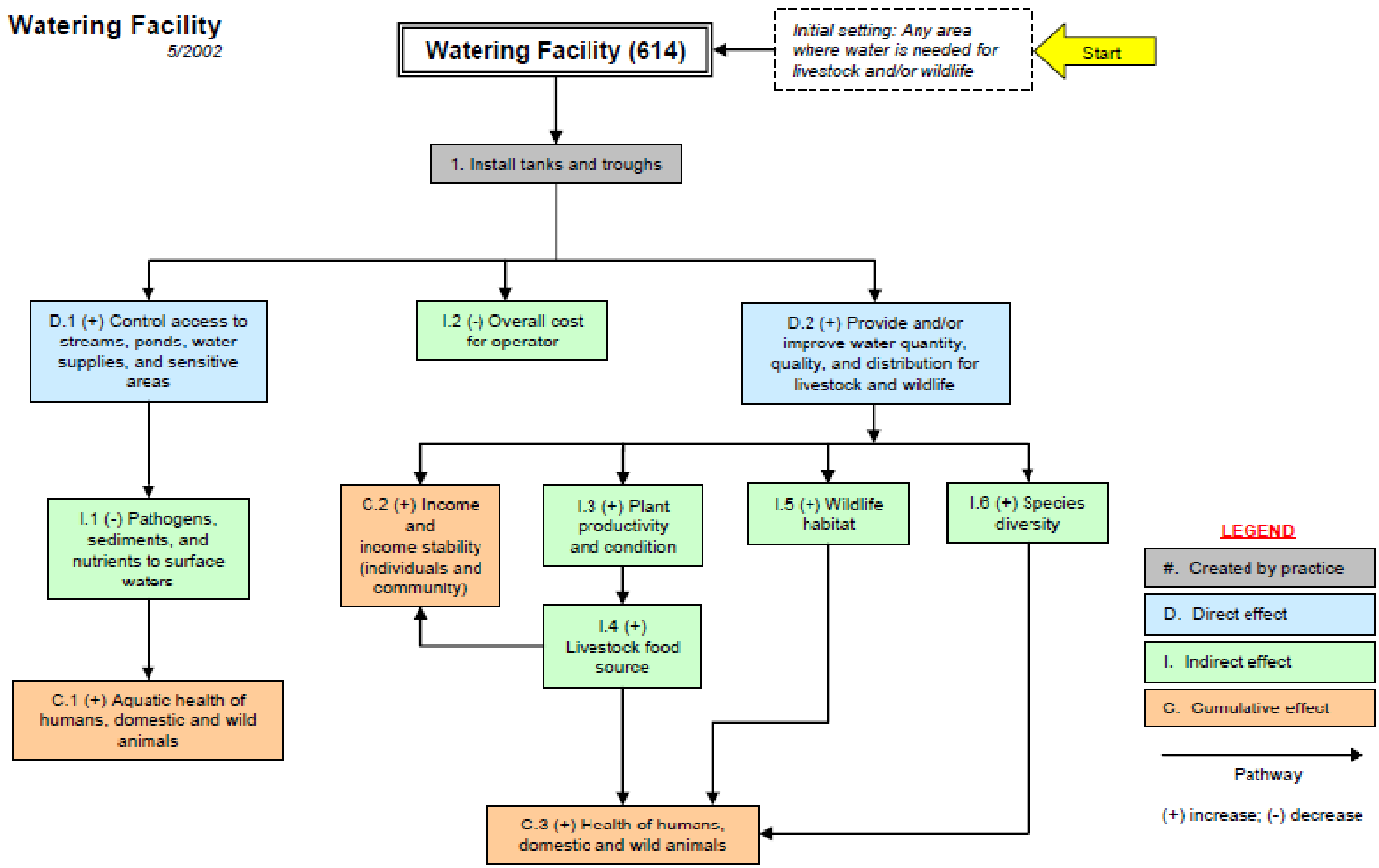


Figure 4.10-1 NRCS NED Diagram: Irrigation Pipeline.



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 4.10-2 NRCS NED Diagram: Watering Facility.

- 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 pland 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.

4.10.2.3 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 graphically in the NRCS's NED displayed in Figure 4.10-3. As displayed 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.

4.10.2.4 Stream Channel Restoration Projects

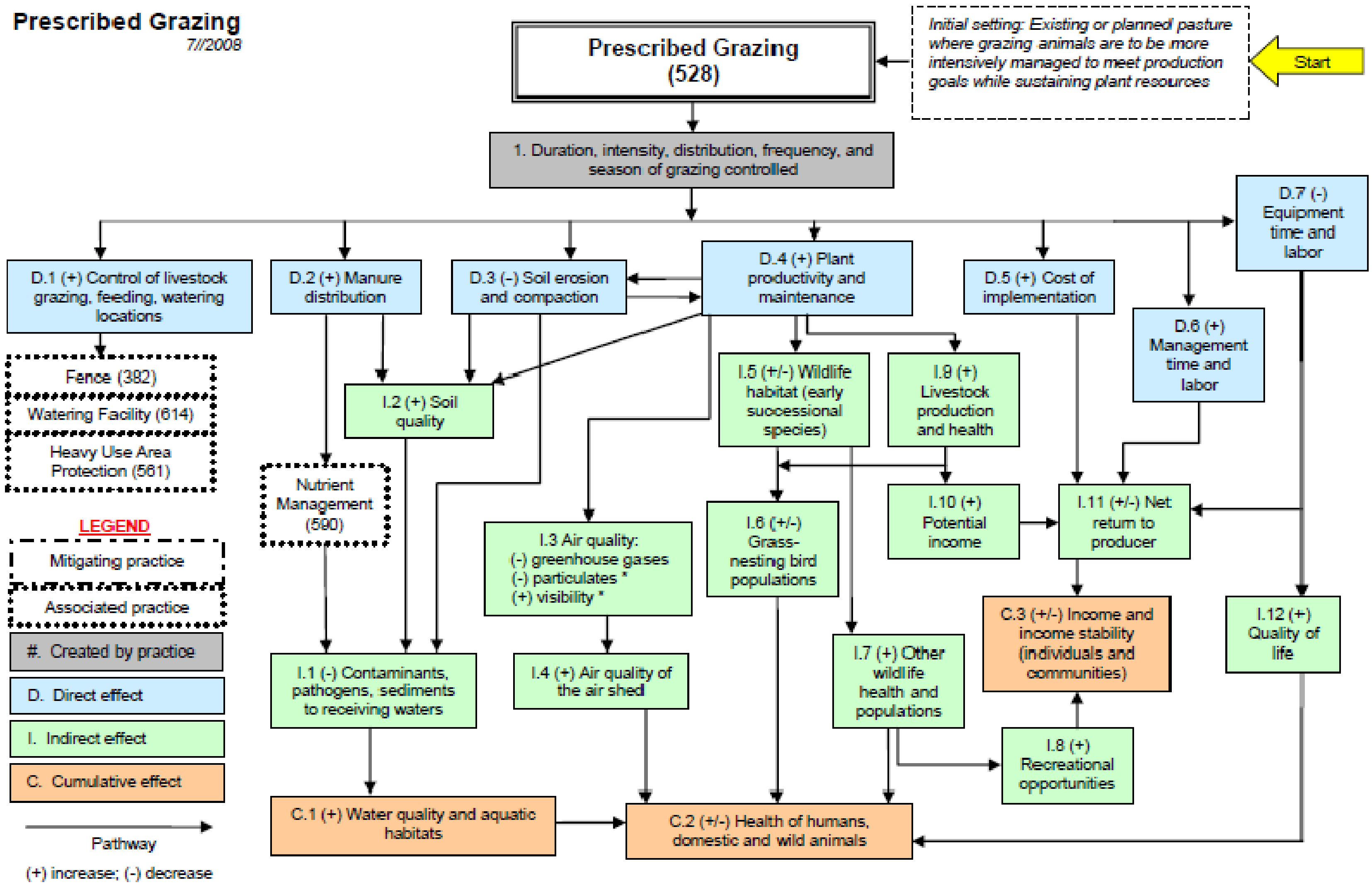
These alternatives include conservation practices and BMPs such as installation of stream channel degradation/incision and streambank erosion mitigation measures based upon site-specific evaluation of conditions along with routine monitoring of completed stream projects to identify necessary maintenance 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 adjacent land uses or other facilities.



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 4.10-3 NRCS NED Diagram: Prescribed Grazing.

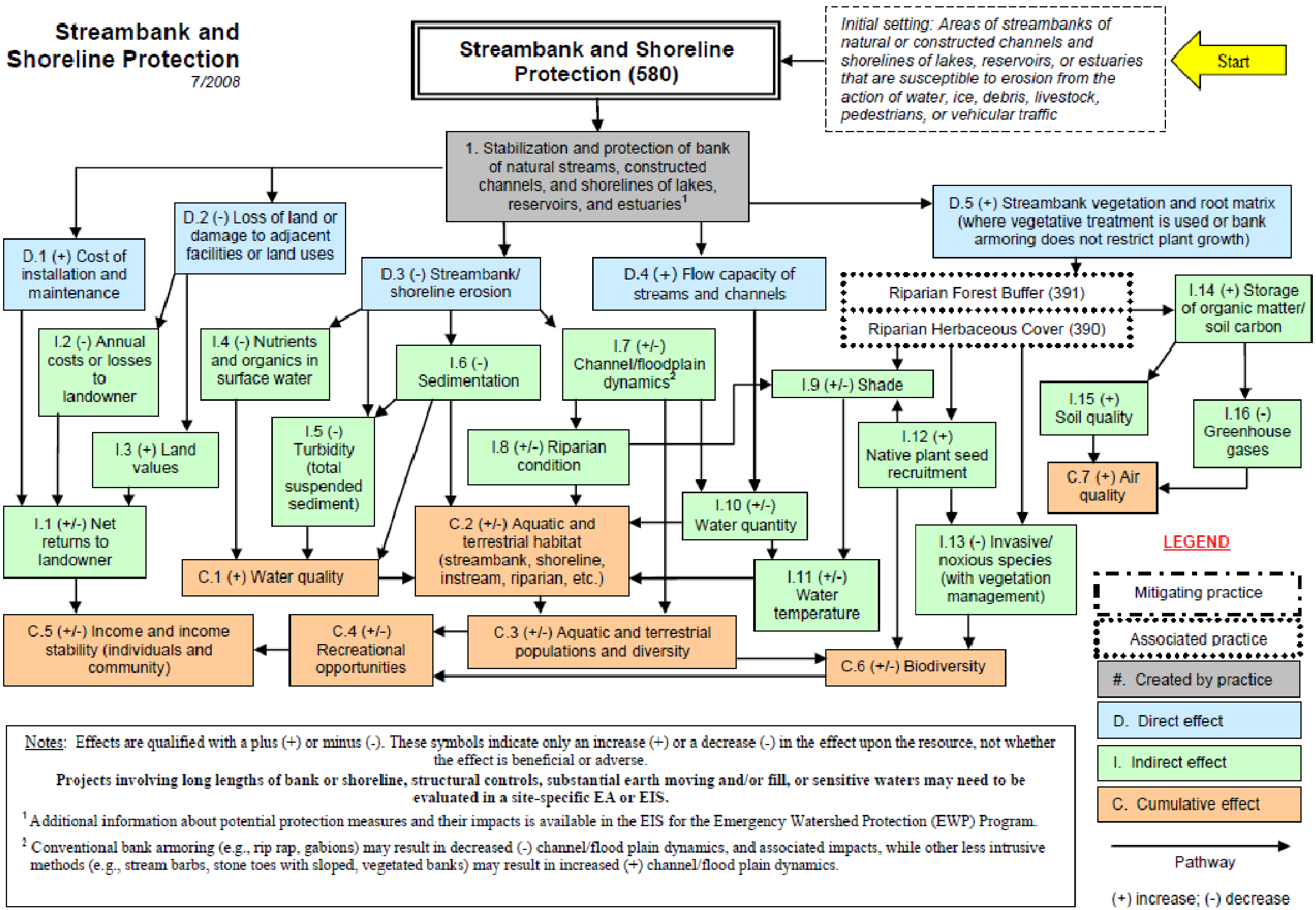
- Protecting historical, archeological, and traditional cultural properties.
- Reducing the offsite or downstream effects of sediment resulting from bank erosion.
- Improving the stream corridor for fish and wildlife habitat, aesthetics, and recreation.

Benefits of implementing streambank and shoreline protection and associated BMPs and conservation practices are numerous and are displayed graphically in the NRCS's NED displayed in Figure 4.10-4. As displayed 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, and
- Improved recreational opportunities.



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 4.10-4 NRCS NED Diagram: Streambank Protection.

V. PERMITS

The following discussion presents the results of an early regulatory process analysis for the types of alternative projects that have been identified in Chapter 5. The purpose of this analysis is to characterize the known and likely environmental processes, permits and related requirements and conditions associated with the alternative projects, including identification of environmental documentation, permits, agency clearances and approvals, and agency coordination steps that would be required for implementation of the proposed actions and alternatives.

Many of the potential projects described in this plan will be subject to the National Environmental Policy Act (NEPA) and other federal environmental regulations administered by federal agencies such as the EPA, Bureau of Land Management (BLM), Army Corps of Engineers (COE), and/or the U.S. Fish and Wildlife Service (FWS). The Wyoming agencies which may have environmental, land use, and other regulatory approval requirements include, but are not necessarily limited to the Department of Environmental Quality (WDEQ), State Engineer's Office (WSEO), State Historic Preservation Officer (SHPO), Board of Land Commissioners through the State Lands and Investments Board (SLIB), and Game and Fish Department (WGFD).

Much of the following text was extracted from previous watershed investigations conducted on behalf of the Wyoming Water Development Commission (WWDC) in which Anderson Consulting Engineers (ACE) participated. Specifically, the Thunder Basin Watershed Management Plan (Olsson Associates, 2009) and the Little Snake River Watershed Study (Anderson Consulting Engineers, 2013) are referenced here as sources of permitting information. The previously prepared descriptions of the permitting process were revised to reflect conditions anticipated within the Badwater Creek / Poison Creek Watershed.

5.1 NEPA Compliance and Documentation

NEPA applies to any of the proposed actions for which the project site is located on federal land, federal funds may be used, and/or when formal federal agency actions are necessary for the project to move forward. One of the primary intentions of the NEPA process is to avoid, minimize and mitigate adverse environmental consequences of federal actions. NEPA requires analysis and documentation of potential adverse and beneficial effects of a proposed action and alternatives and an open public involvement process.

For this project, it is likely that BLM would be the lead federal agency for implementation of the NEPA process for projects on lands under their administration. The COE would presumably be the lead federal agency otherwise where wetlands may be impacted. It is also possible that these agencies may work out a shared lead under a Memorandum of Understanding (MOU) if there are significant issues best led by both agencies for a given project.

5.1.1 NEPA Process Upland Project Types

The applicability of NEPA to projects other than major (non-stock pond) reservoir storage and typical of those incorporated in the watershed management plan, must be determined on a case-by-case basis. For example, proposed new wildlife/livestock watering developments, including especially tank/pipeline systems that cross and/or serve federal or state rangeland will require that an appropriate NEPA process be followed. In this case, and for many of the lesser potential impact projects (e.g., a well, stock/wildlife pond, guzzler, etc.), it is possible if not likely that an EA process will be found appropriate rather than a full EIS (see related discussion in Section 5.1 above).

BLM. Under current practice, NEPA evaluations and processes for projects on BLM lands, reservoir storage projects and other types of projects that may be proposed where BLM is the lead federal agency will be performed by BLM staff or qualified, independent third party experts responsible to BLM. These experts may include specialists from other federal and/or state agencies working under memoranda of understanding (MOU) or other appropriate arrangement(s). Compliance with NEPA will be guided in large part by the Lander Resource Management Plan (LRMP) which is currently being revised and the Casper Resource Management Plan which has been approved.

Other Local/State/Federal Agencies. Depending on the specific circumstances of a particular project, it is possible that another state or federal agency may lead the NEPA process. For example, a project proposed within the Medicine Bow National Forest would presumably be led by the U.S. Forest Service. All of the relevant state and federal land management agencies have management plans developed from NEPA-compliant processes where appropriate. As discussed above for BLM, these plans will guide these agencies' NEPA process for any applicable proposed projects or improvements.

Watershed-Wide Environmental Analysis. Given the significant number of planned and potential wildlife/livestock water development projects and the opportunity for larger-scale, cooperative projects as discussed identified Chapter 4, it is recommended that serious consideration be given to the potential benefits of conducting a comprehensive "watershed-wide" environmental analysis for these and other potential water-resources related improvement projects. A key benefit of this approach would be developing a single baseline characterization and impacts assessment of the relevant environmental issues associated with these types of projects rather than repetitively for many similar individual projects. This should, in turn, substantially reduce the overall resources and time necessary to conduct the required environmental permitting (including especially NEPA compliance) for these projects. If necessary, the overall environmental analysis could be supplemented on a case-by-case basis for a particular issue in a focused, time and resource efficient manner.

5.1.2 NEPA Process for Reservoir Storage Projects

The following discussion characterizes the basic steps of the NEPA process applicable to a reservoir storage project.

Prepare a Purpose and Need Statement for the Project. It is important to develop an accurate and defensible Purpose and Need statement for the project as one of the first steps in the NEPA process. The Purpose and Need statement provides an overall or basic purpose for the proposed action and presents details supporting various needs for the project. The Purpose and Need statement should provide enough information to develop and support a "reasonable range" of alternatives. More specifically, the Purpose and Need statement guides the alternative development and screening process. With the COE as the lead agency, the Purpose and Need would include a reference to finding the "least damaging practicable alternative." This reference relates to the Clean Water Act Section 404 requirements that are under the jurisdiction of the COE and is an important part of the NEPA process for a reservoir storage project. Additional details about the Section 404 process are provided in Section 6.2. Develop Project Alternatives and NEPA Documentation Determination. The NEPA process requires analysis of the No Action alternative and a reasonable range of alternatives that fully address the project's purpose and need. The reasonable range of alternatives may include one or more "build" alternatives, depending on the nature and extent of anticipated project impacts and level of NEPA documentation to be provided.

For new, expanded or reconstructed reservoir storage projects, key issues associated with alternative development will or may include:

- loss of wetland and riparian habitat from direct inundation by a new, expanded or reconstructed reservoir;
- potential impacts on threatened and endangered species;
- potential impacts on fish and other aquatic species; and
- potential impacts on other wildlife (e.g., sage grouse; big game).

Given these issues and risk management considerations, the project team anticipates that an EIS will likely be the appropriate NEPA documentation for reservoir storage projects. An EIS involves analysis of more than one build alternative and typically takes up to several years to complete. An Environmental Assessment (EA) may or may not involve analysis of more than one build alternative and can typically be completed in less than 18 months. The outcome of an EA is either a Finding of No Significant Impact (FONSI) or a recommendation to prepare an EIS. If an EA is prepared, there is a possibility that the outcome might be that an EIS is needed. This could occur as a result of "significant impact findings" or as a result of substantial public controversy over the project's effects. If this occurs at the end of the EA process, the EIS process would need to start from the beginning, wasting a considerable amount of time and money. At this time, it appears it would be prudent to assume that an EIS process would be applicable, while leaving the option open for an EA/FONSI, rather than to proceed with an EA and take the risk that an EIS will ultimately be needed. This decision should be reviewed during a Level II study (should the project advance) when more detailed information is available on a preferred proposed action and its appropriate alternatives.

Conduct a Proactive Public Involvement Program. The NEPA process begins with public and agency outreach and related input focused on alternatives and potential impacts. Education about the project's purpose and need, project details and issues is provided and input is solicited in various ways. It is very important that the public have a clear understanding of the benefits and potential adverse impacts of the proposed action and alternatives. Public involvement is continuous throughout the project and can influence alternative development, alternative screening, issues addressed, mitigation measures, the level of NEPA documentation to be prepared (EA or EIS), and the selection of the preferred alternative.

Collect and Analyze Environmental Baseline Data. It is important to carefully identify environmental constraints and considerations early and incorporate them into alternative development efforts as a means of avoiding and minimizing potential impacts. Early field investigations and agency consultation and coordination efforts help to focus this effort and streamline subsequent analysis methods, schedule needs, and budget requirements. Creating “self-mitigating” alternatives is highly advantageous and fully consistent with the intent of NEPA.

Many NEPA analyses relate to compliance with various laws and regulations. Integrating the NEPA, National Historic Preservation Act, Endangered Species Act and other compliance processes will reduce overall permitting timeframes and costs, and streamline agency decision-making. These issues are discussed in Section 6.2.

Prepare the Draft and Final Environmental Impact Statement. The Draft EIS would be prepared in two versions. A Preliminary Draft EIS would be prepared for internal review. The Draft EIS would respond to comments on the Preliminary Draft EIS. The Draft EIS would be circulated for public review and would be the subject of a public hearing. The Final EIS would also be prepared in two versions. A Preliminary Final EIS would be prepared for internal review. The Final EIS would respond to comments on the Preliminary Final EIS. The Final EIS would be circulated for public review and would be the subject of a public hearing. A Record of Decision would be prepared to complete the NEPA process.

5.2 Permitting/Clearances/Approvals

5.2.1 Dam and Reservoir Construction

In addition to the U.S. Army Corps of Engineers (COE) Section 404 Permit, there are numerous other permits and/or approvals required for new dam and reservoir construction. Presented below are the primary additional permits and/or approvals that would be required for any of the alternative projects under consideration.

Section 404 Permit. Like all water development projects, any dam and reservoir storage project in the watershed will face environmental permitting issues. Typically the most significant environmental permit to be secured is a Section 404 Dredge and Fill permit from the COE, Omaha District. Even when impacts are anticipated to be modest, the process of obtaining a Section 404 permit for new storage projects may take several years from initiation of the NEPA process.
The primary guidance in embarking on the permitting process for a new dam and reservoir storage project is the development of a defensible Purpose and Need for the project. The NEPA process dictates

that the least environmentally damaging practical alternative that addresses the purpose and need be pursued. This is the alternative most likely to be successfully permitted.

Endangered Species Act (Section 7 Consultation). The lead agency would prepare a biological assessment to determine project effects on threatened and endangered plant and animal species listed or proposed for listing (candidate species) under the Endangered Species Act (16 U.S.C. § 1531 et seq.). U.S. Fish and Wildlife Service (FWS) would then issue an opinion on whether federal actions are likely to jeopardize the continued existence of a threatened or endangered species, or destroy or adversely modify critical habitat. FWS must approve the preparation of a biological assessment to comply with the Endangered Species Act in order to render its decision. If FWS determines that the preferred alternative would jeopardize the continued existence of a species, it may offer a reasonable and prudent alternative.

Fish and Wildlife Coordination Act. The Fish and Wildlife Coordination Act requires federal agencies involved in actions that will result in the control or structural modification of any natural stream or body of water for any purpose to take action to protect the fish and wildlife resources which may be affected by the action. It requires federal agencies or applicants to first consult with state and federal wildlife agencies to prevent, mitigate and compensate for project-caused losses of wildlife resources, as well as to enhance those resources.

Laws and Regulations Addressing Cultural Resources. Because federal approvals are likely involved with any of the identified alternatives, a consideration of effects on cultural resources must be undertaken (Section 106 consultation), as required under the following laws and regulations: the National Historic Preservation Act (NHPA) of 1966 (16 U.S.C. § 470 et seq.); the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C., § 4321); the Archaeological Resources Protection Act (ARPA) of 1979 (16 U.S.C. § 470aa et seq.); the National Park Services (NPS) procedures concerning the National Register of Historic Places (NR) (36 CFR Part 60); the Advisory Council on Historic Preservation's Procedures for the Protection of Cultural Properties (36 CFR Part 800); the Treatment of Archaeological Properties of 1980: Determination of Eligibility for Inclusion in the NR (36 CFR 63); the Secretary of Interior’s Standards and Guidelines for Archaeological Historical Preservation of 1983; Reservoir Salvage Act of 1960; and the l974 Amendment to the Reservoir Salvage Act of 1960. The State of Wyoming Historic Preservation Office (SHPO) coordinates with federal agencies in determining the significance of cultural resources potentially affected by ground disturbing activities.

In addition, consultation with relevant Native American groups concerning traditional cultural properties is required under the American Indian Religious Freedom Act of 1978 (AIRFA, P.L. 95-341.42 U.S.C. § 1996) and Section 4 of ARPA of 1979. Guidelines for evaluation of traditional cultural properties are contained in Bulletin 38 issued by the National Park Service.

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

Wyoming State Engineer’s Office Surface Water Storage Permit. The State Engineer’s Office administers the water rights system of appropriation within the state. The Applicant must obtain the necessary water rights permits from the State of Wyoming for the diversion and storage of the State’s surface water.

Wyoming State Engineer’s Office Permit to Construct/Dam Safety Review. The Wyoming Dam Safety Law (W.S. 41-3) requires that any persons, public company, government entity or private company who proposes to construct a dam which is greater than 20 feet high or which will impound more than 50 acre-feet of water, or a diversion system which will carry more than 50 cubic feet of water per second, must obtain approval for construction of the dam or ditch from the Wyoming State Engineer's Office. The approval by the State Engineer's Office of a dam's construction is contingent upon the Office's review and approval of all dam plans and specifications, which must be prepared by a registered professional engineer licensed in Wyoming. Design, construction, and operation of jurisdictional dams must also comply with dam safety regulations promulgated pursuant to the Dam Safety Act.

Wyoming State Engineer’s Office Ditch Enlargement Permit. In addition to the permits and clearances that will be required for reservoir construction, existing irrigation ditches may required to convey water to off-channel reservoirs. If so, this effort would require an enlargement filing with the Wyoming SEO. Even if physical enlargement of the existing ditch was found to not be required, the enlargement filing would be a legal formality as a water right requirement.

Wyoming Department of Environmental Quality – National Pollution Discharge Elimination System (NPDES) permit and Section 401 Certification. The federal Clean Water Act is administered in Wyoming by the Department of Environmental Quality (WDEQ), Water Quality Division (WQD) consistent with the Wyoming Environmental Quality Act. The Section 401 Certification is the State’s approval to ensure that the activities authorized under Section 404 meet state water quality standards and do not degrade water quality. Any discharge of pollutants into the broadly defined “waters of the state” requires application to and permit issuance by WQD in accord with WQD’s Rules and Regulations. This body of regulations sets forth classification of surface and groundwater uses and establishes water quality standards (Wyoming Water Quality Standards). The WQD administers the NPDES permit system including storm water permits and construction-related, short-term discharge permits.

Implementation of any of the action alternatives would require application for and compliance with the provisions of the statewide general NPDES Construction Storm Water Discharge Permit (WYR10-000). Construction activities associated with dam construction or enlargement often result in the requirement to temporarily discharge pumped water. These discharges are provided for in a general permit. Upon acceptance of the application by DEQ, the temporary discharge must be in compliance with the terms of the general permit and any stipulations applied as a result of the application’s review.

EPA has oversight responsibility for federal Clean Water Act programs delegated to and administered by the State Water Quality Division. EPA also may intervene to resolve interstate disputes where discharges of pollutants in an upstream state may affect water quality in a downstream state.

Mining Permit. A Wyoming mining permit is not required for development of an aggregate and/or borrow material source solely for use in construction of one of the various reservoir alternatives and whose product is not for commercial sale. Commercial sources of aggregate, rock, or other mined materials are responsible for obtaining and maintaining all required permits and clearances for their operations.

Special Use Permits/Rights-of-Way/Easements. Special use permits, rights-of-way (ROW) or easements will be required wherever access across the lands of others (private, state or federal) is needed for construction and/or operation of the project facilities. These may be temporary (e.g., access to a temporary borrow area or quarry site to be closed and reclaimed; construction of a new haul road; etc.) or permanent (e.g., construction of a wildlife/livestock pipeline alignment). Usually privately owned lands that will be rendered permanently unavailable (such as the dam and reservoir footprint of a storage project) would be purchased unless the owner desired (and the sponsoring entity agreed) to a permanent easement. Permanent use of BLM lands would most likely be administered under a grant with an appropriate term issued under their ROW process; the U.S. Forest Service would use their equivalent special use process. An easement or ROW from the Wyoming Department of Transportation (WYDOT), Carbon County and/or Sweetwater County may also be required. The specific requirements for rights-of-way, special use permits and easements vary widely and should be determined as part of the early stages of planning for a specific proposed project. This will help to avoid the potential for significant project delay, higher costs, or required changes in location/alignment or design during project development and implementation.

Other. In addition to the above, there may be other permits and clearances required for a given dam and reservoir project. These might include permits typically required to be provided by the construction contractor (e.g., air quality permit; trash/slash burning permit; etc.).

5.2.2 Other Project Types

Permits, clearances and approvals for projects other than major dams and storage reservoirs will depend on the specific nature and location of the project. Various permits and clearances discussed above in Section 6.2.1 may also apply to other types of projects. The specific permits and clearances necessary for a particular project should be determined early in the planning stages of the project to ensure compliance with applicable laws and regulations, and to avoid possible delays, increased costs and possibly re-design later during project implementation.

5.3 Environmental Considerations

Proposed, Threatened and Endangered Species. The following species have the potential to occur within the proposed project areas within the watershed:

Endangered: Black-footed Ferret (*Mustela nigripes)*

(Wyoming Natural Diversity Database [WYNDD], 2013).

Other Animal Species of Concern. The Wyoming Natural Diversity Database (WYNDD) lists several other species of concern existing within the study area. This list was presented and discussed in Chapter 3 of this report and contained 2 amphibians, 1 reptile, 2 fish, 36 birds, 21 mammals, 1 crustacean, 6 mollusks, and 14 flowering plants.

The potential exists for some of these species to occur within appropriate habitats within the watershed. Although none of these species receive federal or state protection, sage grouse are identified as a sensitive species/species of concern and merit special attention as discussed in some detail in the following paragraphs.

The greater sage grouse (Centrocercus urophasianus) is a native species to the area and is almost totally dependent on open sagebrush plain. The males will gather in the early spring to lek (breeding ground) locations to start their elaborate courtship rituals (strutting). They are considered omnivores, eating insects, sagebrush and seeds; but are most reliant upon sagebrush for both cover from predators and for food.

The greater sage grouse is listed as a sensitive species by the BLM, and a species of concern 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 refugia or other unique habitats. WGFD lists the greater sage grouse as: species that are widely distributed, with population status or trends unknown but suspected to be stable; habitat restricted or vulnerable but no recent or on-going significant loss; species likely sensitive to human disturbance. The sage grouse are 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/recommendations to help protect the sage grouse.

BLM has recommended that there be no surface occupancy within 0.25-mile radius of any known lek location or a 2-mile radius during the breeding season, on BLM land or lands adjacent to BLM lands. Recent studies have shown that the 2-mile radius is not sufficient, showing declines in the number of males returning to the leks with activities occurring beyond the 2-mile radius. Thus, the current recommendations may change over time.

It is recommended that coordination with BLM and WGFD occur regarding any proposed or alternative project that has the potential to impact sage grouse habitat. Note that providing water to areas where water is limited may create a beneficial impact for sage grouse and should be considered when evaluating the net potential impacts to this species.

Rare Plant Species of Concern. The WYNDD has 34 known sensitive plant species of concern located in the watershed as discussed in Chapter 3 of this report. The potential exists for some of these species to occur within appropriate habitats within the project area. However, none of these species receive federal or state protection.

Big Game. The Little Badwater / Poison Creek watershed contains portions of crucial big game habitat for antelope, mule deer, elk and moose managed by the Wyoming Game and Fish Department (WGFD) and big game (elk and moose) parturition (birthing) sites. The WGFD maps the seasonal ranges by herd unit for each big game species and makes special note of areas listed as crucial habitat. 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.

Fisheries. Most of the alternative reservoir sites are located on tributaries that are considered perennial and contain viable fisheries resources. Impacts to the various streams and associated fishery resources will occur with any of the alternative dam and reservoir storage alternatives and should be considered during further environmental evaluation of these sites.

Wetland Resources. Formal wetland delineation in accordance with the Corps of Engineers guidelines was beyond the scope of this Level I study and was not conducted. GIS digital mapping from the National Wetland Inventory (NWI) was acquired to preliminarily identify wetland habitats in the study area. Likewise, LANDFIRE data were obtained and evaluated as presented in Chapter 3. The various locations identified as potential alternative reservoir storage sites are all located on what are considered intermittent to perennial riverine systems. These systems are associated with streambeds and their associated wetland/riparian habitat. Riparian habitats are considered to be valuable habitat for both mammals and birds, along with assisting in reducing flooding. The creation of a reservoir on the drainage would inundate the basin bottoms changing the landscape/habitat.

Some of the areas identified on the NWI maps and within the LANDFIRE datasets as wetlands or other riparian system categories, may in fact not qualify as jurisdictional wetlands upon subsequent detailed examination in the field. This is due to inherent limitations in the aerial photography or satellite imagery-based methodologies used to prepare the NWI maps. In general, our previous experience suggests that estimates of wetland acreage based on the NWI maps or within LANDFIRE datasets tend to be conservatively high and actual acreage of jurisdictional wetlands may be less.

Formal wetlands delineation would be necessary prior to construction at any proposed reservoir storage site, and in any other areas of proposed disturbance (e.g., at spring development sites and along associated pipeline alignments) to determine the level of impacts to wetlands located in the alternative project area and to identify and quantify any necessary mitigation of those impacts.

5.4 Mitigation

Based on prior experience, mitigation could be required at any of the identified alternative dam and reservoir sites to address impacts to wetlands, riparian vegetation, stream channel habitat, cultural resources, fish and game resources, and possibly threatened or endangered species. It is preferred to avoid the need for mitigation of a potentially significant impact by relocation and/or “self-mitigating” design if technically and economically feasible.

Detailed mitigation plans would need to be prepared and approved to replace any lost wetlands identified and quantified by formal wetlands delineation, and riparian vegetation communities. However, given the relatively small acreages of wetlands at the alternative dam and reservoir sites (ranging from less than 1 to 12.2 acres), it is anticipated that mitigation of this resource will be possible at any of the sites by constructing additional wetlands nearby, ideally in the same mainstem stream and/or in a close-by tributary.

Mitigation of potential raptor and big game impacts would generally involve control of certain construction activities during sensitive time periods, and avoidance of direct disturbance of the subject species. Mitigation of potential sage grouse lek impacts will be given special consideration as discussed previously. If any T&E species were encountered at a given site special studies would be required to determine if appropriate mitigation could be implemented. In general, any such impacts would be avoided to the greatest extent possible by relocation of site facilities.

Additional cultural and historic resource fieldwork would need to be completed to identify and document any such resources that would be inundated or otherwise impacted as a result of constructing any one (or more) of the alternative dams and reservoirs or other potential projects described in Chapter 5. This would include, in turn, a class I (literature search) survey, a Class II (reconnaissance inventory) survey, and if needed, a class III (intensive inventory) survey. Ultimately, a mitigation plan for cultural resources would be developed which would culminate in a Memorandum of Agreement (MOA) between the Wyoming SHPO and the lead federal agency with concurrence by the project sponsor(s), and possibly affected Native American tribes. The agreement would require approval from the Advisory Council on Historic Preservation.

5.5 Land Ownership and Property Owners

Where applicable, permission should be negotiated for easement/right-of-access for all construction activities associated with the project.

VI. FUNDING OPPORTUNITIES

6.1 Overview

Project funding/financing is a critical aspect associated with the implementation of watershed improvement projects. Given the scope of the investigation and the perceived projects which may be pursued (storage reservoirs, irrigation infrastructure improvements, wildlife/stock watering, stream/riparian corridor rehabilitation, and "other" water-resource related project types), there may be a large variety of funding sources which may be available to provide funding for future watershed improvements.

Alternative sources of funding to watershed projects are discussed in the pages that follow. Potential sources include local, state, and federal entities. Much of the information contained in this report was obtained through the following sources which provide a wealth of information on grant, loan and in-kind support for watershed related projects:

- ***Water Management & Conservation Assistance Programs Directory, Fourth Edition*** (WWDC, May 2009) first compiled by the Wyoming State Engineer's Office and now maintained by the Wyoming Water Development Commission at the following website:
  http://wwdc.state.wy.us/wconsprog/WtrMgntConsDirectory.html.

- ***Catalog of Federal Funding Sources for Watershed Protection*** developed and maintained by the Environmental Protection Agency. This site is a searchable database of financial assistance sources (grants, loans, cost-sharing programs, etc.) available to fund a variety of watershed protection projects. The document is available at the following website:
  http://cfpub.epa.gov/fedfund/

- ***Habitat Extension Bulletin No. 50 – Fisheries and Wildlife Habitat Cost Share Programs and Grants*** published by the Wyoming Game and Fish Department provides a very comprehensive listing of potential funding sources for fisheries and wildlife habitat projects. The document is available at the following website:
  http://wgfd.wyo.gov/web2011/Departments/Wildlife/pdfs/BULLETIN_NO500001792.pdf

In addition, discussions of several funding programs were extracted from previous watershed investigations completed on behalf of the Wyoming Water Development Commission. Specifically, the Little Snake River Watershed Investigation (Anderson Consulting Engineers, 2013) and the Thunder Basin Watershed Investigation (Olsson, 2011) were reviewed and sections incorporated herein where appropriate.

It is important to understand that the potential sources identified herein are not necessarily exhaustive of the resources that may be available, that existing programs change and sometimes disappear over time, new programs arise, funding levels vary year to year, and competition for many of the programs is significant. Also, contact information for various programs and key people can also change. Key local contacts for current information on funding sources relevant to watershed protection, restoration and conservation, wildlife/stock watering, and irrigation infrastructure improvements include, but are not limited to the following:

- Lower Wind River Conservation District (307-856-7524)
- Natrona County Conservation District (307-261-5436 Ext. 103)
- NRCS Riverton Office (307-856-7524)
- Bureau of Land Management/Worland District Office (307-347-5100)
- Bureau of Land Management/Lander District Office (307-332-8400)
- Bureau of Land Management/Casper District Office (307-261-7600)

Key aspects and information about the primary funding programs identified are discussed in the following sections and summarized in a matrix format (Table 6.1-1).

6.2 Local Agencies

6.2.1 Conservation Districts

The Lower Wind River and Natrona County Conservation Districts serve as the local liaison between local landowners and resource users and state and federal government agencies. In addition to their many other roles and responsibilities, these districts can also provide funding assistance as follows:

- In-kind technical assistance as local resources, capacity and expertise allow.
- Administration of programs, projects and grants on behalf of recipients of state and federal natural resources program funding.
- Assistance in development of leveraged, partnered programs and projects.

6.2.2 County Weed and Pest Districts

Wyoming Weed and Pest Districts provide in-kind support to landowners and other agencies/entities including, but not necessarily limited to:

- Assistance in the identification of noxious weeds and other undesirable plants;
- Organization and/or participation in local meetings, seminars and field trips to educate local landowners and agencies on the problems and potential solutions for weed and other undesirable plant control;

Table 6.1-1 Potential Funding Sources.

Agency/Entity	Program Name	Project Type(s)	Internet Site	Telephone	Email
Local					
Lower Wind River Conservation District	n/a	Liaison, in-kind administrative and technical assistance, program coordination/partnering	N/A	307-856-7524	cathy.meyer@wy.nacdnet.net
Natrona County Conservation District	n/a		http://www.natronacountyconservationdistrict.com/	307-261-5436 Ext. 103	lisa.ogden@wy.nacdnet.net
NRCS Riverton Office	n/a		http://www.nrcs.usda.gov/wps/portal/nrcs/site/wy/home/	307-326-8156	nick.biltoft@wy.usda.gov
Fremont County Weed and Pest	n/a		http://www.fcwp.org/	307-273-9683	fcwp@wyoming.com
Natrona County Weed and Pest			http://www.natronacountyweeds.com/	307-472-5559	
Hot Springs County Weed and Pest	n/a		N/A	307-864-2278	
State					
Wyoming Department of Environmental Quality	Nonpoint Source Implementation Grants (319 Program)	Water quality BMPs	http://deq.state.wy.us/wqd/watershed/index.asp	307-777-6080	jennifer.zygmunt@wyo.gov
Wyoming Game and Fish Department	Riparian Habitat Improvement Grant	Stock water development; streambank stabilization; etc.	http://wgfd.wyo.gov/web2011/home.aspx	Scott Talbott Director 307-777-4600	See WGF Website for contact diretories
	Water Development/Maintenance Habitat Project Grant	Water developments (springs, windmills, guzzlers, pumps, etc.)			
	Upland Development Grant	Range management; prescribed burns			
	Fish Wyoming	Public fishing opportunities	http://wgfd.wyo.gov/web2011/fishing-1000182.aspx		
	Wyoming Sage Grouse Conservation Fund	Sage-grouse habitat protection or improvement	http://wgfd.wyo.gov/web2011/WILDLIFE-1000817.aspx		
Wyoming Office of State Lands and Investments	Regular Farm Loans	Projects involving most agricultural purposes	http://lands.state.wy.us/	307-777-7331	slfmail@wyo.gov
	Small Water Development Project Loans	Converson of dry land to irrigated land and/or water use efficiency improvements			
Wyoming Water Development Commission	Wyoming Water Development Program	Planning, design and construciton of new reservoir storage and rehabiliation of existing reservoir storage projects	http://wwdc.state.wy.us/	307-777-7626	jon.wade@wyo.gov
	Small Water Project Program	Small reservoirs and stock ponds, wells, pipelines/conveyance, spring			ron.vore@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	307-777-8024	NA
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	307-332-8400 (Lander FO) 307-261-7600 (Casper FO) 307-347-5100 (Worland FO)	Lander_WYMail@blm.gov Casper_WYMail@blm.gov Worland_WYMail@blm.gov
	Cooperative Agreement for Range Improvements	Reservoirs, pits, spring developments, wells, and associated distribution pipelines	http://www.blm.gov/wy/st/en/info/offices.html	307-332-8400 (Lander FO) 307-261-7600 (Casper FO) 307-347-5100 (Worland FO)	Lander_WYMail@blm.gov Casper_WYMail@blm.gov Worland_WYMail@blm.gov
Bureau of Reclamation	WaterSMART Grants Program	Water conservation, efficiency and marketing	http://www.usbr.gov/WaterSMART/grants.html	307-261-5671	http://www.usbr.gov/gp/contact.html
Environmental Protection Agency	Targeted Watershed Grants Program	Riparian, wetland, aquatic and upland habitat protection and improvement	http://water.epa.gov/grants_funding/shedfund/watershedfunding.cfm	800-227-8917 (Region 8 EPA)	r8eisc@epa.gov
Farm Service Agency	Conservation Reserve Program (CRP)	Removal of highly erobible lands from production	http://www.fsa.usda.gov/FSA/stateoffapp?mystate=wy&area=home&subject=landing&topic=landing	307-261-5231	gregor.goertz@wy.usda.gov
	Continuous Sign-Up for High Priority Conservation Practices	Riparian buffers, filter strips, grass waterways, salt tolerant vegetation, shallow water areas for wildlife, etc.			
	Emergency Conservation Program (ECO)	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
	North American Wetlands Conservation Act Program	Various wetlands conservation projects	http://www.fws.gov/birdhabitat/Grants/NAWCA/index.shtm		
	Landowner Incentive Program (Non-Tribal)	Funding to WGFD to support above project types	http://wsfrprograms.fws.gov/Subpages/GrantPrograms/LIP/LIP.htm		
Natural Resources Conservation Service	Environmental Quality Incentives Program	Conservation planning, range management, irrigation rehabilitation, livestock watering, etc.	http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/	307-233-6750 (State Office) 307-261-5402 (Casper Office) 307 856-7524 (Riverton Office) 307-864-3488 (Thermopolis Office)	astrid.martinez@wy.usda.gov
	Watershed and Flood Prevention Operations Program	Water supply, water quality control, erosion and sediment control, wetland creation and restoration, fish and wildlife habitat enhancement, flood control, public recreation, etc.	http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/wfpo/		
	Wildlife Habitat Incentives Program(WHIP)	See websites and/or local contacts for detailed information on these programs	http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/financial/whip/?cid=nrcs143_008423		
	Wetlands Reserve Program (WRP)		http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/wetlands/		
	Grassland Reserve Program (GRP)		http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/grassland/		
	Conservation Security Program (CSP)		http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/alphabetical/csp		
	Farm and Ranchlands Protection Program (FRPP)		http://www.nrcs.usda.gov/programs/frpp/		
	Emergency Watershed Protection (ERP)		http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/ewp/		
	Sage Grouse Restoration Project (SGRP)		http://sgrp.usu.edu/		
	Grazing Lands Conservation Initiative (GLCI) Grants		http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/technical/?cid=nrcs143_008456		
Private					
Ducks Unlimited	n/a	Waterfowl aquatic and upland habitat protection, restoration and enhancement	http://www.ducks.org/conservation/du-regional-offices	Great Plains Regional Office: 701-355-3550	
National Fish and Wildlife Foundation	Pulling Together Initiative	Long-term weed management projects	http://www.nfwf.org/whatwedo/grants/Pages/home.aspx	202-857-0166	info@nfwf.org
	Native Plant Conservation Initiative	Restoration of native plant communities			
	Bring Back the Natives Grant Program	Riverine habitat and aquatic species restoration projects			
	Five-Star Restoration Program	Wetland and riparian habitat restoration			
Trout Unlimited	Western Restoration	Erosion control, fish habitat structures, willow and other riparian plantings, etc.	http://www.tu.org/tu-programs/western-restoration	1-800-834-2419 (National Office)	wcolyer@tu.org

- Facilitating work days attended by a broad base of stakeholders (e.g., Russian olive tree cutting); and
- Assistance in preparation of grant applications.

The Fremont County, Natrona County or Hot Springs County Weed and Pest Districts should be contacted to determine the specific assistance available from each.

6.3 State Programs

6.3.1 Wyoming Department of Environmental Quality

The Wyoming Department of Environmental Quality (WDEQ) provides funding for implementation of best management practices (BMPs) to address non-point sources of pollution under Section 319 of the Clean Water Act. Section 319 grant funding requires a non-federal (i.e., local) match of 40 percent from the applicant. These matching funds may be provided by landowners, a conservation district, other quasigovernmental entities (e.g., watershed improvement district, irrigation district, etc.), and/or non-profit organizations (e.g., Trout Unlimited, Ducks Unlimited, and the Rocky Mountain Elk Foundation). Applications (proposals) conforming to a specified format are required. The proposal describes in some detail the issues to be addressed and the proposed methods/BMPs to be implemented, as well as providing all other information required to evaluate the proposed project and matching fund entity (ies). These proposals are normally due in August or September of each year.

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, 2009):

"The Wyoming Game and Fish Department offers a funding program to help landowners, conservation groups, institutions, land managers, government agencies, industry and non-profit organizations develop and/or maintain water sources for fish and wildlife. This program also provides funding for the improvement and/or protection of riparian/wetland areas for fish and wildlife resources in Wyoming. Applications for projects are accepted any time with approval on January 1 and August 1 of each year."

- **Riparian Habitat Improvement Grant**. The purpose of this program is to improve or maintain riparian and wetland resources. Fencing, herding, stock water development, streambank stabilization, small damming projects and beaver transplanting are a few examples of efforts that qualify under this program. Permits, NEPA compliance, construction, maintenance, access and management planning are all grantee responsibilities. There is $10,000/project maximum available with 50% cash or in-kind required from grantee.

- **Water Development/Maintenance Habitat Project Grant.** The purpose of this program is to develop or maintain water for fish and wildlife. Spring development, windmills, guzzlers, water protection and pumping payments are examples of the extent of this program. Permits, NEPA compliance, maintenance, access and water rights are responsibilities of the grantee. There is a maximum of $7,500/project and 50% cash or in-kind contribution required from the grantee.

- **Upland Development Grant**. The purpose of this program is to develop upland wildlife habitat. Example project include management, grazing systems, prescribed burning, wildlife food plots such as oat, millet or corn plantings, range pitting and range seeding. Permits, NEPA compliance, maintenance, access and management planning are responsibilities of the grantee. There is a maximum of $10,000/project and 50% cash or in-kind contribution required from the grantee.

- **Fish Wyoming**. The purpose of this program is to develop public fishing opportunities. Examples of projects within this effort are boat ramps and fishing access. This program provides a 50% match of funding which is channeled through a private organization or municipality."

- **Wyoming Sage Grouse Conservation Fund**. WGFD also administers the Wyoming Sage-Grouse Conservation Fund (WSGCF); http://wgfd.wyo.gov/web2011/home.aspx). The WSGCF is a special fund established by the Wyoming State Legislature to support the efforts of Local Sage-Grouse Working Groups (LWGs). The WSGCF funding is intended to promote conservation of sage grouse populations and habitat (sagebrush ecosystems), including socio-economic and human use of the habitat. The BHLWG has recently completed the Sage-grouse Conservation Plan for the Big Horn Basin (BHLWG, 2007) to identify and guide implementation of these objectives.

Requests for WSGCF funding must be made on a Project Proposal Form available at: http://gf.state.wy.us/wildlife/wildlife_management/sagegrouse/BigHornBasin/BHB%20SgConservPlanFinal.pdf . Funding is normally considered for projects ranging between $5,000 and $50,000, with priority given to those with matching funds, established partnerships, multi-species benefits, management relevance and consistency with the local sage-grouse conservation plan, highest wildlife impact, appropriate budgets, landscape scale, and a lasting legacy of benefits. Evaluation criteria include: consistency with the local plan, likelihood of project success, project readiness, availability of matching funds, multiple species benefits, significance at local/state/regional level, duration of benefits, and adequacy of funding. Application may be made at any time, but should be made by February 1 to receive first round consideration. Funds awarded must be expended between July 1 of the year received and September 30 of the second year after award. The funds are normally distributed as reimbursable grants (i.e., payments are made for expenses incurred and not "up-front"). Requests for funding of habitat improvement projects, including water developments, must include a livestock grazing management plan. A Project Close-out Report must also be submitted upon completion to allow tracking of expenditures and tracking of results.

6.3.3 Wyoming Office of State Lands and Investments

As the administrative advisory arm of the Board of Land Commissioners and State Loan and Investment Board, the Office of State Lands and Investments (OSLI) administers Regular Farm Loans and Small Water Development Project Loans that may be applicable to potential projects identified in Chapter 5.

- **Regular Farm 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. Single loans or combinations of loans cannot exceed an outstanding principal balance of $600,000. Loan rates are 8 percent for loans up to 50 percent of the appraised value of the security land and improvements and 9 percent for loans between 50 and 60 percent of the security. The term of a given loan is limited to 30 years.
- **Small Water Development Project Loans**. These loans are authorized for projects for development and use of water upon agricultural lands for agricultural purposes. These projects may convert dry land into irrigated land or lead to more efficient use of water and/or increased crop or forage production. Eligible recipients may include court approved water districts, agencies of state and local government, persons, corporations, associations, and other legal entities recognized under state law. Individual loans up to $150,000 may be made. Interest is currently set at 6 percent and the maximum term of loans is 40 years.

6.3.4 Wyoming Water Development Commission

The mission of the Wyoming Water Development Commission (WWDC) as defined in the enabling legislation is to: *"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 abatement of pollution, for preservation and development of fish and wildlife resources…and shall help make available the waters of the state for all beneficial uses…"* (W.S. 41-2-112(a)).

Key aspects of the Wyoming Water Development Program and the Small Water Project Program administered by WWDC are described in the following subsections.

6.3.4.1 Wyoming Water Development Program

The main Wyoming Water Development Program encompasses new development, dams and reservoirs, rehabilitation, water resources planning and master planning. Of most relevance to the

Badwater/Poison Creek Study Area in terms of implementing alternative projects are the New Development -Rehabilitation Programs and Dams and Reservoirs Program described below. This information was abstracted from the Operating Criteria of the Wyoming Water Development Program available at: http://wwdc.state.wy.us/opcrit/final_opcrit.pdf and from a form titled Information for New Applicants available at the following website: http://wwdc.state.wy.us/projappl/New_Ap_Info.pdf .

It is very important to ensure that the most current information on funding is reviewed prior to making an application as WWDC's policies and procedures can and do change over time in response to legislative direction and/or Commission action. Review of information available at the above websites and contact with the staff of the WWDC (306.776.7626) is recommended prior to beginning the application process.

- New Development Program — the New Development Program develops presently unused and/or unappropriated waters of Wyoming.
- Rehabilitation Program — The Rehabilitation Program provides funding assistance for the improvement of water projects completed and in use for at least fifteen (15) years.
- 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.
- Water Resource Planning — The Wyoming Water Development Commission serves as the water development planning agency for the State of Wyoming. In this capacity, the WWDC can provide the following assistance to project sponsors.
    - Basin Wide Plans — the program serves to develop basin wide plans for each of the state's major drainage basins.
    - Master Plans — the program provides a service to municipalities, districts and other entities to assist in the preparation of planning documents which serve as master plans for future water supply systems and improvements. The plans serve as 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 efficient water supplies. Municipalities and special districts that purvey drinking water are eligible to receive up to $400,000 in grant funds if 25% of the total project costs will be paid by local matching funds.

New Development Program. This program provides technical assistance and funding to develop waters of the state that are unused and/or unappropriated at present. It deals with a wide range of projects; including as most relevant to the Badwater/Poison Creek Study Area are the following types of projects:

- Multiple Purpose (including among other uses two or more of the following: agriculture, recreation, environmental, and erosion control);
- New Storage (dams and reservoirs less than 2,000 acre-feet);
- New Supply (e.g., deep wells, alluvial wells, diversion dams);
- Watershed Improvement (for components whose primary function or benefit is water development); and
- Recreation.

These project types are listed above in the order of preference assigned by WWDC when determining what projects to pursue among all of the applications received for funding.

Rehabilitation Program. The Rehabilitation Program addresses the improvement of water projects completed and in use for at least fifteen years in order to assist in keeping existing water supplies effective and viable for the future. Relative to the Badwater/Poison Creek Study Area, the Rehabilitation Program can improve existing agricultural storage facilities or conveyance systems to insure safety, decrease operation and maintenance (O&M) costs, and increase the efficiency of agricultural water use. The types of projects supported relevant to this watershed are essentially the same as listed above for the New Development Program.

Note that on-farm improvements (e.g., gated pipe, side rolls, center pivots and related facilities and/or equipment such as pumps, 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. The source of revenue for the program is Water Development Account No. III [W.S. 41-2-124(a) (iii)], which has received Water Development Account No. I appropriations and budget reserve account appropriations on occasion, as approved by the legislature; the interest earnings that have accrued to the Water Development Account No. III; and a percentage (0.5%) of the revenues which accrue to the state's severance tax distribution account. Legislative approval must be granted prior to allocating funds to a particular purpose or project.

Dams and reservoirs typically provide opportunities for many potential uses. While water supply shall be emphasized in the development of reservoir operating plans, recreation, environmental enhancement, flood control, erosion control and hydropower uses should be explored as secondary purposes.

Key Criteria and Procedures. An application for funding under either the New Development and Rehabilitation Programs must meet the following key criteria most applicable to potential projects as identified in Chapter 5:

- *"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 improvements..."*

Important procedures, deadlines and requirements for applications to the New Development and Rehabilitation Programs include but are not necessarily limited to the following:

- A fee of $1,000 must be submitted with 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 are:

- *"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:

- Sixty-seven (67) percent grant to thirty-three (33) percent loan mix.
- Minimum four (4) percent loan interest rate (current rate is 4 percent, but legislature may increase rate).
- Maximum 50-year term of loans; term shall not exceed 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 grant 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 due to 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 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 feels 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. This will allow the applicant to know if there is a viable project prior to 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 two-year duration with the study being completed the first year and the sponsor forming a 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. As the evaluations of the feasibility of new dams are complex, this will allow the applicant to know if the proposed reservoir is feasible prior to becoming a public entity. However, the applicant must be a public entity before applying for Level II, Phase III funding.

6.3.4.2 Small Water Project Program

The Small Water Project Program (SWPP) is intended to be compatible with the conventional WWDC program described above. Small water projects are defined as providing multiple benefits where the total estimated project costs (including construction, permitting, construction engineering, and land procurement) are less than $100,000 or where WWDC's maximum financial contribution is 50 percent of project costs or twenty-five thousand dollars ($25,000), whichever is less. SWPP funding is a "one-time" grant so that ongoing operation and maintenance costs are not included. Loans are not available under SWPP.

Eligibility. The kinds of projects eligible for SWPP funding include, but are not necessarily limited to:

- small reservoirs and stock watering ponds (up to 20 feet high and 20 acre-feet capacity);
- wells;
- pipelines and conveyance facilities;
- spring developments;
- windmills;
- wetland developments;
- solar platforms; and
- irrigation infrastructure.

These projects may address environmental concerns by providing water supplies to support plant and animal species, and serve as instruments to improve range land conditions.

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 as noted previously. Some key aspects of the process and procedures applicable to the potential projects identified in Chapter 5 include the following:

1. 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 describing 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.

2. Applications shall be received by January 1 of each calendar year. Applications meeting criteria requirements will be considered during the regularly scheduled WWDC meeting in March. Applications shall include a project application, 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.

3. 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.

4. The sponsoring entity will be required to address the WWDC and provide testimony and other additional supporting evidence that justifies SWPP funding whenever the public benefit documentation, submitted with the application, is deemed to be insufficient by the WWDO.

6.3.5 Wyoming Wildlife and Natural Resource Trust

The Wyoming Wildlife and Natural Resource Trust (WWNRT) was formed by the state legislature in 2005 to preserve and enhance Wyoming's wildlife and natural resources. Projects funded by WWNRT must provide a public benefit such as continued agricultural production to maintain open space and healthy ecosystems, enhancements to water quality, and maintenance or enhancement of wildlife habitat.

Wildlife and Natural Resource Trust funding is available for a wide variety of projects throughout the state, including 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 minimum amounts, and acquisition presents the necessary factor in attaining or preserving desired 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.

Funding is by grant with no matching funds required. Non-profit and governmental organizations (including watershed improvement districts, conservation districts, etc.) are eligible for funding by WWNRT. Projects will be funded in July and January. Applications may be filed any time, but must be filed within 90 days of the next funding cycle to receive consideration in that cycle.

6.4 Federal Agencies

6.4.1 Bureau of Land Management

- **BLM's Riparian Habitat Management Program** offers the opportunity to coordinate with outside interests on riparian improvement projects. The goal of BLM's riparian-wetland management is to maintain, restore, improve, protect, and expand these areas so they are in proper functioning condition for their productivity, biological diversity, and sustainability. The overall objective is to achieve an advanced ecological status, except where resource management objectives, including proper functioning condition, would require an earlier successional stage. The goal includes aggressive riparian-wetland information, inventory, training, and research programs as well as improving the partnerships and cooperative management processes.

Partnerships have been available for riparian improvement projects and for research into riparian issues. Funding is available on an annual basis subject to budget allocations from Congress. All submitted cooperative projects compete for the funds available in the riparian program. For information on the riparian habitat program within BLM, please contact Mark Gorges (307) 775-6100.

- **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 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. They also contribute labor on occasion. For information on the range improvement program within BLM, please contact Jim Cagney (307) 775-6194.

- **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 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 TMDL's for these watersheds, BLM will be routinely involved in watershed health assessments, planning, project implementation and Best Management Practice (BMP) monitoring.

Now, and in the future, the goals of cooperative watershed projects will typically be the restoration and maintenance of healthy watershed function. These goals will typically be accomplished through approved BMP's, e.g. prescribe burns, vegetation treatments, instream structures, too enhance vegetation cover, control accelerated soil erosion, increase water infiltration and enhance stream flows and water quality.

Currently, 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 Bureau of Reclamation

The Bureau of Reclamation (BOR) administers the Water 2025 Challenge Grant Program. This program provides funding on a competitive basis for projects focused on water conservation, efficiency and water marketing. Preference is given to projects that can be completed within 24 months that will help to prevent crises over water in areas identified as "hot spots" where potential for conflict is judged to be moderate to highly likely by 2025.

6.4.3 Environmental Protection Agency

The Targeted Watershed Grants Program administered by the Environmental Protection Agency (EPA) "encourages watershed practitioners to examine local water related problems in the context of the larger watershed in which they exist, to develop solutions to those problems by creatively applying the full array of available tools, including general, state and local programs, to restore and preserve water resources through strategic planning and coordinated project management that draw in public and private sector partners..." as described in the following program website: http://www.epa.gov/twg/2006/2006faq.html#intro. Organizations eligible for funding include nonprofits, tribes, and local governments. The assistance provided consists of grants for up to 75 percent of the total project costs. A match of at least 25 percent is required. The typical median amount awarded is $700,000 with a typical range of $300,000 to $900,000. It is important to note that application must be made by the governor, and that the competition for these grants is keen.

6.4.4 Farm Service Agency

The Farm Service Agency (FSA) administers three different programs that may be applicable to some of the alternative projects identified in Chapter 5. Technical assistance for the FSA programs is provided by NRCS. Each of these three programs is briefly discussed below.

- **Conservation Reserve Program (CRP).** This is a voluntary program under which eligible highly erodible cropland is removed from production in return for annual rental payments and cost share assistance by FSA over a 10-15 year period. The producer is required to establish long-term conservation practices on the erodible, environmentally sensitive lands taken out of production. Continuous Sign-Up for High Priority Conservation Practices. Under this program farmers and ranchers implement certain high-priority conservation practices on their eligible CRP lands. These practices may include: riparian buffers, filter strips, grass waterways, shelter belts, field windbreaks, living snow fences, contour grass strips, salt tolerant vegetation, and shallow water areas for wildlife.

  This cost share program offers rental rates for the CRP lands based on the average value of dryland cash rent with an additional financial incentive of up to 20 percent of the soil rental rate for selected practices. Establishing permanent cover merits up to a 50 percent cost share.

- **Emergency Conservation Program (ECP)**. This program provides emergency funding and technical assistance for implementing emergency livestock watering conservation measures during periods of severe drought and rehabilitating farmland damaged during natural disasters. Cost share assistance up to 75 percent of the cost to implement the emergency measure(s) is available.

- **<u>Continuous Sign-Up for High Priority Conservation Practices:</u>** Continuous sign-up provides management flexibility to farmers and ranchers to implement certain high-priority conservation practices on eligible land. Land must meet the requirements of CRP and be determined by the NRCS to be eligible and suitable for:

Riparian buffers	Living snow fences
Filter strips	Contour grass strips
Grass waterways	Salt tolerant vegetation
Shelter belts	Shallow water areas for wildlife Field windbreaks

  This is a cost share program that offers rental rates based on the average value of dryland cash rent with an additional financial incentive of up to 20% of the soil rental rate for field windbreaks, grass waterways, filter strips and riparian buffers. An additional 10% may be added if the land is located in an EPA-designated wellhead protection area. There is also a provision for cost share of up to 50% of the cost of establishing permanent cover.

6.4.5 Fish and Wildlife Service

Technical and financial assistance are available to private landowners, 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 Wildlife Habitat** This program provides technical and financial assistance directly to private landowners through voluntary cooperative agreements called Wildlife Extension Agreements (WEA). The program targets habitats that are in need of management, restoration or enhancement such as riparian areas, streams, wetlands and grasslands. Under these Wildlife Extension Agreements, private landowners agree to maintain the restoration projects as specified in the agreement but otherwise retain full control of the land. Depending on the number of partners, the cost share may vary somewhat but is typically 75% partners and 25% landowner.

- **North American Wetlands Conservation Act Grant Program** This grant 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 acquisition, enhancement and restoration of wetlands and wetlands associated habitat. This program encourages voluntary, public-private partnerships. Public or private, profit or non-profit entities or individuals establishing public-private sector partnerships are eligible. Cost-share partners must at least match grant funds with non-federal monies.*. Small Grants are typically for $50,000.*

- **Wildlife Conservation and Appreciation Program .** This program provides grants to state fish and wildlife agencies to fund projects that bring together USFWW S, state agencies and private organizations and individuals. Projects include identification of significant problems that can adversely affect fish and wildlife and their habitats, actions to conserve species and their habitats, actions that will provide opportunities for the public to use and enjoy fish and wildlife through non-consumptive activities, monitoring of species and identification of significant habitats.

- **Cooperative Endangered Species Conservation Fund.** This program is available to states that have a cooperative agreement with the Secretary of Interior. The intent is to provide Federal assistance too any state to assist in the development of programs for the conservation of endangered and threatened species. Potential programs include animal, plant and habitat surveys, research, planning, management, land acquisition, protection and public education. Single states may receive up to 75% of program costs

- **Landowner Incentive Program (Non-Tribal**). This program provides funding directly to the lead state wildlife service agency (WGFD in Wyoming) for programs addressing the issues noted previously.

6.4.6 Natural Resources Conservation Service

The Natural Resources Conservation Service (NRCS) administers a number of funding and technical assistance programs applicable to many of the alternative projects identified in Chapter 5. These programs are briefly described below and summarized in Table 6.1-1.

- **Environmental Quality Incentives Program.** The Environmental Quality Incentives Program (EQIP) is a voluntary program available to agricultural producers that provides technical assistance, cost sharing and incentive payments for projects and practices that improve water quality, enhance grazing lands, and/or increase water conservation. Current priorities used by NRCS in allocating EQIP funds that are applicable to the Badwater/Poison Creek study area include reduction of nonpoint source pollution of surface waters, reduction in soil erosion and sedimentation from agricultural lands, and promotion of at-risk species habitat conservation.

  Non-federal landowners (including American Indian tribes) that engage in livestock operations or agricultural production are eligible for funding. Eligible land includes cropland, rangeland, pasture, forestland, and other farm and ranch lands. Eligibility also requires that the applicant develop an EQIP plan of operations that becomes the basis of the cost-sharing agreement between NRCS and the participant.

  EQIP provides payments up to 75 percent of the incurred costs and income foregone of certain conservation practices and activities. However certain historically underserved producers (Limited resource farmers/ranchers, beginning farmers/ranchers, socially disadvantaged producers) may be eligible for payments up to 90 percent of the estimated incurred costs and income foregone. Farmers and ranchers may elect to use a certified Technical Service Provider (TSP) for technical assistance needed for certain eligible activities and services. The new Farm Bill established a new payment limitation for individuals or legal entity participants who may not receive, directly or indirectly, payments that, in the aggregate, exceed $300,000 for all program contracts entered during any six year period. Projects determined as having special environmental significance may, with approval of the NRCS Chief, have the payment limitation raised to a maximum of $450,000.

  Detailed information about the EQIP program is available at the following website: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/.

- **Watershed Protection and Flood Prevention Program.** Also known as the "Small Watershed Program" or the "PL 566 Program," this program provides technical and financial assistance to address resource and related economic problems on a watershed basis. Projects related to watershed protection, flood prevention, water supply, water quality, erosion and sediment control, wetland creation and restoration, fish and wildlife habitat enhancement, and public recreation are eligible for assistance. Technical and financial assistance is also available for planning and installation of works of improvement to protect, develop, and use land and water resources in small watersheds.

Applicants eligible for funding through this program that are potentially relevant to the Badwater/Poison Creek study area include: local or state agencies, counties, conservation districts, or other subunits of state government (e.g., watershed improvement, water conservancy and irrigation districts) with the authority and capacity to carry out, operate, and maintain installed works of improvement. Projects are limited to watersheds containing less than 250,000 acres.

The assistance provided consists of technical assistance and cost sharing (amount varies) for implementation of NRCS-authorized watershed plans. Technical assistance is provided on watershed surveys and planning. Although projects vary significantly in scope and complexity, projects receiving $3.5 million to $5 million in federal financial assistance are not uncommon.

- **Other NRCS Programs.** Other programs administered through NRCS that may be relevant to certain of the alternative projects discussed in Chapter 5 include, but are not necessarily limited to the following:

    - **Wildlife Habitat Incentives Program (WHIP**) – Through WHIP, technical and financial assistance is provided to landowners and others to develop and improve wildlife habitat on private lands.
    - **Wetlands Reserve Program (WRP)** – Eligible landowners may receive technical and financial assistance through the WRP to address wetland, wildlife habitat, soil, water and related natural resource concerns on private lands.
    - **Grassland Reserve Program (GRP**) – This program emphasizes support for grazing operations, plant and animal biodiversity, and grassland and land containing shrubs and forbs under the greatest threat of conversion.
    - **Farm and Ranch Lands Protection Program (FRPP**) – FRPP is designed to help farmers and ranchers keep their land in agriculture. It provides matching funds to State, Tribal or local governments and non-governmental organizations with existing farm and ranch land protection programs to purchase conservation easements.
    - **Resource Conservation and Development (RC&D)** – Wyoming's five RC&D areas assist communities by promoting conservation, development and use of natural resources; improving the general level of economic activity; and enhancing the environment and standard of living for residents of those communities.
    - **Emergency Watershed Protection (ERP)**
    - **Small Watershed Rehabilitation Program**
    - **Sage Grouse Restoration Project (SGRP)**
    - **Grazing Lands Conservation Initiative (GLCI) Grants**
    - **Cooperative Conservation Partnership Initiative (CCPI)**

Information on all NRCS programs is available from the local contacts listed Table 6.1-1.

6.4.7 US Army Corps of Engineers

The Army Corps of Engineers 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 flood plain 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 flood plain 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 flood plain 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. A study, at federal expense, is initiated followed by a feasibility plan that is cost-shared 25% by the sponsor.

- **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 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. This would include dams and dikes, levees, riprap, bank stabilization and development fill. There are three kinds of permits issued by the Corps. They are Individual, Nationwide and Regional General permits.

6.4.8 Rural Utilities Service

The United States Department of Agriculture, Rural Development's utilities program 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.

Funding may be obtained through Rural Development only when the applicant is unable to secure funding from other sources at reasonable rates and terms. The applicant must have legal capacity to borrow and repay loans, 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 connected 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.

USDA Rural Development also guarantees loans to eligible commercial lenders to improve, develop or finance water or waste disposal facilities in rural areas. This guarantee is a warrant to protect the lender and may cover up to 90% of the principal advanced. The guarantee fee is 1% of the loan amount multiplied by the percent of the guarantee. Interest rates will be negotiated between the lender and the borrower.

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.

6.5.2 National Fish and Wildlife Foundation

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 grant funding on a competitive basis through their Keystone Initiative Grants and Special Grant Program. Some of the grants/programs that may be applicable to potential projects in the Badwater/Poison Creek Study Area include, but are not limited to the following:

- **Pulling Together Initiative** - 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.
- **Native Plant Conservation Initiative** – funding preference for "on-the-ground" projects that involve local communities and citizen volunteers in the restoration of native plant communities.
- **Bring Back the Natives Grant Program** – funds to restore damaged or degraded riverine habitats and their native aquatic species provided by BLM, Bureau of Reclamation, FWS, Forest Service, and NFWF; minimum 2:1 nonfederal match required.
- **Five-Star Restoration 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; average grant is $13,000.

Information about all of these and other NFWF grants/programs is available at their website: http://nfwf.org/.

6.5.3 Trout Unlimited

The Wyoming Council of 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.

VII. COST ESTIMATES

Conceptual-level costs have been developed for each of the alternative potential projects identified and described in Chapter 4. The bases for these costs are described in the following subsections for each of the overall project categories. Cost estimates presented represent 2014 dollars.

7.1 Irrigation System Components (Watershed Management Plan Component I)

Costs associated with irrigation system components of the watershed management plan were estimated based upon current itemized unit costs for individual improvements. NRCS EQIP cost data were used where feasible for typical design items. These costs are included in Table 7.1-1.

7.2 Upland Wildlife/Livestock Water Components (Watershed Management Plan Component LW)

The anticipated costs associated with these components of the watershed management plan were based upon previous experience completing similar projects throughout Wyoming, previous 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 $3,000 was used because site-specific information was not available.

Conventional Windmills: Typical costs associated with installation of a windmill in an existing well is from $5,000 to $10,000 for the windmill, mechanical pump, tank pad, and tank depending on well yield, tank size, and depth to water.

Wind Turbine/Tower: A cost of $5,000 was used for a 1kW, 24 VDC turbine, controller, and 80-foot tilt-up tower for installation at an existing well.

Wells: $10,000-$15,000 (see discussion in Section 7.4 below).

Pipelines: A cost of approximately $1.34 / lineal foot (installed) for 1.5-inch diameter pipe was used and is based upon recently completed projects in the Bighorn Basin. Length of pipe associated with each project was approximated within the GIS environment.

Water Tanks (Stock and Storage): A cost of $3,000 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.

Table 7.1-1 Conceptual Cost Estimates: Irrigation System Components (Watershed Management Plan Component I).

Watershed Plan Component: Irrigation Infrastructure Projects (I)				
Plan Component	Ditch	Structure Type	Replace / Rehabilitate / Install	Estimated Total Project Cost
I-01	Dry Creek Ditch No. 2	Grade Control / Headgate	Grade Control / Headgate	$35,000
I-02	Woodruff Ditch	Grade Control / Sand Trap Wasteway / Siphon	Grade Control / Sand Trap Wasteway / Siphon	$50,000
I-03	Elsass Ditch	Grade Control	Grade Control	$20,000
I-04	Moore Ditch	Grade COntrol	Grade Copntrol	$20,000

Guzzlers: A cost of $10,000 was used for a 2,250 square feet catchment area feeding a 1800 gallon, BOSS brand tank.

Solar Water Pump: A total cost of $8,640 was used for a typical system.

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.

Table 7.2-1 Conceptual Costs: Upland Wildlife/Livestock Water Components (Watershed Management Plan Component LW).

Project		1	2	3	4	5	6	7	8	9
		Watershed Component L/W-01	Watershed Component L/W-02	Watershed Component L/W-03	Watershed Component L/W-04	Watershed Component L/W-05	Watershed Component L/W-06	Watershed Component L/W-07	Watershed Component L/W-08	Watershed Component L/W-09
Description		Spring Development / Pipeline / Stock Tank Construction	Spring Development / Pipeline / Stock Tank Construction	Rehabilitation of Existing Well	Rehabilitation of Existing Well	Rehabilitation of Existing Well	Rehabilitation of Existing Well	Rehabilitation of Existing Well	Spring Development / Pipeline / Stock Tank Construction	Stock Reservoir Reconstruction
Project Name		Frank Upland Project 1	Frank Upland Project 2	Frank Upland Project 3	Frank Upland Project 4	Frank Upland Project 5	Frank Upland Project 6	Frank Upland Project 7	Cameron Upland Project 1	Cameron Upland Project 2
Water Source:		Existing Spring	Existing Spring	Existing Well	Existing Well	Existing Well	Existing Well	Existing Well	Existing Spring	Existing Reservoir
Well Construction / Spring Development	Mobilization	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
	Source:	Existing Spring	Existing Spring	Existing Well	Existing Well	Existing Well	Existing Well	Existing Well	Existing Spring	Existing Reservoir
	Units (each)	1	1		0				1	
	Depth Each	NA	NA		NA				NA	
	Unit Cost ($/LF wells ror $/EA springs	$5,000	$5,000		$5,000				$5,000	
	Well Screen (LF each well)	NA	NA		NA				NA	
	Well Screen ($/LF)	NA	NA		NA				NA	
	Component Subtotal	$8,000	$8,000	$3,000	$3,000	$3,000	$3,000	$3,000	$8,000	$3,000
Stock Pond / Guzzler Construction / Rehabilitation	Units (each)	NA	NA	NA	NA	NA	NA	NA	NA	1
	Pond/Guzzler Const. Unit Cost ($ EA)									$25,000
	Number of Ponds to Seal									
	Bentonite Sealing (total square feet)									
	Tons (4lbs/ft2)									
	Bentonite Cost per Ton									
	Bentonite Cost									
	Transportation (15% of Bentonite)									
	Pond Component Subtotal									$25,000
Pump	Units (EA)	1	1	1	NA	NA	NA	NA	NA	NA
	Type	Solar Pump	Solar Pump	Solar Pump						
	Unit Cost (EA)	$8,500	$8,500	$8,500						
	Component Subtotal	$8,500	$8,500	$8,500						
Pipeline	**Low Pressure 1 1/2 in Pipe Diameter:**	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	NA
	Units (LF)	150	75	300	100	100	10,560	300	100	
	Unit Cost (EA)	$1.60	$1.60	$1.60	$1.60	$1.60	$1.60	$1.60	$1.60	
	Component Subtotal	$240	$120	$480	$160	$160	$16,896	$480	$160	
	Other Pipe	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Units (LF)									
	Unit Cost (EA)									
	Component Subtotal									
Additional Storage Tanks	Units (EA)	NA	NA	NA	1	1	1	NA	NA	NA
	Size (gal)				$10,000	$10,000	$10,000			
	Unit Cost ($/gal)				$1	$1	$1			
	Component Subtotal				$10,000	$10,000	$10,000			
Livestock / Wildlife Water Tanks	Units (EA)	1	1	1	1	1	2	1	1	NA
	Size (gal)	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	
	Unit Cost	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	
	Component	$3,000	$3,000	$3,000	$3,000	$3,000	$6,000	$3,000	$3,000	
Miscellaneous	Item	Fencing	Fencing	N/A	N/A	N/A	N/A	N/A	Fencing	NA
	Units (Each)	500	500						500	
	Unit Cost ($/ea)	$2.50	$2.50						$2.50	
	Component Subtotal	$1,250.00	$1,250.00						$1,250.00	
Construction Subtotal		$20,990	$20,870	$14,980	$16,160	$16,160	$35,896	$6,480	$12,410	$28,000
Engineering (10%)		$2,099	$2,087	$1,498	$1,616	$1,616	$3,590	$648	$1,241	$2,800
Constuction and Engineering Subtotal		$23,089	$22,957	$16,478	$17,776	$17,776	$39,486	$7,128	$13,651	$30,800
Contingency (15%)		$3,463	$3,444	$2,472	$2,666	$2,666	$5,923	$1,069	$2,048	$4,620
Total Construction Cost		$26,552	$26,401	$18,950	$20,442	$20,442	$45,408	$8,197	$15,699	$35,420
Final Plans and Specs		$1,500	$1,500	$1,500	$1,500	$1,500	$2,500	$6,000	$1,500	$1,500
Additional		$0	$0	$0	$0	$0	$0	$0	$0	$0
Permitting / Legal Fees / Access and Rights of Way		$1,000	$0	$0	$1,000	$1,000	$2,000	$1,000	$500	$0
Total Project Cost		**$29,052**	**$27,901**	**$20,450**	**$22,942**	**$22,942**	**$49,908**	**$15,197**	**$17,699**	**$36,920**

Table 7.2-1 Conceptual Costs: Upland Wildlife/Livestock Water Components (Watershed Management Plan Component LW) (Continued).

Project		10	11	12	13	14	15	16	17	18
		Watershed Component L/W-10	Watershed Component L/W-11	Watershed Component L/W-12	Watershed Component L/W-13	Watershed Component L/W-14	Watershed Component L/W-15	Watershed Component L/W-16	Watershed Component L/W-17	Watershed Component L/W-18
Description		Infiltration gallery / Pipeline / Stock Tank Construction	Rehabilitation of Existing Well	Rehabilitation of Existing Well	Rehabilitation of Existing Well	Rehabilitation of Existing Well	Spring Development / Pipeline / Stock Tank Construction	Spring Development / Pipeline / Stock Tank Construction	Spring Development / Pipeline / Stock Tank Construction	Spring Development / Pipeline / Stock Tank Construction
Project Name		Cameron Upland Project 3	Cameron Upland Project 4	Humphreys Upland Project 1	Humphreys Upland Project 2	Cady Upland Project 1	Cady Upland Project 2	Cady Upland Project 3	Cady Upland Project 4	Cady Upland Project 5
Water Source:		Existing Spring	Existing Well	Existing Well	Existing Well	Existing Well	Existing Spring	Existing Spring	Existing Spring	Existing Spring
Well Construction / Spring Development	Mobilization	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
	Source:	Existing Spring	Existing Well	Existing Well	Existing Well	Existing Well	Existing Spring	Existing Spring	Existing Spring	Existing Spring
	Units (each)	1		0	0		1	1	1	1
	Depth Each	NA		NA	NA		NA	NA	NA	NA
	Unit Cost ($/LF wells ror $/EA springs	$5,000		$5,000	$5,000		$5,000	$5,000	$5,000	$5,000
	Well Screen (LF each well)	NA		NA	NA		NA	NA	NA	NA
	Well Screen ($/LF)	NA		NA	NA		NA	NA	NA	NA
	Component Subtotal	$8,000	$3,000	$3,000	$3,000	$3,000	$8,000	$8,000	$8,000	$8,000
Stock Pond / Guzzler Construction / Rehabilitation	Units (each)	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Pond/Guzzler Const. Unit Cost ($ EA)									
	Number of Ponds to Seal									
	Bentonite Sealing (total square feet)									
	Tons (4lbs/ft2)									
	Bentonite Cost per Ton									
	Bentonite Cost									
	Transportation (15% of Bentonite)									
	Pond Component Subtotal									
Pump	Units (EA)	NA	NA	NA	1	NA	NA	NA	NA	NA
	Type				Solar Pump					
	Unit Cost (EA)				$8,500					
	Component Subtotal				$8,500					
Pipeline	Low Pressure 1 1/2 in Pipe Diameter:	1.5	NA	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	Units (LF)	100		200	500	300	300	600	300	100
	Unit Cost (EA)	$1.60		$1.60	$1.60	$1.60	$1.60	$1.60	$1.60	$1.60
	Component Subtotal	$160		$320	$800	$480	$480	$960	$480	$160
	Other Pipe	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Units (LF)									
	Unit Cost (EA)									
	Component Subtotal									
Additional Storage Tanks	Units (EA)	NA	NA	NA	NA	1	NA	NA	NA	NA
	Size (gal)					$10,000				
	Unit Cost ($/gal)					$1				
	Component Subtotal					$10,000				
Livestock / Wildlife Water Tanks	Units (EA)	1	1	1	2	1	2	1	1	1
	Size (gal)	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
	Unit Cost	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
	Component	$3,000	$3,000	$3,000	$6,000	$3,000	$6,000	$3,000	$3,000	$3,000
Miscellaneous	Item	Fencing	Well Rehabilitation	N/A	N/A	N/A	Fencing	Fencing	Fencing	Fencing
	Units (Each)	500	1				500	500	500	500
	Unit Cost ($/ea)	$2.50	$15,000.00				$2.50	$2.50	$2.50	$2.50
	Component Subtotal	$1,250.00	$15,000.00				$1,250.00	$1,250.00	$1,250.00	$1,250.00
Construction Subtotal		$12,410	$21,000	$6,320	$18,300	$16,480	$15,730	$13,210	$12,730	$12,410
Engineering (10%)		$1,241	$2,100	$632	$1,830	$1,648	$1,573	$1,321	$1,273	$1,241
Constuction and Engineering Subtotal		$13,651	$23,100	$6,952	$20,130	$18,128	$17,303	$14,531	$14,003	$13,651
Contingency (15%)		$2,048	$3,465	$1,043	$3,020	$2,719	$2,595	$2,180	$2,100	$2,048
Total Construction Cost		$15,699	$26,565	$7,995	$23,150	$20,847	$19,898	$16,711	$16,103	$15,699
Final Plans and Specs		$1,500	$6,000	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500
Additional		$0	$0	$0	$0	$0	$0	$0	$0	$0
Permitting / Legal Fees / Access and Rights of Way		$500	$1,500	$0	$0	$500	$0	$0	$0	$1,000
Total Project Cost		**$17,699**	**$34,065**	**$9,495**	**$24,650**	**$22,847**	**$21,398**	**$18,211**	**$17,603**	**$18,199**

Table 7.2-1 Conceptual Costs: Upland Wildlife/Livestock Water Components (Watershed Management Plan Component LW) (Continued).

Project		19	20	21	22	23	24	25	26	27
		Watershed Component L/W-19	Watershed Component L/W-20	Watershed Component L/W-21	Watershed Component L/W-22	Watershed Component L/W-23	Watershed Component L/W-24	Watershed Component L/W-25	Watershed Component L/W-26	Watershed Component L/W-27
Description		Spring Development / Pipeline / Stock Tank Construction	Well Construction	Well Construction	Stock Reservoir Reconstruction	Pipeline / Stock Tank Construction	Spring Development / Pipeline / Stock Tank Construction	Rehabilitation of Existing Well	Stock Reservoir Reconstruction	Spring Development / Pipeline / Stock Tank Construction
Project Name		Allen Upland Project 1	Allen Upland Project 2	Allen Upland Project 3	Thoren Upland Project 1	Thoren Upland Project 2	Thoren Upland Project 3	Thoren Upland Project 4	Thoren Upland Project 6	Bloomquist / Mccoy Upland Project 1
Water Source:		Existing Spring	Proposed Well	Proposed Well	Existing Reservoir	Existing Reservoir	Existing Spring	Existing Well	Existing Reservoir	Existing Spring
Well Construction / Spring Development	Mobilization	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
	Source:	Existing Spring	Proposed Well	Existing Well	Existing Reservoir	Existing Reservoir	Existing Spring	Existing Well	Existing Reservoir	Existing Spring
	Units (each)	1	1	1		0	1		0	1
	Depth Each	NA	500	500		NA	NA			NA
	Unit Cost ($/LF wells ror $/EA springs	$5,000	$40	$40		$5,000	$5,000			$5,000
	Well Screen (LF each well)	NA	40	40		NA	NA			NA
	Well Screen ($/LF)	NA	$50	$50		NA	NA			NA
	Component Subtotal	$8,000	$25,000	$25,000	$3,000	$3,000	$8,000	$3,000	$3,000	$8,000
Stock Pond / Guzzler Construction / Rehabilitation	Units (each)				Agri-Drain Outlet				Spillway	
	Pond/Guzzler Const. Unit Cost ($ EA)				$3,000				Rock: $15,000	
	Number of Ponds to Seal				Installation:				Outlet: $5,000	
	Bentonite Sealing (total square feet)				$5,000				Earthwork: $15,000	
	Tons (4lbs/ft2)	NA	NA	NA		NA	NA	NA		NA
	Bentonite Cost per Ton									
	Bentonite Cost									
	Transportation (15% of Bentonite)									
	Pond Component Subtotal				$8,000					
Pump	Units (EA)	1	1	1				1		1
	Type	Solar Pump	Solar Pump	Solar Pump	NA	NA	NA	Solar Pump		Solar Pump
	Unit Cost (EA)	$8,500	$8,500	$8,500				$8,500		$8,500
	Component Subtotal	$8,500	$8,500	$8,500				$8,500		$8,500
Pipeline	**Low Pressure 1 1/2 in Pipe Diameter:**	1.5	1.5	1.5		1.5	1.5	1.5		1.5
	Units (LF)	200	1,400	200	NA	400	300	4,600		900
	Unit Cost (EA)	$1.60	$1.60	$1.60		$1.60	$1.60	$1.60		$1.60
	Component Subtotal	$320	$2,240	$320		$640	$480	$7,360		$1,440
	Other Pipe	6-inch								
	Units (LF)	1,800								
	Unit Cost (EA)	$6	NA	NA	NA	NA	NA	NA		NA
	Component Subtotal	$10,800								
Additional Storage Tanks	Units (EA)									
	Size (gal)	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Unit Cost ($/gal)									
	Component Subtotal									
Livestock / Wildlife Water Tanks	Units (EA)	1	1	1		1	1	1		1
	Size (gal)	1,200	1,200	1,200	NA	1,200	1,200	1,200		1,200
	Unit Cost	$3,000	$3,000	$3,000		$3,000	$3,000	$3,000		$3,000
	Component	$3,000	$3,000	$3,000		$3,000	$3,000	$3,000		$3,000
Miscellaneous	Item	Fencing				AgriDrain	Fencing			Fencing
	Units (Each)	500	N/A	N/A	NA	1	500	NA	NA	500
	Unit Cost ($/ea)	$2.50				$6,000.00	$2.50			$2.50
	Component Subtotal	$1,250.00				$6,000.00	$1,250.00			$1,250.00
Construction Subtotal		$31,870	$38,740	$36,820	$11,000	$12,640	$12,730	$21,860	$38,000	$22,190
Engineering (10%)		$3,187	$3,874	$3,682	$1,100	$1,264	$1,273	$2,186	$3,800	$2,219
Constuction and Engineering Subtotal		$35,057	$42,614	$40,502	$12,100	$13,904	$14,003	$24,046	$41,800	$24,409
Contingency (15%)		$5,259	$6,392	$6,075	$1,815	$2,086	$2,100	$3,607	$6,270	$3,661
Total Construction Cost		$40,316	$49,006	$46,577	$13,915	$15,990	$16,103	$27,653	$48,070	$28,070
Final Plans and Specs		$2,500	$2,500	$2,500	$1,000	$1,500	$1,500	$6,000	$6,000	$1,500
Additional		$0	$0	$0	$0	$0	$0	$0	$0	$0
Permitting / Legal Fees / Access and Rights of Way		$0	$500	$500	$0	$0	$0	$1,500	$1,500	$0
Total Project Cost		**$42,816**	**$52,006**	**$49,577**	**$14,915**	**$17,490**	**$17,603**	**$35,153**	**$55,570**	**$29,570**

Table 7.2-1 Conceptual Costs: Upland Wildlife/Livestock Water Components (Watershed Management Plan Component LW) (Continued).

Project		28	29	30	31	32	33	34	35	36
		Watershed Component L/W-28	Watershed Component L/W-29	Watershed Component L/W-30	Watershed Component L/W-31	Watershed Component L/W-32	Watershed Component L/W-33	Watershed Component L/W-34	Watershed Component L/W-35	Watershed Component L/W-36
Description		Spring Development / Pipeline / Stock Tank Construction	Spring Development / Pipeline / Stock Tank Construction	Spring Development / Pipeline / Stock Tank Construction	Spring Development / Pipeline / Stock Tank Construction	Spring Development / Pipeline / Stock Tank Construction	Spring Development / Pipeline / Stock Tank Construction	Spring Development / Pipeline / Stock Tank Construction	Pipeline / Stock Tank Construction	Pipeline / Stock Tank Construction
Project Name		Bloomquist / Mccoy Upland Project 2	Bloomquist / Mccoy Upland Project 3	Hendry Upland Project 1	Campbell Upland Project 1	Campbell Upland Project 2	Campbell Upland Project 3	Bloomquist / Mccoy Upland Project 4	Pingetzer Upland Project 1	Pingetzer Upland Project 2
Water Source:		Existing Spring	Existing Spring	Existing Spring	Existing Spring	Existing Spring	Existing Spring	Existing Spring	Existing Well	Existing Well
Well Construction / Spring Development	Mobilization	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
	Source:	Existing Spring	Existing Spring	Existing Spring	Existing Spring	Existing Spring	Existing Spring	Existing Spring	Existing Well	Existing Well
	Units (each)	1	1	1	1	1	1	1		
	Depth Each	NA	NA	NA	NA	NA	NA	NA		
	Unit Cost ($/LF wells ror $/EA springs	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000		
	Well Screen (LF each well)	NA	NA	NA	NA	NA	NA	NA		
	Well Screen ($/LF)	NA	NA	NA	NA	NA	NA	NA		
	Component Subtotal	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000	$8,000	$3,000	$3,000
Stock Pond / Guzzler Construction / Rehabilitation	Units (each)	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Pond/Guzzler Const. Unit Cost ($ EA)									
	Number of Ponds to Seal									
	Bentonite Sealing (total square feet)									
	Tons (4lbs/ft2)									
	Bentonite Cost per Ton									
	Bentonite Cost									
	Transportation (15% of Bentonite)									
	Pond Component Subtotal									
Pump	Units (EA)	NA	NA	NA	NA	NA	NA	1	1	1
	Type							Solar Pump	Solar Pump	Solar Pump
	Unit Cost (EA)							$8,500	$8,500	$8,500
	Component Subtotal							$8,500	$8,500	$8,500
Pipeline	**Low Pressure 1 1/2 in Pipe Diameter:**	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	Units (LF)	300	1,500	21,000	900	600	400	2,800	6,300	5,300
	Unit Cost (EA)	$1.60	$1.60	$1.60	$1.60	$1.60	$1.60	$1.60	$1.60	$1.60
	Component Subtotal	$480	$2,400	$33,600	$1,440	$960	$640	$4,480	$10,080	$8,480
	Other Pipe	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Units (LF)									
	Unit Cost (EA)									
	Component Subtotal									
Additional Storage Tanks	Units (EA)	NA	NA	1	NA	NA	NA	NA	NA	NA
	Size (gal)			$10,000						
	Unit Cost ($/gal)			$1						
	Component Subtotal			$10,000						
Livestock / Wildlife Water Tanks	Units (EA)	1	1	6	NA	1	2	2	2	1
	Size (gal)	1,200	1,200	1,200		1,200	1,200	1,200	1,200	1,200
	Unit Cost	$3,000	$3,000	$3,000		$3,000	$3,000	$3,000	$3,000	$3,000
	Component	$3,000	$3,000	$18,000		$3,000	$6,000	$6,000	$6,000	$3,000
Miscellaneous	Item	Fencing	Fencing	Fencing	Fencing	Fencing	Fencing	Fencing	Fencing	Fencing
	Units (Each)	500	500	500	500	500	500	500	0	500
	Unit Cost ($/ea)	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50
	Component Subtotal	$1,250.00	$1,250.00	$1,250.00	$1,250.00	$1,250.00	$1,250.00	$1,250.00	$0.00	$1,250.00
Construction Subtotal		$12,730	$14,650	$70,850	$10,690	$13,210	$15,890	$28,230	$27,580	$24,230
Engineering (10%)		$1,273	$1,465	$7,085	$1,069	$1,321	$1,589	$2,823	$2,758	$2,423
Constuction and Engineering Subtotal		$14,003	$16,115	$77,935	$11,759	$14,531	$17,479	$31,053	$30,338	$26,653
Contingency (15%)		$2,100	$2,417	$11,690	$1,764	$2,180	$2,622	$4,658	$4,551	$3,998
Total Construction Cost		$16,103	$18,532	$89,625	$13,523	$16,711	$20,101	$35,711	$34,889	$30,651
Final Plans and Specs		$1,500	$1,500	$2,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500
Additional		$0	$0	$0	$0	$0	$0	$0	$0	$0
Permitting / Legal Fees / Access and Rights of Way		$0	$500	$2,500	$0	$1,500	$0	$0	$0	$1,000
Total Project Cost		**$17,603**	**$20,532**	**$94,625**	**$15,023**	**$19,711**	**$21,601**	**$37,211**	**$36,389**	**$33,151**

VIII. CONCLUSIONS AND RECOMMENDATIONS

A multidisciplinary inventory of the Badwater / Poison Creek watershed was conducted in an effort to identify and evaluate key resource issues and concerns. 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,*
- *Stream Channel Condition and Stability,*
- *Surface Water Storage Opportunities,*
- *Grazing Management Opportunities, and*
- *Other Upland Management Opportunities.*

In summary, the following conclusions are provided.

8.1.1 Irrigation System Components

1. Irrigation within the study area is limited to primarily the floodplain of Badwater Creek and its principal tributaries. Irrigation takes place in other portions of the watershed to a lesser extent. In addition to limited water supplies, irrigation appears to be at least partially restricted by incision of stream channels with makes diversion problematic.

   Completion of channel restoration projects in conjunction with an irrigation headgate would likely not require a 404 permit through the USACE due to the irrigation infrastructure exclusion. Coordination with the COE Omaha District’s Wyoming Regulatory Office in Cheyenne would be necessary to verify permit requirements.

2. Several irrigation system rehabilitation needs were identified during the course of this investigation. Responsible individuals and ditch owners should review the pertinent

portions of this report and the specific recommendations reviewed for future planning efforts.

3. Funding assistance for irrigation system rehabilitation projects within the study area is available from a number of sources, especially the WWDC Small Water Project Program and various programs administered by the NRCS.

4. Given the propensity of weeds to become established with application of water, any irrigation system improvement projects should consider the potential impacts to weed infestations and should involve consultation with the local weed and pest district.

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. 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.

3. A total of 36 potential wildlife/livestock water supply projects were identified based upon evaluation of available water sources and input from the LWRCD, local land owners and allotment permittees. Conceptual plans and conceptual level cost estimates were prepared for each project.

4. Any such improvements and practices must be fully implemented and maintained by the responsible landowner / agency to gain the maximum overall benefits to the watershed.

8.1.3 Stream Channel Condition and Stability

1. Based on the geomorphic assessment, several impaired channel reaches were identified within the watershed. The categories of impairments identified include, but are not limited to channel degradation and incision, degradation of riparian vegetation and degradation of riparian condition in the form of stream bank erosion and channel degradation.

2. Priority should be given to stabilization of active headcuts in an effort to limit continued entrenchment processes. Likewise, where feasible, channel gradient restoration projects should be investigated in an effort to restore entrenched stream channels to pre-incision profiles. Entrenchment of stream channels is deleterious to overall watershed health by (1) removing the connection between the stream and its floodplain, (2) lowering local groundwater tables, and (3) making irrigation diversions problematic.

3. Site-specific solutions should be developed to mitigate the channel impairment and ultimately included in the watershed management rehabilitation plan.

4. Locally-sponsored stream channel and habitat improvement projects could provide numerous benefits to the watershed. 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.

8.1.4 Storage Opportunities

1. The results of the flow availability investigation confirmed in conjunction with the Wind / Bighorn Basin Planning study confirms that water is available for storage and is available primarily during the spring runoff period, predominantly during May and June.

2. A limited number of potential reservoir storage sites were included in the Badwater / Poison Creek watershed management plan. These sites are relatively limited in size but appear to be commensurate with local hydrologic conditions. Development of storage opportunities could provide a valuable source of late season irrigation water.

3. Permitting efforts and NEPA compliance associated with completion of reservoir projects will likely be complicated, lengthy, and involve coordination with several regulatory agencies.

8.1.5 Grazing Management Opportunities

1. 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.

8.2 Recommendations

Based upon the information presented throughout this report and the conclusions presented above, the recommendations listed below are presented for consideration:
All of the identified 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 district but does require an entity sponsor such as the local conservation district. Consequently, individuals can seek funding through this program. As discussed in Chapter 8, projects providing multiple benefits and for which total project cost are less than $100,000 are eligible for funding under this program. Grants are available for up to 50 percent of the total project cost or $25,000, whichever is less.

Creative strategies for funding/financing of projects should be more fully investigated following identification of projects worthy of additional evaluation and potential implementation. *By combining funding sources, the sponsor could conceivably obtain grants for most, if not all, of the project costs.*

Local landowners in the project study area have shown a high level of interest and are proactive managers of their lands. Implementation of projects outlined in this report could serve to help maintain this interest and provide momentum to future planning efforts.

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APPENDIX 1

WATER RIGHTS TABULATION

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.	ACRES	HG LOC.	Notes
	BADWATER CREEK, Tributary Big Horn River							
Terr.	Okie	J. B. Okie	-1884	I	1.12	79.00	3-38-090	
	(Point of diversion changed from 34-39-90, November 18, 1959.)							
Terr.	Ralston	D. J. Ralston	-1889	I	0.28	20.00	8-38-090	
146E	Enl. Okie	Big Horn Sheep Co.	07-15-1895	I	2.38	167.00	3-38-090	
	(Point of diversion changed from 34-39-90, November 18, 1959.)							
34R	Okie Res	Big Horn Sheep Co.	08-31-1895	I	217.00 a.f.		34-39-090	
	(Stored water is for Okie Ditch, Territorial priority, 1884; for Cummings Ditch, Permit No. 2547; for Smith Ditch, Permit No. 2722; and for Tyrell Ditch, Permit No. 2623.)							
1144	Slick	Charles Bader	02-20-1896	I	0.32	22.50	17-39-089	
1693	Climax	R. W. Spratt and Sons, Inc.	12-28-1897	I	2.20	154.00	24-39-090	
	(Amended certificate issued to successor of G. W. Woolf, original appropriator; change of point of diversion of 141.3 acres (2.02 c.f.s.), as amended, to a new point within the same section, township and range, and change of point of diversion and means of conveyance of 12.7 acres (0.18 c.f.s.) to the Leahy Ditch situate within the same section, township, and range, May 29, 1991.)							
1695	Reed	Frank Davis, et al.	01-04-1898	I	0.57	40.00	14-39-089	
	(Change of point of diversion to a location within the same section, township and range, April 19, 1933.)							
1695	Reed	J. M. Reed	01-04-1898	I	0.70	49.00	14-39-089	
	(Change of point of diversion to a location within the same section, township and range, April 19, 1933.)							
299E	Enl. Slick	Chas. Badar	01-04-1898	I	1.14	80.00	17-39-089	
299E	Enl. Slick	Minnie Badar	01-04-1898	I	1.51	106.00	17-39-089	
1728	Hitchew No. 2	Geo. A. Davis	02-01-1898	I	0.50	35.00	24-39-089	
1728	Hitchew No. 1	Geo. A. Davis	02-01-1898	I	0.71	50.00	18-39-088	
1893	Nott	Clear Creek Cattle Co.	07-22-1898	I	0.35	25.00	19-39-088	
	(Actual amount of appropriation is 0.357 c.f.s.)							
1893	Nott	David Davis	07-22-1898	I	0.25	18.00	19-39-088	
2402	Cheever	A. L. Reed	12-16-1899	I	0.91	64.00	12-38-092	
2533	Fuller	D. E. Fuller	04-03-1900	I	0.28	20.00	9-38-091	
2547	Cummings	J. B. Okie	04-14-1900	I	0.57	40.00	9-38-090	
2556	Bostleman No. 1	Ernest Bostleman	04-16-1900					
	(Actually diverts from Spring Creek, tributary Badwater Creek.)							
2557	Bostleman No. 2	Ernest Bostleman	04-16-1900	D,I,S	0.11	8.00	28-39-088	
2624	Pistolfoot	David Davis	05-18-1900	I	0.28	20.00	29-39-088	
	(Point of diversion and means of conveyance changed to the Swaim Ditch, 29-39-88, from 28-39-88, February 27, 1991.)							
2624	Pistolfoot	David Davis	05-18-1900	I	0.11	8.00	29-39-088	
	(Point of diversion and means of conveyance changed to the Swaim Ditch, 29-39-88, from 28-39-88, February 27, 1991.)							
2722	Smith	Big Horn Sheep Co.	07-17-1900	I	0.18	13.00	3-38-090	
2723	Tyrell	Della Smith	07-17-1900	I	0.47	33.00	26-39-090	
	(Point of diversion and means of conveyance changed to Lost Cabin Water Works Ditch, 26-39-90.)							
2886	Sheepherders	David Schoening	10-30-1900	I	0.07	4.90	18-38-090	
	(Voluntary abandonment of 33.0 acres (0.47 c.f.s.) acres from 37.9 acres (0.54 c.f.s.), April 20, 1949.)							
2909	Millard No. 1	Carrie C. Davis	11-13-1900	I	0.57	40.00	22-39-088	
2910	Millard No. 2	Carrie C. Davis	11-13-1900	I	0.42	30.00	22-39-088	
3149	Swaim	George A. Davis	05-03-1901	I	0.39	27.00	28-39-088	
3149	Swaim	Davis Bros.	05-03-1901	I	0.42	30.00	28-39-088	
3247	Alva	William Hendry	06-20-1901	I	0.37	26.00	13-39-089	
5408	Coughey	Big Horn Sheep Co.	04-10-1903	I	0.31	22.00	26-39-090	
	(Point of diversion and means of conveyance changed to Lost Cabin Water Works Ditch, 26-39-90.)							
5575	Norton	Big Horn Sheep Co.	04-10-1903	I	0.28	20.00	26-39-090	
	(Point of diversion and means of conveyance changed to Lost Cabin Water Works Ditch, 26-39-90.)							
1060E	Enl. Climax	R. W. Spratt and Sons, Inc.	05-22-1903	I	0.04	2.80	24-39-090	
	(Amended certificate issued to successor of Nellie M. Woolf, original appropriator of 14.5 acres (0.20 c.f.s.), with a reduction of 11.7 acres (0.16 c.f.s.), May 29, 1991. Point of diversion and means of conveyance of 2.8 acres, as amended, to the Leahy Ditch situate within the same section, township, and range, May 29, 1991.)							
1087E	Enl. Fuller	E. L. Crabb	09-15-1903	I	0.12	9.00	9-38-091	
5953	Griffin	W. F. Griffin	10-13-1903	I	0.17	12.00	33-40-087	

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.	ACRES	HG LOC.	Notes
5953	Griffin	W. F. Griffin	10-13-1903	I	0.18	13.00	33-40-087	
1311E	Enl. Sheepherder	Hannah W. Day	12-08-1904					
	(Voluntary abandonment, April 20, 1949.)							
1478E	Enl. Coughey	Big Horn Sheep Co	12-19-1905	I	0.84	59.00	26-39-090	
	(Point of diversion and means of conveyance changed to Lost Cabin Water Works Ditch, 26-39-90.)							
7198	Leahy	Jesse B. Lewis, et al	04-02-1906	I	0.20	14.00	24-39-090	
7198	Leahy	George W. Woolf	04-02-1906	I,S	0.47	33.50	24-39-090	
1630E	Enl. Fuller	Douglas E. Fuller	11-07-1906	I	0.40	28.00	9-38-091	
1010R	Schoening Res	David Schoening	03-06-1907					
	(Voluntary abandonment, April 20, 1949.)							
7908	Pierce	Minnie Pierce	07-19-1907	I	0.87	60.50	18-38-093	
1737E	Enl. Fuller No. 2	Anna Fuller	07-19-1907	D,I,S	0.99	69.00	9-38-091	
8971	Lost Cabin Water Works	Big Horn Sheep Co	10-27-1908	D,I Supply Ditch	0.60	42.00	26-39-090	
	(Also supply ditch for Lost Cabin Water Works Nos. 1 and 2 Res., Permit Nos. 1488R. and 1489R. Water is stored in Lost Cabin Water Works Nos. 1 and 2 Res., Permit Nos. 1488R. and 1489R.)							
1488R	Lost Cabin Water Works No. 1 Res	Big Horn Sheep Co	10-27-1908	D,I	22.99 a.f.		4-38-090	
	(Stored water is for Lost Cabin Water Works Ditch, Permit No. 8971.)							
1489R	Lost Cabin Water Works No. 2 Res	Big Horn Sheep Co	10-31-1908	I	33.45 a.f.		4-38-090	
	(Stored water is for Lost Cabin Water Works Ditch, Permit No. 8971.)							
9008	Mahaffey	Jozina Davis Robinson	04-03-1909	I	0.44	31.00	14-39-089	
	(Amended certificate issued to successor of Wm. H. Mahaffey, original appropriator, November 16, 1929.)							
2128E	Enl. Sheepherder	David Schoening	10-04-1909					
	(Voluntary abandonment, April 20, 1949.)							
2129E	Enl. Lost Cabin Water Works	Bertha M. Schoening	10-04-1909	I	3.20	224.00	26-39-090	
2227E	Enl. Okie	R. W. Spratt and Sons, Inc	04-30-1910	I	4.82	337.50	L 2, 3-38-090	
	(Point of diversion changed from 34-39-90, November 18, 1959. Amended certificate issued to successors of Big Horn Sheep Company, original appropriator, resulting in a reduction of 43.5 acres (0.62 c.f.s.) from 381.0 acres (5.44 c.f.s.), March 19, 1992.)							
2227E	Enl. Okie	Big Horn Sheep Co	04-30-1910	I	1.14	80.00	3-38-090	
	(Point of diversion changed from 34-39-90, November 18, 1959.)							
2227E	Enl. Okie	H. F. Okie	04-30-1910	I	1.86	130.00	3-38-090	
	(Point of diversion changed from 34-39-90, November 18, 1959.)							
2227E	Enl. Okie	Van Guelder Okie	04-30-1910	I	2.68	188.00	3-38-090	
	(Point of diversion changed from 34-39-90, November 18, 1969.)							
2283E	Enl. Lost Cabin Water Works	Big Horn Sheep Co	05-27-1910	I	8.16	571.00	26-39-090	
2283E	Enl. Lost Cabin Water Works	H. F. Okie	05-27-1910	I	0.43	30.00	26-39-090	
2283E	Enl. Lost Cabin Water Works	Van Guelder Okie	05-27-1910	I	1.30	91.00	26-39-090	
2283E	Enl. Lost Cabin Water Works	R.W. Spratt & Sons, Inc	05-27-1910	I	2.76	193.00	26-39-090	
	(Amended certificate issued to successor of Big Horn Sheep Company, original appropriator; right reduced by 505.0 acres (7.21 c.f.s.), from 698.0 acres (9.97 c.f.s.). Amended certificate issued allowing a change of place of use, March 19, 1992.)							
1918R	Lost Cabin Waterworks No. 3 Res	R.W. Spratt and Sons, Inc., et al.	05-27-1910	I	33.20 a.f.		4-38-090	
	(This Certificate issued in accordance with an Order of the Fifth Judicial District Court, entereed April 23, 1998, in Civil No. 86-0012-3008, entitled, "In Re: The General Adjudication of All Rights to Use Water in the Big Horn River System and All Other Sources, State of Wyoming." For supporting documents, see Division No. 3 Proof File, Proof No. 37713.)							
10445	O.S.W. Supply	Amelia M. Knapp	08-24-1910	Supply Ditch			9-38-090	
	(Amended certificate issued to successor of Chicago, Burlington, and Quincy Railroad Co., original appropriator.)							
2080R	O.S.W. Res	Amelia M. Knapp	08-24-1910	D,I,S	160.69 a.f.		7-38-090	
	(Amended certificate issued to successor of Chicago, Burlington, and Quincy Railroad Co., original appropriator, for change in use from railroad to irrigation.)							
10446	O.S.W. Pipe Line	Amelia M. Knapp	02-23-1911	D,I,S	Sec.Sup.		7-38-090	
	(Water is stored in O.S.W. Reservoir, Permit No. 2080R. Amended certificate issued to successor of Chicago, Burlington and Quincy Railroad Co., original appropriator, for change in use from railroad to irrigation, with no specific lands shown.)							
2685E	Enl. Slick	Jesse P. Lewis	04-04-1911	I	1.01	71.88	17-39-089	
2686E	Enl. Slick	Minnie Bader	04-04-1911	I	0.14	10.40	17-39-089	
2691E	Enl. Alva	William Hendry	08-09-1911	I	0.69	48.00	13-39-089	
2402R	M. J. Leahy Res	Minnie Bader	09-13-1912	I	17.28 a.f.		18-39-089	
	(Stored water is for Enl. Slick Ditch, Permit No. 2687E.)							

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.	ACRES	HG LOC.	Notes
11542	Erastus Fuller	Jesse P. Lewis	10-28-1912	I	0.09	6.00	24-39-090	
	(Water is stored in Erastus Fuller Res., Permit No. 2403R.)							
2403R	Erastus Fuller Res	Jesse P. Lewis	10-28-1912	I	6.66 a.f.		24-39-090	
2687E	Enl. Slick	Jesse P. Lewis	11-09-1912	Supply Ditch			17-39-089	
	(Supply ditch for Erastus Fuller Res., Permit No. 2403R.)							
11592	Ellis Extension	John S. Johnson	11-29-1912					
	(Declaration of abandonment, April 21, 1939.)							
2421R	Ellis Res	John S. Johnson	11-29-1912					
	(Declaration of abandonment, April 21, 1939.)							
12613	Everett H. Knapp	Everett H. Knapp	08-01-1914	I	0.30	21.80	7-38-090	
	(Water is stored in Erastus Fuller Res., Permit No. 2403R.)							
3015E	Enl. Burlington Res. Supply	Everett H. Knapp	08-01-1914	Supply Ditch			9-38-090	
	(Supply ditch for Everett H. Knapp Res., Permit No. 2714R.)							
2714R	Everett H. Knapp Res	Everett H. Knapp	08-01-1914	I	21.00 a.f.		7-38-090	
14365	Jente	Ida A. Anderson	09-27-1916					
	(Abandonment pursuant to Paragraph 3, Section 41-9, W.S. 1957, inundated lands, May 18, 1972.)							
3770E	Enl. Jente	August Anderson	03-20-1917					
	(Abandonment pursuant to Paragraph 3, Section 41-9, W.S. 1957, inundated lands, May 18, 1972.)							
4138E	Enl. Slick	Myrtle Lybyer	06-29-1920	I	0.40	28.00	17-39-089	
19850	Davis	Cecil L. Davis	11-12-1943	I	0.47	32.90	29-39-088	
5365E	Enl. Swaim	Cecil L. Davis	02-23-1944	I	0.66	46.00	28-39-088	
20123	Lost Cabin Water Works	R. W. Spratt & Sons, Inc.	09-30-1947					
	(Voluntarily abandoned (detached) 45.45 acre-feet of stored water; to be reverted back to the Enl. Water Works No. Three Reservoir for use on other lands, March 19, 1992.)							
5449E	Enl. Lost Cabin Water Works	R. W. Spratt & Sons, Inc.	09-30-1947	Supply Ditch			26-39-090	
	(Supply ditch for Enl. Waterworks No. 3 Res., Permit No. 5627R.)							
5627R	Enl. Waterworks No. 3 Res	R. W. Spratt & Sons, Inc.	09-30-1947	I,S	45.45 a.f.		4-38-090	
	(Stored water is for Lost Cabin Water Works Ditch, Permit No. 20123.)							
20347	Knapp	Amelia M. Knapp	11-28-1949	D,I,S	2.09	146.60	17-38-090	
5962E	Enl. Lost Cabin Waterworks Extension Ditch	R.W. Spratt and Sons, Inc.	11-05-1951	Res. Supply			26-39-090	
	(Supply for Second Enlargement Waterworks No. 3 Reservoir, Permit No. 6463R. The amount of this appropriation shall be limited to the amount benefically used to supply the Second Enlargement Waterworks No. 3 Reservoir, not to exceed 132.5 acre feet from all sources for any one year, at a rate not to exceed 40.67 c.f.s.)							
6463R	Enl. Lost Cabin Waterworks No. 3 Res.	R. W. Spratt & Sons, Inc.	11-05-1951	I	132.50 a.f.		4-38-090	
	(This reservoir receives water from Badwater Creek through the Enl. Lost Cabin Waterworks Extension Ditch, Permit No. 5962 Enl.)							
	GULCH, Tributary Badwater Creek							
10414	Bonneville Pipe Line	Chicago, Burlington, & Quincy R. R. Co.	08-16-1910	RR,S	Sec.Sup.		36-39-094	
	(Water is stored in Bonneville Res., Permit No. 2071R.)							
2071R	Bonneville Res	Chicago, Burlington, & Quincy R. R. Co.	08-16-1910	RR	511.00 a.f.		36-39-094	
12401	Embry	Edwin V. Embry	05-25-1914	I	0.10	7.00	36-39-094	
12469SR	Haystack Butte Stock Res	USDI, Bureau of Land Management	11-01-1982	S	1.00 a.f.		19-39-093	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of consturction issued.)							
	THOREN LAKE, Tributary Badwater Creek							
13061	Thoren	Emil Thoren	03-10-1915	D,I,S	0.13	9.00	18-38-093	

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.	ACRES	HG LOC.	Notes
	STINKY CREEK, Tributary Badwater Creek							
12705SR	Me-Oh-My Stock Res	USDI, Bureau of Land Management	11-01-1982	S	1.00 a.f.		21-38-093	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)							
	HOODOO CREEK, Tributary Badwater Creek							
2229	Hoodoo	John S. Johnson	08-04-1899	I	0.35	25.00	27-40-093	
2229	Hoodoo	Quien Sabe Ranch	08-04-1899	I	0.04	3.00	27-40-093	
	(Amended certificate issued, February 17, 1994.)							
1542E	Enl. Hoodoo	E. R. Thoren	05-04-1906	I	0.21	15.00	27-40-093	
1787R	Quien Sabe Res	Emil Thoren	05-06-1910	I,S	12.09 a.f.		34-40-093	
	(Stored water is for Hoodoo Ditch, Permit Nos. 2229 and 1542E.)							
10301	Elsie	Elsie Thoren	11-14-1910	I	0.76	53.00	34-40-093	
10385	Cunningham	John Cunningham	12-21-1910	I	0.38	27.00	22-39-093	
11898	Hoodoo	Chicago, Burlington, & Quincy R. R. Co.	07-21-1913	Supply Ditch			9-39-093	
	(Supply ditch for Bonneville Res., Permit No. 2071R., from Gulch, tributary Badwater Creek.)							
	DRY CREEK, Tributary Badwater Creek							
10115	Westfall	Perry A. Westfall	08-26-1910	D,I,S	1.20	84.00	30-40-092	
	(Adjudicated as from Prong of Dry Creek.)							
10675	Yankee	Herman A. Parker	05-17-1911	I	0.20	14.40	29-40-092	
	(Adjudicated as from Branch of Dry Creek.)							
12950	Woodruff	William A. Jeanne Frank	12-22-1913	I	1.48	104.00	30-39-092	
	(Amended certificate issued to successors of D.J. Woodruff, original appropriator.)							
3126E	Enl. Woodruff	William A. Jeanne Frank	02-08-1915	I	0.50	35.00	30-39-092	
	(Amended certificate issued to successors of D.J. Woodruff, original appropriator, March 2, 1995.)							
	EAST FORK DRY CREEK, Tributary Dry Creek							
7612	Depass Pipe Line	Williams Luman Mining Co.	01-07-1907	D			14-40-092	
	(Actual amount of appropriation is 0.0015 c.f.s.)							
7853	Rochester	Dora Berger	05-27-1907	D,I	0.03	2.00	34-40-092	
13787	Berger	Ernest Berger	09-07-1915	D,I,S	0.32	22.50	23-40-092	
14391	Berger	Dora Berger	07-24-1916	I	0.57	40.00	34-40-092	
15738	Peterson	Magnus Peterson	04-02-1920	D,I,S	0.36	25.00	3-39-092	
	TRICKLE DRAW, Tributary East Fork Dry Creek							
13068SR	Cedar Ridge Stock Res	USDI, Bureau of Land Management	11-01-1982	S	15.20 a.f.		15-39-092	
	(Adjudicated by Decree of District Court, Fifth Judicial District, dated February 9, 1983. No certificate of construction issued.)							
	WEST FORK OF EAST FORK DRY CREEK, Tributary East Fork Dry Creek							
14526	Preston	Heirs Waldron Estate	11-15-1916	D,I,S Supply Ditch	0.33	23.00	29-40-092	
	(Adjudicated as from Branch of Dry Creek. Supply ditch for Preston Res., Permit No. 3388R. Water is stored in Preston Res., Permit No. 3388R.							
3388R	Preston Res	Heirs Waldron Estate	11-15-1916	D,I,S	9.44 a.f.		32-40-092	

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.	ACRES	HG LOC.	Notes
	HOLDBERG OR HOLBERG DRAW, Tributary Middle Fork or East Fork Dry Creek, Tributary West Fork Creek							
10113	Holdberg...........................	Est. Louis Holdberg...............	08-26-1910	I	0.56	39.00	28-40-092	
	(Adjudicated as from Prong of Dry Creek, and as Holberg Ditch, under name of Estate Louis Holberg.)							
2866SR	Holberg Stock Res.................	Clinton Reed and Jeanne Frank......	09-29-1959	S	2.83 a.f.		28-40-092	
	EAST FORK OF EAST FORK DRY CREEK, Tributary East Fork Dry Creek							
11540	Miranville........................	C. P. Miranville..................	08-31-1911	I	0.58	41.00	22-40-092	
	(Adjudicated as from Branch of Dry Creek.)							
14447	Terrell...........................	W. C. Boyd........................	10-16-1916	D,I,S	0.63	44.00	27-40-092	
	(Adjudicated as from Prong Dry Creek.)							
	WEST FORK DRY CREEK, Tributary Dry Creek							
2227	Dry Creek No. 1...................	Otto Chandler.....................	08-04-1899	I	0.49	34.00	12-39-093	
	(Adjudicated as from Dry Creek.)							
2228	Dry Creek No. 2...................	Otto Chandler.....................	08-04-1899	I	0.60	42.00	12-39-093	
	(Adjudicated as from Dry Creek.)							
10677	Dykes No. 1.......................	George B. Fuller..................	05-20-1911	I	0.06	4.00	24-40-093	
	(Adjudicated as from Dry Creek.)							
11966	Williams..........................	George B. Fuller..................	02-15-1912	D,I,S	0.74	52.30	26-40-093	
	(Adjudicated as from Dry Creek.)							
11966	Williams..........................	Lisle M. Williams.................	02-15-1912	D,I,S	0.10	6.40	26-40-093	
	(Adjudicated as from Dry Creek.)							
15443	School............................	Caroline Fuller...................	04-25-1919	D,I,S	0.58	41.00	26-40-093	
	(Adjudicated as from West Dry Creek.)							
17315	Wimsey No. One....................	Est. Lois Wimsey, et al...........	12-21-1927	D,I,S	0.17	12.00	1-39-093	
17316	Wimsey No. Two....................	Est. Lois Wimsey, et al...........	12-21-1927	D,I,S	0.11	7.50	1-39-093	
17317	Wimsey No. Three..................	Est. Lois Wimsey, et al...........	12-21-1927	D,I,S	0.03	2.00	12-39-093	
18918	Howard............................	John Frank Howard.................	05-10-1938	I	0.10	7.10	1-39-093	
	BRENNAN SPRINGS, Tributary West Fork Dry Creek							
17313	Brennan No. 1.....................	F. W. Brennan.....................	11-30-1927	D,I,S	S.S.	1.65	18-39-092	
	(Original supply is from West Fork Dry Creek through Dry Creek No. 1 Ditch, Permit No. 2227.)							
	SPRINGS, Tributary West Branch of West Fork Dry Creek, Tributary West Fork Dry Creek							
10678	Dykes No. 2.......................	George B. Fuller..................	05-20-1911	I	0.17	12.00	23-40-093	
	SOUTH DRAW, Tributary Badwater Creek							
9958SR	South Badwater Stock Res..........	USDI, Bureau of Land Management	02-19-1986	S	3.22 a.f.		15-38-092	
	(This stock reservoir is unadjudicated but built within the terms of the permit. No certificate of construction will be issued.)							

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.	ACRES	HG LOC.	Notes
	WEST FORK SCHOENING CREEK, Tributary Schoening Creek, Tributary Badwater Creek							
13065SR	Schoening Creek Stock Res	USDI, Bureau of Land Management	11-01-1982	S	4.50 a.f.		25-39-092	
	(Adjudicated by Decree of District Court, Fifth Judicial District, dated February 9, 1983. No certificate of construction issued.)							
	LONG BUTTE GULCH, Tributary Badwater Creek							
13069SR	Long Butte Stock Res	UDSI, Bureau of Land Management	11-01-1982	S	1.20 a.f.		31-39-091	
	(Adjudicated by Decree of District Court, Fifth Judicial District, dated Februaru 9, 1983. No certificate of construction issued.)							
	BRANCH FIRST SAND DRAW, Tributary First Sand Draw							
13066SR	E. Dolus Stock Res	USDI, Bureau of Land Management	11-01-1982	S	4.50 a.f.		28-39-091	
	(Adjudicated by Decree of District Court, Fifth Judicial District, dated February 9, 1983. No. certificate of construction issued.)							
	GOLD MINE CREEK, Tributary First Sand Draw, Tributary Flood Gulch, Tributary Badwater Creek							
12806SR	Philp Stock Res	USDI, Bureau of Land Management	11-01-1982	S	8.00 a.f.		34-40-091	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)							
13067SR	Dry Hole Stock Res	USDI, Bureau of Land Management	11-01-1982	S	7.10 a.f.		9-39-091	
	(Adjudicated by Decree of District Court, Fifth Judicial District, dated February 9, 1983. No certificate of construction issued.)							
	BRIDGER CREEK, Tributary Badwater Creek							
Terr.	Long	Wm. Long	-1887	I	0.82	58.00	34-41-091	
Terr.	Sheaf No. 1	Alison Shoemaker	-1889	I	0.35	25.00	1-41-091	
588	Sheaf No. 2	Alison Shoemaker	09-14-1893	I	0.37	26.00	11-41-091	
757	"Two B" No. 2	David Picard	07-02-1894	I	0.83	58.55	22-41-091	
	(Certificate corrected to show correct priority date of July 2, 1894, from the incorrect date of November 13, 1894, and to correct the Permit No. from 842 to 757, and the correct Proof No. from 5790 to 5789, February 14, 1990.)							
759	Sheaf No. 4	Alison Shoemaker	07-03-1894	I	0.20	14.00	11-41-091	
842	"Two B" No. 1	David Picard	11-13-1894	I	0.77	53.94	22-41-091	
	(Corrected certificate to show correct priority date of November 13, 1894, from the incorrect date of July 2, 1894, and to correct the Permit No. from 757 to 842, and the correct Proof No. from 5789 to 5790, February 14, 1990.)							
151E	Enl. Long	C. J. Long	04-27-1895	I	0.61	43.00	34-41-091	
1001	Warden	Sam P. Warden	06-25-1895	I	0.40	28.00	15-40-091	
1069	Day	John S. Day	10-29-1895					
	(Declared abandoned, February 27, 1991.)							
2026	Jasper	B. F. Bausman	01-16-1899					
	(Declaration of abandonment, Nov. 18, 1916.)							
2026	Jasper	Wm. McComb	01-16-1899	I	0.57	40.00	6-39-090	
2586	Puntney	Walter Puntney	04-24-1900	I	0.68	48.00	14-40-091	
2635	Barker	J. A. Barker	05-29-1900					
	(Declared abandoned, Nov. 14, 1931.)							
3668	Barnard	D. Davis	01-04-1902					
	(Declaration of abandonment, Nov. 14, 1931.)							
5840	Elsass	Jos. Dolis	02-17-1904	I	0.90	63.00	25-39-091	
1645E	Enl. Puntney	Walter Puntney	10-04-1906	I	0.16	11.50	14-40-091	
1687E	Enl. Jasper	B. F. Bausman	04-17-1907					
	(Declaration of abandonment, Nov. 18, 1916.)							
1986E	Enl. Jasper	Bessie J. Grier	09-30-1907	I	0.61	43.00	6-39-090	

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.		ACRES	HG LOC.	Notes
1986E	Enl. Jasper	William McComb	09-30-1907	I	0.34		24.00	6-39-090	
1836E	Enl. Jasper	Percy H. Shallenberger	02-28-1908	I	1.20		84.00	6-39-090	
1987E	Enl. Jasper	Percy H. Shallenberger	12-05-1908	I	0.35		25.00	6-39-090	
2021E	Enl. Zaradnicek	Percy H. Shallenberger	02-04-1909	I	1.99		139.53	13-39-091	
	(Is actually an enlargement of Moore Ditch, Permit No. 571 (cancelled).)								
10122	Battle Axe No. 2	J. S. Day	07-25-1910	D,I	2.75		192.50	36-39-091	
1956R	Battle Axe Res	J. S. Day	07-25-1910	D,I	98.00	a.f.		2-38-091	
	(Stored water is for Day Ditch, Permit No. 1069.)								
11349	Percy	Percy H. Shallenberger	10-02-1911	D,I,S	Sec.Sup.		86.00	24-39-091	
	(Water is stored in Percy Res., Permit No. 2344R. Original supply for 54 acres is through Enl. Zaradnicek Ditch, Permit No. 2021E., and for 32 acres is through Enl. Moore Ditch, Permit No. 2635E.)								
2344R	Percy Res	Percy H. Shallenberger	10-02-1911	I	17.00	a.f.		24-39-091	
2635E	Enl. Moore	Percy H. Shallenberger	10-02-1911	D,I,S	0.46		32.00	13-39-091	
2635E	Enl. Moore of Chevy Chase Ditch	Philp Sheep Company	10-02-1911	I,S	0.47		33.00	13-39-091	
	(Point of use for stock which drink directly along the course of the ditch enlargement.)								
2636E	Enl. Jasper	Percy H. Shallenberger	04-15-1912	Supply Ditch				6-39-091	
	(Supply ditch for Percy Res., Permit No. 2344R.)								
3274E	Enl. "Two B" No. 1	David R. Picard	12-24-1914	I,S	0.67		47.00	22-41-091	
3736E	Enl. Jasper	E. H. Knapp, et al	01-15-1917	D,S	0.10			6-39-090	
3736E	Enl. Jasper	E. H. Knapp, et al	01-15-1917	I	1.37		96.00	6-39-090	
4339E	Enl. Long	R. C. Heslap	12-20-1922	I	1.42		100.00	34-41-091	
5473E	Enl. Battle Axe No. Two	J. Harold Day, et al	07-08-1948	D,I,S	1.78		124.50	36-39-091	
	(Voluntarily abandoned 5.0 acres (0.07 c.f.s.) from 129.5 acres (1.85 c.f.s.), December 4, 1991.)								
7035E	Enl. Battle Axe No. 2	Montex Drilling Co., and State Board of Land Commissioners	08-08-1991	I	0.77		54.00	36-39-091	

COTTONWOOD CREEK, Tributary Bridger Creek

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.		ACRES	HG LOC.	Notes
15444	Cottonwood	Percy H. Shallenberger	04-25-1919	D,I	0.73		51.00	24-40-090	
8861SR	Stewart No. 3 Stock	Patricia E. Stewart	02-26-1981	S	5.13	a.f.		1-40-090	

EAST FORK COTTONWOOD CREEK, Tributary Cottonwood Creek

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.		ACRES	HG LOC.	Notes
12711SR	Stop Gap Stock Res	USDI, Bureau of Land Management	11-01-1982	S	11.20	a.f.		30-40-089	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)								

ASPEN DRAW, Tributary Cottonwood Creek

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.		ACRES	HG LOC.	Notes
12712SSR	Gumbo Stock Res	USDI, Bureau of Land Management	11-01-1982	S	4.10	a.f.		27-40-090	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)								

COTTONWOOD DRAW, Tributary Cottonwood Creek

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.		ACRES	HG LOC.	Notes
10626	Nichols	C. Nichols	03-11-1911	I	0.41		29.20	1-40-090	
8862SR	Stewart No. 4 Stock	Patricia E. Stewart	02-26-1981	S	1.07	a.f.		1-40-090	

BIG BUTTE CREEK, Tributary Davis Draw, Tributary Bridger Creek

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.		ACRES	HG LOC.	Notes
12283SR	Big Butte Stock Res	USDI, Bureau of Land Management	11-01-1982	S	1.30	a.f.		3-39-090	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)								

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.		ACRES	HG LOC.	Notes
	POISON SPRINGS DRAW, Tributary Bridger Creek								
14694	Owl	Percy H. Shallenberger	04-20-1917	I	S.S.		213.00	13-39-091	
	(Original supply is from Bridger Creek, for 84 acres through Enl. Jasper Ditch, Permit No. 1836E. and for 20 acres through Enl. Jasper Ditch, Permit No. 1987E., for 77 acres through Enl. Zaradnicek Ditch, Permit No. 2021E., and for 32 acres through Enl. Moore Ditch, Permit No. 2635E; also supply ditch for Percy Res., Permit No. 2344R., if supply from Bridger Creek is deficient.)								
17584	D. E. Fuller No. 1	D. E. Fuller	06-14-1929	D,I,S	0.43		30.00	19-40-091	
17585	D. E. Fuller No. 2	D. E. Fuller	06-14-1929	D,I,S	0.76		53.00	20-40-091	
	HI LINE DRAW, Tributary Poison Springs Draw								
12285SR	Hi Line Stock Res	USDI, Bureau of Land Management	11-01-1982	S	5.30	a.f.		35-40-091	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)								
	POISON SPRINGS, Tributary Poison Springs Draw								
9093	Violet	Leonard D. Cheever	06-07-1909	D,I,S	0.21		15.00	21-40-091	
2509R	Violet Res	Leonard D. Cheever	07-14-1913	D,I,S	2.20	a.f.		20-40-091	
	(Stored water is for Violet Ditch, Permit No. 9093.)								
	CHEEVER SPRING, Tributary Poison Springs Draw								
17587	Cheever Spring	D. E. Fuller	06-14-1929	D,I,S	0.03		2.00	20-40-091	
	RUTH FULLER DRAW, Tributary Poison Springs Draw								
2867SR	Ruth Fuller Homestead Stock Res	Ruth E. Fuller	04-14-1960	S	1.93	a.f.		20-40-091	
	MAPLE SPRING, Tributary Poison Springs Draw								
17586	Maple Spring	D. E. Fuller	06-14-1929	D,I,S	0.16		11.00	19-40-091	
	LYSITE CREEK, Tributary Bridger Creek								
1174	Lysite	B. F. Bausman	03-26-1896	I	1.00		70.00	7-39-090	
1634	Wroth	Thomas Wroth	10-22-1897	I	0.78		55.00	26-41-090	
2292	Two Day	W. M. Doubleday	09-27-1899	I	0.81		57.00	22-41-090	
2292	Two Day Ditch	Richard C. & Susan M. Okie	09-27-1899	I	0.05			22-41-090	
	(Actual amount of appropriation 0.056 c.f.s.)								
910E	Enl. Two Day	W. M. Doubleday	08-26-1901	I	0.42		30.00	22-41-090	
5361	Doubleday Home	W. M. Doubleday	03-16-1903	I	0.04		3.00	22-41-090	
396R	Doubleday Res	Big Horn Sheep Co.	04-04-1903	I	11.69	a.f.		22-41-090	
5921	Lysite	Philip Berger	03-30-1904	I	0.65		45.50	20-40-090	
1688E	Enl. Two Day	May E. Doubleday	04-17-1907	I	0.87		61.00	22-41-090	
1689E	Enl. Lysite	B. F. Bausman	04-17-1907	I	0.55		39.00	7-39-090	
1837E	Enl. Lysite	Percy H. Shallenberger	02-28-1908	I	0.61		43.00	7-39-090	

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.	ACRES	HG LOC.	Notes
	FRANCIS DRAW, Tributary Sagebrush Draw, Tributary Lysite Creek							
12284SR	Francis Stock Res	USDI, Bureau of Land Management	11-01-1982	S	1.00 a.f.		21-40-090	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)							
	BOW AND ARROW CREEK, Tributary Bridger Creek							
12286SR	Bow and Arrow Stock Res	USDI, Bureau of Land Management	11-01-1982	S	2.30 a.f.		30-40-090	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)							
	SQUAW ROCK CREEK, Tributary Chalk Butte Creek, Tributary Bridger Creek							
12281SR	Squaw Rock Stock Res	USDI, Bureau of Land Management	11-01-1982	S	4.30 a.f.		L6 24-40-091	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)							
	MEADOW CREEK, Tributary Bridger Creek							
1576	Mountain	C. C. Reck	08-23-1897	I	0.62	44.00	29-41-090	
2305	Meadow	C. C. Reck	10-04-1899	I	0.12	9.00	32-41-090	
2496	Stuchell	Jas. W. Stuchell	03-02-1900	D,I,S	0.46	32.80	12-40-091	
3484	Meadow No. 2	Grace B. Stuchell	10-25-1901	I	0.30	21.00	20-41-090	
1654E	Enl. Meadow	C. C. Reck	12-26-1906	I	0.17	12.00	32-41-090	
16225	Crescent C.	Thomas Dunne	09-06-1921	I,S	0.77	54.00	2-40-091	
16225	Crescent C.	William B. Ramage, et al	09-06-1921	I,S	0.20	14.00	2-40-091	
4507E	Enl. Crescent C.	Fay May	10-29-1926	D,I,S	1.10	77.00	2-40-091	
	CLOVER CREEK, Tributary Meadow Creek							
12282SR	Meadow Creek Dam Stock Res	USDI, Bureau of Land Management	11-01-1982	S	2.70 a.f.		12-40-091	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)							
	EAST MEADOW CREEK, Tributary Meadow Creek							
13750	Alice	Alice V. Reck	09-07-1915	I	0.61	43.00	20-41-090	
3412R	Alice Res	Alice V. Reck	12-01-1916					
	(Voluntarily abandoned, February 11, 1987.)							
	RECK SPRING, Tributary East Meadow Creek							
18679	The Reck Ditch	Clarence H. Gardner	10-15-1935	D,I,S	0.07	5.00	29-41-090	
	BURNT SPRINGS DRAW, Tributary Bridger Creek							
9203	Florence	Paul E. Goedicke	06-29-1909	I	0.26	18.00	17-40-091	

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.	ACRES	HG LOC.	Notes
	TIGER CREEK, Tributary Burnt Springs Draw							
9095	Aunt Hannah	Robert A. Fuller	06-07-1909	I	0.03	2.00	13-40-092	
	SAM WARDEN DRAW OR FLOOD GULCH, Tributary Bridger Creek							
17175	Dunne	Lander State Bank	11-13-1926	D,I,S	0.33	22.50	11-40-091	
					S.S.	4.50		
	(Original supply for 4.5 acres is from Bridger Creek through Warden Ditch, Permit No. 1001.)							
	SOUTH FORK BRIDGER CREEK OR DRY DRAW, Tributary Bridger Creek							
6716	Foster	Inez May Long	06-03-1905	I	2.24	157.00	7-40-091	
17337	Hillside	Everett H. Knapp, et al	01-19-1928	D,S	1.00		2-40-092	
4583E	Enl. Hillside	Everett H. Knapp, et al	05-25-1928	D,S	1.00		2-40-092	
4634E	Enl. Hillside	Everett H. Knapp, et al	07-24-1929	D,S	0.25		2-40-092	
17655	Amelia	Wyoming State Board of Land Commissioners, et al	01-14-1930		Res. Supply		1-40-092	
	(This Certificate issued in accordance with an Order of the Fifth Judicial District Court, entered November 18, 1998, in Civil No. 86-0012-2344, entitled, "In Re: The General Adjudication of All Rights To Use Water in the Big Horn River System and All Other Sources, State of Wyoming." For supporting documents, see Division No. 3 Proof File, Proof No. 37688.)							
12987SR	Amelia Stock Res	Philp Sheep Company, et al	11-15-1996	S	0.38 a.f.		1-40-092	
	(This stock reservoir is unadjudicated, but built within the terms of the permit. No certificate of construction will be issued.)							
	HILLSIDE DRAW, Tributary South Fork Bridger Creek or Dry Draw							
12988SR	Hillside Stock Res	Philp Sheep Company	11-15-1996	S	0.40 a.f.		12-40-092	
	(This stock reservoir is unadjudicated, but built within the terms of the permit. No certificate of construction will be issued.)							
	WEST BRIDGER CREEK, Tributary Bridger Creek							
2673	Vermont	C. C. Moore	06-20-1900	I	0.34	24.00	33-41-092	
2673	Vermont	James V. Wilson & Terry Lee Wilson.	06-20-1900	D,S	0.05		33-41-092	
	(Actual amount of appropriation is 0.056 c.f.s.)							
7906	Guffey	John Guffey, et al	07-19-1907	I	0.32	23.00	34-41-092	
	BOBCAT COULEE, Tributary Brown Spring Draw, Tributary West Bridger Creek							
2258SR	VeBar Bridger No. 1 Stock Res	Wyoming State Board of Land Commissioners - Owners James and Terry Wilson - Lessees	01-21-1958	S	0.62 a.f.		36-41-092	
	SPRING, Tributary West Bridger Creek							
15785	Guam	James Lee Nichols	07-12-1920	D,I,S	0.17	12.00	29-41-091	

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.	ACRES	HG LOC.	Notes
	JENKS SPRING, Tributary Bridger Creek							
13226	Lovestedt........................	Carl Lovestedt....................	08-15-1912	D,I,S	0.49	34.30	26-41-091	
	MAMY'S FORK, Tributary Bridger Creek							
12393	Bloomquist.......................	Arvid Bloomquist..................	04-30-1914	I	0.17	12.00	15-41-091	
	(Water is stored in Bloomquist Res. Nos. 1 and 2, Permit Nos. 2643R and 2644R.)							
2643R	Bloomquist No. 1 Res..............	Arvid Bloomquist..................	04-30-1914	I	5.70 a.f.		14-41-091	
2644R	Bloomquist No. 2 Res..............	Arvid Bloomquist..................	04-30-1914	I	6.02 a.f.		15-41-091	
	PINE CREEK, Tributary Bridger Creek							
758	Sheaf No. 3.......................	Alison Shoemaker..................	07-03-1894	I	0.28	20.00	12-41-091	
	MCCARTHY SPRING, Tributary Bridger Creek							
15539	McCarthy Spring...................	Mike McCarthy.....................	06-10-1919	D,S	0.10		30-42-090	
	O.S.W. DRAW, Tributary Badwater Creek							
30186	Lysite Recreation Park No. 1....... Pipeline	Fremont County School District.... No. 24; and USDI, Bureau of Land Management	01-31-1989	I	0.04	2.80	7-38-090	
	SOUTH FORK BADWATER CREEK, Tributary Badwater Creek							
9904SR	Sand Creek Pit Stock Res..........	USDI, Bureau of Land Management....	02-19-1986	S	0.32 a.f.		28-39-089	
	(This stock reservoir is unadjudicated but built within the terms of the permit. No certificate of construction will be issued. The capacity is 0.322 acre-feet.)							
	PADLOCK DRAW, Tributary Badwater Creek							
9905SR	Padlock Pit Stock Res.............	USDI, Bureau of Land Management....	02-19-1986	S	3.40 a.f.		35-39-090	
	(This stock reservoir is unadjudicated but built within the terms of the permit. No certificate of appropriation will be issued.)							
	SOURDOUGH GULCH OR CRAWFORD CREEK, Tributary Badwater Creek							
7133R	Synder Creek Detention............	USDI, Bureau of Land Management....	08-01-1963	S,TFC	86.53 a.f.		13-39-090	
	(Total capacity of reservoir is 347.54 acre-feet of which 261.01 acre feet is for flood control purposes for which no appropriation is granted.)							
	GOURLY DRAW, Tributary Sourdough Gulch or Crawford Creek,							
5309R	Hendry No. 2......................	Clear Creek Cattle Co.............	07-19-1940	S	6.24 a.f.		5-39-089	

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.		ACRES	HG LOC.	Notes
	ALKALI CREEK, Tributary Badwater Creek								
10415	Jack Pot Pipe Line..................	Chicago, Burlington, & Quincy...... R. R. Co.	01-04-1911	RR	Sec.Sup.			26-38-087	
	(Water is stored in Jack Pot Res., Permit Nos. 2073R. and 2431R.)								
2073R	Jack Pot Res.......................	Chicago, Burlington, & Quincy...... R. R. Co.	01-04-1911	RR	482.00	a.f.		26-38-087	
2431R	Enl. Jack Pot Res..................	Chicago, Burlington, & Quincy...... R. R. Co.	12-09-1912	RR	290.00	a.f.		26-38-087	
5104R	State Res..........................	Home Sheep Compnay.................	08-24-1939						
	(Actually diverts from South Fork Alkali Creek, tributary Alkali Creek.)								
	JACKSON SPRING, Tributary Alkali Creek								
18738	Jackson Stock Ditch................	R.W. Spratt and Sons...............	02-17-1937	S	0.30	a.f.		24-38-089	
	LITTLE WASSEY DRAW, Tributary Alkali Creek								
10809SR	Wassey Stock Res...................	USDI, Bureau of Land Management....	10-05-1989	S	6.49	a.f.		11-37-090	
	(This stock reservoir is unadjudicated but built within the terms of the permit. No certificate of construction will be issued.)								
	GREY WASH, Tributary Crooked Channel Creek, Tributary Alkali Creek								
5392SR	Little Wassy Stock Res.............	USDI, Bureau of Land Management....	05-24-1965	S	2.23	a.f.		10-37-090	
	ALKALI DRAW, Tributary Crooked Channel Creek, Tributary Alkali Creek								
7090R	Thumb..............................	USDI, Bureau of Land Management....	02-26-1964	S,Wildlife	39.93	a.f.		5-37-090	
	EAST FORK ALKALI DRAW, Tributary Alkali Draw, Tributary Crooked Channel Creek								
5387SR	Little Durf Stock Res..............	USDI, Bureau of Land Management....	05-24-1965	S	2.23	a.f.		4-37-090	
	EAST FORK RESERVOIR CREEK, Tributary Alkali Draw								
5390SR	Little John Stock Res..............	USDI, Bureau of Land Management....	05-24-1965	S	2.23	a.f.		6-37-090	
	PONY CREEK, Tributary Alkali Creek								
11499SR	Logan No. 1 Stock Res..............	USDI, Bureau of Land Management....	11-01-1982	S	3.20	a.f.		23-38-089	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)								

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.		ACRES	HG LOC.	Notes
	COLT DRAW, Tributary Pony Creek, Tributary Alkali Creek								
5388SR	Little Dick Stock Res.............	USDI, Bureau of Land Management....	05-24-1965	S	2.17	a.f.		31-38-089	
	SOUTH FORK PONY CREEK, Tributary Pony Creek								
5389SR	Big Dick Stock Res................	USDI, Bureau of Land Management....	05-24-1965	S	2.23	a.f.		28-38-089	
	SODA DRAW, Tributary Alkali Creek								
7091R	Alkali............................	USDI, Bureau of Land Management....	05-27-1964	S,Wildlife	95.45	a.f.		5-37-089	
	YEARLING DRAW, Tributary Alkali Creek								
9476SR	Yearling Stock Res................	USDI, Bureau of Land Management....	05-04-1984	S	2.89	a.f.		24-37-089	
	EAST TODD DRAW, Tributary Alkali Creek								
11545SR	Resv. C Stock Res.................	USDI, Bureau of Land Management....	11-01-1982	S	20.00	a.f.		12-37-089	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)								
	CEDAR RIDGE GULCH, Tributary Alkali Creek								
4538R	B. S. C...........................	Big Horn Sheep Co..................	04-25-1933	D,S	2.72	a.f		19-38-088	
	FOSSIL DRAW, Tributary Alkali Creek								
9766R	Fossil Detention Dam Res..........	USDI, Bureau of Land Management....	11-01-1982	S	19.00	a.f.		27-38-088	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)								
	DUNN DRAW, Tributary Fossil Draw, Tributary Alkali Creek								
11498SR	R-11 Stock Res....................	USDI, Bureau of Land Management....	11-01-1982	S	1.75	a.f.		22-38-088	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)								
	IRON SPRING, Tributary Alkali Creek								
2422	Okie..............................	J. B. Okie.........................	01-02-1900	D,S				16-37-088	
	PRATT GULCH, Tributary Iron Spring								
11163SR	Pratt No. 2A Stock Res............	Two Bar C Livestock, Inc...........	12-04-1990	S	4.00	a.f.		21-37-088	
	(This stock reservoir is unadjudicated, but built within the terms of the permit. No certificate of construction will be issued.)								

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.	ACRES	HG LOC.	Notes
	HOAGLAND DRAW, Tributary Alkali Creek							
9765R	Sullivan Reservoir No. 2 Res.......	USDI, Bureau of Land Management....	11-01-1982	S	20.00 a.f.		4-37-088	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of consturction issued. Total capacity with enlargement is 30.0 acre-feet. See below.)							
11543SR	Enl. Hoagland Draw Stock Res.......	USDI, Bureau of Land Management....	11-01-1982	S	0.55 a.f.		33-38-088	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued. Total capacity with enlargement is 1.50 acre-feet.)							
9765R	Sullivan Reservoir No. 2 Res.......	USDI, Bureau of Land Management....	12-28-1990	S	10.00 a.f.		4-37-088	
	(Total capacity with enlargement is 30.0 acre-feet. Unadjudicated.)							
	SPRING GULCH OR RED CREEK, Tributary Alkali Creek							
1518R	Red Ranch Res.....................	Jozina Davis, et al................	04-03-1909	I	82.50 a.f.		18-38-087	
	(Stored water is for Red Ranch Ditch, Permit No. 9039 and for Red Ranch Ditch No. 2, Permit No. 9040.)							
9040	Red Ranch No. 2....................	Jozina Davis.......................	04-19-1909	I	0.81	57.30	18-38-087	
9039	Red Ranch..........................	Jozina Davis, et al................	05-03-1909	I	3.11	218.00	18-38-087	
11386	Twidale............................	M. O. Co...........................	08-09-1911	I	Sec.Sup.	38.00	19-38-087	
	(Water is stored in Twidale Res., Permit No. 2359R.)							
2359R	Twidale Res........................	M. O. Co...........................	08-09-1911	I	17.36 a.f.		19-38-087	
9742R	Red Creek Detention Dam Res........	USDI, Bureau of Land Management....	11-01-1982	S	19.00 a.f.		L2 25-38-088	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)							
	JOE'S DRAW, Tributary Spring Gulch or Red Creek							
6031SR	Joe's Draw Stock Res...............	Frank Sullivan.....................	09-11-1967	S	0.71 a.f.		36-38-088	
	SAND SPRINGS CREEK, Tributary Joe's Draw							
6036SR	Sand Springs Creek Stock Res.......	Frank Sullivan.....................	09-11-1967	S	1.96 a.f.		36-38-088	
	DERN DRAW, Tributary Spring Gulch or Red Creek							
11486SR	Sullivan Draw Stock Res............	USDI, Bureau of Land Management....	11-01-1982	S	1.00 a.f.		35-38-088	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)							
	DEATON DRAW, Tributary Spring Gulch or Red Creek							
1620SR	Deaton Draw Stock Res..............	Two-Bar C Livestock, Inc...........	10-08-1956	S	1.64 a.f.		26-38-088	
	HEALY DRAW, Tributary Deaton Draw							
11546SR	Resv. No. 6 Stock Res..............	USDI, Bureau of Land Management....	11-01-1982	S	1.00 a.f.		23-38-088	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)							

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.	ACRES	HG LOC.	Notes
	DRY DRAW, Tributary Spring Gulch or Red Creek							
4737R	Carlson Res........................	A. J. Carlson......................	07-24-1937	S	0.36 a.f.		24-38-088	
	HITCHCOCK DRAW, Tributary Dry Draw							
11547SR	Resv. No. 1 Stock Res.............	USDI, Bureau of Land Management....	11-01-1982	S	1.00 a.f.		23-38-088	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)							
	RIDGE DRAW, Tributary Spring Gulch or Red Creek							
4967SR	Ridge Draw Stock Res..............	Frank Sullivan.....................	11-18-1964	S	1.16 a.f.		25-38-088	
11495SR	Sullivan Pit Stock Res............	USDI, Bureau of Land Management....	11-01-1982	S	1.10 a.f.		25-38-088	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)							
	HART DRAW, Tributary Spring Gulch or Red Creek							
9771R	Hart Res..........................	USDI, Bureau of Land Management....	11-01-1982	S	20.00 a.f.		L1 19-38-087	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued. Total capacity with enlargement is 40.10 acre-feet. See below.)							
9771R	Hart Res..........................	USDI, Bureau of Land Management....	12-28-1990	S	20.10 a.f.		L1 19-38-087	
	(Total capacity with enlargement is 40.10 acre-feet. Unadjudicated.)							
	RED RANCH DRAW, Tributary Spring Gulch or Red Creek							
6964SR	Red Ranch Stock Res...............	USDI, Bureau of Land Management....	05-04-1971	S	3.44 a.f.		20-38-087	
	WHITEROCK DRAW, Tributary Spring Gulch or Red Creek							
9767R	Pine Ridge Detention Dam Res.......	USDI, Bureau of Land Management....	11-01-1982	S	20.00 a.f.		8-38-087	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued. Total capacity with enlargement is 20.10 acre-feet. See below.)							
9768R	Whiterock Detention Dam Res.......	USDI, Bureau of Land Management....	11-01-1982	S	20.00 a.f.		8-38-087	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued. Total capacity with enlargement is 45.0 acre-feet. See below.)							
9767R	Pine Ridge Detention Dam Res.......	USDI, Bureau of Land Management....	12-28-1990	S	0.10 a.f.		8-38-087	
	(Total capacity with enlargement is 20.10 acre-feet. Unadjudicated.)							
9768R	Whiterock Detention Dam Res........	USDI, Bureau of Land Management....	12-28-1990	S	25.00 a.f.		8-38-087	
	(Total capacity with enlargement is 45.0 acre-feet. Unadjudicated.)							
	TOWSON DRAW, Tributary Nicole Draw, Tributary Alkali Creek							
11541SR	Sullivan Pit 4 Stock Res..........	USDI, Bureau of Land Management....	11-01-1982	S	8.10 a.f.		15-37-088	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)							

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.	ACRES	HG LOC.	Notes
	NATHAN GULCH, Tributary Nicole Draw, Tributary Alkali Creek							
8743SR	Two Bar C No. 1 Stock Res..........	Two-Bar C Livestock, Inc...........	07-23-1980	S	3.36 a.f.		23-37-088	
	AGATE DRAW, Tributary Alkali Creek							
2225SR	Agate Draw Stock Res...............	USDI, Bureau of Land Management....	03-13-1958	S	1.20 a.f.		31-38-087	
9741R	Lynx Detention Dam Res.............	USDI, Bureau of Land Management....	11-01-1982	S	20.00 a.f.		11-37-088	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued. Total capacity with enlargement is 100.0 acre-feet. See below.)							
9741R	Lynx Detention Dam Res.............	USDI, Bureau of Land Management....	12-28-1990	S	80.00 a.f.		11-37-088	
	(Total capacity with enlargement is 100.0 acre-feet. Unadjudicated.)							
	GREY BUTTE GULCH, Tributary Agate Draw							
11491SR	Sullivan Pit 3 Stock Res...........	USDI, Bureau of Land Management....	11-01-1982	S	13.30 a.f.		L2 31-38-087	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)							
	CROSSLEY DRAW, Tributary Grey Butte Gulch, Tributary Agate Draw							
11490SR	Sagebrush Stock Res................	USDI, Bureau of Land Management....	11-01-1982	S	1.90 a.f.		L2 31-38-087	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)							
	SQUAW GULCH OR POWERLINE DRAW, Tributary Alkali Creek							
1856SR	Squaw Gulch Stock Res..............	USDI, Bureau of Land Management....	01-14-1957	S	0.95 a.f.		29-38-087	
6963SR	Powerline Stock Res................	USDI, Bureau of Land Management....	05-04-1971	S	3.20 a.f.		32-38-087	
9737R	Bridge Detention Dam Res...........	USDI, Bureau of Land Management....	11-01-1982	S	20.00 a.f.		7-37-087	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued. Total capacity with enlargement is 50.0 acre-feet. See below.)							
9736R	Donlin Detention Dam Res...........	USDI, Bureau of Land Management....	11-01-1982	S	20.00 a.f.		L2 5-37-087	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued. Total capacity with enlargement is 233.0 acre-feet. See below.)							
9737R	Bridge Detention Dam Res...........	USDI, Bureau of Land Management....	12-28-1990	S	30.00 a.f.		7-37-087	
	(Total capacity with enlargement is 50.0 acre-feet. Unadjudicated.)							
9736R	Donlin Detention Dam Res...........	USDI, Bureau of Land Management....	12-28-1990	S	213.00 a.f.		L2 5-37-087	
	(Total capacity with enlargement is 233.0 acre-feet. Unadjudicated.)							
	HEARD DRAW, Tributary Squaw Gulch or Powerline Draw							
11493SR	Home Sheep Co. Stock Res...........	USDI, Bureau of Land Management....	11-01-1982	S	9.30 a.f.		33-38-087	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)							
	WOO POO DRAW, Tributary Squaw Gulch or Powerline Draw							
7125SR	Mike Draw Stock Res................	USDI, Bureau of Land Management....	09-29-1971	S	5.60 a.f.		27-38-087	

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.		ACRES	HG LOC.	Notes
	HALL DRAW, Tributary Woo Poo Draw								
9740R	Hall Detention Dam Res.............	USDI, Bureau of Land Management....	11-01-1982	S	20.00	a.f.		29-38-087	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued. Total capacity with enlargement is 32.4 acre-feet. See below.)								
11492SR	Mike Wash Stock Res................	USDI, Bureau of Land Management....	11-01-1982	S	16.00	a.f.		33-38-087	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)								
9052SR	Hall Stock Res.....................	USDI, Bureau of Land Management....	12-06-1982	S	1.15	a.f.		29-38-087	
10924SR	Hall Stock Res.....................	A. L. Carlson......................	04-04-1990	S	2.75	a.f.		20-38-087	
	(This stock reservoir is unadjudicated, but built within the terms of the permit. No certificate of construction will be issued.)								
9740R	Hall Detention Dam Res.............	USDI, Bureau of Land Management....	12-28-1990	S	12.40	a.f.		29-38-087	
	(Total capacity with enlargement is 32.40 acre-feet. Unadjudicated.)								
	TRAIL DRAW, Tributary Woo Poo Draw								
1858SR	Trail Draw Stock Res...............	USDI, Bureau of Land Management....	01-14-1957	S	0.95	a.f.		33-38-087	
11489SR	Resv. No. 8 Stock Res..............	USDI, Bureau of Land Management....	11-01-1982	S	1.00	a.f.		28-38-087	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)								
	RED BLUFF DRAW, Tributary Woo Poo Draw								
9739R	Mike Wash Diversion Res...........	USDI, Bureau of Land Management....	11-01-1982	S	20.00	a.f.		L1 28-38-087	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued. Total capacity with enlargement is 29.0 acre-feet. See below.)								
9770R	Red Bluff Detention Res............	USDI, Bureau of Land Management....	11-01-1982	S	14.90	a.f.		10-38-087	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)								
9739R	Mike Wash Diversion Res............	USDI, Bureau of Land Management....	12-28-1990	S	9.00	a.f.		L1 28-38-087	
	(Total capacity with enlargement is 29.0 acre-feet. Unadjudicated.)								
	MIKE WASH, Tributary Red Bluff Draw, Tributary Woo Poo Draw								
9769R	Three Forks Det. Dam Res...........	USDI, Bureau of Land Management....	11-01-1982	S	11.00	a.f.		10-38-087	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)								
	ROCKY RIDGE DRAW, Tributary Alkali Creek								
1857SR	Rocky Ridge Stock Res..............	USDI, Bureau of Land Management....	01-14-1957	S	1.86	a.f.		29-37-087	
	BENNET DRAW, Tritubary Rocky Ridge Draw								
11488SR	Resv. No. 5........................	USDI, Bureau of Land Management....	11-01-1982	S	2.80	a.f.		19-37-087	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)								
	CHARLOTTE DRAW, Tributary Alkali Creek								
6391R	Charlotte Res......................	USDI, Bureau of Land Management....	12-27-1956	S	24.23	a.f.		34-38-087	
7116SR	Association Stock Res..............	USDI, Bureau of Land Management....	09-29-1971	S	3.69	a.f.		3-37-087	
9738R	Antelope Detention Dam Res.........	USDI, Bureau of Land Management....	11-01-1982	S	20.00	a.f.		8-37-087	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued. Total capacity with enlargement is 76.0 acre-feet. See below.)								

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.		ACRES	HG LOC.	Notes
11487SR	R-9 Stock Res	USDI, Bureau of Land Management	11-01-1982	S	1.00	a.f.		4-37-087	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)								
9738R	Antelope Detention Dam Res	USDI, Bureau of Land Management	12-28-1990	S	56.00	a.f.		8-37-087	
	(Total capacity with enlargement is 76.0 acre-feet. Unadjudicated.)								
	SOUTH FORK ALKALI CREEK, Tributary Alkali Creek								
5104R	State Res	Home Sheep Company	08-24-1939	D,S	11.85	a.f.		16-37-087	
	(Adjudicated as from Alkali Creek.)								
	SULLIVAN DRAW, Tributary Donlin Draw, Tributary South Fork Alkali Creek								
4888R	Home Sheep Company Res	Home Sheep Company	08-20-1937	S	3.48	a.f.		33-37-087	
	DRY RUN DRAW, Tributary South Fork Alkali Creek								
1716R	Bad Water Creek Res	USDI, Bureau of Land Management, owner & Metropolitan Life Insurance Company, lessee	02-21-1910	S	59.20	a.f.		14-37-087	
	INDIAN DRAW, Tributary Alkali Creek								
1859SR	Indian Draw Stock Res	A. L. Carlson	01-14-1957	S	0.60	a.f.		15-37-087	
	HORSE PASTURE DRAW, Tributary Alkali Creek								
1854SR	Horse Pasture Stock Res	USDI, Bureau of Land Management	01-14-1957	S	0.46	a.f.		10-37-087	
	SOUTH E-K CREEK, Tributary Alkali Creek								
9745R	E-K Diversion Dam No. 1 Res	USDI, Bureau of Land Management	11-01-1982	S	11.00	a.f.		35-38-087	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)								
	PEAVINE DRAW, Tributary E-K Creek, Tributary Alkali Creek								
9746R	Peavine Res	USDI, Bureau of Land Management	11-01-1982	S	9.30	a.f.		1-38-087	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)								
	DEADMAN BUTTE DRAW, Tributary E-K Creek, Tributary Alkali Creek								
11503SR	Deadman Retention Dam 2	USDI, Bureau of Land Management	11-01-1982	S	3.20	a.f.		L16 6-38-086	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of consturcion issued.)								

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.		ACRES	HG LOC.	Notes

CARLSON DRAW, Tributary Alkali Creek, Tributary Badwater Creek

957SR	Carlson Draw No. 1	USDI, Bureau of Land Management	11-04-1954	S	0.70	a.f.		23-38-087	

CRAWFORD CREEK OR SOUR DOUGH GULCH, Tributary Badwater Creek

1718	Crawford	O. E. Snyder	01-27-1898	I	0.42		30.00	19-40-089	
3206R	Little Henry Res	Percy H. Shallenberger	09-01-1915	I,S	5.20	a.f.		31-40-089	

(Stored water is for Little Henry Ditch, Permit No. 11968, from Sour Dough Springs.)

BANTA DRAW, Tributary Crawford or Sour Dough Gulch

5279R	Cottonwood	USDI, Bureau of Land Management	04-29-1940	S	13.19	a.f.		6-39-089	

GOURLEY DRAW, Tributary Crawford Creek or Sour Dough Gulch

5309R	Hendry No. 2	Clear Creek Cattle Co.	07-19-1940	S	6.24	a.f.		5-39-089	

SOUR DOUGH SPRINGS, Tributary Crawford Creek or Sour Dough Gulch

11968	Little Henry	Percy H. Shallenberger	04-24-1913	I,S	0.34		24.00	31-40-089	
3144E	Enl. Little Henry	Percy H. Shallenberber	03-24-1915	I	0.38		27.00	31-40-089	

SIOUX CREEK, Tributary Badwater Creek

1918	Root	Robert and Phyllis Britain	08-01-1898	I	0.56		39.00	22-40-089	
1918	Root	Daniel Root	08-01-1898	I	0.88		62.00	22-40-089	
1382E	Enl. Root	Daniel Root	05-17-1905	I	1.40		98.00	22-40-089	

NO CATCHUM DRAW, Tributary Sioux Creek

5308R	Hendry No. 1 Res	Clear Creek Cattle Company	07-19-1940	S	1.80	a.f.		8-39-089	

(This Certificate issued in accordance with an Order of the Fifth Judicial District Court, entered April 13, 1998, in Civil No. 86-0012-3021, entitled, "In Re: The General Adjudication of All Rights to Use Water in the Big Horn River System and All Other Sources, State of Wyoming." For supporting documents, see Division No. 3 Proof File, Proof No. 37715.)

5308R	Hendry No. 1 Res	U.S.D.I., B.L.M.	07-19-1940	S	1.80	a.f.		8-39-089	

(This Certificate issued in accordance with an Order of the Fifth Judicial District Court, entered April 13, 1988, in Civil No. 86-0012-3021, entitled, "In Re: The General Adjudication of All Rights to Use Water in the Big Horn River System and All Other Sources, State of Wyoming." For supporting documents, see Division No. 3 Proof File, Proof No. 37716.)

BRITAIN DRAW, Tributary Sioux Creek

5598R	Britain Res	Phyllis and Robert Britain, Lessees, and USDI Bureau of Land Management	08-19-1946	S	10.90	a.f.		28-40-089	

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.	ACRES	HG LOC.	Notes
	SPRING, Tributary Sioux Creek							
9426	Black Douglas	M. B. Douglas	10-04-1909	I	0.14	10.00	9-40-089	
	WILLOW SPRINGS, Tributary Sioux Creek							
20145	Willow Springs	Mary Trenchard	09-29-1947	D,I,S	0.10	7.00	15-40-089	
	GOURLEY SPRINGS, Tributary Sioux Creek							
20143	Gourley	Mary Trenchard	09-29-1947	I	0.12	8.40	10-40-089	
	LIME KILN SPRINGS, Tributary Badwater Creek							
3934	Swain	E. G. Swain	06-14-1902	I	0.52	37.00	3-39-089	
	(Erroneously adjudicated with priority of June 14, 1892.)							
8782	Dennler	A. L. Dennler	11-21-1908	I	0.51	36.00	4-39-089	
	SULPHUR SPRINGS, Tributary Badwater Creek							
2389	Shelly	S. D. Laing	12-05-1899	I	0.57	40.00	2-39-089	
2389	Shelly	R.W. Spratt and Sons, Inc.	12-05-1899	D,S	0.05		2-39-089	
	(Actual amount of appropriation is 0.056 c.f.s.)							
	CLEAR CREEK, Tributary Badwater Creek							
2251	Temple	Charles Bader	08-28-1899					
	(Actually diverts from West Fork Clear Creek.)							
11551	Alva Feeder	William Hendry	10-04-1912	I	Sec.Sup.	74.00	7-39-088	
	(Also supply ditch for Alva Res., Permit No. 2408R. Water is stored in Alva Res., Permit No. 2408R. Original supply is from Badwater Creek through Alva Ditch, Permit Nos. 3247 and 2691E.)							
2408R	Alva Res	William Hendry	10-04-1912	I	62.00 a.f.		13-39-089	
	(This reservoir is located in a Gulch, tributary to Badwater Creek. It receives water from Clear Creek through the Alva Feeder Ditch, Permit No. 11551.)							
	WEST FORK CLEAR CREEK, Tributary Clear Creek							
2251	Temple	Charles Bader	08-28-1899	I	0.42	30.00	30-40-088	
	(Adjudicated as from Clear Creek.)							
2251	Temple	USDA, Bureau of Land Management	08-28-1899	S	0.05		30-40-088	
	SPRING (24-39-89), Tributary Badwater Creek							
11281	Hitshew No. 2 Feeder	M. O. Company	06-09-1911	I,S	S.S.	35.00	24-39-089	
	(Original supply is from Badwater Creek through Hitchew No. 2 Ditch, Permit No. 1728.)							

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.	ACRES	HG LOC.	Notes
	SPRING (18-39-88), Tributary Badwater Creek							
11282	Nott Feeder	M. O. Company	08-09-1911	I	S.S.	18.00	18-39-088	
	(Also supply ditch for Nott Res., Permit No. 2303R. Water is stored in Nott Res., Permit No. 2303R. Original supply is from Badwater Creek through Nott Ditch, Permit No. 1893.)							
2303R	Nott Res.	M. O. Company	08-09-1911	I	9.10 a.f.		19-39-088	
	DOUBLE DRAW, Tributary Badwater Creek							
11500SR	Resv. No. 2 Stock Res.	USDI, Bureau of Land Management	11-01-1982	S	1.00 a.f.		21-39-088	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)							
	DRY FORK CREEK, Tributary Badwater Creek							
6342	Dry Fork	J. B. Okie	08-30-1904	I	0.31	22.00	34-39-087	
14244	G. M. B.	Gertrude M. Bostleman	07-12-1916	I	0.40	28.00	33-39-088	
	CEDAR ROCK DRAW, Tributary Dry Fork Creek							
4992SR	Cedar Rock Draw Stock Res.	Frank Sullivan	08-05-1963	S	0.90 a.f.		34-39-088	
	BALD MOUNTAIN DRAW, Tributary Dry Fork Creek							
6356SR	Bald Mountain Stock Res.	Frank Sullivan	11-13-1968	S	0.61 a.f.		35-39-088	
	BRANCH OF DRY FORK CREEK, Tributary Dry Fork Creek							
2557SR	Dry Fork of Badwater Creek Stock Res.	State Board of Land Commissioners	12-12-1958	S	1.70 a.f.		36-39-088	
	WILLOW CREEK, Tributary Dry Fork Creek							
18393	Lichty	A. J. Carlson	01-15-1934	D,S	1.12		10-39-087	
	SPRING CREEK, Tributary Badwater Creek							
2556	Bostleman No. 1	Ernest Bostleman	04-16-1900	I	0.65	46.00	27-39-088	
	(Adjudicated as from Badwater Creek.)							
8141	Old Hand	Ernest Bostleman	01-13-1908	I	0.05	4.00	27-39-088	
	POISON CREEK, Tributary Big Horn River							
36R	Poison Creek Res.	Chicago & Northwestern Railway Company	12-26-1895	D,S			8-36-087	
	(No amount of appropriation given.)							
6972	Merriam	Edward Merriam	11-14-1905	I	0.18	12.50	23-37-091	
1255R	Hemry Res.	Charles D. Hemry	04-04-1908					
	(Voluntarily abandoned, March 19, 1992.)							

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.		ACRES	HG LOC.	Notes
9190	Denny	P. E. Denny	06-29-1909	I	0.26		18.00	27-38-094	
	(Also supply ditch for Denny No. 1 Res., Permit No. 1582R. Water is stored in Denny No. 1 Res., Permit No. 1582R.)								
1582R	Denny No. 1 Res	P. E. Denny	06-29-1909	I	18.60	a.f.		28-38-094	
3506SR	Rochelle - Poison Creek Pit Stock Res.	C. A. and Mary Jane Fenton	12-12-1960	S	2.27	a.f.		3-36-087	
8475SR	Shoshoni Wastewater Storage	Town of Shoshoni	05-07-1982	PC,Misc	26.82	a.f.		28-38-094	
	(This appropriation issued in accordance with an Order of the Fifth Judicial District Court, entered June 2, 1998, in Civil No. 86-0012-3019, entitled, "In Re: The General Adjudication Of All Rights To Use Water In The Big Horn River System And All Other Sources, State Of Wyoming." For supporting documents, see Division No. 3 Proof File, Proof No. 37526.)								

GULCH, Tributary Poison Creek

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.		ACRES	HG LOC.	Notes
1536R	Skinner Res	John A. Skinner	06-07-1909	D,Mfg	3.15	a.f.		34-38-094	

GAS DRAW, Tributary Poison Creek

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.		ACRES	HG LOC.	Notes
5229R	Ocla Res	USDI, Bureau of Land Management	01-30-1940	S	67.39	a.f.		32-38-092	

ANDIDOTE DRAW, Tributary Linn Draw, Tributary Poison Creek

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.		ACRES	HG LOC.	Notes
5391SR	Big John Stock Res	USDI, Bureau of Land Management	05-24-1965	S	2.23	a.f.		10-37-091	

MONETA DRAW, Tributary Poison Creek

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.		ACRES	HG LOC.	Notes
9960SR	Lower Graham Stock Res	USDI, Bureau of Land Management	02-19-1986	S	3.68	a.f.		14-37-091	
	(This stock reservoir is unadjudicated, but built within the terms of the permit. No certificate of construction will be issued.)								

DEER CREEK, Tributary Poison Creek

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.		ACRES	HG LOC.	Notes
1314	Holliday	John J. Holliday	08-27-1896	I	0.50		35.00	7-33-088	
9431	Cross Ell	Clear Creek Cattle Company	10-11-1909	I	0.98		68.60	7-33-088 1-33-089	
17093	Diamond Ring Ditch No. 5	Wyoming State Board of Land Commissioners (Owners) Clear Creek Cattle Company (Lessee)	03-18-1926	I	0.21		14.60	1-33-089	
4483E	Enl. No. 3 Cross Ell	Clear Creek Cattle Company	03-18-1926	I	0.19		13.40	40-33-088	

CANYON CREEK, Tributary Deer Creek

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.		ACRES	HG LOC.	Notes
3457R	Merriam No. 1 Res	Edward Merriam	01-23-1918	S	2.10	a.f.		27-35-090	
3458R	Merriam No. 2 Res	Edward Merriam	01-23-1918	S	1.65	a.f.		10-35-090	
15179	C. B. C	C. B. Cunningham	08-09-1918	D,I,S	0.17		12.00	4-33-089	

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.		ACRES	HG LOC.	Notes
	BIG DRAW, Tributary Canyon Creek, Tributary Deer Creek								
5455SR	J. L. Thompson Stock Res..........	Thompson Ranch, Inc...............	11-01-1965	S	2.54	a.f.		27-35-090	
	THOMPSON DRAW, Tributary Canyon Creek, Tributary Deer Creek								
3452SR	J. L. Thompson, Sr. Stock Res......	Thompson Ranch, Inc...............	06-25-1962	S	0.96	a.f.		15-35-090	
	VECA DRAW, Tributary Union Draw, Tributary West Canyon Creek, Tributary Canyon Creek								
9573R	Veca Pond........................	Bureau of Land Management, et al...	01-23-1990	S, Wildlife	55.55	a.f.		22-33-089	
	BUSS DRAW (A CLOSED BASIN), Tributary West Canyon Creek								
10039R	Buss I Res........................	Bureau of Land Management, et al...	03-31-1994	S	1,026.00	a.f.		27-33-089	
	(This reservoir is actually in the drainage of Buss Draw (a closed basin.) Water for this reservoir is also supplied by the Buss I Reservoir Well, Permit No. U.W. 95290, with priority of April 26, 1994.)								
10040R	Buss III Res......................	Bureau of Land Management, et al...	03-31-1994	S	14.90			27-33-089	
	(This reservoir is actually in the drainage of Buss Draw (a closed basin.)								
	CH. 4 DRAW, Tributary Buss Draw (A Closed Basin)								
10041R	Cap Pit Res.......................	Bureau of Land Management, et al...	03-31-1994	S	50.86	a.f.		27-33-089	
	(This reservoir is actually in the drainage of Buss Draw (a closed basin.)								
	SEVENTY-ONE SPRING, Tributary Deer Creek								
1579S	71................................	Edward Merriam.....................	07-26-1920	D,I,S	0.19		13.00	20-36-090	
	(Water is stored in 71 Res., Permit No. 3631R.)								
3631R	71 Res............................	Edward Merriam.....................	07-26-1920	I	1.82	a.f.		20-36-090	
	MAVERICK BUTTE DRAW, Tributary Deer Creek								
11504SR	Resv. No. 4 Stock Res.............	USDI, Bureau of Land Management....	11-01-1982	S	9.60	a.f.		26-35-089	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)								
	SHEEP CORRAL DRAW, Tributary Maverick Butte Draw								
11501SR	Noname Reservoir No. 2 Stock Res...	USID, Bureau of Land Management....	11-01-1982	S	2.40	a.f.		L10 7-35-088	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)								
	STROHECKER DRAW, Tributary Deer Creek								
10806SR	Strohecker Stock Res..............	Clear Creek Cattle Company, et al..	09-15-1989	S	1.19	a.f.		22-33-088	
	(This stock reservoir is unadjudicated, but built within the terms of the permit. No certificate of construction will be issued.)								

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.		ACRES	HG LOC.	Notes
	DAYTON DRAW, Tributary Poison Creek								
11502SR	Resv. B 7 Stock Res................	USDI, Bureau of Land Management....	11-01-1982	S	6.00	a.f.		27-37-089	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)								
11544SR	Resv. No. 3 Stock Res..............	USDI, Bureau of Land Management....	11-01-1982	S	1.10	a.f.		26-37-089	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)								
	NEFF DRY LAKE, In the Drainage of Poison Creek								
5223SR	Dry Lake Stock Res.................	L. R. Neff..........................	11-24-1964	S	0.45	a.f.		11-36-089	
	LITTLE ROCHELLE DRAW, Tributary Poison Creek								
11542SR	Rochelle Pit Stock Res.............	USDI, Bureau of Land Management....	11-01-1982	S	1.30	a.f.		29-37-088	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)								
	GARRISON GULCH OR DRAW, Tributary Poison Creek								
18043	Lucky..............................	Mrs. Dorothy Garrison..............	04-08-1931	I,S	Sec.Sup.		19.00	35-37-088	
	(Water is stored in Lucky Res., Permit No. 4471R.)								
4471R	Lucky Res..........................	Mrs. Dorothy Garrison..............	04-08-1931	I,S	11.41	a.f.		35-37-088	
6687SR	Garrison Relocated Stockwater...... Pit Stock Res.	A. L. Carlson......................	03-24-1970	S	1.96	a.f.		35-37-088	
	ZELMA DRAW, Tributary Garrison Gulch or Draw								
11494SR	Carlson Stockwater Pit Stock Res...	USDI, Bureau of Land Management....	11-01-1982	S	2.40	a.f.		35-37-088	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)								
	FLOOD GULCH, Tributary Poison Creek								
12090	Sedda Stock........................	Charles D. Hemry...................	10-30-1913	D,S				9-36-088	
	(Water is used to fill natural lake bed. No amount of appropriation given.)								
	PINGETZER DRAW, Tributary Poison Creek								
9747R	Resv. A Res........................	USDI, Bureau of Land Management....	11-01-1982	S	20.00	a.f.		L2 30-36-087	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued. Total capacity with enlargement is 21.7 acre-feet. See below.)								
9747R	Resv. A Res........................	USDI, Bureau of Land Management....	12-31-1990	S	1.70	a.f.		L2 30-36-087	
	(Total capacity with enlargement is 21.7 acre-feet. Unadjudicated.)								
	NEEDLES EYE BUTTE DRAW, Tributary Poison Creek								
11505SR	Rochelle Stock Res.................	USDI, Bureau of Land Management....	11-01-1982	S	2.80	a.f.		L4 7-36-087	
	(Adjudicated by Decree of District Court Fifth Judicial District dated February 9, 1983. No certificate of construction issued.)								

CARLSON DRAW, Tributary Poison Creek

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.	ACRES	HG LOC.	Notes
4759R	Carlson Res........................	A. J. Carlson......................	08-06-1937	D,S	23.88 a.f.		9-36-087	

WHISKEY DRAW, Tributary Poison Creek

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.	ACRES	HG LOC.	Notes
6077SR	Whiskey Draw Stock Res............	Carlson Properties................	11-30-1967	S	10.10 a.f.		9-36-087	

SAND GULCH, Tributary Five Mile Creek, Tributary Big Horn River

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.	ACRES	HG LOC.	Notes
23442	Haggerty Pump Line No. 1...........	Cleo G. Haggerty..................	07-06-1970	I	1.07	75.10	14-2N-04E	

BURDEN DRAIN, Tributary Ocean Drain, Tributary Five Mile Creek, Tributary Big Horn River

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.	ACRES	HG LOC.	Notes
28856	Burden Drain Diversion............	Herbert T. Burden.................	03-01-1985	I	0.37	25.90	34-3N-03E	

DEWEY DRAW, Tributary Ocean Drain, Tributary Five Mile Creek, Tributary Big Horn River

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.	ACRES	HG LOC.	Notes
7486R	Ocean Lake Habitat No. 5 Res.......	Wyoming Game and Fish Commission...	09-28-1972	Wildlife	87.20 a.f.		32-3N-03E	
7487R	Ocean Lake Habitat No. 6 Res.......	Wyoming Game and Fish Commission...	09-28-1972	Wildlife	61.15 a.f.		33-3N-03E	
7489R	Ocean Lake Habitat No. 2 Res.......	Wyoming Game and Fish Commission...	09-28-1972	Wildlife	83.50 a.f.		29-3N-03E	

DUCK DRAW, Tributary Ocean Drain, Tributary Five Mile Creek, Tributary Big Horn River

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.	ACRES	HG LOC.	Notes
7484R	Ocean Lake Habitat No. 1 Res.......	Wyoming Game and Fish Commission...	09-28-1972	Wildlife	22.37 a.f.		29-3N-03E	
7485R	Ocean Lake Habitat No. 4 Res.......	Wyoming Game and Fish Commission...	09-28-1972	Wildlife	46.15 a.f.		32-3N-03E	

COX SLOUGH, Tributary Cox Draw, Tributary Ocean Lake, Tributary Ocean Drain, Tributary Five Mile Creek, Tributary Big Horn River

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.	ACRES	HG LOC.	Notes
23959	R 7 Supply.........................	Wyoming Game and Fish Commission...	09-28-1972	Supply Ditch			6-2N-03E	
	(Supply ditch for Ocean Lake Habitat Res. No. 7, Permit No. 7488R., not to exceed 2.10 c.f.s.)							
7488R	Ocean Lake Habitat No. 7 Res.......	Wyoming Game and Fish Commission...	09-28-1972	Wildlife	23.35 a.f.		6-2N-03E	

GATHERING DRAIN, Tributary Ocean Lake, Tributary Ocean Drain, Tributary Five Mile Creek, Tributary Big Horn River

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.	ACRES	HG LOC.	Notes
30836	Asmundson No. 1 Pipeline...........	F. Gunnar and Asta Asmundson.......	06-03-1991	D,S	0.07		33-2N-03E	
	(Actual amount of appropriation is 0.078 c.f.s.)							

DRAIN NO. 17.2.3, Tributary Gathering Drain

PERMIT NO.	DITCH	APPROPRIATOR	PRIORITY	USE	C.F.S.	ACRES	HG LOC.	Notes
9937R	Peterson Area-Ocean Lake........... Habitat Unit	USDI, Bureau of Reclamation	07-26-1993	Wildlife	188.17 a.f.		17-2N-03E	

APPENDIX 2

ALLOTMENT LISTING

Allotment Number	Map ID	Allotment Name	Field Office	GIS Acreage
1308	1	167A SCOTT-ROBSON	Lander	1,974.5
1340	2	168A NORTH OF SEE	Lander	853.8
1341	3	168A STOCK DRIVEW	Lander	3,206.4
10024	4	3 BUTTES	Casper	92,443.4
1000	5	33 MILE SDW	Casper	7,964.9
360	6	ARROWHEAD I	Casper	3,490.7
10419	7	BADWATER CREEK	Casper	3,562.9
1331	8	BATTLE AXE BERGER	Lander	11,930.4
1330	9	BATTLE AXE LYSITE	Lander	5,238.2
1328	10	BATTLE AXE SOUTH	Lander	9,591.9
1318	11	BELOW THE HILL PASTURE	Lander	3,355.9
2512	12	BILLYS FLATS	Worland	3,422.3
11513	13	BLACKJACK RANCH	Lander	36,783.4
1346	14	BONNEVILLE RESERV	Lander	13,084.5
1332	15	BOW & ARROW	Lander	2,557.6
1317	16	BRANDAU RANCH ALL	Lander	1,868.1
1368	17	BRIDGER CREEK	Lander	1,132.0
2507	18	BRIDGER CREEK	Worland	3,063.2
1366	19	CABIN PASTURE	Lander	1,145.3
1353	20	CAMPBELL	Lander	6,920.2
1306	21	CANNING ALLOTMENT	Lander	733.3
10019	22	CANTRIL-TODD	Casper	16,908.3
1301	23	CANTRIL JACK ALLO	Lander	11,364.9
11504	24	CANYON CREEK	Lander	19,288.2
10018	25	CLEAR CREEK	Casper	40,281.9
1373	26	COPPER MOUNTAIN	Lander	7,180.4
1334	27	COTTONWOOD PASS	Lander	9,421.7
1337	28	DE PASS RANCH	Lander	7,025.9
11506	29	DEER CREEK AMP	Lander	15,612.3
10126	30	DEVIL SLIDE	Casper	3,929.8
1315	31	DITCH PASTURE	Lander	761.0
1325	32	EAST OF RANCH	Lander	7,503.5
21009	33	EAST TRAIL AREA	Casper	2,524.6
20213	34	ELKHORN-LRA	Casper	530.5
10015	35	ELLIS-MOUNTAIN	Casper	2,799.7
10044	36	ERVAY BASIN	Casper	21,136.4
10095	37	FENTON	Casper	9,490.0
11502	38	FRASER DRAW	Lander	98,071.2
1323	39	FULLER ALLOTMENT	Lander	4,187.2
1338	40	FULLER RANCH PAST	Lander	2,163.9
11508	41	GAS HILLS	Lander	58,290.7
1333	42	GATES DRAW ALLOTM	Lander	16,737.4
126	43	GORELY	Casper	1,372.8
1367	44	HENRICH PASTURE	Lander	561.5
10012	45	HILAND	Casper	5,259.5
1324	46	HOODOO CREEK ALLO	Lander	30,021.2

Allotment Number	Map ID	Allotment Name	Field Office	GIS Acreage
1363	47	HOODOO HQ PASTURE	Lander	536.0
1356	48	HOWARD PASTURE	Lander	3,878.0
1348	49	J.HERBST SUMMER	Lander	4,294.9
1349	50	J.HERBST TUFF CRE	Lander	2,979.3
2531	51	JENKS CREEK	Worland	434.0
1352	52	JOE JOHNS PASTURE	Lander	2,999.7
1347	53	JONES CREEK BASIN	Lander	7,270.8
1311	54	KEENAN	Lander	2,388.7
1342	55	KNAPP INDIVIDUAL	Lander	1,266.9
1326	56	LICHTENSTEIN	Lander	7,447.4
1309	57	LOGAN PASTURE	Lander	6,197.7
1355	58	LOOKOUT HILL	Lander	9,853.2
1305	59	LYBYER NORTH	Lander	4,512.7
1362	60	LYBYER SOUTH	Lander	3,446.9
2560	61	LYSITE CREEK	Worland	3,051.9
1329	62	LYSITE MOUNTAIN	Lander	13,469.9
1316	63	MADDEN RANCH PAST	Lander	5,525.3
1307	64	MALLET-SMITH PASTURE	Lander	1,413.3
10020	65	MATADOR	Casper	33,973.1
416	66	MAYNARD 2	Casper	2,036.8
461	67	MAYNARD PASTURE	Casper	15,820.0
2550	68	MELTON MOUNTAIN	Worland	3,979.4
1314	69	MONETA HILLS PAST	Lander	8,973.7
1345	70	MOUNTAIN PASTURE	Lander	2,357.6
11501	71	MUSKRAT-LINN	Lander	86,817.9
1407	72	MUSKRAT AMP	Lander	47,191.4
1327	73	MYRTLE REED ALLOTMENT	Lander	1,707.0
1302	74	NORTH OF CB&Q R.R	Lander	2,572.8
1312	75	NORTH OF TRACKS	Lander	18,030.6
1336	76	OCLA NORTH OF R.R	Lander	6,126.3
1335	77	OCLA SOUTH OF R.R	Lander	9,041.1
10148	78	OKIE TRAIL	Casper	46,151.8
383	79	OSBORNE PLACE	Casper	14,457.1
2509	80	PEAK	Worland	21,999.5
1339	81	PICARD PRIVATE AL	Lander	5,283.7
1369	82	PICARD RANCH HQ	Lander	524.3
1406	83	POISON CREEK	Lander	19,966.8
1365	84	QUIEN SABE RANCH	Lander	3,606.2
10013	85	RAILROAD	Casper	14,793.9
1359	86	RAMAGE RANCH	Lander	17,576.7
1364	87	RED RANCH PASTURE	Lander	127.7
1360	88	RUTH FULLER PRIVA	Lander	793.9
20512	89	SAND DRAW	Casper	1,462.1
1351	90	SCOTT DRAW	Lander	3,707.1
10189	91	SIOUX CREEK	Casper	4,891.8
10145	92	SKYLINE	Casper	52,675.4

Allotment Number	Map ID	Allotment Name	Field Office	GIS Acreage
2559	93	SLOPE PASTURE	Worland	3,014.8
10006	94	SOUTH CAVE GULCH	Casper	14,810.5
11505	95	SOUTH DEER CREEK	Lander	18,143.0
10030	96	SOUTH HILAND	Casper	21,103.1
1303	97	SOUTH OF CB&Q R.R	Lander	7,299.5
1313	98	SOUTH OF TRACKS	Lander	12,895.4
1321	99	ST CLAIR RANCH	Lander	406.8
1320	100	ST CLAIR WEST	Lander	362.2
1322	101	ST.CLAIR SOUTH PA	Lander	4,951.5
1354	102	STINKING WELL	Lander	12,687.0
10066	103	SULLIVAN	Casper	44,252.6
1357	104	SUMMER ALLOTMENT	Lander	2,425.0
2020	105	TANNER-MOUNTAIN	Worland	2,746.4
1358	106	TOP OF MOUNTAIN	Lander	1,787.1
1343	107	TUFF CREEK PASTUR	Lander	19,231.3
1319	108	TWIDALE	Lander	805.8
2514	109	V-H DRAW	Worland	12,660.4
10008	110	WALTMAN	Casper	6,363.9
20516	111	WELBY RANCH	Casper	9,229.4
124	112	WEST SIDE SUMMER	Worland	32,630.0
1344	113	WESTFALL	Lander	4,853.1
1404	114	WM HERBST WINTER	Lander	3,621.8
1350	115	WM.HERBST SUMMER	Lander	1,690.2
2516	116	WOOD'S BASIN	Worland	2,420.7

APPENDIX 3

STOCK RESERVOIR EVALUATION

Township	Range	Section	Subwatershed	Latitude	Longitude	Surface Ownership
033N	089W	27	Upper Canyon Creek-Deer Creek	42.80268	-107.494	BLM
033N	089W	27	Upper Canyon Creek-Deer Creek	42.80963	-107.487	BLM
033N	088W	20	Upper Deer Creek-Poison Creek	42.81053	-107.402	BLM
033N	089W	22	Upper Canyon Creek-Deer Creek	42.81712	-107.498	BLM
033N	088W	20	Upper Deer Creek-Poison Creek	42.82052	-107.407	BLM
033N	089W	23	Upper Canyon Creek-Deer Creek	42.82318	-107.474	BLM
033N	089W	21	Upper Canyon Creek-Deer Creek	42.82425	-107.519	BLM
033N	088W	18	Upper Deer Creek-Poison Creek	42.83425	-107.44	BLM
033N	089W	13	Upper Canyon Creek-Deer Creek	42.8349	-107.46	BLM
034N	089W	29	Lower Canyon Creek-Poison Creek	42.88726	-107.532	BLM
034N	089W	19	Lower Canyon Creek-Poison Creek	42.90334	-107.559	BLM
034N	089W	18	Lower Canyon Creek-Poison Creek	42.92167	-107.557	BLM
034N	089W	10	Upper Deer Creek-Poison Creek	42.92762	-107.498	BLM
035N	089W	36	Middle Deer Creek	42.9671	-107.46	State of Wyoming
035N	089W	26	Middle Deer Creek	42.97096	-107.471	BLM
035N	089W	22	Upper Deer Creek-Poison Creek	42.98993	-107.484	BLM
035N	090W	10	Lower Canyon Creek-Poison Creek	43.01505	-107.615	BLM
036N	090W	34	Lower Canyon Creek-Poison Creek	43.04706	-107.614	BLM
036N	087W	28	Poison Creek-Hiland Reservoir	43.06264	-107.281	State of Wyoming
036N	087W	30	Poison Creek-Hiland Reservoir	43.06545	-107.319	BLM
036N	087W	19	Poison Creek-Hiland Reservoir	43.07139	-107.303	State of Wyoming
036N	087W	7	Poison Creek-Hiland Reservoir	43.10029	-107.319	BLM
036N	090W	8	Lower Deer Creek	43.1078	-107.65	BLM
036N	090W	3	Poison Creek-Frenchie Draw	43.12355	-107.605	BLM
037N	089W	31	Poison Creek-Frenchie Draw	43.12657	-107.571	State of Wyoming
037N	092W	33	Poison Creek-Ocla Draw	43.13096	-107.889	BLM
037N	091W	36	Lower Deer Creek	43.13433	-107.703	State of Wyoming
037N	088W	35	Poison Creek-Garrison Draw	43.13907	-107.371	BLM
037N	087W	29	Alkali Creek-Arminto	43.14524	-107.303	BLM
037N	088W	29	Poison Creek-Garrison Draw	43.14675	-107.431	BLM
037N	089W	26	Poison Creek-Garrison Draw	43.15065	-107.484	BLM
037N	087W	19	Alkali Creek-Arminto	43.15732	-107.327	BLM
037N	093W	24	Poison Creek-Ocla Draw	43.15808	-107.935	BLM
037N	090W	22	Poison Creek-Frenchie Draw	43.16166	-107.63	BLM
037N	089W	22	Alkali Creek-Todd Ranch	43.1649	-107.516	BLM
037N	090W	21	Poison Creek-Frenchie Draw	43.16598	-107.64	BLM
037N	091W	14	Poison Creek-Linn Draw	43.17057	-107.725	BLM
037N	087W	16	Alkali Creek-Arminto	43.1706	-107.298	State of Wyoming
037N	090W	13	Alkali Creek-Reservoir Creek	43.17517	-107.587	BLM
037N	087W	14	Alkali Creek-Arminto	43.17606	-107.253	BLM
037N	091W	14	Poison Creek-Linn Draw	43.18021	-107.727	BLM
037N	087W	16	E-K Creek	43.18086	-107.281	State of Wyoming

Township	Range	Section	Subwatershed	Latitude	Longitude	Surface Ownership
037N	088W	15	Alkali Creek-Corral	43.18102	-107.379	BLM
037N	093W	11	Poison Creek-Ocla Draw	43.18309	-107.961	BLM
037N	088W	16	Alkali Creek-Corral	43.18366	-107.417	State of Wyoming
037N	091W	8	Poison Creek-Linn Draw	43.18491	-107.791	BLM
037N	091W	12	Poison Creek-Linn Draw	43.18521	-107.705	BLM
037N	087W	8	Alkali Creek-Arminto	43.18682	-107.306	BLM
037N	090W	11	Alkali Creek-Reservoir Creek	43.18726	-107.613	BLM
037N	087W	11	E-K Creek	43.18908	-107.252	BLM
037N	087W	11	E-K Creek	43.18996	-107.248	BLM
037N	090W	10	Alkali Creek-Reservoir Creek	43.19048	-107.616	BLM
037N	089W	12	Alkali Creek-Todd Ranch	43.19063	-107.466	BLM
037N	087W	8	Alkali Creek-Arminto	43.19134	-107.303	BLM
037N	087W	7	Alkali Creek-Arminto	43.19325	-107.333	BLM
037N	091W	10	Poison Creek-Linn Draw	43.19633	-107.746	BLM
037N	088W	11	Alkali Creek-Corral	43.19803	-107.363	BLM
037N	090W	4	Alkali Creek-Reservoir Creek	43.19893	-107.643	BLM
037N	094W	3	Wind River- Hidden Valley	43.2023	-108.093	BLM
037N	090W	5	Alkali Creek-Reservoir Creek	43.20242	-107.658	BLM
037N	087W	4	Alkali Creek-Arminto	43.20463	-107.281	BLM
037N	089W	5	Alkali Creek-Todd Ranch	43.20584	-107.551	BLM
037N	088W	4	Alkali Creek-Corral	43.20594	-107.406	BLM
037N	089W	6	Alkali Creek-Reservoir Creek	43.20652	-107.573	BLM
037N	089W	6	Alkali Creek-Reservoir Creek	43.20809	-107.575	BLM
037N	091W	6	Poison Creek-Ocla Draw	43.20832	-107.812	BLM
037N	092W	6	Poison Creek-Ocla Draw	43.20895	-107.922	BLM
037N	089W	6	Alkali Creek-Reservoir Creek	43.20969	-107.572	BLM
037N	090W	6	Alkali Creek-Reservoir Creek	43.21001	-107.679	BLM
037N	087W	3	Alkali Creek-Arminto	43.21248	-107.276	BLM
038N	090W	32	Alkali Creek-Reservoir Creek	43.21484	-107.663	BLM
038N	087W	33	Alkali Creek-Arminto	43.21583	-107.293	BLM
038N	087W	34	Alkali Creek-Arminto	43.21591	-107.271	BLM
038N	088W	33	Alkali Creek-Corral	43.21647	-107.404	BLM
038N	088W	36	Red Creek-Badwater Creek	43.21718	-107.352	State of Wyoming
038N	087W	31	Alkali Creek-Corral	43.22061	-107.336	BLM
038N	087W	31	Alkali Creek-Corral	43.22116	-107.333	BLM
038N	093W	36	Poison Creek-Shoshone Point	43.22227	-107.948	State of Wyoming
038N	090W	31	Alkali Creek-Reservoir Creek	43.22282	-107.679	BLM
038N	092W	32	Poison Creek-Ocla Draw	43.22378	-107.911	BLM
038N	087W	32	Alkali Creek-Arminto	43.22415	-107.304	BLM
038N	089W	31	Alkali Creek-Todd Ranch	43.22547	-107.561	BLM
038N	087W	32	Alkali Creek-Arminto	43.22651	-107.307	BLM
038N	087W	33	Alkali Creek-Arminto	43.2272	-107.296	BLM

Township	Range	Section	Subwatershed	Latitude	Longitude	Surface Ownership
038N	087W	28	Alkali Creek-Arminto	43.22743	-107.284	BLM
038N	089W	29	Alkali Creek-Todd Ranch	43.22881	-107.541	BLM
038N	087W	26	E-K Creek	43.22973	-107.246	BLM
038N	092W	27	Poison Creek-Ocla Draw	43.23007	-107.866	BLM
038N	092W	25	Badwater Creek-Gates Draw	43.23192	-107.816	BLM
038N	087W	29	Alkali Creek-Arminto	43.23464	-107.314	BLM
038N	088W	27	Alkali Creek-Corral	43.235	-107.392	BLM
038N	087W	28	Alkali Creek-Arminto	43.23867	-107.283	BLM
038N	088W	25	Red Creek-Badwater Creek	43.23955	-107.343	BLM
038N	091W	24	Badwater Creek-South Fork Badwater Creek	43.23991	-107.711	BLM
038N	087W	27	Alkali Creek-Arminto	43.24016	-107.278	BLM
038N	087W	29	Alkali Creek-Arminto	43.24033	-107.303	BLM
038N	091W	23	Badwater Creek-South Fork Badwater Creek	43.24139	-107.728	BLM
038N	087W	29	Alkali Creek-Arminto	43.24172	-107.304	BLM
038N	090W	24	Alkali Creek-Reservoir Creek	43.24296	-107.579	BLM
038N	089W	23	Alkali Creek-Todd Ranch	43.24724	-107.492	BLM
038N	086W	19	E-K Creek	43.25164	-107.212	BLM
038N	087W	24	E-K Creek	43.25217	-107.24	BLM
038N	088W	23	Red Creek-Badwater Creek	43.25318	-107.361	BLM
038N	087W	23	E-K Creek	43.25325	-107.257	BLM
038N	088W	23	Red Creek-Badwater Creek	43.25327	-107.374	BLM
038N	091W	15	Badwater Creek-South Fork Badwater Creek	43.25406	-107.734	BLM
038N	089W	23	Alkali Creek-Todd Ranch	43.25438	-107.485	BLM
038N	088W	22	Alkali Creek-Corral	43.25477	-107.39	BLM
038N	087W	19	Red Creek-Badwater Creek	43.25578	-107.335	BLM
038N	087W	24	E-K Creek	43.25616	-107.23	BLM
038N	088W	19	Alkali Creek-Todd Ranch	43.25645	-107.448	BLM
038N	090W	13	Sand Creek-Badwater Creek	43.25875	-107.584	BLM
038N	088W	16	Alkali Creek-Todd Ranch	43.25932	-107.404	State of Wyoming
038N	089W	16	Sand Creek-Badwater Creek	43.25971	-107.534	State of Wyoming
038N	091W	13	Badwater Creek-South Fork Badwater Creek	43.26019	-107.704	BLM
038N	092W	15	Badwater Creek-Gates Draw	43.26331	-107.863	BLM
038N	088W	13	Red Creek-Badwater Creek	43.26845	-107.35	State of Wyoming
038N	088W	11	Red Creek-Badwater Creek	43.27292	-107.374	State of Wyoming
038N	088W	10	Red Creek-Badwater Creek	43.27311	-107.381	BLM
038N	094W	9	Badwater Creek-Hoodoo Creek	43.27752	-108.117	Bureau of Reclamation
038N	090W	7	Badwater Creek-South Fork Badwater Creek	43.27771	-107.684	State of Wyoming
038N	087W	10	Alkali Creek-Arminto	43.2826	-107.279	BLM
038N	091W	4	Badwater Creek-Schoening Creek	43.28368	-107.754	State of Wyoming
038N	087W	10	Alkali Creek-Arminto	43.28453	-107.262	BLM
038N	091W	2	Badwater Creek-Schoening Creek	43.28831	-107.729	State of Wyoming
038N	086W	6	E-K Creek	43.29102	-107.217	BLM

Township	Range	Section	Subwatershed	Latitude	Longitude	Surface Ownership
038N	087W	2	Alkali Creek-Arminto	43.29209	-107.26	State of Wyoming
038N	089W	6	Badwater Creek-South Fork Badwater Creek	43.29682	-107.561	BLM
038N	089W	4	Sand Creek-Badwater Creek	43.29721	-107.527	BLM
039N	093W	33	Badwater Creek-Hoodoo Creek	43.29985	-108.007	BLM
039N	088W	36	Badwater Creek-Dry Fork Badwater Creek	43.30557	-107.355	State of Wyoming
004N	006E	22	Wind River-Boysen Reservoir	43.30575	-108.163	Bureau of Reclamation
039N	090W	35	Badwater Creek-South Fork Badwater Creek	43.30627	-107.603	BLM
039N	088W	33	Badwater Creek-Clear Creek	43.30699	-107.416	State of Wyoming
039N	091W	31	Badwater Creek-Schoening Creek	43.30868	-107.793	BLM
039N	091W	27	Dolus Creek	43.31326	-107.749	BLM
039N	088W	30	Badwater Creek-Clear Creek	43.3177	-107.441	State of Wyoming
039N	091W	28	Dolus Creek	43.31879	-107.755	BLM
039N	091W	28	Dolus Creek	43.31912	-107.754	BLM
039N	091W	27	Dolus Creek	43.31948	-107.733	BLM
039N	089W	29	Badwater Creek-South Fork Badwater Creek	43.32006	-107.548	BLM
039N	092W	25	Badwater Creek-Schoening Creek	43.32131	-107.818	BLM
039N	089W	30	Badwater Creek-South Fork Badwater Creek	43.32377	-107.564	BLM
039N	088W	30	Badwater Creek-Clear Creek	43.32405	-107.443	State of Wyoming
039N	088W	30	Badwater Creek-Clear Creek	43.3248	-107.448	State of Wyoming
039N	089W	30	Badwater Creek-South Fork Badwater Creek	43.32563	-107.572	BLM
039N	090W	19	Cottonwood Creek-Badwater Creek	43.32731	-107.676	State of Wyoming
039N	091W	23	Dolus Creek	43.32841	-107.722	BLM
039N	090W	22	Badwater Creek-South Fork Badwater Creek	43.33147	-107.615	BLM
039N	088W	21	Badwater Creek-Clear Creek	43.3321	-107.405	BLM
039N	089W	24	Badwater Creek-Clear Creek	43.33332	-107.457	BLM
039N	090W	20	Cottonwood Creek-Badwater Creek	43.33683	-107.655	State of Wyoming
039N	091W	21	Dolus Creek	43.34113	-107.753	BLM
039N	093W	16	Badwater Creek-Hoodoo Creek	43.35147	-107.996	BLM
039N	093W	16	Badwater Creek-Hoodoo Creek	43.3528	-108.013	BLM
039N	088W	17	Badwater Creek-Clear Creek	43.35313	-107.421	BLM
039N	090W	13	Badwater Creek-Sioux Creek	43.35443	-107.579	BLM
039N	091W	9	Dolus Creek	43.35669	-107.765	BLM
039N	090W	10	Cottonwood Creek-Badwater Creek	43.36012	-107.618	BLM
039N	089W	8	Badwater Creek-Sioux Creek	43.36244	-107.541	BLM
039N	091W	7	Dolus Creek	43.36387	-107.811	BLM
039N	089W	6	Badwater Creek-Sioux Creek	43.37632	-107.569	BLM
039N	094W	2	Tough Creek	43.3785	-108.077	BLM
039N	090W	3	Bridger Creek-East Bridger Creek	43.38073	-107.628	BLM
039N	090W	3	Bridger Creek-East Bridger Creek	43.38398	-107.634	BLM
040N	090W	36	Cottonwood Creek-Badwater Creek	43.38734	-107.583	State of Wyoming
040N	091W	34	Dolus Creek	43.39364	-107.754	BLM
040N	091W	35	Bridger Creek-East Bridger Creek	43.39834	-107.735	BLM

Township	Range	Section	Subwatershed	Latitude	Longitude	Surface Ownership
040N	091W	27	Bridger Creek-East Bridger Creek	43.40143	-107.745	BLM
040N	090W	28	Lysite Creek	43.40575	-107.648	BLM
040N	090W	26	Cottonwood Creek-Badwater Creek	43.40681	-107.605	BLM
040N	090W	27	Cottonwood Creek-Badwater Creek	43.40929	-107.618	BLM
040N	089W	30	Cottonwood Creek-Badwater Creek	43.4114	-107.571	BLM
040N	090W	21	Lysite Creek	43.41959	-107.64	BLM
040N	089W	10	Badwater Creek-Sioux Creek	43.44489	-107.503	BLM
040N	092W	1	Bridger Creek-West Bridger Creek	43.46422	-107.819	State of Wyoming
041N	092W	36	Bridger Creek-West Bridger Creek	43.47883	-107.843	State of Wyoming
041N	090W	36	Lysite Creek	43.47977	-107.605	State of Wyoming
041N	090W	15	Lysite Creek	43.51758	-107.644	State of Wyoming
041N	090W	16	Bridger Creek-East Bridger Creek	43.52189	-107.665	State of Wyoming
041N	090W	9	Lysite Creek	43.53416	-107.666	State of Wyoming
041N	090W	9	Lysite Creek	43.53599	-107.673	State of Wyoming
042N	090W	28	Bridger Creek-West Bridger Creek	43.57596	-107.669	BLM
033N	088W	19	Upper Deer Creek-Poison Creek	42.81315	-107.434	CLEAR CREEK CATTLE CO A WY CORP
033N	088W	22	Upper Deer Creek-Poison Creek	42.81764	-107.377	STROHECKER RANCH LLC
033N	088W	17	Upper Deer Creek-Poison Creek	42.82524	-107.399	CLEAR CREEK CATTLE CO A WY CORP
033N	089W	15	Upper Canyon Creek-Deer Creek	42.82943	-107.482	UMETCO MINERALS CORP TAX DEPARTMENT
033N	090W	13	Upper Canyon Creek-Deer Creek	42.82974	-107.57	FINCH E
034N	089W	22	Upper Deer Creek-Poison Creek	42.8998	-107.491	R B KEITH RANCH LLC
034N	089W	21	Lower Canyon Creek-Poison Creek	42.90619	-107.52	R B KEITH RANCH LLC
034N	090W	3	Lower Canyon Creek-Poison Creek	42.95244	-107.606	KEY RANCHES LLC A WYO LLC COMPANY
035N	088W	33	Poison Creek-Hiland Reservoir	42.96822	-107.399	MARTIN, CHRISTOPHER L ET UX
035N	088W	29	Poison Creek-Hiland Reservoir	42.97099	-107.417	MARTIN, CHRISTOPHER L ET UX
035N	090W	26	Lower Canyon Creek-Poison Creek	42.97874	-107.598	KEY RANCHES LLC A WYO LLC COMPANY
035N	089W	29	Upper Deer Creek-Poison Creek	42.98047	-107.539	R B KEITH RANCH LLC
035N	088W	29	Poison Creek-Hiland Reservoir	42.98174	-107.401	MARTIN, CHRISTOPHER L ET UX
035N	090W	27	Lower Canyon Creek-Poison Creek	42.9845	-107.62	KEY RANCHES LLC A WYO LLC COMPANY
035N	088W	19	Poison Creek-Hiland Reservoir	42.99124	-107.425	MARTIN, CHRISTOPHER L ET UX
035N	089W	23	Middle Deer Creek	42.99369	-107.469	MARTIN, CHRISTOPHER L ET UX
035N	089W	24	Middle Deer Creek	42.99414	-107.454	MARTIN, CHRISTOPHER L ET UX
035N	088W	17	Poison Creek-Hiland Reservoir	42.99994	-107.41	MARTIN, CHRISTOPHER L ET UX
035N	088W	15	Poison Creek-Hiland Reservoir	43.01185	-107.38	MARTIN, CHRISTOPHER L ET UX
035N	088W	9	Poison Creek-Hiland Reservoir	43.02207	-107.388	POWDER RIVER AGRI-ORGANIC LLC
035N	088W	8	Middle Deer Creek	43.02404	-107.416	MARTIN, CHRISTOPHER L ET UX
035N	088W	8	Middle Deer Creek	43.02417	-107.416	MARTIN, CHRISTOPHER L ET UX
035N	089W	3	Middle Deer Creek	43.03375	-107.488	MILLARD, GLENN R ET UX
035N	089W	1	Middle Deer Creek	43.04192	-107.462	MILLARD, GLENN R ET UX
036N	088W	31	Middle Deer Creek	43.0449	-107.434	MARTIN, CHRISTOPHER L ET UX
036N	090W	28	Lower Canyon Creek-Poison Creek	43.05721	-107.623	R O BAR RANCHES INC
036N	089W	28	Middle Deer Creek	43.06203	-107.518	HILAND CATTLE COMPANY LLC

Township	Range	Section	Subwatershed	Latitude	Longitude	Surface Ownership
036N	089W	25	Poison Creek-Garrison Draw	43.06556	-107.462	MILLARD, GLENN R ET UX
036N	090W	28	Lower Canyon Creek-Poison Creek	43.06821	-107.634	R O BAR RANCHES INC
036N	089W	26	Poison Creek-Garrison Draw	43.0694	-107.476	MILLARD, GLENN R ET UX
036N	089W	26	Poison Creek-Garrison Draw	43.07097	-107.468	MILLARD, GLENN R ET UX
036N	088W	20	Poison Creek-Garrison Draw	43.07515	-107.403	MILLARD, GLENN R ET UX
036N	088W	21	Poison Creek-Garrison Draw	43.07707	-107.391	DEER CREEK RANCH INC
036N	088W	19	Poison Creek-Garrison Draw	43.07777	-107.443	MILLARD, GLENN R ET UX
036N	087W	20	Poison Creek-Hiland Reservoir	43.07837	-107.292	DEER CREEK RANCH INC
036N	087W	19	Poison Creek-Hiland Reservoir	43.08149	-107.313	DEER CREEK RANCH INC
036N	090W	20	Lower Deer Creek	43.08319	-107.654	R O BAR RANCHES INC
036N	088W	18	Poison Creek-Garrison Draw	43.08493	-107.432	MILLARD, GLENN R ET UX
036N	089W	14	Poison Creek-Garrison Draw	43.08637	-107.469	MILLARD, GLENN R ET UX
036N	087W	18	Poison Creek-Hiland Reservoir	43.08653	-107.317	DEER CREEK RANCH INC
036N	087W	17	Poison Creek-Hiland Reservoir	43.0919	-107.298	CARLSON, BRAD
036N	089W	13	Poison Creek-Garrison Draw	43.09638	-107.462	MILLARD, GLENN R ET UX
036N	088W	18	Poison Creek-Garrison Draw	43.09837	-107.439	MILLARD, GLENN R ET UX
036N	089W	13	Poison Creek-Garrison Draw	43.09916	-107.444	MILLARD, GLENN R ET UX
036N	087W	18	Poison Creek-Hiland Reservoir	43.09938	-107.308	CARLSON, BRAD
036N	087W	10	Poison Creek-Hiland Reservoir	43.10465	-107.256	CARLSON PROPERTIES
036N	090W	8	Lower Deer Creek	43.10712	-107.649	R O BAR RANCHES INC
036N	088W	9	Poison Creek-Garrison Draw	43.10846	-107.397	DEER CREEK RANCH INC
036N	087W	9	Poison Creek-Hiland Reservoir	43.10909	-107.27	CARLSON PROPERTIES
036N	088W	10	Poison Creek-Hiland Reservoir	43.10971	-107.371	RICHEY, WAYNE G ET UX
036N	089W	10	Poison Creek-Garrison Draw	43.11297	-107.484	CLEAR CREEK CATTLE CO A WY CORP
036N	087W	4	Poison Creek-Hiland Reservoir	43.11616	-107.272	CARLSON PROPERTIES
036N	089W	3	Poison Creek-Garrison Draw	43.11718	-107.489	CLEAR CREEK CATTLE CO A WY CORP
036N	087W	3	Poison Creek-Hiland Reservoir	43.12143	-107.254	CARLSON, BRAD
036N	087W	3	Poison Creek-Hiland Reservoir	43.12288	-107.249	CARLSON, BRAD
036N	087W	6	Poison Creek-Hiland Reservoir	43.1242	-107.318	CARLSON, BRAD
036N	089W	6	Poison Creek-Frenchie Draw	43.12436	-107.554	SPRATT TJ & JENNIE LEE
036N	087W	2	Poison Creek-Hiland Reservoir	43.12477	-107.233	FLYING A RANCH INC
036N	089W	6	Poison Creek-Frenchie Draw	43.12513	-107.553	SPRATT TJ & JENNIE LEE
037N	090W	33	Poison Creek-Frenchie Draw	43.13075	-107.647	R O BAR RANCHES INC
037N	087W	33	Alkali Creek-Arminto	43.13553	-107.28	FLYING A RANCH INC
037N	089W	35	Poison Creek-Garrison Draw	43.13652	-107.48	CLEAR CREEK CATTLE CO A WY CORP
037N	088W	35	Poison Creek-Garrison Draw	43.13755	-107.37	RICHEY, WAYNE G ET UX
037N	087W	27	Alkali Creek-Arminto	43.14385	-107.266	FLYING A RANCH INC
037N	090W	30	Poison Creek-Frenchie Draw	43.14891	-107.676	R O BAR RANCHES INC
037N	087W	28	Alkali Creek-Arminto	43.1523	-107.282	FLYING A RANCH INC
037N	089W	27	Poison Creek-Garrison Draw	43.15273	-107.513	CLEAR CREEK CATTLE CO A WY CORP
037N	088W	21	Alkali Creek-Corral	43.163	-107.412	TWO BAR C LIVESTOCK INC
037N	088W	18	Alkali Creek-Corral	43.17445	-107.443	CLEAR CREEK CATTLE CO A WY CORP

Township	Range	Section	Subwatershed	Latitude	Longitude	Surface Ownership
037N	087W	18	Alkali Creek-Arminto	43.1768	-107.325	CARLSON, BRAD
037N	087W	18	Alkali Creek-Arminto	43.17826	-107.327	CARLSON, BRAD
037N	089W	14	Alkali Creek-Todd Ranch	43.18212	-107.485	CLEAR CREEK CATTLE CO A WY CORP
037N	088W	13	Alkali Creek-Corral	43.18324	-107.346	TWO BAR C LIVESTOCK INC
037N	088W	18	Alkali Creek-Corral	43.18354	-107.44	CLEAR CREEK CATTLE CO A WY CORP
037N	087W	10	E-K Creek	43.18669	-107.271	C & S LIMMER LIVESTOCK CORP
037N	087W	10	Alkali Creek-Arminto	43.19115	-107.28	C & S LIMMER LIVESTOCK CORP
037N	088W	7	Alkali Creek-Corral	43.19246	-107.442	CLEAR CREEK CATTLE CO A WY CORP
037N	092W	11	Poison Creek-Ocla Draw	43.19348	-107.84	R O BAR RANCHES INC
037N	087W	10	Alkali Creek-Arminto	43.19394	-107.28	C & S LIMMER LIVESTOCK CORP
037N	088W	10	Alkali Creek-Corral	43.19739	-107.381	TWO BAR C LIVESTOCK INC
037N	087W	10	Alkali Creek-Arminto	43.19831	-107.272	C & S LIMMER LIVESTOCK CORP
037N	087W	5	Alkali Creek-Arminto	43.19984	-107.31	C & S LIMMER LIVESTOCK CORP
037N	088W	2	Red Creek-Badwater Creek	43.21147	-107.369	TWO BAR C LIVESTOCK INC
037N	087W	5	Alkali Creek-Arminto	43.21177	-107.307	C & S LIMMER LIVESTOCK CORP
038N	089W	34	Alkali Creek-Todd Ranch	43.21805	-107.506	BADWATER RANCH INC
038N	089W	33	Alkali Creek-Todd Ranch	43.21886	-107.522	BADWATER RANCH INC
038N	087W	32	Alkali Creek-Arminto	43.22312	-107.303	C & S LIMMER LIVESTOCK CORP
038N	087W	26	E-K Creek	43.23495	-107.248	SULLIVAN, FRANK ET UX
038N	089W	25	Alkali Creek-Todd Ranch	43.24032	-107.465	BADWATER RANCH INC
038N	088W	27	Alkali Creek-Corral	43.24119	-107.394	TWO BAR C LIVESTOCK INC
038N	087W	20	Alkali Creek-Arminto	43.2479	-107.302	C & S LIMMER LIVESTOCK CORP
038N	087W	22	Alkali Creek-Arminto	43.24813	-107.278	C & S LIMMER LIVESTOCK CORP
038N	088W	23	Red Creek-Badwater Creek	43.25496	-107.36	TWO BAR C LIVESTOCK INC
038N	088W	24	Red Creek-Badwater Creek	43.257	-107.352	BADWATER RANCH INC
038N	089W	13	Alkali Creek-Todd Ranch	43.25871	-107.467	BADWATER RANCH INC
038N	087W	14	E-K Creek	43.25873	-107.258	CLEAR CREEK CATTLE CO
038N	089W	13	Alkali Creek-Todd Ranch	43.26006	-107.461	BADWATER RANCH INC
038N	088W	14	Red Creek-Badwater Creek	43.26271	-107.378	TWO BAR C LIVESTOCK INC
038N	089W	15	Sand Creek-Badwater Creek	43.26618	-107.515	BADWATER RANCH INC
038N	089W	14	Sand Creek-Badwater Creek	43.2703	-107.487	BADWATER RANCH INC
038N	090W	12	Sand Creek-Badwater Creek	43.27945	-107.582	LOUISIANA LAND & EXPLORATION COMP C/O CONOCO PHILLIPS
038N	090W	9	Badwater Creek-South Fork Badwater Creek	43.28209	-107.64	LOUISIANA LAND & EXPLORATION COMP C/O CONOCO PHILLIPS
038N	086W	7	E-K Creek	43.28213	-107.219	CLEAR CREEK CATTLE CO
038N	087W	8	Red Creek-Badwater Creek	43.28284	-107.311	TWO BAR C LIVESTOCK INC
038N	091W	3	Badwater Creek-Schoening Creek	43.28704	-107.735	MONTEX DRILLING CO A TX CORP
038N	089W	4	Sand Creek-Badwater Creek	43.28891	-107.523	BADWATER RANCH INC
038N	090W	4	Badwater Creek-South Fork Badwater Creek	43.28983	-107.634	LOUISIANA LAND & EXPLORATION COMP C/O CONOCO PHILLIPS
038N	090W	4	Badwater Creek-South Fork Badwater Creek	43.29102	-107.646	LOUISIANA LAND & EXPLORATION COMP C/O CONOCO PHILLIPS
038N	091W	3	Badwater Creek-Schoening Creek	43.29224	-107.74	MONTEX DRILLING CO A TX CORP
038N	090W	4	Badwater Creek-South Fork Badwater Creek	43.29232	-107.646	LOUISIANA LAND & EXPLORATION COMP C/O CONOCO PHILLIPS
038N	090W	4	Badwater Creek-South Fork Badwater Creek	43.2932	-107.633	LOUISIANA LAND & EXPLORATION COMP C/O CONOCO PHILLIPS

Township	Range	Section	Subwatershed	Latitude	Longitude	Surface Ownership
038N	090W	4	Badwater Creek-South Fork Badwater Creek	43.29348	-107.646	LOUISIANA LAND & EXPLORATION COMP C/O CONOCO PHILLIPS
038N	089W	2	Sand Creek-Badwater Creek	43.29406	-107.484	BADWATER RANCH INC
038N	090W	4	Badwater Creek-South Fork Badwater Creek	43.29631	-107.645	LOUISIANA LAND & EXPLORATION COMP C/O CONOCO PHILLIPS
038N	090W	4	Badwater Creek-South Fork Badwater Creek	43.29745	-107.645	LOUISIANA LAND & EXPLORATION COMP C/O CONOCO PHILLIPS
038N	090W	3	Badwater Creek-South Fork Badwater Creek	43.29775	-107.627	LOUISIANA LAND & EXPLORATION COMP C/O CONOCO PHILLIPS
039N	090W	34	Badwater Creek-South Fork Badwater Creek	43.3002	-107.616	LOUISIANA LAND & EXPLORATION COMP C/O CONOCO PHILLIPS
039N	090W	34	Badwater Creek-South Fork Badwater Creek	43.30127	-107.626	LOUISIANA LAND & EXPLORATION COMP C/O CONOCO PHILLIPS
039N	094W	36	Reservoir Creek	43.30637	-108.069	FLAGSTONE RANCH LLC A WYO LLC COMPANY
039N	088W	32	Badwater Creek-Clear Creek	43.30822	-107.425	BADWATER RANCH INC
039N	089W	28	Badwater Creek-South Fork Badwater Creek	43.31596	-107.532	CLEAR CREEK CATTLE CO A WY CORP
039N	093W	27	Badwater Creek-Hoodoo Creek	43.3277	-107.978	DIAMOND X RANCH LLC
039N	091W	24	Bridger Creek-East Bridger Creek	43.33234	-107.712	PHILP SHEEP CO
039N	090W	23	Badwater Creek-South Fork Badwater Creek	43.33363	-107.601	SPRATT R W & SONS A WY CORP
039N	091W	24	Bridger Creek-East Bridger Creek	43.33545	-107.707	PHILP SHEEP CO
039N	091W	24	Bridger Creek-East Bridger Creek	43.33905	-107.702	PHILP SHEEP CO
039N	090W	19	Bridger Creek-East Bridger Creek	43.33983	-107.675	PHILP SHEEP CO
039N	091W	23	Bridger Creek-East Bridger Creek	43.3406	-107.721	PHILP SHEEP CO
039N	088W	18	Badwater Creek-Clear Creek	43.34813	-107.449	CLEAR CREEK CATTLE CO A WY CORP
039N	089W	13	Badwater Creek-Clear Creek	43.34875	-107.466	CLEAR CREEK CATTLE CO A WY CORP
039N	091W	13	Bridger Creek-East Bridger Creek	43.35231	-107.696	PHILP SHEEP CO
039N	092W	18	Dry Creek-Badwater Creek	43.35414	-107.923	DIAMOND X RANCH LLC
039N	089W	15	Badwater Creek-Clear Creek	43.35715	-107.499	CLEAR CREEK CATTLE CO A WY CORP
039N	089W	8	Badwater Creek-Sioux Creek	43.36006	-107.551	CLEAR CREEK CATTLE CO A WY CORP
039N	091W	12	Bridger Creek-East Bridger Creek	43.36629	-107.704	PHILP SHEEP CO
039N	089W	11	Badwater Creek-Clear Creek	43.36695	-107.494	CAMPBELL LIVESTOCK LLC
039N	089W	4	Badwater Creek-Sioux Creek	43.37248	-107.522	ALLEN LARRY D & VICKI JO & ALLEN EDNA
039N	089W	4	Badwater Creek-Sioux Creek	43.37312	-107.537	ALLEN LARRY D & VICKI JO & ALLEN EDNA
039N	089W	2	Badwater Creek-Clear Creek	43.37449	-107.493	CAMPBELL LIVESTOCK LLC
039N	089W	3	Badwater Creek-Clear Creek	43.37476	-107.502	CAMPBELL LIVESTOCK LLC
039N	090W	6	Lysite Creek	43.37586	-107.674	RAMAGE WILLIAM B & MARGARET J & ETAL & STEWART NANCY & ETAL
039N	089W	5	Badwater Creek-Sioux Creek	43.37737	-107.551	CLEAR CREEK CATTLE CO A WY CORP
039N	089W	4	Badwater Creek-Sioux Creek	43.38066	-107.517	ALLEN LARRY D & VICKI JO & ALLEN EDNA
039N	092W	2	Badwater Creek-Schoening Creek	43.38194	-107.842	PHILP SHEEP CO
040N	093W	34	Badwater Creek-Hoodoo Creek	43.38856	-107.991	QUIEN SABE RANCH A WY LTD PART
040N	090W	35	Cottonwood Creek-Badwater Creek	43.39817	-107.597	RAMAGE RANCH CO A WY CORP
040N	091W	26	Bridger Creek-East Bridger Creek	43.39979	-107.719	RAMAGE RANCH CO A WY CORP
040N	089W	28	Badwater Creek-Sioux Creek	43.40341	-107.527	BRITAIN PHYLLIS J TRUSTEE(1/2) BRITAIN ROBERT J (1/4 INT) &;BRITAIN BRI
040N	094W	25	Tough Creek	43.41107	-108.055	THOREN BRUCE J & SABRINA K
040N	091W	21	Bridger Creek-East Bridger Creek	43.41544	-107.774	FULLER DOUGLAS P & SUZANNE M
040N	093W	22	Badwater Creek-Hoodoo Creek	43.41703	-107.979	QUIEN SABE RANCH A WY LTD PART
040N	089W	21	Badwater Creek-Sioux Creek	43.41733	-107.527	COLLIE ROSS J
040N	090W	19	Bridger Creek-East Bridger Creek	43.41951	-107.681	RAMAGE RANCH CO A WY CORP

Township	Range	Section	Subwatershed	Latitude	Longitude	Surface Ownership
040N	089W	24	Badwater Creek-Sioux Creek	43.42559	-107.471	CLEAR CREEK CATTLE CO
040N	090W	19	Bridger Creek-East Bridger Creek	43.42745	-107.692	RAMAGE RANCH CO A WY CORP
040N	091W	15	Bridger Creek-East Bridger Creek	43.42896	-107.75	PHILP SHEEP CO
040N	087W	21	Badwater Creek-Dry Fork Badwater Creek	43.42995	-107.3	UNKNOWN
040N	090W	15	Lysite Creek	43.43297	-107.623	RAMAGE RANCH CO A WY CORP
040N	089W	15	Badwater Creek-Sioux Creek	43.43851	-107.512	TRENCHARD, JOHN
040N	094W	12	Wind River-Boysen Reservoir	43.44709	-108.061	CRISTLER JAMES E & SANDRA L & MORALES VICTORIA K
040N	090W	12	Cottonwood Creek-Badwater Creek	43.44952	-107.592	CLEAR CREEK CATTLE CO A WY CORP
040N	094W	11	Wind River-Boysen Reservoir	43.44958	-108.083	HERBST JOHN JR
040N	092W	12	Bridger Creek-West Bridger Creek	43.45109	-107.824	PHILP SHEEP CO
040N	091W	11	Bridger Creek-East Bridger Creek	43.45292	-107.717	GARDNER LIVESTOCK LLC
040N	094W	11	Wind River-Boysen Reservoir	43.45466	-108.09	HERBST JOHN JR
040N	091W	3	Bridger Creek-West Bridger Creek	43.45767	-107.747	PICARD LIVESTOCK CO A WY CORP
040N	094W	3	Wind River Canyon	43.45913	-108.104	HERBST JOHN JR
040N	090W	1	Cottonwood Creek-Badwater Creek	43.46725	-107.588	RAMAGE RANCH CO A WY CORP
040N	090W	3	Lysite Creek	43.46824	-107.626	RAMAGE RANCH CO A WY CORP
040N	092W	4	Bridger Creek-West Bridger Creek	43.46876	-107.885	V VENTURES LLC A WY LLC V RANCH
040N	091W	6	Bridger Creek-West Bridger Creek	43.46894	-107.798	PICARD LIVESTOCK CO A WY CORP
040N	090W	2	Lysite Creek	43.46913	-107.607	RAMAGE RANCH CO A WY CORP
041N	092W	33	Bridger Creek-West Bridger Creek	43.47262	-107.903	V VENTURES LLC
041N	091W	31	Bridger Creek-West Bridger Creek	43.47331	-107.833	BATTLE AXE CATTLE CO INC C/O WAGNER SHARON
041N	090W	35	Lysite Creek	43.47353	-107.619	RAMAGE FAMILY TRUST DTD 7-25-02 BRADDOCK MAVIS JEAN
041N	092W	35	Bridger Creek-West Bridger Creek	43.47358	-107.864	V VENTURES LLC
041N	092W	33	Bridger Creek-West Bridger Creek	43.47728	-107.906	V VENTURES LLC
041N	091W	31	Bridger Creek-West Bridger Creek	43.47844	-107.829	BATTLE AXE CATTLE CO INC C/O WAGNER SHARON
041N	092W	34	Bridger Creek-West Bridger Creek	43.47883	-107.894	V VENTURES LLC
041N	091W	35	Bridger Creek-West Bridger Creek	43.4826	-107.751	PICARD LIVESTO
041N	092W	34	Bridger Creek-West Bridger Creek	43.48373	-107.894	V VENTURES LLC
041N	090W	31	Bridger Creek-East Bridger Creek	43.48451	-107.711	PICARD LIVESTO
041N	090W	32	Bridger Creek-East Bridger Creek	43.4861	-107.687	SANFORD NORMAN
041N	091W	28	Bridger Creek-West Bridger Creek	43.48992	-107.78	PICARD LIVESTO
041N	091W	26	Bridger Creek-West Bridger Creek	43.49056	-107.739	TWO-B LAND & LIVESTOCK CO INC C/O SLACK HARRY & ET AL
041N	090W	29	Bridger Creek-East Bridger Creek	43.49134	-107.691	LYMAN RANCH CO
041N	090W	26	Lysite Creek	43.49311	-107.621	RAMAGE RANCH C
041N	091W	30	Bridger Creek-West Bridger Creek	43.49606	-107.829	BATTLE AXE CATTLE CO INC C/O WAGNER SHARON
041N	091W	30	Bridger Creek-West Bridger Creek	43.49783	-107.832	PHILP SHEEP CO
041N	090W	20	Bridger Creek-East Bridger Creek	43.50122	-107.678	SANFORD NORMAN
041N	090W	21	Bridger Creek-East Bridger Creek	43.50654	-107.665	SANFORD NORMAN
041N	090W	23	Lysite Creek	43.51174	-107.625	LUNGREN CATTLE
041N	091W	23	Bridger Creek-West Bridger Creek	43.51437	-107.754	BLOOMQUIST VICTOR TRUSTEE
041N	091W	15	Bridger Creek-West Bridger Creek	43.52303	-107.758	BLOOMQUIST VICTOR TRUSTEE
041N	090W	8	Bridger Creek-West Bridger Creek	43.53945	-107.689	LYMAN RANCH CO

Township	Range	Section	Subwatershed	Latitude	Longitude	Surface Ownership
041N	091W	12	Bridger Creek-West Bridger Creek	43.54108	-107.733	LYMAN RANCH CO
041N	090W	5	Bridger Creek-West Bridger Creek	43.54619	-107.683	DENNIS RANCH L

APPENDIX 4

LANDFIRE DATA ANALYSIS

Badwater Creek Watershed : LANDFIRE			
Existing Vegetation Type	**Acres**	**Percent of Watershed**	**Cumulative Percent**
Inter-Mountain Basins Big Sagebrush Shrubland	208,476.39	35.500%	35.500%
Inter-Mountain Basins Big Sagebrush Steppe	66,479.50	11.320%	46.820%
Introduced Upland Vegetation-Annual and Biennial Forbland	53,671.35	9.139%	55.959%
Inter-Mountain Basins Mat Saltbush Shrubland	45,037.78	7.669%	63.628%
Inter-Mountain Basins Montane Sagebrush Steppe	37,604.69	6.403%	70.032%
Inter-Mountain Basins Semi-Desert Grassland	27,268.68	4.643%	74.675%
Rocky Mountain Foothill Limber Pine-Juniper Woodland	20,869.94	3.554%	78.229%
Rocky Mountain Lower Montane-Foothill Shrubland	20,001.27	3.406%	81.634%
Northern Rocky Mountain Lower Montane-Foothill-Valley Grassland	13,353.23	2.274%	83.908%
Wyoming Basins Dwarf Sagebrush Shrubland and Steppe	12,188.78	2.076%	85.984%
Inter-Mountain Basins Sparsely Vegetated Systems	11,531.15	1.964%	87.947%
Artemisia tridentata ssp. vaseyana Shrubland Alliance	9,026.55	1.537%	89.484%
Western Great Plains Floodplain Systems	8,379.60	1.427%	90.911%
Northwestern Great Plains Mixedgrass Prairie	7,427.09	1.265%	92.176%
Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland	6,598.00	1.124%	93.299%
Inter-Mountain Basins Greasewood Flat	5,421.09	0.923%	94.223%
Inter-Mountain Basins Semi-Desert Shrub-Steppe	5,270.30	0.897%	95.120%
Northern Rocky Mountain Subalpine-Upper Montane Grassland	4,624.92	0.788%	95.907%
Introduced Riparian Vegetation	4,009.77	0.683%	96.590%
Barren	3,472.91	0.591%	97.182%
Rocky Mountain Subalpine-Montane Mesic Meadow	2,056.93	0.350%	97.532%
Middle Rocky Mountain Montane Douglas-fir Forest and Woodland	1,889.24	0.322%	97.854%
Rocky Mountain Subalpine/Upper Montane Riparian Systems	1,828.75	0.311%	98.165%
Rocky Mountain Montane Riparian Systems	1,596.79	0.272%	98.437%
Developed-Open Space	1,591.90	0.271%	98.708%
Southern Rocky Mountain Ponderosa Pine Woodland	1,087.29	0.185%	98.893%
Rocky Mountain Aspen Forest and Woodland	1,032.36	0.176%	99.069%
Developed-Low Intensity	850.44	0.145%	99.214%
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	591.57	0.101%	99.314%
Agriculture-Pasture and Hay	555.32	0.095%	99.409%
Inter-Mountain Basins Mixed Salt Desert Scrub	466.36	0.079%	99.488%
Southern Rocky Mountain Montane-Subalpine Grassland	445.46	0.076%	99.564%
Western Great Plains Sparsely Vegetated Systems	403.65	0.069%	99.633%
Northern Rocky Mountain Montane-Foothill Deciduous Shrubland	317.13	0.054%	99.687%
Northwestern Great Plains Shrubland	285.11	0.049%	99.736%

Inter-Mountain Basins Juniper Savanna	275.10	0.047%	99.782%
Southern Rocky Mountain Ponderosa Pine Savanna	273.77	0.047%	99.829%
Northern Rocky Mountain Subalpine Deciduous Shrubland	196.37	0.033%	99.862%
Introduced Upland Vegetation-Annual Grassland	150.56	0.026%	99.888%
Rocky Mountain Alpine/Montane Sparsely Vegetated Systems	133.21	0.023%	99.911%
Developed-Medium Intensity	116.09	0.020%	99.930%
Rocky Mountain Lodgepole Pine Forest	98.08	0.017%	99.947%
Western Great Plains Shortgrass Prairie	72.28	0.012%	99.959%
Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland	37.14	0.006%	99.966%
Western Great Plains Depressional Wetland Systems	30.25	0.005%	99.971%
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	22.68	0.004%	99.975%
Open Water	22.46	0.004%	99.979%
Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland	21.57	0.004%	99.982%
Northern Rocky Mountain Subalpine Woodland and Parkland	19.13	0.003%	99.986%
Developed-High Intensity	18.90	0.003%	99.989%
Western Great Plains Sand Prairie	16.23	0.003%	99.992%
Western Great Plains Wooded Draw and Ravine	14.90	0.003%	99.994%
Northwestern Great Plains-Black Hills Ponderosa Pine Woodland and Savanna	14.23	0.002%	99.997%
Agriculture-Cultivated Crops and Irrigated Agriculture	12.23	0.002%	99.999%
Colorado Plateau Pinyon-Juniper Woodland	4.45	0.001%	99.999%
Introduced Upland Vegetation-Perennial Grassland and Forbland	2.22	0.000%	100.000%
Rocky Mountain Poor-Site Lodgepole Pine Forest	0.44	0.000%	100.000%

Poison Creek Watershed : LANDFIRE			
Existing Vegetation Type	Acres	Percent of Watershed	Cumulative Percent
Inter-Mountain Basins Big Sagebrush Shrubland	194,047.65	58.808%	58.808%
Inter-Mountain Basins Big Sagebrush Steppe	46,663.70	14.142%	72.950%
Inter-Mountain Basins Mat Saltbush Shrubland	27,183.50	8.238%	81.188%
Inter-Mountain Basins Semi-Desert Grassland	11,525.82	3.493%	84.681%
Introduced Upland Vegetation-Annual and Biennial Forbland	10,541.05	3.195%	87.876%
Inter-Mountain Basins Semi-Desert Shrub-Steppe	6,745.67	2.044%	89.920%
Northern Rocky Mountain Lower Montane-Foothill-Valley Grassland	4,859.10	1.473%	91.393%
Rocky Mountain Lower Montane-Foothill Shrubland	4,853.54	1.471%	92.864%
Western Great Plains Floodplain Systems	3,966.63	1.202%	94.066%
Inter-Mountain Basins Greasewood Flat	3,580.11	1.085%	95.151%
Wyoming Basins Dwarf Sagebrush Shrubland and Steppe	3,542.08	1.074%	96.224%
Developed-Open Space	2,309.34	0.700%	96.924%
Artemisia tridentata ssp. vaseyana Shrubland Alliance	2,102.52	0.637%	97.561%
Inter-Mountain Basins Sparsely Vegetated Systems	1,915.26	0.580%	98.142%
Introduced Riparian Vegetation	1,124.65	0.341%	98.482%
Barren	890.69	0.270%	98.752%
Rocky Mountain Montane Riparian Systems	567.33	0.172%	98.924%
Rocky Mountain Foothill Limber Pine-Juniper Woodland	563.10	0.171%	99.095%
Inter-Mountain Basins Montane Sagebrush Steppe	523.07	0.159%	99.253%
Rocky Mountain Subalpine/Upper Montane Riparian Systems	521.74	0.158%	99.412%
Developed-Low Intensity	504.61	0.153%	99.564%
Inter-Mountain Basins Mixed Salt Desert Scrub	455.69	0.138%	99.703%
Inter-Mountain Basins Juniper Savanna	275.99	0.084%	99.786%
Western Great Plains Depressional Wetland Systems	154.56	0.047%	99.833%
Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland	125.88	0.038%	99.871%
Rocky Mountain Aspen Forest and Woodland	103.64	0.031%	99.902%
Agriculture-Pasture and Hay	88.96	0.027%	99.929%
Developed-Medium Intensity	61.83	0.019%	99.948%
Northwestern Great Plains Mixedgrass Prairie	42.03	0.013%	99.961%
Western Great Plains Shortgrass Prairie	33.58	0.010%	99.971%
Southern Rocky Mountain Ponderosa Pine Woodland	26.91	0.008%	99.979%
Rocky Mountain Subalpine-Montane Mesic Meadow	21.79	0.007%	99.986%
Introduced Upland Vegetation-Annual Grassland	17.12	0.005%	99.991%
Open Water	14.90	0.005%	99.996%
Middle Rocky Mountain Montane Douglas-fir Forest and Woodland	6.00	0.002%	99.997%

Developed-High Intensity	3.11	0.001%	99.998%
Agriculture-Cultivated Crops and Irrigated Agriculture	1.78	0.001%	99.999%
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	1.56	0.001%	99.999%
Colorado Plateau Pinyon-Juniper Woodland	0.89	0.000%	100.000%
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	0.67	0.000%	100.000%

APPENDIX 5

UNGAGED BASIN DISCHARGES

HUC12 Basin Name	A (mi2)	Q 1.5	Q 2	Q 2.33	Q 5	Q 10	Q 25	Q 50	Q 100
1 - Wind River Canyon	9.95	54.4	89.0	109.2	230.1	374.2	616.9	843.0	1,114.6
2 -West Bridger Creek	61.63	131.9	211.7	257.4	527.6	845.6	1,373.7	1,860.1	2,441.5
3 - Lysite Creek	32.13	96.1	155.4	189.5	392.3	631.9	1,032.0	1,401.9	1,845.0
4 - East Bridger Creek	65.36	135.7	217.7	264.6	541.9	868.1	1,409.6	1,908.1	2,504.0
5 - Cottonwood Creek	23.95	83.3	135.2	165.1	343.2	554.2	907.2	1,234.2	1,626.2
6 - Wind River-Boysen Reservoir	30.19	93.2	150.9	184.0	381.3	614.6	1,004.2	1,364.6	1,796.3
7 - Dry Creek	53.11	122.7	197.3	240.0	493.1	791.2	1,286.9	1,743.8	2,290.2
8 - Sioux Creek	37.17	103.2	166.5	202.9	419.2	674.5	1,100.3	1,493.6	1,964.5
9 - Hoodoo Creek	62.90	133.2	213.8	259.9	532.5	853.3	1,386.1	1,876.6	2,463.0
10 - Clear Creek	46.96	115.6	186.1	226.5	466.2	748.8	1,219.2	1,653.1	2,172.2
11 - Dry Fork Badwater Creek	59.86	130.0	208.8	253.9	520.6	834.6	1,356.2	1,836.7	2,411.1
12 - Reservoir Creek	20.33	77.0	125.0	152.8	318.6	515.1	844.3	1,149.6	1,515.6
13 - Dolus Creek	25.86	86.5	140.2	171.1	355.4	573.5	938.3	1,276.0	1,680.7
14 - Badwater Creek-Schoening Creek	41.20	108.5	174.9	213.0	439.3	706.3	1,151.2	1,561.9	2,053.4
15 - Badwater Creek-South Fork Badwater Creek	45.47	113.8	183.3	223.1	459.4	738.1	1,202.0	1,630.0	2,142.2
16 - Badwater Creek-Gates Draw	39.52	106.3	171.5	208.9	431.0	693.3	1,130.3	1,533.9	2,017.0
17 - Sand Creek-Badwater Creek	25.52	85.9	139.3	170.1	353.2	570.1	932.8	1,268.6	1,671.0
18 - E-K Creek	25.82	86.4	140.1	171.0	355.1	573.1	937.6	1,275.0	1,679.4
19 - Alkali Creek-Arminto	40.23	107.2	172.9	210.6	434.5	698.8	1,139.1	1,545.7	2,032.3
20 - Red Creek	22.58	81.0	131.4	160.6	334.1	539.8	884.1	1,203.1	1,585.5
21 - Todd Ranch	53.65	123.3	198.2	241.1	495.3	794.7	1,292.6	1,751.4	2,300.2
22 - Corral	32.50	96.6	156.2	190.5	394.3	635.2	1,037.3	1,409.0	1,854.2
23 - Poison Creek-Shoshone Point	31.87	95.7	154.8	188.8	390.8	629.7	1,028.4	1,397.1	1,838.7
24 - Ocla Draw	53.99	123.7	198.8	241.9	496.8	797.0	1,296.2	1,756.3	2,306.5
25 - Hidden Valley	13.93	64.0	104.5	127.9	268.2	434.9	715.1	975.5	1,288.1
26 - Linn Draw	39.48	106.2	171.4	208.8	430.8	693.0	1,129.8	1,533.2	2,016.1
27 - Frenchie Draw	42.49	110.1	177.5	216.1	445.5	716.1	1,166.8	1,582.9	2,080.7
28 - Garrison Draw	51.22	120.6	193.9	236.0	485.0	778.5	1,266.6	1,716.6	2,254.9
29 - Lower Deer Creek	30.70	94.0	152.1	185.5	384.2	619.3	1,011.7	1,374.6	1,809.4
30 - Scotty Clark Road	22.42	80.7	131.0	160.0	333.1	538.1	881.4	1,199.4	1,580.7
31 - Poison Creek-Hiland Reservoir	55.54	125.4	201.5	245.1	503.2	807.1	1,312.4	1,777.9	2,334.7
32 - Middle Deer Creek	48.22	117.1	188.5	229.4	471.9	757.7	1,233.5	1,672.2	2,197.1
33 - Lower Canyon Creek	44.76	112.9	181.9	221.5	456.1	732.9	1,193.8	1,619.0	2,127.8
34 - Upper Deer Creek	48.02	116.8	188.1	228.9	471.0	756.3	1,231.1	1,669.1	2,193.0
35 - Upper Canyon Creekk	34.11	99.0	159.9	194.9	403.1	649.1	1,059.6	1,439.0	1,893.3
36 - Tough Creek	23.33	82.3	133.5	163.0	339.1	547.7	896.8	1,220.3	1,607.9
37 - Alkali Creek-Reservoir Creek	39.46	106.2	171.3	208.7	430.7	692.8	1,129.5	1,532.8	2,015.5

Methodology Source: Miller, 2003