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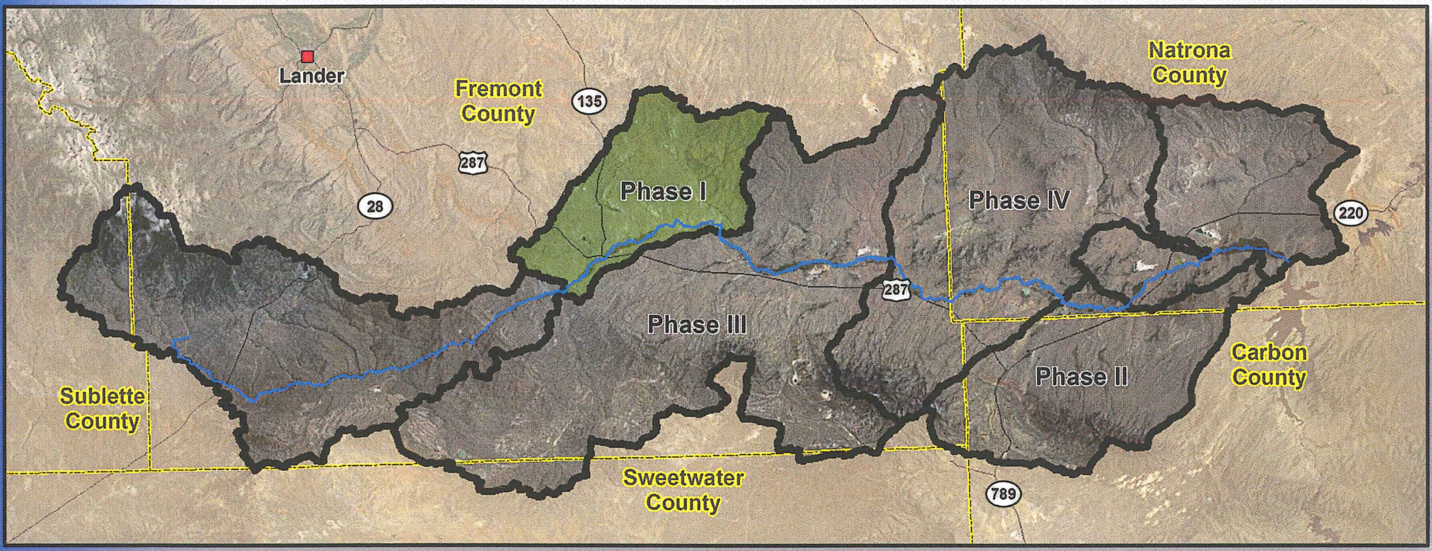
# FINAL REPORT
# FOR THE
# SWEETWATER RIVER WATERSHED STUDY PHASE I
# LONG CREEK WATERSHED MANAGEMENT PLAN

*Prepared For:*

*Wyoming Water Development Commission*
*6920 Yellowtail Road*
*Cheyenne, WY 82002*




*Prepared By:*

*Anderson Consulting Engineers, Inc.*
*375 E. Horsetooth Rd. Bldg. 5*
*Fort Collins, CO 80525*
*(ACE Project No. WYWDC26)*

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

April 20, 2012

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***April 20, 2012***

Professional Engineer (Civil)
Bradley Alan Anderson
5150
Date 4/20/12
WYOMING

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# *I. INTRODUCTION AND OVERVIEW*

# I. INTRODUCTION AND OVERVIEW

In 2005 the Popo Agie Conservation District (PACD) requested funding from the Wyoming Water Development Commission (WWDC) for the completion of a watershed management plan for the Sweetwater River watershed. The intent was to have a comprehensive watershed inventory completed which identified issues related to land use and water resources and to then develop a plan addressing those issues. The WWDC approved funding for the project and Anderson Consulting Engineers, Inc. (ACE) was ultimately contracted in June, 2006 to complete the project.

Briefly, the overall objective of the watershed study is to generate a watershed management and irrigation rehabilitation plan for the Sweetwater River watershed that is not only technically sound, but also one that is practical and economically feasible.

Due to the vast extent of the Sweetwater watershed and the range of conditions found within it, as well as varying level of interest and willingness to participate among stakeholders, it was determined that ACE would focus upon the development of watershed management plans at the subwatershed level. This strategy was selected to promote stakeholder participation and the development of plans more detailed and practical than would be afforded at the larger scale.

Following a series of initial public meetings, landowners and stakeholders within the Long Creek basin expressed high levels of interest and participation. For these reasons, and at the direction of the Steering Committee, the Popo Agie Conservation District (PACD) and the Wyoming Water Development Office (WWDO), Long Creek watershed was selected for the first phase of this effort.

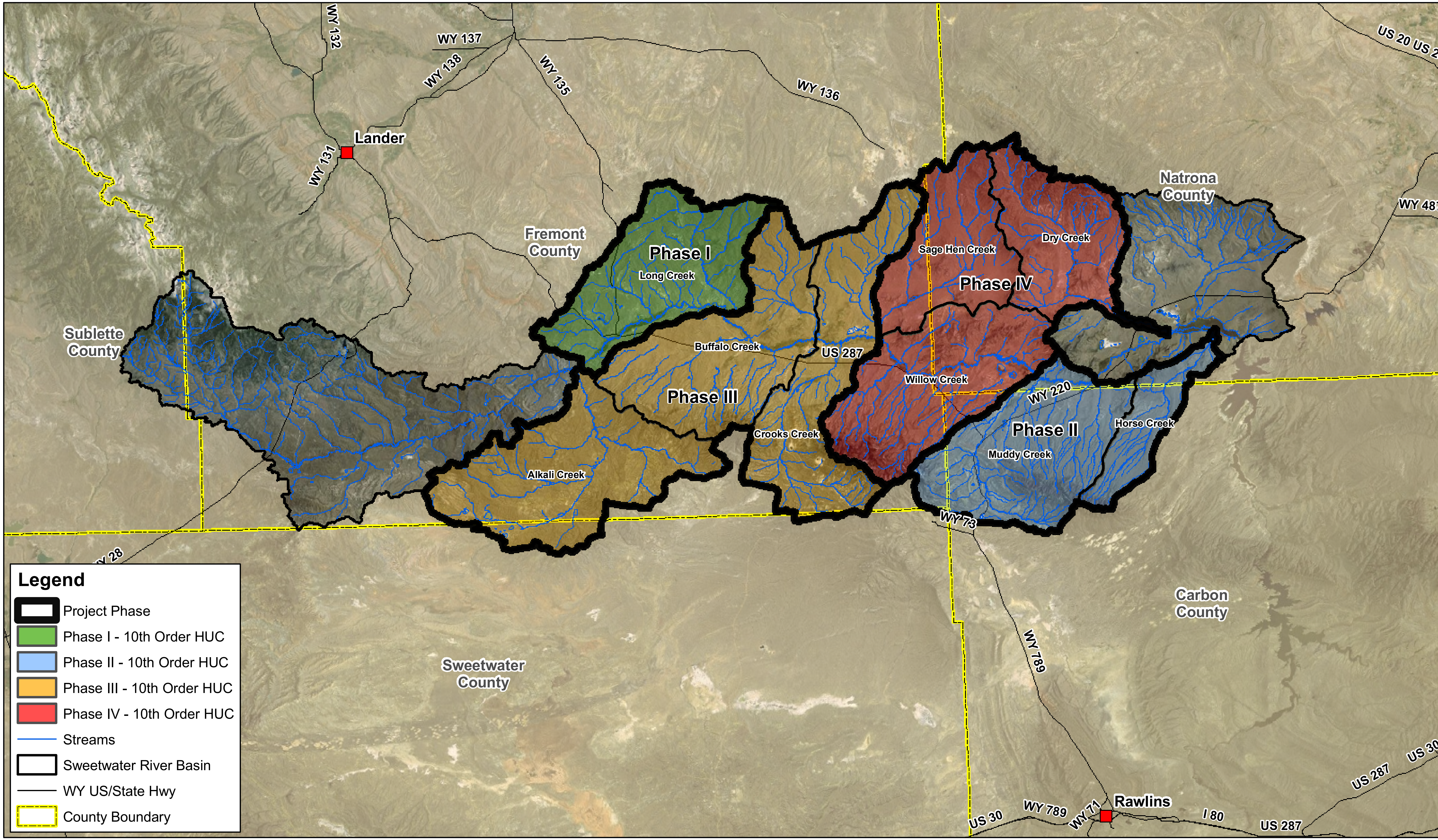
Four phases of the project were ultimately completed which focused a subwatershed approach that ranged in areal extent from one to three of the 10$^{th}$ order Hydrologic Units defined by the United States Geologic Survey (USGS). (The hydrologic units delineated by the USGS are designated a hydrologic unit code, or HUC as discussed at the following website: http://water.usgs.gov/GIS/huc.html).

Upon completion of the four phases addressing subwatersheds within the Sweetwater River basin, a fifth phase entitled "Sweetwater River Watershed Study: Basinwide Summary" was completed which summarizes the results of the individual phases as well as providing a description of the entire Sweetwater River Watershed. Table 1.1 summarizes the various phases of the project and Figure 1.1 displays their locations. Each of the five phases have been published as separate and stand-alone documents.

This report presents the results of the Phase I investigation.

**Table 1.1 Sweetwater River Watershed Investigation, Level I: Project Phases.**

| Phase | Hydrologic Unit Code | HUC Order | Watershed Name |
|---|---|---|---|
| **Phase I:** | **HUC 1018000604** | **10th Order** | **Long Creek** |
| Phase II: | HUC 1018000609 | 10th Order | Muddy Creek |
| | HUC 1018000611 | 10th Order | Horse Creek (Arkansas Creek subbasin only) |
| Phase III: | HUC 1018000603 | 10th Order | Alkali Creek |
| | HUC 1018000606 | 10th Order | Crooks Creek |
| | HUC 1018000605 | 10th Order | Buffalo Creek |
| Phase IV: | HUC 1018000607 | 10th Order | Sage Hen Creek |
| | HUC 1018000610 | 10th Order | Dry Creek |
| | HUC 1018000608 | 10th Order | Willow Creek |
| Basinwide | HUC 10180006 | 8th Order | Sweetwater River Watershed |




N
W E
S

0 100,000 200,000
Feet

**Figure 1.1 Sweetwater River Phase I: Location Map**

# *II. WATERSHED DESCRIPTION AND INVENTORY*

# II. WATERSHED DESCRIPTION AND INVENTORY

## 2.1 Data Collection

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)
- Wyoming Water Development Commission (WWDC)
- Wyoming Department of Environmental Quality (WDEQ)
- Wyoming Game and Fish Department (WGFD)
- Wyoming State Engineer's Office (WSEO)
- Wyoming Oil and Gas Conservation Commission (WOGCC)
- Wyoming State Geological Survey (WSGS)
- Wyoming Geographic Information Science Center (WyGISC)
- Fremont County
- Natrona County
- Popo Agie Conservation District

## 2.2 Land Use and Management

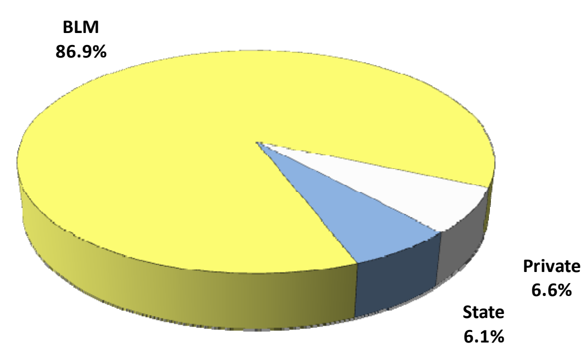



**Figure 2.1 Distribution of Surface Ownership Within the Phase I Study Area.**

The total land area within the Long Creek watershed is 156,353 acres (244.3 square miles). The distribution of land ownership within the watershed is shown on Figure 2.1. Only about 6.6 percent (10,250 acres) are privately owned. The remainder of the watershed is either federally owned and managed by the BLM

(86.9 percent), the State of Wyoming (6.1 percent), or classified as water (0.4 percent). All of the BLM lands are administered by the Lander District. As is evident in Figure 2.2, the privately owned lands are located primarily along the riparian corridors.

## 2.3 Vegetation

### *2.3.1 Overview*

Vegetative cover within the watershed was evaluated using data obtained through the LANDFIRE project. 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-gound 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 summarized in Table 2.1. The Inter-Mountain Basins Big Sagebrush Shrubland vegetative community dominates the watershed, covering over seventy five percent (75.8%) of the area. It is an important source of forage for livestock, wild horses, and wildlife. It occurs at nearly all elevations, soil types, and precipitation zones. The remaining vegetation types include the Rocky Mountain Lower Montane-Foothill Shrubland (6.4%), Western Great Plains Floodplain

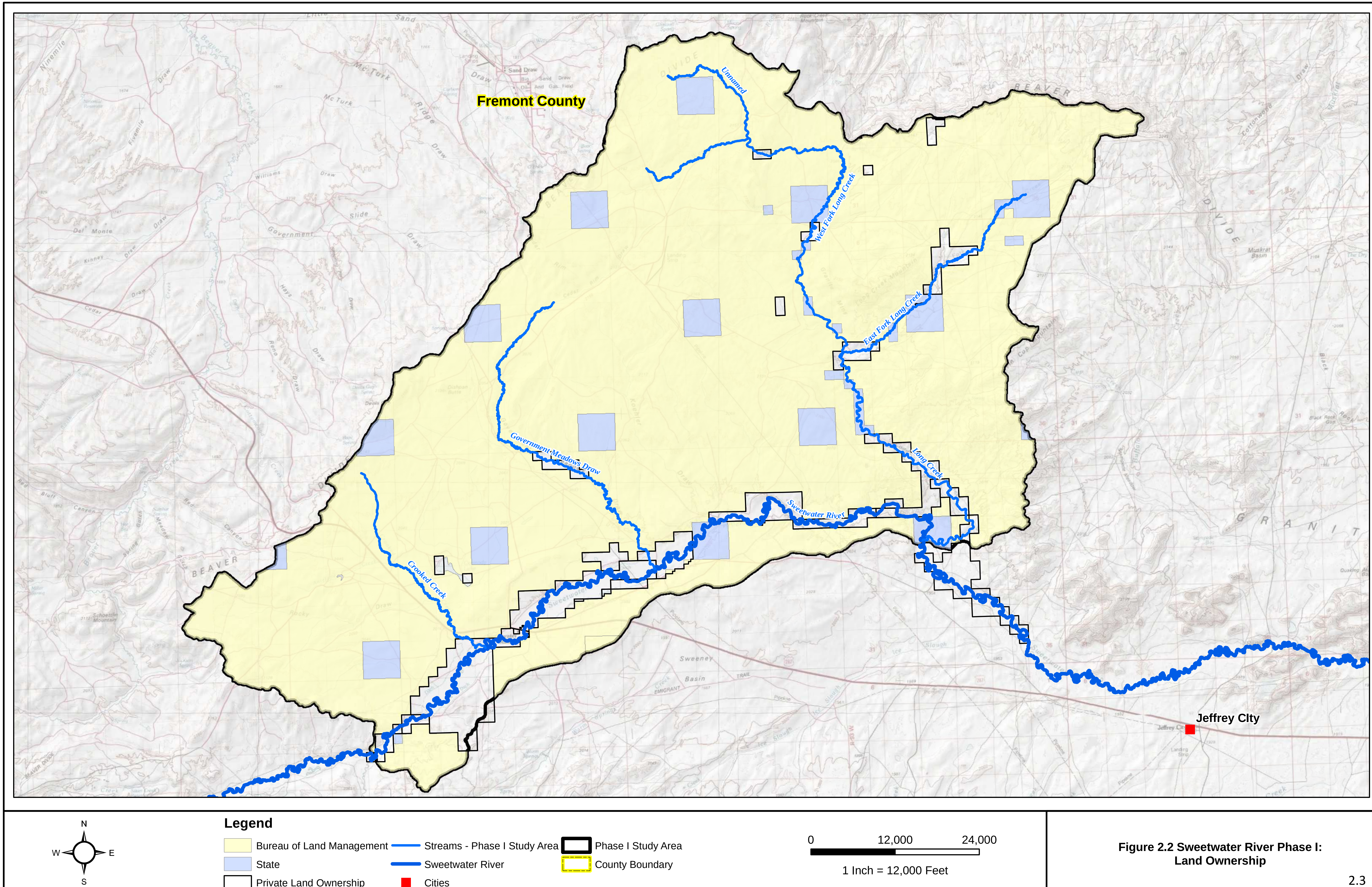



**Figure 2.2 Sweetwater River Phase I: Land Ownership**

systems (3.9%), Rocky Mountain Subalpine/Upper Montane Riparian Systems (3.2%), and the Inter-Mountain Basins Mat Saltbush Shrubland (3.1%). The remaining vegetative communities comprise less than 2 percent each of the watershed.

**Table 2.1 Tabulation of LANDFIRE Data Available Within the Phase I Study Area.**

| Vegetation Type | Acres | Percent |
|---|---|---|
| Inter-Mountain Basins Big Sagebrush Shrubland | 118,586.2 | 75.85% |
| Rocky Mountain Lower Montane-Foothill Shrubland | 9,984.2 | 6.39% |
| Western Great Plains Floodplain Systems | 6,172.1 | 3.95% |
| Rocky Mountain Subalpine/Upper Montane Riparian Systems | 4,950.9 | 3.17% |
| Inter-Mountain Basins Mat Saltbush Shrubland | 4,842.4 | 3.10% |
| Artemisia tridentata ssp. vaseyana Shrubland Alliance | 2,887.3 | 1.85% |
| Rocky Mountain Montane Riparian Systems | 1,314.1 | 0.84% |
| Inter-Mountain Basins Greasewood Flat | 1,265.6 | 0.81% |
| Agriculture-Pasture/Hay | 1,210.6 | 0.77% |
| Inter-Mountain Basins Semi-Desert Grassland | 1,181.1 | 0.76% |
| Inter-Mountain Basins Big Sagebrush Steppe | 1,070.4 | 0.68% |
| Wyoming Basins Low Sagebrush Shrubland | 578.3 | 0.37% |
| Developed-Open Space | 550.1 | 0.35% |
| Inter-Mountain Basins Juniper Savanna | 256.9 | 0.16% |
| Inter-Mountain Basins Montane Sagebrush Steppe | 252.1 | 0.16% |
| Rocky Mountain Foothill Limber Pine-Juniper Woodland | 248.0 | 0.16% |
| Inter-Mountain Basins Semi-Desert Shrub-Steppe | 223.2 | 0.14% |
| Introduced Upland Vegetation - Annual and Biennial Forbland | 193.2 | 0.12% |
| Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland | 175.8 | 0.11% |
| Developed-Low Intensity | 133.2 | 0.09% |
| Northern Rocky Mountain Lower Montane-Foothill-Valley Grassland | 89.7 | 0.06% |
| Inter-Mountain Basins Sparsely Vegetated Systems | 63.4 | 0.04% |
| Barren | 60.0 | 0.04% |
| Inter-Mountain Basins Mixed Salt Desert Scrub | 17.7 | 0.01% |
| Rocky Mountain Aspen Forest and Woodland | 12.8 | 0.01% |
| Open Water | 6.4 | <0.01% |
| Introduced Upland Vegetation - Annual Grassland | 4.9 | <0.01% |
| Western Great Plains Depressional Wetland Systems | 4.4 | <0.01% |
| Middle Rocky Mountain Montane Douglas-fir Forest and Woodland | 4.0 | <0.01% |
| Southern Rocky Mountain Ponderosa Pine Woodland | 3.8 | <0.01% |
| Northwestern Great Plains Mixedgrass Prairie | 3.5 | <0.01% |
| Colorado Plateau Pinyon-Juniper Woodland | 2.5 | <0.01% |
| Developed-Medium Intensity | 2.1 | <0.01% |
| Rocky Mountain Gambel Oak-Mixed Montane Shrubland | 1.6 | <0.01% |
| Introduced Upland Vegetation - Perennial Grassland and Forbland | 0.4 | <0.01% |
| **Total** | **156,353** | **100%** |

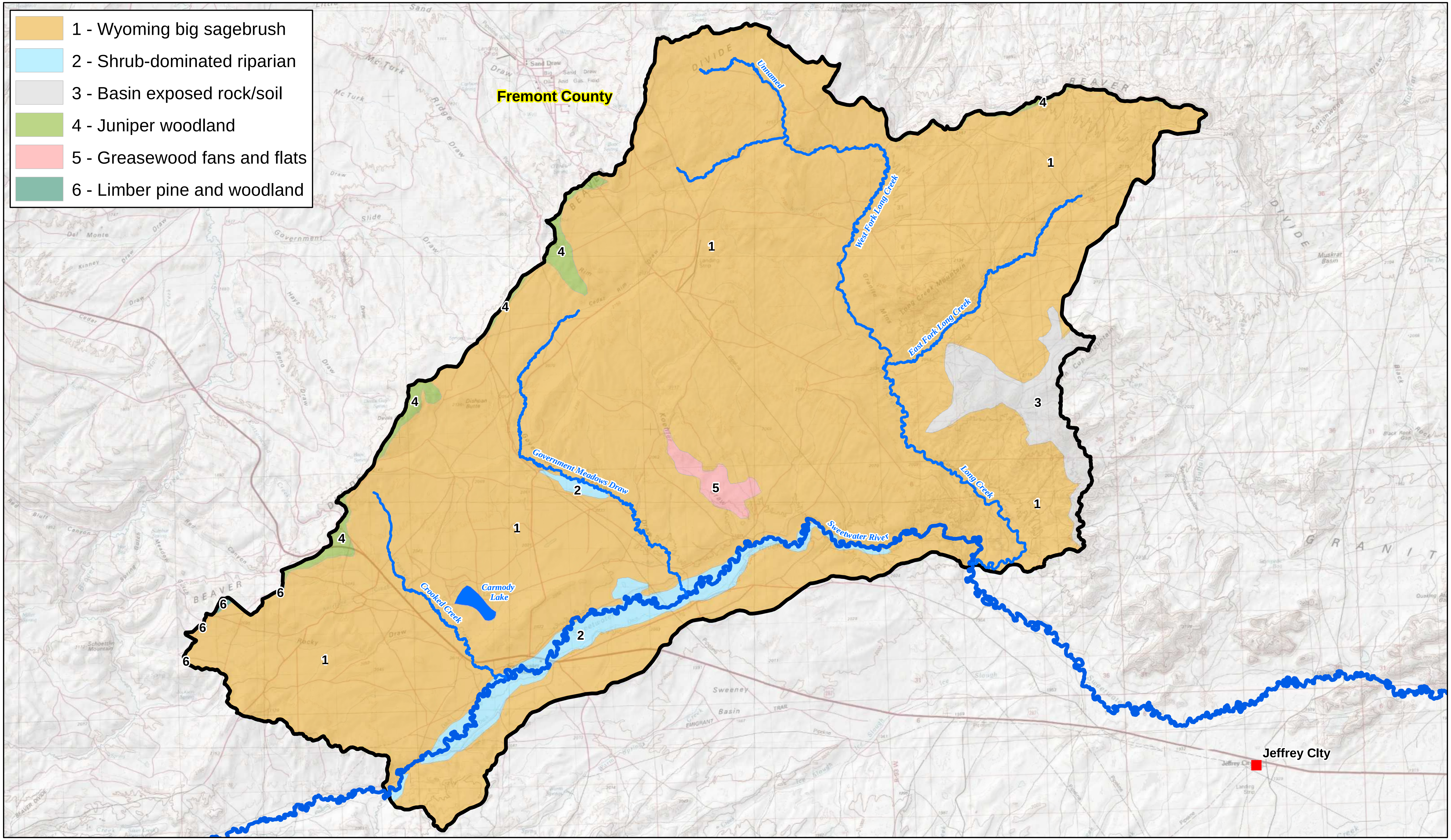
While the LANDFIRE data provides valuable insight into watershed conditions, its display is difficult because of the fact the data are represented by a grid with 30-meter spacing. For graphical purposes, data obtained through the Wyoming Gap Analysis program are shown on Figure 2.3 (http://www.wygisc.uwyo.edu/wbn/gap.html).

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).

The Wyoming Natural Diversity Database (WYNDD) lists several vegetation species within the Phase I study area which are apparent within the Phase I study area. Table 2.2 presents the results of a database query conducted by the WYNDD for the watershed. The project area encompasses the entire worldwide distribution of the Desert Yellowhead (Yermo xanthocephalus), including designated critical habitat. "It is an upland plant with a narrow distribution, and not directly affected by water developments unless impoundments were constructed in the vicinity of the two populations (changing livestock utilization), or unless infrastructure was built in the vicinity of the two populations (WYNDD, 2012)".

**Table 2.2 Wyoming Natural Diversity Database: Vegetative Species in the Sweetwater River Watershed Phase I Study Area.**

| Scientific Name | Common Name | Listing Status | Tracked / Watched |
|---|---|---|---|
| **Flowering Plant** | | | |
| Antennaria arcuata | Meadow pussytoes | | Tracked |
| Boechera pendulina var. russeola | Daggett rockcress | | Watched |
| Cirsium pulcherrimum var. aridum | Cedar Rim thistle | | Tracked |
| Lesquerella fremontii | Fremont bladderpod | | Tracked |
| Oxytropis besseyi var. obnapiformis | Maybell locoweed | | Tracked |
| Phacelia tetramera | Tiny phacelia | | Tracked |
| Phlox pungens | Beaver Rim phlox | | Tracked |
| Physaria eburniflora | Devil's Gate twinpod | | Watched |
| Physaria saximontana var. saximontana | Rocky Mountain twinpod | | Tracked |
| Yermo xanthocephalus | Desert yellowhead | Threatened (T) | Tracked |




Legend

| | |
|---|---|
| Cities | County Boundary |
| Phase I Study Area | Streams - Phase I Study Area |
| Sweetwater River | |

0 12,000 24,000

1 Inch = 12,000 Feet

**Figure 2.3 Sweetwater River Phase I: Vegetative Cover 100K**

In general, vegetation types within the Phase I Study Area vary greatly but generally consist of meadow, grass, sagebrush, mountain shrubs, conifer, and deciduous trees. Wyoming big sagebrush is the dominant shrub. Grass plants found within upland range communities include western wheatgrass, bluebunch wheatgrass, threadleaf sedge, prairie junegrass, and needle-and-thread grass. Conifers are generally limited to higher elevations (above 7,000 feet) and consist of lodgepole, limber pine and mixed lodgepole-spruce stands. Discontinuous juniper stands are found throughout the lower elevations. Deciduous trees consist primarily of willows and cottonwoods along the perennial creeks.

### *2.3.2 Wetland – Riparian Vegetation*

Wetland-riparian areas provide the highest vegetation production of plan communities within the study area yet comprise approximately 4.0 percent of the total area based upon the Landfire data analysis discussed above. Consequently, these areas receive high utilization by wildlife, wild horses, and livestock. Field observations of riparian areas confirmed heavy utilization of some of these areas.

Existing mapping of wetlands within the Phase I Study Area available for this study 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. It is generally understood by users of the NWI mapping that the data are suitable for broadscale 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, the LANDFIRE data includes limited determination of wetlands as well. Based upon the LANDFIRE data analysis, there are approximately 4.0 acres of Western Great Plains Depressional Wetlands with the watershed. Other types of wetlands are not included in the LANDFIRE data, however, two riparian vegetation categories are found within the watershed: Rocky Mountain Subalpine/Upper Montane Riparian Systems (4,951 acres) and Rocky Mountain Montane Riparian Systems (1,314 acres). 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. Figure 2.4 displays the available

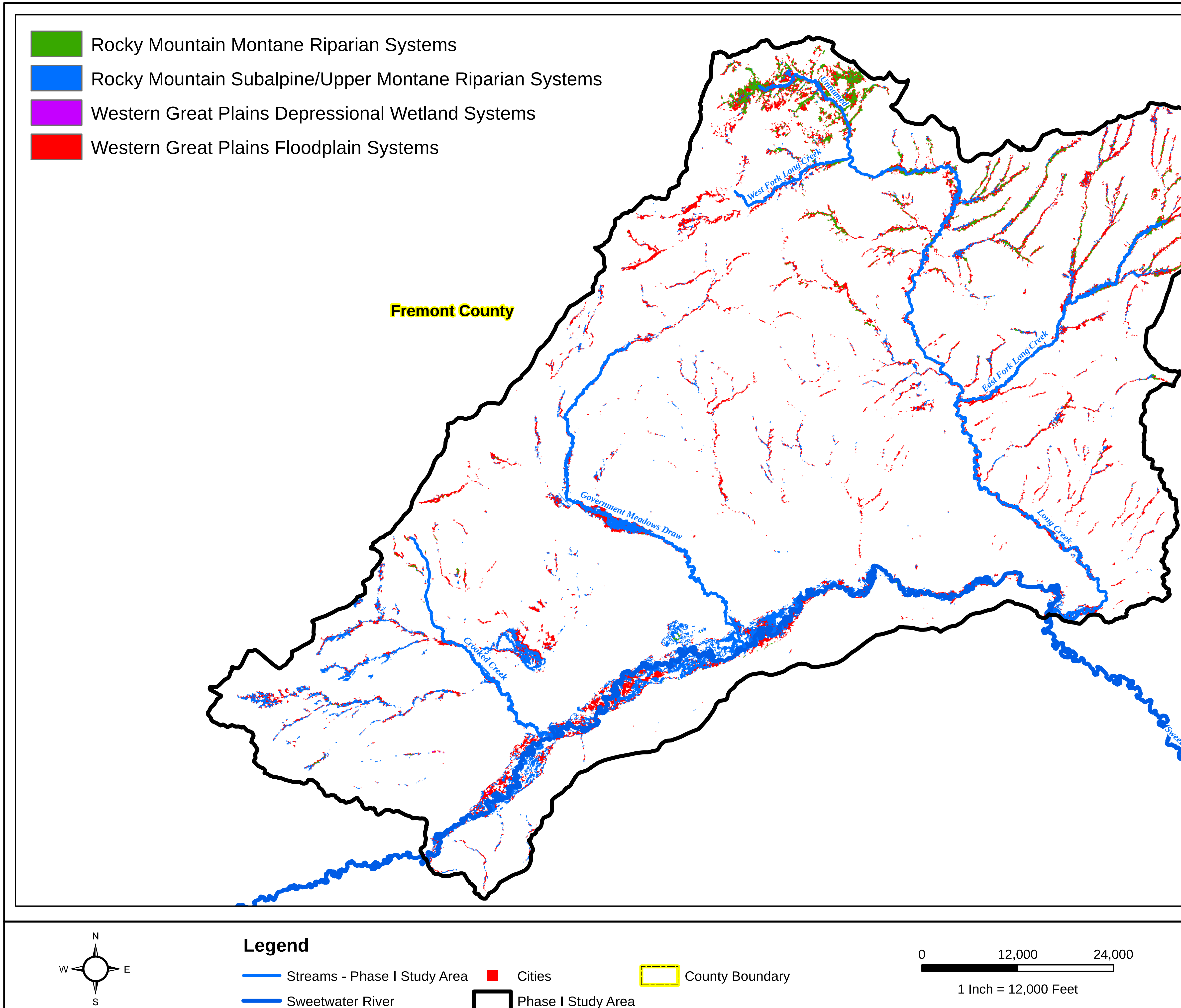



**Figure 2.4 Sweetwater River Phase I: LANDFIRE Riparian Areas**

wetlands mapping data. Note that due to the limited extent of wetland mapping units, presentation of a background topographic map as is present in other figures, is not feasible.

## 2.4 Wildlife

Much of the watershed has been mapped by the Wyoming Game and Fish Department (WGFD) as crucial habitat for big game species. Specifically, the entire study area has been identified as seasonal habitat for mule deer, and antelope and extensive portions of the area are seasonal habitat for elk and moose. In addition, crucial habitat has been mapped for antelope (12,862), elk (10 acres), mule deer (4,562 acres) and moose (6,867 acres). The 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). 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 certain level over a long period of time. Figures 2.5 through 2.8 display the seasonal range, crucial range, parturition range, and migration corridors for big game species in the study area: antelope, elk, moose, and mule deer.

The Wyoming Natural Diversity Database (WYNDD) lists numerous non-game species of concern within the watershed, including amphibians, birds, and mammals. No fish or reptiles were apparent in the database. Table 2.3 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. Review of the list shows that the endangered species known to have been observed within the study area are the black-footed ferret (*Mustela nigripes)* and the whooping crane *(Grus americana).* However, observations of both species are historic and neither is considered residents of the study area.

The potential exists for some of these species to occur within appropriate habitats within the study area. For example, areas of known greater sage grouse (*Centrocercus urophasianus*) leks are displayed in Figure 2.9. 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

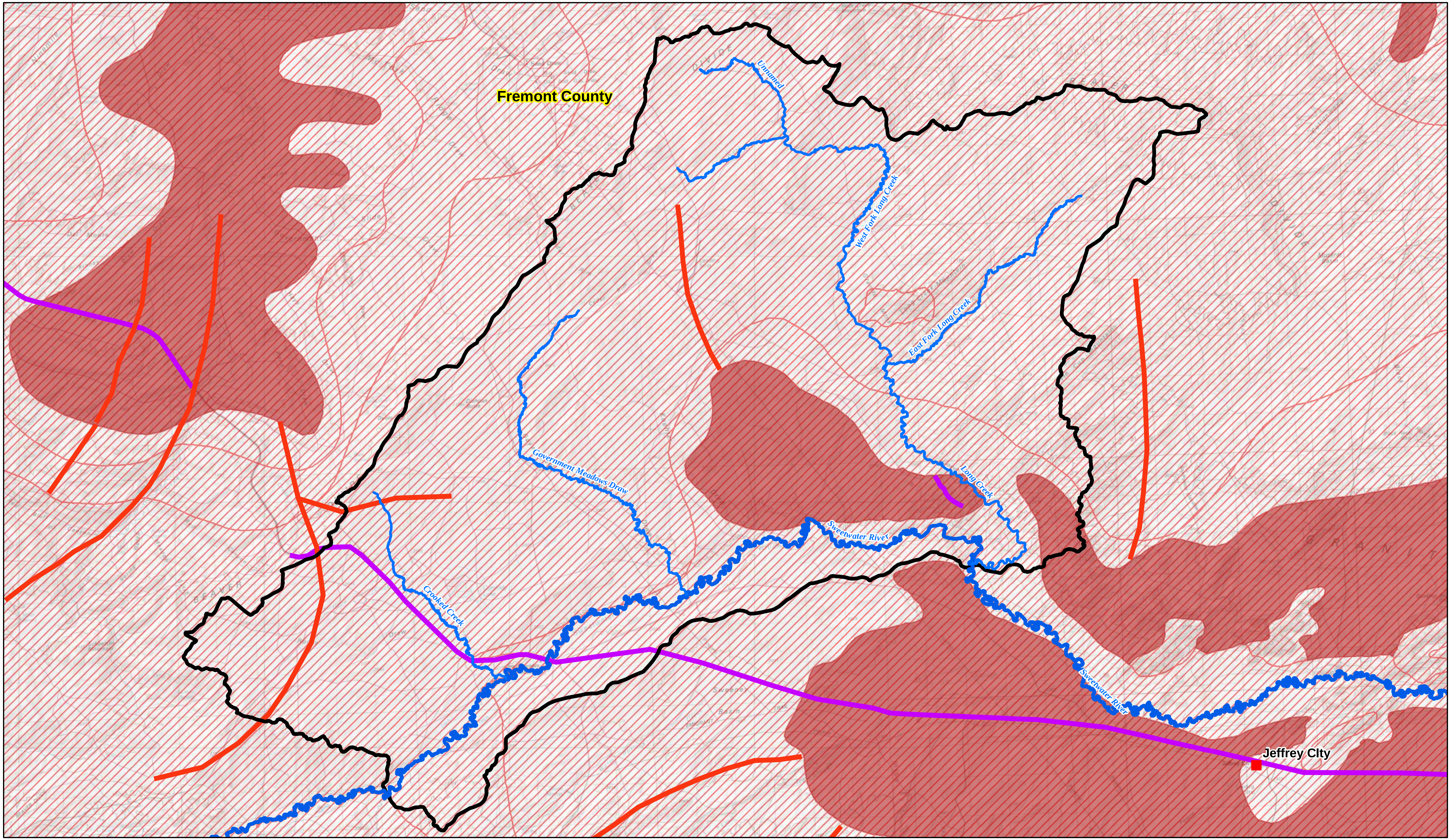
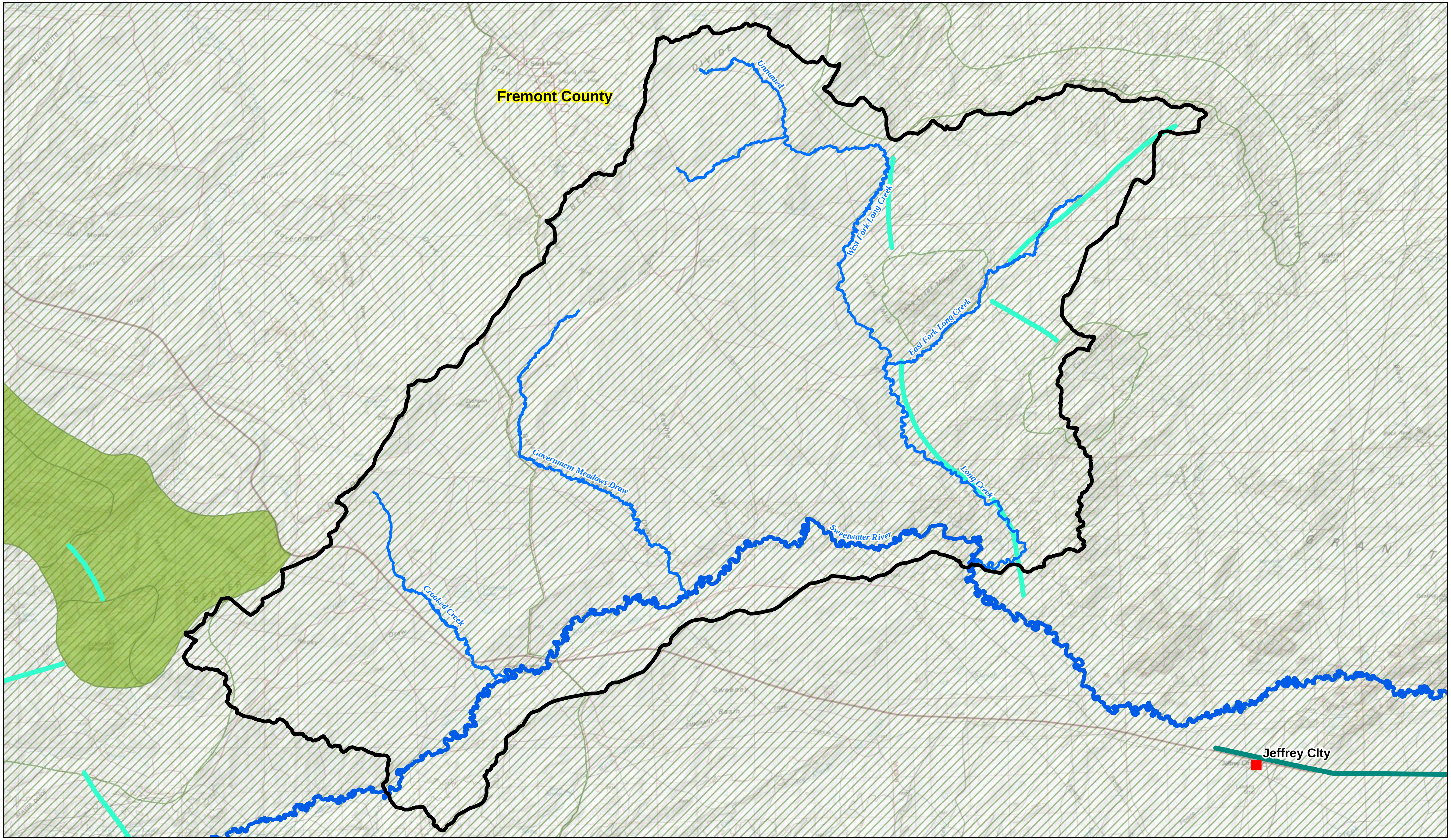



**Figure 2.5 Sweetwater River Phase I: Antelope Habitat**




**Legend**

- Migration Barrier
- Migration Routes
- Crucial Range
- Seasonal Range
- Streams - Phase I Study Area
- Sweetwater River
- Cities
- Phase I Study Area
- County Boundary

0 12,000 24,000

1 Inch = 12,000 Feet

**Figure 2.6 Sweetwater River Phase I: Elk Habitat**

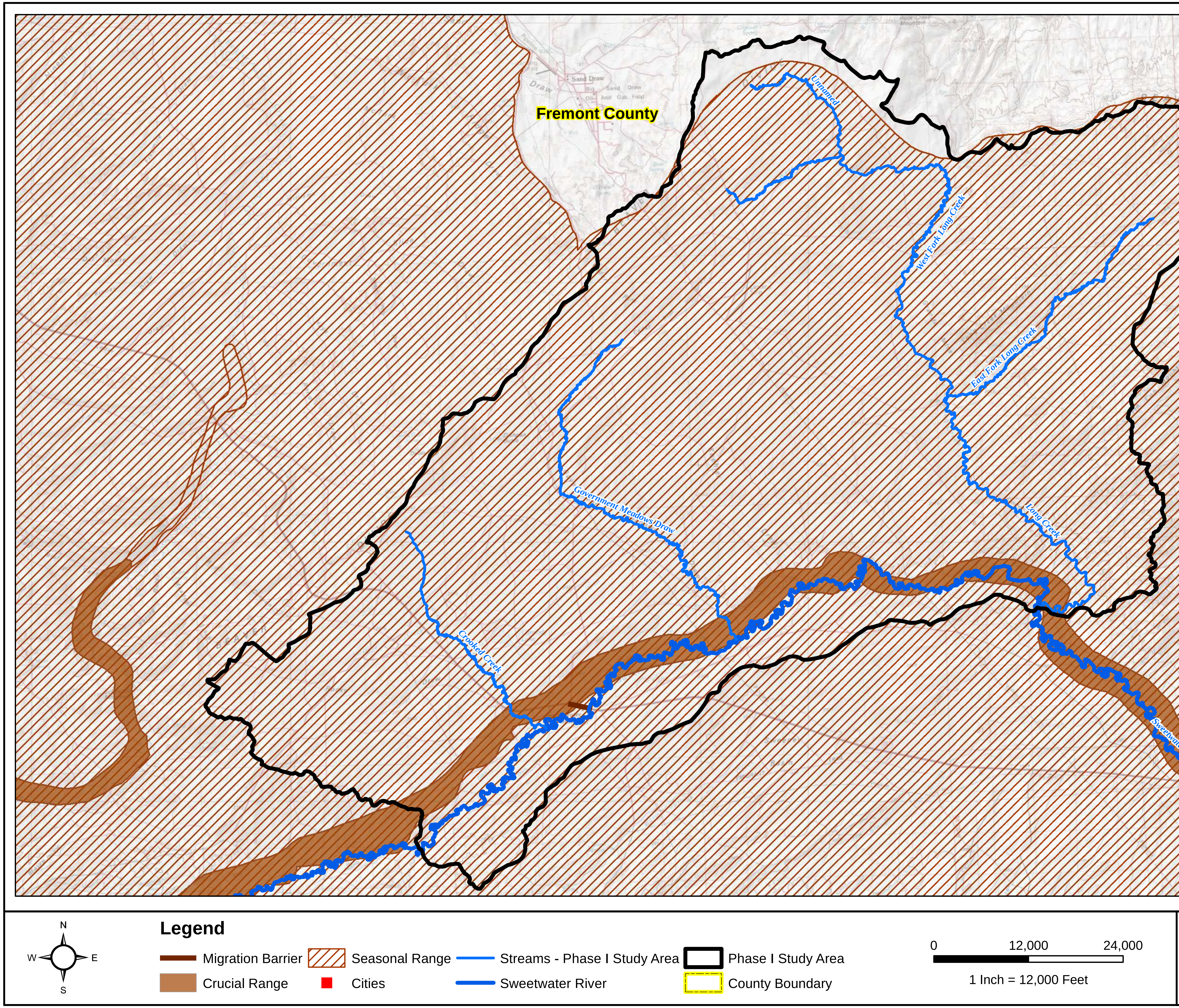
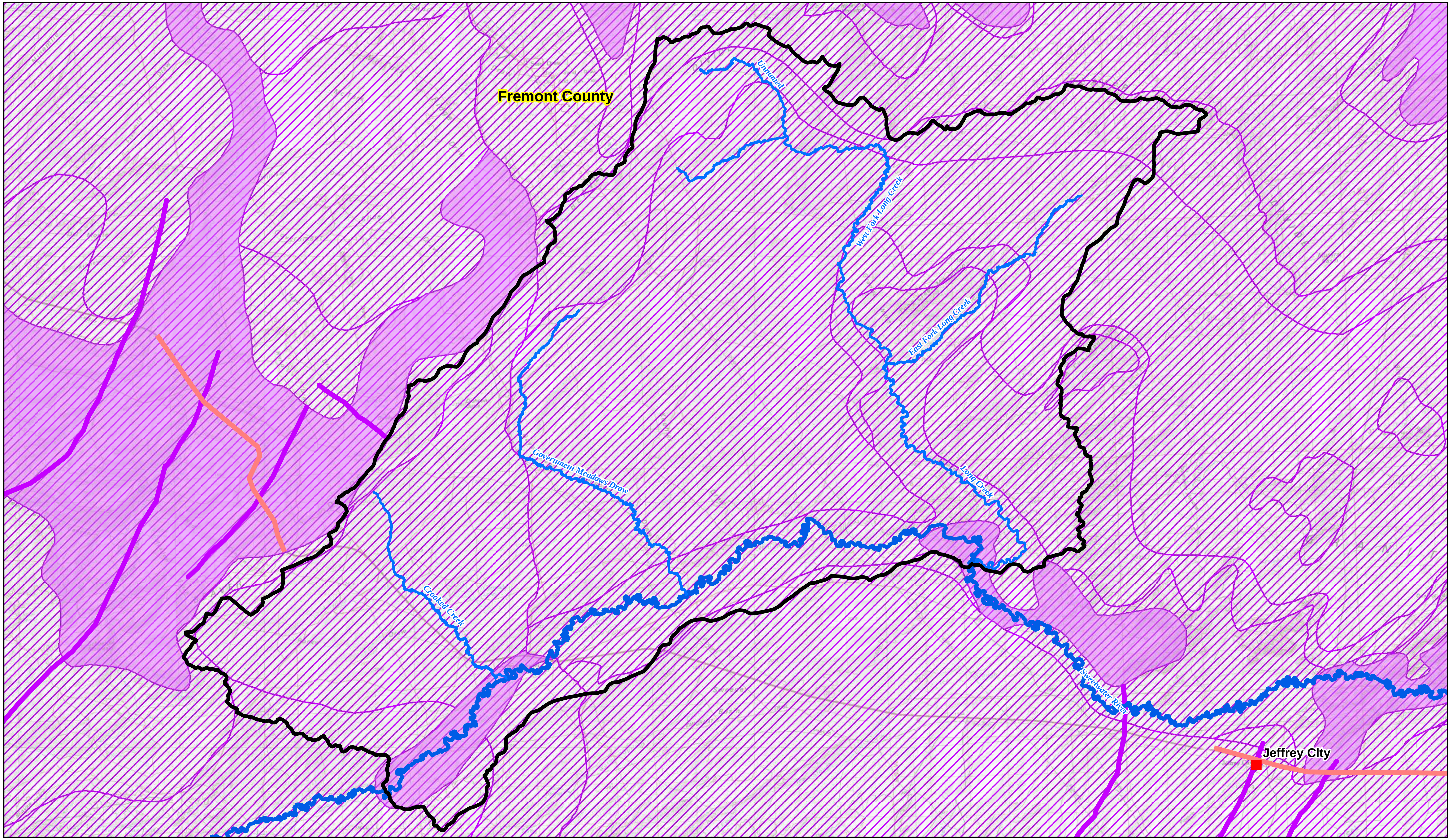



**Figure 2.7 Sweetwater River Phase I: Moose Habitat**




**Legend**

N S E W

Migration Barrier
Migration Routes
Crucial Range
Seasonal Range
Streams - Phase I Study Area
Sweetwater River
Cities
Phase I Study Area
County Boundary

0 12,000 24,000
1 Inch = 12,000 Feet

**Figure 2.8 Sweetwater River Phase I: Mule Deer Habitat**

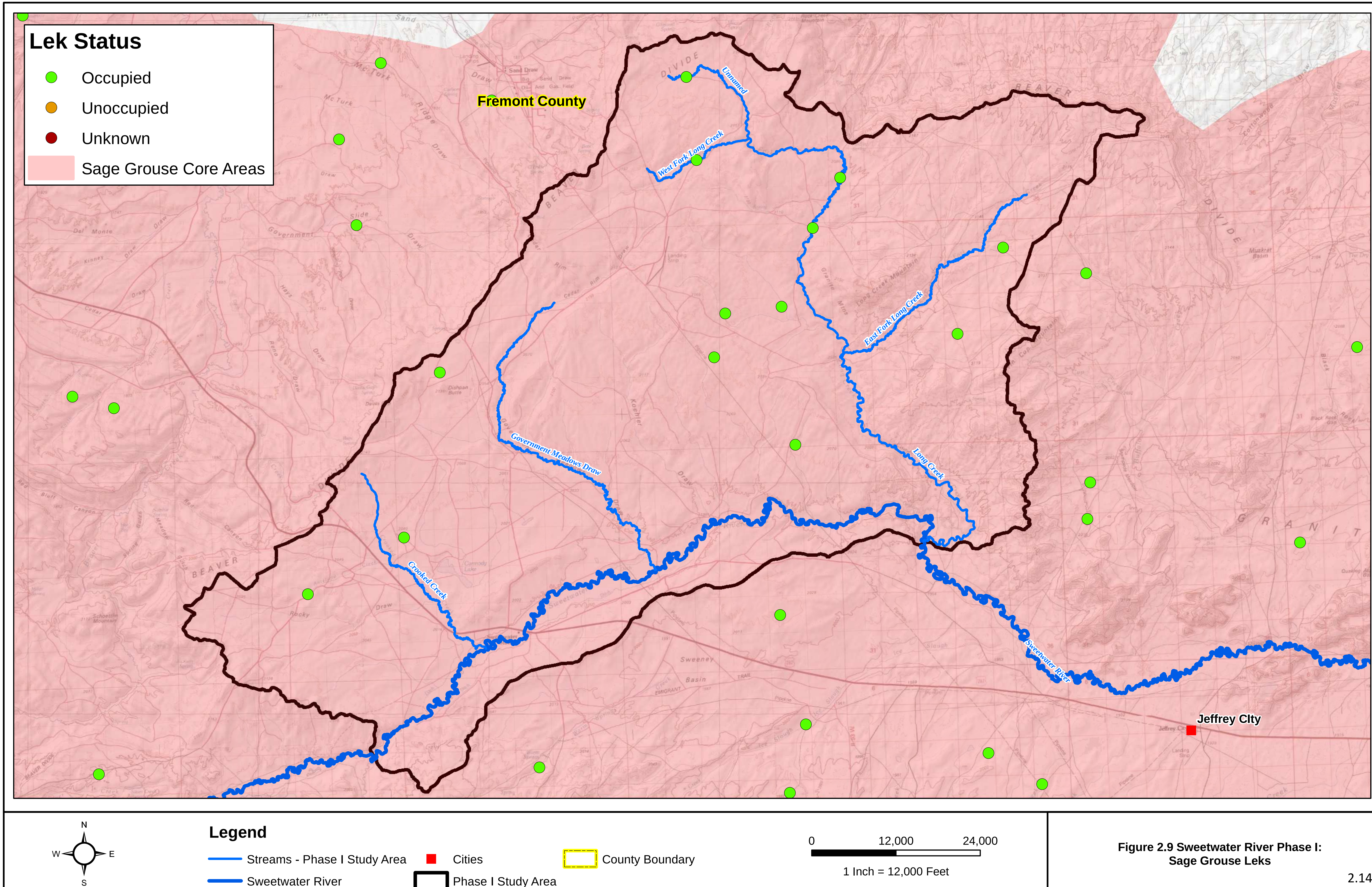



**Figure 2.9 Sweetwater River Phase I: Sage Grouse Leks**

**Table 2.3 Wyoming Natural Diversity Database: Wildlife Species in the Sweetwater River Watershed Phase I Study Area.**

| Scientific Name | Common Name | Listing Status | Tracked / Watched |
|---|---|---|---|
| **Amphibians** | | | |
| Lithobates pipiens | Northern Leopard Frog | Listing Denied | Tracked |
| Spea intermontana | Great Basin Spadefoot | | Tracked |
| **Birds** | | | |
| Amphispiza belli | Sage Sparrow | | Tracked |
| Aquila chrysaetos | Golden Eagle | | Watched |
| Athene cunicularia | Burrowing Owl | | Tracked |
| Buteo regalis | Ferruginous Hawk | | Tracked |
| Calcarius mccownii | Mccown's Longspur | | Tracked |
| Centrocercus urophasianus | Greater Sage Grouse | Candidate | Tracked |
| Charadrius montanus | Mountain Plover | Listing Denied | Tracked |
| Cygnus columbianus | Tundra Swan | | Watched |
| Egretta thula | Snowy Egret | | Watched |
| Falco peregrinus anatum | American Peregrine Falcon | Delisted | Tracked |
| Gavia immer | Common Loon | | Tracked |
| Grus americana | Whooping Crane | Endangered | Tracked |
| Grus canadensis | Sandhill Crane | | Watched |
| Haliaeetus leucocephalus | Bald Eagle | Delisted | Tracked |
| Himantopus mexicanus | Black-necked Stilt | | Watched |
| Lanius ludovicianus | Loggerhead Shrike | | Tracked |
| Larus californicus | California Gull (Breeding Colonies) | | Watched |
| Larus delawarensis | Ring-billed Gull (Breeding Colonies) | | Watched |
| Oreoscoptes montanus | Sage Thrasher | | Watched |
| Pandion haliaetus | Osprey | | Watched |
| Pelecanus erythrorhynchos | American White Pelican (Breeding Colonies) | | Tracked |
| Spizella breweri | Brewer's Sparrow | | Watched |
| Spizella pallida | Clay-colored Sparrow | | Watched |
| **Crustaceans** | | | |
| Branchinecta constricta | A Fairy Shrimp | | Tracked |
| **Mammals** | | | |
| Brachylagus idahoensis | Pygmy Rabbit | Listing Denied | Tracked |
| Cynomys leucurus | White-tailed Prairie Dog | Listing Denied | Tracked |
| Mustela nigripes | Black-footed Ferret | Endangered | Tracked |
| Perognathus fasciatus | Olive-backed Pocket Mouse | | Watched |

extent possible on the maintenance and enhancements of habitat within them. The Core Sage Grouse Population Areas and known leks within the Phase I study area are delineated in Figure 2.9.

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 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.*

The study area also lies within the Dishpan Butte Wild Horse Herd Area (Figure 2.10). It is our understanding that the objective number of horses for the Big Pasture Allotment is often exceeded. The horses use all areas throughout the year. Antelope, mule deer, elk, sage grouse, and many other small animals live in this area. Herd objectives and wildlife habitat discussions can be found in the Big Pasture AMP.

In 2004, the Wyoming Game and Fish Department (WGFD) completed assessments on the West Fork, Middle Fork and East Fork in the Long Creek Watershed. It was determined at that time that these streams were within the historical and current range of the Yellowstone cutthroat and that the possibility exists for reintroduction. Results of summer assessments were favorable; however, fall evaluations revealed grazing pressures would likely preclude reintroduction of this fish species (WGFD, 2004).

## 2.5 Geology and Soils

The Phase I Study Area is located on the Sweetwater Plateau and separated from the Wind River Basin by the Beaver Rim escarpment. The plateau area is comprised of a thick sequence of Tertiary age sedimentary rocks derived from the erosion of the Granite Mountains which are exposed throughout the Sweetwater River Drainage and the Sweetwater Plateau.

Surface geology mapping completed by the United States Geologic Survey was obtained from the Wyoming Geographic Information and Science Center (WyGISC) and incorporated into the project GIS. The distribution of surficial geologic deposits within the Phase I Study Area is displayed in Figure 2.11. This figure shows that the majority of the watershed is covered with residuum (materials formed in place) or colluvium (transported and deposited by gravity). Alluvial deposits occur adjacent to the major tributaries within the study area (Sweetwater

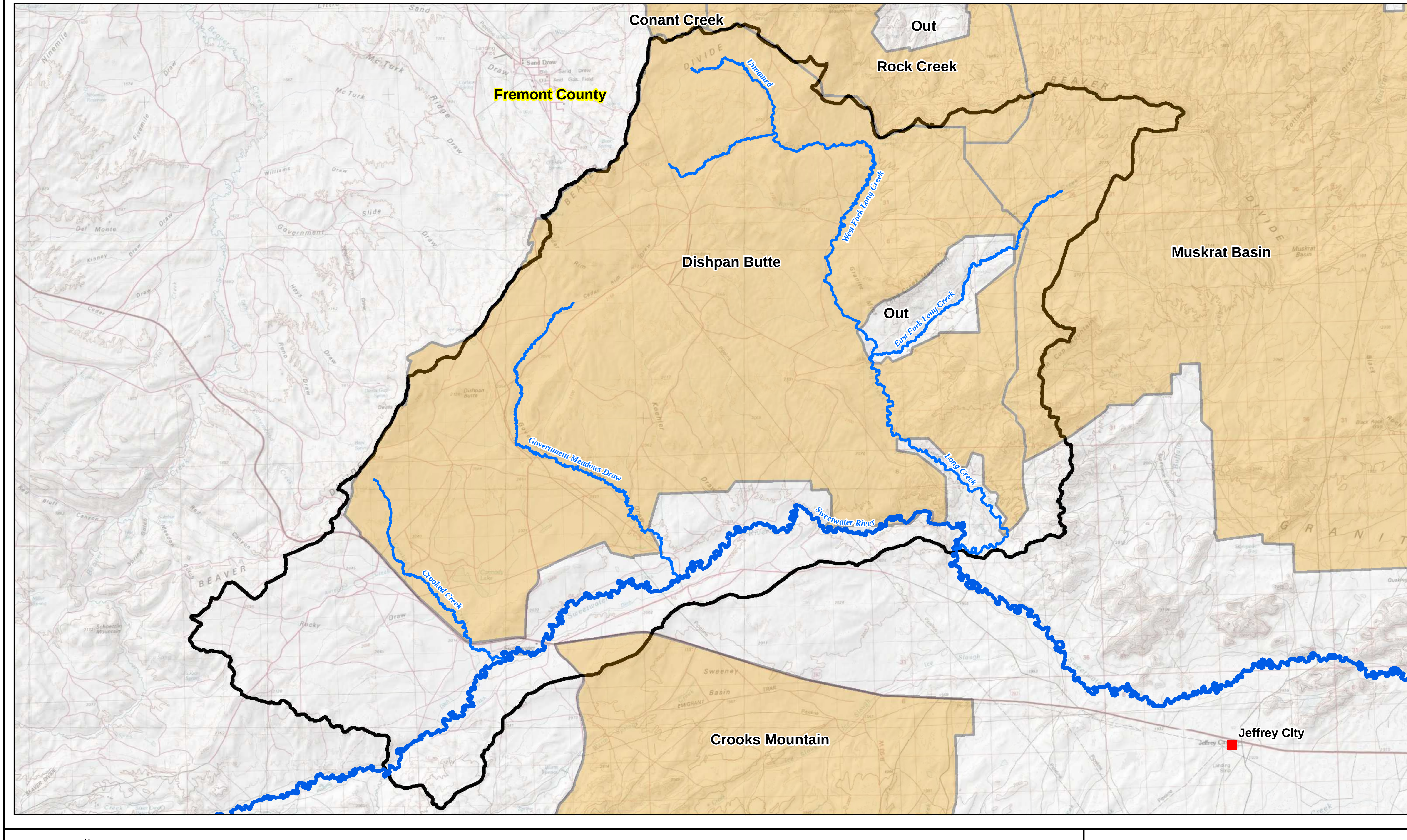



**Figure 2.10 Sweetwater River Phase I: Wild Horse Management Areas**

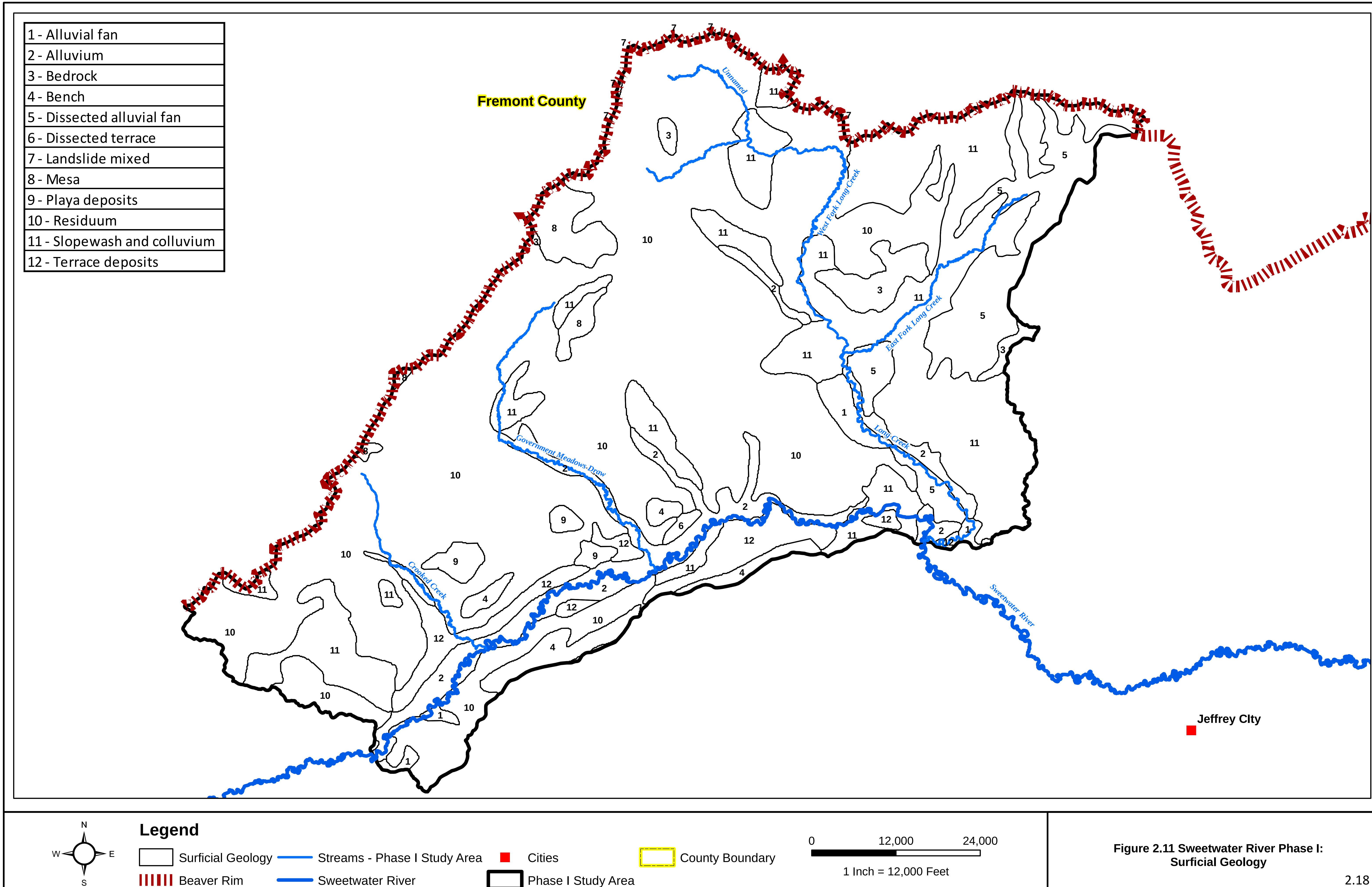



**Figure 2.11 Sweetwater River Phase I: Surficial Geology**

River, Crooked Creek, Government Meadows Draw, Long Creek and its tributaries). Dissected alluvial fans appear on the slopes of Granite Mountain and small pockets of mixed landslide material exist along the Beaver Rim at the very northern edge of the study area (difficult to show at the watershed scale).

Mapping of bedrock geology was also completed by the USGS and obtained through WyGISC. Figure 2.12 shows the distribution of outcropping or near surface bedrock (and the major surficial geologic units) within the watershed.

Soils mapping data were obtained from the Natural Resources Conservation Service (NRCS). This information is displayed in Figure 2.13.

## 2.6 Hydrology

### *2.6.1 Surface Water Hydrology*

The location and extent of the Phase I Study Area, the mainstem streams, significant tributaries, existing reservoirs, and USGS stream gages are shown on Figure 2.14. As indicated in this figure, there are two major tributaries to Long Creek: East Fork Long Creek and West Fork Long Creek.

Long Creek, the primary tributary to the Sweetwater River in the Phase I study area, is a perennial stream beginning a short distance downstream of the confluence of East and West Forks Long Creek and extending to the Sweetwater River. East Fork Long Creek is classified as a perennial stream throughout much of its length. Springs in upper watershed and the vicinity of the Long Creek Ranch provide year-round sources of water. Upstream of the springs, the stream is classified as ephemeral. Other streams within the study area are intermittent through much of their lengths (i.e., Crooked Creek, Government Meadows Draw, and Koehler Draw). These streams flow for portions of the year, generally drying up during drier summer / fall months.

The USGS maintained a gaging station on the Sweetwater River (USGS Gage Number 06638090: Sweetwater River near Sweetwater Station, WY) from 1973 through 1192). Data collected at this gage are summarized in the Sweetwater River Basin Summary Report accompanying this document.

There are no other stream gages located within the watershed nor have there been any gages reported in the past. Regional hydrologic methods exist which rely upon

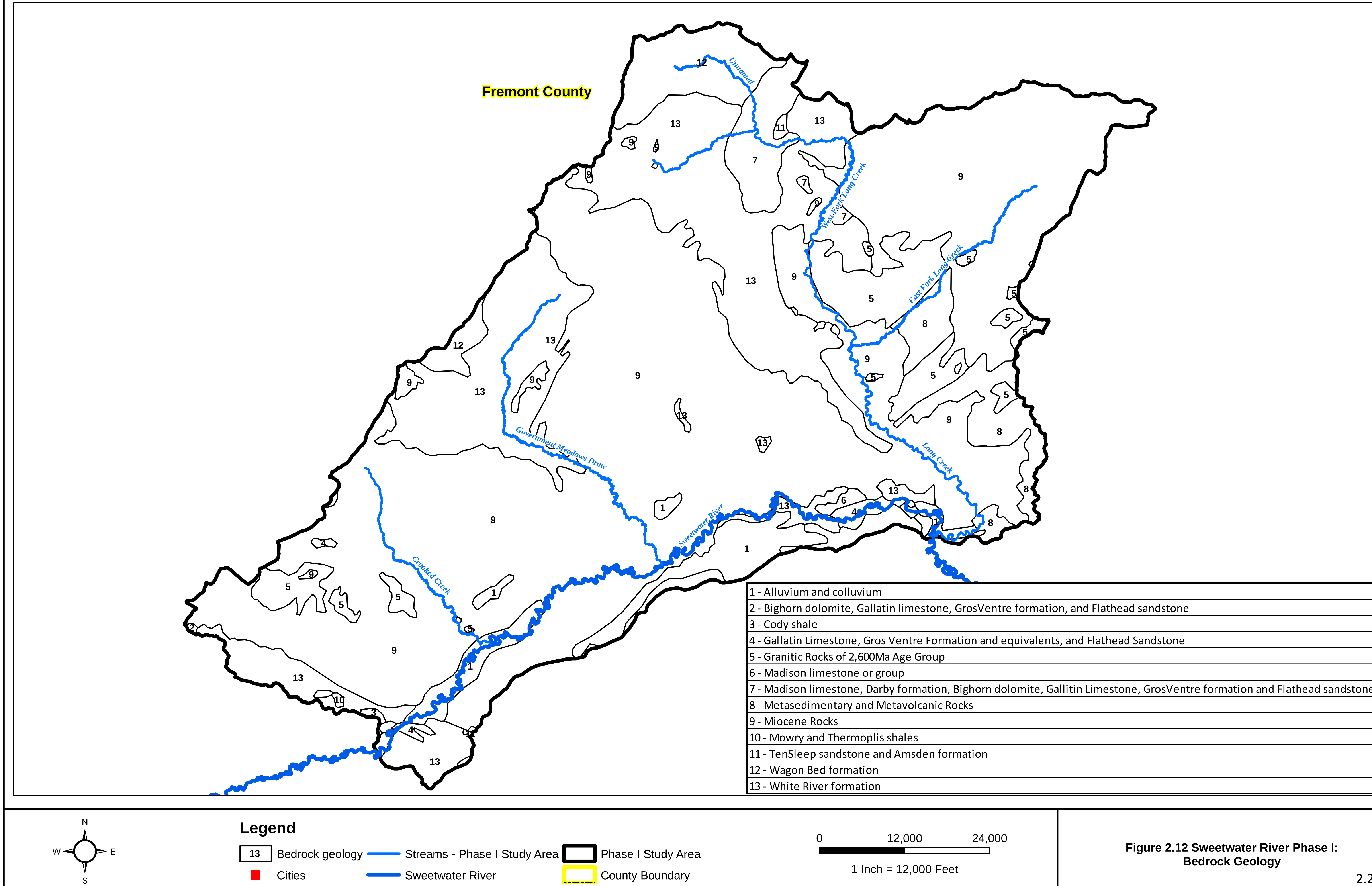



**Figure 2.12 Sweetwater River Phase I: Bedrock Geology**

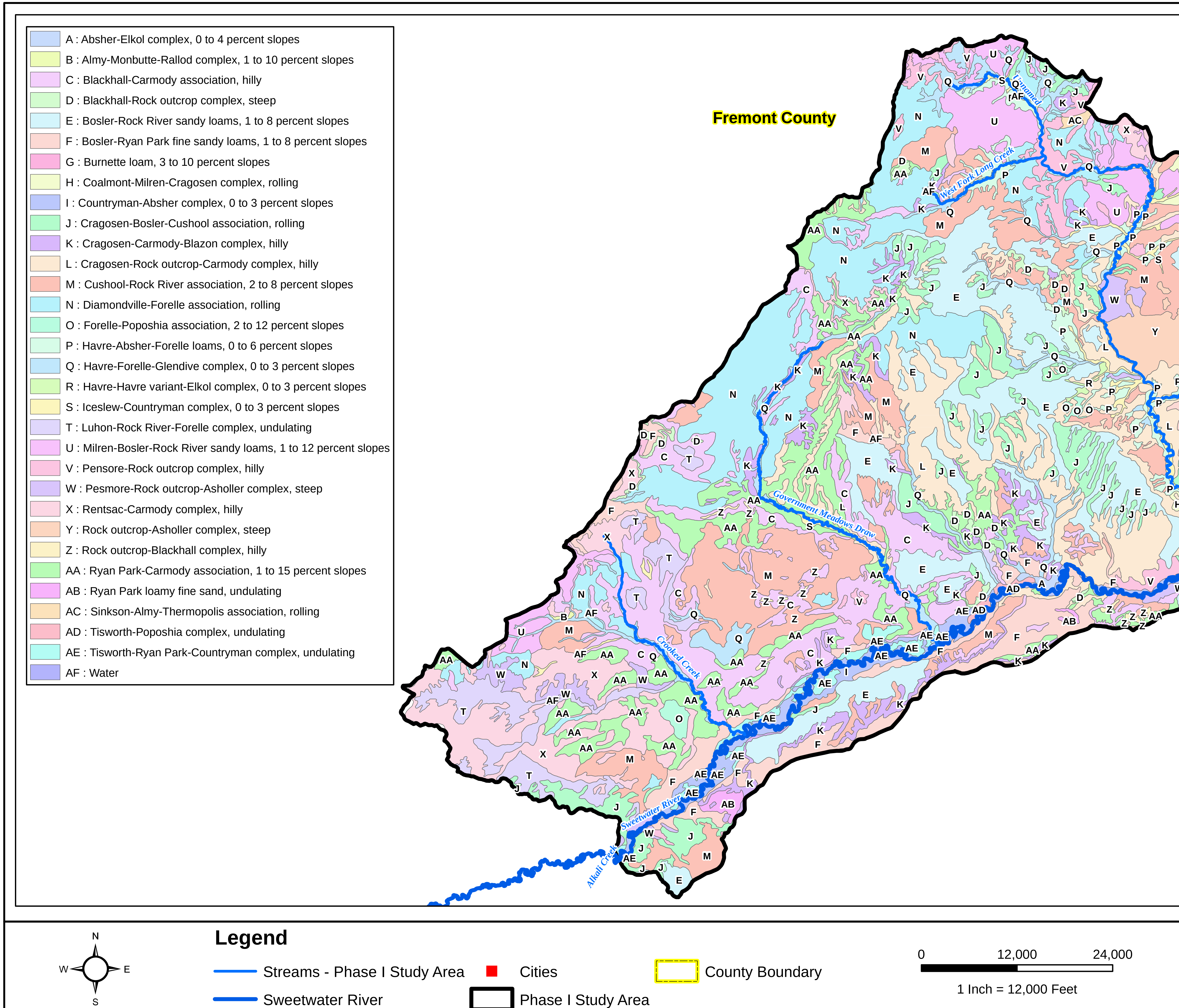



**Figure 2.13 Sweetwater River Phase I: Soils Mapping at 1:24,000**

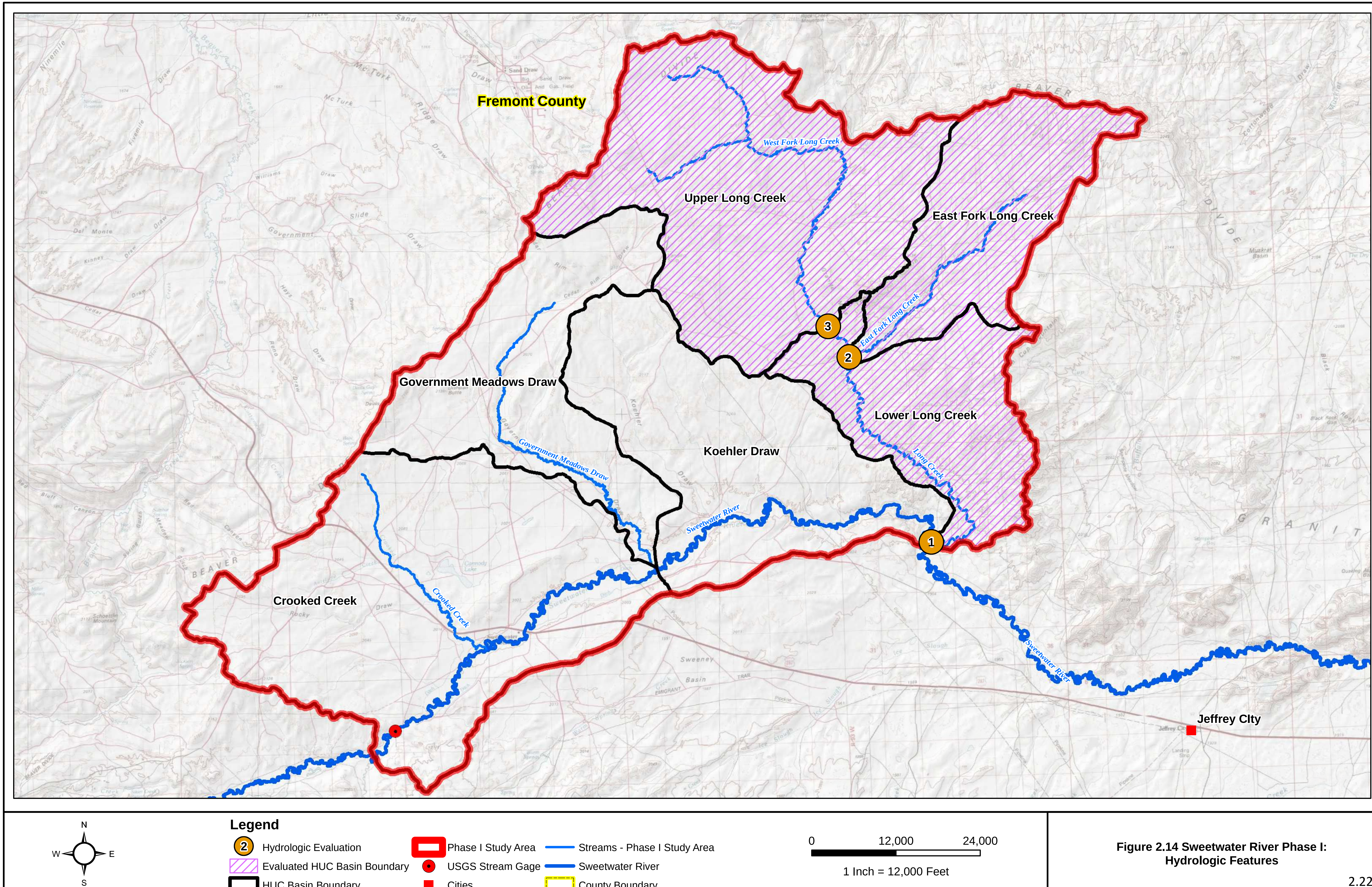



**Figure 2.14 Sweetwater River Phase I: Hydrologic Features**

regressional relationships between measured discharge and basin physical characteristics (area, slope, precipitation, etc). Using these techniques, the mean annual discharge for Long Creek is estimated to be approximately 3.3 cfs or an annual yield of approximately 2,385 acre-feet. Similarly, the mean annual yield of East Fork Long Creek and West Fork Long Creek are estimated to be approximately 1.47 cfs (1,065 acre-feet) and 2.31 cfs (1,665 acre-feet) respectively. It must be recognized that these estimates do not include spring-derived flows and are provided as an approximation only.

Surface waters of the State of Wyoming are placed, by WDEQ, into subclasses under one of the appropriate four classes of water quality. Detailed descriptions of the various classes and subclasses can be found at: http://deq.state.wy.us. The classes can be briefly characterized as follows:

- **Class 1:** These are those high quality waters in which no further degradation of water quality will be allowed.
- **Class 2:** These waters are waters other than those designated as Class 1 that presently support, or have the potential to support, game fish or drinking water supplies.
- **Class 3:** These waters are waters other than those designated as Class 1 that are intermittent, ephemeral, or isolated waters that do not have the potential to support fish. These waters do provide support for invertebrates, amphibians, or other flora and fauna which inhabit waters of the state at some stage in their life cycles.
- **Class 4:** These waters are waters other than those designated as Class 1, where it has been determined that aquatic uses are not attainable pursuant to provisions of WDEQ regulations. Uses designated on Class 4 waters include recreation, wildlife, industry, agriculture, and scenic value. Ditches and canals also have this designation.

Table 2.4 summarizes the classification of streams within the Phase I Study Area. Within the Phase I study area, there are no stream segments classified as WDEQ Class 1. However, the Sweetwater River upstream of Alkali Creek (and outside of the physical limits of the study area), is designated as Class 1. The remainder of the streams are designated as either Class 2AB or 3B.

**Table 2.4 Summary of WDEQ Stream Classifications for Streams within the Phase I Study Area.**

| Stream | WDEQ Class |
|---|---|
| Sweetwater River above Alkali Creek | 1 |
| Sweetwater River below Alkali Creek | 2AB |
| Long Creek | 2AB |
| West Fork Long Creek | 2AB |
| East Fork Long Creek | 2AB |
| Koehler Draw | 3B |
| Crooked Creek | 3B |

Class 2AB waters are a subclass of Class 2 waters and 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 3B waters are a subclass of Class 3 waters characterized as 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.

### *2.6.2 Groundwater Hydrology*

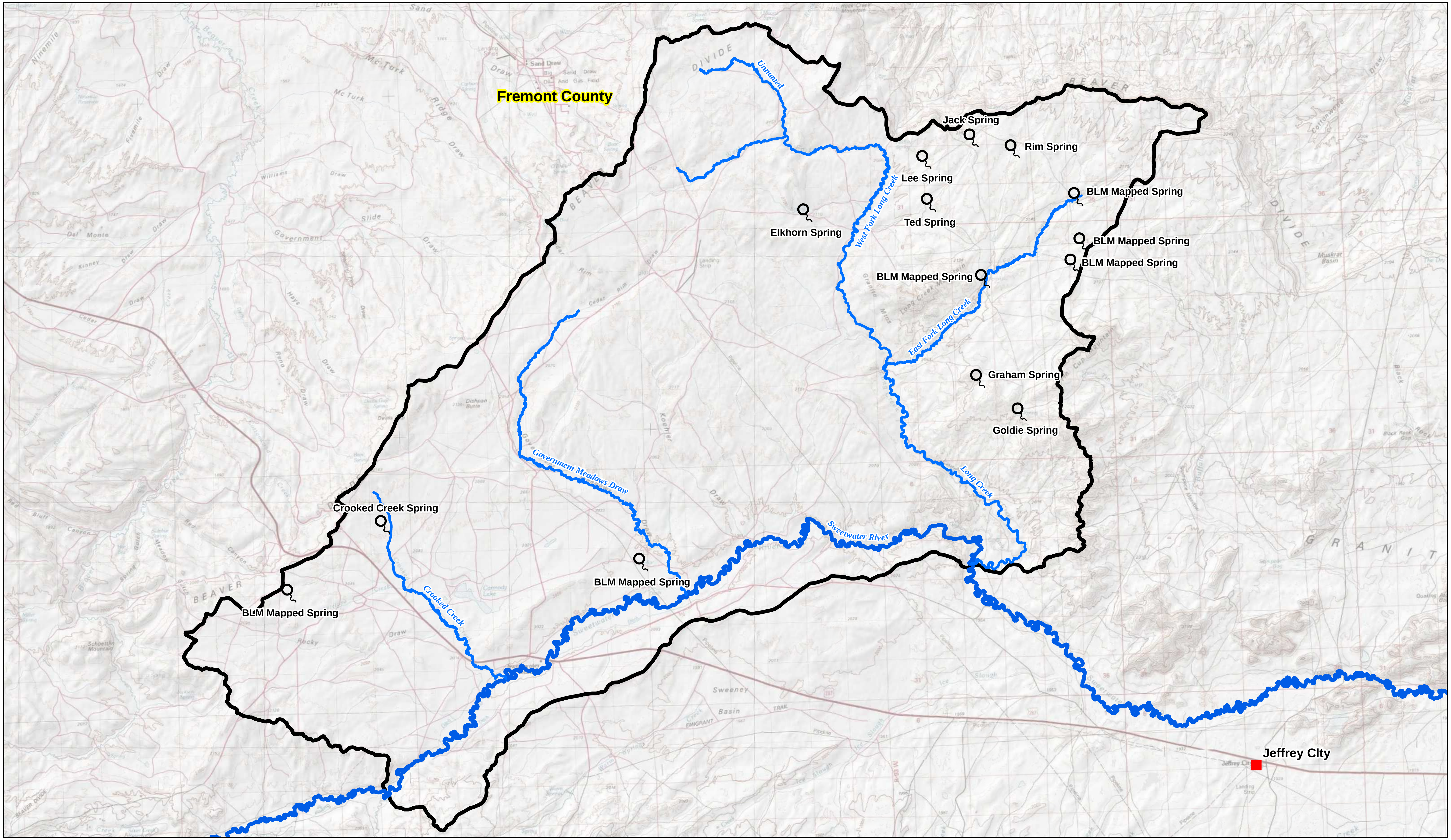
Several springs are located within the watershed as indicated in Figure 2.15. Several of these springs have sufficient yield to provide supplemental supply to surface waters (East Fork Long Creek). Others consist of “wet spots” and support local vegetation and livestock usage. Springs within the watershed are generally found within the undifferentiated Miocene formations.

Figure 2.16 displays the location of permitted wells within the study area and the surrounding vicinity. Appendix A tabulates pertinent information on wells within the study area.

## 2.7 Stream Channel Conditions

### *2.7.1 Rosgen Level I Classification*

The purpose of the Level I geomorphic classification is to provide an inventory of the Phase I 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)




**Legend**

Spring

Streams - Phase I Study Area

Sweetwater River

Cities

Phase I Study Area

County Boundary

0 12,000 24,000

1 Inch = 12,000 Feet

**Figure 2.15 Sweetwater River Phase I: Spring Locations**

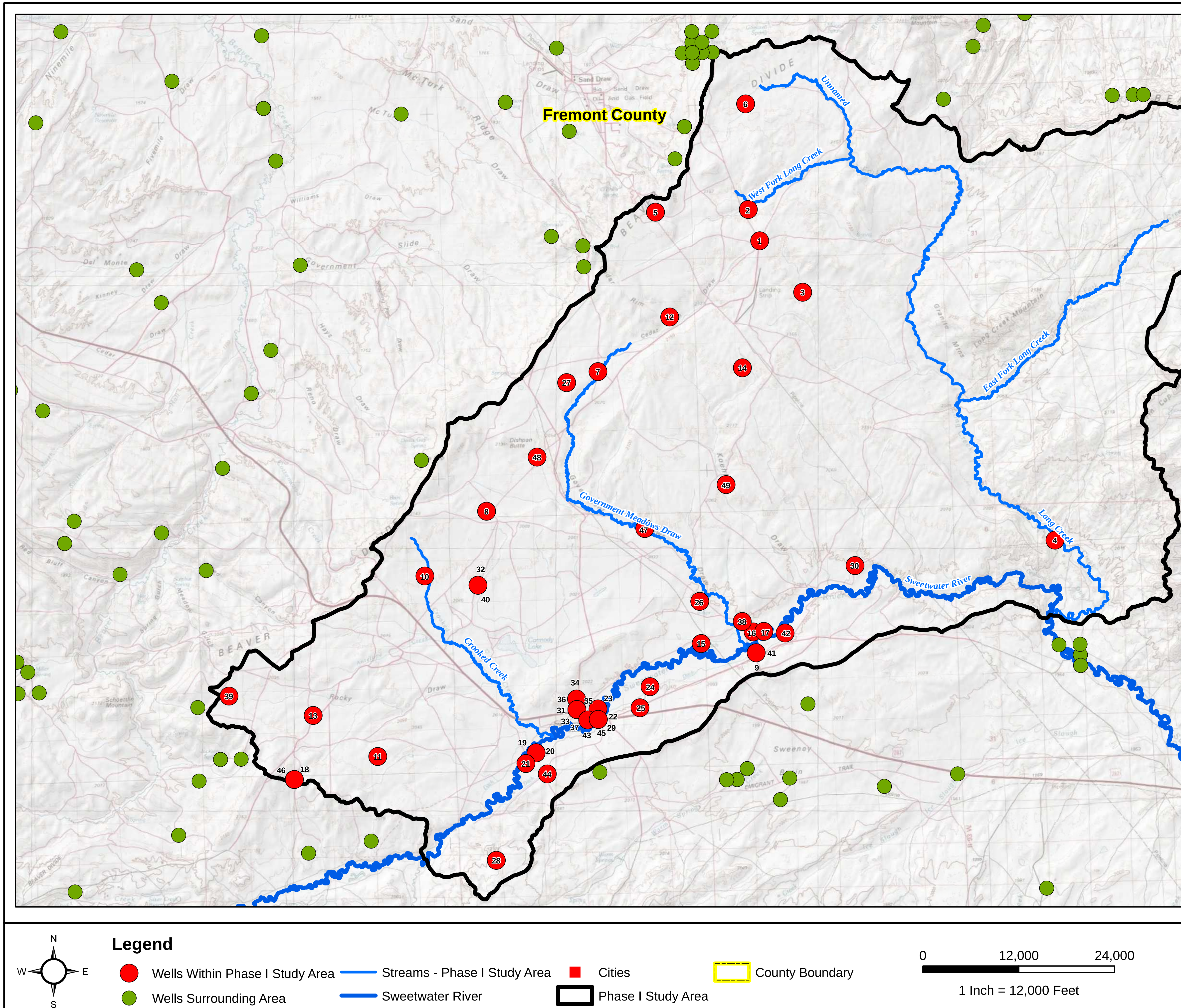



**Figure 2.16 Sweetwater River Phase I: Permitted Groundwater Wells**

providing a graphical “snapshot” of the basin. The end product of the Level I classification is the determination of the major stream types, A through G.

Table 2.5 presents a tabulation of geomorphic parameters quantified within the GIS environment. Figure 2.17 displays the results of the Rosgen Level I classification effort. In addition, results of previous channel assessments conducted by the BLM using the Proper Functioning Condition (PFC) methods have been incorporated.

**Table 2.5 Summary of Geomorphic Parameters: Phase I Study Area.**

| Stream | Reach Number | Station (Distance from Mouth) | | Reach Length (mi) | Sinuosity | Slope | Rosgen |
|---|---|---|---|---|---|---|---|
| | | Station Start (mi) | Station Stop (mi) | | | | |
| Crooked Creek | 1 | 0.0 | 6.4 | 6.4 | 1.43 | 0.002 | B |
| | 2 | 6.4 | 8.5 | 2.1 | 1.06 | 0.021 | A |
| East Fork Long Creek | 1 | 0.0 | 7.5 | 7.5 | 1.43 | 0.008 | B |
| | 2 | 6.7 | 9.6 | 2.8 | 1.43 | 0.006 | A |
| Government Meadows Draw | 1 | 0.0 | 9.1 | 9.1 | 1.55 | 0.003 | B |
| | 2 | 9.1 | 15.2 | 6.1 | 1.39 | 0.005 | B |
| Long Creek | 1 | 0.0 | 11.7 | 11.7 | 1.48 | 0.004 | C |
| Sweetwater River | 1 | 0.0 | 17.0 | 17.0 | 1.75 | 0.002 | C |
| | 2 | 17.0 | 36.4 | 19.4 | 1.98 | 0.001 | C |
| West Fork Long Creek | 1 | 0.0 | 16.7 | 16.7 | 1.33 | 0.005 | B |
| Unnamed | 1 | 0.0 | 4.6 | 4.6 | 1.29 | 0.001 | B |

Reaches within the Phase I Study Area exhibit various degrees of degradation, however, for the most part, riparian conditions are fair. Proper Functioning Condition (PFC) assessment by BLM personnel on these reaches classified the reaches as Functional At Risk (FAR). FAR reaches are considered by BLM to be direct results of significant past or current land use influences. The 2010 BLM Proper Functioning Condition (PFC) data does indicate that a small reach (1,500 feet) of Antelope Creek (tributary to Crooked Creek) is classified as Non-Functioning (NF).

#### *2.7.1.1 __Lower Long Creek__*

Downstream of the confluence of West Fork Long Creek and East Fork Long Creek, the channel is classified as a Type-C channel. These channels are typically characterized by relatively low slopes, meandering planforms (i.e., the shape one would see if viewing from above, as in a map or aerial photo), and pool/riffle sequences (Figure 2.18). This reach of Long Creek is non-entrenched, and appears to be relatively stable.


**Figure 2.18 Long Creek near Confluence with the Sweetwater River.**

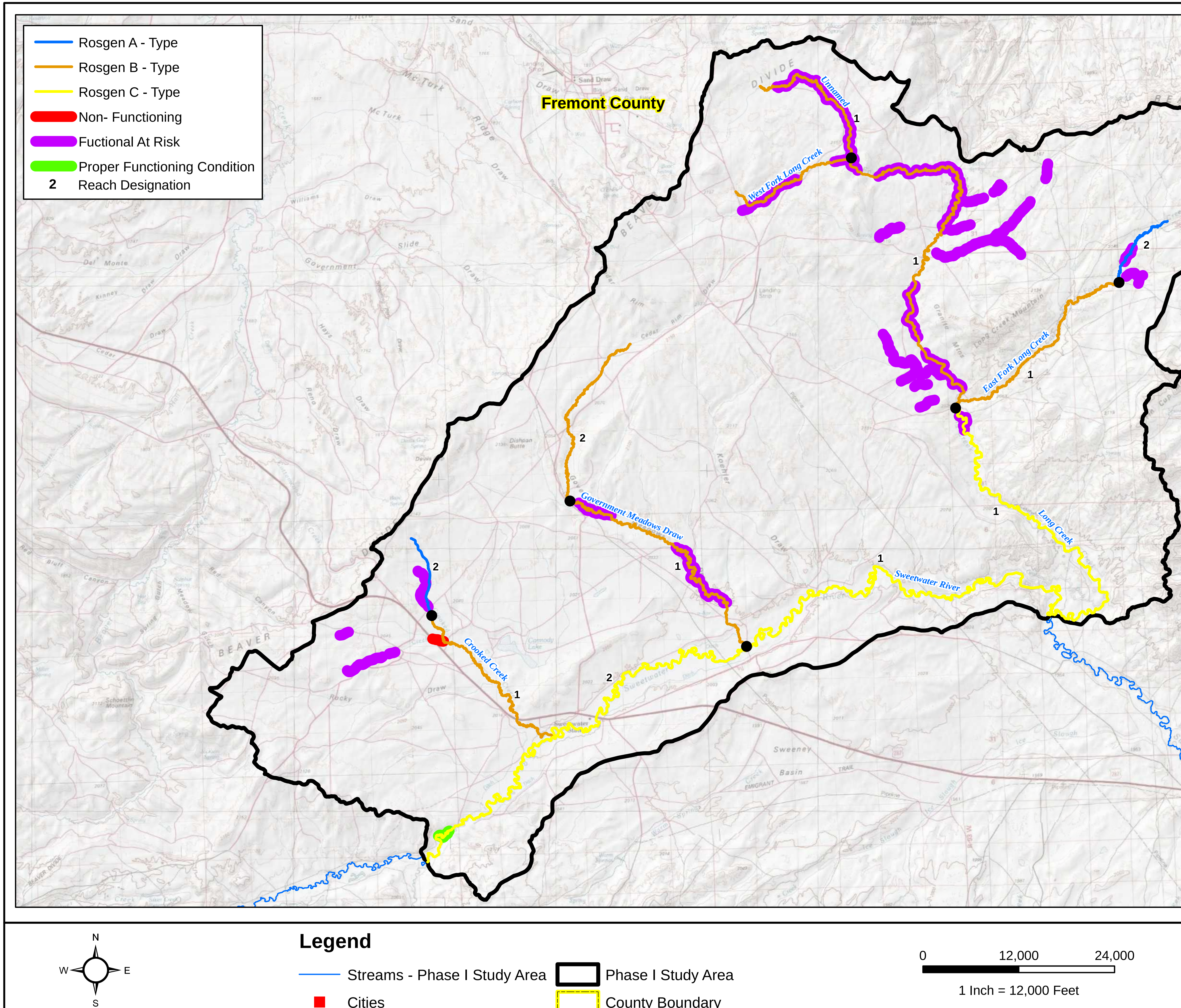



**Figure 2.17 Sweetwater River Phase I: Geomorphic Stream Classifications**

Bed material is coarse and classified as gravel to cobble in size (Figure 2.19).


**Figure 2.19 Lower Long Creek Bed Material.**

C-type channels tend to occur in broad alluvial valleys, and they are typically associated with broad floodplain areas. C-type channels tend to be relatively sinuous, as they follow a meandering course within a single channel thread. Lower Long Creek is bounded by coarse, resistant materials that include hillslope colluvium and residuum. As a result, the channels are laterally stable, and geomorphically resilient.

#### *2.7.1.2 <u>East Fork Long Creek</u>*

East Fork Long Creek was classified as a B-type channel. *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. B-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 disturbance, although, their reduced slopes relative to headwater areas can make them prone to sediment deposition and subsequent adjustment following a large sediment transport event such as an upstream landslide, debris flow, or flood.


**Figure 2.20 East Fork Long Creek Riffle/ Pool Sequence (B-Type Channel**).

East Fork Long Creek is spring fed and in most years flow reflects continuous flow of water in the channel. It exhibited little sign of impairment with respect to the condition of its bed and banks. Stable overhanging banks and pool/riffle sequence were obvious (Figure 2.20). The bed of the channel is well armored with cobble sized substrate (Figure 2.21).

Upstream of the Long Creek Pasture, the East Fork Long Creek originates within the Granite Mountain Allotment. In this vicinity, degraded channel conditions were noted along with a loss of riparian vegetation (Figure 2.22).


**Figure 2.21 East Fork Long Creek Cobble-Sized Bed Material.**

Two reaches within the East Fork Long Creek have been previously assessed by BLM personnel using Proper Functioning Condition protocols. Both sites, located in the upper portions of the subbasin, were classified as "Functional At Risk" meaning they display impacts which are usually a direct result of significant past or current land use influences. Vegetation was noted to be stressed at each site.

**Figure 2.22 Upper East Fork Long Creek.**

#### *2.7.1.3 <u>West Fork Long Creek</u>*

West Fork Long Creek was also classified as a B-type channel. Much of the lower portion is perennial and well-armored with grave to cobble-sized bed materials. Banks were frequently void of riparian vegetation. However, the existing channel appears to be vertically and horizontally stable (see Figure 2.23).

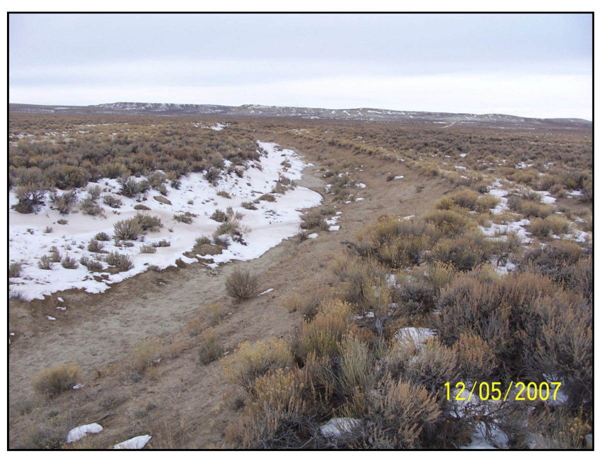



**Figure 2.23 West Fork Long Creek.**

Several locations within the West Fork Long Creek subbasin were previously evaluated by BLM staff using PFC protocols. Eleven locations were evaluated and all were classified as Functional At Risk.

### *2.7.2 Proper Functioning Condition*

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

*"A qualitative method for assessing the condition of riparian-wetland areas. The term PFC is used to describe both the assessment process, and a defined, on-the-ground condition of a riparian-wetland area. The PFC assessment refers to a consistent approach for considering hydrology, vegetation, and erosion/deposition (soils) attributes and processes to assess the condition of riparian-wetland areas. A checklist is used for the PFC assessment, which synthesizes information that is foundational to determining the overall health of a riparian-wetland system". (BLM, 1998).*

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

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

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

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

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

Within the Phase I Study Area, the BLM conducted a limited number of PFC assessments on selected stream segments on public lands. Based upon information provided by the BLM, the assessments appear to have been conducted intermittently between 1995 and 2001 (Figure 2.16). Observer notes indicate the predominate factors contributing to a reach being classified as anything other than PFC were degradation of riparian vegetation or stream channel and bank degradation / erosion.

### *2.7.3 Impairments*

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

- Riparian Vegetation Degradation: Impaired riparian condition and habitat. Figure 2.24 displays a geomorphically stable portion of East Fork Long Creek exhibiting a lack of riparian vegetation and habitat.
- Riparian Degradation: Generally bank erosion and physical disturbance of stream banks. Figure 2.25 displays a photo of Long Creek where channel incision has resulted in over-steepened and unstable stream banks.


**Figure 2.24 Loss of Riparian Vegetation and Habitation East Fork Long Creek.**


**Figure 2.25 Stream Bank Disturbance on Long Creek.**

## 2.8 Ecological Site Descriptions

The Ecological Site Description (ESD) describes the conditions which could be expected for an area based upon its local soils and precipitation condition. ESDs contain a wealth of information pertaining to range conditions, vegetation distribution, soils, and response to treatment (grazing, mechanical, chemical, etc). 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.

The NRCS has delineated Ecological Site Precipitation Zones for the entire state. Within each zone, various ESDs are described. The Phase I Study Area falls within the High Plains Southeast 10 to 14 Inch Precipitation Zone (Figure 2.26). Within this zone, there are up to twenty three (23) ESDs which could be encountered.

Using database tools provided by the NRCS, the available soils mapping was evaluated and Ecological Sites defined within the study area (Table 2.6). Figure 2.27 displays their location within the study area. The relative distribution of the Ecological Sites is shown in Figure 2.28.

Examination of Figure 2.27 reveals that the majority of the uplands areas within the watershed are classified within the Sandy (Sy) 10 – 14 Inch PZ High Plans Southeast and the Loamy (Ly) 10-14" P.Z., High Plains Southeast ESDs. The following descriptions associated with these ESDs are extracted from the NRCS full reports obtained from the Ecological Site Description (ESD) System for Rangeland and Forestland website.

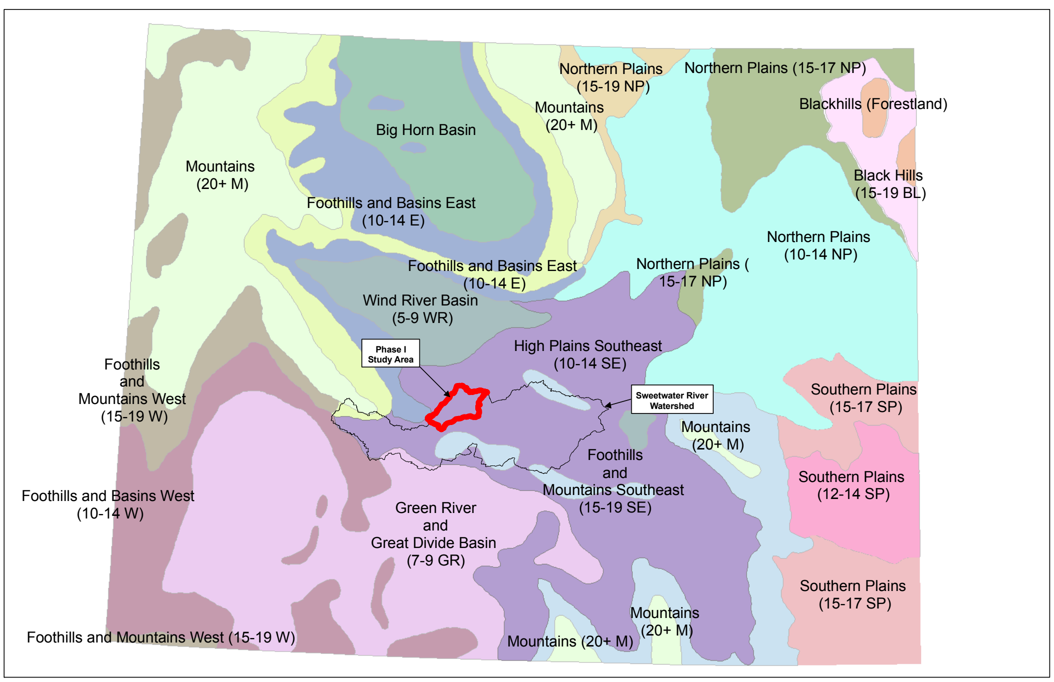



**Figure 2.26 Wyoming Ecological Precipitation Zones.**

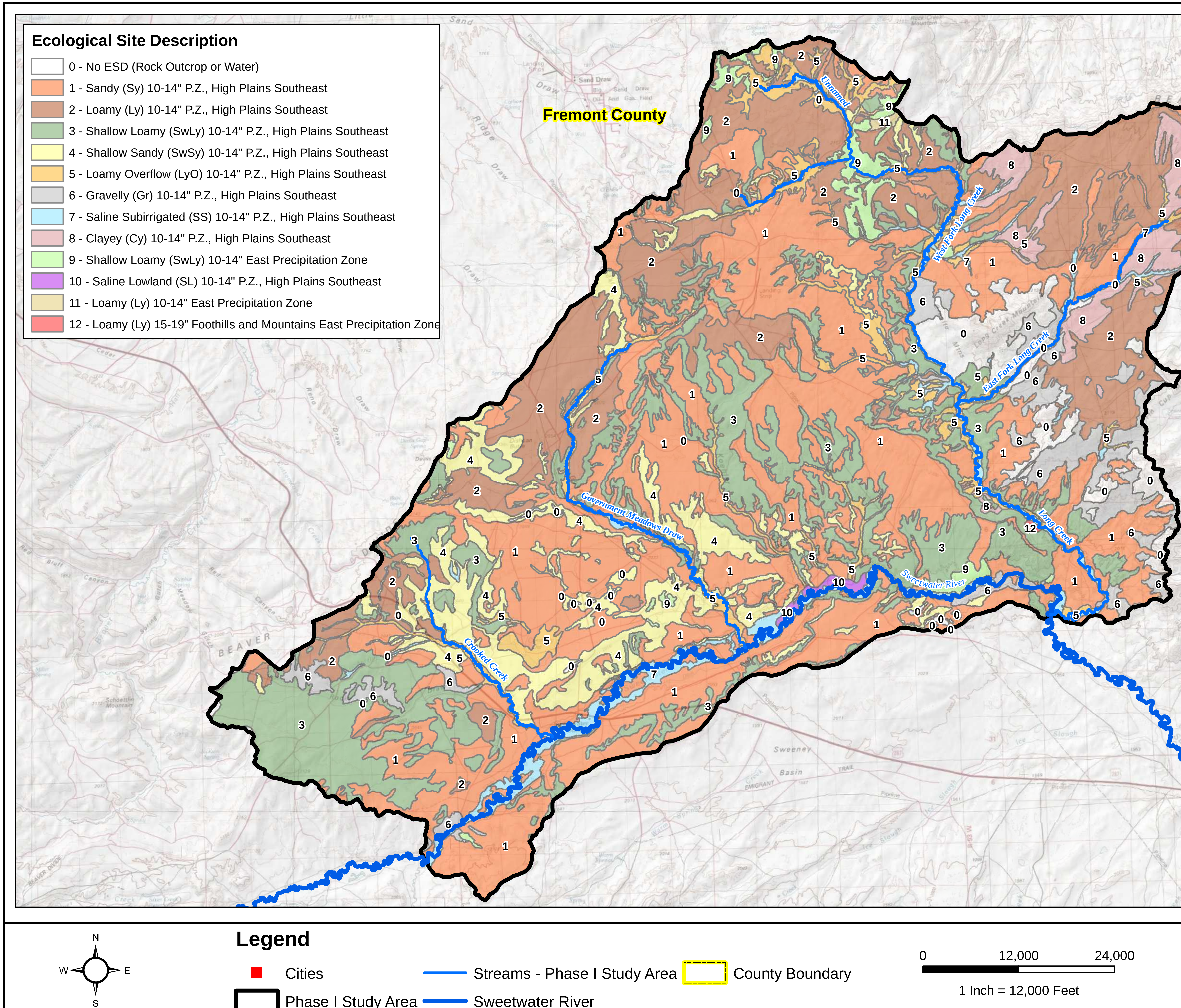



**Figure 2.27 Sweetwater River Phase I: Ecological Sites**

**Table 2.6 Analysis of Ecological Site Distribution in Phase I Study Area.**

| Identifier | Ecological Site Name | Identifier | Acres | Description |
|---|---|---|---|---|
| 1 | SANDY (10-14SE) | R034XY350WY | 57,728.6 | ESD 1: Sandy (Sy) 10-14" |
| 2 | LOAMY (10-14SE) | R034XY322WY | 30,172.0 | ESD 2: Loamy (Ly) 10-14" |
| 3 | SHALLOW LOAMY (10-14 SE) | R034XY362WY | 27,031.9 | ESD 3: Shallow Loamy (SwLy) 10-14" P.Z. |
| 4 | SHALLOW SANDY (10-14SE) | R034XY366WY | 12,192.6 | ESD 4: Shallow Sandy (SwSy) 10-14" P.Z. |
| 5 | LOAMY OVERFLOW (10-14SE) | R034XY326WY | 6,809.4 | ESD 5: Loamy Overflow (LyO) 10-14" P.Z. |
| 6 | GRAVELLY (10-14SE) | R034XY312WY | 5,624.0 | ESD 6: Gravelly (Gr) 10-14" P.Z. |
| 7 | SALINE SUBIRRIGATED (10-14SE) | R034XY342WY | 5,159.9 | ESD 7: Saline Subirrigated (SS) 10-14" P.Z. |
| 8 | CLAYEY (10-14SE) | R034XY304WY | 3,647.2 | ESD 8: Clayey (Cy) 10-14" P.Z. |
| 9 | SHALLOW LOAMY (10-14E) | R032XY362WY | 2,425.8 | ESD 9: Shallow Loamy (SwLy) 10-14" |
| 10 | SALINE LOWLAND (10-14SE) | R034XY338WY | 273.3 | ESD 10: Saline Lowland (SL) 10-14" P.Z. |
| 11 | LOAMY (10-14E) | R032XY322WY | 104.1 | ESD 11: Loamy (Ly) 10-14" |
| 12 | LOAMY (15-19E) | R043XY322WY | 45.0 | ESD 12: Loamy (Ly) 15-19"e |
| 100 | Unclassified | NA | 4,998.3 | ESD 0: Unclassified |

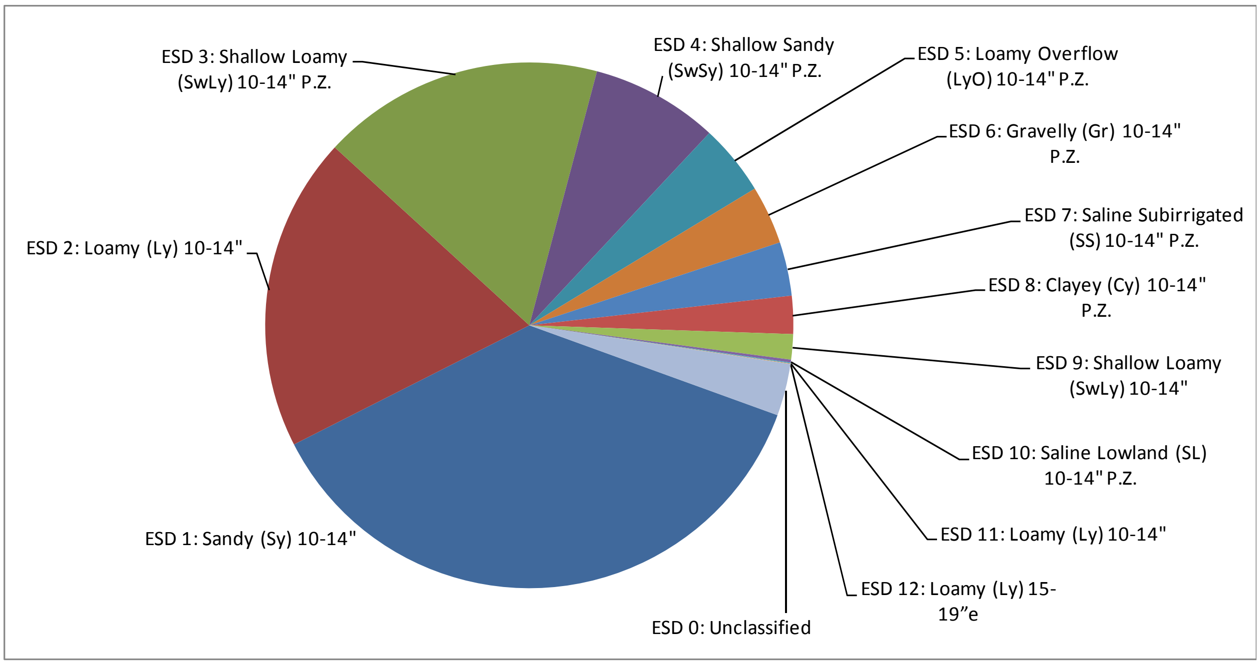



**Figure 2.28 Distribution of Ecological Sites Within the Phase I Study Area.**

***<u>Sandy (Sy) 10 – 14 Inch PZ High Plains Southeast:</u>***

*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).*

***<u>Loamy (Ly) 10-14" P.Z., High Plains Southeast</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. Potential vegetation is about 75% grasses or grass-like plants, 15% forbs, and 10% woody plants. This plant community can be found on areas that are properly managed with grazing and/or prescribed burning, and on areas receiving periods of rest. The cyclical nature of the fire regime in this community prevents big sagebrush from being the dominant landscape.*

*Cool season midgrasses dominate the site. The major grasses include Columbia needlegrass, spikefescue, Idaho fescue, and bluebunch wheatgrass. Big sagebrush is a conspicuous element of this site, occurs in a mosaic pattern, and makes up 5 to 10% of the annual production. Natural fire occurred in this community and prevented sagebrush from being the dominant landscape. A variety of forbs also occurs in this state and plant diversity is high (see Plant Composition Table).*

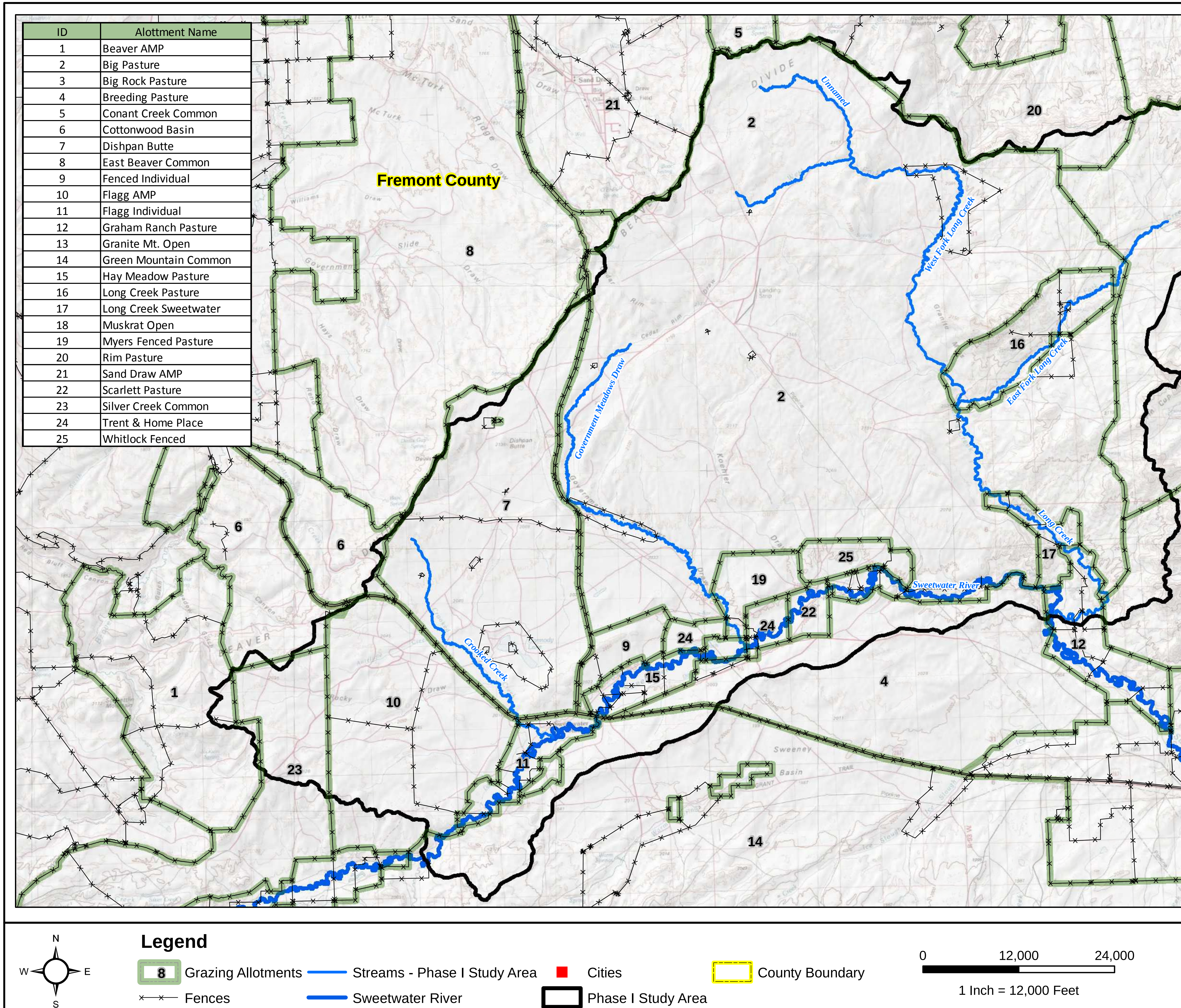
*Annual production on this site ranges from 1100 to 1600 pounds depending on climatic conditions.*

*This plant community is extremely stable and well adapted to the Central Rocky Mountains climatic conditions. The diversity in plant species allows for high drought tolerance. This is a sustainable plant community (site/soil stability, watershed function, and biologic integrity).*

## 2.9 Grazing

### *2.9.1 Grazing Administration*

Grazing on federal lands within the Phase I Study Are is administered by the Bureau of Land Management. The BLM-administered allotments typically include intermingled private, state, and federally-administered lands used for grazing. Figure 2.29 displays the grazing allotments found within the study area. The majority of land in the watershed is contained within one of four large allotments: Big Pasture Allotment (82,417 acres), Dishpan Butte Allotment (17,448 acres), Granite Mountain Allotment (11,489 acres), or Flagg AMP (10,948 acres). The remaining land area is contained within 22 other allotments all smaller than 5,000 acres in size.




| ID | Allotment Name |
|---|---|
| 1 | Beaver AMP |
| 2 | Big Pasture |
| 3 | Big Rock Pasture |
| 4 | Breeding Pasture |
| 5 | Conant Creek Common |
| 6 | Cottonwood Basin |
| 7 | Dishpan Butte |
| 8 | East Beaver Common |
| 9 | Fenced Individual |
| 10 | Flagg AMP |
| 11 | Flagg Individual |
| 12 | Graham Ranch Pasture |
| 13 | Granite Mt. Open |
| 14 | Green Mountain Common |
| 15 | Hay Meadow Pasture |
| 16 | Long Creek Pasture |
| 17 | Long Creek Sweetwater |
| 18 | Muskrat Open |
| 19 | Myers Fenced Pasture |
| 20 | Rim Pasture |
| 21 | Sand Draw AMP |
| 22 | Scarlett Pasture |
| 23 | Silver Creek Common |
| 24 | Trent & Home Place |
| 25 | Whitlock Fenced |

**Figure 2.29 Sweetwater River Phase I: Grazing Allotments**

Under the umbrella of the Lander Resource Management Plan, management of grazing allotments are prioritized based on the classification of the allotments into one of three management categories; Improve (I), Maintain (M), and Custodial (C). These categories broadly define management objectives of the BLM administered public lands in the allotment (BLM,2008).

Livestock grazing is managed is 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, 2007). 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.
- 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.
- 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, 2007). Each standard sets a specific objective, explains the function and importance of the objective, and provides indicators to assess the attainment of the objective.
- Implementation of appropriate range management practices and/or improvements is carried out under an activity or implementation plan, including allotment management plans (AMPs).

Most of the Phase I Study Area is included in the Big Pasture Allotment. A 1991 Allotment Management Plan covers this allotment. It includes the Long Creek Pasture on the East Fork of Long Creek. Livestock grazing is permitted for season long use (approximately May 15 through November 15), depending upon range readiness. Grazing on the Long Creek Pasture is not allowed during the hot season. This pasture is alternately grazed in the spring and fall. General range conditions in this allotment are that the uplands are in fair to low good ecological condition. Riparian areas are generally in fair condition. Conditions in the riparian pastures are generally high fair to low good, with riparian areas in these pastures stable and improving.

Issues identified within the AMP prepared in 1991 persist today and are worthy of reiterating herein:

1. Grazing intensity is an issue within the riparian zones. Range assessments indicated that the non-riparian zones were withstanding stocking rates.
2. The turnout date of May 1 was considered too early for the area.
3. Management of distribution and season of use would benefit riparian areas.
4. Distribution of grazing animals needs to be improved: riparian zones are heavily used and upland zones are lightly utilized.

The Granite Mountain Allotment includes the upper east portion of the watershed. This allotment does not have an Allotment Management Plan. Livestock grazing is permitted for season-long use. Range readiness date averages May 22. General upland condition in this portion of the watershed is fair. Riparian areas appear to be in fair to poor condition.

Livestock classes are generally cows and calves that use the allotment throughout the season (generally May 1 through November 7), and sheep in the spring/early summer and again in the fall.

### *2.9.2 Existing Water Supply*

The Phase I Study Area possesses several reliable water sources for livestock and wildlife. These sources include:

- Perennial and intermittent streams,
- Springs,

- Ponds and reservoirs, and
- Stock tanks, water gaps, etc.

Figure 2.30 displays the general location of these sources.

Perennial and intermittent streams (when flowing) have historically served as reliable sources of water for both livestock and wildlife. Based upon a preliminary review of hydrologic conditions, perennial reaches include the lower reaches of Long Creek, a large extent of East Fork Long Creek, and portions of West Fork Long Creek. Intermittent reaches extend upstream and flow for portions of the year. The remainder of the watershed appears to be ephemeral and flows in response to precipitation events. Throughout most of the area, riparian conditions are in fair condition. Much of the perennial portion of East Fork Long Creek lies within the Long Creek Pasture Allotment. This is a water source for livestock for limited time periods each year and currently does not indicate significant signs of degradation.

Several springs are located within the study area. These sources tend to be more isolated in comparison to the perennial streams, and are subjected to higher intensity use. In addition, several ponds have been constructed in the watershed in accordance with the Big Pasture AMP. Consequently, riparian conditions are degraded within the immediate vicinity of the watering sources. Finally, existing water sources include several developed springs, wells, and pipeline projects. For example, the Boggs well pipeline consists of 19,000 linear feet of pipeline providing water to five stock water tanks.

Springs within the study area, including developed springs, have generally been reliable and provide a source of water for livestock and wildlife throughout the year. However, several springs have displayed reduced flow with current drought conditions.

### *2.9.3 Range Conditions and Needs*

The Phase I Study Area has been grazed by domestic livestock (both cattle and sheep) since the late 1800’s. Generally, range conditions are in “high fair” to “good” ecological condition. Range trends are generally stable to slightly upward overall. Several riparian areas continue to be heavily relied upon for their wildlife and livestock water, feed values, and cover. This inhibits recovery of many of these ecologically important areas, including contributing at least locally to geomorphic stream instability.

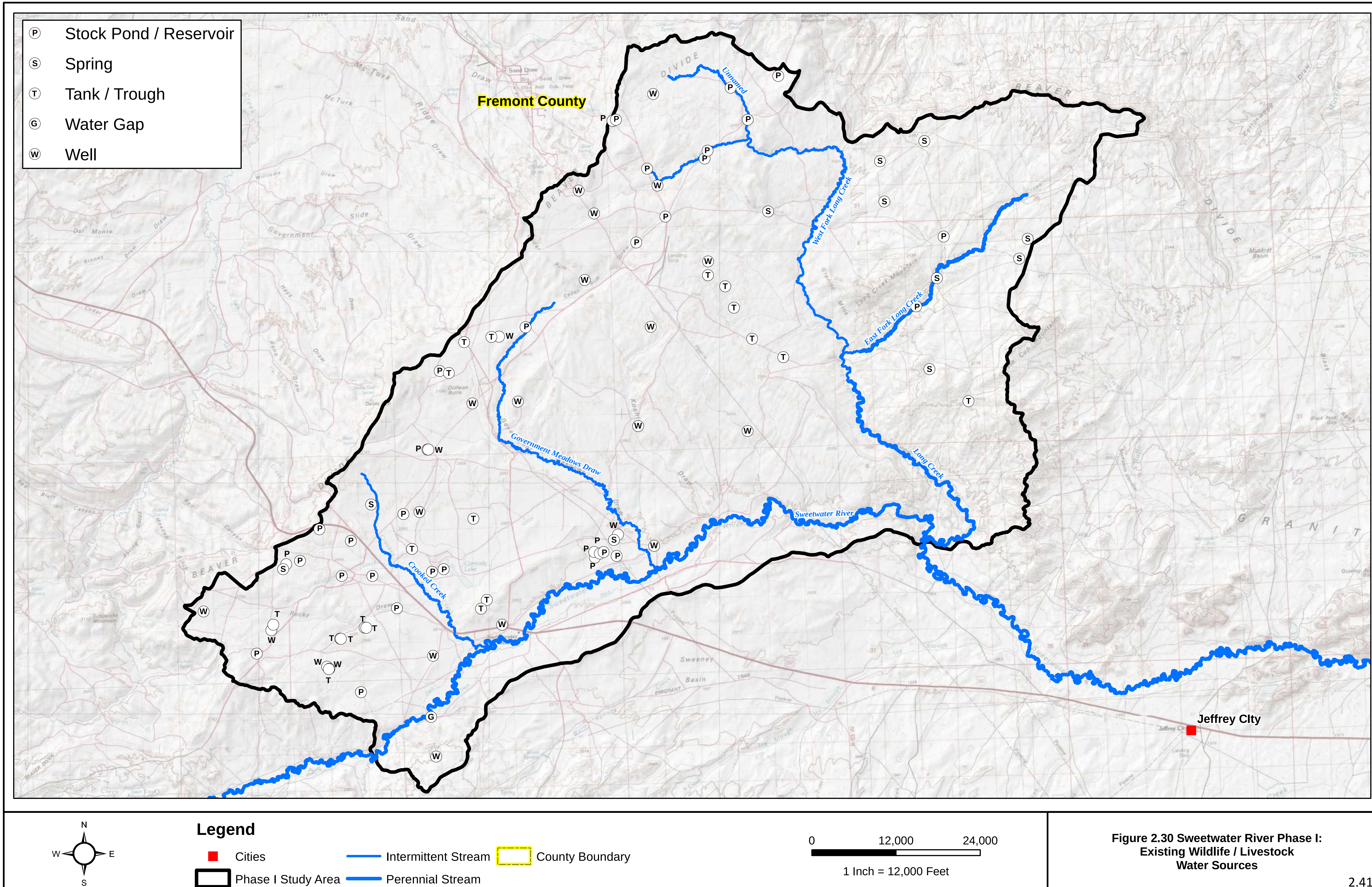



**Figure 2.30 Sweetwater River Phase I: Existing Wildlife / Livestock Water Sources**

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 relative ample water supplies within 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. This is because food reserves in the roots must be utilized for new plant growth. If they do not get to replace these root reserves, the plants are weakened and may eventually die. Less desirable plants eventually take over and plant densities decrease. Without well distributed livestock water, areas near water (frequently riparian areas) are grazed heavily while many other areas are underutilized. 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.

Because plants grow rapidly during the growing season, re-growth is frequently grazed multiple times during each grazing period. This results in depleted root reserves. Because of this, it is often desirable to combine herds so livestock can spend shorter time periods in one pasture. This requires adequate quantities of water to accommodate larger herds.

In addition to restoration of more healthy conditions in currently impacted riparian areas, 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 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 3.5 below. Potential management practices and improvements to address other rangeland/grazing related issues are included in Section 3.6. 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. Since the key to any good grazing system is usually 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 usually occurs on the more productive land. Land that is too steep or shallow can only show limited returns on investments. Finally, to work in the long run, any change in range management must be supported by the land user.

## 2.10 Irrigation

### *2.10.1 Irrigation Overview*

Irrigation systems within the Phase I Study Area are limited primarily to lands adjacent to the Sweetwater River. The remainder of the study area includes only a handful of small privately owned ditches. Total irrigated acres within the watershed were determined to be approximately 1690 acres based upon mapping provided by the WWDC (Figure 2.31). Appendix B summarizes the adjudicated surface water rights information available from the WSEO.

Ditch owners were contacted and invited to participate in the irrigation system inventory phase of the project. Inventories were conducted in the company of the land owner and site-specific issues were discussed. The objective of the evaluation of specific structures was to assess system integrity and determine rehabilitation improvements that would:

- increase the longevity of the irrigation facilities,
- provide water conservation, and
- facilitate greater irrigation efficiency.

The inventory effort consisted of:

- Interviewing with interested irrigators;
- Field inventory of hydraulic structures;
- Inventory of ditch conditions;
- Assessment of the hydraulic efficiency of the structures;
- Photographic documentation of the structures and their condition;
- Location of the structures using GPS technology; and
- Incorporation of data into the project GIS.

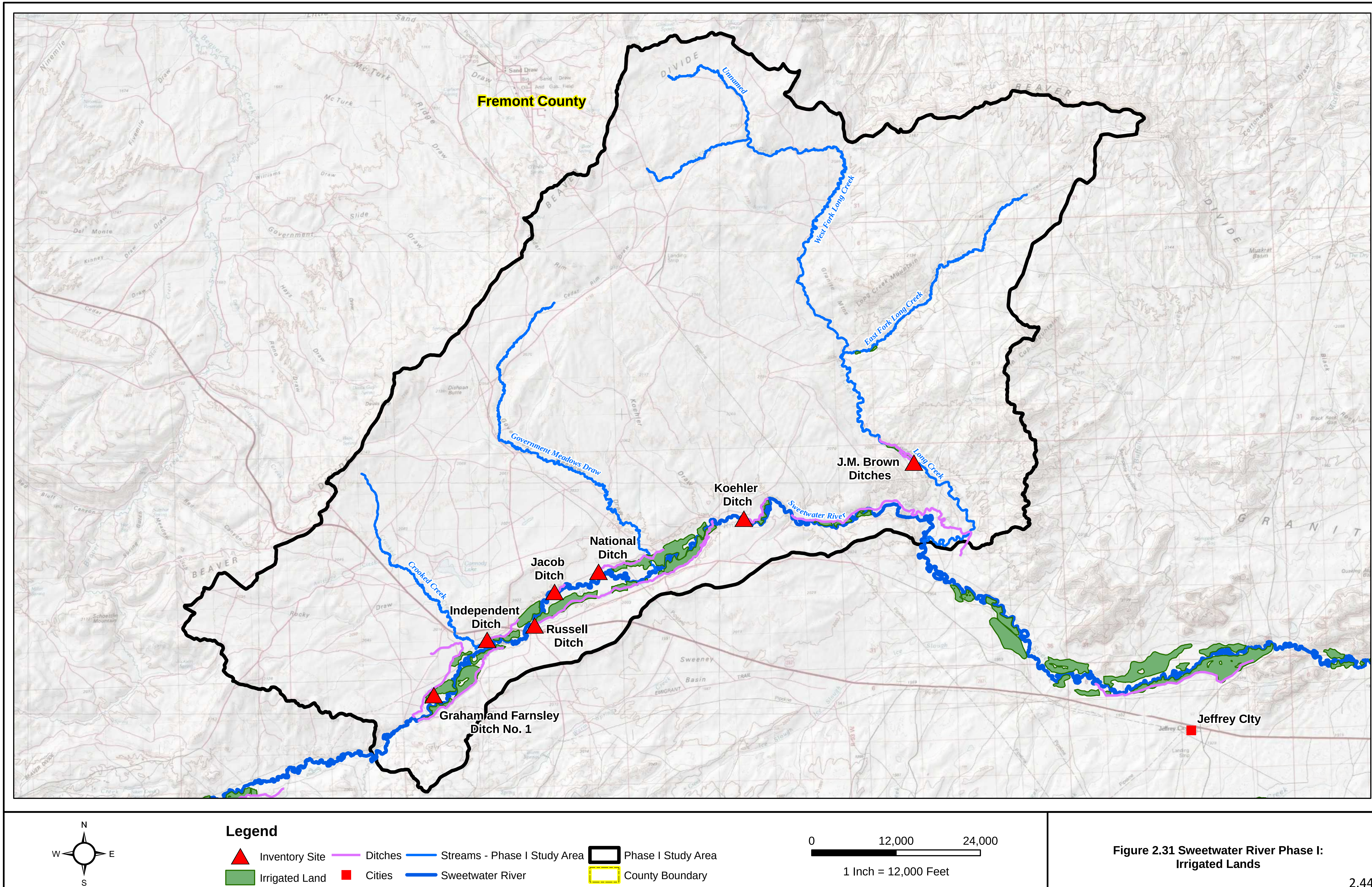



**Figure 2.31 Sweetwater River Phase I: Irrigated Lands**

### *2.10.2 J.M. Brown Ditch (Corbett)*

The Corbett family owns and operates two small irrigation supply ditches located in the lower reaches of Long Creek. The ditches irrigate approximately 42 acres on opposite sides of the creek. Review of State Engineers Office water rights tabulation indicates the ditches have original water rights with priority of 1923 under the adjudicated facility name of J.M. Brown Ditch. Total adjudicated water rights amount to 0.6 cfs. Flood irrigation methods are used.

Figure 2.32 displays the results of the irrigation system inventory. The following general observations were noted during the inventory:

**Figure 2.33 J.M. Brown Ditch (East) Diversion on Lower Long Creek.**

- Neither of the two ditches is equipped with a diversion / headgate structure. Flows are diverted from Long Creek via temporary diversions utilizing tarpaulins and timbers (Figure 2.33). There is a rock check structure located in Long Creek downstream of the lower diversion. There are no gates or other means of controlling the amount of flow diverted.
- The eastern ditch crosses five drainages of one half square miles or more. At these locations, there are no crossing structures. Consequently the ditch captures surface runoff at these locations. It appears that the ditch is periodically washed out and repairs required.
- Both ditches are entirely earthen. Typical of small irrigation systems within the region, seepage appears to be occurring at locations where the ditch is 'perched' above the neighboring terrain.
- No structural controls exist for turnouts on either ditch. Each ditch supplies water to the irrigated parcel via small trenches or a culvert through the ditch levee.
- There are no measurement devices located on either ditch.
- At turnout locations, water is applied to the irrigated land through a level trench that spreads the water onto the adjacent land.

### *2.10.3 Russell Ditch Headgate*

The Russell Ditch diverts water from the Sweetwater River in Section 27, Township 30 North, Range 95 West. According to the WSEO water rights tabulation, the ditch diverts under

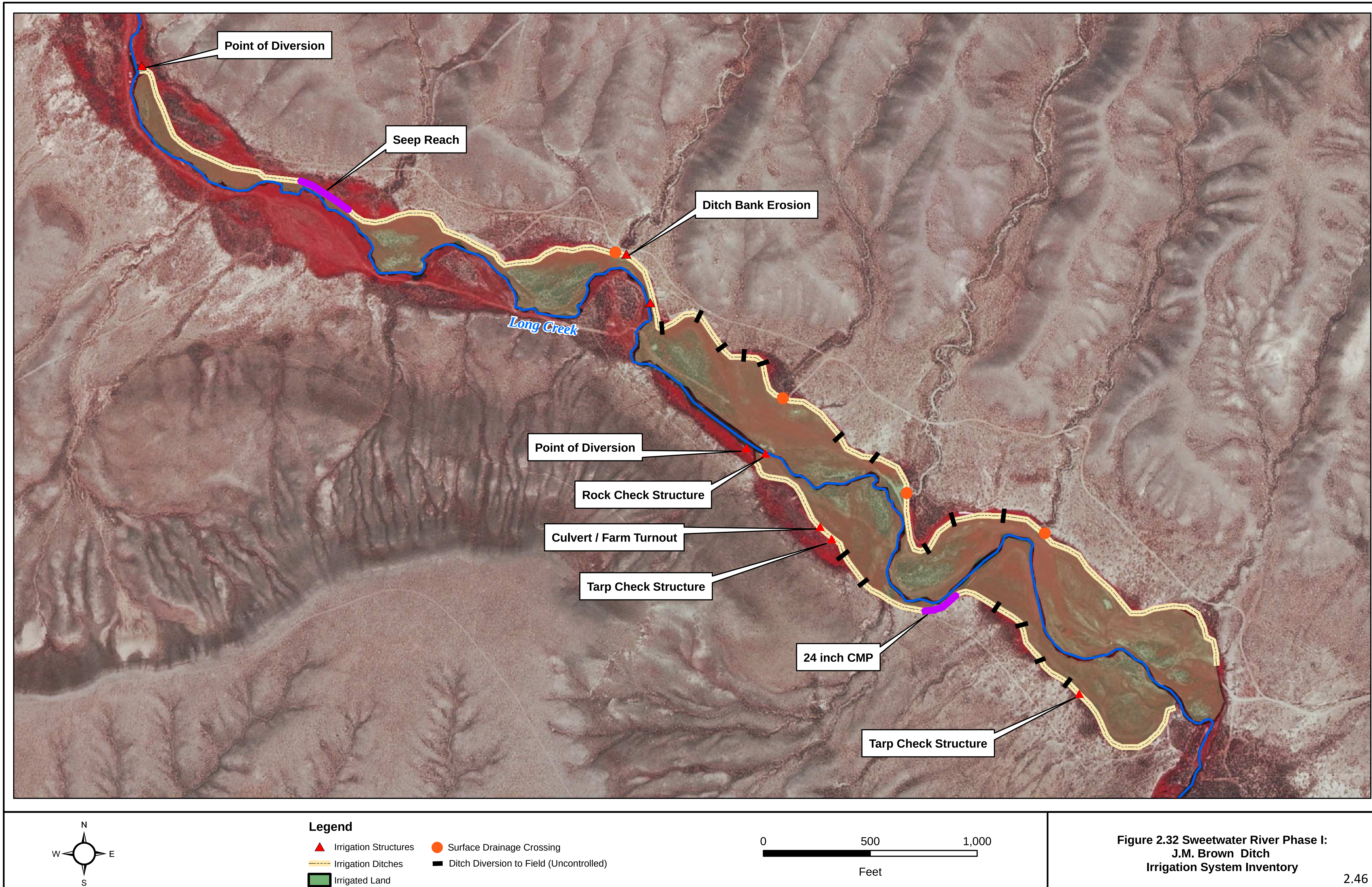



Figure 2.32 Sweetwater River Phase I:
J.M. Brown Ditch
Irrigation System Inventory

Permit No. P1156D with a priority of August 27, 1905 and has the rights to irrigate 212 acres (3 cubic feet per second).

Figure 2.34 displays a photo of the headgate. The following general observations were made during the inventory:

**Figure 2.34 Russell Ditch Headgate.**

- The ditch in the vicinity of the diversion appeared to be in good condition. Only the headgate and its immediate vicinity were evaluated.
- The headgate structure appears to be in fair condition. Concrete apron and walls showed some cracking and deterioration, however, the structure will likely last many years.
- The existing slide gate appears to be difficult to operate and in poor condition. It consists of a wooden gate with chains. Irrigators currently use tarpaulins on the upstream face of the gate to control leakage and flows into the ditch.

### *2.10.4 Independent Ditch Headgate*

The Independent Ditch diverts water from the Sweetwater River in Section 33, Township 30 North, Range 95 West. According to water rights tabulations of the WSEO, the ditch diverts under Permit Nos. P16025D (50 acres/ 0.71 cfs) and P4499E (150 acres / 2.14 cfs) and has a capacity to divert 4.0 cfs.

Figure 2.35 displays a photo of the headgate location and diversion structure. The following general observations were made during the inventory:

- Currently, the ditch headgate is in poor condition and replacement is recommended.
- The diversion structure appears in poor condition and may need rehabilitation in order to enhance diversion capabilities of a reconstructed headgate.
- At the request of the landowner, only this location of the ditch was evaluated.

**Figure 2.35 Independent Ditch Headgate.**

### *2.10.5 Graham and Farnsley Ditch No. 1*

The Graham and Farnsley Ditch No. 1 diverts water from the Sweetwater River in Section 6, Township 29 North, Range 95 West. According to the WSEO water rights tabulation, the ditch diverts under Permit Nos. P1262D (117 acres / 1.65 cubic feet per second) and P3605E (68 acres / 0.97 cubic feet per second). Priority dates for the permits are June 22, 1896 (P1262D) and November 23, 1920 (P3605E).

**Figure 2.36 Splitter Box in Poor Condition on Graham and Farnsley Ditch No. 1.**

At the request of the landowner, a specific problem site was evaluated in his company. Figure 2.36 displays a photograph of a splitter box on the ditch. The following general observations were made during the inventory:

- The splitter box location was the only site the land owner requested the project team to evaluate.
- The existing splitter box is in poor condition and replacement is recommended.
- Concrete had deteriorated and check boards appear to be problematic to install and manage.

### *2.10.6 Jacob Ditch Headgate*

A ditch headgate location was shown to the project team by the current landowner of the surrounding property. The landowner requested information pertaining to restoring diversion capabilities at the location where there is no remaining infrastructure. At that time, there was uncertainty regarding the ditch and permit under which diversions could occur. Preliminary review of water rights data available through the WYSEO's E-Permit website indicates the ditch is the Jacob Ditch (Permit 9554D) with an adjudicated right of 2.29 cubic feet per second (159.6 acres) and a priority date of July 2, 1910.

**Figure 2.37 Headgate Location of the Jacob Ditch.**

The following general observations were made at this site:

- There is currently no headgate or any other associated infrastructure at the ditch diversion (Figure 2.37).
- There is currently no diversion structure in the Sweetwater River to facilitate diversions by the ditch.
- The ditch invert appears to be approximately 2 feet above the ambient (low flow) water level of the Sweetwater River, indicating that a diversion structure would likely be needed in order to divert water at times other than high flows.

### *2.10.7 Koehler Ditch Headgate*

The Koehler Ditch diverts water from the Sweetwater River in Section 10, Township 30 North, Range 94 West. According to the WSEO water rights tabulation, the ditch diverts under permit P18785D with a priority date of September 20, 1935.

At the request of the landowner, the ditch headgate was inspected. The following general observations were made during the inventory:

- The headgate consists of a 36-inch diameter waterman gate and culvert (Figure 2.38).
- There is no headwall associated with the structure.
- Overall, the structure appears to be in poor condition and difficult to operate.

Figure 2.38 Koehler Ditch Headgate.

### *2.10.8 National Ditch Headgate*

The National Ditch diverts water from the Sweetwater River in Section 24, Township 30 North, Range 95 West. According to the WSEO water rights tabulation, the ditch diverts under the following permits:

P69790D: Priority date 12/10/1907 (3.04 cfs / 132 acres)

P2526E: Priority date 11/21/14 (0.31 cfs / 22 acres)

P1730E: Priority date 12/10/07 (0.85 cfs / 60 acres)

The headgate was not inspected specifically. At the request of a landowner associated with the ditch, the diversion location was evaluated to determine the potential for abandonment by the Sweetwater River.

Within the GIS environment, aerial photography taken in 2009 was evaluated. Figure 2.39 displays an overview of the headgate location and meanders of the Sweetwater River. Approximately 900 feet upstream of the headgate, there is a narrow "neck" of land formed by meanders of the river. The Sweetwater River is largely unconfined and has the ability to migrate within a well-defined migration corridor bounded by terraces on both sides of the river.

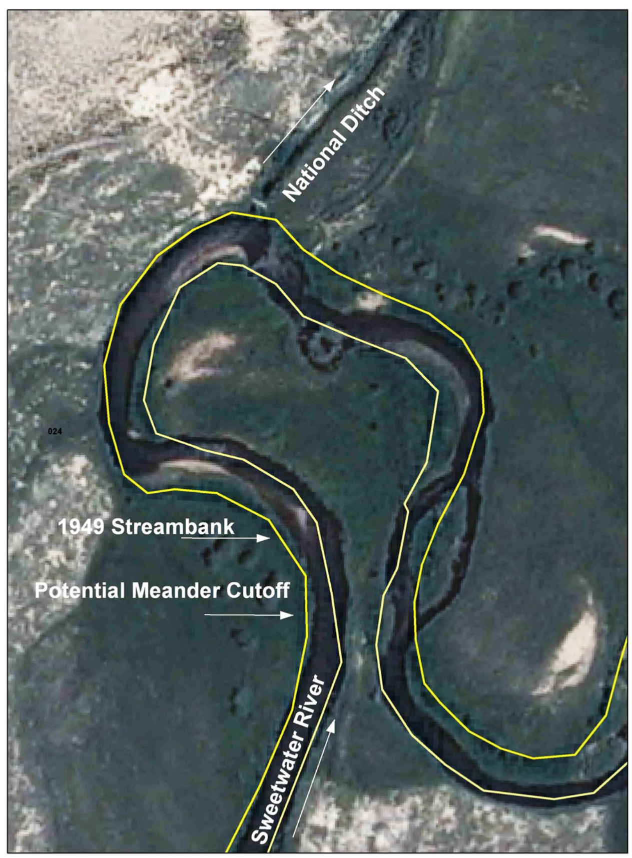



Figure 2.39 National Ditch Headgate Overview.

Examination of the aerial photography shows that the river has historically migrated throughout the migration corridor, as indicated by the numerous abandoned meanders. This natural process is typical of rivers such as the Sweetwater River and it is often desirable to allow the river the “freedom” to meander. However, when existing infrastructure and livelihoods associated with it is threatened, stream stabilization may be prudent.

Figure 2.39 also displays the streambank alignment digitized from the USGS topographic quadrangle, Sweetwater Station. This map was generated by the USGS in 1953 and was based aerial photography dated 1949. As shown in this figure, the right bank of the river (as viewed looking downstream) on the western side of the neck has migrated easterly approximately 25 feet since 1949. It appears likely that the river will cut through the remaining neck at some point in the future without stabilization of stream banks in this vicinity.

# *III. WATERSHED MANAGEMENT AND REHABILITATION PLAN*

# III. WATERSHED MANAGEMENT AND REHABILITATION PLAN

## 3.1 Overview

As stated previously, the objective of this study is to generate a watershed management and irrigation rehabilitation plan that is not only technically sound, but also one that is practical and economically feasible. In conjunction with the development of a database for the watershed, the investigative phase of this study focused on an assessment of the watershed and the identification and evaluation of improvements to address those issues/problems described above. Potential improvements were developed and categorized into the following:

- Irrigation System Conservation and Rehabilitation. 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.

- Stream Channel Condition and Stability. Stream channels within the watershed were characterized with respect to their condition and stability. Impaired channels were identified for further evaluation and alternative improvements developed.

- Livestock / Wildlife Watering Opportunities. Based upon an evaluation of existing water sources and the condition of upland grazing resources, potential upland water source development projects were identified.

- Grazing Management Opportunities. Based upon a review of the pertinent Ecological Site Descriptions (ESDs) and the ambient vegetation and soil conditions, grazing management strategies are presented.

- Other Upland Management Opportunities. Additional watershed management alternatives were identified.

Watershed or irrigation rehabilitation plans have been developed for each category, and are presented in the following portions of this chapter. These plans have been prepared to provide an overview of potential improvements that can partially or fully address the key issues/problems identified within the watershed.

In the remainder of this chapter, the individual plans developed within each discipline are described and evaluated with respect to providing benefits to flood control and low-flow augmentation, and improving the existing water supply through conservation. The results of the geomorphic assessment are further refined to identify those impaired reaches that merit more immediate attention. With respect to irrigation rehabilitation, the plans prepared for the Corbett's irrigation system are further prioritized to identify those improvements that provide the most benefit. In summary, this chapter provides the PACD with a plan that can be used to guide future efforts to enhance the water resources within the Long Creek watershed.

## 3.2 Irrigation System Rehabilitation

### *3.2.1 Irrigation System Rehabilitation Overview*

In this section, a conceptual rehabilitation plan is presented for the inventoried irrigation ditches. The rehabilitation plan represents the integration of individual measures to mitigate problems identified in the inventory phase of the project. Specifically, the improvements that comprise the rehabilitation plan focus on:

- 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 irrigator 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.

In an effort to assist the ditch owner 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 sections, the rehabilitation recommendations associated with the seven ditches which were included in the Phase I study are summarized. Table 3.1 tabulates the specific items at each ditch and the relative priority of each as discussed above.

### *3.2.2 J.M. Brown Ditch Rehabilitation Plan (Corbett)*

Based upon the results of the field inventory, the conceptual rehabilitation plan was developed. Figure 3.1 displays the rehabilitation plan graphically.

The following improvements are included in the plan:

- Permanent diversion structures tied to headgate structures with concrete headwalls should be installed on each of the two ditches.
- Measurement devices are recommended downstream of the headgate on each of the two ditches.
- Under-drain culverts are recommended at each of the five drainage crossings on the eastern ditch.
- At the perched seepage location, an 18-inch plastic irrigation pipe (PIP) is recommended. The PIP would eliminate seepage and provide better protection against damage from cattle/wild horses than a liner. Prior to implementation of this improvement, seepage losses should be quantified in order to determine the viability of the project.
- Check structures are recommended for both ditches at locations to be determined by the ditch owner.

## Table 3.1 Summary of Recommended Irrigation System Improvements.

| Rehabilitation Item Number | Description | Station (feet from headgate) | Priority |
|---|---|---|---|
| **J.M. Brown Ditch East (Corbett)** | | | |
| I-1 | Diversion Structure | 0.0 | 1 |
| I-2 | Install 2-ft Parshall flume | 100 | 2 |
| I-3 | Install 10-inch farm turnout headgates (5) | To Be Determined | 2 |
| I-4 | Install 3-ft wide check structures (3) | To Be Determined | 2 |
| I-5 | Install 24-inch underdrain culverts (4) | Varies | 2 |
| I-6 | Install 8-inch gated pipe (app. 3,000 LF) | To Be Determined | 3 |
| I-7 | Install approx. 300 feet 18-inch PIP at seepage location | 800 to 1100 | 2 |
| **J.M. Brown Ditch West (Corbett)** | | | |
| I-8 | Install diversion structure in creek | 0.0 | 1 |
| I-9 | Install 2-ft Parshall flume | 100 | 2 |
| I-10 | Install 10-inch farm turnout headgates (3) | To Be Determined | 2 |
| I-11 | Install 3-ft wide check structures (3) | To Be Determined | 2 |
| I-12 | Install 8-inch gated pipe (app. 1,200 LF) | To Be Determined | 3 |
| **Russell Ditch** | | | |
| I-13 | Replace existing slide gate with 48-inch slide gate | 0.0 | 1 |
| I-14 | Install 2-ft Parshall flume | 100 | 2 |
| **Independent Ditch** | | | |
| I-15 | Remove existing headgate and replace with 36-inch diameter slide gate/concrete structure | 0.0 | 1 |
| I-16 | Install 2-ft Parshall flume | 100 | 2 |
| **Graham and Farnsley Ditch** | | | |
| I-17 | Remove existing headgate and replace with 36-inch diameter slide | 3860 | 1 |
| I-18 | Install 2-ft Parshall flume | 100 | 2 |
| **Jacob Ditch Headgate** | | | |
| I-18 | Install 24-inch diameter slide gate/concrete headwall | 0 | 1 |
| I-19 | Install 2-ft Parshall flume | 100 | 2 |
| I-20 | Clear vegetation and sediment from Jacob Ditch | 0-2500 | 2 |
| **Koehler Ditch** | | | |
| I-21 | Remove existing headgate and replace with 24-inch diameter slide | 0 | 1 |
| I-22 | Install 2-ft Parshall flume | 100 | 2 |
| **National Ditch** | | | |
| I-23 | Streambank stabilization (J-hook vanes / cross vane weir) | 0 | 1 |
| I-24 | Install 2-ft Parshall flume | 100 | 2 |

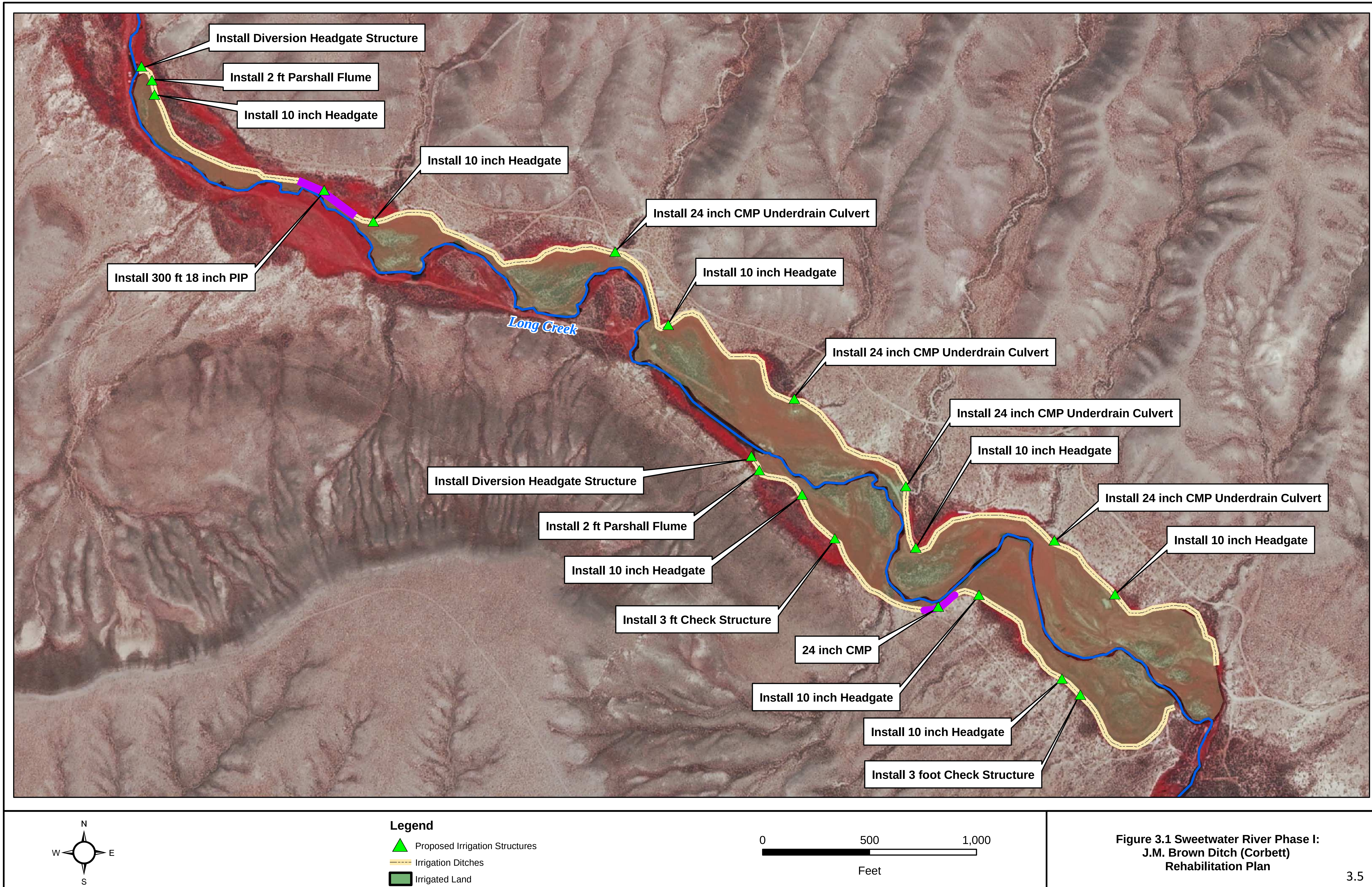



**Figure 3.1 Sweetwater River Phase I: J.M. Brown Ditch (Corbett) Rehabilitation Plan**

- Farm Turnout structures are recommended for each ditch to control delivery to the fields.  Turnouts would consist of Waterman (or equivalent) canal headgates (10-inch). Approximately seven to eight farm turnout structures would likely be required.
- Gated pipe should be installed at selected locations within irrigated parcels under each ditch in an effort to increase efficiency on the irrigated parcel, particularly during periods of low flow when existing flood irrigation methods may not result in efficient delivery of irrigation water.

### *3.2.3 Russell Ditch Headgate Rehabilitation Plan*

Based upon the results of the field inventory, the conceptual rehabilitation plan was developed.  (Due to the simplicity of recommendations, a figure displaying a rehabilitation plan is not included).  As discussed in Chapter 2, the headgate is the only structure associated with the Russell Ditch that was evaluated.

The following components would be included in the plan as displayed Table 3.1:

- The existing wooden slide gate should be removed and replaced with a 48-inch slide gate within the existing concrete structure.
- Install measurement device (24-inch Parshall flume) on the Russell Ditch.

### *3.2.4 Independent Ditch Headgate Rehabilitation Plan*

Based upon the results of the field inventory, the conceptual rehabilitation plan was developed.  (Due to the simplicity of recommendations, a figure displaying a rehabilitation plan is not included).  As discussed in Chapter 2, the headgate is the only structure associated with the Independent Ditch that was evaluated.

The following components would be included in the plan as displayed Table 3.1:

- The existing headgate structure should be removed
- A 36-inch diameter slide gate and concrete headwall should be installed.

### *3.2.5 Graham and Farnsley Ditch No. 1 Rehabilitation Plan*

Based upon the results of the field inventory, the conceptual rehabilitation plan was developed. (Due to the simplicity of recommendations, a figure displaying a rehabilitation plan is not included). As discussed in Chapter 2, the splitter box is the only structure associated with the Graham and Farnsley Ditch that was evaluated.

The following components would be included in the plan as displayed Table 3.1:

- The existing splitter box should be removed.
- A new concrete splitter box should be installed in the location of the existing structure.
- Two 18-inch slide gates should be installed in the replacement splitter box.
- A measurement device (24-inch Parshall flume) should be installed on the ditch.

### *3.2.6 Jacob Ditch Headgate Rehabilitation Plan*

Based upon the results of the field inventory, the conceptual rehabilitation plan was developed. (Due to the simplicity of recommendations, a figure displaying a rehabilitation plan is not included). As discussed in Chapter 2, the headgate location is the only structure associated with the Jacob Ditch that was evaluated.

The following components would be included in the plan as displayed in Table 3.1.

- The existing ditch appears to have not been used in a number of years. It is recommended that the ditch be cleared of vegetation and sediment.
- There is currently no headgate structure on the ditch. Consequently a new headgate/concrete support structure is recommended.
- The new headgate structure should incorporate a 24-inch circular slide gate or its equivalent.
- A measurement device (24-inch Parshall flume) should be installed on the ditch.

### *3.2.7 Koehler Ditch Headgate Rehabilitation Plan*

Based upon the results of the field inventory, the conceptual rehabilitation plan was developed. (Due to the simplicity of recommendations, a figure displaying a rehabilitation plan is not included). As discussed in Chapter 2, the headgate location is the only structure associated with the Koehler Ditch that was evaluated.

The following components would be included in the plan as displayed in Table 3.1.

- A 36-inch diameter slide gate and concrete headwall should be installed.
- A measurement device (24-inch Parshall flume) should be installed on the ditch.

### *3.2.8 National Ditch Headgate Rehabilitation Plan*

As discussed in Chapter 2, bank erosion and natural channel migration at this location threatens to cutoff a meander of the channel resulting in loss of irrigation diversion capabilities. The following components would be included in the plan as displayed in Table 3.1:

- Bank protection measures such as J-hook vanes installed in the Sweetwater River could reduce erosion and thereby reduce the chances of cutoff occurring. J-hook vanes would be required on both the east and west side of the cutoff area (Figure 3.2).
- Streamflow concentrating structures, such as cross-vane weirs, could also be employed to deflect the streamflow from the eroding bank (Figure 3.3).
- A measurement device (24-inch Parshall flume) should be installed on the ditch.

Completion of the channel stabilization and restoration projects in conjunction with an irrigation headgate would likely not require a 404 permit through the USCOE 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.

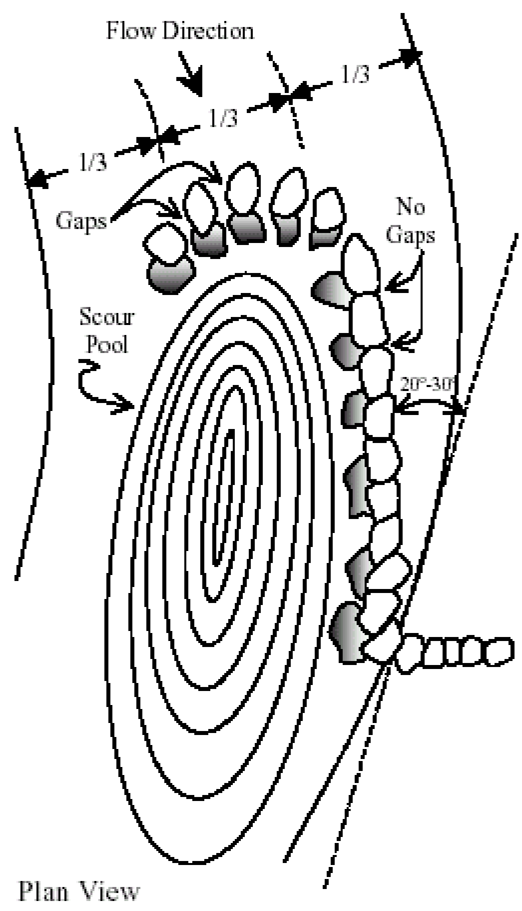



**Figure 3.2 Conceptual Design for J-Hook Vane Stream Channel Stabilization Structure (from Rosgen, 2001)**.

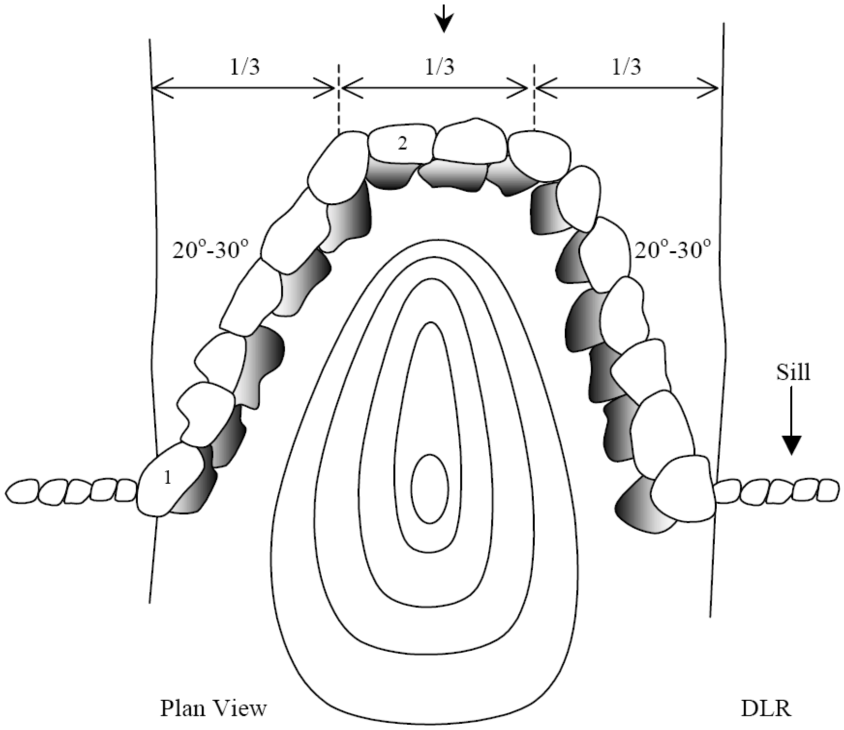



**Figure 3.3 Conceptual Design for Cross-Vane Stream Channel Stabilization Structure (from Rosgen, 2001).**

### *3.2.9 Summary of Irrigation System Components*

Twenty three individual irrigation system components were identified within the Phase I study area. Table 3.2 summarizes the projects and their conceptual costs.

## 3.3 Stream Channel Condition and Stability

The general conditions of the primary stream channels were evaluated during the geomorphic investigation. Proper Functioning Condition (PFC) data were obtained from the BLM Lander District office and incorporated into the assessment. During the evaluation of existing channel conditions, several impaired reaches were identified and two classes of impairments noted. The impairments were classified as indicated below:

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

## Table 3.2 Summary of Recommended Irrigation System Improvements and Conceptual Cost Estimates.

| Rehabilitation Item Number | Description | Station (feet from headgate) | Priority | Construction Cost | Engineering (10%) | Construction and Engineering Subtotal | Contingency (15%) | Total Construction Cost | Final Plans and Specs | Permitting / Legal Fees / Acces and Rights of Way | Total Project Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **J.M. Brown Ditch East (Corbett)** | | | | | | | | | | | |
| I-1 | Diversion Structure | 0.0 | 1 | $18,000 | $1,800 | **$19,800** | $3,000 | **$22,800** | $3,000 | $2,000 | $27,800 |
| I-2 | Install 2-ft Parshall flume | 100 | 2 | $2,000 | $200 | **$2,200** | $300 | **$2,500** | $500 | | $3,000 |
| I-3 | Install 10-inch farm turnout headgates (5) | To Be Determined | 2 | $10,000 | $1,000 | **$11,000** | $1,700 | **$12,700** | $1,800 | | $14,500 |
| I-4 | Install 3-ft wide check structures (3) | To Be Determined | 2 | $6,000 | $600 | **$6,600** | $1,000 | **$7,600** | $2,000 | | $9,600 |
| I-5 | Install 24-inch underdrain culverts (4) | Varies | 2 | $8,000 | $800 | **$8,800** | $1,300 | **$10,100** | $3,000 | | $13,100 |
| I-6 | Install 8-inch gated pipe (app. 3,000 LF) | To Be Determined | 3 | $1,000 | $100 | **$1,100** | $200 | **$1,300** | $1,000 | | $2,300 |
| I-7 | Install approx. 300 feet 18-inch PIP at seepage location | 800 to 1100 | 2 | $4,000 | $400 | **$4,400** | $700 | **$5,100** | $1,600 | | $6,700 |
| **J.M. Brown Ditch West (Corbett)** | | | | | | | | | | | |
| I-8 | Install diversion structure in creek | 0.0 | 1 | $18,000 | $1,800 | **$19,800** | $3,000 | **$22,800** | $3,000 | $2,000 | $27,800 |
| I-9 | Install 2-ft Parshall flume | 100 | 2 | $2,000 | $200 | **$2,200** | $300 | **$2,500** | $500 | | $3,000 |
| I-10 | Install 10-inch farm turnout headgates (3) | To Be Determined | 2 | $6,000 | $600 | **$6,600** | $1,000 | **$7,600** | $1,800 | | $9,400 |
| I-11 | Install 3-ft wide check structures (3) | To Be Determined | 2 | $6,000 | $600 | **$6,600** | $1,000 | **$7,600** | $2,000 | | $9,600 |
| I-12 | Install 8-inch gated pipe (app. 1,200 LF) | To Be Determined | 3 | $4,000 | $400 | **$4,400** | $700 | **$5,100** | $1,000 | | $6,100 |
| **Russell Ditch** | | | | | | | | | | | |
| I-13 | Replace existing slide gate with 48-inch slide gate | 0.0 | 1 | $6,000 | $600 | **$6,600** | $1,000 | **$7,600** | $2,000 | | $9,600 |
| I-14 | Install 2-ft Parshall flume | 100 | 2 | $3,000 | $300 | **$3,300** | $500 | **$3,800** | $500 | | $4,300 |
| **Independent Ditch** | | | | | | | | | | | |
| I-15 | Remove existing headgate and replace with 36-inch diameter slide gate/concrete structure | 0.0 | 1 | $10,000 | $1,000 | **$11,000** | $1,700 | **$12,700** | $2,000 | | $14,700 |
| I-16 | Install 2-ft Parshall flume | 100 | 2 | $3,000 | $300 | **$3,300** | $500 | **$3,800** | $500 | | $4,300 |
| **Graham and Farnsley Ditch** | | | | | | | | | | | |
| I-17 | Remove existing headgate and replace with 36-inch diameter slide | 3860 | 1 | $4,000 | $400 | **$4,400** | $700 | **$5,100** | $2,000 | | $7,100 |
| I-18 | Install 2-ft Parshall flume | 100 | 2 | $3,000 | $300 | **$3,300** | $500 | **$3,800** | $500 | | $4,300 |
| **Jacob Ditch Headgate** | | | | | | | | | | | |
| I-18 | Install 24-inch diameter slide gate/concrete headwall | 0 | 1 | $8,000 | $800 | **$8,800** | $1,300 | **$10,100** | $2,000 | | $12,100 |
| I-19 | Install 2-ft Parshall flume | 100 | 2 | $3,000 | $300 | **$3,300** | $500 | **$3,800** | $500 | | $4,300 |
| I-20 | Clear vegetation and sediment from Jacob Ditch | 0-2500 | 2 | $4,000 | $400 | **$4,400** | $700 | **$5,100** | $0 | | $5,100 |
| **Koehler Ditch** | | | | | | | | | | | |
| I-21 | Remove existing headgate and replace with 24-inch diameter slide | 0 | 1 | $8,000 | $800 | **$8,800** | $1,300 | **$10,100** | $2,000 | | $12,100 |
| I-22 | Install 2-ft Parshall flume | 100 | 2 | $3,000 | $300 | **$3,300** | $500 | **$3,800** | $500 | | $4,300 |
| **National Ditch** | | | | | | | | | | | |
| I-23 | Streambank stabilization (J-hook vanes / cross vane weir) | 0 | 1 | $75,000 | $7,500 | **$82,500** | $12,400 | **$94,900** | $2,000 | $3,000 | $99,900 |
| I-24 | Install 2-ft Parshall flume | 100 | 2 | $3,000 | $300 | **$3,300** | $500 | **$3,800** | $500 | | $4,300 |

The Long Creek mainstem, West Fork Long Creek, and East Fork Long Creek can generally be characterized as geomorphically stable. Bed material throughout most of the study area is relatively coarse, resulting in well-armored channel bed conditions. Consequently, the channels are somewhat resilient to incision. Localized bank erosion due to horizontal migration of the stream channels was noted and appears to be consistent with natural channel evolution and behavior.

Localized riparian degradation is evident within several reaches of Long Creek. East Fork Long Creek, which is a spring-fed perennial stream, appears to be moderately impacted throughout most of its course (i.e., within the Long Creek Pasture). However, within the Granite Mountain Allotment a greater extent of bank erosion and channel degradation was noted.

Various approaches can be taken during typical 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. For instance, methods of restoring incised channels may include construction of gradient restoration facilities (i.e., drop structures) within the incised channel. Based upon the results of this Level I investigation, 'hard' engineering options do not appear to be warranted.

Examples of "soft" approaches include a variety of Best Management Practices (BMPs). Table 3.3 summarizes several BMP strategies available for the impairments noted in the study area. Examples of BMPs designed for channel restoration activities include grazing management alternatives previously discussed, establishment of riparian buffers, etc. 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 3.3 Summary of Channel Restoration Strategies.**

| Impairment | Restoration Strategy |
|---|---|
| **Riparian Vegetation Degradation**: | Grazing management |
| | Riparian buffer zones |
| | Revegetation |
| **Riparian Degradation:** | Restoration of channel profile |
| | Structural rehabilitation measures |
| | Non-structural rehabilitation measures |

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. If further study of reservoir storage is planned within the watershed, the potential effects of such storage on stream stability/geomorphic conditions should be evaluated in appropriate detail as part of those studies. This may also result in identification of further opportunities not only to minimize impacts of any such new storage, but also to improve stream conditions with proper reservoir operations management and implementation of appropriate "hard" and/or "soft" measures as described above.

## 3.4 Surface Water Storage Opportunities

Development of additional storage has been identified as a potential objective within the Long Creek watershed. Storage could be developed as a source of irrigation water for irrigators within the Long Creek watershed and for irrigators on the Sweetwater River downstream. It must be kept in mind when reviewing these alternatives, that evaluation of any storage opportunities would first require evaluation of existing Wyoming water law, specifically, adherence to requirements of the North Platte River Decree.

Four potential reservoir storage opportunities were identified within the Long Creek basin through review of existing topography (Figure 3.4). Sites were selected based upon topographic features facilitating dam and reservoir construction. Based upon existing topographic maps, conceptual-level designs were completed, including estimates of dam size, dam configuration, and reservoir storage capacity.

Potential reservoir yield was estimated using regional hydrologic relationships presented by the USGS (Lowham, 1976). These methods are typically utilized in the absence of measured hydrologic data and are suitable for this level of investigation. Should any of these alternatives be carried forward to further investigation, detailed hydrologic evaluation of the yield for each reservoir will be required. In addition, detailed geologic and geotechnical investigations would be required.

Additional reservoir attributes, including soils, geology, environmental issues, etc, were evaluated based upon existing information and the project Geographic Information System (GIS). Information pertaining to each reservoir alternative is tabulated in a matrix format presented as Table 3.4.

The reservoirs identified are listed below.

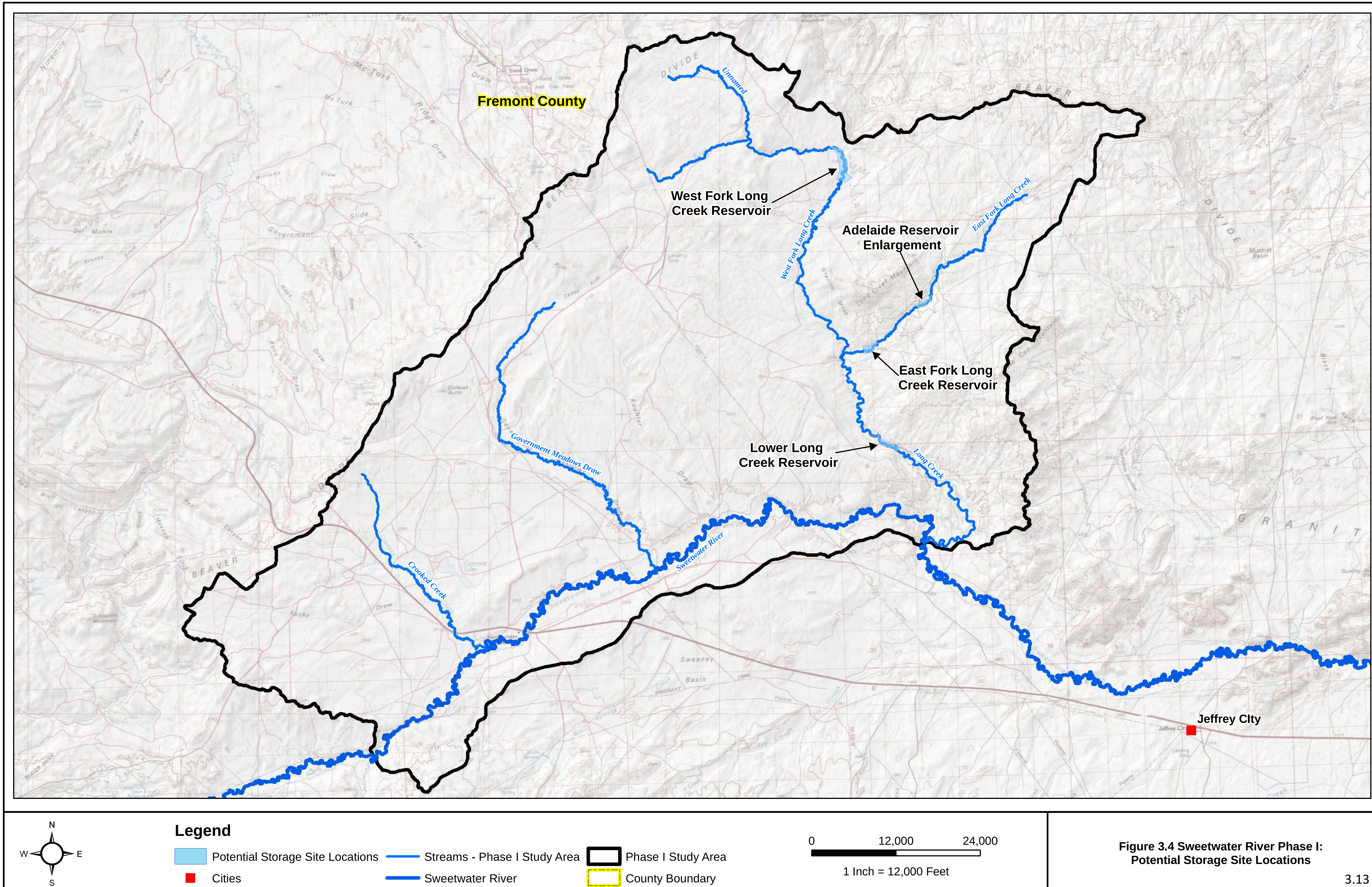



**Figure 3.4 Sweetwater River Phase I: Potential Storage Site Locations**

**Table 3.4 Sweetwater River Phase I Study Area: Reservoir Evaluation Matrix.**

| Site # | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Site Name | Lower Long Creek Reservoir | East Fork Long Creek Reservoir | Adilaide Reservoir Enlargement | Upper West Fork Long Creek Reservoir |
| **Tributary Location** | Lower Long Creek | East Fork Long Creek | East Fork Long Creek | West Fork Long Creek |
| **Surface Ownership** | Private | Private | State | BLM |
| **Reservoir Description** | | | | |
| **On-Channel / Off-Channel** | On-Channel | On-Channel | On-Channel | On-Channel |
| **Supply Source** | Lower Long Creek | East Fork Long Creek | East Fork Long Creek | West Fork Long Creek |
| **Supply Mechanism** | Mainstem Dam | Mainstem Dam | Mainstem Dam | Mainstem Dam |
| **Drainage Areas (square miles)** | 93.0 | 24.8 | 22.4 | 27.3 |
| **Reservoir Statistics** | | | | |
| Capacity (acre-feet) | 1,700 | 860 | 850 | 1,000 |
| Surface Area (acres) | 57 | 30 | 27 | 140 |
| Estimated Runoff Volume (acre-feet) | 2,231 | 1,065 | 1,005 | 1,124 |
| **Irrigation Benefits** | | | | |
| Long Creek Watershed (acres) | 42 | 52 | 52 | 42 |
| Sweetwater River Watershed (acres) | 6,140 | 6,140 | 6,140 | 6,140 |
| **Dam Description** | | | | |
| **Dam Statistics** | | | | |
| Dam Height (feet) | 60 | 30 | 60 | 20 |
| Dam Base (feet) at 2:5 face | 340 | 190 | 340 | 140 |
| Dam Length (feet) | 810 | 960 | 625 | 984 |
| Total Dam Volume (cy) | 342,000 | 122,667 | 263,889 | 65,600 |
| Storage Efficiency (ac-ft/1000cy fill) | 5.0 | 7.0 | 3.2 | 15.2 |
| **Site Geology** | | | | |
| Presence of Karst | No | No | No | Possible |
| Seepage | Possible | Possible | Possible | Possibly Significant |
| Geologic Structure | | | | |
| Dispersive / Soluble soils | Unknown | Unknown | Unknown | Unknown |
| Foundation Strength | Unknown | Unknown | Unknown | Unknown |
| **Hydropower Potential** | | | | |
| Relative potential to develop hydropower | Average | Average | Average | Low |
| **Environmental Issues / Infrastructure** | | | | |
| Dispersive / Soluble soils | Unknown | Unknown | Unknown | Unknown |
| Foundation Strength | Unknown | Unknown | Unknown | Unknown |
| **Environmental Issues** | | | | |
| T&E Species | Minimal | Minimal | Minimal | Moderate |
| Wetlands | Significant | Moderate | Moderate | Minimal |
| Riparian Areas | Moderate | Moderate | Moderate | Moderate |
| Wildlife / Fishery | Moderate | Moderate | Moderate | Minimal |
| Irrigated Acreage | Minimal | Minimal | Minimal | Minimal |
| **Infrastructure** | | | | |
| Residences | None | None | None | None |
| Transportation / Railroad | None | None | None | None |
| Irrigation Canal Improvements | None | None | None | None |
| Other | None | None | None | None |
| **Economic Considerations** | | | | |
| **Estimated Construction** | | | | |
| Total Project Cost | $5,472,844 | $3,724,867 | $4,725,338 | $3,145,074 |
| Total Project per cubic yard of fill | $16.00 | $30.37 | $17.91 | $47.94 |
| Total Project per ac-ft of storage | $3,219.32 | $4,331.24 | $5,559.22 | $3,145.07 |

| | |
|---|---|
| Favorable or Adequate | (green) |
| Potential Fatal Flaw or unfavorable value | (yellow) |
| Probable fatal flaw or very unfavorable value | (pink) |

### *3.4.1 Surface Water Storage Site 1: Lower Long Creek Reservoir*

This potential reservoir site is located on the mainstem of Long Creek approximately five miles upstream of its confluence with the Sweetwater River (Figure 3.5). The drainage area contributing to this reservoir is approximately 93.0 square miles. The storage capacity of the reservoir would be approximately 1,700 acre-feet with an embankment of approximately 60 feet. Based upon preliminary hydrologic estimates, the estimated runoff in a normal year would be approximately 2,231 acre-feet. The surface area of the reservoir at maximum capacity would be approximately 57 acres. This reservoir would provide local benefits to approximately 42 irrigated acres and potentially to more than 6,000 irrigated acres on the Sweetwater River. The reservoir would inundate about one mile of Long Creek and approximately 27 acres of wetlands based upon National Wetlands Inventory (NWI) mapping.

The total estimated cost of this reservoir would be about $5.47 million. This value translates to about $3,200 per acre-foot of storage.

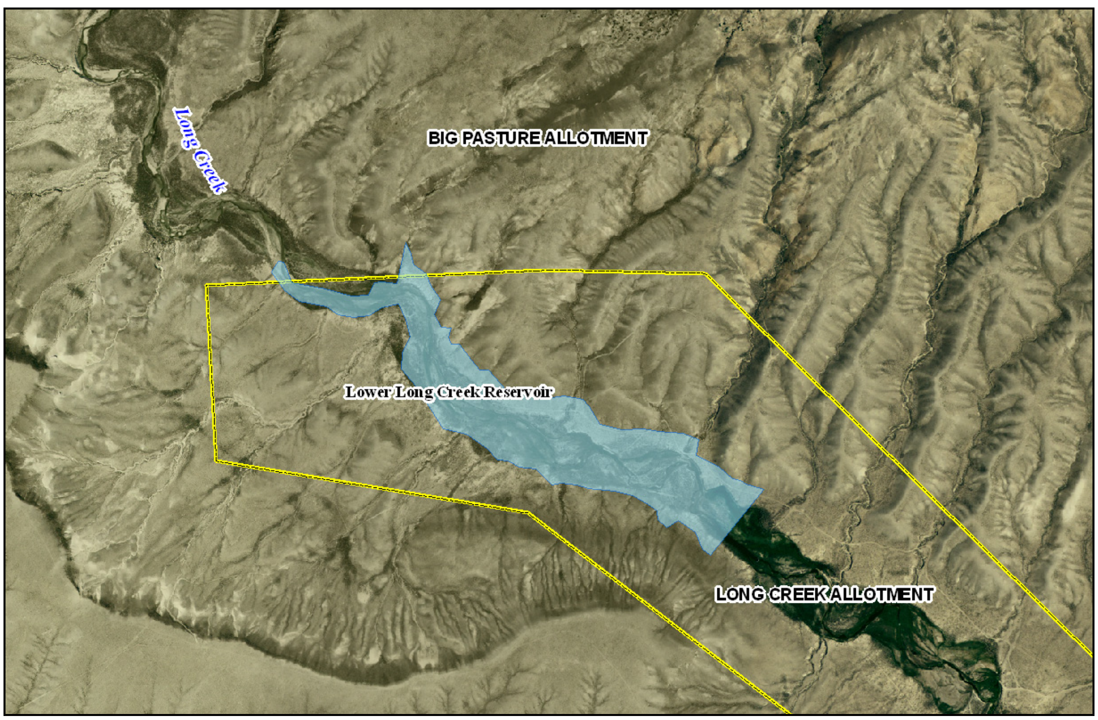



**Figure 3.5 Surface Water Storage Site 1: Lower Long Creek Reservoir.**

### *3.4.2 Surface Water Storage Site 2: East Fork Long Creek Reservoir*

This potential reservoir site is located on the mainstem of East Fork Long Creek approximately one half mile upstream of its confluence with the Long Creek (Figure 3.6). The drainage area contributing to this reservoir is approximately 24.8 square miles. The storage capacity of the reservoir would be approximately 860 acre-feet with an embankment of approximately 30 feet. Based upon preliminary hydrologic estimates, the estimated runoff in a normal year would be approximately 1,065 acre-feet. The surface area of the reservoir at maximum capacity would be approximately 30 acres. This reservoir would provide local benefits to approximately 52 irrigated acres and potentially to more than 6,000 irrigated acres on the Sweetwater River. The reservoir would inundate about one half mile of East Fork Long Creek and approximately 1.5 acres of wetlands based upon NWI mapping.

The total estimated cost of this reservoir would be about $3.72 million. This value translates to about $4,300 per acre-foot of storage.

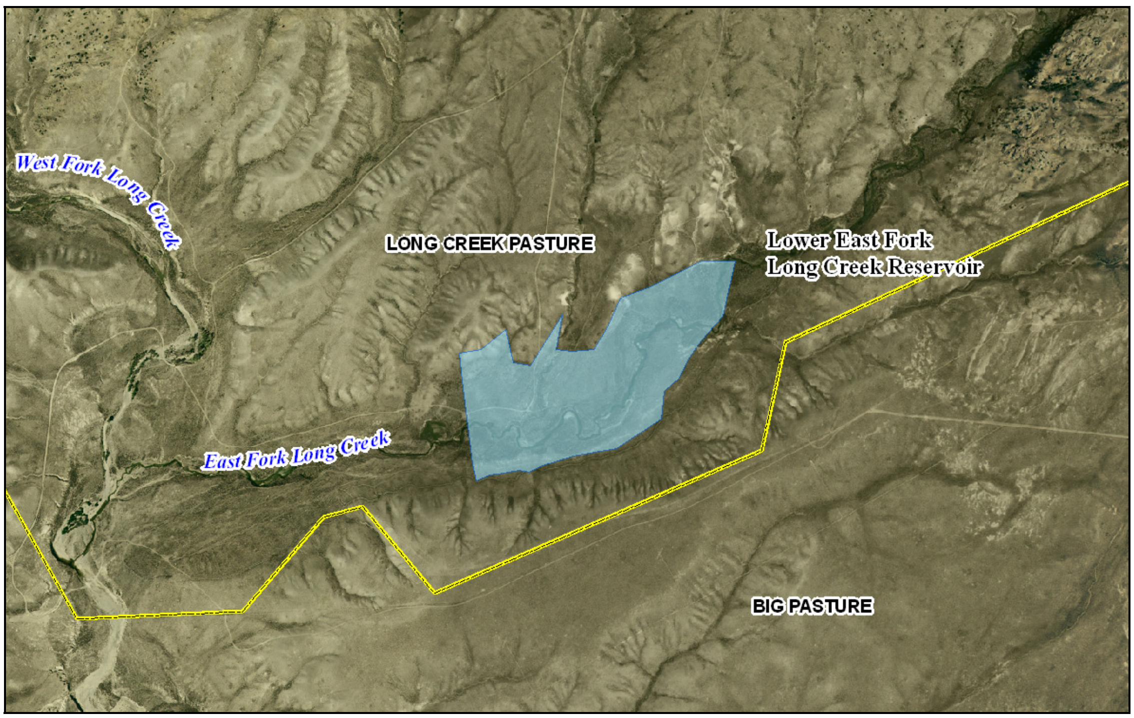



**Figure 3.6 Surface Water Storage Site 2: East Fork Long Creek Reservoir.**

### *3.4.3 Surface Water Storage Site 3: Adelaide Reservoir Enlargement*

This potential reservoir site is located on the mainstem of East Fork Long Creek at the site of the existing Adelaide Reservoir. Under this alternative, the existing embankment would be replaced to facilitate construction of a larger reservoir (Figure 3.7). The drainage area contributing to this reservoir is approximately 22.4 square miles. The storage capacity of the reservoir would be approximately 850 acre-feet with an embankment of approximately 60 feet.

Based upon preliminary hydrologic estimates, the estimated runoff in a normal year would be approximately 1,005 acre-feet. The surface area of the reservoir at maximum capacity would be approximately 27 acres. This reservoir would provide local benefits to approximately 52 irrigated acres and potentially to more than 6,000 irrigated acres on the Sweetwater River. The reservoir would inundate about one half mile of East Fork Long Creek and approximately 1.6 acres of wetlands based upon NWI mapping.

The total estimated cost of this reservoir would be about $4.72 million. This value translates to about $5,560 per acre-foot of storage.

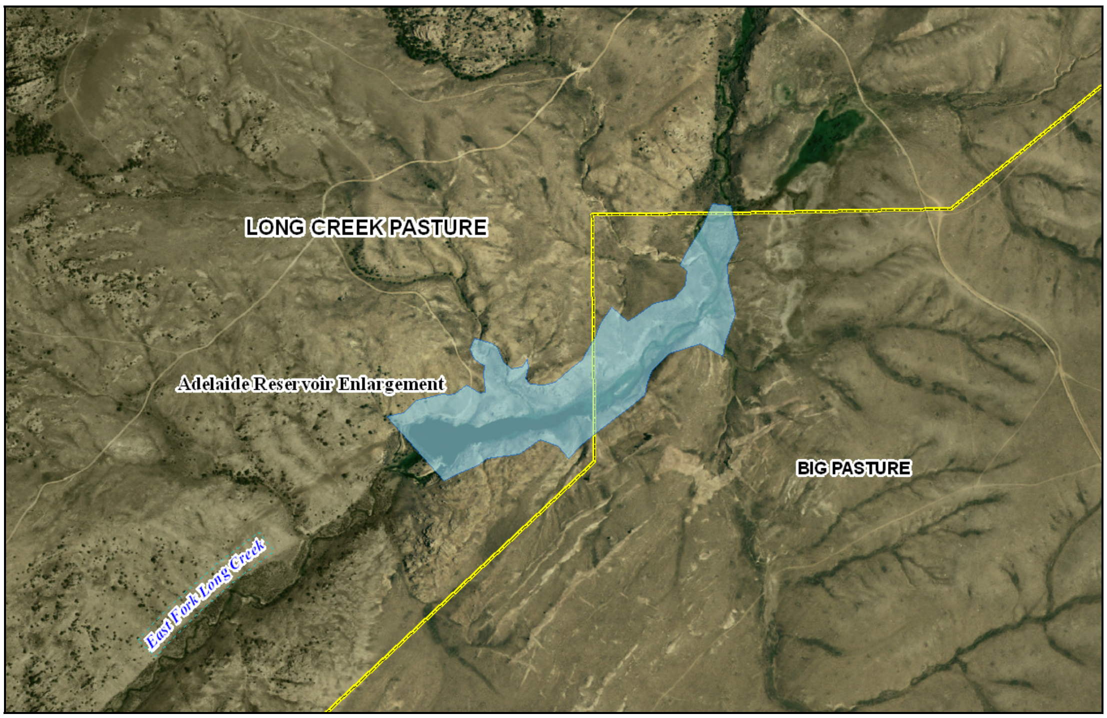



**Figure 3.7 Surface Water Storage Site 3: Adelaide Reservoir Enlargement.**

### *3.4.4 Surface Water Storage Site 4: West Fork Long Creek Reservoir*

This potential reservoir site is located on the mainstem of West Fork Long Creek (Figure 3.8). The drainage area contributing to this reservoir is approximately 27.3 square miles. The storage capacity of the reservoir would be approximately 1,000 acre-feet with an embankment of approximately 20 feet. Based upon preliminary hydrologic estimates, the estimated runoff in a normal year would be approximately 1,124 acre-feet. The surface area of the reservoir at maximum capacity would be approximately 140 acres. This reservoir would provide local benefits to approximately 52 irrigated acres and potentially to more than 6,000 irrigated acres on the Sweetwater River. The reservoir would inundate about one half mile of East Fork Long Creek and approximately 1.5 acres of wetlands based upon NWI mapping.

The total cost of this reservoir is estimated to be about $3.14 million. This value translates to about $3,145 per acre-foot of storage.

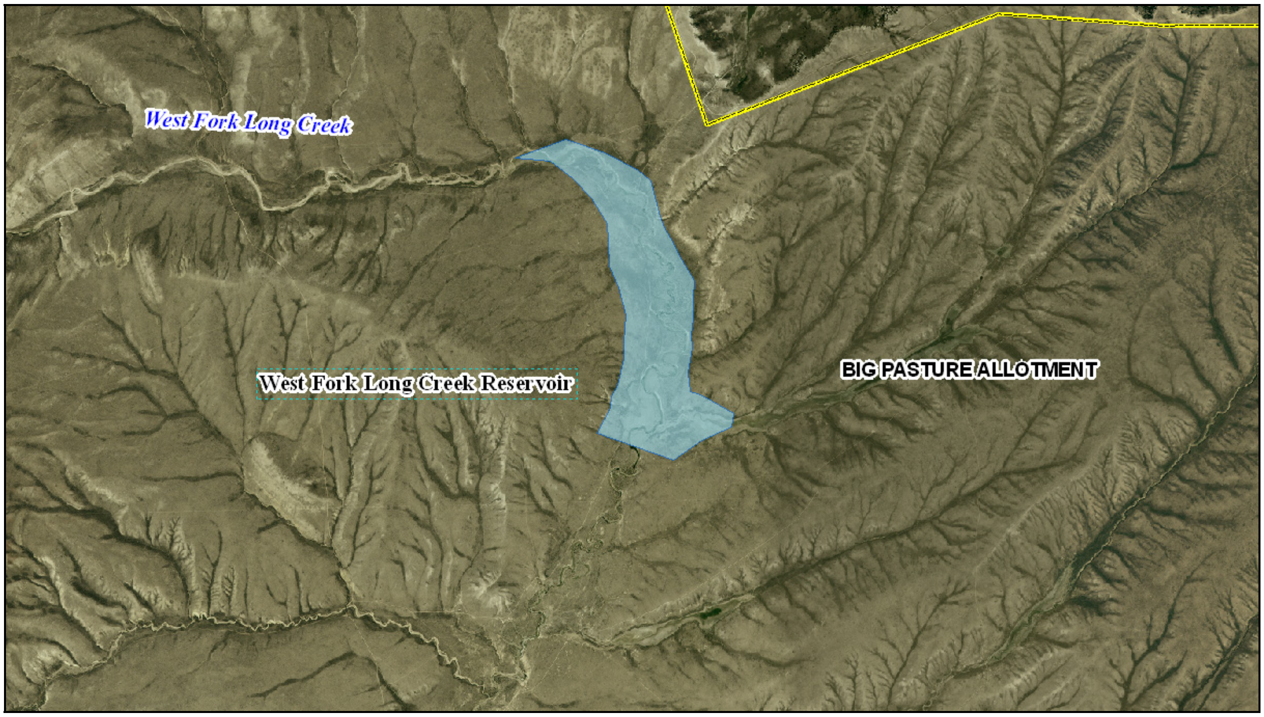



**Figure 3.8 Surface Water Storage Site 4: West Fork Long Creek Reservoir.**

## 3.5 Livestock / Wildlife Watering Opportunities

Given the relatively gentle topography throughout most of the watershed, existing water sources were assumed to be capable of providing water to livestock within a one-mile radius. Based upon this premise, buffers were drawn around existing water sources. (Figure 3.9). The objective of the livestock / wildlife watering investigation was to evaluate alternative upland water supplies. Consequently, Figure 3.9 does not show buffers about perennial / intermittent streams. As indicated in this figure, a large portion of the watershed is adequately supplied with water sources. However, based upon this analysis, several areas may benefit by the development of upland water sources. In addition, allotment permittees indicated locations where existing sources could be developed or infrastructure enhanced.

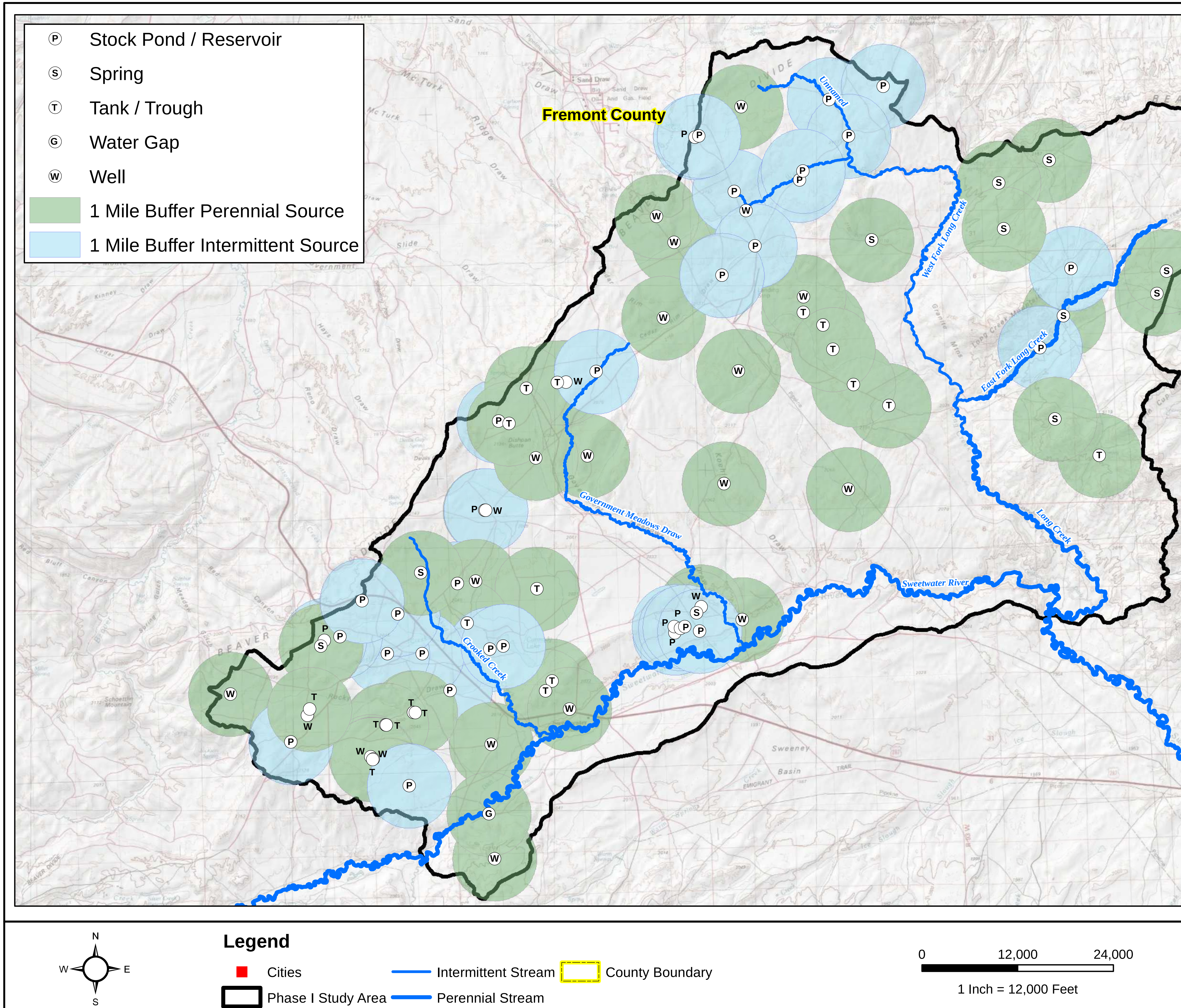



**Figure 3.9 Sweetwater River Phase I: Existing Water Sources with 1 Mile Buffers**

Based upon 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 provide 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. Figure 3.10 displays the location of the proposed projects.

### *3.5.1 East Fork Long Creek Wells Project (Plan Component L/W-01)*

Under this alternative, one to two wells would be drilled within the area, and be equipped with solar pumps and stock tanks. Previous evaluation of this option by the NRCS on behalf of Jack Corbett concluded that a well drilled approximately 200 to 450 feet deep would have an estimated yield of 2 to 10 gallons per minute. Static water level was estimated to be between 75 and 250 feet below the surface (Figure 3.11).

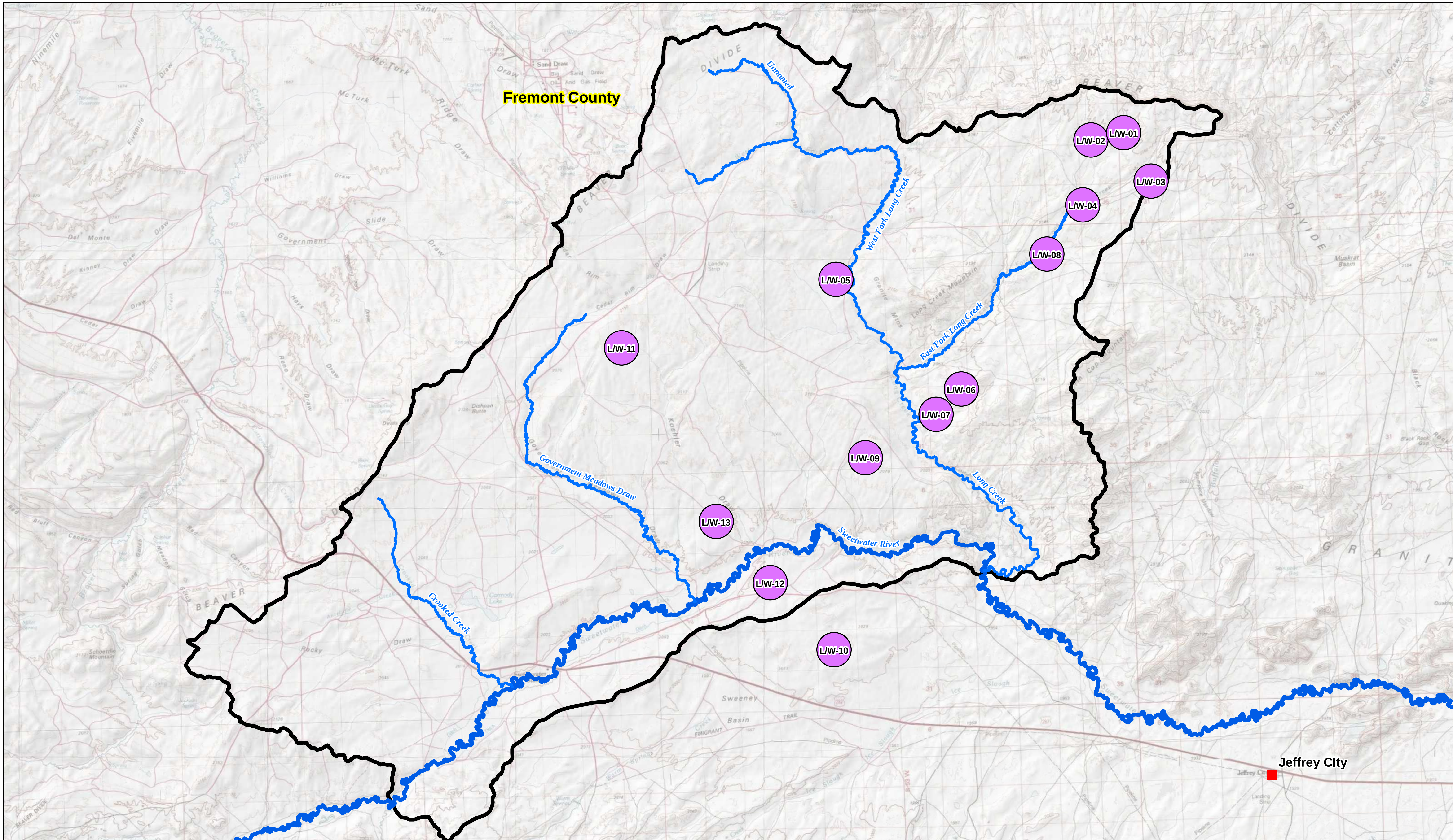
Under this alternative, the following components have been identified:

- Two wells would be drilled within the area, gravel packed, and constructed using PVC casing. Depths of the wells are assumed to be approximately 400 feet.
- Each well would be equipped with a solar powered pump.
- Stock tanks would be provided at each well location.

### *3.5.2 East Fork Long Creek Reservoirs Project (Plan Component L/W-02)*

This alternative involves completion of two small stock reservoirs within the area. The BLM has evaluated two potential stock reservoir sites within this area. Initial soils investigations indicated shallow gravelly layers which would prohibit water retention; consequently, no further action has been completed with respect to these projects (Figure 3.12).

Construction of stock reservoirs are included in this plan with the assumption the ponds would be lined with a geotextile material (e.g. Teranap). Each pond would then be equipped with a pipe feeding a stock tank and be fenced to prevent cattle from damaging the liner.




N
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**Legend**

- Project Locations (L/W-03)
- Cities
- Phase I Study Area
- Streams - Phase I Study Area
- Sweetwater River
- County Boundary

0 12,000 24,000

1 Inch = 12,000 Feet

**Figure 3.10 Sweetwater River Phase I: Locations of Proposed Wildlife and Livestock Water Supply Projects**

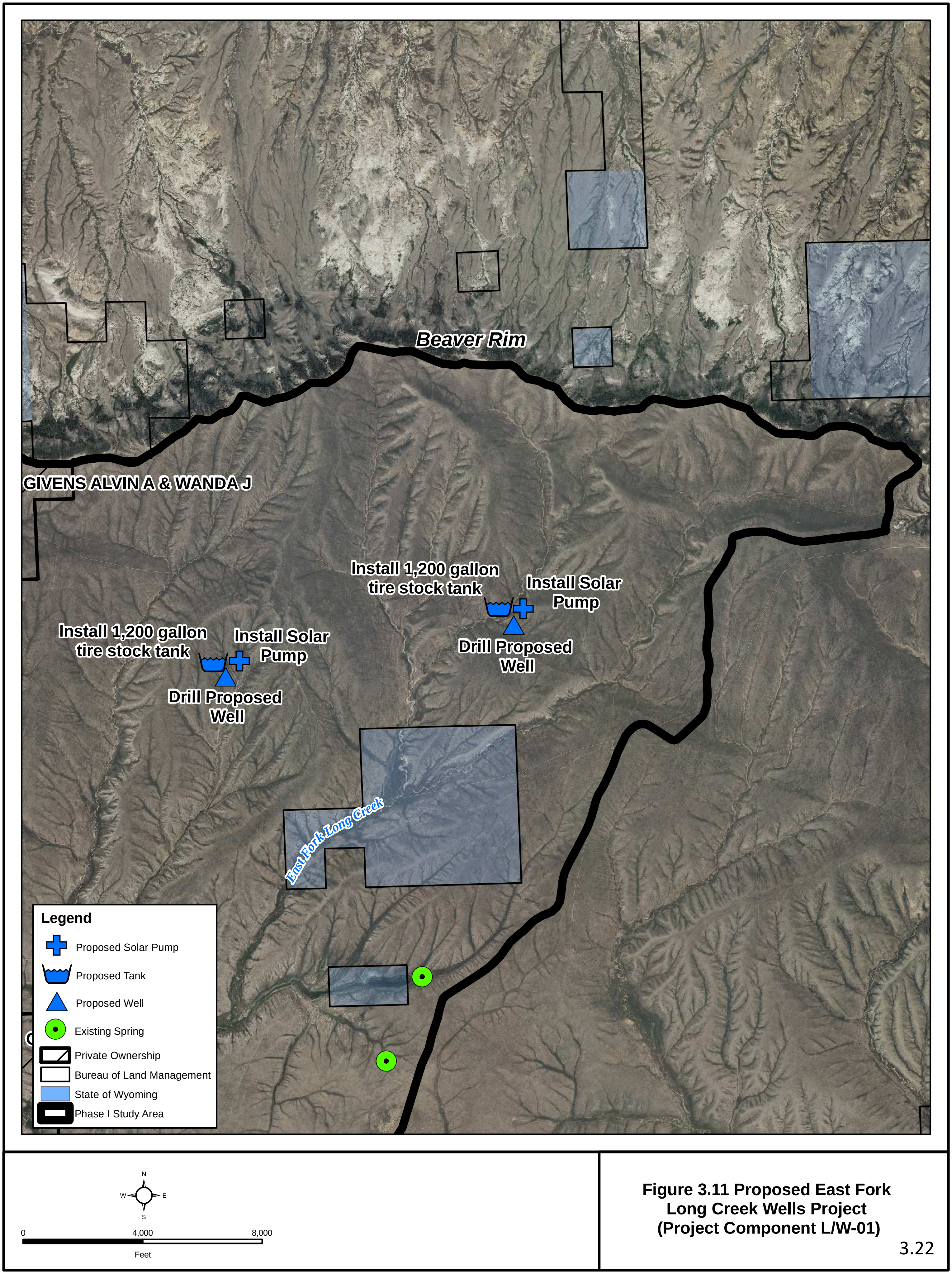


**Figure 3.11 Proposed East Fork Long Creek Wells Project (Project Component L/W-01)**

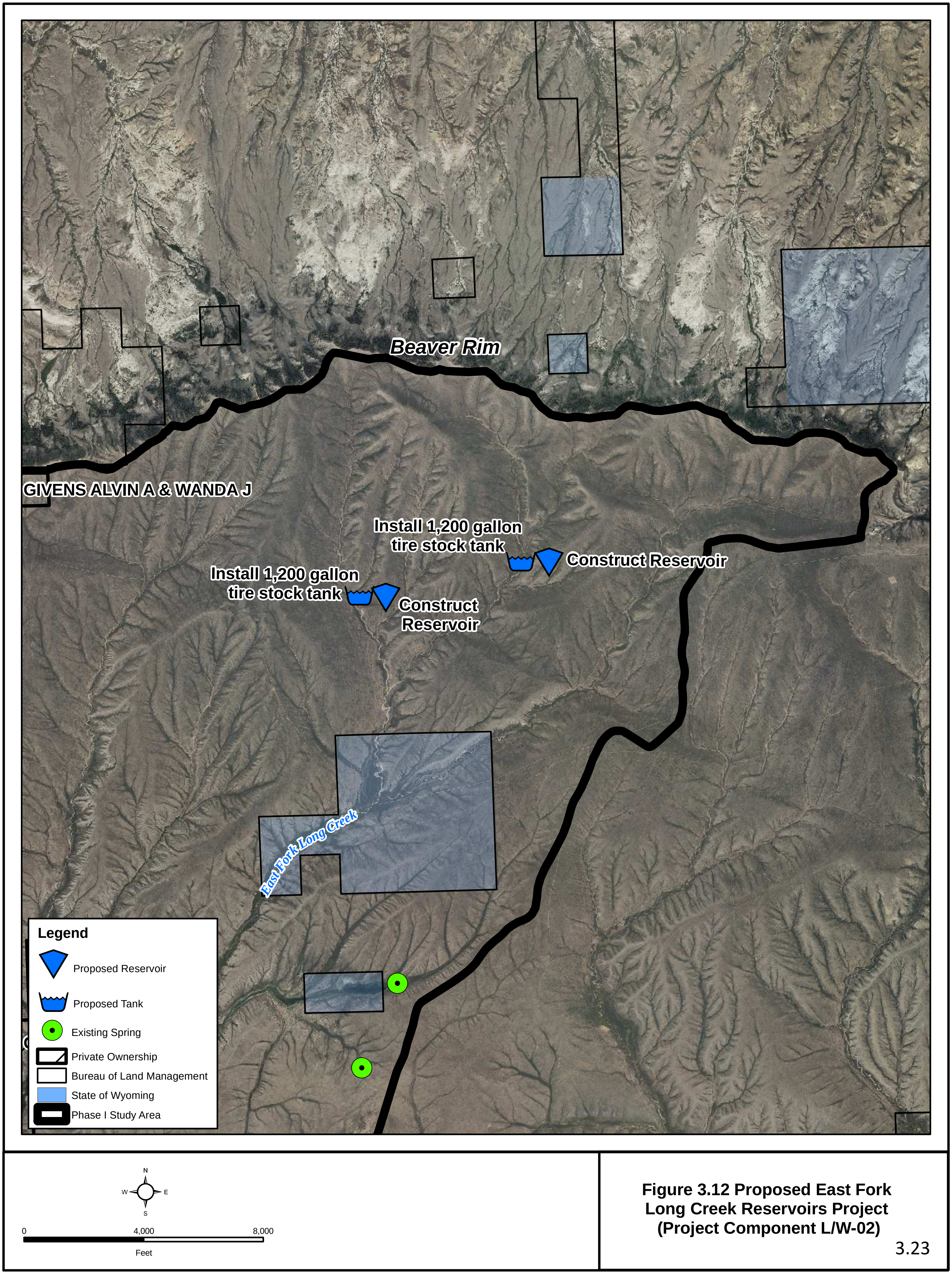


**Figure 3.12 Proposed East Fork Long Creek Reservoirs Project (Project Component L/W-02)**

This alternative would include the following components:

- Two small stock ponds would be excavated in ephemeral channels in the area. Each pond would be approximately 80 feet in length and 80 feet in width. Depth of the reservoirs is estimated to be approximately 8 feet.
- Geomembrane liners would be provided for each pond to limit seepage.
- A stock tank would be installed at each pond location. Each would be equipped with supply lines from the pond and a float valve.
- Each pond would be fenced to prevent wildlife/livestock use from the pond in lieu of the tanks.

### *3.5.3 Divide Well Project (Plan Component L/W-03)*

This alternative involves completion of a well near the watershed divide as indicated in Figure 3.13. A storage tank would be incorporated with the well which would then serve a pipeline and tanks located within Area A.

This alternative would include the following components:

- A well would be constructed on a high location near the watershed divide. The well is assumed to be approximately 500 feet deep.
- A storage tank (approximately 15,000 gallon capacity) would be placed at the well.
- From the storage tank, a gravity pipeline would provide water to stock tanks located within the target area.

### *3.5.4 Grieve Well Pipeline Project (Plan Component L/W-04)*

This alternative involves piping water from a well located east of the Long Creek Study area within the Buffalo Creek drainage (Granite Mountain Allotment). Water would be pumped from the Bronco well to a storage tank located on the watershed divide. A pipeline would then convey water from the storage tank to a series of stock tanks located within Area A (Figure 3.14). It must be noted that this alternative could also provide benefit to areas within the Buffalo Creek watershed.

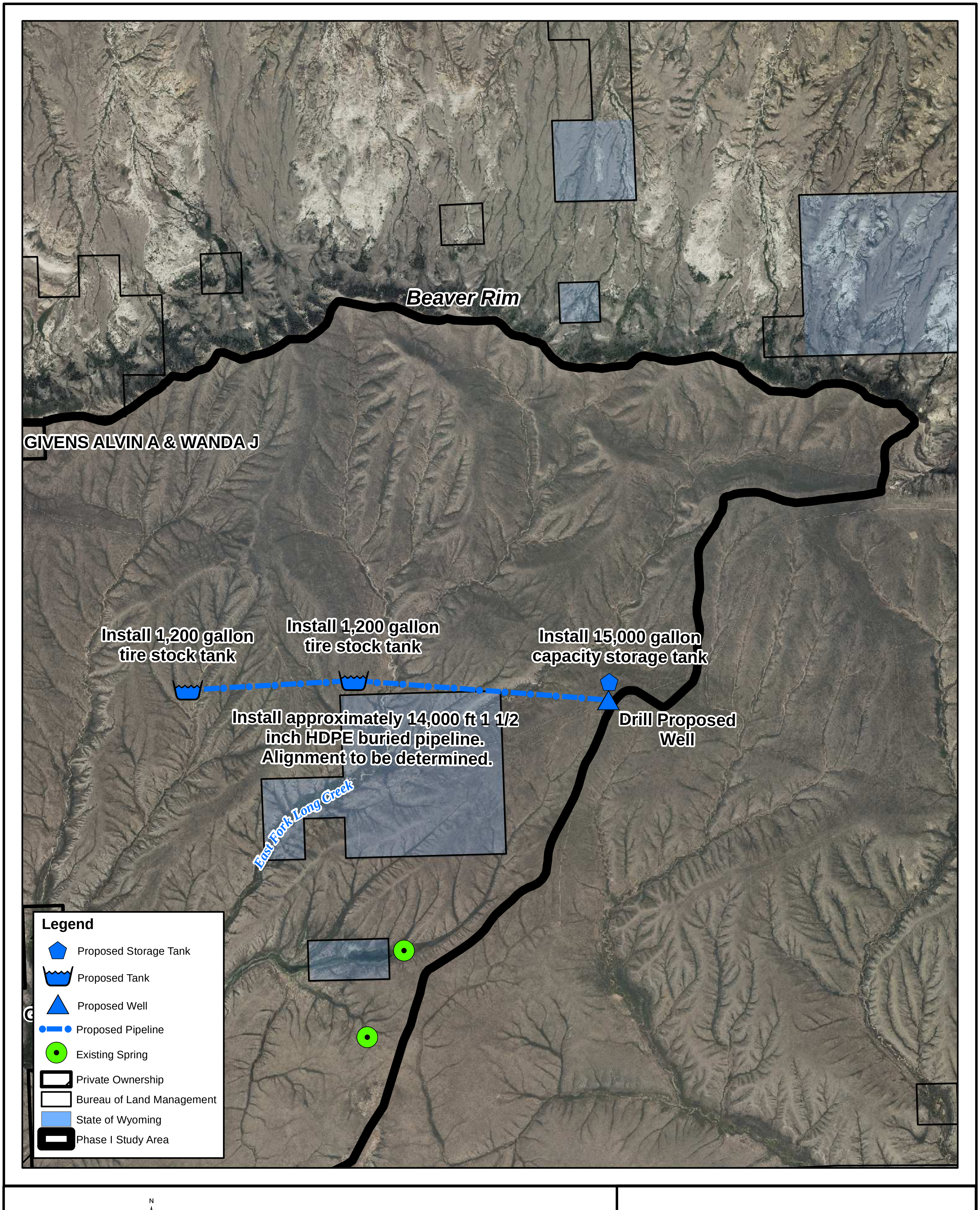


**Figure 3.13 Proposed Divide Well Project (Project Component L/W-03)**

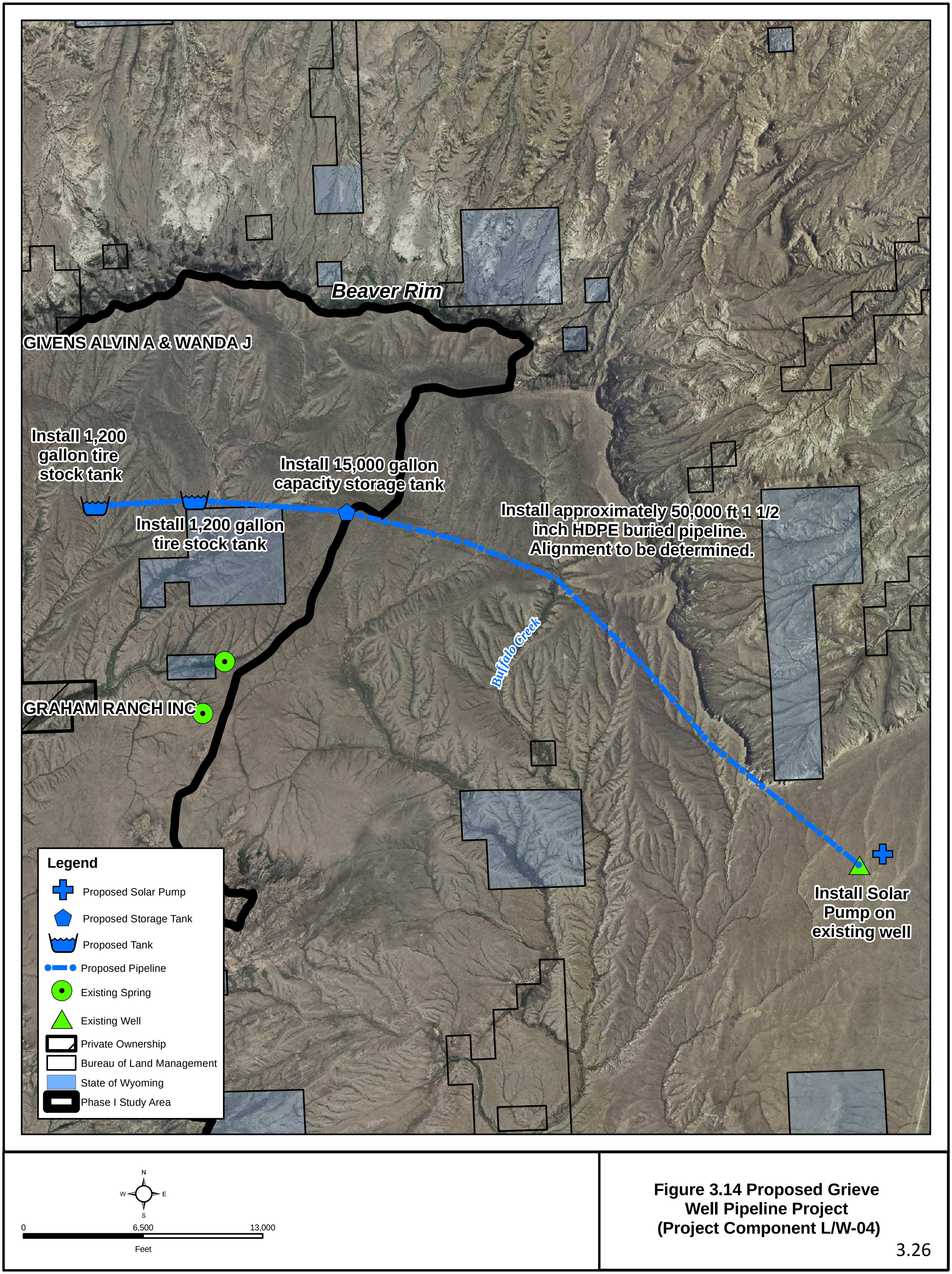


**Figure 3.14 Proposed Grieve Well Pipeline Project (Project Component L/W-04)**

This alternative would include the following components:

- The existing well (NW ¼ S36, T31N, R92W) would be used equipped with a solar pump.
- From the well, a pipeline would be constructed to a storage tank located on the watershed divide between Buffalo Creek and Long Creek. The storage tank would have approximately 15,000 gallons storage capacity.
- From the storage tank, gravity pipeline would provide water to stock tanks located within the target area.

### *3.5.5 Elkhorn Spring Pipeline Project (Pan Component L/W-05)*

Wildlife and livestock in this portion of the Long Creek watershed obtain water from West Fork Long Creek. In an effort to relieve pressure within the riparian corridor, this alternative is provided. The objective of the project would be to provide an alternative water source to the stream and to encourage livestock usage of the upland areas.

This alternative (Alternative B-1) would develop water available at the Elkhorn Spring (Figure 3.15). The objective of this alternative would be to enhance water distribution in addition to providing an alternative water supply to the riparian corridor. The spring could be developed to provide water to the pipeline project to provide livestock watering opportunities away from West Fork of Long Creek (Area B). Elkhorn Spring appears to be a reliable spring that produces an estimated 5 to 10 gpm. Under this alternative, the following components would be employed:

- Elkhorn Spring would be developed to facilitate diversion to a gravity pipeline.
- The pipeline would be routed downslope along the western side of West Fork Long Creek.
- Stock tanks would be placed outside of the riparian West Fork Long Creek corridor.

### *3.5.6 Spring Run Rehabilitation Project (Plan Component L/W-06)*

This alternative involves rehabilitation of springs within the area referred to locally as Spring Run (Figure 3.16). A spring in this area was developed many years ago and provided a seasonal supply of wildlife / livestock water. Water is conveyed from a spring to a small stock

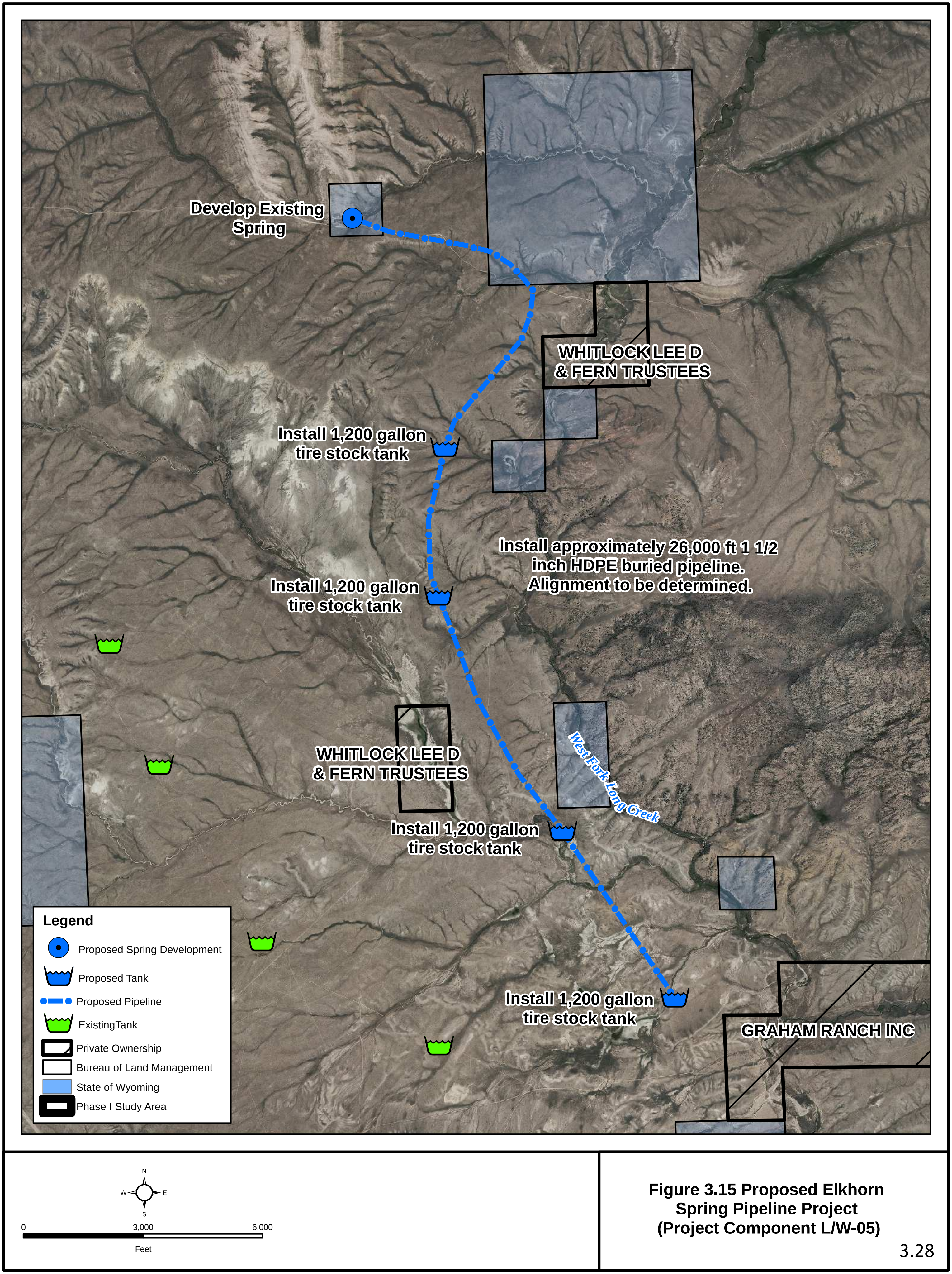


**Figure 3.15 Proposed Elkhorn Spring Pipeline Project (Project Component L/W-05)**

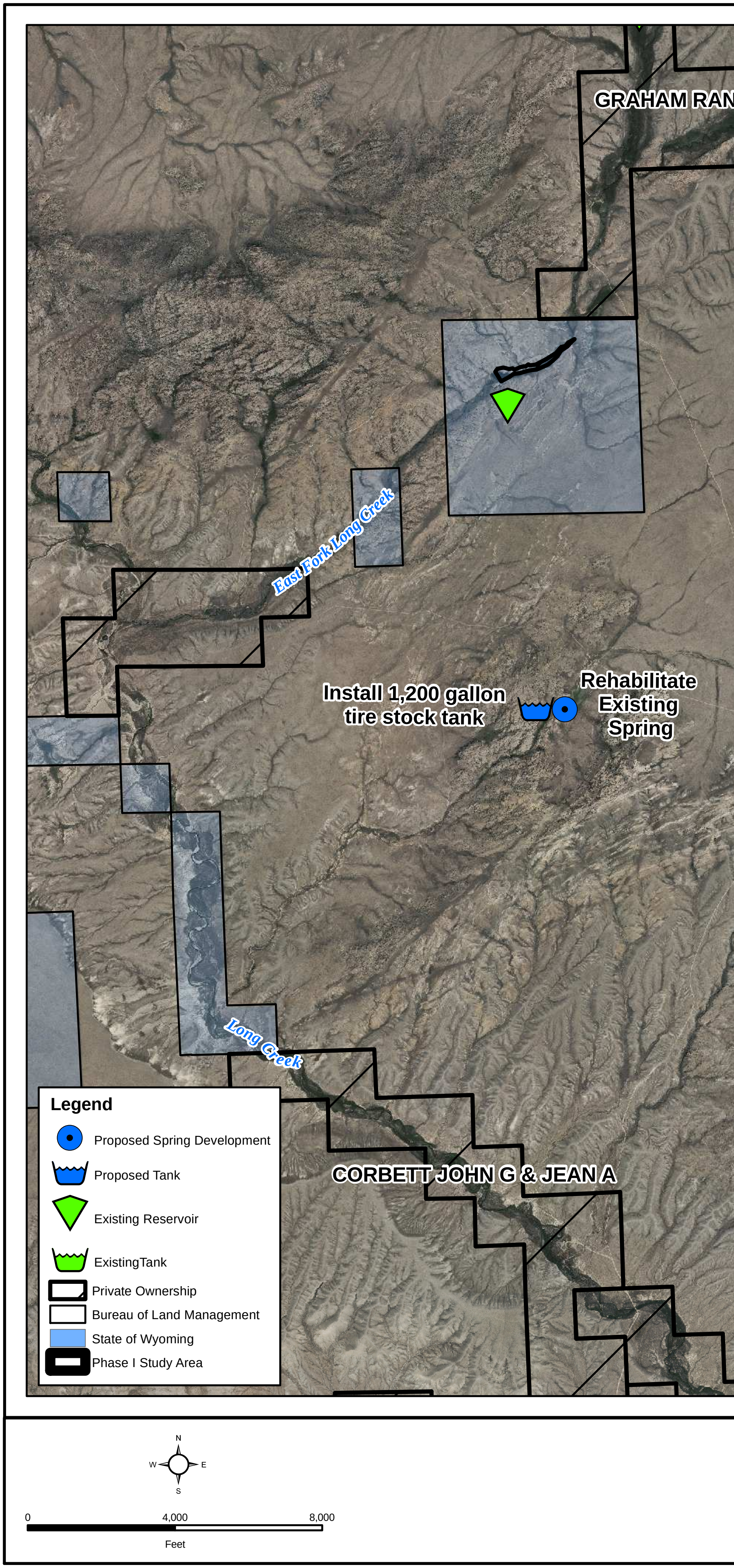


**Figure 3.16 Proposed Spring Run Rehabilitation Project (Project Component L/W-06)**

tank; however, late season supply is limited.  This alternative would include the following features:

- Collection system consisting of a buried perforated pipe within a gravel bed and concrete headwall; and
- Stock tank

### *3.5.7 East Fork Long Creek Solar Pump Project (Plan Component L/W-07)*

The objective of this alternative is to develop the water supplies available in the perennial reach of East Fork Long Creek to provide livestock / wildlife water to the water-short area lying east of Long Creek (Area C) within the Big Pasture Allotment.

This alternative would include the following features as indicated on Figure 3.17:

- A solar power / wind power generator and pump would be installed on the East Fork of Long Creek in the reach downstream of Adelaide Reservoir.
- Water would be pumped to storage tank located on the higher ground south of the East Fork Long Creek.
- A buried pipeline would be extended south from the tank to provide livestock / wildlife water to several stock tanks located outside of the riparian corridor.

The design strategies of alternative C-2 could be used in any remote area with an available water source that cannot be feasibly serviced with electricity.  Solar pump technology has advanced greatly in the last few years, and it is a viable alternative where other practical options are limited.

### *3.5.8 East Fork Long Creek Reservoir Rehabilitation Project (Plan Component L/W-08)*

This alternative includes reconstruction of the breached reservoir located on the East Fork Long Creek at the upstream limit of the Long Creek Pasture Allotment (Figure 3.18).  This breached reservoir could be reconstructed to provide an additional source of livestock / wildlife water, potential fisheries and as limited storage for irrigation uses downstream.  The storage pool of the reservoir encompasses 14 acres and spans the Long Creek Pasture, Big Pasture

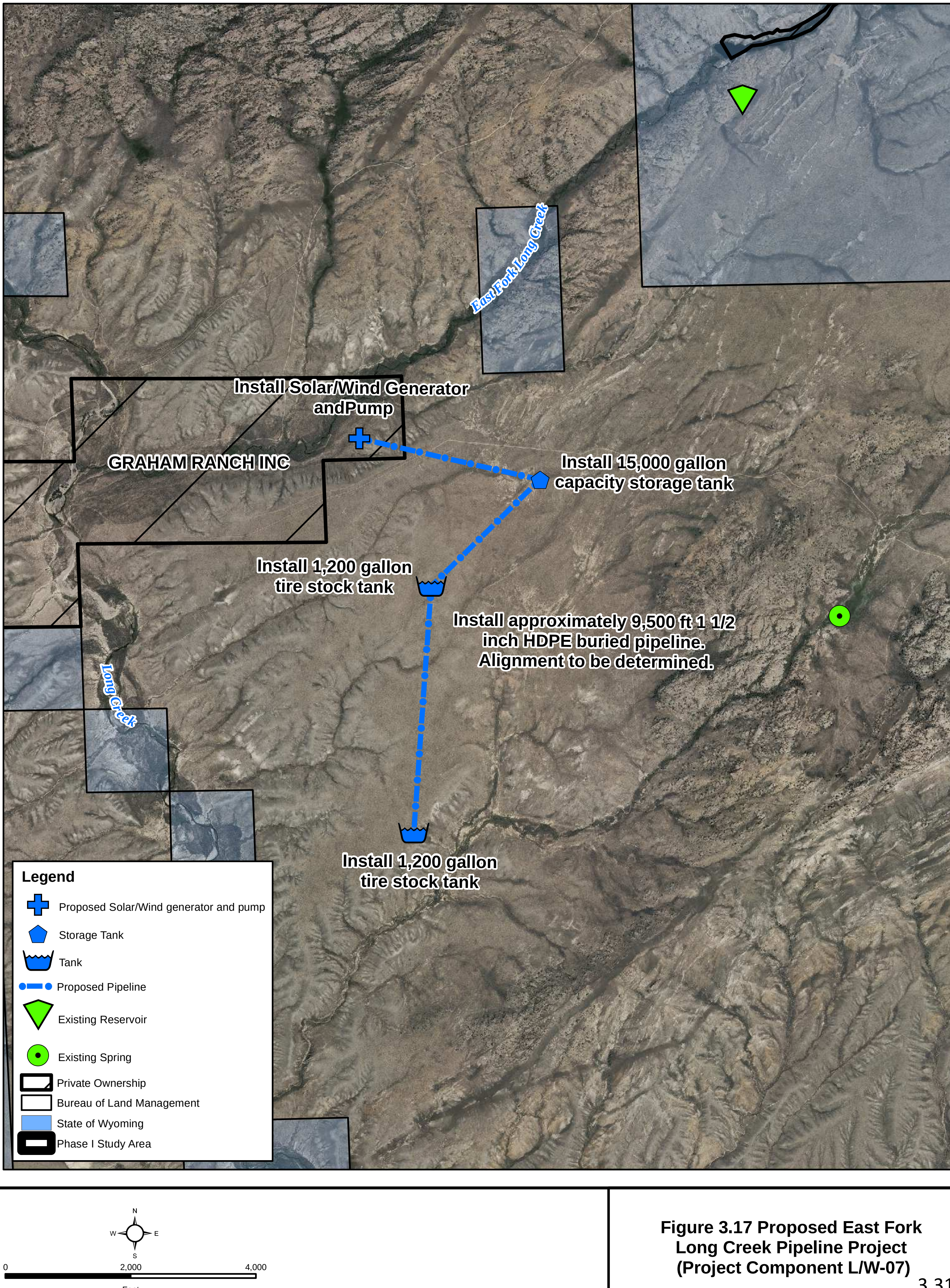


**Figure 3.17 Proposed East Fork Long Creek Pipeline Project (Project Component L/W-07)**

Allotment and the Granite Mountain Allotment. Storage volume would be limited to 20 acre-feet. Construction of this alternative would be contingent upon determination of an adequate source of borrow material for a dam embankment.

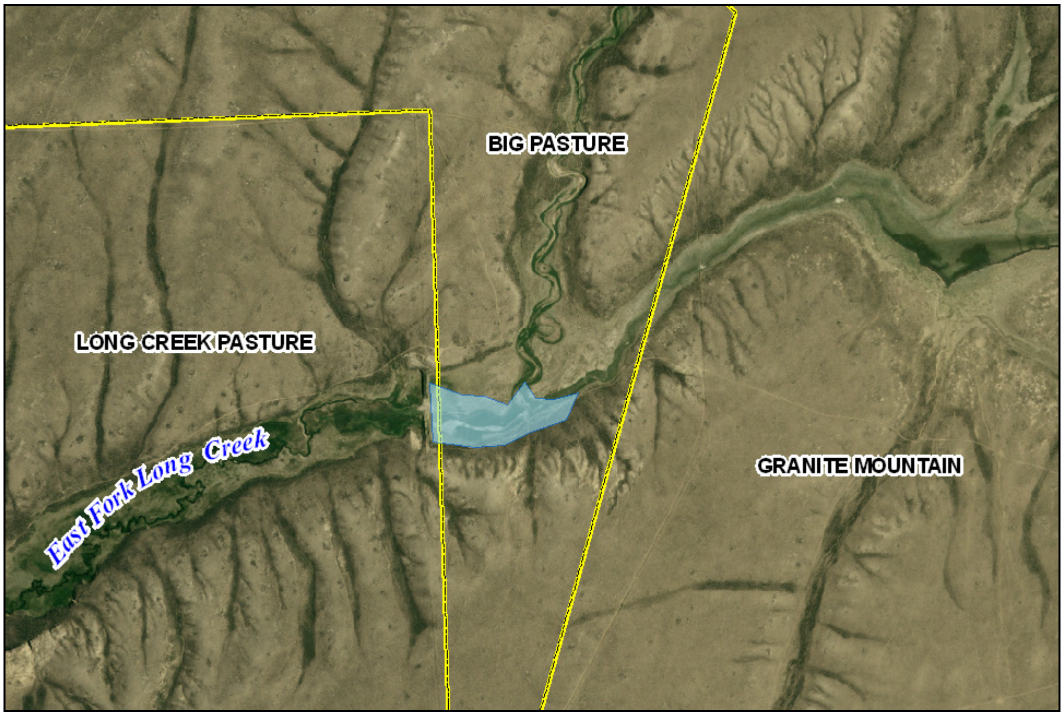


**Figure 3.18 Proposed East Fork Long Creek Reservoir Rehabilitation Project (Project L/W-08).**

This alternative would include the following features:

- Removal of the existing breached embankment and construction of a new embankment at the same location. The embankment is assumed to be approximately 500 feet long and less than 10 feet high at its highest point. The topwidth of the embankment is assumed to be approximately 20 feet wide to facilitate herding of cattle between pastures.
- A commercially available stock pond outlet control mechanism would be utilized to control pond water levels.
- An earthen, grass-lined spillway.

### *3.5.9 Long Creek Divide Well Project (Plan Component L/W-09)*

This alternative would involve completion of a new well in Section 36, Township 31 North, Range 94 West. This area was identified as an area which would benefit from additional upland water supplies. The alternative would involve construction of a new well in the general vicinity indicated in Figure 3.19 and utilization of a solar pump.

The objective of the alternative is to provide a viable source of upland water to livestock and wildlife in an area identified as benefiting from additional upland water sources. The project would be located within the Big Pasture Allotment administered by the Lander District, BLM.

Under this alternative, the following components would be utilized:

- A new well with submersible pump would be constructed in the general vicinity indicated in Figure 3.19. The new well is assumed to be approximately 400 to 450 feet deep based upon reported depth of nearby wells. The actual location of the well would be determined during the design phase of the project.
- A solar pump facility would be incorporated (submersible pump, solar panels, batteries, and connections).
- One rubber tire stock tank (1,200 gallon capacity) would be installed at the well.
- From the well, a pipeline could be installed to provide water to additional stock tanks in an area south of the well which has been identified as benefitting from additional water sources. The alignment displayed is conceptual only and for demonstration purposes. During the design process, the actual alignment and number of stock tanks would be determined. Under the design presented, approximately 9,000 linear feet of 1 ½ inch HDPE buried pipeline would be required.

### *3.5.10 Plateau Well Project (Plan Component L/W-10)*

This alternative involves the completion of a well south of Highway 287 in an area referred to locally as "the Plateau" in Section 26, Township 30 North, Range 94 West. Currently, reliable sources of livestock and wildlife water in this vicinity are lacking. Consequently, construction of new well may provide a reliable source of water.

Under this alternative, the following components would be employed:

- A well would be constructed in the general vicinity of the location shown on Figure 3.20. Based upon the completion depth of nearby wells, a well in this vicinity would likely require drilling to approximately 300-400 feet. For the purpose of this investigation and the uncertainty of the hydrogeologic conditions at the site, a depth of 400 feet was used for cost estimating purposes. The actual location of the well would be determined during the design phase of the project.

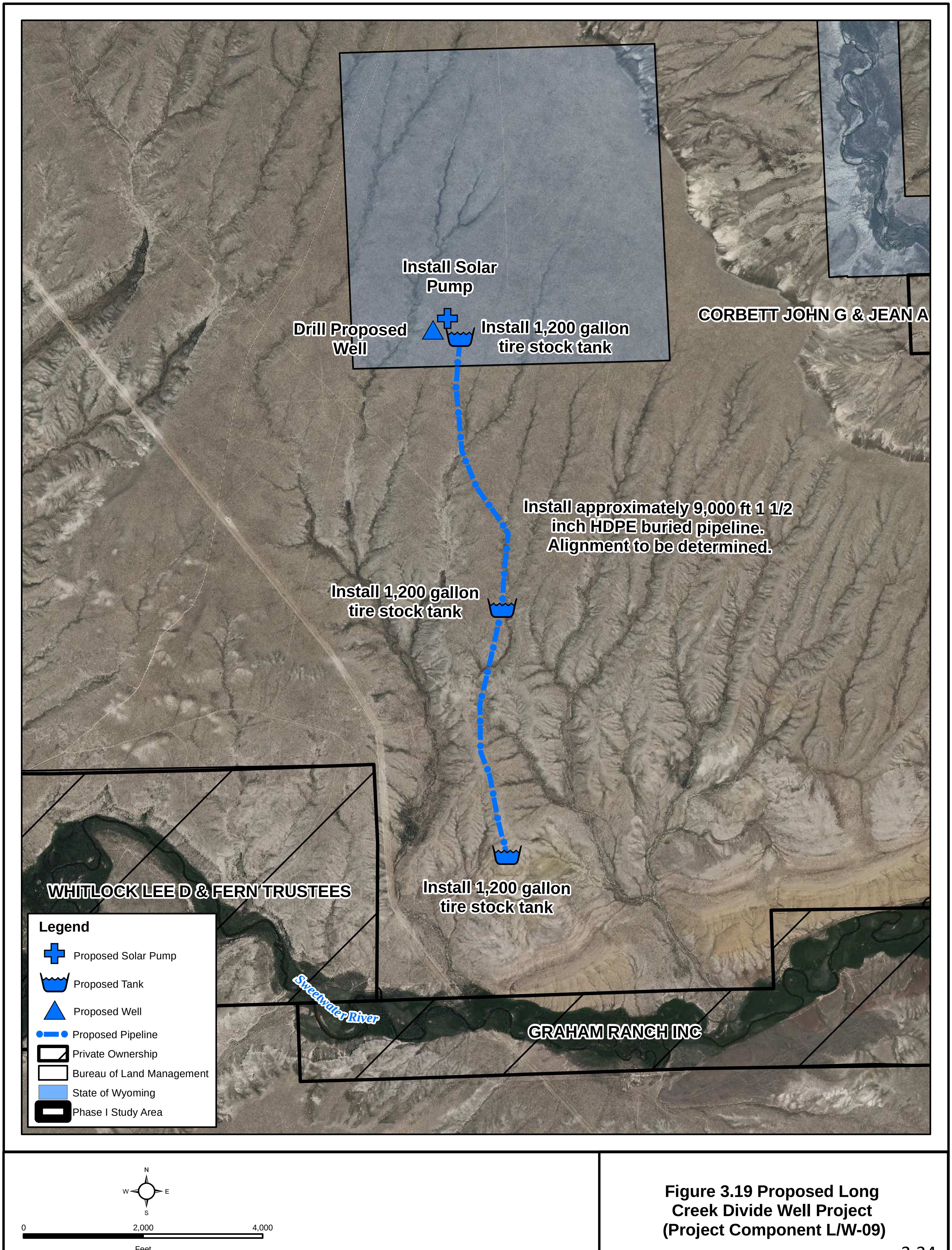


**Figure 3.19 Proposed Long Creek Divide Well Project (Project Component L/W-09)**

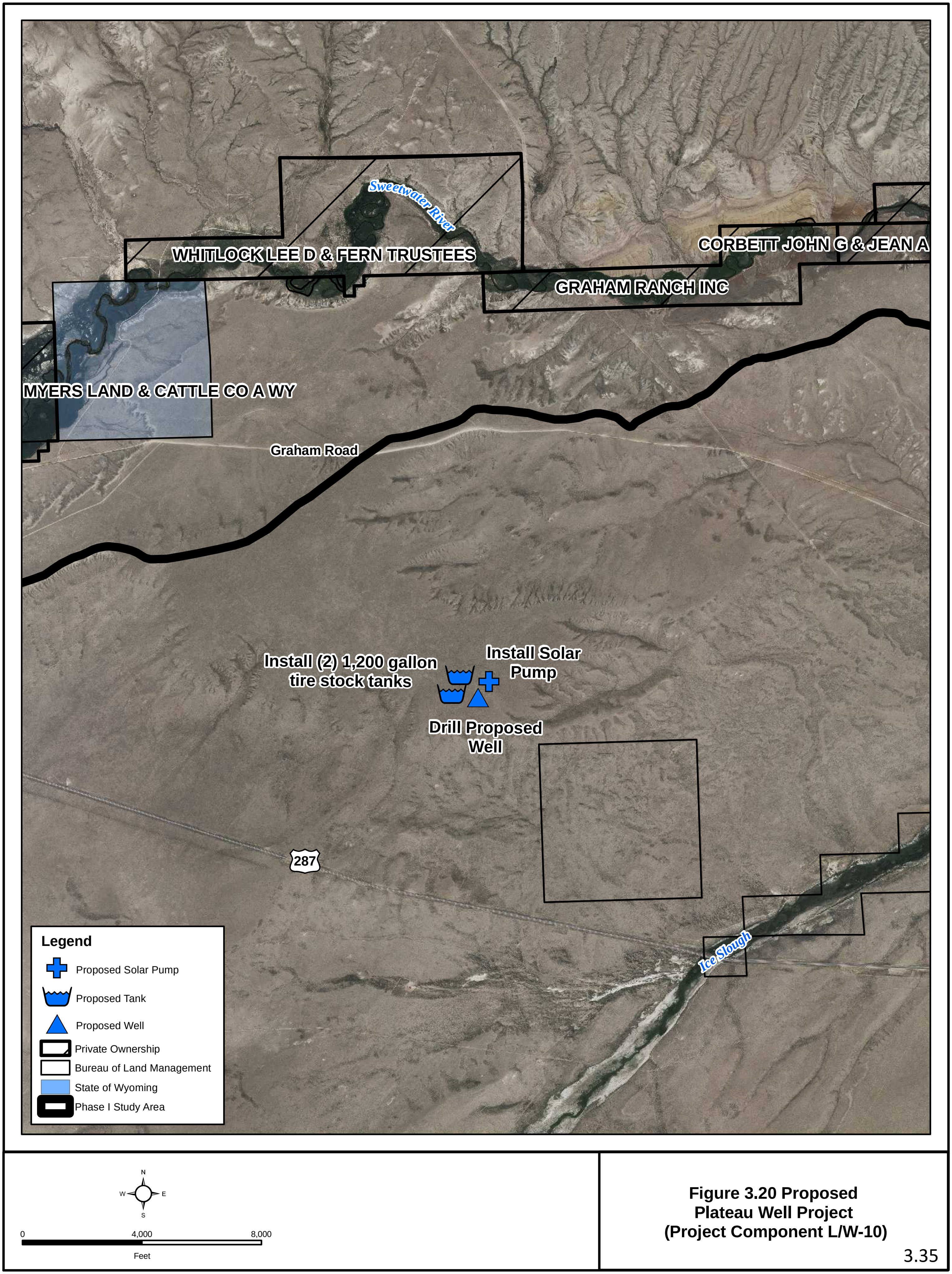


**Figure 3.20 Proposed Plateau Well Project (Project Component L/W-10)**

- A solar pump facility would be incorporated (submersible pump, solar panels, batteries, and connections).
- Two rubber tire stock tanks (1,200 gallon capacity each) would be installed at the well.

NOTE: Technically, this project lies within the Phase III study area of the Sweetwater River Watershed Study. It is included in Phase I of the project because (1) the landowners and allotment permittees are located within the Phase I area and, (2) development of this project would be consistent with their management goals and objectives.

### *3.5.11 Liberty Draw Well Project (Plan Component L/W-11)*

This alternative involves the completion of a well within Section 13, Township 31 North, Range 95 West. Currently, reliable sources of livestock and wildlife water in this vicinity are lacking. Consequently, construction of new well may provide a reliable source of water.

Under this alternative, the following components would be employed:

- A well would be constructed in the general vicinity of the location shown on Figure 3.21. Based upon the completion depth of nearby wells, a well in this vicinity would likely require drilling to approximately 300-400 feet. For the purpose of this investigation and the uncertainty of the hydrogeologic conditions at the site, a depth of 400 feet was used for cost estimating purposes.
- A solar pump facility would be incorporated (submersible pump, solar panels, batteries, and connections).
- One rubber tire stock tank (1,200 gallon capacity) would be installed at the well.

### *3.5.12 School Section Well Project (Plan Component L/W-12)*

This alternative involves the completion of a well within Section 16, Township 30 North, Range 94 West. Currently, reliable sources of livestock and wildlife water in this vicinity are lacking. Consequently, construction of new well may provide a reliable source of water.

Under this alternative, the following components would be employed:

- A well would be constructed in the general vicinity of the location shown on Figure 3.22. Based upon the completion depth of nearby wells, a well in this vicinity would likely

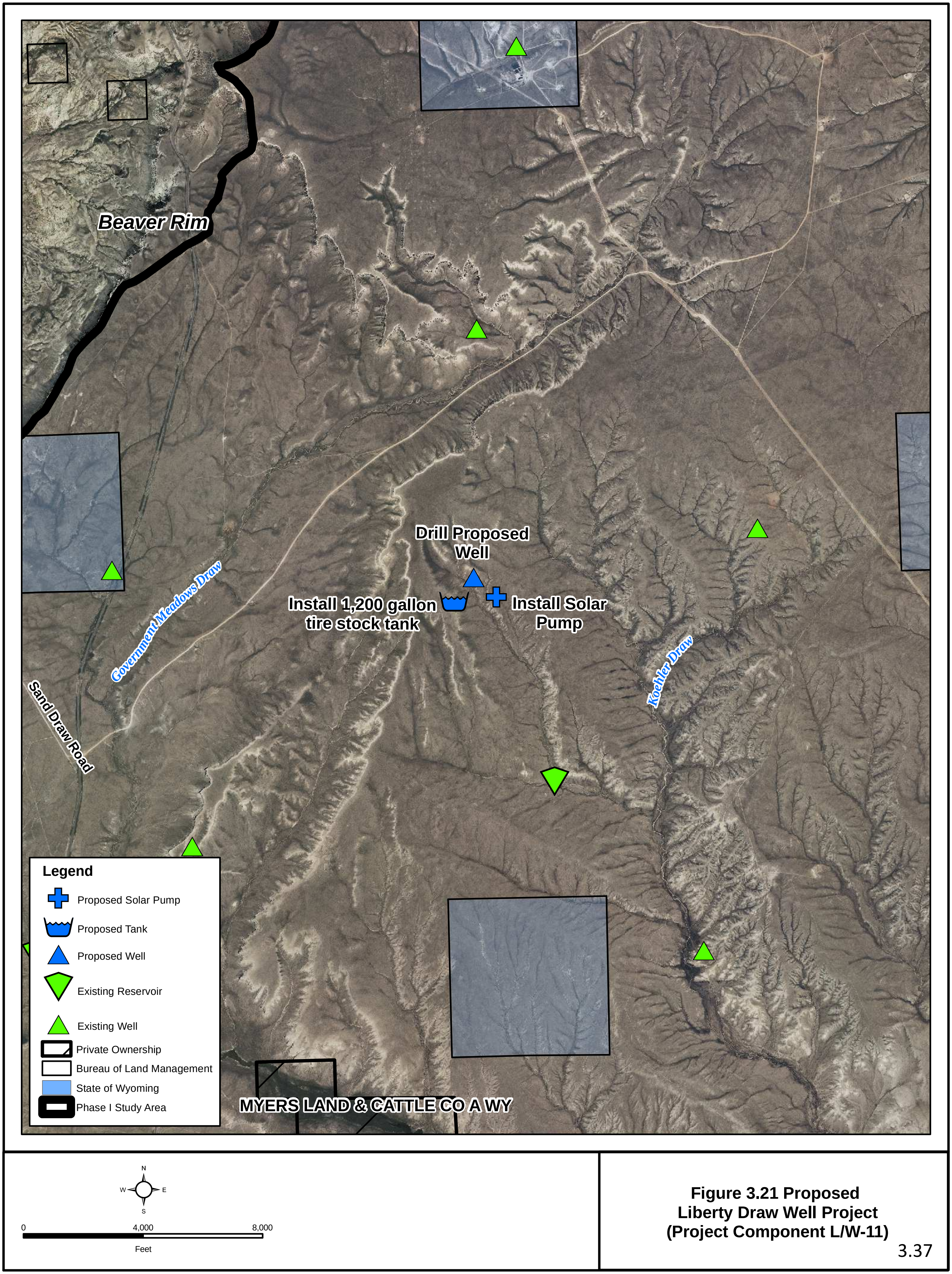


**Figure 3.21 Proposed Liberty Draw Well Project (Project Component L/W-11)**

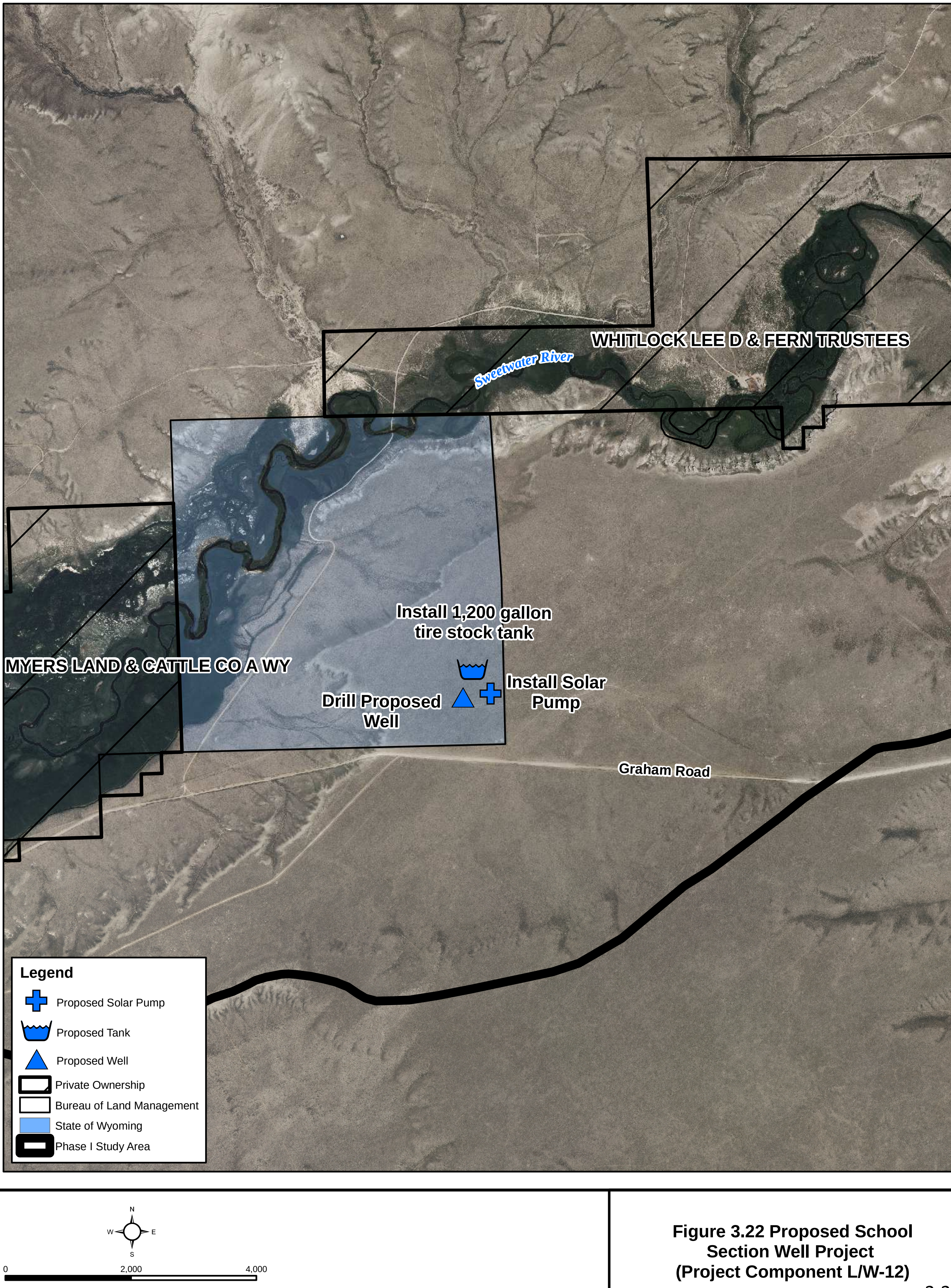


Figure 3.22 Proposed School Section Well Project (Project Component L/W-12)

require drilling to approximately 300-400 feet. For the purpose of this investigation and the uncertainty of the hydrogeologic conditions at the site, a depth of 400 feet was used for cost estimating purposes.

- A solar pump facility would be incorporated (submersible pump, solar panels, batteries, and connections).
- One rubber tire stock tank (1,200 gallon capacity) would be installed at the well.

### *3.5.13 Koehler Draw Well Project (Plan Component L/W-13)*

This alternative involves the completion of a well within Section 8, Township 30 North, Range 94 West. Currently, reliable sources of livestock and wildlife water in this vicinity are lacking. Consequently, construction of new well may provide a reliable source of water.

Under this alternative, the following components would be employed:

- A well would be constructed in the general vicinity of the location shown on Figure 3.23. Based upon the completion depth of nearby wells, a well in this vicinity would likely require drilling to approximately 300-400 feet. For the purpose of this investigation and the uncertainty of the hydrogeologic conditions at the site, a depth of 400 feet was used for cost estimating purposes.
- A solar pump facility would be incorporated (submersible pump, solar panels, batteries, and connections).
- One rubber tire stock tank (1,200 gallon capacity) would be installed at the well.

### *3.5.14 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 3.24 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.

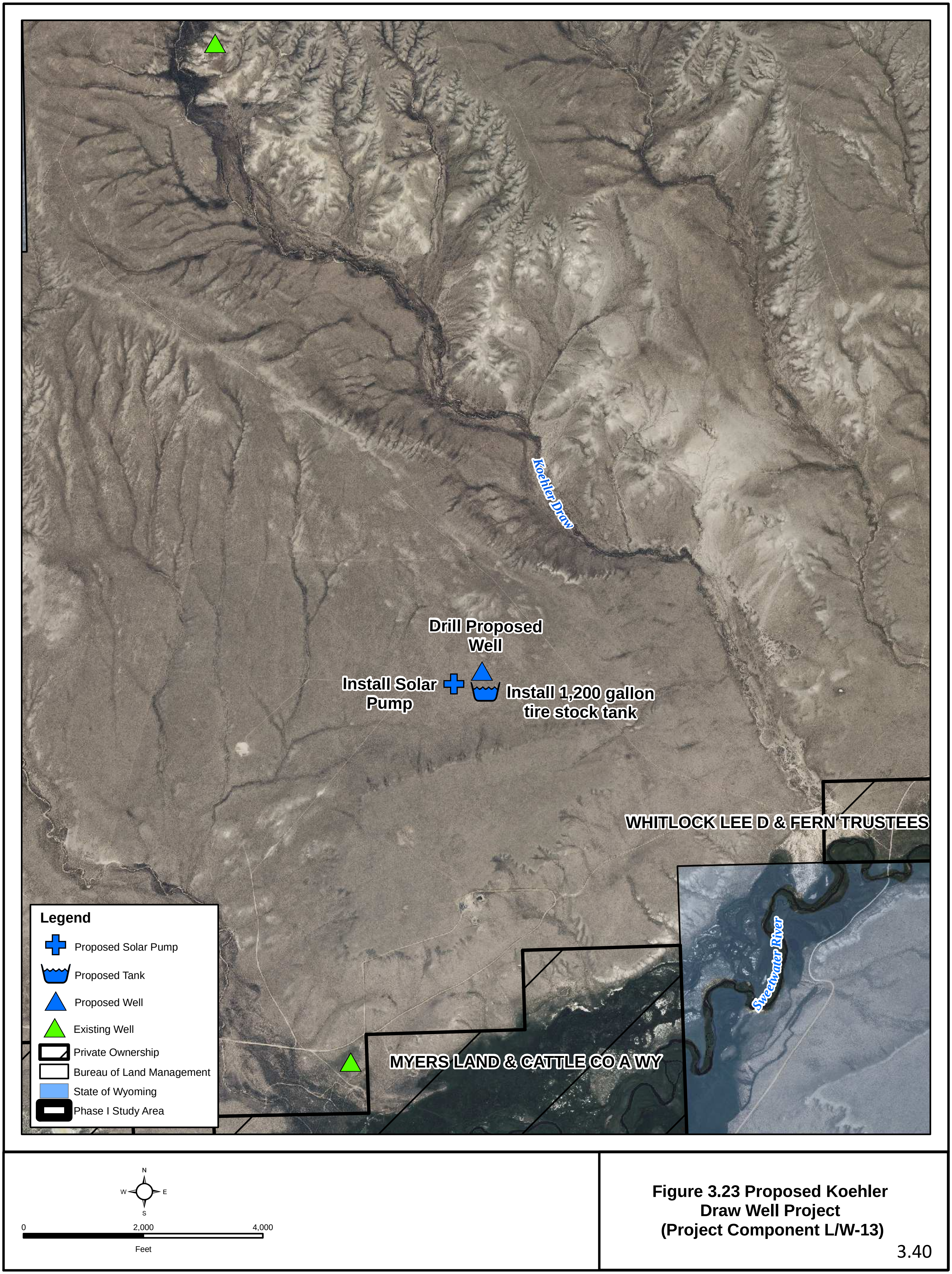


**Figure 3.23 Proposed Koehler Draw Well Project (Project Component L/W-13)**

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:

**Figure 3.24 Typical Wildlife Guzzler**

- 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,
- 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.

### *3.5.15 Summary of Wildlife / Livestock Water Supply Alternatives*

Key areas within the watershed were identified where water supply opportunities either exist or are needed. The areas were identified based upon reconnaissance of the study area, utilization of tools developed with the GIS environment, and from interviews with landowners and allottees. Alternatives were identified which, when implemented, would help alleviate existing water supply shortages for livestock and wildlife. In addition, a generic water supply alternative targeting wildlife is provided with the objective of relieving pressures upon existing water sources by wild horses. Table 3.5 tabulates the project components for each alternative and the estimated total project costs.

**Table 3.5 Summary of Livestock / Wildlife Water Supply Alternatives and Cost Estimates.**

| Project Component | | Livestock / Wildlife Water Development Alternative | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L/W-01 | L/W-02 | L/W-03 | L/W-04 | L/W-05 | L/W-06 | L/W-07 | L/W-08 | |
| | | East Fork Long Creek Wells Project | East Forl Long Creek Reservoirs Project | Divide Well Project | Grieve Well Pipeline Project | Elkhorn Spring Pipeline Project | Spring Run Rehabilitation Project | East Fork Long Creek Solar Pump | East Fork Long Creek Reservoir Reconstruction | |
| Well Construction / Spring Development | Mobilization | $3,000 | NA | $3,000 | $3,000 | $3,000 | $3,000 | $3,000 | Estimated costs of project components | |
| | Well / Spring | New Wells | | New Well | Existing Well | Spring | | | | |
| | Units (each) | 2 | | 1 | 1 | 1 | 1 | 0 | | |
| | Depth Each | 400 | | 500 | 0 | 0 | 0 | | Mobilization | $10,000 |
| | Unit Cost ($/LF wells or $/EA springs) | $40 | | $40 | $0 | $5,000 | $5,000 | | | |
| | Well Screen (LF each well) | 50 | | 50 | $0 | | | | | |
| | Well Screen ($/LF) | $25 | | $25 | $0 | | | | | |
| | Component Subtotal | $37,500 | | $24,250 | $3,000 | $8,000 | $8,000 | $3,000 | | |
| Stock Pond Construction | Mobilization | NA | $5,000 | NA | NA | NA | NA | NA | Embankment: | |
| | Units (EA) | | 2 | | | | | | | |
| | Pond Unit Cost ($ EA) | | $10,000 | | | | | | | |
| | Liner (SF each pond) | | 9,000 | | | | | | | |
| | Liner Unit Cost ($/SF) | | $1.50 | | | | | | | |
| | Liner Cost per Pond | | $13,500 | | | | | | | |
| | Component Subtotal | | $52,000 | | | | | | | |
| Pump | Units (EA) | 2 | NA | 1 | 1 | NA | NA | 1 | Type: | Earthen |
| | Type | Solar | | Solar | Solar | | | Solar/Wind | Volume (cy) | 10,000 |
| | Unit Cost (EA) | $8,600 | | $8,600 | $8,600 | | | $8,640 | Cost ($/cy) | $3 |
| | Component Subtotal | $17,200 | | $8,600 | $8,600 | | | $8,640 | Component cost | $30,000 |
| Pipeline | Units | NA | 2 | 1 | 1 | 1 | NA | 1 | Revegetation (embankment / spillway / borrow area) | |
| | Units (LF) | | 200 | 14,000 | 50,000 | 26,000 | | 9,500 | | |
| | Unit Cost | | $2.60 | $2.60 | $2.60 | $2.60 | | $2.60 | | |
| | Component Subtotal | | $1,040 | $36,400 | $130,000 | $67,600 | | $24,700 | | |
| Additional: Storage Tanks / Fencing / Etc | Units (EA) | NA | NA | 1 | 1 | NA | NA | 1 | Units (ac) | 5 |
| | Size (gal) | | | 15,000 | 15,000 | | | 15,000 | Type: | Broadcast Seed |
| | Unit Cost ($1/gal) | | | $1.00 | $1.00 | | | $1.00 | Unit Cost ($/ac) | $150 |
| | Component Subtotal | | | $15,000.00 | $15,000.00 | | | $15,000.00 | Component cost | $750 |
| Water Tanks | Units (EA) | 2 | 2 | 2 | 2 | 3 | 1 | 2 | | |
| | Size (gal) | 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 | | |
| | Component Subtotal | $6,000 | $6,000 | $6,000 | $6,000 | $9,000 | $3,000 | $6,000 | | |
| Fencing | Units (EA) | NA | 2 | NA | NA | NA | NA | NA | Agridrain water control structure | $4,000 |
| | Units (LF each) | | 600 | | | | | | | |
| | Unit Cost ($/LF) | | $3 | | | | | | | |
| | Component Subtotal | | $3,000 | | | | | | | |
| **Construction Subtotal** | | **$60,700** | **$62,040** | **$90,250** | **$162,600** | **$84,600** | **$11,000** | **$57,340** | **$44,750** | |
| Engineering (10%) | | $6,070 | $6,204 | $9,025 | $16,260 | $8,460 | $1,100 | $5,734 | $4,475 | $0 |
| **Construction and Engineering Subtotal** | | **$66,770** | **$68,244** | **$99,275** | **$178,860** | **$93,060** | **$12,100** | **$63,074** | **$49,225** | |
| Contingency (15%) | | $10,016 | $10,237 | $14,891 | $26,829 | $13,959 | $1,815 | $9,461 | $7,384 | $0 |
| **Total Construction Cost** | | **$76,786** | **$78,481** | **$114,166** | **$205,689** | **$107,019** | **$13,915** | **$72,535** | **$56,609** | |
| Final Plans and Specs | | $2,000 | $5,000 | $3,000 | $3,000 | $2,000 | $2,000 | $3,000 | $7,000 | |
| Additional Geotechnical Services | | | $2,000 | | | | | | $10,000 | |
| Permitting / Legal Fees / Acces and Rights of Way | | $2,000 | $3,000 | $2,000 | $3,000 | $2,000 | $2,000 | $2,000 | $5,000 | |
| **Total Project Cost** | | **$80,786** | **$88,481** | **$119,166** | **$211,689** | **$111,019** | **$17,915** | **$77,535** | **$78,609** | |

**Table 3.5 Summary of Livestock / Wildlife Water Supply Alternatives and Cost Estimates (Continued).**

| Project Component | | Livestock / Wildlife Water Development Alternative | | | | | |
|---|---|---|---|---|---|---|---|
| | | L/W-09 | L/W-10 | L/W-11 | L/W-12 | L/W-13 | L/W-14 |
| | | Long Creek Divide Well Project | Plateau Well Project | Liberty Draw Well | School Section Well Project | Koehler Draw Well Project | Wildlife Guzzlers |
| Well Construction / Spring Development | Mobilization | $3,000 | $3,000 | $3,000 | $3,000 | $3,000 | Three (3) guzzlers to be installed. |
| | Well / Spring | | | | | | |
| | Units (each) | 1 | 1 | 1 | 1 | 1 | |
| | Depth Each | 450 | 400 | 400 | 400 | 400 | |
| | Unit Cost ($/LF wells or $/EA springs | $40 | $40 | $40 | $40 | $40 | |
| | Well Screen (LF each well) | 50 | 50 | 50 | 50 | 50 | |
| | Well Screen ($/LF) | $25 | $25 | $25 | $25 | $25 | |
| | Component Subtotal | $22,250 | $20,250 | $20,250 | $20,250 | $20,250 | |
| Stock Pond Construction | Mobilization | NA | NA | NA | NA | NA | Unit cost for wildlife guzzlers = $10,000 |
| | Units (EA) | | | | | | |
| | Pond Unit Cost ($ EA) | | | | | | |
| | Liner (SF each pond) | | | | | | |
| | Liner Unit Cost ($/SF) | | | | | | |
| | Liner Cost per Pond | | | | | | |
| | Component Subtotal | | | | | | |
| Pump | Units (EA) | 1 | 1 | 1 | 1 | 1 | Catchment = 2250 $ft^2$. |
| | Type | Solar/Wind | Solar/Wind | Solar/Wind | Solar/Wind | Solar/Wind | |
| | Unit Cost (EA) | $8,640 | $8,640 | $8,640 | $8,640 | $8,640 | |
| | Component Subtotal | $8,640 | $8,640 | $8,640 | $8,640 | $8,640 | |
| Pipeline | Units | 1 | NA | NA | NA | NA | |
| | Units (LF) | 9,000 | | | | | |
| | Unit Cost | $2.60 | | | | | |
| | Component Subtotal | $23,400 | | | | | |
| Additional: Storage Tanks / Fencing / Etc | Units (EA) | NA | NA | NA | NA | NA | Storage = 1,800 gal |
| | Size (gal) | | | | | | |
| | Unit Cost ($1/gal) | | | | | | |
| | Component Subtotal | | | | | | |
| Water Tanks | Units (EA) | 3 | 2 | 1 | 1 | 1 | |
| | Size (gal) | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | |
| | Unit Cost | $3,000 | $3,000 | $3,000 | $3,000 | $3,000 | |
| | Component Subtotal | $9,000 | $6,000 | $3,000 | $3,000 | $3,000 | |
| Fencing | Units (EA) | NA | NA | NA | NA | NA | |
| | Units (LF each) | | | | | | |
| | Unit Cost ($/LF) | | | | | | |
| | Component Subtotal | | | | | | |
| **Construction Subtotal** | | **$63,290** | **$34,890** | **$31,890** | **$31,890** | **$31,890** | **$30,000** |
| Engineering (10%) | | $6,329 | $3,489 | $3,189 | $3,189 | $3,189 | $3,000 |
| **Construction and Engineering Subtotal** | | **$69,619** | **$38,379** | **$35,079** | **$35,079** | **$35,079** | **$33,000** |
| Contingency (15%) | | $10,443 | $5,757 | $5,262 | $5,262 | $5,262 | $4,950 |
| **Total Construction Cost** | | **$80,062** | **$44,136** | **$40,341** | **$40,341** | **$40,341** | **$37,950** |
| Final Plans and Specs | | $3,000 | $3,000 | $3,000 | $3,000 | $3,000 | $1,000 |
| Additional Geotechnical Services | | | | | | | |
| Permitting / Legal Fees / Acces and Rights of Way | | $2,000 | $2,000 | $2,000 | $2,000 | $2,000 | $1,000 |
| **Total Project Cost** | | **$85,062** | **$49,136** | **$45,341** | **$45,341** | **$45,341** | **$39,950** |

## 3.6 Grazing Management Opportunities

### *3.6.1 Ecological Site Descriptions*

Proper range management can greatly enhance the watershed values of an area. A healthy range resource puts more water in the ground, and slows and decreases runoff. Healthy rangelands have less bare ground, more plant litter, and higher organic content. This results in less runoff, more infiltration, more plant growth, improved ground water, and increases spring and stream flows.

Using the NRCS Ecological Site Descriptions (ESD), the Long Creek watershed is in the 10-14 Inch Precipitation Zone SE. This is included in Major Land Resource Area (MLRA) 34-A-Cool Central Desertic Basins and Plateaus. The NRCS ESDs can be used to compare what is actually growing on the rangeland with what each site is capable of growing. By comparing current plant communities to potential plant communities on each range site, one can assess the relative health of the resource.

Plant production and watershed values are closely related to range condition. Range condition and range health are categorized as being in excellent condition (76-100%) of potential plant community, good condition (51-75%), fair condition (26-50%), and poor condition (0-25%). NRCS ESDs include Plant Community Descriptions which include detailed vegetative species lists for each range site. Within the Long Creek study area, the predominant ESDs are:

**Sandy (Sy) 10 – 14 Inch PZ High Plains Southeast**

The sandy range site plant communities include Needleandthread/Rhizomatous Wheatgrass, Big Sagebrush/Short Grass, Threadleaf Sedge/Blue Grama, and Cheatgrass/Prickly Pear. Four plant communities are described which correspond to excellent, good, fair and poor range conditions. Respective carrying capacities for the plant communities/condition classes are 0.4, 0.3, 0.2, and 0.06 Animal Unit Months (AUM'S) per acre.

The State and Transition Model Diagram for this ESD is presented in Figure 3.25. The following model can be used to predict vegetation changes in response to Moderate Continued Season Long Grazing and the pathways needed for recovery of rangeland health. These models are available for each of the ESD in the watershed (http://esis.sc.egov.usda.gov).

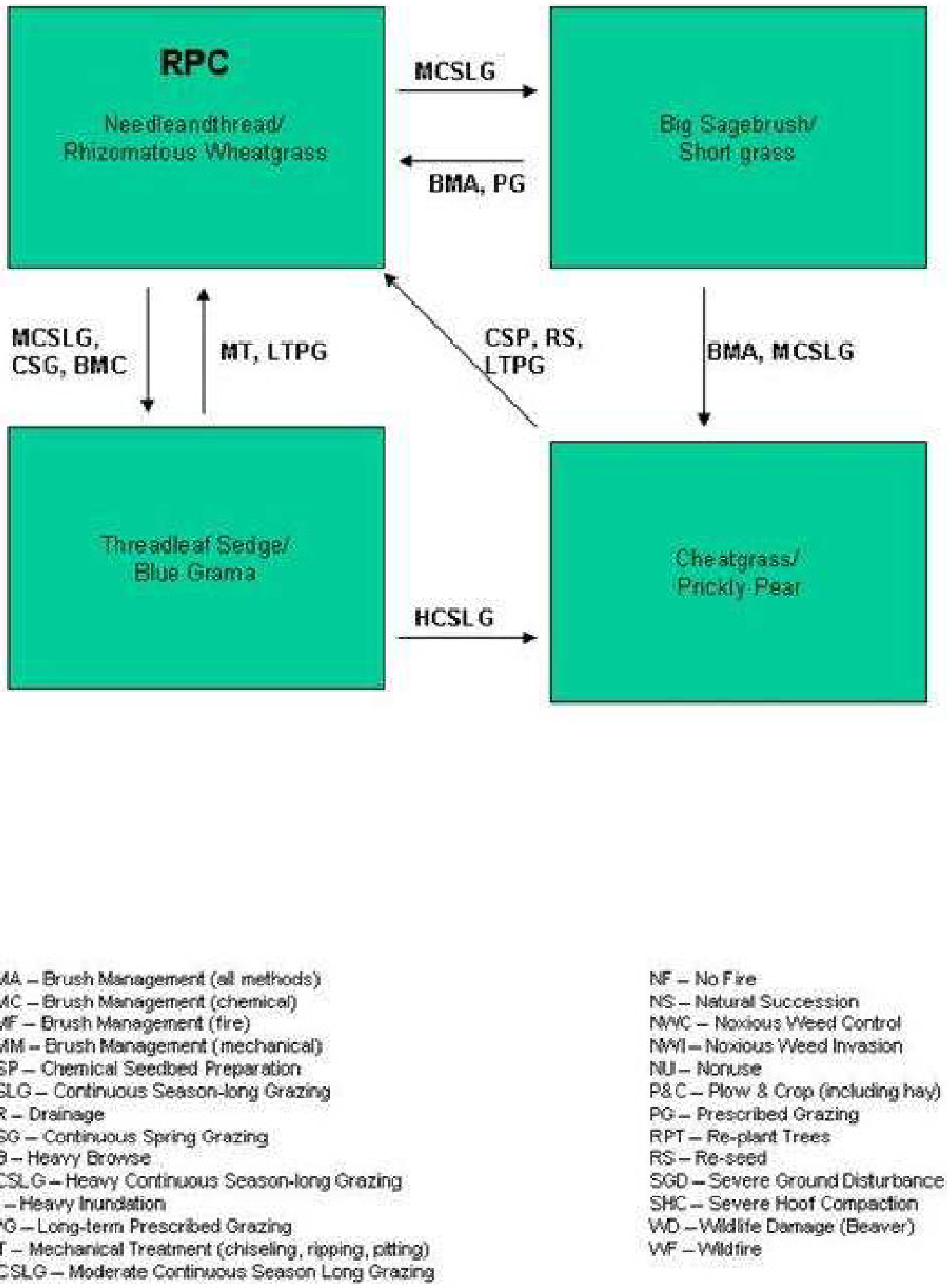


**Figure 3.25 State and Transition Model Diagram:**
**ESD Sandy (Sy) 10 – 14 Inch Precipitation Zone, High Plains Southeast**

As depicted in this figure:

- Continuous season long grazing can result in a transition in community from the Reference Plant Community (RPC) to a big sagebrush/short grass 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.

**Loamy (Ly) 10 – 14 Inch PZ High Plains Southeast**

The loamy range site plant communities include Rhizomatous Wheatgrass/Needle and Thread, Big Sagebrush/Mid Grass, Blue Grama Sod, Rabbitbrush/Cheatgrass, and Heavy Brush. Five plant communities are described that correspond to the excellent, good/fair, and poor conditions. Respective carrying capacities for the plant communities are 0.4, 0.3, 0.2, 0.06, and 0.2 AUMs per acre.

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.

The State and Transition Model for this ESD is presented in Figure 3.26.

### *3.6.2 Range and Grazing Management Considerations*

- 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.
- Fencing to create pastures of similar ecological condition can enable a rest-rotation grazing system.

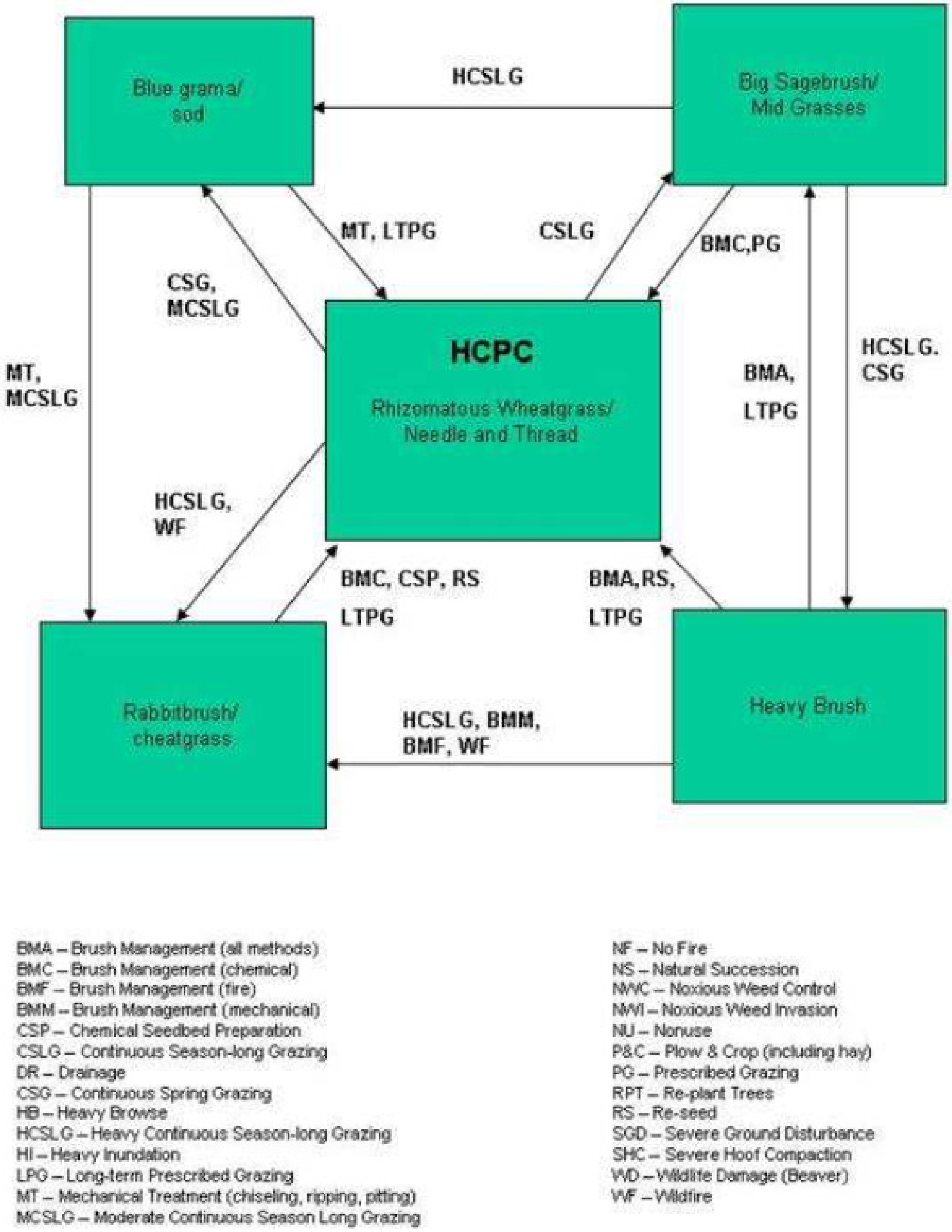


**Figure 3.26 State and Transition Model Diagram:**
**ESD Loamy (Ly) 10 – 14 inch Precipitation Zone, High Plains Southeast.**

- Strategic salting and herding are other tools that can be used to enhance grazing distribution.
- 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.
- These tools can be used to maintain and/or improve watershed function particularly when coupled with implementation of appropriate grazing management strategies.

### *3.6.3 Noxious Weeds / Invasive Species*

Noxious weeds and invasive species were not observed in significant quantities. They are present, however, and should be considered with any watershed management strategies. Problem vegetation in the area includes excessive big sagebrush, cheatgrass, larkspur (in higher elevations), and Russian knapweed (primarily on private lands). Grazing management, prescribed burning, mechanical brush control, and chemical control can be used to control undesirable shrubs and other plants. Fremont County Weed and Pest Department provides assistance with these projects.

## 3.7 The Watershed Management and Rehabilitation Plan

The information presented in this chapter provides recommendations for improvements associated with existing irrigation system conservation and rehabilitation, stream channel condition and stability, water storage, wildlife / livestock water supplies and upland grazing management. These improvements focus on improvements to enhance the land and water resources within the watershed.

For the Sweetwater River Watershed Study, Phase I Study Area, the watershed management and irrigation rehabilitation plan consists of a compilation of the recommendations for each category. The plan is summarized in Table 3.6.

**Table 3.6 Sweetwater River Phase I Study Area Watershed Management Plan.**

| Rehabilitation Item Number | Description | Station (feet from headgate) | Priority | Total Project Cost |
|---|---|---|---|---|
| **Irrigation Components** | | | | |
| **J.M. Brown Ditch East (Corbett)** | | | | |
| I-1 | Diversion Structure | 0.0 | 1 | $27,800 |
| I-2 | Install 2-ft Parshall flume | 100 | 2 | $3,000 |
| I-3 | Install 10-inch farm turnout headgates (5) | To Be Determined | 2 | $14,500 |
| I-4 | Install 3-ft wide check structures (3) | To Be Determined | 2 | $9,600 |
| I-5 | Install 24-inch underdrain culverts (4) | Varies | 2 | $13,100 |
| I-6 | Install 8-inch gated pipe (app. 3,000 LF) | To Be Determined | 3 | $2,300 |
| I-7 | Install approx. 300 feet 18-inch PIP at seepage location | 800 to 1100 | 2 | $6,700 |
| **J.M. Brown Ditch West (Corbett)** | | | | |
| I-8 | Install diversion structure in creek | 0.0 | 1 | $27,800 |
| I-9 | Install 2-ft Parshall flume | 100 | 2 | $3,000 |
| I-10 | Install 10-inch farm turnout headgates (3) | To Be Determined | 2 | $9,400 |
| I-11 | Install 3-ft wide check structures (3) | To Be Determined | 2 | $9,600 |
| I-12 | Install 8-inch gated pipe (app. 1,200 LF) | To Be Determined | 3 | $6,100 |
| **Russell Ditch** | | | | |
| I-13 | Replace existing slide gate with 48-inch slide gate | 0.0 | 1 | $9,600 |
| I-14 | Install 2-ft Parshall flume | 100 | 2 | $4,300 |
| **Independent Ditch** | | | | |
| I-15 | Remove existing headgate and | 0.0 | 1 | $14,700 |
| I-16 | Install 2-ft Parshall flume | 100 | 2 | $4,300 |
| **Graham and Farnsley Ditch** | | | | |
| I-17 | Remove existing headgate and | 3860 | 1 | $7,100 |
| I-18 | Install 2-ft Parshall flume | 100 | 2 | $4,300 |
| **Jacob Ditch Headgate** | | | | |
| I-19 | Install 24-inch diameter slide | 0 | 1 | $12,100 |
| I-20 | Install 2-ft Parshall flume | 100 | 2 | $4,300 |
| I-21 | Clear vegetation and sediment from Jacob Ditch | 0-2500 | 2 | $5,100 |
| **Koehler Ditch** | | | | |
| I-22 | Remove existing headgate and | 0 | 1 | $12,100 |
| I-23 | Install 2-ft Parshall flume | 100 | 2 | $4,300 |
| **National Ditch** | | | | |
| I-24 | Streambank stabilization (J-hook vanes / cross vane weir) | 0 | 1 | $99,900 |
| I-25 | Install 2-ft Parshall flume | 100 | 2 | $4,300 |

**Storage Components**

No reservoir storage alternatives are recommended for inclusion in the watershed management plan at this time

**Stream Channel Restoration and Management Components**

| Stream | Reach |
|---|---|
| Long Creek | Mouth to confluence East Fork Long Creek and West Fork Long Creek |
| East Fork Long Creek | Confluence with Long Creek to East Long Creek Reservoir |
| | Upstream of East Long Creek Reservoir |
| West Fork Long Creek | Confluence with Long Creek to headwaters |

**Recommended Restoration and Management Strategies**

**Riparian Vegetation Degradation:**

Development of alternative wildlife / livestock water supplies

Revegetation

Riparian Fencing

**Wildlife / Livestock Water Supply Alternatives**

| Recommended Alternative | Description | Priority | Cost |
|---|---|---|---|
| L/W 01 | East Fork Long Creek Wells Project | 2 | $ 80,786 |
| L/W 02 | East Fork Long Creek Reservoirs Project | 2 | $ 88,481 |
| L/W 03 | Divide Well Project | 2 | $ 119,166 |
| L/W 04 | Grieve Well Pipeline Project | 2 | $ 211,689 |
| L/W 05 | Elkhorn Spring Pipeline Project | 2 | $ 111,019 |
| L/W 06 | Spring Run Rehabilitation Project | 2 | $ 17,915 |
| L/W 07 | East Fork Long Creek Solar Pump Project | 2 | $ 77,535 |
| L/W 08 | East Fork Long Creek Reservoir Reconstruction | 2 | $ 56,609 |
| L/W 09 | Long Creek Divide Well Project | 2 | $ 85,062 |
| L/W 10 | Plateau Well Project | 2 | $ 49,136 |
| L/W 11 | Liberty Draw Well | 2 | $ 45,341 |
| L/W 12 | School Section Well Project | 2 | $ 45,341 |
| L/W 13 | Koehler Draw Well Project | 2 | $ 45,341 |
| L/W 14 | Wildlife Guzzlers | 2 | $ 39,950 |

**Grazing Management Components**

| Ecological Site Description | Grazing Management Strategy |
|---|---|
| Sandy (Sy) 10 - 14 Inch PZ High Plains Southeast | Mechanical Treatment |
| | Long Term Prescriptive Grazing |
| Loamy (Ly) 10 - 14 Inch PZ High Plains Southeast | Brush Management (all methods) |
| | Prescriptive Grazing |

# *IV. FUNDING SOURCES*

# IV. FUNDING SOURCES

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 as part of any watershed plan, there may be a large variety of funding sources which may be available to provide funding for future watershed improvements.

Table 4.1 is presented as a brief synopsis of some of the various options available for different components of the Phase I Study Area Watershed Management Plan.

**Table 4.1 Funding Options**

| Primary Funding Sources / Program | Irrigation Rehab | Upland Water | Other Range Management |
|---|---|---|---|
| Local: | | | |
| PACD – Rangeland Management Program | | ✓ | ✓ |
| Irrigation Water Management Program | ✓ | | |
| State: | | | |
| WWDC – Small Water Project Program | ✓ | ✓ | ✓ |
| – New Development Program | ✓ | ✓ | |
| WGFD – Riparian Habitat Improvement Grant | | ✓ | ✓ |
| – Walter Development / Maintenance Habitat | | ✓ | ✓ |
| SLIB – Small Water Development Project Loans | ✓ | ✓ | |
| Federal: | | | |
| NRCS – EQIP | ✓ | ✓ | ✓ |
| FSA – Conservation Reserve Program (CRP) | | ✓ | ✓ |
| BLM – Range Betterment Funds | | ✓ | ✓ |
| EPA – Targeted Watershed Grants Program | | ✓ | ✓ |
| USFWS – Landowner Incentive Program | | ✓ | ✓ |
| – North American Wetlands Conservation Act | | ✓ | ✓ |
| Other: | | | |
| TU – Watershed Restoration | ✓ | ✓ | ✓ |
| Weed & Pest – Assistance | | | ✓ |

# *V. REFERENCES*

# V. REFERENCES


Bureau of Land Management, Rawlins District. Environmental Assessment of the Big Pasture AMP, 1991.

Bureau of Land Management, Rawlins District. Big Pasture Allotment Management Plan, 1991.

Bureau of Land Management, Lander District, (1993). Interim Rangeland Management Agreement: Granite Mountain Open Allotment No. 1636.

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. Ecological Systems of the United States: A Working Classification of U.S. Terrestrial Systems. NatureServe, Arlington, VA. 75 p.

Environmental Protection Agency, 1999. Catalog of Federal Funding Sources for Watershed Protection (Second Edition). EPA 841-B-99-003, December

Harrelson, C. C., Rawlins, C. L., and Potyondy, J. P., 1994. Stream Channel Reference Sites: An Illustrated Guide to Field Technique. United States Forest Service Rocky Mountain Forest and Range Experiment Station. General Technical Report RM-245.

Natural Resources Conservation District (NRCS), 2008. Ecological Site Descriptions. Available online at: http://esis.sc.egov.usda.gov/ESIS/About.aspx

NatureServe. 2008. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.0. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer.

Plafcan, M., Eddy-Miller, C.A., Ritz, G. F., Holland, J.P. R. II., 1995. Water Resources of Freemont County, Wyoming. USGS Water Resources Investigations, Report 95-4095.

Rankle, J. G., Montague, E., and Lenz, B. N., 1994. Estimates of Monthly Streamflow Characteristics at Selected Sites, Wind River and Part of Bighorn River Drainage Basins, Wyoming. USGS Water-Resources Investigations Report 94-4014

Rosgen, D. L., 1996. Applied River Morphology: Wildland Hydrology Books, Pagosa Springs, CO. USDA Soil Conservation Service, 1981. Soil Survey of Fremont County, Wyoming Lander Area. Cheyenne, Wyoming

Rosgen, D. and Silvey, L., 1998. Filed Guide for Stream Classification. Wildland Hydrology.

USFS, 2006. LANDFIRE website available at: http://www.landfire.gov/index.php

Wyoming Department of Game and Fish, 2004. Annual Report for Lander Region. Available online at: http://gf.state.wy.us/downloads/pdf/AnnualReports/2004/AN04Lander.pdf

*APPENDIX A*

*GROUNDWATER PERMITS*

## Sweetwater River Watershed Study: Phase I Study Area
## Tabulation of Groundwater Permits

| ACE ID | Permit No. | Priority | Status | Applicant | Facility Name | USES | Reported Yield | Well Depth | Static Water Depth |
|---|---|---|---|---|---|---|---|---|---|
| 1 | P11153P | 7/14/1964 | GST | UNITED STATES GOVERNMENT | FINDLAY LAKE WELL #1 #0130 | STO | 10 | 259 | 140 |
| 2 | P11306P | 4/26/1962 | GST | UNITED STATES GOBERNMENT - BLM | SHANNON WELL #0647 | STO | 6 | 415 | -1 |
| 3 | P12440P | 12/21/1964 | GST | U.S. GOVERNMENT | ELKHORN WELL #0763 | STO | 5 | 242 | 180 |
| 4 | P53020W | 7/18/1980 | | JOHN G. (JACK) CORBETT | CORBETT #1 | | 15 | 60 | 8 |
| 5 | P63384W | 3/9/1983 | GST | USDI BLM, RAWLINS DISTRICT | OBRIEN PROJECT #4838 | STO | 6 | 800 | 214 |
| 6 | P113269W | 12/4/1998 | GST | USDI BLM | WEST LONG CREEK BASING WELL #1839 | STO | 10 | 150 | 16 |
| 7 | P11149P | 6/2/1942 | GST | UNITED STATES GOVERNMENT | GOVERNMENT MEADOWS WELL #0086 | STO | 6 | 160 | 62 |
| 8 | P11309P | 7/30/1945 | GST | UNITED STATES GOVERNMENT - BLM | DISH PAN BUTTE WELL #0206 | STO | 10 | 135 | 65 |
| 9 | P8184P | 11/30/1950 | GST | ALBERT VERNON MYERS | MYERS #3 | DOM | 12 | 50 | 20 |
| 10 | P11137P | 12/31/1966 | GST | UNITED STATES GOVERNMENT | CROOKED CREEK SPRING #0812 | STO | 10 | -1 | -1 |
| 11 | P11310P | 8/14/1964 | GST | UNITED STATES GOVERNMENT - BLM | WHITLOCK WELL #0705 | STO | 5 | 240 | 140 |
| 12 | P11312P | 8/11/1964 | GST | UNITED STATES GOVERNMENT - BLM | CEDAR RIM WELL #0762 | STO | 5 | 160 | 90 |
| 13 | P12429P | 12/15/1964 | GST | U.S. GOVERNMENT | ROCKY DRAW WELL #0721 | STO | 15 | 150 | 65 |
| 14 | P12430P | 7/24/1964 | GST | U.S. GOVERNMENT | FINDLAY LAKE #2 WELL #0128 | STO | 5 | 295 | 135 |
| 15 | P8182P | 10/31/1965 | GST | ALBERT VERNON MYERS | MYERS #1 | STO | 10 | 40 | 10 |
| 16 | P8183P | 10/31/1960 | GST | ALBERT VERNON MYERS | MYERS #2 | STO | 12 | 60 | 20 |
| 17 | P8185P | 10/31/1968 | GST | ALBERT VERNON MYERS | MYERS #4 | STO | 11 | 12 | 5 |
| 18 | P11161W | 11/16/1971 | GST | UNITED STATES GOVERNMENT | ST. MARYS WELL #4022 | STO | 0 | 0 | 0 |
| 19 | P24974P | 10/30/1973 | GST | GEORGE FLAGG | TENANT HOUSE #1 | DOM | 5 | 40 | 20 |
| 20 | P24975P | 10/30/1973 | GST | GEORGE FLAGG | FLAGG HOUSE #1 | DOM | 5 | 12 | 8 |
| 21 | P24976P | 10/30/1973 | GST | GEORGE FLAGG | MEADOW WELL #1 | STO | 5 | 12 | 8 |
| 22 | P33449W | 5/13/1976 | ADJ | FRANCES E. COUNTRYMAN | FRANNIE #1 | MIS,DOM | 15 | 40 | 7 |
| 23 | P39499W | 8/11/1977 | GST | MACE & ELIZABETH CONTRYMAN | COUNTRYMAN #76 | DOM | 10 | 67 | 20 |
| 24 | P54038W | 10/14/1980 | GST | J. B. & LORRAINE FOSTER | HERGENRETER #1 | STO | 8 | 120 | 15 |
| 25 | P54039W | 10/14/1980 | GST | J. B. & LORRAINE FOSTER | FOSTER #1 | STO | 8 | 65 | 10 |
| 26 | P60740W | 5/11/1982 | GST | USDI BLM, RAWLINS DISTRICT | SWEETWATER WELL | STO | 7 | 1080 | -4 |
| 27 | P63712W | 4/1/1983 | GST | WY BOARD OF LAND COMMISSIONERS | GOVERNMENT MEADOWS #1 | STO | 25 | 120 | 49 |
| 28 | P64315W | 6/9/1983 | GST | USDI BLM, RAWLINS DISTRICT | SOUTH SWEETWATER #5098 | STO | 5 | 300 | 202 |
| 29 | P67326W | 5/21/1984 | GST | ARNOLD & AMY WEST | WEST #1 | DOM | 20 | 100 | 45 |
| 30 | P68637W | 10/4/1984 | GST | LEE D. WHITLOCK | WHITLOCK #1 WELL | STO | 5 | 100 | 60 |
| 31 | P74404W | 4/14/1987 | ADJ | WYOMING STATE HIGHWAY DEPARTMENT | SWEETWATER STA #1 | MIS | 20 | 100 | 11.5 |
| 32 | P79328W | 3/31/1989 | GST | USDI BLM | LORRAINE | STO | | | |
| 33 | P108265W | 12/11/1997 | GST | USDI, BLM**DON ABERNATHY | SWEETWATER WELL & PIPELINE #1386 | STO | 20 | 40 | 18 |
| 34 | P114957W | 4/15/1999 | GST | WDOT | SWS-1 | MON | 0 | 28 | 23 |
| 35 | P114958W | 4/15/1999 | GST | WDOT | SWS-2 | MON | 0 | 18 | 13 |
| 36 | P114959W | 4/15/1999 | GST | WDOT | SWS-3 | MON | 0 | 16 | 12 |
| 37 | P114960W | 4/15/1999 | GST | WDOT | SWS-4 | MON | 0 | 15 | 11 |

**Sweetwater River Watershed Study: Phase I Study Area**
**Tabulation of Groundwater Permits**

| ACE ID | Permit No. | Priority | Status | Applicant | Facility Name | USES | Reported Yield | Well Depth | Static Water Depth |
|---|---|---|---|---|---|---|---|---|---|
| 38 | P118323W | 8/12/1999 | GST | MYERS LAND AND CATTLE CO.** USDI, BU | MEADOW DRAW WELL | STO | 4 | 120 | 16 |
| 39 | P82642W | 6/4/1990 | GST | USDI BLM | ASBELL MEADOWS | STO | 3 | 330 | 50 |
| 40 | P85610W | 7/9/1991 | UNA | USDI BLM | ENL LORRAINE WELL | MIS | 0 | 380 | 140 |
| 41 | P91402W | 4/16/1993 | GST | MYERS LAND AND CATTLE CO. | MYERS #1 | DOM,STO | 10 | 60 | 30 |
| 42 | P92804W | 9/3/1993 | GST | MYERS LAND AND CATTLE CO. | THOMPSON #1 | STO | 2 | 100 | -6 |
| 43 | P134775W | 5/11/2001 | GSI | Corp of Presiding BP of the church o | 6Th Crossing RV park | MIS | 15 | 60 | 6 |
| 44 | P134778W | 5/11/2001 | UNA | Corp of Presiding BP of the church o | 6Th Crossing Primitive CG | MIS | 5 | 78 | 13 |
| 45 | P138119W | 8/13/2001 | GSE | FARMLAND RESERVE, INC. A UTAH NON-PR | 6TH CROSSING CAMPGROUND | MIS | | | |
| 46 | P142794W | 2/19/2002 | GSI | BUREAU OF LAND MANAGEMENT/RAWLINS FI | ST. MARY'S WELL # 2 | STO | | | |
| 47 | P148215W | 11/26/2002 | GST | MYERS LAND AND CATTLE CO. | THOMPSON # 1 | STO | 25 | 190 | 17 |
| 48 | P155699W | 11/10/2003 | GSI | DON ABERNATHY** USDI, BUREAU OF LAND | ABERNATHY WELL #1 | STO | | | |
| 49 | P162102W | 9/1/2004 | GST | USDI, BUREAU OF LAND MANAGEMENT | RUSTY BUCKET WELL | STO | 15 | 35 | 15 |

***APPENDIX B***

***SURFACE WATER RIGHTS***

| Permit Number | Facility Name | Status | Township | Tns Suffix | Range | Rng Suffix | Section | Quarter | Lots | Stream Name | Name1 | Name2 | Name3 | Name4 | Name5 | Name6 | Name7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P11271D | MILLER DITCH | ADJ | 29 | N | 95 | W | 6 | 15 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P3571E | MILLER (enlarged) | ADJ | 29 | N | 95 | W | 6 | 15 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P3605E | GRAHAM & FARNSLEY #1 DITCH (enlarged) | ADJ | 29 | N | 95 | W | 6 | 5 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P3819E | MILLER | ADJ | 29 | N | 95 | W | 6 | 15 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P1262D | GRAHAM & FARNSLEY #1 DITCH | ADJ | 29 | N | 95 | W | 7 | 5 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P1263D | GRAHAM & FARNSLEY #2 DITCH | ADJ | 29 | N | 95 | W | 7 | 5 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P16579D | J.M.BROWN DITCH | ADJ | 30 | N | 93 | W | 5 | 6 | L4 | Long's Creek | Missouri River | Platte River | North Platte River | Sweetwater River | Long's Creek | | |
| P2492D | MCKINNEY #2 DITCH | ADJ | 30 | N | 93 | W | 7 | 12 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P2493D | MCKINNEY #1 DITCH | ADJ | 30 | N | 93 | W | 7 | 12 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P1818D | LONG CREEK DITCH | CAN | 30 | N | 93 | W | 9 | 2 | | Long's Creek | Missouri River | Platte River | North Platte River | Sweetwater River | Long's Creek | | |
| P154R | GRAHAM | CAN | 30 | N | 93 | W | 15 | 3 | | Long's Creek | Missouri River | Platte River | North Platte River | Sweetwater River | Long's Creek | | |
| P2380D | GRAHAM RESERVOIR DITCH | CAN | 30 | N | 93 | W | 15 | 3 | | Long's Creek | Missouri River | Platte River | North Platte River | Sweetwater River | Long's Creek | | |
| P1973E | GRAHAM (enlarged) | CAN | 30 | N | 93 | W | 16 | 6 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P1974E | CANYON DITCH (enlarged) | EXP | 30 | N | 93 | W | 16 | 15 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P18785D | KOEHLER DITCH | ADJ | 30 | N | 94 | W | 10 | 15 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P3448D | CANYON DITCH | ADJ | 30 | N | 94 | W | 11 | 15 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P5145D | SHATTUCK | CAN | 30 | N | 94 | W | 11 | 10 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P990E | CANYON (enlarged) | ADJ | 30 | N | 94 | W | 11 | 15 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P28120D | BIG BROWN WELL #1 HAUL | CAN | 30 | N | 94 | W | 16 | 2 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P34061D | Sweetwater River #1 Water Haul | UNA | 30 | N | 94 | W | 20 | 6 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P9956D | GOVERNMENT MEADOWS DITCH | EXP | 30 | N | 95 | W | 2 | 3 | | Government Meadows Creek | Missouri River | Platte River | North Platte River | Sweetwater River | Government Meadows Creek | | |
| P16057D | CROOKED CREEK DITCH | EXP | 30 | N | 95 | W | 18 | 11 | L4 | Crooked Creek | Missouri River | Platte River | North Platte River | Sweetwater River | Crooked Creek | | |
| P5142D | CROOKED CREEK | CAN | 30 | N | 95 | W | 18 | 11 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P1511D | ERVAY | CAN | 30 | N | 95 | W | 23 | 13 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P9954D | JACOB DITCH | ADJ | 30 | N | 95 | W | 23 | 11 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P1703E | NATIONAL DITCH (enlarged) | ADJ | 30 | N | 95 | W | 24 | 8 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P2526E | NATIONAL DITCH (enlarged) | ADJ | 30 | N | 95 | W | 24 | 7 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P5961E | FREDERICK DITCH (enlarged) | ADJ | 30 | N | 95 | W | 24 | 8 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P6979D | NATIONAL DITCH | ADJ | 30 | N | 95 | W | 24 | 5 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P8760D | FREDERICK DITCH | ADJ | 30 | N | 95 | W | 24 | 4 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P1156D | RUSSELL CANAL | ADJ | 30 | N | 95 | W | 27 | 14 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P23455D | OIL & GAS FUTURES INC WATER HAUL | CAN | 30 | N | 95 | W | 27 | 12 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P23464D | OIL & GAS FUTURES INC WATER HAUL | CAN | 30 | N | 95 | W | 27 | 12 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P23858D | M K M EXPLORATION CO WATER HAUL | CAN | 30 | N | 95 | W | 27 | 12 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P25185D | SWEETWATER RIVER PUMP POINT | CAN | 30 | N | 95 | W | 27 | 12 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P25369D | ASHLAND EXPLORATION SWEETWATER DRILLING WATER HAUL | CAN | 30 | N | 95 | W | 27 | 12 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P25925D | DSC RAINFALL SIMULATOR WATER HAUL | CAN | 30 | N | 95 | W | 27 | 12 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P29056D | WEST FORK 29 11 WATER HAUL | CAN | 30 | N | 95 | W | 27 | 12 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P30560D | DISHPAN BUTTE WATER HAUL | CAN | 30 | N | 95 | W | 27 | 12 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P3782E | MEYERS DITCH (enlarged) | ADJ | 30 | N | 95 | W | 27 | 12 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P8991D | KAHLER DITCH | CAN | 30 | N | 95 | W | 27 | 14 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P9955D | MEYERS DITCH | ADJ | 30 | N | 95 | W | 27 | 12 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P16025D | INDEPENDENT DITCH | ADJ | 30 | N | 95 | W | 33 | 5 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P3141E | INDEPENDENT DITCH (enlarged) | CAN | 30 | N | 95 | W | 33 | 5 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P4499E | INDEPENDENT DITCH (enlarged) | ADJ | 30 | N | 95 | W | 33 | 5 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P9953D | INDEPENDENT DITCH | CAN | 30 | N | 95 | W | 33 | 5 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P11770S | UPPER CROOKED CREEK | UNA | 30 | N | 96 | W | 1 | 9 | | Crooked Creek | Missouri River | Platte River | North Platte River | Sweetwater River | Crooked Creek | | |
| P5182R | ANTELOPE SPRINGS | UNA | 30 | N | 96 | W | 23 | 2 | | Antelope Spring Draw | Missouri River | Platte River | North Platte River | Sweetwater River | Antelope Spring Draw | | |
| P6064D | PARKS DITCH | CAN | 31 | N | 93 | W | 1 | 10 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| P3944R | DANIEL F. HUDSON RESERVOIR | ADJ | 31 | N | 93 | W | 2 | 11 | | East Long's Creek | Missouri River | Platte River | North Platte River | Sweetwater River | Long's Creek | East Long's Creek | |
| P6065D | JACKSON DITCH | CAN | 31 | N | 93 | W | 2 | 5 | | Sweetwater River | Missouri River | Platte River | North Platte River | Sweetwater River | | | |
| T5721D | STEWART #1 DITCH | ADJ | 31 | | 93 | | 3 | 15 | | Long's Creek | Missouri River | Platte River | North Platte River | Sweetwater River | Long's Creek | | |
| T5720D | LONGS CREEK #1 DITCH | ADJ | 31 | | 93 | | 4 | 13 | | Long's Creek | Missouri River | Platte River | North Platte River | Sweetwater River | Long's Creek | | |
| T5722D | LONG'S CREEK #2 DITCH | ADJ | 31 | | 93 | | 9 | 4 | | Long's Creek | Missouri River | Platte River | North Platte River | Sweetwater River | Long's Creek | | |
| P1884R | HUDSON RESERVOIR | ADJ | 31 | N | 93 | W | 16 | 8 | | Long's Creek | Missouri River | Platte River | North Platte River | Sweetwater River | Long's Creek | | |
| P1556D | TAYLOR DITCH | ADJ | 31 | N | 93 | W | 20 | 5 | | Long's Creek | Missouri River | Platte River | North Platte River | Sweetwater River | Long's Creek | | |
| P12688D | LONGS CR DITCH | CAN | 31 | N | 93 | W | 31 | 3 | | Long's Creek | Missouri River | Platte River | North Platte River | Sweetwater River | Long's Creek | | |
| P28108D | SEISMIC WATER HAUL #1 | EXP | 31 | N | 94 | W | 2 | 2 | L2 | West Fork of Long's Creek | Missouri River | Platte River | North Platte River | Sweetwater River | Long's Creek | West Fork of Long's Creek | |
| P5330R | GOVERNMENT MEADOWS | EXP | 31 | N | 95 | W | 14 | 6 | | Government Meadows Creek | Missouri River | Platte River | North Platte River | Sweetwater River | Government Meadows Creek | | |
| P5351R | KELLER DRAW | | 31 | N | 95 | W | 25 | 3 | | Keller Draw | Missouri River | Platte River | North Platte River | Sweetwater River | Keller Draw | | |
| P11771S | DISHPAN BUTTE | GST | 31 | N | 95 | W | 33 | 8 | | Dishpan Butte Draw | Missouri River | Platte River | North Platte River | Sweetwater River | Government Meadows Creek | Dishpan Butte Draw | |
| C56/032A | TROUT DITCH | ADJ | 32 | | 92 | | 29 | 16 | | Stampede Springs | Missouri River | Platte River | North Platte River | Sweetwater River | Buffalo Creek | Tin Cup Creek | Stampede Springs |
| P17281S | Buffalo Basin Pit (#2518) Stock Reservoir | CAN | 32 | N | 92 | W | 32 | 3 | | Buffalo Draw | Missouri River | Platte River | North Platte River | Sweetwater River | Buffalo Creek | Buffalo Draw | |
| P18927S | Buffalo Basin Pit Stock Reservoir | UNA | 32 | N | 92 | W | 32 | 3 | | Buffalo Draw | Missouri River | Platte River | North Platte River | Sweetwater River | Buffalo Creek | Buffalo Draw | |
| P17282S | West Granite Pit (#2524) Stock Reservoir | CAN | 32 | N | 93 | W | 24 | 10 | | West Granite Draw | Missouri River | Platte River | North Platte River | Sweetwater River | Long's Creek | East Long's Creek | West Granite Draw |
| P18836S | West Granite Pit Stock Reservoir | UNA | 32 | N | 93 | W | 24 | 10 | | West Granite Draw | Missouri River | Platte River | North Platte River | Sweetwater River | Long's Creek | East Long's Creek | West Granite Draw |
| P12361S | UPPER ROCK CREEK | UNA | 32 | N | 94 | W | 14 | 1 | | West Fork of Long's Creek | Missouri River | Platte River | North Platte River | Sweetwater River | Long's Creek | West Fork of Long's Creek | |