Wyoming's
2014 Integrated 305(b) and 303(d) Report

Draft

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Document #14-1021

Department of Environmental Quality
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List of Acronyms

AFO	Animal Feeding Operation
ALUS	Aquatic Life Use Support
AML	Abandoned Mine Lands
AMPs	Allotment Management Plans
BLM	United States Bureau of Land Management
BMP	Best Management Practices
CBM	Coal Bed Methane
CBPU	Cheyenne Board of Public Utilities
CCCD	Campbell County Conservation District
CCD	Cody Conservation District
CCNRD	Crook County Natural Resource District
CFR	Code of Federal Regulations
CFUs	Colony Forming Units
Chapter 1	Chapter 1 of the Wyoming Water Quality Rules and Regulations
CRM	Coordinated Resource Management
CRP	Conservation Reserve Program
CWA	Federal Clean Water Act
DOI	United States Department of the Interior
DCCD	Dubois County Conservation District
EC	Electrical Conductivity
EIS	Environmental Impact Statement
EMAP	Environmental Monitoring and Assessment Program
HSCCD	Hot Springs County Conservation District
HUC	Hydrologic Unit Code (HUC)
LCD	Lincoln Conservation District
LDCD	Lake DeSmet Conservation District
LRCD	Laramie Rivers Conservation District
MCD	Meeteetse Conservation District
NCCD	Natrona County Conservation District
NCD	Niobrara Conservation District
NRCS	Natural Resource Conservation Service
PACD	Popo Agie Conservation District
PCFCD	Powell-Clarks Fork Conservation District
PCRD	Platte County Resource District
PFC	Proper Functioning Condition
PRBIWG	Powder River Basin Interagency Work Group
PRCD	Powder River Conservation District
RIVPACS	River Invertebrate Prediction and Classification System
SAR	Sodium Adsorption Ratio
SCCD	Sheridan or Sublette County Conservation Districts
SWCCD	Sweetwater County Conservation District
SCD	Shoshone Conservation District
SDDENR	South Dakota Department of Environment and Natural Resources
Section 205j	Section 205j of the CWA
Section 208	Section 208 of the CWA
Section 301	Section 301 of the CWA
Section 319	Section 319 of the CWA
SMCLs	USEPAs Secondary Maximum Contaminant Levels for Drinking Water
TA	Timberline Aquatics, Inc.
TCD	Teton Conservation District
TDS	Total Dissolved Solids

TMDL	Total Maximum Daily Load
TRT	Technical Review Team
TSS	Total Suspended Solids
UAA	Use Attainability Analysis
UCCD	Uinta County Conservation District
USBOR	United States Bureau of Reclamation
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UW	University of Wyoming
WACD	Wyoming Association of Conservation Districts
WCCD	Washakie County Conservation District
WDEQ	Wyoming Department of Environmental Quality
WDH	Wyoming Department of Health
WGFD	Wyoming Game and Fish Department
WLA	Waste Load Allocation
WOGCC	Wyoming Oil and Gas Conservation Commission
WMP	Watershed Monitoring Program
WQD	Wyoming Water Quality Division
WSII	Wyoming Stream Integrity Index
WWP	Western Watersheds Project
WWTF	Waste Water Treatment Facility
WYPDES	Wyoming Point Source Discharge Elimination System

1.0 Introduction

In 1972, Congress enacted the Federal Water Pollution Control Act, otherwise known as the Clean Water Act (CWA). The purpose of the CWA is to promote the restoration and/or maintenance of the chemical, physical and biological integrity of our nation's surface waters and to support the *protection and propagation of fish, shellfish, and wildlife and recreation in and on the water*. The U.S. Environmental Protection Agency (USEPA) is charged with administering the CWA. However, Section 101(b) of the CWA states that *it is the policy of Congress to recognize, preserve, and protect the primary responsibilities and rights of States to prevent, reduce, and eliminate pollution, to plan the development and use (including restoration, preservation, and enhancement) of land and water resources, and to consult with the Administrator in the exercise of his authority under this Act.* As such, the Wyoming Department of Environmental Quality, Water Quality Division (WDEQ/WQD) administers the Clean Water Act in Wyoming. EPA or authorized tribes administer the Clean Water Act in Indian Country, as defined at 18 U.S.C. Section 1151.

1.1 Section 305(b) Requirements

Section 305(b) of the CWA requires that each state prepare and submit a biennial report to USEPA by April 1st of even numbered years. The Federal Code of Regulations (CFR) 130.8 outlines the required content of the report. The report must contain a description of the water quality of all navigable waters of the state for the preceding year, including the extent to which current conditions allow for the protection and propagation of a balanced population of shellfish, fish, and wildlife, and allow recreational activities in and on the water. Section 305(b) also requires each state to report the water quality and the elimination of pollutants necessary for designated use support. Specifically, each state is to identify waters not meeting the above conditions, recommend strategies to achieve these objectives and to estimate the environmental impacts, economic and social costs and benefits and the predicted timeline for project completion. The sources and extent of non-point source pollution in each state must be estimated, including a description of the current program used to mitigate these pollutants and associated financial costs. Lastly, the report must include an assessment of the water quality of all publicly owned lakes, including the status and trends of such water quality as specified in section 314(a)(1) of the CWA.

1.2 Section 303(d) Requirements

Section 303(d) of the CWA requires that states identify and list waters for which the effluent limits outlined in Section 301 are not effective in attaining designated uses. CFR 130.7 outlines the requirements of section 303(d). Each state must submit a 303(d) List of impaired and threatened waters to USEPA by April 1st of each even numbered year. USEPA must review and approve or disapprove the 303(d) List within 30 days of submittal. The 303(d) List must also include waters for which controls on thermal discharges under section 301 of the CWA are not stringent enough to assure the protection and propagation of a balanced population of shellfish, fish, and wildlife. Section 303(d) requires that states develop a separate TMDL for each pollutant/segment combination on the 303(d) List. Waters on the 303(d) List must be prioritized for TMDL development based on the severity of each pollutant/segment combination or listing (see Section 5.0 below). Wyoming's biennial Integrated 305(b) and 303(d) Report (hereafter referred to as the Integrated Report) combines the requirements of both CWA sections into a single document. WDEQ provides a 30-day public comment period for the draft Integrated Report, followed by a formal response to comments. There is then a two week period during which the public may contact the Water Quality Division Administrator and request a review of the proposed 303(d) List before the Water and Waste Advisory Board where there are major objections to proposed waterbodies on the list. The advisory board may consider the comments and objections and make recommendations to WDEQ.

2.0 Determining Surface Water Quality Condition

40 CFR 130.7(b)(5) requires that WDEQ *shall assemble and evaluate all existing and readily available water quality-related data and information to develop the list required by §§130.7(b)(1) and 130.7(b)(2). At a minimum "all existing and readily available water quality-related data and information" includes but is not limited to all of the existing and readily available data and information about the following categories of waters:*

(i) Waters identified by the State in its most recent section 305(b) report as "partially meeting" or "not meeting" designated uses or as "threatened";
(ii) Waters for which dilution calculations or predictive models indicate nonattainment of applicable water quality standards;
(iii) Waters for which water quality problems have been reported by local, state, or federal agencies; members of the public; or academic institutions. These organizations and groups should be actively solicited for research they may be conducting or reporting. For example, university researchers, the United States Department of Agriculture, the National Oceanic and Atmospheric Administration, the United States Geological Survey, and the United States Fish and Wildlife Service are good sources of field data; and
(iv) Waters identified by the State as impaired or threatened in a nonpoint assessment submitted to EPA under section 319 of the CWA or in any updates of the assessment.

Much of the data and information used in making designated use support determinations, or water quality assessments, are generated by WDEQ's Surface Water Quality Monitoring Program. Surface Water Monitoring Program studies typically result in final reports, which are available on WDEQ's webpage. In addition, WDEQ routinely reviews water quality data from a variety of other sources, including Wyoming's 34 conservation districts, federal, state and local government agencies, non-profit organizations and the private sector.

2.1 Data Requirements

WDEQ's Water Quality Assessment Program is responsible for reviewing all readily available surface water quality data, determining designated use support for Wyoming's surface waters and completing the State's Integrated Report. WDEQ solicits data every two years using the department's automated electronic mailing list or listserv. Water quality data must be submitted to WDEQ no later than July 15 during odd-numbered (e.g. 2015) years to be considered for inclusion in the subsequent Integrated Report (e.g. 2016). Any supplemental data or other information deemed necessary by WDEQ must be provided promptly as requested. Incomplete data or those submitted beyond the July 15 deadline are typically considered toward the subsequent Integrated Report (e.g. 2018).

All water quality data are thoroughly evaluated against the surface water quality standards contained in Chapter 1 of Wyoming's Water Quality Rules and Regulations (WDEQ, 2013b) (Chapter 1) and designated use support determinations are made using Wyoming's Methods for Determining Surface Water Quality Condition and TMDL Prioritization. This methodology, last updated on April 29th 2014, is revised periodically to maintain consistency with changes in Chapter 1. The Water Quality Assessment Program uses the methodology in place at the time the sampling was conducted when compiling the Integrated Report.

Credible Data

The Wyoming Environmental Quality Act, Wyoming Statute (W.S.) § 35-11-103(c)(xix), and Section 2(a)(i) of Chapter 1 define credible data as *scientifically valid chemical, physical and biological monitoring data collected under an accepted sampling and analysis plan including quality control, quality assurance procedures and available historical data*. Section 35(b) of Chapter 1 requires that *credible data be*

collected on each water body, and shall be considered for purposes of characterizing the integrity of the water body including consideration of soil, geology, hydrology, geomorphology, climate, stream succession and the influences of man upon the system. These data in combination with other available and applicable information shall be used through a weight-of-evidence approach to designate uses and determine whether those uses are being attained. Chapter 1, Section 35(d) requires that *credible data shall be utilized in determining a water body's attainment of designated uses,* although a less than complete set of data may be used to make a decision on designated use support (i.e. attainment) *in instances where numerical standards contained in these rules are exceeded or on ephemeral or intermittent water bodies where chemical or biological sampling is not practical or feasible* (Chapter 1, Section 35(b)). Hereafter, within this document, the use of the term credible data will refer to the definition above.

As described in Section 35(a)(i) of Chapter 1, data must be collected *using accepted referenced laboratory and field methods employed by a person who has received specialized training and has field experience in developing a monitoring plan, a quality assurance plan, and employing the methods outlined in such plans; or works under the supervision of a person who has these qualifications. Specialized training includes a thorough knowledge of written sampling protocols and field methods such that the data collection and interpretation are reproducible, scientifically defensible, and free from preconceived bias.* Section 35(a)(ii) of Chapter 1 states that *data must include documented quality assurance, consisting of a plan that details how environmental data operations were planned, implemented, and assessed with respect to quality during the duration of the project.*
A variety of scientifically defensible laboratory and field methods may be used to collect and analyze data for water quality assessments. WDEQ's Manual of Standard Operating Procedures for Sample Collection and Analysis contains information regarding the standard sampling and analysis methods and references, data handling and field equipment commonly used by WDEQ's Surface Water Quality Monitoring Program. Quality assurance/quality control documentation, including completed data sheets, instrument calibration logs and a detailed description of study design (e.g. map of study site locations, coordinates, photographs and other relevant descriptive information) must accompany all data submissions. WDEQ may also choose to conduct field audits and/or collect additional samples for verification during the QA/QC process. For data collected specifically for use support determinations (i.e., assessments), WDEQ requires a pre-approved sampling and analysis plan (SAP) and a quality assurance project plan (QAPP) (WDEQ, 2014).

Wyoming's Weight of Evidence Approach

Section 35(b) of Chapter 1 requires that a weight-of-evidence approach be used to analyze credible data when making designated use support determinations. Wyoming's weight-of-evidence approach, as described approach evaluates all relevant data and other information and uses scientific deduction to assess the designated use support of surface waters. In using this approach, WDEQ may utilize statistical tests, analytical procedures and evaluate additional data to ensure the validity, representativeness and objectiveness of data. As a general policy, however, WDEQ uses a weight-of evidence approach when evaluating all data to make designated use support determinations. WDEQ's weight-of-evidence approach has been adapted from Section 3, Volume 2 of USEPA's Guidelines for Preparation of the Comprehensive State Water Quality Assessments, 305(b) Reports and Annual Electronic Updates: Supplement EPA-841-B-97-002B (USEPA, 1997) and Section IV of USEPA's Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act (USEPA, 2005a).

2.2 Designated Uses

Section 2(b)(ix) of Chapter 1 defines designated uses as *those uses specified in water quality standards for each water body or segment whether or not they are being attained*. Designated uses are equivalent

to management goals or expectations for each of Wyoming's surface waters, and are assigned to each water using a tiered classification system described in Section 4 of Chapter 1. This approach places waters into Classes 1-4 (see Table 1) based on their designated uses, with Class 1 waters being managed for the highest and Class 4 the lowest water quality, respectively. Wyoming's current surface water classifications are contained within the Wyoming Surface Water Classification List (WDEQ, 2013c). Section 3 of Chapter 1 states that *the objectives of the Wyoming pollution control program are to provide, wherever attainable, the highest possible water quality commensurate with the following nine uses:*

Drinking water - *The drinking water use involves maintaining a level of water quality that is suitable for potable water or intended to be suitable after receiving conventional drinking water treatment.*

Fisheries - *The fisheries use includes water quality, habitat conditions, spawning and nursery areas, and food sources necessary to sustain populations of cold water game fish, warm water game fish and nongame fish. This use does not include the protection of aquatic invasive species or other fish which may be considered ""undesirable" by the Wyoming Game and Fish Department or the U.S. Fish and Wildlife Service within their appropriate jurisdictions.*

Aquatic life other than fish - *This use includes water quality and habitat necessary to sustain populations of organisms other than fish in proportions which make up diverse aquatic communities common to the waters of the state. This use does not include the protection of human pathogens, insect pests, aquatic invasive species or other organisms which may be considered "undesirable" by the Wyoming Game and Fish Department or the U.S. Fish and Wildlife Service within their appropriate jurisdictions.*

Fish consumption - *The fish consumption use involves maintaining a level of water quality that will prevent any unpalatable flavor and/or accumulation of harmful substances in fish tissue.*

Recreation - *Recreational use protection involves maintaining a level of water quality which is safe for human contact. It does not guarantee the availability of water for any recreational purpose. The recreational designated use includes primary contact recreation and secondary contact recreation subcategories*.

Wildlife - *The wildlife use includes protection of water quality to a level which is safe for contact and consumption by avian and terrestrial wildlife species.*

Agriculture - *For purposes of water pollution control, agricultural uses include irrigation and/or livestock watering.*

Industry - *The industrial use involves maintaining a level of water quality useful for industrial purposes.*

Scenic value - *Scenic value use involves the aesthetics of a waterbody (odor, color, taste, settleable solids, floating solids, suspended solids and solid waste) and is not necessarily related to general landscape appearance.*

Table 1. Wyoming's surface water classifications (far left column) and designated uses (top row). For each surface water class, a Yes indicates that a designated use is protected, while a No indicates that the use is not protected.

	Drinking water	Cold water game fish	Warm water game fish	Nongame fish	Fish consumption	Aquatic life other than fish	Recreation[2]	Wildlife	Agriculture	Industry	Scenic value
1	*Yes*[1]	*Yes*[1]	*Yes*[1]	*Yes*[1]	*Yes*[1]	*Yes*	Yes	Yes	Yes	Yes	Yes
2AB	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2A	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
2B	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2C	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2D	No	If present	If present	If present	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3A	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
3B	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
3C	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
3D	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
4A	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
4B	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
4C	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes

[1] Class 1 waters are not necessarily protected for all uses (indicated by an italicized "*Yes*") in all circumstances. For example, all surface waters in National Parks and Wilderness Areas are Class 1; however, all such waters are not necessarily managed for fisheries or aquatic life other than fish uses (e.g. hot springs, ephemeral waters and wet meadows).
[2] Wyoming's recreational designated use is subdivided into primary and secondary recreational uses, but WDEQ uses only a single recreational designated use in assigning surface water classifications.

2.3 USEPA Categorization

Wyoming's Methods for Determining Surface Water Quality Condition and TMDL Prioritization (WDEQ, 2014) outlines the methodology used by WDEQ for making designated use support determinations, or assessments, on surface waters. Once designated use support determinations are made by WDEQ, USEPA requires that all surface waters of the state be placed into one of five categories (USEPA 2005b, 2006). Because designated uses, water quality standards and designated use support methodologies are not consistent across all states, tribes and territories, surface water categorizations are used to standardize these various approaches for USEPA's national reporting purposes. In Wyoming, designated use support determinations translate directly into the five categories below.

Category 1 - Available data and/or information indicate that all designated uses are supported and no use is threatened.

Category 2 - Available data and/or information indicate that at least one designated use is supported, while one or more other uses are either indeterminate or not assessed.

Category 3 - Available data and/or information are either insufficient or inconclusive and designated use support cannot be determined for any uses.

Category 4 - Available data and/or information indicate that at least one designated use is impaired, but a TMDL is not needed. There are three sub-categories of category 4:

4A. Impaired waters with TMDLs approved by USEPA.

4B. A use impairment that is being addressed by the state through other pollution control measures. For example, a stream that has been historically impaired by excess sedimentation from urban stormwater runoff may be moved to category 4B after stormceptors are installed that are expected to effectively trap the excess sediment before it reaches the stream.

4C. A use impairment not caused by a pollutant, but instead by anthropogenic non-pollutant stressor(s). A pollutant can be thought of as a stressor for which an allowable load can be calculated and is defined in Section 502(6) of the CWA as *dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water*. Examples of anthropogenic non-pollutant stressors for which a pollutant load cannot be calculated include stream flow alterations, stream channelization and concrete lined channels (USEPA, 2005b).

The Wyoming State Engineer's Office (SEO) regulates water quantity in Wyoming's surface waters; neither USEPA nor WDEQ have any regulatory authority over water quantity. Section 101(g) of the CWA states that *it is the policy of Congress that the authority of each State to allocate quantities of water within its jurisdiction shall not be superseded, abrogated or otherwise impaired by this chapter. It is the further policy of Congress that nothing in this chapter shall be construed to supersede or abrogate rights to quantities of water which have been established by any State.* The Code of Federal Regulations, 40 CFR 131.4(a) states that *consistent with section 101(g) and 518(a) of the Clean Water Act, water quality standards shall not be construed to supersede or abrogate rights to quantities of water.* The Wyoming Environmental Quality Act, W.S. 35-11-1104(a)(iii) states that *nothing in this act limits or interferes with the jurisdiction, duties or authority of the state engineer, the state board of control, the director of the Wyoming game and fish department, the state mine inspector, the oil and gas supervisor or the oil and gas conservation commission, or the occupational health and safety commission.* Regarding WDEQ's regulatory authority, Section 1 of Chapter 1 states that *nothing in this definition is intended to expand the scope of the Environmental Quality Act, as limited in W.S. 35-11-1104 nor do these regulations supersede or abrogate the authority of the state to appropriate quantities of water for beneficial uses.*

Augmenting and/or decreasing natural streamflows is collectively termed "flow alterations" by WDEQ for the purpose of assessing designated use support. Flow alterations occur in all of Wyoming's river basins to some degree and their effects on water quality can range from beneficial to deleterious. WDEQ routinely evaluates the effects of flow alterations and other anthropogenic non-pollutant stressors when reviewing water quality data and other information toward designated use support determinations. Waters are not placed on Wyoming's 303(d) List of impaired waters requiring a TMDL (USEPA category 5) when flow alterations are considered to be the primary cause of the water quality impairment. Instead, these waters are placed into USEPA category 4C, which recognizes that a use impairment is not caused by a pollutant, but instead by an anthropogenic non-pollutant stressor(s). Placing a water in category 4C for flow alterations indicates that at least one designated use is impaired, but that neither WDEQ nor EPA has any regulatory authority over the cause of the impairment.

Category 5 - Available data and/or information indicate that at least one designated use is not supported or is threatened. Category 5 waters are added to Wyoming's 303(d) List of impaired waters requiring TMDLs. Each pollutant/segment combination is considered a separate 303(d) Listing. For example, if the aquatic life other than fish use on a stream segment is impaired due to copper, sediment and selenium, these three pollutants would be considered three separate 303(d) Listings.

All categorized waters are georeferenced by WDEQ using GIS (Geographic Information Systems) and the U.S. Geological Survey (USGS) 1:24K NHD (National Hydrography Dataset) data layer. Linear (streams) and polygon (lakes, reservoirs, ponds) shapefiles are updated every two years and submitted to USEPA along with the Integrated 305(b) and 303(d) Report. These shapefiles are available to the public for download on WDEQ's Watershed Protection Program website. Study site locations from available data and/or information are used to delineate the extent of each categorized water. Lakes and reservoirs are typically placed into just one of the five categories, but can also be subdivided into several categories. In contrast, streams commonly have segments in more than one category. WDEQ typically delineates stream segments in one of two ways, depending on the number of study sites used in the assessment. If two or more study sites exist, the segment will usually be delineated to include the distance between the sites. If only one study site exists, however, the segment is usually extended from this site to the nearest upstream and downstream tributary. WDEQ recommends that data submissions include the necessary number of study sites to allow for an accurate delineation of each assessment unit.

A unique 305(b) identifier is assigned to each categorized water by WDEQ and serves as a permanent reference. Each identifier contains information about the state, river basin and 12-digit HUC (hydrologic unit code) containing the water and a sequence number indicating the order in which waters have been categorized within the 12-digit HUC. For example, a 36.5 mile segment of the Bear River, from the confluence with Woodruff Narrows Reservoir upstream to the confluence with Sulphur Creek was placed in category 5 and added to the 303(d) List in 2002. The 305(b) identifier for this segment is WYBR160101010303_01, indicating that it is located in Wyoming (WY), in the Bear River Basin (BR), in 12 digit HUC 160101010303 and that this was the first (01) categorization decision by WDEQ within this 12 digit HUC.

Data and information for all of Wyoming's categorized surface waters are stored in a relational Microsoft Access database called the Assessment Database (ADB). The ADB was created by USEPA to assist states in creating CWA data reports and to improve the quality and consistency of water quality reporting and water quality data analysis. The ADB is updated every two years and is submitted to USEPA along with the Integrated Report.

3.0 Surface Water Quality Monitoring

3.1 Wyoming's Surface Water Monitoring Program

WDEQ's Surface Water Quality Monitoring Program was initiated in 1992 with the collection of physical, chemical and biological data from "least impacted" streams as part of the Reference Stream Project. This dataset remains dynamic and continues to be supplemented and refined as new reference streams are identified. In addition, existing reference streams are re-visited to confirm reference status and document natural temporal variability. These reference data are used to define a range of expected conditions when evaluating the surface water quality of other Wyoming streams of unknown condition. In 1998, the Watershed Monitoring Program began monitoring streams, lakes and reservoirs to determine designated use support and remains committed to collecting the data necessary to provide conclusive use support determinations. The Manual of Standard Operating Procedures for Sample Collection and Analysis, which was last updated in November 2012, describes the data collection methods used by the Watershed Monitoring Program.

The 2010-2019 Watershed Monitoring Program Water Quality Strategy lists ten program objectives; these include: determining water quality standard attainment; identifying impaired waters; identifying causes and sources of impairment; assessing water quality status and trends at multiple scales; evaluating watershed program effectiveness; responding to complaints and emergencies; supporting the development and implementation of water quality standards; providing data and technical support toward the development and evaluation of Total Maximum Daily Loads (TMDLs); providing data and technical support toward the implementation and evaluation of nonpoint source (NPS) restoration projects; and

supporting Wyoming Point Source Discharge Elimination System (WYPDES) permitting and compliance. To achieve these objectives, the Watershed Monitoring Program Monitoring Strategy includes stream reference station monitoring, rotating basin probability surveys and targeted monitoring, monitoring of high priority waters from the 1997 TMDL Workplan and lake and reservoir monitoring. Monitoring for the 2010-2019 strategy focuses on a rotating river basin framework where probabilistic (see *Wyoming's Statewide Water Quality Surveys* below) and targeted monitoring will be integrated. Using this approach, a probabilistic survey will be completed for each river basin, and the results of these surveys will identify waters for targeted monitoring studies. Monitoring to expand WDEQs reference dataset will also occur within the basins under study. WDEQ re-evaluates its water quality monitoring strategy every ten years to allow for adjustment of management goals and objectives as priorities change. WDEQ also provides annual workplans to inform the public, government, non-profit and other groups about the monitoring WDEQ will conduct during a given year and to provide the contact information for WDEQ regional offices. WDEQ frequently involves stakeholders in targeted water quality monitoring studies.

Wyoming's Stream Surface Water Quality Monitoring Networks

WDEQ has entered into a cooperative agreement with the USGS to conduct surface water quality sampling for two monitoring networks in Wyoming. One network is comprised of water quality and gaging stations where sampling is generally conducted on a quarterly to monthly basis. Parameters of interest vary between sites, but include standard physico-chemical measures, nutrients, major ions, trace metals, sediment and pathogens. Study sites are used to collect data in support of nutrient criteria development, monitor impaired streams, evaluate streams associated with point source discharges and to identify trends in the water quality of larger rivers. The second network includes water quality stations associated with natural gas development, most of which are in northeastern Wyoming with a few in south central Wyoming. This network was created to determine whether there are effects of natural gas development on water quality, to establish baseline conditions in less developed areas and to insure compliance with existing water quality standards and WYPDES permitting policies. Sampling locations for these networks as of 2010 are contained within WDEQ's 2010-2019 Surface Water Monitoring Program Strategy.

Wyoming's Surface Water Quality Surveys

The Environmental Monitoring and Assessment Program (EMAP) was established by the USEPA in the late 1980s to develop probability, or randomized, based monitoring tools (e.g. biological indicators, stream survey design, estimates of reference condition) to produce unbiased estimates of the ecological condition of perennial streams across large spatial scales. Within this program, Wyoming and 11 other western states were grouped into EMAP-West. USGS was contracted by WDEQ to complete the sampling and analyses in Wyoming from 2000-2003 and write a final scientific investigations report in 2007. This study (Peterson et al. 2007) first compared the ecological status (i.e. chemical, physical, and biotic condition) of Wyoming's streams to those of the combined EMAP-West reference streams. Next, the ecological status of the three climatic regions within the state (i.e. plains, xeric, and mountain) were compared to these reference streams and used to estimate the suitability of Wyoming streams for aquatic life use support (ALUS). Lastly, the aquatic life other than fish designated use was evaluated using both EMAP and Wyoming's Stream Integrity Index (WSII) (Hargett, 2011) and River Invertebrate Prediction and Classification System (RIVPACS) (Hargett, 2012) biological indices.

WDEQ's first and second statewide probabilistic surveys of Wyoming's perennial streams and rivers (WDEQ, 2013a) were conducted during 2004-2007 and 2008-2011 to fulfill obligations under Section 305(b) of the CWA. Results from these surveys provide an objective summary of trends in the biological condition of Wyoming's streams and identify the most important stressors. These surveys represent a more focused and representative effort relative to EMAP-West. Unlike data from targeted studies and data gathered from the water quality monitoring networks, those collected as part of WDEQ's probabilistic surveys are not used for determining designated use support.

WDEQ's statewide surveys include all non-headwater (i.e. >1st Strahler order) perennial streams and rivers that are not located in national parks, United States Forest Service wilderness areas or the Wind River Indian Reservation. This equates to approximately 17,513 miles (based on 1:24K NHD digital stream coverage) of perennial streams and rivers or almost one-half of the total miles of perennial streams and rivers in Wyoming. Biological condition was evaluated at both the statewide scale and separately for three climatic regions of the State: mountain, plains and xeric. A total of 64 and 45 study sites were evaluated for the first and second statewide surveys, respectively.

According to the most recent statewide survey conducted in 2008-2011, 58% of the perennial streams and rivers in Wyoming were in a least disturbed biological condition or comparable to reference expectations. This percentage is statistically similar to that estimated during 2004-2007 (53%) and the period 2000-2003 (52%). Approximately 18% of Wyoming's perennial stream and river length is considered most-disturbed, implying an appreciable deviation from reference expectations associated with anthropogenic stressors. This estimate is similar to the first statewide survey (22%). Both surveys represent a significant reduction from the estimate of most-disturbed perennial stream miles documented during EMAP-WY (32%).

Based on the second statewide survey, 81% of perennial streams in the mountains climatic region were in the least-disturbed biological condition, which was a significant increase from 66% in the first statewide survey and 51% for EMAP-WY. The percentage of perennial streams in the least disturbed condition for the plains was 39% (similar to the 41% in the first statewide survey) compared to 53% in the xeric, whereas approximately 28% least disturbed was estimated for EMAP-WY. The percentage of least disturbed stream miles in the xeric during the second survey was similar to the first statewide survey (48%) and EMAP-WY (66%). The percentage of perennial streams in the most-disturbed biological condition was 4% in the mountains, which was a significant reduction from the 18% in the first statewide survey and 33% during EMAP-WY. The percentage of perennial stream miles in the plains with a most-disturbed biological condition remained relatively similar between the first (33%) and second (24%) statewide surveys, whereas approximately 63% was estimated as most disturbed for EMAP-WY. Approximately 25% of the perennial streams in the xeric region were in the most-disturbed biological condition, which is statistically equivalent to the first statewide survey (19%) and EMAP-WY (26%). A combination of drought-induced effects, record high flows and historical and current anthropogenic disturbances are presumed responsible for the less favorable biological conditions between surveys within the xeric and plains regions.

Channel instability and total suspended solids (TSS) were the most widespread stressors for both statewide surveys, whereas sedimentation and riparian disturbance were the most common stressors statewide during EMAP-WY. Based on the most recent statewide survey, riparian disturbance was among the most common stressor in all three climatic regions. Riparian disturbance was the second most common stressor in the mountain and the most common stressor in the xeric regions, respectively. TSS was the second most common stressor in the plains. Nutrient enrichment was the least important stressor both statewide and within climatic regions.

WDEQ/WQD has phased out statewide probabilistic surveys for the foreseeable future and has replaced them with a rotating basin probabilistic design that was implemented in 2010 as part of the WDEQ's ten year (2010-2019) monitoring strategy (WDEQ, 2010). Wyoming's probabilistic rotating basin approach establishes an order of rotation and sampling years among five 'superbasins', which are conglomerates of several river basins. Information from each of the five superbasin probabilistic surveys will be used in the future to evaluate and report on the water quality condition of Wyoming streams within each superbasin and statewide once all superbasins have been completed.

3.2 Monitoring by Conservation Districts

Since 1998, many of Wyoming's Conservation Districts, with the guidance and leadership of local watershed steering committees, have taken initiative to improve water quality in the state. All of Wyoming's 34 Conservation Districts are involved in water quality activities at some level; including monitoring waters within their districts, developing watershed plans to address known impairments and threats, and assisting citizens in implementing best management practices (BMPs) to improve water quality (WACD, 2011). Most watershed planning is intended to address waters on the 303(d) List of impaired waters requiring TMDLs and to provide an opportunity for voluntary and incentive based implementation activities to improve water quality (WACD, 2011). These waters are often given a low priority for TMDL development by WDEQ to provide an opportunity for restoration to occur. Ultimately, the goal of watershed planning is to identify and implement BMPs that will result in the removal of waters from the 303(d) List. Data and other information were requested from all 34 of Wyoming's Conservation Districts for this report. A USEPA Section 319 Nonpoint Source Program Success Story involving Uinta County Conservation District (UCCD) is included in this report as an example of how Wyoming's Conservation Districts have successfully contributed to stream restoration (see Appendix A).

4.0 TMDL Prioritization

Section 303(d)(1) of the federal CWA requires states and tribes to "establish a priority ranking" for the segments identified as needing a TMDL. This ranking must evaluate the severity of the pollutant and the specific designated uses adversely impacted by the pollutant. However, the most severe water quality problems or the most toxic pollutants need not always be given the highest priority for TMDL development if circumstances warrant a lower priority. Consistent with 40 CFR § 130.7(b)(4), each state must also submit a priority ranking every two years within the 303(d) List of the Integrated Report, including waters targeted for TMDL development in the next two years. USEPA guidance encourages states to maintain a TMDL schedule in which TMDLs are completed within 8 to 13 years from the time of initial listing. WDEQ anticipates that some TMDLs will take less than a year while others may take upwards of 3 years to finalize.

USEPA's 2006 Integrated Report Guidance recommends that priority rankings be clear and either in the form of a scheduled TMDL completion date or a tiered system such as high, medium and low. Prior to Wyoming's 2008 TMDL Workplan Update, WDEQ utilized a high, medium and low ranking system. Beginning with the 2010 Integrated Report, the prioritization for TMDL development was changed within the 303(d) List to include the approximate dates that each TMDL is expected to be initiated. By including initiation in the 303(d) List, the public will be better informed of the anticipated timeline of each TMDL.

The severity of the impairment, the EPA time frame, data availability and the effective use of resources will be primary factors in developing the ranking schedule. Typically no single factor will have precedence over another factor. In general, factors for priority ranking will be utilized in the following manner:

1. Timeliness. Waterbodies that have been on the 303(d) List the longest will typically be scheduled for TMDL development before newly listed waterbodies.

2. Hazards to Human and Environmental Health. Waterbodies on the Section 303(d) List for pollutants posing a significant human or environmental health risk (i.e. priority pollutants) will typically be scheduled for TMDL development sooner than other waterbodies.

3. Data Quality and Availability. Waterbodies on the 303(d) list having existing data that are sufficient to develop a TMDL will typically be developed before waterbodies needing additional data or analysis. Waterbodies with insufficient data will be given a lower priority to allow time for additional data collection.

4. Endangered Species. Waterbodies supporting aquatic species that are considered threatened, endangered or are species of concern will typically be scheduled for TMDL development before waterbodies without such species.

5. Timely Restoration. Waterbodies with ongoing implementation practices which are believed to have a high possibility of achieving full restoration within 8 years of initial listing will typically be scheduled for TMDL development later than waterbodies without such ongoing efforts.

6. Quality of the Impaired Water. Higher quality waterbodies (Class 1 or 2) on the Section 303(d) List will typically be scheduled for TMDL development sooner than lesser quality (Class 3 or 4) waterbodies.

Once the above factors have been adequately evaluated, the available resources of the TMDL Program are also considered toward determining a TMDL development schedule. TMDLs will be developed on a watershed basis whenever feasible in order to maximize staff efficiency and cost effectiveness.

5.0 Wyoming's Nonpoint Source Program

The Wyoming Nonpoint Source Program operates under the Watershed Management Section of the WDEQ, WQD. Unlike point source pollution, which can be traced back to a single defined source, nonpoint source pollution is diffuse in nature, making it difficult to assess the source of the problem. Nonpoint source pollution occurs when runoff from rainfall or snowmelt travels over and/or percolates through the soil and picks up contaminants. These contaminants are deposited into streams, lakes, rivers, and groundwater. While some nonpoint source pollution can be natural in origin, it is generally associated with human land-disturbing activities such as urban development, road construction, agriculture, recreation, silviculture and mineral exploration. Common nonpoint source contaminants include fertilizers and pesticides from agricultural and residential activity; oil, grease, sediment and toxic chemicals from urban runoff; sediment from construction activity or stream bank erosion; and bacteria and nutrients from livestock and pet waste or failing septic systems.

After recognizing that nonpoint source pollution is a serious impediment to meeting the goals of the CWA and that more focus was needed in this area, Congress amended the CWA in 1987 to include Section 319, Nonpoint Source Management Programs, which provided the basis for the Wyoming Nonpoint Source Program. Through Section 319 grants, funds can be made available to state, federal and local agencies, nonprofit organizations, and private individuals. Projects that reduce the impacts of nonpoint source pollution and improve water quality are eligible. The vision for the Wyoming Nonpoint Source Program is to sponsor projects that reduce or eliminate nonpoint source pollution in threatened, impaired, and high-quality waters of the state so all designated uses are fully supported for the benefit of all Wyoming citizens. Section 319 grant funds are available each year on a competitive basis. Funds are awarded as reimbursement grants, meaning funds can be issued to the recipient only after proof of expenditure on eligible costs. All proposals submitted must identify at least 40 percent of the total project cost as non-federal cash or in-kind services match. The Nonpoint Source Program also administers funds available under Section 604(b)/205(j) of the CWA. Section 205(j) funds are available to local government agencies for the purpose of water quality management planning.

6.0 Emerging Surface Water Quality Issues

Methylmercury

Mercury is a metal that naturally occurs in all of the world's surface waters to some extent and is a water quality pollutant of increasing concern. USEPA estimates that much of the mercury pollution in U.S. surface waters is derived from industrial air emissions from power generation, other industrial and waste

disposal activities within and outside of the U.S. It has been estimated that approximately 67% of atmospheric mercury originates from anthropogenic sources (USGS, 2009a).

The methylation of mercury occurs when inorganic mercury is converted to organic methylmercury. The degree to which mercury is converted to methylmercury in various aquatic environments is currently not well understood. Methylmercury is highly toxic and is known to concentrate, or bioaccumulate, in the tissues of predatory fishes; the primary route of human exposure to methylmercury is through the consumption of fish and shellfish. USEPA's (2001) Recommended Fish Tissue Residue Methylmercury Criterion is 0.3 mg methylmercury/kg, which is based on a fish consumption rate of 0.0175 kg fish/day. USGS (2009a) estimated that approximately 27% of waters surveyed across the U.S. (including only 2 sites in Wyoming) had fish tissue concentrations equaling or exceeding 0.3 mg methylmercury/kg. USEPA's recommended criterion is intended to be used by states as guidance during the development of methylmercury water quality criteria. To date, Wyoming has not adopted fish tissue based methylmercury criteria protective of the fish consumption designated use.

Between 1972 and 2011, the Wyoming Game and Fish Department (WGFD) measured the methyl mercury concentrations of various species of fish collected from several reservoirs across Wyoming. WGFD sampled only omnivorous common carp in 1972 from ten reservoirs and one river across the state and found mostly very low concentrations of mercury. Surveys between 2000 and 2011 were focused almost exclusively on larger predatory fishes (walleye, perch, crappie, sauger, trout, bass, burbot and catfish) and to a lesser extent omnivorous fishes (white sucker, drum and carp). WGFD reported minimum and maximum concentrations of mercury for the various species and collection dates. Maximum values were commonly above USEPA's recommended criterion at several reservoirs across Wyoming. However, because larger size classes were intentionally targeted and maximum values reported, higher concentrations would be expected. The Wyoming Department of Health (WDH), in cooperation with WGFD has issued fish consumption advisories for several reservoirs across the state. These advisories include detailed dietary recommendations to assist the public in making informed fish consumption decisions for their families. The WGFD and WDH included several additional waters in a 2013 updated fish consumption advisory.

Climate Change

In response to four assessment reports by the Intergovernmental Panel on Climate Change (IPCC), USEPA released a document entitled: *NATIONAL WATER PROGRAM STRATEGY: Response to Climate Change* that summarizes the agency's strategies for addressing threats from climate change to aquatic systems. The document lists five anticipated impacts that may directly threaten the water quality of Wyoming's streams, lakes, reservoirs and wetlands; including increased water pollution associated problems from rising stream temperatures, an increase in extreme water related events (e.g. droughts and floods), reductions in available drinking water and the displacement of aquatic communities as water temperatures change. In the National Water Program Strategy, the USEPA lists mitigation, adaptation, and research of climate change as areas of focus and outlines specific goals within each.

Aging forests, prolonged drought and warmer winters have allowed populations of pine beetle in Wyoming to reach epidemic status. USFS estimates that 3.3 million acres of national forest have been infested by pine beetles in Wyoming since the 1990's. Mortality from pine beetle infestations is significant in the Black Hills, Medicine Bow, Shoshone, Uinta-Wasatch-Cache and Bridger-Teton National Forests. Rapid deforestation may result in elevated water yield (Potts 1985, CCSP, 2009) and soil erosion (CCSP, 2009) in effected watersheds, and these symptoms could be exacerbated by an increase in the frequency and severity of forest fires. Some statistical models suggest that temperatures will increase in surface waters, and that the coldwater fisheries of Wyoming are particularly vulnerable to these changes (Rahel et. al. 1996). The ultimate effects of global climate change on Wyoming's aquatic ecosystems are unknown.

7.0 Public Participation

The State of Wyoming encourages participation in the development of this biennial document by various public and private, government and non-government stakeholder groups. Many entities routinely submit water quality data and provide an important external review of the Integrated Report during WDEQ's public comment period. WDEQ acknowledges the important contributions of these groups to the development, review and improvement of this report.

8.0 Basin Descriptions and Surface Water Quality Summaries

In this section, an overview of each of Wyoming's 14 river basins is provided. Basins are then subdivided into individual sub-basins (8 digit HUCs) and the water quality condition within each is summarized. Non-WDEQ informational sources are cited in the text and listed in the references section. WDEQ water quality monitoring reports are also cited within the text, and hyperlinks are provided to electronic copies of many of these documents.

8.1 Bear River Basin

The Bear River Basin drains approximately 2,844 mi^2 in Wyoming as well as portions of Utah and Idaho. The river flows north from its headwaters in the Uinta Mountains of Utah into Wyoming near Hilliard, continues through Evanston and re-enters Utah below Woodruff Narrows Reservoir. The river then flows back into Wyoming at the Cokeville Meadows National Wildlife Refuge before crossing into Idaho near the community of Border. The Bear River Compact of 1958 (amended in 1980) was developed to apportion water from the Bear River among Idaho, Utah and Wyoming as it courses between these three states. The Bear River Commission, which is composed of nine governor appointed commissioners (3 from each state) and one federal commissioner, is tasked with administering the provisions of the compact. The Bear River Watershed Information System provides additional water quality information for the basin. Both Idaho (bacteria, phosphorus and sediment) and Utah (dissolved oxygen and phosphorus) have completed TMDLs for portions of the Bear River Basin. WDEQ has initiated a sediment TMDL on the Bear River that is expected to be completed in 2014.

The Bear River Basin in Wyoming consists of sub-irrigated high valleys, foothills, low mountains and some mid-elevation mountains of the Uinta Mountains (Chapman et al. 2003). Water from the Bear River is extensively diverted within high valleys and used to irrigate alfalfa, grains and pastures. Streams in the basin are mostly perennial at higher elevations, but may be intermittent or ephemeral at lower elevations, which may be due in part to irrigation diversions, channel down cutting, loss of riparian vegetation and damming (ERI, 1992; NRCS, 2001). The geology of the foothills and low mountains consists of easily erodible fine-grained sedimentary formations, which contribute high natural loads of fine sediment, salts, carbonates, sulfates, and/or phosphate. Due to the presence of these highly erodible soils, streams in much of the basin are highly dependent on vegetation for physical stabilization and are typically very sensitive to disturbance. Land uses in the basin include livestock grazing, irrigated agriculture, oil and gas production, historic phosphate and coal mining, wildlife habitat and recreation on Bridger-Teton National Forest and BLM lands.

Historically, Bonneville (Bear River) cutthroat trout were found throughout the Bear River Basin, but competition from non-native species, loss of aquatic habitat and water quality changes have caused populations of these fish to decline. In 1998, a petition was filed with the U.S. Fish and Wildlife Service (USFWS) to list the Bonneville cutthroat trout as threatened under the Endangered Species Act (ESA). In 2008, the USFWS determined that listing was not warranted because a range wide status review indicated that self-sustaining Bonneville cutthroat trout populations are well distributed throughout their historic range and are being restored or protected in all currently occupied watersheds. The Wyoming Game and Fish Department (WGFD) has been working with Idaho, Nevada and Utah as part of a

Bonneville Cutthroat Interagency team to develop conservation strategies to improve and sustain Bonneville cutthroat trout populations.

Upper Bear River Sub-basin (HUC 16010101)

An assessment of Pleasant Valley Creek (WYBR160101010301_01) above Crompton Reservoir (WDEQ, 2001) showed that the aquatic life other than fish use was fully supported. No fish were observed during this study, which supports WDEQ's current classification of the creek as a 3B water. The report also indicated that there may be excess sediment and nutrient loading to Crompton Reservoir.

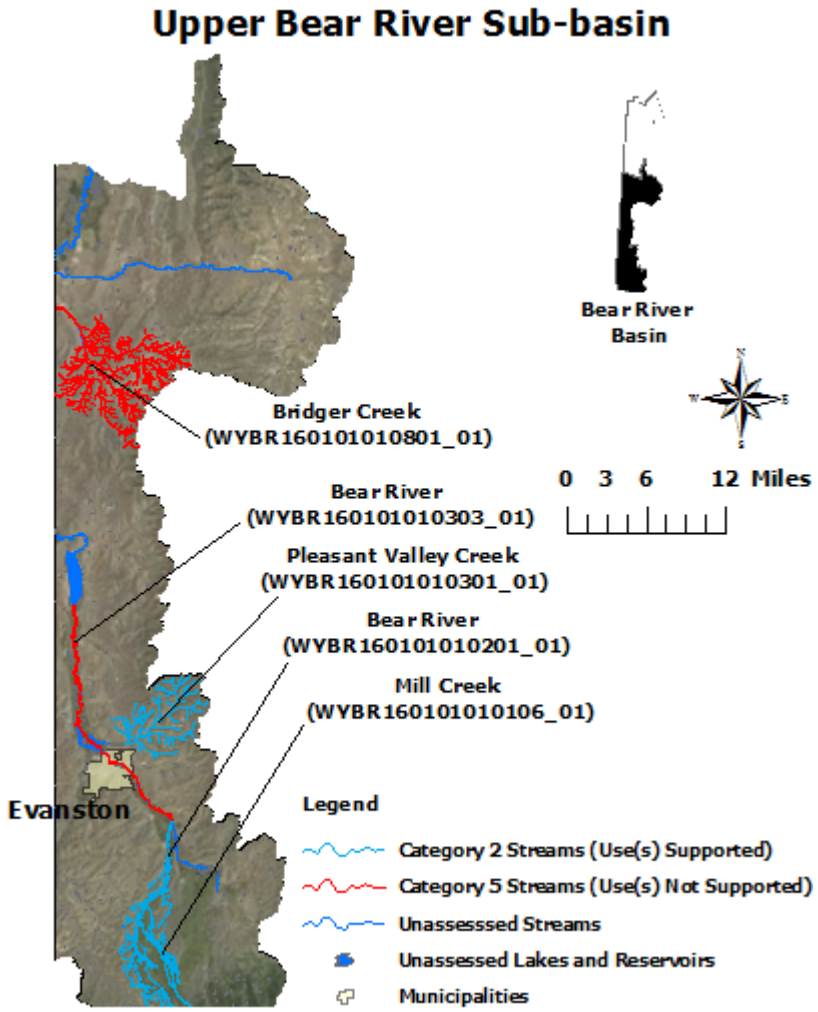
WDEQ (2002) monitored Sulphur Creek in 1998 and 1999. Study sites above and below Sulphur Creek Reservoir identified excess sediment and nutrients as concerns, but designated uses could not be assessed. The report indicated that potential sources of these pollutants were heavy riparian grazing and bank erosion, rapidly fluctuating flows below the reservoir and changes in seasonal flows in the upstream channel.

Water quality monitoring by WDEQ (2001) on the Bear River (WYBR160101010201_01) between 1995 and 1998 indicated that the cold water fishery and aquatic life other than fish uses are supported within the entire upper watershed above Sulphur Creek, excluding Mill Creek. The Bear River (WYBR160101010303_01) below Sulphur Creek (between Sulphur Creek and Woodruff Narrows Reservoir) was not supporting its aquatic life other than fish and cold water fishery uses due to excessive sediment and this segment was added to the 303(d) List in 2002. Sedimentation from Sulphur Creek and from various habitat alterations along the Bear River were identified as sources. The report also noted that much of the river within this segment is channelized and has poor quality trout habitat. A WGFD riparian improvement project on the Bear River has been conducted near Evanston. Uinta County Conservation District (UCCD) has formed a watershed steering committee and has completed a Bear River watershed plan. A sediment TMDL for the Bear River was initiated in January, 2013.

The Twin Creek watershed flows through highly erodible shales that contribute carbonates, salts and metals to the watershed. Twin Creek was channelized during the construction of a railroad line built along the creek in the late 1800s. This channelization has restricted lateral channel adjustments and caused the stream to down cut as much as 8-15 feet below its original flood plain. Resource concerns within the watershed include the loss of perennial flows in upper Twin Creek since the 1970s, sediment and nutrient loading to the Bear River (NRCS, 2001) and damage to riparian areas from historic livestock grazing and other land uses (BLM, 2005b). Phosphate was mined in the drainage between 1910 and 1977, and a phosphate mill operated until about 1985 using ore mined in Idaho. A project to reclaim unstable mine tailings and eroding spoils piles within a 140 acre area along Twin Creek was completed by WDEQ's Abandoned Mine Lands Division (AML) in 2008.

ERI (1992) identified the Bridger Creek watershed as a significant contributor of both sediment and phosphates to the Bear River. Based on this study, the entire Bridger Creek watershed (WYBR160101010801_01) was added to the 303(d) List in 1998 due to threats to the aquatic life other than fish use from sedimentation. Sources include the re-routing and channelization of approximately 2,500 feet of the mainstem of Bridger Creek for road and railroad construction, which has resulted in extensive head cutting and sedimentation in the lower watershed. The study also identified historic livestock and wildlife grazing on the BLM's Cumberland/Uinta Allotment as contributing to poor riparian vegetation cover. This condition has led to extensive down cutting and erosion of the stream channel throughout the watershed. The watershed transitions between intermittent and ephemeral reaches, and the majority of the sediment loading occurs during spring snowmelt runoff and rain storm events. In 1996, a Section 319 Bridger Creek Restoration Project (ERI, 1996) was completed to address these concerns. As part of this project, seven small sediment retention reservoirs were constructed in the upper watershed to trap

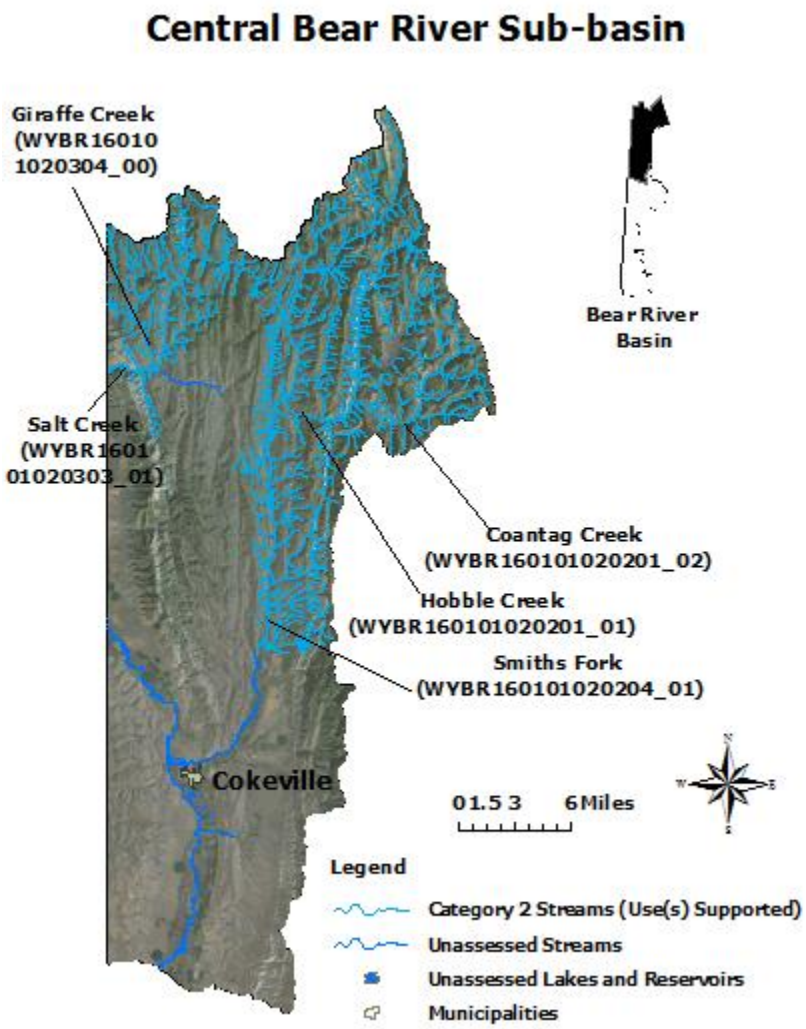
sediment, create an alternative water source for livestock and to reduce further head cutting and down cutting in the upper watershed. In addition, a pre-existing large gravel pit in the lower watershed near the Utah border was modified into a sediment basin designed to reduce head cutting in the stream channel near Highway 30/89 and to trap sediment from the upper watershed. ERI (1996) estimated that the gravel pit reduced sediment loading to the Bear River by 58%. However, sediment data from before and after BMPs were implemented are largely lacking within the Bridger Creek watershed and on the Bear River above and below the confluence with Bridger Creek. Livestock grazing management was also modified through the 1996 BLM Cumberland/Uinta Allotment Operating Plan and the 2000 BLM Cumberland/Uinta Allotment Cooperative Management Plan to enhance riparian vegetation and improve streambank stability. Green line studies conducted by the BLM in 2008-09 indicated that the riparian condition may be improving. However, there are relatively few physical indicators (e.g. sediment load, water temperature and channel morphology) that can be used to determine whether the watershed's condition has improved.



Central Bear River Sub-basin (HUC 16010102)

Stream channelization and willow removal occurred during the mid-1900s along the lower Smiths Fork to increase crop production. These practices have led to accelerated bank erosion and stream widening. A Smiths Fork Steering Committee was formed by WGFD in 2004; goals included reducing sedimentation, improving water quality by increasing bank stability and improving wildlife habitat by modifying grazing practices and using controlled burns (Bear River Watershed Information System, 2013). The BLM's Smithsfork Grazing Allotment is a 90,937-acre cattle and sheep grazing allotment located northeast of Cokeville. A management concern on this allotment is the condition of riparian areas, upland springs and seeps due to past grazing and other activities; these include the chemical spraying of vegetation, which eliminated most of the willows in the late 60's and early 70's and numerous sheep to cattle utilization conversions within grazing allotments. With season-long grazing and a lack of upland water resources, livestock tend to concentrate in riparian areas for most of the growing season. Proper Functioning Condition (PFC) inventory data collected by the BLM indicate that most of the streams within the allotment are "functioning at risk", which means the riparian-wetland areas are functional, but susceptible

to degradation. The BLM released the Smithsfork Allotment Management Plan in March, 2005. The plan provided grazing management strategies that are expected to improve riparian vegetation along stream corridors and upland spring sites, which may improve water quality in the Smiths and Thomas Fork Watersheds (BLM, 2005a). Water quality assessments conducted by (WDEQ, 2002) on Coantag (WYBR160101020201_02) and Hobble (WYBR160101020201_01) Creeks and in the Smiths Fork (WYBR160101020204_01) drainage above North Smiths Fork indicate that these waters fully support their cold water fishery and aquatic life other than fish uses.



Sediment and nutrients have been identified as possible water quality concerns in portions of the Salt Creek watershed, both in Idaho and Wyoming (ERI, 1992). Some reaches of Salt Creek have unstable banks due to naturally erosive geology and channel confinement imposed by the construction of a highway within the valley. A WDEQ (2005) study of Salt Creek (WYBR160101020303_01) indicated that riparian conditions are improving,that a fairly diverse macroinvertebrate community is present and that the stream supports its cold water fisheries use. WGFD and BLM have completed several riparian improvement projects in the Coal and Little Muddy Creek watersheds to enhance Bonneville cutthroat trout populations. A WDEQ assessment of Giraffe Creek (WDEQ, 2001) (WYBR160101020304_00), a tributary to Salt Creek, indicates full support of its cold water fishery and aquatic life other than fish designated use.

8.2 Belle Fourche River Basin

The Belle Fourche River Basin in Wyoming drains approximately 5,512 mi^2. The basin's headwaters originate in the rolling prairie and Pine Scoria Hills of southern Campbell County. The river then flows northeast through the semiarid Pierre Shale Plains and through the Black Hills Foothills before entering South Dakota. Most streams originating in the plains are naturally intermittent; however, discharges from coal mines, CBM production, and those from the city of Gillette provide perennial flows in Donkey Creek, portions of the Belle Fourche River and several other plains streams. Land uses in the basin consist mostly of oil and gas production, coal and bentonite mining, livestock grazing, dryland farming and wildlife habitat (Chapman et al. 2003).

Keyhole Reservoir (193,753 acre-feet) is located on the Belle Fourche River about 17 miles northeast of Moorcroft and is operated by the Bureau of Reclamation (USBOR). The reservoir was built in the 1950s to provide a supplemental water supply to the Belle Fourche Reservoir in South Dakota, to provide recreational opportunities and for flood control. Water stored in the reservoir is allocated between Wyoming (10%) and South Dakota (90%) users through provisions in the Belle Fourche River Compact of 1943. The Belle Fourche River below Keyhole Reservoir has perennial flow due to reservoir releases and perennial tributaries originating in the Black Hills.

The South Dakota Department of Environment and Natural Resources (SDDENR) added the Belle Fourche River from the Wyoming/South Dakota state line downstream to Fruitdale, South Dakota to the 303(d) List in 2002 because total suspended solids (TSS) and fecal coliform bacteria were impairing the Warmwater Permanent Fish Life and Immersion Recreation Uses. SDDENR completed a TMDL for TSS on the Belle Fourche River (Hoyer and Larson, 2005). The TMDL concluded that most of the elevated TSS in the river is likely from stream incision and bank failure. The study also indicated that releases of water from Keyhole Reservoir for irrigation have significantly increased TSS and specific conductivity in South Dakota. SDDENR has also completed a TMDL for fecal coliform (Foreman, 2007) that estimates a 46% reduction in fecal coliform bacteria would be necessary to bring the river into compliance with South Dakota's water quality standards. Bacterial source tracking used in the study failed to distinguish between humans, livestock, and wildlife as potential sources. Bacterial concentrations were the highest during runoff events and during water releases from Keyhole Reservoir, indicating that contamination may be occurring via overland flow and through re-suspension of reservoir sediments. Crook County Natural Resource District (CCNRD) completed a watershed plan for the Belle Fourche River in 2010.

A pesticide occurrence study (USGS, 2011) conducted during the summer of 2009 and spring of 2010 detected 8 and 10 different pesticides, respectively, in the Belle Fourche River near Moorcroft; however, concentrations of these pollutants were well below the WDEQ's drinking water criteria in Appendix B of Chapter 1.

Upper Belle Fourche Sub-basin (HUC 10120201)

The City of Gillette is the fourth largest municipality in Wyoming and is situated at the headwaters of the Donkey Creek watershed. Water quality assessments by WDEQ (2000) indicated that the recreational uses on Donkey (WYBF101202010600_01) and Stonepile (WYBF101202010602_01) Creeks were not supported due to high concentrations of fecal coliform. As a result, a 61.4 mile segment of Donkey Creek, from the confluence with the Belle Fourche River upstream to Brorby Boulevard within the city of Gillette and 7.5 mile segment of Stonepile Creek were added to the 303(d) List in 2000 and 2002, respectively. Supplemental data, collected as part of the 2008 Little Powder River and Belle Fourche Drainages Watershed Implementation Section 319 Project extended the impairment on Stonepile Creek an additional 0.1 mile. The segment now extends 7.6 miles, from the confluence with Donkey Creek upstream to the junction of highways 14/16 and 59. TMDLs were completed in August, 2013 for Donkey and Stonepile Creeks and these waters have been placed in category 4A. A watershed plan and implementation strategy was completed by Campbell County Conservation District (CCCD) in 2010 to address these listings; efforts mainly focused on septic system improvements.

WDEQ currently identifies three segments of the Belle Fourche River as having impaired contact recreation uses (WDEQ 2004a, 2004b): from the confluence with Donkey Creek upstream 5.4 miles, from Arch Creek downstream to Sourdough Creek (WYBF101202010904_00) and from Keyhole Reservoir upstream to the confluence with Donkey Creek (WYBF101202010504_00). USGS (2006-2008, gage#06426500) has also reported high *E. coli* counts in the Belle Fourche River near Moorcroft. Crook County Natural Resource District (CCNRD) has conducted monitoring, implemented septic and animal feeding operation projects and has developed a watershed plan to address these impairments. Monitoring by USGS, as recently as 2009-2010, has shown that the Belle Fourche River below Donkey Creek frequently exceeds WDEQ's aquatic life other than fish acute chloride criterion and that concentrations of

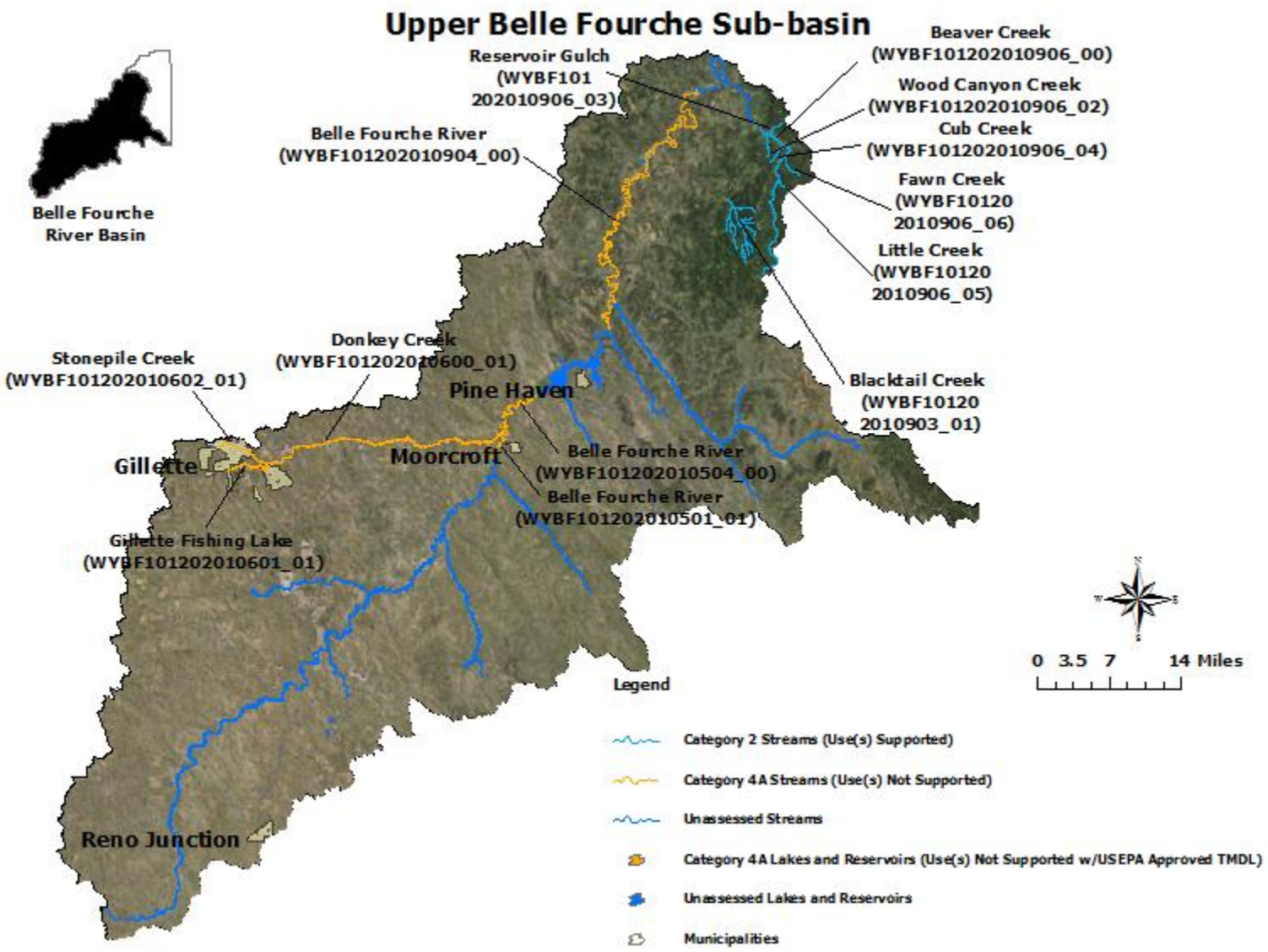
ammonia occasionally exceeds the acute criterion protective of the warm water game fishery use. Therefore, these pollutants were added to the 303(d) List in 2008 for the Belle Fourche River between Keyhole Reservoir and Donkey Creek. TMDLs were completed in August, 2013 for five upper Belle Fourche watershed 303(d) Listings; including three for bacterial impairments on the Belle Fourche River and one each for the ammonia and chloride impairments on the Belle Fourche River. These listings were therefore removed from the 303(d) List in 2014 and placed in category 4A.

Gillette Fishing Lake (WYBF101202010601_01) is a 25 acre lake located within the City of Gillette. The lake was added to the 303(d) List in 1996 because WGFD suggested that excess sediment and phosphate were impairing the aquatic life other than fish and cold water fishery uses. A Section 205j Fishing Lake Water Quality Study (Ecological Services, 1995) was initiated by CCCD to determine the sources of these pollutants. Data suggested that stormwater runoff from the City of Gillette was the primary source. CCCD, in cooperation with the city of Gillette, developed a water quality improvement plan to address these two impairments (WACD, 2011). The three main goals outlined in the plan were to construct a wetland complex at the lake's inlet to trap sediment, stabilize the lake's banks and dredge the lake. In 2011, the city began designing the wetland complex and bank stabilization structures (WACD, 2011). The City of Gillette completed Phase 1 of a Section 319 Project in 2012, which included the construction of the wetland complex with five sediment basins. The City of Gillette initiated sediment and phosphate TMDLs for Gillette Fishing Lake in 2008. These TMDLs were delayed in order to allow a UAA submitted by the City of Gillette to be reviewed. The UAA was approved by WDEQ and USEPA in 2011, changing Gillette Fishing Lake's classification from a cold water game fishery (2AB) to a warm water game fishery (2ABww). TMDLs on Gillette Fishing Lake for sediment and phosphate were approved by USEPA in February, 2013. These listings were therefore removed from the 303(d) List in 2014 and placed in category 4A.

The headwaters of Blacktail Creek (WYBF101202010903_01) are located in the northwestern Black Hills. The creek flows northwest and ultimately confluences with the Belle Fourche River near the town of Hulett. WDEQ (2004) collected physical, chemical and biological data from a single study site along Blacktail Creek within the Black Hills in 2000. Streambanks were considered moderately stable and sedimentation was not considered a problem in the creek channel. The limited physical issues that were noted were attributed to historic grazing activities. There were no exceedances of any water chemistry criteria during this study for the parameters measured. The macroinvertebrate community in Blacktail Creek was only 62% comparable to that of reference condition, but this departure was attributed to the intermittent hydrology of the watershed. The physical, chemical and biological data in the report indicated that the cold water fishery and aquatic life other than fish uses for Blacktail Creek within the Black Hills National Forest are fully supported.

The Beaver Creek (WYBF101202010906_00) watershed's headwaters are located in the Bearlodge Mountains within the Black Hills National Forest. Beaver Creek above Cook Lake is perennial, but then becomes intermittent below the lake's outlet. WDEQ (2004) collected physical, chemical and biological data at 6 sites along Beaver Creek, Wood Canyon, Reservoir Gulch and Cub Creek in 2000. Water temperature within lower portions of Beaver Creek were noted as periodically elevated, but were attributed to riparian degradation from historic grazing and the stream's naturally intermittent hydrology. The study concluded that Beaver Creek, Wood Canyon (WYBF101202010906_02), Reservoir Gulch (WYBF101202010906_03) and Cub Creek (WYBF101202010906_04) were fully supporting their cold water fisheries and aquatic life other than fish uses.

The headwaters of Fawn Creek (WYBF101202010906_06) are located in the Bearlodge Mountains within the Black Hills National Forest. WDEQ, (2004) collected physical, chemical and biological data from a single study site located on Fawn Creek in 2000. No measured chemical parameters exceeded WDEQ water quality criteria during this study. Excess fine sediments were noted, but were attributed to the


Upper Belle Fourche Sub-basin
Belle Fourche River Basin
Reservoir Gulch (WYBF101 202010906_03)
Beaver Creek (WYBF101202010906_00)
Wood Canyon Creek (WYBF101202010906_02)
Cub Creek (WYBF101202010906_04)
Belle Fourche River (WYBF101202010904_00)
Fawn Creek (WYBF10120 2010906_06)
Little Creek (WYBF10120 2010906_05)
Stonepile Creek (WYBF101202010602_01)
Donkey Creek (WYBF101202010600_01)
Pine Haven
Blacktail Creek (WYBF10120 2010903_01)
Gillette
Moorcroft
Belle Fourche River (WYBF101202010504_00)
Belle Fourche River (WYBF101202010501_01)
Gillette Fishing Lake (WYBF101202010601_01)
Reno Junction
0 3.5 7 14 Miles
Legend
Category 2 Streams (Use(s) Supported)
Category 4A Streams (Use(s) Not Supported)
Unassessed Streams
Category 4A Lakes and Reservoirs (Use(s) Not Supported w/USEPA Approved TMDL)
Unassessed Lakes and Reservoirs
Municipalities

stream channel adjusting to historic grazing practices and to the intermittent hydrology of the watershed. Streambanks and riparian condition were considered to be stabilizing due to improvements in grazing management. The marocinvertebrate community was considered relatively comparable to reference condition. The report concluded that the aquatic life other than fish use on Fawn Creek was fully supported from the confluence with Beaver Creek to a point 3.1 miles upstream.

The headwaters of Little Creek are located in the Bearlodge Mountains within the Black Hills National Forest. WDEQ (2004) collected physical, chemical and biological data from a single study site located on Little Creek (WYBF101202010906_05) in 2000. No measured chemical parameters exceeded WDEQ water quality criteria during this study. Elevated fine sediment was noted during this study, but was attributed to the failure of beaver dams. Overall, the streambanks and streambed substrata were described as stable and composed of cobbles and boulders. The comparability of the study site to reference was only 62%; however, this departure was attributed to differences in water chemistry associated with natural geology. The report concluded that the aquatic life other than fish use on Little Creek was fully supported from the confluence with Beaver Creek to a point 1.3 miles upstream.

Lower Belle Fourche Sub-basin (HUC 10120202)

It is currently unknown whether the elevated bacteria concentrations that occur in the upper Belle Fourche sub-basin continue downstream into this sub-basin. *Escherichia coli* data collected along the Belle Fourche River by CCNRD in 2003 and 2004 (EDE, 2005) showed some elevated individual sample concentrations; however, all calculated geometric means were below WDEQ's criterion protective of primary contact recreation. Foreman (2007) reported that 9 of 16 individual samples collected from the Belle Fourche River in South Dakota near the WY/SD border during 2004 and 2005 exceeded SDDENR's 400 CFU/100 mL single sample maximum criterion for fecal coliform bacteria.

Redwater Sub-basin (HUC 10120203)

Springs discharge thousands of gallons of water per minute to Sand Creek, which is protected as a Class 1 water by WDEQ. The lower portion of the creek is considered a high quality trout fishery by WGFD. WDEQ has monitored water quality on Sand Creek, but designated uses could not be assessed.

8.3 Big Horn River Basin

The Big Horn River Basin in Wyoming drains approximately 20,949 mi^2, and is bordered by the Absaroka and Wind River Mountain Ranges to the west, Beaver Rim to the south and the Bighorn Mountains to the east. The Absaroka Mountains are a volcanic mountain range originating 40-50 million years ago from a group of approximately 25 large volcanoes (Chapman et al. 2003). Ecoregions within this mountain range include alpine, sub-alpine and foothills. Soils in these mountains are nutrient rich, and consist of highly erosional ash, tuff, basalt and pumice which can naturally elevate stream turbidity during precipitation events. The Wind River Mountains consist of alpine and sub-alpine granitic mountains flanked by dry sedimentary foothills and low mountains. Soils in the latter two ecoregions are coarse, acidic and low in nutrients; lower elevation sedimentary soils consist of sandstone, shales, siltstone and limestone. The Beaver Rim is composed of rolling sagebrush steppe, which includes rolling plains, mesas and terraces. The Bighorn Mountains are very diverse geologically, containing alpine, granitic and sedimentary sub-alpine, mid-elevation sedimentary mountains and foothills. The mid-elevation Bighorn Mountains are characterized by rounded shale hills, limestone bluffs and sandstone flatirons and multiple steep canyons (Chapman et al. 2003). The Bighorn Basin lies between these mountain ranges and is divided between Bighorn Basin and Bighorn Salt Desert Shrub Basin ecoregions. The basin is an arid depression characterized by alkaline soils consisting of shale, siltstone and sandstone. Land uses in the mountains of the basin include livestock grazing, wildlife habitat and recreation. Livestock grazing, irrigated cropland, oil and gas production, bentonite mining and wildlife habitat are the primary land uses in the lower basin.

Substantial portions of the Upper Wind River and Little Wind River Sub-basins are located within the Wind River Indian Reservation; USEPA or authorized tribes administer the Clean Water Act in Indian Country, as defined at 18 U.S.C. Section 1151..

Water quality is generally good within the mountains of the basin (Ferguson, 2007), but gradually declines as streams flow across the lower basin to the Bighorn River because of natural erosional processes that increase sediment and TDS loads. Most of the lower Bighorn Basin has thin soils derived from highly erodible, saline, alkaline and/or phosphate-rich geologic materials. Much of the precipitation in the lower elevation portions of this arid basin comes from thunderstorms, and these events can cause flash flooding and severe erosion of the sparsely-vegetated soils. Accelerated erosion, irrigated agricultural runoff, discharge from oil and gas development and other human activities may also degrade water quality (USGS, 1956; USGS, 1999). Other anthropogenic impacts, thought to date to the 1880s, have affected sediment transport in some of the lower elevation portions of the basin. For example, historic livestock grazing practices (long term/high density grazing) removed native grasses and began a cycle of intense runoff and gullying that exacerbated naturally unstable conditions (Marston and Anderson, 1991). Wohl et. al. (2007) reported that many streams within the Bighorn National Forest have been substantially impacted by cattle grazing, irrigated crop production, flow regulation and diversion, and timber harvest. The prevalence of dams and other hydrologic modifications have altered the natural flow regime of the basin (USGS, 1956; Bray, 1996).

A study conducted by USGS (2007) compared the concentration of pesticides at two sites on the Bighorn River (near Kane and Basin) and one site on the Shoshone River (near Lovell) across three seasons. Sixteen different pesticides were detected, all of which were at low concentrations and did not exceed the drinking water criteria in Appendix B of Chapter 1. A second pesticide occurrence study (USGS, 2011), conducted during the summer of 2009 and spring of 2010 detected 4 and 12 different pesticides, respectively, in the Bighorn River at Kane. The same studies detected 4 and 10 different pesticides during these two years in the Shoshone River near Lovell. Concentrations of these pollutants in both rivers were well below the state's drinking water criteria.

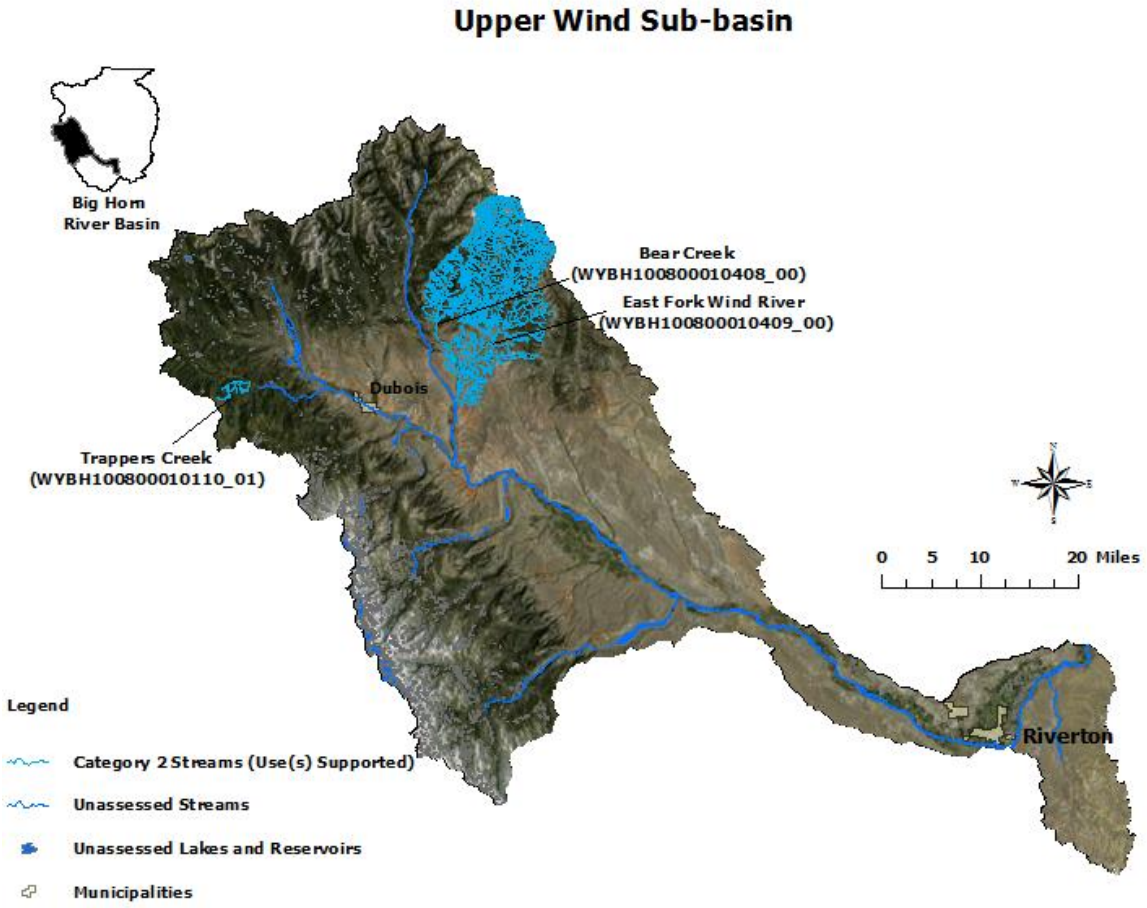
Upper Wind Sub-basin (HUC 10080001)

West Brooks Lake Creek is a small tributary to Brooks Lake within the Shoshone National Forest near Togwotee Pass. The creek was studied by WDEQ (2004) in 1999 and 2004 after data collected by USFS indicated that vegetation removal, stream bank erosion and siltation may be negatively affecting the stream's aquatic life. These conditions were thought to be caused primarily by livestock grazing. In 1999, WDEQ monitored the creek and noted that the stream was much wider than expected, the stream banks were actively eroding, vegetation was sparse and sediment was aggrading in the channel. USFS subsequently changed livestock grazing strategies in the watershed and WDEQ returned in 2004 to again observe channel conditions; no data were collected. Vegetation, most notably willows, was re-establishing along banks and bars and a new floodplain was beginning to form. WDEQ determined that the changes in grazing management were effective in curbing channel degradation on West Brooks Lake Creek, but designated uses could not be assessed.

Trappers Creek is a small tributary to Warm Spring Creek in the northern Wind River Mountains of the Bridger-Teton National Forest. The creek was monitored by WDEQ (2004) in 1999 because data collected by USFS indicated that there may be excess sedimentation in the stream from livestock grazing, timber harvest and roads. Results of the study indicated that sedimentation may be an issue in the creek; however, the macroinvertebrate community was relatively healthy. WDEQ therefore decided to delay making a use support determination on the creek until USFS BMPs could be further implemented. The USFS (2007) conducted surveys throughout the watershed in 2004 and 2005 to assess watershed health. The resulting study concluded that much of the sedimentation in the watershed is natural in origin, that historic management practices accelerated erosion and that current land use practices have improved habitat conditions. WDEQ has determined that the entire Trapper's Creek watershed

(WYBH100800010110_01) upstream of the confluence with Warm Springs Creek is fully supporting its cold water fishery and aquatic life other than fish designated uses. WDEQ (2003) monitored Warm Springs Creek in 1999; designated uses could not be assessed.

Bear Creek (WYBH100800010408_00) was monitored by WDEQ (2003) in 1999 at two study sites. Results indicated that the entire Bear Creek watershed was supporting its cold water fishery and aquatic life other than fish designated uses. WDEQ (2003) also monitored seven sites along the Wind River above and below Dubois in 1999 but designated uses could not be assessed.



The main stem of the East Fork of the Wind River, including its confluence with the Wind River makes up much of the northwest boundary of the Wind River Indian Reservation. WDEQ (2003) monitored the East Fork of the Wind River (WYBH100800010409_00) in 1999 and determined that the entire watershed upstream of the confluence with Wiggins Fork (excluding Bear Creek) is fully supporting its cold water fishery and aquatic life other than fish designated uses.

Horse Creek's headwaters originate within the Absaroka Mountains and flow south to the confluence with the Wind River within the town of Dubois. The creek was monitored by WDEQ (2003) in 1999 because data collected by USFS indicated that there may be excess sedimentation from irrigation, livestock grazing, timber harvest and roads; however, designated uses could not be assessed.

Little Wind Sub-basin (HUC 10080002)

The Beaver Creek watershed's headwaters are located in the foothills of the Wind River Mountains. The creek then flows along Beaver Divide before flowing north to its confluence with the Little Wind River near the community of Arapahoe. WDEQ (2010) assessed the mainstem of Beaver Creek (WYBH100800020301_02) in 1999 and 2005 from its confluence with Little Beaver Creek upstream to its headwaters and found that while low dissolved oxygen concentrations were low at several study reaches, cold water fishery, aquatic life other than fish, drinking water and fish consumption uses were fully supported. Little Beaver Creek (WYBH100800020301_01) was also monitored by WDEQ (2004) in 1999 because BLM, NRCS and USFS data suggested that sedimentation may be negatively affecting aquatic life. The study concluded that cold water fishery and aquatic life other than fish designated uses were fully supported; however, there are concerns regarding heavy livestock grazing and associated erosion within riparian areas.

Popo Agie Sub-basin (HUC 10080003)

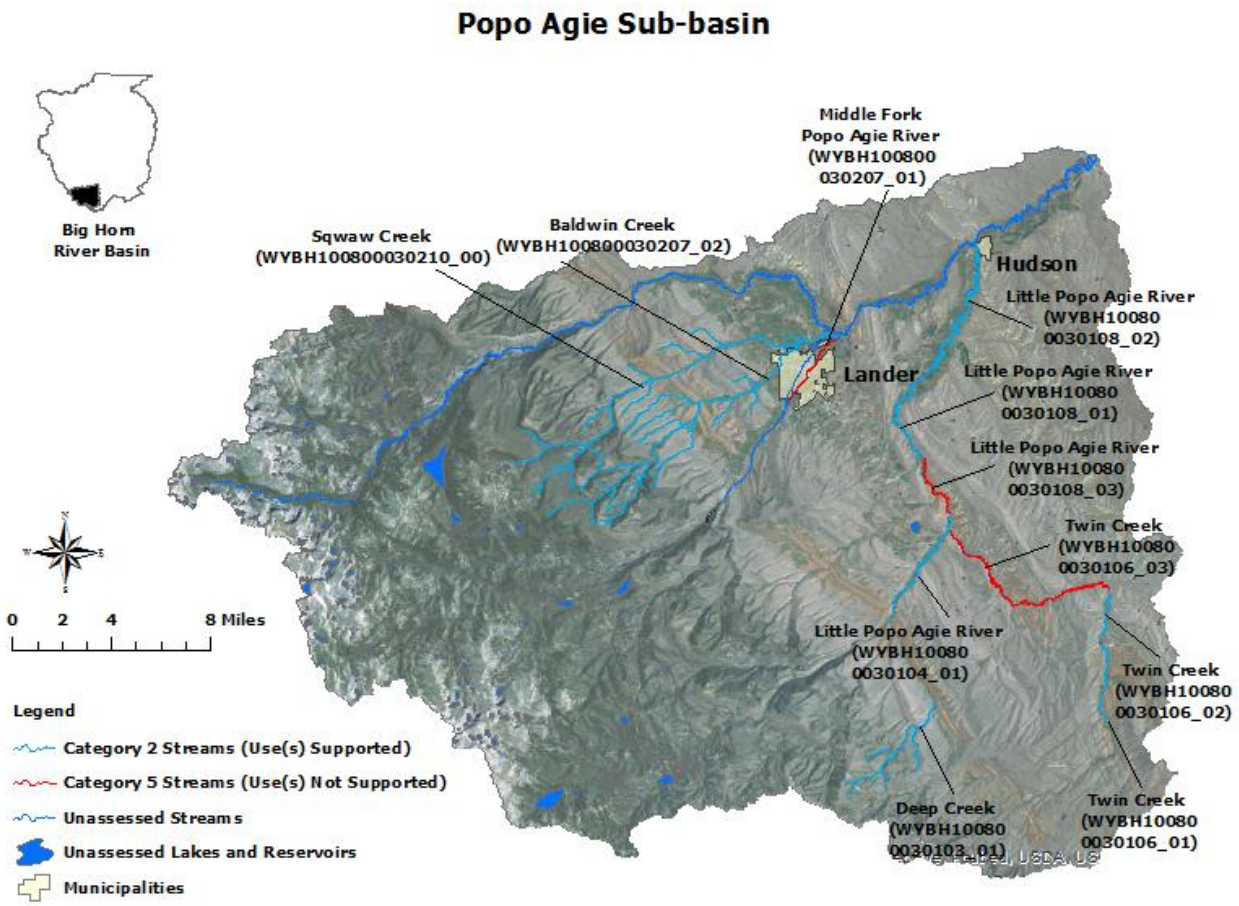
The Middle Fork Popo Agie River's headwaters are in the Popo Agie Wilderness within the southern Wind River Mountains and Shoshone National Forest. The river then flows east through the town of Lander before it confluences with the North Fork Popo Agie River near the Lander-Hudson Oil Field. The Middle Fork Popo Agie River (WYBH100800030207_01) was placed on the 303(d) List in 2002 because fecal coliform data collected by Popo Agie Conservation District (PACD) indicated that the river's contact recreational use was not supported from the confluence with Baldwin Creek to a point 4.0 miles upstream (WDEQ, 2002). PACD developed a watershed plan (PACD, 2001; PACD, 2005) to further identify primary sources of fecal contamination. The primary sources were identified as failing septic systems and

livestock waste from Hornecker Creek, a tributary to the Middle Fork Popo Agie River above Lander; additional sources within Lander also contribute, but to a much lesser degree. The influence of the Hornecker Creek watershed on *E. coli* concentrations in the Middle Fork Popo Agie River is often most pronounced in July and August because most of the discharge in the river above the confluence with the creek is typically diverted for irrigation. The river can sometimes be completely dewatered during drought years for a short segment between cemetery ditch and the confluence with Hornecker Creek. PACD sponsored a Section 319 watershed improvement project in 2006 that replaced several eligible septic systems, implemented agricultural BMPs and supported further source identification and BMP effectiveness monitoring in the watershed. PACD has monitored bacterial concentrations at multiple sites between 2002 and 2012 and plans to continue monitoring through 2014. Data collected by PACD indicate that BMPs in the Hornecker Creek watershed may have been successful in reducing *E. coli* concentrations in the Middle Fork Popo Agie River in 2011. However, a 2012 Section 319 final report indicated that bacterial concentrations again exceeded the primary recreational use criterion at several study sites between Mortimore Lane Bridge and the confluence with Baldwin Creek. WDEQ and PACD will continue to work together to identify additional bacterial sources in the watershed.

The Baldwin Creek watershed, including Squaw Creek, drains an area within and to the north of the town of Lander. The riparian areas along Squaw (WYBH100800030210_00) and Baldwin (WYBH100800030207_02) Creeks were historically damaged by overgrazing, channel alterations, livestock, burning, willow removal and subdivisions development. These stressors combined to contribute to excessive erosion and sedimentation in these watersheds. PACD completed a Section 319 Squaw Creek/Baldwin Creek Water Quality Improvement project in 1998 with the goals of reducing erosion and other nonpoint source pollution and improving water quality. BMPs included: constructing riparian fencing, restoring riparian vegetation, constructing livestock water gaps, stabilizing streambanks, enhancing irrigation efficiency, grading adjacent lands and changing grazing practices. Data collected during the project showed that these BMPs were successful in restoring degraded segments along both creeks and these watersheds were determined to be fully supporting their cold water fishery and aquatic life other than fish designated uses.

Deep Creek is a small foothills stream that originates in the southern foothills of the Wind River Mountains and then flows northeast to its confluence with Red Canyon Creek. WDEQ (2003) monitored the creek in 1999 and 2003 to address BLM's concerns that water quality may be degraded. Chemical, biological and physical data collected by WDEQ indicated that the entire Deep Creek watershed (WYBH100800030103_01) supports its cold water fishery and aquatic life other than fish designated uses.

The headwaters of the Little Popo Agie river originate from several alpine lakes in the southern Wind River Mountains in the Shoshone National Forest. Data and information submitted to WDEQ from NRCS in the early 1990's suggested that water quality may be degraded due to siltation, salinity and chlorides from industrial, agricultural and natural sources. To address these concerns, WDEQ (2013) monitored a portion of the Little Popo Agie River during 1998, 2006, 2011 and 2012, from a WGFD fishing access area near the confluence with Red Canyon Creek downstream to the confluence with the Popo Agie River. The report indicated that there were trends of increasing sedimentation, total suspended solids, sulfates, conductivity and total phosphorus from upstream to downstream between study sites. The study also showed that the aquatic life other than fish, coldwater fishery, drinking water and fish consumption uses were fully supported along three segments of the Little Popo Agie River; including from the confluence with Red Canyon Creek to a point 8.7 miles downstream (WYBH100800030104_01), from the confluence with Coal Mine Draw upstream to the confluence with Willow Creek (WYBH100800030108_01) and from the confluence with the Popo Agie River upstream 11.1 miles to the confluence with Coal Mine Draw (WYBH100800030108_02). Results also indicated that an oil production facility below the confluence with Twin Creek was causing the stream to exceed WDEQ's narrative criterion for oil and grease. Therefore, a segment of the river (WYBH100800030108_03) from the confluence with Willow Creek upstream 4.5 miles to the oil treater facility has been added to the 303(d) List in 2014 because this pollutant has resulted in non-support of the coldwater fishery and aquatic life other than fish designated uses.

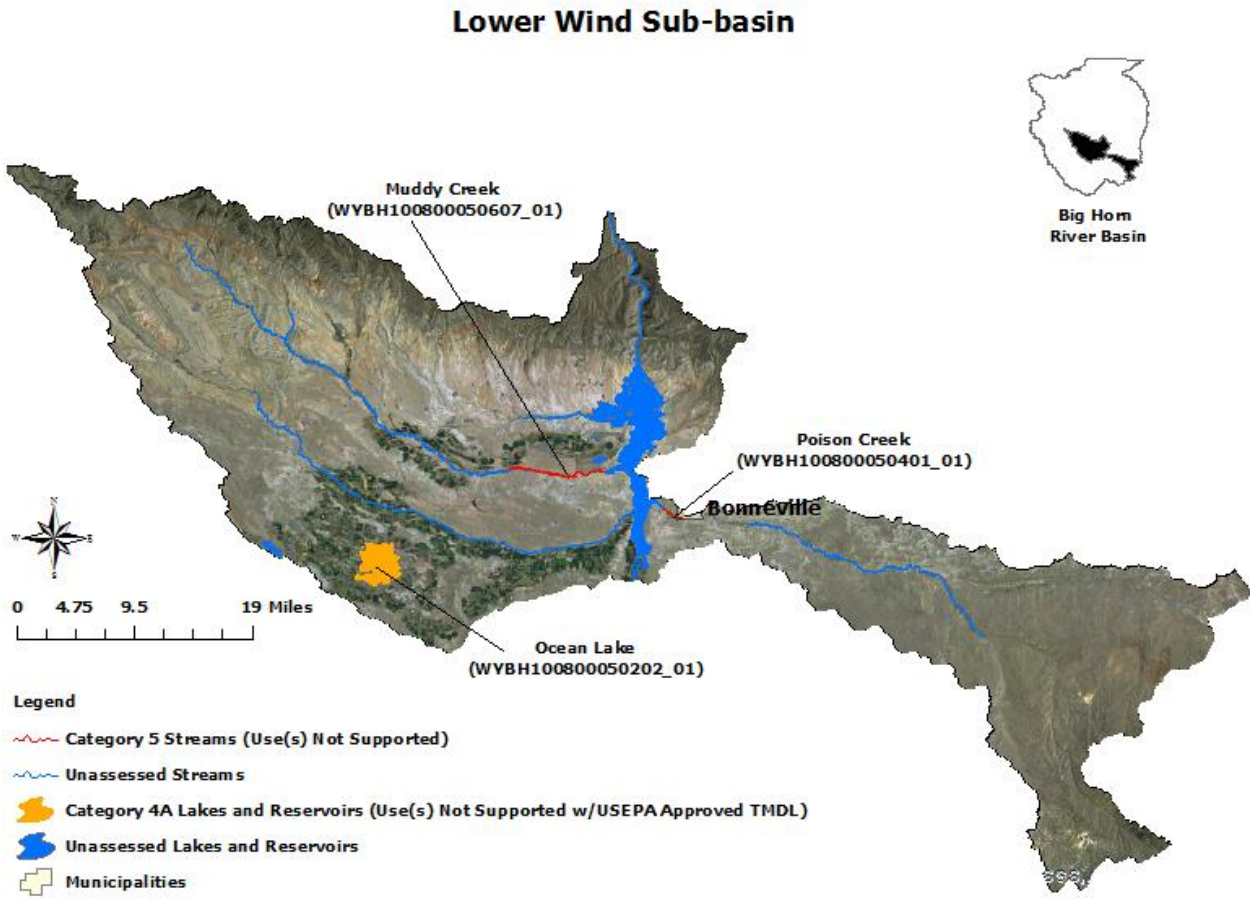


Twin Creek's headwaters are located within the southeastern foothills of the Wind River Mountains. The creek flows northeast and confluences with the Little Popo Agie River just upstream of the Dallas Dome Oil Field. WDEQ (2013) conducted a study on Twin Creek between 1996 and 2009 to address BLM, WGFD and NRCS concerns that aquatic life uses may be degraded. Results of this study indicated that two segments of Twin Creek supported their drinking water and fish consumption uses, while all other uses on these segments were either indeterminate or not assessed. The two stream segments included from Old Highway 287 upstream 3.3 miles to the outlet of Carr Reservoir (WYBH100800030106_02) and from the inlet of Carr Reservoir to a point 6.1 miles upstream (WYBH100800030106_01). The study also indicated that the remainder of lower Twin Creek, from Old 287 downstream 15.6 miles to the confluence with the Little Popo Agie River (WYBH100800030106_03) was not supporting its aquatic life other than fish and cold water fishery uses and this segment was added to the 303(d) List in 2014. The cause of these aquatic life use impairments was determined to be excess sedimentation, and the sources of this pollutant include livestock grazing and historic habitat modifications. The impaired segment of Twin Creek exhibited significant channel instability; including an entrenched channel, raw and unconsolidated banks that are highly erosive. The macroinvertebrate community becomes increasingly degraded with distance downstream within the impaired segment.

Lower Wind Sub-basin (HUC 10080005)

The two primary drainages in the Lower Wind Sub-basin are the Muddy and Poison Creek watersheds. Muddy Creek's headwaters are located in the Owl Creek Mountains, from which the stream flows east through the Wind River Indian Reservation, then the Sand Mesa Wildlife Habitat management Area to its confluence with Boysen Reservoir. Poison Creek is an intermittent watershed that flows west across a

section of high desert and confluences with Boysen Reservoir near the town of Shoshoni. A USGS (2003) synoptic study found that fecal coliform concentrations were elevated above WDEQ's recreational use criterion in Muddy and Poison Creeks. Therefore, WDEQ added Muddy Creek from the confluence with Boysen Reservoir upstream to the boundary of the Wind River Indian Reservation (WYBH100800050607_01) and Poison Creek from the confluence with Boysen Reservoir to a point 2 miles upstream (WYBH100800050404_01) to the 303(d) List in 2002. In 2005, LWRCD collected data as part of a Lower Wind River Conservation District Water Quality Assessment Section 319 project. These samples verified the occurrence of elevated bacterial concentrations in lower Muddy Creek. The same study was inconclusive regarding bacterial concentrations in Poison Creek. A local landowner group has been formed to investigate the sources of bacteria within the Muddy Creek watershed.



Ocean Lake is a small (6075.8 ac.) and very shallow reservoir located in the Ocean Lake State Wildlife Habitat Management Area. A WGFD study conducted in 1985 concluded that Ocean Lake's fishery was declining due to sediment, originating mainly from irrigated agriculture (WDEQ, 2005). Wave action in the lake frequently re-suspends sediment, significantly reducing light penetration and limiting the growth of aquatic plants that would otherwise stabilize the deposited sediment and improve water quality. Elevated nutrients in the lake have also been a concern. The Save Ocean Lake (SOL) committee was formed in 1986 to coordinate efforts to reduce sediment loading to the lake; BMPs included installing drop structures on irrigation ditches, fencing ditches, re-seeding banks, installing water gaps for livestock and the installation of dikes to more efficiently return water from fields to ditches. Ocean Lake (WYBH100800050202_01) was added to the 303(d) List in 1996 for not supporting its warm water fishery and aquatic life other than fish uses due to physical degradation from excessive sedimentation.

Monitoring conducted on Ocean Lake by WDEQ (2005) and WGFD showed that most of the irrigation drains are contributing less sediment to Ocean Lake, but there are still areas contributing high loads. The Lower Wind River Conservation District (LWRCD) sponsored the formation of the Ocean Lake Watershed Steering Committee in 2005 to address anthropogenic water quality issues affecting the lake and a watershed plan was completed in 2009. A TMDL for Ocean Lake has been completed by WDEQ and was approved by USEPA in December of 2009.

Badwater Creek Sub-basin (HUC 10080006)

The Badwater Creek Sub-basin is located within an area of desert basin surrounding Lysite and confluences with Boysen Reservoir just north of Shoshoni. In 2005, LWRCD completed the Lower Wind River Conservation District Water Quality Assessment Section 319 project. The report described the Badwater Creek drainage as having a flashy, ephemeral hydrology, and that the creek only flows following thunderstorms. LWRCD established one site on Badwater Creek near its confluence with Boysen Reservoir for this study. Physical and chemical parameters could only be collected on two dates during 2004-2005 and designated use support could not be assessed. Lastly, the report suggests that this watershed can transport large sediment loads to Boysen Reservoir during storm events.

Upper Big Horn Sub-basin (HUC 10080007)

The headwaters of the Upper Bighorn Sub-basin are located in the foothills of the Absaroka and Owl Creek Mountains. Major drainages within this sub-basin include Owl, Cottonwood, Gooseberry and Fifteen Mile Creeks to the west and Nowater and Kirby Creeks to the east of the Bighorn River.

The Bighorn River near Basin was placed on the 303(d) List in 2000 from the confluence with the Greybull River upstream to the confluence with the Nowood River (WYBH100800071000_02) because USGS data (station 06274300) collected near the town of Basin identified exceedances of WDEQ's fecal coliform criterion. WDEQ collected additional data near basin in June of 2000 and 2001 which also indicated high bacterial concentrations. Data indicated that the highest bacteria concentrations occurred during high flows in May and June, which may indicate that bacterial loading is occurring via overland flow. USGS data collected during 2007-2008 continued to show high levels of *E. coli* bacteria in the Bighorn River near Basin. The South Big Horn Conservation District (SBHCD) had a Section 319 project to evaluate water quality in the lower Bighorn basin and collected samples on the Bighorn River near Basin; 2002-2004 data submitted to WDEQ in a 2005 project report were inconclusive. A second Section 319 project, spanning the years 2005 and 2007 was completed in 2008 by SBHCD. The goals of the project were to improve failing septic systems and to replace or relocate several animal feeding operations (AFOs). Samples collected during the project showed that the Bighorn River continued to have high *E. coli* concentrations. Washakie County Conservation District (WCCD) developed a watershed plan for the upper Bighorn River watershed in 2006 (WACD 2011). A TMDL for this segment of the Bighorn River was completed by WDEQ and approved by USEPA in April of 2014.

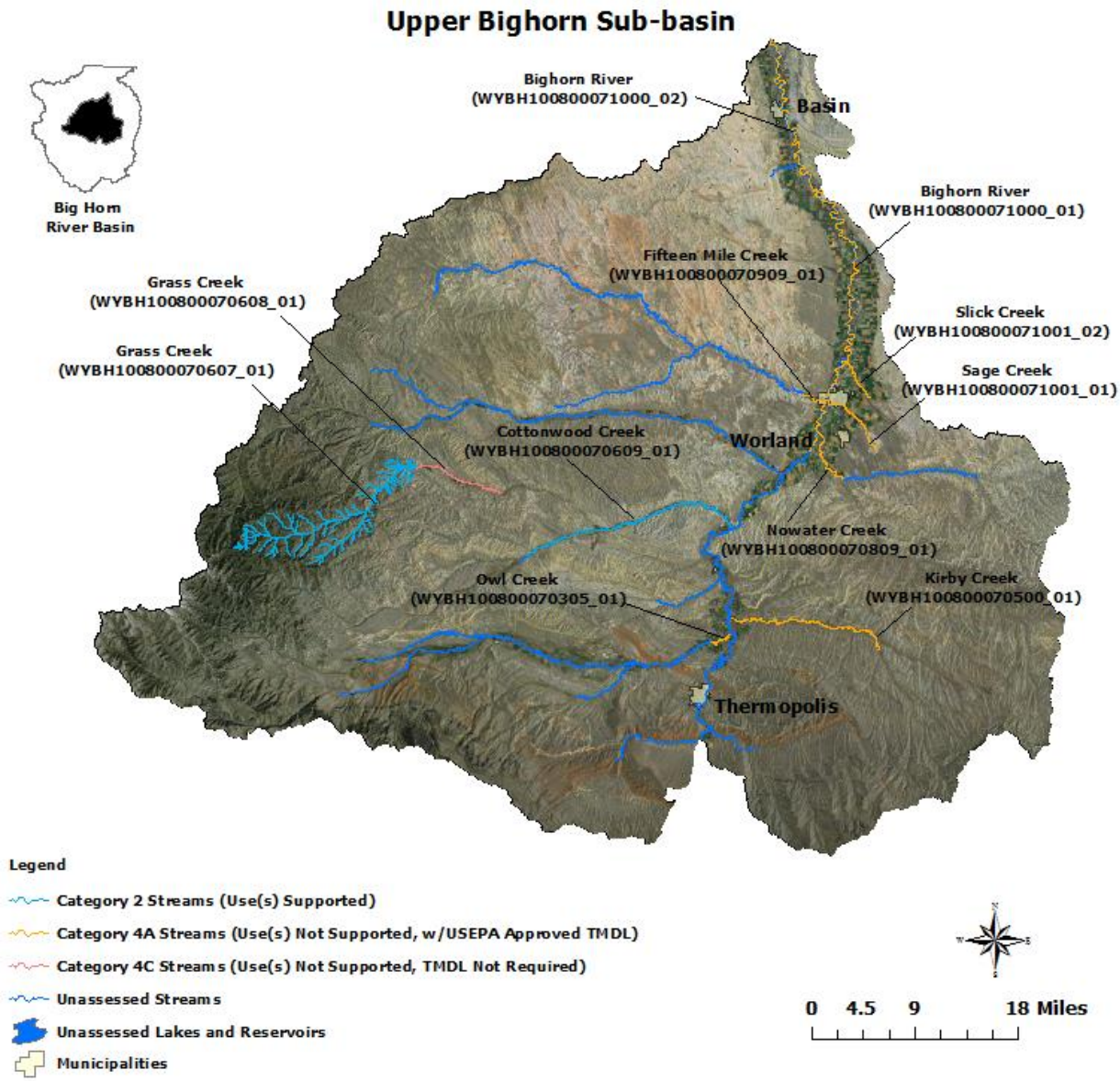
Owl Creek's headwaters are located along the northern edge of the Owl Creek Mountains. Naturally elevated sodium and sulfates, together with silt and clay, affect the water quality in the Owl Creek watershed (Ogle, 1992). An abandoned sulfur mine in the watershed that had historically degraded water quality was reclaimed by AML in 1995. A USGS (2003) synoptic study found that fecal coliform concentrations ranged between 340-1500 cfu/100mL at two locations along lower Owl Creek. Based on this study, a segment of Owl Creek, from the confluence with the Bighorn River to a point 3.8 miles upstream (WYBH100800070305_01) was added to the 303(d) List in 2002 as threatened for not supporting its contact recreational use. Hot Springs Conservation District (HSCD) has sponsored the formation of the Owl Creek Watershed Planning Committee and has been monitoring *E. coli* levels in the creek. The committee finalized a watershed plan in 2006 and is implementing several BMPs (WACD 2011). A TMDL for Owl Creek was completed by WDEQ and approved by USEPA in April of 2014.

The Kirby Creek watershed drains a relatively large portion of the Bighorn Basin east of the town of Lucerne. HSCD completed the Kirby Creek Watershed Assessment and Inventory Section 205j Report in 2003. The report indicated that Kirby Creek has had high erosion rates since the early 1900's due to channel straightening, flow alteration and historic overgrazing. In addition, the elevation of the channel at the confluence with the Bighorn River was historically lowered approximately 10 feet. These activities have resulted in significant instability from down cutting and head cutting, which have contributed large sediment loads to the Bighorn River. The report also identified that fecal coliform was exceeding WDEQ's recreational use criterion in Kirby Creek. A USGS (2003) synoptic study also reported high fecal coliform concentrations (exceeding 500 cfu/100mL) at three locations along the creek. Kirby Creek, from the confluence with the Bighorn River to a point 21.8 miles upstream, was placed on the 303(d) List in 2002 for not supporting its recreational designated use. HSCD sponsored the Kirby Creek Watershed Improvement and Channel Stabilization Project in 2008. There were three main goals for the project: reducing head-cutting and erosion, improving riparian vegetation and reducing fecal bacteria concentrations. Structures have been installed in much of West Kirby Creek to stabilize banks and allow the stream to access its flood plain. BLM and HSCCD have conducted several watershed improvement projects; including healthy rangeland assessments, removal and reclamation of abandoned oil wells and installation of riparian fencing. HSCD also sponsored the 2008 Kirby Creek Stan's Folly Stabilization Section 319 Project to provide information for future project development directed at reducing sedimentation and *E. coli* loading in the watershed. The project provided a map of the physical profile of Kirby Creek for 4 miles in the Stan's Folly area. Several sites throughout the watershed were also monitored for various physical-chemical parameters, discharge and *E. coli*. A Use Attainability Analysis (UAA) to change the classification of Kirby Creek from primary to secondary recreational use was submitted to WDEQ by HSCD in 2007; information in the Kirby Creek UAA was incorporated into a statewide UAA for recreation that is currently in review. The Kirby Creek/Buffalo Creek Watershed plan was completed by HSCD in 2009.

Cottonwood Creek's headwaters are situated in the southeastern foothills of the Absaroka Mountains. WDEQ (2002) monitored Cottonwood Creek in 1998 and noted that there were elevated concentrations of chloride, selenium and sulfate. The report also that there was in-stream habitat degradation, including the presence of a wide and shallow channel and fine sediment aggradation and that riparian vegetation was in poor condition . The Hamilton Dome Oil Field discharges produced water into several unnamed tributaries to Cottonwood Creek. This treated water resulted in exceedances of the chronic chloride and selenium criteria and non-support of the cold water game fish and aquatic life other than fish uses. Cottonwood Creek (WYBH100800070609_01) was therefore added to the 303(d) List in 2004 from the confluence with the Bighorn River upstream to the confluence with Wagonhound Creek. The oil field discharge is critical to maintaining intermittent flows that provide water for irrigation and wildlife. In addition, the facility is an important part of the local economy and the facility upgrades that would be necessary to meet WDEQ's standards would result in the closure of the facility. Therefore, site specific criteria of 43 ug/L for selenium and 860 mg/L for chloride were adopted as part of a UAA for Cottonwood Creek that was approved by USEPA in 2008. Cottonwood Creek was subsequently removed from the 303(d) List in 2008 and placed in category 2 because cold water fishery and aquatic life other than fish uses were determined to be fully supported.

Grass Creek, a tributary to Cottonwood Creek has been monitored and assessed by WDEQ (2003, 2005). These studies indicated that the aquatic life other than fish and cold water fishery uses are not supported in Grass Creek from an irrigation diversion in NENE S23 T46N R99W to a point 14.1 miles downstream. Because these use impairments are caused by flow alterations (i.e. dewatering), this segment of Grass Creek (WYBH100800070608_01) was placed in category 4C in 2006 instead of the 303(d) List of impaired waters requiring TMDLs. Grass Creek (WYBH100800070607_01) above the irrigation diversion supports its aquatic life other than fish and cold water fishery uses, but channel instability and excess sediment were noted. Phase I of a Section 319 Project sponsored by The Nature Conservancy (TNC) was initiated in 2008 with the overall objective of improving physical conditions by improving grazing management in upper Grass Creek. Specific goals included

reducing sedimentation, improving in-stream and riparian habitats and lowering water temperatures. BMPs for this project included off channel spring development as an alternative water source for livestock, the construction of fences to protect springs and weed control to improve riparian health. A 2012 final report indicated that these BMPs had effectively reduced sediment loading and improved the health of riparian vegetation in upper Grass Creek. Phase I also included the collection of baseline comparison data from neighboring Little Grass, Enos and Left Hand Creeks which will be used in Phase II of the project. The results of these projects will ultimately be used to assess whether habitat conditions in the upper watershed are suitable for Yellowstone cutthroat trout reintroduction.



USGS (2003) data indicate that occasional high counts of fecal coliform threaten the contact recreation use of Nowater (WYBH100800070809_01), Sage (WYBH100800071001_01), Fifteen Mile (WYBH100800070909_01) and Slick (WYBH100800071001_02) Creeks, and each stream was added to the 303(d) List in 2002. WCCD had a Section 319 project to improve an AFO and several septic systems and to conduct *E. coli* monitoring. For the 303(d) List in 2010, the status of the Bighorn River above Nowood River, and Fifteen Mile, Nowater, Sage and Slick Creeks were changed from threatened to not

supporting their recreational uses after high levels of *E. coli* were again reported by WCCD in a 2008 Section 319 Report. TMDLs were approved by USEPA in April, 2014 for the bacterial listings on Owl, Kirby, Nowater, Fifteen Mile, Sage and Slick Creeks and two segments of the Bighorn River. All of these waters have been removed from the 303(d) List in 2014 and placed in category 4A.

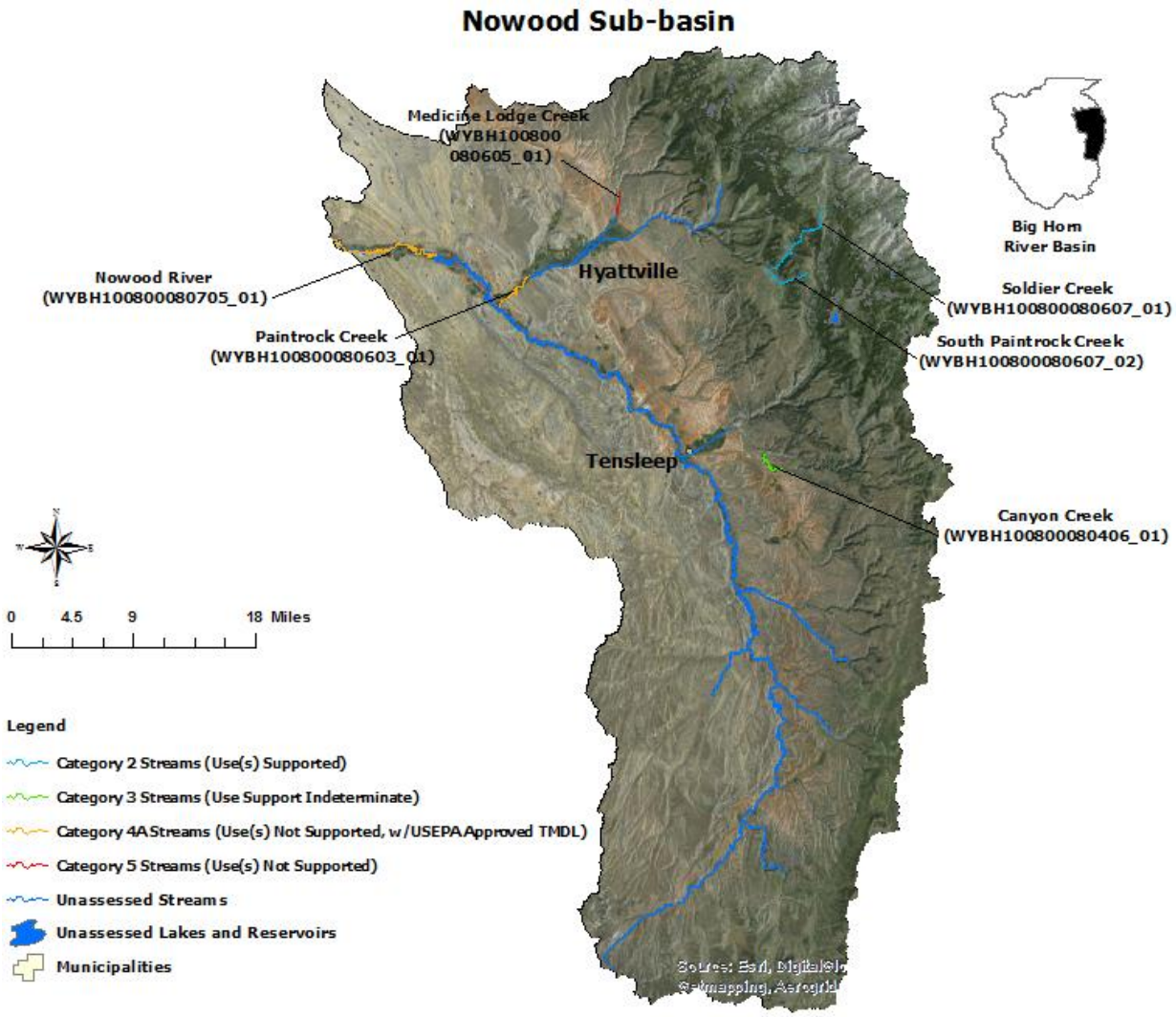
Nowood Sub-basin (HUC 10080008)

The headwaters of the Nowood River are situated along the southwestern edge of the Big Horn Mountains. Fecal bacteria samples collected by WDEQ (2002) in 2000 and 2001 from the Nowood River (WYBH100800080705_01) indicated that there were exceedances of the contact recreation criterion from the confluence with the Bighorn River to a point 13.4 miles upstream. As a result, the Nowood River was placed on the 303(d) List in 2002. Several homes and businesses in the town of Manderson have historically discharged largely untreated wastewater into the Nowood River just upstream from the Bighorn River. In 2005, the town constructed a new mechanical wastewater treatment system which contains a microbe filter. Wastewater is re-circulated through these filters to reduce nitrogen and total suspended solids and then exposed to UV treatment before being discharged.

Paintrock Creek (WYBH100800080607_01), a tributary to the Nowood River, was added to the 303(d) List in 2002 because WDEQ data indicated that the contact recreational use was threatened by occasional high counts of fecal coliform bacteria. A watershed plan was completed by the SBHCD in 2006 (WACD 2011). WDEQ (2010) monitored and assessed South Paintrock Creek (WYBH1008000080603_02) near its confluence with Soldier Creek and found that drinking water and fish consumption uses were fully supported, while all other uses were indeterminate. The aquatic life other than fish and cold water fisheries uses were difficult to assess because of the small size of the watershed which is not well represented in WDEQ's macroinvertebrate models.

The South Big Horn Conservation District (SBHCD) had a Section 319 project to evaluate water quality in the lower Bighorn basin and collected samples on Paintrock Creek and the Nowood River; 2002-2004 data submitted to WDEQ in a 2005 project report were inconclusive. A second Section 319 project, spanning the years 2005 and 2007 was completed in 2008 by SBHCD. The goals of the project were to improve failing septic systems and to replace or relocate AFOs. Combined, twelve septic systems and ten AFO improvements were completed along the Bighorn River, Nowood River and Paintrock Creek; all three waters continued to have high *E. coli* concentrations during the project. TMDLs were approved by USEPA in April 2014 for the bacterial listings on Paint Rock Creek and the Nowood River and these waters have been removed from the 303(d) List in 2014 and placed in category 4A.

WDEQ (2006) collected macroinvertebrates and diatoms in upper Canyon Creek and determined that it was likely reference quality. However, some areas of the lower Canyon Creek watershed have had willows removed in the past, and this is thought to have caused bank instability and increased water temperatures during the summer. WGFD fish surveys in 2007 and 2010 showed an increase in young of the year and 1 year old brown trout but a decrease in mountain whitefish from a status of rarely collected to absent. WGFD stated that the brown trout population is limited by a lack of riparian cover and clean spawning gravels. Indeed, the reach was reportedly composed almost entirely of sand and silt and was determined not to be a viable location for trout reproduction. It was suggested instead that recruitment likely occurs outside the stream reach. To improve habitat conditions in Canyon Creek, WGFD suggested that the banks be stabilized with woody vegetation and that the reach be rested from livestock grazing. A Section 319 Riparian Enhancement Project was completed by local citizens in 2009. Project activities included the installation of a fence along more than a mile of the stream to better manage livestock, planting trees and shrubs and monitoring to evaluate physical trends. The same reach of Canyon Creek (WYBH100800080406_01) was assessed by WDEQ (2010) in 2007 and 2009, at which time the designated use support status was indeterminate.

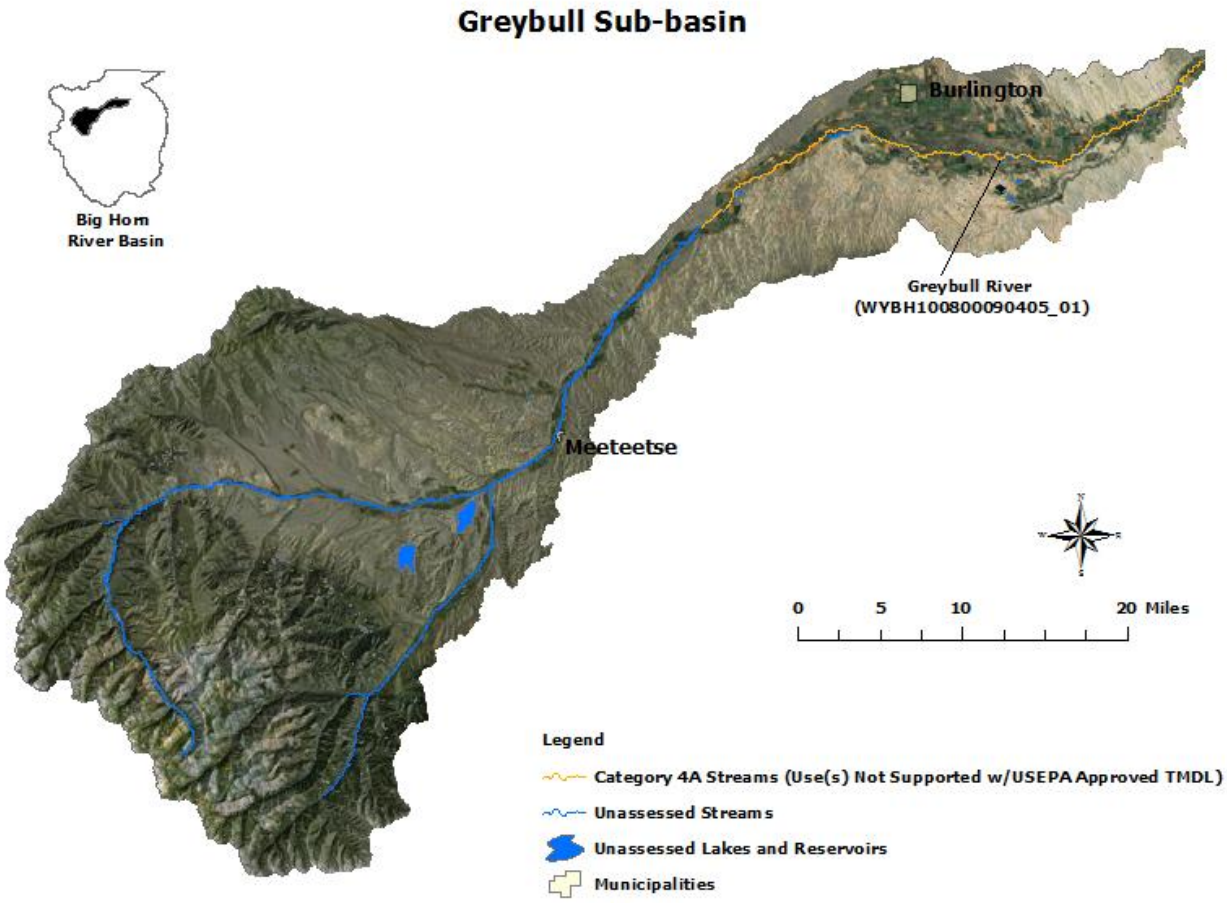


Soldier Creek, a tributary to South Paintrock Creek was monitored at two locations by WDEQ (2007) in 2000. The study concluded that the physical, chemical and biological characteristics of the stream were similar to those of reference condition. Thus, a reach of Soldier Creek (WYBH100800080603_01), extending from the confluence with South Paint Rock Creek to a point 7.4 miles upstream was determined to fully support its cold water fishery and aquatic life other than fish designated uses.

Medicine Lodge Creek's headwaters are situated along the western side of the Bighorn Mountains. The creek flows southwest through Medicine Lodge Canyon and surrounding foothills before it confluences with Paint Rock Creek within the town of Hyattville. WDEQ monitored a site on Medicine Lodge Creek in 2010, and data from a single sample indicated that *E. coli* bacteria concentrations may be elevated in and around Medicine Lodge Archaeological Site State Park. The results of this study are still under evaluation and designated use support has not yet been assessed.

Greybull Sub-basin (HUC 10080009)

The headwaters of the Greybull Sub-basin are in the Absaroka Mountain Range within the Shoshone National Forest. This sub-basin has three major irrigation reservoir projects, and summer flows in the Greybull River at the confluence with the Bighorn River are composed almost entirely of water from irrigation returns. At times there may be little or no flow due to appropriations on the river (RPO, 1979).



USGS gage data (station 06276500) collected near the town of Meeteetse indicated that fecal coliform concentrations on the Greybull River spanning several dates during May and June of 1996, 1998 and 2000 were greater than WDEQ's recreational use criterion. USGS (2003) collected additional data on the lower Greybull River in 2000 and results indicated that concentrations were high at sites near the towns of Burlington and Greybull. WDEQ (2002) also monitored fecal coliform at three sites along the Greybull River in 2000 and 2001. Bacteria concentrations were particularly high at sites near the towns of Greybull and Otto, whereas concentrations near the Burlington waste water treatment facility (WWTF) and at the town of Meeteetse were relatively low. WDEQ and USGS data showed a trend of increasing fecal coliform concentration between the towns of Meeteetse and Greybull. Although high bacteria counts were occasionally recorded as far upstream as Meeteetse by USGS between 2007-2008, samples have been collected too infrequently to calculate a five sample geometric mean. Based on the studies described above, a segment of the Greybull River (WYBH100800090405_01) from the confluence with the Bighorn River upstream to Sheets Flat Bridge was placed on the 303(d) List in 2002 because the contact recreational use was not supported.

The Meeteetse Conservation District (MCD) showed in both the Sheets Flat *E. coli* Project (MCD, 2007) and in the Greybull River *E. coli* Final Report (MCD, 2009) that *E. coli* concentrations in the watershed are elevated during seasonal snowmelt runoff. This information suggests that the bacterial loading to the river is likely from nonpoint sources, but specific sources remain unknown. High water temperatures during drought have raised concerns about the river's ability to support its cold water fishery use during low flows in summer. Watershed planning is in progress for the Greybull River watershed in both Big Horn and Park Counties. The SBHCD had a Section 319 project to evaluate water quality in the lower Bighorn basin and collected samples on the Greybull River; 2002-2004 data submitted to WDEQ in a 2005 project report were inconclusive. A second Section 319 project, spanning the years 2005 and 2007 was completed in 2008 by SBHCD. The goals of the project were to improve failing septic systems and to replace or relocate AFOs. Three septic systems and three AFO improvements were completed in the lower Greybull watershed. The study reported continued high *E. coli* geometric means along the impaired segment of the Greybull River. There was also a trend of increasing bacterial concentrations from upstream to downstream that was attributed to increases in the occurrence of irrigated agriculture and livestock. A TMDL was approved by USEPA in April 2014 for the bacterial listing on the Greybull River and this water has been removed from the 303(d) List in 2014 and placed in category 4A.

Bighorn Lake Sub-basin (HUC 10080010)

Bighorn Lake was constructed between 1963-67 to store water for irrigation, to generate hydroelectric power, for flood control and recreation. The southern one third of the reservoir is in Wyoming and the remainder is in Montana.

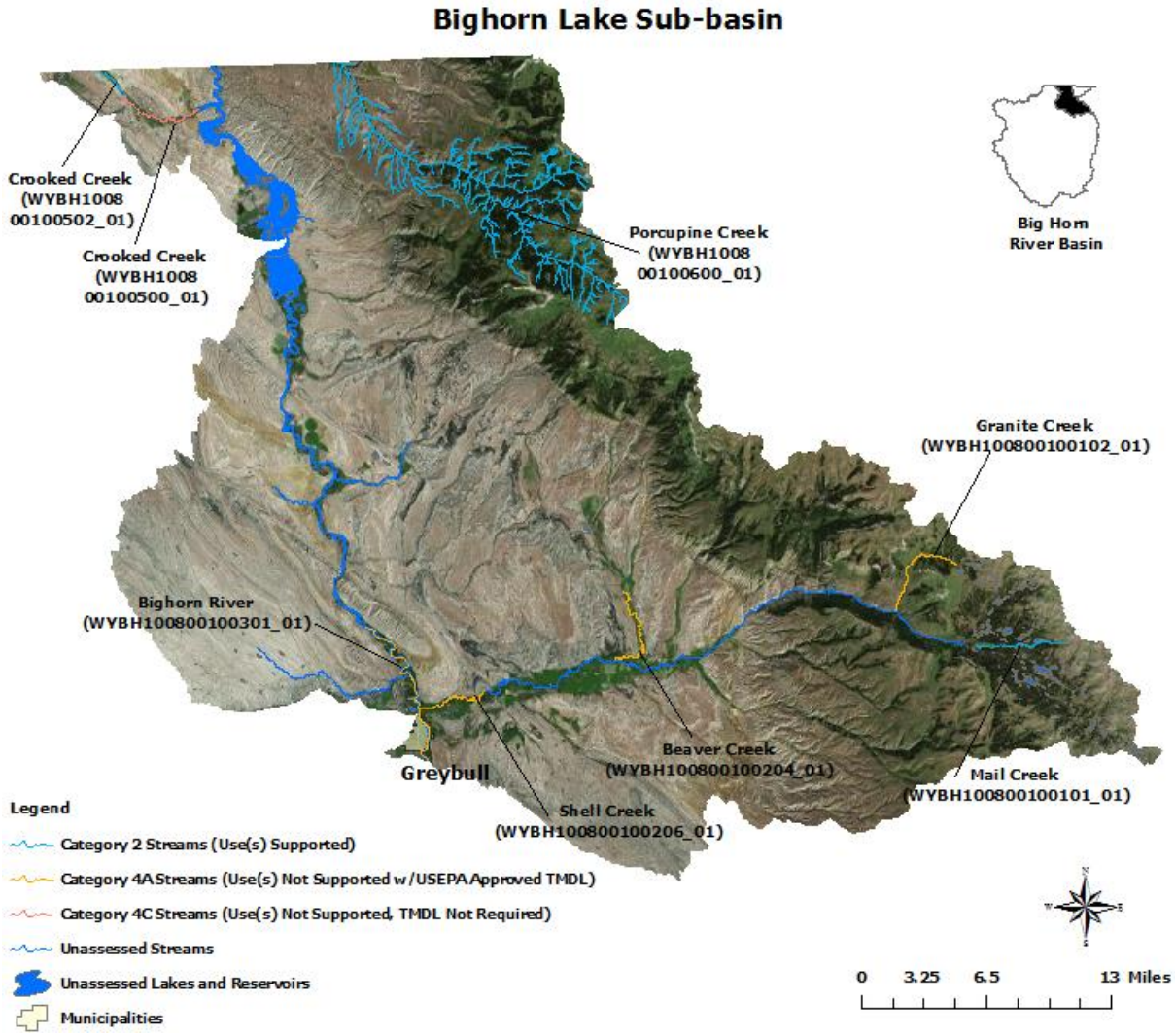
WDEQ (2005) monitored Porcupine Creek (WYBH100800100600_01) in 2001 and concluded that the entire watershed was fully supporting its aquatic life other than fish and cold water fisheries uses. The report noted that the Porcupine Falls area of Porcupine Creek was the site of a historic placer and lode gold mining operation and that because mercury-based amalgamation and potassium cyanide were used for gold extraction, there may be elevated mercury in the creek.

Fecal bacteria monitoring by WDEQ (2002) on the Bighorn River below its confluence with the Greybull River indicated that it is not supporting its contact recreation use. Therefore, a segment of the Bighorn River (WYBH100800100301_01), from the Greybull River to a point 10.5 miles downstream, was added to the 303(d) List in 2002. Samples collected upstream from Bighorn Lake did not exceed the criterion. A TMDL was approved by USEPA in April, 2014 for the bacterial listing the Bighorn River and this water has been removed from the 303(d) List in 2014 and placed in category 4A.

Shell Creek is the largest watershed in the Bighorn Lake sub-basin. Its headwaters are situated along the western slope of the Bighorn Mountains, from which the creek flows west across National Forest, BLM and private lands before it confluences with the Bighorn River. USGS (2003) collected fecal coliform data on Shell Creek just above the Shell Creek Campground within the Bighorn National Forest and near the towns of Shell and Greybull in 2000. Concentrations were low above the USFS campground and near Shell, but were high near Greybull. Shell Creek was also monitored by WDEQ (2002) in 2001 to address concerns over elevated bacteria concentrations. Fecal bacteria samples collected approximately a half mile above the confluence with the Bighorn River in July exceeded WDEQ's fecal coliform criterion. Shell Creek (WYBH100800100206_01) was subsequently added to the 303(d) List in 2002 from the confluence with the Bighorn River to a point 5.3 miles upstream.

Beaver Creek is a major tributary to Shell Creek and these two streams confluence just west of the town of Shell. USGS (2003) collected fecal coliform data on Beaver just upstream of the confluence with Shell Creek in 2000. The reported fecal coliform value exceeded WDEQ's fecal coliform criterion and therefore Beaver Creek (WYBH100800100204_01) was added to the 303(d) List in 2002 as threatened for contact recreational use from its confluence with Shell Creek to a point 7.9 miles upstream. TMDLs were

approved by USEPA in April 2014 for the bacterial listings on Shell and Beaver Creeks and these waters have been removed from the 303(d) List in 2014 and placed in category 4A.



Mail Creek, a small tributary to Shell Creek, originates along the west slope of the Bighorn Mountains within the Cloud Peak Wilderness Area. WDEQ (2004) monitored Mail Creek in 2000 using one study site to address concerns that the biological community may be degraded. The study determined that Mail Creek's (WYBH100800100101_01) cold water fishery and aquatic life other than fish uses are fully supported from the confluence with Shell Creek to a point 5.6 miles upstream.

Granite Creek is another a small tributary to Shell Creek in upper Shell Creek Canyon. USGS (2003) collected data on Granite Creek near the Shell Ranger station in 2000 and results indicated high bacterial concentrations. WDEQ (2002) subsequently monitored Granite Creek in August 2001 at five study sites to determine whether the contact recreation use was supported. Results of the study indicated that Granite Creek (WYBH100800100102_01) is not meeting its contact recreation use due to high levels of bacteria from its confluence with Shell Creek upstream approximately 5.8 miles to the vicinity of the Antelope Butte Ski Area. The septic system leach field at the Antelope Butte Ski Area may have been a significant source of bacteria at the time of sampling. The ski area has not operated since the 2004-05 ski season, and the USFS is in the process of finding a new operator for the facility. The USFS began monitoring

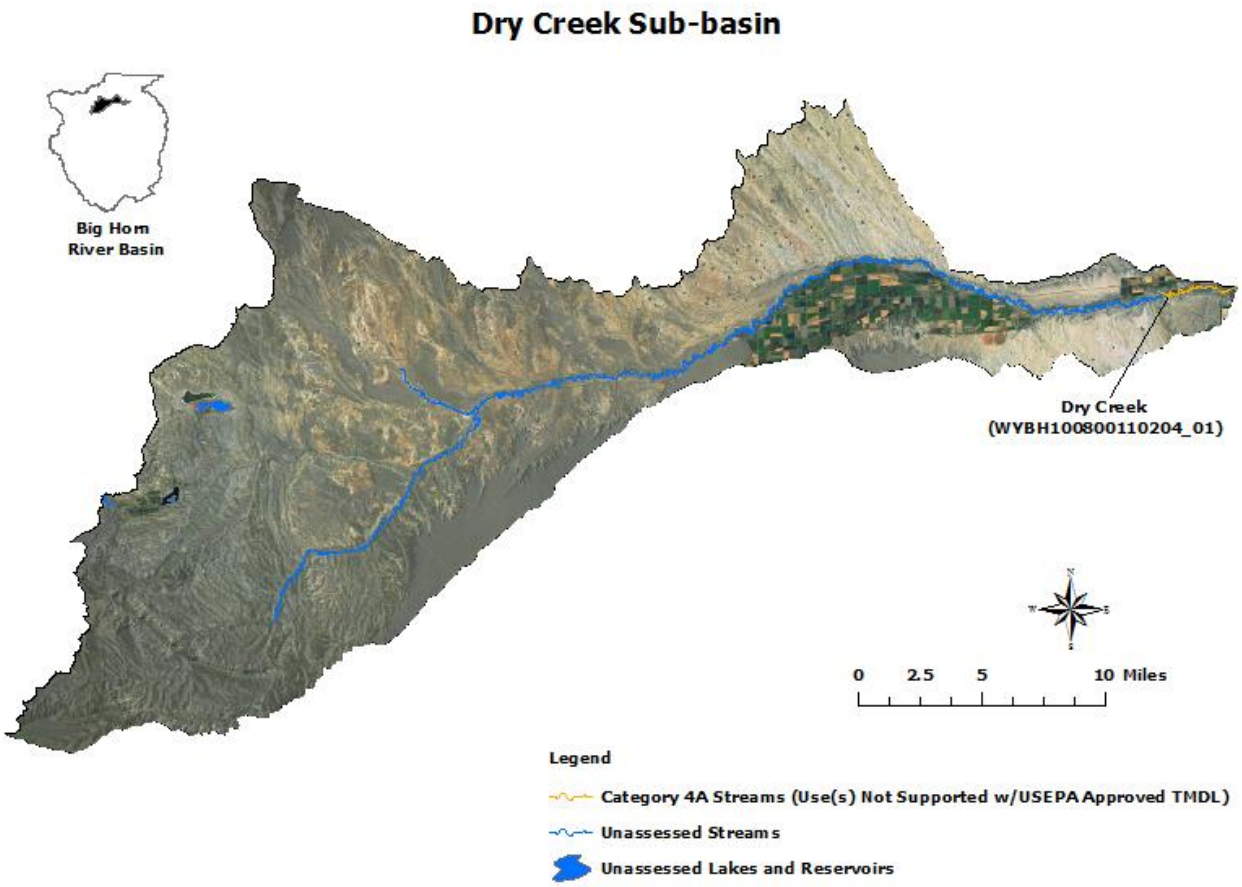
bacterial concentrations in Granite Creek below Antelope Butte Ski Area in late 2004, and data again indicated that there were high *E. coli* concentrations in the creek. During 2005 and 2006 sampling, the maximum single sample concentrations occurred during the primary contact recreation season (April 1st - September 30th), suggesting that loadings from sources other than the ski area may be occurring in the watershed. A TMDL was approved by USEPA in April, 2014 for the bacterial listing on Granite Creek and this water has been removed from the 303(d) List in 2014 and placed in category 4A.

The South Big Horn Conservation District (SBHCD) had a Section 319 project to evaluate water quality in the lower Bighorn basin and collected samples on Shell and Beaver Creeks; 2002-2004 data submitted to WDEQ in a 2005 project report were inconclusive. A second Section 319 project, spanning the years 2005 and 2007 was completed in 2008 by SBHCD. The goals of the project were to improve or replace failing septic systems and to relocate AFOs in the lower Bighorn Basin. Three septic systems and one AFO were improved in the lower Shell Creek watershed. Data collected during this study showed that high *E. coli* concentrations continue to occur on Beaver and Shell Creeks.

Crooked Creek originates in the Pryor Mountains in southern Montana, flows south into Wyoming and confluences with Bighorn Lake. WDEQ (2005) monitored Crooked Creek using two study sites in 2001. Results of the study indicated that portions of Crooked Creek in Wyoming may become dry in summer and freeze solid in winter during some years. Local landowners have indicated Crooked Creek is dewatered for irrigation and is dry during the irrigation season from Section 29, T58N, R95W downstream to Section 35, T58N, R95W, where it is re-wetted at the confluence with Sykes Spring. Cold water fishery and aquatic life other than fish uses are considered fully supported from an irrigation diversion in SWNW Section 29, T58N, R95W upstream to the Montana state line (WYBH100800100502_01). The de-watered segment downstream of this diversion (WYBH100800100500_01) is considered to have an impaired aquatic life other than fish use, and this reach was been placed in Category 4C in 2006. Category 4C waters are those where a use(s) is not supported, but a TMDL is not required.

Dry Creek Sub-basin (HUC 10080011)

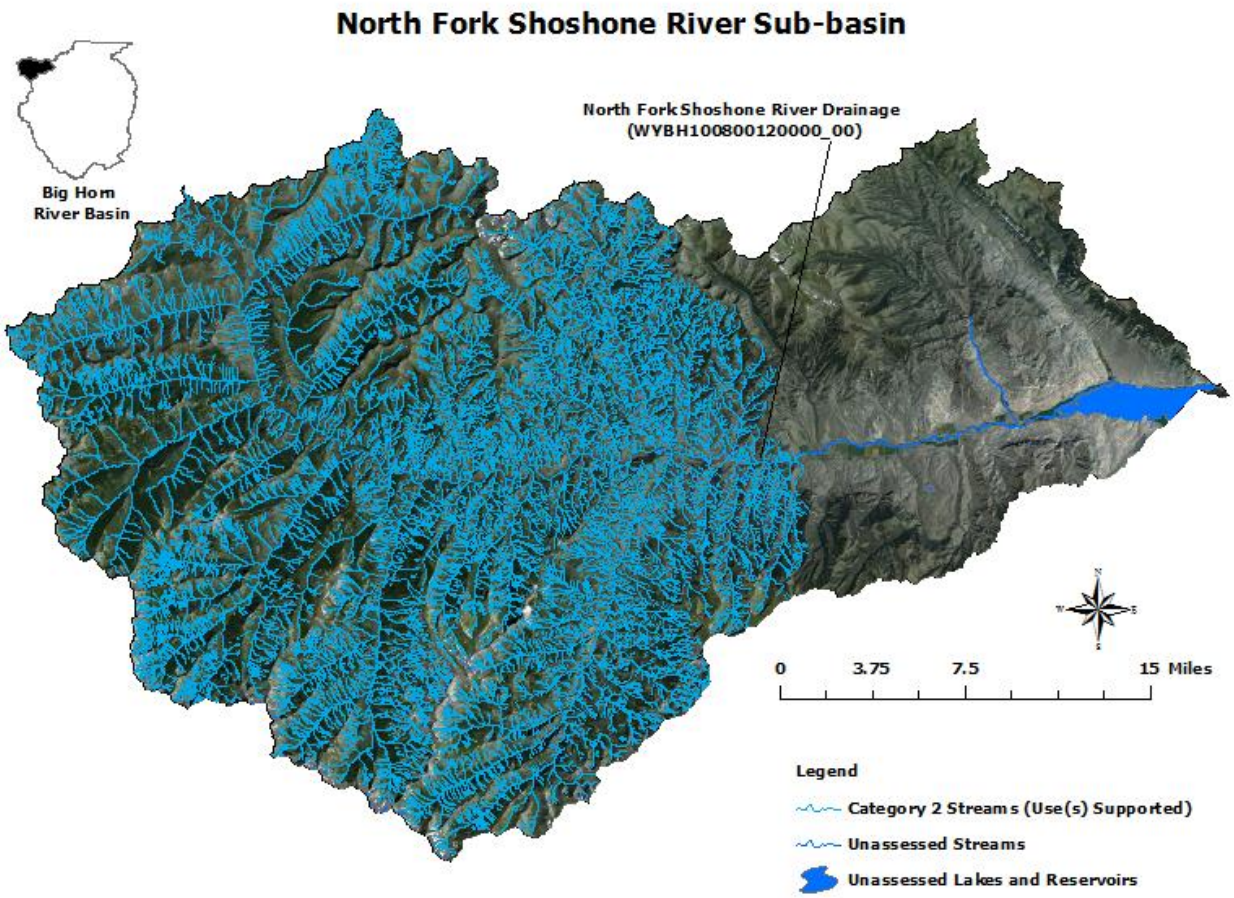
USGS (2003) collected fecal coliform data from two sites along Dry Creek in 2000; one site was located near Emblem and the other within the town of Greybull. Concentrations were estimated to be around five times WDEQ's criterion for fecal coliform. Dry Creek (WYBH100800110204_01), from its confluence with the Bighorn River to a point 4.7 miles upstream, was subsequently placed on the 303(d) List in 2002 because of threats to the recreational designated use. The South Big Horn Conservation District (SBHCD) had a Section 319 project to evaluate water quality in the lower Bighorn Basin and collected samples on Dry Creek; 2002-2004 data submitted to WDEQ in a 2005 project report were inconclusive. A second Section 319 project, spanning the years 2005 and 2007 was completed in 2008 by SBHCD. The goals of the project were to improve failing septic systems and to replace or relocate AFOs. One septic system was improved in the Dry Creek watershed during this project. A TMDL was approved by USEPA in April, 2014 for the bacterial listing on Dry Creek and this water has been removed from the 303(d) List in 2014 and placed in category 4A.



North Fork Shoshone River Sub-basin (HUC 10080012)

The headwaters of the North Fork Shoshone River Sub-basin are located in the highly erodible volcanic geology of the northern Absaroka Range. Mass wasting and landslides are common. For example, a large landslide in the spring of 1997 contributed a significant amount of sediment to Middle Creek. Portions of this watershed also burned in 1988 and again in 2001, which further increased sediment loading to the watershed. These events have raised concerns about the amount of sediment being deposited in Buffalo Bill Reservoir. Despite these concerns, data collected by WDEQ indicate that the North Fork Shoshone River Drainage (WYBH100800120000_00) is meeting its cold water fishery and aquatic life other than fish uses above the confluence with Halfmile Creek. (approximately the Shoshone National Forest boundary). WDEQ data collected in this watershed were not summarized in a report.

Buffalo Bill Reservoir (originally called Shoshone Dam) was built in the early 1900s to capture and store runoff from the North and South Forks of the Shoshone River; water in the reservoir is primarily used for irrigation, generating electricity and for recreation. Sediment entering the reservoir from the North and South Fork Shoshone River settles to the bottom of Buffalo Bill Reservoir, effectively preventing this pollutant from reaching the Shoshone River downstream. However, these sediments can become an air quality issue when the reservoir is low and sediments are exposed to frequent high winds in the area. The USBOR has constructed dust abatement dikes to address this problem (WACD 2011).



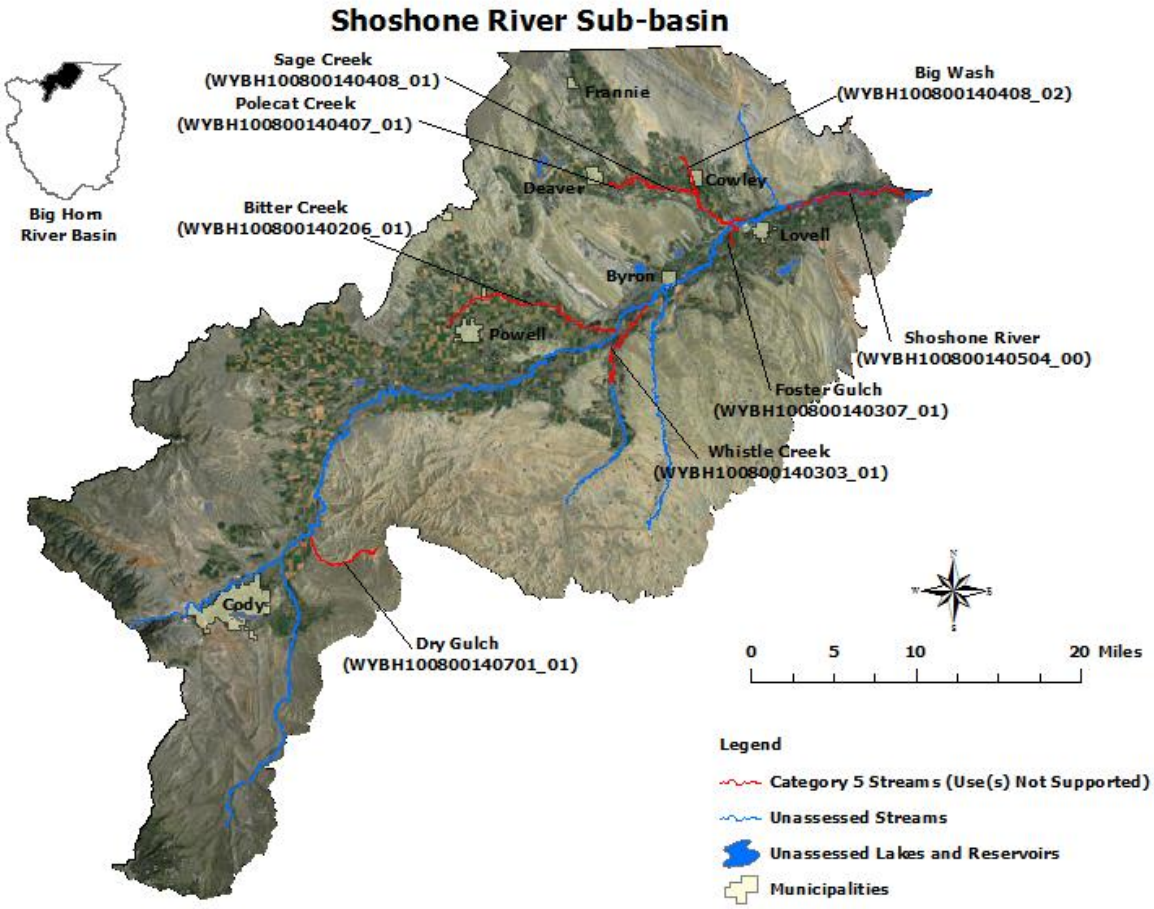
Shoshone River Sub-basin (HUC 10080014)

USGS (2003) collected fecal coliform data at three sites along the Shoshone River in 2000; these sites included above Demaris Springs near Cody, near the town of Lovell and at Kane. Results indicated that the fecal coliform concentrations at Demaris Springs were considered to be nearly non-detect. However, concentrations at the sites near Lovell and at Kane were 4-5 times higher than WDEQ's fecal coliform criterion protective of the recreational designated use. Based on this report, a segment of the Shoshone River (WYBH100800140504_00), from the confluence with Bighorn Lake to a point 9.7 miles upstream was added to the 303(d) List in 2002. The Cody Conservation District (CCD) completed the Shoshone River *E. coli* Baseline Sampling Section 319 Sampling Project in the upper Shoshone River watershed in late 2005 to monitor *E. coli* levels. Results corroborated those reported by USGS; concentrations were minimal immediately below Buffalo Bill Reservoir and increased gradually downstream to just below Corbett Dam. Dry Gulch, a tributary to the Shoshone River, is naturally ephemeral. However, it receives irrigation return flows and thus has water during most of the primary contact recreation season. Sampling conducted by the CCD indicated that Dry Gulch (WYBH100800140107_01), from the confluence with the Shoshone River to a point 7.0 miles upstream exceeds the *E. coli* criterion and it was added to the 303(d) List in 2008 for *E. coli*. TMDLs for the Shoshone River and Dry Gulch were initiated by WDEQ in 2012.

In response to concerns by an area physician who treated several cases of severe gastro-intestinal illness in patients who had been swimming in area waters, WDEQ conducted fecal bacteria monitoring in 2000 in several of the drainages in the lower Shoshone River watershed. Several waters exceeded the fecal bacteria criterion and were added to the 303(d) List in 2002. These included a section of Bitter Creek

(WYBH100800140206_01) from its confluence with the Shoshone River to a point 13.9 miles upstream (WDEQ, 2000); Sage Creek (WYBH100800140408_01) from its confluence with the Shoshone River to a point 14.0 miles upstream (WDEQ, 2002); Polecat Creek (WYBH100800140407_01), from its confluence with Sage Creek to a point 2.5 miles upstream (WDEQ, 2002); Big Wash (WYBH100800140408_02), from its confluence with Sage Creek upstream to Sidon Canal (WDEQ, 2002); and Whistle Creek (WYBH100800140303_01), from its confluence with the Shoshone River to a point 8.7 miles upstream (WDEQ, 2002). Additionally, the lower reach of Foster Gulch (WYBH100800140307_01) was placed on the 303(d) List in 2002 as threatened because of high fecal coliform counts recorded by the USGS (2003). The sources of fecal contamination in these streams are currently unknown. In 2006, PCFCD received a Section 319 grant to improve eligible septic systems in the Bitter Creek watershed. County commissioners and local conservation districts are also considering the establishment of a CWA-State Revolving Loan program to provide low interest loans for additional septic system improvements. The SCD has initiated bacterial monitoring at 16 sites and a septic system improvement program has been implemented using district funds. The Powell-Clarks Fork Conservation District (PCFCD) monitored water quality at five sites along Bitter Creek in 2001 as part of the Bitter Creek Watershed Project 319 Report. The resulting dataset suggested that the elevated bacterial concentrations may occur upstream as far as the Lane 8 Bridge (approximately 2.5 miles upstream of the town of Powell's WWTF). The SCD completed a watershed plan for the Shoshone River in 2006.

In 2007, a malfunction in the Willwood Dam resulted in a large sediment plume being released into the Shoshone River, killing thousands of fish. Similar sediment releases have occurred in the past. The USBOR, which owns the dam, and the irrigation company that operates the dam are working with WDEQ



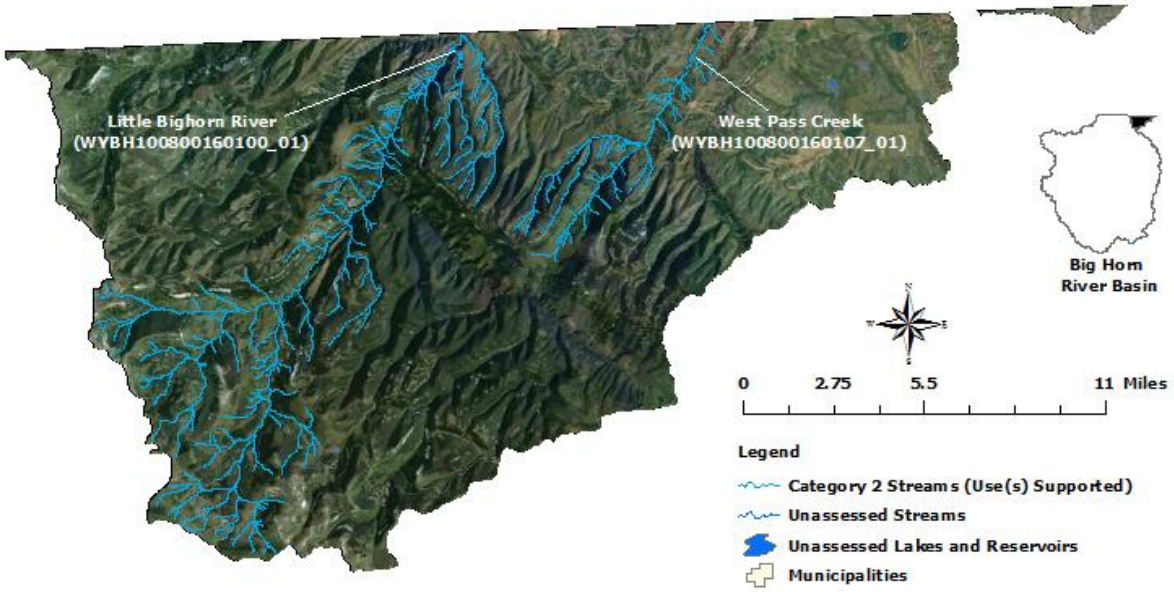
and WGFD to evaluate the issue. A study to assess the designated aquatic life uses on the Shoshone River is currently being conducted by WDEQ.

Information from SCD, WGFD, BLM and a Cooperative River Basin Study (SCS, 1994) suggest that salinity, oil, nutrients and streambank degradation may be additional stressors in Sage and Polecat Creeks in northwest Big Horn County.

Little Big Horn River Sub-basin (HUC10080016)

The headwaters of the Little Bighorn River Sub-basin are in north central Wyoming, mostly within the Bighorn National Forest. West Pass Creek is a major tributary to the Little Bighorn River. Monitoring by WDEQ on the Little Bighorn River (WYBH100800160100_01) WDEQ (2004) and West Pass Creek (WYBH100800160107_01) WDEQ (2004) indicated full support of cold water fishery and aquatic life other than fish uses.

Little Big Horn River Sub-basin



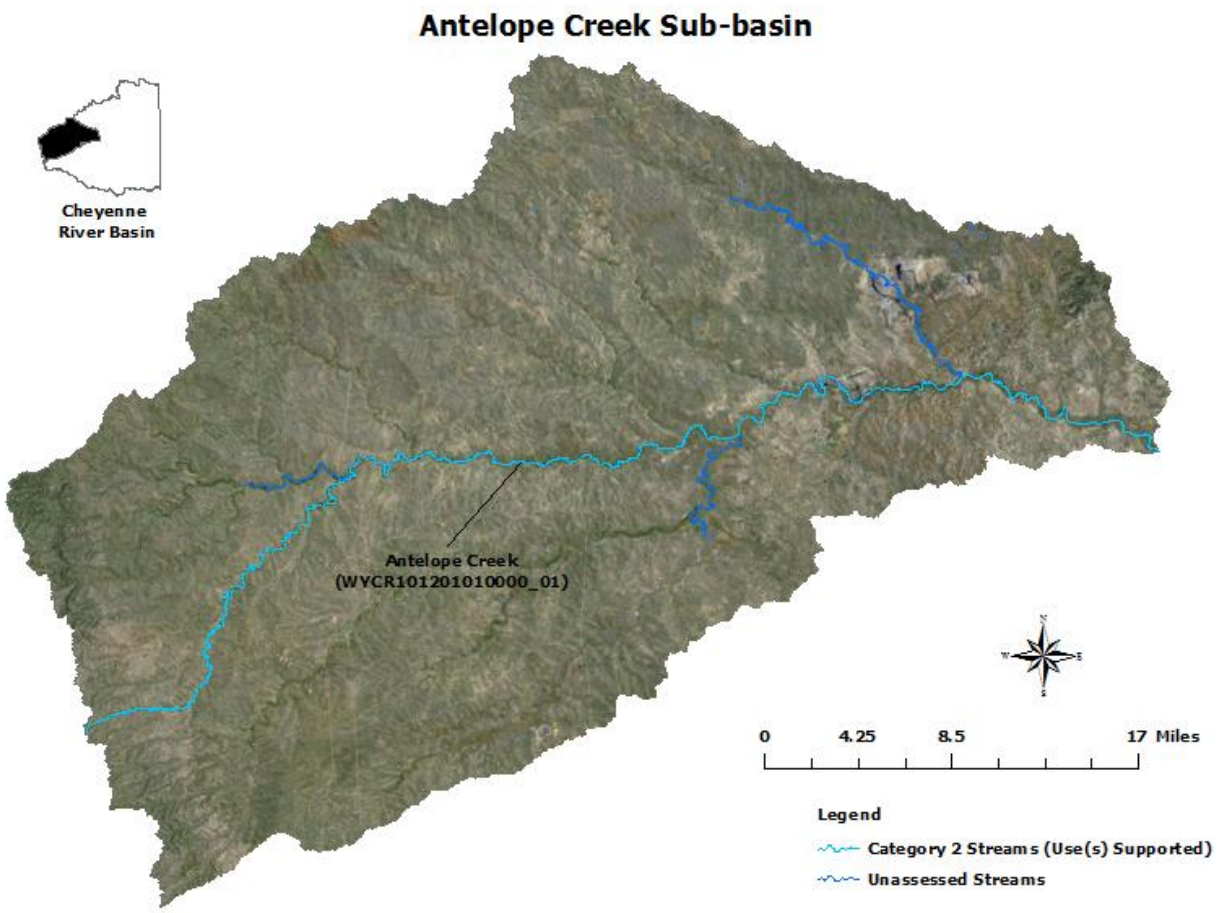
8.4 Cheyenne River Basin

The Cheyenne River Basin drains approximately 8,296 mi^2 in east-central Wyoming. The basin drains mostly the Powder River Geologic Basin, Semiarid Pierre Shale Plains and Black Hills Foothills ecoregions, with isolated areas of Pine Scoria Hills (Chapman et al. 2003). Most of the basin consists of rolling mixed short grass prairie and rocky ponderosa pine forested outcrops of sedimentary shales and sandstones. The Thunder Basin National Grasslands occupy a large portion of the central part of this basin. The Black Hills Foothills to the north contain mixed vegetation, but mostly consist of ponderosa pine with an understory of mixed grasses. The basin receives little precipitation, and many of the streams are intermittent or ephemeral; most perennial streams originate in the Black Hills or Pine Ridge escarpment. Because the sedimentary rocks in the lower portions of the basin contribute naturally elevated levels of iron and manganese to surface waters. Due to the development of site specific criteria in Chapter 1, the numeric human health criteria for iron and manganese do not apply to Little Thunder Creek and Class 2 tributaries of Little Thunder Creek below the confluence with North Prong and Class 2 tributaries of

Antelope Creek. Primary land uses in the basin are livestock grazing, wildlife habitat, coal mining, oil and gas production and some farming.

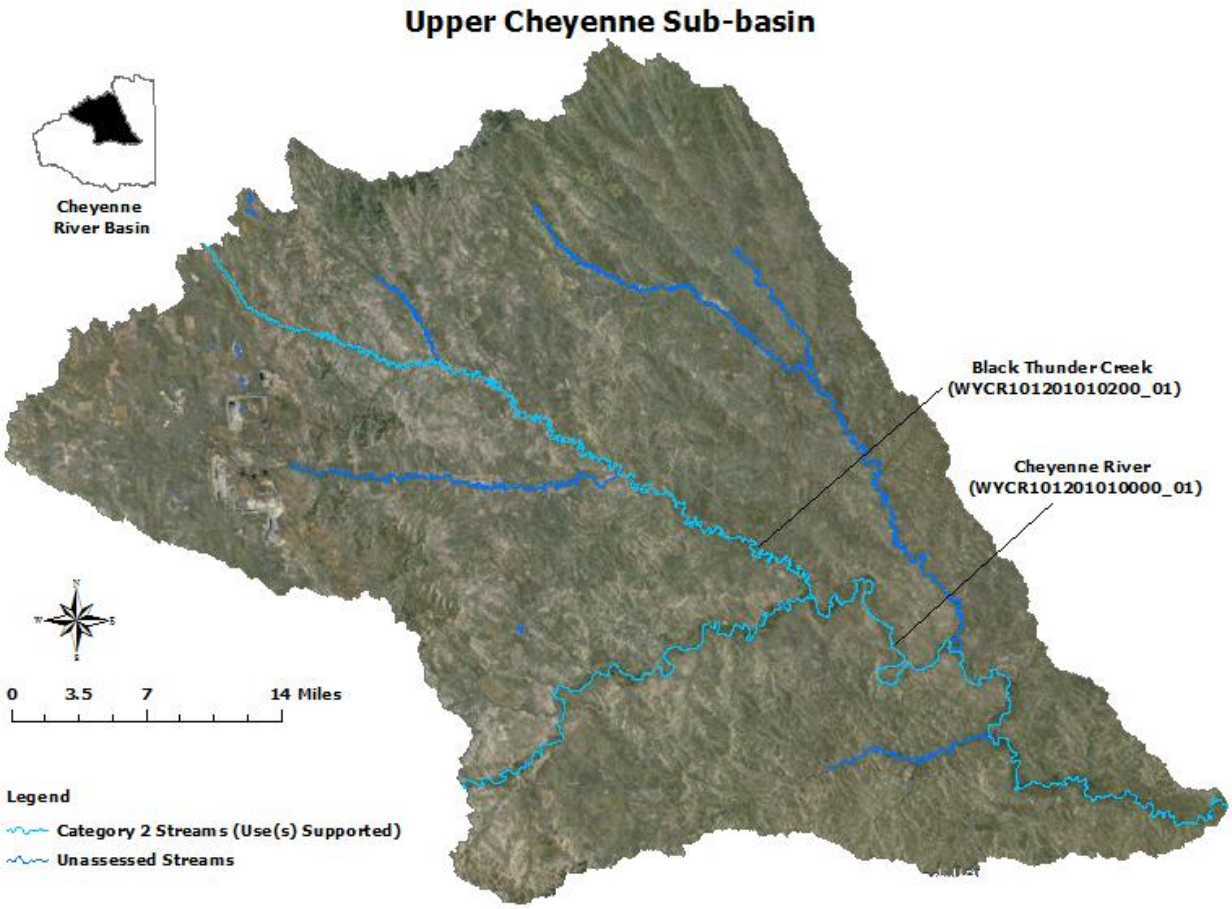
Antelope Creek Sub-basin (HUC 10120101)

The headwaters of the Antelope Creek sub-basin are located along Pine Ridge in western Converse County. The main stem of Antelope Creek is intermittent or ephemeral in the upper watershed and then transitions to a perennial channel before it confluences with the Cheyenne River near Dull Center. Most of the watershed lies within the Thunder Basin National Grassland. The lower, perennial reaches of Antelope Creek contain many beaver dam complexes. Water from this watershed therefore probably does not reach the Cheyenne River except during high flow events. WDEQ (2007) monitoring in 2003 indicated that the macroinvertebrate community of Antelope Creek (WYCR101201010000_01) is comparable to reference condition for intermittent streams in this basin and that it was determined that it was supporting its aquatic life other than fish use in 2008. The report also noted that there is a diverse community of native non-game fish and warm water game fish, indicating the creek may be better classified as 2ABww rather than 3B.



Upper Cheyenne Sub-basin (HUC 10120103)

The upper reaches of the Cheyenne River in this sub-basin typically have an intermittent to perennial flow regime, with flows reduced to standing pools of water fed by springs at times. Beaver activity is extensive, with many semi-permanent complexes of ponds. Assessment by WDEQ (2007) indicates that the Cheyenne River (WYCR101201030000_01) in this sub-basin, from Lance Creek upstream to the Dry Fork of the Cheyenne River fully supports its warm water game fishery and aquatic life other than fish uses and contains a diverse assemblage of benthic macroinvertebrates and fish.

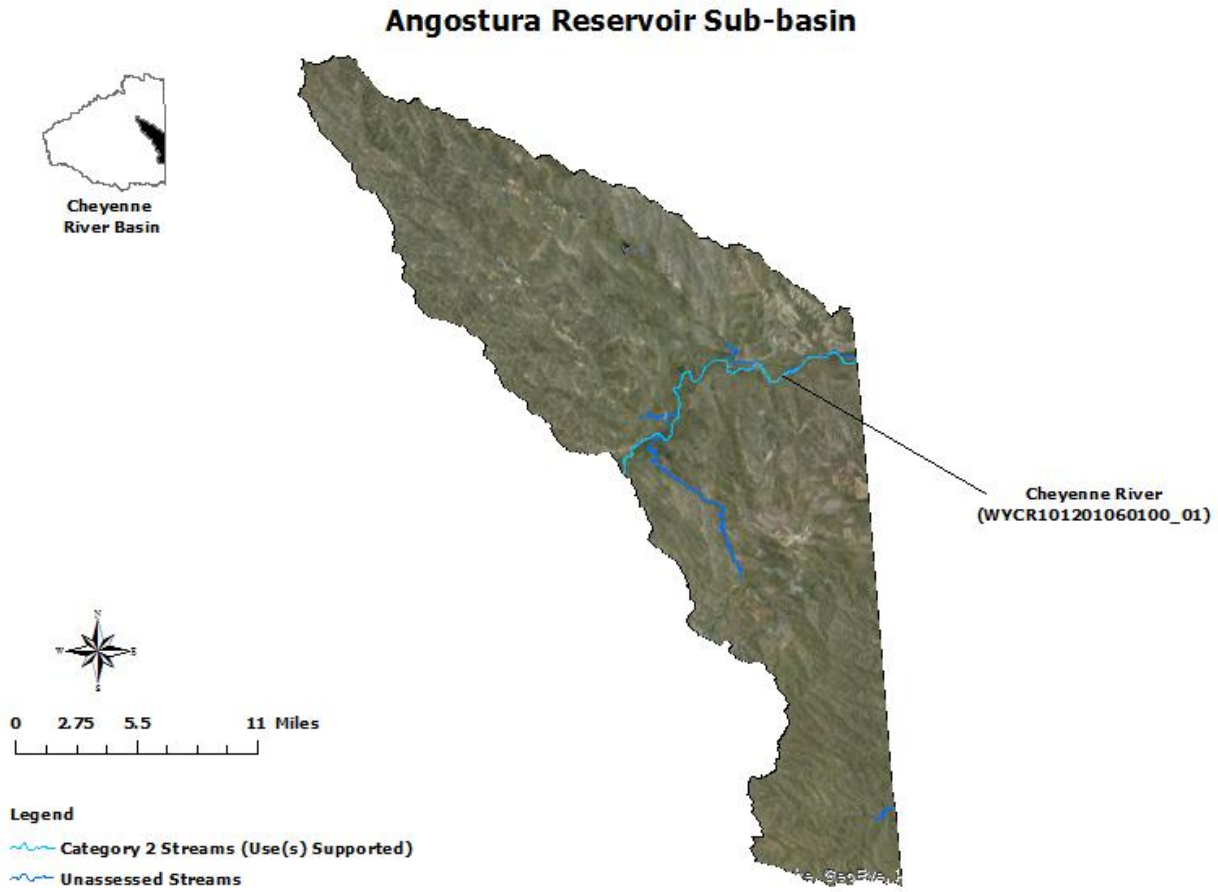


Little Thunder and Black Thunder Creeks occur entirely within the boundaries of the Thunder Basin National Grassland in Campbell and Weston counties. Both creeks are ephemeral to intermittent with some perennial spring fed pools and those maintained by beaver dams. Little Thunder Creek receives some discharge from oil and gas production, but most is either lost to evaporation and infiltration, or is stored within beaver dam complexes before reaching Black Thunder Creek. Monitoring by WGFD on Black Thunder Creek identified a community of native nongame fish and warm water game fish, indicating that the stream may be more appropriately classified as a warm water game fishery (2ABww) rather than only for aquatic life other than fish (3B). WDEQ (2007) monitored Black Thunder Creek (WYCR101201030200_01) in 2003 and found that the benthic macroinvertebrate community is comparable to reference condition for similar intermittent streams and that it is fully supporting its aquatic life other than fish use.

Angostura Reservoir Sub-basin (HUC10120106)

The Cheyenne River in this sub-basin generally has perennial streamflow; however, during low flow, the river is reduced to standing pools maintained by springs. Monitoring by WDEQ (2007) indicates that the Cheyenne River (WYCR101201060100_01) from the confluence with Lance Creek downstream to the South Dakota state line contains a diverse assemblage of macroinvertebrates and fish. WDEQ data indicate that it is fully supporting its aquatic life other than fish and warm water fisheries uses and therefore it was placed in category 2 in 2008.

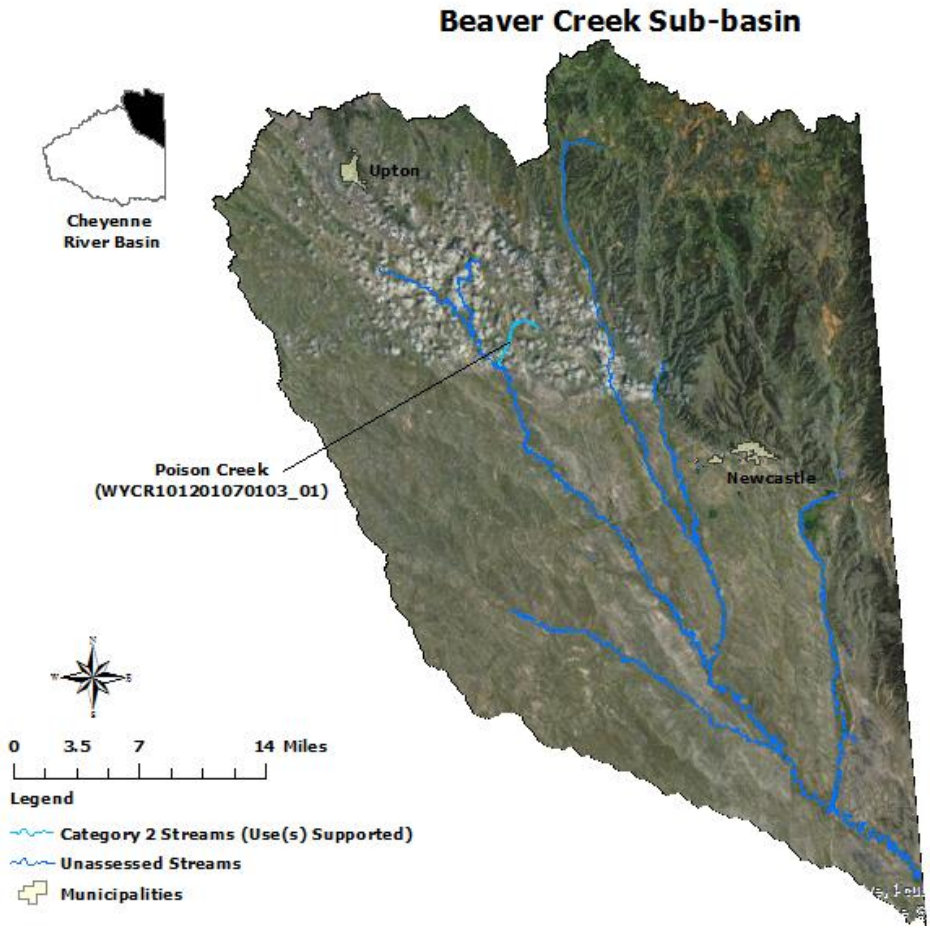
USGS (2007) studied water quality on the lower Cheyenne River in Wyoming immediately upstream of the South Dakota state line as part of a Coal Bed Methane (CBM) effluent monitoring project. Data collected from 2004-2006 showed elevated SAR, EC, TDS and TSS values. It is currently unknown to what extent these pollutants are natural versus anthropogenic and whether they impact designated uses.



Beaver Creek Sub-basin (HUC 10120107)

Most of the perennial and intermittent streams in this sub-basin have headwaters in the Black Hills. Poison Creek flows through the Osage Oil Field and confluences Beaver Creek near Osage. Some small oil seeps are known to reach Poison Creek, but the extent to which these seeps are natural versus anthropogenic is unknown. Poison Creek (WYCR101201070103_01) was placed on the 303(d) List in 2000 as threatened due to these oil seeps. The Wyoming Oil and Gas Conservation Commission (WOGCC)

determined that it would be more cost effective to mitigate the oil seeps rather than attempt to identify all sources, and has conducted cleanup efforts to prevent the contamination of Poison Creek and to protect aquatic life other than fish and wildlife. WDEQ (2008) collected physical, chemical and biological data at five study sites along Poison Creek in 2004 and 2006. The study concluded that WOGCC's reclamation efforts had been successful in eliminating the threat of oil seeps along Poison Creek. The study further concluded that Poison Creek is now supporting its aquatic life other than fish use and it was therefore removed from the 303(d) List in 2008 and placed in category 2.



8.5 Green River Basin

The Green River Basin in Wyoming drains approximately 16,629 mi^2 of southwestern Wyoming. The Green River Basin is part of the Colorado River Compact of 1922, which apportions the Colorado River Basin's water among Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming. The headwaters of the Green River are located in the northern one third of the basin, which is bounded by the Wind River, Gros Ventre and Wyoming Mountain Ranges of the Middle Rocky Mountains. The Wind River Mountains are granitic while the Gros Ventre and Wyoming Mountains are sedimentary. All three of these mountain ranges contain alpine, subalpine and foothills ecoregions. The southwest corner of the basin contains mid-elevation portions of the Uinta Mountains. Snow melt runoff from these mountain ranges dominates the hydrology of the Green River and most of its tributaries. Streams flowing from these mountains continue onto sub-irrigated high valleys and then to lower elevation rolling sagebrush steppe and the salt desert shrub lands of the Wyoming Basin. Land uses in the Green River Basin include livestock grazing, wildlife habitat, recreation, mining and oil and gas production.

Wyoming has the world's largest trona (sodium carbonate typically occurring with halite and gypsum) deposits. Extensive natural salt deposits of trona were first noted in late 1890s in the Green River Basin. These deposits were prospected and mined in the late 1930s-40s and mining continues today. Oil and gas development also occurs throughout much of the basin and is an important industry for the region and state; coal deposits have also been mined in parts of the basin. There are currently concerns that energy development may negatively affect water quality by increasing TDS concentrations in the Colorado River Basin (USBOR, 2011). USGS (2009) collected TDS and specific conductance data in an effort to establish regression relationships for sites on the Green River near the town of Green River. These relationships will allow TDS to be monitored more easily in the future using specific conductance measurements as a surrogate.

A pesticide occurrence study (USGS, 2011) conducted during the summer of 2009 and spring of 2010 detected just one pesticide in the Green River, near the town of Green River; concentrations were well below WDEQ's drinking water criteria.

Upper Green Sub-basin (HUC 14040101)

The headwaters of the upper Green sub-basin are located along the eastern edge of the Wyoming Range within the Bridger-Teton National Forest.

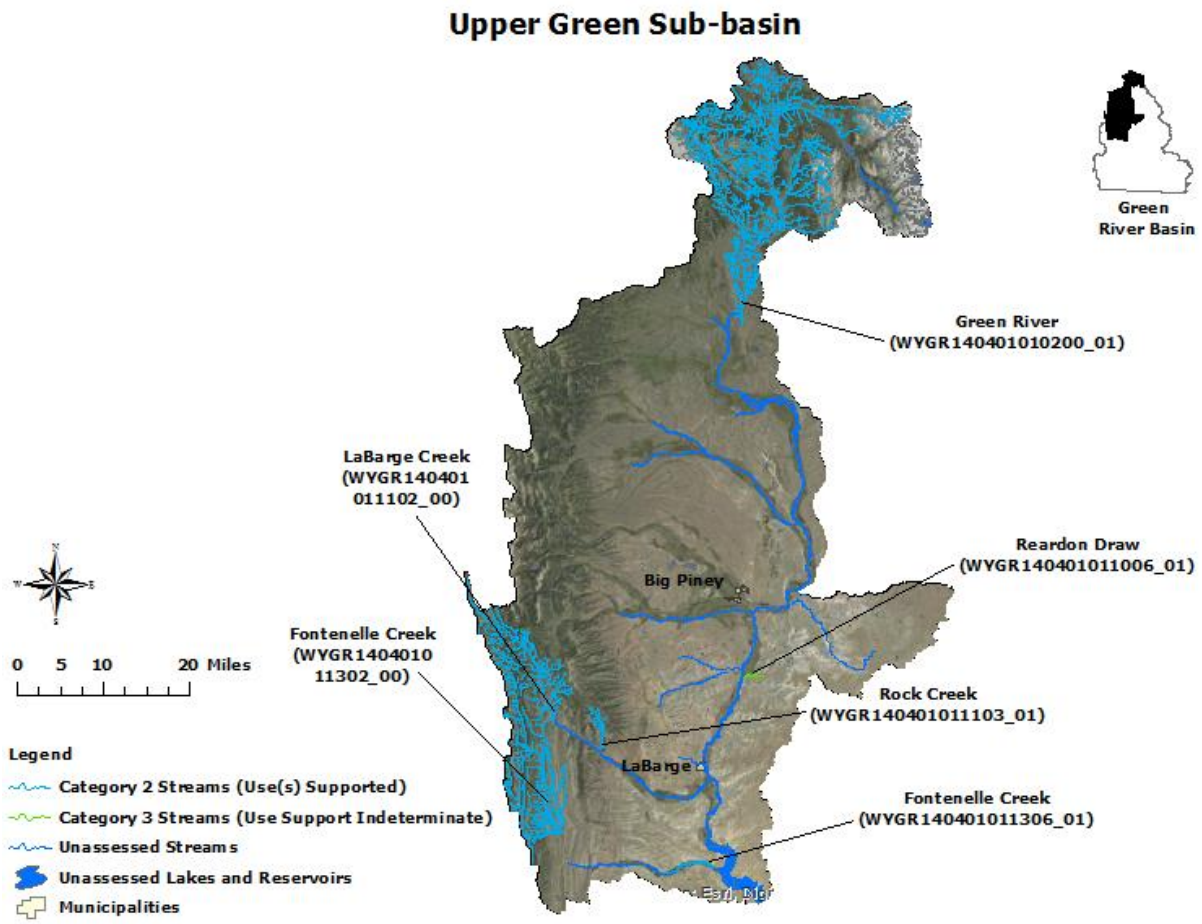
A 984 foot reach of Kendall Warm Springs is the only known habitat of the Kendall Warm Springs dace, a unique fish subspecies (see photo at right). This subspecies is the only Wyoming fish currently listed by the USFWS as federally endangered under the Endangered Species Act. Historic threats to this fish included habitat degradation, over-collection and pollution from detergents and soaps. The USFWS completed a five year review for this subspecies in 2007. WDEQ hasn't assessed designated uses on Kendall Warm Springs.

The headwaters of Dry Piney Creek occur along the eastern foothills of the Wyoming Mountain Range along Hogsback Ridge near Calpet. Historic USGS gage data (1990-1993) indicate that the lower portions of the creek, near its confluence with the Green River may become dry seasonally. WDEQ (2003) monitored Dry Piney Creek at two sites in 1998. There were some indications of habitat degradation and degraded biological condition. However, designated use support was not determined because data were inconclusive. Oil and gas wells and a gas processing facility are located in the headwaters of the LaBarge, Dry Piney, and South Piney Creek drainages. Oil seeps and ponds and physical degradation associated with wells and have been identified as concerns (WDEQ, 2003). Seasonal dewatering of North Piney, Middle Piney, South Piney (WGFD, 2004) and Dry Piney Creeks (WDEQ, 2003) may also limit macroinvertebrate communities in these watersheds. Water quality assessments have not been made for these three watersheds.

Sublette County Conservation District (SCCD) funded a study (Marshall, 2007a) to evaluate the baseline biological condition within the upper Green River Basin (excluding the New Fork Basin) in Sublette County. The study compared samples collected from 19 sites between the years 2001-05 and evaluated biological trends within sites using WDEQ's WSII macroinvertebrate model. The report indicated that the macroinvertebrate communities of Middle Piney Creek and Muddy Creek were in poor condition and that WWTF effluent and irrigation return flows may be having a negative effect. Water quality assessments were not made using this report because there were insufficient physical, chemical and biological data.

WDEQ extensively monitored the upper Green River watershed in 1999. Resulting data indicated that three watersheds supported their cold water fishery and aquatic life other than fish uses. These waters included 735.6 miles of the Green River watershed (WYGR140401010200_01), between Highway 191 and Green River Lakes; 210 miles of Fontenelle Creek (WYGR140401011302_00) upstream of the confluence with Little Coal Creek; and 160.1 miles of the LaBarge Creek watershed (WYGR140401011102_00) upstream of Little Fall Creek Road. Monitoring data from this study were not summarized in a final report.

The WGFD has identified physical degradation in portions of the lower drainage and seasonal dewatering for irrigation in Labarge Creek as concerns (WGFD, 2004). WGFD has been working to re-introduce genetically pure Colorado River cutthroat trout to LaBarge Creek since 1999. Non-native fishes have been removed from the upper watershed and a fish barrier near the USFS boundary has been installed. Water quality assessments could not be made using data and information from the WGFD study.



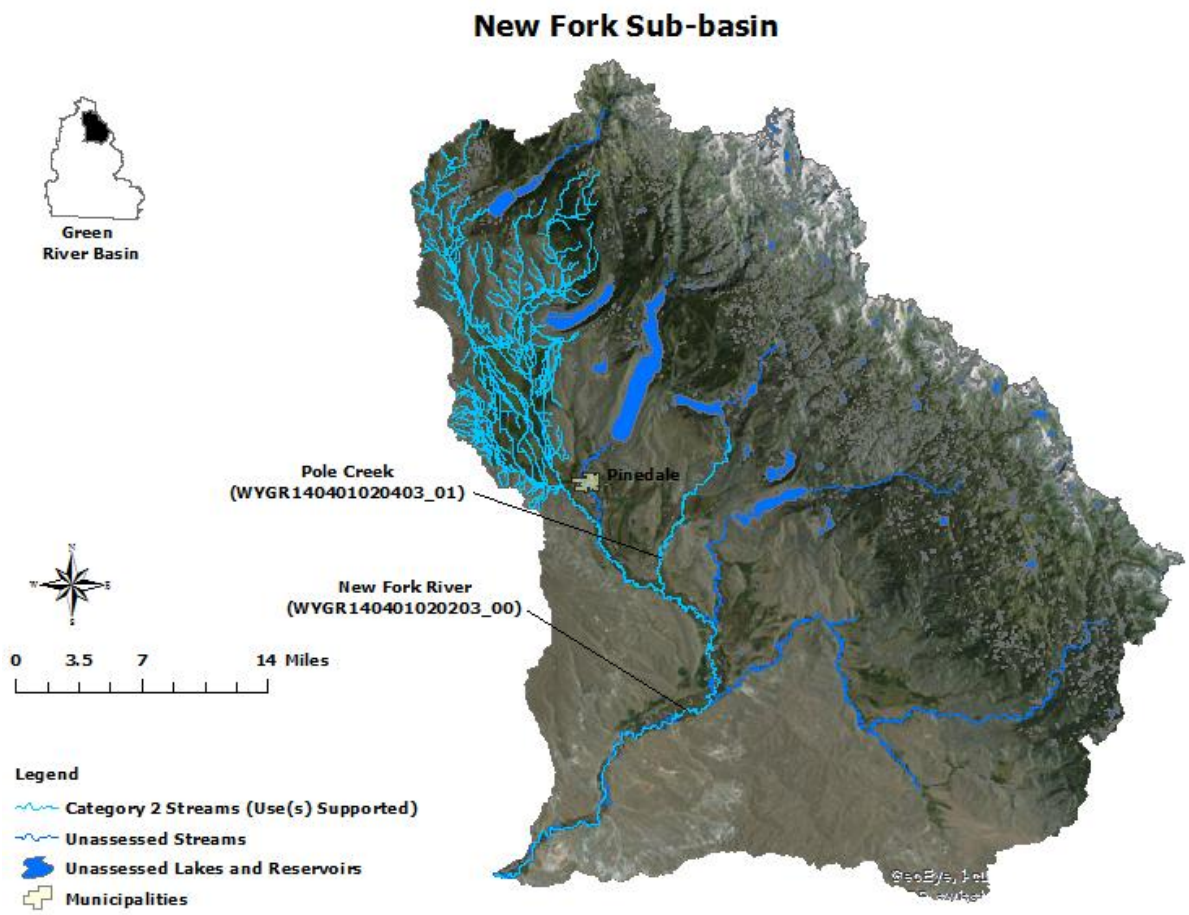
Rock Creek flows south from Deadline Ridge before it confluences with Labarge Creek. WDEQ (1998) monitored Rock Creek using one study site in 1997 due to concerns that siltation and habitat degradation may be impacting aquatic life. Results of the study indicated that the entire Rock Creek watershed (WYGR140401011103_01) upstream of the confluence with LaBarge Creek fully supports its cold water fishery and aquatic life other than fish uses.

Reardon Draw (WYBH140101011006_01) has historically contributed substantial amounts of sediment to the Green River. The source of this excess sediment was habitat degradation from livestock grazing within the Reardon Canyon Common BLM Allotment. WDEQ added a segment of the draw, from the confluence with the Green River to a point 3.2 miles upstream to the 303(d) List in 1998 because SCCD

information suggested that habitat degradation threatened the aquatic life other than fish use. SCCD completed the Section 319 Reardon Draw Watershed Final Project Report in April, 2000. The primary goal of the project was to reduce the sediment load to the Green River from Reardon Draw by 25% by lessening overland runoff and increasing infiltration. This was to be accomplished by changing grazing management, which was expected to increase riparian vegetation cover by 100%. BMPs included providing off channel water and herding cattle away from riparian areas. The project's goal was not achieved because cattle herding was largely unsuccessful and whether water quality improvements have occurred is unknown. Under an agreement with Sublette County CD, Reardon Draw has been removed from the 303(d) List in 2006 and placed in category 3. Category 3 waters are those for which designated use support for some use(s) is indeterminate.

New Fork Sub-basin (HUC 14040102)

The New Fork River originates along the western slope of the Wind River Mountains before flowing southwest to its confluence with the Green River near Marbleton. WDEQ (2005) assessed the New Fork River in 1998 using five study sites sampled between 1996 and 2001. Physical, chemical and biological data indicated that the New Fork River fully supports its cold water fishery and aquatic life other than fish uses along a segment from the confluence with the Green River upstream to Duck Creek and the entire watershed upstream of the confluence with Duck Creek, excluding Pole Creek.



Extensive natural gas development has been occurring in the approximately 198,345 acre[2] Pinedale Anticline area of the lower New Fork watershed since the early 1990's. BLM manages the majority of land in the Pinedale Anticline Project Area (PAPA). One of the outcomes of the BLM's Pinedale Anticline EIS Record of Decision was the need for an expanded ground and surface water monitoring network. The operators of the gas field hired SCCD to conduct the surface water quality monitoring for this project. Chemical and biological monitoring began in 2000 at three locations on the New Fork River and five more sites were added by 2007. A summary report of this baseline study was completed by Marshall (2005), and included trend analyses of chemical and macroinvertebrate samples across 18 study sites. Results from a second study (Marshall, 2007b) suggested that the overall ecological condition of the New Fork River is not significantly different from expected values as defined by the baseline study. However, the study suggests that the macroinvertebrate community at a study site downstream of the majority of the Pinedale Anticline gas field development may be negatively affected by excess fine sediments and fine particulate organic matter. The report notes that the site is below several pipelines constructed below the streambed and approximately 3 miles below the confluence with the East Fork River, which is a sand dominated system. The relative influence of these and other potential sources on aquatic life is currently unknown. Water quality assessments were not made using this report because there were insufficient physical, chemical and biological data.

Pole Creek's headwaters are located along the western slope of the Wind River Mountains. The creek flows south to its confluence with the New Fork River just west of highway 191 between the towns of Pinedale and Boulder. WDEQ (2004) monitored a 25.6 mile segment of Pole Creek using two study sites in 1999 to address WGFD concerns that habitat degradation (channelization) may be negatively impacting aquatic life. Physical, chemical and biological data indicated that Pole Creek (WYGR140401020403_01) fully supports its cold water fishery and aquatic life other than fish uses along a segment from the confluence with the New Fork River to a point 17.2 miles upstream.

Slate Creek Sub-basin (HUC 14040103)

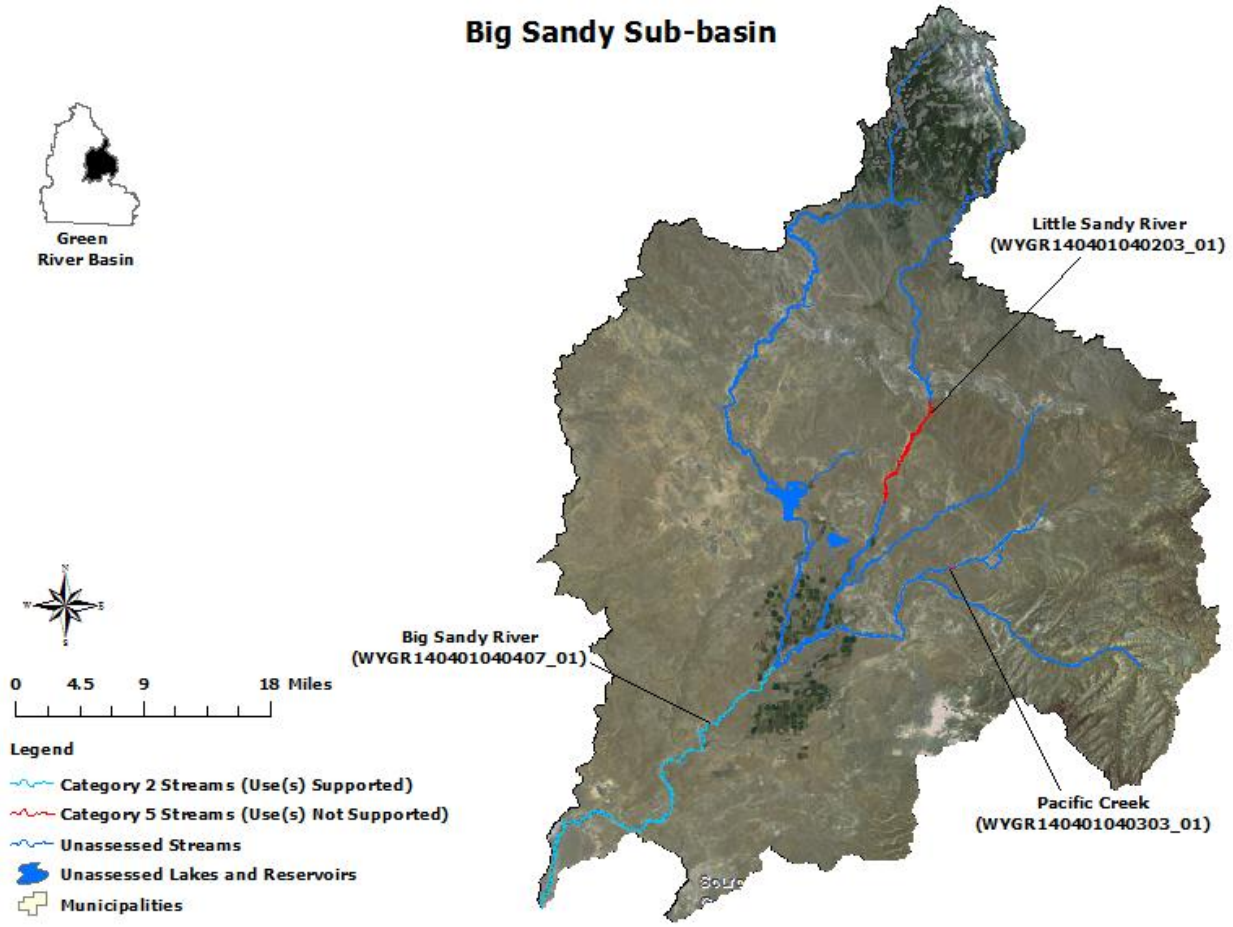
The headwaters of the Slate Creek Sub-basin occur along Oyster and Slate Creek Ridges in central Lincoln County. Slate Creek flows southwest to its confluence with the Green River between Fontenelle Reservoir and the Seedskadee National Wildlife Refuge. The Seedskadee National Wildlife Refuge supports a unique community of waterfowl and is an important recreational fishery. In August 2007, WDEQ and WGFD investigated two fish kills on the Green River in this sub-basin. These studies determined that the cause of the first fish kill near the City of Green River was the aerial application of malathion insecticide. The second fish kill was in the vicinity of the confluence with Slate Creek, immediately downstream of Fontenelle dam, and included several hundred mountain whitefish and some juvenile trout. WDEQ investigated this site shortly thereafter, measuring TDS, TSS, total petroleum hydrocarbons (TPH DRO), DO, pH, temperature and conductivity at three locations within the affected reach. Temperatures were elevated at all three locations. USBOR data indicated that blue-green algae blooms occurred within Fontenelle Reservoir in September 2007, but that toxins were not detected. The occurrence of blue green algae may suggest episodes of elevated nutrients and water temperatures. No water quality assessments were made using the above data.

Big Sandy Sub-basin (HUC 14040104)

The headwaters of the Big Sandy Sub-basin are in the granitic geology of the southern Wind River Range, resulting in streambed substrata dominated by coarse sand from eroded granite. The sub-basin has extensive sedimentary geology in the lower portions of the basin and these deposits are rich in dissolved solids. Salinity in the basin's surface waters is naturally high and has increased in part due to the influence of irrigation returns, water withdrawals, reservoir evaporation and municipal and industrial discharges (WWDO). Water is diverted from the Big Sandy River below Big Sandy Reservoir to irrigate lands in the Eden Project. Irrigation seepage into shallow aquifers has created saline seeps and springs below the Eden Project, which contribute approximately 149,180 tons of salt annually to the Green River

(SCS, 1987). The Green River is the largest tributary to the Colorado River and is subject to salinity control through the Colorado River Basin Salinity Control Forum. High salinity in the Colorado River Basin negatively effects crop selection, crop yield, the amount of water necessary cultivate crops and increases the cost to treat drinking water for municipalities. Since 1988, efforts to reduce salinity loading to the Green River have been implemented in the Big Sandy River Unit within the Big Sandy sub-basin (USBOR, 2011). The goal of this project is to reduce salt loading to the Green River by improving irrigation efficiency across an 18,370 acres near Farson and Eden; this project has reduce salt loading by approximately 52,900 tons/year (CRBSCF, 2002, WWDO). The program, managed through the NRCS, has improved 10,790 acres of irrigated lands to date. Irrigation improvements include 114 improved sprinkler, drip and surface irrigation systems; 39 miles of improved water conveyance; and improved storage efficiency in 54 reservoirs (WWDO). Effects of these salinity reduction efforts on streams in the Big Sandy and other Green River drainages have not been determined, but crop production and water savings have reportedly increased where irrigation conversion has occurred (SWCCD, 2004).

Erosion due to unstable banks and a lack of woody riparian vegetation have been identified as concerns in the lower Big Sandy River. Flow alterations following the construction of Big Sandy Reservoir and cattle grazing are sources. Several riparian livestock exclosures were created in the 1980s to protect riparian areas along the Big Sandy River, between Little Sandy River and the Green River, and to enhance fish habitat. Rock sill structures have also been built in the Big Sandy River and in Bone Draw to raise the water table, improve channel conditions and promote riparian vegetation growth to provide habitat for juvenile fish. The Big Sandy Working Group (BSWG), including BLM, grazing permit holders, WGFD, Trout Unlimited (TU), Sweetwater County Conservation District (SWCCD), various other stakeholders and a



facilitator was formed in 1996. Management changes have included modifying grazing rotations, allotment boundaries and seasons, installing electric fencing to protect riparian areas, developing upland water sources and implementing the monitoring plan developed by BSWG (BLM-GR, 2003).

WDEQ (2003) monitored the Big Sandy River (WYGR140401040407_01) at four study sites along an approximately 35 miles segment during 1998. Almost all of the physical-chemical measurements were below their respective criteria, but low dissolved oxygen and elevated water temperatures were noted. The report also noted that the river has adjusted to transport sediment effectively under the altered flow regime present in the studied segment. There were no indications of anthropogenic impacts on the macroinvertebrate community and the cold water fishery and aquatic life other than fish uses were considered fully supported along a 42 mile segment from the confluence with the Green River upstream to the confluence with the Little Sandy River.

The Little Sandy River was placed on Wyoming's 303(d) List in 1996 because it was determined that it was not supporting its coldwater fisheries and aquatic life other than fish uses along a 26.9 mile segment below Elkhorn Junction. Causes of the impairment were identified as siltation, chloride, salinity and TDS and the sources of these pollutants were livestock grazing and natural sources. The Little Sandy River was subsequently removed from the 303(d) List in 1998 because there were inadequate credible data to justify the listing. Subsequent monitoring by WDEQ (2003) on the Little Sandy River between 1998 and 2003 indicated that siltation, chloride, salinity and TDS were not a concern above Elkhorn Junction. However, areas of habitat degradation, streambank instability and sedimentation were identified along several miles of BLM, State and private lands below Elkhorn Junction. The BLM and grazing permit holders were already in the process of modifying the grazing management plan along the Little Sandy River within the Little Sandy Grazing Allotment to improve riparian and in-stream habitats. Management changes included the installation of electric fencing and the rotation of stock within the allotment (BLM-GR, 2002). In 2004, WDEQ met with a stakeholder group including SCCD, SWCCD, BLM and the Little Sandy Grazing Association (LSGA) to discuss WDEQ's study findings and to conduct a watershed tour. In an effort to evaluate the effectiveness of BMPs at reducing sedimentation within the impacted reach, identify potential sources of sediment and to determine designated use support, WDEQ committed to monitoring the lower Little Sandy River for a period of five years (2004-2008). The resulting study (WDEQ, 2010) found that a section of the Little Sandy River (WYGR140401040203_01) from the northern boundary of Section 33-Township 28 North-Range 104 West-downstream 17.7 miles to the Sublette/Sweetwater County line was not supporting its cold water fishery and aquatic life other than fish uses, and this segment was added to the 303(d) List in 2012. Sources of accelerated bank erosion and sedimentation have been identified as livestock and wildlife grazing and historic habitat/channel modifications. WDEQ has received a formal commitment from the above stakeholder group to complete a watershed based plan for the Little Sandy River Watershed.

In 2010, Western Watersheds Project (WWP) collected *E. coli* samples on Pacific Creek (WYGR140401040303_01), including a geometric mean that exceeded both WDEQ's primary and secondary standards protective of recreational use. A segment of stream from Bar X Road to a point 0.4 miles upstream was added to the 303(d) List in 2012. The source of the elevated bacteria is unknown.

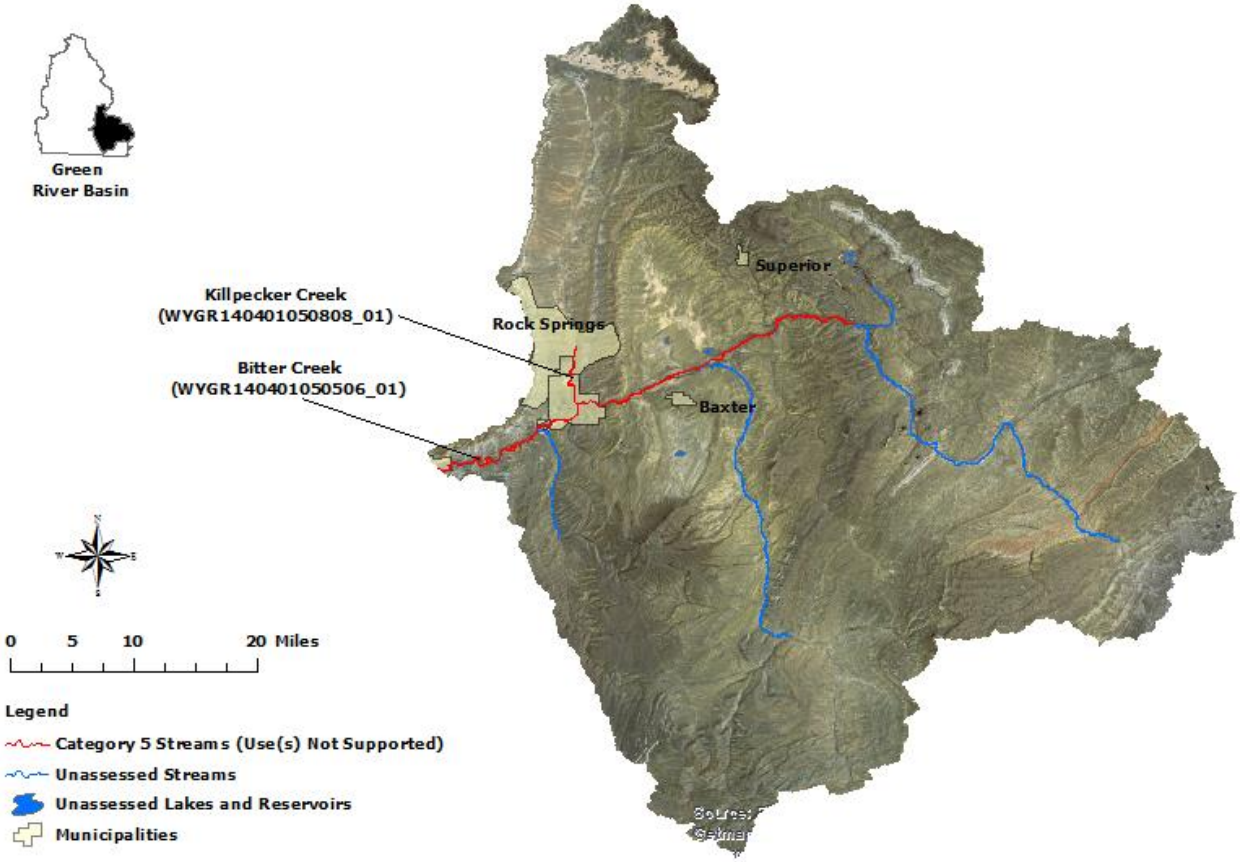
Bitter Creek Sub-basin (HUC 14040105)

The headwaters of Bitter Creek occur between Delaney Rim and Adobe Town Rim in southeastern Sweetwater County. Bitter Creek flows northwest to Point of Rocks, then west along I-80 through Rock Springs to its confluence with the Green River at the town of Green River. The WGFD collected several game and nongame fish in Bitter Creek in 2009 and referred to the stream as "a local gem". Bitter Creek was monitored by WDEQ (2001) in 1998, 1999 and 2001. Data indicated that chloride concentrations exceeded Wyoming's acute aquatic life chloride criterion of 860 mg/L at several locations from just above the confluence with Killpecker Creek downstream to just above the confluence with the Green River. Samples were also collected within Killpecker Creek, above the confluence with Bitter Creek;

concentrations were around twice the highest measured concentrations on Bitter Creek, indicating that Killpecker Creek is a major source of chloride loading to Bitter Creek. Subsequently, a 58.1 mile segment of Bitter Creek (WYGR140401050506_01), extending from the confluence with the Green River upstream to Point of Rocks was added to the 303(d) List in 2002 for not supporting its non-game fishery and aquatic life other than fish uses. Bitter Creek was also monitored by WDEQ (1999) in 1999 at three sampling sites along Bitter Creek ranging from upstream of Rock Springs (near the airport road bridge) to just above the Rock Springs WWTF. Data indicated that the two lowermost sites exceeded the fecal coliform criterion and a small segment of Bitter Creek near Rock Springs was added to the 303(d) List in 2000 for this pollutant. A second study was conducted on Bitter Creek by WDEQ (2000) in 2000 to better delineate the extent of the bacterial impairment. Nine study sites were used, ranging from the northeast edge of Rock Springs downstream to below Rock Spring's WWTF. Only one site (located near Elk Street) exceeded WDEQ's fecal coliform criterion. The study suggested that bacteria levels may have been low due to low flow conditions and because samples were collected early in the recreational season.

Killpecker Creek originates just south of the Killpecker Sand Dune Field. The creek flows directly south along County Route 17 and U.S. Route 191 to its confluence with Bitter Creek in the town of Rock Springs. Killpecker Creek was monitored by WDEQ (1999) in 1999 using a single study site located in the town of Rock Springs immediately downstream of Spring Drive Bridge. Data indicated that WDEQ's fecal coliform criterion was exceeded and a small segment of the creek was added to the 303(d) List in 2000. Killpecker Creek was again sampled by WDEQ (2000) in 2000 at seven sampling sites ranging from upstream of the town of Reliance to immediately upstream of the confluence with Bitter Creek. This second study was intended to better delineate the extent of the bacterial impairment on Killpecker Creek.

Bitter Creek Sub-basin



Data indicated that the fecal coliform criterion was exceeded along a segment of Killpecker Creek (WYGR140401050808_01) from the confluence with Bitter Creek upstream to Reliance; the extent of the original impairment was thus changed in the 303(d) List in 2002. Killpecker Creek was also monitored for several physical-chemical parameters by WDEQ (1999) at a single sampling site near the confluence with Bitter Creek. High chloride concentrations were noted at a site near the confluence with Bitter Creek, but because the creek is classified as a 3B water by WDEQ, chloride criteria do not apply. The study suggested that these high chloride concentrations may be related to a fish kill observed during the study on Bitter Creek just below the confluence with Killpecker Creek.

As part of a 2006 Section 319 study, SWCCD monitored Bitter and Killpecker Creeks in 2004 and 2005 at several sites along the main stems and tributaries of these creeks. The study indicated that there were fecal coliform exceedances in Bitter Creek well upstream of Rock Springs during high flow events, which suggests that there may be a significant nonpoint source of bacteria in the upper watershed. The extent of the fecal coliform impairment on Bitter Creek was therefore changed in the 303(d) List in 2006 to extend from the confluence with the Green River upstream to Point of Rocks. Additionally, high *E. coli* concentrations were observed on Killpecker Creek from Reliance downstream to the confluence with Bitter Creek. The SWCCD study suggested that sources of *E. coli* in the lower reaches of Bitter and Killpecker Creeks may be septic system contamination, urban runoff and leaking sewage lines in contact with groundwater that eventually enters the creeks. Chloride data collected from Bitter Creek showed exceedances of the aquatic life other than fish chronic chloride criterion (230 mg/L) from Point of Rocks downstream to the confluence with Killpecker Creek and exceedances of the aquatic life other than fish acute criterion from Killpecker Creek downstream to the Green River. The primary source of chloride loading is likely the surrounding geology and soils of the watershed, especially in the Killpecker Creek watershed. However, the surface application and infiltration of large amounts of irrigation water for turf grasses adjacent to Killpecker Creek may dissolve and transport salts to the creek. The Bitter Killpecker Watershed Advisory Group (BKWAG) was formed in 2004. BKWAG and SWCCD developed a Bitter and Killpecker Creeks Watershed Management Plan in 2006. WDEQ initiated TMDLs on Bitter (both chloride and fecal coliform) and Killpecker (fecal coliform) Creeks in 2012. Since 2010, water quality monitoring by SWCCD in the Bitter Creek watershed has been primarily focused on gathering physical, chemical and bacterial data toward these TMDLs (EDE, 2013). TMDLs for these waters are expected to be completed in 2015.

Flaming Gorge Sub-basin (HUC 14040106)

The Flaming Gorge Sub-basin includes all of the tributaries to the Green River except the Blacks Fork between Bitter and Vermillion Creeks (located in Colorado). Flaming Gorge Reservoir extends from just south of the town of Green River to the Wyoming/Utah border. The reservoir provides hydropower to approximately 50,000 homes across several western states and has a storage capacity of 3,788,900 acre-feet.

The Little Mountain Watershed Enhancement Project was initiated in 1990 by WGFD, BLM and other stakeholders to address declining Colorado River Cutthroat trout and mule deer populations in the Currant Creek watershed. The project was expanded in 1995 to also include Red Creek watershed. As of 2008, project BMPs included prescribed burns for more than 57,000 acres, the construction of 216 grade control structures, modification of livestock grazing management, prescribed burnsand the re-introduction of beaver to these watersheds. These efforts have resulted in the improvement of both riparian and upland vegetative health, increased native fish populations, reduced sedimentation (Mizuyama, 1993) and increased perennial streamflows.

Blacks Fork Sub-basin (HUC 14040107)

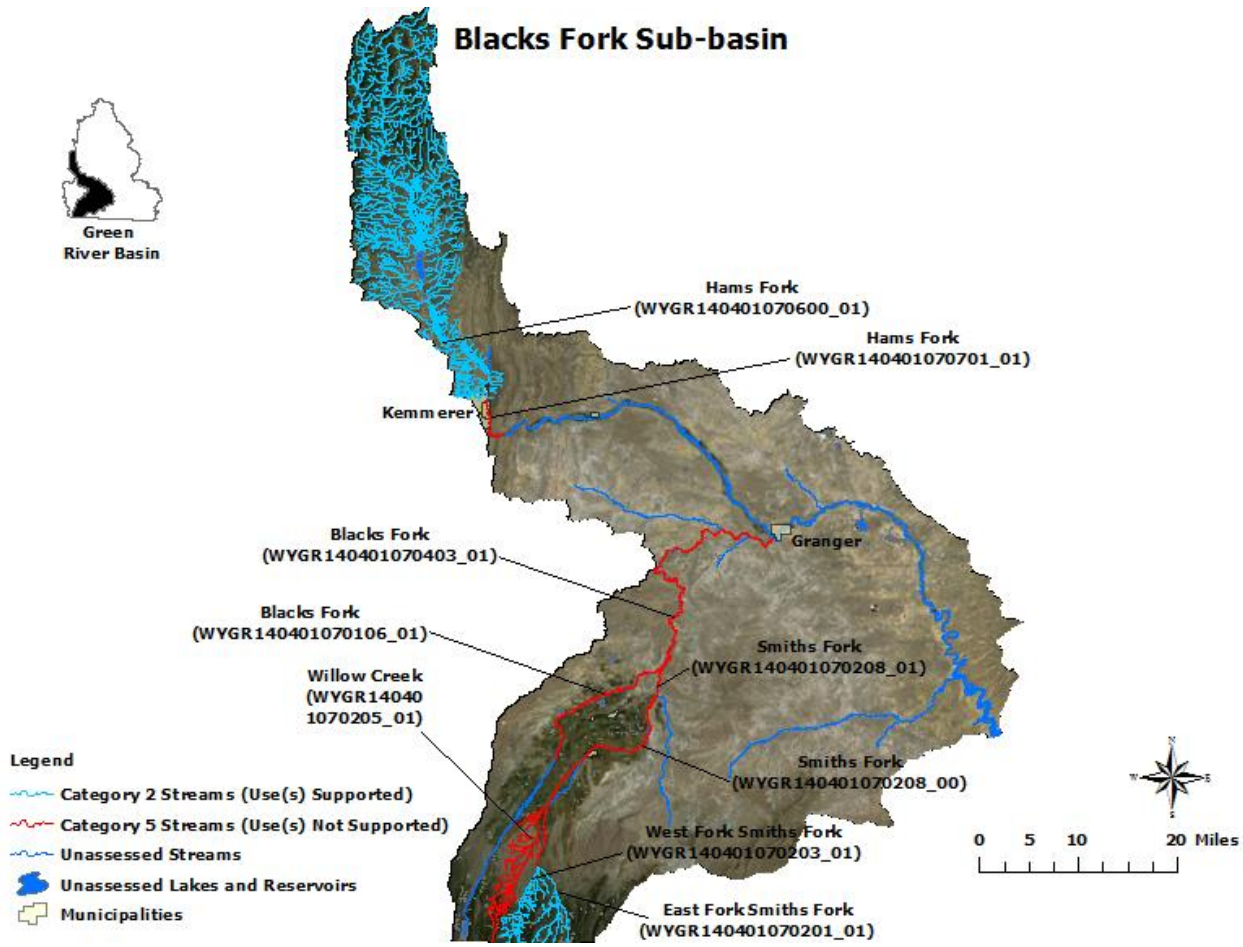
The headwaters of the Blacks Fork Sub-basin are in the Uinta Mountains in northeastern Utah and the Tunp and Wyoming Ranges in Wyoming. The Black's Fork flows through the Bridger Basin before confluencing with Flaming Gorge Reservoir near McKinnon Junction. Major tributaries to the Black's Fork include Smiths Fork and Hams Fork.

The recreational designated use on the lower Blacks Fork (WYGR140401070403_01) was evaluated by WDEQ in 2000 using USGS gage data (#09222000) collected near the town of Lyman. Data showed that WDEQ's fecal coliform criterion was exceeded several times from 1995 to 1998 and a segment from the confluence with the Hams Fork upstream to Millburne was therefore added to the 303(d) List in 2000. The sources of bacterial loading are unknown. WDEQ (2003) monitored five study sites along the Blacks Fork in 1998 to address concerns about possible habitat degradation. Chemical, physical and biological data generated from this study were inconclusive.

USGS gage data (#09221650) and WDEQ monitoring data for the Smiths Fork were summarized in a WDEQ (2000) report. Results suggested that two reaches along the Smiths Fork were impaired due to habitat degradation (i.e. sedimentation) and fecal coliform. The report concluded that the Smiths Fork's banks were highly erosive and that sediment inputs exceed the stream's ability to transport sediment. The cold water fishery and aquatic life other than fish designated uses were not supported along a 4.0 mile segment of the Smiths Fork (WYGR140401070208_01) from the confluence with the Blacks Fork upstream to the confluence with Cottonwood Creek; this segment was added to the 303(d) List in 2000. The source(s) of the bank erosion and resultant sediment loading is unknown. The study also concluded that bacterial concentrations exceeded WDEQ's fecal coliform criterion on several occasions and ranged as high as 5,200 colonies/100mL. Elevated values were recorded by USGS during all flow regimes, but were most prevalent during early summer and fall. The Smiths Fork (WYGR140401070208_00), from its confluence with Cottonwood Creek upstream to the confluence with East and West Forks Smiths Fork was added to the 303(d) List in 2002 for fecal coliform. The source of the bacterial loading is unknown. A second WDEQ (2003) study evaluated an upper reach of the Smiths Fork using a single study site, but designated use support was not assessed.

Uinta County Conservation District (UCCD) monitored water quality at 12 sites in 2006 on the Blacks Fork as part of the Blacks Fork/Smiths Fork Watershed Section 319 Project Report. The goal of the project was to collect physical, chemical and biological data from several study sites along the Blacks Fork and Smiths Fork drainages. Data collected during this project showed that fecal coliform concentrations were above WDEQ's recreational criteria at several sites in both watersheds throughout the study. The report also noted that sedimentation was a concern in both watersheds. UCCD collected *E. coli* data in 2009 and 2010 that showed that bacterial concentrations on the Blacks and Smiths Forks were still exceeding WDEQ's recreational use criteria. UCCD has sponsored a watershed plan for the Blacks Fork and Smiths Fork Watersheds. WDEQ initiated TMDLs for the Smiths and Blacks Forks in 2013.

Willow Creek's headwaters are located in the northern foothills of the Uinta Mountains in the Wasatch-Cache National Forest near the Utah/Wyoming border and is a major tributary to the Smiths Fork. Data and other information collected during the mid-1990s by UCCD showed that Willow Creek was physically degraded due to eroding stream banks and sedimentation. Poor riparian vegetation cover was also noted as a concern. Willow Creek (WYGR140401070205_01) was added to the 303(d) List in 1998 as threatened because the cold water fishery and aquatic life other than fish uses were not supported for the entire watershed upstream of the confluence with the Smiths Fork. The cause of this threat was habitat alterations (i.e. sediment) and the source was identified as livestock grazing. UCCD completed a Section 319 Project for Willow Creek in 1999. The goals of this project were to improve the habitat condition and water quality of Willow Creek using several BMPs. BMPs included revising grazing management plans,



planting riparian vegetation, improving and installing new upland stock watering ponds and fencing some riparian areas. WDEQ (2003) monitored Willow Creek at three sites in 2003 to determine whether the above BMPs were effective in improving the threat to the Willow Creek watershed. Elevated temperature, pH and algal and macrophyte cover were noted as concerns. Riparian condition was fair at all three study sites and streambed embeddedness was an issue within the middle reach. Results of macroinvertebrate sampling were inconclusive. The report concluded that the aquatic life uses on Willow Creek were still threatened, but that habitat condition may be improving. WDEQ's TMDL Program began monitoring Willow Creek again in 2013 to re-assess designated use support.

The headwaters of the Hams Fork are located in the Tunp and Salt River Ranges within the Bridger-Teton National Forest. The river flows south through Kemmerer and Diamondville, then east to its confluence with the Blacks Fork at Granger. USGS gage (#09224050) data collected in the mid 1990's indicated that the Hams Fork occasionally exceeded WDEQ's pH criterion protective of aquatic life. Elevated pH is thought to be due to higher than normal photosynthesis from nutrient enrichment below the Kemmerer-Diamondville WWTF. A segment of the Hams Fork (WYGR140401070701_01) from below the Kemmerer-Diamondville WWTF to a point 7.6 miles downstream was placed on the 303(d) List in 1996 for not supporting its cold water game fishery and aquatic life other than fish uses. Hams Fork was also monitored by WDEQ (2005) between 1995 and 1998 to address concerns that siltation and habitat loss were negatively impacting aquatic life and to better inform the permit renewal process for the Kemmerer WWTF. Eight study sites were established along the Hams Fork and one on Willow Creek (a small tributary to Hams Fork). Sites along the Hams Fork extended from the Bridger-Teton National Forest downstream to the community of Granger and the Willow Creek site was located near the intersection of forest route 306 and U.S. highway 189. Diurnal dissolved oxygen fluctuations and elevated temperature

and nutrients were noted as concerns on Hams Fork and may be related to the high pH observed on Hams Fork. The report also noted that fine sediments and poor riparian condition are concerns on lower Hams Fork near Granger. The entire upper Hams Fork watershed (WYGR140401070600_01) upstream of Kemmerer, excluding the Willow Creek watershed, was determined to be fully supporting its cold water fishery and aquatic life other than fish uses. The designated use support of Willow Creek was not determined.

The East and West Forks of Smith Fork originate in the foothills of the Uinta Mountains in the Wasatch-Cache National Forest. The streams flow north and confluence to form the Smiths Fork. UCCD data and information from the mid-1990s suggested that the cold water fishery and aquatic life other than fish uses within the East (WYGR140401070201_01) and West (WYGR140401070203_01) Forks of Smith Fork were not supported due to excess sedimentation. Both waters were therefore added to the 303(d) List in 1998 from their confluence upstream to the Utah border. Sources of sediment included grazing, vehicle traffic on nearby roads, recreational use, logging, irrigation return flows, riparian degradation and streambank destabilization. UCCD completed a Section 319 project in 1999 to improve stream channels and riparian areas on these and other streams in the upper Smiths Fork watershed. BMPs included repairing or replacing livestock watering tanks and constructing snow fences to divert spring snow melt to these tanks and lessen sediment input to the two streams from overland flow. Uinta County improved the watershed's infrastructure by repairing aging roads and bridges adjacent to the two streams. Volunteers planted assorted trees, shrubs and forbs in riparian zones to help stabilize stream banks and create a sediment buffer. Lastly, farmers constructed fences along the streams to protect re-establishing plant communities, stream banks and channels from the effects of livestock grazing and adopted grazing BMPs that both promote the recovery of these two streams and allow for continued grazing. WDEQ (2003) monitored these streams in 2003 and concluded that habitat had improved and that East and West Forks of Smiths Fork fully support their cold water fishery and aquatic life other than fish uses. These streams were removed from the 303(d) List in 2004, and Section 319 Nonpoint Source Success Stories have been written for both (see Appendix A).

In 2008, BLM conducted a riparian health assessment of the Christensen Allotment, which includes a 0.5 mile section of Cottonwood Creek. The assessment indicated that resource conditions along the creek within the allotment do not meet standards for soils and riparian condition because of excessive soil erosion and a lack of adequate riparian vegetation. The assessment further suggested that these conditions are the result of historic large releases from Reed Reservoir and that livestock are not a significant contributor.

8.6 Little Missouri River Basin

The Little Missouri Basin drains approximately 4,659 mi^2 in northeastern Wyoming. The Little Missouri River Sub-basin contains several ecoregions; including black hills foothills, sagebrush steppe, Powder River basin and pine scoria hills within the headwaters and semiarid pierre shale plains in the lower sub-basin (Chapman et al. 2003). The black hills foothills make up the hydrologic divide between the Little Missouri Sub-basin and the Belle Fourche Basin. This ecoregion is characterized by ponderosa pine forests with an understory of grasses and shrubs. Pine scoria hills are located along the western margin of the sub-basin. These hills are mostly covered with ponderosa pine juniper. Porcellanite (or clinker) overlays a mixture of coal, sandstone and shale. The remaining sub-basin is a mix of rolling plains and sagebrush steppe. Land uses within the sub-basin are livestock grazing, oil and gas production, bentonite mining, dryland farming and wildlife habitat. WDEQ has not completed any water quality reports for this basin.

8.7 Little Snake River Basin

The Little Snake River Basin drains approximately 3,337 mi^2 in Wyoming, where it is bordered to the east by the continental divide and Sierra Madre Mountain Range, to the north by the Great Divide Basin and

the west by the Green River Basin. The Little Snake River's headwaters are located in the Park Mountain Range in Colorado and Wyoming. The river flows west near the Wyoming/Colorado border for several miles before entering Wyoming near Slater, Colorado. The river then continues flowing west along state highway 70 before turning southwest and re-entering Colorado near the town of Baggs. The river ultimately confluences with the Yampa River in Colorado near Deerlodge Park. The Little Snake River basin has more restrictive WYPDES permit requirements because it is within the Colorado River Basin Salinity Control area.

The Little Snake River Basin in Wyoming largely consists of rolling sagebrush steppe, foothill shrublands and low mountains, salt desert shrub basins and mid-elevation forests and shrublands of the Sierra Madre Mountains (Chapman et al. 2003). The geology of the lower basin is mostly sedimentary and is dominated by sandstone and conglomerate sedimentary rock; siltstone, shale and limestone are also common. Soils are alkaline and highly erodible in the lower portions of the basin. Land uses throughout the basin include livestock grazing, mineral extraction, wildlife habitat and recreation.

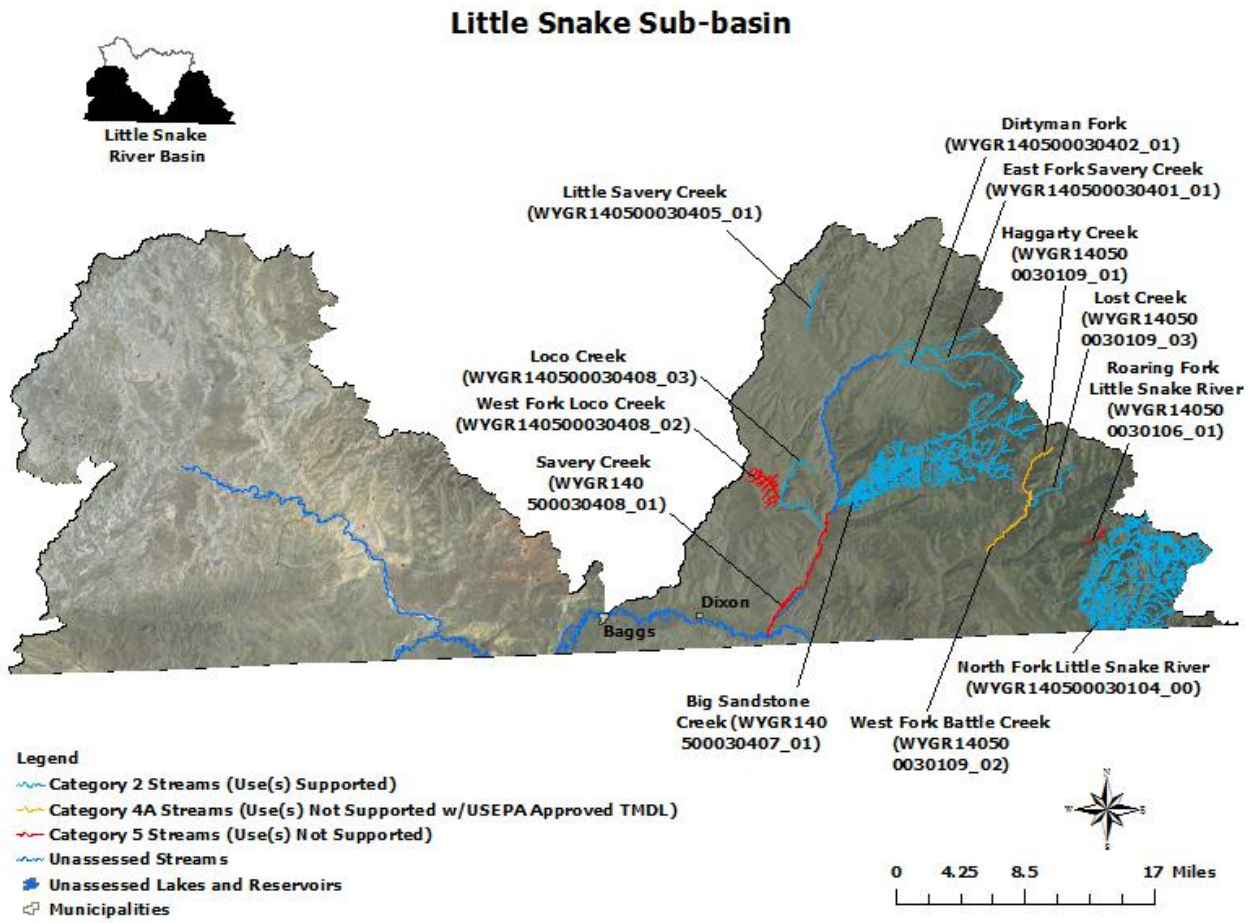
Little Snake Sub-basin (HUC 14050003)

Haggarty Creek's headwaters are located along the continental divide within the Medicine Bow-Routt National Forest. The creek flows southwest to its confluence with Lost Creek, forming West Fork Battle Creek. WDEQ has monitored the chemical, physical and biological condition of Lost Creek (1996, 2001, 2002 and 2004) using a single study site and has determined that it is of reference quality. Lost Creek was determined to be fully supporting its cold water fishery and aquatic life other than fish uses. A WDEQ summary report was not written. The Haggarty Creek watershed was historically mined for copper ore, as is evidenced by the ghost mining towns of Copperton, Dillon and Rudefeha along the creek and the abandoned Ferris-Haggarty Mine (FHM) in the upper watershed. Around the turn of the 19th century, FHM was one of the most productive copper mines in the region. In 1903, the 1,400 foot long Osceola tunnel was constructed within FHM for hauling ore and dewatering the mine; mine effluent was discharged directly to Haggarty Creek. FHM closed in 1908 due to a fire at the smelter plant and declining copper prices. In 1975, a mining company attempted to passively remediate the mine effluent using ion exchange within several sedimentation ponds. The ponds were largely non-operational in the years that followed and were removed in 2005 as part of a WDEQ AML reclamation project. The mine effluent is now conveyed directly to Haggarty Creek through a short surface channel. WDEQ monitored the water quality of Haggarty and West Fork Battle Creeks in 1996. High concentrations of copper, silver and cadmium exceeded WDEQ's chronic aquatic life criteria along Haggarty Creek (WYLS140500030109_01) from the FHM downstream to the confluence with West Fork Battle Creek and this segment was added to the 303(d) List in 1996. WDEQ data also showed that West Fork Battle Creek (WYLS140500030109_02) exceeded WDEQ's chronic aquatic life copper criterion from the confluence with Battle Creek upstream to the confluence with Haggarty Creek and this segment was added to the 303(d) List in 2000. The source of heavy metals for all four of these impairments was determined to be the FHM. In 2001 and 2008, WDEQ conducted additional monitoring on 15 sites in the Haggarty Creek watershed to further characterize the spatial and temporal trends in macroinvertebrate communities and heavy metals pollution. WDEQ reports were not written for any of the 1996-2008 data. TMDLs for Haggarty and West Fork Battle Creeks were initiated by WDEQ in 2008 and approved by USEPA in 2011.

WDEQ has monitored the chemical, physical and biological condition of several reference quality streams within the Little Snake watershed; including Lost Creek (WYLS140500030109_03, sampled during 1996, 2001, 2002 and 2004)and North Fork Little Snake River (WYLS140500030104_00, sampled between 1996 and 1998), using a single study site for each stream. All of these streams were determined to be fully supporting their cold water fishery and aquatic life other than fish uses and were placed in category 2. WDEQ summary reports were not written.

The headwaters of the Savery Creek watershed are located within the foothills along the northwestern edge of the Sierra Madre Mountains. Savery Creek flows southwest to its confluence with the Little Snake

River near the town of Savery. WDEQ has monitored the chemical, physical and biological condition of several reference quality tributaries to Savery Creek; including East Fork Savery Creek (WYLS140500030401_01, sampled during 1997 and 2006), Dirtyman Fork (WYLS140500030402_01, sampled during 1996) and Little Savery Creek (WYLS140500030405_01, sampled during 1997) using a single study site for each stream. These streams were determined to be fully supporting their cold water fishery and aquatic life other than fish uses and were placed in category 2. WDEQ summary reports were not written. Savery Creek (WYLS140500030408_01) was added to the 303(d) List in 1998 because Little Snake River Conservation District (LSRCD) information demonstrated that the cold water fishery and aquatic life other than fish uses were threatened from the confluence with Little Sandstone Creek downstream to the confluence with the Little Snake River. The cause of these threats was habitat alterations (i.e. sediment) and the source was livestock grazing. In 1998, LSRCD completed the Savery Creek Watershed Water Quality Assessment Section 319 Project. The goal of the project was to complete a baseline water quality survey of the Savery Creek watershed, including several of its tributaries. To evaluate water quality, the report summarized physical, chemical and biological data collected in 1996 and 1997. In addition, photo points were compared at each site to evaluate trends in riparian condition over time. The report concluded that the aquatic life uses on lower Savery Creek were likely threatened due to sedimentation. Data and information collected by LSRCD as part of this project showed that the cold water fishery and aquatic life other than fish uses on Loco and Big Sandstone Creeks were fully supported. LSRCD and BLM conducted water quality surveys on West Fork Loco Creek in 1992. The survey determined that the cold water fishery and aquatic life other than fish uses for the entire West



Fork Loco Creek watershed (WYLS140500030408_02) upstream of Loco Creek were threatened due to sedimentation, elevated water temperatures and nutrients and was added to the 303(d) List in 1996 for these pollutants. The source of these pollutants was identified livestock grazing.

The Roaring Fork Little Snake River's (RFLSR) headwaters originate within the Sierra Madre Mountains of southern Wyoming. The river then flows south to its confluence with the Little Snake River near the Colorado border. WDEQ has monitored the chemical, physical and biological condition of North Fork Little Snake River (1996-1998) using a single study site and has determined that it is of reference quality. North Fork Little Snake River, including the entire watershed (212.1 miles) upstream of the Colorado border, was determined to be fully supporting its cold water fishery and aquatic life other than fish uses. A WDEQ summary report was not written for this study. In the late 1990's, the U.S. Bureau of Mines indicate that mine drainage from the abandoned mines in the upper RFLSR was a concern, mostly because of high concentrations of copper. As part of their 2003 Medicine Bow National Forest Plan, USFS committed to coordinating with various agencies to improve water quality in the RFLSR drainage. WDEQ, in cooperation with USFS, monitored water quality within the RFLSR in 2010 and 2012 in the vicinity of the Itmay and Standard mines (WDEQ, 2013). Results of this study indicated that the cold water fishery and aquatic life other than fish uses on RFLSR (WYLS140500030106_01) are not supported from the confluence with a tributary draining the Standard Mine downstream 1.8 miles to the confluence with an unnamed tributary; the cause and source of these impairments have been identified as elevated copper and hardrock mining, respectively. This segment has been added to the 303(d) List in 2012.

Muddy Creek Sub-basin (HUC 14050004)

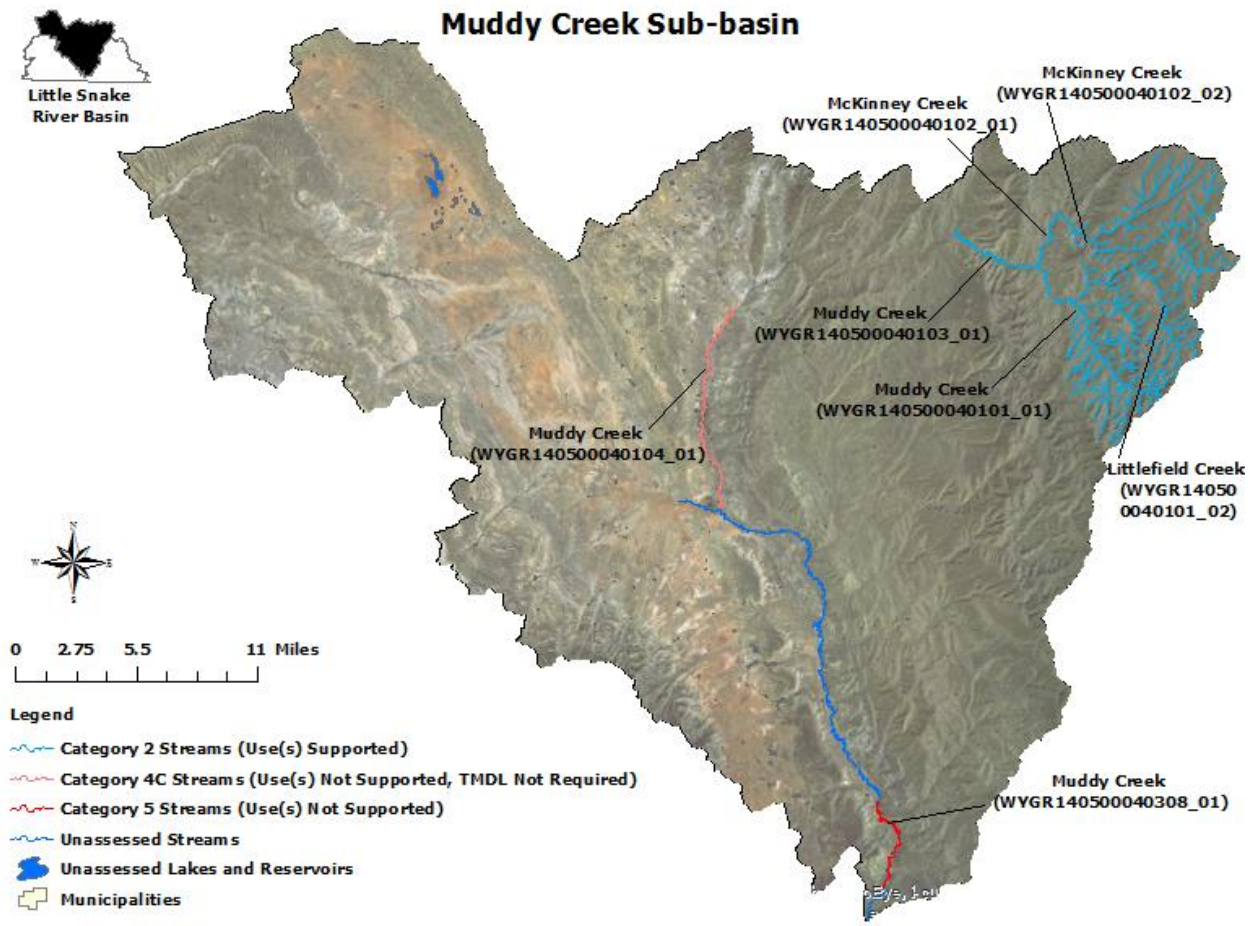
The Muddy Creek watershed's headwaters are located along the continental divide within and adjacent to the Red Rim-Grizzly Wildlife Management Area. Muddy Creek flows southwest to its confluence with the Little Snake River near the town of Baggs. The watershed is located within the high desert/foothills of south central Wyoming and Muddy Creek is described as a high-elevation, cold-desert watershed (BLM, 2001) that naturally transitions from perennial to intermittent in its lower reaches. The Muddy Creek watershed is important for the conservation of several fish species of concern in the Colorado River Basin; these fish include the roundtail chub, bluehead sucker, flannelmouth sucker and Colorado River cutthroat trout (BLM, 2007). The watershed is relatively unique in that it contains an intact relic assemblage of all four species. The decline of these species within the Colorado River Basin has been linked to dams, stream flow alterations, elevated stream temperatures and hybridization and competition with non-native fishes (BLM, 2007).

Muddy Creek was identified in the 1970s-80s as a substantial contributor of sediment to the lower Colorado River drainage. USGS stream gage data from the 1950s-70s was used to estimate water yield and total sediment (i.e. suspended and bed load) and to compare trends between various locations within the Yampa River watershed of the upper Colorado River Basin (Andrews, 1978). Results of this study indicated that while the Little Snake River sub-basin (3,730 mi^2) contributed only 27% of the annual discharge to the Yampa River near Deerlodge Park, CO, it supplied 69% of the annual sediment load. In contrast, the Yampa River sub-basin (3,410 mi^2) contributed 73% of the discharge at this gage but only 27% of the sediment load. It was also estimated that approximately 60% of the sediment load coming from the Little Snake River sub-basin originated within a segment of the Little Snake River between Dixon, WY and Lily, CO (Andrews, 1978). Three stream segments within the Muddy Creek watershed were added to the 303(d) List in 1996 for habitat degradation; these segments included lower Muddy Creek (WYLS140500040104_01) from the confluence with Red Wash upstream to the confluence with Antelope Creek (west of Highway 789), Muddy Creek (WYLS140500040103_01) from the confluence with Alamosa Gulch upstream to the confluence with Littlefield Creek and McKinney Creek (WYLS140500040102_01) from the confluence with Muddy Creek upstream to the confluence with Eagle Creek. All three segments were identified as having physical degradation from livestock grazing, which was considered a threat to the cold water fisheries and aquatic life other than fish uses. The Muddy Creek watershed became the focus of extensive sediment remediation efforts beginning in the early

1990s (LSRCD, 2005). A Coordinated Resource Management (CRM) process, led by the Little Snake River Conservation District (LSRCD) was initiated in 1992 to address several known sources of excess sedimentation within the Muddy Creek watershed and to improve water quality. The CRM combined resources from more than 34 groups to achieve watershed restoration goals at the watershed scale. Watershed-wide best management practices included: development of off-channel water sources for livestock; riparian fencing; herding cattle away from riparian zones and onto uplands; prescribed burns to enhance upland vegetation diversity; planting riparian vegetation; installation of channel stabilization structures; and the repair of breached spreader dikes within the George Dew Wetland Complex. The repair of the George Dew Wetland Complex reduced headcutting, gullying and the threat of sedimentation in the lower Muddy Creek watershed. It is unlikely that the wetland complex will ever be removed and the channel returned to its natural form because this would result in significant instability and damage to the watershed as the stream channel readjusts. Since restoration activities have effectively addressed the cause of the original 1996 303(d) listing, this segment was removed from Wyoming's 303(d) List in 2014 and added to Category 4C.

Additional watershed restoration efforts on Muddy Creek have occurred in the Red Rim-Grizzly Wildlife Habitat Management Area (GWHMA), which includes the upper Littlefield Creek drainage and portions of the upper Muddy Creek drainage. WGFD has been working with BLM, livestock grazing permit holders and LSRCD to implement new grazing strategies, the most important of which is to defer grazing for several years to allow willow re-establishment. BLM, in cooperation with TU, WGFD, LSRCD and NRCS, has also planted a variety of woody riparian vegetation to help stabilize streambanks, removed a stream culvert and restored 0.75 miles of Muddy Creek in the upper watershed. Over the last two decades, groups representing various local, state and federal agencies have produced a variety of information and data in the form of reports, theses, technical manuscripts and raw data relating to the Muddy Creek Watershed. In 2010, WDEQ hired Timberline Aquatics, Inc. (TA) to review and summarize this information and data and to produce a summary report (Rees and McMahon, 2011) that included trend analysis for the impaired reaches of Muddy Creek and McKinney Creek. Credible physical, chemical and biological data indicated that the upper Muddy Creek (WYLS140500040103_01) and McKinney Creek (WYLS140500040103_01) segments are no longer threatened and fully support their cold water fishery and aquatic life other than fish uses. Most pronounced were improvements in the macroinvertebrate communities at these reaches, which were considered to resemble reference condition. There has also been an improvement in the stream channel, which continues to narrow, deepen and to form stable terraces. Recovery of the riparian community has helped to stabilize the naturally erosive soils in the watershed and channel. No water quality parameters were found to exceed WDEQ's water quality standards and values remained relatively constant from 2008-2010. As a result of the above restoration efforts, these segments were removed from the 303(d) List in 2012 and Section 319 Nonpoint Source Program Success Stories have been written for both waters.

Projected increases in CBM development in the Muddy Creek Sub-basin may lead to increases in surface disturbance, erosion and sediment loading (USGS, 2009) in the Colorado River Basin. USGS (2009) collected TDS and specific conductance data in an effort to establish regression relationships for sites on Muddy Creek near the town of Baggs. These relationships will allow TDS to be monitored more easily in the future using specific conductance measurements as a surrogate. Camp, Dresser, and McKee Inc. (CDM) has been monitoring the physical character and water quality of upper Muddy Creek in the Atlantic Rim area since 2008. The resulting Muddy Creek Monitoring Report (CDM, 2010) indicated that the studied section of Muddy Creek is highly erosive and dominated by fine sediments, but that this condition likely did not worsen over the study period. USGS gage (#09258980) data collected on Muddy Creek below Youngs Draw between 2006 and 2009 showed exceedances of the chronic aquatic life chloride and selenium criteria. Muddy Creek was placed on the 303(d) List in 2010 for both of these pollutants from below Youngs Draw upstream to Deep Creek.



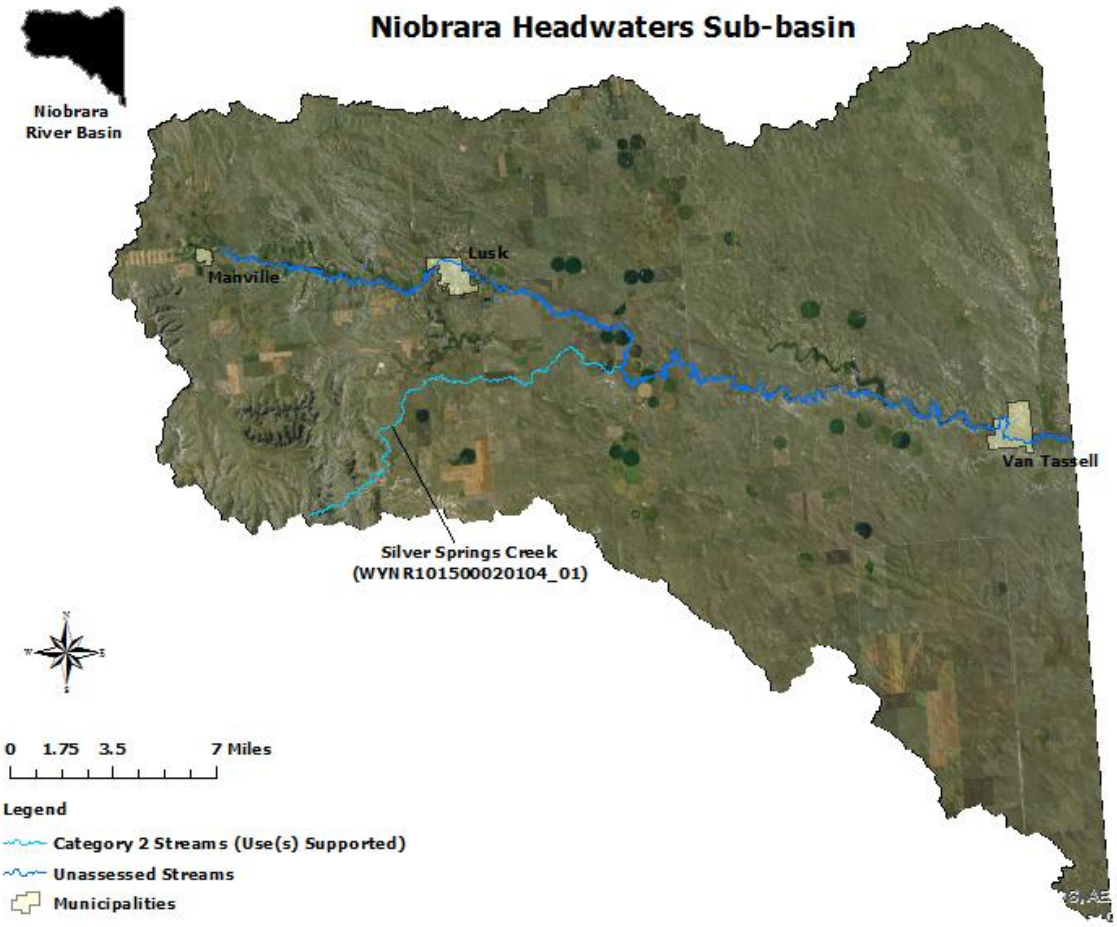
8.8 Niobrara River Basin

The Niobrara River Basin drains approximately 814 mi^2 in Wyoming and contains only the Niobrara Headwaters Sub-basin. The sub-basin is bounded to the north by the Seventy Seven Hills and Hat Creek Breaks and to the southwest by the Wildcat Hills; these formations are composed of sedimentary geology that has been eroded into pine bluffs and hills (Chapman et al. 2003). Most of the lower basin is composed of rolling plains and sandy and silty tablelands, where loamy soils have been formed from weathering sandstone. Land uses are primarily livestock grazing with some dry land and irrigated farming.

Niobrara Headwaters Sub-basin (HUC 10150002)

The headwaters of the Niobrara River are formed from the many springs located in the upper watershed. WGFD has estimated that there are only about four perennial stream miles in the Niobrara Basin in Wyoming, with all other stream miles being either ephemeral or intermittent. The Niobrara River flows east from its headwaters near Manville through the town of Lusk and ultimately crosses the Wyoming/Nebraska border near Van Tassell. Finding stream reference sites in the high plains has proven to be difficult for WDEQ. Thus, WDEQ personnel established reference sites by collecting physical, chemical and biological samples on the Niobrara River within the Agate Fossil Bed National Monument, Nebraska in 2005.

Niobrara Conservation District (NCD) collected data and other information on Silver Spring Creek (WYNR101500020104_01) from 2001 to 2007 that indicated that the aquatic life other than fish use is fully supported from the confluence with the Niobrara River to a point 17.8 miles upstream.



8.9 North Platte River Basin

The headwaters of the North Platte River Basin originate in Medicine Bow, Never Summer, Rabbit Ears and Park mountain ranges surrounding North Park, Colorado; the river then flows north into Wyoming near the community of Cowdrey, Colorado. The basin is the largest in the state, draining approximately 23,306 mi^2 of southeastern Wyoming. The North Platte is by far the most geologically diverse river basin in Wyoming, containing 4 level III and 20 level IV ecoregions (Chapman et al. 2003). The river enters Wyoming in the low elevation forests and shrublands of the Medicine Bow Mountain Range in the Platte River Wilderness Area. It then flows through the sub-irrigated high valleys south of Saratoga and between the Sierra Madre and Medicine Bow Mountain Ranges and north across a large section of the Wyoming Basin between Saratoga and Casper. Lastly, the river flows around the northern edge of the Laramie Mountains and through the Northwestern Plains and High Plains to the Wyoming/Nebraska border. Primary land uses include irrigated agriculture, livestock grazing, oil and gas production, recreation, timber harvest, uranium mining and wildlife habitat.

The North Platte River is impounded by a series of large reservoirs as it courses through Wyoming; these include, from upstream to downstream, Seminoe, Kortes, Pathfinder, Alcova, Gray Reef, Glendo and Guernsey Reservoirs. These reservoirs are mainly utilized for water storage, hydropower and recreation.

The Kendrick Project stores and distributes water and provides hydropower using dams and powerplants at Seminoe and Alcova Reservoirs. Water from the project is distributed to approximately 24,000 acres of irrigated land located between Alcova Reservoir and the City of Casper using a series of canals. A portion of the surface water rights in the North Platte River Basin are allocated by the River Decree (1957) and the North Platte Decree (2001). The River Decree restricts water users in Colorado from using more than 19,875 acre-feet per year. The North Platte Decree restricts water users in Wyoming from irrigating more than 39,000 acre-feet along the Laramie River below Wheatland Number 2 Tunnel north of the town of Wheatland. The North Platte Decree also affected water usage along the North Platte River in Wyoming in three ways: allocating only 25% of the natural flow to Wyoming water users between Guernsey Reservoir and the Tri-State Dam (near the WY/NE border), restricting Wyoming water users to 1,280,000 acre-feet above Pathfinder Dam, and 890,000 acre-feet between Pathfinder Dam and Guernsey Dam during any ten year period.

WDEQ (2007) collected physical, chemical and biological data at 36 study sites along the mainstem of the North Platte River between 1996 and 2004. Nutrients were identified as a concern from the town of Saratoga downstream to the Wyoming/Nebraska border. Selenium concentrations were above WDEQ's chronic aquatic life criterion near the City of Casper and was attributed to irrigation return flows from the Kendrick Project area. These results supported the 1998 303(d) Listing for selenium on the North Platte River (see Middle North Platte Sub-basin below). The river was considered physically stable from the Wyoming/Colorado border downstream to below the city of Casper; sediment aggradation from Casper downstream was noted as a concern. Designated use support was not assessed using this report.

A study conducted by USGS (2007) compared the concentration of pesticides at two sites in the North Platte River Basin across three seasons; one site was located on the Laramie River near Wheatland and a second was along the North Platte River near the WY/NE border. Eight different pesticides were detected, all of which were at low concentrations and did not exceed the drinking water criteria in Appendix B of Chapter 1. A second pesticide occurrence study (USGS, 2011) conducted during the summer of 2009 and spring of 2010 detected 1 and 6 different pesticides, respectively, in the North Platte River below Casper and 4 and 5 different pesticides, respectively, in the North Platte River near the WY/NB border. Concentrations of these pollutants were also well below the state's drinking water criteria.

Upper North Platte Sub-basin (HUC 10180002)

WDEQ collected physical, chemical and biological data at several study sites along a 77.3 mile segment of the upper North Platte River (WYNP101800020000_01) in 1997 between Sage Creek and the Wyoming/Colorado border. Although no final report was written by WDEQ, data indicated that the aquatic life other than fish and cold water fishery uses are fully supported within this segment.

The headwaters of Douglas Creek are located along the western slope of the Medicine Bow Mountain Range. Tie driving probably occurred for longer on Douglas Creek than any other stream in the state, continuing from the late 1860s until 1940, when the Union Pacific Railroad stopped using hand hewn, river driven ties (Thybony et al., 2001). Devils Gate Creek, a tributary to Douglas Creek was deemed too steep and rocky to drive ties, so a large flume was built to carry ties and logs to Douglas Creek. These activities have had long lasting physical effects on this watershed. A second water quality related impact on Douglas Creek was gold and copper mining. Placer gold was first discovered near the historic mining community of Keystone in 1868, and by 1870, hardrock ore bodies were also discovered and mined. Most gold production ceased by the 1890s; copper was mined between 1900 and 1918. Several gold dredgers currently operate in the watershed between the confluence with Lake Creek and USFS's Bobbie Thompson Campground and physical degradation to the stream channel from these activities is a concern (USFS, 2003). WDEQ (1997) collected physical, chemical and biological data at one site on Douglas Creek in 1997. The study determined that the entire watershed, from its confluence with the North Platte River

upstream to the confluence with Muddy Creek, excluding Smith North Creek (WYNP101800020105_03) and the entire watershed from the confluence with the North Platte River upstream to the confluence with Pelton Creek (WYNP101800020107_01) fully supports its aquatic life other than fish and cold water fishery uses.

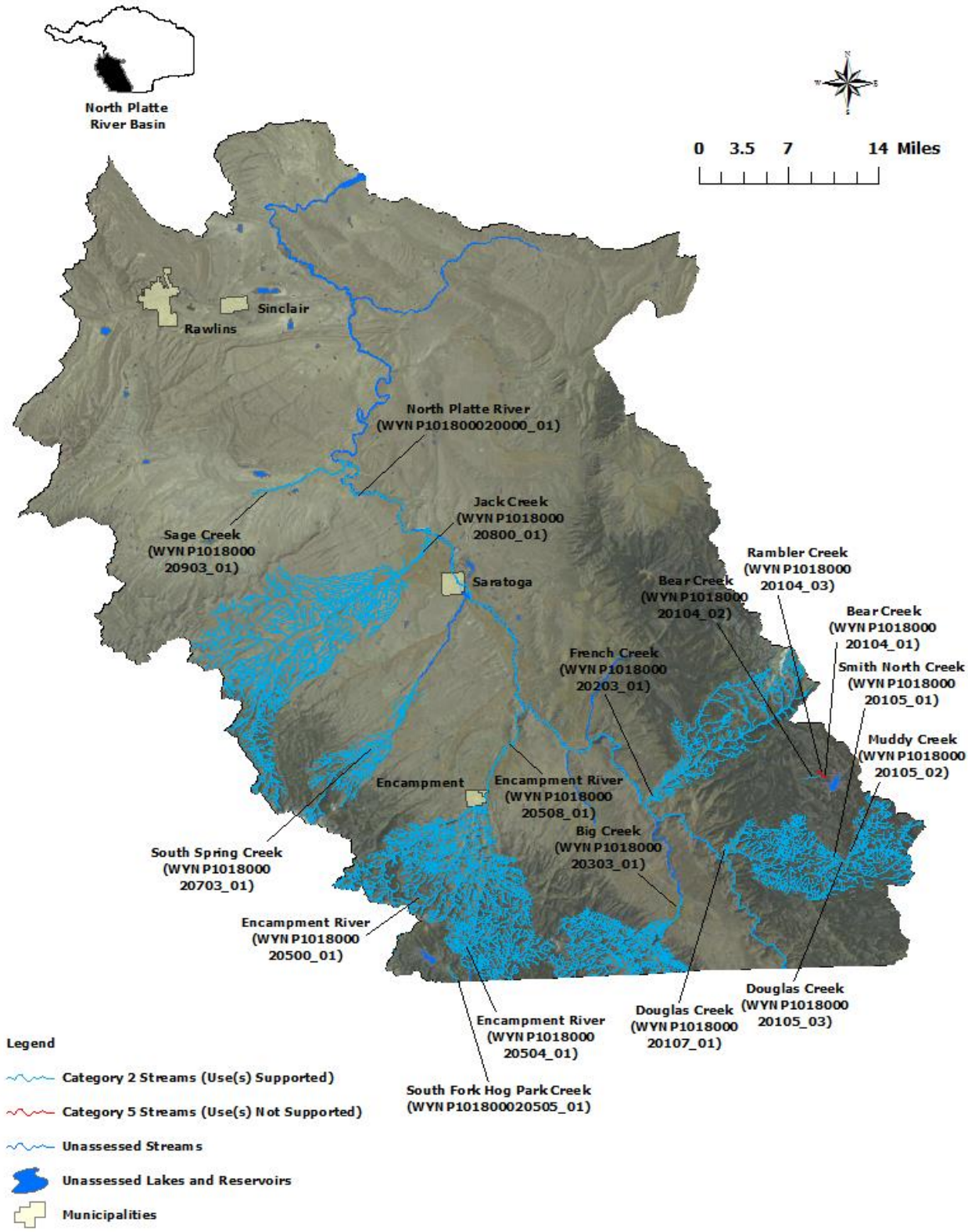
Bear Creek is a small tributary to Rob Roy Reservoir in the upper Douglas Creek watershed. Rambler Creek, a tributary to Bear Creek, drains the now abandoned site of the historic New Rambler Copper Mine. The site includes the mine itself and a broad delta of mine tailings. WDEQ monitoring of Bear Creek (WDEQ, 2010) between 2000 and 2008 showed that copper concentrations on Rambler Creek and Bear Creek below the confluence with Rambler Creek routinely exceed WDEQ's acute and chronic aquatic life copper criteria and are highest during snow melt run-off in spring. However, the aquatic macroinvertebrate community in Bear Creek, both above and below the confluence with Rambler Creek was found to be comparable to both regional reference condition and to other high quality benthic communities in adjacent watersheds. These results suggest that the existing copper criteria may be overly protective for the aquatic life other than fish designated use on Bear Creek. Because little is known about the impact of the copper exceedances on the cold water fish community of Bear Creek. A 2.9 mile segment of Bear Creek, from the confluence with Rob Roy Reservoir to a point 2.9 miles upstream was temporarily placed in category 3 because designated use support was indeterminate. Data and information from the report were subsequently re-assessed for the 2014 Integrated Report. Ultimately, Bear Creek (WYNP101800020104_01) from the confluence with Rambler Creek downstream 0.7 miles to the confluence with Rob Roy Reservoir was added to the 303(d) List in 2014. Rambler Creek (WYNP101800020104_03) was also added to the 303(d) List in 2014 for not supporting its aquatic life other than fish use due to the high copper concentrations. Lastly, this study found that Bear Creek's (WYNP101800020104_02) cold water fishery, aquatic life other than fish, drinking water and fish consumption uses are fully supported from the confluence with Rambler Creek to a point 1.3 miles upstream.

The Stage I/II trans-basin trade system is responsible for supplying approximately 70% of the City of Cheyenne's drinking water. The remaining 30% of the drinking water comes from well fields located northwest of Cheyenne. Rob Roy Reservoir was constructed to temporarily store water from Douglas Creek which is ultimately piped to nearby Lake Owen, Granite Springs and Crystal Lake Reservoirs (located in the Laramie Mountain Range) before finally reaching Cheyenne. Heavy metals pollution was a concern in Rob Roy Reservoir because of past mining activities in the Douglas Creek watershed. USGS (1999) conducted a Section 205j study in 1997-1998 in conjunction with the Cheyenne Board of Public Utilities (CBPU) to evaluate water quality within these four reservoirs. The study used physical, chemical and biological data; including depth profiles, water and sediment chemistries and phytoplankton community characterization. The study did not report any exceedances of WDEQ's water quality criteria, including the acute and chronic copper criteria. Designated use support was not assessed using this report.

Smith North Creek is small tributary to Douglas Creek. WDEQ (2004) monitored approximately four miles of Smiths North Creek to address concerns that physical impacts from road construction and gold dredging had degraded the aquatic life uses in the watershed. Physical, chemical and biological data were collected during 2000 and 2004 at a single study site. Excess fine sediment was observed, but was attributed to upstream beaver dam failures. The study concluded that the aquatic life other than fish and cold water fisheries uses are fully supported within the entire Smith North Creek watershed (WYNP101800020105_01) upstream of the confluence with Douglas Creek.

Muddy Creek is a small watershed that confluences with Douglas Creek approximately 3 miles south of the Bobbie Thompson Campground. Much of the forest surrounding the Muddy Creek drainage was harvested for railroad ties in the 1930s, which is evidenced by remnants of an old splash dam used for driving ties harvested in the upper watershed (Thybony et al. 2001). WDEQ monitored and assessed Muddy Creek in 1998 to address concerns that erosion from adjacent roads may be degrading aquatic life

Upper North Platte Sub-basin



uses. While a couple of road crossings may contribute sediment to the stream, data indicated that Muddy Creek (WYNP101800020105_02) is fully supporting its cold water fishery and aquatic life other than fish uses. A final report was not written for this study.

The Big Creek watershed's headwaters are located in the Sierra Madre Mountain Range near the Wyoming/Colorado border. The creek flows northeast to its confluence with the North Platte River at WGFD's Big Creek public fishing access area. WDEQ monitored three study sites within the watershed in 1999. The sites were located on the North, Middle and South Forks of Big Creek. All three sites were determined to be of reference quality and the entire Big Creek (WYNP101800020303_01) watershed upstream of the confluence with Spring Creek was determined to fully support its aquatic life other than fish and cold water fishery uses. The USFS completed two projects in the South Fork Big Creek watershed in 2002 that were expected to reduce sedimentation. The first project replaced a failing wooden bridge at the Forest Road 498 crossing with a wider bridge expected to reduce erosion occurring in the area (USFS, 2003). The second project re-graded and re-vegetated a steep, eroding and unstable bank that was located approximately 0.3 miles below the bridge. Both projects were successful in reducing sedimentation in the South Fork Big Creek.

The Encampment River watershed's headwaters originate along the continental divide in Colorado's Mt. Zirkel Wilderness Area. The river then flows north into Wyoming, through the Encampment Wilderness Area and ultimately confluences with the North Platte River approximately 7 miles north of the town of Encampment. WDEQ monitored and assessed the upper Encampment River watershed in 1999. Data indicated that the aquatic life other than fish and cold water fishery uses are supported for the Encampment River and several tributaries (WYNP101800020500_01) from the confluence with (and including) the North Fork Encampment River upstream to the confluence with (and including) the East Fork Encampment River, excluding Hog Park Creek. Several reference sites were also established during this study. A final report was not written for this study. WDEQ (2004) monitored the Encampment River in 2000 using one monitoring station and evaluated designated use support using physical, chemical and biological data. Results of this study indicated that aquatic life other than fish and cold water fishery uses are supported along a segment of the Encampment River (WYNP101800020504_01) extending from the confluence with the East Fork Encampment River to a point 10.0 miles downstream. WGFD (2012) has completed several habitat improvement projects within the Encampment River watershed. The first project was completed in 2011, removing a cement weir, restoring the channel and reconnecting eight miles of stream in the upper watershed. The second project was located along the mainstem of the Encampment River below highway 230. Project goals included dissipating stream energy and preventing land loss, improving bedload transport, enhancing grade control by installing several in-stream structures and improving shading from riparian vegetation and creating better pool habitat. Construction restoration along a 300 foot reach began in 2011, and included the creation of a new channel and the planting of willow cuttings for increased stabilization.

The headwaters of Hog Park Creek are located along the eastern side of the continental divide within the Sierra Madre Mountain Range. Hog Park Reservoir was constructed in the 1960's as part of the Stage I/II trans-basin trade system described above. Water from the Little Snake River Basin is diverted across the continental divide and stored in Hog Park Reservoir. South Fork Hog Park Creek's headwaters are located along the continental divide, near the northern edge of Mt. Zirkel Wilderness in Colorado. The creek confluences with Hog Park Creek, which in turn confluences with the Encampment River within the Encampment River Wilderness. WDEQ (2004) monitored South Fork Hog Park Creek using one study site in 2000. The report indicated that the creek was historically used to drive railroad ties, and as a result, was physically unstable and carried a large sediment load. During the 1980s and 1990s, the USFS installed tree revetments to trap sediment. Beaver subsequently removed the revetments to use as dam building materials and constructed dams which have trapped sediment. The resulting beaver dam complexes have allowed the stream to establish a more natural shape, and provided hydrologic diversity, which has ultimately improved the fishery. Results of the WDEQ study indicated that South Hog Park Creek (WYNP101800020505_01) is fully supporting its aquatic life other than fish and cold water fishery

uses along a 2.3 mile segment from the confluence with Hog Park Creek upstream to the Colorado border.

Billie Creek is a small tributary to the Encampment River in the northern portion of the Encampment River Wilderness Area. A diversion ditch in the Billie Creek drainage breached in the late 1990s, eroding a gully and depositing approximately 3,300 tons of sediment in Billie Creek and its floodplain (USFS, 2002). Restoration work to slow erosion on the gully was completed in 2001. Billie Creek was sampled in 2003 by WDEQ, and data indicate that it has a healthy benthic community. WDEQ and SERCD monitoring indicates that the Jack Creek (WYNP101800020800_01) and upper South Spring Creek (WYNP101800020703_01) drainages are supporting their cold water fishery and aquatic life other than fish uses.

The headwaters of the Sage Creek watershed are located along the eastern edge of the continental divide within the northern foothills of the Sierra Madre Mountains. The creek flows northeast to its confluence with the North Platte River at McKeal Meadows. Sage Creek has a naturally high sediment load due to the highly erosive soils and the arid climate in the watershed. The creek has been identified by several studies (WGFD, 1969; SCS, 1980; SERCD, 1998) as a significant contributor of sediment to the Upper North Platte River. WDEQ placed the creek the 303(d) List for this pollutant in 1996 using data collected by WDEQ; a final report was not written for this study. Dam failures, road construction and historic grazing practices have resulted in increased erosion and sediment loading to Sage Creek, especially in the lower portion of the watershed. In 1997, SERCD, in cooperation with land owners, BLM, WDEQ, NRCS and WGFD, initiated two Sage Creek Watershed Section 319 projects, which together included the entire Sage Creek watershed. Resulting BMPs consisted of short duration grazing, riparian and snowdrift fencing, off channel water development, improved road management, grade control structures and water diversion and vegetation filtering. These BMPs were expected to reduce sediment loading from Sage Creek to the North Platte River. Monitoring data collected as part of these projects resulted in reduced sediment loading to the North Platte River and improved riparian and range condition within the Sage Creek watershed. Data indicate that the aquatic life other than fish and coldwater fisheries uses are now fully supported on Sage Creek (WYNP101800020903_01), and therefore it was removed from the 303(d) List in 2008. A USEPA Section 319 Nonpoint Source Success Story has been written for Sage Creek.

Pathfinder-Seminoe Sub-basin (HUC 10180003)

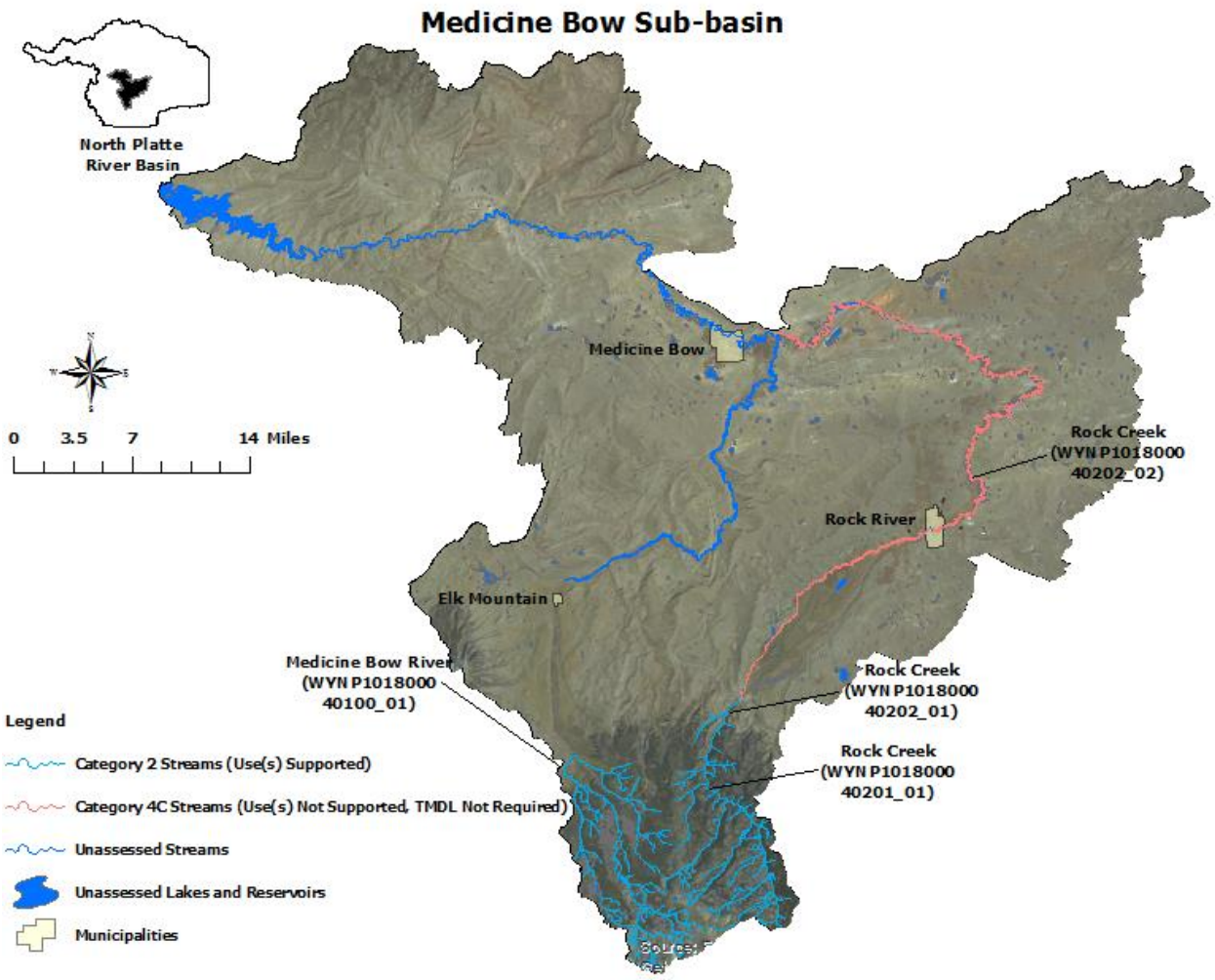
The North Platte River is regulated by a series of dams at Seminoe, Kortes and Pathfinder Reservoirs as it flows through this sub-basin. Seminoe Reservoir is a large reservoir (13,898 surface acres) constructed in 1938, approximately 38 miles northeast of the town of Sinclair. Kortes Reservoir is a small (83 surface acres) reservoir located approximately 1.5 miles downstream of Seminoe Reservoir. Kortes Reservoir was constructed in 1951 in a steep canyon between Seminoe and Pathfinder Reservoirs; the reservoir's dam is uncontrolled and generates hydropower. The 5.5 mile segment of the river between Kortes Dam and the inlet to Pathfinder Reservoir is a trophy trout fishery known as "The Miracle Mile" and has a minimum in-stream flow requirement of 500 cfs. The North Platte River then flows into a large reservoir called Pathfinder Reservoir (22,121 surface acres). This reservoir is used for water storage and was constructed by the USBOR in 1909. The reservoir is part of the North Platte Project, which provides irrigation water to approximately 226,000 irrigated acres in Wyoming and Nebraska. Seminoe and Kortes dams are part of the Kendrick Project, which stores and distributes water and provides hydropower using dams and powerplants at Seminoe and Alcova Reservoirs. Water from the project is distributed to approximately 24,000 acres of irrigated land located between Alcova Reservoir and the City of Casper using a series of canals.

Deweese Creek, which flows into Pathfinder Reservoir, is one of few perennial streams in this sub-basin. WDEQ has monitored the creek and considers it to be a reference stream for the Wyoming Basin Ecoregion. A water quality assessment has not been completed for this creek.

Medicine Bow Sub-basin (HUC 10180004)

The headwaters of the Medicine Bow River are located in the Snowy Range of the Medicine Bow Mountain Range. The river flows north from the mountains, through the foothills and into the lower basin where it confluences with Rock Creek near the town of Medicine Bow. The river then flows northwest to its confluence with the Little Medicine Bow River near the town of Medicine Bow, turns west, and terminates at Seminoe Reservoir. Irrigation in the Medicine Bow River watershed dates to around 1870 (Thybony et al. 2001). WDEQ monitored and assessed the upper Medicine Bow River (WYNP101800040100_01) watershed in 2001 using physical, chemical and biological data. The study found that the entire Medicine Bow River watershed upstream from the confluence with, and including, the East Fork Medicine Bow River was fully supporting its aquatic life other than fish and cold water fishery uses and it was placed in category 2 in 2004. A WDEQ final report was not written for this study.

Rock Creek's headwaters are located within the northern portions of the Medicine Bow Mountains, from which the creek flows north to its confluence with the Medicine Bow River near the town of Medicine Bow. WDEQ monitored the upper Rock Creek watershed in 2001 using physical, chemical and biological data. Results indicated that the



entire Rock Creek watershed (WYNP101800040201_01) upstream of the confluence with, and including, Overland Creek was fully supporting its aquatic life other than fish and cold water fishery uses and it was placed in category 2 in 2004. A final report was not written for this study. In the mid-1990's, NRCS suggested that siltation may be impairing the cold water fishery and aquatic life other than fish uses on lower Rock Creek; however quantitative data were lacking. The Medicine Bow Conservation District (MBCD) and students from the University of Wyoming (UW) conducted monitoring on Rock Creek between 1999 and 2001. Results suggested that biological condition declined in a downstream direction, due to the combined effects of sedimentation, flow alterations and drought. WDEQ (2013) conducted a study during 2009 and 2010 to collect the necessary data to make designated use support determinations on Rock Creek. Results of this study corroborated earlier studies. Specifically, the cold water fishery and aquatic life other than fish uses on Rock Creek (WYNP101800040202_02) from the town of Arlington downstream 106.5 miles to the confluence with the Medicine Bow River were not supported due to flow alterations associated with irrigation. This segment was placed in USEPA category 4C in 2014 because it is impaired by a non-pollutant for which a TMDL cannot be calculated. A second segment of Rock Creek (WYNP101800040202_01), from the town of Arlington to a point 1.6 miles upstream was determined by this study to be fully supporting its cold water fishery, aquatic life other than fish, drinking water and fish consumption uses and was placed in category 2 in 2014.

Little Medicine Bow Sub-basin (HUC 10180005)

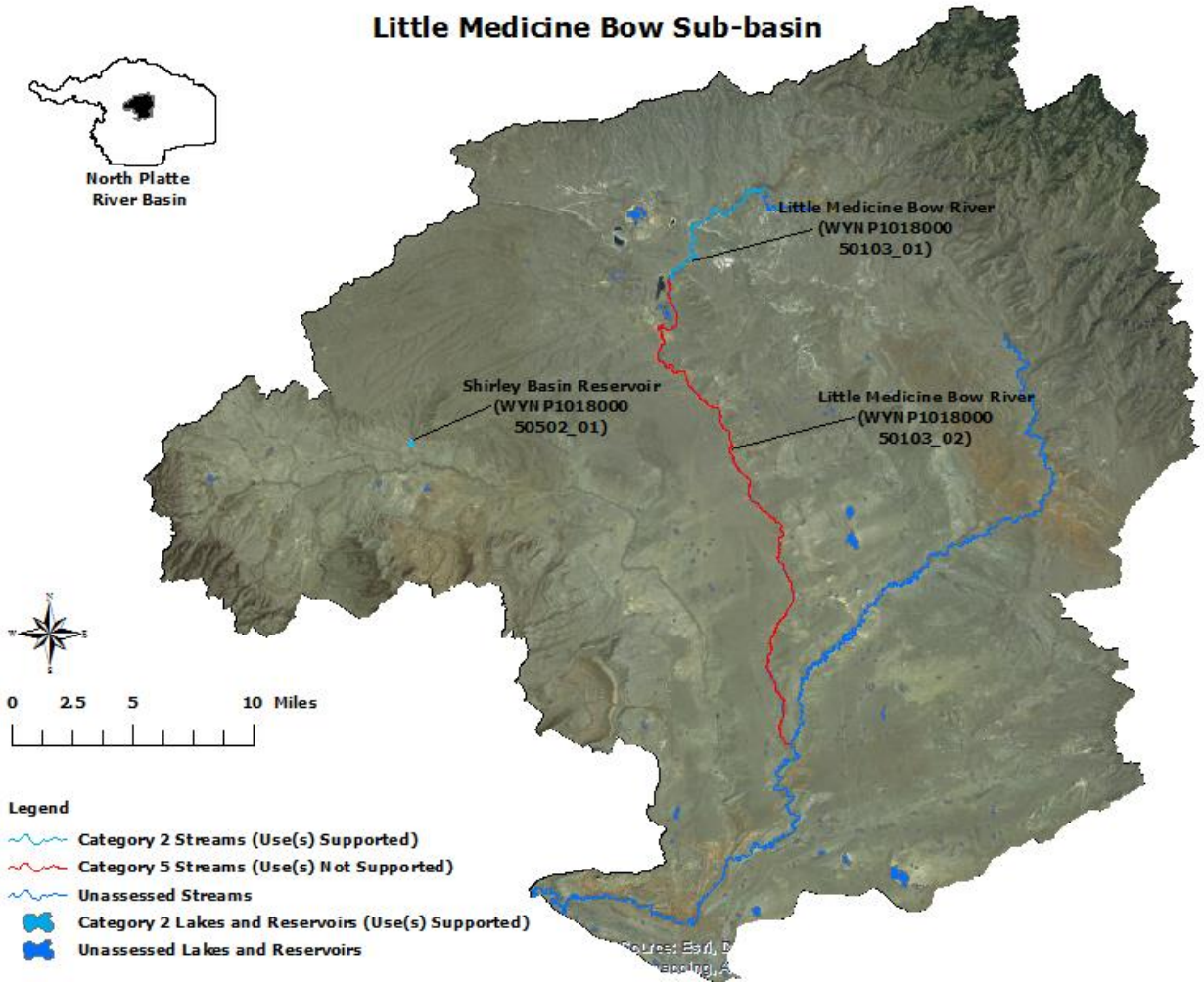
The headwaters of the Little Medicine Bow Sub-basin are located along the northwestern edge of the Laramie Mountains. The North and South Forks of the Little Medicine Bow River confluence to form the Little Medicine Bow River near Brennan Draw. The river then flows southwest across the Shirley Basin to its confluence with the Medicine Bow River near the town of Medicine Bow.

Uranium mining was initiated in 1959 in the northern-central region of the Shirley Basin and open-pit mining operations began in 1969. In 1972, a segment of the Little Medicine Bow River (LMBR) was re-routed to accommodate pit expansion, resulting in a 40% reduction in the LMBR's original channel length. Shortening the channel resulted in excessive channel down cutting (17 to 50 feet of vertical incision) and increased sediment loading to the downstream reaches of the LMBR. Reclamation of the surface mine disturbances began in the 1980's and continues to date. Reclamation work has included the re-establishment of 3.12 miles of the of the LMBR channel in its original location, the construction of 8.4 miles of ephemeral drainage channels, 37 miles of erosion control drainage features and reclamation of 1,640 acres of disturbed mine land. Two post-mine impoundments (Walker/Jenkins and Sullivan Pits) were also retained where large open mine pits once existed. The reconstructed LMBR channel now flows through post-mine topography consisting of re-graded overburden-spoil material that was resurfaced with topsoil and revegetated. Revegetation efforts have failed in some areas of the reclaimed mine region due to erosion on steep regraded side-slopes, low soil fertility and where insufficient topsoil was available to cover regraded overburden materials with sodic, saline and acid-forming qualities.

Between 1999 and 2001, MBCD and graduate students from UW collected water quality data to evaluate the health of the aquatic community of the LMBR. Results of this work indicated that there was biological degradation due to excess sedimentation along the LMBR downstream of the reclaimed uranium mine site and that the sources of this pollutant were predominantly natural. However, this study lacked sufficient credible data to make use support determinations on LMBR. Therefore, WDEQ (2013) conducted a study spanning the years 2007 and 2008 to collect the necessary data to assess LMBR. Excess sediment was determined to be the cause of non-support in this lower segment and the source was primarily an unstable reconstructed channel associated with an abandoned and reclaimed uranium mine. The unstable channel has resulted in severe channel degradation such as channel incision, head cutting and streambank erosion in the reclaimed mine area. The resultant sediment aggradation between the reclaimed mine area and Sheep Creek is beyond the assimilative capacity of the LMBR as evidenced by the presence of a homogenous coarse sand streambed, a wider and shallower channel, bar

development and braiding. Results of this study indicated that the cold water fishery,aquatic life other than fish, drinking water and fish consumption uses of the Little Medicine Bow River (WYNP101800050103_01) were fully supported from County Road 2E upstream to the confluence with the North and South Forks of the Medicine Bow River and this segment was placed in category 2 in 2014. In contrast, the cold water fisheries and aquatic life other than fish uses were not supported on Little Medicine Bow River (WYNP101800050103_02) from County Road 2E downstream 26.2 miles to the confluence with Sheep Creek and this segment has been added to the 303(d) List in 2014.

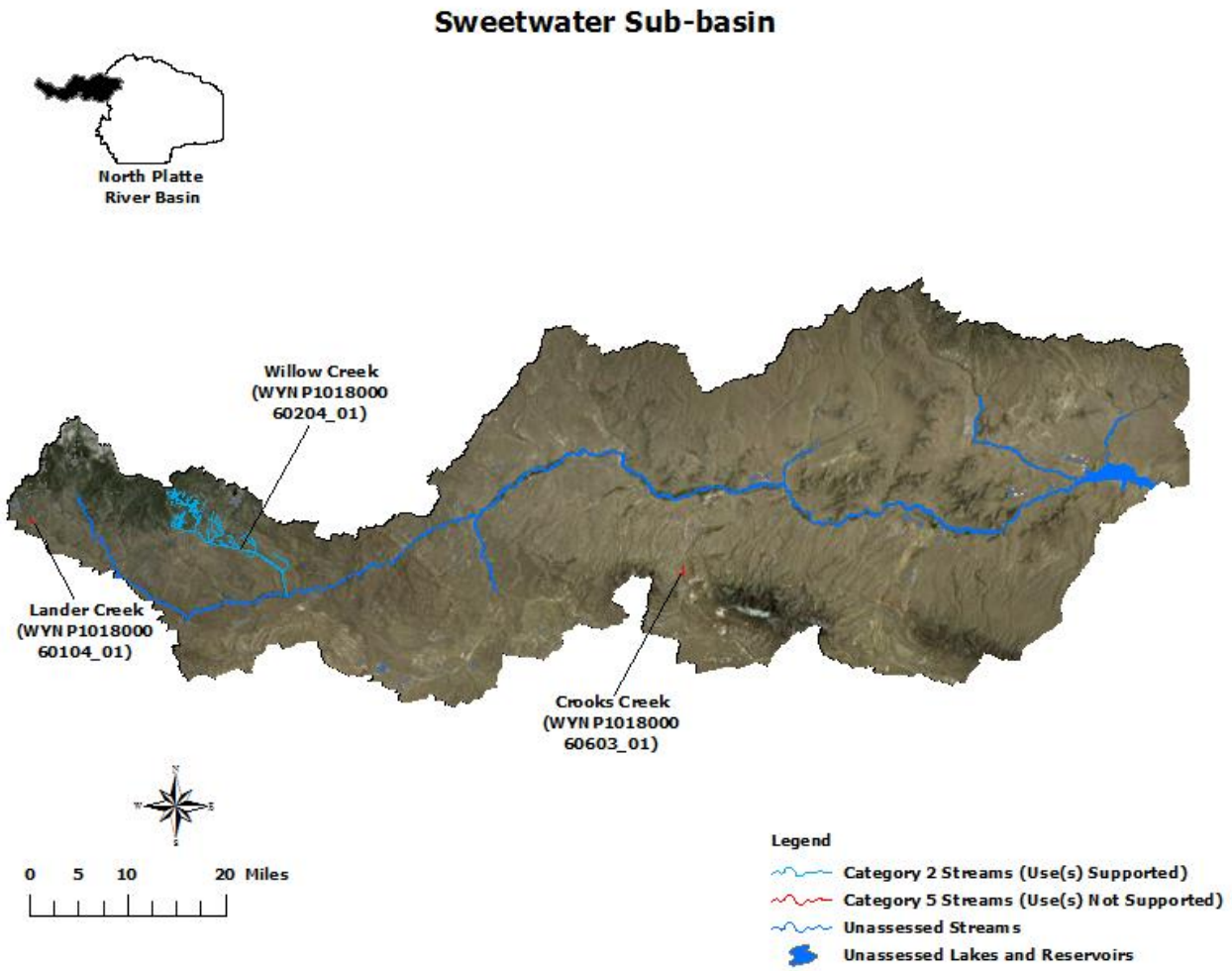
The Muddy Creek watershed's headwaters are located along the northern edge of the Shirley Mountains. The creek flows southeast and confluences with the Little Medicine Bow River approximately 7 miles northeast of the town of Medicine Bow. Shirley Basin Reservoir (WYNP101800050502_01) is a small reservoir located in the upper Muddy Creek watershed. The reservoir receives inflows from three unnamed intermittent tributaries and the outlet confluences with Muddy Creek near the Point of Rocks geologic feature. WDEQ (2006) collected chemical, physical and biological data from the reservoir in 2002 to determine designated use support. The study found that the cold water fishery and aquatic life other than fish uses were fully supported, but recommended that BMPs to reduce erosion and sedimentation be implemented.



Sweetwater Sub-basin (HUC 10180006)

The headwaters of the Sweetwater Sub-basin are located within the Bridger Wilderness in the Wind River Mountain Range. The river flows south to South Pass, where it turns and flows northeast to its confluence with Pathfinder Reservoir. The Sweetwater River is designated by WDEQ as class 1 water upstream of the confluence with Alkali Creek and is a class 2AB water below the confluence.

The Willow Creek watershed's headwaters are located at the bases of Pabst and Granite Peaks within the southern Wind River Mountain Range. The creek flows southeast 20.3 miles to its confluence with the Sweetwater River. Carissa Gulch is an ephemeral tributary to Willow Creek and is located in the South Pass mining district (WDEQ, 2005). The Carissa Gold Mine was constructed on Carissa Gulch in 1867. The mine used chlorination, mercury, cyanide and arsenic to process ore and mine tailings were deposited in the Carissa Gulch and Willow Creek floodplains. Streambed dredging also occurred in Carissa Gulch and Willow Creek between 1933 and 1941 and dredge piles are still common up to 0.5 miles downstream of South Pass City. In 1987, the South Pass City State Historical Site contacted WDEQ and expressed concern over the occurrence of mine tailings in the channel and floodplain of Willow Creek. WDEQ collected physical, chemical and biological samples from Willow Creek above and below the Carissa Gulch confluence in April and November 1988 and April 1989. AML conducted an additional, more intensive study of Willow Creek, Rock Creek and the Sweetwater River in 1989. The study design included the



collection of mercury samples from water column, fish tissue (collected by WGFD) and streambed sediment. Results of these studies showed that although arsenic was elevated at times, most samples were well below WDEQ's water quality criteria. Mercury in streambed sediments does not appear to affect water quality, but this pollutant could be suspended if sediments are disturbed by dredging. Therefore, WDEQ decided not to approve any dredge and fill Section 401 permits on Willow Creek. Fish tissue sampling showed that mercury levels were below the FDA guideline for action limit in muscle, but higher in other tissues. This trend does not suggest a human health concern, but may be a concern for piscivorous wildlife. WDEQ (2005) monitored and assessed Willow Creek using three study sites in 1999 to address BLM concerns that sedimentation was degrading aquatic life. Results suggested that Willow Creek has been physically impacted by historic dredging activities associated with mining activities. However, data indicate that the aquatic life other than fish and coldwater fisheries uses are fully supported within the entire Willow Creek watershed (WYNP101800060204_01) upstream of the confluence with the Sweetwater River and this water was placed in category 2 in 2004.

Crooks Creek's headwaters are located along the southwestern edge of Green Mountain. The creek is perennial as it flows around Green Mountain toward Jeffrey City, but becomes intermittent/ephemeral before it confluences with the Sweetwater River to the east of U.S. Route 287. In 1997, WDEQ collected physical, chemical and biological data in Crooks Creek using two study sites. A layer of oil and grease was observed below the sandy streambed and was attributed to an upstream oil treater discharge. Crook's Creek (WYNP101800060603_01) was placed on the 303(d) List in 1998 for oil and grease from the confluence with Mason Creek to a point 1.4 miles downstream. A final report was not written for this study.

Lander Creek's headwaters are located in the southwestern foothills of the Wind River Mountain Range. The stream flows southeast and confluences with the Sweetwater River near the Prospect Mountains. In 2010, Western Watersheds Project (WWP) collected *E. coli* samples on Lander Creek, and a five sample geometric mean exceeded both WDEQ's primary and secondary standards protective of recreational use. The source of the excess bacteria is livestock grazing. A 0.5 mile segment of Lander Creek (WYNP101800060104_01) between two unnamed tributaries and adjacent to County Route 132 was added to the 303(d) List in 2012.

Middle North Platte Sub-basin (HUC 10180007)

Alcova Reservoir was constructed in 1938 to provide water storage and hydropower. The Casper-Alcova Project was authorized under the 1933 National Industrial Recovery Act. The project included the construction of two dams and reservoirs, two powerplants, six substations, transmission lines, and a series of canals, laterals and drains. The project was renamed the Kendrick Project in 1935 after former Wyoming Governor John Kendrick. The Kendrick Project stores and distributes water and provides hydropower using dams and powerplants at Seminoe and Alcova Reservoirs. Water from the project is distributed to approximately 24,000 acres of irrigated land located between Alcova Reservoir and the City of Casper using a series of canals. The irrigation water is mostly used to grow barley, alfalfa, oats, hay grass and irrigate pastures; fertilizer production is also a common use. The Kendrick Project's irrigated acres are serviced by the Casper-Alcova Irrigation District.

USGS gage (station #06645000) data collected below the City of Casper on the North Platte River during the 1980s and 1990s showed that the chronic selenium criterion protective of aquatic uses was regularly exceeded. As a result, a segment of the North Platte River (WYNP101800070300_01), from the confluence with Muddy Creek upstream to the confluence with Poison Spider Creek was added to the 303(d) List in 1998. The source of excess selenium loading is irrigation return flows across the naturally selenium rich marine shales in Poison Spider Creek from the Kendrick Project area. Patterson, et al. (2009) concluded that higher discharges in the North Platte River correlate with lower selenium concentrations. In addition, conversion from flood to sprinkler irrigation in the Kendrick Irrigation District may reduce loading, but increase selenium concentrations the North Platte River.

In 1985, the U.S. Department of the Interior (DOI) established the Irrigation Drainage Program to address irrigation related water quality concerns on DOI managed lands. The program established a management plan and Task Group to identify priority study areas. The Task Group identified nine priority areas across the western U.S., one of which was the Kendrick Project. WDEQ and the U.S. Department of the Interior (DOI) funded a study spanning 1988-1990 to evaluate selenium concentrations in soil, plants, surface water, stream and lake sediments and animal tissues in the Kendrick Project Area (USGS, 1992). The study concluded that irrigation return flows from irrigated lands within the Kendrick Project contain high levels of selenium, increasing selenium loading to the North Platte River and several other streams, wetlands and reservoirs in and around the project area. These elevated selenium concentrations exceeded the chronic aquatic life other than fish criterion in ten waters within the Kendrick Project Area and these waters were added to the 303(d) List in 2000. Impaired lakes, ponds and reservoirs include Rasmus Lee (WYNP101800070302_02) and Goose (WYNP101800070302_03) Lakes, Illco Pond (WYNP101800070503_01) and Thirty Three Mile Reservoir (WYNP101800070703_01). Impaired streams and ditches include Poison Spring Creek (WYNP101800070302_01), three segments of Poison Spider Creek (WYNP101800070406_01, WYNP101800070406_02 and WYNP101800070406_03), Casper Creek (WYNP101800070504_01) and Oregon Trail Drain (WYNP101800070303_01).

Natrona County Conservation District (NCCD), in cooperation with the Kendrick Watershed Steering Committee completed the Kendrick Watershed Plan in 2005. The plan reviewed available selenium data from the area, watershed condition and land use and water use practices. Goals of the plan included improving water quality through improved irrigation efficiency, identifying financially feasible conservation practices, public outreach and education and improving aquatic habitat. NCCD completed the Historical Data Review - Kendrick Selenium Watershed Project Section 319 Report in 2004. The report summarized the available selenium data for the project area. NCCD completed the Kendrick Best Management Practices Section 319 Report in 2006. The report identified irrigation BMPs within the project area that can reduce selenium loading and established a water quality monitoring network. NCCD completed the Kendrick Selenium Technical Assistance Section 319 Project in 2008 with the goal of reducing selenium loading by 25%. The project implemented selenium reduction BMPs on 2,449 acres, including upgrading to sprinkler irrigation and improving canals and drains. NCCD completed the Kendrick Watershed Plan Implementation - Phase 1 Section 319 Project Final Report in July 2011. NCCD conducted water quality monitoring and educational outreach. WDEQ initiated selenium TMDLs in 2009 on the North Platte River, Rasmus Lee and Goose Lakes, Illco Pond, Thirty Three Mile Reservoir, Poison Spring Creek, three segments of Poison Spider Creek, Casper Creek and Oregon Trail Drain. Preliminary results indicate that the natural background concentration of selenium in the area may exceed WDEQ's chronic aquatic life selenium criterion, and therefore, WDEQ may pursue developing site specific selenium criteria. NCCD is currently sponsoring the 2012 North Platte River Watershed Project Implementation Plan – Segment I Selenium Monitoring Program Section 319 Project. The goals of the project are to evaluate the effectiveness of BMPs in reducing selenium loading in TMDL implementation priority areas, including Oregon Trail Drain, Casper Creek, Poison Spider Creek and Poison Spring Creek.

The headwaters of Garden Creek are located along the northern slope of Casper Mountain in the Laramie Mountain Range. Garden Creek flows from Casper Mountain north through the City of Casper to its confluence with the North Platte River. The stream is channelized and surrounded by impervious surfaces as it flows through Casper and is prone to short duration-high intensity or "flashy" streamflows, which eroded streambanks within Nancy English Park. The City of Casper sponsored the Garden Creek Stream Restoration and Education Section 319 project in 2009. Garden Creek's channel was reconstructed using log and rock structures, which allowed the stream to access its floodplain, provided habitat for non-game fish and facilitated the reestablishment of riparian vegetation.

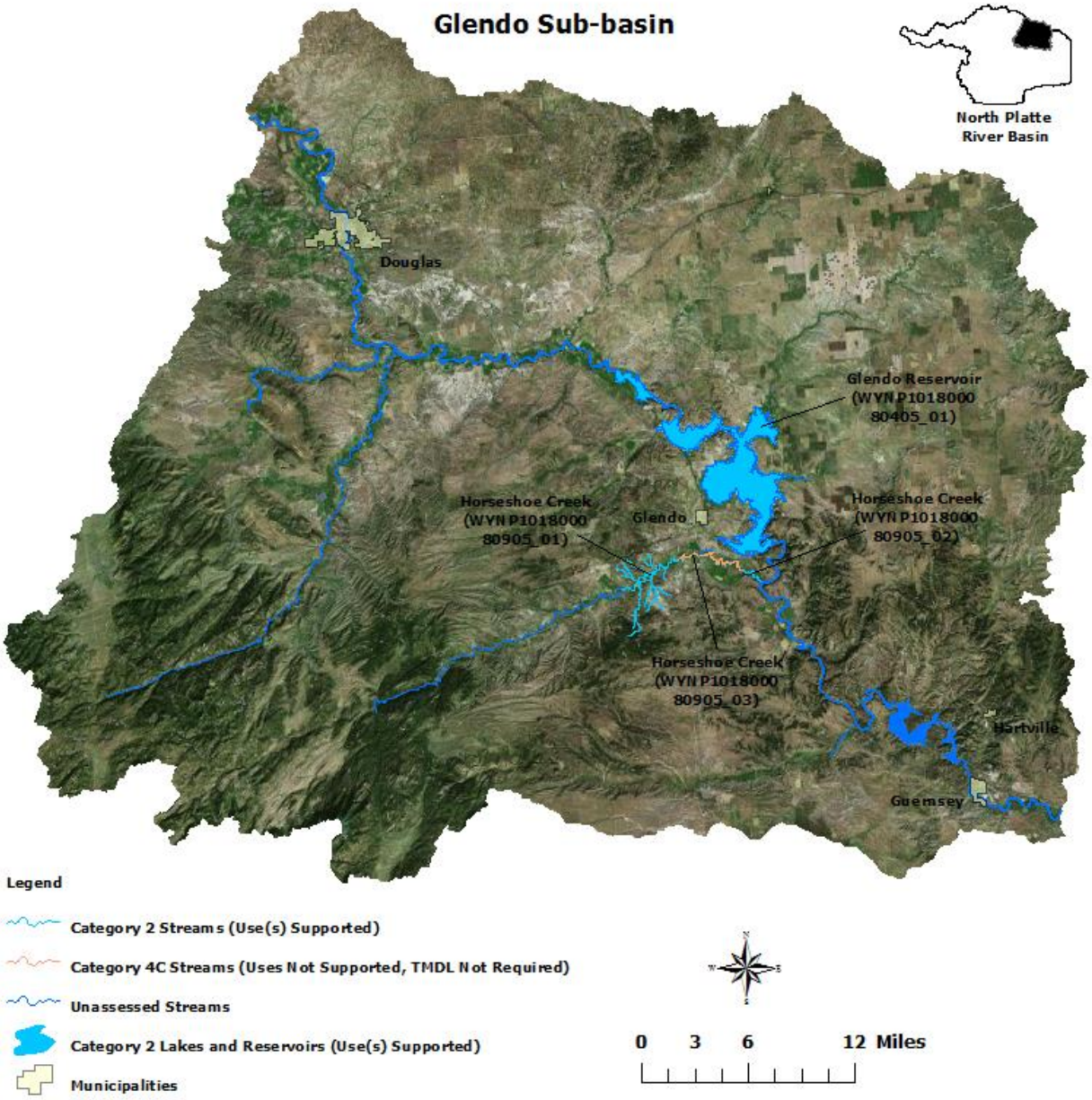
Bolton Creek is a small perennial/intermittent watershed that confluences with the North Platte River below Gray Reef Reservoir. WGFD and BLM began a project in 2010 to reduce head cutting in Bolton Creek, stabilize the channel and raise the water table. WGFD transplanted aspen into the watershed and reintroduced beavers. A culvert near the confluence with the North Platte, which was causing the head cutting, was replaced in 2011.

The occurrence of oil sheens in 2010 and 2011 along the North Platte River near Casper prompted an investigation by WDEQ's Solid and Hazardous Waste Division to determine the source of this pollutant. Hydrocarbons were detected in monitoring wells adjacent to the river, which may suggest that a nearby oil refinery could be a source. The facility operator is continuing to investigate this issue, including collecting water samples, installing more monitoring wells and conducting a sediment study to determine whether the oil is entering the river via erosion and overland flow and/or by groundwater inputs through streambed sediments.

Glendo Sub-basin (HUC 10180008)

The North Platte River is regulated by dams at Glendo and Guernsey Reservoirs within this sub-basin. Guernsey Reservoir was constructed northwest of the town of Guernsey in 1927 and Glendo Reservoir was constructed between Pathfinder and Guernsey reservoirs in 1958. Both reservoirs provide water storage and hydropower to residents of Wyoming and western Nebraska. Water rights in both reservoirs are determined by the North Platte Decree (2001).

Suspended fine sediment, or silt, has historically functioned as a sealant for irrigation canals in the lower North Platte River Basin. The construction of Guernsey Reservoir dam lessened the amount of fine sediment that would otherwise naturally occur in the lower North Platte River. Instead, sediment settles to the bottom of the reservoir and there is very little sediment in the water released below the dam. The removal of this sediment can lead to canal leakage, bank collapse and blockage within downstream irrigation infrastructure. The USBOR uses the annual Guernsey Reservoir Silt Run to remove accumulated sediment from Guernsey Reservoir and maintain downstream irrigation canals and ditches. Water releases from Glendo and Guernsey Reservoir's dams are elevated during an approximate ten day period during summer to produce flushing flows. WDEQ allows a short term exemption, or waiver, from the turbidity criterion for the North Platte River below Guernsey during this event.



WDEQ (2009) monitored physical, chemical and biological parameters at eight sampling sites in Glendo Reservoir between 2004 and 2006. Study sites were selected to represent pelagic (open water) and littoral (shoreline) habitats within riverine, transitional and lacustrine reservoir zones. Two additional sites were located in bays that were of interest to the investigation. There were no exceedances of any WDEQ water quality criteria on Glendo Reservoir (WYNP101800080405_01) during this study and aquatic life other than fish and cold water fishery uses were determined to be fully supported.

Horseshoe Creek's headwaters are located in the Laramie Mountain Range within the Medicine Bow-Routt National Forest. The creek flows northeast to its confluence with the North Platte River, approximately 1.5 miles below Glendo Reservoir Dam. WDEQ (2004) monitored Horseshoe Creek in 1999 using three study sites to address public concerns that hydrocarbons from an abandoned pipeline were leaking into the creek. Two of the study sites were located above and below the pipeline and the third was located near the confluence with the North Platte River. Although oil and grease was present above and below the pipeline, they were not above WDEQ's numeric criterion of 10 mg/L. The source of oil and grease is unknown, but is not thought to be from the pipeline. The study noted that several miles of the lower creek was dry at the time of the study and exhibited habitat degradation due to irrigation withdrawals. A review of the chemical, physical and biological data collected during this study indicated that the aquatic life other than fish and cold water fishery uses were fully supported on Horseshoe Creek from the confluence with the North Platte River to a point 2.3 miles upstream (WYNP101800080905_02) and from the confluence with Spring Creek to a point 12.5 miles upstream (WYNP101800080905_01). However, a lack of perennial flows along a 7.3 mile segment of Horseshoe Creek (WYNP101800080905_03) between these two segments prevents Horseshoe Creek from supporting its aquatic life other than fish and cold water fisheries uses. Habitat degradation appears to be related to changes in flow regime in this reach, but livestock grazing in some areas may also contribute. As a result of this study, Horseshoe Creek was added to Category 4C in 2004 and does not require a TMDL.

Upper Laramie Sub-basin (HUC 10180010)

The Laramie River's headwaters are located within the Rawah Wilderness Area in the southern Medicine Bow Mountain Range in Colorado. The river flows north into Wyoming, turns to the northeast below Woods Landing and continues through the town of Laramie. From Laramie, the river flows north and into Wheatland Reservoir #2.

The South Fork Little Laramie River's (SFLLR) headwaters are located within the Medicine Bow Mountain Range near the town of Albany. The river flows approximately 15 miles east to its confluence with the Middle Fork Little Laramie River. WDEQ (2004) collected physical, chemical and biological data at one study site on the SFLLR in 2000. The study found that streambanks were stable and well vegetated. Moderate sedimentation was noted and attributed to overland runoff from historic patches of forest that had been clear cut. The biological community exceeded reference condition. The report concluded that a segment of SFLLR (WYNP101800100602_01) was fully supporting its aquatic life other than fish and cold water fishery uses from the intersection of State Highway 11 to a point 5.5 miles upstream.

The headwaters of Mill Creek are located in the eastern foothills of the Medicine Bow Mountain Range north of the town of Centennial. The creek flows northeast to its confluence with the Little Laramie River. WDEQ (2004) collected physical, chemical and biological data from one study site on Middle Fork Mill Creek in 2000. Results of this study showed that Middle Fork of Mill Creek (WYNP101800100606_01) fully supports its aquatic life other than fish and cold water fishery uses from the USFS boundary to a point 2.7 miles upstream.

Hanging Lake is a small (4.2 acres), shallow (average depth of 3 feet) subalpine lake located in the upper Little Laramie River watershed within Medicine Bow Mountain Range. Water from snowmelt runoff enters the lake from a diversion on Nash Fork; the lake has no outlet. The lake is managed as a "put and take"

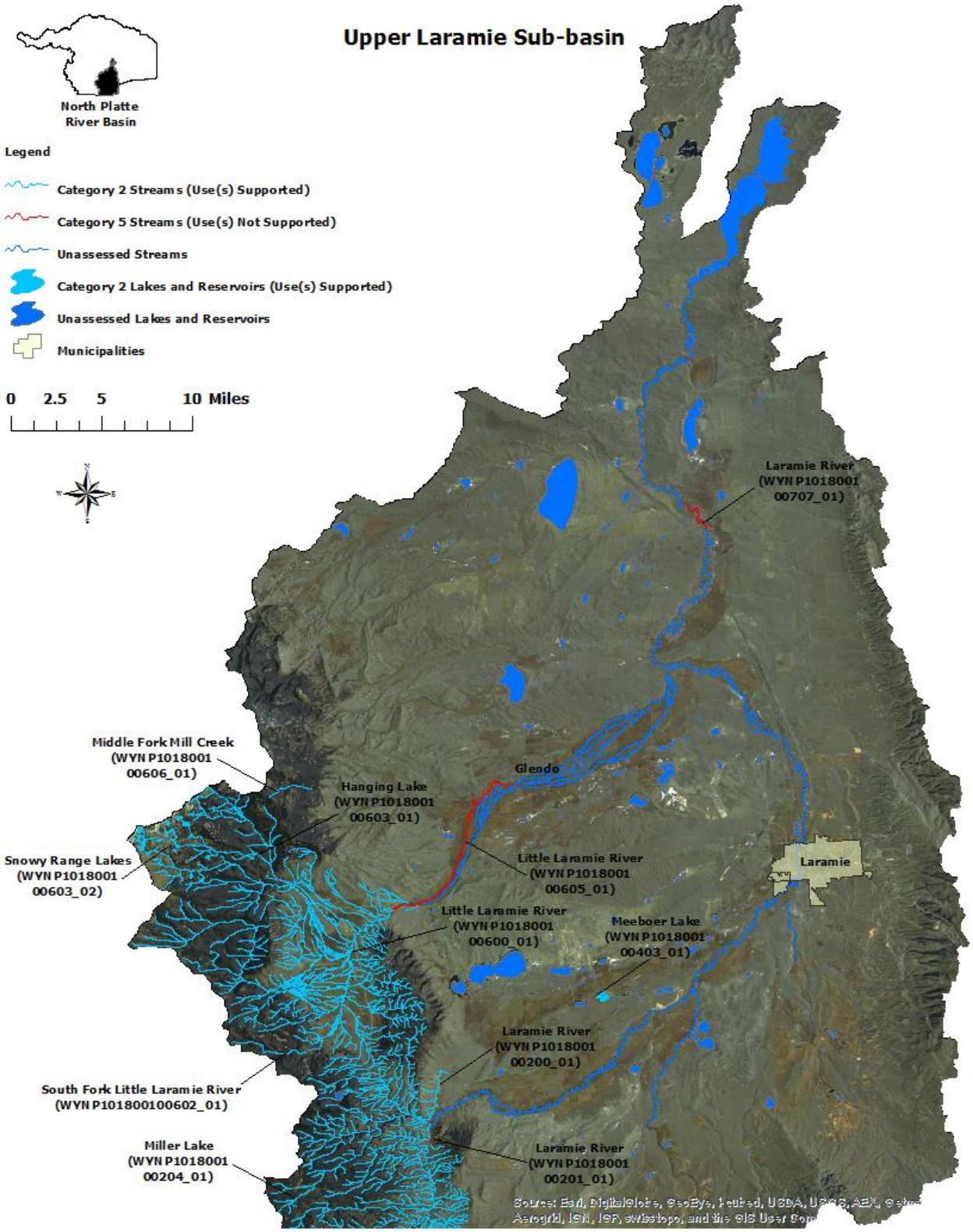
fishery by WGFD because it is very shallow and naturally winterkills. WDEQ (2006) collected chemical and physical data at three locations within Hanging Lake in 2002. The study found that the lake has abundant vegetation, low conductivity, and low alkalinity, which results in naturally elevated pH. The study concluded that Hanging Lake (WYNP101800100603_01) fully supports its aquatic life other than fish and cold water fishery uses.

Miller Lake is another small (4 acres) and shallow (average depth of 4.5 feet) subalpine lake located in the upper Fox Creek watershed within the Medicine Bow Mountain Range. Water from snowmelt runoff enters the lake from a diversion on Evans Creek and water eventually reenters Evans Creek through a spillway. WDEQ (2006) collected chemical and physical data using three study sites on Miller Lake in 2002. Elevated pH was likely due to natural conditions, including the lake's shallowness and high photosynthesis from macrophytes and phytoplankton. The winterkill of fish in the lake is an issue, but is thought to be due to the Lake's shallowness. The study concluded that Miller Lake (WYNP101800100204_01) fully supports its aquatic life other than fish and cold water fishery uses.

Meeboer Lake is a medium sized (113 acres) and shallow (average depth of 4 feet) lake located in the Laramie Plains Lake complex southwest of Laramie. Water enters the lake through groundwater inflows and exits through a canal that connects to Soda Lake. WDEQ (2006) collected chemical and physical data from the lake at 4 study sites in 2002. Water temperatures were somewhat elevated, but were attributed to the natural shallowness of the lake. Shoreline habitat condition were good along the least impacted northern edge of the lake. However, the western edge of the lake was heavily affected by foot and vehicle traffic, and was susceptible to erosion from wind and wave action. WGFD manages Meeboer Lake as a rainbow trout fishery and it is stocked annually because it naturally winterkills. To address this issue, WGFD installed aerators in 1994 and 1995 to maintain open ice and to reduce the potential for winterkill. Assessment by WDEQ indicates that Meeboer Lake (WYNP101800100403_01) fully supports its cold water fishery and aquatic life other than fish uses.

Laramie Rivers Conservation District (LRCD) initiated a restoration project on the Laramie River within the city of Laramie in 2009 to reduce bank erosion and sedimentation, improve trout habitat and educate the public about aquatic habitat restoration. Bank stabilization and habitat improvement structures included large wood, boulders, rip-rap and re-vegetation. The project was conducted in three phases spanning the years 2009-2011 and addressed 53 projects within a 3.6 mile segment. Data collected by the WGFD compared length and frequency of brown trout in the project area before (2008) and after (2012) restoration. Data indicated that the population's health has improved in overall abundance, larval recruitment and the larger size classes. WDEQ conducted water quality monitoring on the Laramie River within the city of Laramie in 2009 and 2010. It is anticipated that a final report for this project will be included in the 2016 Integrated 305(b) and 303(d) Report.

Data collected by LRCD on the Laramie and Little Laramie Rivers during the fall of 2010 and spring of 2011 showed that two segments of the Laramie River exceeded the *E. coli* criterion protective of primary contact recreational use; these segments include from State Highway 10 (near Woods Landing) to a point 0.3 miles upstream (WYNP101800100201_01) and a 2.9 mile segment below Bosler Junction (WYNP101800100707_01). In addition, data showed that the Little Laramie River (WYNP101800100605_01) also exceeded the primary recreational use criterion from Mandell Lane upstream to Snowy Range Road. All three of these segments were added to the 303(d) List in 2012; sources of bacteria are currently unknown. LRCD conducted additional *E. coli* sampling on the Laramie and Little Laramie Rivers during the spring and summer of 2012. The Laramie River near Woods Landing did not exceed the primary contact recreational criterion; however, the segments of the Little Laramie River from Mandell Lane upstream to Snowy Range Road and the Laramie River below Bosler Junction continued to have high bacterial concentrations.


Upper Laramie Sub-basin
North Platte River Basin
Legend
Category 2 Streams (Use(s) Supported)
Category 5 Streams (Use(s) Not Supported)
Unassessed Streams
Category 2 Lakes and Reservoirs (Use(s) Supported)
Unassessed Lakes and Reservoirs
Municipalities
0 2.5 5 10 Miles
Laramie River (WYNP1018001 00707_01)
Middle Fork Mill Creek (WYNP1018001 00606_01)
Hanging Lake (WYNP1018001 00603_01)
Glendo
Snowy Range Lakes (WYNP1018001 00603_02)
Little Laramie River (WYNP1018001 00605_01)
Laramie
Little Laramie River (WYNP1018001 00600_01)
Meeboer Lake (WYNP1018001 00403_01)
Laramie River (WYNP1018001 00200_01)
South Fork Little Laramie River (WYNP101800100602_01)
Miller Lake (WYNP1018001 00204_01)
Laramie River (WYNP1018001 00201_01)

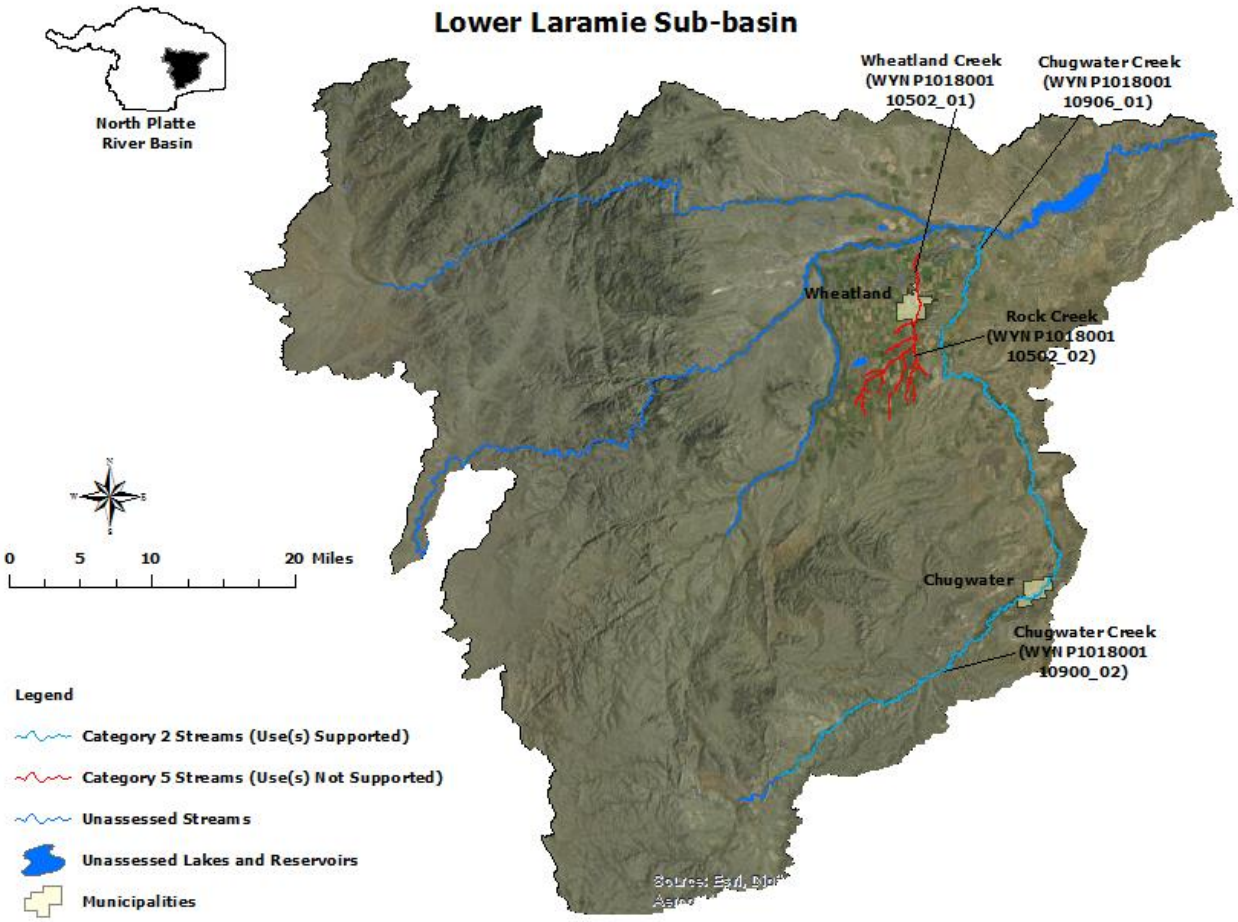
Lower Laramie Sub-basin (HUC 10180011)

The Laramie River in this sub-basin flows northeast from Wheatland Reservoir #2 and through the Laramie Mountain Range. The river then flows north of the town of Wheatland to Greyrocks Reservoir and ultimately confluences with the North Platte River near the town of Fort Laramie.

Rock Creek's headwaters are located to the south of the town of Wheatland. The creek flows northeast through Wheatland, where the name of the creek changes to Wheatland Creek. Wheatland Creek continues north to its confluence with the Laramie River near the Basin Electric Power Plant. Wheatland Creek below the town of Wheatland's WWTF has periodically exceeded WDEQ's ammonia and pH criteria since the 1980s and has also had issues with elevated fecal coliform and low dissolved oxygen. A segment of Wheatland Creek (WYNP101800110502_01) , from the confluence with Rock Creek downstream to Wheatland Highway was added to the 303(d) List in 1996 because WDEQ's ammonia and pH criteria were exceeded and the aquatic life other than fish and nongame fishery uses were not supported. To address the high ammonia concentrations in Wheatland Creek, the WWTF began using zeolite (a clay material) to remove ammonia from the plant's effluent. To evaluate the effectiveness of these changes on water quality in Wheatland Creek, WDEQ (2002) collected physical, chemical and biological data in 1998 using four study sites. Wheatland Creek below the town of Wheatland exceeded WDEQ's water quality criteria for ammonia and pH in the winter and spring; the town of Wheatland's WWTF was identified as the source of these pollutants. WDEQ (2002) later collected 40 fecal coliform bacteria samples during a 26 day period on Rock/Wheatland Creek in 2001 using eight study sites. Three study sites on Rock Creek exceeded WDEQ's recreational use criterion. The entire Rock Creek watershed (WYNP101800110502_02) above the confluence with Wheatland Creek was added to the 303(d) List in 2002 for not supporting the recreation designated use. In addition, a segment of Wheatland Creek (WYNP101800110502_01), from the confluence with Rock Creek downstream to Wheatland Highway was added to the 303(d) List in 2002 for fecal coliform and the source is unknown. The Platte County Conservation District (PCNRD) sponsored watershed planning to identify and address sources of fecal contamination in Rock Creek and a Rock Creek watershed plan was completed in 2007. To date, 79 irrigation efficiency, 12 water quality improvement, 12 grazing management and 32 wildlife habitat enhancement projects have been implemented; these projects were implemented primarily using NRCS funding. Two AFO relocation projects have also occurred in the drainage (WACD 2011). In 2008 the town of Wheatland's WWTF went to a non-discharging treatment facility; instead of discharging to Wheatland Creek, all of the treated water from the WWTF is piped to an adjacent farm where it is stored in two reservoirs and used for crop irrigation. Because the source of elevated ammonia and pH to Wheatland Creek has been eliminated, these two impairments have been removed from the 303(d) List in 2014.

WDEQ monitored and assessed Chugwater Creek in 1998. Data showed that the Chugwater Creek (WYNP101800110906_01) supported its aquatic life other than fish uses above Antelope Gap Road west of Wheatland, but nutrients were noted as a concern. The assessment also indicated that the physical and biological character of the creek changed substantially within a reach below Antelope Gap Road. Specifically, the streambed was dominated by highly mobile sand, a substrate which is poor habitat for most macroinvertebrate taxa. WGFD fish data showed a corresponding reduction in fish community richness. PCNRD conducted monitoring on Chugwater Creek in 2000 and 2001 to better define the extent of the degraded reach. As a result, a segment of Chugwater Creek (WYNP101800110906_02) extending from above an irrigation diversion in NE SW S26 T25N R67W upstream an undetermined distance below Antelope Gap Road was added to the 303(d) List in 2000 as threatened because sedimentation from unknown sources threatened the cold water fisheries and aquatic life other than fish uses. Restoration efforts by landowners, WGFD and Pheasants Forever to improve riparian conditions and wildlife habitat were later implemented along the threatened reach of Chugwater Creek. These efforts mostly involved the installation of riparian fencing in grazed pastures. Additionally, the irrigation district built a small reservoir on a bench above the creek to improve irrigation efficiency by capturing excess irrigation water and converted some flood irrigation to sprinkler irrigation.

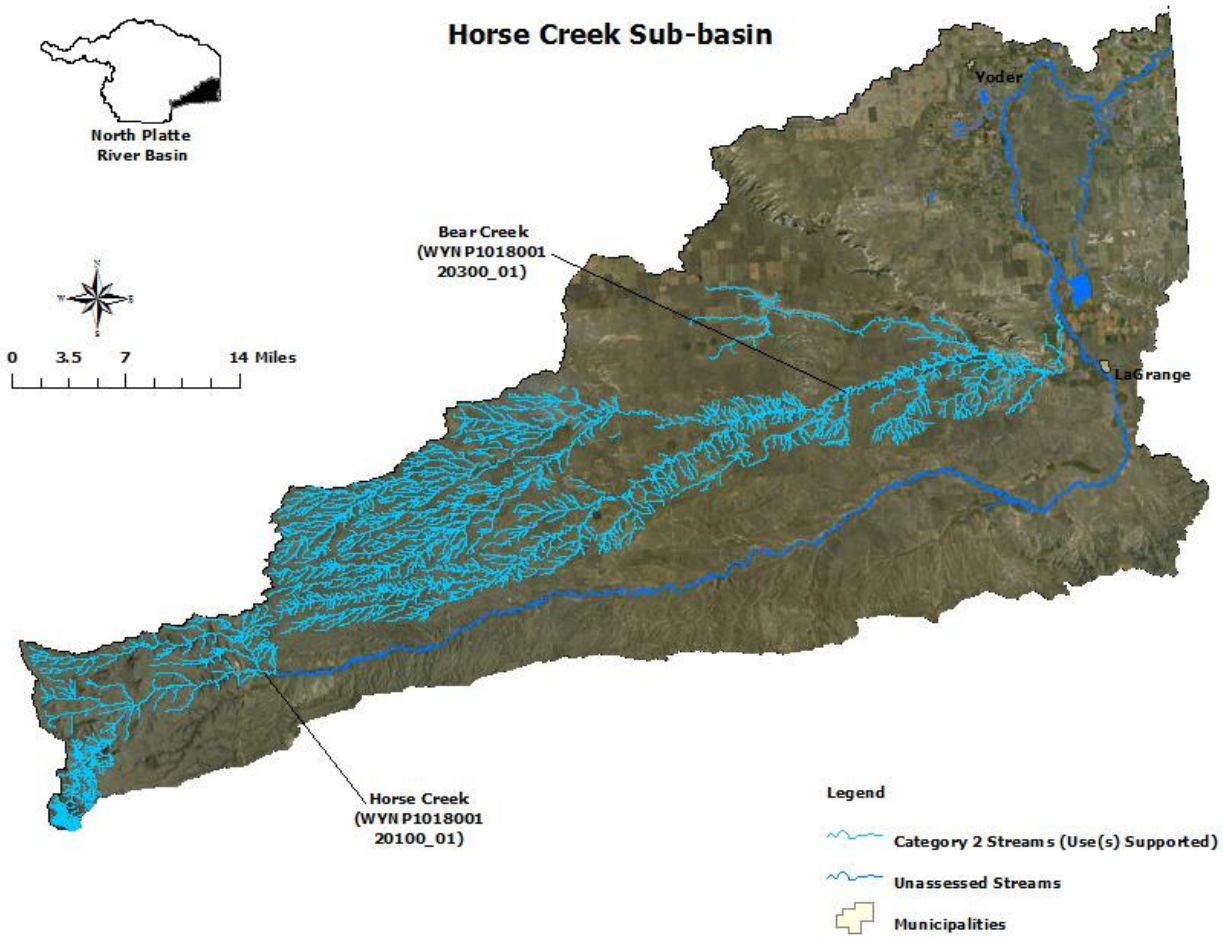
In 2005, the Water and Waste Advisory Board met to consider comments about the decision by WDEQ to list Chugwater Creek and to consider a petition by PCNRD to delist the creek. It was decided that a technical review team (TRT), mediated by the Wyoming Department of Agriculture (WDA), would further investigate Chugwater Creek. The TRT consisted of a panel of four experts in the fields of water quality, geomorphology, range science and soil science to assist in making a final determination on the condition of the threatened stream reach. This determination was to include whether additional data were necessary to accurately assess creek conditions, an assessment of general watershed health and the preparation of a summary report of recommendations. WDEQ and PCRD were available to respond to questions by the TRT, and conducted a site visit of Chugwater Creek. Chemical and physical parameters, including stream temperature, pH, electrical conductivity, dissolved oxygen and oxygen saturation, were measured during the visit, and locations in the upper, middle and lower watershed were assessed for impacts from sediment. The TRT concluded that the 1998 WDEQ assessment did not reflect current conditions and that excess sediment was no longer evident in the listed reach. The TRT also noted that riparian areas had been fenced, grazing periodicity and duration had changed and that streambanks appeared stable. Lastly, the TRT noted that vegetation was now colonizing point bars along the reach. The TRT suggested that water gaps supplied minimal off-channel sediment and that these were necessary for livestock management. WDEQ concluded that the changed management practices within the Chugwater Creek watershed had addressed the sediment threats to this reach and it was removed from the 303(d) List in 2008. The restoration and de-listing of Chugwater Creek has been approved by USEPA as a Section 319 nonpoint source pollution success story.



Horse Creek Sub-basin (HUC 10180012)

The headwaters of the Horse Creek Sub-basin are located in the Laramie Mountain Range. The creek flows northeast across the high plains, then north past Hawk Springs and Goshen Hole Reservoirs and east across the Wyoming/Nebraska border. WDEQ monitored and assessed the upper Horse Creek watershed (WYNP101800120100_01) by collecting physical, chemical and biological data at two study sites in 1999 and 2000. Results of the study indicated that the entire watershed upstream of the confluence with South Fork Horse Creek fully supported its cold water fishery and aquatic life other than fish uses. A final report was not written for this study.

The headwaters of Bear Creek are located in the foothills of the Laramie Mountain Range. The creek flows northeast to its confluence with Horse Creek near the town of La Grange. Physical, chemical and biological data were collected by WDEQ (2003) at 14 sites in 1999. Results indicated that there were no exceedances of any WDEQ water chemistry criteria; however, elevated water temperatures are a concern in the lower watershed. Macroinvertebrate data indicated that there was a decline in water quality in the middle reaches of the watershed, possibly due to sedimentation. The study concluded that the entire Bear Creek watershed (WYNP101800120300_01) upstream from the confluence with Horse Creek is meeting its cold water fishery and aquatic life other than fish uses.



8.10 Powder River Basin

The Powder River drains approximately 10,706 mi^2 in northeastern Wyoming. The Powder River's headwaters are located within the Bighorn Mountain Range and the Casper Arch, which are located to the west and south within the basin, respectively. The Powder River flows northeast through a large expanse of the Northwestern Great Plains before entering Montana near the town of Moorhead, Montana. Nearly all of the naturally perennial streams that reach the Powder River originate in the Bighorn Mountains. In contrast, streams originating in lower portions of the basin are typically ephemeral and flow only in response to snowmelt or rainfall events unless receiving discharge water from point sources .

The Powder River Basin is composed of two level III and six level IV ecoregions (Chapman et al. 2003). The western portion of the basin includes alpine zone, granitic subalpine zone and dry mid-elevation sedimentary mountains of the Bighorn Mountain Range within the Bighorn National Forest. The alpine zone is characterized by high precipitation and rockland, talus, tundra and glacial lakes. Vegetation consists mostly of forbs, sedges and grasses. This ecoregion transitions to the lower elevation granitic subalpine zone, a region which was once covered in sedimentary rock, but now has exposed granite cores following natural erosion. Vegetation consists of mixed forest with an understory of shrubs and grasses. The mountains ultimately transition to the steep gradient dry mid-elevation mountains, consisting of shale foothills, limestone bluffs, sandstone flatirons and forested canyons. Forested areas are patchy due to low precipitation and are dominated by shrubs and grasses. Land uses in the Bighorn Mountains include livestock grazing, wildlife habitat, recreation. The remainder of the basin consists of the lower elevation semiarid Northwestern Great Plains. Soils in this ecoregion consist mostly of shale and sandstone and are often alkaline. Located to the northwest of the city of Casper, The Casper Arch is a transitional area between the Wyoming Basin and the Northwestern Great Plains. The Powder River Basin occupies most of the remainder of the basin with occasional outcrops of the Pine Scoria Hills. Land uses in the basin include coal mining, oil and gas production, livestock grazing, recreation and wildlife habitat. Wohl et. al. (2007) reported that many streams within the Bighorn National Forest have been substantially impacted by cattle grazing, irrigated crop production, flow regulation and diversion, and timber harvest.

Coal bed methane (CBM) production in the Powder River Basin began in the late 1990s, peaked in July, 2009 and has since steadily declined. According to WYPDES, approximately 483 CBM permits, including 3,823 outfalls were present in the Powder River Basin during 2009, whereas approximately 214 permits and 1651 outfalls were present as of August, 2014. The Powder River Basin Interagency Working Group (PRBIWG) was developed to address management issues associated with CBM development in the Powder River Basin in Wyoming and Montana. This group of multiple state (including WDEQ) and federal agencies meets periodically to address issues associated with CBM monitoring and permitting. The group's mission is to provide environmentally responsible CBM development through the use of proper BMPs. Through this cooperative effort, each agency is expected to achieve greater operational efficiency, enhance resource protection and better serve the public. Particular attention has been given to the possibility of cross-border effects of CBM discharge on downstream segments of the Powder River in Montana. To monitor the potential effects of CBM development on natural resources (e.g. water quality and quantity, aquatic life, wildlife and air), both the water quality and aquatic life monitoring task groups were formed and monitoring plans developed for the affected areas of NE Wyoming (see inset map). The USGS has been contracted to do most of the water quality and aquatic life monitoring in the affected region of Wyoming. Several internet resources

are available; including a USGS website and fact sheet; the USGS Water Quality Monitoring Plan; and water quality and aquatic life monitoring plans. USGS (2009c) reported on the ecology of the Powder River Structural Basin in Wyoming and Montana for the years 2005 and 2006. The study indicated that the biological condition of the mainstem Tongue River and the Powder River above and below Salt Creek and between Crazy Woman and Clear Creeks decreased from upstream to downstream. Most streams in the Powder River basin, however, showed a general trend of increasing biological condition from upstream to downstream. A second USGS (2010a) report for the Powder River Structural Basin, spanning the years 2005-2008, was completed in 2010. The goals of the study were to determine the current aquatic ecological conditions and to identify, where possible, the current and future effects of CBM produced water on the aquatic life of the basin. The study found that relatively few of WDEQ's chronic or acute aquatic life criteria were exceeded during the study period. In general, tributaries to the Tongue River had macroinvertebrate communities that were less pollution tolerant than those in the mainstem Tongue River. The macroinvertebrate and algal communities along the Powder River were significantly more pollution tolerant between the confluence with Willow Creek downstream to the confluence with Crazy Woman Creek than the communities above and below this segment. The report was inconclusive as to these causes of these biological patterns. Fish communities were relatively similar throughout the Powder River. Alkalinity, which was used to indicate the influence of CBM produced water, was similar throughout most of the mainstem of the Powder River. An exception to this pattern was noted below the confluence with Burger Draw, where alkalinity was relatively high; however, the same location also had the highest diversity of fish of any site sampled during this study. Sturgeon chub, a native fish in the Powder River Basin, is considered rare by WGFD. The fish is currently only found in the Powder River in Wyoming, and is believed to be adapted to turbid water. USGS (2013) analyzed trends in water quality data for several chemical constituents collected between 1980 and 2010 within the Tongue and Powder River basins. Specifically, conductivity, calcium, magnesium, potassium, sodium adsorption ratio, sodium, alkalinity, chloride, fluoride, dissolved sulfate, and dissolved solids were compared across 16 study sites. The report summarizes general water quality trends, and discusses the potential effects of bicarbonate on aquatic life and sodium on soils.

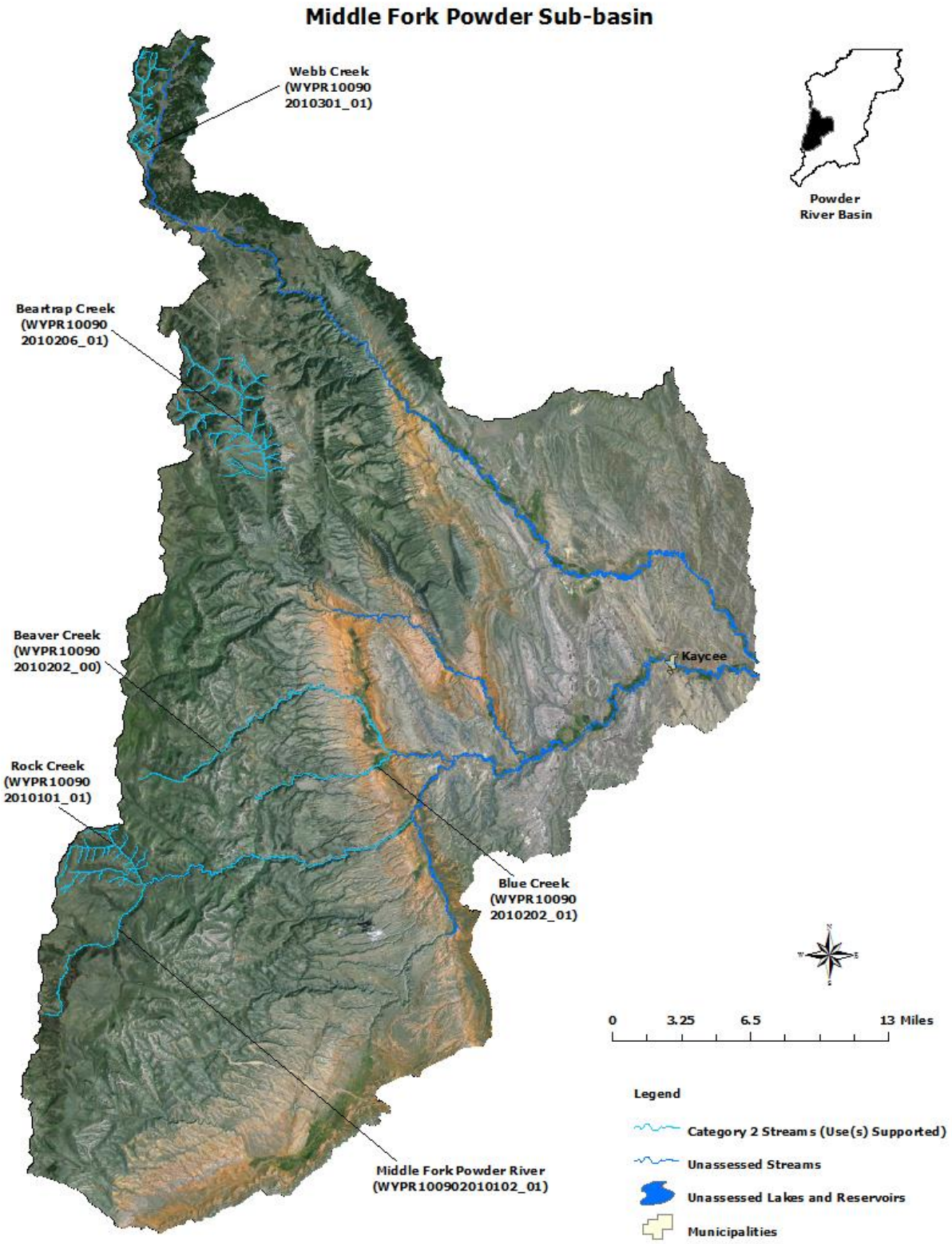
Salt Creek and Meadow Creek have instantaneous maximum site specific chloride criteria of 1,600 mg/L that cannot be exceeded at any time. Lastly, the Powder River below the confluence with Salt Creek has an instantaneous maximum site specific chloride criterion of 984 mg/L that cannot be exceeded at any time.

Middle Fork Powder Sub-basin (HUC 10090201)

The headwaters of the Middle Fork Powder River are located in the southern Bighorn Mountains. The river flows northeast through a steep canyon and the WGFD's Ed O Taylor Wildlife Habitat Management Area. The river ultimately confluences with the South Fork Powder River to form the Powder River approximately 12 miles west of the town of Sussex. WDEQ collected physical, chemical and biological data at several sites along the Middle Fork Powder River (WYPR100902010102_01) and Blue (WYPR100902010202_01) and Rock Creeks (WYPR100902010101_01) during 1993, 1997-1999 and 2007. Data indicate that all of these waters support their coldwater fishery and aquatic life other than fish uses. Final reports were not written for these studies.

Beaver Creek is a small tributary to the Middle Fork Powder River. WDEQ (2003) collected physical, chemical and biological data from a single assessment site near the town of Barnum in 1999. All measured water chemistries were below WDEQ criteria. Habitat quality was very good except for the presence of excess fine sediments that were determined to be from natural sources. The report indicated that Beaver Creek (WYPR100902010202_00) is supporting its coldwater fishery and aquatic life other than fish uses from the confluence with Blue Creek to a point 19.0 miles upstream.

Beartrap Creek is a spring fed stream located in the southern Bighorn Mountain Range and is a tributary of the North Fork Red Fork Powder River. Historically, the upper Beartrap Creek drainage has been used


Middle Fork Powder Sub-basin
Webb Creek (WYPR10090 2010301_01)
Powder River Basin
Beartrap Creek (WYPR10090 2010206_01)
Beaver Creek (WYPR10090 2010202_00)
Kaycee
Rock Creek (WYPR10090 2010101_01)
Blue Creek (WYPR10090 2010202_01)
Middle Fork Powder River (WYPR100902010102_01)
0 3.25 6.5 13 Miles
Legend
Category 2 Streams (Use(s) Supported)
Unassessed Streams
Unassessed Lakes and Reservoirs
Municipalities

as a stock driveway and holding ground. However, management practices have changed over the past twenty years, and livestock now have limited access to streams and are moved through the drainage relatively quickly during a short period in spring and fall. Log drop structures were installed in Beartrap Creek by BLM and WGFD in 1989 to create additional pool and riffle habitats. WDEQ (2008) collected physical chemical and biological data at one site in 1998, 1999 and 2002. All measured water chemistries were below WDEQ's criteria. Habitat quality was good, with abundant pools and an intact riparian zone. The presence of pollution sensitive macroinvertebrate taxa indicated that water quality was good. Beartrap Creek (WYPR100902010206_01) was determined to be fully supporting its coldwater fishery and aquatic life other than fish uses within the entire watershed upstream of the confluence with the Middle Fork Powder River.

Webb Creek is a small tributary to the North Fork Powder River. WDEQ (2004) collected physical, chemical and biological data from one study site in 1998 to address concerns that the aquatic life uses were threatened due to physical degradation of the stream's riparian zone. Results of this study indicated that there were no exceedances of any measured WDEQ water chemistry criteria and that habitat quality and the macroinvertebrate community were in good condition. Thus, the entire Webb Creek watershed (WYPR100902010301_01) upstream of the confluence with the North Fork Powder River was determined to be fully supporting its coldwater fishery and aquatic life other than fish uses.

Upper Powder River Sub-basin (HUC 10090202)

The headwaters of Pumpkin Creek are located north of Pumpkin Buttes in southeastern Campbell County. The creek then flows northwest to its confluence with the Powder River. WDEQ (2003) made physical and biological observations at a single site on Pumpkin Creek in 1999. Designated use support was not assessed.

The headwaters of Fortification Creek are located near Kinney Divide, approximately 15 miles east of the City of Gillette. The creek follows the divide for approximately 20 miles before it confluences with the Powder River. WDEQ (2004) collected only physical data and other information at six study sites along Fortification Creek in 1999 because the stream channel was dry. The resulting report concluded that Fortification Creek is naturally ephemeral and likely only flows during periodic precipitation events. Data and other information were insufficient to determine designated use support.

The headwaters of Fourmile Creek are locate approximately 20 miles northwest of the town of Kaycee. The creek flows east approximately ten miles to its confluence with the Powder River. WDEQ (2005) collected physical data at one study site in 1999. The study found that most of the watershed is ephemeral, with the exception of several on-channel ponds and reservoirs. Streambanks were moderately stable with little sedimentation. The report concluded that the aquatic life other than fish use on Fourmile Creek (WYPR100902020104_01) is fully supported within the entire watershed upstream from the confluence with the Powder River and this water was placed in category 2 in 2006.

The headwaters of Ninemile Creek are located approximately ten miles northeast of the town of Kaycee. The creek flows east approximately 40 miles to its confluence with the Powder River. WDEQ (2005) collected physical data at four study sites along Ninemile Creek in 1998-1999. The report found that, similar to Fourmile Creek, the Ninemile Creek watershed is ephemeral except for on-channel ponds and reservoirs. Localized channel instability was considered moderate, and no excessive sedimentation was present. The report concluded that the entire Ninemile Creek watershed (WYPR100902020100_01) upstream from the confluence with the Powder River was fully supporting its aquatic life other than fish use and this water was placed in category 2 in 2006.

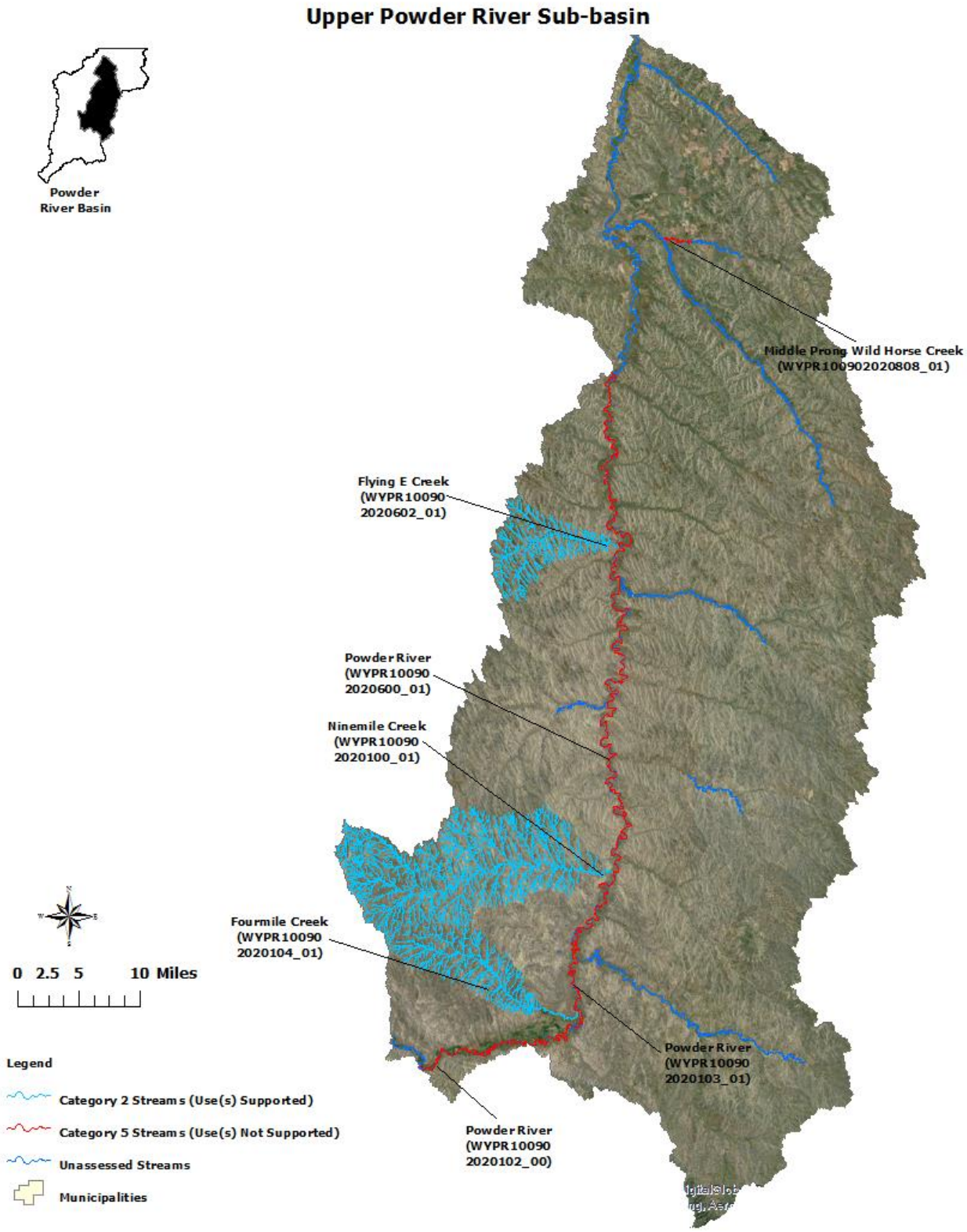
USGS gage (station 06313500) data has shown that that WDEQ's aquatic life chronic selenium criterion has been regularly exceeded in the Powder River at Sussex, Wyoming. Therefore, a segment of the Powder River from the confluence with Salt Creek upstream 15.9 miles to the confluence with the South

Fork Powder River was added to the 303(d) List in 2000. Data from this gage have continued to show exceedances of the criterion as recently as 2010. The same USGS gage data (06313500) has also shown that this segment exceeds WDEQ's aquatic life chronic chloride criterion. Therefore, the Powder River from the confluence with Salt Creek downstream to the confluence with Soldier Creek was placed on the 303(d) List in 1998 because data indicate that the aquatic life other than fish and warm water fishery uses are not supported. A site specific chloride criterion of 984 mg/L was adopted by WDEQ in 2007 for the Powder River below Salt Creek, although USGS gage (06313500) data have shown that this site specific criterion has been exceeded on several occasions. Therefore the impaired segment remains on the 303(d) List. Much of the chloride loading to the Powder River originates in the Salt Creek watershed. Data collected from this gage between 2003 and 2010 have shown that the chronic selenium criterion continues to be regularly exceeded. Data collected from the same USGS gage during 2009 and 2010 showed that the Powder River exceeded WDEQ's total arsenic criterion protective of drinking water along the same segment and it was added to the 303(d) List in 2012 for this pollutant. Data collected at the USGS Salt Creek gage (#06313400) data USGS Salt Creek sampling station indicate that this tributary contributes arsenic to the Powder River, but the source(s) of arsenic within the Salt Creek watershed is unknown.

WDEQ's aquatic life chronic selenium and total arsenic criteria protective of drinking water designated use have also been exceeded along the Powder River at USGS gages above (station 06313590) and below (station 06313605) Burger Draw near the town of Buffalo and at a gage (station 06317000) near Arvada. These data resulted in a 100.6 mile segment, extending from the confluence with Soldier Creek downstream to the confluence with Crazy Woman Creek being added to the 303(d) List for selenium in 2000 and for arsenic in 2012. The Powder River is not used a public drinking water supply.

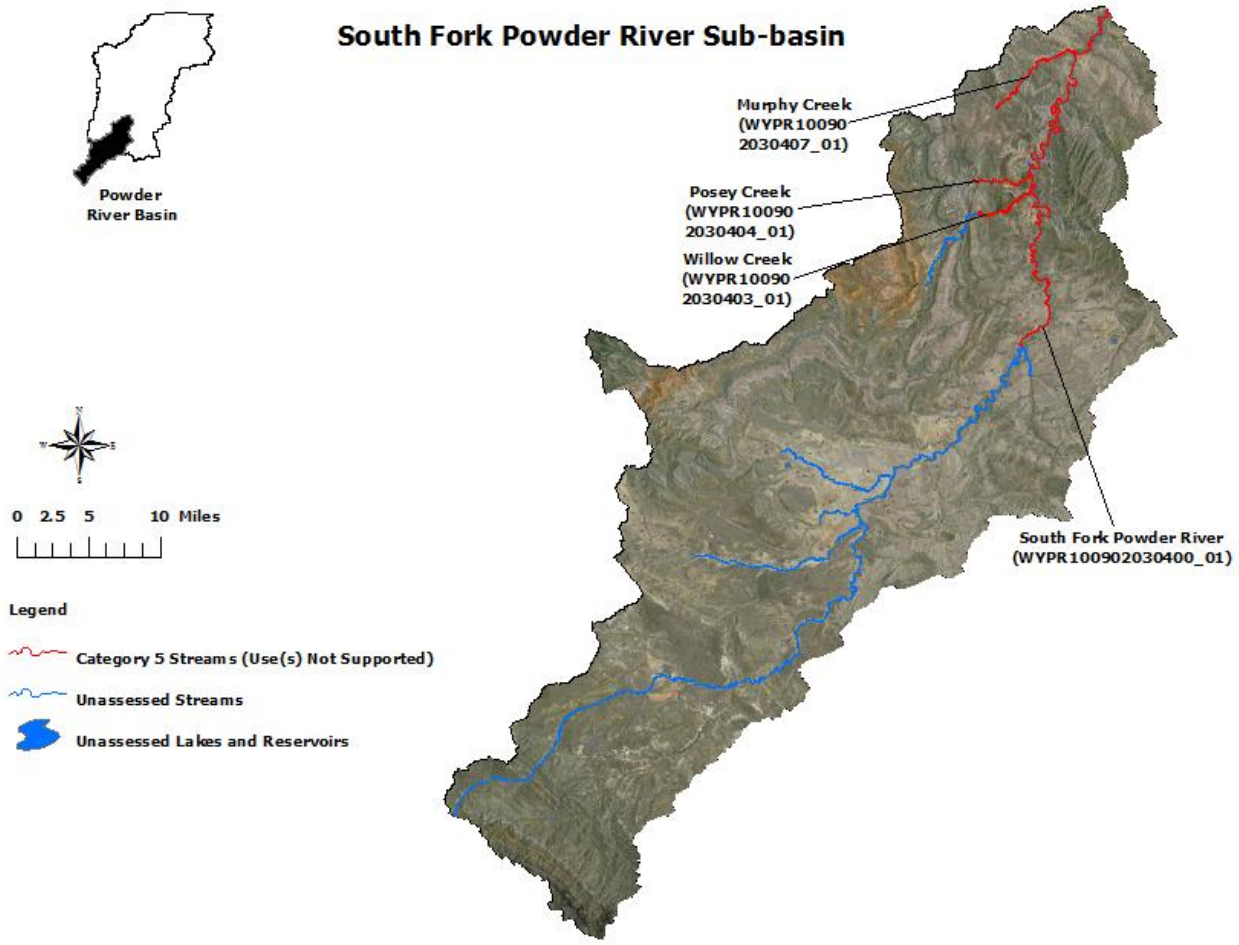
The headwaters of Wildhorse Creek are located east of Arvada in western Campbell County. The creek flows west to its confluence with the Powder River at Arvada. Campbell County Conservation District (CCCD) monitored portions of the Middle Prong of Wild Horse Creek watershed during 2002-2003 as part of the Belle Fourche and Powder River Watersheds Water Quality Data and Analysis Section 319 Report. Data indicated that WDEQ's fecal coliform criterion was exceeded twice in 2003 at a single study site in the lower Middle Prong of Wild Horse Creek. Middle Prong Wildhorse Creek (WYPR100902020808_01) was added to the 303(d) List in 2006 for not supporting its recreational use from its confluence with Wild Horse Creek to a point 4.6 miles upstream and this water was placed in category 2. The source of this impairment is unknown. CCCD and NRCS have assisted landowners in implementing 13 water quality improvement projects in the watershed. CCCD sponsored the Donkey/Stonepile Creek Sub-Watersheds, Little Powder River Sub-Watershed and Upper/Middle Powder River Watershed 2007-2009 Section 319 Project. The goals of this project were to monitor bacterial, chloride and ammonia concentrations in these watersheds, including one study site along Middle Prong Wildhorse Creek. Results showed that the creek continued to exceed WDEQ's recreational use criterion in 2008 and 2009. Local stakeholders and CCCD initiated watershed planning in this watershed in 2007 (WACD 2011).

The headwaters of Flying E Creek are located approximately 19 miles east of the town of Buffalo. This ephemeral creek flows approximately 11 miles northeast to its confluence with the Powder River. WDEQ (2003) assessed Flying E Creek using five study sites in 1999. No data were collected because the stream channel was dry during site visits. The aquatic life other than fish use was determined to be fully supported throughout the entire Flying E. Creek (WYPR100902020602_01) watershed upstream from the confluence with the Powder River.


Upper Powder River Sub-basin
Powder River Basin
Middle Prong Wild Horse Creek (WYPR100902020808_01)
Flying E Creek (WYPR10090 2020602_01)
Powder River (WYPR10090 2020600_01)
Ninemile Creek (WYPR10090 2020100_01)
Fourmile Creek (WYPR10090 2020104_01)
Powder River (WYPR10090 2020103_01)
Powder River (WYPR10090 2020102_00)
0 2.5 5 10 Miles
Legend
Category 2 Streams (Use(s) Supported)
Category 5 Streams (Use(s) Not Supported)
Unassessed Streams
Municipalities

South Fork Powder Sub-basin (HUC 10090203)

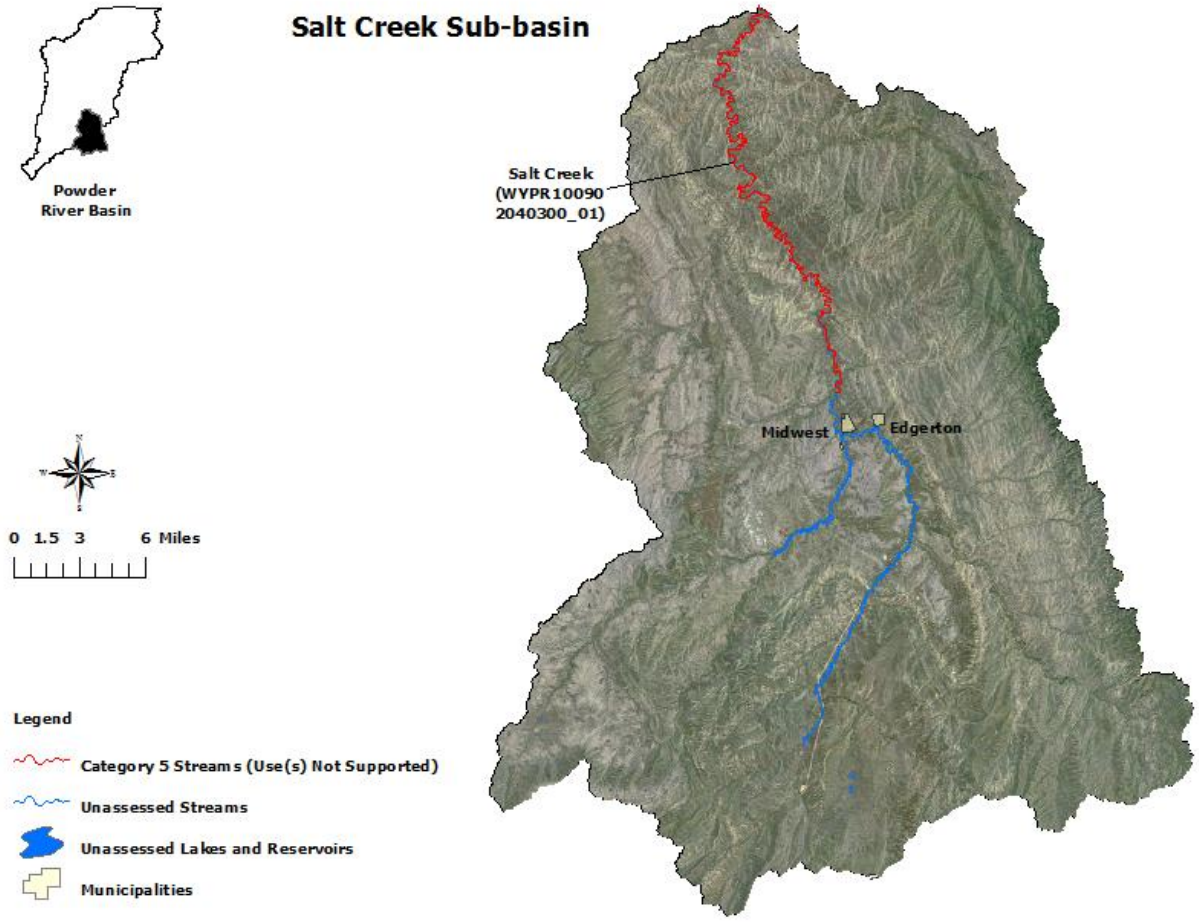
The headwaters of the South Fork Powder River are located in the Gas Hills in western Natrona County. The river flows northeast to its confluence with Middle Fork Powder River near the town of Kaycee. The South Fork and Middle Fork Powder Rivers combine to form the Powder River. The Powder River Conservation District (PRCD) sponsored the South Fork/Salt Creek Water Quality Monitoring Section 319 Project to monitor the water quality of the Powder River, South Fork Powder River and Salt Creek watersheds. Monitoring was conducted between 2003 and 2006 and a final report was completed in 2007. Thirteen selenium samples were collected at two study sites between 2003 and 2004 along the South Fork Powder River. Results showed that the river exceeded WDEQ's chronic aquatic life selenium criterion regularly at both sites during this period, with values ranging from 6-23 µg/L. As a result, a segment of the South Fork Powder River (WYPR100902030400_01) from the confluence with Cloud Creek to a point 47.2 miles downstream was added to the 303(d) List in 2006. Willow Creek is a major tributary to the South Fork Powder River. Seven selenium samples were collected from a single study site on Willow Creek in 2004 between April and October. Concentrations exceeded the chronic aquatic life selenium criterion on all seven sampling events and ranged from 6-127 µg/L. A segment of Willow Creek (WYPR100902030403_01) from the confluence with the South Fork Powder River to a point 10.5 miles upstream was added to the 303(d) List in 2006. Murphy and Posey Creeks are both small tributaries to the South Fork Powder River. Selenium samples were collected on Murphy and Posey Creeks in 2005 and 2006. Data indicated that both of these streams regularly exceeded WDEQ's chronic aquatic life selenium criterion, with concentrations ranging from 5-22 µg/L on Murphy Creek and from 5-154 µg/L on Posey Creek.



Both creeks were added to the 303(d) List in 2008; including Murphy Creek (WYPR100902030407_01) from the confluence with the South Fork Powder River to a point 12.2 miles upstream and Posey Creek (WYPR100902030404_01) from the confluence with the South Fork Powder River to a point 8.0 miles upstream. The sources of selenium loading for both creeks may include the natural geology of the area; WDEQ is currently developing site specific criteria for the Murphy Creek watershed. However, irrigated agriculture in contact with marine shales is another possible source in the Posey Creek watershed. WDEQ (2003) collected physical, chemical and biological data from one study site on Posey Creek in 1999. The report noted that the stream channel was channelized and that larger streambed substrate was embedded by silt. No measured WDEQ water chemistry criteria were exceeded during this study. Pollution tolerant taxa dominated the macroinvertebrate community. Data collected during this study were insufficient to make a designated use support determination on Posey Creek.

Salt Creek Sub-basin (HUC 10090204)

The headwaters of the Salt Creek watershed are located along the western edge of Pine Ridge in western Converse County. Salt Creek flows northwest to its confluence with the Powder River near the community of Sussex. Several natural oil seeps occur within the Salt Creek watershed, which prompted the development of several oil fields beginning in 1908. While most reaches in this semi-arid sub-basin are naturally ephemeral or intermittent, some segments of Salt Creek now have perennial flow due to oil treater discharges. Salt Creek (WYPR100902040300_01) was added to the 303(d) List in 1996 as threatened due to the regular occurrence of oil and produced water spills in the watershed near the town of Midwest. Much of the oil field infrastructure dates to the 1960s, and spills had been primarily due to the age of the infrastructure, including bacterial corrosion in the injection lines. The current operator has



developed a long term upgrade and maintenance plan to reduce the potential for large spills that may affect water quality. The operator has also started using CO_2 flood injection to enhance oil recovery. Switching to CO_2 flood injection has further reduced the occurrence of spills because it has required that injection and production lines be replaced. Lastly, a biocide treatment has been added to many water lines since 2003 to reduce bacterial corrosion. Salt Creek was monitored and assessed by WDEQ in 1996 using study sites located near the town of Midwest. The investigation found that oil and grease deposits occurred at two locations just above the confluence with Castle Creek. A segment of Salt Creek, from the confluence with the Powder River to a point 45.3 miles upstream was added to the 303(d) List in 1996; the source of oil and grease was identified as petroleum production. A final report was not written for this study. The Powder River Conservation District (PRCD) sponsored the South Fork/Salt Creek Water Quality Monitoring Section 319 Project to monitor the water quality of the Powder River, South Fork Powder River and Salt Creek. Monitoring was conducted between 2003 and 2006 and a final report was completed in 2007. Data were collected at seven study sites within the Salt Creek watershed by PRCD. The study found that the chloride concentrations in Salt Creek and the Powder River below the confluence with Salt Creek were high due to oil field discharges. The study also found that selenium concentrations did not exceed WDEQ's chronic aquatic life selenium criterion at the sites sampled. USGS gage data (station 06313400) have shown that chloride concentrations have exceeded Wyoming's aquatic life chronic chloride criterion and a segment from the confluence to the Powder River to an undetermined distance upstream was added to the 303(d) List in 2002. A site-specific chloride criterion of 1,600 mg/L for Salt Creek was approved by USEPA in 2008; this value is an instantaneous value that is not to be exceeded at any time. The segment was subsequently removed from the 303(d) List in 2008. Data collected as part of the site-specific chloride criteria on Salt Creek showed exceedances of the aquatic life chronic selenium criterion. A segment of Salt Creek (WYPR100902040300_01) from the confluence with the Powder River to a point 45.3 miles upstream was added on the 303(d) List in 2008. It is unknown whether the primary source of selenium loading is natural or anthropogenic, but both of these sources are likely contributors.

Crazy Woman Sub-basin (HUC 10090205)

The headwaters of the Crazy Woman watershed are located along the eastern slope of the Big Horn Mountains. Crazy Woman Creek begins at that confluence of the North and Middle Forks of Crazy Woman Creeks, then flows northeast to its confluence with the Powder River near the community of Arvada.

USEPA has established National Secondary Drinking Water Regulations that set water quality standards for 15 contaminants, including manganese. USEPA does not enforce these secondary maximum contaminant levels (SMCLs). Instead, they are intended to serve as guidelines to assist public water systems in managing their drinking water for aesthetic considerations, such as taste, color and odor. These contaminants are not considered to present a risk to human health at these SMCLs (USEPA, 1992). Wyoming's aesthetic drinking water criterion for manganese is set at the USEPA SMCL. However, high manganese concentrations are common in streams in the Powder River Structural Basin due to the natural geology (Wasatch and Fort Union Geologic Formations), and thus much of the basin does not have a human health criterion for this pollutant in Chapter 1. USGS gage data (station 06316400) showed that Crazy Woman Creek (WYPR100902050305_01) regularly exceeded the aesthetic drinking water criterion for manganese between 1999 and 2001. A segment extending from the confluence with the Powder River to a point 9.2 miles upstream was added to the 303(d) List in 2002. The aquatic life other than fish chronic criterion for manganese has not been exceeded on lower Crazy Woman Creek. There are no known anthropogenic sources of manganese in Lower Crazy Woman Creek and it is unlikely that the creek will ever be used as a drinking water source due to its intermittent hydrology. Chapter 1 specifies that secondary drinking water criteria only apply to those waters that are being used as a drinking water source. This segment will be reassessed for the 2016 Integrated Report.

North Fork Crazy Woman Creek's (NFCWC) headwaters are located near Powder Pass along the east slope of the Bighorn Mountains. The creek flows southeast to its confluence with the Middle and South Forks of Crazy Woman Creek, forming Crazy Woman Creek. NFCWC was added to the 303(d) List in 1996

due to water quality threats from habitat degradation, nutrients and bioindicators. A mistake was made when bioindicators was added as a cause of the impairment and it was removed from the 303(d) List in 2012. Twenty two BMP projects were completed as part of a 319(h) grant on NFCWC during the 1990's, focusing mainly on improving irrigation efficiency, relocating livestock corrals away from riparian zones and planting riparian vegetation. Bio-West was contracted by WDEQ to analyze all available data and other information and to determine the effectiveness of the project at reducing nutrients and improving habitat. The final report completed by Bio-West (2001) was inconclusive. WDEQ (2003) collected physical, chemical and biological data at a single study site in 1993 and 1998. Although the habitat appeared to improve following BMPs, the biological community declined slightly, possibly in response to drought. In 2008, WDEQ (2014) again monitored NFCWC to determine designated use support. Data collected in 2008 were combined with historic data and information to make designated use support determinations. The study concluded that habitat degradation is no longer a threat. Study results suggested stable banks, reduced channel incision and little evidence of sedimentation. The evidence of sedimentation that did exist occurred within downstream reaches and was attributed to a reduction in stream gradient and flow alterations. Nutrient and chlorophyll a concentrations were mostly low, indicating that there were no longer threats to the aquatic life other than fish and cold water fisheries uses from nutrients. The habitat degradation and nutrient threats on NFCWC are considered remediated and both impairments have been removed from the 303(d) List in 2014, and a segment of NFCWC (WYPR100902050100_01) extending from Muddy Creek Road to a point 22.6 miles upstream is considered to be fully supporting its cold water fishery, aquatic life other than fish and drinking water uses. NFCWC below this segment is heavily utilized for irrigated agriculture and the natural streamflow regime is highly altered. The report concluded that secondary stressors associated with flow alterations (i.e. surface water withdrawals) during the spring and summer have degraded macroinvertebrate and fish communities. NFCWC (WYPR100902050102_01) from Muddy Creek Road downstream 28 miles to the confluence with Middle Fork Crazy Woman Creek was placed in category 4C of the 2014 Integrated Report.

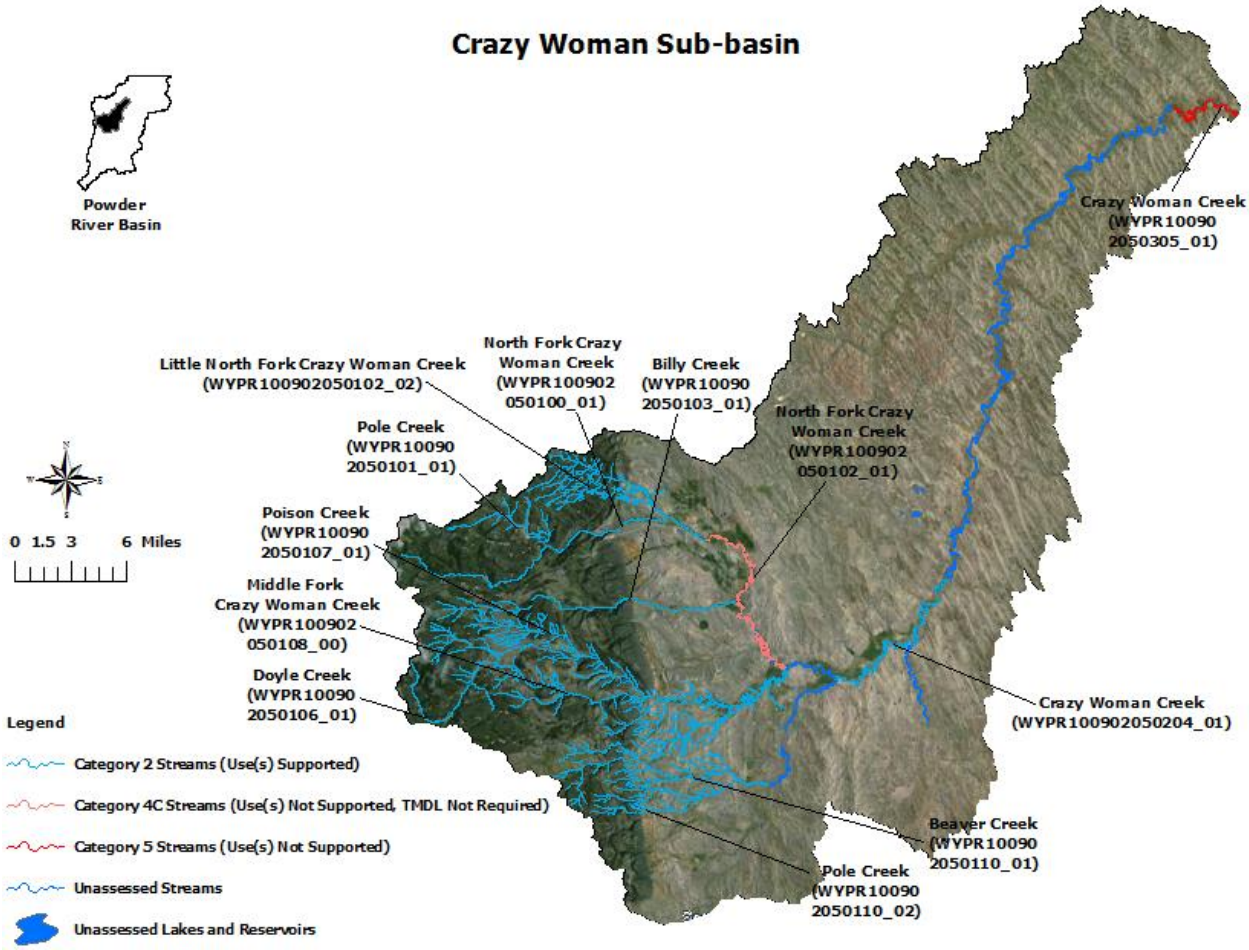
Pole Creek is a small tributary to North Fork Crazy Woman Creek. WDEQ (2003) collected physical, chemical and biological data at two study sites along Pole Creek in 1998. There were no exceedances of measured water chemistry criteria during this study. A high percentage of fine sediment was observed in the stream channel and was attributed to upstream beaver activity. The macroinvertebrate communities at both sites were comparable to three reference streams used for this study. The report concluded that the coldwater fishery and aquatic life other than fish uses were fully supported within the entire Pole Creek watershed (WYPR100902050110_02) upstream from the confluence with Beaver Creek.

Poison Creek is a small spring fed tributary to North Fork Crazy Woman Creek. The headwaters of this watershed are located in the Big Horn Mountains, approximately 3 miles east of Powder River Pass. The creek flows southeast to its confluence with North Fork Crazy Woman Creek at the mouth of Robinson Canyon. WDEQ (2003) collected physical, chemical and biological data from three study sites along Poison Creek in 1998. Results of this study indicate that the entire Poison Creek (WYPR100902050107_01) watershed upstream from the confluence with Middle Fork Crazy Woman Creek is fully supporting its coldwater fishery and aquatic life other than fish uses.

The headwaters of Doyle Creek are located along the eastern slope of the Big Horn Mountains. The creek flows northeast to its confluence with the Middle Fork Crazy Woman Creek near upper Robinson Canyon. WDEQ (2002) collected physical, chemical and biological data from two study sites on Doyle Creek in 1998. All measured water chemistries were within expected ranges and did not exceed WDEQ's water quality criteria. Habitat evaluations showed that there was good in-stream and riparian habitat conditions at the two study sites. Lastly, the macroinvertebrate community at both locations was in good condition. The study concluded that the coldwater fishery and aquatic life other than fish uses are fully supported from the headwaters of Doyle Creek (WYPR100902050106_01) to a point 10.4 miles downstream.

Billy Creek's headwaters are located within the east slope foothills of the Big Horn Mountains south of the town of Buffalo. The creek flows east 10 miles before it confluences with Muddy Creek and Muddy Creek then confluences with North Fork Crazy Woman Creek in approximately 0.20 miles. WDEQ (2004) collected physical, chemical and biological data at two study sites in 1998. There were no exceedances of measured aquatic life water chemistry criteria during this study. The streambed substrate was dominated by sand, but this was attributed to natural contributions from the geology of the watershed. Riparian vegetation was considered healthy, considering the physical constraints of the surrounding narrow terraces. The macroinvertebrate community was also determined to be in good condition. The study concluded that Billy Creek's (WYPR100902050103_01) coldwater fishery and aquatic life other than fish uses are fully supported from the confluence with Muddy Creek to a point 13.4 miles upstream.

Little North Fork Crazy Woman Creek's headwaters are located within the foothills of the eastern slope of the Big Horn Mountains. The creek flows southeast approximately eight miles to its confluence with North Fork Crazy Woman Creek. An herbicide spill occurred in the watershed in the 1970's, resulting in poor riparian vegetation cover and related sedimentation within a localized area. Lake DeSmet Conservation District (LDCD) completed the North Fork Crazy Woman Creek Section 319 Water Quality Project in 1990.



As part of this project, LDCD and NRCS initiated riparian re-seeding and modified livestock grazing management within the affected area. WDEQ (2003) monitored Little North Fork Crazy Woman Creek (WYPR100902050102_02) at a single study site in 1993 and 1998 to determine whether the BMPs described above had reduced sedimentation and to assess designated use support. All measured water chemistries were below WDEQ's associated numeric criteria. Physical data indicated that there had been improvements in bank stability, streambed embeddedness and riparian health. The macroinvertebrate community condition improved over the study period and this trend was thought to be related to habitat improvements. The study concluded that the coldwater fishery and aquatic life other than fish uses were fully supported within the entire watershed upstream from the confluence with North Fork Crazy Woman Creek.

The headwaters of Middle Fork Crazy Woman Creek are located in Robinson Canyon along the east slope of the Big Horn Mountains. The creek flows east to its confluence with North Fork Crazy Woman Creek near Interstate 25; the confluence of these two creeks forms Crazy Woman Creek. WDEQ (2003)collected physical, chemical and biological data from three study sites in 1996 and 1998. No water chemistry measurements exceeded WDEQ's numeric aquatic life criteria. Moderate streambed embeddedness was observed and was thought to be related to an upstream road crossing that had recently washed out. Overall, habitat condition appeared to have improved during the three year study. The biological communities at all three study sites were in good condition. Results of the study indicated that the coldwater fishery and aquatic life other than fish uses were fully supported throughout the entire watershed upstream from the confluence with North Fork Crazy Woman Creek (WYPR100902050108_00), excluding Doyle Creek and Poison Creek.

South Fork Crazy Woman Creek's headwaters are located within the eastern foothills of the Big Horn Mountains. The creek flows northeast for 14 miles to its confluence with Crazy Woman Creek, just east of Interstate 25. Beaver Creek is a small watershed that confluences with the South Fork Powder River near State Route 196. WDEQ (2003) collected physical, chemical and biological data from four sites along South Fork Crazy Woman Creek and one site on Beaver Creek in 1999. No water chemistry measurements exceeded WDEQ's aquatic life numeric criteria. In addition, habitat conditions and riparian condition were good at all study sites. Both creeks have a naturally erosive geology and are low gradient with low stream power. Considering these natural limitations, habitat was considered to be in good condition. Overall, the biological condition at all sites was also good. The report concluded that the coldwater fishery and aquatic life other than fish uses were fully supported on Beaver Creek (WYPR100902050110_01) within the entire watershed upstream from the confluence with South Fork Crazy Woman Creek, excluding Pole Creek and this decision was added to the 2004 Integrated Report. Determine designated use support was not assessed on the South Fork Crazy Woman Creek.

Clear Creek Sub-basin (HUC 10090206)

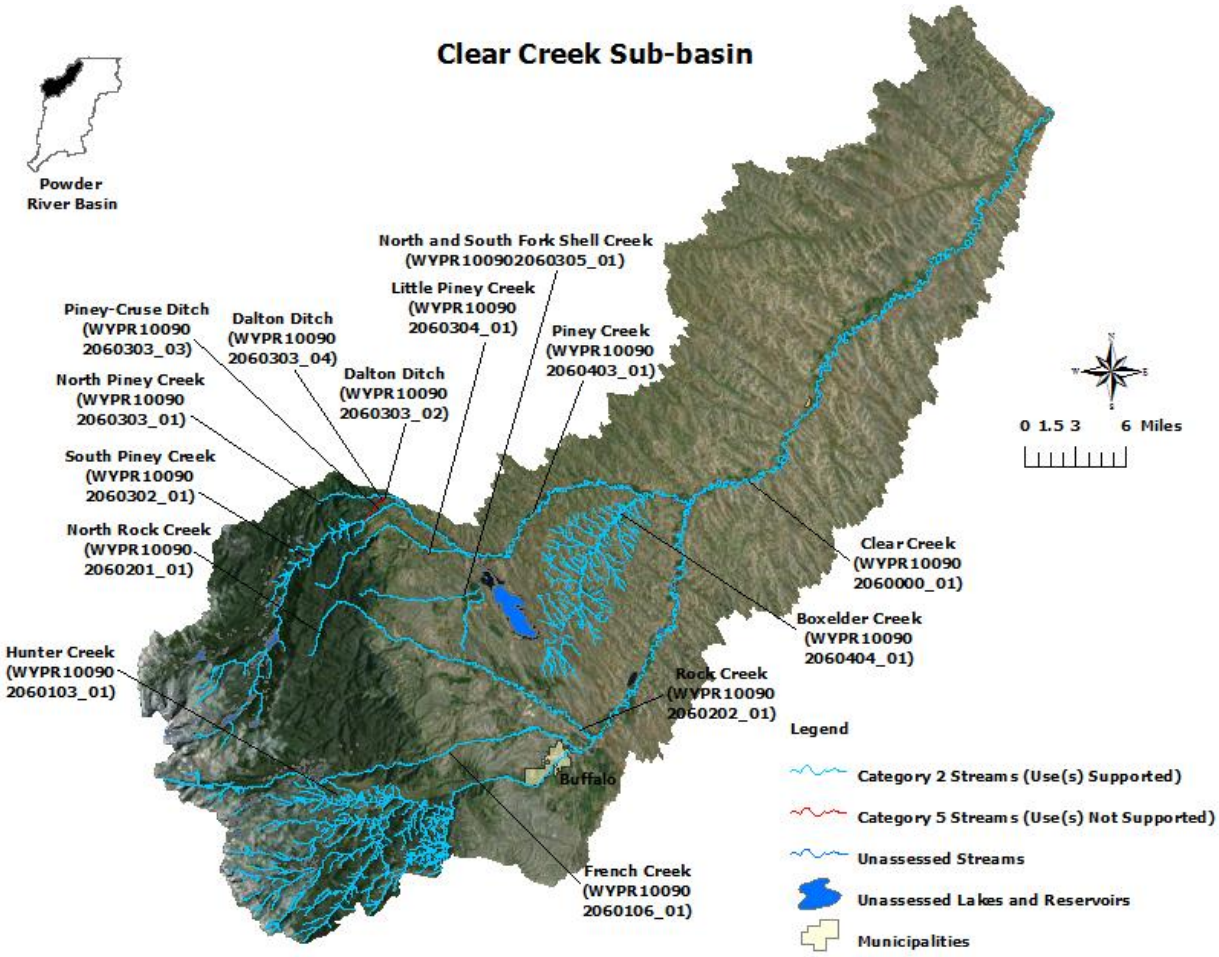
The headwaters of the Clear Creek watershed are located in the Cloud Peak Wilderness Area within the Big Horn Mountains. The creek flows northeast from the mountains, through the town of Buffalo and confluences with the Powder River approximately 10 miles south of the Wyoming/Montana border. WDEQ (2004) monitored the water quality of Clear Creek in 1999 by collecting physical, chemical and biological data at 16 study sites. All water chemistries measurements were within the natural expected ranges for the watershed and none exceeded WDEQ's criteria. Fecal coliform concentrations were also below WDEQ's criterion protective of recreational uses. Weighted embeddedness scores indicated that there was little siltation within Clear Creek and habitat conditions were good. Overall, the biological condition of Clear Creek was also good across study sites. The report concluded that the coldwater fishery and aquatic life other than fish uses were fully supported along the mainstem of Clear Creek (WYPR100902060000_01) from the confluence with the Powder River upstream to the confluence with Grommund Creek and the entire watershed upstream of the confluence with Grommund Creek.

The headwaters of Rock Creek and the North and South Forks of Shell Creek are located northwest of the town of Buffalo within the eastern foothills and mountains of the Big Horn Mountains. Rock Creek flows southeast to its confluence with Clear Creek northeast of the town of Buffalo. The North and South Forks of Shell Creek flow northeast to their confluence with Shell Creek Reservoir. The Rock and North and South Fork Shell Creek Bioassessment Section 205j Project was completed by LDCD in 2001.

Data collected as part of this project indicated that the entire mainstem of North and South Forks Shell Creek (WYPR100902060305_01) upstream from the confluence with South Creek Reservoir were threatened by physical degradation and they were therefore added to the 303(d) List in 1996. Impacts to the North and South Fork Shell Creek drainages are primarily due to irrigation diversions and conveyance. LDCD completed a Section 319 Project which addressed these problems, primarily through the installation of more efficient irrigation systems. Biological data collected as part of the project were highly variable across collection dates and were inconclusive. WDEQ (2003, 2005) monitoring suggested that the BMPs implemented on the North and South Forks of Shell Creek were somewhat effective, but that additional data were needed. WDEQ conducted biomonitoring on these streams again in 2006. Several nongame fish were observed while sampling North and South Fork Shell Creeks, suggesting that these streams may be better classified as 2C. Data indicated full support of the aquatic life other than fish use on these creeks. USEPA Section 319 Nonpoint Source Success Stories has been written for North and South Forks of Shell Creeks.

The Rock and North and South Fork Shell Creek Bioassessment Section 205j Project also evaluated designated use support on Rock Creek. Data collected as part of this project indicated that the Rock Creek (WYPR100902060202_01) from the confluence with Clear Creek upstream to the confluence with South Rock Creek was physically degraded. The primary sources of degradation to Rock Creek were identified as heavy livestock grazing in small horse pastures near the stream. Landowners implemented best management practices (BMPs) specifically designed to improve irrigation efficiency. Data collected by WDEQ (2003) indicated that Rock Creek fully supported its cold water fishery and aquatic life other than fish use and it was removed from the 303(d) List in 2004. A USEPA Section 319 Nonpoint Source Success Story has been written for Rock Creek. North Rock Creek's headwaters are located in the foothills of the Big Horn Mountains northwest of the town of Buffalo. The creek flows east to its confluence with Rock Creek just north of the Bud Love Wildlife Management Area. WDEQ (2003) collected physical, chemical and biological data from seven study sites along North Rock Creek in 1998. All measured chemical parameters were within expected ranges there were no exceedances of any WDEQ aquatic life criteria. The stream channel at several study sites was rectangular and had a high width to depth ratio from flow alterations and livestock grazing. The riparian zone was also considered to be thin and over-utilized by livestock grazing. Macroinvertebrate data indicated that despite these physical concerns, the cold water fishery and aquatic life other than fish uses were determined to be fully supported within North Rock Creek (WYPR100902060201_01) from the confluence with South Rock Creek to a point 9.6 miles upstream.

Hunter Creek is a small tributary to North Fork Clear Creek in the Big Horn Mountains west of the town of Buffalo. WDEQ collected physical, chemical and biological data at two study sites along Hunter Creek in 1997 and 1998. Results indicated that fine sediment entering the stream channel from intensive livestock grazing and from an adjacent road was threatening the aquatic life other than fish use. A segment of Hunter Creek (WYPR100902060103_01) from the confluence with North Clear Creek to a point 2.7 miles upstream was added to the 303(d) List in 1998. WDEQ and USFS implemented a management plan to address these issues in 2003. BMPs included moving the road further from the stream, re-planting vegetation to create a larger riparian buffer, constructing a roadside ditch and reservoir to trap sediment, creating designated cattle crossings and implementing a rotational grazing schedule. WDEQ re-evaluated Hunter Creek in 2003 and 2004 and determined that Hunter Creek fully supports its cold water fishery and aquatic life other than fish uses. As a result, Hunter Creek was removed from the 303(d) List in 2004. Final reports were not completed for the 2003-2004 WDEQ studies. A Section 319 Nonpoint Source Success Story has been written for Hunter Creek.



WDEQ (2005) collected *E. coli* samples within and near the town of Story in July and August of 2005 in response to citizen concerns that sewage from failed septic systems was contaminating local surface waters. There are no other known sources of fecal contamination in the area. Results showed exceedances of the primary contact *E. coli* criterion in Dalton Ditch and North Piney Creek. Thus, North Piney Creek (WYPR100902060303_01) from the confluence with Piney Creek to a point 6.4 miles upstream was added to the 303(d) List in 2006. A 0.3 mile segment of Dalton Ditch (WYPR100902060303_02) within and near the town of Story and Piney-Cruse Ditch (WYPR100902060303_03) from the confluence with North Piney Creek to a point 2.2 miles upstream were also added to the 303(d) List in 2008. As part of the 2009 Story Septic Assessment Section 205j Project, Sheridan County investigated impacts from septic systems on an alluvial aquifer and the potential linkages between contaminated groundwater and surface water in the area. The summary report from this project concluded that much of the community of Story uses a shallow alluvial aquifer for both drinking water and for septic waste disposal. The water level in the aquifer fluctuates seasonally and is highly connected to and is recharged by surface waters during high flows in May and June. Several septic systems within the area were subsequently repaired or replaced, following recommendations contained within the report. WDEQ (2014) collected *E. coli* samples at two study sites along North Piney Creek and five sites along Dalton Ditch between the years 2008-2010 to determine whether *E. coli* concentrations had been reduced within these two waters. The two sites on North Piney Creek were both within the impaired reach, whereas those monitored on Dalton Ditch included sites within and beyond the impaired reach. There were no exceedances of the primary contact recreational criterion at either of the two sites on North Piney Creek during the study. Therefore, North Piney Creek was removed from the 303(d) List

in 2014. The report concluded that it is unknown whether the septic repairs/replacements contributed to the observed reduction in *E. coli* concentrations. Samples collected on Dalton Ditch within the impaired reach showed that this water continued to exceed the primary contact recreational criterion during 2009 and 2010. A study site upstream of this impaired also exceeded the criterion in 2010, resulting in a segment of Dalton Ditch (WYPR100902060303_04), from Cottage Grove Road to a point 0.04 miles upstream being added to the 303(d) List in 2014. The report indicated that the majority of *E. coli* loading to Dalton Ditch occurs between Robertson and Cottage Grove Roads; the source(s) of this pollutant are unknown.

Little Piney Creek's headwaters are located within the foothills of the Big Horn Mountains southeast of the community of Story. The creek flows northeast to its confluence with Piney Creek. WDEQ (2002) collected physical, chemical and biological data at two study sites in 1998. There were no exceedances of any measured WDEQ water quality criteria. Streambed particle embeddedness was minimal and riparian vegetation was in good condition. Lastly, the macroinvertebrate community was described as being in good condition and as being comparable to reference. The report concluded that a segment of Little Piney Creek (WYPR100902060304_01) from the confluence with Piney Creek to a point 14.0 miles upstream was fully supporting its coldwater fishery and aquatic life other than fish uses.

The headwaters of South Piney Creek originate at Lake Mead, within the Cloud Peak Wilderness in the Big Horn Mountains. The creek flows through Cloud Peak Reservoir, Flatiron Lake, Frying Pan Lake and Willow Park Reservoir, then continues flowing northeast to its confluence with North Piney Creek. WDEQ (2003) collected physical, chemical and biological data at two study sites along South Piney Creek in 1996 and 1998. All water chemistries were within expected ranges and none exceeded WDEQ water quality criteria. Cobble was the dominant streambed substrate at both sites and there was very little streambed embeddedness. The macroinvertebrate community was in good condition at both sites in both years. The study concluded that South Piney Creek's (WYPR100902060302_01) coldwater fishery and aquatic life other than fish uses are fully supported from Piney Creek upstream, excluding Kearney Creek.

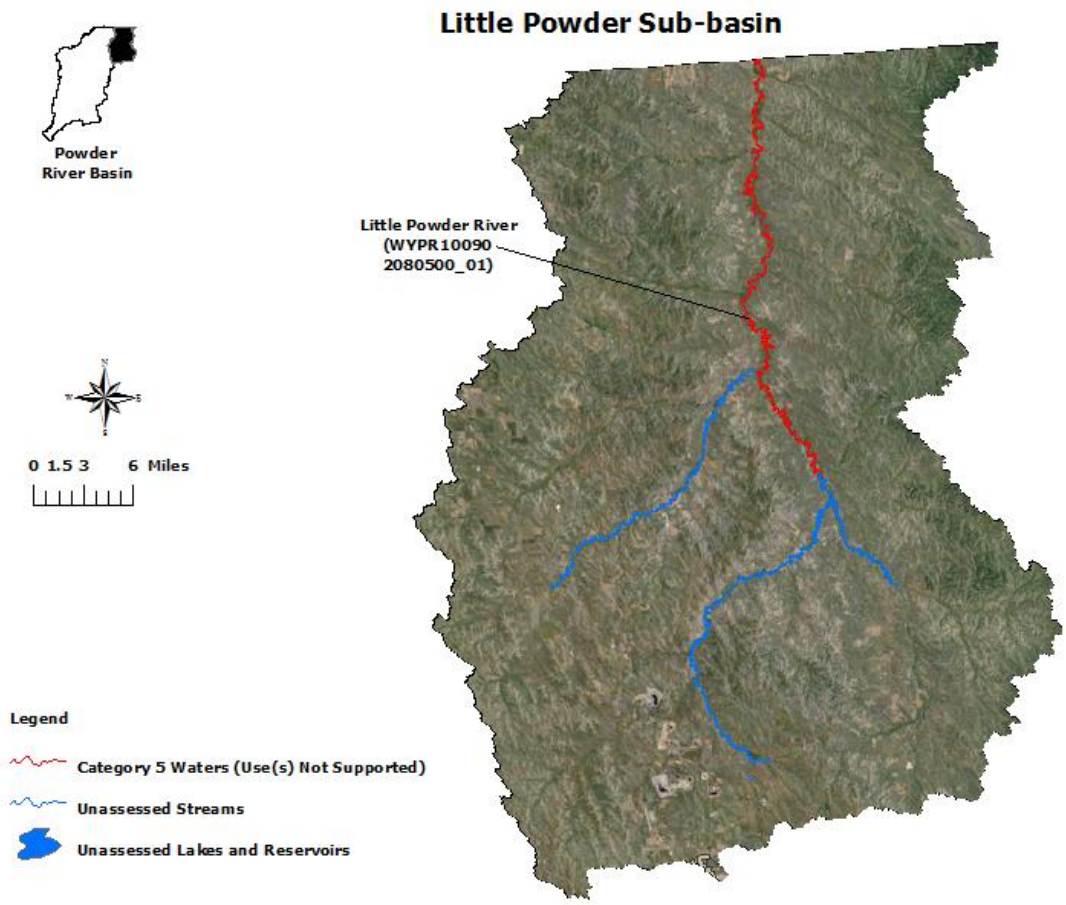
The headwaters of Boxelder Creek originate southeast of Lake DeSmet in northern Johnson County. The creek flows northeast approximately 12 miles to its confluence with Piney Creek. WDEQ (2003) collected physical, chemical and biological data from two sites along Boxelder Creek in 1998. No measured water chemistries exceeded WDEQ's criteria during this study. Channel degradation in the upper watershed from flow alterations and intensive livestock grazing were concerns, whereas bank stability and riparian health were considered excellent in the lower watershed. A more diverse macroinvertebrate community was present in lower Boxelder Creek than in upper Boxelder Creek. The report concluded that the aquatic life other than fish use on Boxelder Creek (WYPR100902060404_01) was fully supported within the entire watershed upstream from the confluence with Piney Creek.

French Creek's headwaters are located in the east slope foothills of the Big Horn Mountains northwest of the town of Buffalo. The creek flows east approximately 17 miles to its confluence with Clear Creek. WDEQ (2004) collected physical, chemical and biological data from four sites along French Creek 1998. There were no exceedances of any of WDEQ's water chemistry criteria during this study. Cobble substrate dominated the three upstream study sites and sand was dominant at the lowermost site. Substrate embeddedness was high and riparian vegetation scores were low at all three of the sites. Macroinvertebrate communities were in good condition at all four study sites. The study concluded that French Creek's (WYPR100902060106_01) coldwater fishery and aquatic life other than fish uses are fully supported from the confluence with Clear Creek to a point 22.3 miles upstream.

Little Powder Sub-basin (HUC 10090208)

The Little Powder River's headwaters are located northwest of the city of Gillette. The river flows north across the WY/MT border and ultimately confluences with the Powder River in Montana. WDEQ monitored the Little Powder River in 1999 and 2005, but data were insufficient to make designated use

support determinations and a final report was not written. USGS gage (#06324970) data collected from the Little Powder River (WYPR100902080500_01) near the Montana border showed exceedances of the fecal bacteria criterion in 1999 through 2001 and the river was placed on the 303(d) List in 2002. CCCD completed the Donkey/Stonepile Sub-watersheds, Little Powder River Sub-watershed and Upper/Middle Powder River Watershed Section 319 project in 2008. The report showed that the Little Powder River impairment should be extended from the WY/MT state line upstream to the confluence with Spring Creek and the segment was modified in the 303(d) List in 2010. CCCD and local citizens sponsored a watershed plan for the Little Powder River in 2010. To date, 8 AFO and 14 septic improvement BMP projects have been implemented (WACD 2011).



8.11 Snake River Basin

The Snake River Basin drains 6,179 mi^2 in Wyoming. Major tributaries to the Snake River include the Gros Ventre, Hoback, Greys and Salt Rivers. The Snake River's headwaters are located in Yellowstone National Park near Two Ocean Plateau. The river then flows southeast into Grand Teton National Park and confluences with Jackson Lake. The river exits Jackson Lake, flows through Jackson Hole and enters Palisade Reservoir near the WY/ID border. The Snake River ultimately confluences with the Columbia River in Idaho.

The Snake River Basin in Wyoming consists solely of the Middle Rockies level III ecoregion (Chapman et al. 2003). This ecoregion is characterized by high mountains covered by open canopy coniferous forests. The basin is bordered by the Teton, Snake River, Gros Ventre, Wyoming and Salt River Mountain Ranges.

Mountains transition to sparsely wooded or shrub/grassland foothills. The basin also includes the mid-elevation sedimentary mountains, alpine zone, yellowstone plateau, granitic subalpine zone, sedimentary subalpine zone, high elevation valleys, partly forested mountains and dissected plateaus and teton basin level IV ecoregions. The northern portion of the basin consists of the volcanically active Yellowstone Plateau, which is part of the greater Yellowstone ecosystem. Soils are dry, coarsely textured and nutrient poor and support coniferous and shrubland forest. The basin's lower elevations consist of Jackson Hole and Star Valley. Both of these areas are high elevation valleys containing wet riparian meadows and marshes surrounded by upland terraces, alluvial fans and low elevation foothills. Mid-elevation sedimentary mountains make up much of the middle and lower portions of the basin. These mountains are composed of marine deposits, including limestone, dolomite, sandstone and shale, which are water soluble and result in higher nutrient concentrations in streams. Partially forested mountains make up the remainder of the middle and lower portions of the basin. These mountains are located within the Snake River and Salt River Mountain Ranges along the WY/ID border. These mountains are dry and steep with shallow soils that limit the extent to which trees can persist. Therefore, vegetation mostly consists of an even mix of conifers, shrubs and grasses. The alpine zones of these mountains are glaciated areas above timberline that consists of open rocky areas, talus slopes, alpine tundra and glacial basins. The alpine zone, receives larger amounts of precipitation as compared to the lower elevation surrounding mountains. The mid-elevation mountains of these ranges have moist sedimentary geology and are characterized by a spruce-fir forest broken by grassy slopes. Lastly, a small portion of the dissected plateaus and Teton Basin ecoregion is situated on the western slope of the Teton Mountain Range. This ecoregion is a high elevation, cold valley, with productive soils and irrigated croplands. Common land uses within the Snake River Basin include wildlife habitat, recreation, logging, mining and livestock grazing.

Jackson Lake and Palisades Reservoir are both part of the USBOR's Minidoka Project. This large irrigation project was initiated in 1902 and was completed in 1907 for the purpose of irrigating lands adjacent to the Snake River in southern Idaho and northwestern Wyoming. The project includes seven dams, 1,600 miles of canals, 4,000 miles of laterals and provides hydropower and water for irrigating more than 1,000,000 acres annually. Palisades Reservoir stores approximately 650,000 acre-feet of water and is used for irrigation, recreation, flood control and hydropower. Jackson Lake Dam was completed in 1916 and stores approximately 847,000 acre-feet of water. A portion of the water stored in Jackson Lake is used for irrigation in the Minidoka Project.

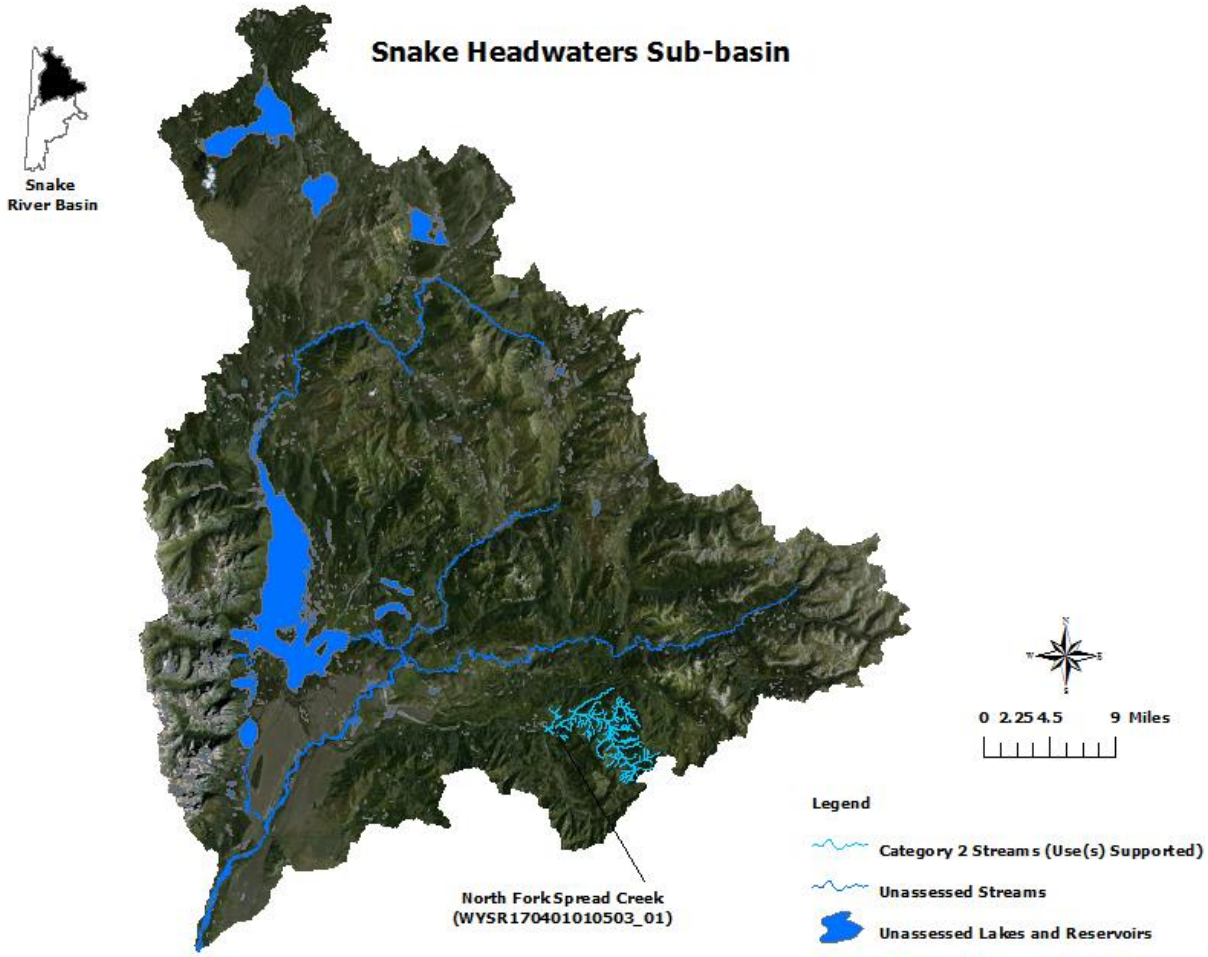
Snake Headwaters Sub-basin (HUC 17040101)

The headwaters of the Snake River are located within this sub-basin in Yellowstone National Park. More than 400 miles of streams in the Snake River Headwaters Sub-basin were designated by Congress in 2009 as Wild and Scenic Rivers. These waters include Bailey, Blackrock, Crystal, Granite, Pacific, Shoal, Willow and Wolf Creeks; Buffalo, North and South Buffalo and Soda Forks and the Gros Ventre and Hoback Rivers.

USGS (2007) collected water quality data from Cottonwood, Taggart, Lake and Granite Creeks in 2006 across several hydrologic regimes. These data were used to characterize the streams and were compared to data collected in 2002 from other streams in the sub-basin for management objectives of Grand Teton National Park.

North Fork Spread Creek's headwaters are located approximately five miles west of Togwotee Pass. The creek flows northwest to its confluence with South Fork Spread Creek, forming Spread Creek. WDEQ collected semi-quantitative physical, chemical and biological data from four study sites along North Fork Spread Creek in 1996. The creek channel was described as wide and shallow with few pools; streambank erosion was common and riparian condition was considered poor. Habitat degradation caused the aquatic life other than fish and coldwater fisheries uses to not be supported. Therefore, the entire North Fork Spread Creek watershed (WYSR170401010503_01) upstream of the confluence with South Fork Spread

Creek was added to the 303(d) List in 1998. USFS completed the North Spread Creek Riparian Demonstration Section 319 Project in 1999 to restore the North Spread Creek watershed. Sections of channel and floodplain were reconstructed and riparian vegetation was re-planted. Trout habitat improved and trout abundance in the creek increased by an estimated 43%. WDEQ monitoring in 2003 indicated that the North Fork Spread Creek watershed was supporting its coldwater fishery and aquatic life other than fish uses and it was removed from the 303(d) List in 2008. WDEQ data from 1996 and 2003 were not incorporated into a formal report. A USEPA Section 319 Nonpoint Source Success Story has been written for the restoration North Fork Spread Creek.



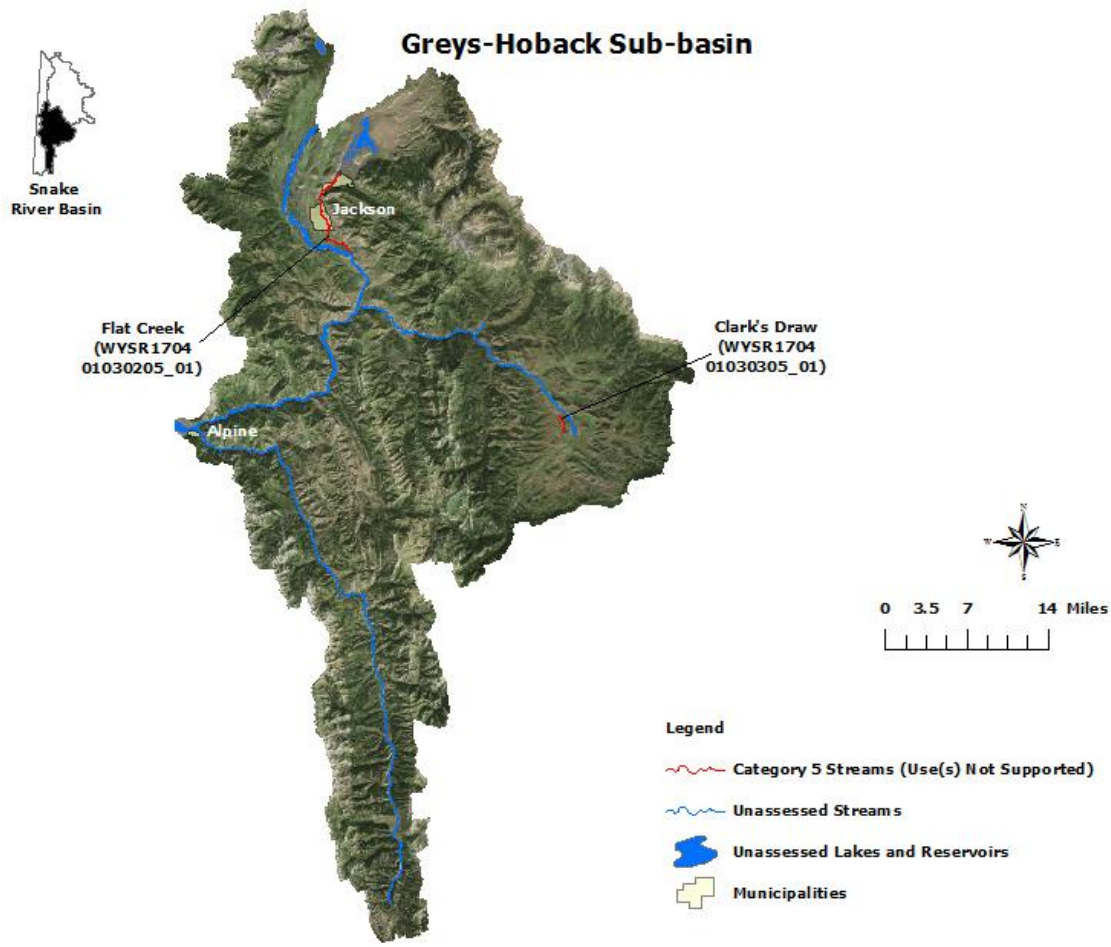
Fish Creek is a classified as a Class 1 water by WDEQ. The headwaters of Fish Creek are located along at the base of the Teton Mountain Range near Teton Village. The creek then flows south to its confluence with the Snake River. A USGS (2009) study was conducted to investigate chronic excessive plant and algae growth in Fish Creek. The study mainly focused on ground-surface water exchange in the Fish Creek watershed and indicated that between spring and fall, upper Fish Creek near Teton Village gains large quantities of groundwater; the middle and lower reaches of the creek also gain groundwater, but to a lesser extent. A second USGS (2010b) study was conducted to: determine nutrient concentrations, potential sources of nutrients, characterize the streambed substrate and the algal, macrophyte and macroinvertebrate communities of Fish Creek. The study reported several chemical and biological trends along the 15.5 mile study reach. The authors suggested that the abundant plant and algae observed in Fish Creek may rapidly assimilate nutrients. Nutrient concentrations measured in groundwater wells surrounding Fish Creek were consistently higher than concentrations in Fish Creek. The authors concluded that additional sampling would be necessary to conclusively determine the cause of the

excessive algal and macrophyte growth in Fish Creek. The resulting USGS (2013) report was published beyond WDEQ's July 15, 2013 data submission deadline and will therefore be reviewed toward Wyoming's 2016 Integrated Report.

Greys-Hoback Sub-basin (HUC 17040103)

The Hoback and Greys Rivers are major tributaries to the Snake River in this sub-basin. The headwaters of the Hoback River are located within the northeastern portion of the Wyoming Mountain Range. The river flows northeast to approximately the town of Bondurant, where it flows northwest to its confluence with the Snake River at Hoback Junction. The Grey River's headwaters are located along the eastern edge of Commissary Ridge in the Salt River Mountain Range. The river flows north between the Salt River and Wyoming Mountain Ranges to its confluence with Palisades Reservoir near the town of Alpine.

The headwaters of Flat Creek are located along the northern edge of Cache Peak within the Gros Ventre Mountain Range. The creek flows northwest through the National Elk Refuge, then south through the town of Jackson to its confluence with the Snake River. Teton Conservation District (TCD) completed the Flat Creek Water Quality Assessment and Jackson, Wyoming Stormwater Discharge Characterization



Section 319 Report in 1998. The goal of the report was to establish baseline physical, chemical and biological data in 1996 and 1997 for Flat Creek at six study sites in around the town of Jackson. The report identified poor biological condition from approximately 0.25 miles below the National Elk Refuge downstream to the South Park Elk Feeding Ground near the confluence with the Snake River. The cause of the poor condition was sedimentation from the town of Jackson's municipal stormwater. WDEQ used this report to determine that the aquatic life other than fish and cold water fishery uses in Flat Creek were threatened due to habitat alterations (sedimentation). A segment of Flat Creek (WYSR170401030205_01) from the confluence with the Snake River upstream to the confluence with Cache Creek was added to the 303(d) List in 2000 as threatened. The source of this pollutant was identified as municipal stormwater from the town of Jackson. The Flat Creek Restoration Project was initiated in 2004, with the goals of improving aquatic habitat and allowing Flat Creek to reach its ecological potential. The project is a cooperative effort between the town of Jackson, TU, TCD, WGFD, and other stakeholders. A Watershed Management Plan for Flat Creek was completed by TCD in 2005. The plan identified the construction of a stormwater treatment wetland in Karns Meadow as having the potential to reduce 27% of the stormwater related pollution to the threatened segment of Flat Creek within the town of Jackson. The Karns Meadow Stormwater Treatment Wetland Section 319 Project was completed by the town of Jackson in 2013. The central goal of the project was to construct a five acre wetland complex designed to intercept and filter stormwater and to restore groundwater and surface water connectivity in Flat Creek. The wetland complex was expected to reduce sediment loading by an estimated 99%, reduce peak stormwater flows and restore surface-groundwater connectivity in Flat Creek adjacent to Karns Meadow. Native vegetation was also re-established in the wetland complex following construction. The Town of Jackson has also adopted a commercial stormwater code, has initiated full time summer street sweeping and has modified the type of salts it uses for ice control on roadways during the winter. WDEQ began collecting physical, chemical and biological data at several study sites within the threatened segment of Flat Creek in 2013 to re-evaluate the aquatic life other than fish and cold water fishery designated uses.

Clark's Draw is a small tributary to the Hoback River near Bondurant. In 2010, Western Watersheds Project (WWP) collected *E. coli* samples on Clark's Draw and a five sample geometric mean exceeded both WDEQ's primary and secondary contact recreation standards. A segment of Clark's Draw (WYSR170401030305_01) from Bar X Road to a point 0.4 miles upstream was added to the 303(d) List in 2012. The primary source of the elevated bacteria was identified as livestock grazing.

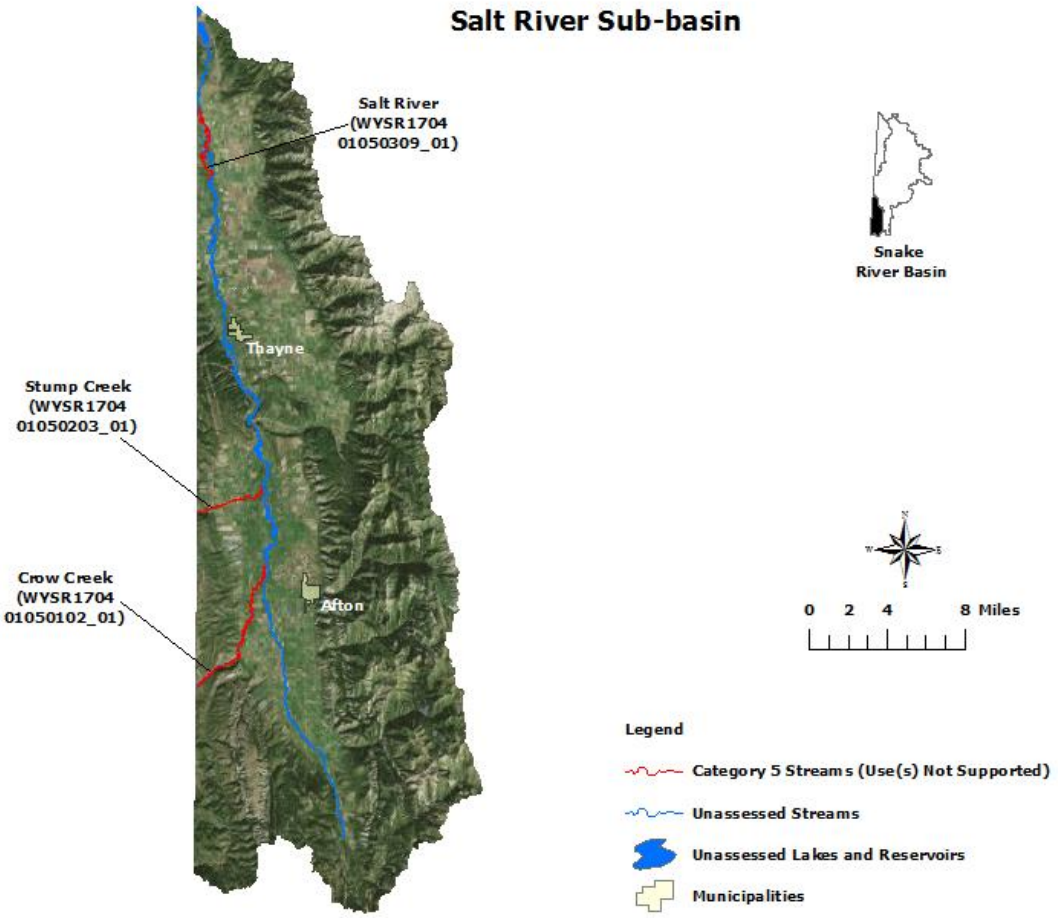
Salt River Sub-basin (HUC17040105)

The headwaters of the Salt River are located within the Salt River Mountain Range. The Salt River flows north through Star Valley to its confluence with Palisades Reservoir near the town of Alpine.

Fecal coliform data collected at USGS gage (station 13027500) on the Salt River near the town of Etna showed that WDEQ's recreational use criterion was exceeded several times during 2000 and 2001. As a result, a 7.5 mile section of the Salt River (WYSR170401050309_01) located 3.4 miles northwest of Etna was placed on the 303(d) List in 2002 as threatened. Additional sampling by Star Valley Conservation District (SVCD) within the threatened segment has indicated that this segment has chronically high bacterial concentrations and therefore its status was changed from threatened to not fully supporting in the 303(d) List in 2006. SVCD has continued to monitor bacterial concentrations along Salt River at sites ranging from just above the confluence with Palisades Reservoir upstream to the USFS boundary near Forest Dell for the years 2008 through 2010.

The headwaters of Stump Creek are located in the Caribou Mountain Range in Idaho. The creek flows east into Wyoming and confluences with the Salt River near the community of Autumn. SVCD completed the Self-Directed Evaluation and Planning for Improved Animal Waste and Nutrient Management in the Salt River Watershed Section 319 Project in 2002. The project was initiated because there were concerns

about high nutrient concentrations measured in ground and surface waters in Star Valley. The two main goals of the project were to conduct water chemistry and bacterial sampling and to determine whether nutrient concentrations were attributable to agricultural practices. A secondary goal was to provide public education on agricultural BMPs. Physical, chemical and biological samples were collected at several study sites within the watershed during 2000 and 2001. Nutrient concentrations were low during the project. However, study results indicated that Stump Creek (WYSR170401050203_01) exceeded WDEQ's *E. coli* criterion at a study site near the WY/ID border and it was added to the 303(d) List in 2008 from the confluence with the Salt River upstream to the Idaho border.



The Smoky Canyon Mine, along with nine other phosphate mines in the Idaho phosphate mining district, are under an Administrative Order of Consent in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) because of releases of selenium to the environment. CERCLA provides federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. The Smoky Canyon Mine consists of open pits, backfilled pits and overburden disposal areas that have impacted surface and groundwater resources through selenium contamination (IDEQ, 2012). Elevated selenium concentration were recorded on Crow Creek by the Idaho Department of Environmental Quality (IDEQ) in 2008. There are currently several tributaries to Crow Creek in Idaho that are on Idaho's 303(d) List for selenium. IDEQ is evaluating proposed site-specific criteria for Crow Creek and several tributaries in Idaho. The proposed criteria are based on fish egg/ovary concentrations that would translate to fish whole body and aqueous concentrations (Formation Environmental and HabiTech, 2012). In May, 2006 WDEQ measured the

concentration of total selenium in Crow Creek at the Idaho/Wyoming state line using a single grab sample. The sample had a total recoverable selenium concentration of 5.2 µg/L, which exceeds WDEQ's aquatic life other than fish chronic criterion of 5.0 µg/L. This single sample was insufficient to make a designated use support determination on Crow Creek. WDEQ (2013) continued monitoring selenium concentrations on Crow Creek and a small tributary between 2008 and 2012. WDEQ's criterion was exceeded 13 times within this period between the ID/WY border and the confluence with the Salt River; the highest concentration was 19 µg/L and the lowest was 5.2 µg/L. Spring Creek, a small tributary to Crow Creek, was used as a chemical reference in this study. Spring Creek did not exceed WDEQ's chronic selenium criterion at any time during this study. Based on the results of this study, a 15.6 mile segment of Crow Creek (WYSR170401050102_01) from the Wyoming/Idaho border downstream to the confluence with the Salt River has been added to the 303(d) List in 2014. The source of elevated selenium is phosphate mining.

8.12 South Platte River Basin

The South Platte River Basin in Wyoming drains approximately 3,623 mi^2 and consists of high plains and southern rockies level III ecoregions (Chapman et al. 2003). The eastern two thirds of the basin contains rolling high plains and tablelands and typically receives low precipitation. There are three level IV ecoregions within the high plains, including flat to rolling plains and pine bluffs and hills to the east and relief plains within the central part of the basin. The Laramie Mountain Range contains two level IV ecoregions; these include the foothills shrublands and mid-elevation forests and shrublands. The higher precipitation that occurs in the Laramie Mountains promotes a more diverse plant community than lower elevation areas in the basin. The foothills shrubland contains prairie grasses, sagebrush, mountain mahogany inset with aspen, pine and fir trees; the mid-elevation forests and shrublands are dominated by forests of aspen, pine and fir trees broken by expanses of shrublands. Streams are generally perennial in the mountains, but can be intermittent in the plains as they flow southeast into Nebraska and Colorado. Primary land uses include dryland and irrigated farming, livestock grazing, wildlife habitat, recreation and logging.

Crow Creek Sub-basin (HUC 10190009)

Crow Creek's headwaters are located in the Laramie Mountain Range west of the City of Cheyenne. The creek flows east through the City of Cheyenne, then southeast into Colorado near the Town of Carpenter.

Streamflows in the upper Crow Creek watershed are augmented by water from the Stage I/II trans-basin trade system, which pipes water from the Douglas Creek drainage in the upper North Platte Sub-basin to Crow Creek to supply a portion of Cheyenne's municipal water supply. The stage I/II trans-basin trade system is responsible for supplying approximately 70% of Cheyenne's drinking water. Water from Rob Roy Reservoir is piped to Granite Springs and Crystal Lake Reservoirs (located in the Laramie Mountain Range) before finally reaching Cheyenne. The remaining 30% of Cheyenne's drinking water comes from well fields located northwest of Cheyenne.

In 1993, WDEQ (1995) conducted monitoring at several study sites along Crow Creek within and near the City of Cheyenne. The study included the collection of chemical, physical and biological data at six study sites; a reference site was located approximately three miles upstream of Cheyenne, three sites were within the city limits and two were downstream of the city. The study concluded that biological communities transitioned from more pollution tolerant taxa within Cheyenne to a community more comparable to reference condition at the most downstream study site. The decline in biological condition within Cheyenne was attributed to unspecified pollutants entering the creek within Cheyenne. Designated use support was not assessed.

USGS gage data (station 06756060) collected on Crow Creek near the town of Archer between 1993 and 1994 showed that the fecal coliform criterion protective of contact recreation was exceeded on several

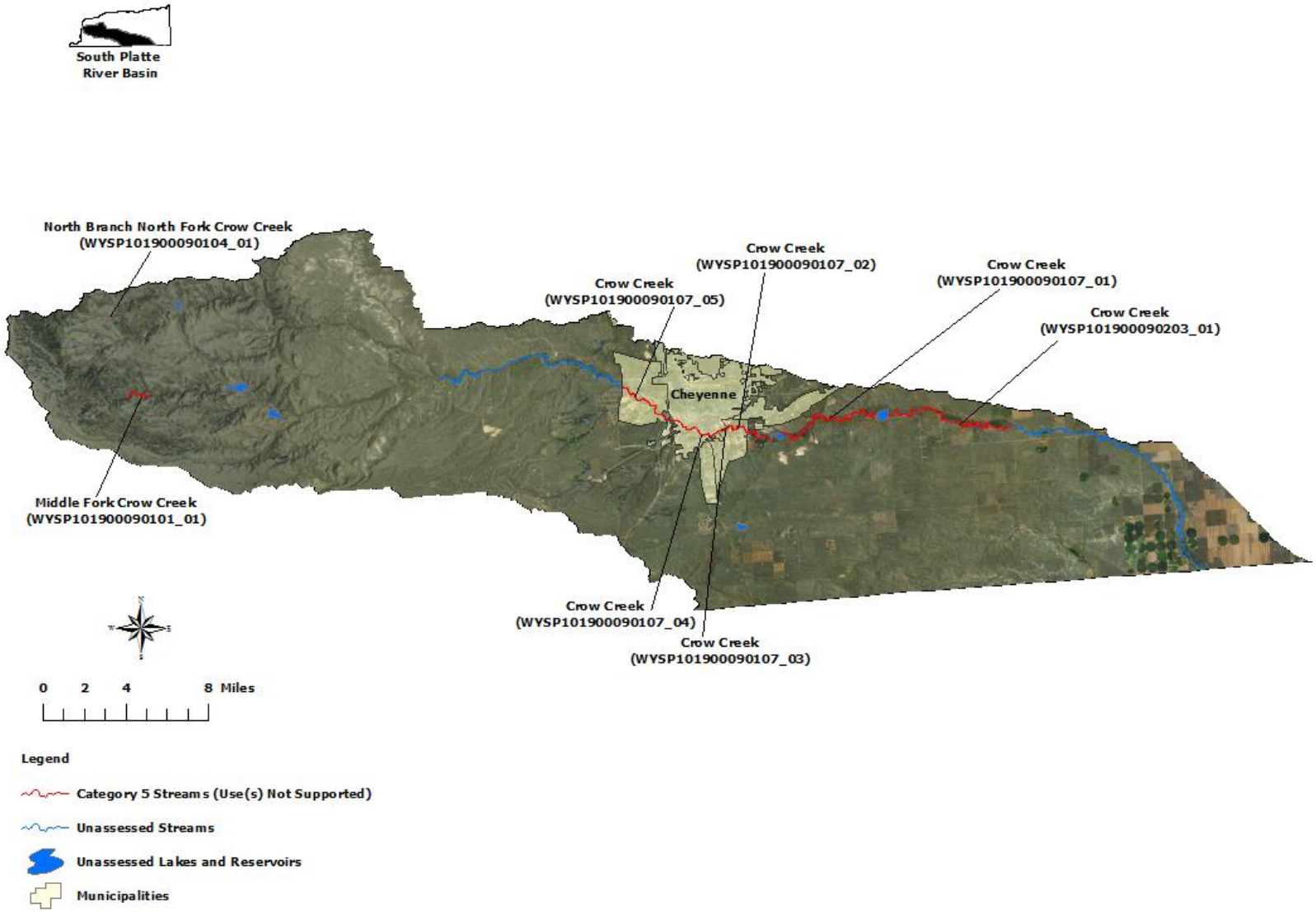
occasions. In addition, the acute and chronic ammonia criteria were exceeded on several occasions between 1993 and 1998, indicating that the aquatic life other than fish, coldwater fishery and nongame fishery uses were not fully supported. Crow Creek was placed on the 303(d) List in 1996 for these pollutants from Dry Creek upstream an undetermined distance above Roundtop Road (WYSP101900090107_01) and from Dry Creek an undetermined distance downstream (WYSP101900090203_01). WDEQ collected fecal coliform and ammonia samples in 1998 and 1999 at several study sites within the impaired segments; data corroborated those collected by USGS. The source of elevated ammonia was Cheyenne's WWTFs. Both of Cheyenne's WWTFs have upgraded to tertiary treatment systems which has reduced or eliminated ammonia loading to Crow Creek. WDEQ (2009) monitoring in 2007-08 and USGS gage data (station 06756060) collected near Archer showed that ammonia concentrations in Crow Creek are now below the chronic criterion protective of aquatic life uses, and thus both of the Crow Creek ammonia impairments were removed from the 303(d) List in 2010. WDEQ (2009) also showed that a section of Crow Creek (WYSP101900090107_02, WYSP101900090107_03 and WYSP101900090107_04) from Happy Jack Road downstream to Hereford Reservoir #1 was not supporting its aquatic life other than fish use due to sedimentation from the City of Cheyenne's stormwater system. In addition, total selenium exceeded the chronic criterion for aquatic life other than fish use from approximately 0.5 mile below Morrie Avenue downstream to Hereford Reservoir #1 (WYSP101900090107_02). Both of these segments were added to the 303(d) List 2010. While delineating the selenium, sediment and *E. coli* impairments on Crow for the 303(d) List in 2010, the classification change from 2AB to 2C that occurs at Morrie Avenue was accidentally overlooked by WDEQ, resulting in segmentation errors in the 303(d) List in 2010. These errors was corrected for the 303(d) List in 2012, resulting in seven additional impairments. Although the number of impaired segments has changed, the overall extent of impairment for *E. coli*, sediment and selenium remains unchanged from 2010. A selenium TMDL for Crow Creek was approved by USEPA in March, 2013 and this impairment was removed from the 303(d) List in 2014. However, this stream segment will remain on the 303(d) List until TMDLs for sediment and selenium are approved by USEPA.

Data from the Laramie County Conservation District (LCCD) 2008-2012 *Crow Creek Watershed Cheyenne Area Water Quality Reports* have also documented bacterial exceedances within the impaired segments of Crow Creek. LCCD continues to monitor water quality and work to provide important education to the public within the watershed. Within the City of Cheyenne, LCCD has implemented BMPs to reduce pollutant loading in Crow Creek, including the construction of wetlands, riparian fencing and buffer strips to trap pollutants, irrigation system improvements, animal feeding operation projects, small acreage grazing projects and storm drain stenciling. LCCD has completed a watershed plan for the Crow Creek watershed.

Clear Creek and Dry Creek are each small tributaries to Crow Creek in Cheyenne. The headwaters of Clear and Dry Creeks are located southwest and west of Cheyenne, respectively. Clear Creek flows northeast to its confluence with Crow Creek and Dry Creek flows southeast through Cheyenne and confluences with Crow Creek between Hereford Reservoir #1 and Hereford Reservoir #2. Laramie County completed the Lower Dry Creek Wetlands Section 319 project in 2011. The goal of the project was to reduce nonpoint source pollution loading from stormwater runoff in Cheyenne to Dry Creek and Crow Creek. Preliminary monitoring indicates that sediment, total suspended solids, bacteria, nutrient, hydrocarbon and metals loading to Dry Creek have been reduced and these reductions are expected to also reduce loading to Crow Creek.

The North Branch North Fork Crow Creek, South Branch Crow Creek and Middle Crow Creek watershed's headwaters are located along the east slope of the Laramie Mountain Range west of Cheyenne. WDEQ (2003) collected fecal coliform data from six study sites on these streams in 2003. The fecal coliform criterion protective of contact recreational use was exceeded on North Branch North Fork Crow Creek near USFS Road 701 and on Middle Crow Creek near USFS Road 700. A 1.3 mile segment of North Branch North Fork Crow Creek (WYSP101900090104_01) and a 1.5 mile segment of Middle Crow Creek

Crow Creek Sub-basin



(WYSP101900090101_01) near USFS Road 700 were placed on the 303(d) List in 2004. Elevated bacterial concentrations in these waters are primarily related to livestock grazing practices. LCCD's Crow Creek Watershed Plan is addressing these impairments, and the USFS, in cooperation with stakeholders, has developed Water Quality Action Plans which combine BMP implementation, monitoring and the management of potential sources. The USFS has also committed to improving wildlife habitat, water quality and livestock grazing in the riparian areas of these watersheds. Weekly fecal coliform and *E. coli* monitoring conducted by LCCD from 2005 through 2007 indicated that Middle Fork Crow Creek did not exceed the fecal coliform or *E. coli* criteria, and thus Middle Crow Creek was removed from the 303(d) List in 2008. However, data from the 2008, 2009 and 2010 Upper Crow Creek Watershed Monitoring Reports indicated that the stream again exceeded the *E. coli* criterion and it was therefore placed on the 303(d) List in 2010. Water quality improvements have occurred on the North Branch of North Fork Crow Creek to address bacterial loading, but *E. coli* levels still periodically exceed the state's criterion protective of primary contact recreation. The extent of the *E. coli* impairment on North Branch North Fork Crow Creek was refined in 2010 using data from the LCCD's 2009 Upper Crow Creek Watershed Monitoring Report. The impairment now extends from FS Road 701 upstream 300 yards. LCCD sampling on North Branch North Fork Crow Creek and Middle Fork Crow Creek in 2011 and 2012 continued to show that bacterial concentrations regularly exceed the primary contact recreational criterion.

Sloans Lake is a popular recreational water located in Cheyenne's Lions Park. The lake is frequented by large numbers of ducks and geese and also receives municipal runoff. The Cheyenne-Laramie County Health Department routinely monitors *E. coli* levels and closes the lake to swimming when *E. coli* levels exceed USEPA's recommended single sample maximum concentration of 235 CFU/100 mL.

8.13 Tongue River Basin

The Tongue River Basin in Wyoming drains approximately 2,533 mi^2 and consists of the Middle Rockies and Northwestern Great Plains level III ecoregions (Chapman et al. 2003). The Middle Rockies ecoregion occupies the western one third of the basin, and includes Alpine Zone, Sedimentary Subalpine Zone, Granitic Subalpine Zone and Dry Mid-Elevation Sedimentary Mountains level IV ecoregions. The Alpine Zone receives high precipitation and is composed of high elevation rocky areas of talus, alpine tundra and glacial basins. The Alpine Zone transitions to the lower elevation sedimentary subalpine and granitic subalpine zones. The sedimentary subalpine zone contains fine sedimentary soils. Vegetation consists of pine, spruce and fir forests broken by open grassy slopes. The Granitic Subalpine Zone contains coarse granitic and shallow bedrock which allow better moisture retention than the sedimentary subalpine zone. Vegetation consists of a dense canopy of pine, spruce and fir and a sparse understory of shrubs, forbs and grasses. The Dry Mid-Elevation Sedimentary Mountains form the lower elevation eastern edge of the Big Horn Mountains. These mountains are a mixture of hills, bluffs, flatirons and canyons of sedimentary rock. The low precipitation has created an open canopy forest of ponderosa pine, mountain mahogany and shrubs. The basin then transitions from the mountains to the Pryor-Bighorn Foothills, Montana Central Grasslands and Mesic Dissected Plains ecoregions making up the eastern two-thirds of the basin. The Pryor-Bighorn Foothills are composed of semi-arid sedimentary terraces, alluvial fans and terraces. Vegetation in this ecoregion consists mostly of grasses, with some scattered ponderosa pine and mountain mahogany. The Montana Central Grasslands consist of clay soils and vegetation dominated by grasses. The Mesic Dissected Plains take up approximately the eastern half of the basin. This ecoregion contains steep grassy hills and alluvial valleys. Perennial streams originating in the Big Horn Mountains and relatively high precipitation have allowed riparian vegetation such as boxelder, snowberry, serviceberry and bullberry to colonize riparian corridors. Common land uses in the basin include irrigated agriculture, livestock grazing, wildlife habitat, recreation, logging and mining.

USGS (2013) analyzed trends in water quality data for several chemical constituents collected between 1980 and 2010 within the Tongue and Powder River basins. Specifically, conductivity, calcium, magnesium, potassium, sodium adsorption ratio, sodium, alkalinity, chloride, fluoride, dissolved sulfate,

and dissolved solids were compared across 16 study sites. The report summarizes general water quality trends, and discusses the potential effects of bicarbonate on aquatic life and sodium on soils.

Wohl et. al. (2007) reported that many streams within the Big Horn National Forest have been substantially impacted by cattle grazing, irrigated crop production, flow regulation and diversion, and timber harvest. Some of these findings are reflected in the categorizations of waters in the basin.

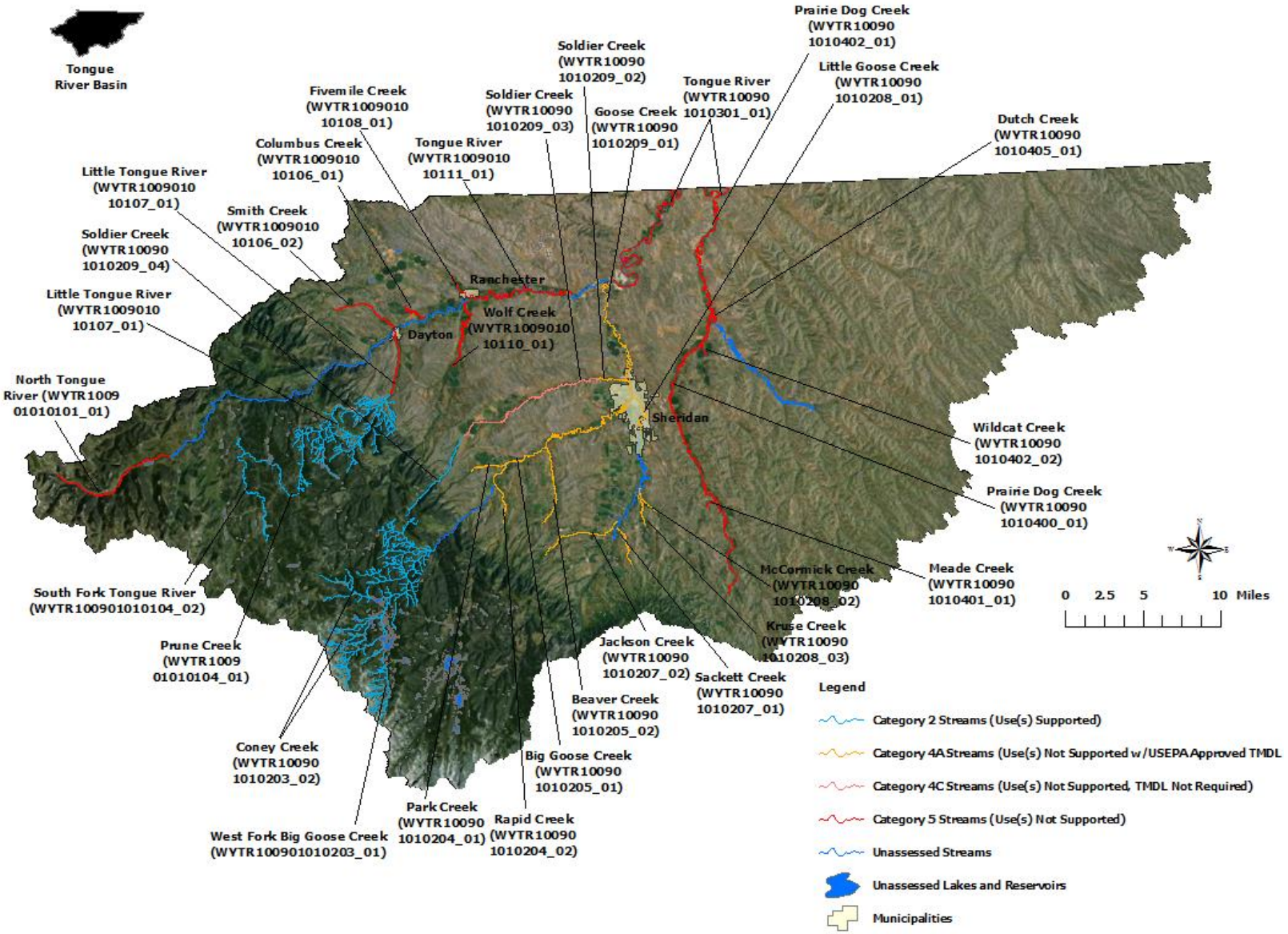
Tongue Sub-basin (HUC 10090101)

The headwaters of the Tongue River watershed are located in the Big Horn Mountains west of the City of Sheridan. The river flows northeast through the towns of Dayton, Ranchester and Monarch and across the WY/MT border near the town of Decker, Montana. WDEQ (2002) collected physical, chemical and biological data in 1998 from four stations along a segment of the Tongue River extending from the WY/MT border upstream to the community of Kleenburn. Although the streambed substrata was composed of more sand and silt below the confluence with Goose Creek, habitat complexity was considered good at all study sites. Macroinvertebrate data collected during this study suggested that water quality declines in the Tongue River below the confluence with Goose Creek. The decline was thought to be related to elevated water temperatures, as measured by WDEQ and USGS gage data (station 06306300). WDEQ's cold water fishery temperature criterion was exceeded on multiple occasions during this study and a segment of the Tongue River (WYTR100901010301_01) from the confluence with Goose Creek downstream to the Montana border was added to the 303(d) List in 2002 because cold water fishery and aquatic life other than fish uses were not supported. The source of the elevated temperatures in the Tongue River are unknown.

The North Tongue River watershed's headwaters are located at the eastern base of Little Bald Mountain in the Big Horn Mountain Range. The river flows northeast approximately 21 miles to its confluence with the Tongue River. In 2003, a citizen complaint was filed with WDEQ regarding high concentrations of cattle in the riparian area of North Tongue River within the Bighorn National Forest. Specifically, the citizen was concerned about the potential human health effects associated fecal contamination. WDEQ (2003) collected *E. coli* samples at six study sites along the North Tongue River in 2003. Sites ranged from just above the confluence with Hidden Teepee Creek downstream to Forest Road 171. The report concluded that the fecal coliform criterion protective of primary contact recreation was exceeded along a segment of the North Tongue River (WYTR100901010101_01) extending from the confluence of Bull Creek upstream an undetermined distance above highway 14A and this segment was added to the 303(d) List in 2004. USFS collected additional *E. coli* data on the North Fork Tongue River between 2003 and 2008 using three study sites; a summary report was not written by USFS. These data showed that WDEQ's recreational use criterion was regularly exceeded during summer months. In addition, the extent of bacterial impairment on North Tongue River was expanded in the 303(d) List in 2010 to include from Forest Road 171 upstream to the confluence with Pole Creek. A diverse stakeholder group, including the USFS, has been working to improve water quality in North Tongue River by implementing livestock BMPs on the grazing allotments within the watershed.

The headwaters of the South Tongue River are located in the Big Horn Mountain Range, near the northern boundary of the Cloud Peak Wilderness. The river flows north to its confluence with the Tongue River, approximately 4 miles north of US Route 14. USFS completed a channel stabilization project in 2003 to stabilize the river's channel and reduce sediment inputs in the vicinity of the Dead Swede Campground. WDEQ (2008) collected physical, chemical and biological data on South Tongue River at four study sites between 1993 and 2003 to determine whether excess sediment was impairing the river's aquatic life other than fish and cold water fishery uses. All measured water chemistries were within WDEQ water quality criteria. Some *E. coli* single sample concentrations were considered elevated during the course of this study, but insufficient samples were collected to assess the recreational use. Habitat conditions at study sites decreased in a downstream direction with sediment aggradation and streambank

Tongue Sub-basin



degradation becoming more pronounced. However, the biological condition at all study sites was determined to be good. The study concluded that the aquatic life other than fish and cold water fishery uses on the South Fork Tongue River (WYTR100901010104_02) were fully supported from 0.3 miles above HWY 14 upstream to the confluence with the East Fork South Fork Tongue River.

Prune Creek's headwaters are located in the Big Horn Mountains southwest of the town of Dayton. The creek flows north to its confluence with Sibley Lake, then flows northwest to its confluence with South Tongue River near US Route 14. WDEQ (2002) collected physical, chemical and biological data at two study sites on Prune Creek in 1998 to address concerns that sedimentation was degrading aquatic life uses. No measured chemical parameters exceeded WDEQ water quality criteria during this study. The habitat quality and the macroinvertebrate communities at both study sites were considered to be comparable to reference condition. The study concluded that Prune Creek (WYTR100901010104_01) fully supported its cold water fishery and aquatic life other than fish uses from the confluence with the South Tongue River to a point 5.4 miles upstream.

The headwaters of the Little Tongue River watershed are located in the Big Horn Mountain Range west of the City of Sheridan. The river flows northeast around Horseshoe Mountain and flows below a large boulder field temporarily before resurfacing. The river then flows approximately 12 miles to its confluence with the Tongue River near the Town of Dayton. WDEQ (2005) collected physical, chemical and biological data from one site during 1996, 1998 and 2004. Sheridan County Conservation District (SCCD) also collected data at this site in 1997 and 1999. Two additional upstream sites were also sampled by WDEQ in 2004. There were no exceedances of any WDEQ water chemistry criteria during this study. Habitat conditions were good at the two upstream study sites and declined only slightly at the lowest site due to sediment aggradation. WDEQ determined that aquatic life other than fish and cold water fisheries uses on the Little Tongue River (WYTR100901010107_01) were fully supported within the entire watershed upstream from the confluence with Frisbee Ditch. Fecal coliform data collected by SCCD in 2000 and 2001 were used to determine that Little Tongue River (WYTR100901010107_02) from the confluence with the Tongue River upstream to the confluence with Frisbee Ditch was not supporting its contact recreational use; this segment was placed on the 303(d) List in 2002.

Columbus, Smith, Fivemile and Wolf Creeks are tributaries to the Tongue River near the towns of Ranchester and Dayton. SCCD completed the Tongue River Watershed Assessment Final Section 319 Report 1996-1999 in September of 2000. The goals of this study were to monitor the water quality of portions of the Tongue River watershed above the Town of Ranchester and to develop a watershed plan. Fecal coliform and *E. coli* samples collected on Columbus (WYTR100901010106_01), Smith (WYTR100901010106_02), Fivemile (WYTR100901010108_01) and Wolf (WYTR100901010110_01) Creeks and the Tongue River (WYTR100901010111_01) indicated that segments of each were not supporting their contact recreational uses; these segments were added to the 303(d) List in 2002. SCCD completed the Tongue River Watershed Plan Implementation Final Section 319 Report in 2004. Implementation occurred between 2001 and 2004; projects included hosting workshops to educate the public, an animal feeding operation (AFO) improvement, a septic system replacement, stream stabilization and streambank protection. The AFO project focused on moving livestock corrals approximately 1000 feet away from Fivemile Creek and re-seeding the original location of the corrals. The septic system replacement project focused on replacing a poorly operating septic tank and absorption field located in the floodplain of the Tongue River. The streambank stabilization project focused on realignment and stabilization of an approximately 1000 foot segment of the Tongue River. WDEQ (2003) collected physical, chemical and biological data in 1998 at six study sites along the Tongue River, extending from just upstream of Dayton downstream to just below Ranchester. Designated use support was not assessed.

The headwaters of the Goose Creek watershed are located in the Big Horn Mountains southwest of the City of Sheridan. Little Goose Creek and Big Goose Creek flow northwest and confluence to form Goose Creek within the City of Sheridan. Goose Creek continues flowing north to its confluence with the Tongue

River near the community of Kleenburn. WDEQ collected fecal coliform data on Big Goose Creek (WYTR100901010205_01) and Little Goose Creek (WYTR100901010208_01) in the mid-1990s. These data showed that WDEQ's fecal coliform criterion was exceeded on both creeks and therefore the recreational use was not supported. The source of elevated fecal coliform was listed as unknown. As a result, a segment of Big Goose Creek from the City of Sheridan upstream to above the community of Beckton and Little Goose Creek from the City of Sheridan upstream to above Bighorn were added to the 303(d) List in 1996. A USGS (2000) study reported that gage data (station 06302200) also showed exceedances of WDEQ's fecal coliform criterion on Big Goose Creek near the community of Beckton in 1999. WDEQ (1999) again collected fecal coliform samples from several study sites on Big Goose Creek and three of its tributaries including Beaver, Park and Rapid Creeks, Little Goose Creek and three of its tributaries including Kruse, Sacket and Jackson Creeks and Goose Creek and one of its tributaries in 1998 and 1999. Five study sites were located along Big Goose Creek, extending from Kendrick Park in Sheridan upstream to the vicinity of the City of Sheridan's drinking water treatment facility at the mouth of Big Goose Creek Canyon. The four downstream study sites on Big Goose Creek exceeded WDEQ's fecal coliform criterion protective of recreational use in 1998. Therefore, the extent of the 1996 Big Goose Creek 303(d) Listing (WYTR100901010205_01) was changed to include a 19.2 mile segment from the confluence with Little Goose Creek upstream to the confluence with Rapid Creek. Beaver, Park and Rapid Creeks were sampled to investigate the extent to which each contributed bacterial loading to Big Goose Creek. One study site was sampled on each of the three creeks, just above their confluence with Big Goose Creek. All three creeks exceeded WDEQ's fecal coliform criterion and were added to the 303(d) List in 2000. The extent of the three impaired segments included: Beaver Creek (WYTR100901010205_02) from the confluence with Big Goose Creek upstream to the confluence with Apple Run; Park Creek (WYTR100901010204_01) from the confluence with Big Goose Creek to a point 2.8 miles upstream; and Rapid Creek (WYTR100901010204_02) from the confluence with Big Goose Creek to a point 3.2 miles upstream. Seven study sites were sampled along Little Goose Creek, ranging from the Coffeen Avenue Bridge in the City of Sheridan upstream to County Road 77, near the mouth of Little Goose Creek Canyon. The lowermost six sites exceeded WDEQ's fecal coliform criterion in 1998 and the extent of the Little Goose Creek listing was changed to include a 3.5 mile segment from the confluence with Big Goose Creek upstream to Brundage Lane in Sheridan. Kruse, Sacket and Jackson Creeks were sampled to investigate the extent to which each water contributed bacterial loading to Little Goose Creek. One study site was sampled on each of the three creeks, just above their confluence with Little Goose Creek. All three creeks exceeded WDEQ's fecal coliform criterion and were added to the 303(d) List in 2000. The three impaired segments included: Kruse Creek (WYTR100901010208_03) from the confluence with Little Goose Creek upstream to the confluence with East Fork Kruse Creek; Sacket Creek (WYTR100901010207_01) from the confluence with Little Goose Creek upstream to the confluence with East Fork Sackett Creek; and Jackson Creek (WYTR100901010207_02) from the confluence with Little Goose Creek to a point 6.4 miles upstream.WDEQ collected fecal coliform samples at four study sites on Goose Creek in 1998 along a segment extending from below the City of Sheridan's WWTF upstream to just above the town of Big Horn. Fecal coliform concentrations exceeded WDEQ's recreational use criterion and a segment of Goose Creek (WYTR100901010209_01) from the confluence with Little Goose Creek downstream to the confluence with the Tongue River was added to the 303(d) List in 2000.

SCCD completed the 2001-2002 Goose Creek Watershed Assessment Section 319 Report in 2003. The project was directed by the Goose Creek Drainages Advisory Group (GCDAG), which included representatives from SCCD, Sheridan County Commissioners and the City of Sheridan. The goal of this project was to conduct an extensive evaluation of the Goose Creek watershed to evaluate water quality. To achieve this goal, physical, chemical and fecal coliform samples were collected at 46 study sites throughout the watershed in 2001 and 2002 on Big Goose, Little Goose and Goose Creeks and several tributary streams. Fecal coliform concentrations at sites on Big Goose, Little Goose, Goose, Kruse, Sackett, Jackson, Beaver, McCormick, Rapid and Soldier Creeks exceeded WDEQ's recreational use criterion, thus supporting existing 303(d) Listings on these waters. The extent of exceedances observed during this study on Big Goose, Little Goose and Goose Creeks was less than that previously reported by

WDEQ, possibly due to low flow conditions. The report noted that elevated water temperatures were common in the lower watershed and that these reaches may be more appropriately classified as warm water fisheries. Elevated water temperatures may also be related to low flow conditions observed during the study.

Soldier Creek's headwaters are located east of Walker Mountain in the foothills of the Bighorn Mountains. The creek flows northeast to its confluence with Goose Creek north of the City of Sheridan. Soldier Creek was sampled in 1999 to investigate whether this water contributed to the high bacteria concentrations on Goose Creek. One study site was sampled on the creek, just above the confluence with Goose Creek. Soldier Creek (WYTR100901010209_02) exceeded WDEQ's fecal coliform criterion and was added to the 303(d) List in 2000 from the confluence with Goose Creek to a point 3.1 miles upstream. Sheridan County Conservation District (SCCD) monitored fecal bacteria in the Goose Creek Watershed in 2001 and 2002, and results corroborate the 1998-1999 WDEQ data (SCCD, 2003). TMDLs were completed 2010 for the bacterial impairments on Big Goose, Little Goose, Goose, Kruse, Sackett, Jackson, Beaver, Rapid and Soldier Creeks and these stream segments were removed from the 303(d) List in 2012 and placed in category 4A. SCCD completed the 2009 Goose Creek Watershed Interim Monitoring Section 319 Report in 2011. Monitoring results confirmed that all of the above waters continue to have high *E. coli* concentrations which tended to increase from 2005 to 2009. The report suggested that *E. coli* may increase in response to precipitation and snow melt runoff events via overland flow and by streamflows re-suspending streambed sediments containing *E. coli*. WDEQ (2005) collected physical, chemical and biological samples from five study sites along Soldier Creek in 1998 and 1999. All measured water chemistries were below WDEQ criteria. TSS and turbidity increased from upstream to downstream study sites, which may have been related to changes in land use and/or a recent precipitation event. Fecal coliform concentrations exceeded WDEQ's criterion at the four most downstream study sites, a pattern similar to that previously reported by WDEQ (1999). Habitat quality was considered to be near that of reference at upstream sites but declined substantially downstream. Macroinvertebrate samples showed that the biological communities at study sites near Sheridan were in poor condition. The report concluded that Soldier Creek (WYTR100901010209_04) is fully supporting its cold water fishery and aquatic life other than fish uses from the headwaters to a point 7.3 miles downstream and it was placed in category 2 in 2010. WDEQ (2009) collected additional physical, chemical and biological data on Soldier Creek in 2003 at five study sites. The purpose of this study was to further investigate whether the aquatic life uses on the middle and lower reaches of Soldier Creek are degraded. The report concluded that flow alterations are causing the aquatic life uses to be impaired on a segment of Soldier Creek (WYTR100901010209_03) from 3.1 miles upstream from the confluence with Goose Creek to a point 17 miles upstream. However, because the impairment is caused by a non-pollutant, flow alterations, the segment was placed in category 4C.

WDEQ (2005) conducted water quality studies within the Goose Creek watershed within the City of Sheridan to collect data toward WYPDES stormwater permit (MS4) requirements. Physical, chemical and biological data were collected from Goose Creek in 2004 directly below four stormwater outfalls to Goose Creek during three separate precipitation events. In addition, samples were collected at nine study sites on Goose Creek ranging from above to below the City of Sheridan. The report concluded that stormwater discharges from the City of Sheridan were contributing excessive sediment to Goose Creek and degrading the aquatic life other than fish and cold water fisheries uses. As a result, 12.7 mile segment of Goose Creek from the confluence with Little Goose Creek downstream to the confluence with the Tongue River was added to the 303(d) List in 2006. The source of the excess sediment is stormwater runoff.

WDEQ (2004) collected physical, chemical and biological data at five study sites along Little Goose Creek in 1999. Elevated water temperature was noted as a concern at several sites during the study. Habitat quality in Little Goose Creek was considered poor due to a degraded riparian zone and a streambed dominated by fine sediments. The macroinvertebrate community was dominated by tolerant taxa adapted to organic pollution and physical degradation. The report concluded that the aquatic life uses on Little Goose Creek were impaired due to sedimentation from stormwater from the City of Sheridan. Therefore,

a sediment impairment was added to the 303(d) List for an existing segment (fecal coliform) of Little Goose Creek (WYTR100901010208_01). The segment extends from the confluence with Big Goose Creek upstream to Brundage Lane in Sheridan. TMDLs were completed in 2010 for the sediment impairments on Little Goose Creek and these stream segments were removed from the 303(d) List in 2012 and placed in category 4A.

The headwaters of West Fork Big Goose Creek are located within the northeastern portion of the Cloud Peak Wilderness in the Bighorn Mountains. The creek flows northeast to its confluence with East Fork Big Goose Creek, thus forming Big Goose Creek near the upper end of Big Goose Creek Canyon. The headwaters of the Coney Creek watershed are located within the northeast portion of the Cloud Peak Wilderness in the Big Horn Mountains. Coney Creek flows approximately 3.5 miles through Coney and Stull Lakes and Twin Lakes Reservoir before it confluences with West Fork Big Goose Creek near the USFS Twin Lakes Campground. WDEQ (1996) collected biological data at two sites on West Fork Big Goose Creek and one site on Coney Creek. These bioassessments included the evaluation of physical, chemical and biological condition. Physical and chemical water quality parameters were within expected ranges within West Fork Big Goose Creek. Coney Creek had relatively high total suspended solids (TSS) and turbidity, related to releases from the Twin Lakes Reservoir expansion project. Habitat quality within West Fork Goose Creek was good; however, sedimentation appeared to increase below the confluence with Coney Creek. Coney Creek's habitat condition was poor, mostly due to sedimentation and streambed embeddedness. Nearly 100% of the streambed was composed of fine sediment. The macroinvertebrate community within West Fork Big Goose Creek declined somewhat in a downstream direction, and this decline was attributed to sedimentation from Coney Creek. The biological condition of Coney Creek was also degraded from sedimentation. The report concluded that the West Fork Big Goose Creek watershed (WYTR100901010203_01), excluding Snail, Sawmill and Coney Creeks, fully supports its cold water fishery and aquatic life other than fish uses. Coney Creek was determined to be in poor physical condition during this study. However, because this condition was the result of a recently completed construction project, it was unknown whether these conditions would persist. WDEQ therefore decided to collect two additional years of data before assessing the designated uses of Coney Creek. WDEQ (2002) collected physical, chemical and biological data at a single study site on Coney Creek below Twin Lakes Reservoir between 1996 and 1998. The objective of the study was to determine the effects of a Twin Lakes Reservoir expansion project on Coney Creek's designated uses. There were no exceedances of any WDEQ water chemistry criteria during the study. There was a trend of decreasing TSS and turbidity; habitat condition including streambed embeddedness and available fish cover improved over the study period. The study site also had an intact riparian zone and minimal human disturbance. Macroinvertebrate samples suggested that the community was in fair condition. The report concluded that the Coney Creek watershed (WYTR100901010203_02) fully supports its cold water fishery and aquatic life other than fish uses.

Prairie Dog Creek's headwaters are located along Moncreiffe Ridge, within the foothills of the Bighorn Mountain Range northwest of the town of Story. The creek ultimately flows northeast across the WY/MT border and confluences with the Tongue River near the town of Decker, MT. Water from Prairie Dog Creek is utilized extensively for irrigated agriculture. The creek is fed by a small spring at its headwaters at a rate of less than 1 cfs. The creek's natural streamflow is significantly augmented (increased to 60-80 cfs) during the irrigation season (May-September) using water diverted from the Piney Creek watershed in the neighboring Powder River basin (EnTech, Inc., 2001). Water is piped to Jenks and Meade Creeks, which are both small tributaries to Prairie Dog Creek. The drop structures on Jenks and Meade Creeks have caused heavy streambank erosion. USGS gage data (station 06306250) spanning 2000-2003 showed that a segment of Prairie Dog Creek exceeded WDEQ's secondary drinking water criterion for manganese and fecal coliform criterion protective of contact recreation. A segment of Prairie Dog Creek (WYTR100901010402_01) from the confluence with the Tongue River to a point 6.7 miles upstream was added to the 303(d) List in 2004 for not supporting its drinking water use. Concentrations of manganese in the creek are far below the human health criteria, but can cause the discoloration of water and the staining of cooking utensils. It is likely that the high manganese concentrations are due to the natural

geology of the basin (Rice et al, 2002). Chapter 1 specifies that secondary drinking water criteria only apply to those waters that are being used as a drinking water source. This segment will be reassessed for the 2016 Integrated Report.

WDEQ (2003) collected physical, chemical and biological data at nine sites on Prairie Dog Creek and one sample each on Jenks, Murphy, Meade and Wildcat Creeks. The report noted elevated TSS, turbidity and suspended sediment during the irrigation season as concerns. No measured WDEQ water chemistry criteria were exceeded during the study and macroinvertebrate communities were considered to be in good condition across most study sites. However, designated uses were not assessed. WDEQ (2005) collected *E. coli* data at six study sites on Prairie Dog Creek in 2003. The purpose of the study was to address concerns that there may be elevated bacterial concentrations in the creek. Data showed that WDEQ's fecal coliform criterion was exceeded at all six sites and a segment of Prairie Dog Creek (WYTR100901010400_01) from I-90 to a point 47.2 miles downstream was added to the 303(d) List in 2004. SCCD completed the final report for the Prairie Dog Creek Watershed Assessment (2007-2008) Section 319 Project in 2009. The report indicated that excess sediment may be affecting the macroinvertebrate community in Prairie Dog Creek and the impact of this pollutant is a concern. Data collected on Prairie Dog Creek and several of its tributaries during this project resulted in seven additional 303(d) listings in 2012. The manganese drinking water criterion and the cold water fishery water temperature criterion were exceeded along a segment of lower Prairie Dog Creek (WYTR100901010400_01), from I-90 to a point 47.2 miles downstream. The cold water fishery temperature criterion was also exceeded on Prairie Dog Creek (WYTR100901010402_01) from the confluence with the Tongue River to a point 6.7 miles upstream. The manganese criterion for drinking water and the *E. coli* criterion protective of primary contact recreation were exceeded on Meade Creek (WYTR100901010401_01) from the confluence with Prairie Dog Creek upstream to the confluence with an unnamed tributary. WDEQ's primary contact recreational use criterion was exceeded on Dutch Creek (WYTR100901010405_01) from the confluence with Prairie Dog Creek to a point 1.9 miles upstream and on Wildcat Creek (WYTR100901010402_02) from the confluence with Prairie Dog Creek to a point 0.8 miles upstream. SCCD completed the 2011 Prairie Dog Creek Watershed Interim Section 319 Monitoring Report in October, 2012. The study largely corroborated results from

SCCD's 2009 report described above and reported elevated temperature and *E. coli* at several sites within the watershed. Excessive fine sediments continue to be a concern within Prairie Dog Creek and may impact the macroinvertebrate community. Chapter 1 specifies that secondary drinking water criteria only apply to those waters that are being used as a drinking water source. Therefore, segments on Prairie Dog and Meade Creeks will be reassessed for the 2016 Integrated Report. SCCD completed a Watershed Based Plan for Prairie Dog Creek in 2011.

As part of a 2009 Sheridan County Watershed Improvement Section 319 Project, SCCD, NRCS and local citizens implemented 31 projects designed to address bacterial impairments in the Tongue River, Goose and Prairie Dog Creek Watersheds; including six to replace septic systems, three streambank stabilization projects, and one large scale river restoration project.

8.14 Yellowstone River Basin

The Yellowstone River Basin drains approximately 6,618 mi^2 in northwest Wyoming. The headwaters of the Yellowstone River are located along the western edge of the Teton Wilderness Area within the Absaroka Mountain Range. The river flows northwest into Yellowstone National Park near Bridger Lake, then continues approximately 15 miles to its confluence with the southeastern arm of Yellowstone Lake. The river flows from Yellowstone Lake's outlet on the north side of the lake and continues flowing north to the WY/MT border. The river ultimately flows northeast across Montana and confluences with the Missouri River near the MT/ND border.

The Yellowstone River Basin consists of two level III ecoregions, including the Middle Rockies and Wyoming Basin (Chapman et al. 2003). The Middle Rockies make up the majority of the basin, whereas the Wyoming Basin represents a relatively small portion of the easternmost portion of the basin. The Middle Rockies consist of high mountains covered by coniferous forests. In contrast, the Wyoming Basin consists of a broad intermountain arid basin. The Middle Rockies in this basin is ecologically diverse, containing Alpine Zone, Absaroka-Gallatin Volcanic Mountains, Yellowstone Plateau, Granitic Subalpine Zone, High Elevation Valleys and Absaroka Volcanic and Sedimentary Subalpine Zones Level IV ecoregions. The Yellowstone Plateau occurs across approximately the western half of the basin. This area contains low mountains composed mostly of rhyolite, basalt and tuff. The plateau is still volcanically active, as is evidenced by numerous geysers and mudpots. Mountains are covered in a mixture of Lodgepole pine and Douglas-fir while side slopes contain big sagebrush and other shrubs. The plateau is interrupted by several small high elevation valleys, including those for the Yellowstone (Hayden Valley) and Lamar Rivers and Pelican Creek. These valleys are characterized by wet riparian areas and marshes surrounded by terraces and foothill slopes. These valleys are important habitat for ungulates such as elk and bison. There is a small area of sedimentary subalpine zone in the northwest corner of the basin. This ecoregion is composed of limestone, dolomite, shale and sandstone and vegetation consists of subalpine fir, Engelmann spruce and Lodgepole pine. The central portion of the basin transitions to the Absaroka-Gallatin Volcanic Mountains, which consists of steep sided mountains, ash beds and mud flows. Due to natural geology, streams originating in these mountains are often very turbid following precipitation events and have elevated nutrients. These mountains transition to the higher elevation intermediate Absaroka Volcanic and Granitic Subalpine Zones before terminating in the Alpine Zone. The former ecoregion, occurring in the Absaroka Mountain Range is relatively narrow in scope due to the erosion of its steep, broken and loosely consolidated cliff faces composed of ash, tuff, basalt and pumice. The Granitic Subalpine Zone occurs in the Beartooth Mountain Range and consists of broad glacial valleys with many lakes. The Alpine Zone is a high precipitation area above treeline; vegetation is limited due to high wind and snow drifting, and largely consists of krummholz (twisted or bent trees) and alpine forbs, sedges and grasses. The east slope of the Beartooth and Absaroka Mountain Ranges transition to the Bighorn and Bighorn Salt Desert Shrub Basins. These ecoregions receive little precipitation and soils are composed of alkaline sedimentary geology such as shale, sandstone and siltstone. Vegetation consists mostly of sagebrush, saltbush greasewood and saltgrass. Common land uses in the Yellowstone Basin include wildlife habitat, livestock grazing, recreation, logging, oil and gas production and mining.

The riparian areas of Yellowstone National Park have been heavily grazed by elk and/or bison and many water quality concerns have been reported (Houston, 1982; Singer, 1996). For example, historical photos of the lower Lamar River Valley show thick stands of willow, which are very important for stabilizing streambanks. Most of these willows were nearly eradicated because of sustained browsing by wildlife, and as a consequence, considerable bank erosion occurred along the river. With the reintroduction of wolves to Yellowstone National Park, ungulates have been forced to become more mobile, and consequently spend less time in riparian areas. As a result, riparian vegetation is recovering within Yellowstone National Park (Ripple and Beschta, 2003).

Yellowstone Headwaters Sub-basin (HUC 10070001)

All waters in the Yellowstone Headwaters sub-basin are classified as Class 1 by WDEQ and are contained within either Yellowstone National Park or Teton Wilderness Area. More than half of Yellowstone National Park is contained within this sub-basin. While the majority of the park in this sub-basin is quite remote and sees relatively few visitors, more than 3 million people visit the more accessible attractions each year.

In 1998, four sewage spills occurred in Yellowstone National Park within the Yellowstone Headwaters sub-basin. Two spills released approximately 180,000 gallons to Yellowstone Lake, approximately 1,000 gallons were released to Myriad Creek and 40,000 gallons were released to the Firehole River. WDEQ subsequently issued discharge permit notice of violations for each of these spills in the latter part of

1998. Yellowstone National Park managers agreed to implement a series of corrective actions in 1999 that were intended to reduce the risk of future spills; the facility upgrades were completed in 2005.

The headwaters of Soda Butte Creek are located in the Absaroka Mountain Range in southern Montana. The creek flows southwest through Cooke City and the historic New World Mining District before it enters Wyoming and confluences with the Lamar River. The New World Mining District includes the McLaren mill mine tailings and the now defunct Republic Smelter. Heavy metals from this area have polluted the upper Soda Butte watershed. As a result of these impacts, the aquatic life uses on Soda Butte Creek in Montana are considered to be impaired due to heavy metals. The Montana Department of Environmental Quality (MDEQ) completed a USEPA approved TMDL for Soda Butte Creek in 2002. The USFS and MDEQ have relocated a large portion of the contaminated mine tailings and data collected by these entities indicate that water quality has improved in Soda Butte Creek at the Yellowstone National Park boundary (Tetra Tech, 2007). It is unknown whether there are impacts to the Soda Butte watershed within Yellowstone National Park.

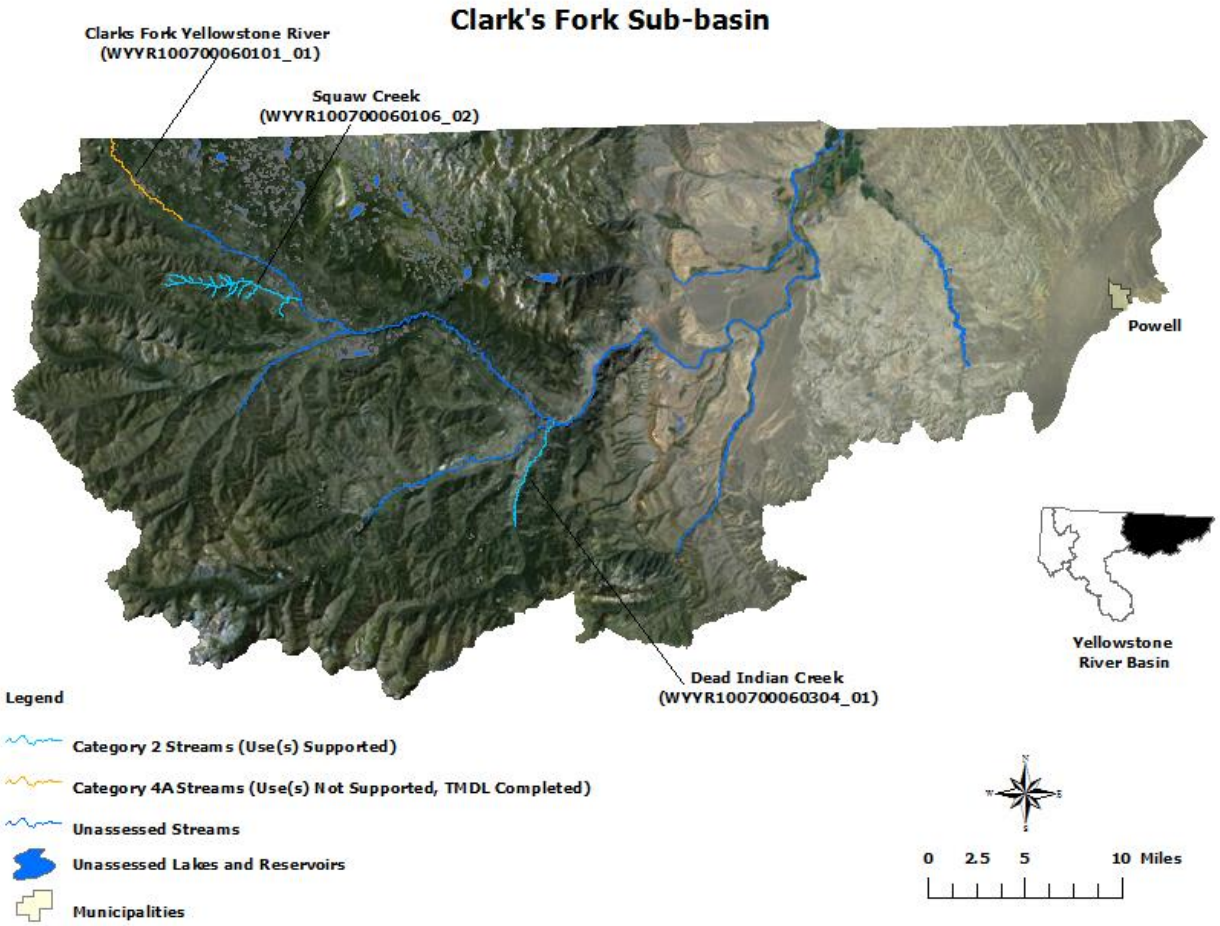
Clarks Fork Yellowstone Sub-basin (HUC 10070006)

The Clarks Fork Yellowstone River is a major tributary to the Yellowstone River. The Clarks Fork Yellowstone River's headwaters are located within in the Absaroka and Beartooth Mountain Ranges in southern Montana. The river flows east through mountains and the steep and rugged Clarks Fork Canyon onto the lower elevation Bighorn Basin. The river continues across the WY/MT border near Chance, Montana and ultimately confluences with the Yellowstone River. The Clarks Fork Wild and Scenic Rivers Act of 1990 added a 20.5 mile segment of the upper Clarks Fork Yellowstone River to the National Wild and Scenic River's System. This segment extends from approximately 0.5 miles downstream of the Clarks Fork bridge on highway 296 downstream to about 1 mile from the Shoshone National Forest boundary, near the mouth of the Clarks Fork Canyon. The Clarks Fork Yellowstone River is classified as class 1 by WDEQ above the Shoshone National Forest boundary.

USGS gage data (station 06205450) collected during the late 1990s showed that cadmium, silver and copper concentrations in the Clarks Fork Yellowstone River near the WY/MT border regularly exceeded WDEQ's aquatic life copper, cadmium and silver criteria. A 6.8 mile segment of the of the Clarks Fork Yellowstone River (WYYR100700060101_01) from the Montana border downstream to the confluence with Crazy Creek was subsequently added to the 303(d) List in 2000. Montana also listed portions of the upper Clarks Fork Yellowstone River on its 303(d) List. The primary source of elevated metals was identified on the Montana 303(d) List as acid mine drainage, impacts from abandoned mine lands and mine tailings from historic mining activities in the New World Mining District near Cooke City, Montana. USEPA approved TMDLs have been completed by Montana and heavy metals remediation continues to occur within the New World Mining District. Montana's TMDLs for the Clarks Fork Yellowstone River were also used by WDEQ to address the three impairments on the river in Wyoming. These TMDLs were approved by USEPA in 2008 and therefore the three impairments were removed from the 303(d) List in 2008 and placed in category 4A.

Squaw Creek's headwaters are located just beyond the northeastern boundary of the North Absaroka Wilderness Area within the Absaroka Mountain Range. The creek flows southeast from the base of Squaw Peak to its confluence with the Clarks Fork Yellowstone River near State Route 296. Several anthropogenic and natural events contributed to the degradation of the aquatic life uses in Squaw Creek during the late 1980s. First, a wildfire severely burned the drainage in 1988. Inadequately sized culverts trapped fine sediments from eroding slopes and then washed out during subsequent runoff events. A diesel fuel spill occurred in 1989, causing a partial fish kill in the watershed. Park County, USFS and WGFD completed the Squaw Creek Watershed Section 319 Project in 2001. The goals of the project were to relocate Forest Road 117 away from the riparian zone and floodplain of Squaw Creek in an effort to reduce sedimentation and improve water quality. The final report for this project was completed in 2001. Data showed that the sedimentation issues had been addressed (Page and Zubik, 2001) and that the

aquatic life other than fish and cold water fishery uses on Squaw Creek (WYYR100700060106_01) were fully supported within the entire watershed upstream from the confluence with the Clarks Fork Yellowstone River and this segment was placed in category 2 in 2002.



Dead Indian Creek's headwaters are located in the North Absaroka Wilderness Area, within the Absaroka Mountain Range west of the town of Cody. The creek flows northeast to its confluence with the Clarks Fork Yellowstone River in Clarks Fork Canyon. WDEQ (2005) collected physical, chemical and biological data from Dead Indian Creek at two study sites located upstream and downstream of State Route 296 in 2001. None of the measured water chemistry parameters exceeded WDEQ's water quality criteria during this study. The habitat quality of the lower study site may have been affected by human activities at the Dead Indian Creek Campground; however habitat condition at both sites were considered good. The macroinvertebrate communities at both sites contained sensitive taxa, further indicating the presence of good water quality. The report concluded that Dead Indian Creek (WYYR100700060304_01) fully supports its aquatic life other than fish and coldwater fisheries uses along a 6.9 mile segment from the confluence with the Clarks Fork upstream to Dry Creek.

9.0 Surface Water Quality Assessment Summary

Wyoming's surface waters are classified by the state using a tiered system outlined in Chapter 1 and described in Section 2.2 above. This approach places waters into classes 1-4, with Class 1 waters being managed for the highest and Class 4 for the lowest water quality and designated uses, respectively. USEPA guidance (USEPA 2005, 2006) specifies that all surface waters of the state be placed into one of five designated use attainment categories (see Section 2.3 above for a detailed discussion of USEPA Categorizations). Wyoming's Methods for Determining Surface Water Quality Condition and TMDL Prioritization (WDEQ, 2014) outlines the methodology used by WDEQ for making designated use support determinations, or assessments, on surface waters. Category 1 waters are those that support all their designated uses and have no water quality threats or impairments. Category 2 waters are those for which some designated uses are supported, but the status of others remains unknown. Category 3 waters are those waters for which insufficient data exists to make use support determinations. Category 4 waters are those waters which have a designated use that is impaired or threatened and either a TMDL has been completed (4A); other pollution control measures are expected to address the impairment (4B); or a non-pollutant (e.g. flow alteration) is the source of impairment (4C). Lastly, Category 5 waters, or those on the state's 303(d) List, are waters where one or more uses are either impaired or threatened and a TMDL is required. There are currently no Category 1 waters in Wyoming. Summary statistics for the overall surface water quality conditions in Wyoming are described below. Wyoming's Category 2, 3, 4, and 5 (2014 303 (d) List) surface waters are listed for each river basin in subsections 9.1-9.4 below.

As of the publication date of Wyoming's 2014 Integrated 305(b) and 303(d) Report, WDEQ has assessed 6.4% (17,770.5 miles) of the 280,804 (1:24K NHD (National Hydrography Dataset)) miles of Wyoming's ephemeral, intermittent and perennial streams. This represents an increase of 0.1% (253 miles) from the assessed stream miles included in the Wyoming's 2012 Integrated 305(b) and 303(d) Report. WDEQ assessed 17 new stream segments along 10 separate streams and re-categorized or re-assessed 29 segments on 25 streams. Most of these stream segments were re-categorized or re-assessed following USEPA approved TMDLs (24) or successful BMP implementation (4). A 2.9 mile segment of Bear Creek, from the confluence with Rob Roy Reservoir to a point 2.9 miles upstream was temporarily placed in category 3 because designated use support was indeterminate. Data and information from the report were subsequently re-assessed for the 2014 Integrated Report. Ultimately, Bear Creek (WYNP101800020104_01) from the confluence with Rambler Creek downstream 0.7 miles to the confluence with Rob Roy Reservoir was added to the 303(d) List in 2014. Rambler Creek (WYNP101800020104_03) was also added to the 303(d) List in 2014 for not supporting its aquatic life other than fish use due to the high copper concentrations. Lastly, this study found that Bear Creek's (WYNP101800020104_02) cold water fishery and aquatic life other than fish uses are fully supported from the confluence with Rambler Creek to a point 1.3 miles upstream.

Water quality monitoring studies conducted by WDEQ, or other entities, are typically designed to evaluate a specific designated use or in some cases several uses. As a result, there are currently no surface streams in Wyoming for which all designated uses have been determined. WDEQ has assessed more miles of aquatic life other than fish and cold water fishery uses than any other uses on Wyoming's streams (Table 9.1). As is described in Wyoming's Methods for Determining Surface Water Quality Condition and TMDL Prioritization (WDEQ, 2014), unless data and/or information suggest otherwise, WDEQ will generally use aquatic life other than fish designated use support as a surrogate measure of wildlife, agriculture and industry. To date, these three uses have only been assessed in this manner with 11,213 miles assessed for each. The recreational and drinking water uses have been assessed along 959 and 485 miles of streams, respectively. Warm water fishery (321 miles), fish consumption (275 miles) and non-game fishery (173 miles) uses have been assessed to a lesser extent and the scenic value use has not been assessed to date. Table 10.2 summarizes the number of stream segments in each USEPA category, the number of assessed miles and the relative percentage of assessed miles in each category. Most of Wyoming's assessed stream miles are in USEPA Category 2 (89%) or Category 5 (8%) with the remainder of assessed stream miles in either Category 4C (1%), 4A (2%) or 3 (<1%) (Table 10.2).

WDEQ has identified 16 causes and 12 sources of impairment (i.e. Category 4 and Category 5) on Wyoming's streams (Table 9.3). The majority of impaired stream miles are caused by *E. coli*/fecal coliform, selenium, sediment, flow alterations, habitat alterations and arsenic. Sources of pollutants are mostly unknown, natural sources, livestock grazing, irrigated agriculture and petroleum production. The relative percentage of causes and sources of impairment on Wyoming streams is shown in Figures 9.1 and 9.2 below.

Table 9.1. Table summarizing designated use support for the eleven designated uses on Wyoming's streams. The table includes the number of miles and percentage of the total miles assessed (17,770.5) for each designated use. The number of miles assessed as fully supporting, not supporting and indeterminate is also reported.

Summary Designated Use Support for Streams					
Designated Use	**Miles Assessed**	**Percent of Total Miles**	**Miles Fully Supporting**	**Miles Threatened or Not Supporting**	**Miles with Indeterminate Use Support**
Drinking Water	490	3%	301	184	5
Aquatic Life other than Fish	17,056	96%	15,871	1100	85
Cold Water Fishery	15,029	85%	14,379	607	43
Warm Water Fishery	327	2%	171	150	6
Nongame Fishery	191	1%	4	169	18
Fish Consumption	301	2%	275	0	26
Recreation	1,025	6%	6	952	67
Wildlife	12,162	68%	11,213	0	949
Agriculture	12,162	68%	11,213	0	949
Industry	12,162	68%	11,213	0	949
Scenic Value	0	0	0	0	0

Table 9.2. Table summarizing the number of stream segments in each USEPA category, total miles assessed and the relative percent of assessed miles in each USEPA category.

Summary of Wyoming's USEPA Categorizations for Streams			
Category	**Number of Segments**	**Total Miles Assessed**	**Relative % of Assessed Miles**
1	0	0	0
2	136	15,779	89
3	2	7.5	<1
4A	35	436	2
4B	0	0	0
4C	7	198	1
5	87	1,350	8

Table 9.3. Ranked summary statistics for the causes and sources of water quality impairment for Wyoming's streams, including both Category 4 and Category 5 (2014 303(d) List) waters. (Please note that each impairment can have more than one cause and source.)

Summary of Causes and Sources of Wyoming's Stream Impairments			
Causes	**Miles**	**Sources**	**Miles**
E. Coli/Fecal Coliform	952	Unknown	1,216
Selenium	375	Natural Sources	480
Sediment	311	Livestock Grazing	465
Flow Alterations	198	Irrigated Agriculture	441
Habitat Modification	131	Petroleum Production	175
Arsenic	120	Mining	62
Chloride	99	Habitat Modification	54
Temperature	89	Municipal Stormwater	52
Manganese	64	Wildlife Grazing	18
Oil and Grease	51	Dam or Impoundment	18
Nutrients	40	Municipal WWTFs	10
Copper	20	Sources Outside WY Border	7
Ammonia	14		
Cadmium	12		
Silver	12		
pH	8		

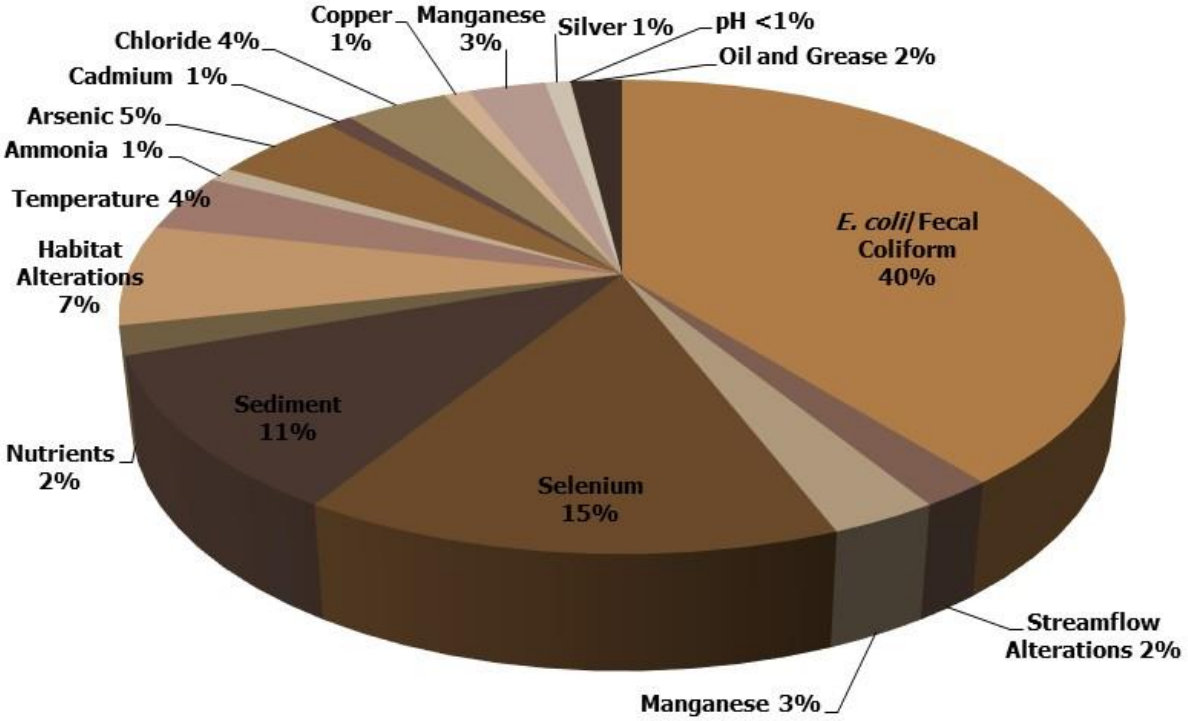


Figure 9.1. Pie chart showing the relative percentage of all of the causes for Wyoming's impaired stream miles for both Category 4 and Category 5 (2014 303(d) List) surface waters.

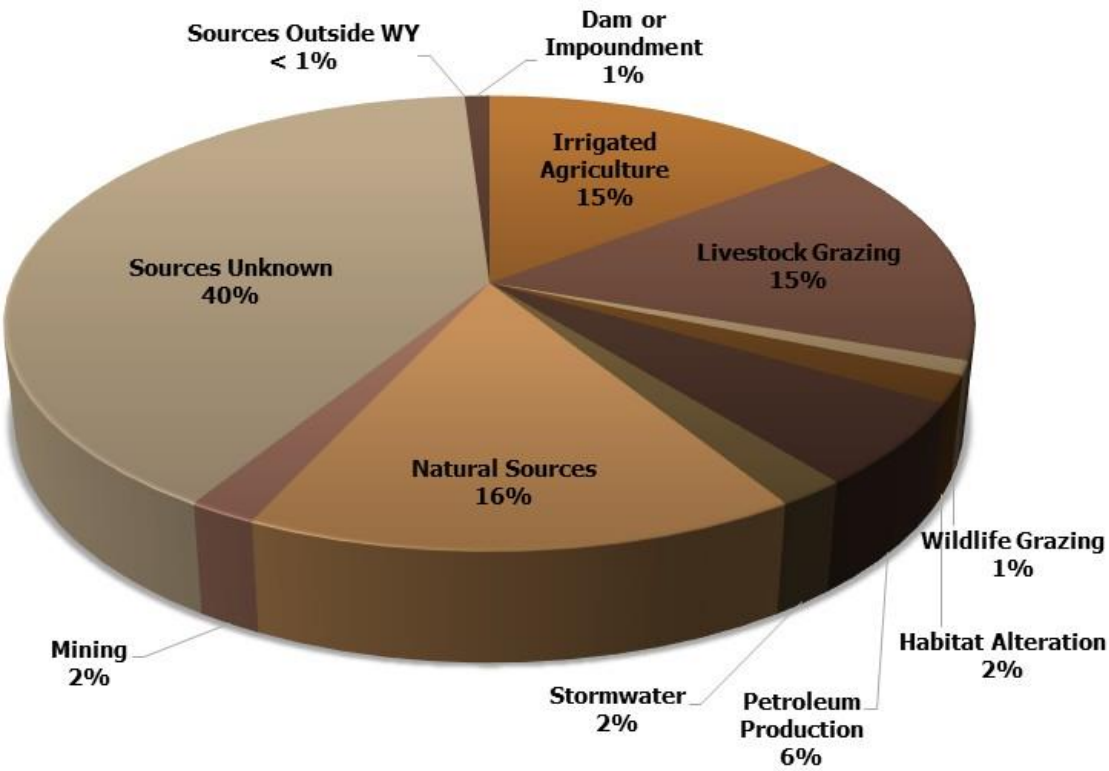


Figure 9.2. Pie chart showing the relative percentage of all of the sources for Wyoming's impaired stream miles for both Category 4 and Category 5 (2014 303(d) List) surface waters.

WDEQ has assessed 3.3% (18,713 acres) of the 591,020 total acres of Wyoming's lakes, reservoirs and ponds in Wyoming identified in the 24k NHD, which is unchanged from Wyoming's 2012 Integrated 305(b) and 303(d) Report. Twelve lakes and reservoirs have been assessed and these are evenly divided between those that are supporting some designated uses, but the use support of others is unknown (Category 2) and those that are considered impaired (Categories 4A and 5) (Table 9.4). TMDLs were completed on Gillette Fishing Lake in 2014 for the phosphate and sediment impairments and therefore this water was removed from the 303(d) List in 2014 (Category 5) for both pollutants and placed in Category 4A.

WDEQ has predominately assessed aquatic life other than fish, cold water fishery, fish consumption, wildlife, agriculture, industry and recreation designated uses on Wyoming's lakes, reservoirs and ponds (Table 9.4). Drinking water, warm water fishery and non-game fishery uses have been assessed to a lesser extent and the scenic value use has not been assessed.

There are currently no lakes or reservoirs in Wyoming for which designated use support for all uses have been determined (Table 9.5). WDEQ has assessed aquatic life other than fish (18,713 acres), cold water fishery (12,491 acres), wildlife, agriculture and industry (12,475 acres each), fish consumption (12,050 acres) and warm water fishery (6,076 acres) uses on Wyoming's lakes, reservoirs and ponds (Table 9.4). As is described in Wyoming's Methods for Determining Surface Water Quality Condition and TMDL Prioritization (WDEQ, 2014), unless data and/or information suggest otherwise, WDEQ will generally use aquatic life other than fish designated use support as a surrogate measure of wildlife, agriculture and industry. To date, these three uses have only been assessed in this manner. The drinking water, recreational, non-game fish and scenic value uses have not been assessed to date. Table 9.5 summarizes the number of assessed lakes, reservoirs or ponds in each USEPA category, the total number of assessed

acres and the relative percentage of assessed acres in each category. All of Wyoming's assessed acres are in either USEPA category 2 (67%), category 4A (32%) or category 5 (1%).

Table 9.4. Table summarizing designated use support for the eleven designated uses on Wyoming's lakes, reservoirs and ponds. Water quality impairment includes both Category 4 and Category 5 (2014 303(d) List) waters. The table includes the number of acres and percentage of the total acres assessed (18,713) for each designated use. The number of acres assessed as fully supporting, not supporting and indeterminate is also reported.

Summary Designated Use Support for Lakes and Reservoirs					
Designated Use	**Acres Assessed**	**Percent of Total Acres**	**Acres Fully Supporting**	**Acres Threatened or Not Supporting**	**Acres with Indeterminate Use Support**
Drinking Water	0	0%	0	0	0
Aquatic Life other than Fish	18,713	100%	12,475	6,238	0
Cold Water Fishery	12,491	67%	12,475	15	0
Warm Water Fishery	6,076	32%	0	6,076	0
Nongame Fishery	0	0%	0	0	0
Fish Consumption	12,050	64%	12,050	0	0
Recreation	0	0%	0	0	0
Wildlife	18,713	67%	12,475	0	6,238
Agriculture	18,713 12,475	67%	12,475	0	6,238
Industry	18,713 12,475	67%	12,475	0	6,238
Scenic Value	0	0%	0	0	0

Table 9.5. Table summarizing the number of stream segments in each category, total acres assessed and the relative percent of assessed acres in each category.

Summary of Wyoming's USEPA Categorizations for Lakes, Reservoirs and Ponds			
Category	**Number of Units**	**Total Acres**	**Relative % of Categorized Acres**
1	0	0	0
2	6	12,475	67
3	0	0	0
4A	2	6,091	32
4B	0	0	0
4C	0	0	0
5	4	147	1

WDEQ has identified 3 causes and 3 sources of impairment (i.e. Category 4 and Category 5) on Wyoming's lakes, reservoirs and ponds (Table 9.6). The majority of impaired acres are caused by sediment; selenium and phosphate are also causes of impairment, but to a lesser extent. The two dominant sources of these pollutants are unknown sources and irrigated crop production. Natural sources are also a source of impairment. Sources of pollutants are mostly unknown, from natural sources, livestock grazing, irrigated agriculture and petroleum production. The relative percentage of causes and sources of impairment on Wyoming's lakes, reservoirs and ponds are shown in Figures 9.3 and 9.4.

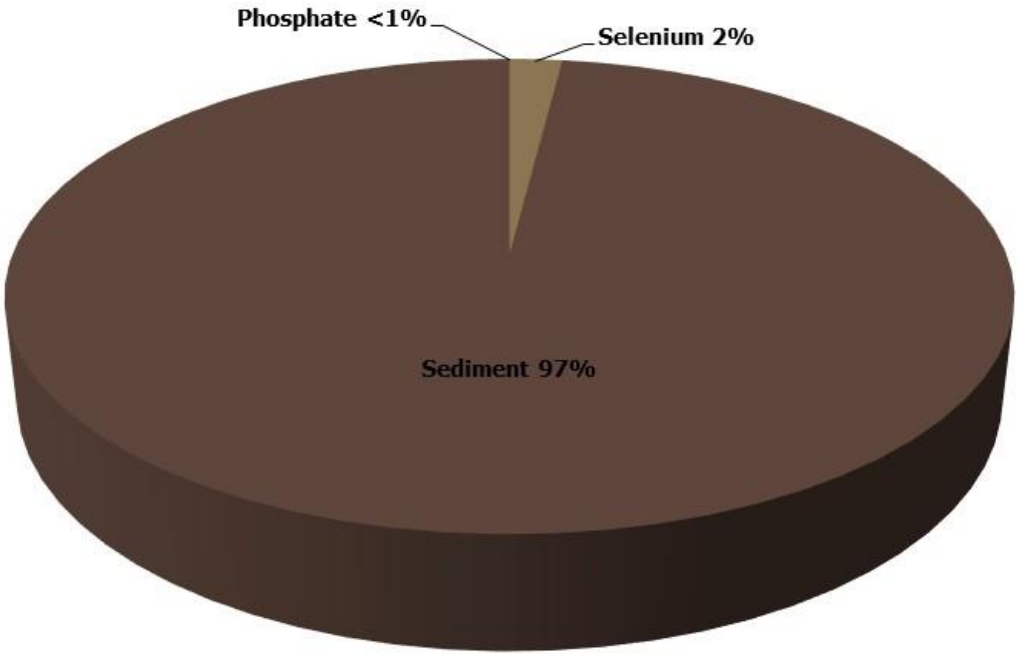


Figure 9.3. Pie chart showing the relative percentage of all of the causes for Wyoming's impaired lakes, reservoirs and ponds for both Category 4 and Category 5 (2014 303(d) List) waters.

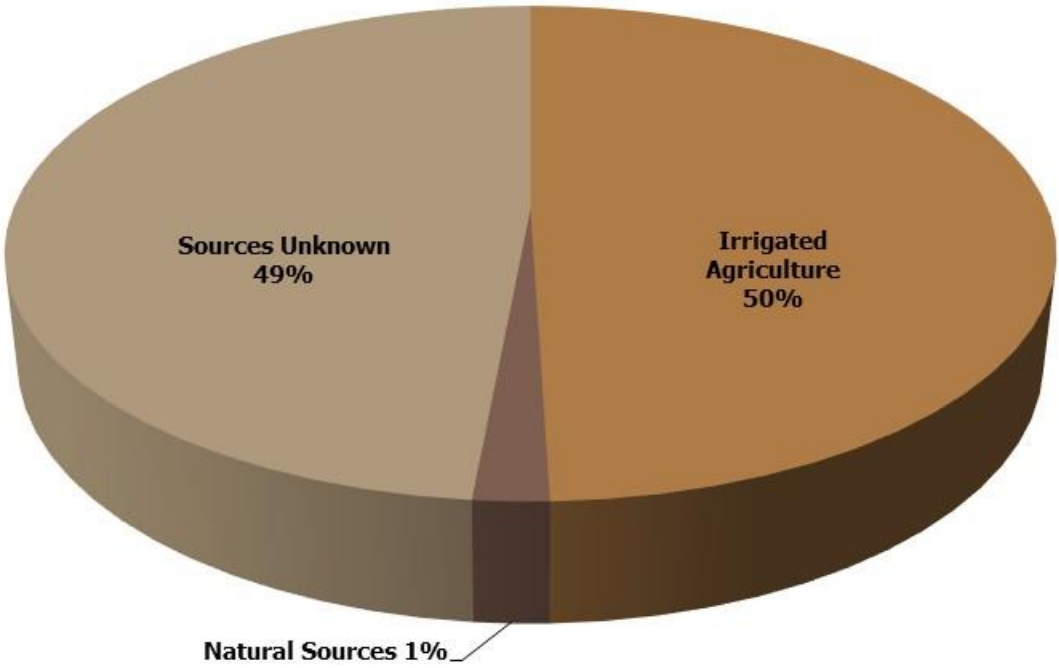


Figure 9.4. Pie chart showing the relative percentage of all of the sources for Wyoming's impaired lakes, reservoirs and ponds for both Category 4 and Category 5 (2014 303(d) List) waters.

Table 9.6. Ranked summary statistics for the causes and sources of impairment for Wyoming's lakes and reservoirs, including both Category 4 and Category 5 (2014 303(d) List) waters. (Please note that each impairment can have more than one cause and source.)

Causes and Sources of Wyoming's Impaired Lakes, Reservoirs and Ponds			
Causes	**Acres**	**Sources**	**Acres**
Sediment	6,091	Unknown	6,238
Selenium	147	Irrigated Crop Production	6,222
Phosphate	15	Natural Sources	147

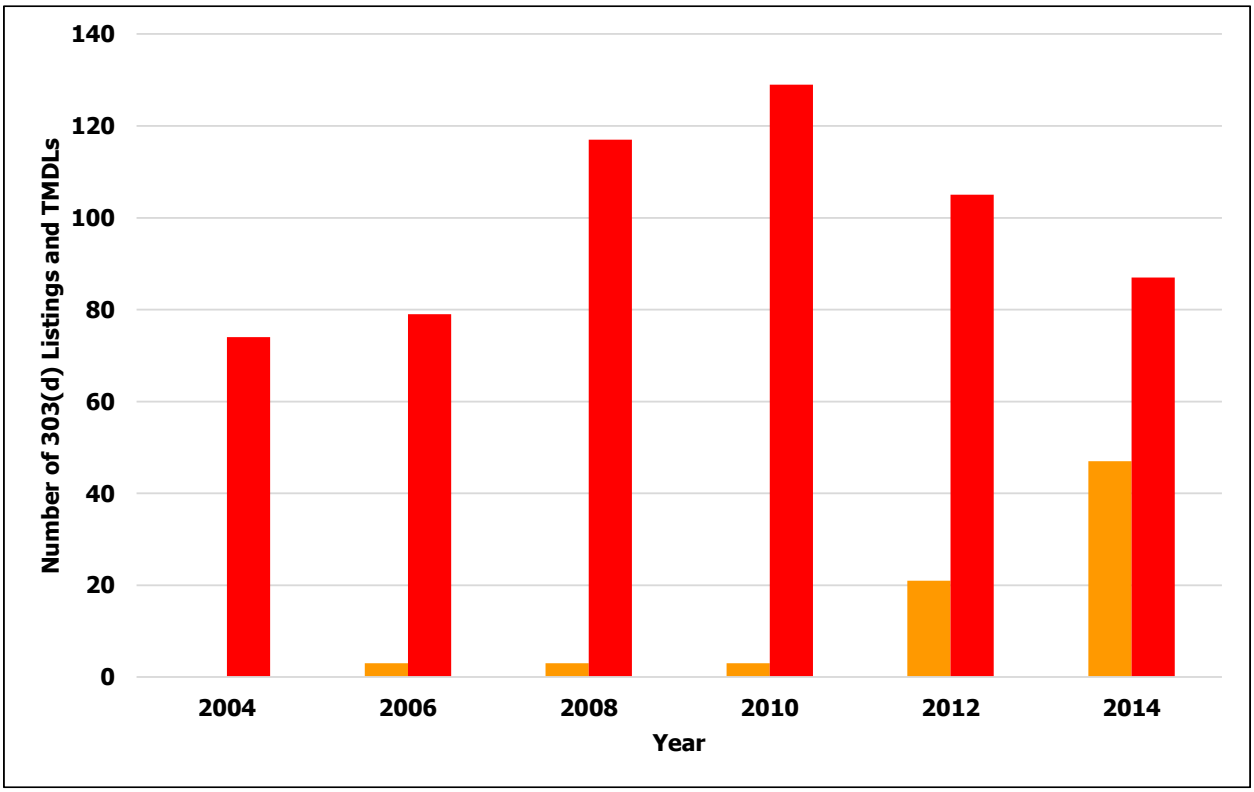


Figure 9.5. Graph showing the number of 303(d) Listings (red bars) and USEPA approved TMDLs (orange bars) between the 2004-2014 Integrated 305(b) and 303(d) Reports.

Between 2004 and 2010, there was a steady increase in the number of 303(d) Listed waters in Wyoming (Figure 9.5). The number of listings peaked in 2010 at 129 and then declined in 2012 (105) and 2014 (87). This negative trend in the number of 303(d) Listed waters is mostly related to a sharp increase in the number of USEPA approved TMDLs in Wyoming, which more than doubled between 2012 (21 TMDLS) and 2014 (47 TMDLs). There are currently 35 additional TMDLs being developed by WDEQ; therefore, these trends are expected to continue.

9.1 Category 2 Surface Waters

Table 9.1.1. Table of Wyoming's Category 2 Surface Waters, or waters that support one or more designated uses, but the use support of other uses is unknown. All 2014 category 2 decisions are bolded. The uses supported column lists only those uses that were directly assessed by WDEQ and does not include surrogate measures of wildlife, agriculture and industry use support. All 2014 Category 2 decisions are bolded.

Bear River Basin						
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Uses Supported**	**Year Assessed**
Mill Creek Watershed	WYBR160101010106_01	Entire Mill Creek watershed upstream of the confluence with the Bear River	2AB	32.9 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Bear River	WYBR160101010201_01	Entire Bear River watershed upstream of the confluence with Sulphur Creek, excluding the Mill Creek watershed	2AB	85.6 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Pleasant Valley Creek	WYBR160101010301_01	Entire Pleasant Valley Creek watershed upstream of the confluence with Crompton Reservoir	3B	64.5 mi.	Aquatic Life other than Fish	2002
Hobble Creek	WYBR160101020201_01	Entire Hobble Creek watershed upstream of Smiths Fork, excluding the Coantag Creek watershed	2AB	126.9 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
Coantag Creek	WYBR160101020201_02	Entire Coantag Creek watershed upstream of the confluence with Hobble Creek	2AB	55.1 mi.	Cold Water Fishery and Aquatic Life other than Fish	2004
Smiths Fork	WYBR160101020204_01	Entire Smiths Fork watershed upstream of the confluence with Muddy Creek	2AB	280.7 mi.	Cold Water Fishery and Aquatic Life other than Fish	2004
Salt Creek	WYBR160101020303_01	Entire Salt Creek watershed upstream of the Idaho border, excluding the Giraffe Creek and Coal Creek watersheds	2AB	105.0 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
Giraffe Creek	WYBR160101020304_00	Entire Giraffe Creek watershed upstream of the confluence with Salt Creek	2AB	40.9 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006

Belle Fourche River Basin						
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Uses Supported**	**Year Assessed**
Blacktail Creek	WYBF101202010903_01	Entire Blacktail Creek watershed above USFS boundary	2AB	28.9 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
Beaver Creek	WYBF101202010906_00	From the confluence with Lame Jones Creek to a point 32.1 miles upstream	2AB	32.1 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
Wood Canyon Creek	WYBF101202010906_02	From the confluence with Beaver Creek to a point 2.7 miles upstream	3B	2.7 mi.	Aquatic Life other than Fish	2006
Reservoir Gulch	WYBF101202010906_03	From the confluence with Beaver Creek to a point 1.8 miles upstream	3B	1.8 mi.	Aquatic Life other than Fish	2006
Cub Creek	WYBF101202010906_04	From the confluence with Beaver Creek to a point 2.1 miles upstream	2AB	2.1 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
Little Creek	WYBF101202010906_05	From the confluence with Beaver Creek to a point 1.3 miles upstream	3B	1.3 mi.	Aquatic Life other than Fish	2006
Fawn Creek	WYBF101202010906_06	From the confluence with Beaver Creek to a point 3.1 miles upstream	3B	3.1 mi.	Aquatic Life other than Fish	2006

Bighorn River Basin						
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Uses Supported**	**Year Assessed**
Trappers Creek	WYBH100800010110_01	Entire Trappers Creek watershed upstream of the confluence with Warm Springs Creek	2AB	13.5 mi.	Cold Water Fishery and Aquatic Life other than Fish	2008
Bear Creek	WYBH100800010408_00	Entire Bear Creek watershed upstream of the confluence with the East Fork Wind River	2AB	79.9 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
East Fork Wind River	WYBH100800010409_00	Entire watershed upstream of the confluence with Wiggins Fork, excluding Bear Creek	2AB	465.2 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
Little Beaver Creek	WYBH100800020301_01	Entire watershed upstream of the confluence with Beaver Creek	2AB	24.1 mi.	Cold Water Fishery and Aquatic Life other than Fish	2008

Bighorn River Basin (continued)						
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Uses Supported**	**Year Assessed**
Beaver Creek	WYBH100800020301_02	Entire mainstem, from the confluence with Little Beaver Creek to a point 19.7 Miles upstream	2AB	19.7 mi.	Cold Water Fishery, Aquatic Life other than Fish, Drinking Water and Fish Consumption	2012
Deep Creek	WYBH100800030103_01	Entire watershed upstream of the confluence with Red Canyon Creek	2AB	10.5 mi.	Cold Water Fishery, Aquatic Life other than Fish	2008
Little Popo Agie River	**WYBH100800030104_01**	**From the confluence with Red Canyon Creek to a point 8.7 miles downstream**	**2AB**	**8.7 mi.**	**Cold Water Fishery, Aquatic Life other than Fish, Drinking Water and Fish Consumption**	**2014**
Twin Creek	**WYBH100800030106_01**	**From the inlet of Carr Reservoir to a point 6.1 miles upstream**	**2AB**	**6.1 mi.**	**Drinking Water and Fish Consumption**	**2014**
Twin Creek	**WYBH100800030106_02**	**From Old Highway 287 upstream 3.3 miles to the outlet of Carr Reservoir**	**2AB**	**3.3 mi.**	**Drinking Water and Fish Consumption**	**2014**
Little Popo Agie River	**WYBH100800030108_01**	**From the confluence with Coal Mine Draw upstream 12.3 miles to the confluence with Willow Creek**	**2AB**	**12.4 mi.**	**Cold Water Fishery and Aquatic Life other than Fish, Drinking Water and Fish Consumption**	**2014**
Little Popo Agie River	**WYBH100800030108_02**	**From the confluence with the Popo Agie River upstream 11.1 miles to the confluence with Coal Mine Draw**	**2AB**	**11.1 mi.**	**Drinking Water and Fish Consumption**	**2014**
Baldwin Creek	WYBH100800030207_02	Entire watershed upstream of the confluence with the Middle Popo Agie River, excluding Squaw Creek	2AB	39.3 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002

Bighorn River Basin (continued)						
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Uses Supported**	**Year Assessed**
Squaw Creek	WYBH100800030210_00	Entire watershed upstream of the confluence with Baldwin Creek	2AB	44.5 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Grass Creek	WYBH100800070607_01	Grass Creek above irrigated withdrawal in NENE S23 T46N R99W	2AB	124.2 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Cottonwood Creek	WYBH100800070609_01	From the confluence with the Bighorn River upstream to the confluence with Wagonhound Creek	2AB	29.5 mi.	Cold Water Fishery and Aquatic Life other than Fish	2008
Soldier Creek	WYBH100800080603_01	From the confluence with South Paint Rock Creek to a point 7.4 miles upstream	2AB	7.4 mi.	Cold Water Fishery and Aquatic Life other than Fish	2008
South Paint Rock Creek	WYBH100800080603_02	From the confluence with Soldier Creek to a point 3.6 miles upstream	2AB	3.6 mi.	Drinking Water and Fish Consumption	2012
Mail Creek	WYBH100800100101_01	From the confluence with Shell Creek to a point 5.6 miles upstream	2AB	5.6 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
Crooked Creek	WYBH100800100502_01	From the Montana border to a point 3.0 miles upstream	2AB	3.0 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
West Pass Creek	WYBH100800160107_01	Entire watershed upstream of the Montana border	2AB	43.7 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
Porcupine Creek	WYBH100800100600_01	Entire watershed upstream of the Montana border, excluding the Deer Creek watershed	2AB	178.1 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
North Fork Shoshone River Drainage	WYBH100800120000_00	Entire watershed above the confluence with Half Mile Creek	2AB	3235.1 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Little Bighorn River	WYBH100800160100_01	Entire watershed upstream of the Montana border, excluding the Dry Fork Little Bighorn watershed	2AB	165.1 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006

Cheyenne River Basin						
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Uses Supported**	**Year Assessed**
Antelope Creek	WYCR101201010000_01	From the confluence with the Cheyenne River to a point 85.6 miles upstream	3B	85.6 mi.	Aquatic Life other than Fish	2008
Cheyenne River	WYCR101201030000_01	From the confluence with Lance Creek upstream to the confluence with Dry Fork Cheyenne River	2ABww	92.1 mi.	Warm Water Fishery, Aquatic Life other than Fish	2008
Black Thunder Creek	WYCR101201030200_01	From the confluence with the Cheyenne River to a point 79.8 miles upstream	3B	79.8 mi.	Aquatic Life other than Fish	2008
Cheyenne River	WYCR101201060100_01	From the confluence with Lance Creek downstream to the South Dakota border	2ABww	17.9 mi.	Warm Water Fishery and Aquatic Life other than Fish	2008
Poison Creek	WYCR101201070103_01	From the confluence with Beaver Creek to a point 7.3 miles upstream	3B	7.3 mi.	Aquatic Life other than Fish	2008

Green River Basin						
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Uses Supported**	**Year Assessed**
Green River	WYGR140401010200_01	Entire watershed between highway 189 and Green River Lakes	2AB	735.6 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
LaBarge Creek	WYGR140401011102_00	Entire watershed upstream of Little Fall Creek Road	2AB	160.1 mi.	Cold Water Fishery and Aquatic Life other than Fish	2008
Rock Creek	WYGR140401011103_01	Entire watershed upstream of the confluence with LaBarge Creek	2AB	16.6 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Fontenelle Creek	WYGR140401011302_00	Entire watershed upstream of the confluence with Little Coal Creek	2AB	210.0 mi.	Cold Water Fishery and Aquatic Life other than Fish	2008
Fontenelle Creek	WYGR140401011306_01	From the confluence with Fontenelle Reservoir to a point 13.2 miles upstream	2AB	13.2 mi.	Cold Water Fishery and Aquatic Life other than Fish	2008
Pole Creek	WYGR140401020403_01	From the confluence with the New Fork River to a point 17.2 miles upstream	2AB	17.2 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006

Green River Basin (continued)						
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Uses Supported**	**Year Assessed**
Big Sandy River	WYGR140401040407_01	From the confluence with the Green River upstream to the confluence with the Little Sandy River	2AB	42.0 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
East Fork Smiths Fork	WYGR140401070201_01	Entire watershed from the confluence with West Fork Smiths Fork upstream to the Utah border	2AB	34.6 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
West Fork Smiths Fork	WYGR140401070203_01	Entire watershed from the confluence with East Fork Smiths Fork upstream to the Utah border	2AB	47.2 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
Hams Fork	WYGR140401070600_01	Entire watershed upstream of Kemmerer, excluding the Willow Creek watershed	2AB	862.8 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006

Little Snake River Basin						
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Uses Supported**	**Year Assessed**
North Fork Little Snake River	WYLS140500030104_00	Entire watershed upstream of the Colorado border	2AB	212.1 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Lost Creek	WYLS140500030109_03	From the confluence with West Fork Battle Creek to a point 5.2 miles upstream	2AB	5.2 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
East Fork Savery Creek	WYLS140500030401_01	From the confluence with Savery Creek to a point 17.0 miles upstream, including Hatch Creek	2AB	17.0 mi.	Cold Water Fishery and Aquatic Life other than Fish	2008
Dirtyman Fork	WYLS140500030402_01	From the confluence with East Fork Savery Creek to a point 7.8 miles upstream	2AB	7.8 mi.	Cold Water Fishery, and Aquatic Life other than Fish	2008
Little Savery Creek	WYLS140500030405_01	From the confluence with McCarty Creek to a point 4.6 miles downstream	2AB	4.6 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Big Sandstone Creek	WYLS140500030407_01	Entire watershed upstream of the confluence with Savery Creek	2AB	177.5 mi.	Cold Water Fishery and Aquatic Life other than Fish	2008

Little Snake River Basin						
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Uses Supported**	**Year Assessed**
Loco Creek	WYLS140500030408_03	From the confluence with Savery Creek to a point 9.1 miles upstream	2AB	9.1 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Muddy Creek	WYLS140500040101_01	Entire watershed upstream of the confluence with Littlefield Creek	2AB	70.6 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Muddy Creek	WYLS140500040103_01	From the confluence with Alamosa Gulch upstream to the confluence with Littlefield Creek	2AB	13.9 mi.	Cold Water Fishery and Aquatic Life other than Fish	2012
Littlefield Creek	WYLS140500040101_02	Entire watershed upstream of the confluence with Muddy Creek	2AB	35.5 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
McKinney Creek	WYLS140500040102_01	From the confluence with Muddy Creek upstream to the confluence with Eagle Creek	2AB	5.9 mi.	Cold Water Fishery and Aquatic Life other than Fish	2012
McKinney Creek	WYLS140500040102_02	Entire watershed upstream of the confluence with Eagle Creek	2AB	60.1 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002

Niobrara River Basin						
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Uses Supported**	**Year Assessed**
Silver Springs Creek	WYNR101500020104_01	From the confluence with the Niobrara River to a point 17.8 miles upstream	3B	17.8 mi.	Aquatic Life other than Fish	2008

North Platte River Basin						
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Uses Supported**	**Year Assessed**
North Platte River	WYNP101800020000_01	From the confluence with Sage Creek upstream to the Colorado border	1	77.3 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Bear Creek	**WYNP101800020104_02**	**From the confluence with Rambler Creek to a point 1.3 miles upstream**	**2AB**	**1.3 mi.**	**Cold Water Fishery, Aquatic Life other than Fish, Drinking Water and Fish Consumption**	**2014**

North Platte River Basin (continued)						
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Uses Supported**	**Year Assessed**
Smith North Creek	WYNP101800020105_01	Entire watershed upstream of the confluence with Douglas Creek	2AB	14.6 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
Muddy Creek	WYNP101800020105_02	Entire watershed upstream of the confluence with Douglas Creek	2AB	44.5 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Douglas Creek	WYNP101800020105_03	From the confluence with Pelton Creek upstream to the confluence with Muddy Creek, excluding Smith North Creek	2AB	104.9 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
Douglas Creek	WYNP101800020107_01	Entire watershed from the confluence with the North Platte River upstream to the confluence with Pelton Creek	1	150.4 mi.	Cold Water Fishery and Aquatic Life other than Fish	2008
French Creek	WYNP101800020203_01	Entire watershed upstream of the confluence with the North Platte River	2AB	192.8 mi.	Cold Water Fishery and Aquatic Life other than Fish	2004
Big Creek	WYNP101800020303_01	Entire watershed upstream of the confluence with Spring Creek	2AB	221.2 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Encampment River	WYNP101800020500_01	Encampment River tributaries from the confluence with (and including) the North Fork Encampment River upstream to the confluence with (and including) the East Fork Encampment River; excluding Hog Park Creek	2AB	536.7 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Encampment River	WYNP101800020504_01	From the confluence with the East Fork Encampment River to a point 10.0 miles downstream	1	10.0 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
South Fork Hog Park Creek	WYNP101800020505_01	From the confluence with Hog Park Creek upstream to the Colorado border	2AB	2.3 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Encampment River	WYNP101800020508_01	From the confluence with the North Platte River to a point 17.7 miles upstream	2AB	17.7 mi.	Cold Water Fishery and Aquatic Life other than Fish	2008

North Platte River Basin (continued)						
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Uses Supported**	**Year Assessed**
South Spring Creek	WYNP101800020703_01	Entire watershed upstream of the confluence with Centennial Creek	2AB	117.4 mi.	Cold Water Fishery and Aquatic Life other than Fish	2008
Jack Creek	WYNP101800020800_01	Entire watershed upstream of the confluence with the North Platte River	2AB	534.7 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Sage Creek	WYNP101800020903_01	From the confluence with the North Platte River to a point 14.7 miles upstream	2AB	14.7 mi.	Cold Water Fishery and Aquatic Life other than Fish	2008
Medicine Bow River	WYNP101800040100_01	Entire watershed upstream from the confluence with, and including, the East Fork Medicine Bow River	2AB	109.5 mi.	Cold Water Fishery and Aquatic Life other than Fish	2004
Rock Creek	WYNP101800040201_01	Entire watershed upstream of the confluence with, and including, Overland Creek	2AB	99.1 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
Rock Creek	**WYNP101800040202_01**	**From the town of Arlington to a point 1.6 miles upstream**	**2AB**	**1.6 mi.**	**Cold Water Fishery, Aquatic Life other than Fish, Drinking Water and Fish Consumption**	**2014**
Little Medicine Bow River	**WYNP101800050103_01**	**From County Road 2E upstream to the confluence with the North and South Forks of the Medicine Bow River**	**2AB**	**11.1 mi.**	**Cold Water Fishery, Aquatic Life other than Fish, Drinking Water and Fish Consumption**	**2014**
Shirley Basin Reservoir	WYNP101800050502_01	Within the Shirley Basin; NW S12 T26N R80W	2AB	15.5 ac.	Cold Water Fishery and Aquatic Life other than Fish	2008
Willow Creek	WYNP101800060204_01	Entire watershed upstream of the confluence with the Sweetwater River	2AB	36.0 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
Glendo Reservoir	WYNP101800080405_01	Southeast of town of Douglas in Platte County	2AB	12,049.8 ac.	Cold Water Fishery, Aquatic Life other than Fish and Fish Consumption	2010
Horseshoe Creek	WYNP101800080905_01	From the confluence with Spring Creek to a point 12.5 miles upstream	2AB	12.5 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006

North Platte River Basin (continued)						
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Uses Supported**	**Year Assessed**
Horseshoe Creek	WYNP101800080905_02	From the confluence with the North Platte River to a point 2.3 miles upstream	2AB	2.3 mi.	Cold Water Fishery and Aquatic Life other than Fish	2008
Laramie River	WYNP101800100200_01	Entire watershed upstream of the confluence with Fox Creek, and including Fox Creek	2AB	354.7 mi.	Cold Water Fishery and Aquatic Life other than Fish	2008
Miller Lake	WYNP101800100204_01	Near Fox Park in Albany County	2AB	7.6 ac.	Cold Water Fishery and Aquatic Life other than Fish	2008
Meeboer Lake	WYNP101800100403_01	Adjacent to Mortensen Lake National Wildlife Refuge in Albany County	2AB	115.8 ac.	Cold Water Fishery and Aquatic Life other than Fish	2008
Little Laramie River	WYNP101800100600_01	Entire watershed above Millbrook, excluding the South Fork Little Laramie River	2AB	454.4 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
South Fork Little Laramie River	WYNP101800100602_01	From the intersection of State Highway 11 to a point 5.5 miles upstream	2AB	5.5 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Hanging Lake	WYNP101800100603_01	Adjacent to State Highway 130; within the Nash Fork Watershed	2AB	3.8 ac.	Cold Water Fishery and Aquatic Life other than Fish	2008
Snowy Range Lakes	WYNP101800100603_02	26 lakes within the upper North Fork Little Laramie Watershed	2AB	282.7 ac.	Cold Water Fishery and Aquatic Life other than Fish	2008
Middle Fork Mill Creek	WYNP101800100606_01	From the USFS boundary to a point 2.7 miles upstream	2AB	2.7 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Chugwater Creek	WYNP101800110900_02	From the intersection of Antelope Gap Road to a point 77.1 miles upstream	2AB	77.1 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Chugwater Creek	WYNP101800110906_01	From the confluence with the Laramie River upstream to Antelope Gap Road	2AB	9.7 mi.	Cold Water Fishery and Aquatic Life other than Fish	2008
Horse Creek	WYNP101800120100_01	Entire watershed upstream of the confluence with South Fork Horse Creek	2AB	253.7 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002

North Platte River Basin (continued)						
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Uses Supported**	**Year Assessed**
Bear Creek	WYNP101800120300_01	Entire watershed upstream from the confluence with Horse Creek	2AB	1,045.9 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002

Powder River Basin						
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Uses Supported**	**Year Assessed**
Rock Creek	WYPR100902010101_01	Entire watershed upstream of the confluence with the Middle Fork Powder River	2AB	26.4 mi.	Cold Water Fishery and Aquatic Life other than Fish	2008
Middle Fork Powder River	WYPR100902010102_01	From the confluence with Buffalo Creek to a point 26.4 miles upstream	1	26.4 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Beaver Creek	WYPR100902010202_00	From the confluence with Blue Creek to a point 19.0 miles upstream	2AB	19.0 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Blue Creek	WYPR100902010202_01	From the confluence with Beaver Creek to a point 8.8 miles upstream	2AB	8.8 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Beartrap Creek	WYPR100902010206_01	Entire watershed upstream of the confluence with the Middle Fork Powder River	2AB	48.8 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
Webb Creek	WYPR100902010301_01	Entire watershed upstream of the confluence with the North Fork Powder River	2AB	17.8 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
Ninemile Creek	WYPR100902020100_01	Entire watershed upstream from the confluence with the Powder River	3B	543.7 mi.	Aquatic Life other than Fish	2006
Fourmile Creek	WYPR100902020104_01	Entire watershed upstream from the confluence with the Powder River	3B	174.9 mi.	Aquatic Life other than Fish	2006
Flying E Creek	WYPR100902020602_01	Entire watershed upstream from the confluence with the Powder River	3B	141.6 mi.	Aquatic Life other than Fish	2008
North Fork Crazy Woman Creek	**WYPR100902050100_01**	**From Muddy Creek Road to a point 22.6 miles upstream**	**2AB**	**22.6 mi.**	**Cold Water Fishery, Aquatic Life other than Fish and Drinking Water**	**2014**

Powder River Basin (continued)						
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Uses Supported**	**Year Assessed**
Pole Creek	WYPR100902050101_01	Entire watershed upstream from the confluence with North Fork Crazy Woman Creek	2AB	17.5 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Little North Fork Crazy Woman Creek	WYPR100902050102_02	Entire watershed upstream from the confluence with North Fork Crazy Woman Creek	2AB	55.5 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Billy Creek	WYPR100902050103_01	From the confluence with Muddy Creek to a point 13.4 miles upstream	2AB	13.4 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
Doyle Creek	WYPR100902050106_01	From the headwaters of Doyle Creek to a point 10.4 miles downstream	2AB	10.4 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Poison Creek	WYPR100902050107_01	Entire watershed upstream from the confluence with Middle Fork Crazy Woman Creek	2AB	70.0 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Middle Fork Crazy Woman Creek	WYPR100902050108_00	Entire watershed upstream from the confluence with North Fork Crazy Woman Creek, excluding Doyle Creek and Poison Creek	2AB	142.2 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Beaver Creek	WYPR100902050110_01	Entire watershed upstream from the confluence with South Fork Crazy Woman Creek, excluding Pole Creek	2AB	66.0 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Pole Creek	WYPR100902050110_02	Entire watershed upstream from the confluence with Beaver Creek	2AB	25.3 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Crazy Woman Creek	WYPR100902050204_01	From the confluence with South Fork Crazy Woman Creek to a point 23.6 miles downstream	2AB	23.6 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Clear Creek	WYPR100902060000_01	Mainstem from the confluence with the Powder River upstream to the confluence with Grommund Creek and entire watershed upstream of the confluence with Grommund Creek	2AB	338.0 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006

Powder River Basin (continued)						
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Uses Supported**	**Year Assessed**
Hunter Creek	WYPR100902060103_01	From the confluence with North Clear Creek to a point 2.7 miles upstream	2AB	2.7 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
French Creek	WYPR100902060106_01	From the confluence with Clear Creek to a point 22.3 miles upstream	2AB	22.3 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
North Rock Creek	WYPR100902060201_01	From the confluence with South Rock Creek to a point 9.6 miles upstream	2AB	9.6 mi.	Cold Water Fishery and Aquatic Life other than Fish	2008
Rock Creek	WYPR100902060202_01	From the confluence with Clear Creek upstream to the confluence with South Rock Creek	2AB	19.3 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
South Piney Creek	WYPR100902060302_01	From Piney Creek upstream, excluding Kearney Creek	2AB	32.9 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
North Piney Creek	**WYPR100902060303_01**	**From the confluence with Piney Creek to a point 6.4 miles upstream**	**2AB**	**6.4 mi.**	**Recreation**	**2014**
Little Piney Creek	WYPR100902060304_01	From the confluence with Piney Creek to a point 14.0 miles upstream	2AB	14.0 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
North and South Fork Shell Creek	WYPR100902060305_01	Entire mainstem of each creek upstream from the confluence with South Creek Reservoir	3B	14.4 mi.	Aquatic Life other than Fish	2008
Piney Creek	WYPR100902060403_01	From the confluence with Clear Creek upstream to North and South Fork Piney Creek	2AB	30.8 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Boxelder Creek	WYPR100902060404_01	Entire watershed upstream from the confluence with Piney Creek	3B	126.6 mi.	Aquatic Life other than Fish	2002

Snake River Basin						
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Uses Supported**	**Year Assessed**
North Fork Spread Creek	WYSR170401010503_01	Entire watershed upstream of the confluence with Spread Creek	2AB	78.4 mi.	Cold Water Fishery and Aquatic Life other than Fish	2008

Tongue River Basin						
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Uses Supported**	**Year Assessed**
Prune Creek	WYTR100901010104_01	From the confluence with the South Tongue River to a point 5.4 miles upstream	2AB	5.4 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
South Fork Tongue River	WYTR100901010104_02	From 0.3 miles above HWY 14 upstream to the confluence with East Fork South Fork Tongue River	1	11.4 mi.	Cold Water Fishery and Aquatic Life other than Fish	2008
Little Tongue River	WYTR100901010107_01	Entire watershed upstream from the confluence with Frisbee Ditch	2AB	79.0 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
West Fork Big Goose Creek	WYTR100901010203_01	Entire watershed upstream of the confluence with Big Goose Creek, excluding Snail and Sawmill Creeks	2AB	95.5 mi.	Cold Water Fishery and Aquatic Life other than Fish	2006
Coney Creek	WYTR100901010203_02	Coney Creek, including tributaries	2AB	13.5 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Soldier Creek	WYTR100901010209_04	From the headwaters to a point 7.3 miles downstream	2AB	7.3 mi.	Cold Water Fishery and Aquatic Life other than Fish	2008

Yellowstone River Basin						
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Uses Supported**	**Year Assessed**
Squaw Creek	WYYR100700060106_01	Entire watershed upstream from the confluence with the Clarks Fork Yellowstone River	2AB	17.9 mi.	Cold Water Fishery and Aquatic Life other than Fish	2002
Dead Indian Creek	WYYR100700060304_01	From the confluence with the Clarks Fork Yellowstone River upstream to the confluence with Dry Fork	2AB	6.9 mi.	Cold Water Fishery and Aquatic Life other than Fish	2008

9.2 Category 3 Surface Waters

Table 9.2.1. Table of Wyoming's surface waters which have been assessed by WDEQ but there is insufficient data to determine whether any designated uses are supported.

Bighorn River Basin					
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Year Assessed**
Canyon Creek	WYBH100800080406_01	From the return of Hunsinger No. 1 Ditch upstream to Canyon Creek Ditch	2AB	4.3 mi.	2012

Green River Basin					
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/Acres**	**Year Assessed**
Reardon Draw	WYBH140101011006_01	From the confluence with the Green River to a point 3.2 miles upstream	2AB	3.2 mi.	2006

9.3 Category 4 Surface Waters

Table 9.3.1. Table of Wyoming's surface waters which are impaired or threatened for a designated use and either a TMDL has been completed and approved by USEPA (4A); other pollution control measures are expected to address the impairment (4B); or a non-pollutant is the source of impairment (4C). All category 4A waterbodies are hyperlinked to their respective TMDL projects. All 2014 Category 4 decisions are bolded.

Category 4A Surface Waters

Belle Fourche River Basin							
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/ Acres**	**Cause(s) of Impairment**	**Initial 303(d) Listing Date**	**Year TMDL Completed**
Belle Fourche River	**WYBF101202010501_01**	**From the confluence with Donkey Creek to a point 6.2 miles upstream**	**2ABww**	**6.2 mi.**	***E. coli***	**1996**	**2013**
Belle Fourche River	**WYBF101202010504_00**	**From the confluence with Keyhole Reservoir upstream to the confluence with Donkey Creek**	**2ABww**	**14.2 mi.**	***E. coli***	**1996**	**2013**

Belle Fourche River Basin (continued)							
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/ Acres**	**Cause(s) of Impairment**	**Initial 303(d) Listing Date**	**Year TMDL Completed**
Belle Fourche River	WYBF101202010504_00	From the confluence with Keyhole Reservoir upstream to the confluence with Donkey Creek	2ABww	14.2 mi.	Ammonia	2008	2013
Belle Fourche River	WYBF101202010504_00	From the confluence with Keyhole Reservoir upstream to the confluence with Donkey Creek	2ABww	14.2 mi.	Chloride	2008	2014
Donkey Creek	WYBF101202010600_01	From the confluence with the Belle Fourche River upstream to Brorby Boulevard within the city of Gillette	3B	61.4 mi.	Fecal Coliform	2000	2014
Gillette Fishing Lake	WYBF101202010601_01	Within the city of Gillette	2ABww	15.4 ac.	Phosphate	1996	2013
Gillette Fishing Lake	WYBF101202010601_01	Within the city of Gillette	2ABww	15.4 ac.	Sediment	1996	2013
Stonepile Creek	WYBF101202010602_01	From the confluence with Donkey Creek upstream to the junction of highways 14/16 and 59	3B	7.6 mi.	Fecal Coliform	2002	2014
Belle Fourche River	WYBF101202010904_00	From the confluence with Arch Creek downstream to the confluence with Sourdough Creek	2ABww	60.7 mi.	Fecal Coliform	1996	2014

Bighorn River Basin							
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/ Acres**	**Cause(s) of Impairment**	**Initial 303(d) Listing Date**	**Year TMDL Completed**
Ocean Lake	WYBH100800050202_01	Within the Ocean Lake Wildlife Management Area	2ABww	6075.8 ac.	Sediment	1996	2009
Owl Creek	**WYBH100800070305_01**	**From the confluence with the Bighorn River to a point 3.8 miles upstream**	**2AB**	**3.8 mi.**	**Fecal Coliform**	**2002**	**2014**
Kirby Creek	**WYBH100800070500_01**	**From the confluence with the Bighorn River to a point 21.8 miles upstream**	**2C**	**21.8 mi.**	**Fecal Coliform**	**2002**	**2014**
Nowater Creek	**WYBH100800070809_01**	**From the confluence with the Bighorn River to a point 21.8 miles upstream**	**3B**	**6.6 mi.**	**Fecal Coliform**	**2002**	**2014**
Fifteen Mile Creek	**WYBH100800070909_01**	**From the confluence with the Bighorn River to a point 2.2 miles upstream**	**3B**	**2.2 mi.**	**Fecal Coliform**	**2002**	**2014**
Bighorn River	**WYBH100800071000_01**	**From the confluence with the Nowood River to a point 36.1 miles upstream**	**2AB**	**36.1 mi.**	***E. coli***	**2002**	**2014**
Bighorn River	**WYBH100800071000_02**	**From the confluence with the Greybull River upstream to the confluence with the Nowood River**	**2AB**	**22.1 mi.**	**Fecal Coliform**	**2000**	**2014**
Sage Creek	**WYBH100800071001_01**	**From the confluence with the Bighorn River to a point 7.4 miles upstream**	**3B**	**7.4 mi.**	**Fecal Coliform**	**2002**	**2014**
Slick Creek	**WYBH100800071001_02**	**From the confluence with the Bighorn River to a point 5.8 miles upstream**	**3B**	**5.8 mi.**	**Fecal Coliform**	**2002**	**2014**

Bighorn River Basin (continued)							
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/ Acres**	**Cause(s) of Impairment**	**Initial 303(d) Listing Date**	**Year TMDL Completed**
Paint Rock Creek	**WYBH100800080603_01**	**From the confluence with the Nowood River to a point 5.2 miles upstream**	**2AB**	**5.2 mi.**	**Fecal Coliform**	**2002**	**2014**
Nowood River	**WYBH100800080705_01**	**From the confluence with the Bighorn River to a point 13.4 miles upstream**	**2AB**	**13.4 mi.**	**Fecal Coliform**	**2002**	**2014**
Greybull River	**WYBH100800090405_01**	**From the confluence with the Bighorn River upstream to Sheets Flats Bridge**	**2AB**	**38.0 mi.**	**Fecal Coliform**	**2002**	**2014**
Granite Creek	**WYBH100800100102_01**	**From the confluence with Shell Creek upstream 5.8 miles, near the Antelope Butte Ski Area**	**2A**	**5.8 mi.**	**Fecal Coliform**	**2002**	**2014**
Beaver Creek	**WYBH100800100204_01**	**From the confluence with Shell Creek to a point 7.9 miles upstream**	**2AB**	**7.9 mi.**	**Fecal Coliform**	**2002**	**2014**
Shell Creek	**WYBH100800100206_01**	**From the confluence with the Bighorn River to a point 5.3 miles upstream**	**2AB**	**5.3 mi.**	**Fecal Coliform**	**2002**	**2014**
Bighorn River	**WYBH100800100301_01**	**From the confluence with the Greybull River to a point 10.5 miles downstream**	**2AB**	**10.5 mi.**	**Fecal Coliform**	**2002**	**2014**
Dry Creek	**WYBH100800110204_01**	**From the confluence with the Bighorn River to a point 4.7 miles upstream**	**2ABww**	**4.7 mi.**	**Fecal Coliform**	**2002**	**2014**

Little Snake River Basin							
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/ Acres**	**Cause(s) of Impairment**	**Initial 303(d) Listing Date**	**Year TMDL Completed**
Haggarty Creek	WYLS140500030109_01	From the Ferris-Haggarty Mine downstream to the confluence with West Fork Battle Creek	2AB	5.6 mi.	Cadmium	1996	2011
Haggarty Creek	WYLS140500030109_01	From the Ferris-Haggarty Mine downstream to the confluence with West Fork Battle Creek	2AB	5.6 mi.	Copper	1996	2011
Haggarty Creek	WYLS140500030109_01	From the Ferris-Haggarty Mine downstream to the confluence with West Fork Battle Creek	2AB	5.6 mi.	Silver	1996	2011
West Fork Battle Creek	WYLS140500030109_02	From the confluence with Battle Creek upstream to the confluence with Haggarty Creek	2AB	4.9 mi.	Copper	2000	2011

Tongue River Basin							
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/ Acres**	**Cause(s) of Impairment**	**Initial 303(d) Listing Date**	**Year TMDL Completed**
Park Creek	WYTR100901010204_01	From the confluence with Big Goose Creek to a point 2.8 miles upstream	2AB	2.8 mi.	Fecal Coliform	2000	2010
Rapid Creek	WYTR100901010204_02	From the confluence with Big Goose Creek to a point 3.2 miles upstream	2AB	3.2 mi.	Fecal Coliform	2000	2010

Tongue River Basin (continued)							
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/ Acres**	**Cause(s) of Impairment**	**Initial 303(d) Listing Date**	**Year TMDL Completed**
Big Goose Creek	WYTR100901010205_01	From the confluence with Little Goose Creek upstream to the confluence with Rapid Creek	2AB	19.2 mi.	Fecal Coliform	1996	2010
Beaver Creek	WYTR100901010205_02	From the confluence with Big Goose Creek upstream to the confluence with Apple Run	2AB	6.5 mi.	Fecal Coliform	2000	2010
Sackett Creek	WYTR100901010207_01	From the Confluence with Little Goose Creek upstream to the confluence with East Fork Sackett Creek	2AB	3.1 mi.	Fecal Coliform	2000	2010
Jackson Creek	WYTR100901010207_02	From the Confluence with Little Goose Creek to a point 6.4 miles upstream	2AB	6.4 mi.	Fecal Coliform	2000	2010
Little Goose Creek	WYTR100901010208_01	From the Confluence with Big Goose Creek upstream to Brundage Lane in Sheridan	2AB	3.5 mi.	Fecal Coliform	1996	2010
Little Goose Creek	WYTR100901010208_01	From the Confluence with Big Goose Creek upstream to Brundage Lane in Sheridan	2AB	3.5 mi.	Habitat Alterations, Sediment	2006	2010
McCormick Creek	WYTR100901010208_02	From the Confluence with Little Goose Creek to a point 2.2 miles upstream	2AB	2.2 mi.	Fecal Coliform	2004	2010
Kruse Creek	WYTR100901010208_03	From the confluence with Little Goose Creek upstream to the confluence with East Fork Kruse Creek	2AB	2.5 mi.	Fecal Coliform	2000	2010

Tongue River Basin (continued)							
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/ Acres**	**Cause(s) of Impairment**	**Initial 303(d) Listing Date**	**Year TMDL Completed**
Goose Creek	WYTR100901010209_01	From the confluence with Little Goose Creek downstream to the confluence with the Tongue River	2AB	12.7 mi.	Fecal Coliform	2000	2010
Goose Creek	WYTR100901010209_01	From the confluence with Little Goose Creek downstream to the confluence with the Tongue River	2AB	12.7 mi.	Habitat Alterations, Sediment	2006	2010
Soldier Creek	WYTR100901010209_02	From the confluence with Goose Creek to a point 3.1 miles upstream	2AB	3.1 mi.	Fecal Coliform	2000	2010

Yellowstone River Basin							
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/ Acres**	**Cause(s) of Impairment**	**Initial 303(d) Listing Date**	**Year TMDL Completed**
Clarks Fork Yellowstone River	WYYR100700060101_01	From the Montana border downstream to the confluence with Crazy Creek	1	6.8 mi.	Cadmium	2000	2006
Clarks Fork Yellowstone River	WYYR100700060101_01	From the Montana border downstream to the confluence with Crazy Creek	1	6.8 mi.	Copper	1998	2006
Clarks Fork Yellowstone River	WYYR100700060101_01	From the Montana border downstream to the confluence with Crazy Creek	1	6.8 mi.	Silver	2000	2006

Category 4C Surface Waters

Bighorn River Basin							
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/ Acres**	**Cause(s) of Impairment**	**Initial 303(d) Listing Date**	**Date added to Category 4C**
Grass Creek	WYBH100800070608_01	From an irrigation withdrawal in NENE S23 T46N R99W to a point 14.1 miles downstream	2AB	14.1 mi.	Flow Alterations	n/a	2006
Crooked Creek	WYBH100800100500_01	From the confluence with Bighorn Lake to a point 7.9 miles upstream	2AB	7.9 mi.	Flow Alterations	n/a	2006

Bighorn River Basin							
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/ Acres**	**Cause(s) of Impairment**	**Initial 303(d) Listing Date**	**Date added to Category 4C**
Muddy Creek	**WYLS140500040104_01**	**From the confluence with Red Wash upstream to the confluence with Antelope Creek**	**2C**	**17.5 mi.**	**Flow Alterations**	**1996**	**2014**

North Platte River Basin							
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/ Acres**	**Cause(s) of Impairment**	**Initial 303(d) Listing Date**	**Date added to Category 4C**
Rock Creek	**WYNP101800040202_02**	**From the town of Arlington downstream 106.5 miles to the confluence with the Medicine Bow River**	**2AB**	**106.5**	**Flow Alterations**	**n/a**	**2014**

North Platte River Basin							
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/ Acres**	**Cause(s) of Impairment**	**Initial 303(d) Listing Date**	**Date added to Category 4C**
Horseshoe Creek	WYNP101800080905_03	From the confluence with Spring Creek to a point 7.3 miles downstream	2AB	7.3 mi.	Flow Alterations	n/a	2006

Powder River Basin							
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/ Acres**	**Cause(s) of Impairment**	**Initial 303(d) Listing Date**	**Date added to Category 4C**
North Fork Crazy Woman Creek	**WYPR100902050102_01**	**From Muddy Creek Road downstream 28 miles to the confluence with the Middle Fork Powder River**	**2AB**	**28.0 mi.**	**Flow Alterations**	**n/a**	**2014**

Tongue River Basin							
Waterbody	**305(b) Identifier**	**Location**	**Class**	**Miles/ Acres**	**Cause(s) of Impairment**	**Initial 303(d) Listing Date**	**Date added to Category 4C**
Soldier Creek	WYTR100901010209_03	From 3.1 miles upstream from the confluence with Goose Creek to a point 17.0 miles upstream	2AB	17.0 mi.	Flow Alterations	n/a	2010

9.4 Category 5 Surface Waters

Surface waters that have been added or removed from the 303(d) List in 2014 and those that have been changed from the 2012 303(d) List are discussed in Section 8 above and a summary of these changes is provided below.

New 303(d) Listings

Twin Creek (Bighorn Basin, WYBH100800030106_03) – Data collected by WDEQ (2013) indicate that the aquatic life other than fish and cold water fishery uses on Twin Creek are not supported due to excess sediment along a segment extending from Old Highway 287 downstream 15.6 miles to the confluence with the Little Popo Agie River.

Little Popo Agie River (Bighorn Basin, WYBH100800030108_03) – Data collected by WDEQ (2013) indicated that the aquatic life other than fish and cold water fishery uses on the Little Popo Agie River are not supported due to excess oil and grease along a segment extending from the confluence with Willow Creek to a point 4.5 miles upstream.

Roaring Fork Little Snake River (Little Snake River Basin, WYLS140500030106_01) – Data collected by WDEQ (2013) indicate that the aquatic life other than fish and cold water fishery uses are not supported on a segment extending from the confluence with a tributary draining the Standard Mine downstream 1.8 miles to the confluence with an unnamed tributary.

Bear Creek (North Platte River Basin, WYNP101800020104_01) – Data collected by WDEQ (2010) indicate that the cold water fishery use is not supported on a segment extending from the confluence with Rambler Creek downstream 0.7 miles to the confluence with Rob Roy Reservoir.

Rambler Creek (North Platte River Basin, WYNP101800020104_03) – Data collected by WDEQ (2010) indicate that the aquatic life other than fish use is not supported on a segment extending from the confluence with Bear Creek to a point 0.5 miles upstream.

Little Medicine Bow River (North Platte River Basin, WYNP101800050103_02) – Data collected by WDEQ (2013) indicate that the aquatic life other than fish and cold water fishery uses are not supported on a segment extending from County Road 2E downstream 26.2 miles to the confluence with Sheep Creek.

Dalton Ditch (WYPR100902060303_04) – Data collected by WDEQ (2014) indicate that the recreational use is not supported on a segment of Dalton Ditch from Cottage Grove Road to a point 0.04 miles (232 feet) upstream.

Crow Creek (Snake River Basin, WYSR170401050102_01) – Selenium data collected by WDEQ (2013) indicate that the aquatic life other than fish and cold water fishery uses are not supported from the Wyoming/Idaho border downstream to the confluence with the Salt River.

New 303(d) De-Listings

Belle Fourche River (Belle Fourche River Basin, WYBF101202010501_01) - A TMDL was developed for the *E. coli* impairment on the Belle Fourche River from the confluence with Donkey Creek to a point 6.2 miles upstream. The TMDL was approved by USEPA in December 2013 and this water was placed in Category 4A.

Belle Fourche River (Belle Fourche River Basin, WYBF101202010504_00) - A TMDL was developed for the *E. coli* impairment on the Belle Fourche River from the confluence with Keyhole Reservoir upstream to the confluence with Donkey Creek. The TMDL was approved by USEPA in December 2013 and this water was placed in Category 4A.

Belle Fourche River (Belle Fourche River Basin, WYBF101202010504_00) - A TMDL was developed for the ammonia impairment on the Belle Fourche River from the confluence with Keyhole Reservoir upstream to the confluence with Donkey Creek. The TMDL was approved by USEPA in December 2013 and this water was placed in Category 4A.

Belle Fourche River (Belle Fourche River Basin, WYBF101202010504_00) - A TMDL was developed for the chloride impairment on the Belle Fourche River from the confluence with Keyhole Reservoir upstream to the confluence with Donkey Creek. The TMDL was approved by USEPA in December 2013 and this water was placed in Category 4A.

Donkey Creek (Belle Fourche River Basin, WYBF101202010600_01) - A TMDL was developed for the chloride impairment on Donkey Creek from the confluence with the Belle Fourche River upstream to Brorby Boulevard within the city of Gillette. The TMDL was approved by USEPA in December 2013 and this water was placed in Category 4A.

Gillette Fishing Lake (Belle Fourche River Basin, WYBF101202010601_01) - A TMDL was developed for the sediment impairment on Gillette Fishing Lake and was approved by USEPA in December 2013 and this water was placed in Category 4A.

Gillette Fishing Lake (Belle Fourche River Basin, WYBF101202010601_01) - A TMDL was developed for the phosphate impairment on Gillette Fishing Lake and was approved by USEPA in December 2013 and this water was placed in Category 4A.

Stonepile Creek (Belle Fourche River Basin, WYBF101202010602_01) - A TMDL was developed for the fecal coliform impairment on Stonepile Creek from the confluence with Donkey Creek upstream to the junction of highways 14/16 and 59. The TMDL was approved by USEPA in December 2013 and this water was placed in Category 4A.

Belle Fourche River (Belle Fourche River Basin, WYBF101202010904_00) - A TMDL was developed for the chloride impairment on the Belle Fourche River from the confluence with Arch Creek downstream to the confluence with Sourdough Creek. The TMDL was approved by USEPA in December 2013 and this water was placed in Category 4A.

Owl Creek (Bighorn River Basin, WYBH100800070305_01) - A TMDL was developed for the fecal coliform impairment on Owl Creek from the confluence with Bighorn River to a point 3.8 miles upstream. The TMDL was approved by USEPA in April 2014 and this water was placed in Category 4A.

Kirby Creek (Bighorn River Basin, WYBH100800070500_01) - A TMDL was developed for the fecal coliform impairment on Kirby Creek from the confluence with Bighorn River to a point 21.8 miles upstream. The TMDL was approved by USEPA in April 2014 and this water was placed in Category 4A.

Nowater Creek (Bighorn River Basin, WYBH100800070809_01) - A TMDL was developed for the fecal coliform impairment on Nowater Creek from the confluence with Bighorn River to a point 6.6 miles upstream. The TMDL was approved by USEPA in April 2014 and this water was placed in Category 4A.

Fifteen Mile Creek (Bighorn River Basin, WYBH100800070909_01) - A TMDL was developed for the fecal coliform impairment on Fifteen Mile Creek from the confluence with Bighorn River to a point 2.2 miles upstream. The TMDL was approved by USEPA in April 2014 and this water was placed in Category 4A.

Bighorn River (Bighorn River Basin, WYBH100800071000_01) - A TMDL was developed for the *E. coli* impairment on the Bighorn River from the confluence with the Nowood River to a point 36.1 miles upstream. The TMDL was approved by USEPA in April 2014 and this water was placed in Category 4A.

Bighorn River (Bighorn River Basin, WYBH100800071000_02) - A TMDL was developed for the fecal coliform impairment on the Bighorn River from the confluence with the Greybull River upstream to the confluence with the Nowood River. The TMDL was approved by USEPA in April 2014 and this water was placed in Category 4A.

Sage Creek (Bighorn River Basin, WYBH100800071001_01) - A TMDL was developed for the fecal coliform impairment on Sage Creek from the confluence with the Bighorn River to a point 7.4 miles upstream. The TMDL was approved by USEPA in April 2014 and this water was placed in Category 4A.

Slick Creek (Bighorn River Basin, WYBH100800071001_01) - A TMDL was developed for the fecal coliform impairment on the Bighorn River from the confluence with Bighorn River to a point 5.8 miles upstream. The TMDL was approved by USEPA in April 2014 and this water was placed in Category 4A.

Paint Rock Creek (Bighorn River Basin, WYBH100800080607_01) - A TMDL was developed for the fecal coliform impairment on Paint Rock Creek from the confluence with Nowood River to a point 5.2 miles upstream. The TMDL was approved by USEPA in April 2014 and this water was placed in Category 4A.

Greybull River (Bighorn River Basin, WYBH100800090405_01) - A TMDL was developed for the fecal coliform impairment on the Greybull River from the confluence with the Bighorn River upstream to Sheets Flats Bridge. The TMDL was approved by USEPA in April 2014 and this water was placed in Category 4A.

Granite Creek (Bighorn River Basin, WYBH100800100102_01) - A TMDL was developed for the fecal coliform impairment on Granite Creek from the confluence with Shell Creek upstream 5.8 miles, near Antelope Butte Ski Area. The TMDL was approved by USEPA in April 2014 and this water was placed in Category 4A.

Beaver Creek (Bighorn River Basin, WYBH100800100204_01) - A TMDL was developed for the fecal coliform impairment on Beaver Creek from the confluence with Shell Creek to a point 7.9 miles upstream. The TMDL was approved by USEPA in April 2014 and this water was placed in Category 4A.

Shell Creek (Bighorn River Basin, WYBH100800100206_01) - A TMDL was developed for the fecal coliform impairment on Shell Creek from the confluence with the Bighorn River to a point 5.3 miles upstream. The TMDL was approved by USEPA in April 2014 and this water was placed in Category 4A.

Bighorn River (Bighorn River Basin, WYBH100800100301_01) - A TMDL was developed for the fecal coliform impairment on the Bighorn River from the confluence with the Greybull River to a point 10.5 miles downstream. The TMDL was approved by USEPA in April 2014 and this water was placed in Category 4A.

Dry Creek (Bighorn River Basin, WYBH100800110204_01) - A TMDL was developed for the fecal coliform impairment on Dry Creek from the confluence with the Bighorn River to a point 4.7 miles upstream. The TMDL was approved by USEPA in April 2014 and this water was placed in Category 4A.

Wheatland Creek (North Platte River Basin, WYNP101800110502_01) – The town of Wheatland's WWTF was converted to a non-discharge facility in 2008. Wheatland Creek is no longer exceeding WDEQ's ammonia criterion from the confluence with Rock Creek downstream to Wheatland Highway and Wheatland Creek has been removed from the 303(d) List in 2014.

Wheatland Creek (North Platte River Basin, WYNP101800110502_01) – The town of Wheatland's WWTF was converted to a non-discharge facility in 2008. Wheatland Creek is no longer exceeding WDEQ's pH criterion from the confluence with Rock Creek downstream to Wheatland Highway and Wheatland Creek has been removed from the 303(d) List in 2014.

North Fork Crazy Woman Creek (Powder River Basin, WYPR100902050100_01) – A report completed in 2013 by WDEQ demonstrated that nutrients are no longer impairing the aquatic life other than fish and cold water fisheries uses on North Fork Crazy Woman Creek. The report determined that the aquatic life other than fish and cold water fisheries these uses are fully supported from Muddy Creek Road to a point 22.6 miles upstream. Therefore, this segment has been removed from the 303(d) List in 2014 and placed in Category 2 (see Table 9.2 above)

North Fork Crazy Woman Creek (Powder River Basin, WYPR100902050100_01) – A report completed in 2013 by WDEQ demonstrated that sediment is no longer impairing the aquatic life other than fish and cold water fisheries uses on North Fork Crazy Woman Creek. The report determined that the aquatic life other than fish and cold water fisheries these uses are fully supported from Muddy Creek Road to a point 22.6 miles upstream. Therefore, this segment has been removed from the 303(d) List in 2014 and placed in Category 2 (see Table 9.2 above)

Muddy Creek (Little Snake River Basin, WYLS140500040104_01) – Extensive sediment remediation efforts, which included the construction of a large wetland complex within the threatened reach, have removed the threat of sedimentation in Muddy Creek. Because it is unlikely that the wetland complex will ever be removed and the channel returned to its natural form, WDEQ is moving Muddy Creek from the confluence with Red Wash upstream to the confluence with Antelope Creek from the 303(d) List (Category 5) to Category 4C in the 2014 Integrated 305(b) and 303(d) Report.

North Piney Creek (Powder River Basin, WYPR100902060303_01) – A report completed in 2014 by WDEQ showed that *E. coli* is no longer impairing North Piney Creek from the confluence with Piney Creek to a point 6.4 miles upstream and this segment has been removed from the 303(d) List in 2014. The report demonstrated that the primary contact recreational use is fully supported along this reach and therefore it has been placed in Category 2.

Crow Creek (South Platte River Basin, WYSP101900090107_02) - A TMDL was developed for the selenium impairment on Crow Creek along a segment from 0.7 miles below Morrie Avenue downstream to the inlet of Hereford Reservoir #1. The TMDL was approved by USEPA in August 2013 and this water was placed in Category 4A.

Other 303(d) List Changes

North Fork Crazy Woman Creek (Powder River Basin, WYPR100902050100_01) – The extent of this segment in 2012 IR was from the confluence with Muddy Creek to a point 28.0 miles upstream. This segment was modified based on a WDEQ (2014) report to more accurately delineate assessment units on North Fork Crazy Woman Creek, and now extends from Muddy Creek Road to a point 22.6 miles upstream.

Wyoming's 2014 303(d) List

Table 9.4.1. Section 303(d) List of Wyoming's impaired surface waters requiring TMDL studies. All 2014 303(d) Listings are bolded. The TMDL date in the far right column represents the year in which WDEQ expects to begin developing each TMDL.

Bear River Basin								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
Bear River	WYBR160101010303_01	2AB	From the confluence with Woodruff Narrows Reservoir upstream to the confluence with Sulphur Creek	36.5 mi.	Cold Water Fishery, Aquatic Life other than Fish	Sediment	2002	2012
					Not Supporting	Habitat Modification		
Bridger Creek	WYBR160101010801_01	3B	Entire watershed upstream of the Utah border	191.4 mi.	Aquatic Life other than Fish	Sediment	1998	2022
					Threatened	Grazing		

Bighorn River Basin								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
Twin Creek	**WYBH100800030106_03**	**2AB**	**From Old Highway 287 downstream 15.6 miles to the confluence with the Little Popo Agie River**	**15.6 mi.**	**Cold Water Fishery, Aquatic Life other than Fish**	**Sediment**	**2014**	**2027**
					Not Supporting	**Livestock Grazing, Historic Habitat Modifications, Unknown**		

Bighorn River Basin (continued)								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
Little Popo Agie River	**WYBH100800030108_03**	**2AB**	**From the confluence with Willow Creek to a point 4.5 miles upstream**	**4.5 mi.**	**Cold Water Fishery, Aquatic Life other than Fish**	**Oil and Grease**	**2014**	**2027**
					Not Supporting	**Petroleum Production**		
Middle Fork Popo Agie River	WYBH100800030207_01	2AB	From the confluence with Baldwin Creek to a point 4.0 miles upstream	4.0 mi.	Recreation	Fecal Coliform	2002	2016
					Not Supporting	Unknown		
Poison Creek	WYBH100800050404_01	2AB	From the confluence with Boysen Reservoir to a point 2.0 miles upstream	2.0 mi.	Recreation	*E. coli*	2002	2015
					Not Supporting	Unknown		
Muddy Creek	WYBH100800050607_01	2AB	From the confluence with Boysen Reservoir upstream to the Wind River Indian Reservation	11.8 mi.	Recreation	*E. coli*	2002	2015
					Not Supporting	Unknown		
Dry Gulch	WYBH100800140107_01	3B	From the confluence with the Shoshone River to a point 7.0 miles upstream	7.0 mi.	Recreation	*E. coli*	2008	2013
					Not Supporting	Unknown		
Bitter Creek	WYBH100800140206_01	2AB	From the confluence with the Shoshone River to a point 13.9 miles upstream	13.9 mi.	Recreation	Fecal Coliform	2000	2013
					Not Supporting	Unknown		
Whistle Creek	WYBH100800140303_01	2AB	From the confluence with the Shoshone River to a point 8.7 miles upstream	8.7 mi.	Recreation	Fecal Coliform	2000	2013
					Not Supporting	Unknown		

Bighorn River Basin (continued)								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
Foster Gulch	WYBH100800140307_01	2C	From the confluence with the Shoshone River to a point 2.0 miles upstream	2.0 mi.	Recreation	Fecal Coliform	2002	2013
					Threatened	Unknown		
Polecat Creek	WYBH100800140407_01	2AB	From the confluence with Sage Creek to a point 2.5 miles upstream	2.5 mi.	Recreation	Fecal Coliform	2002	2013
					Not Supporting	Unknown		
Sage Creek	WYBH100800140408_01	2AB	From the confluence with the Shoshone River to a point 14.0 miles upstream	14.0 mi.	Recreation	Fecal Coliform	2002	2013
					Not Supporting	Unknown		
Big Wash	WYBH100800140408_02	3B	From the confluence with Sage Creek upstream to Sidon Canal	3.2 mi.	Recreation	Fecal Coliform	2002	2013
					Not Supporting	Unknown		
Shoshone River	WYBH100800140504_00	2AB	From the confluence with Bighorn Lake to a point 9.7 miles upstream	9.7 mi.	Recreation	Fecal Coliform	2002	2013
					Not Supporting	Unknown		

Green River Basin								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
Little Sandy River	WYGR140401040203_01	2AB	From the northern boundary of Section 33-Township 28 North-Range 104 West-downstream 17.7 miles to the Sublette/Sweetwater County line	17.7 mi.	Cold Water Game Fishery, Aquatic Life other than Fish	Sediment	2012	2016
					Not Supporting	Livestock and Wildlife Grazing, Historic Habitat Modifications		
Pacific Creek	WYGR140401040303_01	2AB	From Bar X Road to a point 0.4 miles upstream	0.4 mi.	Recreation	*E. coli*	2012	2022
					Not Supporting	Unknown		
Bitter Creek	WYGR140401050506_01	2C	From the confluence with the Green River upstream to Point of Rocks	58.1 mi.	Recreation	Fecal Coliform	2000	2014
					Not Supporting	Unknown		
Bitter Creek	WYGR140401050506_01	2C	From the confluence with the Green River upstream to Point of Rocks	58.1 mi.	Non-Game Fishery, Aquatic Life other than Fish	Chloride	2002	2014
					Not Supporting	Natural Sources, Unknown		
Killpecker Creek	WYGR140401050808_01	3B	From the confluence with Bitter Creek upstream to Reliance	6.3 mi.	Recreation	Fecal Coliform	2000	2014
					Not Supporting	Unknown		
Blacks Fork	WYGR140401070106_01	2AB	From the confluence with the Smiths Fork upstream to Millburne	25.4 mi.	Recreation	Fecal Coliform	2000	2013
					Not Supporting	Unknown		
Willow Creek	WYGR140401070205_01	2AB	Entire watershed upstream of the confluence with the Smiths Fork	73.0 mi.	Cold Water Game Fishery, Aquatic Life other than Fish	Habitat Alterations	1998	2018
					Threatened	Grazing		

Green River Basin (continued)								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
Smiths Fork	WYGR140401070208_00	2AB	From the confluence with Cottonwood Creek upstream to the confluence with East and West Forks Smiths Fork	34.5 mi.	Recreation	Fecal Coliform	2002	2013
					Not Supporting	Unknown		
Smiths Fork	WYGR140401070208_01	2AB	From the confluence with the Blacks Fork upstream to the confluence with Cottonwood Creek	4.0 mi.	Cold Water Game Fishery, Aquatic Life other than Fish	Habitat Alterations	2000	2013
					Not Supporting	Unknown		
Smiths Fork	WYGR140401070208_01	2AB	From the confluence with the Blacks Fork upstream to the confluence with Cottonwood Creek	4.0 mi.	Recreation	*E. coli*	2008	2013
					Not Supporting	Unknown		
Blacks Fork	WYGR140401070403_01	2AB	From the confluence with the Hams Fork upstream to the confluence with the Smiths Fork	45.0 mi.	Recreation	Fecal Coliform	2000	2013
					Not Supporting	Unknown		
Hams Fork	WYGR140401070701_01	2AB	From below the Kemmerer-Diamondville WWTF to a point 7.6 miles downstream	7.6 mi.	Cold Water Game Fishery, Aquatic Life other than Fish	pH	1996	2012
					Not Supporting	Municipal WWTF		

Little Snake River Basin								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
Roaring Fork Little Snake River	**WYLS140500030106_01**	**2AB**	**From the confluence with a tributary draining the Standard Mine downstream 1.8 miles to the confluence with an unnamed tributary**	**1.8 mi.**	**Cold Water Game Fishery, Aquatic Life other than Fish**	**Copper**	**2014**	**2027**
					Not Supporting	**Hardrock Mining**		
Savery Creek	WYLS140500030408_01	2AB	From the confluence with Little Sandstone Creek downstream to the confluence with the Little Snake River	13.7 mi.	Cold Water Game Fishery, Aquatic Life other than Fish	Habitat Alterations	1998	2016
					Threatened	Grazing		
West Fork Loco Creek	WYLS140500030408_02	2AB	Entire West Fork Loco Creek watershed upstream from the confluence with Loco Creek	12.8 mi.	Cold Water Game Fishery, Aquatic Life other than Fish	Habitat Alterations	1996	2016
					Threatened	Grazing		
West Fork Loco Creek	WYLS140500030408_02	2AB	Entire West Fork Loco Creek watershed upstream from the confluence with Loco Creek	12.8 mi.	Cold Water Game Fishery, Aquatic Life other than Fish	Nutrients	1996	2022
					Threatened	Grazing		
West Fork Loco Creek	WYLS140500030408_02	2AB	Entire West Fork Loco Creek watershed upstream from the confluence with Loco Creek	12.8 mi.	Cold Water Game Fishery, Aquatic Life other than Fish	Temperature	1996	2022
					Threatened	Grazing		
Muddy Creek	WYLS140500040308_01	2C	From below the confluence with Youngs Draw upstream to the confluence with Deep Creek	7.7 mi.	Non-Game Fishery, Aquatic Life other than Fish	Selenium	2010	2020
					Not Supporting	Unknown, Natural		

Little Snake River Basin (continued)								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
Muddy Creek	WYLS140500040308_01	2C	From below the confluence with Youngs Draw upstream to the confluence with Deep Creek	7.7 mi.	Non-Game Fishery, Aquatic Life other than Fish	Chloride	2010	2020
					Not Supporting	Unknown, Natural		

North Platte River Basin								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
Bear Creek	**WYNP101800020104_01**	**2AB**	**From the confluence with Rambler Creek downstream 0.7 miles to the confluence with Rob Roy Reservoir**	**0.7 mi.**	**Cold Water Game Fishery**	**Copper**	**2014**	**2015**
					Not Supporting	**Hardrock Mining**		
Rambler Creek	**WYNP101800020104_03**	**3B**	**From the confluence with Bear Creek to a point 0.5 miles upstream**	**0.5 mi.**	**Aquatic Life other than Fish**	**Copper**	**2014**	**2015**
					Not Supporting	**Hardrock Mining**		
Little Medicine Bow River	**WYNP101800050103_02**	**2AB**	**From County Road 2E downstream 26.2 miles to the confluence with Sheep Creek**		**Cold Water Game Fishery, Aquatic Life other than Fish**	**Sediment**	**2014**	**2015**
					Not Supporting	**Surface Mining**		

North Platte River Basin (continued)								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
Lander Creek	WYNP101800060104_01	2AB	A 0.5 section of Lander Creek between two unnamed tributaries and adjacent to County Route 132 (in NW S8 T29N R103W, within HUC 12 boundary 101800060104)	0.5 mi.	Recreation	*E. coli*	2012	2022
					Not Supporting	Grazing		
Crooks Creek	WYNP101800060603_01	2AB	From the confluence with Mason Creek to a point 1.4 miles downstream	1.4 mi.	Cold Water Game Fishery, Aquatic Life other than Fish	Oil and Grease	1998	2022
					Not Supporting	Petroleum Production		
North Platte River	WYNP101800070300_01	2AB	From the confluence with Muddy Creek upstream to the confluence with Poison Spider Creek	36.8 mi.	Cold Water Game Fishery, Aquatic Life other than Fish	Selenium	1998	2009
					Not Supporting	Irrigated Crop Production, Natural Sources		
Poison Spring Creek	WYNP101800070302_01	3B	From Casper Canal downstream to the confluence with the North Platte River	8.2 mi.	Aquatic Life other than Fish	Selenium	2000	2009
					Not Supporting	Irrigated Crop Production, Natural Sources		
Rasmus Lee Lake	WYNP101800070302_02	3B	Within the Kendrick Reclamation Project	85.2 ac.	Aquatic Life other than Fish	Selenium	2000	2009
					Not Supporting	Irrigated Crop Production, Natural Sources		

North Platte River Basin (continued)								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
Goose Lake	WYNP101800070302_03	3B	Within the Kendrick Reclamation Project	30.1 ac.	Aquatic Life other than Fish	Selenium	2000	2009
					Not Supporting	Irrigated Crop Production, Natural Sources		
Oregon Trail Drain	WYNP101800070303_01	3B	Within the Kendrick Reclamation Project	8.6 mi.	Aquatic Life other than Fish	Selenium	2000	2009
					Not Supporting	Irrigated Crop Production, Natural Sources		
Poison Spider Creek	WYNP101800070406_01	2AB	From the confluence with the North Platte River to the confluence with Iron Creek, within the Kendrick Reclamation Project	1.3 mi.	Cold Water Game Fishery, Aquatic Life other than Fish	Selenium	2000	2009
					Not Supporting	Irrigated Crop Production, Natural Sources		
Poison Spider Creek	WYNP101800070406_02	2C	From the confluence with Iron Creek to a point 5.8 miles upstream	5.8 mi.	Non-Game Fishery, Aquatic Life other than Fish	Selenium	2000	2009
					Not Supporting	Irrigated Crop Production, Natural Sources		
Poison Spider Creek	WYNP101800070406_03	3B	From the HUC 12 boundary (101800070406) to a point 6.0 miles downstream, within the Kendrick Reclamation Project	6.0 mi.	Aquatic Life other than Fish	Selenium	2000	2009
					Not Supporting	Irrigated Crop Production, Natural Sources		

North Platte River Basin (continued)								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
Illco Pond	WYNP101800070503_01	3B	NE S13 T35N R81W, within HUC 12 boundary (101800070503)	1.1 ac.	Aquatic Life other than Fish	Selenium	2000	2009
					Not Supporting	Irrigated Crop Production, Natural Sources		
Casper Creek	WYNP101800070504_01	2AB	From the confluence with the North Platte River to a point 21.1 miles upstream, within the Kendrick Reclamation Project	21.1 mi.	Cold Water Game Fishery, Aquatic Life other than Fish	Selenium	2000	2009
					Not Supporting	Irrigated Crop Production, Natural Sources		
Thirty Three Mile Reservoir	WYNP101800070703_01	3B	Along South Fork Casper Creek, within Kendrick Reclamation Project	30.2 ac.	Aquatic Life other than Fish	Selenium	2000	2009
					Not Supporting	Irrigated Crop Production, Natural Sources		
Laramie River	WYNP101800100201_01	2AB	From State Highway 10 to a point 0.3 miles upstream	0.3 mi.	Recreation	*E. coli*	2012	2020
					Not Supporting	Unknown		
Little Laramie River	WYNP101800100605_01	2AB	From Mandel Lane upstream to Snowy Range Road	15.7 mi.	Recreation	*E. coli*	2012	2020
					Not Supporting	Unknown		
Laramie River	WYNP101800100707_01	2AB	A 2.9 mile section of stream intersecting Ione Lane, below Bosler Junction	2.9 mi.	Recreation	*E. coli*	2012	2020
					Not Supporting	Unknown		
Wheatland Creek	WYNP101800110502_01	2C	From the confluence with Rock Creek downstream to Wheatland Highway	2.4 mi.	Recreation	Fecal Coliform	2002	2015
					Not Supporting	Unknown		

North Platte River Basin (continued)								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
Rock Creek	WYNP101800110502_02	2C	Entire watershed above the confluence with Wheatland Creek	34.9 mi.	Recreation	Fecal Coliform	2002	2015
					Not Supporting	Unknown		

Powder River Basin								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
Powder River	WYPR100902020102_00	2ABww	From the confluence with Salt Creek upstream to the confluence with the South Fork Powder River	15.9 mi.	Warm Water Game Fishery, Aquatic Life other than Fish	Selenium	2000	2020
					Not Supporting	Irrigated Crop Production, Natural Sources, Unknown		
Powder River	WYPR100902020103_01	2ABww	From the confluence with Salt Creek downstream to the confluence with Soldier Creek	19.3 mi.	Warm Water Game Fishery, Aquatic Life other than Fish	Chloride	1998	2020
					Not Supporting	Petroleum Production		
Powder River	WYPR100902020103_01	2ABww	From the confluence with Salt Creek downstream to the confluence with Soldier Creek	19.3 mi.	Warm Water Game Fishery, Aquatic Life other than Fish	Selenium	2000	2020
					Not Supporting	Irrigated Crop Production, Natural Sources, Unknown		

Powder River Basin (continued)								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
Powder River	WYPR100902020103_01	2ABww	From the confluence with Salt Creek downstream to the confluence with Soldier Creek	19.3 mi.	Drinking Water	Arsenic	2012	2022
					Not Supporting	Petroleum Production		
Powder River	WYPR100902020600_01	2ABww	From the confluence with Soldier Creek downstream to the confluence with Crazy Woman Creek	100.6 mi.	Warm Water Game Fishery, Aquatic Life other than Fish	Selenium	2000	2020
					Not Supporting	Irrigated Crop Production, Natural Sources, Unknown		
Powder River	WYPR100902020600_01	2ABww	From the confluence with Soldier Creek downstream to the confluence with Crazy Woman Creek	100.6 mi.	Drinking Water	Arsenic	2012	2022
					Not Supporting	Petroleum Production		
Middle Prong Wild Horse Creek	WYPR100902020808_01	3B	From the confluence with Wild Horse Creek to a point 4.6 miles upstream	4.7 mi.	Recreation	*E. coli*	2006	2020
					Not Supporting	Unknown		
South Fork Powder River	WYPR100902030400_01	2C	From the confluence with Cloud Creek to a point 47.2 miles downstream	47.2 mi.	Non-Game Fishery, Aquatic Life other than Fish	Selenium	2006	2020
					Not Supporting	Irrigated Crop Production, Natural Sources, Unknown		

Powder River Basin (continued)								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
Willow Creek	WYPR100902030403_01	2AB	From the confluence with the South Fork Powder River to a point 10.5 miles upstream	10.5 mi.	Cold Water Game Fishery, Aquatic Life other than Fish	Selenium	2006	2020
					Not Supporting	Irrigated Crop Production, Natural Sources, Unknown		
Posey Creek	WYPR100902030404_01	3B	From the confluence with the South Fork Powder River to a point 8.0 miles upstream	8.0 mi.	Aquatic Life other than Fish	Selenium	2008	2020
					Not Supporting	Irrigated Crop Production, Natural Sources, Unknown		
Murphy Creek	WYPR100902030407_01	3B	From the confluence with the South Fork Powder River to a point 12.2 miles upstream	12.2 mi.	Aquatic Life other than Fish	Selenium	2008	2020
					Not Supporting	Natural Sources, Unknown		
Salt Creek	WYPR100902040300_01	2C	From the confluence with the Powder River to a point 45.3 miles upstream	45.3 mi.	Non-Game Fishery, Aquatic Life other than Fish	Selenium	2008	2020
					Not Supporting	Petroleum Production, Natural Sources, Unknown		
Salt Creek	WYPR100902040300_01	2C	From the confluence with the Powder River to a point 45.3 miles upstream	45.3 mi	Non-Game Fishery, Aquatic Life other than Fish	Oil Spills	1996	2015
					Threatened	Petroleum Production		

Powder River Basin (continued)								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
Crazy Woman Creek	WYPR100902050305_01	2ABww	From the confluence with the Powder River to a point 9.2 miles upstream	9.2 mi.	Drinking Water	Manganese	2002	2022
					Not Supporting	Natural, Unknown		
Dalton Ditch	WYPR100902060303_02	3B	Within and near the town of Story	0.3 mi.	Recreation	*E. coli*	2006	2020
					Not Supporting	Unknown		
Piney-Cruse Ditch	WYPR100902060303_03	3B	From the confluence with North Piney Creek to a point 2.2 miles upstream	2.2 mi.	Recreation	*E. coli*	2008	2020
					Not Supporting	Unknown		
Dalton Ditch	WYPR100902060303_04	3B	From Cottage Grove Road to point 0.04 miles (232 feet) upstream	0.04 mi.	Recreation	*E. coli*	2006	2020
					Not Supporting	Unknown		
Little Powder River	WYPR100902080500_01	2AB	From the WY/MT state line upstream to the confluence with Spring Creek	58.7 mi.	Recreation	Fecal Coliform	2002	2015
					Not Supporting	Unknown		

Snake River Basin								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
Flat Creek	WYSR170401030205_01	1	From the confluence with the Snake River upstream to the confluence with Cache Creek	11.1 mi.	Cold Water Game Fishery, Aquatic Life other than Fish	Habitat Alterations	2000	2022
					Threatened	Stormwater		

Snake River Basin (continued)								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
Clark's Draw	WYSR170401030305_01	3B	A 1.9 mile segment adjacent to US Route 189, near town of Bondurant	1.9 mi.	Recreation	*E. coli*	2012	2022
					Not Supporting	Grazing, Unknown		
Stump Creek	WYSR170401050203_01	2AB	From the confluence with the Salt River upstream to the Idaho border	5.6 mi.	Recreation	*E. coli*	2008	2014
					Not Supporting	Unknown		
Crow Creek	**WYSR170401050102_01**	**2AB**	**From the Wyoming/Idaho Border downstream to the confluence with the Salt River**	**15.6 mi.**	**Cold Water Game Fishery, Aquatic Life other than Fish**	**Selenium**	**2014**	**2017**
					Not Supporting	**Unknown**		
Salt River	WYSR170401050309_01	2AB	A 7.5 mile section located 3.4 miles northwest of Etna	7.5 mi.	Recreation	*E. coli*	2002	2014
					Not Supporting	Unknown		

South Platte River Basin								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
Middle Fork Crow Creek	WYSP101900090101_01	2AB	A 1.5 mile section of creek at FS Road 700 crossing	1.5 mi.	Recreation	*E. coli*	2010	2016
					Not Supporting	Grazing		
North Branch North Fork Crow Creek	WYSP101900090104_01	2AB	From FS Road 701 upstream 300 yards	0.2 mi.	Recreation	*E. coli*	2004	2016
					Not Supporting	Grazing		

South Platte River Basin (continued)								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
Crow Creek	WYSP101900090107_01	2C	From the inlet of Hereford Reservoir #2 upstream to the outlet of Hereford Reservoir #1	9.4 mi.	Recreation	Fecal Coliform	1996	2010
					Not Supporting	Stormwater		
Crow Creek	WYSP101900090107_02	2C	From 0.7 miles below Morrie Avenue downstream to the inlet of Hereford Reservoir #1	3.7 mi.	Recreation	*E. coli*	2012	2010
					Not Supporting	Stormwater		
Crow Creek	WYSP101900090107_02	2C	From 0.7 miles below Morrie Avenue downstream to the inlet of Hereford Reservoir #1	3.7 mi.	Non-Game Fishery, Aquatic Life other than Fish	Sediment	2012	2010
					Not Supporting	Stormwater		
Crow Creek	WYSP101900090107_03	2C	From Morrie Avenue to a point 0.7 miles downstream	0.7 mi.	Non-Game Fishery, Aquatic Life other than Fish	Sediment	2010	2010
					Not Supporting	Stormwater		
Crow Creek	WYSP101900090107_03	2C	From Morrie Avenue to a point 0.7 miles dowstream	0.7 mi.	Recreation	*E. coli*	2012	2010
					Not Supporting	Stormwater		
Crow Creek	WYSP101900090107_04	2AB	From Morrie Avenue upstream to Happy Jack Road	3.4 mi.	Recreation	*E. coli*	2012	2010
					Not Supporting	Stormwater		
Crow Creek	WYSP101900090107_04	2AB	From Morrie Avenue upstream to Happy Jack Road	3.4 mi.	Cold Water Game Fishery, Aquatic Life other than Fish	Sediment	2012	2010
					Not Supporting	Stormwater		
Crow Creek	WYSP101900090107_05	2AB	From Happy Jack Road upstream to Roundtop Road	3.1 mi.	Recreation	*E. coli*	2012	2010
					Not Supporting	Unknown		
Crow Creek	WYSP101900090203_01	2C	From Missile Road (HWY 217) upstream to the outlet of Hereford Reservoir #2	10.1 mi.	Recreation	*E. coli*	1996	2010
					Not Supporting	Unknown		

Tongue River Basin								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
North Tongue River	WYTR100901010101_01	1	From Road 171 upstream to the confluence with Pole Creek	11.1 mi.	Recreation	Fecal Coliform	2004	2016
					Not Supporting	Grazing		
Columbus Creek	WYTR100901010106_01	2AB	From the confluence with the Tongue River to a point 3.1 miles upstream	3.1 mi.	Recreation	Fecal Coliform	2002	2016
					Not Supporting	Unknown		
Smith Creek	WYTR100901010106_02	2AB	From the confluence with the Tongue River to a point 5.8 miles upstream	5.8 mi.	Recreation	Fecal Coliform	2002	2016
					Not Supporting	Unknown		
Little Tongue River	WYTR100901010107_02	2AB	From the confluence with the Tongue River upstream to the confluence with Frisbee Ditch	4.8 mi.	Recreation	*E. coli*	2002	2016
					Not Supporting	Unknown		
Fivemile Creek	WYTR100901010108_01	3B	From the confluence with the Tongue River upstream to the confluence with Hanover Ditch	2.1 mi.	Recreation	Fecal Coliform	2002	2016
					Not Supporting	Unknown		
Wolf Creek	WYTR100901010110_01	2AB	From the confluence with the Tongue River upstream to the confluence with East Wolf Creek	10.6 mi.	Recreation	Fecal Coliform	2002	2016
					Not Supporting	Unknown		
Tongue River	WYTR100901010111_01	1	From Monarch Road upstream to Wolf Creek Road	13.5 mi.	Recreation	*E. coli*	2010	2016
					Not Supporting	Unknown		

Tongue River Basin (continued)								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
Tongue River	WYTR100901010301_01	2AB	From the confluence with Goose Creek downstream to the Montana border	22.1 mi.	Cold Water Fishery	Temperature	2002	2022
					Not Supporting	Unknown		
Prairie Dog Creek	WYTR100901010400_01	2AB	From I-90 to a point 47.2 miles downstream	47.2 mi.	Recreation	Fecal Coliform	2004	2016
					Not Supporting	Unknown		
Prairie Dog Creek	WYTR100901010400_01	2AB	From I-90 to a point 47.2 miles downstream	47.2 mi.	Recreation	Manganese	2012	2022
					Not Supporting	Natural Sources, Unknown		
Prairie Dog Creek	WYTR100901010400_01	2AB	From I-90 to a point 47.2 miles downstream	47.2 mi.	Cold Water Fishery	Temperature	2012	2022
					Not Supporting	Unknown		
Meade Creek	WYTR100901010401_01	2AB	From the confluence with Prairie Dog Creek upstream 1.1 miles to the confluence with an unnamed tributary	1.1 mi.	Recreation	*E. coli*	2012	2022
					Not Supporting	Unknown		
Meade Creek	WYTR100901010401_01	2AB	From the confluence with Prairie Dog Creek upstream 1.1 miles to the confluence with an unnamed tributary	1.1 mi.	Drinking Water	Manganese	2012	2022
					Not Supporting	Natural Sources, Unknown		

Tongue River Basin (continued)								
Waterbody	**305(b) Identifier**	**Class**	**Location**	**Miles/Acres**	**Uses**	**Cause(s)**	**List Date**	**TMDL Date**
					Use Support	**Source(s)**		
Prairie Dog Creek	WYTR100901010402_01	2AB	From the confluence with the Tongue River to a point 6.7 miles upstream	6.7 mi.	Drinking Water	Manganese	2002	2022
					Not Supporting	Natural Sources		
Prairie Dog Creek	WYTR100901010402_01	2AB	From the confluence with the Tongue River to a point 6.7 miles upstream	6.7 mi.	Recreation	Fecal Coliform	2004	2016
					Not Supporting	Unknown		
Prairie Dog Creek	WYTR100901010402_01	2AB	From the confluence with the Tongue River to a point 6.7 miles upstream	6.7 mi.	Cold Water Game Fish	Temperature	2012	2022
					Not Supporting	Unknown		
Wildcat Creek	WYTR100901010402_02	3B	From the confluence with Prairie Dog Creek to a point 0.8 miles upstream	0.8 mi.	Recreation	*E. coli*	2012	2022
					Not Supporting	Unknown		
Dutch Creek	WYTR100901010405_01	3B	From the confluence with Prairie Dog Creek upstream 1.9 miles to the confluence with an unnamed tributary	1.9 mi.	Recreation	*E. coli*	2012	2022
					Not Supporting	Unknown		

10.0 References

Andrews, E.D. 1978. Present and Potential Sediment Yields in the Yampa River Basin, Colorado and Wyoming. USGS Water Resources Investigations 78-105

BIO-WEST, Inc. 2001. North Fork Crazy Woman Creek Final Water Quality Report. Wyoming Department of Environmental Quality, Water Quality Division, Cheyenne, WY. 119 pp.

Birkeland, F.S. Chapin III, P.M. Groffman, G.R. Guntenspergen, A.K. Knapp, A.D. McGuire, P.J. Mulholland, D.P.C. Peters, D.D. Roby, and George Sugihara]. U.S. Geological Survey, Reston, VA, 156 pp.

BLM, 2001. Upper Colorado River Basin Rawlins Field Office Standards and Guidelines Assessment, 2001 Field Season. September, 2002. Rawlins Field Office, Rawlins, WY.

BLM-GR, 2002. Environmental Assessment WY-040-EA02-106, Bureau of Land Management, Green River Resource Area, December 2002.

BLM-GR, 2003. Environmental Assessment WY-040-EA02-207, with attachments, Bureau of Land Management, Green River Resource Area, February 2003.

BLM, 2005a. Smithfork Allotment Management Plan, Allotment No. 21005. Kemmerer Field Office, Kemmerer, WY. March 2005. 69pp.

BLM, 2005b. Twin Creek Allotment Cooperative Management Plan. Kemmerer Field Office, Kemmerer, WY. March 2005. 21pp.

BLM. 2007. Environmental Assessment for the Catalina Unit Coalbed Natural Gas Produced Water Disposal Project II. Carbon County, Wyoming. November 2007.

Bray, TJ 1996. Changes in Channel Morphology and Riparian Mosaics on the Bighorn River, Wyoming, MS Thesis, University of Wyoming, December 1996.
CCSP, 2009: *Thresholds of Climate Change in Ecosystems*. A report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research [Fagre, D.B., C.W. Charles, C.D. Allen, C.

CDM, 2010. Atlantic Rim Coal Bed Methane and Natural Gas Project, Carbon County, Wyoming. Muddy Creek Monitoring Report – 2010. Camp, Dresser, and McKee Inc., October 19, 2010.

Chapman, S.S., Bryce, S.A., Omernik, J.M., Despain, D.G., ZumBerge, J., and Conrad, M., 2003, Ecoregions of Wyoming (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,400,000).

CRBSCF, 2002. 2002 Review of Water Quality Standards for Salinity Colorado River System, Colorado River Basin Salinity Control Forum, October 2002.

Darton, LH 1906. The Hot Springs at Thermopolis, Wyoming. Journal of Geology, 14(3): 194-200.

Ecological Services, 1995. Fishing Lake Water Quality Study. Section 205j final report prepared for Campbell County Conservation District by Ecological Services, July 1995.

EDE Consultants, 2005. Belle Fourche River/Donkey Creek 319 Watershed Assessment. 2003-2004 indicator bacteria monitoring report. Prepared for Crook County Natural Resource District. Sundance, WY.

EDE Consultants, 2013. 2004 through 2012 Bitter and Killpecker Creek Watershed Monitoring Comprehensive Data Compilation Document. Prepared by EDE Consultants for Sweetwater County Conservation District. Sundance, WY.

EnTech, 2001. Final Report for Prairie Dog Creek Watershed Level I Study, Prepared for Wyoming Water Development Commission, November 2001.

ERI, 1992. Water Quality in the Upper Bear River, Problems and Mitigation, Ecosystem Research Institute, Logan, Utah.

ERI, 1996. Bridger Creek Restoration Project. Section 319 Nonpoint Source Pollution Control Program Watershed Project Final Report, Ecosystem Research Institute, Logan, UT.

Foreman, C.S. 2007. Belle Fourche River fecal coliform analysis project final report. Section 319 nonpoint source pollution control program Topical Report RSI-1882. SD Dept. Environment and Nat. Resources and Belle Fourche Watershed Partnership. December 2007.

Formation Environmental and Habitech, Inc. 2012. Proposed Site-Specific Selenium Criterion, Sage and Crow Creeks, Idaho. Prepared for J.R. Simplot. Accessed via http://www.deq.idaho.gov/media/804989-simplot-site-specific-selenium-criterion-proposal-0112.pdf

Hargett, E.G., J.R. ZumBerge and C.P. Hawkins. 2005. Development of a RIVPACS Model for Wadeable Streams of Wyoming. Wyoming Department of Environmental Quality, Water Quality Division, Cheyenne, WY.

Hargett, E.G. 2011. The Wyoming Stream Integrity Index (WSII) - Multimetric Indices for Wadeable Streamsand Large Rivers in Wyoming. Wyoming Department of Environmental Quality, Water Quality Division, Cheyenne, WY.
Hargett, E.G. 2012. Assessment of aquatic biological condition using WY RIVPACS with comparisons to the Wyoming Stream Integrity Index (WSII). Wyoming Department of Environmental Quality, Water Quality Division, Cheyenne, WY.

Houston, DB 1982. The northern Yellowstone Elk: ecology and management. Macmillan Publ. Co., New York, N.Y.

Hoyer, D.P., Ph.D. and A.M. Larson. 2005. Belle Fourche River Watershed. Butte, Lawrence, and Meade Counties, SD. Section 319 nonpoint source pollution control program assessment/planning project (TMDL) final report. SD DENR and Belle Fourche Watershed Partnership, June 27, 2005. Rapid City, SD.

Idaho Department of Environmental Quality. 2011. Idaho Department of Environmental Quality Final 2010 Integrated Report. Boise, ID: Idaho Department of Environmental Quality.

Marshall, B.D., 2005. An Assessment of Chemical and Biological Trends in the New Fork River Basin, Sublette County, Wyoming. Prepared for Sublette County Conservation District, Pinedale, Wyoming. Eco Analysts, Inc., Bozeman, MT.

Marshall, B.D. 2007a. Biological Baseline Condition in the Green River Basin, Sublette County, Wyoming: Biological Condition and Within Site Variability 2001-2005. Final Report prepared for Sublette County Conservation District, Pinedale, Wyoming. River Continuum Concepts, Willow Creek, MT and Eco Analysts Inc., Bozeman, MT on December 11, 2007.

Marshall, B.D. 2007b. An assessment of the biological condition of the New Fork River, near the Pinedale Anticline Project Area: 2006. Final Report prepared for Sublette County Conservation District, Pinedale, Wyoming. River Continuum Concepts, Willow Creek, MT.

Marston, RA, and JE Anderson 1991. Watersheds and Vegetation of the Greater Yellowstone Ecosystem. Conservation Biology, Vol.5:338-346.

MCD, 2007. Sheets Flat *E. coli* Project, Meeteetse Conservation District Report to the Wyoming Department of Agriculture, April, 2007.

MCD, 2009. Greybull River *E. coli* Monitoring, Wyoming Department of Agriculture Final Grant Report, January, 2009.

NRCS, 2001. Twin Creek Initial Investigation Report, Natural Resources Conservation Service in cooperation with the Lincoln County Conservation District, October, 2001.

Ogle, KM 1992. Surface-and Ground-water Quality in the Owl Creek Basin, North-Central Wyoming. US Geological Survey Water Resources Investigations Report 91-4108, 1992.

PACD, 2001. Popo Agie Watershed Water Quality Monitoring Project 1999-2000 Final Report, Popo Agie Conservation District, August 2001.

PACD, 2005. Popo Agie Watershed Water Quality Monitoring Project 2001-2002 Final Report, Popo Agie Conservation District, April 2005.

Page, F and R Zubik, 2001. Squaw Creek Watershed Project Final Report. Park County, Shoshone National Forest, US Fish and Wildlife Foundation and Wyoming Game and Fish Department. January 2001.

Patterson, M.M., G.B. Paige, and K.J. Reddy, 2009. Selenium in Surface and Irrigation Waters of the Kendrick Irrigation District, Wyoming. Environmental Monitoring and Assessment, December 18, 2009.
Peterson, D.A., Hargett, E.G., Wright, P.R., and Zumberge, J.R., 2007, Ecological status of Wyoming streams, 2000-2003: U.S. Geological Survey Scientific Investigations Report 2007-5130, 32 p.

Potts, D.F., 1985. HYDROLOGIC IMPACTS OF A LARGE-SCALE MOUNTAIN PINE BEETLE (*DENDROCTONUS PONDEROSAE* HOPKINS) EPIDEMIC. JAWRA, 20:373-377.
Rahel, F.J., C.J. Keleher, and J.L. Anderson. 1996. Potential habitat loss and population fragmentation for cold water fish in the North Platte River Drainage of the Rocky Mountains: Response to Climate Change. Journal of the American Society of Limnology and Oceanography. 41: 1116-1123.

Rees, D.E. and A.E. McMahon. 2011. Review of Habitat Restoration in 303(d) Listed Segments of the Muddy Creek Basin. Timberline Aquatics, Inc. Fort Collins, Colorado

Rice, CA, MS Ellis, TT Bartos and RM Flores 2002. Chemical and Isotopic Composition of Water Co-produced with Coalbed Methane in the Powder River Basin, Wyoming and Montana, in Proceedings of Geological Society of America 2002 Annual Meeting, Denver, Colorado, October 27-30, 2002.

Ripple WJ and RL Beschta 2003. Wolf Reintroduction, Predation Risk, and Cottonwood Recovery in Yellowstone National Park. Forest Ecology and Management, 184:299-313.

RPO, 1979. Bighorn Basin 208 Water Quality Management Plan. Regional Planning Office, Hot Springs, Washakie, Park, and Big Horn Counties, August 1979.

SCCD, 2003. Goose Creek Watershed Assessment Final Report 2001-2002, Sheridan County Conservation District.

SCS, 1980. Watershed Investigation Report, Sage Creek Basin, Carbon County Wyoming, USDA Soil Conservation Service.

SCS, 1987. Colorado River Salinity Control Program Final Environmental Impact Statement for Big Sandy River Unit, Sublette and Sweetwater Counties, Wyoming. USDA Soil Conservation Service, September 1987.

SCS, 1994. Bighorn Basin Surface Water Quality Study, Final Report and Recommendations, Wyoming Cooperative River Basin Study, Project No. 4376. USDA Soil Conservation Service.

SERCD, 1998. North Platte Water Quality Assessment Final Report. Saratoga-Encampment-Rawlins Conservation District.

Singer, F.J., ed. 1996. Effects of grazing by wild ungulates in Yellowstone National Park. USDI, National Park Service, NPS/NRYELL/NRTR/96-01.

SWCCD, 2004. 2004 305(b) and 303(d) Report Comment Letter, Sweetwater County Conservation District, February 10, 2004.

Tetra Tech, 2007. 2006 Surface Water and Groundwater Monitoring Report, New World Mining District, Response and restoration project. Prepared for USDA Forest Service, Gallatin National Forest. Helen, MT, April 2007.

Thybony, S., R. Rosenberg and E. M. Rosenberg, 2001. THE MEDICINE BOWS Wyoming's Mountain Country. Caxton Press; 180 pp.

Trout Unlimited, 2007. Healing Troubled Waters, Preparing Trout and Salmon Habitat for Changing Climate. Report by Trout Unlimited. Arlington, VA. October, 2007.

USEPA, 1992. Secondary Drinking Water Regulations: Guidance for Nuisance Chemicals. July 1992, EPA 810/K-92-001.

USEPA, 1997. Section 3, Volume 2 of USEPA's Guidelines for Preparation of the Comprehensive State Water Quality Assessments, 305(b) Reports and Annual Electronic Updates: Supplement EPA-841-B-97-002B

USEPA, 2001. Water Quality Criterion for the Protection of Human Health: Methylmercury. January 2001, EPA-823-B-03-XXX.

USEPA. 2005a. Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act. July 29, 2005.

USEPA, 2005b. Section IV of USEPA's Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act. July 29, 2005.

USFS, 2002. Billie Creek Water Quality Assessment. Medicine Bow-Routt National Forests and Thunder Basin National Grassland. Saratoga, WY. March, 2002

USFS, 2003. North Zone Aquatics Monitoring and Accomplishment Report FY 2002. Medicine Bow-Routt National Forests and Thunder Basin National Grassland. Saratoga, WY. May 5, 2003.

USFS, 2007. Watershed Assessment of Trappers Creek. A 7th level tributary of Warm Springs Creek (100800010110), which is a tributary to the Wind River (1008000101). Shoshone National Forest, Cody WY

USGS, 1956. Sedimentation and Chemical Quality of Surface Waters in the Wind River Basin, Wyoming. US Geological Survey Water-Supply Paper 1373.

USGS, 1992. DETAILED STUDY OF SELENIUM IN SOIL, REPRESENTATIVE PLANTS, WATER, BOTTOM SEDIMENT, AND BIOTA IN THE KENDRICK RECALAMTION PROJECT. US Geological Survey, Water Investigations Report 91-4131

USGS, 1999. Environmental Setting of the Yellowstone River Basin, Montana, North Dakota, and Wyoming. US Geological Survey Water Resources Investigation Report 98-4269.

USGS, 2003. A Synoptic Study of Fecal-Indicator Bacteria in the Wind River, Bighorn River, Goose Creek Basins, Wyoming. June-July 2000. US Geological Survey Water Resources Investigation Report 03-4055.

USGS, 2007. Pesticides in Surface Waters of the Bighorn and North Platte River Basins, Wyoming, 2006. U.S. Geological Survey Fact Sheet 2007-3017.

USGS, 2009a. Mercury in Fish, Bed Sediment, and Water from Streams Across the United States, 1998-2005. U.S. Geological Survey Water Resources Investigation Report 2009-5109.

USGS, 2009b. Specific Conductance and Dissolved-Solids Characteristics for the Green River and Muddy Creek, Wyoming, Water Years 1999-2008. U.S. Geological Survey Water Resources Investigation Report 2009-5168.

USGS, 2009c. Ecological Assessment of Streams in the Powder River Structural Basin, Wyoming and Montana, 2005-06. U.S. Geological Survey Water Resources Investigation Report 2009-5023.

USGS, 2010a. Assessment of Ecological Conditions and Potential Effects of Water Produced from Coalbed Natural Gas Development on Biological Communities in Streams of the Powder River Structural Basin, Wyoming and Montana, 2005–08. U.S. Geological Survey Water Resources Investigation Report 2009-5124.

USGS, 2010b. Characterization of water quality and biological communities, Fish Creek, Teton County, Wyoming, 2007–08: U.S. Geological Survey Scientific Investigations Report 2010–5188, 70 p., available at http://pubs.usgs.gov/sir/2010/5188/.

USGS, 2011. Pesticides in Wyoming's Rivers, 2006-2010. U.S. Geological Survey Fact Sheet 2011-3011.

USGS, 2013. Trends in major-ion constituents and properties for selected sampling sites in the Tongue and Powder River watersheds, Montana and Wyoming. U.S. Geological Survey Water Resources Investigations Report 2013-5179.

WACD, 2011. Wyoming Watersheds Progress Report 2011 Wyoming Association of Conservation Districts.

WDEQ, 2010. Surface Water Monitoring Strategy 2010-2019. Wyoming Department of Environmental Quality, May 2010.

WDEQ, 2013a. Water Quality Condition of Wyoming Perennial Streams and Rivers - Results of the First (2004-2007) and Second (2008-2011) Statewide Probability Surveys. January, 2013.

WDEQ, 2013b. Chapter 1 of Wyoming's Water Quality Rules and Regulations (WDEQ, 2013a). September 24, 2013

WDEQ, 2013c. Wyoming Surface Water Classification List. Wyoming Department of Environmental Quality, Water Quality Division, Cheyenne, WY.

WDEQ, 2014. Wyoming's 2014 Methods for Determining Surface Water Quality Condition and TMDL Prioritization (WDEQ, 2014). April 29, 2014.

WGFD, 1969. An evaluation of the effects of Teton Reservoir on silt levels in the North Platte River, Wyoming Game and Fish Department, Project #0569-07-6101.

WGFD, 2004. 305(b) and 303(d) Report Comment Letter, Wyoming Game and Fish Department, February 12, 2004.

WGFD, 2012. 2011 Annual Report Strategic Habitat Plan Accomplishments. WGFD, April 2012.

Wohl, E., D. Cooper, L. Poff, F. Rahel, D. Staley, and D. Winters. 2007. Assessment of Stream Ecosystem Function and Sensitivity in the Bighorn National Forest, Wyoming. Environmental Management. 40:284-302.

Appendix A – USEPA Section 319 Nonpoint Source Program Success Story

Section 319 NONPOINT SOURCE PROGRAM SUCCESS STORY

Wyoming

Coordinated Efforts Reduced Sediment Input and Restored Waterbody

Waterbody Improved Excess sediment in Wyoming's East and West Forks of Smiths Fork degraded the habitat to the point that the streams could no longer achieve their designated use of aquatic life. Landowners, federal grazing permit holders and state and federal agencies collaborated to implement various best management practices (BMPs) that reduced sediment input. As a result, water quality improved, and Wyoming removed both waterbodies from its 2004 303(d) list of impaired waters for sediment.

Problem

East Fork Smiths Fork (27 miles long) and West Fork Smiths Fork (9 miles long) combine to form Smiths Fork, which in turn flows into Blacks Fork. The Blacks Fork subbasin is located near the mouth of the Green River Basin of southwestern Wyoming. Wyoming placed both East and West Forks of Smiths Fork (Figure 1) on its 1998 Clean Water Act section 303(d) list because excess sediment physically degraded the stream channels and impaired aquatic life use support. Excess sedimentation negatively affected the streams' biota by blanketing gravel and cobble streambed substrates, often reducing important habitats and algal food resources for many benthic macroinvertebrate groups and limiting the reproductive success of fishes such as the endemic Colorado River cutthroat trout. Sources of sediment included grazing, vehicle traffic on nearby roads, recreational use, logging, irrigation return flows, riparian area deterioration and streambank destabilization.

East and West Forks of Smiths Fork are classified as a Class 2AB waters, which are those known to support game fish. Excess sediment impaired aquatic life by degrading in-stream habitat, violating the state's narrative standard, which states, "floating and suspended solids attributable to or influenced by the activities of man shall not be present in quantities which could result in significant aesthetic degradation, significant degradation of habitat for aquatic life, or adversely affect public water supplies, agricultural or industrial water use, plant life or wildlife."

Figure 1. Photos showing East Fork Smiths Fork (top) and West Fork Smiths Fork (bottom)

Project Highlights

To improve water quality in these two streams, the Uinta County Conservation District (UCCD) addressed some of the pollution sources using funding from a Clean Water Act section 319 nonpoint source control project. UCCD worked with farmers to reduce sedimentation from streambanks by repairing or replacing livestock water tanks that provide off-channel water sources. The farmers also constructed snow fences to divert spring snow melt to these tanks and lessen sediment input to the two streams from overland flow. The Uinta County government improved the surrounding infrastructure by repairing aging roads and bridges adjacent to the two streams. Volunteers planted assorted trees, shrubs and forbs in riparian zones to help stabilize stream banks and create a sediment buffer. Farmers constructed fences along the streams to protect these newly establishing plant communities, stream banks and channels from the effects of livestock grazing. The farmers also adopted grazing BMPs that both promote the recovery of these two streams and allow for continued grazing.

Results

The project efforts were successful. Physical, chemical and biological data collected by Wyoming Department of Environmental Quality in 2003 indicate that sedimentation was minimal and that riparian vegetation was thriving. Both the East Fork Smiths Fork and West Fork Smiths Fork are fully supporting their designated uses, and their water quality threats have been mitigated. Wyoming subsequently removed these two pollutant/segment combinations from its 303(d) list in 2004.

Partners and Funding

The project's funding included $123,300 from the U.S. Environmental Protection Agency, $66,333 from a nonfederal cash match and $16,000 from an in-kind nonfederal cash match. The project was successful in large part because of the close cooperation of a diverse Coordinated Resource Management Team including local landowners, federal grazing permit holders, U.S. Forest Service, the Bureau of Land Management, Wyoming Game and Fish Department, and the Natural Resources Conservation Service.

U.S. Environmental Protection Agency
Office of Water
Washington, DC

EPA 841-F-08-001R
September 2008

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