



# Identification and Assessment of Important Wetlands within the North Platte River Watershed 2009-2010



Colorado  
State  
University

# **Identification and Assessment of Important Wetlands within the North Platte River Watershed**

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# EXECUTIVE SUMMARY

In 2009, the Colorado Water Conservation Board (CWCB) and its North Platte Basin Round Table (NPBRT) contracted with Colorado State University and the Colorado Natural Heritage Program (CNHP) to conduct the project entitled: *Identification and Assessment of Important Wetlands within the North Platte River Watershed*. The study was designed to assist the NPBRT's Non-consumptive Needs assessment sub-committee in meeting their overall goal of identifying important non-consumptive uses in the watershed. Non-consumptive use is a term which describes water used to support wildlife, recreation (fishing, hunting, wildlife viewing, boating) and habitat, contrasted with consumptive use which has historically been applied to water used for agricultural, municipal and industrial benefits.

Due to the sparse wetland information in the watershed, the survey focused on private lands. CNHP surveyed 13 private properties that constituted 45% of the private lands within the watershed. On properties that support significant wetlands a Potential Conservation Area (PCA) was created. The site visits resulted in 68 new element occurrences; these data combined with existing data resulted in the formation of 32 PCAs. Of the 32 PCAs presented in this report, one is of very high biodiversity significance (B2), 22 are of high biodiversity significance (B3), seven are of moderate biodiversity significance (B4) and two are of general biodiversity significance (B5). These PCAs represent the best examples of wetland species and plant communities and their ecological processes observed on the private and public lands that were surveyed in 2009. *The PCA boundaries delineated in this report do not confer any regulatory protection of the site, nor do they automatically recommend exclusion of any activity.*

There are three PCAs, Big Creek Lakes, Chedsey Creek and Arapaho Lakes, which are the only known Colorado sites that support all three montane amphibians: the State Endangered (G4T1QS1) boreal toad (*Bufo boreas boreas*) and two state rare (G5S3) amphibians--northern leopard frog (*Rana pipiens*) and the wood frog (*Rana sylvatica*), both of which are listed as sensitive by the Forest Service, Bureau of Land Management and the Colorado Division of Wildlife. It is worth noting that although CNHP did document new occurrences of the boreal toad and wood frog, only one new occurrence was reported for the northern leopard frog even though considerable habitat was surveyed.

The diversity of wetland and riparian communities found in the North Platte Watershed affords the citizens of Colorado some of the most extensive habitat for waterfowl, shorebirds and aquatic mammals. For example, the Illinois River and Reservoir PCA hosts one of the three known Colorado breeding sites of the American White Pelican (*Pelecanus erythrorhynchos*) and Colorado's largest nesting population of the Willet (*Catoptrophorus semipalmatus*). The Colorado and Little Grizzly Creeks PCA encompasses one of the known nesting populations of the Greater Sandhill Crane (*Grus canadensis tabida*) in Colorado.

The Sawmill Lakes, Big Creek Lakes and Willow Park PCAs consist of floating mat fens (peat-accumulating wetlands) that support numerous rare sedges and populations of the state rare

(G5S2) insectivorous plant, roundleaf sundew (*Drosera rotundifolia*). The Soda Springs at Watson Mountain PCA includes several warm springs which encompass both fens and alkaline wetlands. The 2009 survey also documented several fens in the sagebrush basin that are dominated by analouge sedge (*Carex simulata*), Nebraska sedge (*C. nebrascensis*), beaked sedge (*C. utriculata*). In one newly documented fen, East Sand Creek PCA, a Jackson County record for the state rare (G5S2) sageleaf willow (*Salix candida*), was documented.

Riparian shrublands are the dominate wetland type in the North Platte River Watershed; more important is the fact that these wetland complexes are presently intact and contiguous, providing migration corridors and habitat for animals (including aquatic vertebrates and invertebrates), as well as contributing to the health of aquatic systems by purifying water, filtering runoff, abating floods and decreasing erosion. These riparian wetlands are highly functioning due to the absence of any major hydrological modifications and consequently, the presence of intact floodplains. The willow shrublands are dominated by Geyer willow (*Salix geyeriana*) and Rocky Mountain willow (*S. monticola*), which are the primary shrub component for several globally vulnerable (G3) plant communities. The Michigan River PCA and Illinois River at Rand PCA are the best observed examples of these contiguous riparian shrub habitats observed during the project due to intact hydrology and beaver activity.

In addition to the fieldwork conducted in 2009, this project benefited from collaboration with the *North Platte Basinwide Wetland Profile and Condition Assessment* project also being conducted by CNHP which is a part of the Statewide Wetlands Strategy to quantitatively assess wetland condition for Colorado's wetlands. The Wetland Condition project digitized the National Wetland Inventory (NWI) maps for the North Platte River Watershed. These digitized maps in conjunction with the data collected for this project will provide the NPBRT and the citizens of the watershed with spatial data to identify and assess the wetland resource.

During the course of the survey, CNHP met many landowners and managers who are concerned about the future of the North Platte River and its tributaries. Their best management practices, already in place for many properties, indicate good stewardship of their lands and water, which is not only important for their property but also for those lands, private and public, downstream. Overall, the concentration and quality of imperiled wetland dependent species and habitats attest to the fact that conservation efforts in the North Platte River Watershed will have both statewide and global significance. The results from this project can provide the baseline information needed for proactive planning for conservation and protection of the North Platte River Watershed wetland resource.



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# INTRODUCTION

The North Platte River Watershed encompasses all of Jackson County and a portion of northwestern Larimer County (Figure 1). The wetlands of the North Platte River and its tributaries are among the most popular recreation areas in Colorado for fishing, wildlife viewing, hunting and bird watching. Prior to this project, little data existed on the location, quantity, type and condition of the watershed's wetlands and their wetland dependent species, especially in the valley floor. In 2009 the Colorado Water Conservation Board (CWCB), in collaboration with the North Platte Basin Round Table (NPBRT), contracted with Colorado State University and Colorado Natural Heritage Program (CNHP) to identify and assess biologically significant areas within the watershed. Identification of sites containing natural heritage resources will facilitate conservation of the wetland resources for future generations and this information can be utilized for proactive planning to protect the wetland resource.



Figure 1. Location of North Platte River Watershed.

Both recreational and wildlife resources serve as major economic assets that attract tourists to the watershed. Pro-active and informed planning decisions are critical for the preservation of the unique natural resources, rural and agricultural character and culture of the watershed. Therefore, the need to retain the intrinsic values of the landscape that provide both economic assets and environmental qualities for residents and visitors is essential. CNHP approached this project with the intent of addressing this need. The identification and assessment of important wetlands is part of the ongoing biological surveys of Colorado counties and/or watersheds conducted by CNHP since 1992 (Figure 2). To date, similar surveys have been conducted in 34 Colorado counties.

## North Platte Basin Round Table Background

In 2005, Colorado's legislature passed the *Water for the 21<sup>st</sup> Century Act*. This act established an Inter-basin Compact Process that provides a permanent forum for broad-based water discussions in the state. It created two new structures: Inter-basin Compact Committee (IBCC) and Basin Round Tables. There are nine Basin Round Tables based on

**COLORADO NATURAL HERITAGE PROGRAM  
COUNTY-WIDE SURVEYS OF CRITICAL BIOLOGICAL AND WETLAND RESOURCES  
1992-2009**

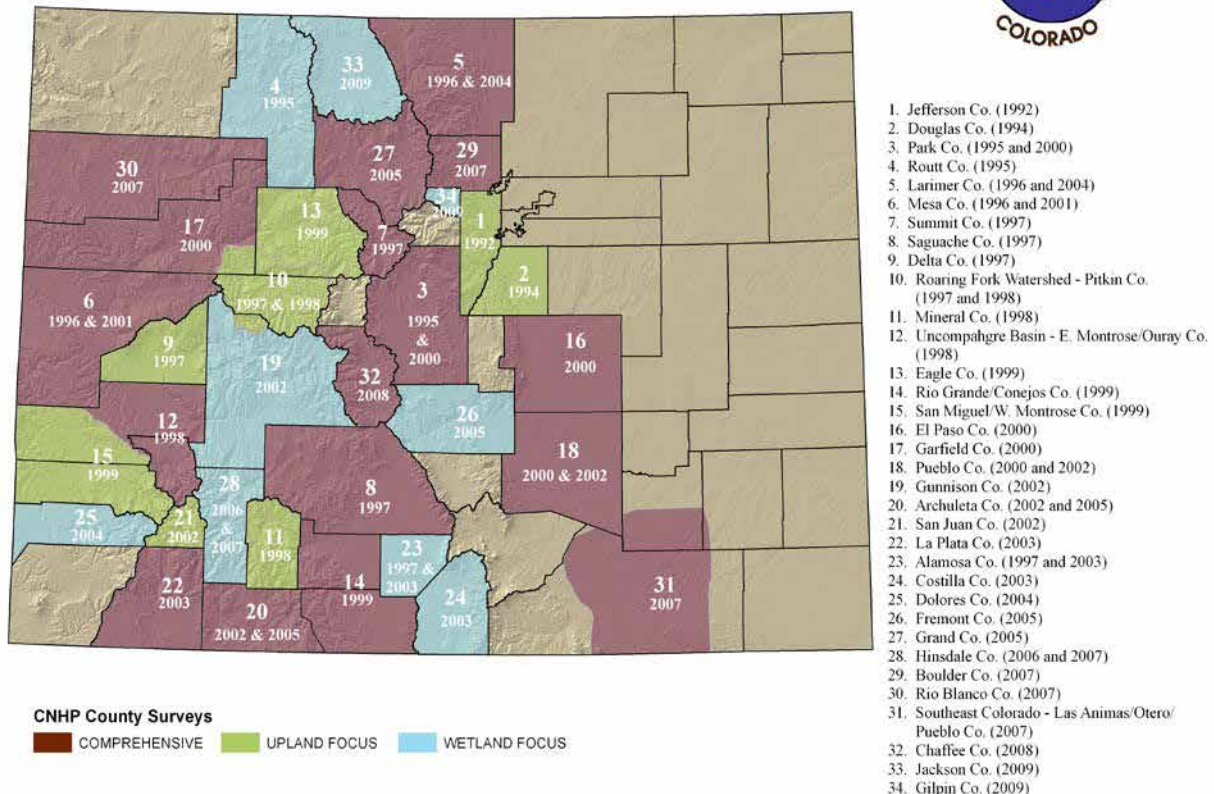


Figure 2. CNHP County Surveys as of 2009.

Colorado's eight major river basins and the Denver metro area. The main focus of the North Platte Basin Round Table (NPBRT) is to provide a forum for discussions about water issues and encourage locally driven collaborative solutions. One of the primary goals of the NPBRT is to develop a basin-wide needs assessment. The NPBRT's Non-consumptive Needs subcommittee was established to help the roundtable develop a Non-consumptive Needs Assessment (NCNA) under the Inter-basin Compact Process.

The statewide goals for NCNA strategy are:

1. Identify priority areas and stream reaches for environmental and recreational attributes,
2. Identify the quantities of seasonal flows necessary to maintain priority areas and reaches and
3. Outreach to interested parties about the existence of information that can be used in water planning efforts.

Specifically, the North Platte Basin's NCNA goals are:

1. Identify important non-consumptive uses in North Platte Basin,
2. Identify important geographical locations for non-consumptive use,

3. Identify non-consumptive uses that benefit from consumptive uses, highlighting positive interactions where found,
4. Estimate water required to support non-consumptive use and
5. Identify “hot spots” that would benefit from conservation/preservation.

The goal of this project was to survey wetlands in the watershed, targeting those on private property which comprise approximately 33% of the area of watershed. The results provide the NPBRT and citizens of the watershed with scientific data on wetland dependent plants and animals which can be used to assist land use planning and management efforts and to balance the needs of natural resources and water developments. Additionally, the results for individual properties can be utilized by the landowners as a baseline for consideration of future conservation options. It is imperative to note, however, that the results from the project do not imply any legal implications for wetlands.

### **North Platte Basin Water Decisions and Decrees Overview**

The waters of the North Platte River and its tributaries are vital to the natural resources and livelihood of citizens in Colorado, Wyoming and Nebraska. As is the case in the rest of the west, every drop of water is accounted for. The first legal decisions affecting the North Platte River Watershed came in 1922 and 1940 with outcome of the State of Wyoming v. State of Colorado. These decrees established the rights of Colorado and Wyoming to water in the Laramie River Basin. It limited total diversions from the Laramie River in Colorado to a total of 37,750 acre feet (AF), divided among specific water facilities, including 15,500 AF to out-of-basin uses through the Laramie-Poudre Tunnel, 18,000 AF through the Skyline Ditch and 4,250 AF through various “meadow land appropriations” (CWCB 2006). In 1945 and 1953 the Nebraska v. Wyoming decision was made allowing equal apportionments of water in the North Platte River between Colorado, Nebraska and Wyoming. The decision limits total irrigation in Jackson County to 145,000 AF and 17,000 AF of storage for irrigation during any one irrigation season. It also limits total water exports from the North Platte River Basin in Colorado to no more than 60,000 AF during any 10-year period (CWCB 2006).

In 2006 the states of Nebraska, Wyoming and Colorado and the Secretary of the Interior signed the Platte River Recovery Implementation Program (PRRIP), which was initiated on January 1, 2007. This program allows for principles of adaptive management to provide habitat benefits for four federally threatened or endangered species in Nebraska: Interior Least Tern (*Sterna antillarum athalassos*), Whooping Crane (*Grus americana*), Piping Plover (*Charadrius melodus*) and the pallid sturgeon (*Scaphirhynchus albus*). The PRRIP requires financial, land, monitoring, implementation and water obligations from Colorado and in particular Jackson and Larimer counties. In 2009, Colorado addressed the water obligation with an amendment plan for future depletions. This amended North Platte River depletion plan is described as “the one-bucket concept”. Under this approach, future development of water in all four categories of use (agricultural, municipal, industrial and piscatorial/ environmental/wildlife) is considered to have a common entitlement from the 1945/1953 base. With this amendment, Colorado and the North Platte water users have additional



flexibility regarding the development of water that can go forward under the PRRIP (CWCB 2009).

### **Wetland Definitions**

The federal regulatory definition of a jurisdictional wetland is found in the regulations used by the U.S. Army Corps of Engineers (Corps) for the implementation of a dredge and fill permit system required by Section 404 of the Clean Water Act Amendments (Mitsch and Gosselink 2007). According to the Corps, wetlands are “those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support and that under normal circumstance do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.” For Corps programs, a wetland boundary must be determined according to the mandatory technical criteria described in the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987). In order for an area to be classified as a jurisdictional wetland (i.e., a wetland subject to federal regulations), it must have all three of the following criteria: (1) wetland plants; (2) wetland hydrology; and (3) hydric soils.

The U.S. Fish and Wildlife Service defines wetlands from an ecological point of view. *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979) states that “wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water.” Wetlands must have *one or more* of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes (wetland plants); (2) the substrate is predominantly un-drained hydric soil; and/or (3) the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year.

CNHP adheres to the wetland definition used by the U.S. Fish and Wildlife Service, because it recognizes that some areas display many of the attributes of wetlands without exhibiting all three characteristics required to fulfill the Corps’ criteria. For example, riparian areas, which often do not meet all three of the Corps’ criteria, perform many of the same functions as other wetland types, including maintenance of water quality, storage of floodwaters and enhancement of biodiversity, especially in the western United States (National Research Council 1995). Thus, the U.S. Fish and Wildlife Service wetland definition is more suitable to CNHP’s objective of identifying ecologically significant wetlands.

### **Wetland Regulation in Colorado**

Wetlands in Colorado are currently regulated, but not protected, under the authority of the Clean Water Act. A permit issued by the Corps is required before placing fill in a wetland and before dredging, ditching, or channelizing a wetland. The Clean Water Act exempts certain filling activities, such as normal agricultural activities.

The 404(b)(1) guidelines, prepared by the Environmental Protection Agency in consultation with the Corps, are the federal environmental regulations for evaluating projects that will impact wetlands. Under these guidelines, the Corps is required to

determine if alternatives exist for minimizing or eliminating impacts to wetlands. When unavoidable impacts occur, the Corps requires mitigation of the impacts. Mitigation may involve creation or restoration of similar wetlands in order to achieve an overall goal of no net loss of wetland area. Colorado's state government has developed no guidelines or regulations concerning the management, conservation and protection of wetlands, but a few county and municipal governments have, including the City and County of Boulder, Summit County and San Miguel County.

### **Wetland Mapping in Colorado**

In the late 1970s, the U.S. Fish and Wildlife Service began an inventory of the extent and types of the nation's wetlands. The Cowardin et al. (1979) classification system provides the basic mapping units for the U.S. National Wetlands Inventory (NWI). Photo-interpretation and field reconnaissance were used to refine wetland boundaries according to the wetland classification system. In Colorado, maps east of the 106<sup>th</sup> parallel were created using 1970s black and white aerial photography. Maps west of the 106<sup>th</sup> parallel were created in the early 1980s using color aerial photography. Though the entire State was mapped on paper during the early years of the NWI program, digital versions of NWI polygons are very limited for Colorado. For the North Platte River Watershed, only four 1:24,000 topographic quads were digitized: Walden, Gould NW, MacFarlane Reservoir and Owl Ridge.

The Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979) describes ecological taxa, arranges them in a system useful to resource managers, furnishes units for mapping and provides uniformity of concepts and terms. Systems form the highest level of the classification hierarchy; five are defined—Marine, Estuarine, Riverine, Lacustrine and Palustrine. For the North Platte River Watershed and the majority of the Intermountain West, only the Palustrine System is applicable to our wetlands. The next level of the classification indicates the life form of the dominant vegetation. Four life forms are identified:

- (1) Palustrine Aquatic Bed (PAB)--dominated by plants that grow principally on or below the surface of the water;
- (2) Palustrine Emergent Wetland (PEM)--dominated by emergent herbaceous flowering plants;
- (3) Palustrine Scrub-Shrub Wetland, (PSS)--dominated by shrubs or small trees; and
- (4) Palustrine Forested Wetland (PFO)--dominated by large trees.

Digitizing of the remaining NWI maps for the North Platte River Watershed was conducted as part of the *North Platte Basinwide Wetland Profile and Condition Assessment* (Lemly, in prep), a project funded by the Environmental Protection Agency, Region 8 and ongoing during the same time period as the present study.

### **Wetland Functions and Ecological Services**

Wetland functions are natural processes of wetlands that continue regardless of their perceived value to humans (Novitzki et al. 1996). These include;

- storage of water;

- transformation of nutrients;
- growth of living matter;
- habitat for wildlife species; and
- diversity of wetland plants.

Ecological services are the wetland functions that are valued by society (Millennium Ecosystem Assessment 2005). For example, biogeochemical cycling (which includes retention and supply) is an ecological function whereas nutrient removal/retention is an ecological service to society. Also, overbank flooding/subsurface water storage is an ecological function whereas flood abatement/flood-flow alteration is an important ecological service.

Ecological services are typically the value people place on wetlands that is the primary factor determining whether a wetland remains intact or is converted for some other use (National Audubon Society 1993). The actual value attached to any given function or value listed above depends on the needs and perceptions of society (National Research Council 1995).

### **Wetland Condition Assessment**

For past county-wide wetland survey and assessment projects, CNHP utilized a qualitative, descriptive functional assessment based on the best professional judgment of CNHP ecologists while incorporating some of the principles of the hydrogeomorphic (HGM) assessment method. The assessment was used to provide a rapid determination of each wetland's functional integrity. This functional assessment method used various qualitative indicators of structure, composition and land use to represent and estimate the degree to which a function was being performed. This, as well as most functional assessments, requires the following assumptions: (1) the combination of variables adequately represents the function and (2) their combination results in an estimated "amount" of the function being performed. The result is that most functional assessments are not rapid and do not directly measure functions (Cole 2006).

Condition assessments are 'holistic' in that they consider *ecological integrity* to be an "integrating super-function" (Fennessy et al. 2004). Condition assessments or ecological integrity assessments provide insight into the integrity of a wetland's natural ecological functions that are directly related to the underlying integrity of biotic and abiotic processes. In other words, a wetland with excellent ecological integrity will perform all of its functions at full levels expected for its wetland class or type. Ecological integrity assessments are simply concerned with measuring the condition of the wetland and assume that ecological functions follow a similar trend. This assumption may not be true for all functions, especially ecological services or those functions which provide specific societal value. For example, ecological services such as flood abatement or water quality improvement may still be performed even if ecological integrity has been compromised. However, given that CNHP is attempting to identify and prioritize ecologically significant wetlands, it seemed more pertinent to focus the assessment on ecological integrity or condition of each wetland rather than specific ecological functions, services or values.



The element occurrence rank (see CNHP methodology section, Table 6) used by CNHP is a rapid assessment of the condition of on-site and adjacent biotic and abiotic processes that support and maintain the element. This method was used to assess wetland condition for this report. Recently, NatureServe and CNHP revised this method making it more transparent and repeatable. The Ecological Integrity Assessment (EIA) framework is a conditional assessment of wetlands that identifies biotic and abiotic metrics to measure integrity (Faber-Langendoen et al. 2008). Principles of the EIA framework have been incorporated into CNHP's element occurrence ranks.

#### **Water Quality—Colorado River Watch**

CNHP staff volunteered to collect water samples throughout the watershed during the summer field season in cooperation with the River Watch Program, a statewide volunteer water quality-monitoring program operated by the non-profit Colorado Watershed Assembly in cooperation with the Colorado Division of Wildlife. Their mission is to work with voluntary stewards to monitor water quality and other indicators of watershed health and utilize this high quality data to educate citizens and inform decision makers about the condition of Colorado's waters (Colorado River Watch 2009). Samples were analyzed in the field for hardness, alkalinity, dissolved oxygen, pH and temperature. Additional samples were analyzed by River Watch staff for nutrients (nitrate, phosphate, sulfate, chloride and total suspended solids) and metals and other cations (aluminum (Al), arsenic (As), calcium (Ca), magnesium (Mg), selenium (Se), zinc (Zn), cadmium (Cd), copper (Cu), lead (Pb), iron (Fe) and manganese (Mn)).

# PROJECT BACKGROUND

## Location of the Study Area

The North Platte River Watershed is located in north-central Colorado, adjacent to the Wyoming border, which defines the northern boundary of the study area. The study area encompasses some 2,017 square miles (5,224 km<sup>2</sup>), including all of Jackson County, together with the north-westernmost portion of Larimer County that belongs to the Laramie River watershed. To the east in Larimer County, the rolling mountains of the northern Colorado Front Range extend 30-40 miles to the plains, while to the west the gentle peaks of the Elkhead Mountains in Routt County give rise to the Yampa River, flowing toward the Colorado Plateau. Grand County lies to the south. The wide high valley of North Park forms the central portion with the continental divide running along the rim of the area to the south and west. On the eastern side of the area, the Rawah peaks of the southern end of the Medicine Bow Mountains separate North Park from the Laramie River Valley, which is in turn bounded by the Laramie Mountains to the east. The western margin of the watershed, on the continental divide, is formed by the Park Range. The Rabbit Ears Range, also part of the continental divide, forms the southern margin of the watershed, separating North and Middle Parks and the northern end of the Never Summer Mountains forms the southeastern boundary. Elevations in the study area range from about 7,700 feet where the Laramie River enters Wyoming to 12,180 feet at Mount Zirkel in the Park Range and nearly 13,000 feet at Mount Richthofen (12,940 ft) and Clark Peak (12,951 ft) in the Never Summer Mountains. The majority of the study area lies above 8,000 feet.

## Ecoregions

The North Platte River Watershed is part of two different ecoregions as defined by The Nature Conservancy (TNC 1997, modified from Bailey 1995). The majority of the area belongs to the Southern Rocky Mountain ecoregion (Figure 3). At lower elevations along the Wyoming border, the area falls within the Wyoming Basins ecoregion.

The Southern Rocky Mountain ecoregion includes the north-south trending mountain ranges with their intervening valleys and parks (including North Park) from southern Wyoming to northern New Mexico and, in Colorado, more westerly mountain ranges and high plateaus. The major ecological zones are alpine, subalpine, upper montane, lower montane and foothill (Neely et al. 2001). The Wyoming Basins ecoregion is represented along the northern border of the area. This shrub-dominated semi-desert ecoregion dominates central and western Wyoming, extending from northern Colorado and Utah northward to Montana and Idaho.

Within the North Platte River Watershed, the EPA recognizes a number of finer division ecoregions (Chapman et al. 2006, Omernik 1987). The Level Four ecoregions (Table 1) represent “areas of general similarity in ecosystems and in the type, quality and quantity of

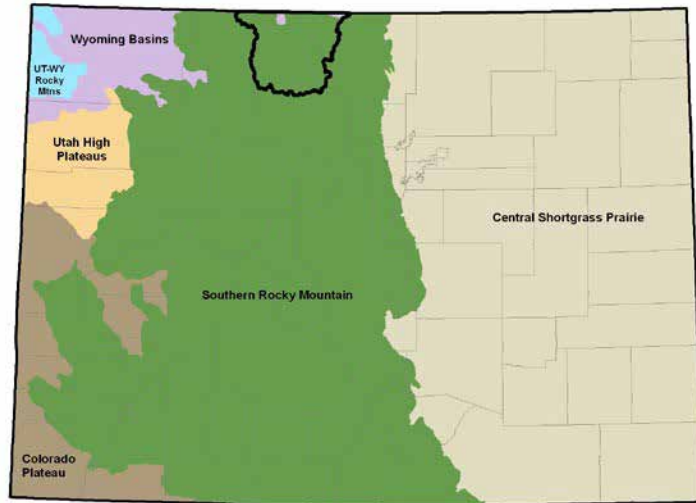


Figure 3. Location of North Platte River Watershed.

environmental resources; they are designed to serve as a spatial framework for the research, assessment, management and monitoring of ecosystems and ecosystem components". Regions were identified based on patterns of geology, physiographic, vegetation, climate, soils, land use, wildlife and hydrology. Level 4 ecoregions of the North Platte River Watershed are shown in Figure 4 and described briefly in Table 1. Descriptions are from Chapman et al. (2006).

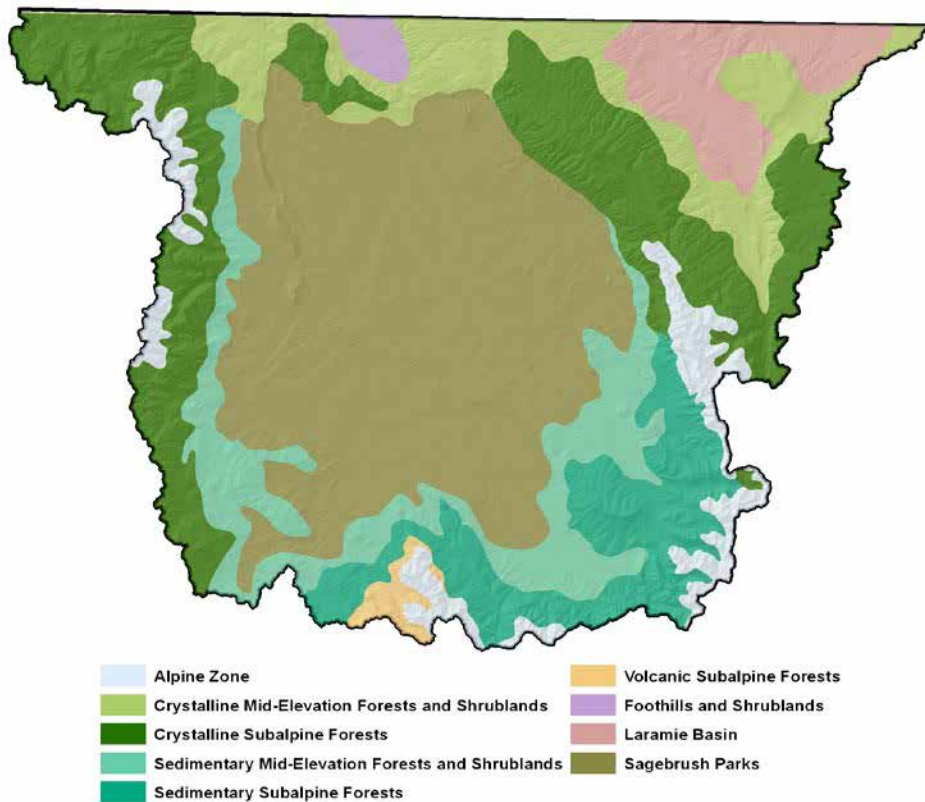


Figure 4. North Platte River Watershed Level 4 Ecoregions.

Table 1. Descriptions of North Platte River Watershed Level Four Ecoregions.

NAME	DESCRIPTION
<b>Alpine Zone</b>	The <b>Alpine Zone</b> occurs on mountain tops above treeline, beginning at about 10500 to 11000 feet. It includes alpine meadows as well as steep, exposed rock and glaciated peaks. Annual precipitation ranges from about 35 to greater than 70 inches, falling mostly as snow. Vegetation includes low shrubs, cushion plants and wildflowers and sedges in wet meadows. The forest-tundra interface is sparsely colonized by stunted, deformed Engelmann spruce, subalpine fir and limber pine (krummholz vegetation). Rocky Mountain bristlecone pines, some of the oldest recorded trees in North America, are also found here. Land use, limited by difficult access, is mostly wildlife habitat and recreation. Alpine is snow-free only 8 to 10 weeks annually. Snow cover is a major source of water for lower, more arid ecoregions.
<b>Crystalline Subalpine Forests</b>	The <b>Crystalline Subalpine Forests</b> ecoregion occupies a narrow elevational band on the steep, forested slopes of the mountains, becoming more extensive on the north-facing slopes. The elevation range of the region is 8500 to 12000 feet, just below the Alpine Zone. The lower elevation limit is higher in the south, starting at 9000 to 9500 feet. The dense forests are dominated by Engelmann spruce and subalpine fir; aspen and pockets of lodgepole pine locally dominate some areas. Subalpine meadows also occur. Forest blowdown, insect outbreaks, fire and avalanches affect the vegetation mosaic. Soils are weathered from a variety of crystalline and metamorphic materials, such as gneiss, schist and granite, as well as some areas of igneous intrusive rocks. Recreation, logging, mining and wildlife habitat are the major land uses. Grazing is limited by climatic conditions, lack of forage and lingering snowpack.
<b>Crystalline Mid-Elevation Forests</b>	The <b>Crystalline Mid-Elevation Forests</b> are found mostly in the 7000 to 9000 feet elevation range on crystalline and metamorphic substrates. Most of the region occurs in the eastern half of the Southern Rockies. Natural vegetation includes aspen, ponderosa pine, Douglas-fir and areas of lodgepole pine and limber pine. A diverse understory of shrubs, grasses and wildflowers occurs. The variety of food sources supports a diversity of bird and mammal species. Forest stands have become denser in many areas due to decades of fire suppression. Land use includes wildlife habitat, livestock grazing, logging, mineral extraction and recreation, with increasing residential subdivisions.
<b>Sedimentary Subalpine Forests</b>	The <b>Sedimentary Subalpine Forests</b> ecoregion occupies much of the western half of the Southern Rockies, on sandstone, siltstone, shale and limestone substrates. The elevation limits of this region are similar to the crystalline and volcanic subalpine forests. Stream water quality, water availability and aquatic biota are affected in places by carbonate substrates that are soluble and nutrient rich. Soils are generally finer-textured than those found on crystalline or metamorphic substrates of crystalline subalpine zone and are also more alkaline where derived from carbonate-rich substrates. Subalpine forests dominated by Engelmann spruce and subalpine fir are typical, often interspersed with aspen groves or mountain meadows. Some Douglas-fir forests are at lower elevations.
<b>Sedimentary Mid-Elevation Forests</b>	The <b>Sedimentary Mid-Elevation Forests</b> ecoregion occurs in the western and southern portions of the Southern Rockies, at elevations generally below sedimentary subalpine forest. The elevation limits and vegetation of this region are similar to the crystalline and volcanic mid-elevation forests; however, a larger area of Gambel oak woodlands and forest is found in this region. Carbonate substrates in some areas affect water quality, hydrology and biota. Soils are generally finer-textured than those found on crystalline and metamorphic substrates such as those in the crystalline mid-elevation forest.
<b>Volcanic Subalpine Forests</b>	The steep, mountainous <b>Volcanic Subalpine Forests</b> ecoregion is composed of volcanic and igneous rocks, predominately andesitic with areas of basalt. The region is found mainly in the San Juan Mountains, which have the most rugged terrain and the harshest winters in the Southern Rockies of Colorado. Smaller areas are found in the West Elk Mountains, Grand Mesa, Flat Tops and in the Front Range. The area is highly mineralized and gold, silver, lead and copper have been mined. Relatively young geologically, the mountains are among the highest and most rugged of North America and still contain some large areas of intact habitat. Engelmann spruce, subalpine fir and aspen forests support a variety of wildlife.
<b>Foothill Shrublands</b>	The <b>Foothill Shrublands</b> ecoregion is a transition from the higher elevation forests to the drier and lower Great Plains to the east and to the Colorado Plateaus to the west. This semiarid region has rolling to irregular terrain of hills, ridges and foot slopes, with elevations generally 6000 to 8500 feet. Sagebrush and mountain mahogany shrubland, pinyon-juniper woodland and scattered oak shrublands occur. Other common low shrubs include serviceberry and skunkbush sumac. Interspersed are some grasslands of blue grama, june grass and western wheatgrass. Land use is mainly livestock grazing and some irrigated hayland adjacent to streams.

NAME	DESCRIPTION
<b>Laramie Basin</b>	The <b>Laramie Basin</b> ecoregion is a wide intermontane valley of Wyoming that extends slightly into northern Colorado. Elevations in the Colorado portion are generally 7800 to 9100 feet, with annual precipitation of 15 to 20 inches. For the region as a whole, natural vegetation is mainly grassland compared to the sagebrush steppe in other regions of Ecoregion 18. Needle-and-thread, western wheatgrass, blue grama, Indian ricegrass and other mixed grass species are typical, along with rabbitbrush, fringed sage and various forb and shrub species. The rolling, high elevation valley of grass and shrubland is used primarily for seasonal livestock grazing. Some hay is produced along the Laramie River.
<b>Sagebrush Parks</b>	The <b>Sagebrush Parks</b> ecoregion contains the large, semiarid, high intermontane valleys that support sagebrush shrubland and steppe vegetation. The ecoregion includes North Park, Middle Park and the Gunnison Basin and is slightly drier than the Grassland Parks. Summers tend to be hot and winters very cold, with annual precipitation of 10-16 inches. Land use is mostly rangeland and wildlife habitat, with some hay production near streams. The sagebrush provides forage and habitat to many animals and birds. Sandy loam soils are typical, formed in residuum from crystalline and sedimentary rocks, glacial outwash and colluvial or alluvial materials.

## Hydrology

### *Surface Water*

The North Platte River Watershed is defined by the headwaters of the North Platte River in Colorado. The North Platte is the only major river originating in Colorado that drains north into Wyoming. It collects runoff from most of southeastern Wyoming and the southern Nebraska panhandle, before eventually joining the South Platte River near the Town of North Platte, Nebraska. Major tributaries include the Canadian, Michigan, Grizzly, North Fork of the North Platte, Illinois and Laramie rivers (Figure 5).

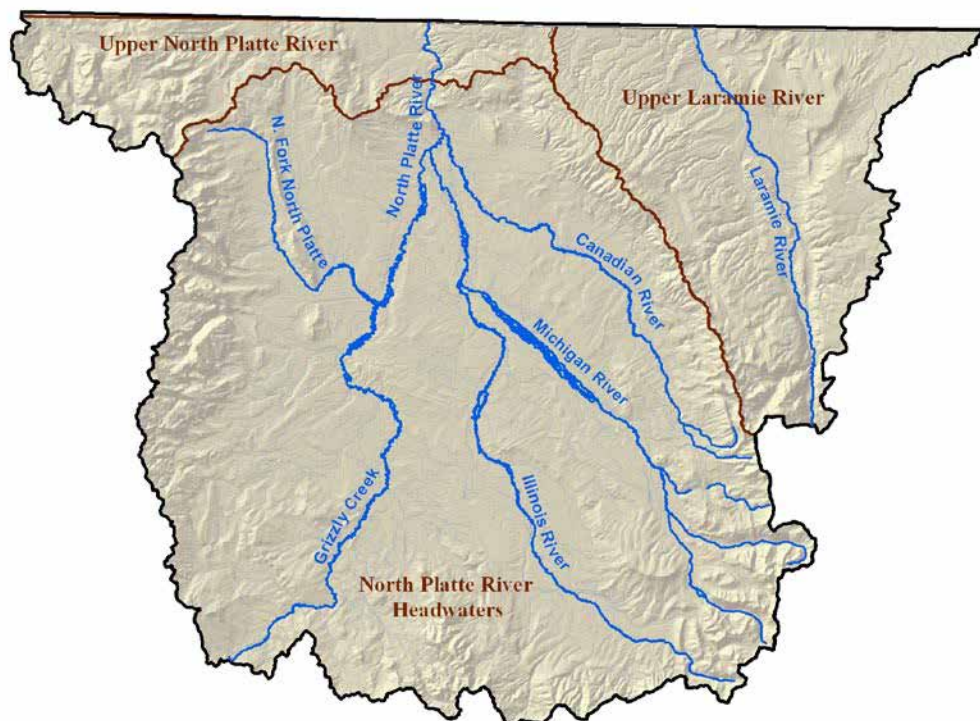


Figure 5. North Platte River and Major Tributaries

Almost all streams in Jackson County flow into the North Platte River and pass through the Northgate stream flow gauging station at the state border. The mean annual flow at the Northgate gage is about 307,686 AF. (USGS Water Data 2009). From the Northgate gage, the North Platte flows through the Northgate Canyon Wilderness Area. The average yearly discharge for the Laramie River at Glendevy is 52,126 AF. (USGS Water Data 2009). There are thirteen reservoirs in the watershed (Table 2) that store a total of 45,114 AF/yr. Evapotranspiration rates are significant for the watershed. In 1996, Robson and Graham state that 78% of the precipitation in the North Park area is lost by evaporation from open water, snow and ice and by transpiration from vegetation.

Table 2. Major Reservoirs in the Watershed (CWCB 2006).

Reservoirs	Normal Storage (AF)
Chambers Lake	11,478
Lake John	7,092
MacFarlane Reservoir	6,951
Walden Reservoir	4,506
Meadow Creek Reservoir	4,400
Laune Reservoir	3,722
Pole Mountain Reservoir	1,905
North Michigan Creek Reservoir	1,703
Lower Big Creek Reservoir	1,434
Aqua Fria Reservoir	550
Seymour Reservoir	525
West Arapahoe Reservoir	497
Buffalo Reservoir	351

### *Groundwater*

The main aquifer unit for the North Park basin is the Coalmont Formation that is as much as 6,500 feet thick. The Coalmont Formation is a basin fill unit derived from the surrounding uplifted mountains, consisting of coarse- and fine-grained sediments (Topper et al. 2003). The Coalmont Formation has the potential to produce 120 million AF of recoverable ground water in storage (Robson and Graham 1996). However, only the upper 1,000 feet, equaling roughly 39 million AF, is recoverable due to water quality issues. Within the basin, the ground-water discharge rate is equal to the ground-water recharge rate at 117,000 AF (Robson and Graham 1996). Groundwater in the upper part of the Coalmont Formation is generally unconfined (Robson and Graham 1996). The general

direction of ground water flow is toward the center of the basin and northward to the North Platte River. Groundwater levels are recharged with precipitation and snowmelt mainly from the Park Range (Topper et al. 2003).

#### *Water Quality*

Overall, the water quality in the North Platte River Watershed is suitable quality for all uses. There are two streams that are listed by EPA as impaired within the watershed; Illinois River and Spring Creek. The Illinois River has a high concentration of iron, likely due from a natural source (NCCG 2002). Spring Creek has low dissolved oxygen or under saturated criteria recommended for aquatic life. This could be due to the low gradient, meandering, nature of the stream. Both streams are being monitored by the Colorado Department of Public Health and Environment. All streams have metal concentrations well below primary and secondary drinking standards (NCCG 2002). However, the long-term viability and integrity of the watershed's wetlands are threatened by mineral extraction (e.g., oil, coal-bed methane, natural gas) that could result in the loss or impairment of critical wetlands, wildlife habitat, and affect agriculture and water quality/quantity.

#### **Geology**

The dominant geologic feature of the study area is the North Park synclinal basin, formed during the Laramide orogeny from the late Cretaceous to early Tertiary. The syncline is a structural fold where the underlying strata dip toward the center of the structure, resulting in older strata being exposed at the margins of the basin and younger strata toward the center (Figure 6). The basin floor is formed in sedimentary rocks of Mesozoic (230-65 mya) and Tertiary (65-2 mya) age and is flanked by the Precambrian (>570 mya) rocks of the Park Range to the west and the Front Range to the east. The southern end of the study area is formed by the Rabbit Ears Range, a high ridge of sedimentary and volcanic rocks that separates North and Middle Parks. Near the Wyoming border, the basin is cut off by the Independence Mountain thrust fault, where Precambrian rocks slid 4-12 miles southwest over younger rocks (Tweto 1957, Chronic and Williams 2002).

The oldest rocks in the study area are the Precambrian metamorphic and igneous cores of the surrounding Park and Front Ranges and Medicine Bow and Never Summer Mountains. Sedimentary rocks in the area range in age from Permian to Holocene. The thick continental and marine sediment deposits of Mesozoic age, topped by the Cretaceous Pierre Shale, are exposed along the edges of the valley floor (Behrendt et al. 1969). The valley floor of North Park is largely covered by Tertiary sediments of the Coalmont Formation. The younger North Park Formation, flanked by the White River Formation, forms the center of the syncline and is exposed on the low ridge extending northwest from Owl Mountain southeast of Walden. In the later part of the Tertiary, igneous intrusions and volcanic outpourings occurred in the Rabbit Ears Range and Never Summer Mountains. Large stretches of the area are overlain by more recent Quaternary alluvial, colluvial, glacial and eolian deposits.



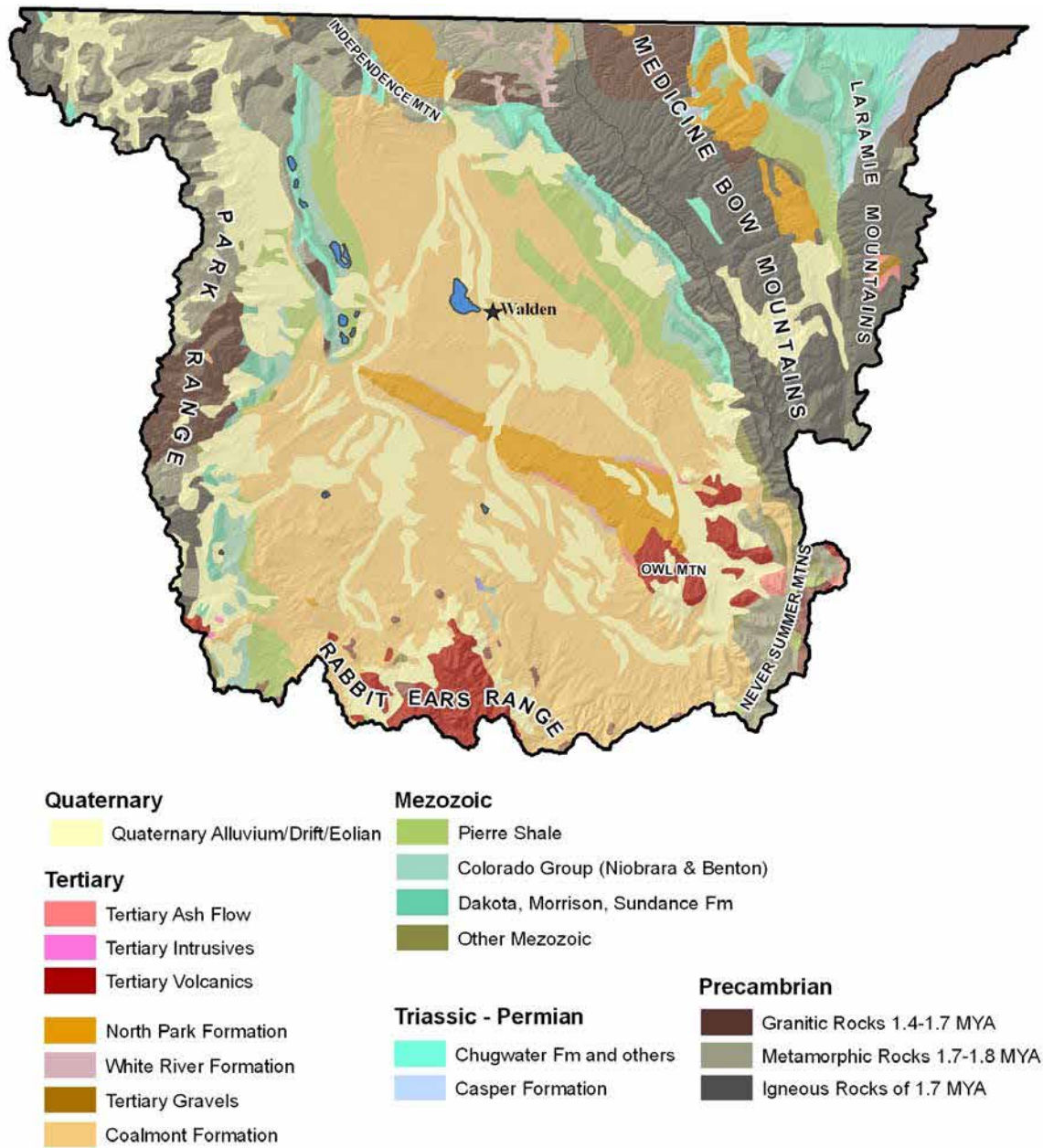


Figure 6. Generalized surface geology of the North Platte River Watershed (Tweto 1979).

On the northeast margin of the Park, there are substantial deposits of wind-blown (eolian) sand between the Medicine Bow Mountains and the Canadian River. Within this area, the North and East Sand Hills are active dune fields and provide an example of high elevation, cold-climate sand dunes (Ahlbrandt and Andrews 1978). Other noteworthy features of the area include the local landmark “Rabbit Ears” atop the Park Range, which are hard volcanic breccia with volcanic rock fragments embedded in lava (Chronic and Williams 2002) and on the western edge of North Park, Delany Butte and Sheep Mountain which are part of a prominent hogback of Mesozoic and Precambrian rocks at some distance from the mountain front (Behrendt et al. 1969).

## **Soils**

The dry, cool conditions of the North Platte River Watershed generally act to restrain vegetation growth and slow the chemical and biological processes needed for good soil development. Consequently, soils of the area have low fertility. Soils of the valley bottoms are the most productive and support grass hay production, while adjacent upland soils are more suitable for rangeland (Fletcher 1981).

The USDA Soil Conservation Service survey of the Jackson County Area (Fletcher 1981) divides the soils of the county (not including US Forest Service lands at the basin margins) into four landscape groups: 1) low terraces, on flood plains, in upland depressions and on irrigated benches 2) benches and uplands, 3) high terraces, mountain foot slopes and sandy uplands and 4) mountains. Soils of the first group are deep, poorly to well drained sandy loams, loams and clay loams formed in alluvium and outwash. The soils of the benches and uplands are shallow to deep sandy loams, loams and clays that are moderately well to well drained. These soils are formed in alluvium, outwash and material derived from sandstone or shale. Soils of the high terraces, mountain foot slopes and sandy uplands are generally deep, formed in outwash, alluvium and materials derived from sedimentary rock and are well drained. Mountain soils are generally deep, well drained sandy loams, loams and rock outcrop, formed in glacial till, old alluvium and material weathered from bedrock.

## **Climate**

The North Platte River Watershed has a continental mountain climate characteristic of high valleys in the Rocky Mountains. Dry air, sunny days, clear nights, variable precipitation, moderate evaporation and large diurnal temperature changes are indicative of this climate (Fletcher 1981). Precipitation and temperature varies with elevation (Figure 7). Annual precipitation is highest on the western edge of the area in the Park Range, where areas above about 10,000 feet average 50 or more inches a year. In southern and eastern areas at similar elevations, annual precipitation averages are generally above 30 inches. Lower elevations in North Park and the Laramie River Valley are drier, with average annual precipitation in the 15-20 inch range. Temperatures follow a similar elevation pattern to precipitation, with generally cooler temperatures with increasing elevation during the summer. For the period of record at Walden, summer temperatures are generally pleasant, with highs in the 70s and 80s and lows in the 30s (Figure 8), while winter highs in the 30s and lows in the 0s are most common. The highest temperature recorded at Walden was 96 in 1973 and the lowest was -49, in 1951 (Western Regional Climate Center 2009). The growing season is consequently very short, lasting from 15-45 days depending on elevation (Fletcher 1981).

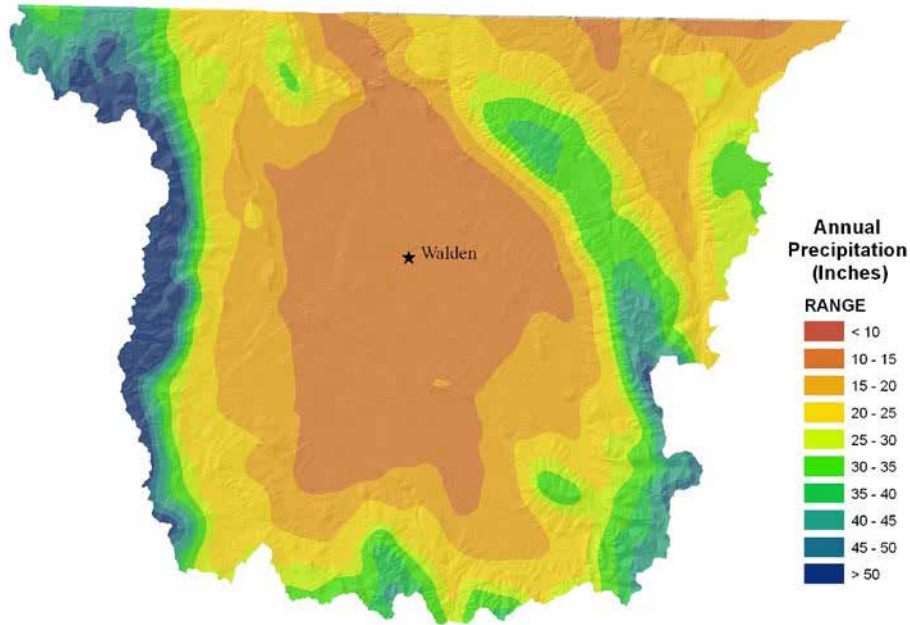


Figure 7. Annual precipitation in the North Platte River Watershed.

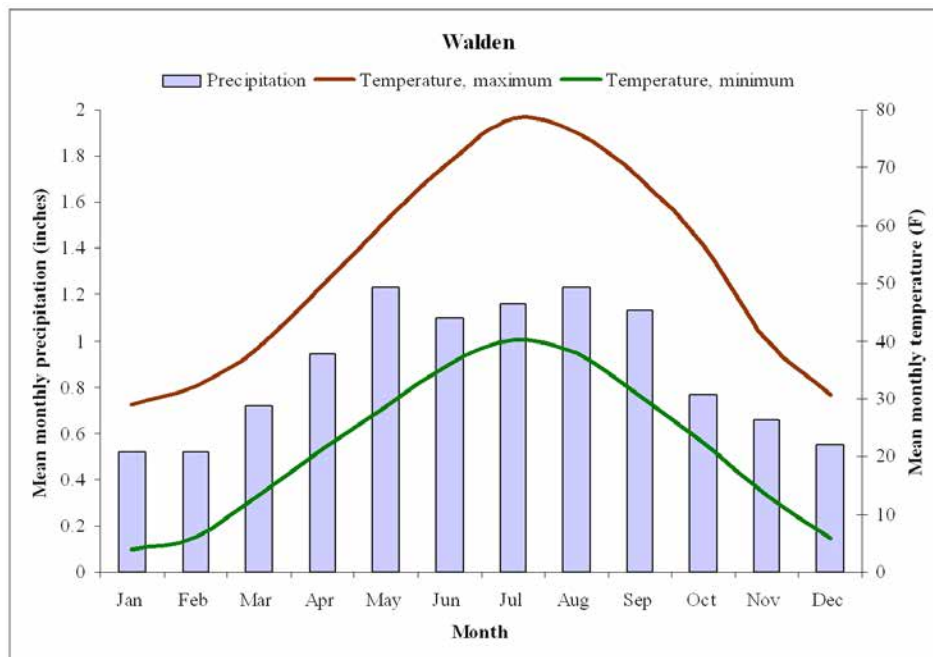


Figure 8. Climate data from the NWS Co-op Station at Walden, Colorado (WRCC 2009).

## Population

The North Platte River Watershed in Colorado is very sparsely populated; less than one person per square mile. The estimated 2008 population of Jackson County was less than 1,350, down from 1,577 at the 2000 census (U.S. Census Bureau 2000). Only four other Colorado counties, Hinsdale, Kiowa, Mineral and San Juan, have smaller populations. The population within the watershed is fairly dispersed, with many occupied ranches, but

nearly half of population of the area lives in or near the single principle Town of Walden. The portion of the study area that falls in Larimer County has no established towns.

### **Land Ownership**

Approximately two thirds of the land in the North Platte River Watershed is under federal or state management. Of this, US Forest Service lands of the Medicine Bow-Routt and Arapaho-Roosevelt National Forests account for about 39% of the county's acreage, primarily in the higher elevation margins, while Bureau of Land Management lands make up about 17% and lie generally in the lower, middle portions of North Park and the Laramie Valley. The Arapaho National Wildlife Refuge accounts for nearly 2% of the acreage of central North Park. State-owned lands of both the Colorado State Forest and State Landboard school land account for some 10% of the area and the remaining 33% of the county is privately owned. US Forest Service lands include portions of the Mount Zirkel, Rawah and Platte River Wilderness Areas. Bureau of Land Management lands include a small Wilderness Study Area adjacent to the Platte River Wilderness. State Wildlife Areas include Brownlee, Cowdrey Lakes, Delaney Butte Lakes, Diamond J, Irvine, Lake John, Manville, Murphy, Odd Fellows, Owl Mountain, Richard, Seymour Lake, Verner and Walden Reservoir. There are four State Land Board parcels that have been designated as part of the Stewardship Trust.

### **Land Use History**

Throughout pre-European history, the North Park basin was utilized, at different times, as hunting grounds by several different Native American tribes including the Arapaho, Sioux, Ute and Crow. According to early explorer John C. Frémont (1845), these groups called the area the "bull pen," in reference to the numerous buffalo, deer and elk that inhabited the grassy valley. Trappers began moving into the area during the early 1800s, attracted by the presence of beaver in the many streams crisscrossing the basin. In

1861, the area was split from the Nebraska Territory, becoming part of Larimer County in the newly established Colorado Territory; Jackson County was not established until 1909 when it split from Larimer County. Although the area was located off of the Mormon and Oregon Trails, immigrants did cross the North Park basin throughout the 1800s, leaving a rich pioneer history in their wake but few permanent settlements due to the long, cold winters. Miners seeking gold, fluorspar and copper moved into the area beginning in the 1870s, leading to the development of several large towns such as Teller City that once boasted more than 3,000 residents (Fletcher 1981). Cattle ranching was introduced in 1878 on the heels of the development of irrigation systems. Water rights for the North Platte and its tributaries date back to this time (North Park



Early farming in North Park. Photo: Denver Public Library, Western History Collection

Wetlands Focus Area Committee 2002). Today, cattle ranching dominates the economy, employing 39% of the population of Jackson County. The average size of ranches is 3500 acres, many of which are devoted to the production of wild hay (Topper et al. 2003).

Tourism employs the second highest percentage (12%) of Jackson County residents due to the ample recreational opportunities available in the watershed (Topper et al. 2003). The North Platte River and its tributaries are designated as “gold medal” fisheries by the Colorado Wildlife Commission due to the cold swift current that provides the best fly-fishing in northern Colorado for rainbow, brown and brook trout (CDOW 2009a). Kayaking, rafting and birding are also popular activities along the river system. Hunting is a major draw in the area for both in-state and out-of-state residents with many of the local ranches participating in the Colorado Division of Wildlife’s “Ranching for Wildlife Program.” The Town of Walden is the “Moose Viewing Capital of Colorado,” claiming that over 600 moose live within the North Park basin after a successful reintroduction program in the 1970s.

Today, 46% of the land in the basin is forested while shrubland and grassland account for 24% and 17% respectively (CWCB 2006). Oil and natural gas extraction has occurred for many years in the South and North McCallum oil fields in North Park. In 2008, Jackson County produced 147,726 barrels of oil and 1,359,608 million cubic feet (MCF) of natural gas (Colorado Oil and Gas Conservation Commission 2008). Coal has been mined commercially since 1909 from the rich reserves in the Coalmont Formation; the Town of Coalmont was once the hub of coal mining activity for the entire basin (Fletcher 1981). Logging was once the primary industry in North Park due to heavy demand for railroad ties with the construction of the Union Pacific Railroad in the 1870s, as well as for fuel, building materials, mine props, etc. The center of logging operations was the Town of Gould, which saw a peak in the number of portable saw mills and residents in the 1930s. Today, the timber industry is only the third largest industry in the area which has witnessed the closing of several large permanent saw mills and the subsequent economic downturn associated with it (North Park Wetlands Focus Area Committee 2002). However, processing of beetle-killed trees into wood pellets is a newly established industry in the area.

### **Ecological Systems**

The North Platte River Watershed in Colorado is dominated by shrubland and montane forest ecological systems characteristic of the Southern Rocky Mountain ecoregion (Table 3). Alpine types are restricted to the highest elevations of the Park and Rabbit Ears Ranges and similar elevations in the Medicine Bow and Never Summer Mountains. With descending elevation, vegetation communities shift through subalpine spruce-fir forests, lodgepole, aspen and mixed conifer forests to sagebrush and lower montane shrublands (Figure 9). The most widespread types are sagebrush shrublands and lodgepole pine forests.

Table 3. Ecological systems of the North Platte River Watershed.

<b>Vegetation or cover type</b>	<b>Acres</b>
Inter-Mountain Basins Montane Sagebrush Steppe	
Inter-Mountain Basins Big Sagebrush Shrubland	465,027
Rocky Mountain Lodgepole Pine Forest	274,309
Rocky Mountain Subalpine Dry-Mesic & Mesic-Wet Spruce-Fir Forest and Woodland	225,930
Agriculture	102,553
<b>Vegetation or cover type</b>	<b>Acres</b>
Rocky Mountain Aspen Forest and Woodland	
Inter-Mountain West Aspen-Mixed Conifer Forest and Woodland Complex	77,586
Rocky Mountain Subalpine-Montane Riparian Shrubland	43,367
Rocky Mountain Alpine Bedrock and Scree	
Rocky Mountain Alpine Fell-Field	
North American Alpine Ice Field	16,338
Southern Rocky Mountain Montane-Subalpine Grassland	16,249
Rocky Mountain Lower Montane-Foothill Shrubland	13,181
Rocky Mountain Alpine-Montane Wet Meadow	11,979
Rocky Mountain Cliff, Canyon and Massive Bedrock	7,759
Rocky Mountain Dry Tundra	7,458
Open Water	6,713
Rocky Mountain Gambel Oak-Mixed Montane Shrubland	6,451
Rocky Mountain Ponderosa Pine Woodland	4,327
Rocky Mountain Montane Dry-Mesic & Mesic Mixed Conifer Forest and Woodland	3,828
Rocky Mountain Subalpine Mesic Meadow	3,689
Rocky Mountain Subalpine-Montane Riparian Woodland & Rocky Mountain Lower Montane Riparian Woodland and Shrubland	2,004
Other natural vegetation	1,670
Other disturbed	1,437
Inter-Mountain Basins Active and Stabilized Dune	926
Developed Low to Medium Intensity	662

The major ecological systems (with occurrence >5,000 ac) of the North Platte River Watershed are described briefly below (CNHP 2005, NatureServe 2009):

*Inter-Mountain Basins Montane Sagebrush Steppe*

This matrix forming ecological system is the most widespread system in the North Platte River Watershed, accounting for about 21% of the area. Similar sagebrush communities are found at montane and subalpine elevations across the western U.S. In general this system shows an affinity for mild topography, fine soils and some source of subsurface moisture. Soils generally are moderately deep to deep, well-drained and of loam, sandy loam, clay loam, or gravelly loam textural classes; soils often have a substantial volume of coarse fragments and are derived from a variety of parent materials. This system primarily occurs on deep-soiled to stony flats, ridges, nearly flat ridgetops and mountain slopes. Colorado occurrences are found primarily on the west slope, often in proximity to big sagebrush shrublands. These shrublands are dominated by *Artemisia tridentata* ssp. *vaseyana* (mountain big sagebrush) and related taxa such as *Artemisia tridentata* ssp. *spiciformis* (=



*Artemisia spiciformis*; spiked big sagebrush), non-riparian *Artemisia cana* ssp. *viscidula* (mountain silver sagebrush) and *Artemisia arbuscula* ssp. *arbuscula* (dwarf sagebrush). A variety of other shrubs including *Artemisia frigida* (prairie sagebrush), *Artemisia arbuscula* (dwarf sagebrush), *Ericameria nauseosa* (rubber rabbitbrush), *Chrysothamnus viscidiflorus* (sticky-leaf rabbitbrush), *Symphoricarpos oreophilus* (mountain snowberry), *Purshia*

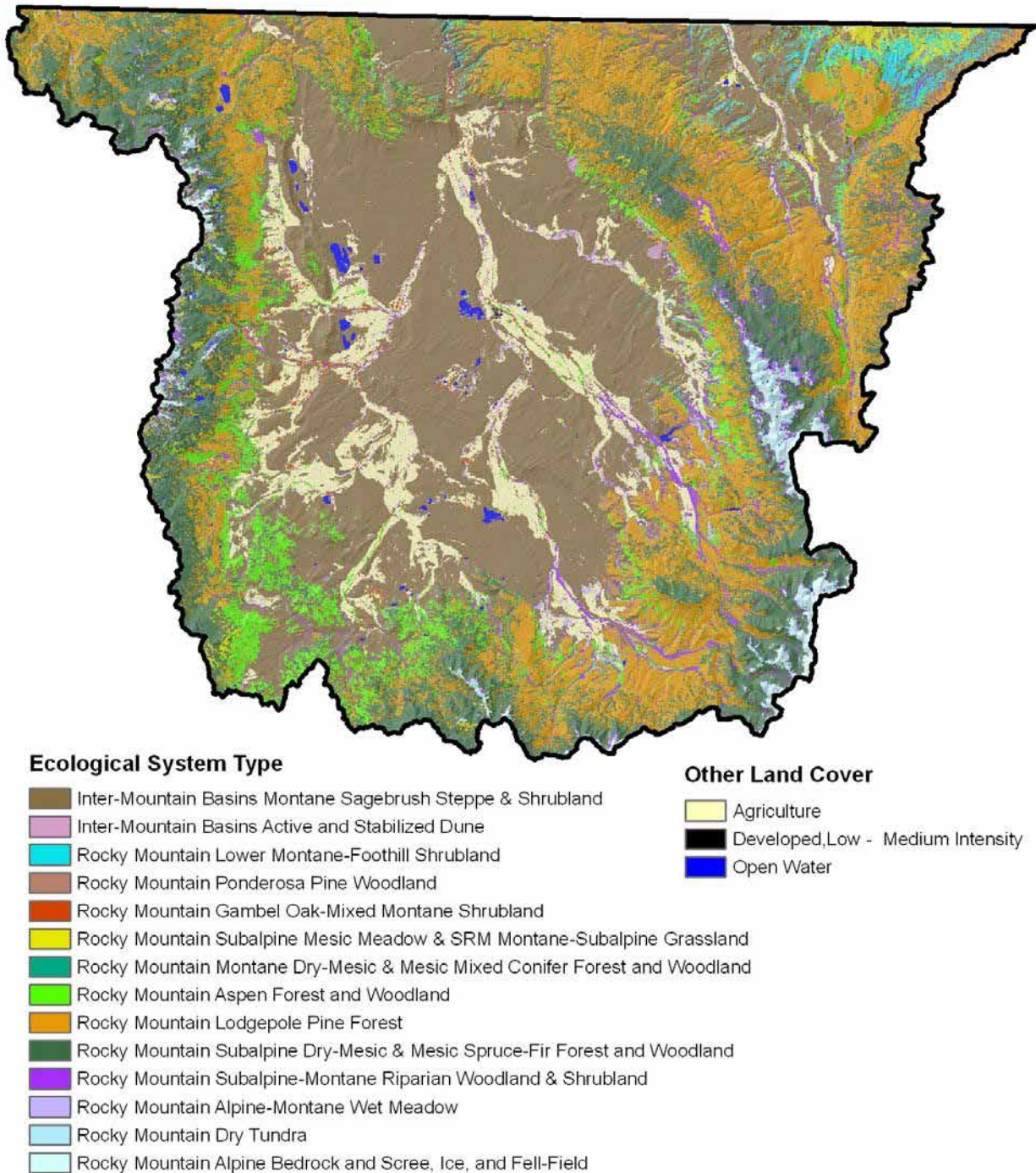


Figure 9. Major ecological systems of the North Platte River Watershed.



*tridentata* (antelope bitterbrush), *Peraphyllum ramosissimum* (squaw apple), *Ribes cereum* (wax currant), *Rosa woodsii* (Wood's rose), *Ceanothus velutinus* (tobacco ceanothus) and *Amelanchier alnifolia* (Saskatoon serviceberry) can be found in some occurrences, but these are seldom dominant. The canopy cover is usually between 20-80%. Although the herbaceous layer is typically well represented, bare ground may be common in particularly arid or disturbed occurrences. Graminoids that can be abundant include *Festuca idahoensis* (Idahoe fescue), *Festuca thurberi* (Thurber's fescue), *Festuca ovina* (sheep fescue), *Elymus elymoides* (bottlebrush squirrel-tail), *Deschampsia caespitosa* (tufted hairgrass), *Danthonia intermedia* (Vasey's oatgrass), *Danthonia parryi* (Parry's oatgrass), *Stipa* spp. (needlegrass), *Pascopyrum smithii* (western wheatgrass), *Bromus carinatus* (California brome), *Elymus trachycaulus* (slender wild rye), *Koeleria macrantha* (prairie junegrass), *Pseudoroegneria spicata* (bluebunch wheatgrass), *Poa fendleriana* (muttongrass), *Poa secunda* (curly bluegrass) and *Carex* spp. (sedges). Forbs are often numerous and an important indicator of health. Forb species may include *Castilleja* (Paintbrush), *Potentilla* (cinquefoil), *Erigeron* (fleabane), *Phlox* (phlox), *Astragalus* (milkvetch), *Geum* (avens), *Lupinus* (lupine), *Eriogonum* (wild buckwheat), *Balsamorhiza sagittata* (arrowleaf balsamroot), *Achillea millefolium* (common yarrow), *Antennaria rosea* (rosy pussytoes), *Fragaria virginiana* (Virginia strawberry), *Artemisia ludoviciana* (white sagebrush) and *Dugladii hoopesii* (= *Helenium hoopesii*; orange-sneezeweed). Healthy sagebrush shrublands are very productive and are often grazed by domestic livestock. Prolonged livestock use can cause a decrease in the abundance of native bunch grasses and an increase in the cover of shrubs and non-native grass species, such as *Poa pratensis* (Kentucky bluegrass).

#### *Inter-Mountain Basins Big Sagebrush Shrubland*

This matrix forming ecological system occupies about 15% of the North Platte River Watershed. Big sagebrush shrublands are typically found in broad basins between mountain ranges, on plains and foothills. This system is usually found on flat to rolling hills with well-drained clay soils between 7000 to 10,000 ft (2134 to 3049 m) in elevation. Soils are typically deep, well-drained and non-saline. In Colorado, the largest occurrences are in the western half of the state, but this system can also be found in eastern Colorado. Northwestern Colorado, North Park, Middle Park and the upper Gunnison Basin have large and continuous stands of sagebrush shrublands. This system is characterized by a dense shrubland of taller *Artemisia* species with a significant herbaceous understory. These taller shrubs distinguish it from sagebrush steppe, which is dominated by dwarf sagebrush species (*Artemisia arbuscula* (dwarf sagebrush) and *A. nova* (black sagebrush)). These shrublands are dominated by *Artemisia tridentata* ssp. *tridentata* (big sagebrush) and/or ssp. *wyomingensis* (Wyoming big sagebrush), or *A. cana* (hoary sagebrush), with occasional component shrubs such as *Chrysothamnus* spp. (rabbitbrush), *Purshia tridentata* (antelope bitterbrush) and *Krascheninnikovia lanata* (winter-fat). Scattered *Sarcobatus vermiculatus* (greasewood) and *Atriplex* spp. (saltbush) may be present in some stands. *Ericameria nauseosa* (rubber rabbitbrush) or *Chrysothamnus viscidiflorus* (sticky-leaf rabbitbrush) may codominate disturbed stands. Perennial herbaceous components typically contribute less than 25% vegetative cover. Common graminoid species include *Achnatherum hymenoides* (Indian ricegrass), *Bouteloua gracilis* (blue grama), *Carex geyeri* (Geyer's sedge), *Elymus lanceolatus* (streamside wild rye), *Festuca idahoensis* (Idahoe fescue), *F. thurberi* (Thurber's

fescue), *Hesperostipa comata* (needle-and-thread grass), *Leymus cinereus* (Great Basin wildrye), *Pleuraphis jamesii* (James' galleta), *Pascopyrum smithii* (western wheatgrass), *Poa secunda* (curly bluegrass), or *Pseudoroegneria spicata* (blue-bunch wheatgrass). Sage-grouse (*Centrocercus* spp.) is an indicator of a healthy sagebrush shrubland.

#### *Rocky Mountain Lodgepole Pine Forest*

This matrix forming system is the most widespread forest type in the North Platte River Watershed, covering about 19.5% of the area. These are subalpine forests where the dominance of *Pinus contorta* (lodgepole pine) is related to fire history and topo-edaphic conditions. Soils supporting these forests are typically well-drained, gravelly, have coarse textures, are acidic and rarely formed from calcareous parent materials. In Colorado, lodgepole pine forests generally occur from 8000 to 10,000 ft (2438 to 3048 m) on gentle to steep slopes on all aspects. Stands are dominated by *Pinus contorta* (lodgepole pine) with shrub, grass, or barren understories. Sometimes there are intermingled mixed conifer/*Populus tremuloides* (aspen) stands with the latter occurring with inclusions of deeper, typically fine-textured soils. The shrub stratum may be conspicuous to absent; common species include *Arctostaphylos uva-ursi* (bearberry), *Ceanothus velutinus* (tobacco ceanothus), *Linnaea borealis* (twinline), *Mahonia repens* (Oregon grape), *Purshia tridentata* (antelope bitterbrush), *Spiraea betulifolia* (white meadowsweet), *Spiraea douglasii* (Douglas' spiraea), *Shepherdia canadensis* (buffaloberry), *Vaccinium caespitosum* (dwarf huckleberry), *Vaccinium scoparium* (grouseberry), *Vaccinium myrtillus* (whortleberry), *Symphoricarpos albus* (snowberry) and *Ribes* spp. (currants and gooseberries). Shrub and herbaceous layers are often poorly developed in lodgepole pine forests and plant species diversity is low. This low understory diversity is probably related to the single age class and dense canopy of many stands.

#### *Rocky Mountain Subalpine Dry-Mesic and Mesic-Wet Spruce-Fir Forest and Woodland*

Spruce-fir dry-mesic forest and spruce-fir mesic-wet forest ecological systems form the primary matrix systems of the montane and subalpine zones of the Southern Rocky Mountains ecoregion, with Colorado elevations ranging from 8200 to 11,000 ft (2500 to 3355 m). Sites within this system are cold year-round and precipitation is predominantly in the form of snow, which may persist until late summer. Snowpacks are deep and late-lying and summers are cool. Mesic-wet occurrences are typically found in locations with cold-air drainage or ponding, or where snowpacks linger late into the summer, such as north-facing slopes and high-elevation ravines. These forests cover about 17.5% of the North Platte River Watershed. *Picea engelmannii* (Engelmann spruce) and *Abies lasiocarpa* (subalpine fir) dominate the canopy, either mixed or alone. *Pinus contorta* (lodgepole pine) is common in many occurrences and patches of pure *Pinus contorta* are not uncommon, as well as mixed conifer/*Populus tremuloides* (aspen) stands. Xeric species may include *Juniperus communis* (common juniper), *Linnaea borealis* (twinline), *Mahonia repens* (Oregon grape), or *Vaccinium scoparium* (grouseberry). Mesic understory shrubs include *Rhododendron albiflorum*, *Amelanchier alnifolia* (Saskatoon serviceberry), *Rubus parviflorus* (raspberry), *Ledum glandulosum*, *Phyllodoce empetrififormis* and *Salix* spp. (willow). Herbaceous species include *Actaea rubra* (baneberry), *Maianthemum stellatum* (starflower Solomon's-plume), *Cornus canadensis* (dwarf dogwood), *Erigeron eximius* (superb

fleabane), *Saxifraga bronchialis* (matte saxifrage), *Luzula glabrata* var. *hitchcockii* (smooth woodrush), or *Calamagrostis canadensis* (blue-joint reedgrass). Disturbances include occasional blow-down, insect outbreaks and stand-replacing fire. Pine martens (*Martes americana*) are primarily a spruce-fir obligate species that require a healthy and sizeable amount of mature forest and are an indicator of a healthy and viable occurrence of the spruce-fir system.

#### *Rocky Mountain Aspen Forest and Woodland &*

##### *Inter-Mountain West Aspen-Mixed Conifer Forest and Woodland Complex*

Aspen dominated forests occupy about 6% of the North Platte River Watershed. In Colorado this widespread system is quite common on the west slope, with smaller stands represented on the east slope. Elevations generally range from 5000 to 10,000 ft (1525 to 3050 m), but may be lower in some regions. Topography is variable, sites range from level to steep slopes. These are upland forests and woodlands dominated by *Populus tremuloides* (aspen) without a significant conifer component (<25% relative tree cover). They usually occur as a mosaic of many plant associations and may be surrounded by a diverse array of other systems, including grasslands, wetlands, coniferous forests, etc. Occurrences have a somewhat closed canopy of trees of 15 to 65 ft (5 to 20 m) tall, dominated by *Populus tremuloides* (aspen). Conifers that may be present but never codominant include *Abies concolor* (white fir), *Abies lasiocarpa* (subalpine fir), *Picea engelmannii* (Engelmann spruce), *Picea pungens* (blue spruce), *Pinus ponderosa* (ponderosa pine) and *Pseudotsuga menziesii* (Douglas-fir). Conifer species may contribute up to 15% of the tree canopy before the occurrence is reclassified as a mixed conifer occurrence. Common shrubs include *Acer glabrum* (mountain maple), *Amelanchier alnifolia* (Saskatoon serviceberry), *Artemisia tridentata* (big sagebrush), *Juniperus communis* (common juniper), *Prunus virginiana* (chokecherry), *Rosa woodsii* (Wood's rose), *Shepherdia canadensis* (buffaloberry), *Symphoricarpos oreophilus* (mountain snowberry) and the dwarf-shrubs *Mahonia repens* (Oregon grape) and *Vaccinium* spp. (huckleberry). The herbaceous layers may be lush and diverse. Common graminoids may include *Bromus carinatus* (California brome), *Calamagrostis rubescens* (pine reedgrass), *Carex siccata* (= *Carex foenea*; dry-spike sedge), *Carex geyeri* (Geyer's sedge), *Carex rossii* (short sedge), *Elymus glaucus* (smooth wild rye), *Elymus trachycaulus* (slender wild rye), *Festuca thurberi* (Thurber's fescue) and *Hesperostipa comata* (needle-and-thread grass). Associated forbs may include *Achillea millefolium* (common yarrow), *Eucephalus engelmannii* (= *Aster engelmannii*; Engelmann's aster), *Delphinium* spp. (larkspur), *Geranium viscosissimum* (sticky geranium), *Heracleum sphondylium* (cow parsnip), *Ligusticum filicinum* (fern-leaf loveage), *Lupinus argenteus* (silvery lupine), *Osmorhiza berteroi* (= *Osmorhiza chilensis*; Chilean sweet-cicely), *Pteridium aquilinum* (bracken fern), *Rudbeckia occidentalis* (western coneflower), *Thalictrum fendleri* (Fendler's meadowrue), *Valeriana occidentalis* (small-flower valerian), *Wyethia amplexicaulis* (northern mule's ears) and many others. Exotic grasses such as the perennials *Poa pratensis* (Kentucky bluegrass) and *Bromus inermis* (smooth brome) and the annual *Bromus tectorum* (cheatgrass) are often common in occurrences disturbed by grazing. As the occurrences age, *Populus tremuloides* (aspen) is slowly reduced until the conifer species become dominant.

#### *Rocky Mountain Subalpine-Montane Riparian Shrubland*

This ecological system covers about 3.5% of the North Platte River Watershed. These montane to subalpine riparian shrublands may occur as narrow bands of shrubs lining streambanks and alluvial terraces, or as extensive willow carrs in broad, hummocky floodplains and subalpine valleys. This system is more commonly found at higher elevations, but occurs anywhere from 5600 to 11,800 ft (1700 to 3595 m). Occurrences can also be found around seeps, fens and isolated springs on hillslopes away from valley bottoms. This system often occurs as a mosaic of multiple communities that are shrub- and herb-dominated and includes above-treeline, willow-dominated, snowmelt-fed basins that feed into streams. The dominant shrubs reflect the large elevational gradient and include *Alnus incana* (speckled alder), *Betula nana* (swamp birch), *B. occidentalis* (river birch), *Cornus sericea* (red-osier dogwood), *Salix bebbiana* (Bebb's willow), *S. boothii* (Booth's willow), *S. brachycarpa* (short-fruit willow), *S. drummondiana* (Drummond's willow), *S. eriocephala* (heartleaf willow), *S. geyeriana* (Geyer's willow), *S. ligulifolia* (strapleaf willow), *S. monticola* (mountain willow), *S. planifolia* (planeleaf willow) and *S. wolfii* (Idaho willow). Generally the upland vegetation surrounding these riparian systems are either conifer or aspen forests. At lower elevations in the range of this system, occurrences are more likely to be non-willow shrublands dominated by *Alnus incana* (speckled alder), *Betula occidentalis* (= *B. fontinalis*; river birch), or *Cornus sericea* (red-osier dogwood). At the highest elevations communities dominated by short-statured species such as *Betula nana* (swamp birch), *Salix brachycarpa* (short-fruit willow), *S. planifolia* (planeleaf willow) and *S. wolfii* (Idaho willow) are most common. Many of the plant associations included in this system are associated with beaver activity, which can be important for maintaining the health of the riparian ecosystem. Beaver dams abate channel down cutting, bank erosion and downstream movement of sediment. Beaver dams raise the water table across the floodplain and provide year-round saturated soils. Plant establishment and sediment build-up behind beaver dams raises the channel bed and creates a wetland environment.

#### *Rocky Mountain Alpine Bedrock and Scree, Rocky Mountain Alpine Fell-Field, and North American Alpine Ice Field (North American Glacier and Ice Field)*

These three sparsely vegetated or barren ecological systems of high elevations account for a little over 1% of the North Platte River Watershed. Sites are rocky, with poorly developed soils and are typically exposed to desiccating winds, making it difficult for vegetation to exist. Most fell-field plants are cushioned or matted, frequently succulent, flat to the ground in rosettes and often densely haired and thickly cutinized. Plant cover is 15-50%, while exposed rocks make up the rest. Scree slopes may have sparse cover of forbs, grasses, lichens and low shrubs. Fell-fields are usually within or adjacent to alpine tundra dry meadows. Common species include *Arenaria capillaries* (fescue sandwort), *Geum rossii* (alpine avens), *Kobresia myosuroides* (pacific kobresia), *Minuartia obtusiloba* (alpine sandwort), *Myosotis asiatica* (Asian forget-me-not), *Paronychia pulvinata* (Rocky Mountain nailwort), *Phlox pulvinata* (cushion phlox), *Sibbaldia procumbens* (creeping sibbaldia), *Silene acaulis* (moss campion), *Trifolium dasyphyllum* (whip-root clover) and *Trifolium parryi* (Parry's clover). Ice fields lack vascular plants; biotic composition may include algal blooms, insect communities and birds or mammals foraging on the insects.

### *Southern Rocky Mountain Montane-Subalpine Grassland*

These large patch grasslands occupy slightly over 1% of the North Platte River Watershed, primarily in the Laramie River and Sand Creek drainages in the northeastern portion of the study area. In Colorado this ecological system typically occurs from 7200 to 10,000 ft (2200 to 3000 m), on flat to rolling plains and parks or on lower sideslopes that are dry. These large patch grasslands are intermixed with matrix stands of spruce-fir, lodgepole, ponderosa pine and aspen forests. These grasslands are intermixed with forests of spruce-fir, lodgepole, ponderosa pine, mixed conifers and aspen. Within the subalpine zone, forbs tend to be more prominent at higher elevations and shrubs at lower elevations.

Associations are variable depending on site factors such as slope, aspect, precipitation, etc., but generally lower elevation montane grasslands are more xeric and dominated by *Muhlenbergia* spp. (muhly), *Pseudoroegneria spicata* (bluebunch wheatgrass), *Festuca arizonica* (Arizona fescue) and *Festuca idahoensis* (Idaho fescue), while upper montane or subalpine grasslands are more mesic and may be dominated by *Festuca thurberi* (Thurber's fescue) or *Danthonia intermedia* (Vasey's oatgrass). *Danthonia parryi* (Parry's oatgrass) is found across most of the elevational range of this system. Grasses of the foothills and piedmont, such as *Bouteloua gracilis* (blue grama), *Bouteloua curtipendula* (sideoats grama), *Hesperostipa comata* (needle-and-thread grass), *Koeleria macrantha* (prairie junegrass), *Pascopyrum smithii* (western wheatgrass), *Poa secunda* (curly bluegrass) and *Schizachyrium scoparium* (little bluestem) may be included in lower elevation occurrences. Higher, more mesic locations may support additional graminoid species including *Agrostis* spp. (bentgrass), *Carex* spp. (sedge). *Festuca brachyphylla* (shortleaf fescue), *Juncus drummondii* (Drummond's rush), *Phleum alpinum* (alpine timothy), *Poa* spp. (bluegrass), or *Trisetum spicatum* (narrow false oats). Woody species are generally sparse or absent, but occasional individuals from the surrounding forest communities may occur. Scattered dwarf-shrubs may be found in some occurrences; species vary with elevation and location. Forbs are more common at higher elevations.

### *Rocky Mountain Lower Montane-Foothill Shrubland*

This large patch ecological system covers about 1% of the North Platte River Watershed, primarily in the northeastern corner of the area. These shrublands occur in the foothills, ridges, canyon slopes and lower mountains of the Rocky Mountains and on outcrops, mesas and canyon slopes in the western Great Plains, at elevations from 4900 to 9500 ft (1500 to 2900 m). This type is common where *Quercus gambelii* (Gambel oak) is absent, such as the northern Colorado Front Range and in drier foothills and prairie hills. This system is generally drier than Rocky Mountain Gambel Oak-Mixed Montane Shrubland, but may include mesic montane shrublands where *Quercus gambelii* (Gambel oak) does not occur. It may occur as a mosaic of two or three plant associations often surrounded by grasslands or woodlands. Communities of this system are diverse and species composition varies with elevation, aspect, soils and disturbance history. Only a few of the component associations have a widespread distribution; many are restricted to a relatively small portion of the region. Communities range from xeric to mesic and may be transitional to riparian woodland and shrublands. The dominant shrub species are generally well adapted to poor soils, dry sites and disturbance by fire. Associations of this system are dominated by low to

moderate height shrubs averaging 1-2 m in height. The herbaceous stratum rarely exceeds 1m in height. Scattered trees or inclusions of grassland patches or steppe may be present, but the vegetation is typically dominated by a variety of shrubs including *Amelanchier utahensis* (Utah serviceberry), *Cercocarpus montanus* (birchleaf mountain-mahogany), *Purshia tridentata* (antelope bitterbrush), *Rhus trilobata* (Skunkbrush), *Ribes cereum* (wax currant), *Symphoricarpos oreophilus* (snowberry), or *Yucca glauca* (small soapweed yucca). Grasses present may include species of *Muhlenbergia* (muhly), *Bouteloua* (grama), *Hesperostipa* (needlegrass) and *Pseudoroegneria spicata* (bluebunch wheatgrass).

#### *Rocky Mountain Alpine-Montane Wet Meadow*

These high-elevation herbaceous-dominated communities cover less than 1% of the North Platte River Watershed. These communities occur as large meadows in montane or subalpine valleys, as narrow strips bordering ponds, lakes and streams and along toeslope seeps. Occurrences range in elevation from montane to alpine (in Colorado from 7000 to 11,800 ft (2100 to 3600 m) and are found on wetter sites with very low-velocity surface and subsurface flows. They are typically found on flat areas or gentle slopes, but may also occur on sub-irrigated sites with slopes up to 10%. In alpine regions, sites typically are small depressions located below late-melting snow patches or on snowbeds. Often alpine dwarf-shrublands, especially those dominated by *Salix* (willow), are immediately adjacent to the wet meadows. Wet meadow ecological systems provide important water filtration, flow attenuation and animal habitat. This system often occurs as a mosaic of several plant associations, often dominated by graminoids, such as *Calamagrostis stricta* (northern reedgrass), *Carex illota* (small head sedge), *Carex microptera* (small-wing sedge), *Carex nigricans* (black alpine sedge), *Carex scopulorum* (Rocky Mountain sedge), *Carex utriculata* (beaked sedge), *Carex vernacula* (native sedge), *Deschampsia caespitosa* (tufted hairgrass), *Eleocharis quinqueflora* (few-flowered spikerush) and *Juncus drummondii* (Drummond's rush). Common forb species include *Caltha leptosepala* (marsh marigold), *Cardamine cordifolia* (heartleaf bittercress), *Phippsia algida* (ice grass), *Rorippa alpina* (yellowcress), *Senecio triangularis* (arrow-leaf groundsel), *Trifolium parryi* (Parry's clover) and *Trollius laxus* (globeflower). Within the elevational gradient covered by this system, some communities are typically confined to the alpine, while others are usually found only at montane elevations.

#### *Rocky Mountain Cliff, Canyon and Massive Bedrock*

These largely vertical environments account for less than 1% of the North Platte River Watershed. This ecological system is found from foothill to subalpine elevations and includes barren and sparsely vegetated landscapes (generally <10% plant cover) of steep cliff faces, narrow canyons and smaller rock outcrops of various igneous, sedimentary and metamorphic bedrock type. Also included are unstable scree and talus slopes that typically occur below cliff faces. Soil development is limited, as is herbaceous cover. There may be small patches of dense vegetation, but it typically includes scattered trees and/or shrubs. Characteristic trees includes *Pseudotsuga menziesii* (Douglas-fir), *Pinus ponderosa* (ponderosa pine), *Pinus flexilis* (limber pine), *Populus tremuloides* (aspen), *Abies concolor* (white fir) and *Abies lasiocarpa* (subalpine fir), or *Pinus edulis* (pinyon pine) and *Juniperus* spp. (juniper) at lower elevations. There may be scattered shrubs present such as *Jamesia*

*americana* (fivepetal cliffbush), *Mahonia repens* (Oregon grape), *Rhus trilobata* (skunkbush), *Amelanchier alnifolia* (Saskatoon serviceberry) and species of *Holodiscus* (oceanspray), *Ribes* (currants and gooseberries), *Physocarpus* (ninebark), *Rosa* (rose) and *Juniperus* (juniper).

#### *Rocky Mountain Dry Tundra (Rocky Mountain Alpine Turf)*

These high elevation herbaceous systems are found from 10,000 to 14,000 ft (3048 to 4267 m) and occupy less than 1% of the North Platte River Watershed. Vegetation in these areas is controlled by snow retention, wind desiccation, permafrost and a short growing season. This system is characterized by a dense cover of low-growing, perennial graminoids and forbs. Rhizomatous, sod-forming sedges are the dominant graminoids and prostrate and mat-forming plants with thick rootstocks or taproots characterize the forbs. Dominant species include *Artemisia arctica* (boreal sagebrush), *Carex elynoides* (blackroot sedge), *Carex siccata* (dry-spike sedge), *Carex rupestris* (rock sedge), *Festuca brachyphylla* (shortleaf fescue), *Festuca idahoensis* (Idaho fescue), *Geum rossii* (alpine avens), *Kobresia myosuroides* (pacific kobresia), *Phlox pulvinata* (cushion phlox) and *Trifolium dasyphyllum* (whip-root clover). This system typically intermingles with alpine bedrock and scree, ice field, fell-field, alpine dwarf-shrubland and alpine/subalpine wet meadow systems.

#### *Rocky Mountain Gambel Oak-Mixed Montane Shrubland*

This large patch ecological system covers less than 1% of the North Platte River Watershed, primarily in the southwestern portion of the area. These shrublands are most commonly found along dry foothills, lower mountain slopes and at approximately 6500 to 9500 ft (2000 to 2900 m) in elevation. There may be inclusions of other mesic montane shrublands with *Quercus gambelii* (Gambel oak) absent or as a relatively minor component. This ecological system intergrades with the lower montane-foothills shrubland system and shares many of the same site characteristics. The vegetation is typically dominated by *Quercus gambelii* (Gambel oak) alone or codominant with *Amelanchier alnifolia* (Saskatoon serviceberry), *Amelanchier utahensis* (Utah serviceberry), *Artemisia tridentata* (big sagebrush), *Cercocarpus montanus* (birchleaf mountain mahogany), *Prunus virginiana* (chokecherry), *Purshia stansburiana* (cliffrose), *Purshia tridentata* (antelope bitterbrush), *Robinia neomexicana* (New Mexico locust), *Symphoricarpos oreophilus* (mountain snowberry), or *Symphoricarpos rotundifolius* (roundleaf snowberry). Vegetation types in this system may occur as sparse to dense shrublands composed of moderate to tall shrubs. Occurrences may be multi-layered, with some short shrubby species occurring in the understory of the dominant overstory species. In many occurrences of this system, the canopy is dominated by the broad-leaved deciduous shrub *Quercus gambelii* (Gambel oak), which occasionally reaches small tree size. Occurrences can range from dense thickets with little understory to relatively mesic mixed-shrublands with a rich understory of shrubs, grasses and forbs. These shrubs often have a patchy distribution with grass growing in between.



## Wetland-dependent Flora

Prior to irrigation, wetlands in the North Platte River Watershed were found mainly along the North Platte River and its major tributaries including the Laramie River in northwestern Larimer County. Along the eastern flank of the Park Rank, ponds or kettle lakes are scattered throughout the area concentrated on top of the glacial till, defined by lateral and terminal moraines. These kettle ponds are a remnant of melting glacial ice stagnation lacking an inlet or outlet. The vegetation of the kettle ponds occurs in succession zones from the open water to lake margins. Open



Roundleaf sundew. D. Culver

water areas are dominated by water lilies (*Nuphar lutea* ssp. *polysepala*), water smartweed, (*Persicaria amphibia*), pondweed (*Potamogeton* spp.), buckbean (*Menyanthes trifoliata*), bur-reeds (*Sparganium natans*, *S. angustifolium*) and bladderwort (*Utricularia minor*). The herbaceous-dominated lake margins that surround the open water are dominated by sedges (*Carex lasiocarpa*, *C. aquatilis*, *C. lasiocarpa*, *C. canescens*, *C. utriculata*, *C. buxbaumi*, *C. brunnescens*), cottongrasses (*Eriophorum gracile*, *E. angustifolium*), mannagrass (*Glyceria borealis*, *G. elata*), spike rush (*Eleocharis palustris*, *E. acicularis*), blue joint reedgrass (*Calamagrostis canadensis*, *C. stricta*), tufted hairgrass (*Deschampsia cespitosa*) and rushes (*Juncus longistylis*, *J. ensifolius*, *J. drummondii*). Forbs within the lake margin include: purple cinquefoil (*Comarum palustre*), water hemlock (*Cicuta douglasii*) and coltsfoot (*Petasites sagittatus*). Floating mats are found along the edges of the larger ponds. These mats can support round-leaf sundew (*Drosera rotundifolia*), mud sedge (*Carex limosa*) and pale sedge (*C. livida*) with *Sphagnum* spp.

The montane riparian flora is dominated by a matrix of low and tall stature willows. The low stature shrubs include; wolf willow (*Salix wolfii*) and short-fruited willow (*S. brachycarpa*) with shrubby cinquefoil (*Dasiphora floribunda*) and bog birch (*Betula nana*). The tall shrubs typically consist of Rocky Mountain willow (*S. monticola*), Drummond's willow (*S. drummondiana*), planeleaf willow (*S. planifolia*), Bebb's willow (*S. bebbiana*) and thin-leaf alder (*Alnus incana*). The herbaceous understory is a mix of native forbs and grasses.

The lower valley riparian flora is co-dominated by Geyer willow (*S. geyeriana*) and Rocky Mountain willow. The herbaceous understory is dominated by introduced hay grasses such as creeping foxtail (*Alopecurus arundinaceus*), timothy (*Phleum pratense*) and Kentucky bluegrass (*Poa pratensis*).

## Wetland-dependent Fauna

### Mammals

Most animals utilize wetlands in some way, such as forage, habitat, or breeding. However, many species require wetland habitat to remain viable. Numerous bat species use open water from lakes, rivers and beaver ponds to forage for insects. In 2006, CNHP conducted a

one month survey for bats in Jackson County (Schorr 2006). Five species were documented during that survey: silver-haired bat (*Lasionycteris noctivagans*), little brown bat (*Myotis lucifugus*), long-legged myotis (*M. volans*), long-eared myotis (*M. evotis*) and hoary bat (*Lasiurus cinereus*). In addition to these five species, two other bats are known to occur in the watershed; the big brown bat (*Eptesicus fuscus*) and Townsend's big-eared bat (*Plecotus townsendii*) (Fitzgerald et al. 1994).

Shrews occur in moist habitats within the montane and subalpine forest of the watershed, especially in willow carrs and wet meadows. The most common shrew, masked shrew (*Sorex cinereus*) was documented during the 2009 field season. Other shrews known to occur in the watershed include: pygmy shrew (*S. hoyi*), montane shrew (*S. monticolus*), dwarf shrew (*S. nanus*) at higher elevations and water shrew (*S. palustris*) (Fitzgerald et al. 1994). Other small mammals that can be found in riparian areas, fens and wet meadows include: long-tailed vole (*Microtus longicaudus*), montane vole (*M. montanus*), southern red-backed vole (*Clethrionomys gapperi*) and western jumping mouse (*Zapus princeps princeps*) (Fitzgerald et al. 1994; Huggins 2008)

One of the most important mammals and a keystone to the viability of the watershed's riparian system is the American beaver (*Castor canadensis*). Beavers are primary users as well as maintainers of riparian shublands. Beaver activity forms ponds that slow spring runoff and flooding and retain water that will be released slowly during the growing season (Huggins 2008). River otter (*Lontra canadensis*) is one of the only carnivorous aquatic mammals in the Rockies and their presence is indicative of a high quality riparian system (CDOW 2009b, Fitzgerald et al. 1994). They were extirpated from Colorado in the early 1900's and were reintroduced in the 1970's by the CDOW, which currently lists the species as threatened in Colorado (CDOW 2009b). As a top predator, river otters are essential to the proper function of riverine systems and through their preference for non-game fish they actually benefit game fisheries by reducing competition for food (Davis et al. 1992). Muskrat (*Ondatra zibethicus*) is also an important indicator of a healthy wetland. Muskrats are perhaps North America's most valuable semi-aquatic furbearer (Huggins 2008). They typically inhabit the same ponds as beaver, but are able to adapt to living in human made ponds better than beaver.



Beaver Pond on Silver Creek. D. Culver

### Birds

The North Platte River Watershed is one of the best birding areas in Colorado. The wetland dependent birds use the reservoirs, ponds and rivers for breeding and brooding. Typical bird species that are known to breed in the watershed include: American White Pelican (*Pelecanus erythrorhynchos*), Pied-billed Grebe (*Podilymbus podiceps*), Eared Grebe (*Podiceps nigricollis*) Western Grebe (*Aechmophorus occidentalis*), Double-crested Cormorant (*Phalacrocorax auritus*), Great Blue Heron (*Ardea herodias*), Snowy Egret

(*Egretta thula*), Black-crowned Night-Heron (*Nycticorax nycticorax*), Canada Goose (*Branta canadensis*), Gadwall (*Anas strepera*), American Wigeon (*Anas americana*), Mallard (*Anas platyrhynchos*), Blue-winged Teal (*Anas discors*), Cinnamon Teal (*Anas cyanoptera*), Northern Shoveler (*Anas clypeata*), Common Merganser (*Mergus merganser*), and the Ruddy Duck (*Oxyura jamaicensis*). Gulls and tern species known to breed in the watershed include: California Gull (*Larus californicus*), Ring-billed Gull (*Larus delawarensis*) and Forster's Tern (*Sterna forsteri*). Birds that forage and nest along the lake shores and shallow waters include: Greater Sandhill Crane (*Grus canadensis tabida*), American Avocet (*Recurvirostra americana*), Willet (*Catoptrophorus semipalmatus*), Common Snipe (*Gallinago gallinago*), Wilson's Phalarope (*Phalaropus tricolor*) and several sandpipers. The Bald Eagle (*Haliaeetus leucocephalus*) and Osprey (*Pandion haliaetus*), two aquatic dependent raptors, are also known to breed in the watershed (Kingery 1998).



Greater Sandhill Crane. M. Menefee

The Greater Sage-grouse (*Centrocercus urophasianus*) is the largest grouse in North America (CDOW 2008). This species occurs commonly within the North Platte River Watershed and occupies a total of 413,915 acres throughout North Park (CDOW 2008). North Park supports approximately 40% of the Greater Sage-Grouse breeding population in Colorado and has one of the largest populations open to hunting (CDOW 2009c) (Figure 10). However, Greater Sage-Grouse have shown long term declines throughout North America and their distribution is down by as much as 56% since European settlement (Nature Serve 2009). Conservation planning is occurring on a state by state basis and in 1998 the North Park Sage Grouse Working Group was formed. Their mission is “to develop, implement and monitor a conservation plan to maintain a viable sage-grouse population in Jackson County, Colorado” (NPSGWG 2001). The North Park Greater Sage-Grouse Conservation Plan was then completed and signed in December 2001 (CDOW 2008).

The Greater Sage-Grouse requires an extensive mosaic of sagebrush of varying densities and heights, which provides for: survival over winter, escape cover adjacent to lek sites, nesting cover, early brood-rearing habitat, late brood rearing habitat and fall habitat (NPSGWG 2001). Seeps, wet meadows and riparian areas become very significant during the brood rearing season, when hens and chicks venture into these areas due to the abundance of forbs and insects that comprise the bulk of a Greater Sage-Grouse chick's diet during the first 12 weeks. Availability of forbs and invertebrates directly affects survival of Greater Sage-Grouse chicks, particularly during drought years (CPF 2000). Broodless hens and males also utilize the riparian habitat but move into these areas earlier in the summer.

Management of sage-grouse habitat should include all habitat types, including wetlands, necessary for completion of their life history needs (CDOW 2008). Sage-grouse populations have been significantly affected by anthropogenic activities, e.g., introduction of non-native game birds, West Nile Virus, drought, improper grazing, stream degradation and noxious weeds. The timing and intensity of livestock grazing may positively or negatively affect



sage-grouse and sage-grouse habitat (SRM 2006). Proper timing and stocking rates can be used to favorably alter vegetation and enhance sage-grouse habitat (CDOW 2008). However, improper grazing of and trampling by domestic livestock can negatively impact breeding grounds, nest sites and the brood-rearing mesic areas (CDOW 2008).

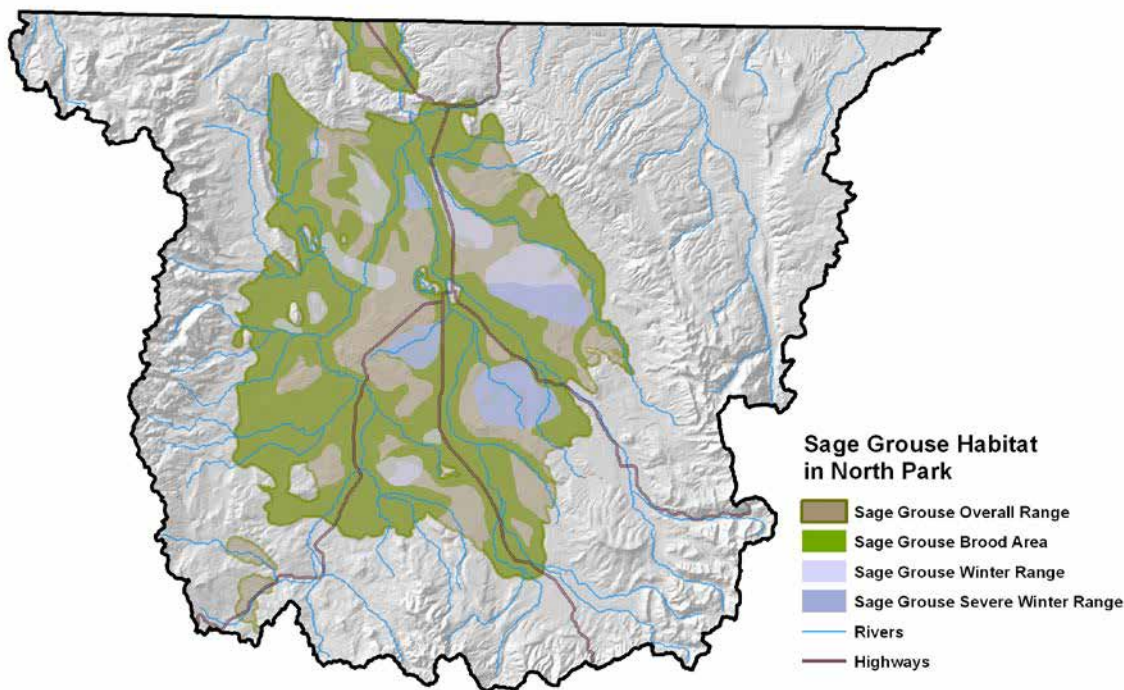


Figure 10. Sage Grouse Habitat in North Park.

### Fish

The North Platte River is a popular destination for fishing enthusiasts, with several State Wildlife Areas, Delaney Buttes Lakes, Lake John, Seymour Lakes and Cowdrey Lakes, that are stocked by the CDOW with fingerling trout every spring. Game fish that are known to occur or are stocked in the watershed include, Rainbow trout (*Oncorhynchus mykiss*), Snake River cutthroat (*Oncorhynchus clarki bouvieri*), brook trout (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*). Non-game fish that are known to occur in the watershed include the bigmouth shiner (*Notropis dorsalis*), brook stickleback (*Culaea inconstans*), fathead minnow (*Pimephales promelas*), Johnny darter (*Etheostoma nigrum*), longnose dace (*Rhinichthys cataractea*) and white sucker (*Catostomas commersoni*). The Laramie River offers good lake and stream fishing. The Hohnholtz Lakes State Wildlife Area is stocked with brown trout and Snake River cutthroat. Chambers Lake is an easily accessible campground and reservoir with a stocked fishery. The lake chub (*Couesius plumbeus*), a small minnow that is a glacial relict in Colorado, is listed as endangered by the CDOW and is known from Johnson Reservoir at the headwaters of the Laramie River.

### Amphibians

The boreal or western toad (*Bufo boreas boreas*) was once common in the mountains of Colorado, southern Wyoming and northern New Mexico, however it has declined

throughout its range during the last 20 years (Corn et al. 1989, Carey 1993, Hammerson 1999, Loeffler 2001). Due to these declines, the boreal toad was listed in Colorado as a state endangered species in 1993. The boreal toad was considered “warranted but precluded” for federal listing under the Endangered Species Act, but was withdrawn from consideration in 2005. There are approximately 71 breeding sites known in Colorado that comprise 38 separate populations (Jackson 2008).



Boreal toad. J. Sovell

In the North Platte River Watershed, boreal toads were historically common in the Park Range, Rabbit Ears Mountains and the Medicine Bow Range at elevations between 8,000 and 11,000 ft. (Hammerson 1999). At present there are only three known breeding sites in Jackson County, two of which are monitored by the Boreal Toad Recovery Team (Jackson 2008). Results of recent amphibian surveys in Jackson and Larimer Counties show that boreal toads are now absent from many historical sites, but still persist in small numbers at a few scattered locations in the North Platte River Watershed (CNHP 2009).



Wood frog. J. Huggins

The wood frog (*Rana sylvatica*) is listed as a species of special concern by the CDOW and is listed as a sensitive species by the US Forest Service. The distribution of the wood frog in Colorado is limited to the mountains surrounding North Park, the upper Laramie River drainage in Larimer County and the upper tributaries of the Colorado River in Grand County between 7,900 ft. and 9,800 ft. (Hammerson 1999). Data from recent survey efforts indicate that wood frogs generally still occupy their historic distribution in Colorado, although many historical locations have not been resurveyed (CNHP 2009).

Survey work is also needed from the upper Laramie River in the Chambers Lake area to confirm the presence of wood frogs.

The Northern leopard frog (*Rana pipiens*) is classified by the CDOW as a species of concern and the US Forest Service classifies it as a sensitive species. It occurs statewide except the southeastern corner of the state with a wide elevational range of 3,500 ft. in northeastern Colorado to 11,000 ft. in southwest Colorado (Hammerson 1999). In the North Platte River Watershed there are records in the Park Range south to the Rabbit Ears Pass area and in the upper Laramie River drainage in Larimer County. Recent observations demonstrate the persistence of leopard frogs in the Park Range, but data are lacking for current trends in the Rabbit Ears Mountains and Medicine Bow Range. A new observation



Northern leopard frog. J. Bell

by CNHP field crews in the summer of 2009 northeast of Walden represents the first documentation of leopard frogs for northeastern Jackson County.

Two additional amphibians: the chorus frog (*Pseudacris maculata*) and the tiger salamander (*Ambystoma mavortium*), are common and widespread in Colorado and can be found throughout the watershed in Jackson County and Larimer County.

The main threat to the viability of the amphibians is chytrid fungus or *Batrachochytrium dendrobatidis* (Bd). Other threats to amphibians in the North Platte River Watershed include water quality, habitat loss/alterations and introduced nonnative predators (e.g., exotic fish, bullfrogs). Since all of the amphibian species in Colorado breed in ponds and slow moving streams, water quality and fluctuating water levels can have a large impact on new recruitment into populations.

# POTENTIAL IMPACTS TO WETLANDS IN THE NORTH PLATTE RIVER WATERSHED

## Hydrological Modifications

There are three trans-basin exports from the North Platte to the South Platte Basin; 1) Laramie-Poudre Tunnel, 2) Michigan Ditch and 3) Wilson Supply Ditch. Annual diversions from the Laramie-Poudre Tunnel average 18,500 AF per year (CWCB 2006). The tunnel was built in the 1900s to facilitate the transfer of Laramie River water into the Poudre River Basin. The water shares are owned by the City of Greeley, North Weld County Water and the Fort Collins-Loveland water district (City of Greeley 2009). The Michigan Ditch diverts water from Michigan River at the headwaters of the North Platte River and transports it via Cameron Pass into Joe Wright Creek, a tributary of the Cache la Poudre River in the South Platte River Basin. Storage for Michigan Ditch water is available in Joe Wright Reservoir and Chambers Lake. This ditch is owned by the City of Fort Collins (NCCG 2002). The annual diversion is an average of 3,294 AF per year. The Wilson Supply Ditch diverts water from Sand Creek and Deadman Creek and delivers it to Sheep Creek, a tributary of the North Fork of the Cache la Poudre River. Wilson Supply Ditch was formerly known as the Sand Creek System or Sand Creek Ditch. Diversions through the Wilson Supply Ditch include water diverted from the Laramie River Basin into Sand Creek through Deadman Ditch (Colorado Division of Water Resources 2004). The average annual diversion via the Wilson Supply ditch is 1,482 AF (CWCB 2006).

In 1986, the passage of House Bill 1011 added a section to the Colorado Revised Statutes (37-60-115(4)(a)) that directed the CWCB to compile an inventory of potential dam and reservoir sites within the state of Colorado. The sites that were evaluated had to have a capacity of at least 20,000 acre feet (CO Division Water Resources Dam Inventory 2009). There are two proposed water storage projects in the watershed; Coalmont Reservoir and Laramie River Reservoir (Figure 11).



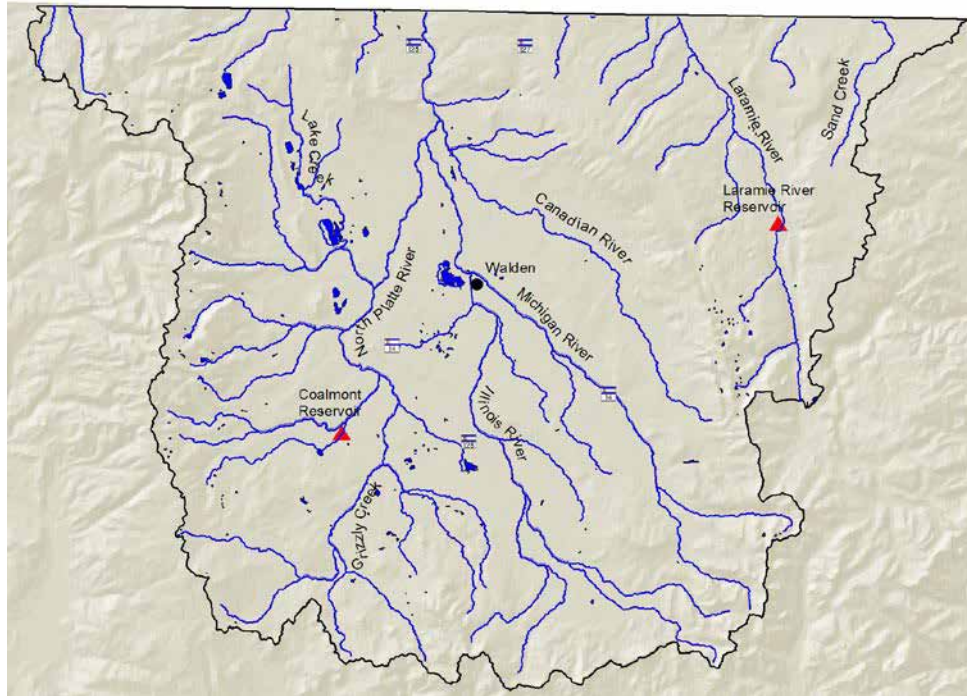


Figure 11. Proposed Reservoirs within the Watershed.

Livestock production is by far the dominant land use in the watershed, not only for private lands, but for federal and state lands as well. Irrigation for hay production is an essential component of ranching. Irrigating does pull water out of upper reaches of streams, but waters do eventually flow back to streams either by surface flow or discharge from saturated alluvium, therefore re-timing the flow.

### Climate Change Impacts to Wetlands

Data from the Intergovernmental Panel on Climate Change (IPCC) (Ray et al. 2008) suggest that Colorado climate will undergo future changes. State climate models project Colorado will warm by 2.5°F by 2025, relative to the 1950–99 baseline and 4°F by 2050. For the North Platte River Watershed and the north central mountains, the 50 year seasonal trend (1957-2006) is an increase in the annual average maximum temperature by 3.2°F. Projections show that spring temperatures will warm (4.7°F) more than summer temperatures (3.0°F) (Ray et al. 2008). The IPCC primary conclusions are:

- Temperatures are increasing and will continue to increase;
- There is uncertainty with regard to precipitation projections;
- Even with no change in precipitation, temperature increases alone will lead to a decline in runoff for most of Colorado's river basins by the mid 21<sup>st</sup> century;
- Synthesis of findings suggests a reduction in total water availability by the mid 21<sup>st</sup> century; and
- Warming climate increases the risk to Colorado's water supply even if precipitation remains at historical levels.

Implications of a changing climate to the watershed's resources are numerous. Increasing temperatures will raise evapotranspiration by plants, lower soil moisture, alter growing seasons and thus increase water demand. Earlier runoff may complicate prior appropriation systems and interstate water compacts, affecting which rights holders receive water. Increasing temperature and soil moisture changes may shift current mountain plant assemblages toward higher elevation and may result in the loss of some plant assemblages at the highest elevations. Stream temperatures are expected to increase as the climate warms, which could have direct and indirect effects on aquatic ecosystems, including the spread of in-stream non-native species and diseases to higher elevations (Ray et al. 2008). Climate change impacts are just now being discussed and researched but are worthy of mention for the North Platte River Watershed.

### **Mineral Extraction Impacts**

Oil, natural gas, coal, fluorospar and gold are found in the Jackson County portion of the North Platte River Watershed (Fletcher 1981). Gold mining started in the early 1870s near Independence and Owl mountains (Patten 1994, as cited in North Park Wetlands Focus Area Committee 2002). Most of the early gold mining activities were centered on Independence Mountain and later Hahns Peak. The first claim was recorded in 1879 when productive veins of silver, gold and lead were discovered near the headwaters of the Illinois River and Jack Creek. Subsequent claims led to the development of Park city and Teller City (also known as Jack City). By 1880, a number of mines were developed in Jackson County, but the largest camp continued to be Teller City, at one point a city of 3,000 residents (Duncan 1990). In 1890 coal of good grade was discovered 18 miles south of Walden (Fletcher 1981). Coal was first mined commercially at Coalmont. Three open pit coalmines began operation in 1974 and ceased in 1993 (Patten 1994). There are still large quantities in reserve in the Coalmont Formation found throughout the North Park Basin. Oil and natural gas are produced on both the eastern and western sides of North Park. The McCallum oil field was first explored in 1926 by Continental Oil Company (BLM Auto Tour pamphlet). Fluorspar was first discovered in 1918 near Northgate and the eastern side of North Park. Fluospar production was intermittent until the mines closed in 1973 (Rex Shaw, former supervisor Ozark Mahoning Mine ).

Environmental issues to be considered for future mineral extraction projects include: erosion, road construction, formation of sinkholes, loss of biodiversity and contamination of soil, groundwater and surface water by chemicals from mining processes. Cost of transportation to processing plants is also an issue to be considered due to the lack of railroad transportation in and out of the watershed.

### **Mountain Pine Bark Beetle and Timber Harvest Impacts**

The Mountain Pine Bark Beetle (*Dendroctonus ponderosae*) is a native insect having a large ecological impact on the pine forests in the Medicine Bow and Routt National Forests, as well as throughout other parts of Colorado, the western United States and Canada. As of 2007, 76 percent of lodgepole pine acreage in Jackson County was impacted by the beetle (AWRA 2009). Mountain pine beetle infestations are cyclical, with small epidemics occurring every 10 to 30 years (USDA Forest Service 2008). This cycle of disturbance

evolved naturally and has benefited forest ecosystems through thinning of dense stands and through increasing stand diversity. However, the large extent of the current mountain pine beetle infestation appears to be unprecedented and quite significant. Several reasons are reported as to why this infestation is so extreme. Past fire suppression and areas of intense clear-cutting led to the current conditions of dense, even aged stands of older lodgepole pines, a perfect setting for a severe mountain pine beetle infestation. Also, the severe drought from 1998-2003 served to weaken the trees constitution at the same time that the mountain pine beetles numbers were increasing (Witcosky 2006). Earlier snow melts and warmer temperatures have allowed the mountain pine beetle to expand into higher elevation areas and helped the insect to reduce its life cycle from two years to one year (Witcosky 2006).



Mountain Pine Bark Beetle.  
CSU Extension

The adult mountain pine beetle is about the size of a grain of rice or approximately 5mm (USDA Forest Service 2008). Adults attack living, green trees by tunneling under the bark. The trees try to resist the attack by secreting resin to prevent beetle entry. Drought stricken trees are weaker and thus may produce less resin for defense. If the tree is unsuccessful in defending itself, the adult beetles mate and the females lay approximately 75 eggs in the vertical tunnel or egg gallery (USDA Forest Service 2008). Mountain pine beetles also release a pheromone to summon other pine beetles once the female has burrowed into the inner bark. During tunneling, the pine beetle introduces the bluestain fungus into the tree via spores that are transported on the beetle's body and legs. The fungus multiplies blocking the transport of water up the tree's trunk and contributing to the effects of the beetle in killing the tree (USDA Forest Service 2008). The fungi also give a blue-gray appearance to the sapwood (Leatherman et al. 2009). Larvae develop in the tree bark from September through June and continue to feed on the inner bark. The larvae overwinter under the bark, metabolizing glycerol as an anti-freeze to assist in their survival. It takes 5 consecutive days of -35 degree Fahrenheit temperatures to freeze and kill bark beetles (Leatherman et al. 2009). The larvae transform into pupae in June and July. They emerge as new adults in July and August and begin the cycle again. Leatherman et al. reported in 2009 that "under epidemic or outbreak conditions, enough beetles can emerge from an infested tree to kill at least two and possibly more, trees the following year". The tree needles will then turn red or reddish brown eight to ten months after the tree has been attacked by bark beetles (USDA Forest Service 2008).

Scientists cannot predict what the full extent and duration of the current mountain pine beetle infestation will be (USDA Forest Service 2008). There is no doubt that the pine forests of Colorado and throughout other parts of the west will be changed by this infestation. Mixed forests may eventually emerge to replace the dense monoculture pine forests as the surviving young lodgepole pines grow quickly without competition from dense mature trees. These stands may then mix with aspen, and other tree species that have moved in as the infected pines died off. These changes could increase biodiversity in some areas by creating mixed stands and providing improved habitat to certain wildlife

species. However, the detrimental impacts to native fauna and flora, watersheds, soil, water quality and natural ecosystem succession are potentially forthcoming (Hoobler 2008).

Some of the ecological concerns associated with the beetle induced pine die-offs include increased fuel loads due to the standing dead and dying trees which could lead to crown fires, as well as potential catastrophic ground fires once the trees fall. Fires of this nature can cause soil damage and erosion and sedimentation concerns for riparian areas and watersheds. Also, dense, live pine stands have contributed to the accumulation of winter snowpack as well as provided shade in the spring during snow melt. Changes in the forest structure caused by the mountain pine beetle could alter snow pack amounts and affect snow melt. Pugh and Tilton's (2008) research from the Colorado Rockies shows that the snow water equivalent is lower and the mean snowpack temperature is warmer in dead lodgepole pine stands and that snow in dead tree stands becomes isothermal sooner than snow in living tree stands. This leads to earlier snowmelt and likely earlier peak runoff. Hydrologic modeling research from 2006 suggests that the effects of mountain pine beetle infestations on forest hydrology may be similar to those experienced after forest harvesting of even-aged stands without significant understory (Uunila et al. 2006). These effects include: "increases in annual water yield, increases in late summer and fall low flows, variable responses in peak flow size and possibly earlier timing of peak flows...these effects *may* last up to 60-70 years"(Uunila et al. 2006). There is also potential impact to beaver habitat and potential pond failure associated with increased water yields from the beetle epidemic. The beaver should respond fairly well since beaver are generally good at rebuilding, however there may be times that they fail to rebuild ponds for some reason (L. Schnackenberg, FS Hydrologist 2009). Hydrologic responses vary between even-aged stands and multi-aged stands as well as between individual watersheds thus making it hard to forecast the hydrologic effects the mountain pine beetle infestation will ultimately have on the North Platte River Watershed. Research on the effects of mountain pine bark beetle is on-going and not conclusive at the time of this report.

## **Non-native Species**

### *Vascular Plants*

Invasion of non-native and aggressive species and their replacement of native species is a threat to the North Platte River watershed; however, compared to other more populated Colorado watersheds, the threat is not so prominent. The Colorado Department of Agriculture Noxious Weed Program lists species according to their degree of invasiveness. List A species are designated by the State Commissioner for eradication. No List A species were documented during the project. List B weed species are species for which the State develops and implements state noxious weed management plans designed to stop the continued spread of these species. And List C weed species are species for which the Commissioner will develop and implement state noxious weed management plans designed to support the efforts of local governing bodies to facilitate more effective integrated weed management on private and public lands.

**List B species****documented within the watershed:**

Bull thistle (*Cirsium vulgare*)  
Butter and eggs (*Linaria vulgaris*)  
Canada thistle (*Breia arvensis*)  
Dames's rocket (*Hesperis matronalis*)  
Diffuse knapweed (*Acosta diffusa*)  
Houndstongue (*Cynoglossum officinale*)  
Ox-eye daisy (*Leucanthemum vulgare*)  
Russian knapweed (*Acroptilon repens*)  
Spotted knapweed (*Acosta maculosa*)  
White top or hoary cress (*Cardaria draba*)

**List C species****documented within the watershed:**

Burdock (*Arctium minus*)  
Cheatgrass (*Anisantha tectorum*)  
Common mullein (*Verbascum thapsus*)

Two other non-native species that are widespread in the watershed but are not on the State weed list are creeping foxtail (*Alopecurus arundinaceus*) and hoary alyssum (*Berteroa incana*). Creeping foxtail is the primary grass planted in the watershed, especially in North Park. This species produces numerous aggressive underground rhizomes and proliferates by windborne and waterborne seeds (USDA NRCS 2009) that invade non-pasture lands along riparian corridors outcompeting the native grasses such as bluejoint reedgrass (*Calamagrostis canadensis*) and manna grasses (*Glyceria* spp.). Hoary alyssum is native to Europe and is an invader in disturbed areas such as roadsides and berms and is much less common in the watershed than creeping foxtail.

**Mussels**

The zebra mussel (*Dreissena polymorpha*) and the quagga mussel (*Dreissena bugensis*) are non-native aquatic mussels that have recently been documented in Colorado. Both zebra and quagga mussel larvae are from the following waters as of May 2009: Blue Mesa, Granby Lake, Grand Lake, Jumbo Lake, Pueblo Reservoir, Shadow Mountain Reservoir, Tarryall Lake and Willow Creek Reservoir (CDOW 2009d) (Figure 12). The North Platte River Watershed is just north of the Grand County occurrences, therefore simple procedures need to be followed before leaving a lake or waterway to prevent the spread of zebra and quagga mussels: 1) drain the water from the boat and the lower unit of the engine, 2) clean the hull of your boat, 3) dry the boat, fishing gear and equipment, 4) inspect all exposed surfaces and 5) remove all plants and animals (CO State Parks 2009).

The New Zealand mudsnail (*Potamopyrgus antipodarum*) arrived in the western U.S. in the 1980s. Because this snail reproduces asexually and has no natural predators, it will invade new habitats and consume aquatic vegetation upsetting the balance of the aquatic environment. In Colorado, it is currently only known from the South Platte and Yampa Rivers (Figure 13). Prevention is paramount and one uses the same sterilization methods of cleaning, sterilizing and drying as for the zebra and quagga mussel (CDOW 2009d).



Figure 12.

Zebra and quagga mussel western distribution.

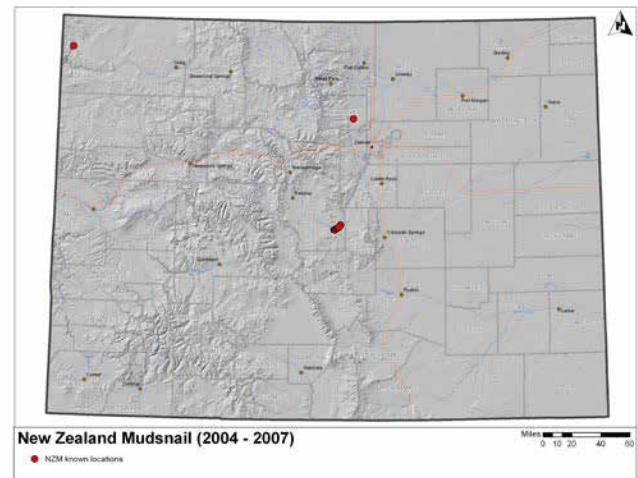


Figure 13.

New Zealand mudsnail Colorado distribution.

### *Chytrid Fungus*

The western toad (*Bufo boreas boreas*) and other amphibians have experienced dramatic population declines over the past two decades in montane habitats between 7,000-12,000 feet in the Southern Rocky Mountains. Reasons for the declines appear to be related to infection by the chytrid fungus or *Batrachochytrium dendrobatidis* (Bd). Chytrid fungus is a potentially lethal disease that has been implicated in worldwide declines of amphibians (Carey 2000, Lipps et al. 2006) and is believed to be responsible for recent declines of boreal toads in Colorado (Muths et al. 2003, Scherer et al. 2005). The fungus attacks the skin of amphibians causing a disruption in the electrolyte balance which can be lethal to infected amphibians (Voyles et al. 2009). In the North Platte River Watershed there have been two boreal toad localities and several chorus frog sites test positive for chytrid fungus (Lauren Livo, University of Colorado, Boulder, pers. comm., Jackson 2008). To reduce the spread of chytrid fungus, the Boreal Toad Recovery Team Conservation Plan (Loeffler 2001) recommends that people disinfect waders, boots, nets etc. with a bleach solution of 1 part bleach to 32 parts water, or stronger when moving between ponds and streams.



# METHODS

The methods for assessing and prioritizing conservation needs over a large area, such as a watershed, are necessarily diverse. CNHP follows a general method that is continuously being developed and updated specifically for this purpose. The survey was conducted in several steps summarized below. Additionally, input from NPBRT and its Non-consumptive Needs subcommittee was sought at all stages.

## *Survey Methods*

### **Collect Available Information**

CNHP databases were updated with information regarding the known locations of wetland-dependent species and significant plant associations within North Platte River Watershed. A variety of information sources were searched for this information. The Colorado State University museums and herbaria were searched, as were plant and animal collections at the University of Colorado, Rocky Mountain Herbarium and local private collections. Both general and specific literature sources were incorporated into CNHP databases, either in the form of locational information or as biological data pertaining to a species in general. Other information was gathered to help locate additional occurrences of natural heritage elements. Such information covers basic species and community biology including range, habitat, phenology (reproductive timing), food sources and substrates. This information was entered into CNHP's Biodiversity Tracking and Conservation System (BIOTICS).

### **Identify rare or imperiled species and significant plant associations with potential to occur in North Platte River Watershed**

The information collected in the previous step was used to refine a list of potential species and natural plant communities and to refine the search areas. In general, species and plant communities that have been recorded from the North Platte River Watershed or from adjacent counties are included in this list. Over 50 rare species and significant plant communities were targeted in this survey. Given the limited amount of time and funding, a specific subset of species and communities were the priority of our inventory efforts. These elements were considered to be a priority because of their high level of biological significance (G1-G3) (see Table 4) and/or because they are known to occur in areas that are subject to various development pressures such as hydrological.

### **Contact Landowners**

Obtaining permission to conduct surveys on private property was essential to this project. Once survey sites were chosen, land ownership of these areas was determined using GIS land ownership coverage obtained from the Jackson and Larimer counties assessor's office or stakeholders. Landowners were then contacted either by phone or in person. If landowners could not be contacted, or if permission to access the property was denied, this was recorded and the site was not visited. **Under no circumstances were private properties surveyed without landowner permission.**



## **Conduct Field Surveys and Gather Data**

Survey sites where access could be obtained were visited at the appropriate time as dictated by the seasonal occurrence (or phenology) of the individual elements. It was essential that surveys took place during a time when the targeted elements were detectable. For instance, plants are often not identifiable without flowers or fruit that are only present during certain times of the year or breeding birds cannot be surveyed outside of the breeding season, because they are most visible in breeding plumage and are easier to spot when singing to attract mates. Amphibians are best surveyed in spring when adults are calling and mating, in mid-summer when tadpoles are out and adults are still active and in late summer when metamorphs are present. Where necessary and permitted, voucher specimens were collected and deposited in local university museums and herbaria.

When a rare species or significant plant community was discovered, its precise location and known extent was recorded with a global positioning system (GPS) unit. Other data recorded at each occurrence include numbers observed, breeding status, habitat description, disturbance features, observable threats and potential protection and management needs. The overall significance of each occurrence, relative to others of the same element, was estimated by rating the size of the population or community, the condition or naturalness of the habitat and the landscape context (its connectivity and the ease or difficulty of protecting) of the occurrence. These factors are combined into an element occurrence rank, useful in refining conservation priorities. See the following section on Natural Heritage Program Methodology for more about element occurrence ranking (see Table 6).

Site visits and assessments were conducted as follows:

### **1). On-site assessments**

On-site assessment is the preferred method. It is the only assessment technique that can yield high-confidence statements concerning the known or potential presence of rare and imperiled elements or excellent examples of common associations. On-site assessments are also the most resource intensive because of the effort required to contact landowners. In several cases where on-site assessments were desired, they could not be conducted because either field personnel were denied access to the property by the landowner, or CNHP was unable to contact the landowner during the time frame of this study.

### **2). Wetland animal data collection**

The methods used in the surveys vary according to the animal that was being targeted. In most cases, the appropriate habitats were visually searched in a systematic fashion, attempting to cover the area as thoroughly as possible in the given time. Some types of organisms require special techniques to document their presence. These are summarized below followed by specific reference sources:



- Amphibians: visual observation, vocal surveys and capture using aquatic dip nets (Hammerson 1999)
- Birds: visual observation or identification by song or call (Kingery 1998 andrews and Righter 1992, National Geographic Society 2006)
- Invertebrates: sweep netting (Opler et al. 2009, Opler and Wright 1999, Scott 1986)
- Mammals: visual observation, pit fall trapping, Sherman live trapping and mist-netting for bats (Fitzgerald et al. 1994)
- Fish: capture using aquatic dip nets (Woodling 1985)

### **3). Wetland plant and plant community data collection**

- Lists of all plant associations in the survey area, including the percent cover by that community. In almost all cases, plant associations were immediately placed within both the International National Vegetation Classification (Anderson et al. 1998; Comer et al. 2003) and the Comprehensive Statewide Wetlands Classification (Carsey et al. 2003). Plant synonym follows Kartesz (1999).
- Vegetation data using Weber and Wittman (2001) for each major plant association in the wetland were collected using visual ocular estimates of species cover in a representative portion of the plant association, including non-native species.
- Soil description
- Water chemistry
- Site information including;
- UTM coordinates and elevation from Garmin GPSmap 76CSx.
- Current and historic land use (e.g., grazing, logging, recreational use) when apparent.
- Notes on geology and geomorphology.
- Reference photos of the site.
- Indicators of disturbance such as logging, grazing, flooding, etc.



#### *Natural Heritage Methodology*

To determine the status of species within Colorado, CNHP gathers information on plants, animals and plant communities. Each of these elements of natural diversity is assigned a rank that indicates its relative degree of imperilment on a five-point scale (for example, 1 = extremely rare/imperiled, 5 = abundant/secure). The primary criterion for ranking elements is the number of occurrences (in other words, the number of known distinct localities or populations). This factor is weighted more heavily than other factors because

an element found in one place is more imperiled than something found in twenty-one places. Also of importance are the size of the geographic range, the number of individuals, the trends in both population and distribution, identifiable threats and the number of protected occurrences.

Element imperilment ranks are assigned both in terms of the element's degree of imperilment within Colorado (its State-rank or S-rank) and the element's imperilment over its entire range (its Global-rank or G-rank). Taken together, these two ranks indicate the degree of imperilment of an element. CNHP actively collects, maps and electronically processes specific occurrence information for animal and plant species considered extremely imperiled to vulnerable in the state (S1 - S3). Several factors, such as rarity, evolutionary distinctiveness and endemism (specificity of habitat requirements), contribute to the conservation priority of each species. Certain species are "watchlisted," meaning that specific occurrence data are collected and periodically analyzed to determine whether more active tracking is warranted. A complete description of each of the Natural Heritage ranks is provided in Table 4.

This single rank system works readily for all species except those that are migratory. Those animals that migrate may spend only a portion of their life cycles within the state. In these cases, it is necessary to distinguish between breeding, non-breeding and resident species. As noted in Table 4, ranks followed by a "B," for example S1B, indicate that the rank applies only to the status of breeding occurrences. Similarly, ranks followed by an "N," for example S4N, refer to non-breeding status, typically during migration and winter. Elements without this notation are believed to be year-round residents within the state.

Table 4. Definition of Natural Heritage Imperilment Ranks.

<b>G/S1</b>	Critically imperiled globally/state because of rarity (5 or fewer occurrences in the world/state; or 1,000 or fewer individuals), or because some factor of its biology makes it especially vulnerable to extinction.
<b>G/S2</b>	Imperiled globally/state because of rarity (6 to 20 occurrences, or 1,000 to 3,000 individuals), or because other factors demonstrably make it very vulnerable to extinction throughout its range.
<b>G/S3</b>	Vulnerable through its range or found locally in a restricted range (21 to 100 occurrences, or 3,000 to 10,000 individuals).
<b>G/S4</b>	Apparently secure globally/state, though it may be quite rare in parts of its range, especially at the periphery. Usually more than 100 occurrences and 10,000 individuals.
<b>G/S5</b>	Demonstrably secure globally/state, though it may be quite rare in parts of its range, especially at the periphery.
<b>G/SX</b>	Presumed extinct globally, or extirpated within the state.
<b>G#?</b>	Indicates uncertainty about an assigned global rank.
<b>G/SU</b>	Unable to assign rank due to lack of available information.
<b>GQ</b>	Indicates uncertainty about taxonomic status.
<b>G/SH</b>	Historically known, but usually not verified for an extended period of time.
<b>G#T#</b>	Trinomial rank (T) is used for subspecies or varieties. These taxa are ranked on the same criteria as G1-G5.
<b>S#B</b>	Refers to the breeding season imperilment of elements that are not residents.
<b>S#N</b>	Refers to the non-breeding season imperilment of elements that are not permanent residents. Where no consistent location can be discerned for migrants or non-breeding populations, a

	rank of SZN is used.
<b>SZ</b>	Migrant whose occurrences are too irregular, transitory and/or dispersed to be reliably identified, mapped and protected.
<b>SA</b>	Accidental in the state.
<b>SR</b>	Reported to occur in the state but unverified.
<b>S?</b>	Unranked. Some evidence that species may be imperiled, but awaiting formal rarity ranking.
	Note: Where two numbers appear in a state or global rank (for example, S2S3), the actual rank of the element is uncertain, but falls within the stated range.

### *Legal Designations for Rare Species*

Natural Heritage imperilment ranks should not be interpreted as legal designations. Although most species protected under state or federal endangered species laws are extremely rare, not all rare species receive legal protection. Legal status is designated by both the U.S. Fish and Wildlife Service under the Endangered Species Act or by the Colorado Division of Wildlife under Colorado Statutes 33-2-105 Article 2. In addition, the U.S. Forest Service recognizes some species as “Sensitive,” as does the Bureau of Land Management. Table 5 defines the special status assigned by these agencies and provides a key to abbreviations used by CNHP.

Table 5. Federal and State Agency Special Designations for Rare Species.

<b>Federal Status:</b>	
<b>1. U.S. Fish and Wildlife Service (58 Federal Register 51147, 1993) and (61 Federal Register 7598, 1996)</b>	
LE	Listed Endangered: defined as a species, subspecies, or variety in danger of extinction throughout all or a significant portion of its range.
LT	Listed Threatened: defined as a species, subspecies, or variety likely to become endangered in the foreseeable future throughout all or a significant portion of its range.
P	Proposed: taxa formally proposed for listing as Endangered or Threatened (a proposal has been published in the Federal Register, but not a final rule).
C	Candidate: taxa for which substantial biological information exists on file to support proposals to list them as endangered or threatened, but no proposal has been published yet in the Federal Register.
PDL	Proposed for delisting.
XN	Nonessential experimental population.
<b>2. U.S. Forest Service (Forest Service Manual 2670.5) (noted by the Forest Service as S’)</b>	
FS	Sensitive: those plant and animal species identified by the Regional Forester for which population viability is a concern as evidenced by: Significant current or predicted downward trends in population numbers or density. Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.
<b>3. Bureau of Land Management (BLM Manual 6840.06D) (noted by BLM as “S”)</b>	
BLM	Sensitive: those species found on public lands designated by a State Director that could easily become endangered or extinct in a state. The protection provided for sensitive species is the same as that provided for C (candidate) species.
<b>4. State Status:</b>	
The Colorado Division of Wildlife has developed categories of imperilment for non-game species (refer to the Colorado Division of Wildlife’s Chapter 10 – Nongame Wildlife of the Wildlife Commission’s regulations). The categories being used and the associated CNHP codes are provided below.	
E	Endangered: those species or subspecies of native wildlife whose prospects for survival or recruitment within this state are in jeopardy, as determined by the Commission.
T	Threatened: those species or subspecies of native wildlife which, as determined by the Commission, are not in immediate jeopardy of extinction but are vulnerable because they exist in such small numbers, are so extremely restricted in their range, or are experiencing such low recruitment or

	survival that they may become extinct.
SC	Special Concern: those species or subspecies of native wildlife that have been removed from the state threatened or endangered list within the last five years; are proposed for federal listing (or are a federal listing “candidate species”) and are not already state listed; have experienced, based on the best available data, a downward trend in numbers or distribution lasting at least five years that may lead to an endangered or threatened status; or are otherwise determined to be vulnerable in Colorado.

### *Element Occurrences and their Ranking*

Actual locations of elements, whether they are single organisms, populations, or plant communities, are referred to as element occurrences. The element occurrence is considered the most fundamental unit of conservation interest and is at the heart of the Natural Heritage Methodology. To prioritize element occurrences for a given species, an element occurrence rank (EO-Rank) is assigned according to the ecological quality of the occurrences whenever sufficient information is available. This ranking system is designed to indicate which occurrences are the healthiest and ecologically the most viable, thus focusing conservation efforts where they will be most successful. The EO-Rank is based on three factors:

**Size** – a measure of the area or abundance of the element’s occurrence. Takes into account factors such as area of occupancy, population abundance, population density, population fluctuation and minimum dynamic area (which is the area needed to ensure survival or re-establishment of an element after natural disturbance). This factor for an occurrence is evaluated relative to other known and/or presumed viable, examples.

**Condition/Quality** – an integrated measure of the composition, structure and biotic interactions that characterize the occurrence. This includes measures such as reproduction, age structure, biological composition (such as the presence of exotic versus native species), structure (for example, canopy, understory and ground cover in a forest community) and biotic interactions (such as levels of competition, predation and disease).

**Landscape Context** – an integrated measure of two factors: the dominant environmental regimes and processes that establish and maintain the element and connectivity. Dominant environmental regimes and processes include herbivory, hydrologic and water chemistry regimes (surface and groundwater), geomorphic processes, climatic regimes (temperature and precipitation), fire regimes and many kinds of natural disturbances. Connectivity includes such factors as a species having access to habitats and resources needed for life cycle completion, fragmentation of ecological communities and systems and the ability of the species to respond to environmental change through dispersal, migration, or re-colonization.

Each of these factors is rated on a scale of A through D, with A representing an excellent rank or D representing a poor rank. These ranks for each factor are then averaged to determine an appropriate EO-Rank for the occurrence. If not enough information is available to rank an element occurrence, an EO-Rank of E is assigned. EO-Ranks and their definitions are summarized in Table 6.

Table 6. Element Occurrence Ranks and their Definitions.

<b>A</b>	Excellent viability.
<b>B</b>	Good viability
<b>C</b>	Fair viability.
<b>D</b>	Poor viability.
<b>H</b>	Historic: known from historical record, but not verified for an extended period of time.
<b>X</b>	Extirpated (extinct within the state).
<b>E</b>	Extant: the occurrence does exist but not enough information is available to rank.
<b>F</b>	Failed to find: the occurrence could not be relocated.

### *Potential Conservation Areas*

In order to successfully protect populations or occurrences CNHP designs Potential Conservation Areas (PCAs). These PCAs focus on capturing the ecological processes that are necessary to support the continued existence of a particular element occurrence of natural heritage significance. PCAs may include a single occurrence of a rare element, or a suite of rare element occurrences or significant features. The PCA is designed to identify a land area that can provide the habitat and ecological processes upon which a particular element occurrence, or suite of element occurrences, depends for its continued existence. The best available knowledge about each species' life history is used in conjunction with information about topographic, geomorphic and hydrologic features; vegetative cover; and current and potential land uses. In developing the boundaries of a PCA, CNHP scientists consider a number of factors that include, but are not limited to:

- Ecological processes necessary to maintain or improve existing conditions;
- Species movement and migration corridors;
- Maintenance of surface water quality within the PCA and the surrounding watershed;
- Maintenance of the hydrologic integrity of the groundwater;
- Land intended to buffer the PCA against future changes in the use of surrounding lands;
- Exclusion or control of invasive exotic species; and
- Land necessary for management or monitoring activities.

The boundaries presented are meant to be used for conservation planning purposes and have no legal status. The proposed boundary does not automatically recommend exclusion of any activity. Rather, the boundaries designate ecologically significant areas in which land managers may wish to consider how specific activities or land use changes within or near the PCA affect the natural heritage resources and sensitive species on which the PCA is based. Please note that these boundaries are based on our best estimate of the primary area supporting the long-term survival of targeted species and plant communities. A thorough analysis of the human context and potential stresses has not been conducted. However, CNHP's conservation planning staff is available to assist with these types of analyses where conservation priority and local interest warrant additional research.

### *Ranking of Potential Conservation Areas*

CNHP uses element and element occurrence ranks to assess the overall biological diversity significance of a PCA, which may include one or many element occurrences. Based on these ranks, each PCA is assigned a biological diversity rank (or B-rank). See Table 7 for a summary of these B-ranks.

Table 7. Natural Heritage Program Biological Diversity Ranks and their Definitions.

<b>B1</b>	Outstanding Significance (indispensable): only known occurrence of an element A-ranked occurrence of a G1 element (or at least C-ranked if best available occurrence) concentration of A- or B-ranked occurrences of G1 or G2 elements (four or more)
<b>B2</b>	Very High Significance: B- or C-ranked occurrence of a G1 element A- or B-ranked occurrence of a G2 element One of the most outstanding (for example, among the five best) occurrences rangewide (at least A- or B-ranked) of a G3 element. Concentration of A- or B-ranked G3 elements (four or more) Concentration of C-ranked G2 elements (four or more)
<b>B3</b>	High Significance: C-ranked occurrence of a G2 element A- or B-ranked occurrence of a G3 element D-ranked occurrence of a G1 element (if best available occurrence) Up to five of the best occurrences of a G4 or G5 community (at least A- or B-ranked) in an ecoregion (requires consultation with other experts)
<b>B4</b>	Moderate Significance: Other A- or B-ranked occurrences of a G4 or G5 community C-ranked occurrence of a G3 element A- or B-ranked occurrence of a G4 or G5 S1 species (or at least C-ranked if it is the only state, provincial, national, or ecoregional occurrence) Concentration of A- or B-ranked occurrences of G4 or G5 N1-N2, S1-S2 elements (four or more) D-ranked occurrence of a G2 element At least C-ranked occurrence of a disjunct G4 or G5 element Concentration of excellent or good occurrences (A- or B-ranked) of G4 S1 or G5 S1 elements (four or more)
<b>B5</b>	General or State-wide Biological Diversity Significance: good or marginal occurrence of common community types and globally secure S1 or S2 species.

### *Protection Urgency Ranks*

Protection urgency ranks (P-ranks) refer to the timeframe in which it is recommended that conservation protection occur. In most cases, this rank refers to the need for a major change of protective status (for example agency special area designations or ownership). The urgency for protection rating reflects the need to take legal, political, or other administrative measures to protect the area. Table 8 summarizes the P-ranks and their definitions.



Table 8. Natural Heritage Program Protection Urgency Ranks and their Definitions

<b>P1</b>	Protection actions needed immediately. It is estimated that current stresses may reduce the viability of the elements in the PCA within 1 year.
<b>P2</b>	Protection actions may be needed within 5 years. It is estimated that current stresses may reduce the viability of the elements in the PCA within this approximate timeframe.
<b>P3</b>	Protection actions may be needed, but probably not within the next 5 years. It is estimated that current stresses may reduce the viability of the elements in the PCA if protection action is not taken.
<b>P4</b>	No protection actions are needed in the foreseeable future.
<b>P5</b>	Land protection is complete and no protection actions are needed.

A protection action involves increasing the current level of protection accorded one or more tracts within a potential conservation area. It may also include activities such as educational or public relations campaigns, or collaborative planning efforts with public or private entities, to minimize adverse impacts to element occurrences at a site. It does not include management actions. Situations that may require a protection action may include the following:

- Forces that threaten the existence of one or more element occurrences at a PCA. For example, development that would destroy, degrade or seriously compromise the long-term viability of an element occurrence; or timber, range, recreational, or hydrologic management that is incompatible with an element occurrence's existence;
- The inability to undertake a management action in the absence of a protection action; for example, obtaining a management agreement;
- In extraordinary circumstances, a prospective change in ownership or management that will make future protection actions more difficult.

#### *Management Urgency Ranks*

Management urgency ranks (M-ranks) indicate the timeframe in which it is recommended that a change occur in management of the PCA. This rank refers to the need for management in contrast to protection (for example, increased fire frequency, decreased grazing, weed control, etc.). The urgency for management rating focuses on land use management or land stewardship action required to maintain element occurrences at the potential conservation area.

A management action may include biological management (prescribed burning, removal of exotics, mowing, etc.) or people and site management (building barriers, re-routing trails, patrolling for collectors, hunters, or trespassers, etc.). Management action does not include legal, political, or administrative measures taken to protect a potential conservation area. Table 9 summarizes M-ranks and their definitions.

Table 9. Natural Heritage Program Management Urgency Ranks and their Definitions

<b>M1</b>	Management actions may be required within one year or the element occurrences could be lost or irretrievably degraded.
<b>M2</b>	New management actions may be needed within 5 years to prevent the loss of the element occurrences within the PCA.
<b>M3</b>	New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the PCA.
<b>M4</b>	Current management seems to favor the persistence of the elements in the PCA, but management actions may be needed in the future to maintain the current quality of the element occurrences.
<b>M5</b>	No management needs are known or anticipated in the PCA.

### **National Wetland Inventory Map Digitizing**

As part of the collaboration with the EPA-funded North Platte Basinwide Wetland Profile and Condition Assessment project, original National Wetland Inventory (NWI) paper topographic maps were scanned, brought into ArcGIS 9.2 and geo-referenced. Wetland polygon features were extracted using Definiens eCognition image recognition software (Definiens, Inc., New Jersey, USA). Once polygons were extracted, extraneous lines and jagged edges were cleaned by hand ArcGIS. Each polygon was attributed using the original NWI code, following the US FWS's Cowardin classification (Cowardin et al. 1979). All polygons and attributes were reviewed for quality assurance using the QA/QC tools available from the NWI program. Invalid codes no longer used by the NWI program were updated to the currently accepted codes. No effort was made to modify polygons based on land use changes since the original photo interpretation. The goal of the effort was to digitize the original NWI maps as they were and not to update or re-photo interpret wetlands.

### **Colorado River Watch Program Sampling**

CNHP staff and NPBRT Non-consumptive Needs committee chair, Barbara Vasquez attended a one day workshop in May 2009 conducted by CDOW personnel on sampling protocol. The following are field data collected for 12 sampling stations:

1. River temperature,
2. pH,
3. Total Alkalinity,
4. Hardness and
5. Dissolved oxygen.

Additional samples were sent to River Watch personnel to determine metals and nutrients. For sampling protocol see <http://wildlife.state.co.us/landwater/riverwatch/>

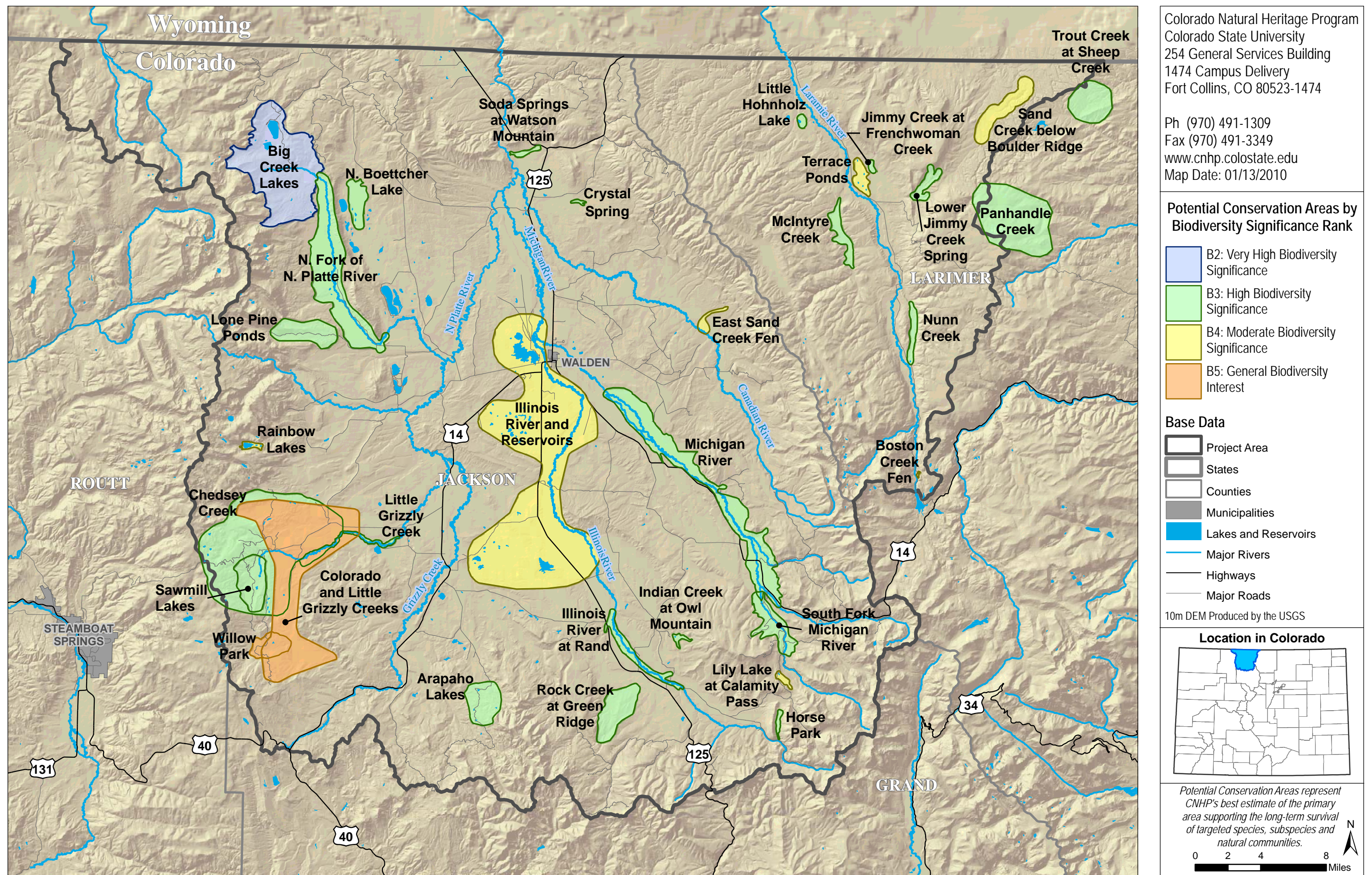
# RESULTS

Results of the 2009 survey of North Platte River Watershed's important wetlands confirmed that there are many areas with high biological significance. CNHP ecology team documented 13 new plant occurrences and 25 new plant community occurrences. CNHP zoology team documented 30 new animal occurrences (Table 11) that are contained within 32 Potential Conservation Areas (PCAs) in the North Platte River Watershed (Table 10) (Map 1).

Table 10. Potential Conservation Areas in North Platte River Watershed.

Biodiversity Rank	Potential Conservation Area
B2: Very High Biodiversity Significance	Big Creek Lakes
B3: High Biodiversity Significance	Arapaho Lakes Chedsey Creek Crystal Spring Horse Park Illinois River at Rand Indian Creek at Owl Mountain Jimmy Creek at Frenchwoman Creek Little Grizzly Creek Little Hohnholz Lake Lone Pine Ponds Lower Jimmy Creek Spring McIntyre Creek Michigan River North Boettcher Lake North Fork of North Plattte River Nunn Creek Panhandle Creek Rock Creek at Green Ridge Sawmill Lakes Soda Springs at Watson Mountain South Fork Michigan River Trout Creek at Sheep Creek
B4: Moderate Biodiversity Significance	Boston Creek Fen East Sand Creek Fen Illinois River and Reservoirs Lily Lake at Calamity Pass Rainbow Lakes Sand Creek below Boulder Ridge Terrace Ponds
B5: General Biodiversity Significance	Colorado and Little Grizzly Creeks Willow Park





Map 1. Wetland and Riparian Potential Conservation Areas in the North Platte Watershed.



During the course of the summer, CNHP had access to over 177,000 privately owned acres, approximately 45% of the private land in the watershed (Figure 14) and many of the wetland dependent elements were documented on these private lands.

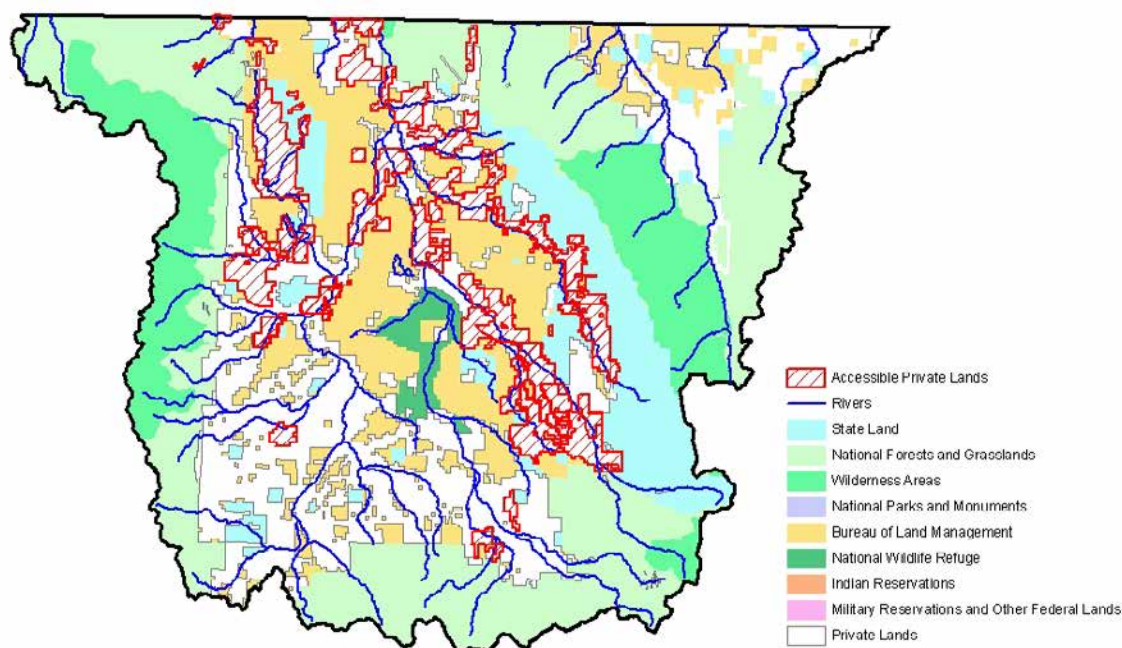


Figure 14. Accessible Private Lands during 2009.

There are three PCAs, Big Creek Lakes, Chedsey Creek and Arapaho Lakes, which are the only known sites that support all three montane amphibians: the State Endangered (G4T1QS1) boreal toad (*Bufo boreas*) and two state rare (G5S3) amphibians--northern leopard frog (*Rana pipiens*) and the wood frog (*Rana sylvatica*). The western chorus frog was documented frequently and across all elevations, but only one occurrence of the northern leopard frog was documented in 2009 from the basin floor even though suitable habitat was documented throughout the park.



Boreal toad. B. Lambert

The Sawmill Lakes, Big Creek Lakes and Willow Park PCAs encompass floating mat fens that harbor numerous state rare sedges, such as; mud sedge (*Carex limosa*), livid sedge (*C. livida*), slender sedge (*C. lasiocarpa*), bristly-stalk sedge (*C. leptalea*) and little green sedge (*C. viridula*). These plants, as well as the state rare insectivorous plant, roundleaf sundew (*Drosera rotundifolia*) are common in the boreal regions of North America (Wolf et al. 2005). These fen species are considered relic or disjunct species from the Tertiary age when the North America flora was contiguous with Asiatic flora



*Salix candida*. D. Culver

(Weber 2003). They are adapted to cold and wet environments and have persisted in the Rocky Mountains only in specialized habitats, such as floating mat fens (Cooper 2005).

In one newly documented fen, East Sand Creek PCA, a Jackson County record for the state rare (G5S2) sageleaf willow (*Salix candida*) was documented. This willow is also fairly common in more northern (boreal) latitudes of North America, but is found only in isolated populations in Colorado, Wyoming and South Dakota. Throughout its range, sageleaf willow is an indicator of fens.

Riparian shrublands are the dominate wetland type in the North Platte River Watershed; more important is the fact that these wetland complexes are presently intact and contiguous, providing migration corridors and habitat for animals (including aquatic vertebrates and invertebrates). These riparian wetlands are highly functioning due to the absence of any major hydrological modifications and consequently, the presence of intact floodplains. The willow shrublands are dominated by Geyer willow (*Salix geyeriana*) and Rocky Mountain willow (*S. monticola*), which are the primary shrub component for several globally vulnerable (G3) plant communities. The Michigan River PCA and Illinois River at Rand PCA are the best observed examples of these contiguous riparian shrub habitats observed during the project due to intact hydrology and beaver activity.

Riparian shrublands are the dominate wetland type in the North Platte River Watershed; more important is the fact that these



Illinois River. D. Culver



Table 11. Significant Wetland Dependent Elements Known From North Platte River Watershed (as of 12/31/2009) and the NWI Classification for Plant Communities.

Scientific Name	Common Name	Globe Rank	State Rank	NWI Class	USESA	FEDSENS
<b>Amphibians</b>						
Bufo boreas boreas	Western Toad - Southern Rocky Mountains	G4T1Q	S1			
Rana pipiens	Northern Leopard Frog	G5	S3			BLM/USFS
Rana sylvatica	Wood Frog	G5	S3			USFS
<b>Birds</b>						
Catoptrophorus semipalmatus	Willet	G5	S1B			
Centrocercus urophasianus	Greater Sage-Grouse	G4	S4			BLM/USFS
Grus canadensis tabida	Greater Sandhill Crane	G5T4	S2B,S4N			
Numenius americanus	Long-billed Curlew	G5	S2B			BLM/USFS
Pelecanus erythrorhynchos	American White Pelican	G3	S1B			BLM
Plegadis chihi	White-faced Ibis	G5	S2B			BLM
Sterna forsteri	Forster's Tern	G5	S2B,S4N			
<b>Invertebrate</b>						
Acroloxus coloradensis	Rocky Mountain Capshell	G3	S1			USFS
<b>Plant Communities</b>						
Abies lasiocarpa - Picea engelmannii / Alnus incana Forest	Subalpine fir-Engelmann spruce/ thin leaf alder forest	G5	S5	PFO		
Abies lasiocarpa - Picea engelmannii / Mertensia ciliata Forest	Subalpine fire-Engelmann spruce/bluebell forest	G5	S5	PFO		
Abies lasiocarpa - Picea engelmannii / Vaccinium myrtillus Forest	Subalpine fir-Engelmann spruce/grouse whortle berry forest	G5	S5	PFO		
Alnus incana / Mesic Forbs Shrubland	Thin leaf alder/ mesic forbs shrubland	G3	S3	PSS		
Betula nana / Mesic Forbs - Mesic Graminoids Shrubland	Bog birch/mesic forb and mesic grasses shrubland	G3G4	S3	PSS		
Carex aquatilis - Carex utriculata Herbaceous Vegetation	Water sedge – beaked sedge herbaceous vegetation	G4	S4	PEM		
Carex lasiocarpa Herbaceous Vegetation	Woolly sedge herbaceous vegetation	G4?	S1	PEM		
Carex simulata Herbaceous Vegetation	Analouge sedge herbaceous vegetation	G4	S3	PEM		
Carex utriculata Herbaceous Vegetation	Beaked sedge herbaceous vegetation	G5	S4	PEM		
Deschampsia caespitosa - Carex nebrascensis Herbaceous Vegetation	Tufted hairgrass-Nebraska sedge herbaceous vegetation	G3?Q	S1	PEM		
Eleocharis quinqueflora Herbaceous Vegetation	Few flowered spikerush herbaceous vegetation	G4	S3S4	PEM		
Glaux maritima Herbaceous Vegetation	Sea milkwort herbaceous vegetation	G3	S2	PEM		

Scientific Name	Common Name	Globe Rank	State Rank	NWI Class	USESA	FEDSENS
Glyceria borealis Herbaceous Vegetation	Northern mannagrass herbaceous vegetation	G4	S3	PEM		
Nuphar lutea ssp. polysepala Herbaceous Vegetation	Rocky Mountain pond lily herbaceous vegetation	G5	S3	PAB		
Picea pungens / Alnus incana Woodland	Colorado blue spruce/ thin leaf alder woodland	G3	S3	PFO		
Populus tremuloides / Alnus incana Forest	Quaking aspen/ thin leaf alder forest	G3	S3	PFO		
Salix bebbiana Shrubland	Bebb's willow shrubland	G3?	S2	PSS		
Salix drummondiana / Calamagrostis canadensis Shrubland	Drummond's willow/ bluejoint reedgrass shrubland	G3	S3	PSS		
Salix drummondiana / Mesic Forbs Shrubland	Drummond's willow/ mesic forbs shrubland	G4	S4	PSS		
Salix geyeriana - Salix monticola / Calamagrostis canadensis Shrubland	bluejoint reedgrass shrubland	G3	S3	PSS		
Salix geyeriana - Salix monticola / Mesic Forbs Shrubland	Geyer's willow- Rocky Mountain willow/ mesic forbs shrubland	G3	S3	PSS		
Salix geyeriana / Calamagrostis canadensis Shrubland	Geyer's willow/ bluejoint reedgrass shrubland	G5	S3	PSS		
Salix geyeriana / Carex aquatilis Shrubland	Geyer's willow/ water sedge shrubland	G3	S3	PSS		
Salix geyeriana / Carex utriculata Shrubland	Geyer's willow/ beaked sedge shrubland	G5	S3	PSS		
Salix geyeriana / Mesic Forbs Shrubland	Geyer's willow/ mesic forbs shrubland	G3	S3	PSS		
Salix geyeriana / Mesic Graminoids Shrubland	Geyer's willow/ mesic graminoids shrubland	G3?	S3	PSS		
Salix monticola / Calamagrostis canadensis Shrubland	Rocky Mountain willow/ bluejoint reedgrass shrubland	G3	S3	PSS		
Salix monticola / Carex aquatilis Shrubland	Rocky Mountain willow/ water sedge shrubland	G3	S3	PSS		
Salix monticola / Mesic Forbs Shrubland	Rocky Mountain willow/ mesic forbs shrubland	G4	S3	PSS		
Salix monticola / Mesic Graminoids Shrubland	Rocky Mountain willow/mesic graminoids shrubland	G3	S3	PSS		
Salix planifolia / Carex aquatilis Shrubland	Planeleaf willow/ water sedge shrubland	G5	S4	PSS		
Salix wolfii / Carex aquatilis Shrubland	Wolf willow/ water sedge shrubland	G4	S3	PSS		
Salix wolfii / Mesic Forbs Shrubland	Wolf willow/mesic forbs shrubland	G3	S3	PSS		
Schoenoplectus acutus - Typha latifolia - Herbaceous Vegetation	Bulrush – cattail herbaceous vegetation	G4	S2S3	PEM		

Scientific Name	Common Name	Globe Rank	State Rank	NWI Class	USESA	FEDSENS
Schoenoplectus maritimus Herbaceous Vegetation	Alkali Bulrush herbaceous vegetation	G4	S2	PEM		
Triglochin maritima Herbaceous Vegetation	Seaside arrowgrass herbaceous vegetation	GU	SU	PEM		
<b>Vascular Plants</b>						
Allium schoenoprasum var. sibiricum	Wild Chives	G5T5	S1			
Azaleastrum albiflorum	White-flowered Azalea	G4	S2			
Carex diandra	Lesser Panicked Sedge	G5	S1			USFS
Carex lasiocarpa	Slender Sedge	G5	S1			
Carex leptalea	Bristly-stalk Sedge	G5	S1			
Carex limosa	Mud Sedge	G5	S2			
Carex livida	Livid Sedge	G5	S1			BLM/USFS
Carex viridula	Little Green Sedge	G5	S1			BLM
Comarum palustre	Marsh Cinquefoil	G5	S1S2			
Cypripedium fasciculatum	Clustered Lady's-slipper	G4	S3			
Drosera rotundifolia	Roundleaf Sundew	G5	S2			USFS
Eriophorum gracile	Slender Cotton-grass	G5	S2			BLM/USFS
Listera borealis	Northern Twayblade	G4	S2			BLM
Listera convallarioides	Broad-leaved Twayblade	G5	S2			
Packera debilis	Rocky Mountain Ragwort	G4	S1			
Sagittaria calycina var. calycina	Long-lobe Arrowhead	G5T5?	S1			
Salix candida	Hoary Willow	G5	S2			BLM/USFS
Sisyrinchium pallidum	Pale Blue-eye-grass	G2G3	S2			BLM
Thelypodium paniculatum	Northwestern Thelypody	G2	S1			
Thelypodium sagittatum	Slender Thelypody	G4	S1			
Utricularia minor	Lesser Bladderwort	G5	S2			USFS

### Wetland Mapping and Wetland Plant Communities

Through the EPA-funded *North Platte Basinwide Wetland Profile and Condition Assessment* project, 44 original National Wetland Inventory paper topographic maps were scanned and digitized. Four additional topographic quads had already been digitized prior to this project. Of the 1,289,005 acres in the North Platte River Watershed, 10% are classified as wetlands according to the National Wetland Inventory maps. The intersection between the number of wetland acres from the NWI maps and the CDSS (2005) data is 78,038. The amount of 115,375 irrigated acres is the official amount submitted by the State Engineers Office as required by the North Platte Decree in 2009.

The majority of the wetland acres, 69%, are located in the sagebrush park ecosystem, which is mainly privately owned (Table 12). However, based on information from the Colorado Decision Support System (2009), 76% of mapped wetland acres within the sagebrush park ecosystem are irrigated lands (Figure 15).

Table 12. Total acres within each Omernik ecoregion with NWI classification.

	Totals in acres						
	All Wetlands				Total		
	PAB (Aquatic Bed)	PFO (Forested Wetland)	PSS (Shrub Wetland)	PEM (Emergent Wetland)	All Wetlands	Irrigated Wetlands	% Irrigated
Laramie Basin	12	13	1,491	3,887	5,403 (4%)	2,601	<b>48%</b>
Sagebrush Parks	1,210	2	6,919	81,726	89,857 (69%)	68,143	<b>76%</b>
Mid-Elevation	1,086	138	9,009	10,148	20,381 (16%)	7,260	<b>36%</b>
Subalpine	972	128	8,177	4,384	13,661 (10%)	34	<b>.25%</b>
Alpine	40	0	509	583	1,132 (1%)	0	<b>0%</b>
<b>Grand Total</b>	<b>3,320</b>	<b>281</b>	<b>26,105</b>	<b>100,728</b>	<b>130,434</b>	<b>78,038</b>	<b>60%</b>

A key environmental attribute requested by the NPBRT and its Non-consumptive Needs sub-committee was the mapping of wetland types and wetland plant communities. Using ArcGIS, the NWI layer was intersected with Omernik's Ecoregions. The result was maps of five broad based ecoregions: Laramie Basin, Sagebrush Park, Mid Elevation, Subalpine and Alpine (Figures 16, 17, 18; maps were not produced for the subalpine and alpine ecoregions due to the relative small coverage of wetlands within the scale of the ecoregions). Potential habitat for plant communities listed in Table 10 can be located based on the NWI Class affiliation.

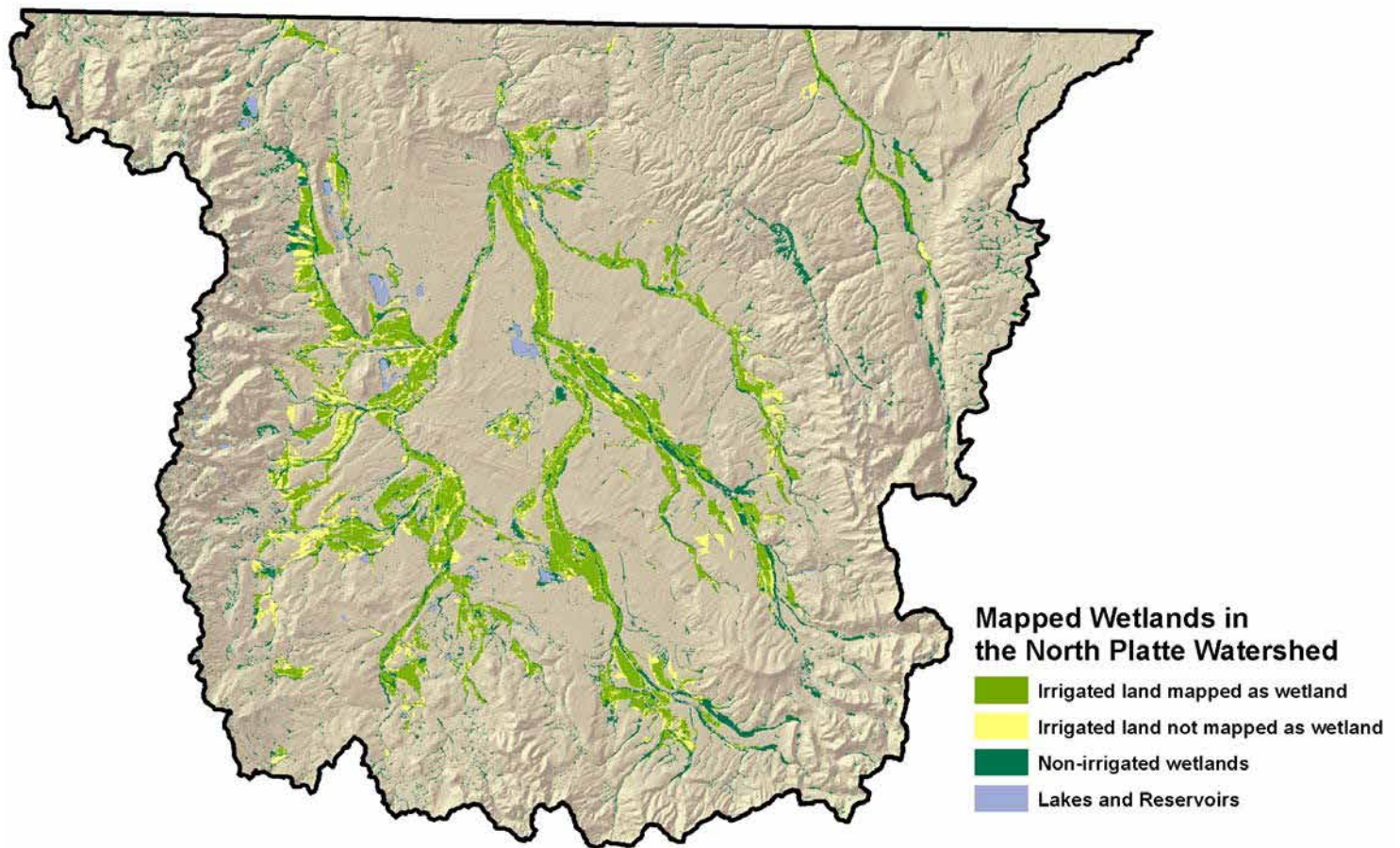


Figure 15. Irrigated wetlands in North Platte River Watershed

# **Mapped Wetlands in the Laramie Basin Ecoregion of the North Platte Watershed**

## **Wetland Type:**

- |   |  |
|---|--|
|  PAB (Aquatic Bed) |  PSS (Scrub- Shrub Wetland) |
|  PEM (Emergent)    |  PFO (Forested Wetland)     |

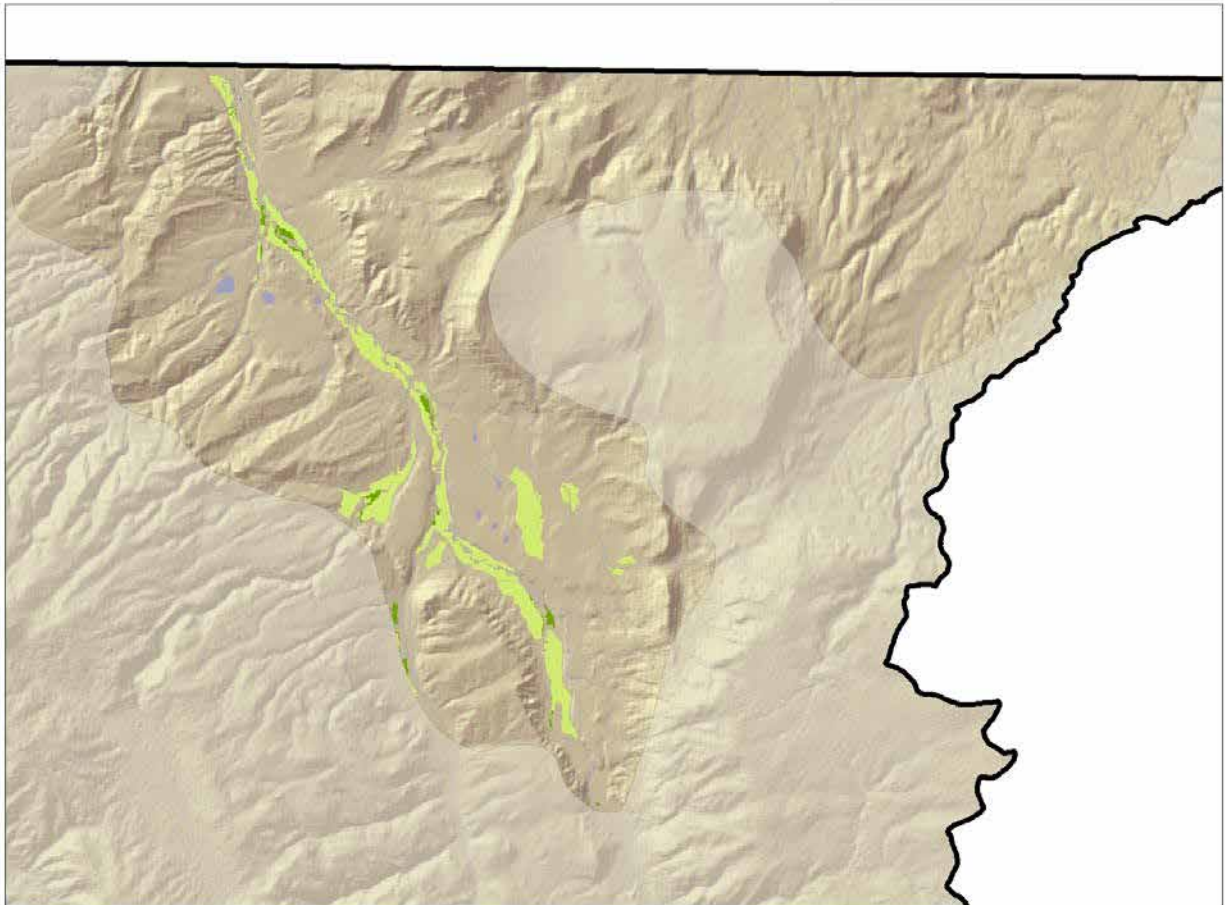
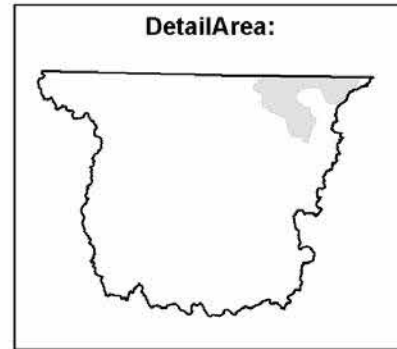


Figure 16. Mapped Wetlands in the Laramie Basin Ecoregions.



**Mapped Wetlands in the Sagebrush Parks Ecoregion of the North Platte Watershed**

Wetland Type:

- |   |  |
|---|--|
|  PAB (Aquatic Bed) |  PSS (Scrub- Shrub Wetland) |
|  PEM (Emergent)    |  PFO (Forested Wetland)     |

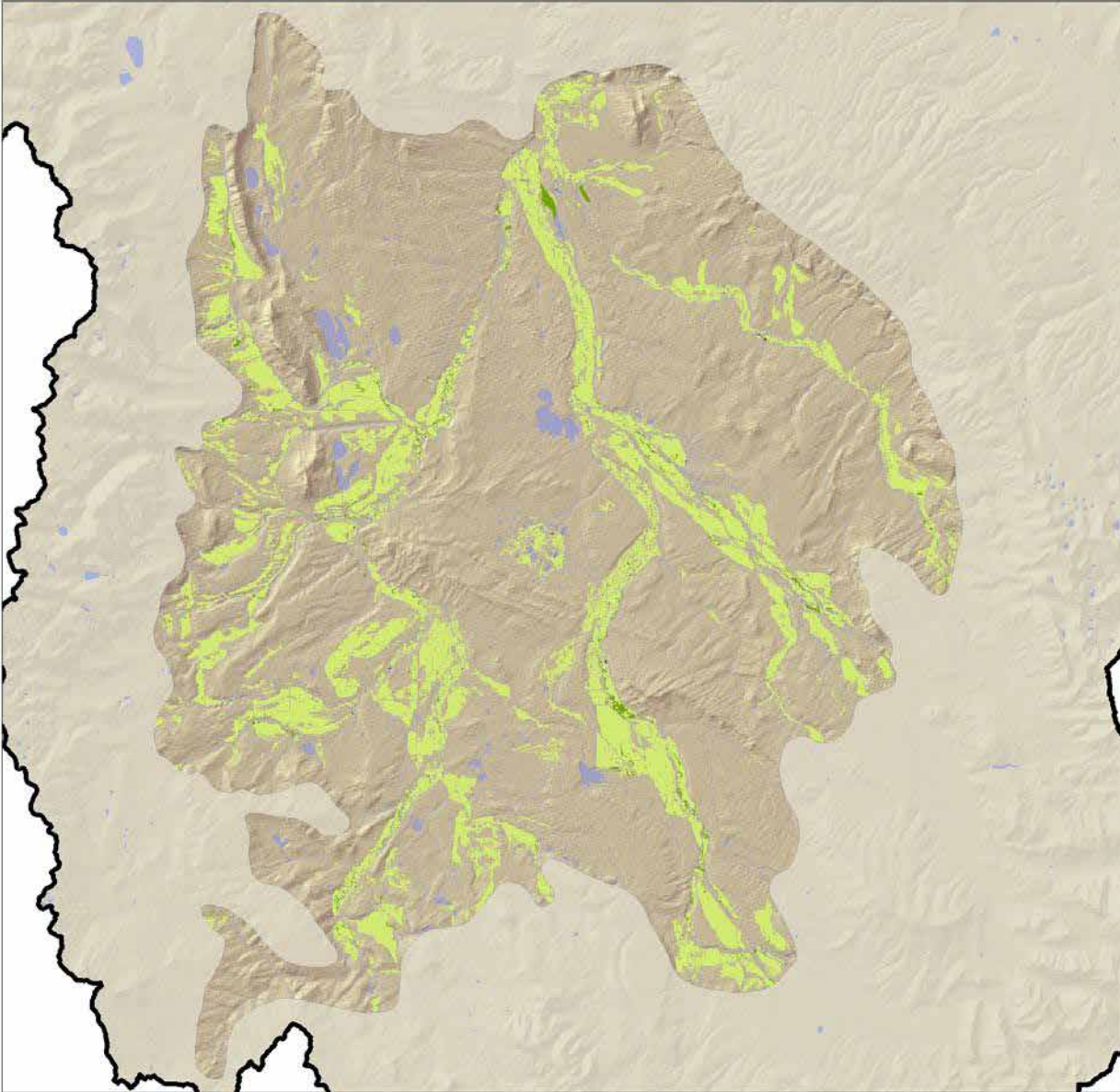


Figure 17. Mapped Wetlands in the Sagebrush Parks Ecoregion.

## Mapped Wetlands in the Mid-elevation Ecoregions of the North Platte Watershed

### Wetland Type:

 PAB (Aquatic Bed)	 PSS (Scrub- Shrub Wetland)
 PEM (Emergent)	 PFO (Forested Wetland)

### DetailArea:

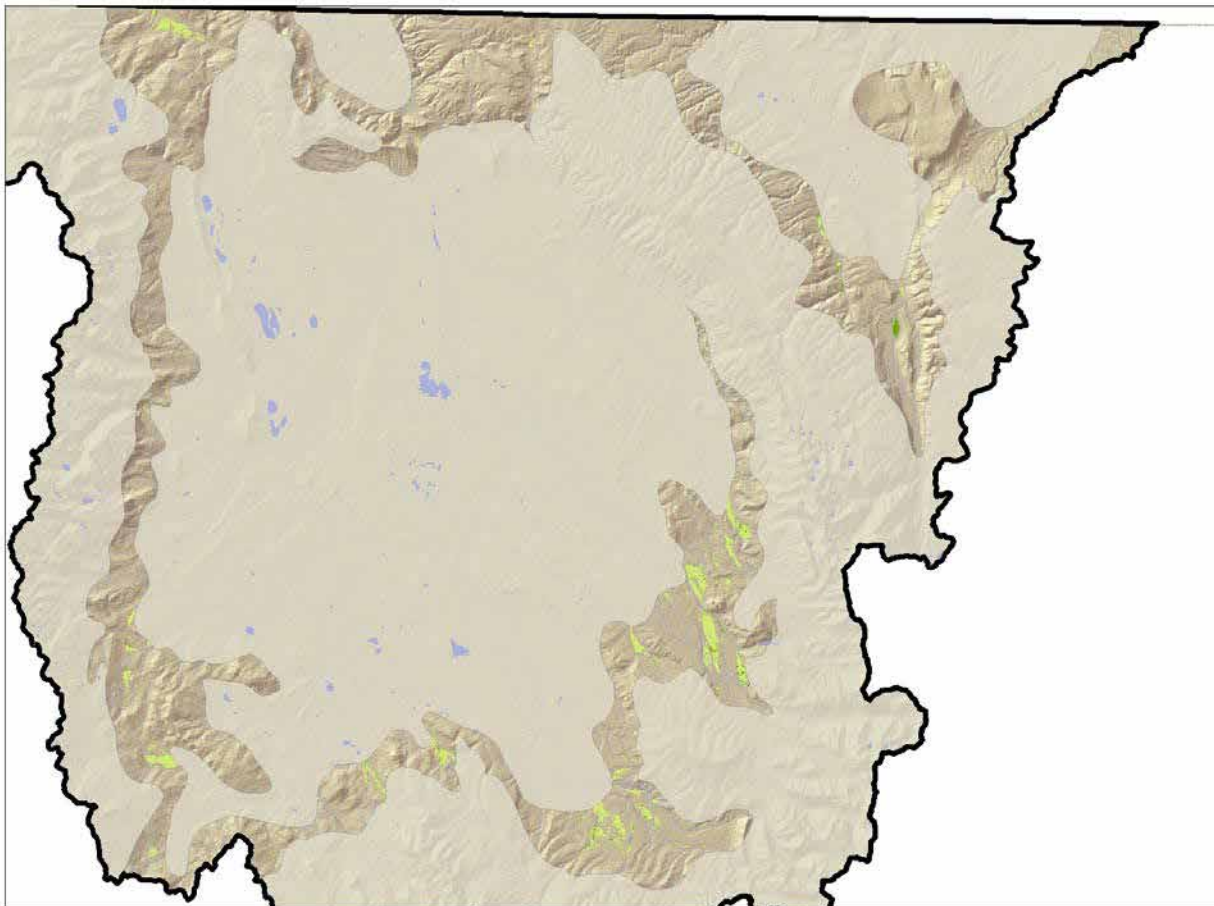
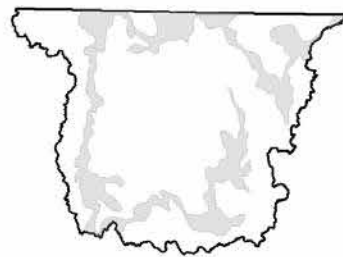


Figure 18. Mapped Wetlands in the Mid-elevation Ecoregions.

### **Colorado River Watch Sampling**

CNHP collected water samples from 12 stations throughout the watershed. These data are the baseline information for future sampling. The following parameters were measured: temperature, dissolved oxygen, pH, alkalinity, hardness, nutrients (Chloride, Nitrate, Sulfate, Total Phosphates and Total Suspended Solids) and metals (Aluminum, Arsenic, Selenium, Zinc, Cadmium, Copper, Lead, Iron) (Table 13). Field data taken by CNHP staff consisted of river temperature, pH, total alkalinity, hardness and dissolved oxygen. Minerals and nutrient samples were sent to River Watch staff for evaluation. The mineral data are pending from River Watch staff and were not available for the report. Per Barb Horn, CDOW Water Resource Specialist, there are no standard values available to compare the North Platte results to, however there were no values in the 2009 results that were out of the normal range for other sampled Colorado waters.

Table 13. Results from North Platte Water Samples.

Sample Date	Station Number	River	Dissolved Oxygen (mg/l)	Dissolved Oxygen (% sat)	pH	Phenol Alkalinity (µg/l)	Total Alkalinity as CaCO <sub>3</sub> (mg/l)	Total Hardness (mg/l)	Temp (C)	Chloride (mg/l)	Nitrate (µg/l)	Sulfate (mg/l)	Total Phosphate (mg/l)	Total Suspended Solids (mg/l)
6/9/2009	3900	N Fork N. Platte	8.2	68	8.3	0	34	54	N/A	0.00	0.03	6.43	0.01	11.20
6/10/2009	3901	Roaring Fork	7.3	66	7.9	0	110	102	N/A	1.62	0.00	18.90	0.07	11.60
6/25/2009	3902	Owl Creek	7	70	8.3	N/A	440	500	16.2	0.00	0.00	25.90	0.02	10.40
7/9/2009	3903	North Platte River	8.4	84	8.4	8	123	122	N/A	1.67	0.00	24.90	0.05	8.70
7/2/2009	3904	Little Grizzly Creek	6.8	70	8	0	100	110	17.4	0.00	0.10	21.50	0.03	8.80
8/19/2009	3905	Canadian River	N/A	66	8.4	16	84	92	17.3	0.00	0.03	25.30	0.03	7.90
8/14/2009	3906	Illinois River	11.3	115	8.4	20	112	100	16.9	1.42	0.00	8.66	0.03	1.90
8/14/2009	3907	North Platte	6.7	62	N/A	4	76	88	15	1.12	0.00	15.20	0.02	4.60
8/14/2009	3908	Illinois River	8.5	79	8.3	8	84	76	17.6	1.04	0.00	7.16	0.02	0.00
8/14/2009	3909	Michigan River	9.9	103	8.4	28	106	100	17.3	1.46	0.00	13.80	0.03	0.00
9/16/2009	3910	Grizzly Creek	N/A	72	8.1	0	54	150	13.7	1.09	0.00	7.13	0.16	7.60
8/20/2009	3911	Hell Creek	8	73	8.3	12	184	178	11.31	3.19	0.00	46.40	0.04	11.20

## DISCUSSION

The results from the *Identification and Assessment of Important Wetlands within the North Platte River Watershed* project clearly illustrate the importance of non-consumptive uses within the watershed. The wetlands of the watershed support the only known Colorado locations where all three of the montane amphibians (boreal toad, wood frog and northern leopard frog) exist. The diversity of wetland and riparian communities found in the North Platte Watershed offer some of Colorado's most extensive habitat for waterfowl, shorebirds and aquatic mammals. The watershed hosts one of the three known Colorado breeding sites of the American White Pelican (*Pelecanus erythrorhynchos*), Colorado's largest nesting population of Willet (*Catoptrophorus semipalmatus*), one of the largest nesting populations of Greater Sandhill Crane (*Grus canadensis tabida*) (CNHP 2009; Kingery 1998) and populations of resident river otter (*Lontra canadensis*), beaver (*Castor canadensis*) and muskrat (*Ondatra zibethicus*).

Three new locations of fens were documented in 2009. Fens are a type of peatland that are groundwater fed with at least 40 cm (16 inches) of organic soil or peat. Peat forms when plant biomass production is greater than decomposition due to saturation. In Colorado, peat accumulates at a rate of 20 cm (8 inches)/1,000 years (Chimner et al. 2002). For example, Soda Springs Fen at Watson Mountain has a peat depth of at least 40 inches therefore this wetland is at least 5,000 years old. The North Platte River watershed, especially along the toe slope of the Park Range, provides all three components for fen formation; geology, past glacier activity and hydrology. Fens support plants that can tolerate these saturated, low oxygen conditions. For example, five of the known eight Colorado occurrences of the roundleaf sundew (*Drosera rotundifolia*) are located within the watershed. Additionally, there are several sites throughout the watershed, Big Creek Lakes, Sawmill Lakes, Willow Park, East Sand Creek Fen, which support fens that harbor concentrations of several state rare plants that are indicative of these unique, irreplaceable wetlands.

The contiguous, relatively unaltered riparian corridors are the most significant asset in the watershed. These willow carrs are dominated by several globally vulnerable plant communities. These intact corridors support large, viable herds of elk, deer, moose and some of the best fishing in Colorado. An important component of this ecosystem is the beaver, which create and maintain habitat not only for wildlife, but for amphibians, waterfowl, shorebirds and passerine birds.

The northern leopard frog was not encountered as frequently in the park as the distribution of its suitable habitat would predict. The absence of northern leopard frogs from the basin is difficult to explain. Past surveys in North Park suggest that northern leopard frogs are restricted to the west side of North Park at elevations above the basin floor and that this amphibian was never common (Hammerson 1999). The majority of current and historic records for the northern leopard frog are from public lands administered by the US Forest Service and these records may define an accurate

distribution for the frog. Alternatively, they may reflect sampling bias due to a lack of access in the past to the privately owned lands of the basin floor. Western chorus frogs frequently occur with northern leopard frogs (Hammerson 1999) and chorus frogs were frequently found in the basin during the 2009 survey; therefore northern leopard frogs theoretically should have been encountered more frequently. The absence of northern leopard frogs could be explained through empirical evidence suggesting that western chorus frogs are known to persist in areas positive for chytrid fungus (L. Livo, pers. comm., Jackson 2008) while northern leopard frogs are thought to be more sensitive to the fungus. It is possible that historically northern leopard frogs were distributed in the basin and that subsequent introduction of chytrid fungus resulted in the loss of these populations. Whether historic in nature or of more recent origin, the absence of northern leopard frogs from suitable habitat in the North Park basin is worth noting.

The North Platte Basin Watershed also includes the northwestern portion of Larimer County. Unfortunately, after several positive conversations with landowners at the beginning of the project, CNHP only received permission from one landowner. However, in 1996 and 2004 CNHP did conduct a county-wide survey for critical biological resources for the County (Kettler et al. 1996, Doyle et al. 2004). These wetland PCAs have been incorporated within this report.

Finally, CNHP would like to recommend the following conservation strategies to be considered by the NPBRT and its Non-consumptive Needs subcommittee.

**1). Integrate the results and specifically the PCAs profiled in this report in the needs assessment for the watershed. The PCAs will assist in identification of priority areas and reaches for environmental and recreational attributes.** The PCAs in this report provide a basic framework for implementing a comprehensive conservation program. The B2 and B3 sites, because they have global biological significance, are in need of priority attention. Consider incentive-based programs such as purchasing development rights or outright purchase from willing owners of land for significant sites that are in need of protection. Support local organizations, such as land trusts, in purchasing or acquiring conservation easements for protection of biological diversity or open space. Explore opportunities to form partnerships to access state and federal funding for conservation projects, such as those offered through the Colorado Division of Wildlife or the Farm Bill.

**2). Take the data presented in this report into consideration when reviewing of proposed activities in or near Potential Conservation Areas to determine whether or not those proposed activities may adversely affect elements of biodiversity.** All of the PCAs presented contain elements of biodiversity of state or global significance. Weighing the biodiversity represented by PCAs should allow planners and biologists to consider natural resource conservation when making land use decisions. Certain land uses on or near a site may affect the element(s) present there. Wetland and riparian areas are particularly susceptible to impacts from off-site activities if the activities affect water quality or hydrologic regimes. In addition, cumulative impacts from many small changes can have effects as profound and far-reaching as one large change. As proposed land use changes are considered, they should be compared to the maps presented herein (also



available in GIS format). If a proposed project has the potential to impact a site, planning personnel should contact persons, organizations, or agencies with the appropriate biological expertise for input in the planning process. CNHP is continually updating biodiversity data throughout the state and can provide up-to-date information in the area of concern. To contact CNHP's Environmental Review Coordinator call (970) 491-7331.

**3). Recognize the importance of larger, contiguous natural communities.** While the PCAs identified in this report contain known locations of significant elements of natural diversity, protection of large contiguous riparian corridors may ensure that we do not lose species that have not yet been located. Work to protect large blocks of land within the watershed and avoid fragmenting large natural areas unnecessarily with roads, trails, etc. Although large migrating animals like deer and elk are not tracked by CNHP as rare species, they are part of our natural diversity and their needs for winter range and access to protected corridors to food and water should be taken into consideration.

**4). Promote and educate citizens and recreational users about the spread of chytrid fungus, zebra, quagga mussels and New Zealand mudsnail.** Occurrences of these invasive species can be prevented with outreach and education of users of North Platte River Watershed's waters due to the popularity of the area for fishing and boating.

**5). Encourage public education outreach, functions and publications.** A significant early step in the process of conserving biodiversity is educating local citizens and other stakeholders on the value that such areas offer the public. As described in this report, North Platte River Watershed is rich in animal and plant diversity. Conveying the value and function of these habitats and the species that inhabit them to the public can generate greater interest in conserving lands. Conducting forums or presentations that highlight the biodiversity of North Platte River Watershed should increase awareness of the uniqueness of the habitats within the County.

**6). Increase efforts to protect biodiversity by promoting cooperation and incentives among landowners, pertinent government agencies and non-profit conservation organizations.** Involve all stakeholders in land use planning. The long-term protection of natural diversity in North Platte River Watershed will be facilitated by the cooperation of private landowners, businesses, government agencies and non-government organizations. Efforts to provide stronger ties among federal, state, local and private interests involved in the protection or management of natural lands will increase the chance of success. By developing incentives that encourage biodiversity considerations in land-use planning, the likelihood of conserving biodiversity should increase. Such incentives will make planning for conservation a higher priority for private and public entities. Suggested entities include, but are not limited to, Colorado Cattleman's Agriculture Land Trust, Owl Mountain Partnership, Duck's Unlimited, Legacy Land Trust, The Nature Conservancy and Colorado Natural Areas.

# SITES OF BIODIVERSITY SIGNIFICANCE

The 32 most important sites in North Platte River Watershed are profiled in this section as Potential Conservation Areas (PCAs) with biodiversity ranks (Table 10, Map 1).

Each Potential Conservation Area (PCA) is described in a standard PCA profile report that reflects data fields in CNHP's Biodiversity Tracking and Conservation System (BIOTICS). The contents of the profile report are outlined and explained below. Optional fields marked with an \* may or may not be included in Potential Conservation Area descriptions.

## PCA Profile Explanation

### **Biodiversity Rank: B#**

The overall significance of the PCA in terms of rarity of the Natural Heritage resources and the quality (condition, abundance, etc.) of the occurrences. Please see *Natural Heritage Ranking System* section for more details.

### **Protection Urgency Rank: P#**

A summary of major land ownership issues that may affect the long-term viability of the PCA and the element(s).

### **Management Urgency Rank: M#**

A summary of major management issues that may affect the long-term viability of the PCA and the element(s).

**USGS 7.5-minute Quadrangle name(s):** A list of USGS 7.5 minute quadrangles which contain the boundary of the PCA; all quadrangles are from Colorado unless otherwise noted.

**Size:** Expressed in acres.

**\*Elevation:** Expressed in feet.

**General Description:** A brief narrative of the topography, hydrology, vegetation and current use of the potential conservation area.

**\*Key Environmental Factors:** A description of key environmental factors that are known to have an influence on the PCA, such as seasonal flooding, wind, geology, soil type, etc.

**\*Climate Description:** Where climate has a significant influence on the elements within a PCA, a brief description of climate, weather patterns, seasonal and annual variations, temperature and precipitation patterns is included.

**\*Land Use History:** General comments concerning past land uses within the PCA which may affect the elements occurring within the boundary.

**\*Cultural Features:** Where pertinent, a brief description is given of any historic, cultural, or archeological features found within the PCA.

**Biodiversity Significance Rank Comments:** A synopsis of the rare species and significant plant communities that occur within the proposed conservation area. A table within the area profile lists each element occurrence found in the PCA, global and state

ranks of these elements, the occurrence ranks and federal and state agency special designations. See Table 4 for explanations of ranks and Table 5 for legal designations.

**Boundary Justification:** Justification for the location of the proposed PCA boundary delineated in this report, which includes all known occurrences of Natural Heritage resources and, in some cases, adjacent lands required for their protection.

**\*Protection Urgency Rank Comments:** Brief comments to justify the rating assigned to the PCA.

**\*Management Urgency Rank Comments:** Brief comments to justify the rating assigned to the PCA.

**\*Land Use Comments:** Brief comments describing the current and/or past land use as it affects those elements contained in the PCA.

**\*Natural Hazard Comments:** If any potential natural hazards such as cliffs, caves, poisonous plants, etc. are prominent within the PCA and relevant to a land manager or steward, comments are included along with any precautions that may need to be taken.

**\*Exotic Species Comments:** A description of potentially damaging exotic (i.e., alien) flora and/or fauna within the PCA, including information on location, abundance and their potential effect on the viability of the targeted elements within the PCA.

**\*Offsite Considerations:** Where offsite land uses or other activities (e.g., farming, logging, grazing, dumping, watershed diversion, etc.) may have a significant influence on the elements within a PCA, a brief description of these is included.

**\*Information Needs:** A brief summary of any information that may still be needed in order to effectively manage the PCA and the elements within it.

## Big Creek Lakes

**Biodiversity Rank - B2: Very High Biodiversity Significance**

**Protection Urgency Rank - P4: No Threat or Special Opportunity**

**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Davis Peak, Mount Zirkel, Boettcher Lake, Pearl

**Size:** 15,705 acres (6,356 ha)      **Elevation:** 8,600 - 9,800 ft. (2,621 - 2,987 m)

**General Description:** The Big Creek Lakes site is situated on the east flank of the Park Range, which forms the northwestern border of North Park. The site is drained by the North Fork of the North Platte River along with the major tributaries: Forester, Goose, and Shafer creeks. The area consists of Pleistocene deposits and glacial drift of the Pinedale and Bull Lake glaciations (Tweto 1979). Throughout the site are closed depressions, kettle ponds, and sharp lateral and terminal moraines. The depressions and kettle ponds are concentrated on top of the glacial till. Kettle ponds are a remnant of melting glacial ice stagnation and lack an inlet or outlet. The Big Creek Lakes area is one of the most extensive kettle pond areas known in Colorado. The vegetation of the kettle ponds occurs in successional zones from the open water to lake margins. Open water areas are dominated by water lilies (*Nuphar lutea* ssp. *polysepala*), water smartweed, (*Persicaria amphibia*), pondweed (*Potamogeton natans*), buckbean (*Menyanthes trifoliata*), bur-reeds (*Sparganium natans*, *S. angustifolium*) and bladderwort (*Utricularia minor*). The herbaceous-dominated lake margins that surround the open water are dominated by graminoids (*Carex lasiocarpa*, *C. aquatilis*, *C. lasiocarpa*, *C. canescens*, *C. utriculata*, *C. buxbaumi*, *C. brunnescens*), cottongrasses (*Eriophorum gracile*, *E. angustifolium*), manna grass (*Glyceria borealis*, *G. elata*), spike rush (*Eleocharis palustris*, *E. acicularis*), bluejoint reedgrass (*Calamagrostis canadensis*, *C. stricta*), tufted hairgrass (*Deschampsia cespitosa*) and rushes (*Juncus longistylis*, *J. ensifolius*, *J. drummondii*). Forbs within the lake margin include marsh cinquefoil (*Comarum palustre*) and coltsfoot (*Petasites sagittatus*). Floating mats are found along the edges of the larger ponds. These mats support roundleaf sundew (*Drosera rotundifolia*), bog sedge (*Carex limosa*), pale sedge (*C. livida*) with *Sphagnum* spp. Water analysis performed by the Forest Service in 2005 indicate that the fens are classified as intermediate poor fens with a relatively low pH (5.3) and low cation concentration 55.3 microsiemens per centimeter. Amphibians that are known to occur in the ponds are western toad (*Bufo boreas boreas*), wood frog (*Rana sylvatica*), northern leopard frog (*Rana pipiens*), and the striped chorus frog (*Pseudacris triseriata*). The slopes and ridges surrounding the kettles consist of sandy loams, characterized by coarse glacial till and cobbles. The upland vegetation consists of lodgepole pine (*Pinus contorta*) forests that have been severely impacted by the mountain pine beetle (*Dendroctonus* spp.).

**Key Environmental Factors:** Intact hydrology is the main ecological factor. Climate

change could become another driving ecological factor in the future.

**Climate Description:** This site is located in a wetter area of North Park, receiving 25-30 inches of precipitation annually.

**Land Use History:** There are two major ditches in the general area, Pleasant Valley and Independence ditches. The ditches are owned by a private ranch and take water off the North Fork and out of Big Creek Lakes. The Forest Service operates a 54 unit campground that is found at Lower Big Creek Lakes. Fishing, non motorized boating and hiking are the main activities.

**Biodiversity Significance Rank Comments (B2):** This site contains three rare amphibians and a very high concentration of several state rare plants. Plants include slender cottongrass (*Eriophorum gracile*) (G5/S2), bristly stalk sedge (*Carex leptalea*) (G5/S1), livid sedge (*Carex livida*) (G5/S1), roundleaf sundew (*Drosera rotundifolia*) (G5/S2), lesser bladderwort (*Utricularia minor*) (G5/S2), mud sedge (*Carex limosa*) (G5/S2), slender sedge (*Carex lasiocarpa*) (G5/S1), and marsh cinquefoil (*Comarum palustre*) (G5/S1S2). There are several excellent (A-ranked) occurrences of globally common wetland communities such as pond lily herbaceous wetland (*Nuphar lutea* ssp. *polysepala*) (G5/S3), beaked sedge - water sedge herbaceous wetland (*Carex utriculata* - *Carex aquatilis*) herbaceous wetland, and beaked sedge herbaceous wetland (*Carex utriculata*) (G5/S4). Rare amphibians include wood frog (*Rana sylvatica*) (G5/S3), northern leopard frog (*Rana pipiens*) (G5/S3) and a breeding population of the boreal toad (*Bufo boreas*) (G4T1Q/S1). The boreal toad was once common throughout the mountains of Colorado, but has undergone declines over the last 20 years (Goettl 1997). Reasons for the decline are unknown, but postulated to be due to a chytrid fungus (Cunningham 1998 as cited in Hammerson 1999). In 1993, the boreal toad was listed as state endangered by the Colorado Division of Wildlife. The northern leopard frog and the wood frog are globally common, but considered by the Federal and State agencies as sensitive. In 2009, the Forest Service and DOW documented 5 adult and 10 juvenile northern leopard frogs and 1 adult and 7 juveniles from Big Creek Lakes area.

Natural Heritage element occurrences at the Big Creek Lakes PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Amphibians	Bufo boreas pop. 1	Boreal Toad (Southern Rocky Mountain Population)	G4T1Q	S1		SE		E	1994-07-20
Amphibians	Bufo boreas pop. 1	Boreal Toad (Southern Rocky Mountain Population)	G4T1Q	S1		SE		E	2009-08-05
Amphibians	Rana pipiens	Northern Leopard Frog	G5	S3		SC	BLM/USFS	E	2007-08-08
Amphibians	Rana pipiens	Northern Leopard Frog	G5	S3		SC	BLM/USFS	E	1997-08-20
Amphibians	Rana sylvatica	Wood Frog	G5	S3		SC	USFS	B	2007-08-09
Amphibians	Rana sylvatica	Wood Frog	G5	S3		SC	USFS	E	2009-08-19
Mollusks	Acroloxus coloradensis	Rocky Mountain Capshell	G3	S1		SC	USFS		1993-07-22
Natural Communities	Carex aquatilis - Carex utriculata Herbaceous Vegetation	Montane Wet Meadows	G4	S4				A	1991-08-22
Natural Communities	Salix wolfii / Carex aquatilis Shrubland	Subalpine Riparian Willow Carr	G4	S3				B	2009-08-04
Natural Communities	Carex utriculata Herbaceous Vegetation	Beaked Sedge Montane Wet Meadows	G5	S4				A	1990-09-19
Natural Communities	Carex utriculata Herbaceous Vegetation	Beaked Sedge Montane Wet Meadows	G5	S4				A	1991-08-22
Natural Communities	Nuphar lutea ssp. polysepala Herbaceous Vegetation	Western Slope Floating / Submergent Palustrine Wetlands	G5	S3				A	1990-09-19
Natural Communities	Nuphar lutea ssp. polysepala Herbaceous Vegetation	Western Slope Floating / Submergent Palustrine Wetlands	G5	S3				A	1991-08-22
Vascular Plants	Sisyrinchium pallidum	pale blue - eyed grass	G2G3	S2			BLM	D	1993-07-17



Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	Cypripedium fasciculatum	clustered lady's - slipper	G4	S3				C	1996-08-13
Vascular Plants	Cypripedium fasciculatum	clustered lady's - slipper	G4	S3				A	1996-08-13
Vascular Plants	Carex lasiocarpa	slender sedge	G5	S1				A	1991-08-21
Vascular Plants	Carex lasiocarpa	slender sedge	G5	S1				A	2005-08-06
Vascular Plants	Carex leptalea	bristle - stalk sedge	G5	S1				E	2005-08-06
Vascular Plants	Carex limosa	mud sedge	G5	S2				A	1991-08-22
Vascular Plants	Carex limosa	mud sedge	G5	S2				A	2005-08-05
Vascular Plants	Carex livida	livid sedge	G5	S1			BLM/USFS	E	2005-06-21
Vascular Plants	Comarum palustre	marsh cinquefoil	G5	S1S2				A	1989-08-03
Vascular Plants	Drosera rotundifolia	roundleaf sundew	G5	S2			USFS	A	2005-08-05
Vascular Plants	Drosera rotundifolia	roundleaf sundew	G5	S2			USFS	A	1991-08-22
Vascular Plants	Eriophorum gracile	slender cottongrass	G5	S2			BLM/USFS		1989-08-02
Vascular Plants	Eriophorum gracile	slender cottongrass	G5	S2			BLM/USFS	A	1989-09-19
Vascular Plants	Utricularia minor	lesser bladderwort	G5	S2			USFS	A	2005-08-05
Vascular Plants	Sagittaria montevidensis ssp. calycina	long - lobe arrowhead	G5T5?	S1				E	1989-08-03

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The boundary is drawn to capture the immediate watershed that supports the rare elements. The boundary starts at the northeastern flank of Red Elephant Mountain and encompasses the drainages, lakes, kettle ponds, and wet meadows within the glacial basin up to Twisty Park.

**Protection Urgency Rank Comments (P4):** Site is a mixed ownership between private and Forest Service. Portions of the site are located within the Mt. Zirkel Wilderness Area. Research Natural Area designation is warranted due to the high

concentration of state rare plants and breeding populations of frogs and toads. Any hydrological modifications regarding the Independence Ditch should consider the effects on the wetland dependent elements.

**Management Urgency Rank Comments (M3):** Off trail hikers and researchers should be aware of potential damage to wetland plants and animals. Any hydrological alterations should be avoided.

**Off-Site Considerations:** Management within the Big Creek Lakes watershed should be evaluated for significant alteration to the hydrology and negative impacts to the elements present.

### **References**

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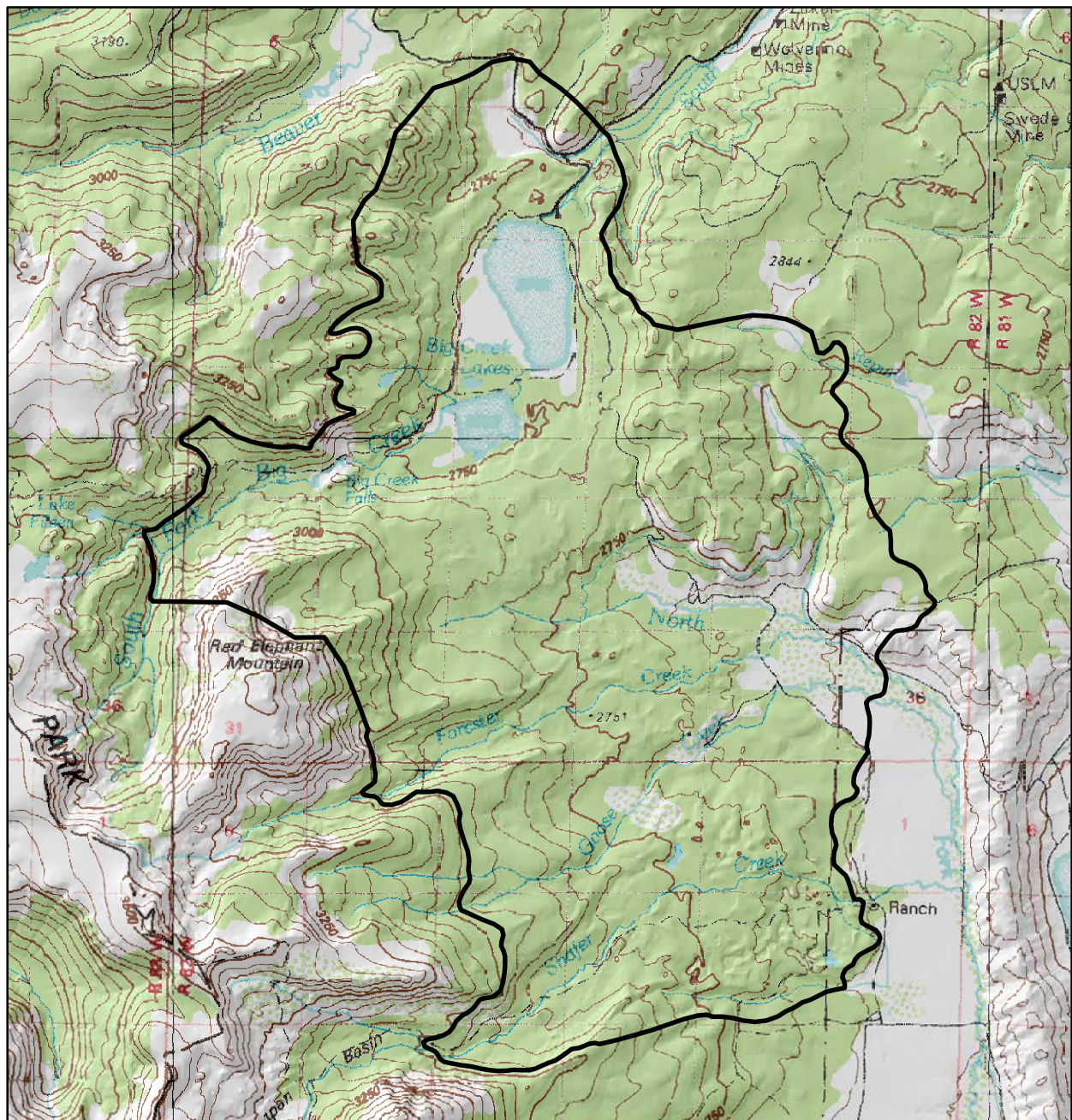
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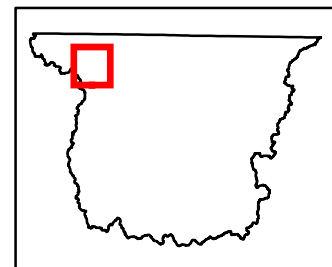
## Legend

 PCA Boundary

Walden, 40106-E1

30x60 Minute Digital Raster  
Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed



Map 2. Big Creek Lakes Potential Conservation Area, B2: Very High Biodiversity Significance





Big Creek Lakes fen.



Roundleaf sundew (*Drosera rotundifolia*).

## Arapaho Lakes

**Biodiversity Rank - B3: High Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Buffalo Peak, Spicer Peak

**Size:** 2,958 acres (1,197 ha)

**Elevation:** 8,860 - 9,900 ft. (2,701 - 3,018 m)

**General Description:** The Arapaho Lakes site is located at the northern flank of the Rabbit Ears Range. The area consists of Quaternary alluvium and surficial deposits, Tertiary deposits of sandstone, and Tertiary metamorphic and igneous rock (Tweto 1979). The dominant features are the wetlands and the permanent and intermittent lakes formed from closed depressions defined by sharp lateral and terminal moraines. There are over 75 acres of lakes within the site and amphibians that are known to occur in these lakes and also in the wetlands of the site include the boreal toad (*Bufo boreas*), northern leopard frog (*Rana pipiens*), wood frog (*Rana sylvatica*), and the western chorus frog (*Pseudacris triseriata*). There is also a montane riparian willow carr community within the site (*Salix monticola* / mesic graminoids). The upland vegetation varies along an elevation gradient with deciduous aspen (*Populus tremuloides*) forest and subalpine mixed forbs and grassland occurring at the lowest elevations. There are also herbaceous riparian wetlands dominated by sedges at this elevation. At intermediate elevations there are lodgepole pine (*Pinus contorta*) forests and lodgepole / aspen mixed forest that have been severely impacted by the mountain pine beetle (*Dendroctonus* spp.). At higher elevation the forest grades into an Engelmann spruce (*Picea engelmannii*) and white fir (*Abies lasiocarpa*) coniferous forest.

**Key Environmental Factors:** The hydrology of the area is the important feature of the site. The riparian areas, wetlands, and depressional lakes of the site flood annually from snow melt and spring runoff, creating significant habitat for amphibians.

**Climate Description:** The climate is semiarid and is characterized as having short, cool summers followed by long, cold winters. Mean annual air temperature in Walden, 20 miles north of the site, is 36.4 degrees Fahrenheit and temperatures range from minus 39 degrees to 90 degrees Fahrenheit, based on the National Weather Bureau's 30-year average data (USFWS 2004). The annual mean rainfall in Walden is 10.83 inches and seventy percent falls as snow with Walden averaging 53 inches of snow per year (USFWS 2004). The highest average monthly precipitation occurs in March, April, May, and August (Lischka et al. 1983).

**Biodiversity Significance Rank Comments (B3):** The site supports a good (B-ranked) occurrence of a globally imperiled (G3/S3) *Salix monticola* / mesic graminoid montane willow carr. In addition, there are several rare amphibians including a poor (D-ranked) occurrence of the globally critically imperiled (G4T1Q/S1) boreal toad (*Bufo boreas*), an extant occurrence of the state rare (G5/S3) northern leopard frog (*Rana pipiens*), and an occurrence of the state rare (G5/S3) wood frog (*Rana sylvatica*).

Natural Heritage element occurrences at the Arapaho Lakes PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Amphibians	<i>Bufo boreas</i> pop. 1	Boreal Toad (Southern Rocky Mountain Population)	G4T1Q	S1		SE		D	1996-09-24
Amphibians	<i>Rana pipiens</i>	Northern Leopard Frog	G5	S3		SC	BLM/USFS	E	1996-07-25
Amphibians	<i>Rana sylvatica</i>	Wood Frog	G5	S3		SC	USFS		1997-06-10
Natural Communities	<i>Salix monticola</i> / Mesic Graminoids Shrubland	Montane Riparian Willow Carr	G3	S3				B	1998-07-12

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The site boundary was drawn to protect the watershed within which the wetlands, riparian zones, and lakes of the site lie. The location of the boundary and the identification of plant communities important to the site were identified using the digital orthophoto quad for Jackson County and GIS layers from the Colorado Vegetation Classification Project. The site protects the drainages and the adjacent uplands of the watershed that supplies the snow melt and spring runoff to the site's lakes and wetlands. Protecting the watershed from erosion and sedimentation is critical to maintaining the hydrologic function upon which the amphibians native to the site are dependent. The site protects a diversity of wetland types that are necessary for successful reproduction of the amphibian species that are present.

**Protection Urgency Rank Comments (P3):** The site is mostly U. S. Forest Service property with a small portion of private property along the north boundary of the site. The publicly owned parcels are ostensibly protected, however, remaining breeding populations of boreal toad should be considered for Special Area designation in the forest plan revision.

**Management Urgency Rank Comments (M3):** Current land uses dominated



primarily by livestock grazing and recreation are compatible with continued viability of the biological resources. However, conservation of the amphibian populations is dependent upon preventing large scale disturbances to the upland forests (e.g. logging or fire) that could lead to erosion, increased sedimentation, and consequently degradation of water quality within the watershed. Declines in water quality would not benefit the amphibian populations inhabiting the site.

**Land Use Comments:** Grazing by cattle and recreation are the predominant land use at the site.

**Natural Hazard Comments:** There are areas within the site that contain rough terrain with steep slopes that should be navigated with caution.

**Off-Site Considerations:** The main offsite activities include livestock grazing and recreation, uses that are compatible with continued viability of the amphibian species. Any offsite activities such as road construction, trail construction, or timber harvesting that has the potential to increase erosion and sediment loading into the drainages of the site would not benefit the amphibian populations.

## References

Culver, D.R., K. Decker, J. Parker, J. Bell, J. Sovell, and J. Huggins. 2010. CNHP Final Report: Identification and Assessment of Important Wetlands within the North Platte Watershed, CO. Colorado Natural Heritage Program, Fort Collins, CO.

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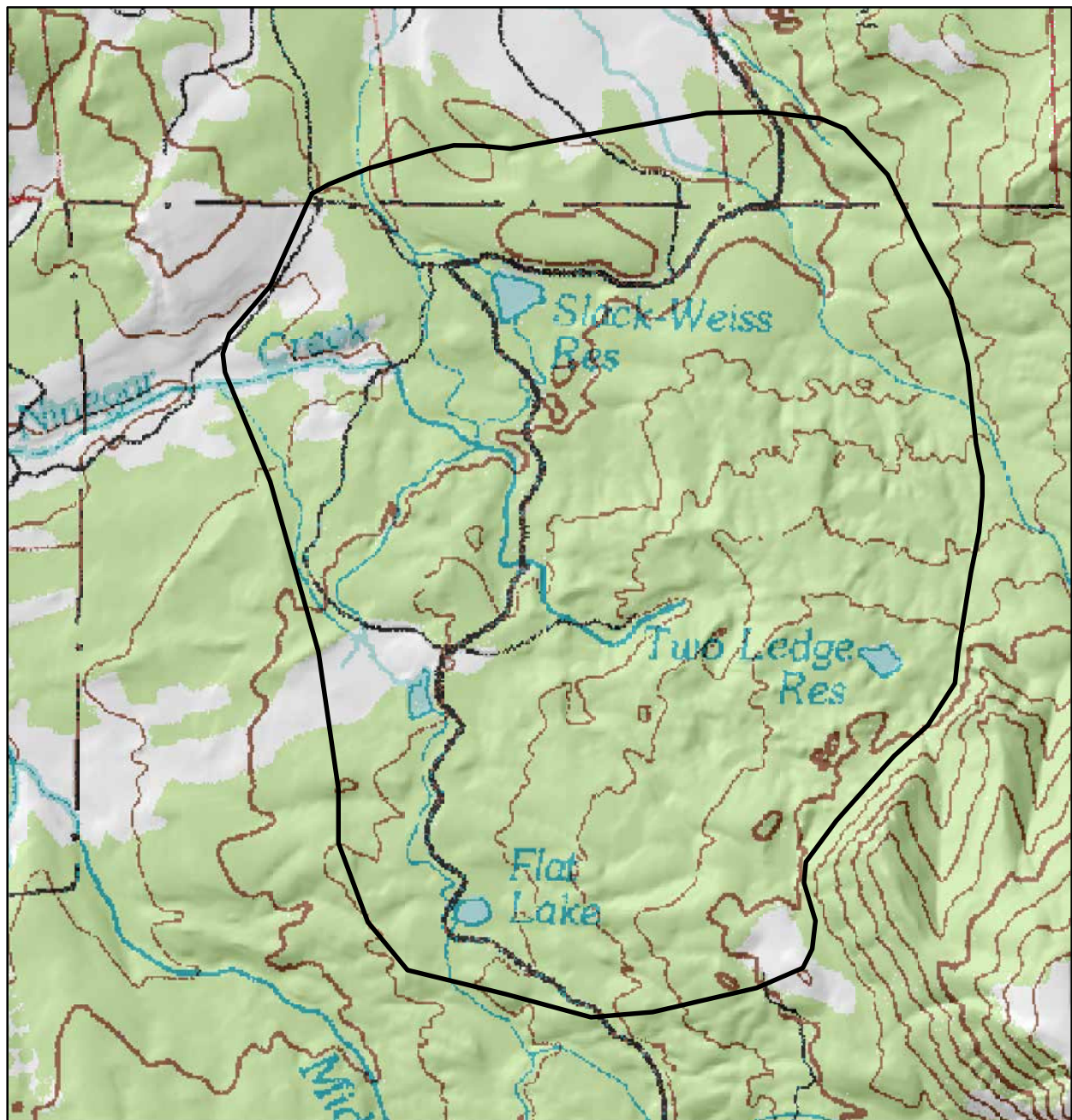
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**Version Date:** 12/10/2009



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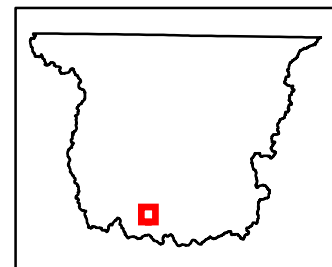
### Legend

 PCA Boundary

Steamboat Springs, 40106-A1

30x60 Minute Digital Raster  
Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed



Map 3. Arapaho Lakes Potential Conservation Area, B3: High Biodiversity Significance



Northern leopard frog (*Rana pipiens*).



Wood frog (*Rana sylvatica*).



Boreal toad (*Bufo boreas boreas*).



## Chedsey Creek

**Biodiversity Rank - B3: High Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future**

**U.S.G.S. 7.5-minute quadrangles:** Rabbit Ears Peak, Teal Lake, Buffalo Pass, Mount Werner

**Size:** 27,910 acres (11,295 ha)      **Elevation:** 8,260 - 10,600 ft. (2,518 - 3,231 m)

**General Description:** The Chedsey Creek site is located at the eastern flank of the Park Range. The area consists of Pleistocene deposits and glacial drift of the Pinedale and Bull Lake glaciations (Tweto 1979). The dominant features are the wetlands and the permanent and intermittent lakes formed from closed depressions defined by sharp lateral and terminal moraines. The vegetation of the lakes can vary by elevation, but in general there are successional zones from the open water to lake margins. Open water areas are dominated by water lilies (*Nuphar lutea* ssp. *polysepala*), water smartweed, (*Persicaria amphibia*), and pondweed (*Potamogeton* spp.). The herbaceous-dominated lake margins that surround the open water are dominated by graminoids (*Carex aquatilis*, *C. canescens*, *C. utriculata*). Amphibians known to occur in the lakes and wetlands include the boreal toad (*Bufo boreas*), northern leopard frog (*Rana pipiens*), wood frog (*Rana sylvatica*), and the western chorus frog (*Pseudacris triseriata*). The slopes and ridges surrounding the kettles consist of sandy loams, characterized by coarse glacial till and cobbles. The upland vegetation varies along an elevation gradient with hay meadows, perennial and annual grasses, and big sagebrush (*Artemisia tridentata*) occurring at the lowest elevations. At intermediate elevations, lodgepole pine (*Pinus contorta*) forests that have been severely impacted by the mountain pine beetle (*Dendroctonus* spp.), and aspen (*Populus tremuloides*) and lodgepole pine mixed forest are present. At higher elevations, the forest grades into Engelmann spruce (*Picea engelmannii*) and white fir (*Abies lasiocarpa*) while subalpine grassland is present at the highest elevations.

**Key Environmental Factors:** The hydrology of the area is the important feature of the site. The riparian areas, wetlands, and depressional lakes flood annually from snow melt and spring runoff, creating significant habitat for wetland dependent animal species, most importantly amphibians.

**Climate Description:** The climate is semiarid and is characterized as having short, cool summers followed by long, cold winters. Mean annual air temperature in Walden, 15 miles northeast of the site, is 36.4 degrees Fahrenheit and temperatures range from minus 39 degrees to 90 degrees Fahrenheit, based on the National

Weather Bureau's 30-year average data (USFWS 2004). The annual mean rainfall in Walden is 10.83 inches and seventy percent falls as snow with Walden averaging 53 inches of snow per year (USFWS 2004). The highest average monthly precipitation occurs in March, April, May, and August (Lischka et al. 1983).

**Biodiversity Significance Rank Comments (B3):** The site supports several rare amphibians including a fair (C-ranked) occurrence of the globally critically imperiled (G4T1Q/S1) boreal toad (*Bufo boreas*), fair (C-ranked) and historical occurrences of the state rare (G5/S3) wood frog (*Rana sylvatica*), and good (B-ranked) and extant occurrences of the state rare (G5/S3) northern leopard frog (*Rana pipiens*). Additionally, an occurrence of the globally vulnerable (G3/S1) invertebrate, the Rocky Mountain capshell (*Acroloxus coloradensis*), is known from Teal Lake. The boreal toad was once common throughout the mountains of Colorado, but has undergone declines over the last 20 years (Goettl 1997). Reasons for the decline are unknown, but postulated to be due to a chytrid fungus (Cunningham 1998 as cited in Hammerson 1999). In 1993, the boreal toad was listed as state endangered by the Colorado Division of Wildlife. The northern leopard frog was once abundant, but has become scarce in many areas of Colorado (Hammerson 1999). The reasons vary from habitat loss to climate change. In 2009, the Forest Service and DOW documented 128 adults and 11 juveniles in Teal Lake and 34 adults and 17 juveniles in Tiago Lake. The leopard frog is listed as sensitive for the Forest Service, BLM, and the Colorado Division of Wildlife.

Natural Heritage element occurrences at the Chedsey Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Amphibians	Bufo boreas pop. 1	Boreal Toad (Southern Rocky Mountain Population)	G4T1Q	S1		SE		C	1996-99-99
Amphibians	Rana pipiens	Northern Leopard Frog	G5	S3		SC	BLM/USFS	E	1996-07-11
Amphibians	Rana pipiens	Northern Leopard Frog	G5	S3		SC	BLM/USFS	B	2007-08-08
Amphibians	Rana sylvatica	Wood Frog	G5	S3		SC	USFS	C	2001-06-06
Amphibians	Rana sylvatica	Wood Frog	G5	S3		SC	USFS	H	1967-06-99
Amphibians	Rana sylvatica	Wood Frog	G5	S3		SC	USFS	H	1946-07-17
Mollusks	Acroloxus coloradensis	Rocky Mountain Capshell	G3	S1		SC	USFS		1993-07-19

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The wetlands, riparian areas, permanent and intermittent lakes associated with Chedsey, Doran, Little Grizzly, and Newcomb creeks and their tributaries are included within the boundary. The location of the boundary and the identification of plant communities important to the site were identified using the digital orthophoto quad for Jackson County and GIS layers from the Colorado Vegetation Classification Project. The site protects the drainages and the adjacent uplands of the watershed that supplies the snow melt and spring runoff to the creeks, wetlands, and lakes. Protecting the watershed from erosion and sedimentation is critical to maintaining the hydrologic function upon which the amphibian's depend. The site protects a diversity of wetland types that are necessary for successful reproduction of the amphibian species that are present.

**Protection Urgency Rank Comments (P3):** The site is split between U. S. Forest Service property and privately owned land with cattle ranching and recreation as the two dominant activities. Current livestock grazing regimes appear compatible with the continued viability of the amphibian populations. Protection of the elements could be improved by increasing the intent and tenure of legal protection. Applying a special agency designation would be a relatively effective method to increase protection. Remaining breeding populations of boreal toad should be considered for Special Area designation in the forest plan revision.

**Management Urgency Rank Comments (M4):** Current land use is dominated primarily by livestock grazing and recreation appears compatible with continued viability of the biological resources. Maintaining the current hydrologic regime to ensure long-term viability of the amphibian population is the most important management need. It will also be important to protect the amphibian populations from the introduction of the Chytrid fungus or *Bd* (*Batrachochytrium dendrobatidis*).

**Land Use Comments:** Land uses include cattle grazing and at lower elevation hay production.

**Natural Hazard Comments:** There are areas at the western edge of the site containing rough terrain with steep slopes that should be navigated with caution.

**Off-Site Considerations:** The main offsite activities include livestock grazing and hay production on irrigated pastures and these uses are compatible with continued viability of the amphibian species that populate the site. Any offsite activities such as road construction, trail construction, or timber harvest that has the potential to increase erosion and sediment loading into the drainages of the site would not benefit the amphibian and invertebrate populations.

**Information Needs:** Further research on the causes of boreal toad declines is critical.



## References

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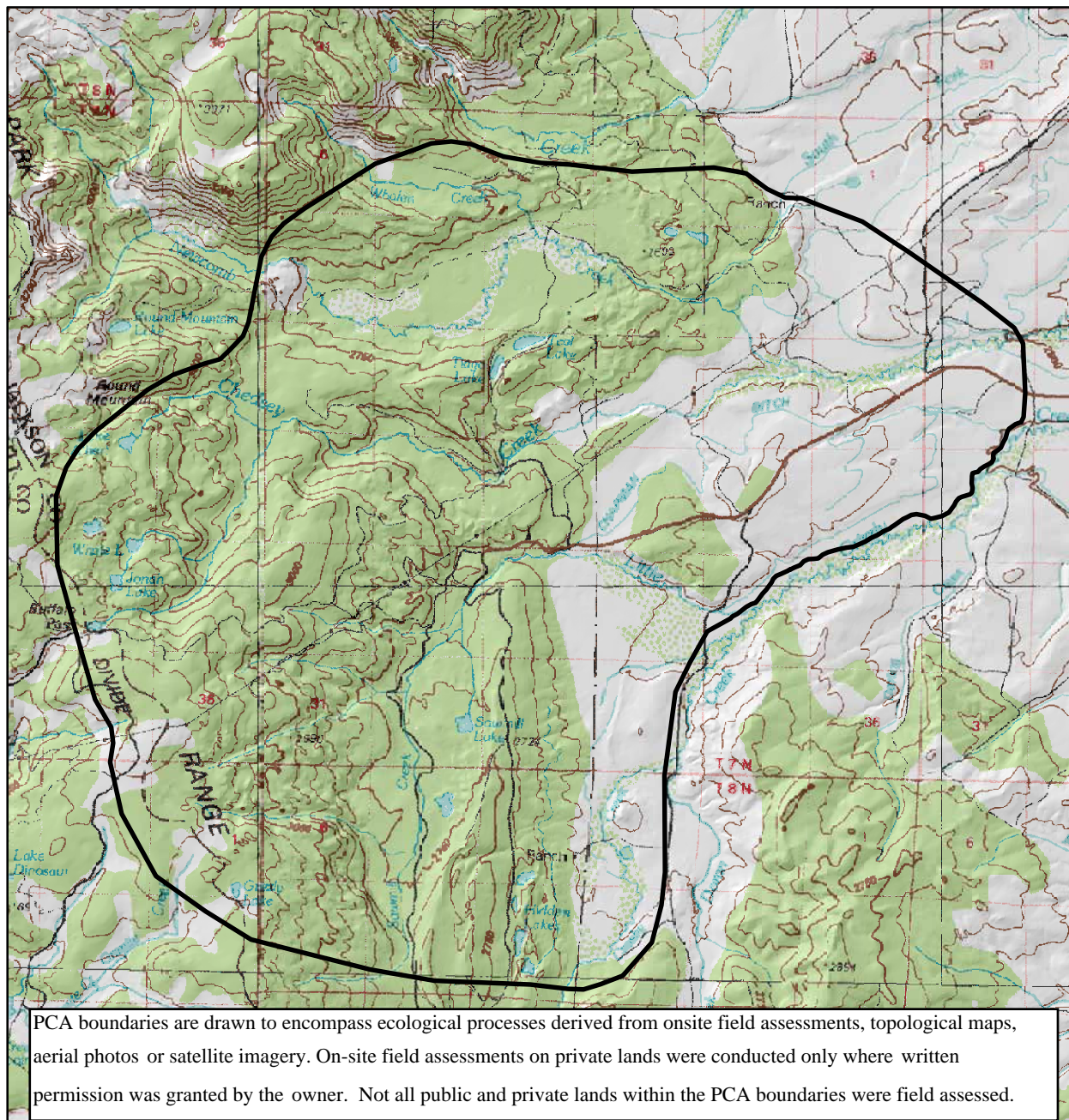
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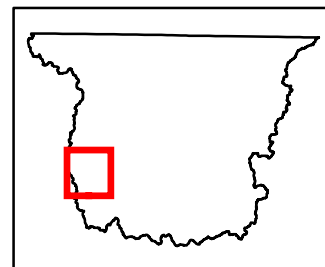
### Legend

 PCA Boundary

Walden, 40106-E1  
Steamboat Springs, 40106-A1

30x60 Minute Digital Raster  
Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed



Map 4. Chedsey Creek Potential Conservation Area, B3: High Biodiversity Significance





Boreal toad (*Bufo boreas boreas*) adult.



Boreal toad (*Bufo boreas boreas*) juvenile.

## Crystal Spring

**Biodiversity Rank - B3: High Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Eagle Hill, Cowdrey

**Size:** 114 acres (46 ha)

**Elevation:** 8,020 - 8,080 ft. (2,445 - 2,463 m)

**General Description:** Crystal Springs is a groundwater discharge west of the North Park Sand Dunes area. The water likely percolates down from the Medicine Bow Mountains and flows west through the eolian deposits. Crystal Springs supports an area of open water that is ringed with graminoids such as Nebraska sedge (*Carex nebrascensis*), beaked sedge (*C. utriculata*), analogue sedge (*C. simulata*), brook grass (*Catabrosa aquatica*), swordleaf rush (*Juncus ensifolius*), and Baltic rush (*J. balticus*). Forbs include Brewer's bittercress (*Cardamine breweri*), seep monkey flower (*Mimulus guttatus*), fringed willowherb (*Epilobium ciliatum*), and American speedwell (*Veronica americana*). Soils are very sandy; no peat formation was documented. Hummocks are present on both sides of Crystal Spring Creek that support shrubby cinquefoil (*Dasiphora floribunda*), pussy toes (*Antennaria rosea*), bedstraw (*Galium septentrionale*), meadow zizia (*Zizia aperta*), wind flower (*Anemone cylindrical*), and silvery primrose (*Primula incana*). Uplands are dominated by mountain phlox (*Phlox austromontana*) in more mesic areas with silver sagebrush (*Artemisia cana*), while drier areas support mountain sagebrush (*Artemisia tridentata* ssp. *pauciflora*) with Sandberg bluegrass (*Poa secunda*).

**Key Environmental Factors:** The presence of groundwater discharge.

**Climate Description:** The site is located in an intermountain basin that is enclosed on most sides by mountains that create precipitation shadows for air and moisture. Climate records for Walden indicate a mean annual precipitation of 10.53 inches (WRCC 2009). Annual mean for snowfall is 57.1 inches. The lowest average temperature (Jan.) is 3.9 degrees F and the highest average temperature (July) is 78.5 degrees F.

**Biodiversity Significance Rank Comments (B3):** The site supports a fair (C-ranked) occurrence of the globally imperiled (G2G3/S2) pale blue-eyed grass (*Sisyrinchium pallidum*), a good (B-ranked) occurrence of the state imperiled (G4/S1) slender thelypody (*Thelypodium sagittatum*), and a good (B-ranked) occurrence of the state imperiled (G4/S1) Rocky Mountain ragwort (*Packera debilis*). In addition, there are extant occurrences of the state imperiled (G5/S1) Willet (*Catoptrophorus semipalmatus*) and the state rare northern leopard frog (*Rana pipiens*).

## Natural Heritage element occurrences at the Crystal Spring PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Amphibians	<i>Rana pipiens</i>	Northern Leopard Frog	G5	S3		SC	BLM/USFS	E	
Birds	<i>Catoptrophorus semipalmatus</i>	Willet	G5	S1B				E	
Vascular Plants	<i>Sisyrinchium pallidum</i>	pale blue - eyed grass	G2G3	S2			BLM	C	2009-07-09
Vascular Plants	<i>Packera debilis</i>	Rocky Mountain ragwort	G4	S1				B	2009-07-09
Vascular Plants	<i>Thelypodium sagittatum</i>	slender thelypody	G4	S1				B	2009-07-09

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** Boundaries are drawn to capture the immediate watershed that starts at the spring discharge area. The boundaries were developed to include immediate ecological processes. Specifically the primary ecological process is hydrology, especially spring discharge. Only private lands with written permission were surveyed.

**Protection Urgency Rank Comments (P3):** The entire site is located with private lands. Grazing is part of the ranch's management at the time of survey. Government Ditch No. 2 is located east of the site and effects on spring are unknown. Any alterations to flow should consider the wetland dependent elements.

**Management Urgency Rank Comments (M3):** Control of Canada thistle (*Breca arvensis*) and musk thistle (*Carduus nutans*) should be addressed in 5 years to prevent further spread.

**Exotic Species Comments:** Canada thistle (*Breca arvensis*) and musk thistle (*Carduus nutans*) are present.

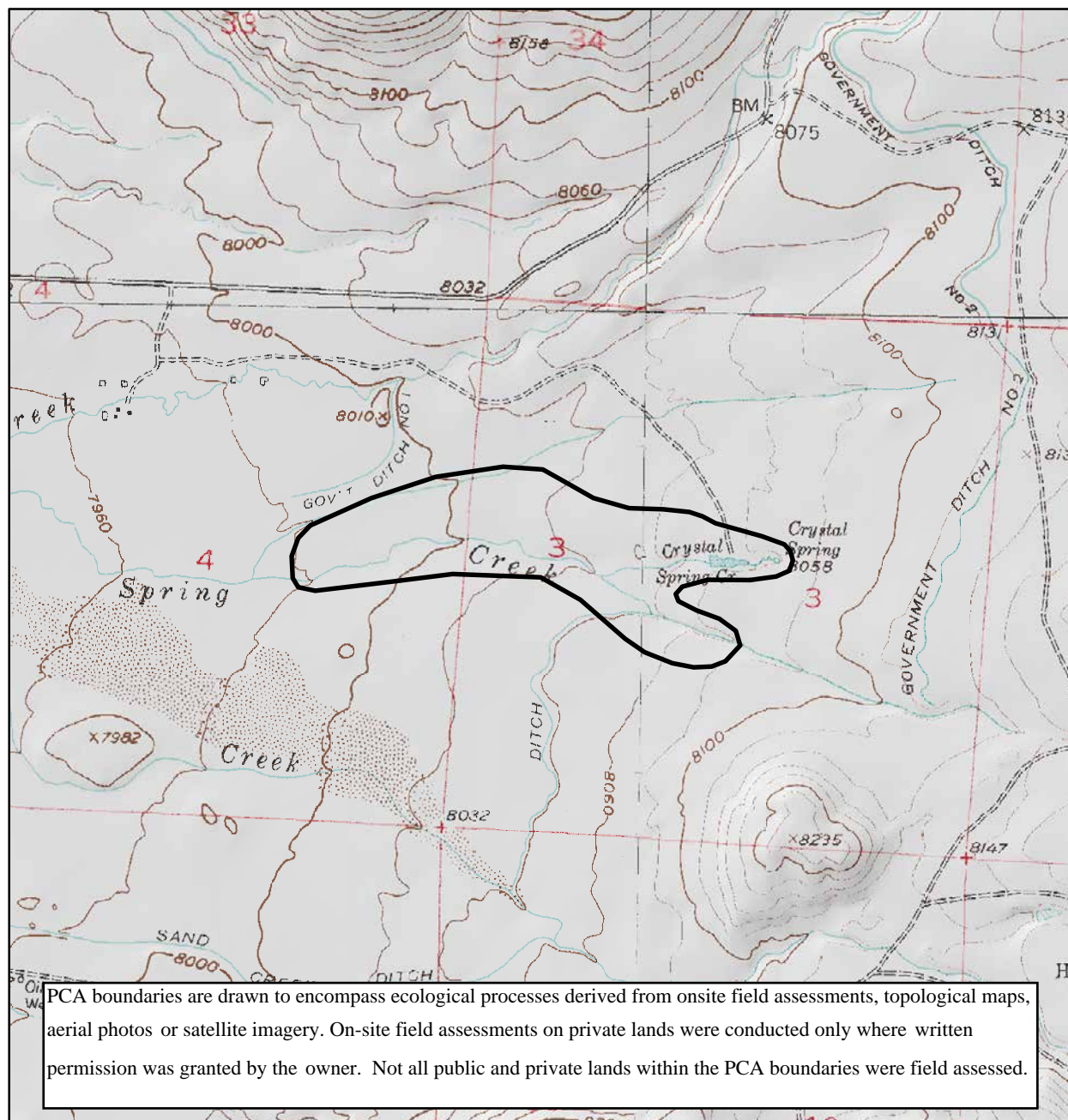
## References

Culver, D.R., K. Decker, J. Parker, J. Bell, J. Sovell, and J. Huggins. 2010. CNHP Final Report: Identification and Assessment of Important Wetlands within the North Platte Watershed, CO. Colorado Natural Heritage Program, Fort Collins, CO.

Western Regional Climate Center. 2009. Record Climate Summaries. Accessed in 2009. <http://www.wrcc.dri.edu/>

**Version Author:** Culver, D.R.

**Version Date:** 11/05/2009



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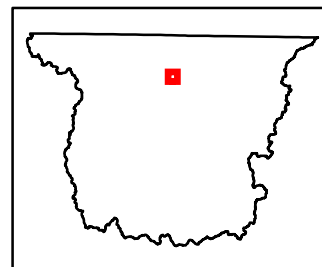
## Legend

PCA Boundary

Eagle Hill, 40106-G2  
Cowdrey, 40106-G3

7.5 Minute Digital Raster  
Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed



Map 5. Crystal Spring Potential Conservation Area, B3: High Biodiversity Significance





Crystal Springs looking west towards the Park Range.



Pale blue-eyed grass (*Sisyrinchium pallidum*).



Rocky Mountain ragwort (*Packera debilis*)

## Horse Park

**Biodiversity Rank - B3: High Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Jack Creek Ranch

**Size:** 248 acres (100 ha)

**Elevation:** 9,299 - 9,600 ft. (2,834 - 2,926 m)

**General Description:** Horse Park is a basin located between glacial moraines, La Fevre Ridge to the west and an unnamed moraine to the east. Horse Park is the headwaters of Horse Creek that flows into the Illinois River, eventually feeding into the North Platte River watershed. Horse Park is a wet meadow dominated by graminoids (*Deschampsia caespitosa*, *Carex aquatilis*, *C. utriculata*, and *Calamagrostis canadensis*) with a series of depressions or ponds that vary in saturation levels. Ponds support pond lily (*Nuphar lutea*), burreed (*Sparganium angustifolium*), and buckbean (*Menyanthes trifoliata*). Short stature willows dominated the drier edges e.g., planeleaf willow (*Salix planifolia*) and wolf willow (*Salix wolfii*). The hydrology of Horse Park is likely the combination of groundwater discharge and surface flows from precipitation and snow melt. The lower portion of the Horse Park site supports several quaking fens at the edge of the wet meadow. These fens are determined from peaty soils and floating mats of vegetation, typically consisting of elephanthead (*Pedicularis groenlandica*), marsh marigold (*Caltha leptosepala*), and arrowleaf ragwort (*Senecio triangularis*). The surrounding uplands are dominated by lodgepole pine (*Pinus contorta*) and grouse whortleberry (*Vaccinium cespitosum*).

**Key Environmental Factors:** Groundwater discharge and seasonal surface flows.

**Biodiversity Significance Rank Comments (B3):** This site is drawn for an excellent (A-ranked) occurrence of a globally vulnerable (G3/S3) plant community, *Salix wolfii* / mesic forb riparian shrubland. This plant community typically grows where the water table is usually within the top 3 feet of soil and/or where groundwater slowly seeps to the surface. Although not tracked by CNHP, there is a population of buckbean (*Menyanthes trifoliata*) which is a Forest Service Species of Concern.

## Natural Heritage element occurrences at the Horse Park PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Salix wolfii / Mesic Forbs Shrubland	Subalpine Riparian Willow Carr	G3	S3				A	2006-07-10

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The boundary includes Horse Park and Horse Creek drainage. It incorporates the immediate watershed that supports the wetland-dependent plant and animals with a small buffer which should protect the elements from local disturbance or degradation, including, but not limited to, exotic species invasion and local hydrologic alterations.

**Protection Urgency Rank Comments (P3):** The adjacent area is being logged. Upcoming grazing could pose threats.

**Management Urgency Rank Comments (M3):** Monitor grazing and wildlife use to determine if unacceptable degradation occurs.

**Off-Site Considerations:** Elements are linked to the hydrologic regime. Activities within the watershed which could impact hydrology, including water quality, quantity, and hydroperiod, should be evaluated for impacts to the elements.

## References

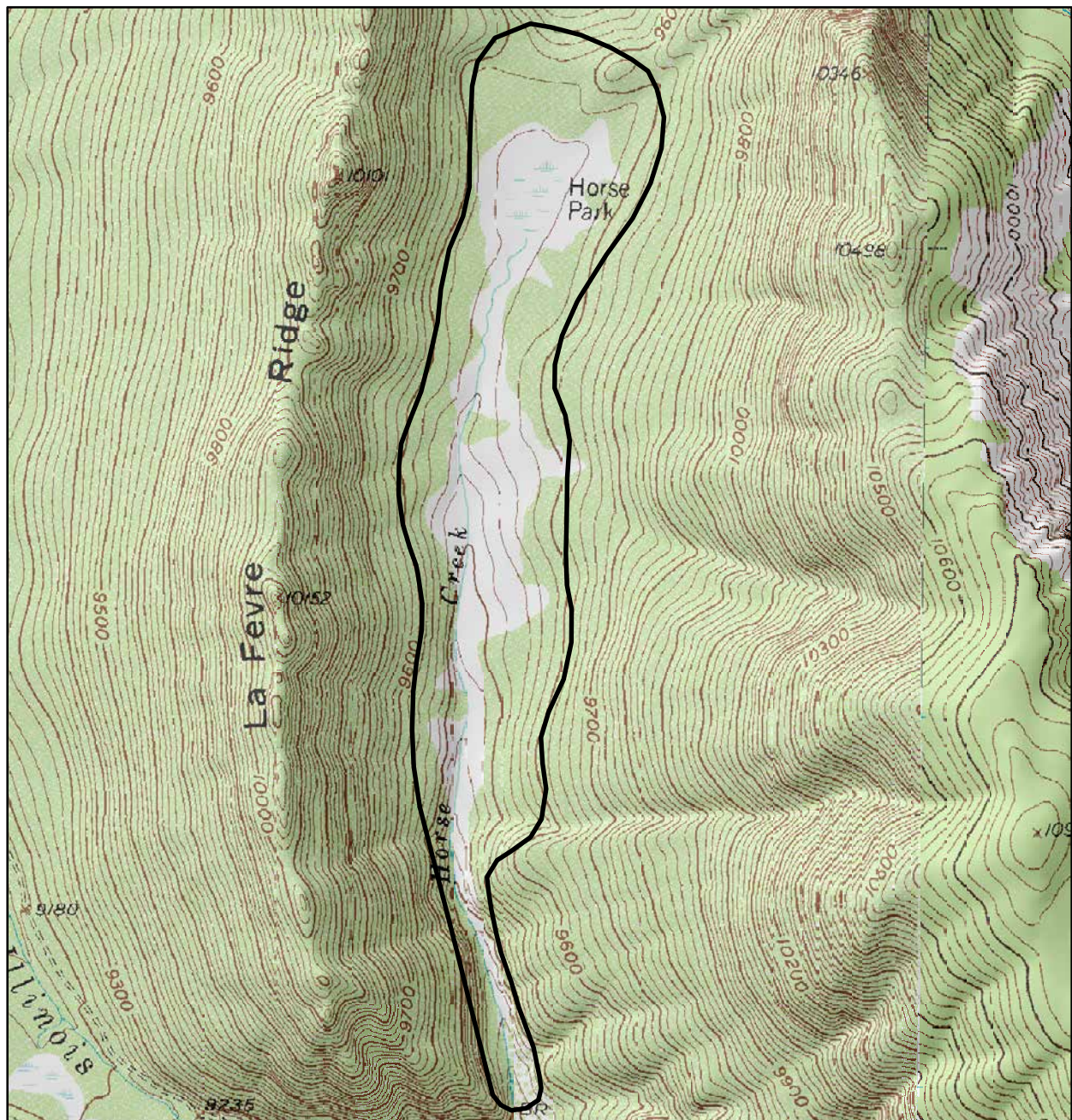
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Culver, D.R., K. Decker, J. Parker, J. Bell, J. Sovell, and J. Huggins. 2010. CNHP Final Report: Identification and Assessment of Important Wetlands within the North Platte Watershed, CO. Colorado Natural Heritage Program, Fort Collins, CO.

**Version Author:** Culver, D.R.

**Version Date:** 10/16/2006





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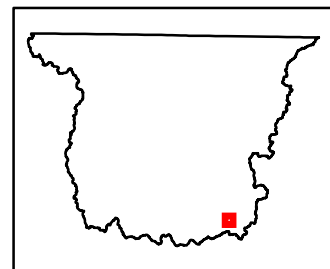
## Legend

 PCA Boundary

Jack Creek Ranch, 40106-D1

7.5 Minute Digital Raster  
Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed



Map 6. Horse Park Potential Conservation Area, B3: High Biodiversity Significance





Horse Park Ponds.



Narrow-leaf burreed (*Sparganium angustifolium*).



## Illinois River at Rand

**Biodiversity Rank - B3: High Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Jack Creek Ranch, Rand, Owl Ridge

**Size:** 1,963 acres (795 ha)

**Elevation:** 8,420 - 8,700 ft. (2,566 - 2,652 m)

**General Description:** The Illinois River is a tributary of the Michigan River that drains part of the North Park basin south of Walden. Its headwaters are located near Bowen Pass in the Never Summer Range. It flows northward through the valley as a winding stream, past Rand and the Arapaho National Wildlife Refuge, to its confluence with the Michigan at Walden. There are several ditches that take water out of the Illinois River eventually releasing it back through irrigation. These include Ottawa, Macfarlane Ext., Monroe, and Arnold ditches. The riparian shrubland located along the Illinois River and its floodplain has a shared dominant tall shrub layer between Rocky Mountain willow (*Salix monticola*) and Geyer's willow (*S. geyeriana*). Other shrubs with less cover include whiplash (*S. lasiandra*) and thinleaf alder (*Alnus incana*). The understory is dominated by typical riparian forbs such as gooseberry (*Ribes inerme*), twinberry (*Lonicera involucrata*), and shrubby cinquefoil (*Dasiphora floribunda*). Graminoids include beaked sedge (*Carex utriculata*), Nebraska sedge (*C. nebrascensis*), meadow sedge (*C. praeegracilis*), timothy (*Phleum pratense*), creeping foxtail (*Alopecurus arundinaceus*), canary reedgrass (*Phalaris arundinaceae*), manna grass (*Glyceria striata*), Baltic rush (*Juncus balticus*), swordleaf rush (*J. ensifolius*) and bluejoint reedgrass (*Calamagrostis canadensis*). There are low areas that hold spring run-off and are completely dominated by sedges with willow along drier edges. Wildlife signs included muskrat (*Ondatra zibethicus*), waterfowl, and Great Blue Heron (*Ardea herodias*). The site supports excellent fish habitat evidenced by the numerous areas of ripples and pools.

**Key Environmental Factors:** Beaver (*Castor canadensis*) are primary users as well as maintainers to montane riparian shrublands. Beaver activity forms ponds that slow spring runoff and flooding and retain water that will be released slowly during the growing season. The primary abiotic ecological process to maintain viability is hydrology and more specifically surface flow. Annual and episodic flooding is important in maintaining riparian shrublands (Rondeau 2001).

**Climate Description:** The site is located in an intermountain basin that is enclosed on most sides by mountains that create precipitation shadows for air and moisture. Climate records for Walden indicate a mean annual precipitation of 10.53 inches (WRCC 2009). Annual mean for snowfall is 57.1 inches. The lowest average

temperature (Jan.) is 3.9 degrees F and the highest average temperature (July) is 78.5 degrees F.

**Biodiversity Significance Rank Comments (B3):** This site supports an excellent (A-ranked) occurrence of the globally vulnerable (G3/S3) Geyer's willow (*Salix geyeriana*) - Rocky Mountain willow (*Salix monticola*) / mesic forbs shrubland. Imprecise records of wood frog (*Rana sylvatica*), a state vulnerable (G5/S3) amphibian, were historically documented in the site, but current information is needed to verify the frog populations.

Natural Heritage element occurrences at the Illinois River at Rand PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Salix geyeriana - Salix monticola / Mesic Forbs Shrubland	Geyer's Willow - Rocky Mountain Willow/Mesic Forb	G3	S3				A	2009-08-26

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** Boundaries are drawn to capture the immediate watershed that starts at the confluence of the Illinois River and Jack Creek to the confluence of Willow Creek with the Illinois. The boundaries were developed to include immediate ecological processes. Specifically the primary ecological process is hydrology, especially surface flow (Rondeau 2001). Only private lands with written permission were surveyed.

**Protection Urgency Rank Comments (P3):** The site is a mix of private lands ownership. The property surveyed was managed for wildlife and fisheries habitat.

**Management Urgency Rank Comments (M3):** Canada thistle (*Breca arvensis*) and musk thistle (*Carduus nutans*) are present in the disturbed, drier areas within the site and should be controlled to prevent further spread.

**Exotic Species Comments:** Canada thistle (*Breca arvensis*) and musk thistle (*Carduus nutans*) are present in the disturbed, drier areas within the site.

**Information Needs:** Current field surveys are needed to verify populations of wood frog (*Rana sylvatica*).

## References

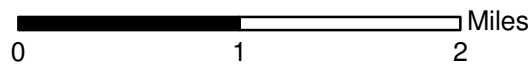
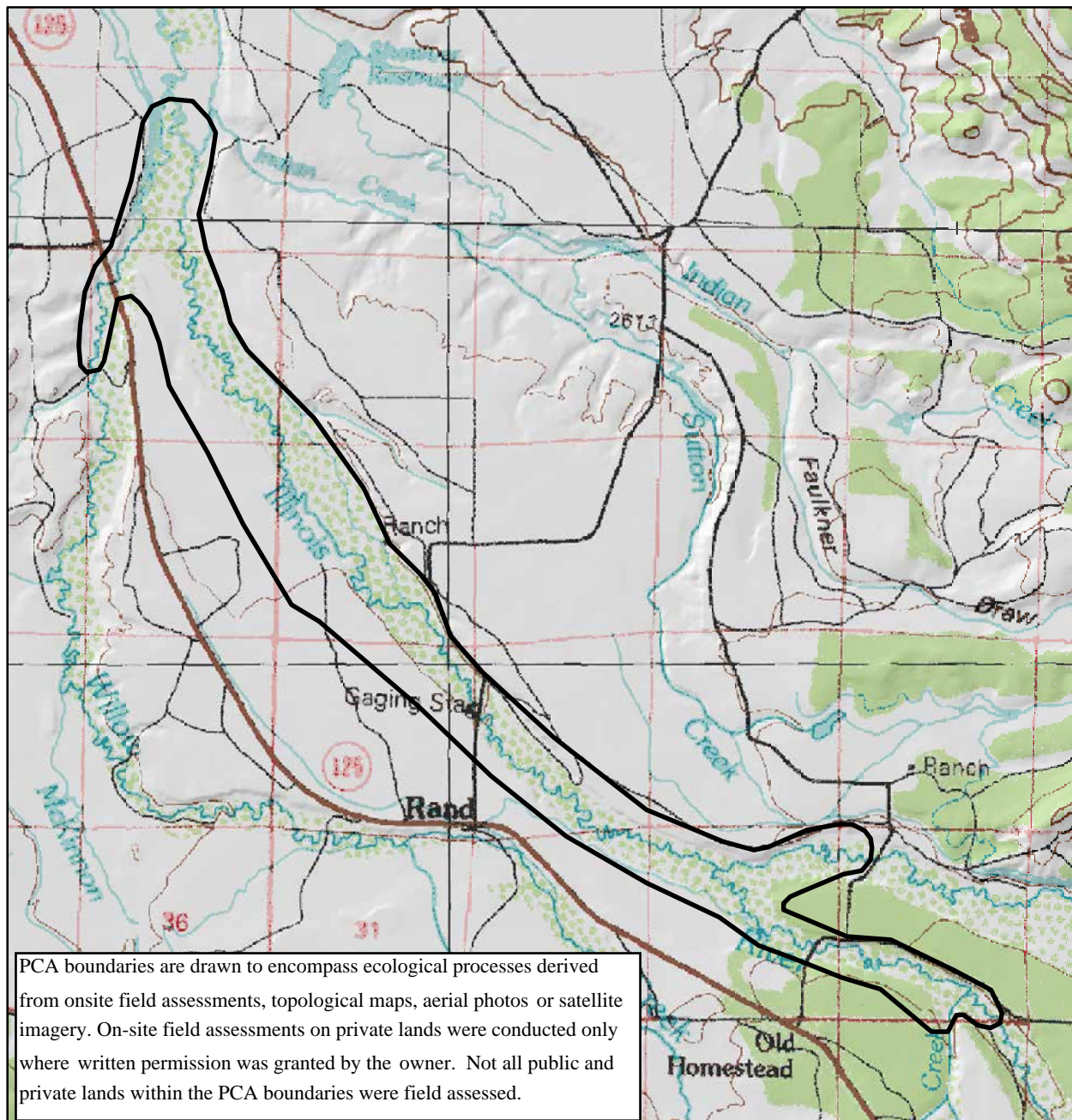
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Rondeau, R. 2001. Ecological system viability specifications for Southern Rocky Mountain ecoregion. First Edition. Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO. 181 pp.

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**Version Author:** Culver, D.R.

**Version Date:** 11/05/2009



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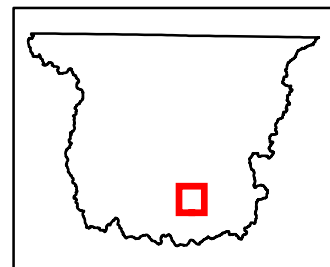
## Legend

PCA Boundary

Steamboat Springs, 40106-A1  
Walden, 40106-E1

30x60 Minute Digital Raster  
Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed



Map 7. Illinois River at Rand Potential Conservation Area, B3: High Biodiversity Significance





Gravel bars along the Illinois River at Rand.



Illinois River at Rand overview.



## Indian Creek at Owl Mountain

**Biodiversity Rank - B3: High Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Jack Creek Ranch, Rand

**Size:** 236 acres (95 ha)

**Elevation:** 8,680 - 8,920 ft. (2,646 - 2,719 m)

**General Description:** The Indian Creek at Owl Mountain site is located in the North Park intermountain basin east of the Illinois River. Indian Creek flows northwest from Owl Mountain through the site. Two human-made ponds are located along Indian Creek that are utilized for private fishing clubs. The ponds are likely supplemented with springs that flow out of the Coalmont Formation sandstone and saturated alluvium layer. The wetland plant communities are indicative of saturated soils as well. The bog birch (*Betula nana*) wetland plant community typically occurs on saturated soils from either snowmelt or groundwater discharge. Associated plants include shrubby cinquefoil (*Dasiphora floribunda*), mixed with low stature willows (*Salix brachycarpa* and *S. planifolia*). There are several peat-forming areas within this occurrence, up to 26 inches (10.4 cm) and water logged spongy ground. The other wetland plant community is dominated by thinleaf alder (*Alnus incana*), located where groundwater discharge from a spring descends through an aspen (*Populus tremuloides*) forest and empties into Deer Creek. Associated lower canopy shrubs include Drummond's willow (*Salix drummondiana*), Rocky Mountain willow (*S. monticola*), currant (*Ribes inerme*), common juniper (*Juniperus communis*), twinberry (*Lonicera involucrata*) and elderberry (*Sambucus microbotrys*). A pair of boreal toads (*Bufo boreas*) was also documented in the site. The upland vegetation consists of lodgepole pine (*Pinus contorta*) forests that have been severely impacted by the mountain pine beetle (*Dendroctonus* spp.) and quaking aspen forest.

**Key Environmental Factors:** Groundwater discharge and peat formation

**Land Use History:** Ranching prior to the current operation of a dude ranch.

**Biodiversity Significance Rank Comments (B3):** This site supports a good (B-ranked) occurrence of the globally vulnerable (G3G4/S3) *Betula nana* / mesic forbs - mesic graminoids subalpine riparian shrubland. Two boreal toads (*Bufo boreas*) were documented within the site. The boreal toad was once common throughout the mountains of Colorado, but has undergone declines over the last 20 years (Goettl 1997). Reasons for the decline are unknown, but postulated to be due to a chytrid fungus (Cunningham 1998 as cited in Hammerson 1999). In 1993, the boreal toad was listed as state endangered by the Colorado Division of Wildlife.

# Natural Heritage element occurrences at the Indian Creek at Owl Mountain PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Amphibians	Bufo boreas pop. 1	Boreal Toad (Southern Rocky Mountain Population)	G4T1Q	S1		SE		E	2009-07-16
Natural Communities	Betula nana / Mesic Forbs - Mesic Graminoids Shrubland	Subalpine Riparian Shrubland	G3G4	S3				B	2009-07-16

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** Boundaries are drawn to capture the immediate watershed of Indian Creek that starts below Owl Mountain. The boundaries were developed to include immediate ecological processes. Specifically the primary ecological process is hydrology, especially groundwater discharge. Only private lands with written permission were surveyed.

**Protection Urgency Rank Comments (P3):** The site is privately owned and conservation potential is unknown.

**Management Urgency Rank Comments (M3):** Control of Canada thistle (*Breea arvensis*) in drier area is recommended.

**Exotic Species Comments:** Canada thistle (*Breea arvensis*) has been documented in the site.

## References

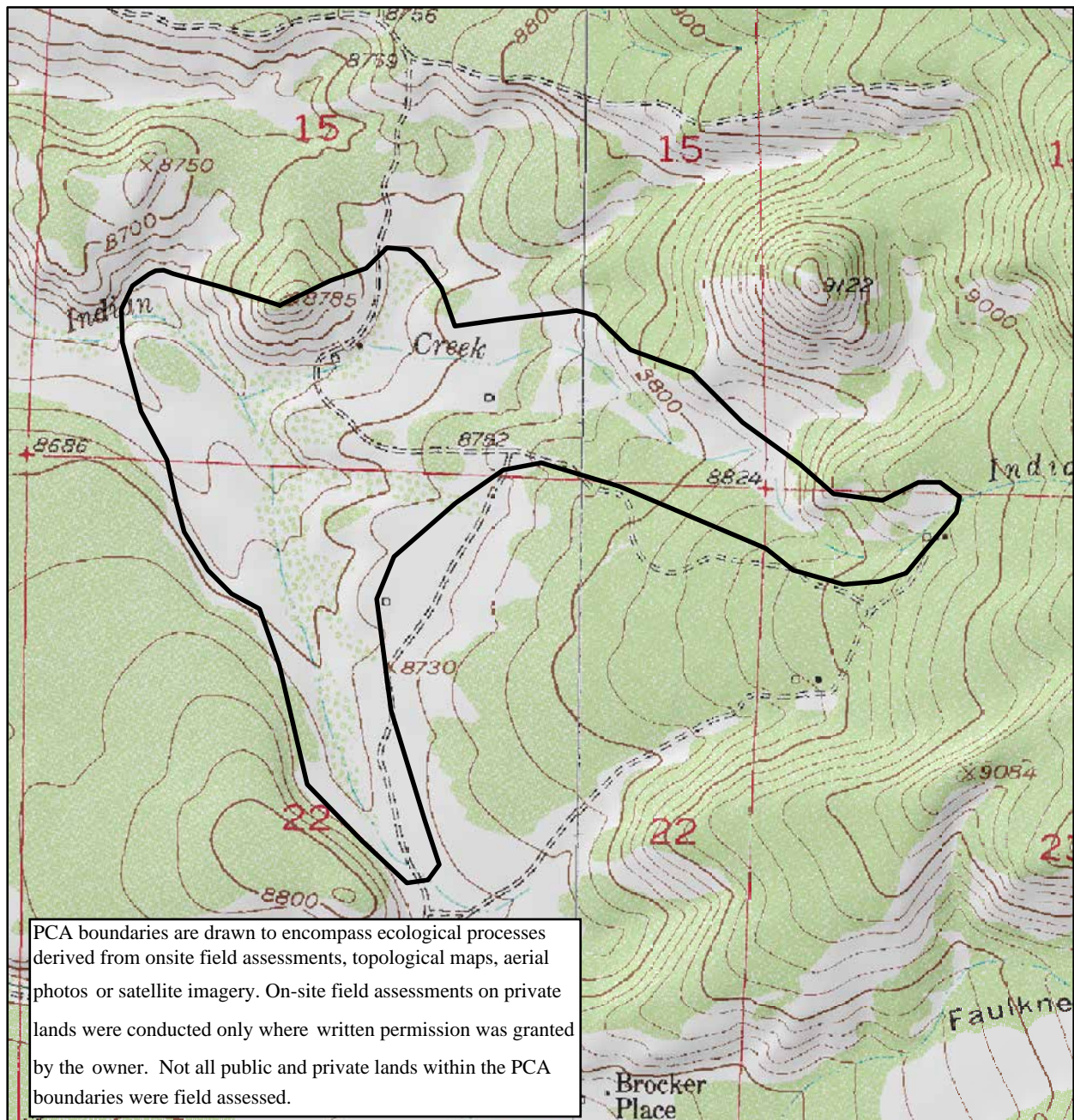
Culver, D.R., K. Decker, J. Parker, J. Bell, J. Sovell, and J. Huggins. 2010. CNHP Final Report: Identification and Assessment of Important Wetlands within the North Platte Watershed, CO. Colorado Natural Heritage Program, Fort Collins, CO.

Goettl, J. P. Jr., and The Boreal Toad Recovery Team. 1997. Boreal Toad (*Bufo boreas boreas*) (Southern Rocky Mountain Population), Recovery Plan. Colorado Division of Wildlife, Denver.

Hammerson, G.A. 1999. Amphibians and Reptiles in Colorado. Second Edition. University Press of Colorado. Niwot, CO.

**Version Author:** Culver, D.R.

**Version Date:** 11/18/2009



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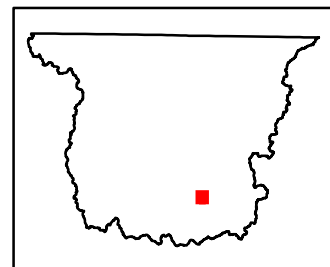
## Legend

 PCA Boundary

Jack Creek Ranch, 40106-D1  
Rand, 40106-D2

7.5 Minute Digital Raster  
Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed

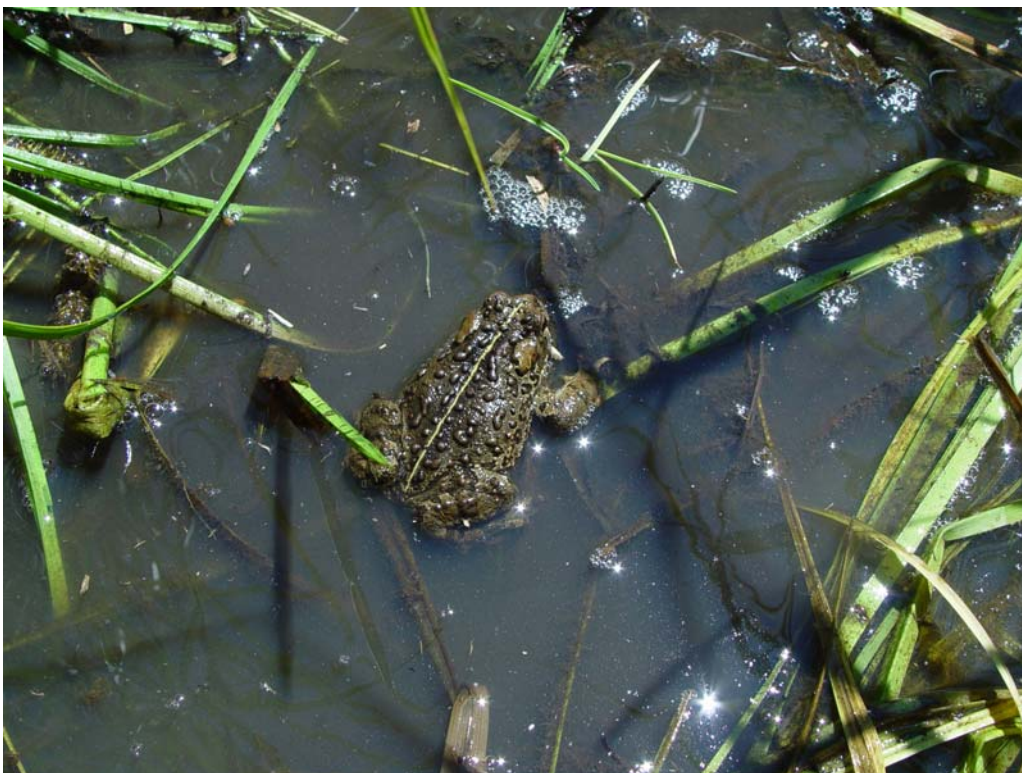


Map 8. Indian Creek at Owl Mountain Potential Conservation Area, B3: High Biodiversity Significance





Pond within Indian Creek at Owl Mountain site.



Adult boreal toad (*Bufo boreas boreas*).

## Jimmy Creek at Frenchwoman Creek

**Biodiversity Rank - B3: High Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future**

**U.S.G.S. 7.5-minute quadrangles:** Crazy Mountain

**Size:** 167 acres (68 ha)

**Elevation:** 8,000 - 8,040 ft. (2,438 - 2,451 m)

**General Description:** Jimmy Creek is a perennial creek flowing at the west base of low, sedimentary mountains and along the eastern edge of a large, relatively flat river terrace that was probably formed at the end of the last ice age (around 13,000 years ago at the close of the Pleistocene). Several creeks flow out of the mountains into Jimmy Creek, and the creek is also fed by spring flow out of the ancient river terrace on the west side of the creek. The creek is separated by a low ridge from several shallow ponds (both permanent and ephemeral) that are fed by ground water seeping to the surface, the same ground water that feeds the creek. West of the creek and upstream are irrigated fields used to grow non-native grasses. The pale blue-eyed grass (*Sisyrinchium pallidum*) is found in a wet meadow fed by overflow from Jimmy Creek, ground water from the creek, and especially ground water seeping to the surface from the river terrace to the west.

**Biodiversity Significance Rank Comments (B3):** This site contains a fair (C-ranked) occurrence of pale blue-eyed grass (*Sisyrinchium pallidum*), a globally imperiled (G2G3/S2) wetland plant. It also contains an unranked occurrence of state rare (G4/S1) plant Rocky Mountain Ragwort (*Packera debilis*). The site is in fair condition, containing mostly native species, but with much evidence of past and current agricultural use.

Natural Heritage element occurrences at the Jimmy Creek at Frenchwoman Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	<i>Sisyrinchium pallidum</i>	pale blue - eyed grass	G2G3	S2			BLM	C	1996-08-14
Vascular Plants	<i>Packera debilis</i>	Rocky Mountain ragwort	G4	S1					1996-08-14

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The site boundary includes the known location of the



element, adjacent natural wet meadows, the creek itself, and a buffer of approximately 500 feet to protect from direct impacts to the plant. The element could occur along a much larger stretch of Jimmy Creek.

**Protection Urgency Rank Comments (P3):** The site is privately owned by one landowner. Development pressures are likely to increase in the near future.

**Management Urgency Rank Comments (M4):** Management may be needed in the future to maintain current quality of element occurrences.

**Information Needs:** The inventory of *Sisyrinchium pallidum* at this site was done after the most important character for distinguishing this species, flower color, was gone. A full inventory of this site during *Sisyrinchium pallidum*'s flowering period is warranted.

### References

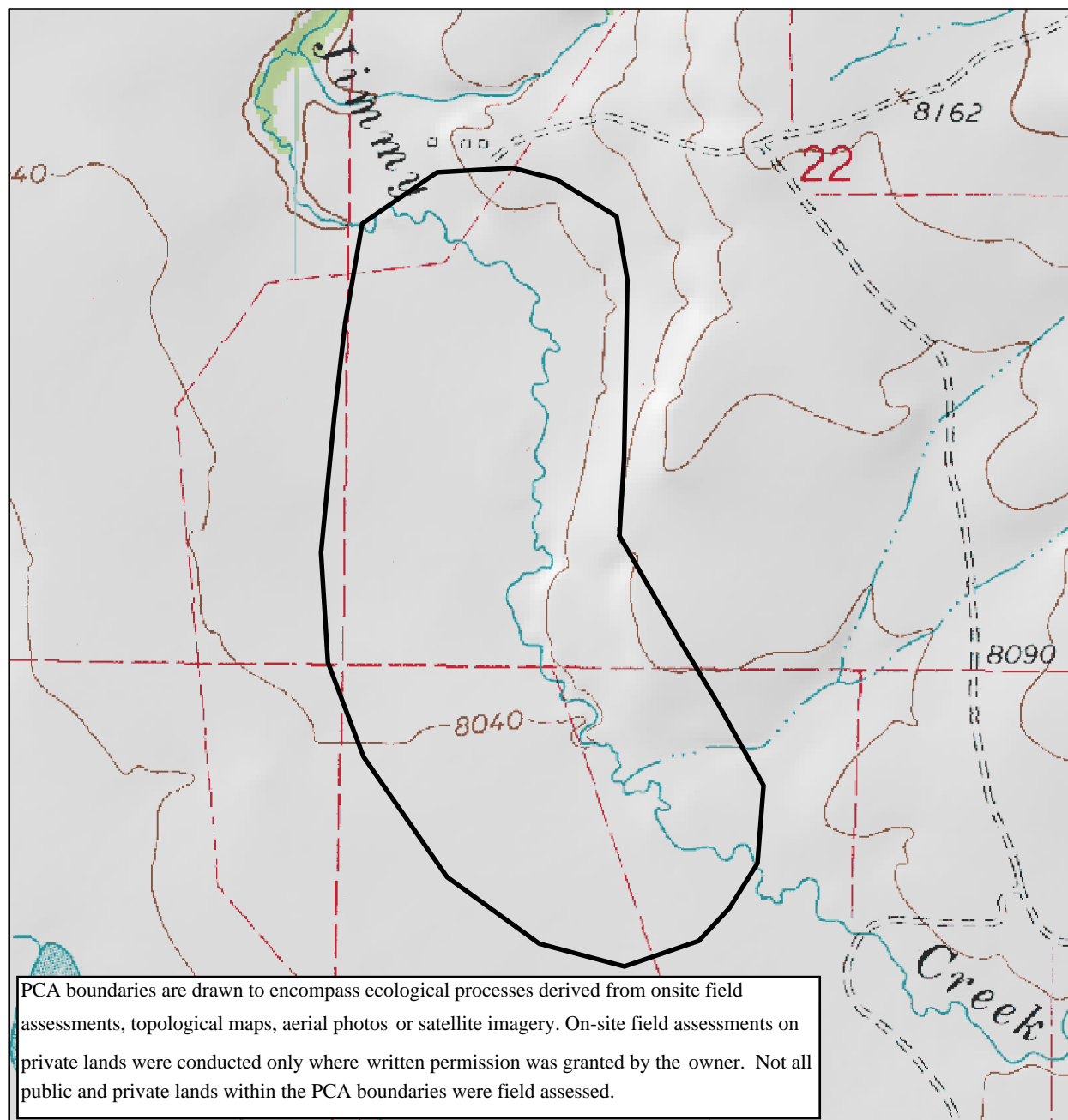
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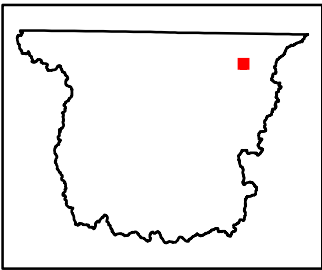
**Version Author:** Culver, D.R.

**Version Date:** 12/09/2009



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Map 9. Jimmy Creek at Frenchwoman Creek Potential Conservation Area, B3: High Biodiversity Significance

## Little Grizzly Creek

**Biodiversity Rank - B3: High Biodiversity Significance**

**Protection Urgency Rank - P4: No Threat or Special Opportunity**

**Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future**

**Size:** 1,251 acres (506 ha)

**Elevation:** 8,100 - 8,600 ft. (2,469 - 2,621 m)

**General Description:** The Little Grizzly Creek site encompasses a meandering, stream that began in the Park Range to the west. Little Grizzly Creek is joined by Doran, Darling, and Pony creeks within the site. Pole Mountain, to the south, consists of sandstone and shales from the Coalmont Formation. Pole Mountain Lake is likely fed by springs that have filtered down through the sandstone layers. Several ditches take water out of the Little Grizzly Creek releasing it back to the Creek by irrigation, these include: Jennie, Chedsey Ditch No. 2, Powell, Cook, Darling, and Nairn ditches. The riparian shrubland is dominated by Geyer willow (*Salix geyeriana*), Rocky Mountain willow (*S. monticola*), and scattered planeleaf willow (*S. planifolia*), whiplash willow (*S. lasiandra*) and Bebb's willow (*S. bebbiana*). Thinleaf alder (*Alnus incana*) occurs along the river banks. The understory is dominated by the introduced grasses, creeping foxtail (*Alopecurus arundinaceus*) and timothy (*Phleum pratense*). In the wetter areas, under the willows, water sedge (*Carex aquatilis*), analogue sedge (*C. simulata*), meadow sedge (*C. praegracilis*), and beaked sedge (*C. utriculata*) exist. Within the floodplain, the soils are derived from modern alluvium. Current land use within the site is hay production and cattle and wildlife grazing. There are signs of active beaver (*Castor canadensis*) along the river and its tributaries. Elk (*Cervus canadensis*) and mule deer (*Odocoileus hemionus*) sign are found throughout the site. The river is bordered on both sides by hay fields with a network of irrigation ditches. The uplands consist of sagebrush (*Artemisia tridentata* var. *pauciflora* and *A. cana*) shrublands. Additionally, the Coaltown sagebrush (*Artemisia argilosa*) was noted within the site. This species' taxonomy is still being researched, but it is currently thought to only occur in North Park between Coalmont area and Lake Creek (Winward 2004).

**Key Environmental Factors:** Hydrology, specifically a natural flow regime with annual episodic flooding, and beaver activities that enable out-of-bank flows and high soil moisture are key driving factors that exert a major influence on the elements at the site.

**Biodiversity Significance Rank Comments (B3):** This site supports an excellent (A-ranked) occurrence of a globally vulnerable (G3/S3) Geyer willow (*Salix geyeriana*) / mesic forbs montane willow carr. Greater Sandhill Cranes (*Grus*

*canadensis tabida*) have been documented along the creek but are not a target for this site.

Natural Heritage element occurrences at the Little Grizzly Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Salix geyeriana / Mesic Forbs Shrubland	Montane Willow Carr	G3	S3				A	2009-07-02

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** Boundaries are drawn to capture the immediate watershed that starts at the confluence of Doran and Little Grizzly creeks. The boundaries were developed to include immediate ecological processes. Specifically the primary ecological process is hydrology, especially surface flow (Rondeau 2001). Only private lands with written permission were surveyed.

**Protection Urgency Rank Comments (P4):** The majority of the site has been placed within a conservation easement.

**Management Urgency Rank Comments (M4):** Monitor the spread of Canada thistle (*Breca arvensis*) along ditches and drier areas.

**Exotic Species Comments:** Canada thistle (*Breca arvensis*) is present.

### References

Culver, D.R., K. Decker, J. Parker, J. Bell, J. Sovell, and J. Huggins. 2010. CNHP Final Report: Identification and Assessment of Important Wetlands within the North Platte Watershed, CO. Colorado Natural Heritage Program, Fort Collins, CO.

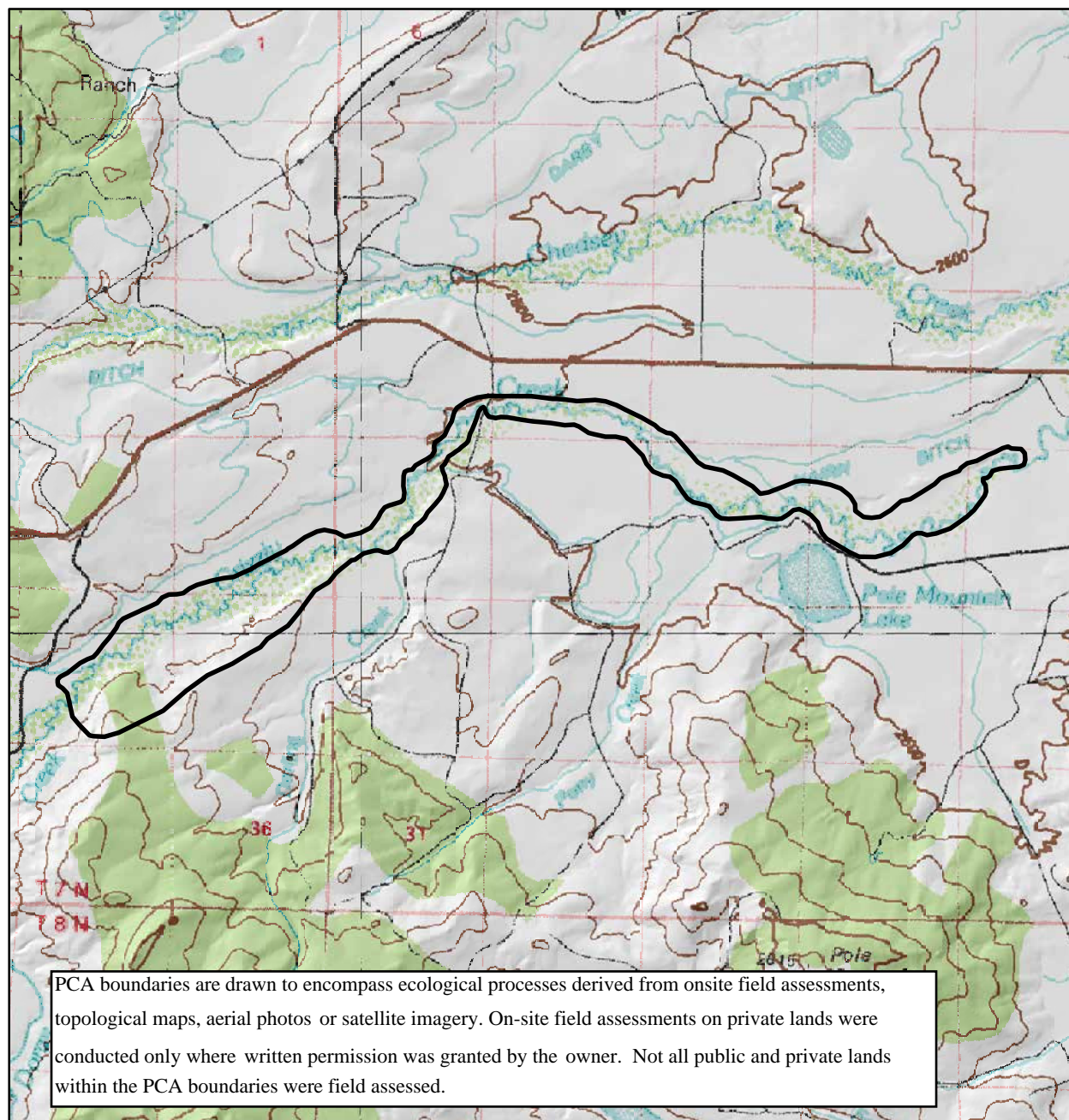
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**Version Author:** Culver, D.R.

**Version Date:** 10/20/2009



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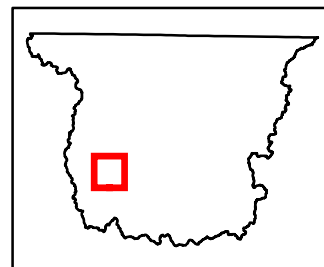
### Legend

 PCA Boundary

Walden, 40106-E1

30x60 Minute Digital Raster  
Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed



Map 10. Little Grizzly Creek Potential Conservation Area, B3: High Biodiversity Significance





Little Grizzly Creek overview.



Pond located on north side of Pole Mountain.

## Little Hohnholz Lake

**Biodiversity Rank - B3: High Biodiversity Significance**

**Protection Urgency Rank - P4: No Threat or Special Opportunity**

**Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss**

**U.S.G.S. 7.5-minute quadrangles:** Crazy Mountain

**Size:** 245 acres (99 ha)

**Elevation:** 7,920 - 8,000 ft. (2,414 - 2,438 m)

**General Description:** The Little Hohnholz Lake site is a wetland along a reservoir shore surrounded by poor to good condition sagebrush plains. The wetlands are alkaline and support Nebraska sedge (*Carex nebrascensis*), sedge (*Carex simulata*), spikerush (*Eleocharis quinqueflora*), pale blue-eyed grass (*Sisyrinchium pallidum*), arrowgrass (*Triglochin* sp.) and lousewort (*Pedicularis crenulata*). The reservoir is naturally spring fed, and the springs support small but good condition wetland habitat. The sagebrush shrublands surrounding the reservoir are dominated by big sagebrush (*Artemisia tridentata*), milkvetch (*Astragalus* sp.), and mixed graminoids, as well as larch-leaf beardtongue (*Penstemon laricifolius* ssp. *exilifolius*) and dropleaf buckwheat (*Eriogonum exilifolium*).

**Biodiversity Significance Rank Comments (B3):** This site supports a fair (C-ranked) occurrence of a globally imperiled (G2G3/S2) plant species pale blue-eyed grass (*Sisyrinchium pallidum*), and a fair (C-ranked) occurrence of an alkaline spring wetland (*Eleocharis quinqueflora*) that is rare (G4/S3S4) in Colorado.

Natural Heritage element occurrences at the Little Hohnholz Lake PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Eleocharis quinqueflora Herbaceous Vegetation	Alpine Wetlands	G4	S3S4				C	1996-08-13
Vascular Plants	Sisyrinchium pallidum	pale blue - eyed grass	G2G3	S2			BLM	C	1996-07-21

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The boundary includes the element occurrences and a buffer for these elements to protect the hydrology and to ensure against erosion. It is important to note that hydrologic modifications (e.g., wells, diversions) to the north, west, and south of the site may affect the hydrology of the site even if the modifications occur beyond the site boundary.

**Protection Urgency Rank Comments (P4):** Ownership of the site is a mixture of private, BLM, and land managed by the Colorado Division of Wildlife. No threats known for foreseeable future.

**Management Urgency Rank Comments (M2):** New management action to control invasive non-native vegetation may be needed within 5 years to prevent loss of element occurrences. Recreational uses and the associated increase in non-native plant species may threaten the occurrences, especially the pale blue-eyed grass.

**Land Use Comments:** Recreational use for fisherman is high. The area appears to be at least partially grazed. There appears to be old irrigation ditches on the north side of the reservoir. This may have been an old hay meadow before the reservoir was put in. The Colorado Division of Wildlife owns and manages most of this site and the rest is privately owned. Recreational uses and the associated increase in non-native plant species may threaten the occurrences, especially the pale blue-eyed grass.

**Exotic Species Comments:** Yellow sweetclover (*Melilotus officinale*) poses a significant threat to *Sisyrinchium pallidum*. One patch of *Melilotus officinale* 20x10m was observed immediately adjacent to the *Sisyrinchium pallidum* occurrence, as well as scattered individuals. At least one area of Kentucky bluegrass (*Poa pratensis*) was observed. White clover (*Trifolium repens*), yarrow (*Achillea lanulosa*), and Canada thistle (*Cirsium arvense*) were also noted.

**Off-Site Considerations:** Adjacent lands are used as grazing land and are dominated by sagebrush grasslands.

## References

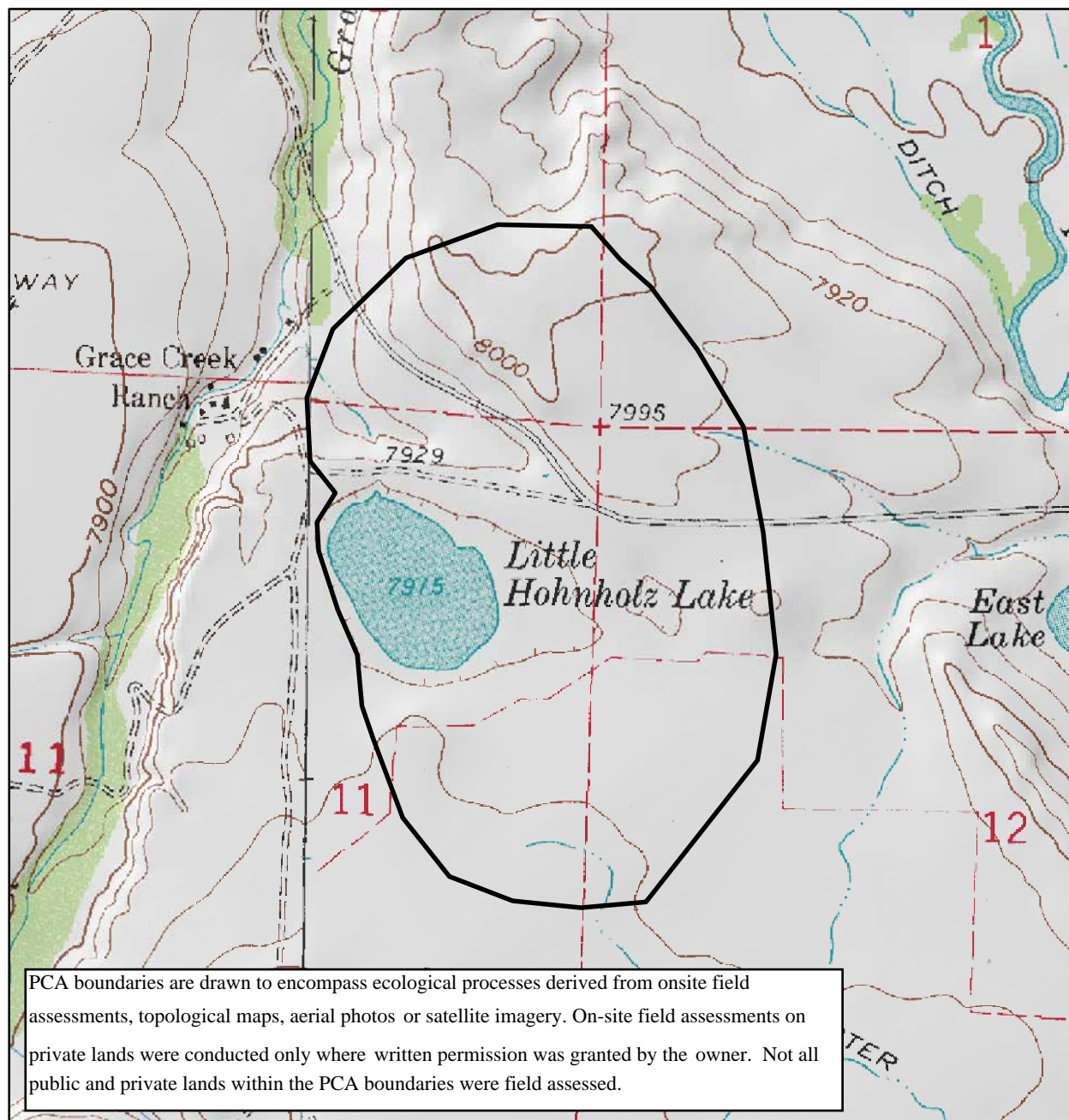
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**Version Author:** Culver, D.R.

**Version Date:** 12/09/2009



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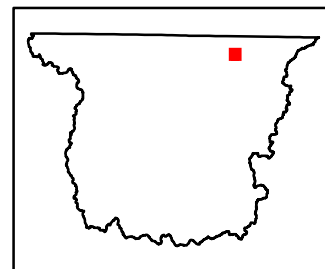
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 PCA Boundary

Crazy Mountain. 40105-H8  
Old Roach, 40106-H1

7.5 Minute Digital Raster  
Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed



Map 11. Little Hohnholz Lake Potential Conservation Area, B3: High Biodiversity Significance





Few-flower spike rush (*Eleocharis quinqueflora*) wetland.



## Lone Pine Ponds

**Biodiversity Rank - B3: High Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Boettcher Lake, Pitchpine Mountain

**Size:** 3,149 acres (1,275 ha)

**Elevation:** 8,500 - 9,800 ft. (2,591 - 2,987 m)

**General Description:** The Lone Pine Ponds site is located on the east side of the Park Range in Jackson County. The site is drained by Lone Pine Creek whose headwaters are located at Lake Katherine and Bighorn Lake in the Mount Zirkel Wilderness. The area consists of Pleistocene deposits and glacial drift of the Pinedale and Bull Lake glaciations (Tweto 1979). Throughout the site there are closed depressions, kettle ponds, and sharp lateral and terminal moraines. The depressions and kettle ponds are concentrated on top of the glacial till. Kettle ponds are a remnant of melting glacial ice stagnation and lack an inlet or outlet. The vegetation of the kettle ponds occurs in successional zones from the open water to lake margins. Open water areas are dominated by water lilies (*Nuphar lutea* ssp. *polysepala*), water smartweed, (*Persicaria amphibia*), pondweed (*Potamogeton epiphydrus*), arrowhead (*Sagittaria montevidensis*), bur-reed (*Sparganium angustifolium*), and bladderwort (*Utricularia macrorhiza*). The herbaceous-dominated lake margins that surround the open water are dominated by sedges (*Carex aquatilis*, *C. canescens*, *C. utriculata*), weak mannagrass (*Torreyochloa pauciflora*), spike rush (*Eleocharis palustris*, *E. acicularis*), blue joint reedgrass (*Calamagrostis canadensis*), tufted hairgrass (*Deschampsia cespitosa*) and rushes (*Juncus longistylis*, *J. ensifolius*, *J. drummondii*). Forbs within the lake margin include water hemlock (*Cicuta douglasii*) and arrowleaf ragwort (*Senecio triangularis*). Amphibians that are known to occur in the ponds are the wood frog (*Rana sylvatica*) and the striped chorus frog (*Pseudacris triseriata*). The aquatic and emergent vegetation at the pond margin is essential to the reproducing wood frog population. The slopes and ridges surrounding the kettles consist of sandy loams, characterized by coarse glacial till and cobbles. The upland vegetation consists of lodgepole pine (*Pinus contorta*) forests that have been severely impacted by the mountain pine beetle (*Dendroctonus* spp.).

**Key Environmental Factors:** The hydrology of the area is the important feature of the site. The kettle ponds flood annually from snow melt and spring runoff, creating significant breeding habitat for the wood frog.

**Climate Description:** The site is located in an intermountain basin that is enclosed on most sides by mountains that create precipitation shadows for air and moisture. Climate records for Walden indicate a mean annual precipitation of 10.53 inches

(WRCC 2009). Annual mean for snowfall is 57.1 inches. The lowest average temperature (Jan.) is 3.9 degrees F and the highest average temperature (July) is 78.5 degrees F.

**Land Use History:** Prior to 1820, the Ute peoples used North Park to hunt wild game in the summer but moved to lower altitudes in the fall to avoid the severe winters that are common in the mountain park. After 1820, European trappers started to visit the area and miners and prospectors who panned for gold followed them. Since European settlement began in earnest in the late 1880's and 90's ranching, including both hay production and cattle grazing, has been the dominant land use at the site.

**Biodiversity Significance Rank Comments (B3):** The site supports an excellent (A-ranked) occurrence of a globally vulnerable (G3/S3) *Alnus incana* / mesic forb riparian shrubland and an extant occurrence of the state rare (G5/S3) wood frog (*Rana sylvatica*). The wood frog is a common northern species whose distribution in Colorado is at its southern extent (Hammerson 1999). The wood frog is listed as a sensitive species by the Forest Service, BLM, and the Colorado Division of Wildlife.

Natural Heritage element occurrences at the Lone Pine Ponds PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Amphibians	<i>Rana sylvatica</i>	Wood Frog	G5	S3		SC	USFS	E	2009-08-06
Natural Communities	<i>Alnus incana</i> / Mesic Forbs Shrubland	Thinleaf Alder / Mesic Forb Riparian Shrubland	G3	S3				A	1998-06-11

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** Boundaries are drawn to capture the immediate watershed that starts below Lake Katherine. The boundaries were developed to allow potential migration routes for the wood frog among the kettle ponds. Only private lands with written permission were surveyed. Field surveys and GIS layers from the Colorado Vegetation Classification Project, and the digital orthophoto quad for Jackson County were used to delineate the boundary.

**Protection Urgency Rank Comments (P3):** The site is privately owned and plans for the area are unknown.

**Management Urgency Rank Comments (M3):** There is moderate to heavy grazing within the site. Grazing impacts to wood frog populations are not known. Canada thistle (*Breca arvensis*) was documented on drier soils. There was evidence of past logging within the site as well.

**Land Use Comments:** Cattle ranching is the only land use at the site.

**Exotic Species Comments:** Canada thistle (*Breca arvensis*) was documented on drier soils.

### **References**

Culver, D.R., K. Decker, J. Parker, J. Bell, J. Sovell, and J. Huggins. 2010. CNHP Final Report: Identification and Assessment of Important Wetlands within the North Platte Watershed, CO. Colorado Natural Heritage Program, Fort Collins, CO.

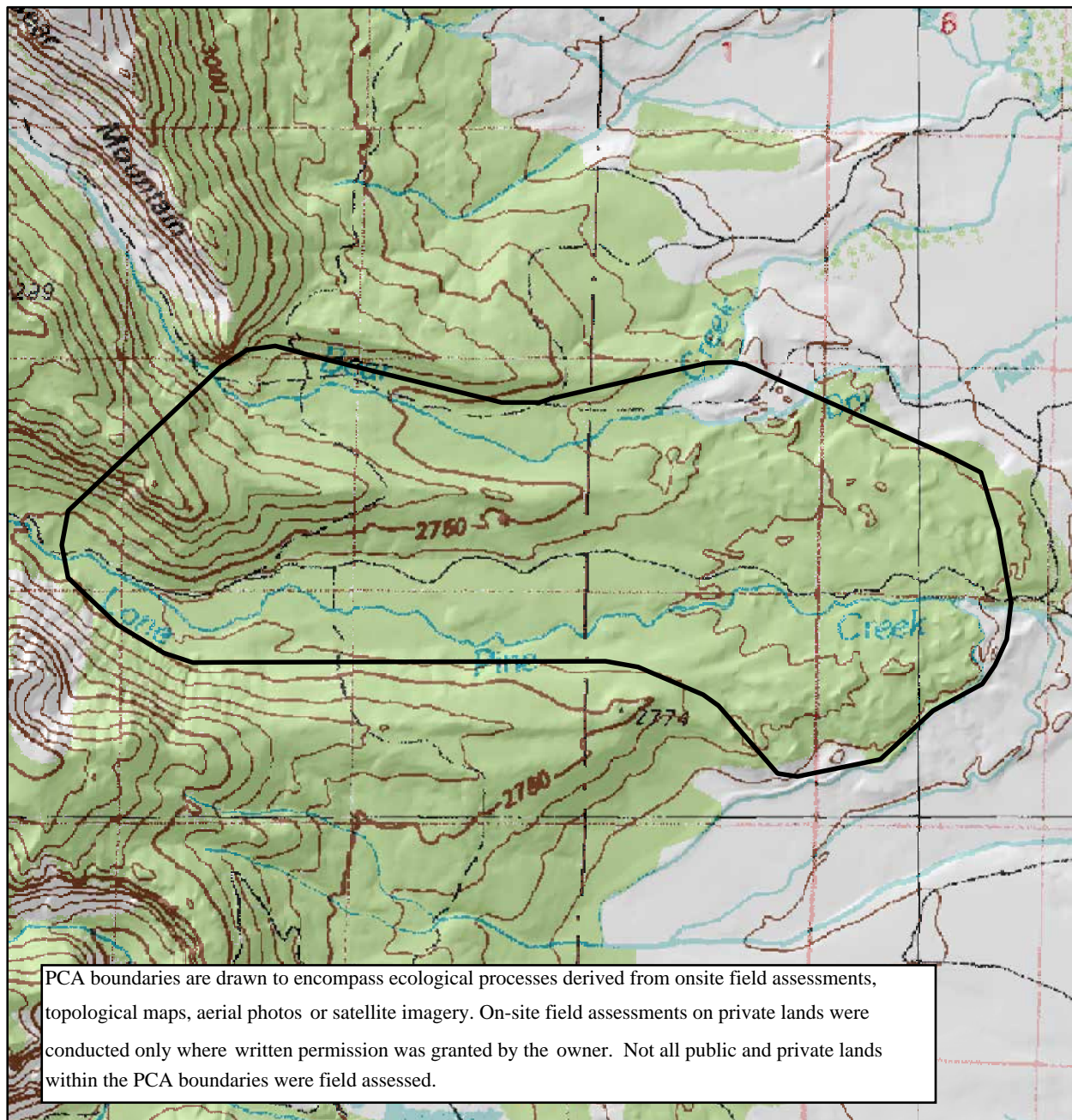
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**Version Author:** Sovell, J.R.

**Version Date:** 11/18/2009



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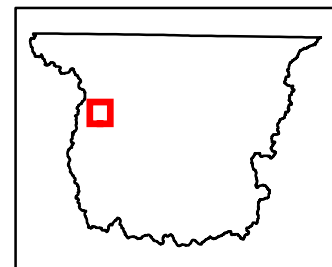
## Legend

 PCA Boundary

Walden, 40106-E1

30x60 Minute Digital Raster  
Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed



Map 12. Lone Pine Ponds Potential Conservation Area, B3: High Biodiversity Significance





One of several kettle ponds within Lone Pine Ponds site.



Wood frog (*Rana sylvatica*).



## Lower Jimmy Creek Spring

**Biodiversity Rank - B3: High Biodiversity Significance**

**Protection Urgency Rank - P4: No Threat or Special Opportunity**

**Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss**

**U.S.G.S. 7.5-minute quadrangles:** Deadman, Sand Creek Pass

**Size:** 1,051 acres (425 ha)

**Elevation:** 8,600 - 8,700 ft. (2,621 - 2,652 m)

**General Description:** This site is in a small valley in the Laramie River drainage that is surrounded by rolling hills dominated by sagebrush and grassland communities with a diverse assemblage of native forbs. The soil is red and sandy, with gravel that appears to be high in quartz. The valley bottom consists of a sedge (*Carex* spp.) dominated wetland along Jimmy Creek.

**Biodiversity Significance Rank Comments (B3):** This site includes a fair (C-ranked) occurrence of pale blue-eyed grass (*Sisyrinchium pallidum*), a globally imperiled (G2G3/S2S3) wetland plant and a fair (C-ranked) occurrence of a Rocky Mountain ragwort (*Packera debilis*), a state critically imperiled (G4/S1) wetland plant. As of 2005, this site is one of the few documented locations of pale blue-eyed grass (*Sisyrinchium pallidum*) in Larimer County. In Colorado, this species is known primarily from peatlands in Park County. The site is in fair condition, containing mostly native species, but with much evidence of past and current livestock grazing.

Natural Heritage element occurrences at the Lower Jimmy Creek Spring PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	<i>Sisyrinchium pallidum</i>	pale blue - eyed grass	G2G3	S2			BLM	C	2004-07-15
Vascular Plants	<i>Packera debilis</i>	Rocky Mountain ragwort	G4	S1				C	2004-07-15

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The boundary includes the wet meadow with the rare plant occurrences and buffer of about 1,000 feet to protect from direct disturbance. The boundary does not encompass the recharge area for the springs supporting the wetland.

**Protection Urgency Rank Comments (P4):** The site includes a State Land Board section on which the wetland is located and upstream US Forest Service land. The State Land Board section is part of the Stewardship Trust Program. The wetland and the pale blue-eyed grass should be the highest priority for protection at this site.

**Management Urgency Rank Comments (M2):** New management of livestock grazing may be needed within five years to prevent loss of element occurrences. A grazing rotation system could be set up to allow the imperiled species time during each growing season to produce seed. The Colorado Department of Transportation should be informed of the significance of the site as road maintenance may also impact the elements.

### **References**

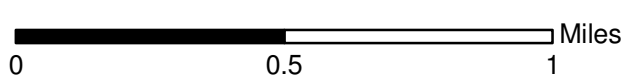
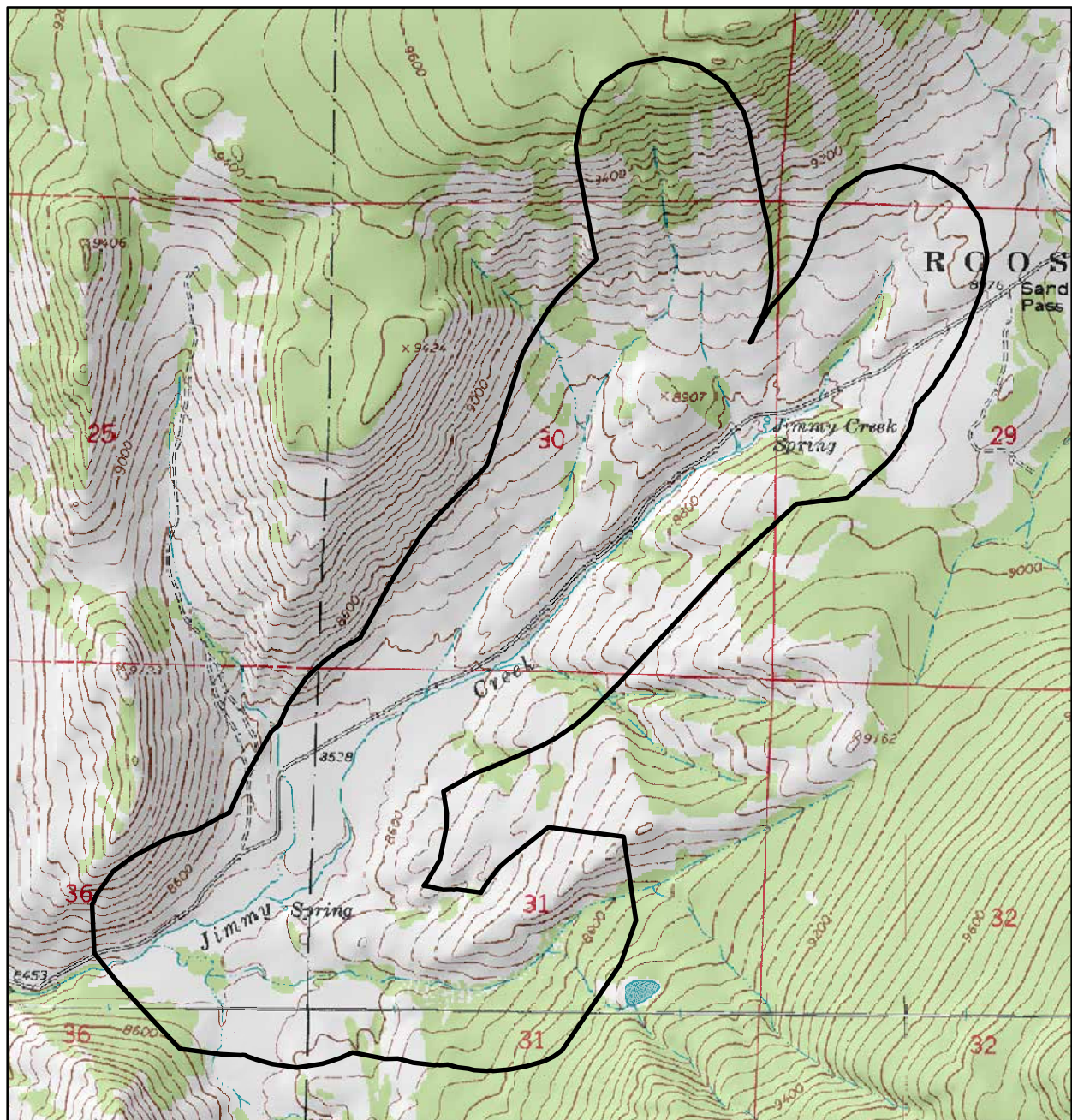
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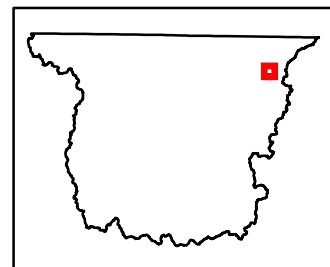
## Legend

 PCA Boundary

Deadman, 40105-G7  
Sand Creek Pass, 40105-H7

7.5 Minute Digital Raster  
Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed



Map 13. Lower Jimmy Creek Spring Potential Conservation Area, B3: High Biodiversity Significance

## McIntyre Creek

**Biodiversity Rank - B3: High Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future**

**U.S.G.S. 7.5-minute quadrangles:** Glendevey

**Size:** 1,415 acres (573 ha)

**Elevation:** 8,000 - 8,250 ft. (2,438 - 2,515 m)

**General Description:** The site is located on the western flank of North Middle Mountain in the Laramie River Valley. McIntyre Creek is one of the major tributaries to the Laramie River as it flows north to Wyoming. The headwaters of McIntyre Creek are located in the Medicine Bow Mountain in the Rawah Wilderness Area. The geology is composed of the North Park Formation of the Tertiary Age, sandstone, siltstone and conglomerate (Tweto 1979). The Medicine Bow Mountains are primarily igneous bedrock, with significant influence from Pleistocene glaciation (Tweto 1979). The riparian shrubland is dominated by tall willows: Geyer willow (*Salix geyeriana*), Rocky Mountain willow (*S. monticola*), planeleaf willow (*S. planifolia*) and thinleaf alder (*Alnus incana*). The understory with smaller shrubs such as, shrubby cinquefoil (*Dasiphora floribunda*), gooseberry (*Ribes inerme*), and twinberry (*Lonicera involucrata*). The understory is dominated by the introduced grasses, creeping foxtail (*Alopecurus arundinaceus*) and timothy (*Phleum pratense*). In the wetter areas, under the willows, water sedge (*Carex aquatilis*), meadow sedge (*C. praegracilis*), and beaked sedge (*C. utriculata*) exist. Beaver (*Castor canadensis*), moose (*Alces alces*), elk (*Cervus canadensis*), and mule deer (*Odocoileus hemionus*) activity was evident throughout both drainages. The river is bordered on both sides by hay fields with a network of irrigation ditches. The uplands consist of sagebrush (*Artemisia tridentata* var. *pauciflora* and *A. cana*) shrublands.

**Key Environmental Factors:** Beaver (*Castor canadensis*) are primary users as well as maintainers to riparian shrublands. Beaver activity forms ponds that slow spring runoff and flooding and retain water that will be released slowly during the growing season. The primary abiotic ecological process to maintain viability is hydrology and more specifically surface flow. Annual and episodic flooding is important in maintaining riparian shrublands (Rondeau 2001).

**Land Use History:** Haying and grazing along most of the stream.

**Biodiversity Significance Rank Comments (B3):** This site contains a good (B-ranked) occurrence of a riparian plant community which is vulnerable on a global scale (G3/S3), Geyer willow - Rocky Mountain willow / bluejoint reedgrass (*Salix*

*geyeriana* - *Salix monticola* / *Calamagrostis canadensis*) shrubland.

Natural Heritage element occurrences at the McIntyre Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Salix geyeriana</i> - <i>Salix monticola</i> / <i>Calamagrostis canadensis</i> Shrubland	Montane Willow Carrs	G3	S3				B	2009-09-18

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The site includes all of the riparian area that is either intact or with high potential for restoration. The site also includes a minimum 300 foot buffer around the riparian zone to protect the area from direct impacts of heavy agricultural use and development, and from indirect impacts of vehicles and runoff.

**Protection Urgency Rank Comments (P3):** The site is primarily under private ownership as one large parcel. Development pressure may increase in the area in the near future.

**Management Urgency Rank Comments (M4):** The willow community appears in equilibrium with the agricultural activities along the creek.

### References

Culver, D.R., K. Decker, J. Parker, J. Bell, J. Sovell, and J. Huggins. 2010. CNHP Final Report: Identification and Assessment of Important Wetlands within the North Platte Watershed, CO. Colorado Natural Heritage Program, Fort Collins, CO.

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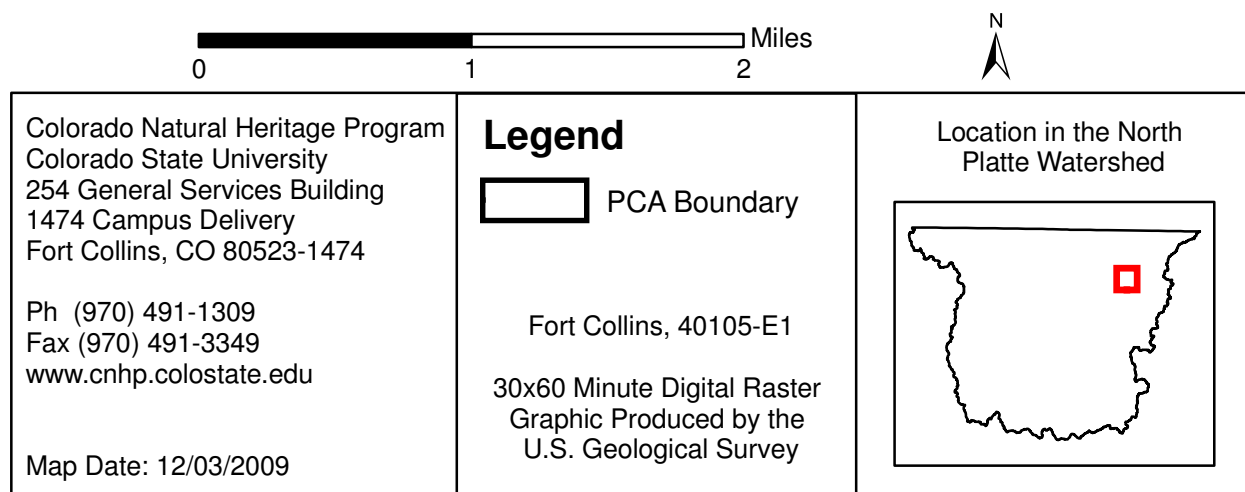
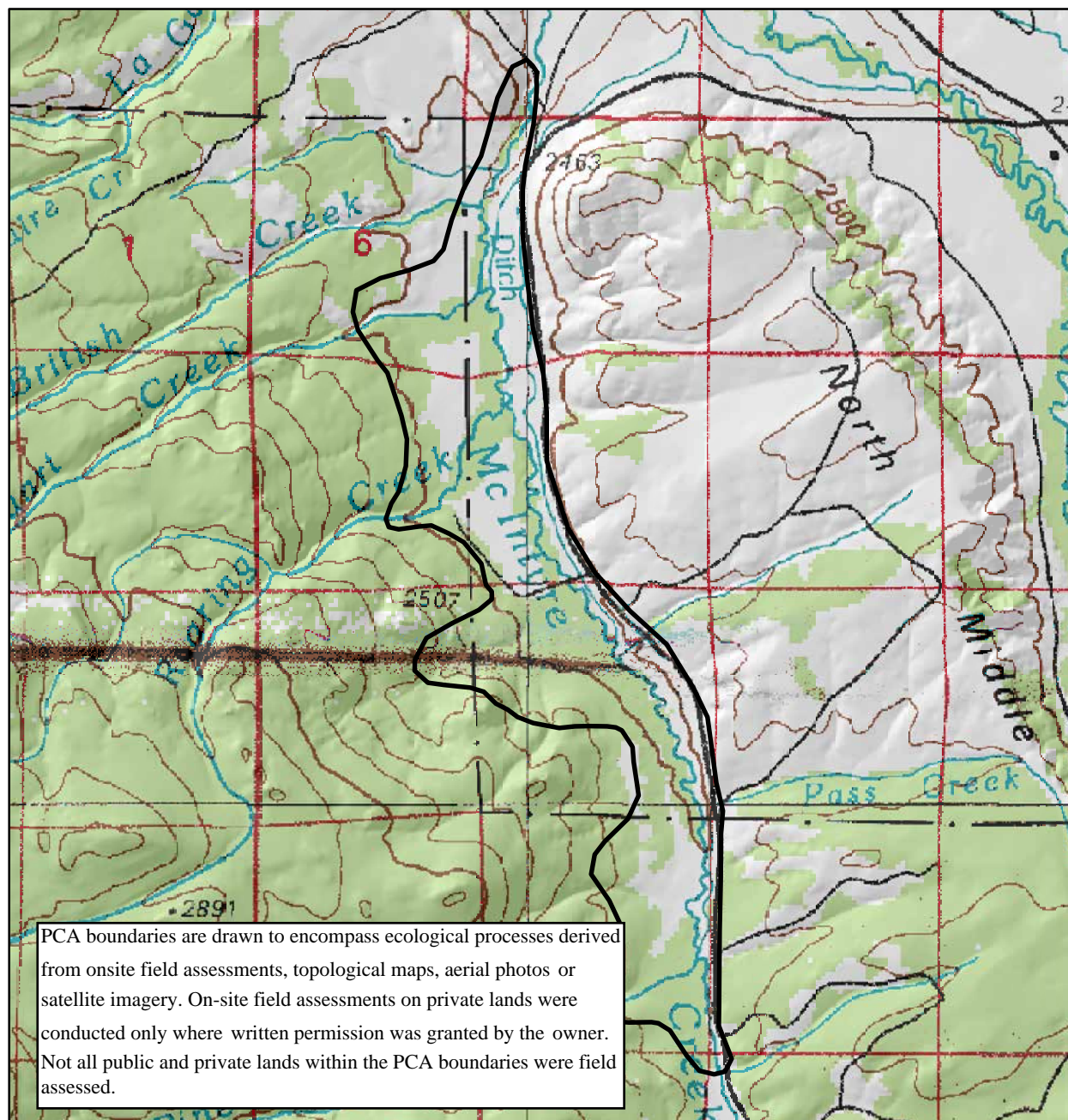
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**Version Author:** Culver, D.R.

**Version Date:** 10/12/2009





Map 14. McIntyre Creek Potential Conservation Area, B3: High Biodiversity Significance



Geyer willow / Rocky Mountain willow/ bluejoint reedgrass (*Salix geyeriana* – *S. monticola*/ *Calamagrostis canadensis*) willow shrubland.



## Michigan River

**Biodiversity Rank - B3: High Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss**

**Size:** 11,962 acres (4,841 ha)

**Elevation:** 8,200 - 8,900 ft. (2,499 - 2,713 m)

**General Description:** The Michigan River site occurs in the glacially carved valley bordered to the east by the Medicine Bow Mountains and to the west by Owl Mountain and Owl Ridge. Throughout the site the low gradient, meandering Michigan River flows northwest towards the Town of Walden. The main tributaries are the North and South Forks of Michigan River, Sales, Meadow, Sage Hen, and Owl creeks. Two reservoirs, North Michigan and Meadow Creeks reservoirs, are located outside of the site but influence the hydrology of the main stem of the Michigan River. The riparian shrubland is dominated by Geyer willow (*Salix geyeriana*), Rocky Mountain willow (*S. monticola*), and scattered planeleaf willow (*S. planifolia*), Wolf willow (*S. wolfii*), and Bebb's willow (*S. bebbiana*). Thinleaf alder (*Alnus incana*) with river birch (*Betula occidentalis*) occurs along the river banks. The understory is dominated by the introduced grasses, creeping foxtail (*Alopecurus arundinaceus*) and timothy (*Phleum pratense*). In the wetter areas, under the willows, water sedge (*Carex aquatilis*), analogue sedge (*C. simulata*), meadow sedge (*C. praegracilis*), and beaked sedge (*C. utriculata*) exist. Within the floodplain, the soils are derived from modern alluvium. There are spring-fed wetlands that have peat accumulating soils within the site. Current land use is hay production and cattle and wildlife grazing. There are signs of active beaver (*Castor canadensis*) along the river and its tributaries. Elk (*Cervus canadensis*) and mule deer (*Odocoileus hemionus*) are found throughout. The river is bordered on both sides by hay fields with a network of irrigation ditches. The uplands consist of sagebrush (*Artemisia tridentata* var. *pauciflora* and *A. cana*) shrublands.

**Key Environmental Factors:** Beaver (*Castor canadensis*) are primary users as well as maintainers to riparian shrublands. Beaver activity forms ponds that slow spring runoff and flooding and retain water that will be released slowly during the growing season. The primary abiotic ecological process to maintain viability is hydrology and more specifically surface flow. Annual and episodic flooding is important in maintaining riparian shrublands (Rondeau 2001).

**Climate Description:** The site is located in an intermountain basin that is enclosed on most sides by mountains that create precipitation shadows for air and moisture. Climate records for Walden indicate a mean annual precipitation of 10.53 inches

(WRCC 2009). Annual mean for snowfall is 57.1 inches. The lowest average temperature (Jan.) is 3.9 degrees F and the highest average temperature (July) is 78.5 degrees F.

**Biodiversity Significance Rank Comments (B3):** The site supports an excellent (A-ranked) occurrence of a globally vulnerable (G3/S3) *Salix geyeriana* / mesic forbs montane willow carr, a good (B-ranked) occurrence a globally vulnerable (G3/S3) *Salix monticola* / mesic graminoid montane riparian willow carr and an excellent (A-ranked) occurrence of a state rare (G4/S3) *Salix monticola* / mesic forbs montane riparian willow carr. Several rare plants have been observed including a fair (C-ranked) occurrence of the state imperiled (G4/S1) slender thelypody (*Thelypodium sagittatum*), a poor (D-ranked) occurrence of the state imperiled (G4/S1) Rocky Mountain ragwort (*Packera debilis*) and a fair (C-ranked) occurrence of the state imperiled (G5T5/S1) wild chives (*Allium schoenoprasum* var. *sibiricum*). In 2009, a nesting pair of Sandhill Cranes (*Grus canadensis tabida*) were noted, although this site is not designed for that species.

Natural Heritage element occurrences at the Michigan River PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Salix geyeriana</i> / Mesic Forbs Shrubland	Montane Willow Carr	G3	S3				A	2009-07-21
Natural Communities	<i>Salix monticola</i> / Mesic Graminoids Shrubland	Montane Riparian Willow Carr	G3	S3				B	2009-07-21
Natural Communities	<i>Salix monticola</i> / Mesic Forbs Shrubland	Montane Riparian Willow Carr	G4	S3				A	2009-06-30
Vascular Plants	<i>Packera debilis</i>	Rocky Mountain ragwort	G4	S1				D	2009-06-25
Vascular Plants	<i>Thelypodium sagittatum</i>	slender thelypody	G4	S1				C	2009-06-30
Vascular Plants	<i>Allium schoenoprasum</i> var. <i>sibiricum</i>	wild chives	G5T5	S1				C	2009-06-25

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** Boundaries are drawn to capture the immediate watershed that starts at the confluence with the South and North Forks of the Michigan at Gould. The boundaries were developed to include immediate ecological processes. Specifically, the primary ecological process is hydrology, especially surface flow (Rondeau 2001). Only private lands with written permission were surveyed.

**Protection Urgency Rank Comments (P3):** One property within the site, 2100 acres, is under a conservation easement. Other landowners within the site are considering conservation easements as well.

**Management Urgency Rank Comments (M2):** Maintaining the natural hydrology and a wide floodplain is essential to the long-term viability of the riparian corridor. Improper grazing from cattle and wildlife was noted as evidenced by the "mushroom shaped" pruned willows. Additionally, concentrated cattle and wildlife can cause trailing with the floodplain essentially creating ditches that drain away surface water. Drier portions of the site contained non-native plants that need to be controlled. These species include Canada thistle (*Breea arvensis*), musk thistle (*Carduus nutans*), and in particular a small occurrence of Dames rocket (*Hesperis matronalis*) was observed along the river banks.

**Exotic Species Comments:** Exotic species include Canada thistle (*Breea arvensis*), musk thistle (*Carduus nutans*), and a small occurrence of Dames rocket (*Hesperis matronalis*) that was observed along the river banks.

### References

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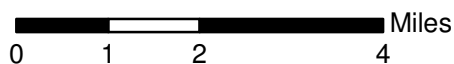
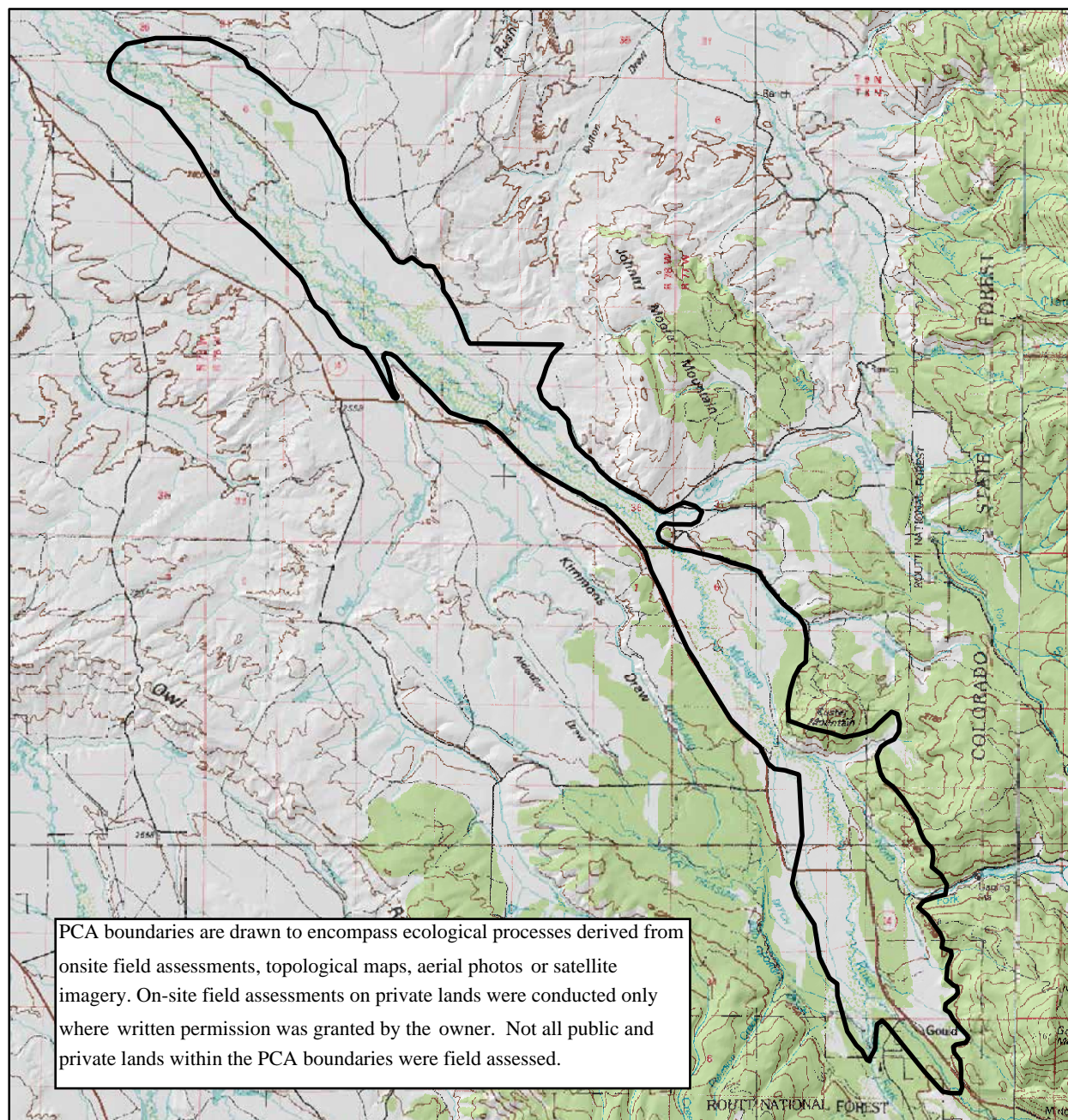
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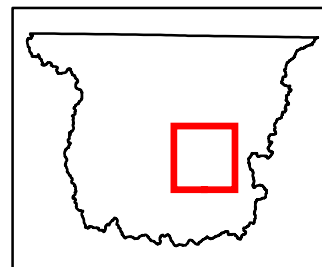
## Legend

 PCA Boundary

Walden, 40106-E1

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Location in the North  
Platte Watershed



Map 15. Michigan River Potential Conservation Area, B3: High Biodiversity Significance





Michigan River.



Riparian shrubland along Michigan River.

## North Boettcher Lake

**Biodiversity Rank - B3: High Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Lake John, Boettcher Lake, Pearl

**Size:** 1,711 acres (692 ha)

**Elevation:** 8,100 - 8,200 ft. (2,469 - 2,499 m)

**General Description:** The North Boettcher Lake site is located on the northeastern flank of Sheep Mountain. It encompasses a series of ponds that retain water for irrigation. The source of water is likely from springs with contributions from irrigation ditches e.g., Hill Ditch No. 1. The vegetation that surrounds the ponds are alkaline. The vegetation forms a mosaic that is defined by saturation and alkalinity. There is a peat-forming wetland that contains approximately 10 inches (25 cm) of peat at the surface with heavy sulfurous odor. The fen is dominated by water sedge (*Carex aquatilis*), beaked sedge (*C. utriculata*), and woolly sedge (*C. lanuginosa*). The more alkaline areas are dominated by milky seawort (*Glaux maritima*) with arrowgrass (*Triglochin maritima*), Baltic rush (*Juncus balticus*), Sandberg bluegrass (*Poa secunda*), salt grass (*Distichlis spicata*), foxtail barley (*Hordeum jubatum*), spike rush (*Eleocharis palustris*) and redwool plantain (*Plantago eriopoda*) the open water areas are dominated by bulrush (*Schoenoplectus lacustris* ssp. *acutus*), and three square (*Scirpus pungens*). The uplands consist of sagebrush (*Artemisia tridentata* var. *pauciflora*, *A. tridentata* var. *wyomingensis* and *A. cana*) shrublands.

**Key Environmental Factors:** Intact hydrology is necessary for the continual formation of peat.

**Climate Description:** The site is located in an intermountain basin that is enclosed on most sides by mountains that create precipitation shadows for air and moisture. Climate records for Walden indicate a mean annual precipitation of 10.53 inches (WRCC 2009). Annual mean for snowfall is 57.1 inches. The lowest average temperature (Jan.) is 3.9 degrees F and the highest average temperature (July) is 78.5 degrees F.

**Biodiversity Significance Rank Comments (B3):** The site supports an excellent (A-ranked) occurrence of the globally vulnerable (G3/S2) sea milkwort (*Glaux maritima*) herbaceous vegetation community.

## Natural Heritage element occurrences at the North Boettcher Lake PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Glaux maritima</i> Herbaceous Vegetation [Provisional]	Sea Milkwort	G3	S2				A	2009-06-30

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** Boundaries are drawn to capture the immediate watershed that starts east of Sheep Mountain ridge and west of Lake Creek. The eastern boundary is the top of Sheep Mountain and the west boundary incorporates several of the tributaries of the North Fork. The boundaries were developed to include immediate ecological processes. Specifically the primary ecological process is hydrology, especially surface flow and groundwater discharge (Rondeau 2001). Only private lands with written permission were surveyed

**Protection Urgency Rank Comments (P3):** The entire site is located on private lands owned by one ranch. The water rights with Boettcher Lakes and the series of ponds is also owned by that ranch.

**Management Urgency Rank Comments (M3):** Currently the area is managed as a cattle ranch, moderate grazing pressure was observed within the wetlands.

### References

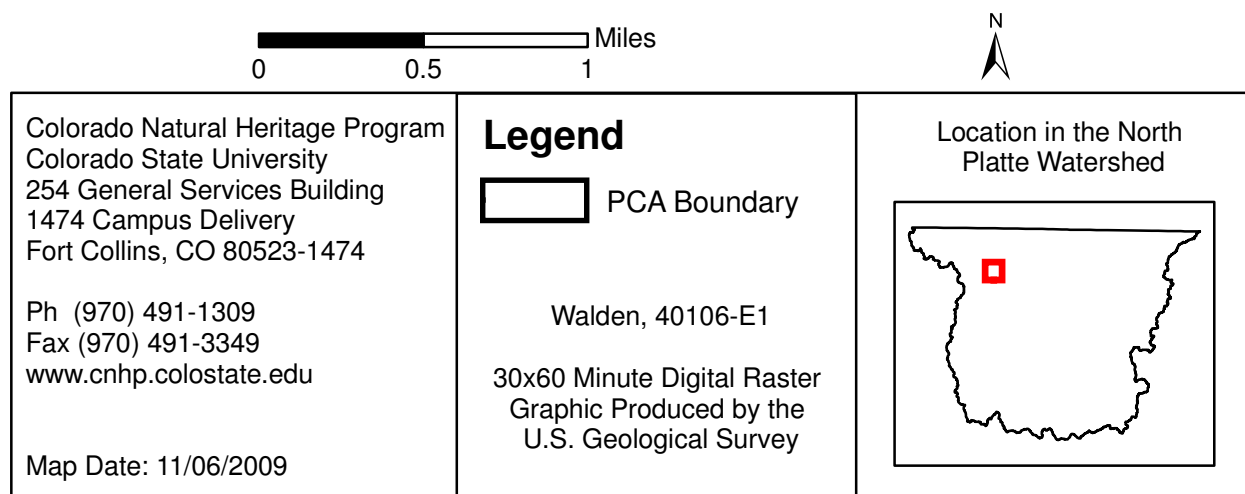
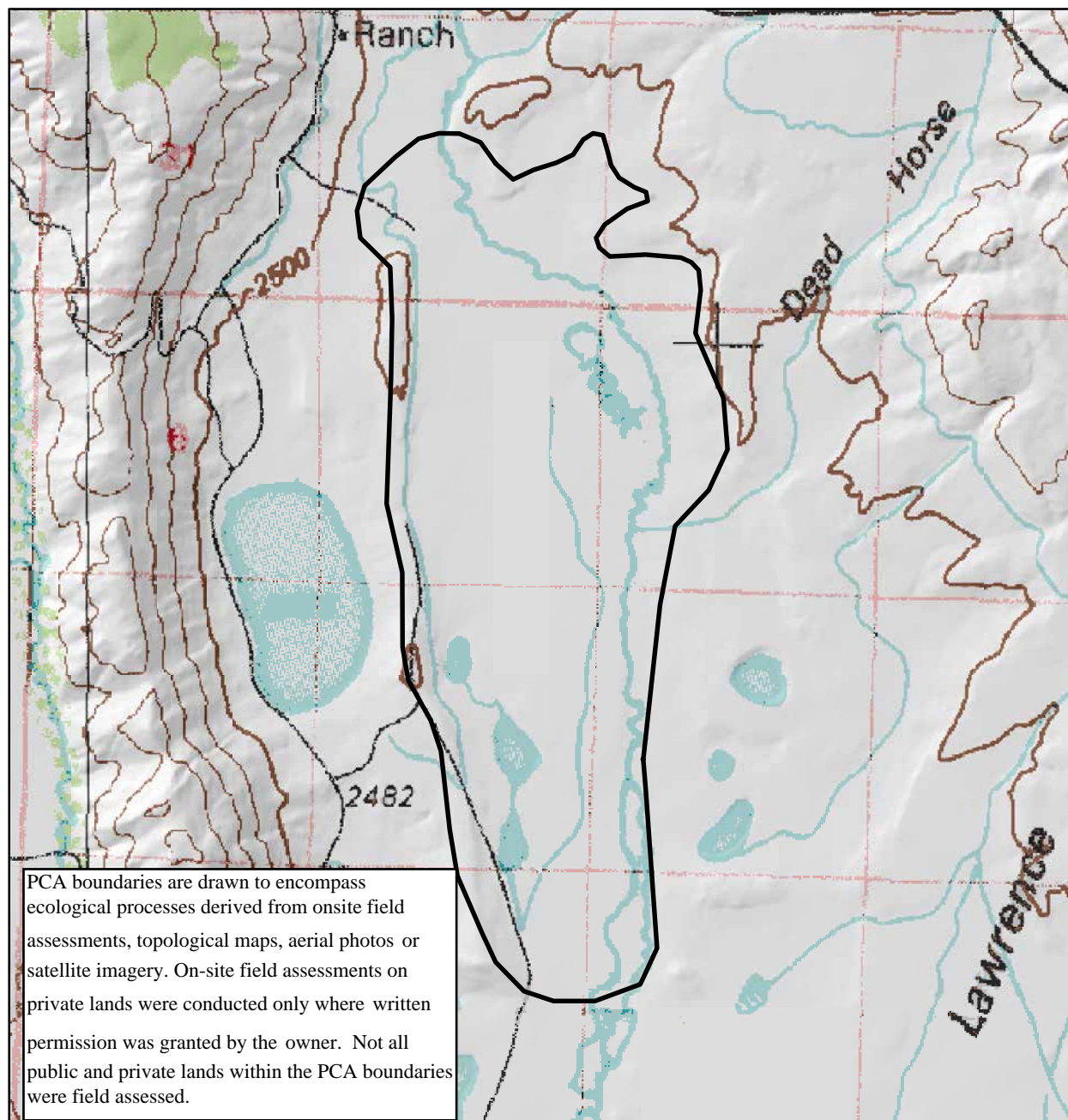
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Map 16. North Boettcher Lake Potential Conservation Area, B3: High Biodiversity Significance





Boettcher Ponds overview.



Sea milkwort (*Glaux maritima*).

## North Fork of North Platte River

**Biodiversity Rank - B3: High Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss**

**Size:** 10,734 acres (4,344 ha)

**Elevation:** 8,500 - 8,800 ft. (2,591 - 2,682 m)

**General Description:** The North Fork of the North Platte site is located on the western edge of North Park between the eastern slope of the Park Range and Sheep Mountain. The North Fork headwaters are located to the northwest of the site at the base of Red Elephant Mountain. The North Fork meanders south along the granitic outcrop of Sheep Mountain before heading east to the confluence with the North Platte at Lake John. Several first order streams confluence with the North Fork throughout the site. They include Goose, Hill, Lake, Ute, Brown, and Lone Pine creeks. The alluvium deposited by eons of deposition from the Park Range has created a gravelly floodplain that supports an almost contiguous riparian corridor of willows. The dominant willows include Rocky Mountain willow (*Salix monticola*), Geyer's willow (*S. geyeriana*), Bebb's willow (*S. bebbiana*) and coyote willow (*S. exigua*) with thinleaf alder (*Alnus incana*) and river birch (*Betula occidentalis*) along the river banks. The understory consists of bluejoint reedgrass (*Calamagrostis canadensis*), water sedge (*Carex aquatilis*), beaked sedge (*C. utriculata*), silvery sedge (*C. canescens*), and hay grasses. The willow carr is interspersed with wet meadows, hay fields, and open stream channels. There are no major hydrological alterations on the North Fork within the site, however several irrigation ditches are located throughout the site. The riparian shrubland along the river provides excellent fish habitat. The upland vegetation consists of lodgepole pine (*Pinus contorta*) forests that have been severely impacted by the mountain pine beetle (*Dendroctonus* spp.).

**Key Environmental Factors:** Beaver are primary users as well as maintainers to riparian shrublands. Beaver activity forms ponds that slow spring runoff and flooding and retain water that will be released slowly during the growing season. The primary abiotic ecological process to maintain viability is hydrology and more specifically surface flow. Annual and episodic flooding is important in maintaining riparian shrublands (Rondeau 2001).

**Climate Description:** The site is located in an intermountain basin that is enclosed on most sides by mountains that create precipitation shadows for air and moisture. Climate records for Walden indicate a mean annual precipitation of 10.53 inches (WRCC 2009). Annual mean for snowfall is 57.1 inches. The lowest average temperature (Jan.) is 3.9 degrees F and the highest average temperature (July) is 78.5

degrees F.

**Biodiversity Significance Rank Comments (B3):** The site supports a good (B-ranked) occurrence of a globally vulnerable (G3/S3) *Salix geyeriana* - *Salix monticola* / *Calamagrostis canadensis* montane willow carr and a fair (C-ranked) occurrence of a globally vulnerable (G3/S3) *Salix geyeriana* / *Carex aquatilis* montane willow carr. Riparian shrublands dominated by *Salix geyeriana* appear to be stable and long-lived, especially if the water table does not drop below 3 feet of the surface (Carsey et al. 2003). Wild chives (*Allium schoenoprasum* var. *sibiricum*) (G5T5/S1) is a globally common, state rare plant that has been historically documented in the area, but current surveys are needed to precisely locate populations.

Natural Heritage element occurrences at the North Fork of North Platte River PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Salix geyeriana</i> - <i>Salix monticola</i> / <i>Calamagrostis canadensis</i> Shrubland	Montane Willow Carrs	G3	S3				B	2009-06-09
Natural Communities	<i>Salix geyeriana</i> / <i>Carex aquatilis</i> Shrubland	Montane Willow Carr	G3	S3				C	1998-07-10

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** Boundaries are drawn to capture the immediate watershed that starts below Red Elephant Mountain. The eastern boundary is the top of Sheep Mountain and the west boundary incorporates several of the tributaries of the North Fork. The boundaries were developed to include immediate ecological processes such as flooding and wildlife habitat. Only private lands with written permission were surveyed.

**Protection Urgency Rank Comments (P3):** The upper portion of the site is utilized for hay production and cattle. From aerial photography and roadside observations, it appears that current grazing practices are impacting the willow shrubland and reducing the herbaceous cover along the river banks. The lower portion of the site is managed for recreational fishing and wildlife habitat.

**Management Urgency Rank Comments (M2):** Control of beaver is detrimental to the health of the riparian occurrence. Non-native plants, especially aggressive hay grasses such as creeping foxtail (*Alopecurus arundinaceus*) will outcompete native grasses.

**Land Use Comments:** Current owner is removing willow to allow easier access for fishing. Caution is suggested for the willows also maintain the hydrology and food

chain support necessary for a viable trout population.

**Exotic Species Comments:** There are non-native hay grasses.

**Information Needs:** Current field surveys are needed to verify populations of wild chives (*Allium schoenoprasum* var. *sibiricum*).

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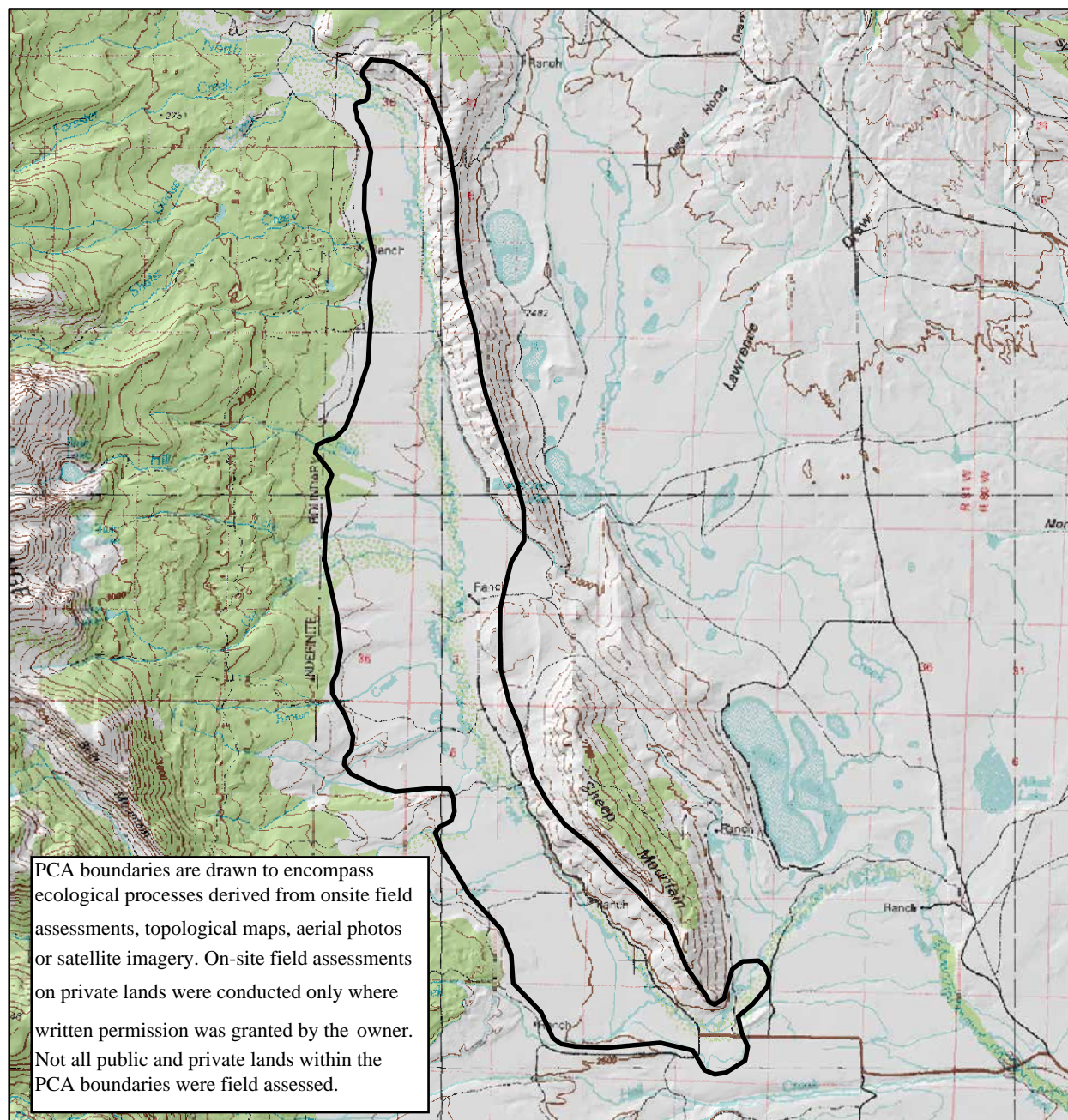
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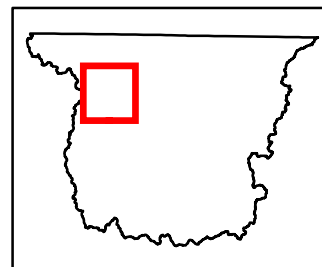
## Legend

 PCA Boundary

Walden, 40106-E1

30x60 Minute Digital Raster  
Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed



Map 17. North Fork of North Platte River Potential Conservation Area, B3: High Biodiversity Significance





Overview of North Fork of North Platte River.



North Fork with Sheep Mountain.

## Nunn Creek

**Biodiversity Rank - B3: High Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future**

**U.S.G.S. 7.5-minute quadrangles:** Boston Peak, Deadman

**Size:** 900 acres (364 ha)

**Elevation:** 8,400 - 8,800 ft. (2,560 - 2,682 m)

**General Description:** The Nunn Creek site is located on the western base of the Laramie Mountains. Nunn Creek's headwaters are at Nunn Creek Basin, flowing west towards its juncture with the Laramie River. The river and its floodplain is located on alluvium derived from granitic rock (Tweto 1979). The riparian shrubland is dominated by Geyer willow (*Salix geyeriana*) and Rocky Mountain willow (*S. monticola*). Other shrubs include short-fruited willow (*S. brachycarpa*), planeleaf willow (*S. planifolia*), thinleaf alder (*Alnus incana*), and shrubby cinquefoil (*Dasiphora floribunda*). The herbaceous layer consists of bluejoint reedgrass (*Calamagrostis canadensis*), manna grass (*Glyceria borealis*), tufted hairgrass (*Deschampsia cespitosa*), beaked sedge (*Carex utriculata*), water sedge (*C. aquatilis*), spikerush (*Eleocharis palustris*, *E. quinqueflora*), and Baltic rush (*Juncus balticus*). There are signs of active beaver (*Castor canadensis*) along the river and its tributaries. Elk (*Cervus canadensis*) and mule deer (*Odocoileus hemionus*) are found throughout the site. The uplands consist of sagebrush (*Artemisia tridentata* var. *pauciflora* and *A. cana*) shrublands.

**Key Environmental Factors:** Beaver (*Castor canadensis*) are primary users as well as maintainers to riparian shrublands. Beaver activity forms ponds that slow spring runoff and flooding and retain water that will be released slowly during the growing season. The primary abiotic ecological process to maintain viability is hydrology, and more specifically, surface flow. Annual and episodic flooding is important in maintaining riparian shrublands (Rondeau 2001).

**Biodiversity Significance Rank Comments (B3):** This site supports a good (B-ranked) occurrence of a globally vulnerable (G3/S3) montane willow carr, *Salix geyeriana* - *Salix monticola* / *Calamagrostis canadensis*. There is also a fair (C-ranked) occurrence of a state rare (G4/S3S4) alkaline seep plant association, *Eleocharis quinqueflora*, a good (B-ranked) occurrence of a state rare (G5/S3) montane riparian willow carr, *Salix geyeriana* / *Calamagrostis canadensis*, and a good occurrence of a state rare (G4/S3) *Glyceria borealis* montane emergent wetland.

Natural Heritage element occurrences at the Nunn Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Salix geyeriana - Salix monticola / Calamagrostis canadensis Shrubland	Montane Willow Carrs	G3	S3				B	1996-08-20
Natural Communities	Eleocharis quinqueflora Herbaceous Vegetation	Alpine Wetlands	G4	S3S4				C	1996-08-20
Natural Communities	Glyceria borealis Herbaceous Vegetation	Montane Emergent Wetland	G4	S3				B	1996-08-20
Natural Communities	Salix geyeriana / Calamagrostis canadensis Shrubland	Montane Riparian Willow Carr	G5	S3				B	1996-08-20

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** Includes all the elements at the site, the entire bottom of the valley, and a 300 foot buffer extending back from the riparian area. The valley bottom is included to insure that natural riverine processes can continue. The small buffer is included to protect from adverse indirect effects of runoff from logging, road building, etc.

**Protection Urgency Rank Comments (P3):** The site is privately owned and US Forest Service land. The private land is primarily one large narrow parcel running north south along the creek. Development pressures are likely to increase in the area in the near future.

**Management Urgency Rank Comments (M4):** Management of non-native species may be needed in the future to maintain the current quality of the element occurrences.

**Exotic Species Comments:** Many alien grass species are present, as well as a small amount of Canada thistle.

**Information Needs:** Appropriate habitat for wood frog (*Rana sylvatica*) exists, but specific locational data for wood frog occurrences is needed.



## References

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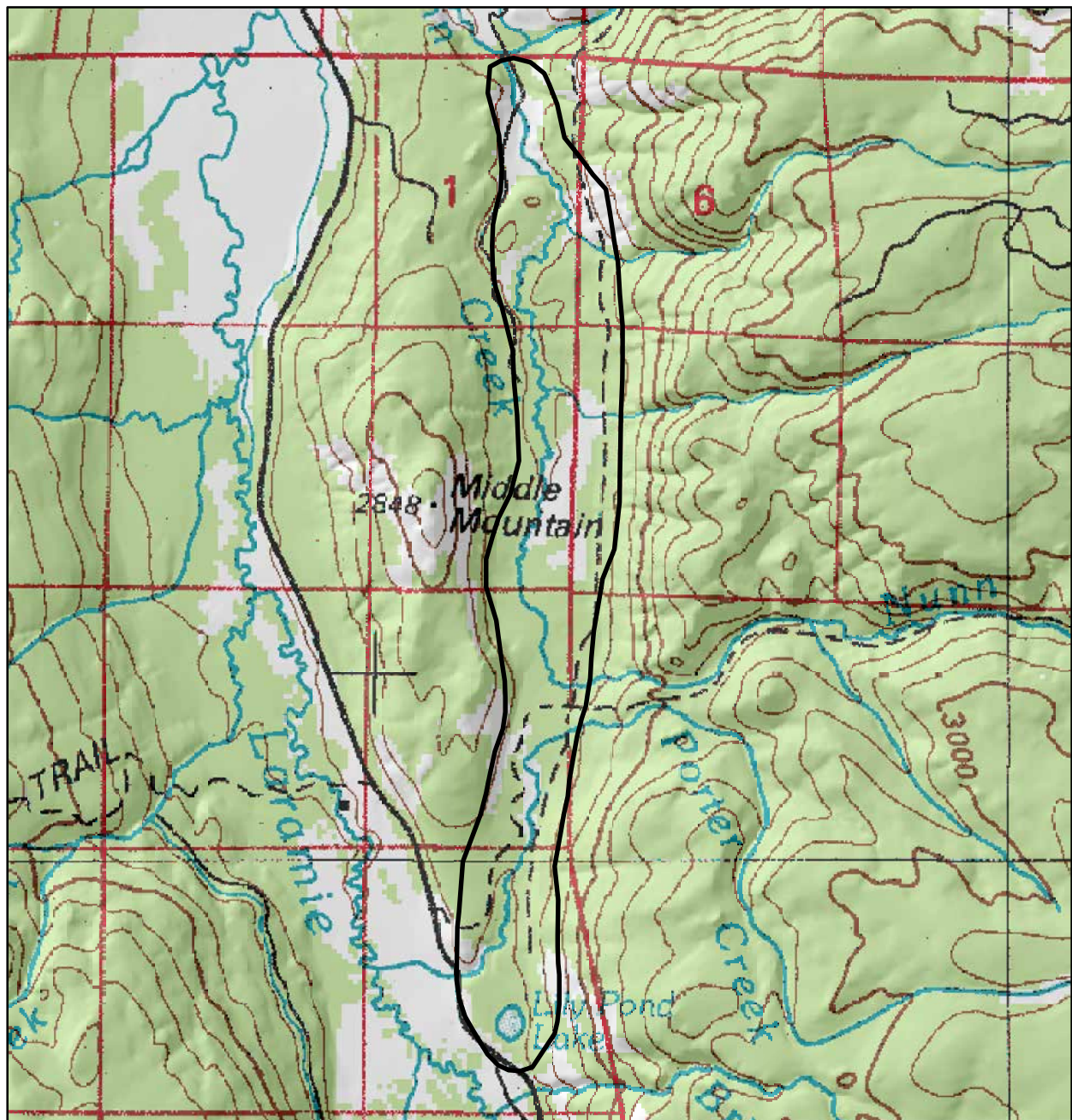
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**Version Author:** Culver, D.R.

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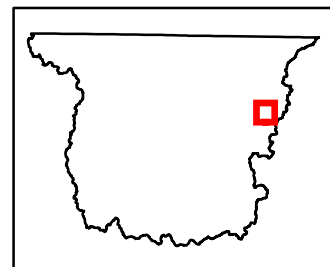
## Legend

 PCA Boundary

Fort Collins, 40105-E1

30x60 Minute Digital Raster  
Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed



Map 18. Nunn Creek Potential Conservation Area, B3: High Biodiversity Significance

## Panhandle Creek

**Biodiversity Rank - B3: High Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Deadman, Sand Creek Pass, Eaton Reservoir, South Bald Mountain

**Size:** 10,187 acres (4,123 ha)      **Elevation:** 9,600 - 10,440 ft. (2,926 - 3,182 m)

**General Description:** Panhandle Creek drains Little Bald Mountain and flows downstream through the Crystal Lakes subdivision, a private mountain subdivision located a few miles northwest of Red Feather Lakes. Upstream of Crystal Lakes, USFS biologists recently discovered adult boreal toads on both the main stem and south fork of Panhandle Creek. The creek includes an array of ponds and wet meadows along its course. The uplands support coniferous forest. Adult toads were found at six locations within the site at elevations ranging from 9,600 to 10,440 feet. The closest known boreal toads are at a newly discovered breeding location at Trout Creek just east of Eaton Reservoir. The Trout Creek breeding ponds are about seven miles northwest of the Panhandle Creek adult toad sightings. The next closest known active boreal toad breeding locations are at Rocky Mountain National Park (CNHP 2004).

**Biodiversity Significance Rank Comments (B3):** Panhandle Creek supports adult boreal toads (*Bufo boreas*) (G4T1Q), which is a globally critically imperiled subspecies. The size of the population at Panhandle Creek is not well documented as 2005 surveys were conducted in early August. Eight adult toads were documented at six locations within the site. The boreal toad was once common throughout the mountains of Colorado, but has undergone declines over the last 20 years (Goettl 1997). Reasons for the decline are unknown, but postulated to be due to a chytrid fungus (Cunningham 1998 as cited in Hammerson 1999). In 1993, the boreal toad was listed as state endangered by the Colorado Division of Wildlife.

Natural Heritage element occurrences at the Panhandle Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Amphibians	<i>Bufo boreas</i> pop. 1	Boreal Toad (Southern Rocky Mountain Population)	G4T1Q	S1		SE		E	2006-07-27

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The boundary includes the known boreal toad locations, adjacent contiguous habitat and a buffer to prevent direct disturbance, which should protect potential breeding habitat and some post-breeding dispersal. As this species is known to move over 2 1/2 miles (4 km) between breeding and non-breeding habitat (Hammerson 1999), it could be impacted by off-site factors. This is an estimate of the area needed to maintain local hydrological conditions and represents the minimum area that should be considered for a conservation management plan. Any activities along the creek, such as water diversions, impoundments, incompatible livestock grazing, logging, and development could potentially be detrimental to the functioning of the wetland areas.

**Protection Urgency Rank Comments (P3):** The site is owned and managed by the U.S. Forest Service with the exception of two sections (29 and 31) in the northeast quadrant of the site that are privately owned by a single owner. The privately owned portion is within a mile of the toad sightings. The U.S. Forest Service property has no special conservation status. Most of the land to the north, south, and west is owned by the USFS. The Crystal Lakes subdivision is a mile east of the site.

**Management Urgency Rank Comments (M3):** Current management seems to favor the persistence of the toad. Uses of the USFS portion of the creek include logging, cattle grazing, and recreational uses including fishing. Uses on private lands are currently unknown.

**Information Needs:** Future surveys in early spring will help define the local population size and locate breeding ponds.

### References

Culver, D.R., K. Decker, J. Parker, J. Bell, J. Sovell, and J. Huggins. 2010. CNHP Final Report: Identification and Assessment of Important Wetlands within the North Platte Watershed, CO. Colorado Natural Heritage Program, Fort Collins, CO.

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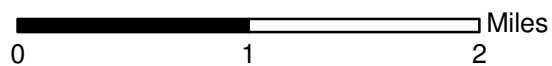
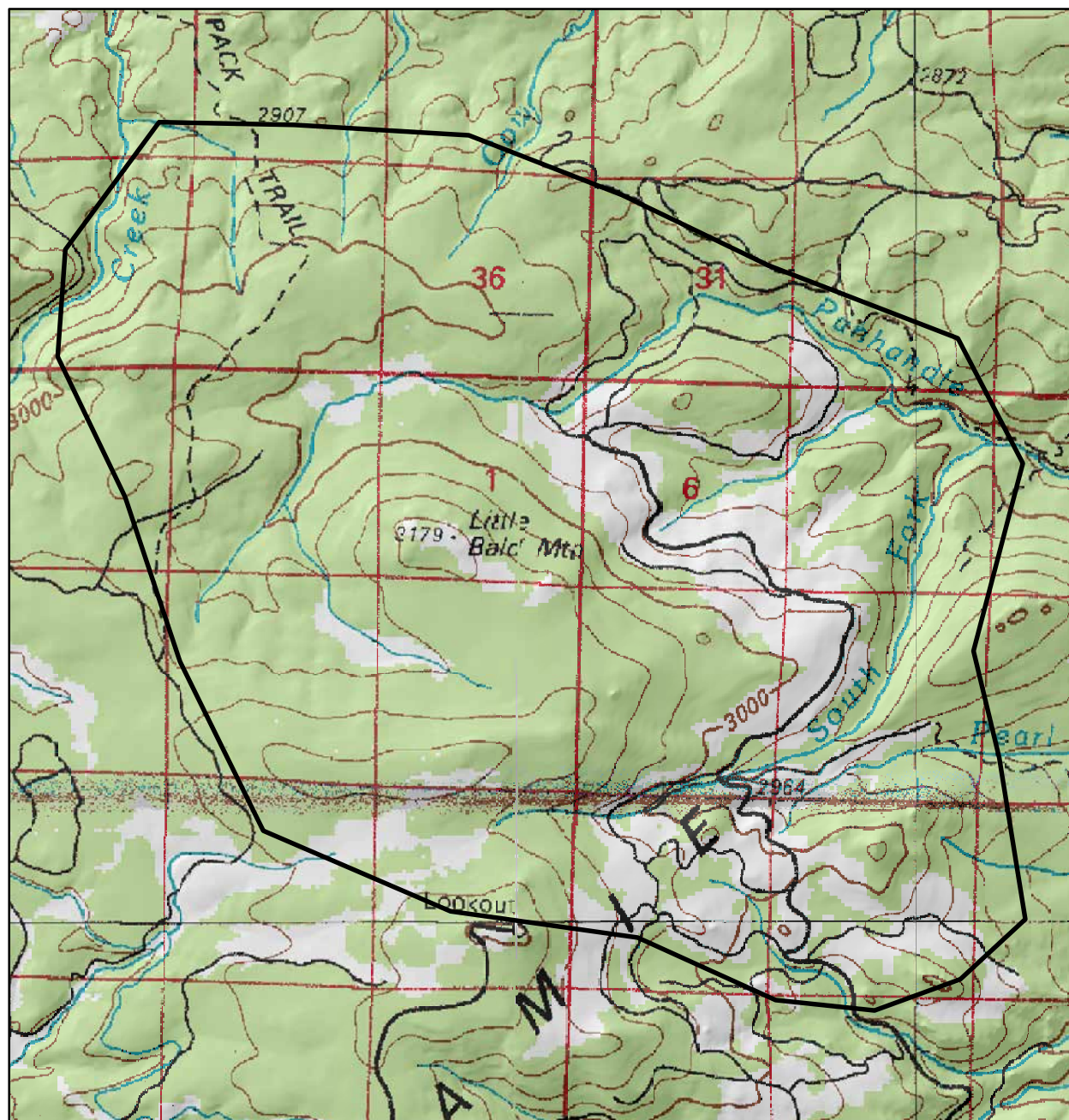
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**Version Author:** Culver, D.R.

**Version Date:** 12/09/2009





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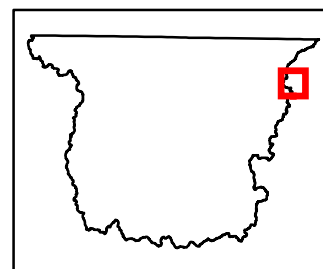
### Legend

 PCA Boundary

Fort Collins, 40105-E1

30x60 Minute Digital Raster  
Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed



Map 19. Panhandle Creek Potential Conservation Area, B3: High Biodiversity Significance

## Rock Creek at Green Ridge

**Biodiversity Rank - B3: High Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Rand

**Size:** 3,364 acres (1,361 ha)

**Elevation:** 8,600 - 9,000 ft. (2,621 - 2,743 m)

**General Description:** The Rock Creek at Green Ridge site encompasses the watershed of Rock and McKinnon creeks. Rock Creek's headwaters are located in Arapahoe Ridge and McKinnon Creek begins at Green Ridge; both creeks confluence with Willow Creek at CO Highway 125. The riparian shrubland is dominated by tall willows: Geyer willow (*Salix geyeriana*), Rocky Mountain willow (*S. monticola*), planeleaf willow (*S. planifolia*), and short-fruited willow (*S. brachycarpa*). The understory with smaller shrubs such as, shrubby cinquefoil (*Dasiphora floribunda*), gooseberry (*Ribes inerme*), and twinberry (*Lonicera involucrata*). The understory is dominated by the introduced grasses, creeping foxtail (*Alopecurus arundinaceus*) and timothy (*Phleum pratense*). In the wetter areas, under the willows, water sedge (*Carex aquatilis*), meadow sedge (*C. praeegracilis*), and beaked sedge (*C. utriculata*) exist. Within the floodplain, the soils are derived from shales and sandstones of the Coalmont Formation. Moose (*Alces alces*), elk (*Cervus canadensis*), and mule deer (*Odocoileus hemionus*) activity was evident throughout both drainages. The rivers are bordered on both sides by hay fields with a network of irrigation ditches. The uplands consist of sagebrush (*Artemisia tridentata* var. *pauciflora* and *A. cana*) shrublands.

**Key Environmental Factors:** Beaver (*Castor canadensis*) are primary users as well as maintainers to riparian shrublands. Beaver activity forms ponds that slow spring runoff and flooding and retain water that will be released slowly during the growing season. The primary abiotic ecological process to maintain viability is hydrology and more specifically surface flow. Annual and episodic flooding is important in maintaining riparian shrublands (Rondeau 2001).

**Climate Description:** The site is located in an intermountain basin that is enclosed on most sides by mountains that create precipitation shadows for air and moisture. Climate records for Walden indicate a mean annual precipitation of 10.53 inches (WRCC 2009). Annual mean for snowfall is 57.1 inches. The lowest average temperature (Jan.) is 3.9 degrees F and the highest average temperature (July) is 78.5 degrees F.

**Biodiversity Significance Rank Comments (B3):** The site supports a good

(B-ranked) occurrence of the globally vulnerable (G3/S3) *Salix geyeriana* / mesic forbs montane willow carr and a good (B-ranked) occurrence of the globally vulnerable (G3/S3) *Salix geyeriana* / *Carex aquatilis* montane willow carr.

Natural Heritage element occurrences at the Rock Creek at Green Ridge PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Salix geyeriana</i> / <i>Carex aquatilis</i> Shrubland	Montane Willow Carr	G3	S3				B	2009-06-17
Natural Communities	<i>Salix geyeriana</i> / Mesic Forbs Shrubland	Montane Willow Carr	G3	S3				B	2009-06-17

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** Boundaries are drawn to capture the immediate watershed that starts below Green Ridge. The boundaries were developed to include immediate ecological processes. Specifically the primary ecological process is hydrology, especially surface flow (Rondeau 2001). Only private lands with written permission were surveyed.

**Protection Urgency Rank Comments (P3):** The private landowner is open to conservation easement options for the property.

**Management Urgency Rank Comments (M3):** Maintaining the natural hydrology and a wide floodplain is essential to the long-term viability of the riparian corridor. Improper grazing from cattle and wildlife was noted within the site evidenced by the "mushroom shaped" pruned willows. Additionally, concentrated cattle and wildlife can cause trailing with the floodplain essentially creating ditches that drain away surface water. Drier portions of the site contained non-native plants that need to be controlled. Canada thistle (*Breca arvensis*) and musk thistle (*Carduus nutans*) were observed along the river banks.

**Exotic Species Comments:** Canada thistle (*Breca arvensis*) and musk thistle (*Carduus nutans*) were observed along the river banks.

## References

Culver, D.R., K. Decker, J. Parker, J. Bell, J. Sovell, and J. Huggins. 2010. CNHP Final Report: Identification and Assessment of Important Wetlands within the North Platte Watershed, CO. Colorado Natural Heritage Program, Fort Collins, CO.

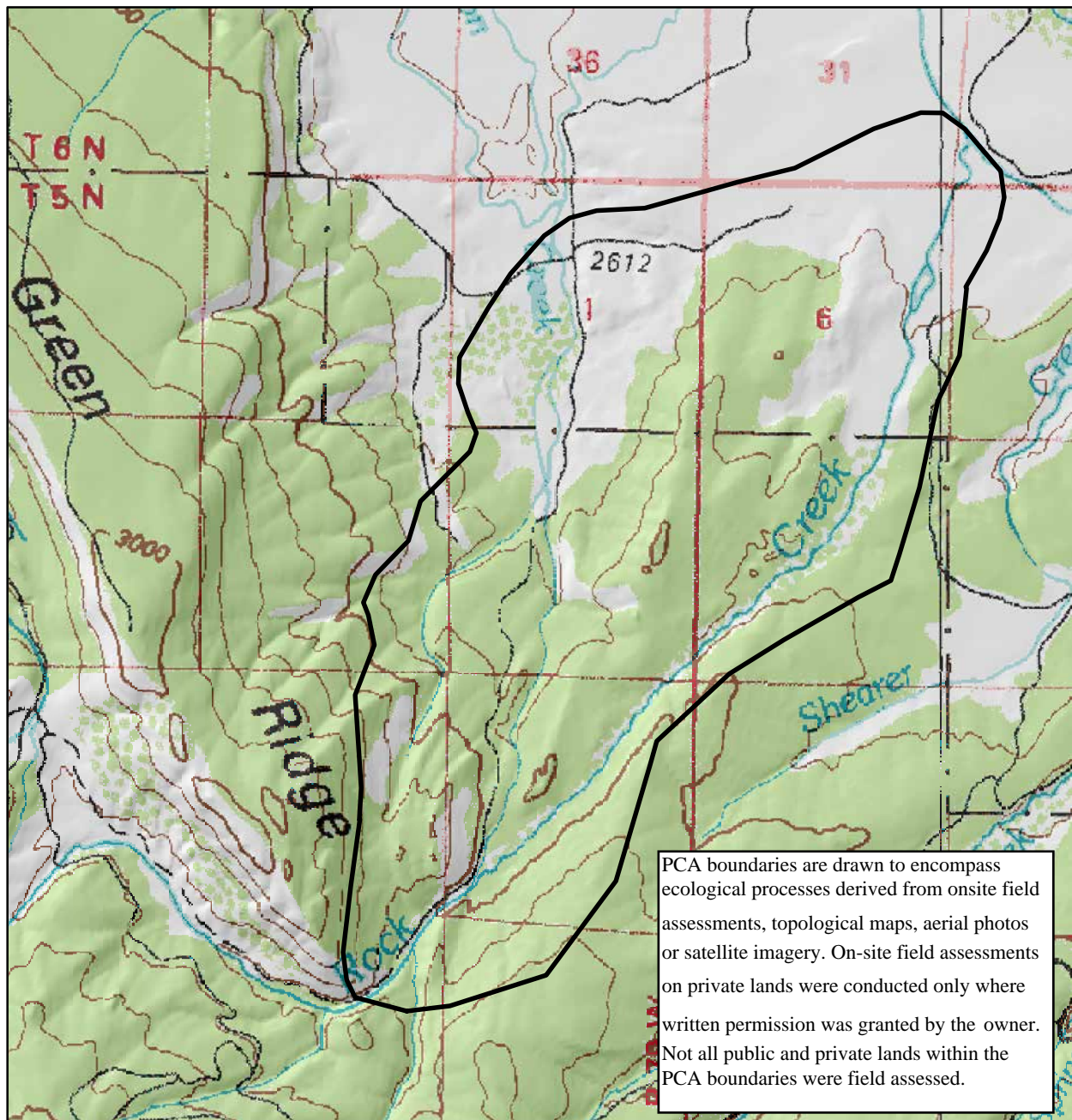
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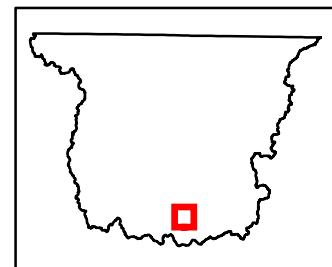
## Legend

 PCA Boundary

Steamboat Springs, 40106-A1

30x60 Minute Digital Raster  
Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed



Map 20. Rock Creek at Green Ridge Potential Conservation Area, B3: High Biodiversity Significance



Willow carr along McKinnon Creek.



Riparian shrubland along Rock Creek.



## Sawmill Lakes

**Biodiversity Rank - B3: High Biodiversity Significance**

**Protection Urgency Rank - P4: No Threat or Special Opportunity**

**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Teal Lake, Buffalo Pass

**Size:** 3,252 acres (1,316 ha)

**Elevation:** 8,700 - 9,400 ft. (2,652 - 2,865 m)

**General Description:** The Sawmill Lake site is located on the east side of the Park Range in Jackson County. The site is a glaciated basin that is bordered on each side by moraines. The site encompasses several large basin fens created by stagnant glaciers that had become buried in glacial drift during the Pinedale and Bull Lake glaciation. The herbaceous-dominated wetlands surround open water ponds. The wetlands are dominated by sedges (*Carex lasiocarpa*, *C. aquatilis*, *C. limosa*, *C. utriculata*) and cottongrasses (*Eriophorum gracile*, *E. angustifolium*). Round-leaf sundew (*Drosera rotundifolia*) is found with several species of *Sphagnum* (*S. warnstorffii*, *S. teres*, *S. squarrosum*, and *S. fimbriatum*) within the sedge mats along with purple cinquefoil (*Comarum palustre*). Ponds support water lilies (*Nuphar lutea* ssp. *polysepala*), buckbean (*Menyanthes trifoliata*), small bur-reed (*Sparganium natans*) and bladderwort (*Utricularia minor*). The uplands surrounding the wetland complex are dominated by lodgepole pine (*Pinus contorta*) and Engelmann spruce (*Picea engelmannii*). The hydrology of the area is driven primarily by melting snowpack that trickles down through glacial strata, then emerges on the surface as groundwater discharge. The site is defined as a fen due to the presence of water logged spongy ground and the formation of organic soils or histosols. Histosols are organic soils formed by slow accumulation of plant debris in waterlogged situations where it cannot decompose and accumulates as peat. Water analysis performed in 2005 by the Forest Service classifies this wetland as an intermediate poor fen with relatively low pH (4.9-5.5) and low cation concentrations. Amphibians that are known to occur in the ponds are boreal toad (*Bufo boreas*), wood frog (*Rana sylvatica*), and the striped chorus frog (*Pseudacris triseriata*). The upland vegetation consists of lodgepole pine (*Pinus contorta*) forests that have been severely impacted by the mountain pine beetle (*Dendroctonus* spp.).

**Key Environmental Factors:** Groundwater discharge and the presence of peat accumulation.

**Land Use History:** Current and past logging and domestic cattle grazing.

**Biodiversity Significance Rank Comments (B3):** The site supports a plethora of state rare plants that only occur in fens. These species include an excellent (A-ranked) occurrence of the state imperiled (G5/S1S2) marsh cinquefoil (*Comarum*

*palustre*), an excellent (A-ranked) occurrence of the state imperiled (G5/S1) slender sedge (*Carex lasiocarpa*), an excellent (A-ranked) occurrence of the state rare (G5/S2) slender cottongrass (*Eriophorum gracile*), an excellent (A-ranked) occurrence of the state rare (G5/S2) lesser bladderwort (*Utricularia minor*), an excellent (A-ranked) occurrence of the state rare (G5/S2) roundleaf sundew (*Drosera rotundifolia*) and an excellent (A-ranked) occurrence of the state rare (G5/S2) mud sedge (*Carex limosa*). There is also an excellent (A-ranked) occurrence of the state imperiled (G4?/S1) *Carex lasiocarpa* montane wetland. Wood frogs (*Rana sylvatica*) and boreal toads (*Bufo boreas*) have been documented in the area, but the site was not designed for these amphibians.

Natural Heritage element occurrences at the Sawmill Lakes PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	<i>Carex lasiocarpa</i> Herbaceous Vegetation	Montane Wetland	G4?	S1				A	2008-07-30
Vascular Plants	<i>Carex lasiocarpa</i>	slender sedge	G5	S1				A	2008-08-01
Vascular Plants	<i>Carex limosa</i>	mud sedge	G5	S2				A	2005-08-06
Vascular Plants	<i>Comarum palustre</i>	marsh cinquefoil	G5	S1S2				A	2008-07-30
Vascular Plants	<i>Drosera rotundifolia</i>	roundleaf sundew	G5	S2			USFS	A	2008-07-30
Vascular Plants	<i>Eriophorum gracile</i>	slender cottongrass	G5	S2			BLM/USFS	A	2008-07-30
Vascular Plants	<i>Utricularia minor</i>	lesser bladderwort	G5	S2			USFS	A	2008-07-30

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The boundary encompasses the immediate watershed that contains all of the wetland dependent botanical species found within the kettle lake basin that is located between Forest Service Roads 60 and 20.

**Protection Urgency Rank Comments (P4):** The site is located within Forest Service boundaries. It is suggested, that due to the site's unique wetland characteristics, that a Research Natural Area designation be considered.

**Management Urgency Rank Comments (M3):** The surrounding lodgepole uplands could potentially be logged due to beetle kill. The effects on the wetland are unknown. Additionally, a few areas with Canada thistle (*Breca arvensis*) were observed and information was forwarded to the USFS Park Ranger District office.



Control of this noxious weed is recommended.

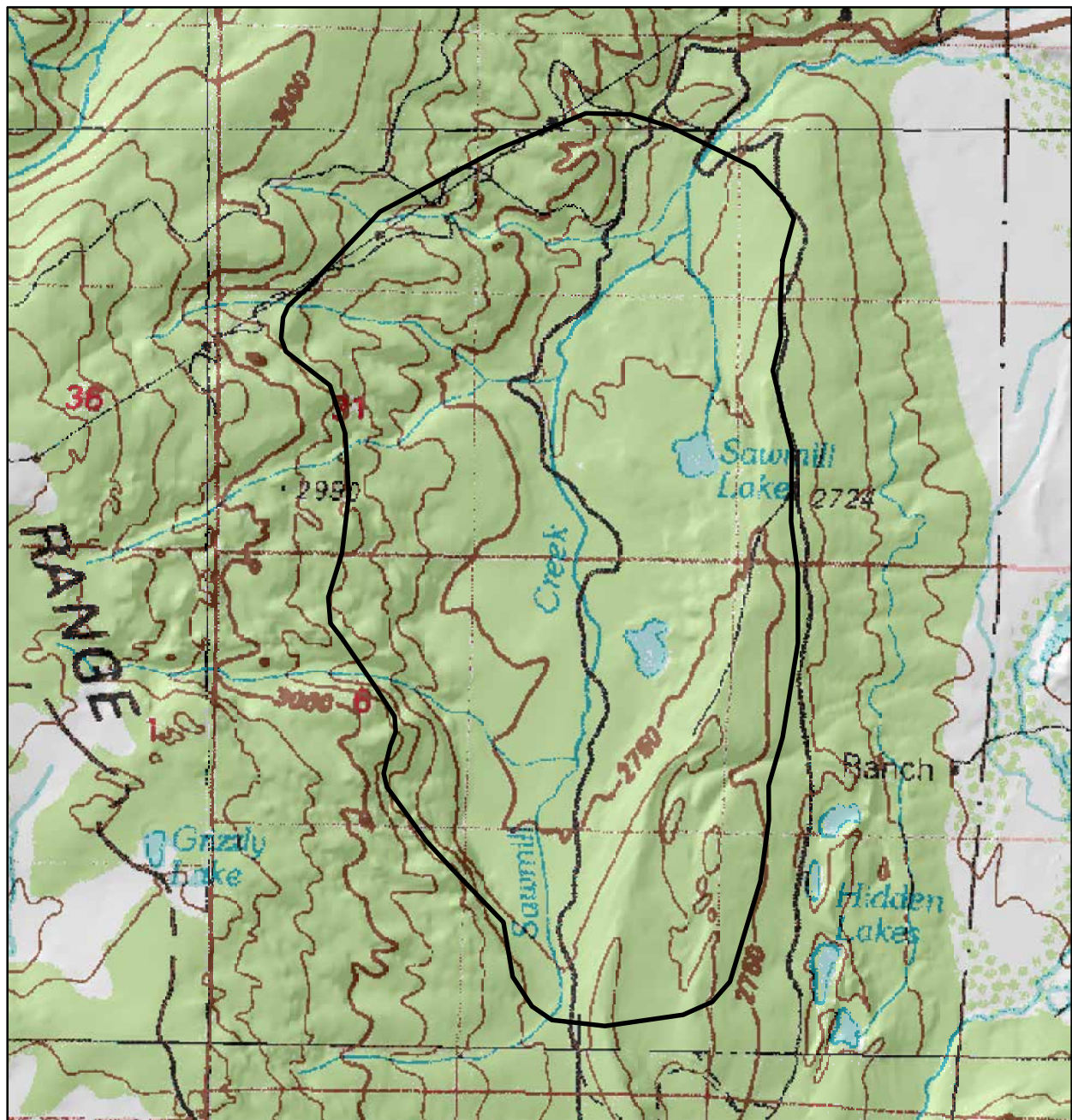
**Exotic Species Comments:** A few areas with Canada thistle (*Breea arvensis*) were noted.

### **References**

Culver, D.R., K. Decker, J. Parker, J. Bell, J. Sovell, and J. Huggins. 2010. CNHP Final Report: Identification and Assessment of Important Wetlands within the North Platte Watershed, CO. Colorado Natural Heritage Program, Fort Collins, CO.

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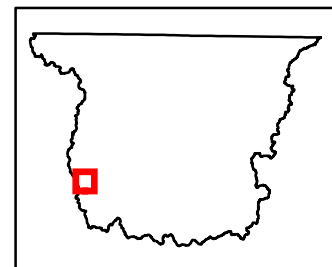
## Legend

 PCA Boundary

Walden, 40106-E1

30x60 Minute Digital Raster  
Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed



Map 21. Sawmill Lakes Potential Conservation Area, B3: High Biodiversity Significance





Roundleaf sundew (*Drosera rotundifolia*) with buckbean (*Menyanthes trifoliata*).



Narrow-leaf cottongrass (*Eriophorum angustifolium*).

## Soda Springs at Watson Mountain

**Biodiversity Rank - B3: High Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**Size:** 316 acres (128 ha)

**Elevation:** 7,800 - 7,950 ft. (2,377 - 2,423 m)

**General Description:** The Soda Springs at Watson Mountain site is located on the south side of Watson Mountain, a metamorphic rock of the Precambrian Age, in northern Jackson County. The site encompasses a groundwater discharge area that is approximately 1 mile long. Additional water is likely contributing to the wetland via the Capron Ditch that runs parallel to the site. The vegetation is a mosaic of alkaline and fen plant associations defined by saturation of soils. Analogue sedge (*Carex simulata*) occurs at the east side of the site where there is a viable spring that has started the formation of a fen (more than 40 cm of histosols). Nebraska sedge (*Carex nebrascensis*) and beaked sedge (*C. utriculata*) ring the fen. The other plant association mosaics are tolerant of alkaline soils, where the soils are dry during a portion of the growing season, therefore creating alkaline conditions. These plants include alkali cordgrass (*Spartina gracilis*), alkali grass (*Puccinellia airoides*), Baltic rush (*Juncus balticus*), spikerush (*Eleocharis palustris*), popcorn flower (*Plagiobothrys scouleri*), sea milkwort (*Glaux maritima*), arrowgrass (*Triglochin maritima*), silvery primrose (*Primula incana*), blue-eyed grass (*Sisyrinchium montanum*), weak groundsel (*Packera debilis*), falsegold groundsel (*P. pseud aurea*), and meadow lousewort (*Pedicularis crenulata*). The soils in this portion of the site are characterized with saline deposits and marl deposits in areas of open water with a pH of 6.3. The uplands consist of sagebrush (*Artemisia tridentata* var. *pauciflora*, *A. tridentata* var. *wyomingensis* and *A. cana*) shrublands.

**Key Environmental Factors:** Key factors include unaltered hydrology or groundwater discharge that creates saturated soils so that peat can continue to form.

**Climate Description:** The site is located in an intermountain basin that is enclosed on most sides by mountains that create precipitation shadows for air and moisture. Climate records for Walden indicate a mean annual precipitation of 10.53 inches (WRCC 2009). Annual mean for snowfall is 57.1 inches. The lowest average temperature (Jan.) is 3.9 degrees F and the highest average temperature (July) is 78.5 degrees F.

**Biodiversity Significance Rank Comments (B3):** The site supports a good (B-ranked) occurrence of a globally vulnerable (G3/S2) sea milkwort (*Glaux*



*maritima*) herbaceous vegetation, an excellent (A-ranked) occurrence of a state rare (G4/S3) *Carex simulata* wet meadow, an excellent (A-ranked) occurrence of a *Triglochin maritima* Western Slope salt meadow whose global rank is unknown (GU/SU) and an excellent (A-ranked) occurrence of a state imperiled (G4/S1) plant, Rocky Mountain ragwort (*Packera debilis*). An historical occurrence of wild chives (*Allium schoenoprasum* var. *sibiricum*), a state imperiled (G5T5/S1) plant, was documented in the early 1900s, but current information is needed to identify the precise location and quality of the rare plant populations.

Natural Heritage element occurrences at the Soda Springs at Watson Mountain PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Glaux maritima Herbaceous Vegetation [Provisional]	Sea Milkwort	G3	S2				B	2009-07-08
Natural Communities	Carex simulata Herbaceous Vegetation	Wet Meadow	G4	S3				A	2009-07-07
Natural Communities	Triglochin maritima Herbaceous Vegetation	Western Slope Salt Meadows	GU	SU				A	2009-07-07
Vascular Plants	Packera debilis	Rocky Mountain ragwort	G4	S1				A	2009-07-08

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** Boundaries are drawn to capture the immediate watershed that starts below the south flank of Watson Mountain. The boundaries were developed to include immediate ecological processes. Specifically the primary ecological process is hydrology, especially groundwater discharge (Rondeau 2001). Only private lands with written permission were surveyed.

**Protection Urgency Rank Comments (P3):** Entire site is privately owned by one ranch. Owner is open to a discussion about conservation easements.

**Management Urgency Rank Comments (M3):** There is grazing within the site as well as in the drier portions. It is suggested that fencing off the fen would prevent both degradation of the wetland and harm to cattle.

**Information Needs:** Current field surveys are needed to identify the precise location and quality of wild chive (*Allium schoenoprasum* var. *sibiricum*) populations.

## References

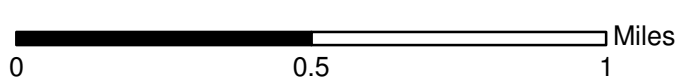
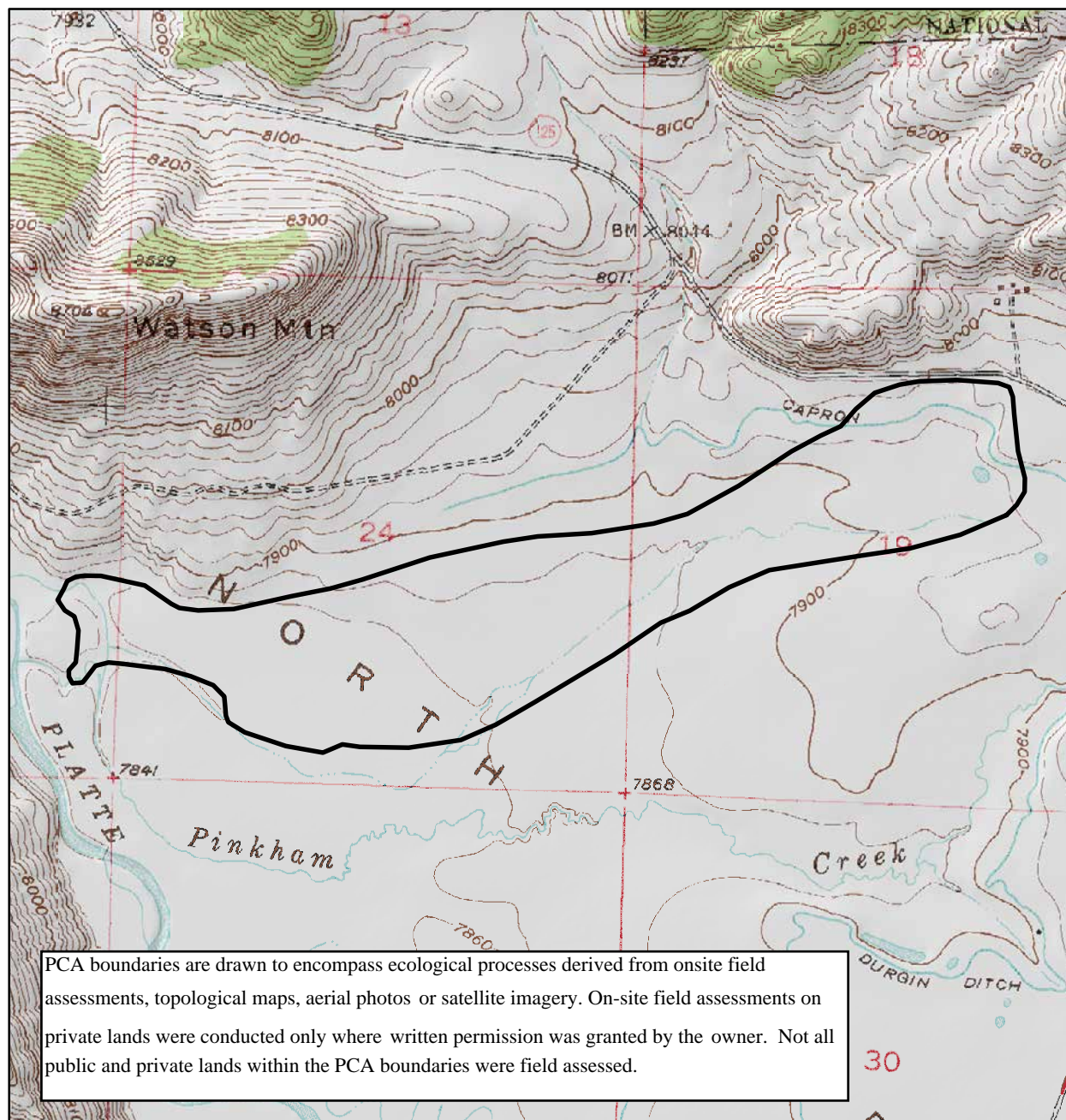
Culver, D.R., K. Decker, J. Parker, J. Bell, J. Sovell, and J. Huggins. 2010. CNHP Final Report: Identification and Assessment of Important Wetlands within the North Platte Watershed, CO. Colorado Natural Heritage Program, Fort Collins, CO.


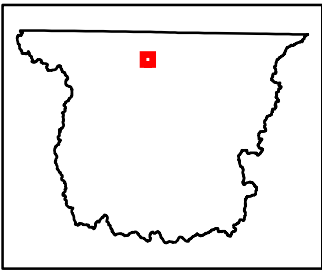
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Western Regional Climate Center. 2009. Record Climate Summaries. Accessed in 2009. <http://www.wrcc.dri.edu/>

**Version Author:** Culver, D.R.

**Version Date:** 10/26/2009



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Map 22. Soda Springs at Watson Mountain Potential Conservation Area, B3: High Biodiversity Significance





Soda Springs Wetland.



Soda Springs fen dominated by analogue sedge with peat depth of at least 40 cm.



## South Fork Michigan River

**Biodiversity Rank - B3: High Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Jack Creek Ranch, Mount Richthofen, Gould

**Size:** 2,901 acres (1,174 ha)

**Elevation:** 8,870 - 9,550 ft. (2,704 - 2,911 m)

**General Description:** The South Fork Michigan River at Silver Creek site is located at the northeastern slope of Owl Mountain. The South Fork and its major tributaries, Mill, No Name, and LaFevre creeks drain the east flank of Owl Mountain while Silver and Porcupine creeks flow west from Seven Utes Mountain to the confluence with the South Fork. The site is typical of a montane, glacially carved riparian shrubland in this portion of Northern Colorado. The upper portion of the riparian shrubland is dominated by a short-stature willow (*Salix wolfii*) carr that is supported by the meandering, low gradient South Fork. The understory vegetation varies with soil saturation; sedges (*Carex utriculata* and *C. aquatilis*) are found in the wettest areas, where grasses such as tufted hairgrass (*Deschampsia cespitosa*), bluejoint reedgrass (*Calamagrostis canadensis*), and several forbs are found in areas that are drier. The lower portions of the site consist of Drummond's willow (*Salix drummondiana*), Rocky Mountain willow (*S. monticola*), and planeleaf willow (*S. planifolia*). The understory supports several native graminoids such as bluejoint reedgrass, water sedge (*Carex aquatilis*), and beaked sedge (*C. utriculata*). Beaver (*Castor canadensis*) activity is evident throughout the site, creating ponds and channels. The upland vegetation consists of lodgepole pine (*Pinus contorta*) forests that have been severely impacted by the mountain pine beetle (*Dendroctonus* spp.).

**Key Environmental Factors:** Beaver (*Castor canadensis*) are primary users as well and maintain the riparian shrublands. Beaver activity forms ponds that slow spring runoff and flooding and retain water that will be released slowly during the growing season. The primary abiotic ecological process to maintain viability is hydrology and more specifically surface flow. Annual and episodic flooding is important in maintaining riparian shrublands (Rondeau 2001).

**Climate Description:** The site is located within the southeastern portion of an intermountain basin that is enclosed on most sides by mountains that create precipitation shadows for air and moisture. Climate records for Walden indicate a mean annual precipitation of 10.53 inches (WRCC 2009). Annual mean for snowfall is 57.1 inches. The lowest average temperature (Jan.) is 3.9 degrees F and the highest average temperature (July) is 78.5 degrees F.

**Biodiversity Significance Rank Comments (B3):** This site supports a good (B-ranked) occurrence of a globally vulnerable (G3/S3) *Salix wolfii* / mesic forb riparian shrubland, a good (B-ranked) occurrence of a globally vulnerable (G3/S3) *Salix drummondiana* / *Calamagrostis canadensis* lower montane willow carr, a fair (C-ranked) occurrence of a globally vulnerable (G3/S3) *Picea pungens* / *Alnus incana* montane riparian forest and a fair (C-ranked) occurrence of a globally vulnerable (G3/S3) *Salix monticola* / *Carex aquatilis* montane riparian willow carr. In addition, there is an extant occurrence of the state rare (G5/S3) wood frog (*Rana sylvatica*).

Natural Heritage element occurrences at the South Fork Michigan River PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Amphibians	<i>Rana sylvatica</i>	Wood Frog	G5	S3		SC	USFS	E	1993-07-01
Natural Communities	<i>Picea pungens</i> / <i>Alnus incana</i> Woodland	Montane Riparian Forests	G3	S3				C	1993-07-01
Natural Communities	<i>Salix drummondiana</i> / <i>Calamagrostis canadensis</i> Shrubland	Lower Montane Willow Carrs	G3	S3				B	1993-07-07
Natural Communities	<i>Salix monticola</i> / <i>Carex aquatilis</i> Shrubland	Montane Riparian Willow Carr	G3	S3				C	1993-07-07
Natural Communities	<i>Salix wolfii</i> / Mesic Forbs Shrubland	Subalpine Riparian Willow Carr	G3	S3				B	2006-07-10

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** Boundaries are drawn to capture the immediate watershed that starts below Owl and Seven Utes mountains to the confluence with the mainstem of the Michigan River. The boundaries were developed to include immediate ecological processes. Specifically the primary ecological process is hydrology, especially surface flow (Rondeau 2001). Only private lands with written permission were surveyed.

**Protection Urgency Rank Comments (P3):** The land ownership in the site is a mix of private and Forest Service. There are no known threats as of 2009.

**Management Urgency Rank Comments (M3):** This area is used heavily in the winter by snowmobilers. Impacts from the compressed snow by recreation are not fully known.

**Land Use Comments:** Camping and all terrain vehicle use occur in summer;

snowmobiling is popular in winter.

**Exotic Species Comments:** Canada thistle is present in drier areas.

**Information Needs:** Snowmobiling impacts on vegetation are unknown.

### **References**

Culver, D.R. 2006. Final Report: Rare Plant Survey for Owl Mountain Area and Medicine Bow/Routt National Forest. Colorado Natural Heritage Program, Fort Collins, CO.

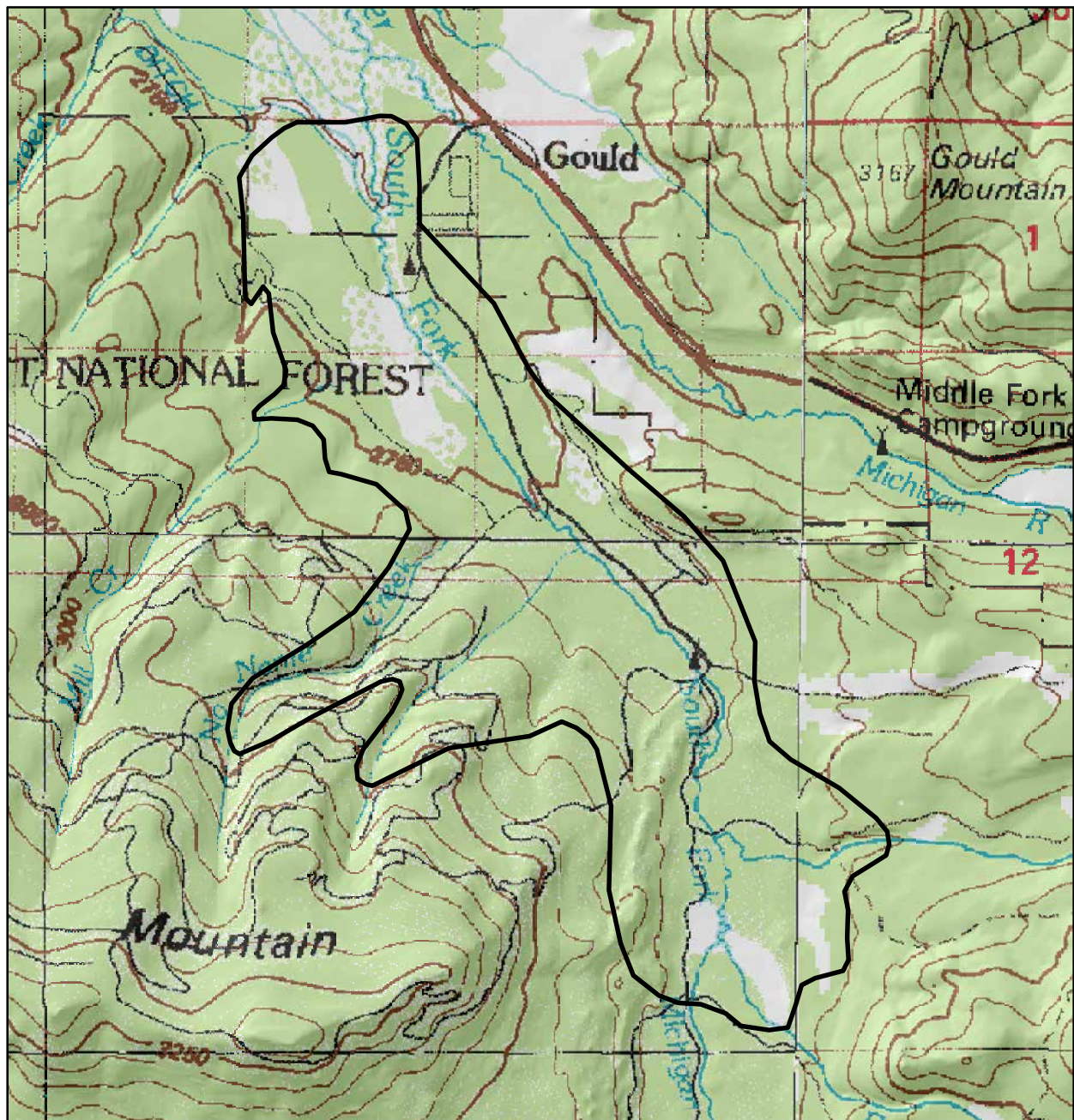
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Rondeau, R. 2001. Ecological system viability specifications for Southern Rocky Mountain ecoregion. First Edition. Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO. 181 pp.

Western Regional Climate Center. 2009. Record Climate Summaries. Accessed in 2009. <http://www.wrcc.dri.edu/>

**Version Author:** Culver, D.R.

**Version Date:** 11/05/2009



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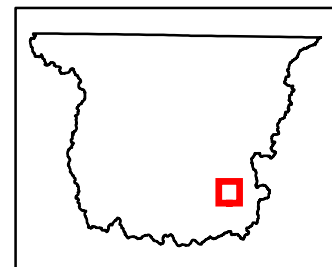
### Legend

 PCA Boundary

Estes Park, 40105-A1  
Steamboat Springs, 40106-A1  
Walden, 40106-E1

30x60 Minute Digital Raster  
Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed



Map 23. South Fork Michigan River Potential Conservation Area, B3: High Biodiversity Significance





South Fork of Michigan River.



One of numerous springs along South Fork.

## Trout Creek at Sheep Creek

**Biodiversity Rank - B3: High Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Eaton Reservoir

**Size:** 3,420 acres (1,384 ha)

**Elevation:** 8,400 - 9,140 ft. (2,560 - 2,786 m)

**General Description:** Trout Creek site consists of a small stream with a series of active beaver ponds. Adjacent slopes are vegetated with a mosaic of lodgepole pine (*Pinus contorta*) forest and sagebrush (*Artemisia* ssp.) shrublands. The beaver ponds support dense stands of beaked sedge (*Carex utriculata*) and water sedge (*C. aquatilis*) with shrublands of Geyer willow (*Salix geyeriana*) and planeleaf willow (*S. planifolia*) at the outer edges. Wildlife noted using the wetlands include moose, elk, deer, and a variety of songbirds. A four-wheel drive road travels along the creek and at places is nearly inundated by the beaver pond wetlands.

**Biodiversity Significance Rank Comments (B3):** Trout Creek site supports a breeding location for the boreal toad (*Bufo boreas*) (G4T1Q), a globally critically imperiled subspecies. The size of the population at Trout Creek is not well documented as surveys were conducted in mid-summer 2005 after the breeding season. Two adult toads and two breeding pools with boreal toad tadpoles were found at the edges of beaver ponds. The elevation of the ponds (8,520 feet) is at the low end of the usual boreal toad elevation range (8,500 - 11,500 feet) (Hammerson 1999). The closest known boreal toads are about seven miles southeast at the newly documented Panhandle Creek site northwest of Red Feather Lakes. The next closest known active boreal toad breeding locations are at Rocky Mountain National Park. The boreal toad was once common throughout the mountains of Colorado, but has undergone declines over the last 20 years (Goettl 1997). Reasons for the decline are unknown but postulated to be due to a chytrid fungus (Cunningham 1998 as cited in Hammerson 1999). In 1993, the boreal toad was listed as state Endangered by the Colorado Division of Wildlife.

Natural Heritage element occurrences at the Trout Creek at Sheep Creek PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Amphibians	Bufo boreas pop. 1	Boreal Toad (Southern Rocky Mountain Population)	G4T1Q	S1		SE		E	2006-99-99

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The boundary includes the known boreal toad breeding locations and adjacent contiguous habitat. A buffer is provided to prevent direct disturbance to the aquatic habitats. These boundaries are intended to protect potential breeding habitat and some post-breeding dispersal. As this species is known to move over 2 1/2 miles (4 km) between breeding and non-breeding habitat (Hammerson 1999), it could be impacted by off-site factors. The boundary represents an estimate of the area needed to maintain local hydrological conditions. Any activities along the creek, such as water diversions, impoundments, incompatible livestock grazing, and development could potentially be detrimental to the functioning of the wetland areas within the site. This boundary represents the minimum area that should be considered for a conservation management plan.

**Protection Urgency Rank Comments (P3):** Three-fourths of the site is owned and managed by the U.S. Forest Service with no special conservation status. The northwest quadrant (Section 34) is privately owned with parcels ranging in size from 40 to 240 acres. The privately owned portions are within a quarter mile (400 meters) of the known breeding locations.

**Management Urgency Rank Comments (M3):** Land uses on the USFS portion of the site include livestock grazing, logging, and recreation. Uses on private lands within the site are currently unknown. Canada thistle (*Breaa arvensis*) and other non-native species often associated with grazing occur at the edges of some of the wetlands.

**Information Needs:** Future surveys in early spring will help define the local population size.

## References

Culver, D.R., K. Decker, J. Parker, J. Bell, J. Sovell, and J. Huggins. 2010. CNHP Final Report: Identification and Assessment of Important Wetlands within the North Platte Watershed, CO. Colorado Natural Heritage Program, Fort Collins, CO.

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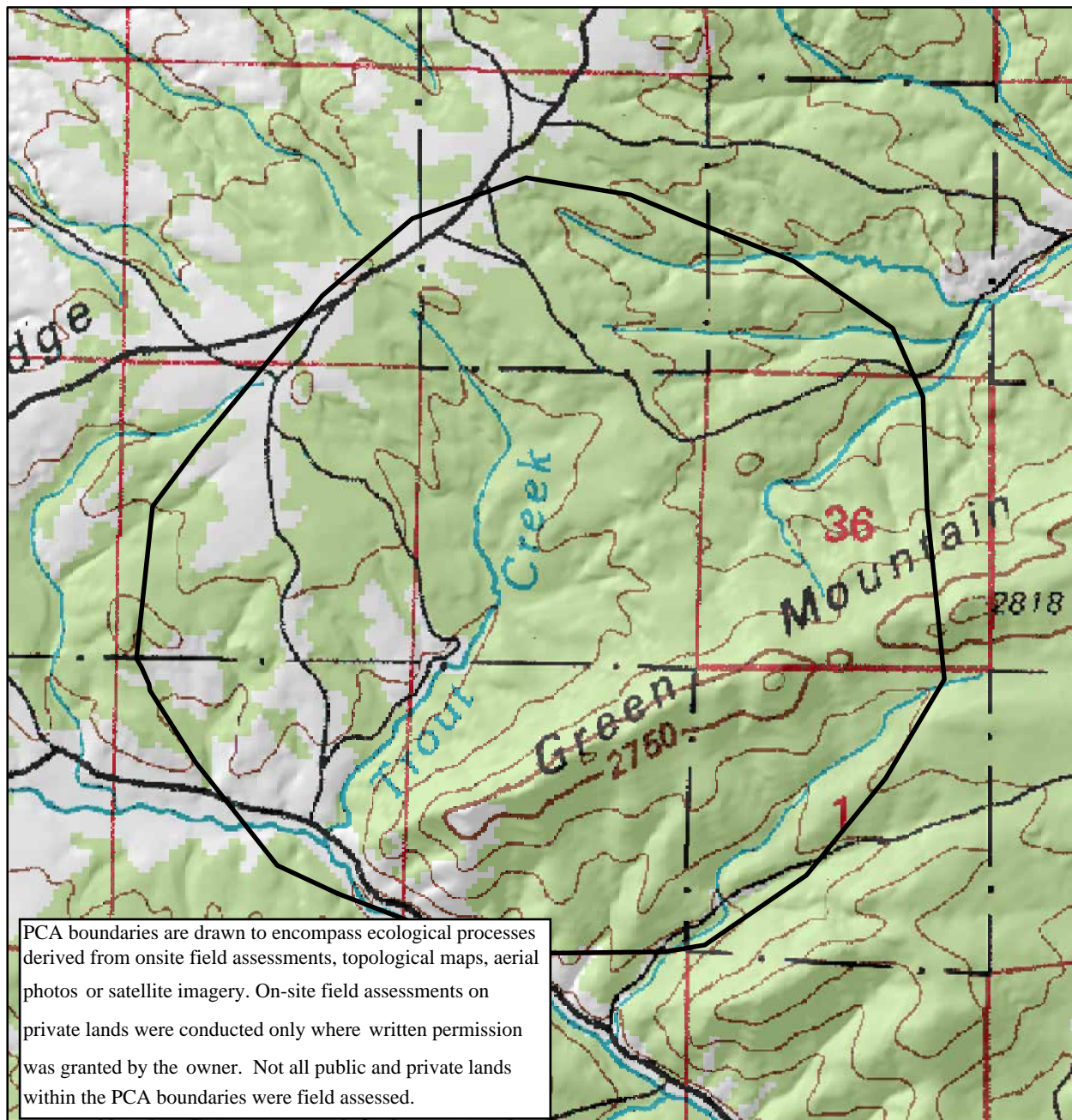
Goettl, J. P. Jr., and The Boreal Toad Recovery Team. 1997. Boreal Toad (*Bufo boreas boreas*) (Southern Rocky Mountain Population), Recovery Plan. Colorado Division of Wildlife, Denver.

Hammerson, G.A. 1999. *Amphibians and Reptiles in Colorado*. Second Edition. University Press of Colorado. Niwot, CO.

**Version Author:** Culver, D.R.

**Version Date:** 12/09/2009





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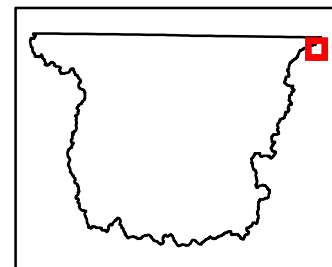
## Legend

 PCA Boundary

Fort Collins, 40105-E1

30x60 Minute Digital Raster  
Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed



Map 24. Trout Creek at Sheep Creek Potential Conservation Area, B3: High Biodiversity Significance

## Boston Creek Fen

**Biodiversity Rank - B4: Moderate Biodiversity Significance**

**Protection Urgency Rank - P4: No Threat or Special Opportunity**

**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Boston Peak

**Size:** 28 acres (11 ha)

**Elevation:** 8,920 - 8,920 ft. (2,719 - 2,719 m)

**General Description:** The Boston Creek fen is a glaciated basin that is bordered on each side by moraines. The site encompasses a small fen that is located on glacial drift during the Pinedale and Bull Lake glaciation. The herbaceous-dominated wetlands surround open water ponds. The wetlands are dominated by sedges (*Carex lasiocarpa*, *C. diandra*, *C. aquatilis*, *C. limosa*, *C. utriculata*). The uplands surrounding the wetland complex are dominated by lodgepole pine (*Pinus contorta*) and Engelmann spruce (*Picea engelmannii*). The hydrology of the area is driven primarily by melting snowpack that trickles down through glacial strata and emerges on the surface as groundwater discharge. The site is defined as a fen due to the presence of water logged spongy ground and the formation of organic soils or histosols. Histosols are organic soils formed by slow accumulation of plant debris in waterlogged situations where it cannot decompose and accumulates as peat. The upland vegetation consists of lodgepole pine (*Pinus contorta*) forests that have been severely impacted by the mountain pine beetle (*Dendroctonus* spp.).

**Key Environmental Factors:** Groundwater discharge and peat formation.

**Biodiversity Significance Rank Comments (B4):** The site supports a good (B-ranked) occurrence of the state critically imperiled (G5/S1) livid sedge (*Carex livida*) and good (B-ranked) occurrences of two state imperiled (G5/S2) plants: hoary willow (*Salix candida*) and mud sedge (*Carex limosa*). In addition, there are unranked occurrences of the state critically imperiled (G5/S1) lesser panicled sedge (*Carex diandra*) and slender sedge (*Carex lasiocarpa*). The hoary willow is fairly common in more northern (boreal) latitudes of North America, but is also found in rare isolated populations in Colorado, Wyoming, and South Dakota. In these areas, the species has remained as a relic from the previous glaciations, when what is now typical boreal vegetation was found much further south on the continent. Throughout its range, *Salix candida* is typically associated with fens, bogs, marshes, and other areas of permanently saturated soils where peat is present.

# Natural Heritage element occurrences at the Boston Creek Fen PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	Carex diandra	lesser panicked sedge	G5	S1			USFS		1996-99-99
Vascular Plants	Carex lasiocarpa	slender sedge	G5	S1					1996-08-12
Vascular Plants	Carex limosa	mud sedge	G5	S2				B	1996-08-12
Vascular Plants	Carex livida	livid sedge	G5	S1			BLM/USFS	B	1996-08-12
Vascular Plants	Salix candida	hoary or silver willow	G5	S2			BLM/USFS	B	1996-08-12

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The boundary includes the immediate watershed that includes the wetland dependent occurrences and a narrow upslope buffer to protect the natural processes. The hydrology is likely dependent on groundwater discharge and any impacts within the larger watershed would affect the viability of the fen.

**Protection Urgency Rank Comments (P4):** No known immediate threats. This site has been recommended for RNA status.

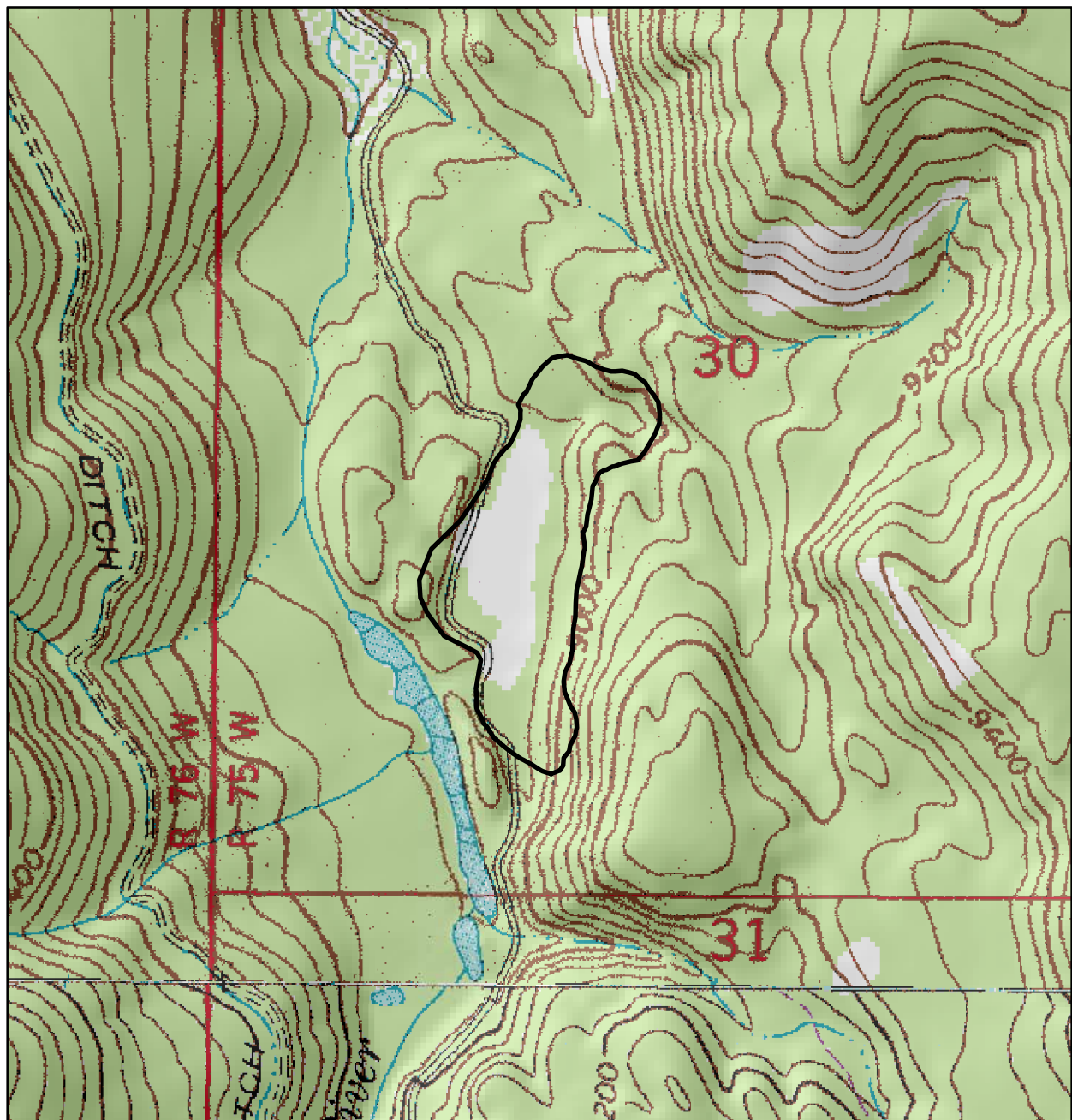
**Management Urgency Rank Comments (M3):** The fen is undisturbed, but there is a road adjacent and logging on the slopes. This site should be monitored for adverse impacts resulting from road maintenance and timber activities.

## References

Culver, D.R., K. Decker, J. Parker, J. Bell, J. Sovell, and J. Huggins. 2010. CNHP Final Report: Identification and Assessment of Important Wetlands within the North Platte Watershed, CO. Colorado Natural Heritage Program, Fort Collins, CO.

**Version Author:** Culver, D.R.

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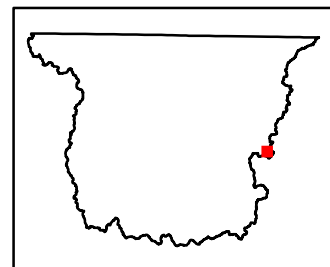
## Legend

 PCA Boundary

Boston Peak, 40105-F7

7.5 Minute Digital Raster  
Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed



Map 25. Boston Creek Fen Potential Conservation Area, B4: Moderate Biodiversity Significance



## East Sand Creek Fen

**Biodiversity Rank - B4: Moderate Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future**

**U.S.G.S. 7.5-minute quadrangles:** Shipman Mountain

**Size:** 509 acres (206 ha)

**Elevation:** 8,000 - 8,280 ft. (2,438 - 2,524 m)

**General Description:** East Sand Creek Fen site is located between the Canadian River and the base of East Sand Dunes. The fen is perched above the Canadian River in a natural basin that is fed by numerous groundwater discharge areas or springs. The fen is dominated by analogue sedge (*Carex simulata*) with pockets of standing water that supports broadleaf cattail (*Typha latifolia*). Sageleaf willow (*Salix candida*) is found scattered throughout the wetland with Booth's willow (*S. boothii*) and Geyer's willow (*S. geyeriana*). The site is defined as a fen due to the presence of water logged spongy ground and the formation of at least 40 cm of organic soils or histosols. Histosols are organic soils formed by slow accumulation of plant debris in waterlogged situations where it cannot decompose and accumulates as peat. There are several areas that "quake" as one walks upon the suspended vegetation. The outer ring of the wetland consists of Nebraska sedge (*C. nebrascensis*), beaked sedge (*C. utriculata*), and tufted hairgrass (*Deschampsia cespitosa*). Stripped chorus frogs (*Pseudacris triseriata*) were heard during the 2009 survey. The uplands are typical montane sagebrush (*Artemisia tridentata* ssp. *pauciflora*) shrublands.

**Key Environmental Factors:** The presence of groundwater discharge and the peat formation.

**Climate Description:** The site is located in an intermountain basin that is enclosed on most sides by mountains that create precipitation shadows for air and moisture. Climate records for Walden indicate a mean annual precipitation of 10.53 inches (WRCC 2009). Annual mean for snowfall is 57.1 inches. The lowest average temperature (Jan.) is 3.9 degrees F and the highest average temperature (July) is 78.5 degrees F.

**Biodiversity Significance Rank Comments (B4):** The site supports an excellent (A-ranked) occurrence of a state rare (G4/S3) *Carex simulata* wet meadow community and an excellent (A-ranked) occurrence of a state rare (G5/S2) plant, sageleaf willow (*Salix candida*). This willow is fairly common in more northern (boreal) latitudes of North America, but is also found in rare isolated populations in Colorado, Wyoming, and South Dakota. In these areas, the species has remained as a

relic from the previous glaciations, when what is now typical boreal vegetation was found much further south on the continent. Throughout its range, *Salix candida* is typically associated with fens, bogs, marshes, and other areas of permanently saturated soils where peat is present.

Natural Heritage element occurrences at the East Sand Creek Fen PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Carex simulata Herbaceous Vegetation	Wet Meadow	G4	S3				A	2009-08-20
Vascular Plants	Salix candida	hoary or silver willow	G5	S2			BLM/ USFS	A	2009-08-20

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The boundary includes East Sand Creek from the East Sand Dunes to its confluence with the Canadian River. The boundary is intended to capture the immediate groundwater discharge area that supports the fen. Only private lands with written permission were surveyed.

**Protection Urgency Rank Comments (P3):** The site has a mixed ownership between State Lands and private land ownership. At the time of the survey it did not appear that cattle or any other use was affecting the quality of the site.

**Management Urgency Rank Comments (M4):** The cattle grazing was limited to the drier sagebrush hills and no impacts were noted within the fen. The Medicine Bow Ditch runs above the site. Its effects, pro or con, are unknown at this time.

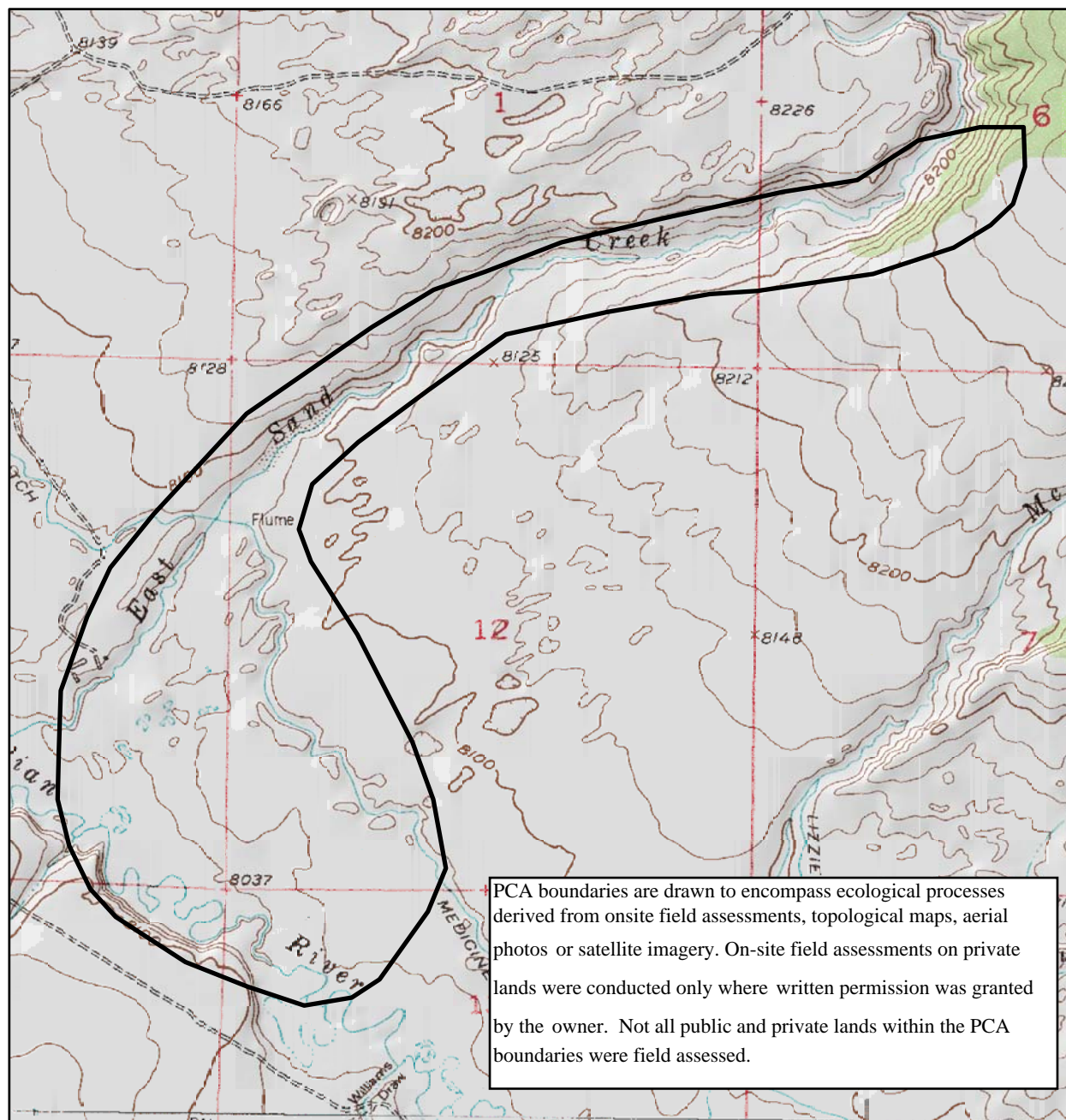
### References

Culver, D.R., K. Decker, J. Parker, J. Bell, J. Sovell, and J. Huggins. 2010. CNHP Final Report: Identification and Assessment of Important Wetlands within the North Platte Watershed, CO. Colorado Natural Heritage Program, Fort Collins, CO.

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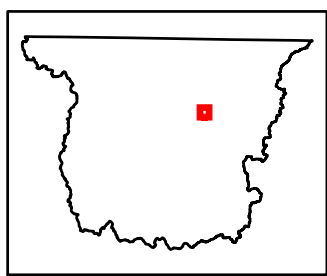
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**Version Date:** 11/05/2009



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Map 26. East Sand Creek Fen Potential Conservation Area, B4: Moderate Biodiversity Significance





Analouge sedge (*Carex simulata*) dominated fen.



Groundwater upwelling within East Sand Creek Fen.



## Illinois River and Reservoirs

**Biodiversity Rank - B4: Moderate Biodiversity Significance**

**Protection Urgency Rank - P4: No Threat or Special Opportunity**

**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Gould NW, Walden, MacFarlane Reservoir, Coalmont, Owl Ridge, Cowdrey

**Size:** 46,800 acres (18,939 ha)      **Elevation:** 8,580 - 9,040 ft. (2,615 - 2,755 m)

**General Description:** The Illinois River and Reservoirs site is located in North Park, an intermountain glacial basin located in north-central Colorado that is approximately 35 miles wide and 45 miles in length. There are numerous soil types within the site, but the most dominant are sandy loam soils that have slow to moderate permeability. The dominant features are the Illinois River, its associated tributaries, and Walden and Macfarlane reservoirs and their associated wetlands. There is approximately 1,500 acres of open water that support abundant populations of waterfowl including species of conservation concern like the American White Pelican (*Pelecanus erythrorhynchos*), Forster's Tern (*Sterna forsteri*), White-faced Ibis (*Plegadis chihi*), and Willet (*Catoptrophorus semipalmatus*). Walden and MacFarlane reservoirs hosts one of Colorado's three known breeding sites of the American White Pelican and Walden Reservoir hosts Colorado's largest nesting populations of Willets and Eared Grebes (*Podiceps nigricollis*). Walden Reservoir also is the only known site of nesting Franklin's Gulls (*Leucophaeus pipixcan*) in the state (Audubon 2009, Kingery 1998) and it regularly supports nesting California Gulls (*Larus californicus*), Double-crested Cormorants (*Phalacrocorax auritus*), and Western Grebes (*Aechmophorus occidentalis*). Black Terns (*Chlidonias niger*) may nest at Walden in small numbers. Other wetland dependent species recorded from the site include numerous species of ducks, grebes, herons, egrets, sandpipers, phalaropes, gulls, and American Bittern (*Botaurus lentiginosus*), wood frog (*Rana sylvatica*), northern leopard frog (*Rana pipiens*), American beaver (*Castor canadensis*), and river otter (*Lontra canadensis*) among others (Audubon 2009, CNHP 2009, USFWS 2004, Kingery 1998). There are over 15,000 acres of sagebrush shrublands in the uplands that support the Greater Sage Grouse, a species of conservation concern. Plant communities consist of four broad types including riparian, wetland, meadow, and upland (USFWS 2004). Habitat ranges from emergent wetlands dominated by sedges at the lowest elevations along the Illinois River and its tributaries, to uplands dominated by big mountain sagebrush at higher elevations. There are over 4,000 acres of riparian habitat that includes willow carrs along portions of the channel and floodplain of the Illinois River and Spring Creek (USFWS 2004). The willow complex supports numerous species of migrating songbirds such as yellow warbler and willow flycatcher. There are over 1,500 acres of wetlands in the site consisting of over 70 natural and created ponds and lakes (USFWS 2004). These wetlands supply

critical habitat to numerous wetland dependent species including aquatic birds, amphibians, and aquatic mammals. There are over 2,500 acres of irrigated hay meadows within the site along the Illinois River and Spring Creek that supply nesting habitat for waterfowl, shorebirds, and songbirds (USFWS 2004). Other secondary plant communities limited patches of greasewood.

**Key Environmental Factors:** The hydrology of the area is the important feature of the site. Prior to settlement, the bottoms and meadows of the Illinois River and its tributaries flooded annually from snow melt and spring runoff, creating significant breeding habitat for wetland dependent species (USFWS 2004). With settlement, numerous irrigation ditches were constructed altering the natural hydrology. Subsequently much of the natural floods and pond creation were reduced and irrigated meadows replaced ponds and marshes. The majority of the site lies within the Arapaho National Wildlife Refuge and since its creation in 1967 refuge management has created new wetland habitat through the diversion of water into natural depressions and the Fish and Wildlife Service has constructed ponds (USFWS 2004). The islands of Walden and MacFarlane reservoirs are another important feature of the site. Construction of the dams and formation of the reservoirs and their islands created nesting habitat for the American White Pelican, Willet, Forster's Tern, Double-crested Cormorant and other aquatic birds that rely on the protection afforded by islands from ground predators like fox and coyote (Knopf and Evans 2004).

**Climate Description:** The climate is semiarid and is characterized as having short, cool summers followed by long, cold winters. Mean annual air temperature in Walden, one mile north of the site, is 36.4 degrees Fahrenheit and temperatures range from minus 39 degrees to 90 degrees Fahrenheit, based on the National Weather Bureau's 30-year average data (USFWS 2004). The annual mean rainfall in Walden is 10.83 and seventy percent falls as snow with Walden averaging 53 inches of snow per year (USFWS 2004). The highest average monthly precipitation occurs in March, April, May, and August (Lischka et al. 1983).

**Land Use History:** Prior to 1820, the Ute peoples used North Park to hunt wild game in the summer but moved to lower altitudes in the fall to avoid the severe winters that are common in the mountain park. After 1820, European trappers started to visit the area and miners and prospectors who panned for gold followed them. Since European settlement began in earnest in the late 1880's and 90's and up until 1967 ranching, including both hay production and cattle, has been the dominant land use at the site. In 1967, the area became part of the National Wildlife Refuge system and the Fish and Wildlife Service has since then managed the area to provide suitable nesting and rearing habitat for migratory birds.

**Cultural Features:** The only specific historical or cultural resources within the site are grave sites, which the refuge protects. The philosophy of the refuge is to comply

with existing cultural resource-related laws and policies and to protect cultural resources from degradation (USFWS 2004).

**Biodiversity Significance Rank Comments (B4):** The site contain an excellent (A-ranked) breeding occurrence of the Willet (*Catoptrophorus semipalmatus*) and an extant occurrence of Forster's Tern (*Sterna forsteri*), two species that are extremely rare (S1 and S2 respectively), in Colorado. This site also contains two of the best breeding occurrences (both C-ranked) in Colorado of the globally vulnerable (G3/S1) American White Pelican (*Pelecanus erythrorhynchos*).

Natural Heritage element occurrences at the Illinois River and Reservoirs PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Birds	Pelecanus erythrorhynchos	American White Pelican	G3	S1B			BLM	C	1994-99-99
Birds	Pelecanus erythrorhynchos	American White Pelican	G3	S1B			BLM	C	2009-07-09
Birds	Catoptrophorus semipalmatus	Willet	G5	S1B				A	2009-05-19
Birds	Plegadis chihi	White - faced Ibis	G5	S2B			BLM	E	1994-08-99
Birds	Sterna forsteri	Forster's Tern	G5	S2B,S 4N				E	2008-06-18

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The wetland complex, riparian areas associated with the Illinois River and its tributaries, the surrounding meadows, and Walden and MacFarlane reservoirs all lie within the boundary. Field surveys verified the location of the important plant communities and the boundary was drawn using field notes, GIS layers from the Colorado Vegetation Classification Project, and the digital orthophoto quad for Jackson County. The site protects a large area to provide enough space for the American White Pelican, Forster's Tern, and Willet that can cover significant distances during foraging trips (Knopf and Evans 2004, Ryan and Renken 1987). The site also provides both grassland habitat and a diversity of wetland types that are necessary for successful reproduction of the species attached to the site (Kantrud and Higgins 1992). Forster's Tern require open water for nesting and the boundary includes over 70 lakes, ponds, and reservoirs suitable as habitat for nesting Forster's Terns.

**Protection Urgency Rank Comments (P4):** Most of the site lies within the boundary of the Arapaho National Wildlife Refuge and it is closed to the public unless specific uses are determined compatible with the purposes of the refuge, which is to provide suitable nesting and rearing habitat for migratory birds (USFWS 2004).

**Management Urgency Rank Comments (M3):** American White Pelicans are highly sensitive to human intrusion into breeding colonies, which cause desertions and exposure of eggs and young to temperature extremes and gull predation (Knopf and Evans 2004). Disturbance by motor boats and low airplanes can cause birds to flee from nesting colonies or feeding or roosting areas (Knopf and Evans 2004). The BLM has issued oil and gas leases right up to the shoreline of MacFarlane Reservoir, and given the sensitivity of pelicans to human disturbance, any development of these leases may not benefit continued nesting by American White Pelican at the site.

**Land Use Comments:** Past and current uses include cattle grazing and hay production and some grazing is still permitted on the refuge. Grazing is used as a tool to invigorate and maintain healthy grass stands necessary for migratory bird nesting. On the refuge, cattle are applied as a tool generally in mid- to late summer for grassland management, but they are not wintered on the refuge (USFWS 2004). Other activities include a driving tour of the wetlands in the northwest portion of the site, hiking, hunting, fishing, wildlife observation, and photography at designated parking areas, and there is a refuge visitor center and headquarters.

**Exotic Species Comments:** Canada thistle can be abundant along ditch banks, dikes, and in the edges of riparian and sub-irrigated areas within the site (USFWS 2004). Other non-native species that occur in small amounts include musk thistle, yellow toadflax, white top, and houndstongue (USFWS 2004). Other invasive plants reported, particularly along highway right-of-ways, include spotted, diffuse, and Russian knapweeds, Dalmatian toadflax, and leafy spurge (USFWS 2004). Non-native fish include brook, brown, and rainbow trout (USFWS 2004). Management of the invasive plants is required by Jackson County and management actions of the refuge include annual monitoring and control of invasives through a combination of mechanical, biological, cultural, and chemical applications (USFWS 2004). The refuge actively manages to promote both the native and non-native fishery through the altering irrigation diversions to restore in-stream flows, installation of structures to prevent erosion and increase sinuosity, and monitoring fish responses to the management applications.

**Off-Site Considerations:** The main offsite activities include livestock grazing and hay production on irrigated pastures. Use of the Illinois River flows by offsite ranches could affect water management on the refuge and thus this site. Because the refuge holds water rights on the Illinois River of over 17,000 acre feet and 550 cubic feet per second for its reservoirs, ponds, and ditches shortages of water, although possible during drought, are unlikely during periods of normal precipitation.

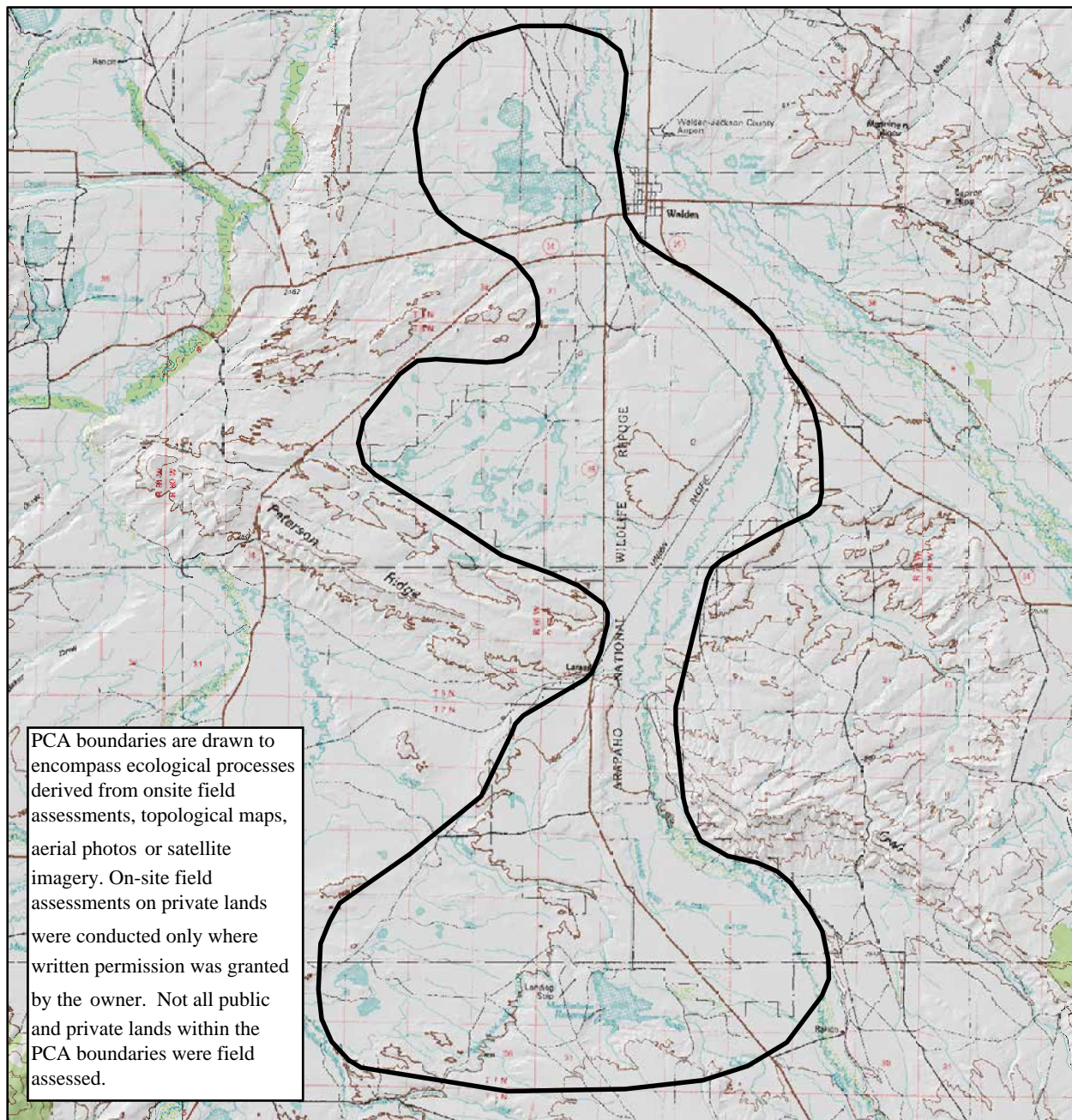


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<http://www.fws.gov/mountain-prairie/planning/States/Colorado/colorado.htm>

**Version Author:** Sovell, J.R.

**Version Date:** 11/24/2009



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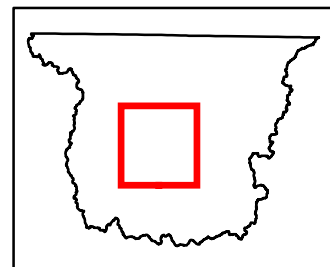
## Legend

 PCA Boundary

Walden, 40106-E1

30x60 Minute Digital Raster  
Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed



Map 27. Illinois River and Reservoirs Potential Conservation Area, B4: Moderate Biodiversity Significance

## Lily Lake at Calamity Pass

**Biodiversity Rank - B4: Moderate Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss**

**U.S.G.S. 7.5-minute quadrangles:** Jack Creek Ranch, Mount Richthofen

**Size:** 276 acres (112 ha)

**Elevation:** 9,663 - 9,893 ft. (2,945 - 3,015 m)

**General Description:** Lily Lake at Calamity Pass site consists of a series of glacial wetlands, kettle ponds and wet meadows. The site is located northeast of Calamity Pass along Forest Service Road 740. The ponds are dominated by pond lily (*Nuphar lutea* ssp. *polysepala*) and buckbean (*Menyanthes trifoliata*). The adjacent wet meadows consist of graminoids such as tufted hairgrass (*Deschampsia caespitosa*), water sedge (*Carex aquatilis*), beaked sedge (*C. utriculata*), Buxbaum's sedge (*Carex buxbaumi*), boreal bog sedge (*C. paupercula*), bluejoint reedgrass (*Calamagrostis canadensis*), marsh marigold (*Caltha leptosepala*), elephanthead (*Pedicularis groenlandica*), arrowleaf ragwort (*Senecio triangularis*), and marsh cinquefoil (*Comarum palustre*). Short stature willows, such as planeleaf willow (*Salix planifolia*) and wolf willow (*Salix wolfii*), dominate the drier edges. The hydrology is likely the combination of groundwater discharge and surface flows from precipitation and snow melt. The surrounding uplands are dominated by lodgepole pine (*Pinus contorta*) and grouse whortleberry (*Vaccinium cespitosum*).

**Key Environmental Factors:** Groundwater discharge, peaty soils, and snowmelt are significant environmental factors.

**Biodiversity Significance Rank Comments (B4):** The site supports an excellent (A-ranked) occurrence of the state imperiled (G5/S1S2) marsh cinquefoil (*Comarum palustre*). There are also extant occurrences of the state rare (G5/S1) livid sedge (*Carex livida*) and the state rare (G5/S2) slender cottongrass (*Eriophorum gracile*), both FS Sensitive species, as well as an extant occurrence of the state rare (G5/S2) mud sedge (*Carex limosa*) which is a FS Species of Local Concern. Although not drawn for this species, the state rare (G5/S3) wood frog (*Rana sylvatica*) is known from the Lily Lake. In 2009, the Forest Service and DOW documented 2 adults. The wood frog is a common northern species whose distribution in Colorado is at its southern extent (Hammerson 1999) and it is listed as sensitive by the Forest Service, BLM, and the Colorado Division of Wildlife.

# Natural Heritage element occurrences at the Lily Lake at Calamity Pass PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	Carex limosa	mud sedge	G5	S2				E	2005-08-07
Vascular Plants	Carex livida	livid sedge	G5	S1			BLM/USFS	E	2005-08-07
Vascular Plants	Comarum palustre	marsh cinquefoil	G5	S1S2				A	2006-08-05
Vascular Plants	Eriophorum gracile	slender cottongrass	G5	S2			BLM/USFS	E	2006-08-05

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** Boundary is drawn to encompass the immediate watershed that supports the wetland dependent plants. It includes the area to the northeast of Calamity Pass and FS Road 740 to the adjacent ridge (moraine).

**Protection Urgency Rank Comments (P3):** The site is within a timber sale area.

**Management Urgency Rank Comments (M2):** The site is located next to a popular FS Road used by All Terrain Vehicles (ATVs). The potential for destruction from off-road travel is high.

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Culver, D.R. 2006. Final Report: Rare Plant Survey for Owl Mountain Area and Medicine Bow/Routt National Forest. Colorado Natural Heritage Program, Fort Collins, CO.

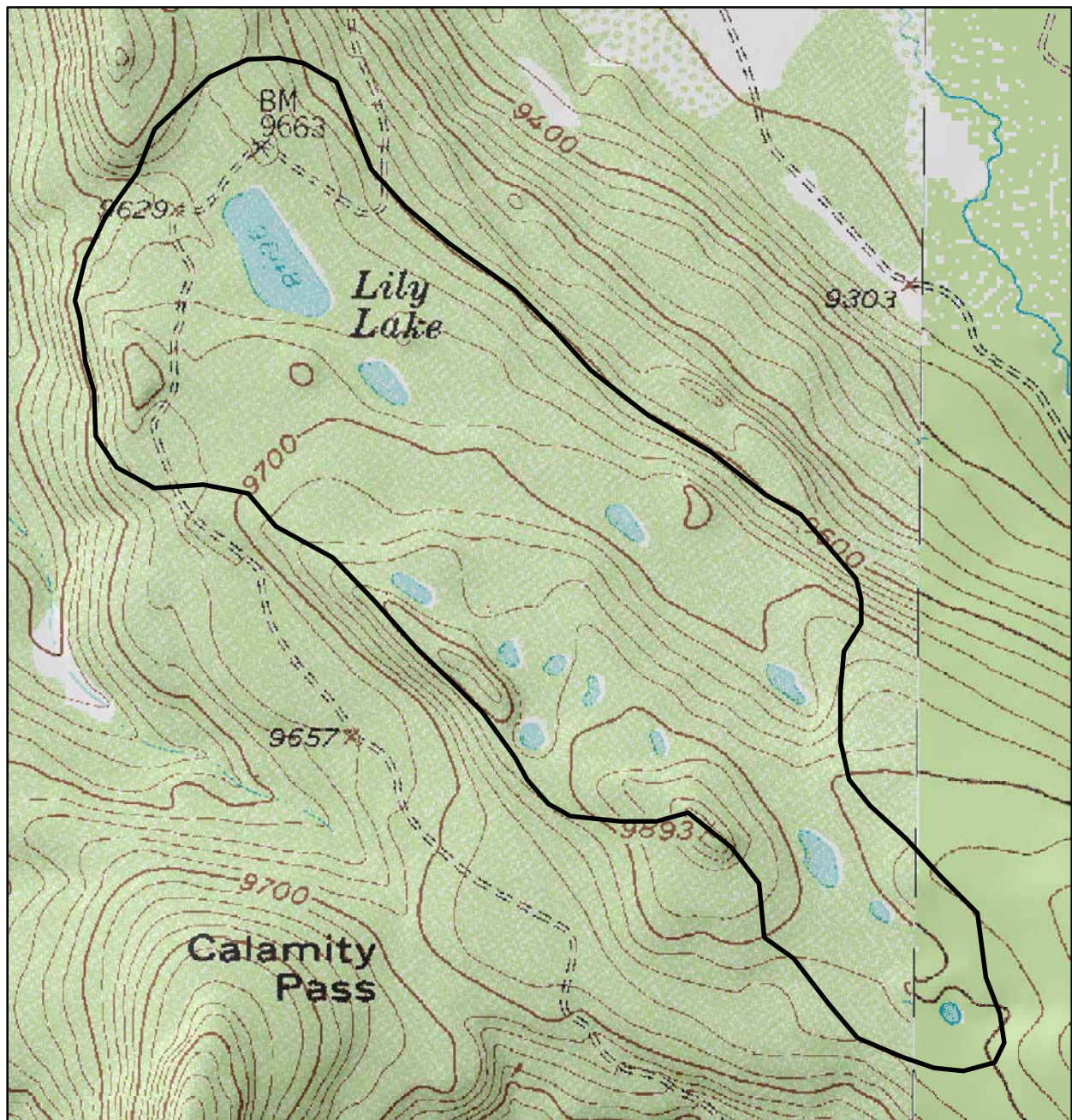
Culver, D.R., K. Decker, J. Parker, J. Bell, J. Sovell, and J. Huggins. 2010. CNHP Final Report: Identification and Assessment of Important Wetlands within the North Platte Watershed, CO. Colorado Natural Heritage Program, Fort Collins, CO.

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**Version Author:** Culver, D.R.

**Version Date:** 10/17/2006





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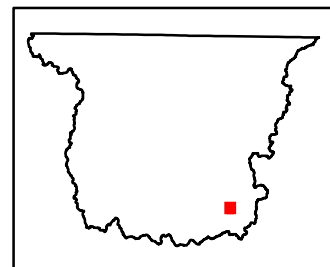
## Legend

 PCA Boundary

Mount Richthofen, 40105-D8  
Jack Creek Ranch, 40106-D1

7.5 Minute Digital Raster  
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U.S. Geological Survey

Location in the North  
Platte Watershed



Map 28. Lily Lake at Calamity Pass Potential Conservation Area, B4: Moderate Biodiversity Significance





Overview of Lily Lake at Calamity Pass.



Pond with buckbean (*Menyanthes trifoliata*) and pond lily (*Nuphar lutea* ssp. *polysepala*).

## Rainbow Lakes

**Biodiversity Rank - B4: Moderate Biodiversity Significance**

**Protection Urgency Rank - P4: No Threat or Special Opportunity**

**Management Urgency Rank - M4: Not Needed Now; No Current Threats; May Need in Future**

**Size:** 291 acres (118 ha)

**Elevation:** 9,750 - 10,000 ft. (2,972 - 3,048 m)

**General Description:** The Rainbow Lakes site is located on the east side of the Park Range in Jackson County. The site encompasses three tarn lakes: Lower, Middle, and Rainbow lakes. Rainbow Lake is fed from snowmelt from Mount Ethel via Slide Lake and Norris Creek. The lakes are bordered by typical subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*) forest. The shrub layer is dominated by the state rare plant white-flowered azalea (*Rhododendron albiflorum*). It occurs at the shoreline of the three lakes and extends up into the drier hillsides where it is eventually replaced by common juniper (*Juniperus communis*) and grouse whortleberry (*Vaccinium scoparium*). Surrounding the lakes are steep hillsides; however at the western edge of Rainbow Lake where Norris Creek enters, a small peatland has formed. It is dominated by sedges (*Carex aquatilis*, *C. utriculata*) and the state rare slender cottongrass (*Eriophorum gracile*).

**Key Environmental Factors:** Acidic soils support the *Rhododendron albiflorum* and peaty soils support the *Eriophorum gracile*.

**Biodiversity Significance Rank Comments (B4):** This site supports an excellent (A-ranked) occurrence of the state rare (G4/S2) white-flowered azalea (*Azaleastrum albiflorum*) and an extant occurrence of the state rare (G5/S2) slender cottongrass (*Eriophorum gracile*).

Natural Heritage element occurrences at the Rainbow Lakes PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Vascular Plants	<i>Azaleastrum albiflorum</i>	white - flowered azalea	G4	S2				A	2008-08-19
Vascular Plants	<i>Eriophorum gracile</i>	slender cottongrass	G5	S2			BLM/USFS	A	2008-08-19

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The boundaries include the upper reach of Norris Creek as it enters the series of Rainbow lakes to the outlet at Lower Rainbow Lake. The

boundaries include the immediate watershed of Rainbow Lakes and a buffer of 1/4 of mile for the cottongrass and the white-flowered azalea.

**Protection Urgency Rank Comments (P4):** The site is owned by US Forest Service and is utilized as a popular fishing and backpacking destination.

**Management Urgency Rank Comments (M4):** The only use is for recreation by hikers and fishermen.

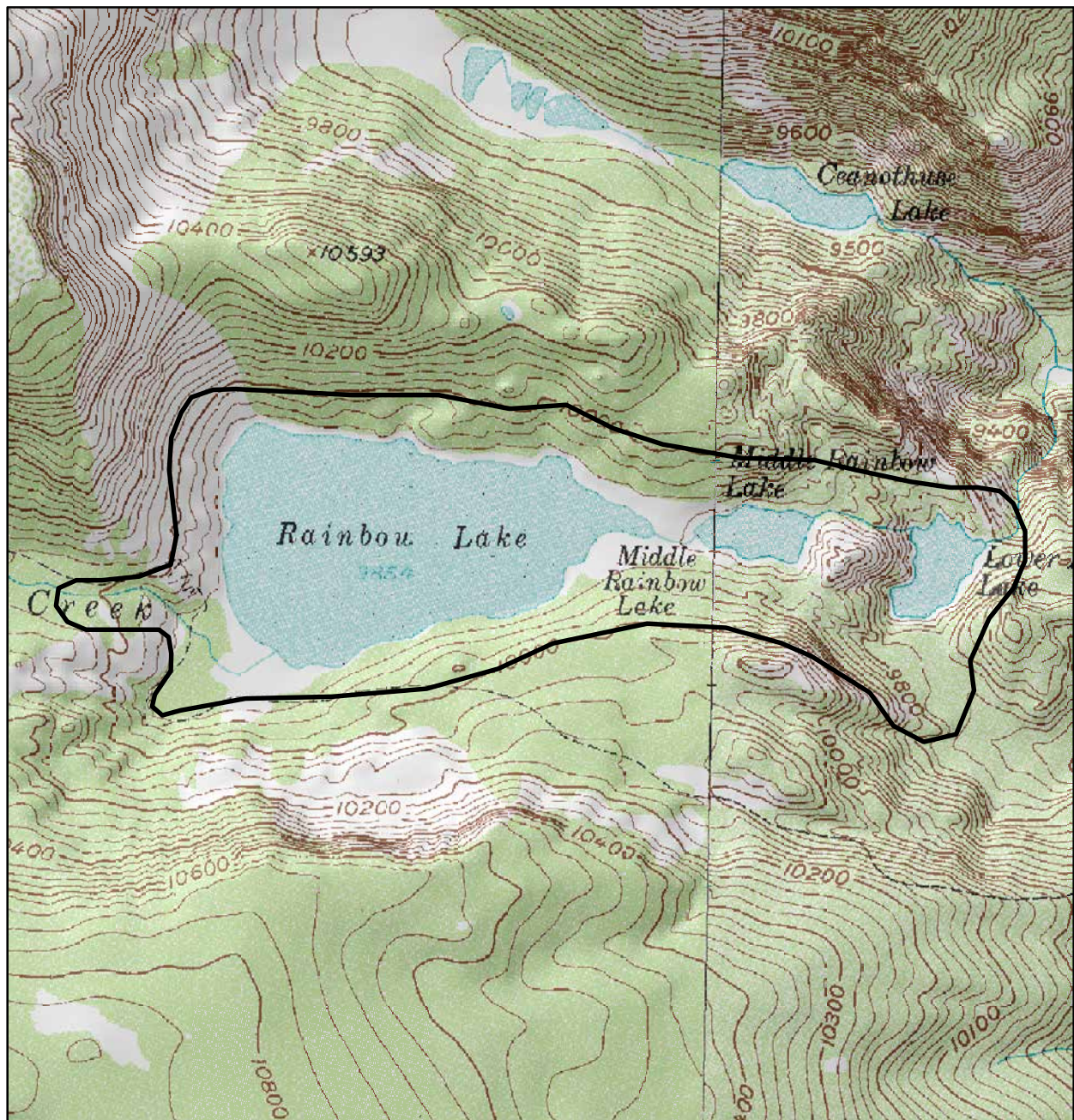
### **References**

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**Version Author:** Culver, D.R.

**Version Date:** 10/20/2009





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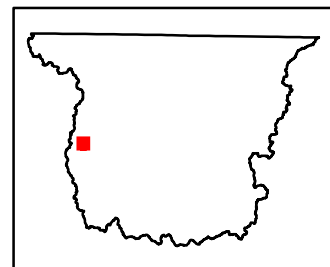
## Legend

 PCA Boundary

Pitchpine Mountain, 40106-F5  
Mount Ethel, 40106-F6

7.5 Minute Digital Raster  
Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed



Map 29. Rainbow Lakes Potential Conservation Area, B4: Moderate Biodiversity Significance





Rainbow Lake.



Slender cottongrass (*Eriophorum gracile*).

## Sand Creek below Boulder Ridge

**Biodiversity Rank - B4: Moderate Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Sand Creek Pass, Eaton Reservoir

**Size:** 2,994 acres (1,212 ha)

**Elevation:** 8,100 - 8,500 ft. (2,469 - 2,591 m)

**General Description:** The Sand Creek site occurs south of Chimney Rock near the Colorado-Wyoming border. It forms a wide open valley of rolling hills supporting sagebrush shrublands, mountain mahogany shrublands, and native grasslands. Limber pine (*Pinus flexilis*) occurs on rock outcrops and ridges. Swales and valleys are dominated by three-tipped sage (*Artemisia tripartita*) and a variety of grasses such as Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass (*Pseudoroegneria spicata*) and needle-and-thread grass (*Hesperostipa comata*). A dense, very wet willow thicket occupies the riparian corridor of Sand Creek, which flows north into Wyoming. On the state land board section, Sand Creek flows through a picturesque granitic canyon. There are numerous stream channels and most are ephemeral. Adjacent to the site is Bull Mountain, dominated by stands of aspen (*Populus tremuloides*) and Douglas-fir (*Pseudotsuga menziesii*) on steep east to north-facing slopes. Sandhill Cranes (*Grus canadensis* ssp. *tabida*) have been noted to occur near this reach of Sand Creek. Larchleaf beardtongue (*Penstemon laricifolius* ssp. *exilifolius*) also occurs along roads and rock outcrops throughout the area.

**Biodiversity Significance Rank Comments (B4):** This site supports a good (B-ranked) occurrence of the state rare (G5/S3) Geyer's willow / beaked sedge (*Salix geyeriana* / *Carex utriculata*) shrubland and a fair (C-ranked) occurrence of a globally vulnerable (G3/S3) riparian natural community, park willow (*Salix monticola*) / mesic graminoid shrubland.

# Natural Heritage element occurrences at the Sand Creek below Boulder Ridge PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Salix monticola / Mesic Graminoids Shrubland	Montane Riparian Willow Carr	G3	S3				C	2004-07-16
Natural Communities	Salix geyeriana / Carex utriculata Shrubland	Geyer's Willow / Beaked Sedge	G5	S3				B	1996-08-15

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The element occurrences along this reach of Sand Creek were buffered by 2,000 feet. Keate (2004), Utah Division of Wildlife Resources, suggests a 2,000-foot buffer distance to minimize impacts to associated wildlife.

**Protection Urgency Rank Comments (P3):** The site is primarily privately owned although one State Land Board section is included. Most of the site has already been subdivided into 35-acre ranchettes; therefore, protection actions directed toward the landowners association may be the most beneficial.

**Management Urgency Rank Comments (M3):** Discourage planting of non-native, potentially invasive species, especially non-native willow species, in landscaping projects within the site. Further, consultation with Colorado Division of Wildlife for recommendations on buffer distance that avoid disturbance to the cranes during nesting would be beneficial.

## References

Culver, D.R., K. Decker, J. Parker, J. Bell, J. Sovell, and J. Huggins. 2010. CNHP Final Report: Identification and Assessment of Important Wetlands within the North Platte Watershed, CO. Colorado Natural Heritage Program, Fort Collins, CO.

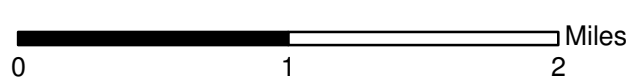
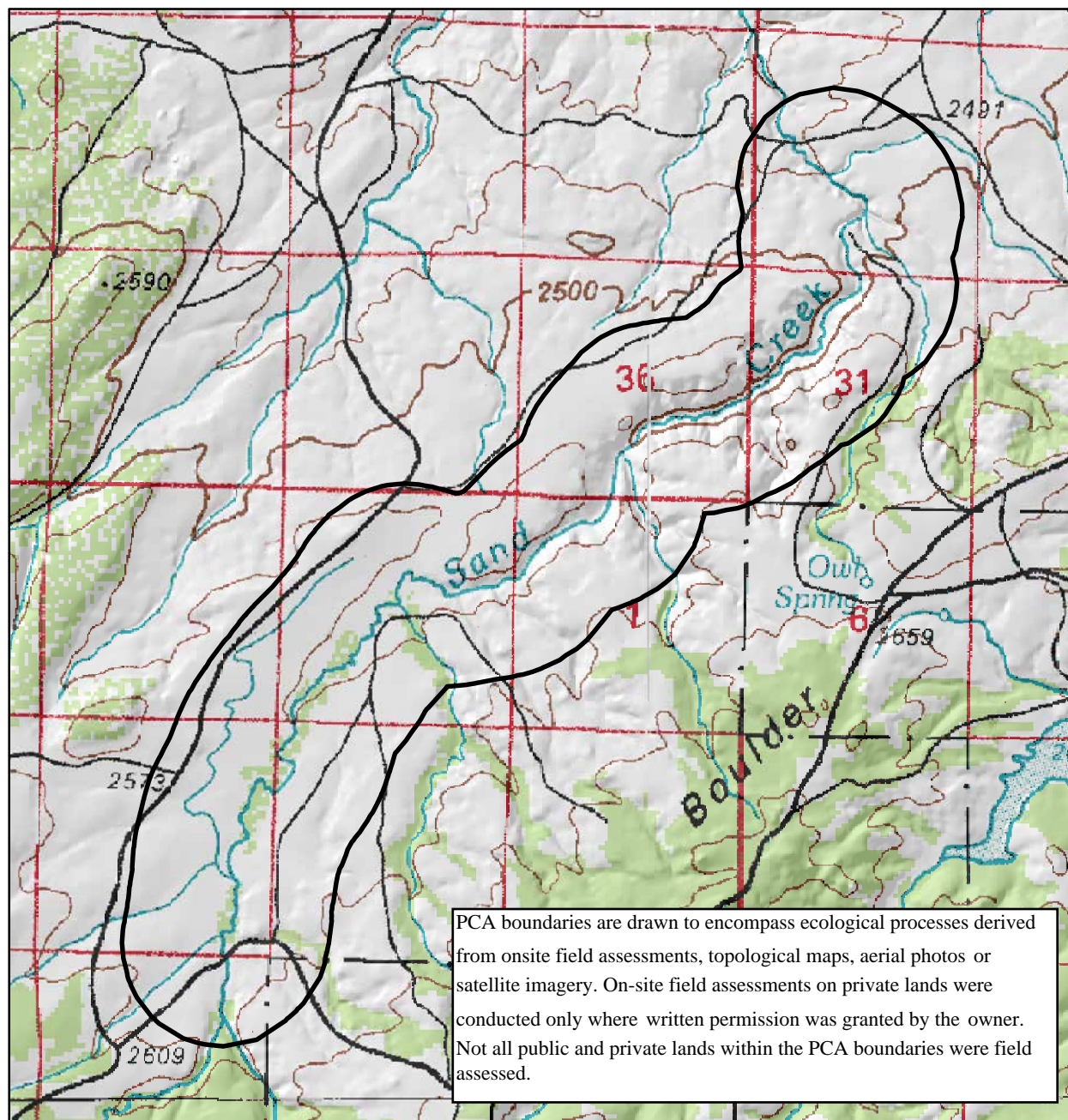
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**Version Author:** Culver, D.R.

**Version Date:** 12/09/2009





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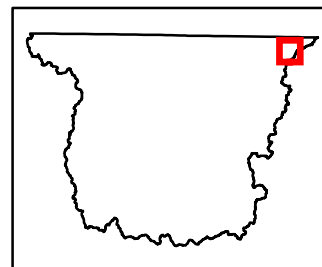
## Legend

 PCA Boundary

Fort Collins, 40105-E1

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Location in the North  
Platte Watershed



Map 30. Sand Creek below Boulder Ridge Potential Conservation Area, B4: Moderate Biodiversity Significance

## Terrace Ponds

**Biodiversity Rank - B4: Moderate Biodiversity Significance**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M2: Essential within 5 Years to Prevent Loss**

**U.S.G.S. 7.5-minute quadrangles:** Crazy Mountain

**Size:** 984 acres (398 ha)

**Elevation:** 7,990 - 8,040 ft. (2,435 - 2,451 m)

**General Description:** The area east of the Laramie River just north of Four Corners is apparently a large river terrace formed during the Ice Age (the Pleistocene). The area is mostly flat with shallow depressions (probably formed by wind erosion) and gentle slopes rising from the wet, low areas. The depressions intercept a high water table, forming a few permanent shallow water bodies. Most of the permanent water bodies appear heavily impacted by cattle, but one appears to contain very robust emergent communities in excellent condition. The wet (often flooded) meadow between the ponds contains both native and non-native communities. The native communities consist largely of species that succeed under intense grazing, e.g. Nebraska sedge (*Carex nebrascensis*) and Baltic rush (*Juncus balticus*), while foxtail barley (*Hordeum jubatum*) completely dominates some areas.

**Biodiversity Significance Rank Comments (B4):** This site supports two occurrences of good (B-ranked) quality, state imperiled wetland communities; *Schoenoplectus maritimus* (G4/S2) and *Schoenoplectus acutus* - *Typha latifolia* - (*Schoenoplectus tabernaemontani*) (G4/S2S3). The two communities are globally secure and widespread across North America, but in Colorado they are uncommon and considered imperiled (as are many wetland communities). Good examples of these communities are quite rare in Colorado, and very rare in Larimer County. Terrace Ponds contains by far the best example of both of these communities in Larimer County. These wetlands also have high value for migrating and nesting waterfowl and shorebirds.

Natural Heritage element occurrences at the Terrace Ponds PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Schoenoplectus acutus - Typha latifolia - (Schoenoplectus tabernaemontani) Sandhills Herbaceous Vegetation	Great Plains Marsh	G4	S2S3				B	1996-08-15
Natural Communities	Schoenoplectus maritimus Herbaceous Vegetation	Emergent Wetland (Marsh)	G4	S2				B	1996-08-15

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The boundary encompasses all the ponds on this one large terrace and all contiguous wetlands. A buffer of 300 ft. or slightly more is designated to protect the wetlands from direct impacts from vehicles, grazing animals, etc., as well as indirect impacts from water runoff from disturbed areas. The buffer is designed to also provide security for nesting and migrating waterfowl and shorebirds.

**Protection Urgency Rank Comments (P3):** The site is privately owned by one landowner. Development pressure is likely to increase in the near future.

**Management Urgency Rank Comments (M2):** New management action may be needed within 5 years to prevent loss of element occurrences. The location of the marsh community is currently very well managed. However, similar ponds nearby have been heavily impacted by grazing.

**Land Use Comments:** The site is privately owned and used for livestock (bison?). We are not aware of any formal protection provided to the wetlands.

**Off-Site Considerations:** Hydrologic modifications off-site may affect the elements.

## References

Culver, D.R., K. Decker, J. Parker, J. Bell, J. Sovell, and J. Huggins. 2010. CNHP Final Report: Identification and Assessment of Important Wetlands within the North Platte Watershed, CO. Colorado Natural Heritage Program, Fort Collins, CO.

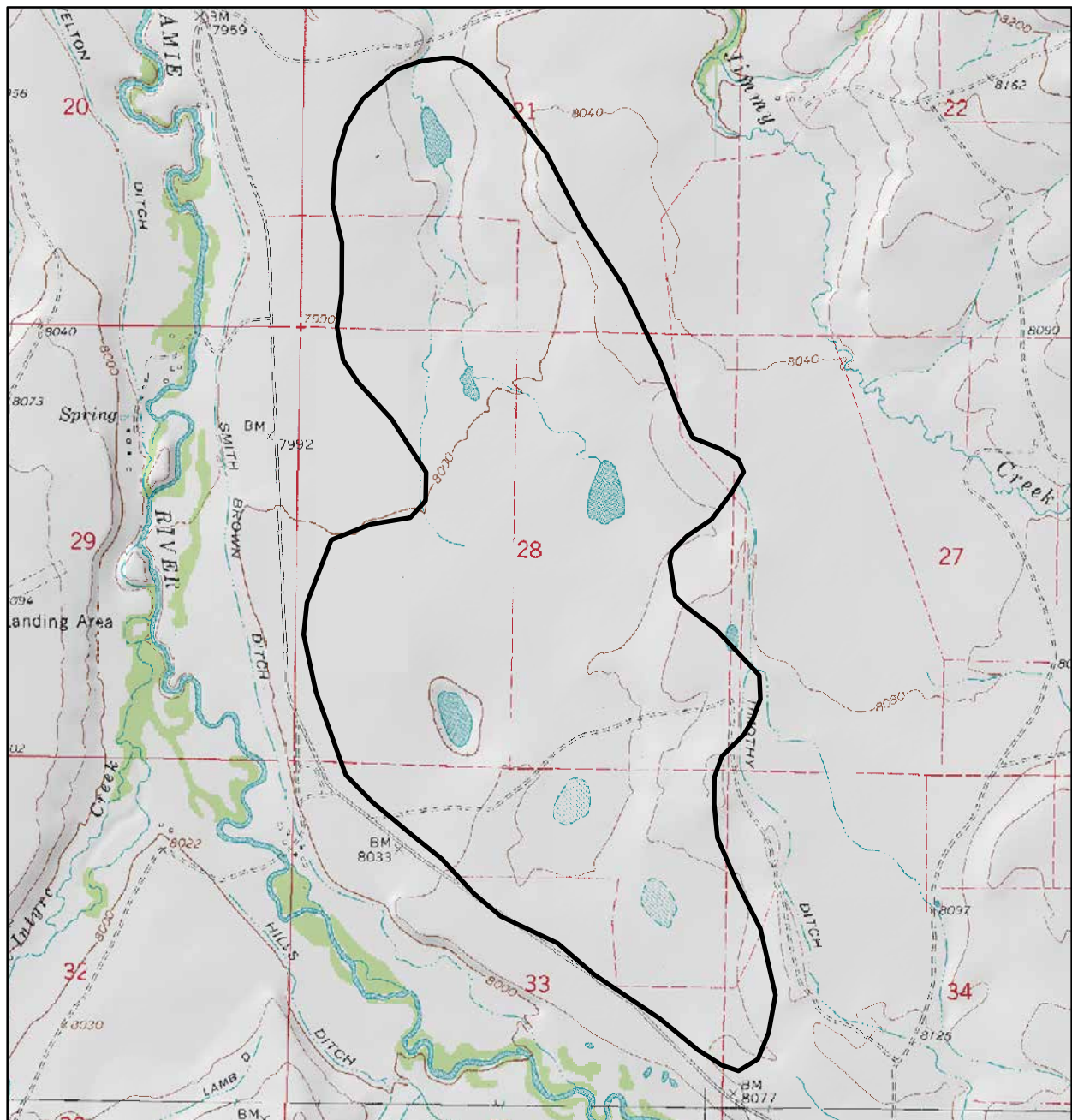
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**Version Author:** Sanderson, J.S.

**Version Date:** 12/01/1996





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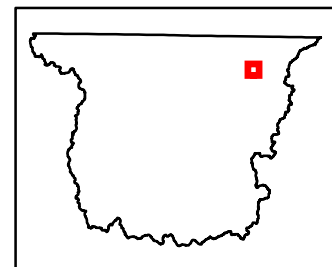
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 PCA Boundary

Crazy Mountain, 40105-H8

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Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed



Map 31. Terrace Ponds Potential Conservation Area, B4: Moderate Biodiversity Significance

## Colorado and Little Grizzly Creeks

**Biodiversity Rank - B5: General Biodiversity Interest**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Rabbit Ears Peak, Teal Lake, Buffalo Pass

**Size:** 23,086 acres (9,343 ha)

**Elevation:** 8,040 - 8,580 ft. (2,451 - 2,615 m)

**General Description:** The Colorado and Grizzly Creeks site is located in North Park, an intermountain glacial basin located in north-central Colorado that is approximately 35 miles wide and 45 miles in length. The dominant features are Colorado and Grizzly Creeks, and their associated tributaries and wetlands. There is over 110 acres of open water on the site and approximately 80 miles of creeks that support a nesting population of Greater Sandhill Cranes (*Grus canadensis tabida*). The creeks and their tributaries host the second largest nesting population of Greater Sandhill Cranes in Colorado (CNHP 2009, Kingery 1998). The broader area, including parts of this site, includes historical records for the boreal toad (*Bufo boreas*) and wood frog (*Rana sylvaticus*). There is also a population of northern leopard frogs at Tiago Lake that was observed in 2007 by the U.S. Forest Service. Plant communities consist of four broad types including riparian, wetland, meadow, and upland. Habitat ranges from emergent wetlands dominated by sedges and willow riparian shrublands at the lowest elevations along the creeks, to uplands dominated by big mountain sagebrush, aspen, lodgepole pine, or aspen - fir forest at higher elevations. The riparian habitat includes willow carrs along portions of the channel and floodplain of both Colorado and Grizzly creeks. There are numerous wetlands that supply critical habitat to wetland dependent species including aquatic birds and amphibians (CNHP 2009). There are irrigated hay meadows along both Colorado and Grizzly creeks that supply nesting habitat for waterfowl, shorebirds, and songbirds. The sagebrush supplies habitat for Greater Sage Grouse.

**Key Environmental Factors:** The hydrology of the area is the important feature of the site. The riparian areas, wetlands and meadows flood annually from snow melt and spring runoff, creating significant breeding habitat for wetland dependent species including the Sandhill Crane and the amphibians.

**Climate Description:** The climate is semiarid and is characterized as having short, cool summers followed by long, cold winters. Mean annual air temperature in Walden, 14 miles northeast of the site, is 36.4 degrees Fahrenheit and temperatures range from minus 39 degrees to 90 degrees Fahrenheit, based on the National Weather Bureau's 30-year average data (USFWS 2004). The annual mean rainfall in Walden is 10.83 inches and seventy percent falls as snow with Walden averaging 53

inches of snow per year (USFWS 2004). The highest average monthly precipitation occurs in March, April, May, and August (Lischka et al. 1983).

**Land Use History:** Prior to 1820, the Ute peoples used North Park to hunt wild game in the summer but moved to lower altitudes in the fall to avoid the severe winters that are common in the mountain park. After 1820, European trappers started to visit the area and miners and prospectors who panned for gold followed them. Since European settlement began in earnest in the late 1880's and 90's ranching, including both hay production and cattle grazing, has been the dominant land use at the site.

**Biodiversity Significance Rank Comments (B5):** The site contains a breeding occurrence of the Greater Sandhill Crane (*Grus canadensis tabida*), a species that is rare (G5T4/S2) in the state and a Colorado species of special concern.

Natural Heritage element occurrences at the Colorado and Little Grizzly Creeks PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Birds	<i>Grus canadensis tabida</i>	Greater Sandhill Crane	G5T4	S2B,S 4N		SC		E	1991-05-30

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The wetland complex, riparian areas associated with Colorado and Grizzly creeks and their tributaries, and the surrounding meadows all lie within the boundary of this site and are important to the nesting Sandhill Crane population. Field surveys and GIS layers from the Colorado Vegetation Classification Project, and the digital orthophoto quad for Jackson County were used to delineate the boundary. The site protects a large area to provide enough space for Sandhill Cranes that require large home ranges for breeding, nesting, and foraging (Tacha 1992).

**Protection Urgency Rank Comments (P3):** Most of the site is privately owned and plans for the area are unknown.

**Management Urgency Rank Comments (M3):** Sandhill Cranes are highly sensitive to human intrusion during the incubation and chick-rearing periods, which can result in nest abandonment and loss of young (NatureServe 2009). The BLM has issued oil and gas leases within parts of this site, and given the sensitivity of cranes to human disturbance, any development of these leases might not benefit continued nesting by Sandhill Crane.

**Land Use Comments:** Land uses include cattle grazing and hay production.

**Off-Site Considerations:** The main offsite activities include livestock grazing and

hay production on irrigated pastures. The use of creek flows for hay production that increases wet meadow habitat could benefit the nesting cranes.

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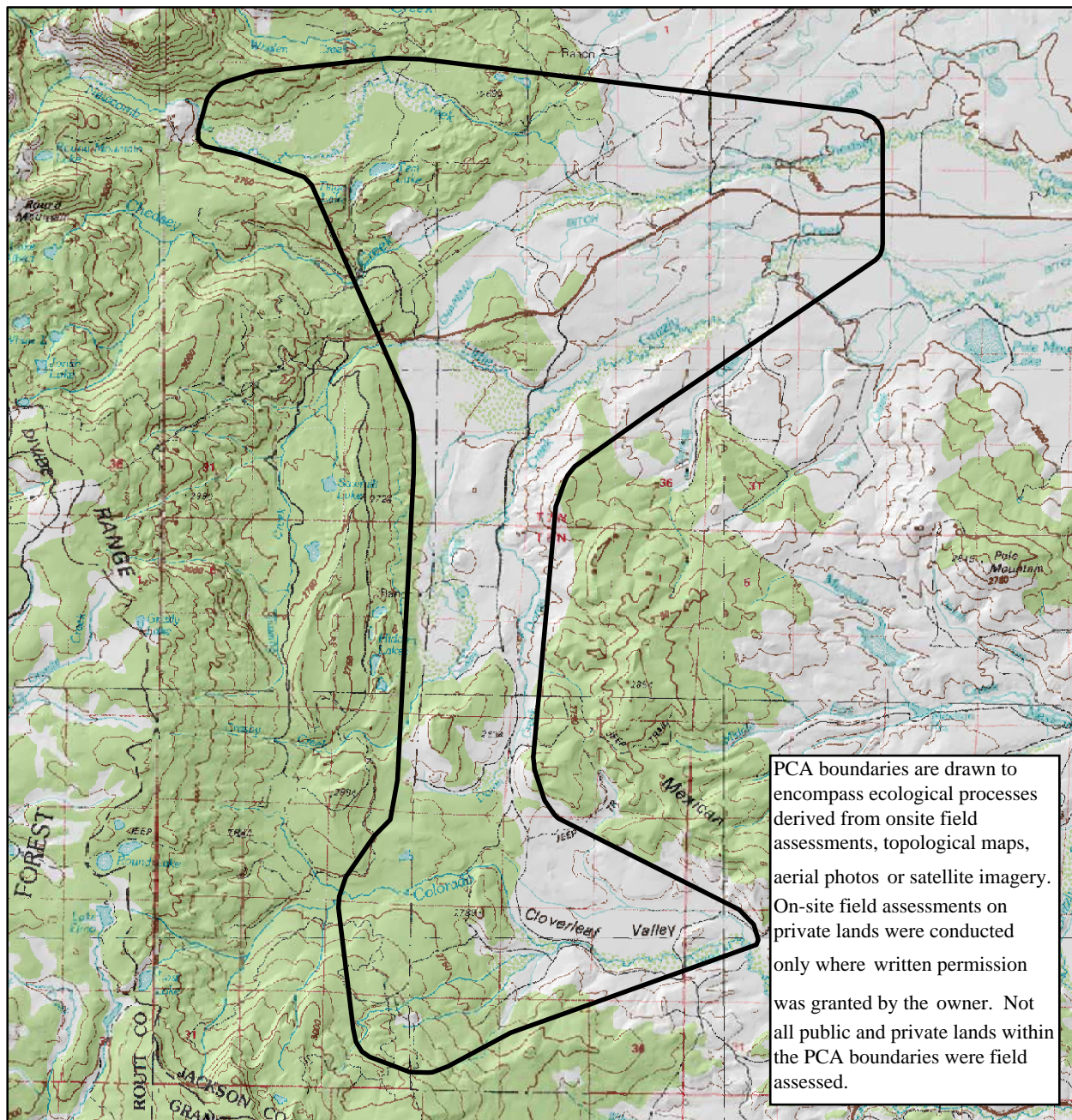
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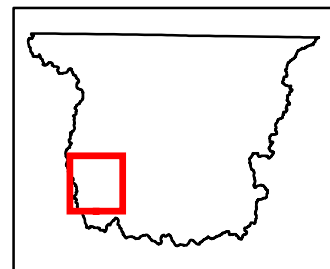
## Legend

 PCA Boundary

Steamboat Springs, 40106-A1  
Walden, 40106-E1

30x60 Minute Digital Raster  
Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed



Map 32. Colorado and Little Grizzly Creeks Potential Conservation Area, B5: General Biodiversity Interest

## Willow Park

**Biodiversity Rank - B5: General Biodiversity Interest**

**Protection Urgency Rank - P3: Definable Threat/Opportunity but not within 5 Years**

**Management Urgency Rank - M3: Needed within 5 Years to Maintain Quality**

**U.S.G.S. 7.5-minute quadrangles:** Rabbit Ears Peak, Mount Werner

**Size:** 1,843 acres (746 ha)

**Elevation:** 8,750 - 9,000 ft. (2,667 - 2,743 m)

**General Description:** Willow Park site is located in the Park Range in North Park. Colorado Creek meanders through the site. Above Colorado Creek, there are several kettle ponds that were formed by stranded glaciers during the Pinedale and Bull Lake Glaciation Period. The glaciers became stranded and melted, creating ponds that are surrounded by floating sedge mats. These wetlands support a population of roundleaf sundew (*Drosera rotundifolia*), a carnivorous plant associated with nutrient poor soils and acidic water. Sundew occurs on floating mats that are held together with woolly-fruit sedge (*Carex lasiocarpa*), water sedge (*Carex aquatilis*), beaked sedge (*Carex utriculata*), bluejoint reedgrass (*Calamagrostis canadensis*), marsh cinquefoil (*Comarum palustre*) and tufted hairgrass (*Deschampsia cespitosa*). The ponds support a large population of water lilies (*Nuphar lutea* ssp. *polysepala*) and buck bean (*Menyanthes trifoliata*). The uplands surrounding the wetland complex are dominated by lodgepole pine (*Pinus contorta*) and Engelmann spruce (*Picea engelmannii*). The hydrology of the area is driven primarily by melting snowpack that trickles down through glacial strata then emerges on the surface as groundwater discharge. The site is defined as a fen due to the presence of water logged spongy ground and the formation of organic soils or histosols. Histosols are organic soils formed by slow accumulation of plant debris in waterlogged situations where it cannot decompose and accumulates as peat. Water analysis performed by the Forest Service in 2005 classifies this wetland as an intermediate poor fen with a relatively low pH (4.7-5.6) and low cation concentration.

**Key Environmental Factors:** The presence of groundwater discharge and histosols are indicative of fens.

**Land Use History:** Grazing and logging occur in adjacent areas. One of the ponds has been bermed for cattle.

**Biodiversity Significance Rank Comments (B5):** This site supports an extant occurrence of the state imperiled (G5/S1S2) marsh cinquefoil (*Comarum palustre*), a fair (C-ranked) occurrence of the state imperiled (G5/S2) roundleaf sundew (*Drosera rotundifolia*) and a fair (C-ranked) occurrence of the state imperiled (G4?/S1) woolly fruit sedge (*Carex lasiocarpa*) herbaceous vegetation. Although not drawn for this

species, the state rare (G5/S3) northern leopard frog (*Rana pipiens*) has been documented in the area.

Natural Heritage element occurrences at the Willow Park PCA.

Major Group	State Scientific Name	State Common Name	Global Rank	State Rank	Federal Status	State Status	Fed Sens	EO Rank	Last Obs Date
Natural Communities	Carex lasiocarpa Herbaceous Vegetation	Montane Wetland	G4?	S1				C	2008-08-01
Vascular Plants	Comarum palustre	marsh cinquefoil	G5	S1S2				E	2008-08-01
Vascular Plants	Drosera rotundifolia	roundleaf sundew	G5	S2			USFS	C	2008-08-01

\*\* The records above are sorted in the following order 1) Major Group 2) Global Rank and 3) Scientific name.

**Boundary Justification:** The boundary encompasses the kettle ponds and a buffer to protect against direct disturbance from anthropogenic activities such as timber harvest.

**Protection Urgency Rank Comments (P3):** Timber harvest could have negative impacts. Seasonal restrictions and significant buffers are warranted.

**Management Urgency Rank Comments (M3):** Control of non native species such as Canada thistle is advised. Impacts from grazing and logging should be assessed before current practices are altered.

**Off-Site Considerations:** Maintaining natural hydrologic regime will be important. Also need to maintain feeding habitat and other element populations not included in site.

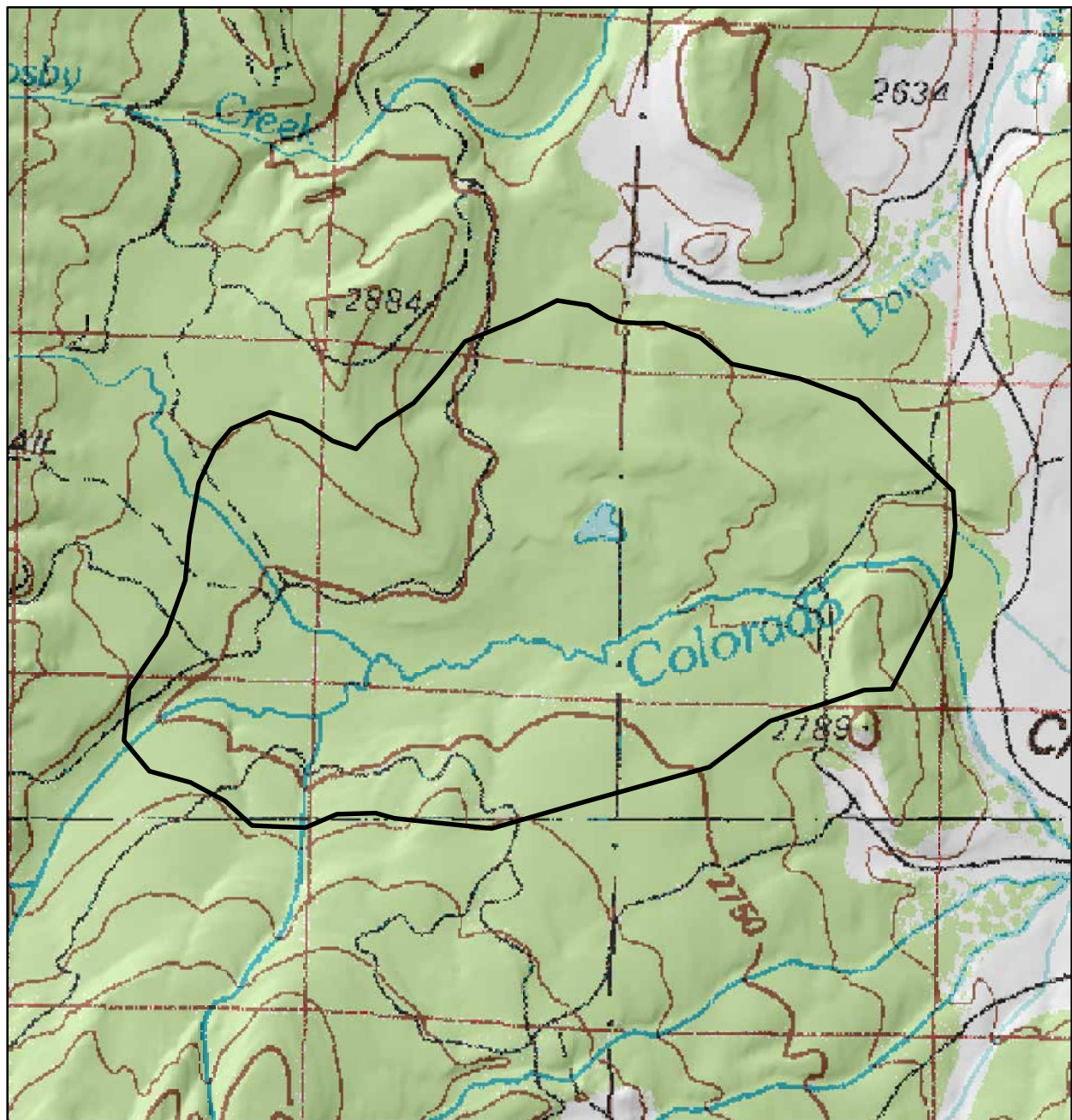
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**Version Date:** 12/14/2009





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Map Date: 11/30/2009

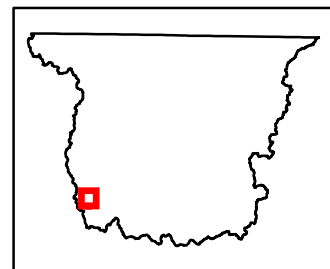
### Legend

 PCA Boundary

Steamboat Springs, 40106-A1

30x60 Minute Digital Raster  
Graphic Produced by the  
U.S. Geological Survey

Location in the North  
Platte Watershed



Map 33. Willow Park Potential Conservation Area, B5: General Biodiversity Interest





Pond with roundleaf sundew (*Drosera rotundifolia*) located in the middle.



Edge of pond dominated by beaked sedge (*Carex utriculata*).

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