

**Survey of Seeps and Springs within the Bureau of Land
Management's Grand Junction Field Office Management Area
(Garfield County, CO)**



**Colorado Natural Heritage Program
College of Natural Resources, 254 General Services Building
Colorado State University
Fort Collins, Colorado 80523**



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Management's Grand Junction Field Office Management Area
(Garfield County, CO)**

Prepared for:

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EXECUTIVE SUMMARY

Springs and seeps are unique habitats, which have often been found to harbor concentrations and refuges of endemic plants and animals. Because seeps and springs provide relatively constant water temperature and chemistry, due to their dependence on subterranean flow through aquifers, many spring source species do not occupy downstream habitats where temporal fluctuations in water temperature and flow are greater (Sada 2000; Martinson 1980). Surveys conducted in the Great Basin have shown that seeps and springs are often hot spots of biological diversity, providing habitat for many uncommon species of plants and animals, including some that proved to be new to science. In Colorado, several rare plant and animal species are known to be limited to these wet areas within otherwise dry landscapes.

No biological survey has been conducted for seeps and springs on BLM lands in the Grand Junction Field Office Management Area. The objective of this project was to survey the most intact or relatively pristine seeps and springs on BLM land within the Grand Junction Field Office Management Area (GJFOMA) in Garfield County. This project was completed in conjunction with the Survey of Critical Biological Resources conducted in 2000 for Garfield County, funded by Great Outdoors Colorado, and the Survey of Critical Wetlands and Riparian Areas in Garfield County for the Colorado Department of Natural Resources via a grant from the Environmental Protection Agency, Region VIII.

Information, regarding the location of seeps and springs within the BLM, GJFOMA portion of Garfield County, was gathered to assist in prioritizing which seeps and springs would be visited. Under the assumption that most disturbed or “developed” springs would likely have lower biodiversity, due to sparse vegetation cover (trampling and overgrazing), disruption of hydrology, and presence of non-native species (Sada 2000; Sada and Nachlinger 1996), CNHP decided to focus inventory efforts on those springs where ecological processes have not been altered.

Site assessments included a general description, rating of Proper Functioning Condition (Bureau of Land Management 1998; Bureau of Land Management 1994; Bureau of Land Management 1993), species list, assessment of any natural heritage elements, discussion of ecological functions, collection of water chemistry data and macroinvertebrates, and restoration and management needs.

Most seeps and spring within the study area (BLM GJFOMA within Garfield County) occur on private land (approximately 200 identified) while the remaining occur on BLM land (approximately 70 identified)

Of the 73 seeps and springs identified on BLM land in the project area, 63 were identified as potentially existing with natural ecological processes intact. Of these, 29 were visited while 34 were considered, upon initial observation, to be too heavily disturbed, due to water developments and/or heavy grazing activity, for further investigation or were not

visited due to their remoteness coupled with time constraints. Thus, the 29 seeps and springs visited were considered to either harbor biodiversity values despite anthropogenic disturbances or had most ecological processes intact.

Garfield County has one of the highest concentrations of seeps and springs in Colorado (over 900) due to unique geologic substrates, the Green River Shale Formation and Uinta Formation in the western portion of the county and the Leadville Limestone Formation in the eastern half. These seeps and springs are important to regional landscape diversity, especially in western Garfield County (or more specifically, the project area), where most areas receive less than 20 inches of annual precipitation, as they provide small but widely distributed habitat that offers a perennial source of water, food, cover, nesting habitat, and habitat for rare and/or unique species.

CNHP documented 15 elements of biodiversity significance as occurring in seeps and springs in the project area while another five elements are potentially found in these wetlands but were not documented in 2000. Some of the more significant elements documented include the state critically imperiled (G2G3Q/S1) large-flower globemallow (*Iliamna grandiflora*), the globally vulnerable (G2G3/S2S3) beaked spikerush emergent wetland (*Eleocharis rostellata*), the globally vulnerable (G3/S2) lower montane river birch riparian shrubland (*Betula occidentalis*/mesic forb), the state critically imperiled (G4S/S1) lower montane Douglas fir/Rocky Mountain maple forest (*Pseudotsuga menziesii*/*Acer glabrum*), and a unique stand of balsam poplar (*Populus balsamifera*). Additionally, 18 of the seeps and springs documented in this report occurred within a CNHP Potential Conservation Area.

No rare or endemic macroinvertebrates were found during this project. However, it is likely that their populations are different than those found in other riparian/wetland habitats (streams, lakes, ponds, etc.) and represent an important aspect of biodiversity in Garfield County.

INTRODUCTION

Springs and seeps are unique habitats, which have often been found to harbor concentrations and refuges of endemic plants and animals. Because seeps and springs provide relatively constant water temperature and chemistry, due to their dependence on subterranean flow through aquifers, many spring source species do not occupy downstream habitats where temporal fluctuations in water temperature and flow are greater (BLM 2000; Martinson 1980).

Surveys conducted in the Great Basin have shown that seeps and springs are often hot spots of biological diversity, providing habitat for many uncommon species of plants and animals, including some that proved to be new to science. Of particular interest are spring snails, which have been little studied to date, and may prove to be unique to particular seeps and springs (BLM 2000).

In Colorado, several rare plant and animal species are known to be limited to these wet areas within otherwise dry landscapes. For example, Unaweep Seep in Mesa County is home to the Nokomis fritillary (*Speyeria nokomis nokomis*) butterfly, canyon bog orchid (*Limnorchis ensifolia*) and helleborine orchid (*Epipactis gigantea*); seeps above Coyote Wash in Montrose County are the sites of the Kachina daisy (*Erigeron kachinensis*) and Eastwood's monkeyflower (*Mimulus eastwoodiae*); and seeps in Escalante Canyon in Delta and Montrose counties support helleborine orchids and canyon bog orchids. These sites have been ranked by CNHP as B1 and B2 Potential Conservation Areas based on their unique flora and fauna. Other plant species that may be found in this unique habitat in Garfield County include yellow lady's slipper (*Cypripedium calceolus*), canyon bog-orchid (*Limnorchis ensifolia*), and the globally vulnerable hanging garden sullivantia (*Sullivantia hapemannii* var. *purpusii*). Northern leopard frogs (*Rana pipiens*) also use these small wetlands. Invertebrate species include various springsnails (*Pyrgulopsis* spp., *Tryonia* spp., *Fluminicola* spp.), aquatic beetles (*Stenelmis* spp., *Microcylleopus* spp.), butterflies (Nokomis fritillary (*Speyeria nokomis nokomis*), Theano alpine (*Erebia theano*), and naucorid or creeping water bugs (*Ambrysus* spp., *Limnocois* spp.).

No biological survey has been conducted for seeps and springs on BLM lands in the Grand Junction Field Office Management Area. Since human activity has been focused on these ecosystems, leading to alteration and loss of native species, it is imperative that the remaining pristine seeps and springs be identified, and that impacted areas be assessed for potential restoration.

The objective of this project was to survey the most intact or relatively pristine seeps and springs on BLM land within the Grand Junction Field Office Management Area (GJFOMA) in Garfield County. This project was completed in conjunction with the Survey of Critical Biological Resources conducted in 2000 for Garfield County, funded by Great Outdoors Colorado, and the Survey of Critical Wetlands and Riparian Areas in Garfield County for the Colorado Department of Natural Resources via a grant from the Environmental Protection Agency, Region VIII.

PROJECT BACKGROUND

Location and Physical Characteristics of Study Area

Garfield County is located in northwestern Colorado, extending over one hundred miles from the Utah border eastward. It encompasses 2,948 square miles. It is bordered by Rio Blanco County on the north, Mesa and Pitkin counties on the south, and Routt and Eagle counties on the east (Figure 1). Garfield County lies primarily within two geologically distinct regions: the plateau country in the western two thirds, and the Rocky Mountains in the eastern third. The boundary between the two regions is defined by the western edge of the Grand Hogback, a large monocline that runs north to south through the county. This project focused on the western third of the county. Major features within the western plateau area are the Roan Plateau and the Bookcliffs, along with a small part of the Grand Valley south of the Bookcliffs in the southwest.

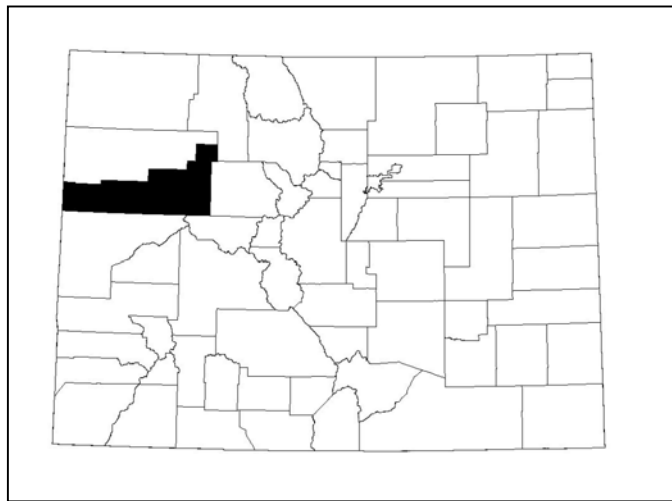


Figure 1. Location of Garfield County in Colorado

The entire county is within the drainage of the Colorado River. While most of the area drains south directly into the Colorado River, a small area in the northern part of the county drains into the White River, which is a tributary of the Colorado.

Elevations in the western portion of the county range from 4960 feet where the Colorado River crosses the Garfield-Mesa County line, to approximately 8800 feet near Douglas Pass and Upper 4A Ridge.

Climate of the western portion of the county varies with elevation, however most of this area is considered semi-arid. The driest areas are in the south and southwest, which receive between 10 and 15 inches annual precipitation. Higher elevations, such as those near Douglas Pass, receive 25 to 30 inches annual precipitation. Average annual high temperatures near Douglas Pass are 62.7 degrees F. and average annual low temperatures

are 30.3 degrees F. Fruita, which is at a lower elevation, has an annual high temperature of 66.6 degrees and lows of 34.0 degrees (Western Regional Climate Center 2001).

The western third of Garfield County is sparsely populated. There are no major towns located in the area and the closest major population center is south at Fruita and Grand Junction in Mesa County. The only major roadway is Colorado Hwy. 139 and there are very few other paved roads located in this portion of the county.

Ownership in the western third of the county is mainly BLM while private land ownership increases eastward. Private lands are located primarily along the river corridors and on the Roan Plateau, where much of the land is either owned or leased by oil and gas companies. Although private lands often comprise only a narrow strip along streams and roads, they effectively block access to vast amounts of public lands.

Geology and Hydrology

The geological features of the western part of the county mainly consist of relatively horizontal layers of sedimentary rock that were deposited during the Cretaceous Period when the area was covered by a great inland sea, and during the Tertiary Period, when much of the area was under a large inland lake known as Lake Uinta (Figure 2). Beginning in the southwest, with the oldest layers, Cretaceous Mancos shale is exposed in the Grand Valley south of the Book Cliffs. This formation is more extensive in Mesa County. To the north, the Bookcliffs are composed of Mesaverde Formation sandstone and shale. Mesa tops in this area are capped by the Cretaceous Hunter Canyon Formation. Farther east, the Roan Plateau is composed of soft, erodable shales of the Tertiary Green River Formation, capped by the more resistant Uinta Formation. The Roan Cliffs, visible from Interstate 70 between Rifle and DeBeque, expose thousands of feet of pink and gray Green River Formation, with the Wasatch Formation at their base. The Green River Formation holds the richest oil-shale beds in the world, with over 1.8 trillion barrels (Chronic 1980). One layer of this formation, the Mahogany Ledge, is said to average 27 gallons of oil per ton. (Chronic 1980). Although it is not presently economical to mine the oil shale, there are numerous operating natural gas wells in the area. The Green River Formation is exposed again south of the Colorado River on Battlement Mesa. South and southeast of the Roan Plateau, above the Colorado River the soft sandstones and shales of the Tertiary Wasatch and Ohio Formations form a transitional zone between the alluvial deposits of the Colorado River Valley and the Green River Formation. This formation represents the sediments on the floodplains around Lake Uinta.

Most of the seeps and springs within the western third of the county are supported by groundwater flow from two main aquifers, which are separated by the Mahogany Ledge (Martinson 1980). The upper aquifer is primarily located within the Uinta Formation (sandstone and marlstone) and increases in importance (in terms of seeps and springs discharge) eastward, while the lower aquifer is located in the Parachute Creek Member of the Green River formation (mainly dolomitic marlstone) and is the principal aquifer associated with seeps and springs in the study area (Martinson 1980) (Figure 2). In the most western portion of Garfield County, the upper aquifer generally discharges above 7000-8000 feet and supports a small amount of seeps and springs relative to the lower aquifer, as much of the Uinta Formation in this area has eroded away (Figure 2). Most of

the exposed bedrock in this area is the Parachute Creek Member of the Green River Formation, which supports the majority of the seeps and springs in the study area (Weeks 1974). Permeability in the Uinta Formation and Parachute Creek Member of the Green River formations is mainly due to fractures and faults, with some leaching (Weeks 1974). The lower aquifer is highly saline mainly due to the dissolution of sodium rich minerals such as nahcolite (NaHCO_3) and halite (NaCl) (Weeks 1974). The Mahogany Ledge separates the two aquifers both hydraulically and chemically except in recharge and discharge areas (Martinson 1980). Thus, many seeps and springs associated with the lower aquifer have high conductivity and a high pH. Recharge to the aquifers occurs mainly through snow-melt since most summer rainfall is quickly lost to runoff or evapotranspiration from moisture deficient soil (Weeks 1974). Groundwater is discharged, mainly from the lower aquifer, to the alluvium within valley floors and via seeps and springs along the valley walls (Martinson 1982).

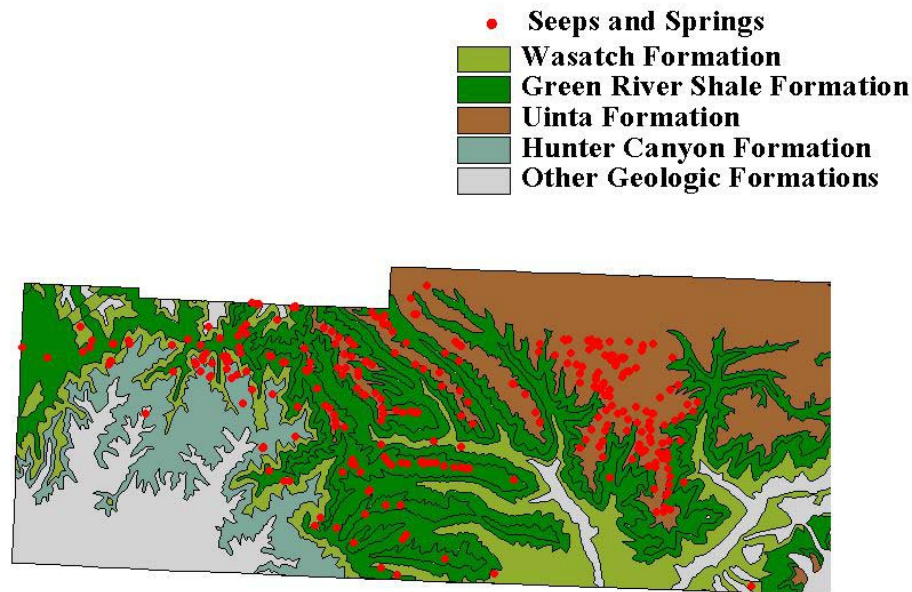


Figure 2. Geologic formations associated with seeps and springs.

Vegetation

Vegetation in western Garfield County is closely related to geology, and even more to elevation. Nine broad vegetation types can be recognized. In order of elevation, they are: Salt desert shrublands; Shale barrens; Sagebrush shrublands; Pinyon-juniper woodlands; Mixed mountain shrublands; Mountain and foothill grasslands; Aspen forests; Douglas fir forests; and Spruce fir forests. Riparian vegetation varies with

elevation, and is found in conjunction with all of the upland vegetation types above. In addition to the natural vegetation types, there is a small amount of agricultural land, both dryland and irrigated. This classification is simplified; in reality there is much overlap between the types described below, and mosaics consisting of patches of several different types often occur within a small area.

Agricultural land is concentrated along the major river valleys, The Colorado, Roaring Fork, and to a lesser extent, Parachute, Roan and Divide Creeks, where crops are irrigated. Dry land agriculture is practiced on mesa tops such as Hunter Mesa and Hubbard Mesa. Major crops are grass hay and alfalfa.

Salt desert shrublands are found primarily at low elevations (5,000 to 6,000 ft), in the Grand Valley south of the Bookcliffs, in the southwestern part of Garfield County. Soils here are derived from Mancos Shale, and support a mixed shrub and grass community dominated by members of the Goosefoot Family (*Chenopodiaceae*). Common shrubs are shadscale (*Atriplex confertifolia*), Gardner saltbush (*A. gardneri*), mat saltbush (*A. corrugata*), and greasewood (*Sarcobatus vermiculatus*). Common grasses in the community are needle and thread (*Stipa comata*), Indian rice grass (*Oryzopsis hymenoides*), and Salina wildrye (*Leymus salinus*) and inland saltgrass (*Distichlis spicata*). A frequent invasive exotic species is cheatgrass (*Bromus tectorum*). The harsh environment produced by the highly erodable Mancos shale limits the species that are able to survive in this habitat, and has produced several rare plants, such as Grand buckwheat (*Eriogonum contortum*). Salt desert shrublands also occur in the Roan Creek drainage on Wasatch and Green River formations, although they tend to be in small patches that are not shown on the map. In addition to the species mentioned above, bluebunch wheatgrass (*Pseudoroegneria spicata*) is often associated with the shrubs here. The rare Uinta Basin hookless cactus (*Sclerocactus glaucus*) is found in this area, as well as in the pinyon-juniper woodlands in the foothills around Roan Creek. Plant communities within this type that are tracked by CNHP include *Atriplex confertifolia*/*Leymus salinus*, *Atriplex confertifolia*/*Oryzopsis hymenoides*, *Atriplex confertifolia*/*Pseudoroegneria spicata*, and *Distichlis spicata* salt meadows. This vegetation type is more extensive in Mesa County and to the west in Utah.

Pinyon-juniper woodlands are the most extensive vegetation type in Garfield County, as well as much of southwestern Colorado. They are found primarily in the foothills areas between the valley bottoms and the mesa tops. The dominant species are Colorado pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). In cooler and more moist areas, the Utah juniper may be replaced by Rocky Mountain juniper (*Juniperus scopulorum*). The understory of pinyon-juniper woodlands varies widely depending on the age and structure of the tree canopy. Open woodlands might include species such as sagebrush, oak, serviceberry, snowberry, and mountain mahogany mixed with grasses and forbs. Often there is considerable bare ground. Rare plants found in the pinyon-juniper communities of Garfield County include DeBeque milkvetch (*Astragalus debequaeus*), DeBeque phacelia (*Phacelia scopulina* var. *submutica*), Wetherill milkvetch (*Astragalus wetherillii*), and Naturita milkvetch (*Astragalus naturitensis*).

Shale barrens are an outstanding feature of Garfield County. They occur on the Roan Plateau, primarily on south facing slopes of the Green River shale. These areas are shown on vegetation maps as exposed rock, and although they appear from a distance to be devoid of vegetation, they support a very specific array of plants that are adapted to this habitat. These species are able to survive in the constantly moving scree, often by having elongated, flexible root systems. They are also able to survive the severe drought that results from the inability of the shale to hold moisture. Several rare and endemic plant species are found in this community, including the Parachute penstemon (*Penstemon debilis*), Piceance bladderpod (*Lesquerella parviflora*), Arapien stickleaf (*Nuttallia argillosa*), sun-loving meadowrue (*Thalictrum heliophilum*), and Utah fescue (*Argillochloa dasyclada*).

Sagebrush shrublands are widespread throughout Garfield County, both at elevations below and above pinyon-juniper woodlands. They are often found on mesa tops where sagebrush forms nearly pure stands. In addition to the areas where sagebrush is dominant, sagebrush is often an important constituent of pinyon-juniper woodlands and salt desert shrublands. Several species of sagebrush occur here, including Big sagebrush (*Artemisia tridentata* ssp. *tridentata*), the largest species, which is usually found in deep alluvial soils along bottom lands and on stream terraces, often associated with greasewood (*Sarcobatus vermiculatus*) fourwing saltbush (*Atriplex canescens*), and rabbitbrush (*Chrysothamnus nauseosus*). Wyoming sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) are found at higher elevations in open upland areas, commonly mixed with other shrubs such as snowberry (*Symphoricarpos oreophilus*), Utah serviceberry (*Amelanchier utahensis*), and various grasses and forbs. Common understory species at lower elevations include Indian rice grass (*Oryzopsis hymenoides*) and needle and thread (*Stipa comata*). Common associated species at the upper elevations include Kentucky bluegrass (*Poa pratensis*), Idaho fescue (*Festuca idahoensis*) and Thurber fescue (*Festuca thurberi*). Rare plants that are associated with sagebrush include Harrington's penstemon (*Penstemon harringtonii*). Less common in Garfield County is black sagebrush, a low shrub usually found in drier pinyon-juniper communities.

Mountain shrublands are found throughout the county, at elevations between the pinyon-juniper and forested areas. Most mountain shrublands are dominated by Gambel's oak (*Quercus gambelii*), with associated shrubs that include mountain mahogany, serviceberry, chokecherry and snowberry. Typical associated species in drier sites include mountain sagebrush (*Artemisia tridentata* ssp. *vaseyana*), arrowleaf balsamroot (*Balsamorhiza sagittata*), rabbitbrush (*Chrysothamnus* sp.), muttongrass (*Poa fendleriana*), junegrass (*Koeleria macrantha*), prickly pear cactus (*Opuntia polyacantha*), longleaf phlox (*Phlox longifolia*). More mesic shrublands have understories with elk sedge (*Carex geyeri*), mountain lover (*Paxistima myrsinites*), and Oregon grape (*Mahonia repens*). Gambel's oak and other associated shrubs often occur as understory or in patches in the pinyon-juniper zone below and the forested zones above. None of the rare plants of the county were found in this community.

Mountain and foothill grasslands are scattered throughout the county, but often occur in small patches within other vegetation types. Some of the most extensive grasslands occur south of the Colorado River between Rifle and Silt, at around 6,000 feet elevation. The deep rich soils that support the grasslands also make this an important agricultural area. Another large grass dominated area occurs on Coulter Mesa, north of Rifle. Native grass species that are sometimes dominant in Garfield County include (roughly from lower to higher elevations): inland saltgrass (*Distichlis spicata*), galleta (*Hilaria jamesii*), Basin wildrye (*Elymus cinereus*), Salina wildrye (*Leymus salinus*), bluebunch wheatgrass (*Pseudoroegneria spicata*), muttongrass (*Poa fendleriana*), Thurber fescue (*Festuca thurberi*), Idaho fescue (*Festuca idahoensis*), slender wheatgrass (*Elymus trachycaulus*) and tufted hairgrass (*Deschampsia cespitosa*). Forbs are often important components of these communities. Common forbs found in montane meadow sites include orange sneezeweed (*Dugaldia hoopsii*), Geranium (*Geranium* sp.), white peavine (*Lathyrus leucanthus*), American vetch (*Vicia americana*), edible valerian (*Valeriana edulis*). Wet subalpine meadows dominated by tufted hairgrass are often associated with marsh marigold (*Caltha leptosepala*), elephantella (*Pedicularis groenlandica*), and several species of sedges and rushes.

Aspen forests are found in the northwest corner of the county, on the Roan Plateau, the Flat Tops, and Battlement Mesa, mostly at elevations between 8,000 and 9,000 feet. The aspen groves often form a mosaic with patches of Douglas fir, mixed shrubs, grassland and meadows, and at upper elevations, Engelmann spruce. Understory species are extremely varied. Common species found in aspen communities are snowberry (*Symphoricarpos oreophilus*), serviceberry (*Amelanchier utahensis*), mountain lover (*Paxistima myrsinties*), white peavine (*Lathyrus leucanthus*), butterweed groundsel (*Senecio serra*), meadowrue (*Thalictrum fendleri*), blue wildrye (*Elymus glaucus*), and elk sedge (*Carex geyeri*). Generally considered to be a pioneer species, aspen thrives on disturbance. It is generally the dominant tree species where it occurs. It is a clonal species and sprouts new growth from suckers or shoots of old roots. It has been suggested that the root system of aspen clones are among the largest living organisms on earth, although the individual trees themselves are not long lived (75-80 years). In many cases aspen will eventually be replaced by a shade tolerant species such as Douglas Fir or Engelmann spruce. A rare plant associated with aspen is the large-flower globemallow (*Iliamna grandiflora*), described below.

Douglas fir forests are concentrated in the western half of the county, but are also scattered throughout the White River Plateau, especially in the deeper canyons. They tend to occur at the same elevations as aspen, but on cooler sites. Common understory species occurring with Douglas fir include snowberry (*Symphoricarpos oreophilus*), mountain lover (*Paxistima myrsinities*), elk sedge (*Carex geyeri*), Oregon grape (*Mahonia repens*) and Gambel's oak (*Quercus gambelii*). Occasionally ponderosa pine (*Pinus ponderosa*) may be mixed with the fir, but in general, ponderosa pine is uncommon in the county. At middle elevations, forested areas often have a mixture of Douglas fir, Engelmann spruce, subalpine fir, aspen, and lodgepole pine.

Spruce fir forests of Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) are located primarily in the White River National Forest north of Glenwood Springs, including the Flat Tops Wilderness. They are also found south of the Colorado River on Battlement Mesa and in the White River National Forest west of the Roaring Fork Valley in the Fourmile Creek area around the Sunlight Ski Area. Elevations are mostly between 9000 and 11,000 feet. On the Flat Tops, spruce bark beetle epidemics in the 1940's left many standing dead trees, sometimes called "silver forests". At their upper limit, these trees form islands and dense patches of dwarfed trees called "krummholz". Common understory species include elk sedge (*Carex geyeri*), whortleberry (*Vaccinium* sp.), heartleaf arnica (*Arnica cordifolia*), parrots beak (*Pedicularis racemosa*), thimbleberry (*Rubus parviflorus*), and Jacob's ladder (*Polemonium pulcherrimum*). Two state rare plants, the northern twayblade (*Listera borealis*), an orchid which is known historically from a wet bog, and the common moonwort (*Botrychium lunaria*) have been found within this vegetation type in Garfield County.

Wetland and Riparian vegetation typically includes narrowleaf cottonwood (*Populus angustifolia*), aspen (*P. tremuloides*), Colorado blue spruce (*Picea pungens*), subalpine fir (*Abies lasiocarpa*), thinleaf alder (*Alnus incana*), and red-osier dogwood (*Cornus sericea*) along subalpine and montane streams while narrowleaf cottonwood, skunkbrush (*Rhus trilobata*), river birch (*Betula occidentalis*), thinleaf alder, sandbar willow (*Salix exigua*), and mountain willow (*S. monticola*) are common along riparian areas at lower elevations. Fremont's cottonwood (*Populus deltoides* ssp. *wislizenii*), narrowleaf cottonwood, skunkbrush, silverberry (*Shepherdia argentea*), Russian olive (*Elaeagnus angustifolia*), and tamarisk (*Tamarix ramosissima*) are dominant along the Colorado River. Subalpine and montane herbaceous wetlands are typically dominated by various sedges and rushes (e.g., *Carex utriculata*, *C. simulata*, *C. lanuginosa*, *Eleocharis palustris*, and *Juncus balticus*). Herbaceous wetlands along the Colorado River's floodplain are dominated by cattail (*Typha latifolia*), bulrushes (*Schoenoplectus acutus* and *Scirpus pungens*), saltgrass (*Distichlis spicata*), and Baltic rush (*Juncus balticus*). Seep and spring wetlands are typically dominated by beaked sedge (*Carex utriculata*), monkshood (*Aconitum columbianum*), fowl mannagrass (*Glyceria striata*), Baltic rush, oil shale columbine (*Aquilegia barnebyi*), and occasionally the rare hanging garden sullivantia (*Sullivantia hapemanii* var. *purpurea*). Additional rare plants associated with wetland and riparian areas include canyon bog-orchid (*Limnorchis ensifolia*), yellow lady's slipper (*Cypripedium calceolus* subsp. *parviflorum*), and the lesser panicled sedge (*Carex diandra*).

Seeps/Springs Ecology

Seeps and springs are small wetland ecosystems that are hydrologically supported by groundwater discharge (Hynes 1970). They are distinctive from other wetland and riparian habitats by the relatively constant water temperature and chemistry of the discharging groundwater (Sada 2000). This results from the groundwater being in contact with minerals for an extended period of time, which equilibrates solute concentrates. Thus, spring water tends to have constant concentrations of dissolved minerals while surface-fed streams vary in response to rainfall and snowmelt (Mc Cabe

1998). Seeps differ from springs in that they often periodically dry and consequently support a lower diversity of wetland vegetation. Springs often have a more persistent source of water and thus support a greater diversity of wetland vegetation and often provide aquatic habitat (Sada 2000). However, springs supported by local aquifers may periodically dry, since local aquifers are comparatively small and shallow, and the amount of groundwater discharge associated with them varies in response to local precipitation levels. Springs supported by regional aquifers, or aquifers covering thousands of square kilometers, rarely dry, even during droughts, since the quantity of water within the aquifer is high and the groundwater flow is typically slow (Sada 2000). Many springs in western North America, below an elevation of 7000 feet, are isolated from other wetlands, frequently flow a short distance before infiltrating back into the ground, and periodically dry out (Hendrickson and Minckley 1984). This lack of connectivity restricts dispersal of many macroinvertebrates and fishes and thus, along with unique environmental characteristics (water chemistry, geology, etc.), has resulted in many unique and endemic species occupying these isolated spring wetlands.

Spring environments (water temperature, water chemistry, etc.) are typically less variable than other aquatic habitats such as lakes, ponds, and streams. This results in low variability in macroinvertebrate populations at spring sources while downstream habitats typically show more variability in population dynamics (Sada 2000). In addition, the factors that lead to the evolution of endemic species or to the value of these isolated wetlands as refugia for relict species, can also result in low species richness due to the small size, isolation, and adverse conditions of these wetlands (Myers 1999). Martinson (1980) found that macroinvertebrate populations in the Piceance Basin, Colorado had greater density and biomass but fewer species (less diversity) at spring sources than in downstream habitats. This may be attributed to various factors: (a) constant, or less variable, environmental conditions at spring sources may prevent the initiation or completion of the life cycles of some species; (b) those organisms able to survive these conditions may be able to expand their populations due to less competition; (c) the absence of suspended particles in discharging groundwater does not allow filter feeding organisms to survive; and (d) drift patterns may play a role, since there are no upstream sources of macroinvertebrates for the springs (many occur at the headwaters of first-order streams) (Martinson 1980). In that same study, Martinson also found that, although many spring sources had similar water temperatures and water chemistry, they often exhibited a different suite of macroinvertebrate species. This may be due to the variation in topographic gradients in which the springs occur, which influence water depth, water velocity, seasonal fluctuations, and substrate type (e.g. gravel vs. silt). Given similar geology and geographic proximity to the Piceance Basin, similar patterns in the structure of macroinvertebrate populations would be expected for the seeps and springs surveyed for this project.

Seeps and springs often exhibit diverse flora composition and structural characteristics which provide potential cover for resting, nesting, and feeding for many different organisms, especially birds (Sada 2000). For example, submergent vegetation such as pondweed (*Potamogeton* sp.), duckweed (*Lemna* sp.), ditch-grass (*Ruppia* sp.), horned-pondweed (*Zannichellia* sp.), and watercress (*Rorippa* sp.) provide a food source for

waterfowl, while watercress has been shown to be a critical resource for mollusks (Sada 1996). Watercress, duckweed, and hornwort (*Ceratophyllum demersum*) were the most common submergent plant species located in springs in western Garfield County. Sedges (*Carex utriculata*, *C. microptera*, *C. nebrascensis*, and *C. lanuginosa*), rushes (*Juncus balticus* and *J. saximontanus*), grasses (*Catabrosa aquatica*, *Agrostis gigantea*, and *Glyceria striata*), and other herbaceous species such as monkshood (*Aconitum columbianum*), alkali crowfoot (*Halerpestes cymbalaria* subsp. *saximontana*), and large-leaved avens (*Geum macrophyllum*), which are often found growing along the banks of springbrooks and in spring wetlands, help regulate water temperatures and provide areas for hiding and nesting, in addition to the habitat they provide for macroinvertebrates (Sada 1996). Some springs in the project area support an overstory of occasional trees (*Populus angustifolia* and *P. balsamifera*) and shrubs such as river birch (*Betula occidentalis*), thinleaf alder (*Alnus incana*), and various willows (*Salix* sp.), which provide excellent habitat for birds and browse for large mammals. Unique water chemistry and/or edaphic conditions often provide habitat for rare plant species. In western Garfield County, species such as the globally vulnerable hanging garden sullivantia (*Sullivantia hapemanii* var. *purpusii*), a western Colorado endemic species, occurs in seeps and springs associated with the Green River Formation. The alkalinity of the groundwater, due to the dolomitic and calcareous nature of the Green River oil shale, provides a unique environment in which this species has been able to take advantage of.

Many seeps and springs in Garfield County have been altered and/or modified from their natural condition due to anthropogenic disturbances such as livestock grazing and diversions and impoundments to capture water for human or livestock use. These disturbances can result in an increase in non-native species, decrease in vegetation cover, inundation of springbrook habitat, replacement of species requiring flowing water with those more adapted to stagnate or slow moving water (lakes, ponds, etc.), and cause the extirpation of endemic spring species (Sada In press.). Sada and Nachlinger (1996) found higher levels of biodiversity in undisturbed springs while disturbed springs had a high percentage of non-native species present.

Diversions, which decrease flow from spring sources, can result in greater variation of water temperature which causes a shift in the composition of macroinvertebrate species from those adapted to spring source habitats, where water temperature is fairly constant, to those adapted to downstream habitats, where water temperature exhibits more variation. In addition, typically an increase in water temperature, which often occurs when water flow is decreased, decreases the number of aquatic invertebrate species found in that location (Myers 1999). Seeps and springs which are isolated, are especially susceptible to disturbances since they lack connectivity, and thus, little mechanisms for recolonization via drift and upstream movements. Restoring disturbed wetlands can result in the reestablishment of wetland plant species and adequate vegetation structure, however it does not guarantee the restoration of endemic fauna, especially for species that have limited dispersal capabilities (Myers 1999).

THE NATURAL HERITAGE NETWORK AND BIOLOGICAL DIVERSITY

Colorado is well known for its rich diversity of geography, wildlife, plants, and plant communities. However, like many other states, it is experiencing a loss of much of its flora and fauna. This decline in biodiversity is a global trend resulting from human population growth, land development, and subsequent habitat loss. Globally, the loss in species diversity has become so rapid and severe that (Wilson 1988) has compared the phenomenon to the great natural catastrophes at the end of the Paleozoic and Mesozoic eras.

The need to address this loss in biodiversity has been recognized for decades in the scientific community. However, many conservation efforts made in this country were not based upon preserving biodiversity; instead, they primarily focused on preserving game animals, striking scenery, and locally favorite open spaces. To address the absence of a methodical, scientifically based approach to preserving biodiversity, Robert Jenkins, in association with The Nature Conservancy, developed the Natural Heritage Methodology in 1978.

Recognizing that rare and imperiled species are more likely to become extinct than common ones, the Natural Heritage Methodology ranks species according to their rarity or degree of imperilment. The ranking system is scientifically based upon the number of known locations of the species as well as its biology and known threats. By ranking the relative rareness or imperilment of a species, the quality of its populations, and the importance of associated proposed Conservation Areas, the methodology can facilitate in prioritizing conservation efforts so the most rare and imperiled species may be preserved first. As the scientific community began to realize that plant communities are equally important as individual species, this methodology has also been applied to ranking and preserving rare plant communities as well as the best examples of common communities.

The Natural Heritage Methodology is used by Natural Heritage Programs throughout North, Central, and South America, forming an international database network. Natural Heritage Network data centers are located in each of the 50 U.S. states, five provinces of Canada, and 13 countries in South and Central America and the Caribbean. This network enables scientists to monitor the status of species from a state, national, and global perspective. It also enables conservationists and natural resource managers to make informed objective decisions in prioritizing and focusing conservation efforts.

What is Biological Diversity?

Protecting biological diversity has become an important management issue for many natural resource professionals. Biological diversity at its most basic level includes the full range of species on Earth, from species such as bacteria, and protists, through multicellular kingdoms of plants, animals, and fungi. At finer levels of organization,

biological diversity includes the genetic variation within species, both among geographically separated populations and among individuals within a single population. On a wider scale, diversity includes variations in the biological communities in which species live, the ecosystems in which communities exist, and the interactions among these levels. All levels are necessary for the continued survival of species and plant communities, and all are important for the well-being of humans. It stands to reason that biological diversity should be of concern to all people.

The biological diversity of an area can be described at four levels:

1. **Genetic Diversity** -- the genetic variation within a population and among populations of a plant or animal species. The genetic makeup of a species is variable between populations within its geographic range. Loss of a population results in a loss of genetic diversity for that species and a reduction of total biological diversity for the region. This unique genetic information cannot be reclaimed.
2. **Species Diversity** -- the total number and abundance of plant and animal species and subspecies in an area.
3. **Community Diversity** -- the variety of plant communities within an area that represent the range of species relationships and inter-dependence. These communities may be diagnostic or even endemic to an area. It is within communities that all life dwells.
4. **Landscape Diversity** -- the type, condition, pattern, and connectedness of plant communities. A landscape consisting of a mosaic of plant communities may contain one multifaceted ecosystem, such as a wetland ecosystem. A landscape also may contain several distinct ecosystems, such as a riparian corridor meandering through shortgrass prairie. Fragmentation of landscapes, loss of connections and migratory corridors, and loss of natural communities all result in a loss of biological diversity for a region. Humans and the results of their activities are integral parts of most landscapes.

The conservation of biological diversity must include all levels of diversity: genetic, species, community, and landscape. Each level is dependent on the other levels and inextricably linked. In addition, and all too often omitted, humans are also linked to all levels of this hierarchy. We at the Colorado Natural Heritage Program believe that a healthy natural environment and human environment go hand in hand, and that recognition of the most imperiled elements is an important step in comprehensive conservation planning.

Colorado Natural Heritage Program

The Colorado Natural Heritage Program is the state's primary comprehensive biological diversity data center, gathering information and field observations to help develop statewide conservation priorities. After operating in Colorado for 14 years, the Program was relocated from the State Division of Parks and Outdoor Recreation to the University of Colorado Museum in 1992 and more recently to the College of Natural Resources at Colorado State University.

The multi-disciplinary team of scientists and information managers gathers comprehensive information on rare, threatened, and endangered species and significant plant communities of Colorado. Life history, status, and locational data are incorporated into a continually updated data system. Sources include published and unpublished literature, museum and herbaria labels, and field surveys conducted by knowledgeable naturalists, experts, agency personnel, and our own staff of botanists, ecologists, and zoologists. Information management staff carefully plot the data on 1:24,000 scale USGS maps and enter it into the Biological and Conservation Data System. The database can be accessed from a variety of angles, including taxonomic group, global and state rarity rank, federal and state legal status, source, observation date, county, quadrangle map, watershed, management area, township, range, and section, precision, and conservation unit.

The CNHP is part of an international network of conservation data centers that use the Biological and Conservation Data System developed by The Nature Conservancy. The CNHP has effective relationships with several state and federal agencies, including the Colorado Natural Areas Program, Colorado Department of Natural Resources and the Colorado Division of Wildlife, the U.S. Environmental Protection Agency, and the U.S. Forest Service. Numerous local governments and private entities also work closely with the CNHP. Use of the data by many different individuals and organizations, including Great Outdoors Colorado, encourages a proactive approach to development and conservation thereby reducing the potential for conflict. Information collected by the Natural Heritage Programs around the globe provides a means to protect species before the need for legal endangerment status arises.

Concentrating on site-specific data for each element of natural diversity allows the CNHP to evaluate the significance of each location to the conservation of Colorado's, and indeed the nation's, natural biological diversity. By using species imperilment ranks and quality ratings for each location, priorities can be established for the protection of the most sensitive or imperiled sites. A continually updated locational database and priority-setting system such as that maintained by the CNHP provides an effective, proactive land planning tool.

The Natural Heritage Ranking System

Information is gathered by the CNHP on the state's plants, animals, and plant communities. Each of these species and plant communities is considered an **element of**

natural diversity, or simply an **element**. Each element is assigned a rank that indicates its relative degree of imperilment on a five-point scale (e.g., 1 = extremely rare/imperiled, 5 = abundant/secure). The primary criterion for ranking elements is the number of occurrences, i.e., the number of known distinct localities or populations. This factor is weighted more heavily because an element found in one place is more imperiled than something found in twenty-one places. Also of importance is the size of the geographic range, the number of individuals, trends in population and distribution, identifiable threats, and the number of already protected occurrences.

Element imperilment ranks are assigned both in terms of the element's degree of imperilment within Colorado (its State or S-rank) and the element's imperilment over its entire range (its Global or G-rank). Taken together, these two ranks give an instant picture of the degree of imperilment of an element. The CNHP actively collects, maps, and electronically processes specific occurrence information for elements considered extremely imperiled to vulnerable (S1 - S3). Those with a ranking of S3S4 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 3.

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 3, ranks followed by a "B", e.g., S1B, indicate that the rank applies only to the status of breeding occurrences. Similarly, ranks followed by an "N", e.g., S4N, refer to nonbreeding status, typically during migration and winter. Elements without this notation are believed to be year-round residents within the state.

Table 1. Definitions of Colorado Natural Heritage imperilment ranks.

Global imperilment ranks are based on the range-wide status of a species. State imperilment ranks are based on the status of a species in an individual state. State and Global ranks are denoted, respectively, with an "S" or a "G" followed by a character. These ranks should not be interpreted as legal designations.	
G/S1	Critically imperiled globally/state because of rarity (5 or fewer occurrences in the world/state; or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extinction.
G/S2	Imperiled globally/state because of rarity (6 to 20 occurrences), or because of other factors demonstrably making it very vulnerable to extinction throughout its range.
G/S3	Vulnerable through its range or found locally in a restricted range (21 to 100 occurrences).
G/S4	Apparently secure globally/state, though it might be quite rare in parts of its range, especially at the periphery.
G/S5	Demonstrably secure globally/state, though it may be quite rare in parts of its range, especially at the periphery.
GX	Presumed extinct.

G#?	Indicates uncertainty about an assigned global rank.
G/SU	Unable to assign rank due to lack of available information.
GQ	Indicates uncertainty about taxonomic status.
G/SH	Historically known, but not verified for an extended period, usually.
G#T#	Trinomial rank (T) is used for subspecies or varieties. These taxa are ranked on the same criteria as G1-G5.
S#B	Refers to the breeding season imperilment of elements that are not permanent residents.
S#N	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
SZ	Migrant whose occurrences are too irregular, transitory, and/or dispersed to be reliably identified, mapped, and protected.
SA	Accidental in the state.
SR	Reported to occur in the state, but unverified.
S?	Unranked. Some evidence that species may be imperiled, but awaiting formal rarity ranking.
Notes: Where two numbers appear in a state or global rank (e.g., S2S3), the actual rank of the element falls between the two numbers.	

Legal Designations

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 either the U.S. Fish and Wildlife Service under the Endangered Species Act or by the Colorado Division of Wildlife under Colorado Statute 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 4 defines the special status assigned by these agencies and provides a key to the abbreviations used by the CNHP.

Please note that the U.S. Fish and Wildlife Service has issued a Notice of Review in the February 28, 1996 Federal Register for plants and animal species that are "candidates" for listing as endangered or threatened under the Endangered Species Act. The revised candidate list replaces an old system that listed many more species under three categories: Category 1 (C1), Category 2 (C2), and Category 3 (including 3A, 3B, 3C). Beginning with the February 28, 1996 notice, the Service will recognize as candidates for listing only species that would have been included in the former Category 1. This includes those species for which the Service has sufficient information on their biological status and threats to propose them as endangered or threatened under the Endangered Species Act. Candidate species listed in the February 28, 1996 Federal Register are indicated with a "C". While obsolete legal status codes (Category 2 and 3) are no longer

used, the CNHP will continue to maintain them in its Biological and Conservation Data system for reference.

Table 2. Federal and state agency special designations.

Federal Status:	
1. U.S. Fish and Wildlife Service (58 Federal Register 51147, 1993) and (61 Federal Register 7598, 1996)	
LE	Endangered; species formally listed as endangered.
E(S/A)	Endangered due to similarity of appearance with listed species.
LT	Threatened; taxa formally listed as threatened.
P	Proposed endangered or threatened; species formally proposed for listing as endangered or threatened
C	Candidate: species for which the Service has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened.
2. U.S. Forest Service (Forest Service Manual 2670.5) (noted by the Forest Service as “S”)	
FS	Sensitive: those plant and animal species identified by the Regional Forester for which population viability is a concern as evidenced by:
a.	Significant current or predicted downward trends in population numbers or density.
b.	Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.
3. Bureau of Land Management (BLM Manual 6840.06D) (noted by BLM as “S”)	
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.
State Status:	
1. Colorado Division of Wildlife	
E	Endangered
T	Threatened
SC	Special Concern

Element Occurrence Ranking

Actual locations of elements, whether they be 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. In order to prioritize element occurrences for a given species, an element occurrence rank (EO-Rank) is assigned according to the estimated viability or probability of persistence (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:

1. **Size** – a quantitative measure of the area and/or abundance of an occurrence such as area of occupancy, population abundance, population density, or population fluctuation.
2. **Condition** – an integrated measure of the quality of biotic and abiotic factors, structures, and processes within the occurrence, and the degree to which they affect the continued existence of the occurrence. Components may include reproduction and health, development/maturity for communities, ecological

processes, species composition and structure, and abiotic physical or chemical factors.

3. **Landscape Context** – an integrated measure of the quality of biotic and abiotic factors, and processes surrounding the occurrence, and the degree to which they affect the continued existence of the occurrence. Components may include landscape structure and extent, genetic connectivity, and condition of the surrounding landscape.

Each of these factors is rated on a scale of A through D, with A representing an excellent grade and D representing a poor grade. These grades are then averaged to determine an appropriate EO-Rank for the occurrence. If there is insufficient information available to rank an element occurrence, an EO-Rank is not assigned. Possible EO-Ranks and their appropriate definitions are as follows:

- | | |
|----------|--|
| A | Excellent estimated viability. |
| B | Good estimated viability. |
| C | Fair estimated viability. |
| D | Poor estimated viability. |
| E | Verified extant, but viability has not been assessed. |
| H | Historically known, but not verified for an extended period. |

Potential Conservation Areas

In order to successfully protect populations or occurrences of rare or imperiled elements, it is necessary to recognize Proposed Conservation Areas. 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. Proposed Conservation Areas may include a single occurrence of a rare element or a suite of rare element occurrences or significant features.

Once the presence of rare or imperiled species or significant natural communities has been confirmed, the first step towards their protection is the delineation of a proposed conservation planning boundary. In general, the proposed conservation planning boundary is an estimate of the landscape that supports the rare elements as well as the ecological processes that allow them to persist. In developing such boundaries, the CNHP staff consider a number of factors that include, but are not limited to:

- extent of current and potential habitat for the elements present, considering the ecological processes necessary to maintain or improve existing conditions;
- species movement and migration corridors;
- maintenance of surface water quality within the site and the surrounding watershed;
- maintenance of the hydrologic integrity of the groundwater, e.g., by protecting recharge zones;

- land intended to buffer the site against future changes in the use of surrounding lands;
- exclusion or control of invasive non-native species;
- land necessary for management or monitoring activities.

As the label "conservation planning" indicates, the boundaries presented here are for planning purposes. They delineate ecologically sensitive areas where land-use practices should be carefully planned and managed to ensure that they are compatible with protection goals for natural heritage resources and sensitive species. All land within the conservation planning boundary should be considered an integral part of a complex economic, social, and ecological landscape that requires wise land-use planning at all levels.

Furthermore, it is often the case that all relevant ecological processes cannot be contained within a site of reasonable size. Taken to the extreme, the threat of ozone depletion could expand every site to include the whole globe. The boundaries illustrated in this report signify the immediate, and therefore most important, area in need of protection. Continued landscape level conservation efforts are needed. This will involve county-wide efforts as well as coordination and cooperation with private landowners, neighboring land planners, and state and federal agencies.

Ranking of Potential Conservation Areas

One of the strongest ways that the CNHP uses element and element occurrence ranks is to assess the overall biodiversity significance of a site, which may include one or many element occurrences. Based on these ranks, each site is assigned a **biodiversity** (or B-) **rank**:

- B1 Outstanding Significance (Irreplaceable): only site known for an element, or an excellent (A-ranked) occurrence of a G1 species, or a concentration of excellent or good (A- or B-ranked) occurrences of G1 or G2 elements (4 or more).
- B2 Very High Significance (Almost irreplaceable): good or fair (B- or C-ranked) occurrence of a G1 species, or excellent or good (A- or B-ranked) occurrence of a G2 species, or a concentration of excellent or good occurrences (A- or B-ranked) of G3 species (4 or more), or concentration of fair (C-ranked) G2 elements (4 or more).
- B3 High Significance: excellent (A-ranked) example of a community type, excellent or good (A- or B-ranked) occurrence of a G3 species, or a fair occurrence of a G2 species, or up to 5 of the best occurrences of a G4 or G5 community in an ecoregion.

- B4 Moderate Significance: good (B-ranked) example of a community type, excellent or good (A- or B-ranked) occurrence of state-imperiled (S1 or S2) species, or a large concentration of excellent or good (A- or B-ranked) occurrences of state rare (S3) species (4 or more).
- B5 General or Local Biodiversity Significance: good or marginal occurrence of a community type, S1, or S2 species.

Protection and Management Urgency Ranks

Protection urgency ranks (P-ranks) refer to the time frame in which conservation protection must occur. In most cases, this rank refers to the need for a major change of protective status (e.g., agency special area designations or ownership). The urgency for protection rating reflects the need to take legal, political, or other administrative measures to alleviate threats that are related to land ownership or designation. The following codes are used to indicate the rating which best describes the urgency to **protect** the area:

- P1** Very high urgency. Protection actions needed immediately. It is estimated that stresses may reduce the viability of the elements in the PCA within 1 year.
- P2** High urgency. Protection actions may be needed within 5 years. It is estimated that stresses may reduce the viability of the elements in the PCA within this approximate timeframe.
- P3** Moderate urgency. Protection actions may be needed, but probably not within the next 5 years. It is estimated that stresses may reduce the viability of the elements in the PCA if protection action is not taken.
- P4** Low urgency. No protection actions are needed in the foreseeable future.
- P5** Land protection is complete and no protection actions are needed.

A protection action involves increasing the current level of legal protection accorded one or more tracts at 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, i.e., any action requiring stewardship intervention. Threats that may require a protection action are as follows:

- 1) Anthropogenic forces that threaten the existence of one or more element occurrences at a site; e.g., development that would destroy, degrade or seriously compromise the long-term viability of an element occurrence and timber, range, recreational, or hydrologic management that is incompatible with an element occurrence's existence;
- 2) The inability to undertake a management action in the absence of a protection action; e.g., obtaining a management agreement;
- 3) In extraordinary circumstances a prospective change in ownership management that will make future protection actions more difficult.

Management urgency ranks (M-ranks) indicate the time frame in which a change in management of the element or site must occur. Using best scientific estimates, this rank refers to the need for management in contrast to protection (e.g., increased fire frequency, decreased herbivory, 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, rerouting 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. The following codes are used to indicate the action needed to be taken at the area:

- M1** Very high urgency. Management actions may be required within one year or the element occurrences could be lost or irretrievably degraded.
- M2** High urgency. New management actions may be needed within 5 years to prevent the loss of the element occurrences within the PCA.
- M3** Moderate urgency. New management actions may be needed within 5 years to maintain the current quality of the element occurrences in the PCA.
- M4** Low urgency. 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.
- M5** No management needs are known or anticipated in the PCA.

METHODS

Survey Site Selection

Information, regarding the location of seeps and springs within the BLM, GJFOMA portion of Garfield County, was gathered to assist in prioritizing which seeps and springs would be visited. Under the assumption that most disturbed or “developed” springs would likely have lower biodiversity, due to sparse vegetation cover (trampling and overgrazing), disruption of hydrology, and presence of non-native species (BLM 2000; Sada and Nachlinger 1996), CNHP decided to focus inventory efforts on those springs where ecological processes have not been altered. The locations of intact or relatively undisturbed seeps and springs and/or those seeps and springs with known biodiversity values were identified by:

- Utilizing ArcView coverage, provided by the Bureau of Land Management, of seeps and springs within the BLM GJFOMA.
- Cross-referencing spring locations on UGSS 1:24,000 topographic maps and the ArcView coverage with National Wetland Inventory Maps, which often indicate whether a wetland has been modified by anthropogenic activity, and the BLM 1996 Grand Junction Resource Area Map, which also indicates whether a spring has been developed.
- Using aerial photography.
- Information regarding the known locations of species and significant plant communities within the study area’s seeps and springs were downloaded from CNHP’s Biological Conservation Database (BCD)

Additionally, many seeps and springs were encountered in the field that were not identified via maps or aerial photography. CNHP estimates that at least 30 additional seeps and springs, not identified from the various sources listed above, exist in the project area. This estimate is based on the number CNHP encountered during this survey and extrapolating it to those areas not visited by CNHP.

Site Assessment

Access to some BLM lands was limited by private inholdings and/or right-of-way restrictions. Landowners were contacted, prior to attempting to access these areas, to obtain permission to cross their properties. The inability to contact certain landowners and time constraints did not allow CNHP to visit every seep and spring targeted. Thus, it is important to note that although the seeps and springs presented in this report represent CNHP's estimate of the highest quality seeps and springs in the project area, there are undoubtedly additional seeps and springs, which harbor significant biodiversity value, in the project area.

Seeps and springs visited were assigned a simple label with a numeric order, SSR1.....SSR2...SSR3...etc. This was done to eliminate name confusions among

springs, as the ArcView coverage supplied by the BLM often had springs with the same name/label. Thus, these labels make it easy to discern which were visited by CNHP.

Site assessments included a general description, rating of Proper Functioning Condition (Bureau of Land Management 1998; Bureau of Land Management 1994; Bureau of Land Management 1993) species list, assessment of any natural heritage elements, discussion of ecological functions, collection of water chemistry data and macroinvertebrates, and restoration and management needs.

The following information was collected and is described in this report:

General Description

- Hydrological characteristics of the site
- Ecological processes maintaining site characteristics
- Landscape context
- GPS location (GPS units were set to NAD 27 using UTM coordinates).
- Elevation (from 7.5 min. USGS topographic maps)
- Current and historic land use (e.g., grazing, logging, recreational use) when apparent
- Notes on geology and geomorphology
- Indicators of disturbance such as grazing, flooding, spring “development”, etc.
- Reference photos of the site

Proper Functioning Condition

Each seep/spring visited was assessed using the Bureau of Land Management’s wetland/riparian functional assessment, “Process for Assessing Proper Functioning Condition” (Bureau of Land Management 1993). Thus, each site was given a rating of:

- (1) **Proper Functioning Condition** – riparian/wetland area has all natural ecological functions intact.
- (2) **Functional-At Risk** – riparian/wetland area that is in functional condition but some attribute of the site makes it susceptible to degradation.
- (3) **Nonfunctional** – riparian/wetland areas is clearly not providing natural ecological functions.

(See Bureau of Land Management 1998; Bureau of Land Management 1994; and Bureau of Land Management 1993 for more details).

Plant and Animal Species List and Dominant Plant Associations

- List of all plant and animal species observed
- List of all dominant plant species and/or plant associations in the seep/spring area. Plant associations were classified according to CNHP's Statewide Wetland Classification and Characterization Project, which is based on the U.S. National Vegetation Classification System (Anderson et. al 1998).
- Vegetation data 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.

Natural Heritage Information

- List of elements present or expected at the site
- Element occurrence (EO) ranks or information that will lead to EO Rank
- Potential Conservation Area (if a particular seep or spring is within a potential conservation area identified by CNHP)

Discussion of Ecological Functions

- Hydrological functions (i.e., groundwater recharge/discharge, flood storage, shoreline anchoring)
- Biogeochemical functions (i.e., sediment trapping, nutrient and toxicant retention/removal)
- Biological functions (i.e., foodchain support, production export, fish and wildlife habitat, habitat diversity)

Water Chemistry and Macroinvertebrates

Using an Oyster Model 34145A pH/Conductivity/Temperature Meter the following were measured:

- pH
- Conductivity
- Temperature

Also, the following was determined:

- Estimate of flow volume using a drop weir or ocular estimate
- Species of targeted macroinvertebrates (mussels and snails) observed and/or collected (these were sent to Dr. Rob Guralnick, at the University of Colorado's Invertebrate Museum, for identification).

Note: For approximately the first month, CNHP did not have the proper pH/Temp/Conductivity meter to measure water quality, as funds for the meter had not yet been made available. However, CNHP used a simple pH meter until the former meter was available. Later comparisons of this pH meter determined that it might have been off up to 0.5, which is a large amount, but still provides a general idea of the pH of the first 12 springs visited.

Restoration Potential and Management Needs

- Cause of disturbances, if any (i.e., alteration of hydrology, peat/soil removal, fill material, improper grazing, presence of non-native species, etc.)
- Feasibility of rectifying the disturbance (re-establishing natural hydrological regime, remove fill material, plant native species, altering grazing regime, etc.)

RESULTS

Upon completion of the initial survey site selection (see Methods section) it was determined that most seeps and springs within the study area (BLM GJFOMA within Garfield County) occur on private land (approximately 200 identified) while the remaining occur on BLM land (approximately 73 identified) (Figure 3). However, the field survey indicated that many seeps and springs in the project area are not identified on maps or are not visible using aerial photography. CNHP estimates that at least 30 additional seeps and springs, not identified from the initial survey site selection, exist in the project area. Some of these are documented in this report, however time restraints limited the number of seeps and springs CNHP could document. *Thus, it is very important to realize that there are many intact seeps and springs in the project area not highlighted in this report.* Calf Canyon, the Right and Left Fork of Barrel Spring Creek, and 4A Ridge are areas where additional seeps and springs are expected and/or encountered. The globally vulnerable (G3) hanging garden sullivantia (*Sullivantia hapemanii* var. *purpusii*) is known to occur near seeps and springs in the 4A Ridge area. Natural resource managers should consider any impacts to seeps or springs in these areas, especially if any elements listed in Table 5 exist at the site.

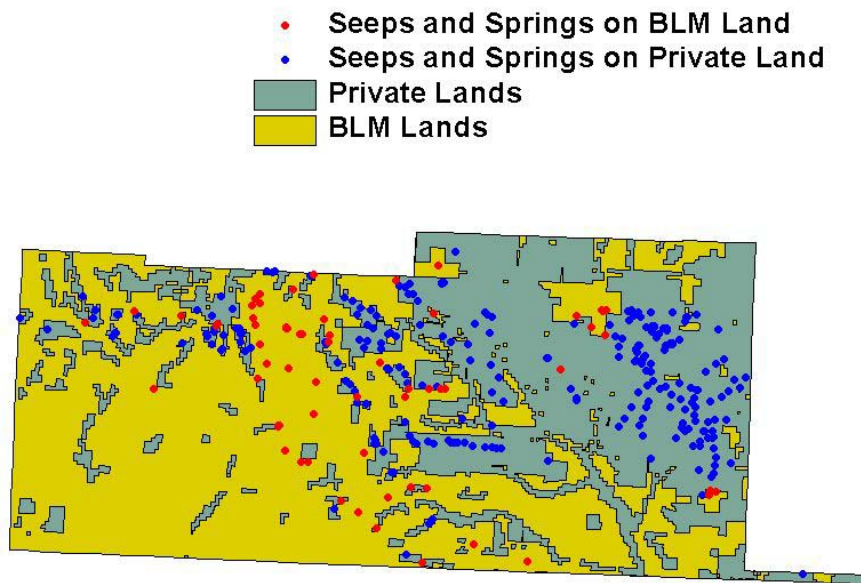
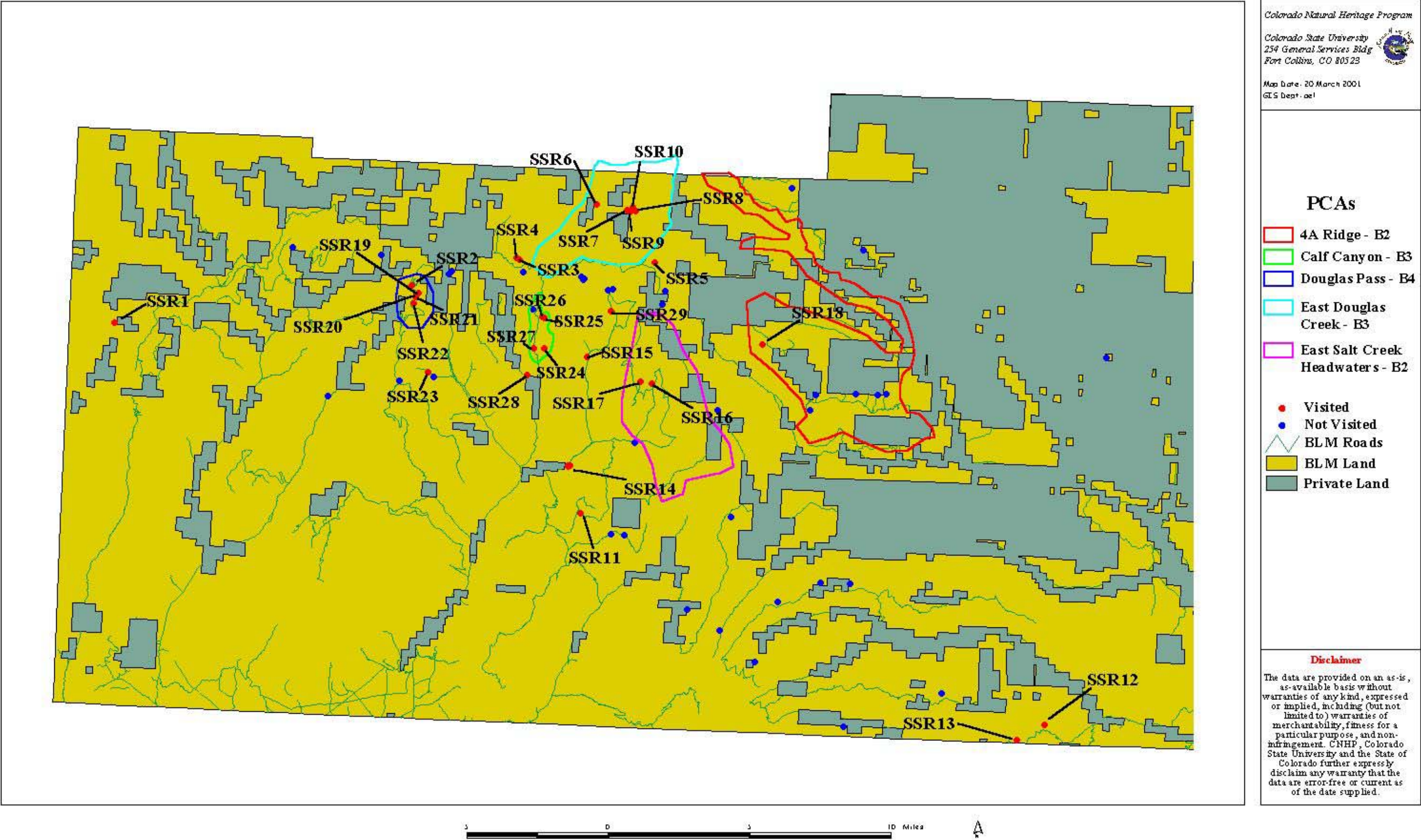


Figure 3. Distribution of seeps and springs by land ownership in western Garfield County.

Seeps and Springs Visited by CNHP within the Grand Junction Field Office Management Area



Of the 73 seeps and springs identified on BLM land in the project area, 63 were identified as potentially existing with natural ecological processes intact. Of these, 29 were visited while 34 were considered, upon initial observation, to be too heavily disturbed, due to water developments and/or heavy grazing activity, for further investigation or were not visited due to their remoteness coupled with time constraints (Figure 4). Thus, the 29 seeps and springs visited were considered to either harbor biodiversity values despite anthropogenic disturbances or had most ecological processes intact (Figure 4). This report documents those seeps and springs. It should be noted that six seeps and springs (SSR1, SSR6-10), contained within the BLM Craig District, were mistakenly thought to occur within the project area and were visited during this survey. Nonetheless, they are still included in this report.

Summary of Results

Garfield County has one of the highest concentrations of seeps and springs in Colorado (over 900) due to unique geologic substrates, the Green River Shale Formation and Uinta Formation in the western portion of the county and the Leadville Limestone Formation in the eastern half. These seeps and springs are important to regional landscape diversity, especially in western Garfield County (or more specifically, the project area), where most areas receive less than 20 inches of annual precipitation, as they provide small but widely distributed habitat that offers a perennial source of water, food, cover, nesting habitat, and habitat for rare and/or unique species.

Many springs in western North America, below an elevation of 7000 feet, are isolated from other wetlands. Additionally, springsnails are generally found in springs below 6900 feet, although they do occur in mountain springs (BLM 2000). Thus, while Hershler (1998) documented 58 new species of springsnails (*Pyrgulopsis*) in spring habitats throughout Nevada and Utah, no rare or endemic macroinvertebrates were found during this project (Table 3). This might be explained by the fact that most of the springs surveyed for this project were above 6500 feet, thus at the upper elevational limit for springsnails, and, although western Garfield County has a semi-arid climate and many of the springs occur below 7000 feet, most of the springs flow year round and provide base flow to numerous streams (Martinson 1980). Thus, connectivity to streams and other spring wetlands has potentially allowed macroinvertebrate species to disperse to other potential habitats in western Garfield County. However, Martinson (1980) found that although many spring sources in the Piceance Basin, CO had similar water temperatures and water chemistry, they often exhibited a different suite of macroinvertebrate species than each other. Additionally, he also found that the density and biomass of macroinvertebrates in springs was greater than downstream habitats. Thus, while no rare or endemic snail or mussel species were located in any of the seeps and springs in the project area, it is likely that their populations are different than those found in other riparian/wetland habitats (streams, lakes, ponds, etc.) and represent an important aspect of biodiversity in Garfield County.

Table 3. List of mussels and snails collected in the project area.

Element	Common Name	Global Rank	State Rank	Seep/Spring collected at
Mussel				
<i>Pisidium nitidum</i>	Shiny peaclam	G5	SU	SSR3, SSR26
Snails				
<i>Physa</i> sp. ¹	Aquatic snails	GU	SU	SSR8
<i>Lymnaea elodes</i>	Marsh pondsnail	G5	SU	SSR2, SSR15
<i>Lymnaea</i> sp.	Unidentified pondsnail	G?	S?	SSR26
<i>Oreohelix</i> sp. ²	Land snail	GU	SU	SSR20

As was mentioned above, many seeps and springs in Garfield County have been altered and/or modified from their natural condition due to anthropogenic disturbances such as livestock grazing and diversions and impoundments to capture water for human or livestock use. These disturbances often result in an increase in non-native species, decrease in vegetation cover, inundation of springbrook habitat, replacement of species requiring flowing water with those more adapted to stagnate or slow moving water (lakes, ponds, etc.), and can cause the extirpation of endemic spring species. These disturbances could also potentially alter ecosystem functions. However, of the 29 seeps and springs visited 24 were rated as Proper Functioning Condition (seven of these are threatened by current management (downward trend)), while five were considered to be Functional At Risk (Table 4).

Table 4. Assessment of Proper Functioning Condition of Seeps and Springs Visited.

Seep or Spring Label	Functional Rating	Trend
SSR1	Proper Functioning Condition	Not Apparent
SSR2	Proper Functioning Condition	Downward
SSR3	Proper Functioning Condition	Not Apparent
SSR4	Proper Functioning Condition	Not Apparent
SSR5	Proper Functioning Condition	Downward
SSR6	Functional At Risk	Downward
SSR7	Proper Functioning Condition	Not Apparent
SSR8	Functional At Risk	Downward
SSR9	Proper Functioning Condition	Not Apparent
SSR10	Proper Functioning Condition	Not Apparent
SSR11	Proper Functioning Condition	Not Apparent
SSR12	Proper Functioning Condition	Not Apparent
SSR13	Proper Functioning Condition	Not Apparent
SSR14	Proper Functioning Condition	Downward
SSR15	Functional At Risk	Downward
SSR16	Proper Functioning Condition	Downward
SSR17	Proper Functioning Condition	Downward
SSR18	Functional At Risk	Downward
SSR19	Proper Functioning Condition	Downward
SSR20	Proper Functioning Condition	Not Apparent

¹ *Physa* needs a lot of systematic revision, which is in progress. Until then all Colorado *Physa* are recognized only to genus (Guralnick, personal communication).

² Specimen did not allow for species identification.

SSR21	Proper Functioning Condition	Not Apparent
SSR22	Proper Functioning Condition	Not Apparent
SSR23	Functional At Risk	Downward
SSR24	Proper Functioning Condition	Downward
SSR25	Proper Functioning Condition	Not Apparent
SSR26	Proper Functioning Condition	Not Apparent
SSR27	Proper Functioning Condition	Not Apparent
SSR28	Proper Functioning Condition	Not Apparent
SSR29	Proper Functioning Condition	Not Apparent

Significant Elements Associated with Seeps and Springs

CNHP documented 15 elements of biodiversity significance as occurring in seeps and springs in the project area while another five elements are potentially found in these wetlands but were not documented in 2000 (Table 5). Some of the more significant elements documented include the state critically imperiled (G2G3Q/S1) large-flower globemallow (*Iliamna grandiflora*), the globally vulnerable (G2G3/S2S3) beaked spikerush emergent wetland (*Eleocharis rostellata*), the globally vulnerable (G3/S2) lower montane river birch riparian shrubland (*Betula occidentalis*/mesic forb), the state critically imperiled (G4S/S1) lower montane Douglas fir/Rocky Mountain maple forest (*Pseudotsuga menziesii*/*Acer glabrum*), and a unique stand of balsam poplar (*Populus balsamifera*). The globally vulnerable (G3) hanging garden sullivantia (*Sullivantia hapemanii* var. *purpusii*) was not located in any of the seeps and springs documented in this report, however populations of this species are known to occur in spring on private land in the 4A Ridge area. Thus, seeps and springs on BLM land in this area should be closely monitored for this species. Additionally, 18 of the seeps and springs documented in this report occurred within a CNHP Potential Conservation Area (Table 5).

Table 5. Seeps and springs occurring within CNHP Potential Conservation Areas.

Biodiversity Rank	Potential Conservation Area	Seep or Spring
B2	4A Ridge	SSR18
B2	East Salt Creek	SSR16 and SSR17
B3	Calf Canyon	SSR24, SSR25, SSR26, SSR27, and SSR28
B3	East Douglas Creek	SSR6, SSR7, SSR8, SSR9, and SSR10
B4	Douglas Pass	SSR2, SSR19, SSR20 SSR21 and SSR22

Although not located at any of the seeps and springs in this report, the globally critically imperiled (G3T1/S1) Nokomis Fritillary (*Speyeria nokomis nokomis*) is a biologically significant element that may depend on these wetlands. The Nokomis Fritillary has specific habitat needs, which are seeps and springs with permanent flowing water that support healthy populations of their host plant, the northern bog violet (*Viola nephrophylla*) (Ferris and Brown 1981). The female lays eggs near the host plant then upon hatching the caterpillar feeds on the leaves of the host plant in the spring while the adults nectar on thistles (Opler and Wright 1999). CNHP found the northern bog violet at many of the seeps and springs documented in this report. Thus, although the Nokomis

Fritillary was not found during this survey, the potential for its presence should not be overlooked for three main reasons: (1) nearby populations exists in Mesa County at Unaweep Seep and in Uintah County in Utah; (2) there are many seeps and springs that have permanent flowing water and support populations of the northern bog violet in the project area; and (3) the timing of CNHP's survey of the seeps and springs may have not been synchronized with the flight times of the local populations as this species has one flight/year, which generally occurs between mid-July through September depending on climatic and elevational variation (Opler and Wright 1999). Many populations of this butterfly have disappeared because of the capping of springs, lowering of water tables due to pumping and/or rerouting of water, and habitat modification, such as heavy (not light) grazing (Opler and Wright 1999; Ferris and Brown). Natural resource managers should conduct a thorough survey for this species, prior to any management activity, in those seeps or springs with permanent groundwater discharge and which support the northern bog violet. Protecting these areas from hydrological alteration and habitat modification will ensure that viable habitat for the Nokomis Fritillary is maintained throughout its range.

Table 6. List of elements known or potentially associated with seeps and springs in western Garfield County. Elements in **Bold** are those documented in the project area.

Element	Common Name	Global Rank	State Rank	Federal and State Status
Plants				
<i>Cypripedium calceolus</i>	Yellow lady's slipper	G5	S2	
<i>Epipactis gigantea</i>	Helleborine orchid	G4	S2	FS
<i>Iliamna grandiflora</i>	Large-flower globe-mallow	G2G3Q	S1	
<i>Limnorchis ensifolia</i>	Canyon bog-orchid	G4G5T4	S3	
<i>Sullivantia hapemannii</i> var. <i>purpusii</i>	Hanging garden sullivantia	G3T3	S3	FS
Plant Communities				
<i>Betula occidentalis</i>/mesic graminoid	Lower montane riparian shrublands	G3	S2	
<i>Carex utriculata</i>	Beaked sedge montane wet meadows	G5	S4	
<i>Carex nebrascensis</i>	Nebraska sedge spring wetland	G4	S3	
<i>Carex praeegracilis</i>	Wet meadow	G3G4	S3S4	
<i>Eleocharis palustris</i>	Creeping spike-rush emergent wetland	G5	S4	
<i>Eleocharis rostellata</i>	Beaked spike-rush emergent wetland	G2G3	S2S3	
<i>Juncus balticus</i> var. <i>balticus</i>	Wet meadow	G5	S5	
<i>Populus angustifolia</i>/<i>Salix exigua</i>	Narrowleaf cottonwood riparian forest	G4	S4	
<i>Populus balsamifera</i>	Montane riparian forest	G3?	S3	
<i>Pseudotsuga menziesii</i>/<i>Acer glabrum</i>	Lower montane forest	G4	S1	
<i>Schoenoplectus acutus</i>	Freshwater bulrush marsh	G5	S3?	
Amphibians				
<i>Rana pipiens</i>	Northern leopard frog	G5	S3	FS/BLM, SC
Invertebrates				
<i>Euphilotes spaldingi</i>	Spalding's blue	G3G4	S2	
<i>Speyeria nokomis nokomis</i>	Nokomis Fritillary	G3T1	S1	BLM
<i>Valvata sincera</i>	Mossy valvata	G5	S3	

Seeps and Spring Surveyed

Site Profile Explanation

Each seep/spring site is described in a standard site profile report that reflects information collected during field visits. The contents of the profile report are outlined and explained below:

Seep/spring Name

Location (including GPS point):

Legal Description:

Elevation:

Dominant Plant Species and/or Associations:

General Description (current/past land use, geology, disturbance, etc.):

Plant and Animal Species Observed:

Natural Heritage Program Element Occurrences:

Discussion of Ecological Functions:

Proper Functioning Condition Rating:

Nonnative and Aggressive Species:

Restoration and Management Comments:

Water Chemistry:

Macroinvertebrates:

Photos:

SSR1

Location: Along Bitter Creek in extreme western Garfield County near the Utah border. The spring discharges along the western side of the creek just downstream of Brewster Canyon. GPS Point: Zone 12, 0670045E, 4380724N.

Legal Description: USGS 7.5-minute quadrangle: Rat Hole Ridge. T6S R104W Section 7 NE4 NE4.

Elevation: 7800 feet.

Dominant Plant Species and/or Associations: A river birch/mesic graminoids (*Betula occidentalis*/mesic graminoid) plant association occupies this spring. Beaked sedge (*Carex utriculata*) and monkshood (*Aconitum columbianum*) are dominant herbaceous species.

General Description: This is a small spring located on a southeast-facing slope along Bitter Creek. This area is very remote. A dirt road, which originates at Baxter Pass, separates the spring from the creek. Cattle are grazing in the area but the spring itself does not appear to be highly disturbed from this activity. Upland vegetation in the area includes aspen (*Populus tremuloides*), Utah serviceberry (*Amelanchier utahensis*), and snowberry (*Symphoricarpus oreophilus*). There was no standing water within the spring but soils were saturated near the source.

Plant and Animal Species Observed: River birch (*Betula occidentalis*), Bebb's willow (*Salix bebbiana*), and gooseberry (*Ribes inerme*) comprise the shrubs in the area. Graminoids included beaked sedge (*Carex utriculata*), small-winged sedge (*C. microptera*), fowl mannagrass (*Glyceria striata*), Rocky Mountain rush (*Juncus saximontanus*), and Kentucky bluegrass (*Poa pratensis*). Herbaceous species (unknown Asteraceae species), and field horsetail (*Equisetum arvense*).

Numerous insects were observed in the area.

Natural Heritage Program Element Occurrences:

Table 7. Natural Heritage elements at SSR1.

Element	Common Name	Global Rank	State Rank	EO Rank	Federal and State Status
Plant Communities					
<i>Betula occidentalis</i> /mesic graminoid	Lower montane riparian shrublands	G3	S2	D	

The river birch/mesic graminoid community has been well documented in several western states but is threatened by poor livestock management, stream flow alteration, and heavy recreation use. This occurrence is in good condition but is very small, hence

the low EO rank. This spring was not located within a CNHP Potential Conservation Area.

Ecological Functions: Overall, this wetland is in relatively good condition. Groundwater discharge is occurring on site and is hydrologically supporting Bitter Creek via seepage to the creek channel. There was some evidence of hoof action (small pits or hummocks scattered throughout the wetland) from livestock indicating a potential for soil disturbance resulting in erosion, altered hydrology, and altered nutrient cycles. The shrubs provide good habitat for birds and the herbaceous vegetation offers forage for larger mammals. The spring also supports many insects thereby providing food chain support. The spring does not provide fish habitat, as the amount of water flowing from the source is limited.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition as all ecological processes are intact.

Nonnative and Aggressive Species: Kentucky bluegrass (*Poa pratensis*) was fairly abundant, possibly indicating that long-term grazing has occurred at this site, given that Kentucky bluegrass is considered to tolerate grazing and often increases under heavy grazing pressure.

Restoration and Management Comments: Surrounding areas are grazed heavily, however the vegetation around the spring did not show any evidence of heavy grazing disturbance at the time of the site visit. The abundance of Kentucky bluegrass and the presence of hummocks suggest that long-term grazing does occur in the area. The grazing regime might be altered to benefit the ecological health of the riparian area along Bitter Creek and maintain current conditions at the spring by implementing deferred and rest rotation-grazing cycles appropriate for this site.

Water Chemistry: Water chemistry or flow was not measured at this spring, as there was no standing or flowing water from which to collect data.

Macroinvertebrates: No macroinvertebrates were collected at this site. Lack of standing or flowing water limited potential habitat and no targeted macroinvertebrates were observed.

Photos: C1 and C2.

SSR2

Location: Along the west side of South Canyon Road, approximately 0.1 mile from the intersection with CO Hwy. 139. GPS Point: Zone 12, 0686729E, 4383947N.

Legal Description: USGS 7.5-minute quadrangle: Douglas Pass. T5S R102W Section 34 NW4 NE4.

Elevation: 7800 feet.

Dominant Plant Species and/or Associations: A Douglas-fir/Rocky Mountain maple (*Pseudotsuga menziesii*/*Acer glabrum*) association occurs above the pond along the springbrook. Emergent vegetation along the shore of the pond included creeping spikerush (*Eleocharis palustris*) and mare's tail (*Hippuris vulgaris*). Dominant shrubs along the pond border include red-osier dogwood (*Cornus sericea*), wild rose (*Rosa woodsii*), and river birch (*Betula occidentalis*).

General Description: This area consists of a few small seeps and springs that are discharging and draining from an east-facing slope down to a pond, which did not contain an outlet. The pond appears to have been developed to provide livestock with a water source and was likely constructed many years ago, considering the amount of organic matter accumulated on the pond bottom. The dry hillsides have a cover of Gambel's oak (*Quercus gambelii*), Utah serviceberry (*Amelanchier utahensis*) and other mountain shrubs, while the moist areas around the hillside seeps harbor a luxuriant plant community with Douglas fir, aspen (*Populus tremuloides*), and Rocky Mountain maple. Along the sides of South Canyon Road is one of the largest populations known of the globally vulnerable large-flower globemallow (*Iliamna grandiflora*), a spectacular plant with bushy growth and large white or pink flowers. There is a historic record of northern leopard frogs occupying the pond, although none were observed during the 2000 field season.

Plant and Animal Species Observed: Plant species diversity is fairly high. Trees and shrubs near the springs and pond include Douglas-fir, aspen, river birch (*Betula occidentalis*), elderberry (*Sambucus* sp.), wild rose, red-osier dogwood (*Cornus sericea*), and chokecherry (*Prunus virginiana*). Herbaceous species include mare's tail, creeping spikerush, fowl mannagrass (*Glyceria striata*), Baltic rush (*Juncus balticus*), Nebraska sedge (*Carex nebrascensis*), woolly sedge (*C. lanuginosa*), short-beaked sedge (*C. simulata*), Kentucky bluegrass (*Poa pratensis*), houndstongue (*Cynoglossum officinale*), bull thistle (*Cirsium vulgare*), mullein (*Verbascum thapsus*), knapweed (*Acosta* ssp.), false Solomon's seal (*Maianthemum stellatum*), golden banner (*Thermopsis montana*), stinging nettle (*Urtica dioica*), monument plant (*Frasera speciosa*), hookedspur violet (*Viola adunca*), **northern bog violet (*V. nephrophylla*)**, and alkali crowfoot (*Ranunculus cymbalaria*).

The pond harbors an abundance of invertebrate activity including water striders, dragonflies (both larvae and adults), mayflies (both larvae and adults), damselflies, water

boatmen, and marsh pond snails (*Lymnaea elodes*). There is also an abundance of tiger salamander larvae that occupy the pond. Their population is quite large probably due to a lack of predation by fish as none were observed in the pond. However, there was an abundance of garter snakes both within the pond and along the shore, which were likely feeding on the larval salamanders.

Natural Heritage Program Element Occurrences:

Table 8. Natural Heritage elements at SSR2.

Element	Common Name	Global Rank	State Rank	EO Rank	Federal and State Status
Plant Communities					
<i>Pseudotsuga menziesii/Acer glabrum</i>	Lower montane forests	G4	S1	B	B
Amphibians					
<i>Rana pipiens</i>	Northern leopard frog	G5	S3		H
Snails					
<i>Lymnaea elodes</i>	Marsh pondsnail	G5	SU	E	

This spring is contained within CNHP's **Douglas Pass Potential Conservation Area**, which is ranked as a **B4** site (Moderate Significance) (see Rocchio et al. 2001, Lyon et al. 2001). This PCA has one of the largest known occurrences of the large-flower globemallow (*Iliamna grandiflora*; G3?Q/S1), a plant that is very rare in Colorado. It also contains a good occurrence of the state rare Douglas fir/Rocky Mountain maple lower montane forest plant community (*Pseudotsuga menziesii/Acer glabrum*; G4/S1). The Douglas fir/Rocky Mountain maple plant association was found to be in good condition in this area. There are eight documented occurrences of this plant community in Colorado, including this one, in seven counties. This is the first documented occurrence for Garfield County.

Ecological Functions: The springbrook, especially at its confluence with the pond, is trampled and sparsely covered with vegetation, thus limiting bank stabilization functions. However, upslope, within the Douglas fir/maple community, the springbrook is densely vegetated and functioning at potential. The organic-rich soils along the springbrook restrict water movement, which, along with the presence of the pond, provides storage of discharging groundwater. The spring and associated pond provide a permanent source of water in an otherwise arid landscape, thus many species use these areas for water and forage. The pond, emergent shoreline vegetation, and large woody debris on shore and in the water support a large amount of invertebrate life. Many birds, small mammals, tiger salamanders, garter snakes, invertebrates, and numerous butterfly species were observed near the spring. No fish were observed in the pond and the springbrook is too short and shallow to support fish populations. Since the pond does not have an outlet, this wetland does not provide much in the way of production export.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition as all ecological processes are intact. The wetland is functioning at potential, although current grazing regime could threaten the functional integrity of the site.

Nonnative and Aggressive Species: Kentucky bluegrass (*Poa pratensis*), houndstongue (*Cynoglossum officinale*), bull thistle (*Cirsium vulgare*), mullein (*Verbascum thapsus*), and knapweed (*Acosta* ssp.) are abundant in the area. There is some tamarisk (*Tamarix ramosissima*) present in the area.

Restoration and Management Comments: The area around the pond is heavily grazed, trampled, and weedy due to livestock and heavy recreation use (as indicated by loads of trash in the area). The pond is very close to Hwy. 139, thus the area probably gets a lot of visitors. Fencing off highly disturbed areas from people and livestock would allow these areas to recover. Installation of educational signs or displays, such as one describing the springs on site or simply discussing "pond-life", might prevent users from leaving trash in the area. Efforts should be taken to control and eradicate the non-native species. The presence of tamarisk is especially noteworthy as this is an unusually high elevation for this species to be thriving. The large-flowered globemallow should probably be protected from direct impacts by road maintenance and weed spraying. However, it appears to prefer roadside habitats, perhaps because of the extra moisture from runoff, and because it seems to need some degree of disturbance. In the most natural sub-populations, which were farthest from the road, there was still a high degree of natural erosion.

Water Chemistry: Water chemistry or flow was not measured at this spring as there was no flowing water emerging from the spring source.

Macroinvertebrates: Two snails were collected from aquatic vegetation near the shore of the pond. Both were determined to be marsh pond snails (*Lymnaea elodes*), a globally common species (G5/SU).

Photos: C20, C21, and C22.

SSR3

Location: At the headwaters of Brush Creek, approximately 3.5 miles east of Douglas Pass. GPS Point: Zone 12, 0692744E, 4385800N.

Legal Description: USGS 7.5-minute quadrangle: Douglas Pass. T5S R101W Section 29 NW4 NW4.

Elevation: 8300 feet.

Dominant Plant Species and/or Associations: Near the spring source and downstream, along the springbrook, monkshood (*Aconitum columbianum*), Rock Mountain rush (*Juncus saximontanus*), toad rush (*J. bufonius*), fowl mannagrass (*Glyceria striata*), small-winged sedge (*Carex microptera*), and stinging nettle (*Urtica dioica*) were dominant.

General Description: This is a small spring located at the headwaters of Brush Creek on a west-facing slope nestled at the base of a very steep hillside. Other springs downstream contribute to base flow in Brush Creek but this particular spring is literally the headwaters for the creek. At the time of the site visit, flow appeared to be lower than normal as indicated by wetland vegetation growing in fairly dry areas. There are a few small beaver dams just downstream of the springs. Flow from the springs shortly infiltrates until the alluvium and does not resurface until the next spring downstream (SSR4). Douglas-fir (*Pseudotsuga menziesii*), snowberry (*Symphoricarpos* sp.), and subalpine fir (*Abies lasiocarpa*) are dominant in surrounding uplands and the area is in fairly good shape. This area is very remote.

Plant and Animal Species Observed: Plant species observed included monkshood, small-winged sedge, fowl mannagrass, Rocky Mountain rush, toad rush (*J. bufonius*), baneberry (*Actaea rubra* subsp. *arguta*), false-Solomon's seal (*Maianthemum stellatum*), common dandelion (*Taraxacum officinale*), stinging nettle, willowherb (*Epilobium* sp.), redtop (*Agrostis gigantea*), American brooklime (*Veronica americana*), large-leaved avens (*Geum macrophyllum*), and blue wildrye (*Elymus glauca*).

Numerous insects were observed in the area.

Natural Heritage Program Element Occurrences:

Table 9. Natural Heritage elements at SSR3.

Element	Common Name	Global Rank	State Rank
Mussel			
<i>Pisidium nitidum</i>	Shiny peaclam	G5	SU

This spring was not located within a CNHP Potential Conservation Area.

Ecological Functions: This wetland is in relatively good condition. Groundwater discharge is occurring on site and is hydrologically supporting Brush Creek via direct discharge to the creek channel (the spring serves as the headwaters and beginning of Brush Creek). The spring provides an excellent watering/feeding location for wildlife as signs of use by deer and/or elk were observed. Insects are abundant thus the area is providing food chain support. Nesting or cover habitat for birds is minimal as there is no shrub or tree cover supported by the spring, however the spring does provide a source of insects and water for birds to utilize. There didn't appear to be any fish in this reach of the creek. Despite low flow from the spring, soils were saturated and organic matter accumulation was high indicating that nutrient cycles are intact and that the area is likely providing some export of carbon and nutrients to downstream reaches of the creek.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition as all ecological processes are intact.

Nonnative and Aggressive Species: Common dandelion was present, but not overly abundant.

Restoration and Management Comments: The site was in good condition. The remote location and steepness of the area probably limits the amount of livestock grazing that occurs in the area.

Water Chemistry: Water pH was determined to be 9.1 near the source. This is a very high reading, which is may be reflective of the instrument used (we did not have the pH/Temp/Conductivity meter yet). Later comparisons of the pH meter used at this site determined that it might have been off up to 0.5, which is a large amount, but would still indicate that the spring is alkaline. Flow could not be determined using a drop weir due to rocky soil, however an ocular estimate was < 1/4 gallon per minute (GPM).

Macroinvertebrates: No snails were observed, however a mussel, shiny peaclam (*Pisidium nitidum*), was collected from sediments just downstream of the spring source.

Photos: C24, C25, C26, and C27.

SSR4

Location: At the headwaters of Brush Creek, approximately 3.5 miles east of Douglas Pass and just downstream from SSR3. GPS Point: Zone 12, 0692557E, 4385885N.

Legal Description: USGS 7.5-minute quadrangle: Douglas Pass. T5S R101W Section 29 NW4 NW4.

Elevation: 8300 feet.

Dominant Plant Species and/or Associations: Dominant plant species include fowl mannagrass (*Glyceria striata*), small-winged sedge (*Carex microptera*), blue wildrye (*Elymus glauca*), butterweed groundsel (*Senecio serra* var. *admirabilis*), and an unidentified fern and moss species.

General Description: This is a small spring located at the headwaters of Brush Creek on a northeast-facing slope, just downstream of SSR3. The spring is discharging directly out of exposed bedrock (thought to be the Green River shale formation). There was minimal wetland vegetation growing near the spring as most of this area consisted of exposed bedrock. However, further downstream along the springbrook vegetation growth was lush. Douglas-fir (*Pseudotsuga menziesii*), aspen (*Populus tremuloides*), snowberry (*Symphoricarpos* sp.), and subalpine fir (*Abies lasiocarpa*) are dominant in surrounding uplands. Groundwater discharge from this spring was much greater than upstream at SSR3. This area is very remote and is in good condition. A pack trail leads to the spring indicating that wildlife use this area regularly. There was no evidence of recent livestock grazing.

Plant and Animal Species Observed: Plant species observed included golden currant (*Ribes aureum*), monkshood (*Aconitum columbianum*), beaked sedge (*Carex utriculata*), small-winged sedge, fowl mannagrass, butterweed groundsel (*Senecio serra* var. *admirabilis*), Kentucky bluegrass (*Poa pratensis*), fringed brome (*Bromus ciliata*), common dandelion (*Taraxacum officinale*), bluebells (*Mertensia ciliata*), baneberry (*Actaea rubra* subsp. *arguta*), false-Solomon's seal (*Maianthemum stellatum*), stinging nettle (*Urtica dioica*), willowherb (*Epilobium* sp.), redtop (*Agrostis gigantea*), American brooklime (*Veronica americana*), large-leaved avens (*Geum macrophyllum*), and blue wildrye (*Elymus glauca*).

Numerous insects were observed in the area.

Natural Heritage Program Element Occurrences:

No elements tracked by the CNHP were documented at this site. This spring was not located within a CNHP Potential Conservation Area.

Ecological Functions: This wetland is in relatively good condition. Groundwater discharge is occurring on site and is hydrologically supporting Brush Creek via direct

discharge to the creek channel (the spring is contributing current base flow to Brush Creek). The spring provides an excellent watering/feeding location for wildlife as signs of use by deer and/or elk were observed. Insects are abundant thus the area is providing food chain support. Nesting or cover habitat for birds is minimal as there is no shrub or tree cover supported by the spring, however the spring does provide source of insects and water for birds to utilize. There didn't appear to be any fish in this reach of the creek, however characteristics of good fish habitat (woody debris, step pools, riffles, etc.) were present. Soils were saturated along the springbrook and organic matter accumulation was high indicating that nutrient cycles are intact and that the area is likely providing some export of carbon and nutrients to downstream reaches of the creek.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition as all ecological processes are intact.

Nonnative and Aggressive Species: Common dandelion and Kentucky bluegrass were present, but not overly abundant.

Restoration and Management Comments: The site was in good condition. The remote location and steepness of the area probably limits the amount of livestock grazing that occurs in the area.

Water Chemistry: Flow could not be measured with the drop weir as bedrock and rocky soil limited the depth at which the weir could be used. However, flow was calculated to be approximately 3/4 GPM by measuring the time it took for discharging groundwater to fill a 500 ml bottle. Water pH was determined to be 9.4 near the source. This is a very high reading, which is may be reflective of the instrument used (we did not have the pH/Temp/Conductivity meter yet). Later comparisons of the pH meter used at this site determined that it might have been off up to 0.5, which is a large amount, but would still indicate that the spring is alkaline.

Macroinvertebrates: No macroinvertebrates were observed.

Photos: C28, C29, C30, and C31.

SSR5

Location: At the headwaters of Roan Creek. GPS Point: No GPS point was taken due to inability to receive signal.

Legal Description: USGS 7.5-minute quadrangle: Calf Canyon. T5S R101W Section 24 SE4 SE4.

Elevation: 8500 feet.

Dominant Plant Species and/or Associations: Dominant plant species include mountain willow (*Salix monticola*), monkshood (*Aconitum columbianum*), small-winged sedge (*Carex microptera*), fowl mannagrass (*Glyceria striata*), and large-leaved avens (*Geum macrophyllum*).

General Description: This spring is located at the headwaters of Roan Creek on a northeast-facing slope. The spring is discharging from multiple locations in the area, all at the head of a steep drainage, which, along with other drainages in the area, form the headwaters of Roan Creek. However, groundwater discharge at the time of the site visit appeared to be below normal. Groundwater discharge is occurring on a very steep slope and appeared to be below normal during the time of the site visit, possibly due to lack of precipitation in recent weeks. This spring was once developed to supply livestock with a permanent water source. Remnants of piping and an old stock tank exist in the area, but neither are functional. The pipe is still imbedded in the bedrock but the stock tank is disassembled. The surrounding upland area is very steep and dominated by Douglas-fir (*Pseudotsuga menziesii*), and subalpine fir (*Abies lasiocarpa*). This area is very remote and is in relatively good condition. Livestock apparently still use the area but probably not as much relative to when the spring development structures were functional.

Plant and Animal Species Observed: Near the main source Rocky Mountain maple (*Acer glabrum*), red raspberry (*Rubus ideas*), monkshood, small-winged sedge, fowl mannagrass, and large-leaved avens were observed. Mountain willow occurred along the springbrook. Other plant species growing in the area include stinging nettle (*Urtica dioica*), blue wildrye (*Elymus glauca*), willowherb (*Epilobium* sp.), golden currant (*Ribes aureum*), bluebells (*Mertensia ciliata*), and elderberry (*Sambucus microbotrys*).

Numerous insects, small mammals, and birds were observed in the area. Also, fresh bear scat was observed near the spring.

Natural Heritage Program Element Occurrences:

No elements tracked by the CNHP were documented at this site. This spring was not located within a CNHP Potential Conservation Area.

Ecological Functions: This wetland is in relatively good condition. Groundwater discharge is occurring on site and is hydrologically supporting Roan Creek via direct

discharge to the creek channel. The area provides excellent wildlife habitat, especially as a water source. Various avian, butterfly, small mammals, and insect species were observed using the spring. The small stands of mountain willow were very active with bird activity (chickadees, yellow warbler, nuthatches, etc.). Hoof action from livestock is leading to minimum vegetation cover in some areas. This could potentially lead to erosion. Soils were saturated along the springbrook and organic matter accumulation was high indicating that nutrient cycles are intact and that the area is likely providing some export of carbon and nutrients to downstream reaches of the creek.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition as all ecological processes are intact. However, an increase in livestock use could detrimentally affect ecosystem processes.

Nonnative and Aggressive Species: None were observed.

Restoration and Management Comments: Removal of the imbedded pipe might reestablish groundwater discharge patterns in the area. Debris from the stock tank could also be removed as to not pose a hazard to livestock and/or wildlife. Currently, livestock have not degraded the site, but increased use will likely disrupt soils leading to a change in hydrology, decreased vegetation cover, altered nutrient cycles, and increased erosion.

Water Chemistry: Water chemistry and flow were not measured at this site due to a lack of sufficient flow.

Macroinvertebrates: No macroinvertebrates were observed.

Photos: C32, C33, and C34.

SSR6

Location: At the headwaters of an unnamed intermittent stream that drains into Bear Park Creek. An old dirt road, originating from the East Douglas Creek road, leads up to the spring. GPS Point: Zone 12, 0696895E, 4389233N.

Legal Description: USGS 7.5-minute quadrangle: Brushy Point. T5S R101W Section 10 SE4 SE4.

Elevation: 7600 feet.

Dominant Plant Species and/or Associations: Dominant plant species include Nebraska sedge (*Carex nebrascensis*), beaked sedge (*C. utriculata*), redtop (*Agrostis gigantea*), and creeping spikerush (*Eleocharis palustris*).

General Description: This area consists of a main spring and numerous seeps and is located in an open meadow on a bench above Bear Park Creek. There is a main source where groundwater discharge is heaviest, however numerous small seeps occur throughout the meadow. Aspen (*Populus tremuloides*) is scattered throughout the meadow and, along with Gambel's oak (*Quercus gambelii*), comprise the upland vegetation surrounding the area. The seeps and edges of the main spring wetland are heavily grazed. The interior portion of the main spring wetland is protected from overgrazing simply due to a dense thicket of willows.

Plant and Animal Species Observed: Near the main spring, mountain willow (*Salix monticola*), wild rose (*Rosa woodsii*), willowherb (*Epilobium* sp.), alkali crowfoot (*Ranunculus cymbalaria*), American brooklime (*Veronica americana*), creeping spikerush, beaked sedge, hardstem bulrush (*Schoenoplectus acutus*), fowl mannagrass (*Glyceria striata*), and brookgrass (*Catabrosa aquatica*) are common. Seeps are dominated by Nebraska sedge and redtop. Other plant species growing in the area include wild mint (*Mentha arvensis*), bull thistle (*Cirsium vulgare*), Canada thistle (*Cirsium arvense*), curly dock (*Rumex crispus*), meadow barley (*Hordeum brachyantherum*), and Kentucky bluegrass (*Poa pratensis*).

No signs of wildlife use, probably due to the persistent presence of livestock.

Natural Heritage Program Element Occurrences:

No elements tracked by the CNHP were documented at this specific location, however this spring is located within CNHP's **East Douglas Creek Potential Conservation Area**, which is ranked as a **B3** (High Significance) site (see Rocchio et al. 2001 and Lyon et al. 2001). This PCA contains an occurrence of the globally imperiled blue spruce/river birch montane riparian woodland (*Picea pungens/Betula occidentalis*; G2) and also contains some of the most intact and pristine seeps and springs observed in western Garfield County during the survey of 2000.

Ecological Functions: Some ecological functions, such as wildlife habitat and hydrological functions, have been disrupted from heavy grazing. Soil compaction and hummocks (caused by hoof action in wet areas) in the seeps and around the edge of the main spring could potentially alter hydrology and lead to erosion, increased sedimentation downstream, and dewatering of the wetlands. Nutrient cycles in the wetland have also likely been altered by heavy livestock use. Non-native species are abundant. It is probable that these wetlands are receiving an abundance of nitrogen via livestock excrement, which potentially could (or has) change plant species and macroinvertebrate composition of the spring wetlands. These seep/spring wetlands have high potential for excellent wildlife habitat under a different grazing regime.

Proper Functioning Condition Rating: This spring is rated as Functional At Risk (downward trend), as many ecological processes are disrupted by current land use.

Nonnative and Aggressive Species: Bull thistle, Canada thistle, curly dock, redtop, and Kentucky bluegrass are all abundant.

Restoration and Management Comments: Mountain willow is less tolerant of browsing pressure than other willow species, and they often form the characteristic "mushroom" shape when they are overgrazed (Hansen et al. 1995). The willows at this site were exhibiting this characteristic shape indicating that these areas are being overgrazed. The grazing regime might be altered to benefit the ecological health of the seep/spring wetlands by implementing deferred and rest rotation-grazing cycles appropriate for this site. Late summer and early fall grazing is not recommended for areas where willows occur, as willow species are vulnerable to pruning damage due to limited regrowth at the end of the growing season (Hansen et al. 1995). However, the area could be rested to allow the native vegetation to regain vigor. There is also an impounded pond downstream from the main spring source. Allowing livestock to use this area and fencing off the natural seep and spring wetlands may be another means to achieve proper functioning condition of the wetlands and maintain grazing in the area.

This spring was included in this report due to excellent restoration potential. The amount of groundwater being discharged in the area suggests that with proper management, these seeps and springs could support excellent habitat for birds, small and large mammals, insects, and biologically rich wetlands (plant species diversity is already fairly high).

Water Chemistry: Flow was determined to be < 1/4 GPM. Water pH was determined to be 8.6 near the source. This is a very high reading, which is may be reflective of the instrument used (we did not have the pH/Temp/Conductivity meter yet). Later comparisons of the pH meter used at this site determined that it might have been off up to 0.5, which is a large amount, but would still indicate that the spring is alkaline.

Macroinvertebrates: No macroinvertebrates were observed.

Photos: C35, C36, C37, D1, D2, and D3.

SSR7

Location: Along the northern side of upper East Douglas Creek, about 1/3 mile downstream of Windy Canyon. GPS Point: Zone 12, 0698796E, 4388920N.

Legal Description: USGS 7.5-minute quadrangle: Brushy Point. T5S R101W Section 13 NW4 NW4.

Elevation: 7400 feet.

Dominant Plant Species and/or Associations: Beaked sedge (*Carex utriculata*) is the dominant plant association. Other dominant herbaceous species include woolly sedge (*C. lanuginosa*), redtop (*Agrostis gigantea*), and alkali crowfoot (*Ranunculus cymbalaria*).

General Description: This spring discharges on an adjacent south-facing slope to East Douglas Creek (East Fork) near the headwaters of this drainage. The spring surfaces from beneath a large, exposed, Douglas-fir (*Pseudotsuga menziesii*) root near the top of the slope. The spring then flows down slope towards East Douglas Creek where the spring wetland widens before draining into the creek channel. Douglas-fir, serviceberry (*Amelanchier utahensis*), and Gambel's oak (*Quercus gambelii*) are common in the surrounding uplands. A pack trail passes near the source.

Plant and Animal Species Observed: Species present include beaked sedge, woolly sedge, redtop, field horsetail (*Equisetum arvense*), bull thistle (*Cirsium vulgare*), alkali crowfoot, and fowl mannagrass (*Glyceria striata*).

Numerous butterflies, including fritillary and crescents (Family *Nymphalidae*), whites and sulphurs (Family *Pieridae*), skippers (Family *Hesperiidae*), and swallowtails (Family *Papilionidae*), were observed in the area.

Natural Heritage Program Element Occurrences:

Table 10. Natural Heritage elements at SSR7.

Element	Common Name	Global Rank	State Rank	EO Rank	Federal and State Status
Plant Communities					
<i>Carex utriculata</i>	Beaked sedge montane wet meadows	G5	S4	C	

Beaked sedge montane wet meadows are common along the border of beaver ponds, lakes, and slow-moving streams. The community often indicates that the water table is at or near the soil surface for most of the growing season. This occurrence is rated a "C" due to its small size and is in otherwise good condition.

This spring is located within CNHP's **East Douglas Creek Potential Conservation Area**, which is ranked as a **B3** (High Significance) site (see Rocchio et al. 2001 and Lyon et al. 2001). This PCA contains an occurrence of the globally imperiled blue spruce/river

birch montane riparian woodland (*Picea pungens*/*Betula occidentalis*; G2) and also contains some of the most intact and pristine seeps and springs observed in western Garfield County during the course of this survey.

Ecological Functions: Overall, this wetland is in relatively good condition. Groundwater discharge is occurring on site and is hydrologically contributing to the flow of East Douglas Creek via seepage to the creek channel. A permanent water source and allochthonous organic substrates provide various sources of carbon (both dissolved and particulate) and nutrients for downstream ecosystems. There was some evidence of hoof action near the source, indicating a potential for soil disturbance resulting in erosion and altered hydrology. Currently, the spring wetland is providing good bank stabilization functions. Herbaceous vegetation offers forage for larger mammals and habitat for numerous invertebrates. The spring does not provide fish habitat, as the amount of water flowing within a defined channel is limited.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition as all ecological processes are intact.

Nonnative and Aggressive Species: Bull thistle was present, but did not appear to be displacing native species at this time. Additionally, the butterflies were observed using the plant for nectar. However, if this species spreads it should be eradicated from the site.

Restoration and Management Comments: Considering the proximity of the pack trail to the source and the fact that vegetation in this area appeared to be disturbed from trampling, consideration should be given to fencing off this particular area. The actual spring wetland was not affected by trampling, probably due to the steepness of the slope in which the wetland occurs.

Water Chemistry: Flow was determined to be 1/2 GPM using the drop weir. Water pH was determined to be 8.7 near the source. This is a very high reading, which is may be reflective of the instrument used (we did not have the pH/Temp/Conductivity meter yet). Later comparisons of the pH meter used at this site determined that it might have been off up to 0.5, which is a large amount, but would still indicate that the spring is alkaline.

Macroinvertebrates: No macroinvertebrates were collected at this site as none were observed.

Photos: D4, D5, and D6.

SSR8

Location: On a bench high above the north side of East Douglas Creek (East Fork). It is located upslope and upstream of SSR7. GPS Point: Zone 12, 0698934E, 4389184N.

Legal Description: USGS 7.5-minute quadrangle: Brushy Point. T5S R101W Section 13 NW4 NW4.

Elevation: 7700 feet.

Dominant Plant Species and/or Associations: Beaked sedge (*Carex utriculata*) and Nebraska sedge (*C. nebrascensis*) are the dominant plant associations.

General Description: Numerous springs discharge along a long, sloping, south-facing bench approximately 300 feet above East Douglas Creek. The springs discharge throughout the length of the slope and many have been impounded to provide water for livestock. A small drainage flows out of the lowermost impoundment and flows down slope toward East Douglas Creek. Beaked and Nebraska sedge, hardstem bulrush (*Schoenoplectus acutus*), and alkali crowfoot (*Ranunculus cymbalaria*) occupy the fringe of the impoundments. Upland vegetation consists of Douglas-fir (*Pseudotsuga menziesii*), serviceberry (*Amelanchier utahensis*), and Gambel's oak (*Quercus gambelii*).

Plant and Animal Species Observed: Species present include beaked sedge, Nebraska sedge, redtop (*Agrostis gigantea*), field horsetail (*Equisetum arvense*), bull thistle (*Cirsium vulgare*), alkali crowfoot, monkshood (*Aconitum columbianum*), white panicle aster (*Aster lanceolatus* subsp. *hesperius*), western mountain aster (*Aster spathulatus*), horsemint (*Monarda fistulosa*), Baltic rush (*Juncus balticus*), Rocky Mountain rush (*J. saximontanus*), hardstem bulrush, meadow barley (*Hordeum brachyantherum*), and houndstongue (*Cynoglossum officinale*).

Numerous insects, such as dragonflies, damselflies, water striders, water boatmen, butterflies (Wood nymphs, Skippers, etc.) were observed in the area. Aquatic snails (*Physa* sp.) and tiger salamander larvae were also observed in the impoundments.

Natural Heritage Program Element Occurrences:

Table 11. Natural Heritage elements at SSR8.

Element	Common Name	Global Rank	State Rank	EO Rank	Federal and State Status
Plant Communities					
<i>Carex utriculata</i>	Beaked sedge montane wet meadows	G5	S4	C	
Snails					
<i>Physa sp.</i>	Aquatic snails	GU	SU	E	

Beaked sedge montane wet meadows are common along the border of beaver ponds, lakes, and slow-moving streams. The community often indicates that the water table is at or near the soil surface for most of the growing season. This occurrence is rated a "C" due to its small size and is in otherwise good condition. *Physa* needs a lot of systematic revision, which is in progress. Until then all Colorado *Physa* are recognized only to genus (Guralnick, personal communication).

This spring is located within CNHP's **East Douglas Creek Potential Conservation Area**, which is ranked as a **B3** (High Significance) site (see Rocchio et al. 2001 and Lyon et al. 2001). This PCA contains an occurrence of the globally imperiled blue spruce/river birch montane riparian woodland (*Picea pungens/Betula occidentalis*; G2) and also contains some of the most intact and pristine seeps and springs observed in western Garfield County during the course of this survey.

Ecological Functions: Many of the wetlands have been artificially increased in extent due to the construction of the impoundments. Thus, many natural ecological functions have been altered. Nutrient cycles have been altered from transformations that typically occur in wetlands with flowing water to those that commonly occur in under stagnant inundation (the latter is more anaerobic). Groundwater discharge is occurring on site but is artificially being contained. Water, carbon, and nutrients that would normally be flowing downstream and supporting associated wetlands are now contained. These impoundments appear to be supporting healthy populations of invertebrates and amphibians although they are most likely different species than prior to the construction of the impoundments.

Proper Functioning Condition Rating: This spring is rated as Functional At Risk (downward trend) since the impoundments have greatly altered the aquatic environment from one in which organisms were dependent on flowing, aerated water to an environment dominated by slow moving, stagnant water. If considered under current conditions, the spring would receive a Proper Functioning Condition rating, but it is important to consider the natural context of this wetland and the ecological changes that have likely resulted from the construction of multiple impoundments.

Nonnative and Aggressive Species: Bull thistle, houndstongue, and redtop were present, but their abundance was not great enough to be displacing native species at this time.

However, populations of these species should be closely monitored to ensure that they do not spread.

Restoration and Management Comments: Although removal of the berms, and thus the impoundments, would likely drain some of the existing wetlands, it would restore natural hydrological patterns in the area and potentially allow species more typically of spring environments, especially macroinvertebrates, to reestablish.

Water Chemistry: Flow from the source was a seep and did not have visible discharge. However, there was ample flow discharging from some of the impoundments. Water pH was determined to be 7.8 near the main or highest source. Later comparisons of the pH meter used at this site determined that it might have been off up to 0.5, which is a large amount, but would still indicate that the spring is alkaline.

Macroinvertebrates: An aquatic snail (*Physa* sp.) was collected from the lowermost impoundment. Many individuals were present. *Physa* needs a lot of systematic revision, which is in progress. Until then all Colorado *Physa* are recognized only to genus (Guralnick, personal communication).

Photos: D7, D8, D9, D10, D11, D12, and D13.

SSR9

Location: Along the northern side of upper East Douglas Creek, just downstream of Windy Canyon. GPS Point: Zone 12, 0699110E, 4389010N.

Legal Description: USGS 7.5-minute quadrangle: Brushy Point. T5S R101W Section 13 NE4 NW4.

Elevation: 7400 feet.

Dominant Plant Species and/or Associations: Narrowleaf cottonwood (*Populus angustifolia*) is the dominant overstory species while beaked sedge (*Carex utriculata*) is dominant near the spring sources and springbrooks.

General Description: There are multiple springs that discharge from a south-facing slope in the area. The springs emerge directly out of bedrock (assumed to be the Green River shale formation), form small herbaceous wetlands (mainly beaked sedge), then either infiltrate into the soil or drain directly into the creek. Upland vegetation consists of Douglas-fir (*Pseudotsuga menziesii*), aspen (*Populus tremuloides*) and Gambel's oak (*Quercus gambelii*). There is a unique stand of mature narrowleaf cottonwoods that has established at the base of a large shale cliff, where many small springs had or were emerging. The stand is linear, extensive, and obviously delineates former locations of numerous springs. The soils in these cottonwood areas were fairly dry, indicating that groundwater discharge no longer occurs in the area. However, the cottonwoods probably established during a period when springs did emerge from those areas.

Plant and Animal Species Observed: Species present include narrowleaf cottonwood, river birch (*Betula occidentalis*), blue spruce (*Picea pungens*), beaked sedge, Nebraska sedge (*Carex nebrascensis*), fowl mannagrass (*Glyceria striata*), Kentucky bluegrass (*Poa pratensis*), false-Solomon's seal (*Maianthemum stellatum*), bull thistle (*Cirsium vulgare*), alkali crowfoot (*Ranunculus cymbalaria*), monkshood (*Aconitum columbianum*), western mountain aster (*Aster spathulatus*), Baltic rush (*Juncus balticus*), and houndstongue (*Cynoglossum officinale*).

Natural Heritage Program Element Occurrences:

Table 12. Natural Heritage elements at SSR9.

Element	Common Name	Global Rank	State Rank	EO Rank	Federal and State Status
Plant Communities					
<i>Carex utriculata</i>	Beaked sedge montane wet meadows	G5	S4	C	

Beaked sedge montane wet meadows are common along the border of beaver ponds, lakes, and slow-moving streams. The community often indicates that the water table is at or near the soil surface for most of the growing season. This occurrence is rated a "C" due to its small size and is in otherwise good condition.

This spring is located within CNHP's **East Douglas Creek Potential Conservation Area**, which is ranked as a **B3** (High Significance) site (see Rocchio et al. 2001 and Lyon et al. 2001). This PCA contains an occurrence of the globally imperiled blue spruce/river birch montane riparian woodland (*Picea pungens/Betula occidentalis*; G2) and also contains some of the most intact and pristine seeps and springs observed in western Garfield County during the course of this survey.

Ecological Functions: Overall, this wetland is in good condition. Groundwater discharge is occurring on site and is contributing to the flow of East Douglas Creek via seepage to the creek channel. Permanent groundwater discharge and subsequent organic matter accumulation produces dissolved organic carbon sources that eventually make their way downstream and provide carbon for macroinvertebrates and nutrients for plant growth. Currently, the spring wetland is providing good bank stabilization functions. Herbaceous vegetation offers forage for larger mammals and habitat for numerous invertebrates. The tree canopy, plus the presence of permanent water provide excellent habitat for birds. The spring does not provide fish habitat.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition as current ecological processes are intact.

Nonnative and Aggressive Species: Bull thistle, houndstongue, and Kentucky bluegrass were present, but their abundance was not great enough to be displacing native species at this time. However, populations of these species should be closely monitored to ensure that they do not spread.

Restoration and Management Comments: The site was in good condition. The remote location and alkalinity of the spring water probably limits the amount of livestock grazing that occurs in the area.

Water Chemistry: Flow was determined from the main source (identified by the spring which had the greatest flow) to be 2.5 GPM. Water pH was determined to be 8.5 near the main source. This is a very high reading, which is may be reflective of the instrument used (we did not have the pH/Temp/Conductivity yet). Later comparisons of the pH used at this site determined that it might have been off up to 0.5, which is a large amount, but would still indicate that the spring is alkaline.

Macroinvertebrates: No macroinvertebrates were observed in the wetland.

Photos: D14, D15, D16, D17, D18, D19, and D20.

SSR10

Location: On a bench above the northeast side of East Douglas Creek down stream of SSR7 and upstream of the confluence with Bear Park Creek. GPS Point: Zone 12, 0698602E, 4389019N.

Legal Description: USGS 7.5-minute quadrangle: Brushy Point. T5S R101W Section 14 NE4 NE4.

Elevation: 7300 feet.

Dominant Plant Species and/or Associations: Baltic rush (*Juncus balticus*) occupies mesic meadows while beaked sedge (*Carex utriculata*) occupies wetter areas. Redtop (*Agrostis gigantea*) is also quite common.

General Description: The spring emerges from exposed bedrock (assumed to be Green River shale formation) and forms a mosaic of wet meadows, with scattered narrowleaf cottonwood (*Populus angustifolia*) and blue spruce (*Picea pungens*), on a southwest-facing bench above East Douglas Creek before draining down into the creek channel. The spring was not flowing at the time of the site visit, but many areas were still saturated. Surrounding uplands consisted of pinyon-juniper (*Pinus edulis-Juniperus* sp.) woodlands.

Plant and Animal Species Observed: Species present include narrowleaf cottonwood, blue spruce, beaked sedge, woolly sedge (*Carex lanuginosa*), redtop, willowherb (*Epilobium* sp.), rush, Rocky Mountain rush (*Juncus saximontanus*), and bull thistle (*Cirsium vulgare*).

Natural Heritage Program Element Occurrences:

Table 13. Natural Heritage elements at SSR10.

Element	Common Name	Global Rank	State Rank	EO Rank	Federal and State Status
Plant Communities					
<i>Carex utriculata</i>	Beaked sedge montane wet meadows	G5	S4	C	
<i>Juncus balticus</i> var. <i>balticus</i>	Wet meadow	G5	S5	C	

Beaked sedge montane wet meadows are common along the border of beaver ponds, lakes, and slow-moving streams. The community often indicates that the water table is at or near the soil surface for most of the growing season. Baltic rush is a common plant association that often increases in abundance with increased disturbance. Both of these occurrences are rated "C" due to their small size and are otherwise in good condition.

This spring is located within CNHP's **East Douglas Creek Potential Conservation Area**, which is ranked as a **B3** (High Significance) site (see Rocchio et al. 2001 and Lyon

et al. 2001). This PCA contains an occurrence of the globally imperiled blue spruce/river birch montane riparian woodland (*Picea pungens/Betula occidentalis*; G2) and also contains some of the most intact and pristine seeps and springs observed in western Garfield County during the course of this survey.

Ecological Functions: Overall, this wetland is in good condition. Groundwater discharge is occurring on site and is contributing to the flow of East Douglas Creek via seepage to the creek channel. Semi-permanent groundwater discharge and subsequent organic matter accumulation produces dissolved organic carbon sources that eventually make their way downstream and provide carbon for macroinvertebrates and nutrients for plant growth. Currently, the spring wetland is providing good bank stabilization functions and provides temporary surface water storage in the small depression dominated by beaked sedge. Herbaceous vegetation offers forage for larger mammals and habitat for numerous invertebrates. The sporadic tree canopy, plus the presence of semi-permanent water provides good habitat for birds. The spring does not provide fish habitat.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition as current ecological processes are intact.

Nonnative and Aggressive Species: Bull thistle is present, but its abundance does not appear great enough to be displacing native species at this time. However, populations of this species should be closely monitored to ensure that they do not spread. Redtop was very abundant and is displacing native grasses and forbs from the area.

Restoration and Management Comments: The site was in good condition, except for the abundance of redtop and presence of bull thistle. Measure should be taken to control and eradicate these two species.

Water Chemistry: Although most of the area was saturated, there was no definable flow from the spring. However, it was obvious that typically groundwater discharges from the exposed bedrock. Water pH was determined to be 8.0 near the main source. Later comparisons of the pH meter used at this site determined that it might have been off up to 0.5, which is a large amount, but would still indicate that the spring is alkaline.

Macroinvertebrates: No macroinvertebrates were observed in the wetland.

Photos: D21, D22, and D23.

SSR11

Location: On a bench at the head of an unnamed tributary to East Salt Creek. GPS Point: Zone 12, 0696411E, 4371133N.

Legal Description: USGS 7.5-minute quadrangle: Brushy Point. T7S R102W Section 12 N2 SW4 and S2 NW4.

Elevation: 7100 feet.

Dominant Plant Species and/or Associations: Baltic rush (*Juncus balticus*) and western wheatgrass (*Pascopyrum smithii*) occupy mesic meadows while creeping spikerush (*Eleocharis palustris*) occupies wet areas around the small impoundments.

General Description: Numerous seeps support a large wet meadow on bench that lies at the head of an unnamed tributary to East Salt Creek. There are a few impoundments or small, excavated areas that retain discharging groundwater seasonally. Most of the area was dry during the site visit. The extent of the meadows was impressive, and was one of the largest seep/spring wetlands observed during the course of this project (the other being SSR12). The presence of a historic cabin near the seeps suggests that this area provides a fairly reliable source of water, at least seasonally.

Plant and Animal Species Observed: Species present include Baltic rush, field clustered sedge (*Carex praegracilis*), creeping spikerush, bull thistle (*Cirsium vulgare*), Kentucky bluegrass (*Poa pratensis*), western wheatgrass, and foxtail barley (*Hordeum jubatum*).

Natural Heritage Program Element Occurrences:

Table 14. Natural Heritage elements at SSR11.

Element	Common Name	Global Rank	State Rank	EO Rank	Federal and State Status
Plant Communities					
<i>Eleocharis palustris</i>	Emergent wetland	G5	S4	C	
<i>Juncus balticus</i> var. <i>balticus</i>	Wet meadow	G5	S5	C	

The creeping spikerush plant association is a conspicuous, common, emergent association that occurs in shallow, mostly still water. Most of the sites where it occurs experience water levels that fluctuate to some degree throughout the growing season. Baltic rush is a common plant association that often increases in abundance with increased disturbance. Both of these occurrences are rated "C" due to their small size and are otherwise in good condition. This spring was not located within a CNHP Potential Conservation Area.

Ecological Functions: Overall, this wetland is in good condition. Groundwater discharge and surface water storage is occurring on site. Nutrient cycles appear to be

intact. The wetland likely provides forage for wildlife, although both creeping spikerush and Baltic rush are not very palatable.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition as current ecological processes are intact.

Nonnative and Aggressive Species: Bull thistle and Kentucky bluegrass are present. Populations of these species should be closely monitored to ensure that they do not spread. Need more information regarding the impoundments on site and how they may be affecting natural hydrological patterns.

Restoration and Management Comments: The site was in good condition. It is possible that western wheatgrass was more prevalent than its current population and has been displaced by Baltic rush as a result of the effects of long-term grazing, as Baltic rush generally increases with increased disturbance. However, Baltic rush is a native species and there was no evidence of recent, improper grazing, thus it is difficult to determine whether this stand is grazing induced. More information is needed on the historical land use of this area.

Water Chemistry: Water chemistry or flow was not measured at this seep, as there was no standing or flowing water from which to collect data.

Macroinvertebrates: No macroinvertebrates were observed in the wetland.

Photos: D24 and D25.

SSR12

Location: Along the southeast side of Pedigo Gulch. GPS Point: Zone 12, 0724256E, 4361470N.

Legal Description: USGS 7.5-minute quadrangle: The Saddle. T8S R99W Section 11 SW4 NE4.

Elevation: 6400 feet.

Dominant Plant Species and/or Associations: Baltic rush (*Juncus balticus*) and alkali sacaton (*Sporobolus airoides*) occupy most of the area while alkali bulrush (*Scirpus maritimus*) is dominant in wet areas around the small impoundment.

General Description: There are many springs, that typically have flowing water but did not during the site visit, scattered about the area. Most of the area consists of wet meadow vegetation, however there is an impoundment that has alkali bulrush growing around the fringe. The two, uppermost springs were dominated by cattail (*Typha latifolia*) and Russian olive (*Elaeagnus angustifolia*). The plant species growing in the wetland and the presence of a thick deposit of salt crusts encrusted on woody debris near one of the springs and on the soil surface near the impoundment, indicate that the local soils are saline. There was no evidence of livestock grazing, possibly due to the extreme salinity of the area. Upland areas are dominated by pinyon-juniper (*Pinus edulis-Juniperus* sp.) and sagebrush (*Artemisia* sp.).

Plant and Animal Species Observed: Species present include Baltic rush, alkali sacaton, alkali bulrush, gumweed (*Grindelia integrifolia*), cocklebur (*Xanthium strumarium*), foxtail barley (*Hordeum jubatum*), tamarisk (*Tamarix ramosissima*), goosefoot (*Chenopodium berlandieri*), creeping spikerush (*Eleocharis palustris*), unidentified sedge (*Carex* sp.), yellow sweetclover (*Melilotus officinale*), cattail, and Russian olive.

Natural Heritage Program Element Occurrences:

Table 15. Natural Heritage elements at SSR12.

Element	Common Name	Global Rank	State Rank	EO Rank	Federal and State Status
Plant Communities					
<i>Juncus balticus</i> var. <i>balticus</i>	Wet meadow	G5	S5	C	

Baltic rush is a common plant association that often increases in abundance with increased disturbance. This occurrence is rated "C" due to their small size and are otherwise in good condition. This spring was not located within a CNHP Potential Conservation Area.

Ecological Functions: Overall, this wetland is in good condition. Groundwater discharge and surface water storage are occurring on site. Nutrient cycles appear to be intact. The wetland likely provides some forage for wildlife, although many of the species present are not very palatable to livestock. The area supports a healthy population of invertebrates.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition as current ecological processes are intact.

Nonnative and Aggressive Species: Yellow sweetclover, tamarisk, Russian olive, and goosefoot are present in relative abundance. Need more information regarding the impoundments on site and how they may be affecting natural hydrological patterns.

Restoration and Management Comments: The site was in good condition except for the prevalence of non-native species. Efforts should be given to eradicating the tamarisk, yellow sweetclover, and Russian olive as soon as possible. These species, especially tamarisk, have the potential to quickly displace native species and alter ecosystem functions.

Water Chemistry: Water flow was not measured at this site, as there was no standing or flowing water from which to collect data. Water pH was determined to be 8.4 from standing water in the impoundment. Later comparisons of the pH meter used at this site determined that it might have been off up to 0.5, which is a large amount, but would still indicate that the spring is alkaline. Although not measured, conductivity was assumed to be high based on the salt crusts in the area.

Macroinvertebrates: No macroinvertebrates were observed in the wetland.

Photos: D26, D27, and D28. Also, the cover photo of this report is of SSR12.

SSR13

Location: West of Pedigo Gulch and is shown on quadrangle maps as Willow Spring. GPS Point: Zone 12, 0722663E, 43604499N.

Legal Description: USGS 7.5-minute quadrangle: Winter Flats. T8S R99W Section 10 SW4 SE4.

Elevation: 6700 feet.

Dominant Plant Species and/or Associations: Sandbar willow (*Salix exigua*), skunkbrush (*Rhus trilobata*), and tamarisk (*Tamarix ramosissima*) dominate the springbrook while Baltic rush (*Juncus balticus*) is dominant in the wet meadow.

General Description: The spring was not flowing and soils were very dry during the site visit. A stock tank exists down slope from the spring but did not contain any water. The plant species growing in the wetland indicate that the local soils and discharging groundwater are saline. There was no evidence of livestock grazing, possibly due to the extreme salinity of the area. Upland areas are dominated by pinyon-juniper (*Pinus edulis-Juniperus* sp.) while Gambel's oak (*Quercus gambelii*) is present near the drainages.

Plant and Animal Species Observed: Species present include Baltic rush, sandbar willow, skunkbrush, tamarisk, alkali sacaton (*Sporobolus airoides*), gumweed (*Grindelia integrifolia*), Kentucky bluegrass (*Poa pratensis*), foxtail barley (*Hordeum jubatum*), showy milkweed (*Asclepias speciosa*), whorled milkweed (*A. subverticillata*), goldenrod (*Solidago canadensis*), wild rose (*Rosa woodsii*), greasewood (*Sarcobatus vermiculatus*), and blue lettuce (*Lactuca pulchella*).

Natural Heritage Program Element Occurrences:

No elements tracked by the CNHP were documented at this site. This spring was not located within a CNHP Potential Conservation Area.

Ecological Functions: Overall, this wetland is in good condition. Groundwater discharge is occurring on site. Nutrient cycles appear to be intact. The wetland likely provides some forage for wildlife, although many of the species present are not very palatable to livestock, and provides a periodic source of water.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition as current ecological processes are intact.

Nonnative and Aggressive Species: Tamarisk is present in relative abundance.

Restoration and Management Comments: The site was in good condition except for the presence of tamarisk. Efforts should be given to eradicating this species as soon as

possible as it has the potential to quickly displace native species and alter ecosystem functions.

Water Chemistry: Water chemistry and flow were not measured at this site, as there was no standing or flowing water from which to collect data. Although salinity was assumed to be high based on the vegetation growing in the area.

Macroinvertebrates: No macroinvertebrates were observed in the wetland.

Photos: D31, D32, D33, and D34.

SSR14

Location: At the base of a north-facing slope on the south side of East Salt Creek, just downstream from Bear Canyon. GPS Point: Zone 12, 0696249E, 4374344N.

Legal Description: USGS 7.5-minute quadrangle: Garvey Canyon. T6S R102W Section 36 SE4 NW4.

Elevation: 6100 feet.

Dominant Plant Species and/or Associations: Baltic rush (*Juncus balticus*), sea-blite (*Suaeda calceoliformis*), greasewood (*Sarcobatus vermiculatus*), hardstem bulrush (*Schoenoplectus acutus*), and alkali crowfoot (*Ranunculus cymbalaria*) are dominant near the springs.

General Description: There are numerous springs (a total of four) that discharge from the base of the north-facing slope. These spring wetlands were saturated and some locations had standing water, but all appeared to be drier than normal. A ditch exists between the springs and the road, carrying water from East Salt Creek downstream to horse pastures. At the time of the site visit, discharging groundwater only flowed for a few meters before it infiltrated back into the soil never reaching the ditch. There is heavy grazing in the area with lots of hoof action apparent in the spring wetlands. Upland areas are dominated by pinyon-juniper (*Pinus edulis-Juniperus* sp.) and serviceberry (*Amelanchier utahensis*) while sagebrush (*Artemisia* sp.) and giant wildrye (*Leymus cinereus*) occur on the bottomland flats between the adjacent slopes and East Salt Creek.

Plant and Animal Species Observed: Species present include Baltic rush, sea-blite, greasewood, alkali crowfoot, tamarisk (*Tamarix ramosissima*), hardstem bulrush, alkali bulrush (*Scirpus maritimus*), salt grass (*Distichlis spicata*), skunkbrush (*Rhus trilobata*), box elder (*Acer negundo*), Russian olive (*Elaeagnus angustifolia*), cocklebur (*Xanthium strumarium*), foxtail barley (*Hordeum jubatum*), clustered field sedge (*Carex praegracilis*), alkaligrass (*Puccinellia airoides*), chicory (*Cichorium intybus*), and red clover (*Trifolium pratense*).

A northern leopard frog and damselflies were observed in the spring wetlands.

Natural Heritage Program Element Occurrences:

Table 16. Natural Heritage elements at SSR14.

Element	Common Name	Global Rank	State Rank	EO Rank	Federal and State Status
Amphibians					
<i>Rana pipiens</i>	Northern leopard frog	G5	S3	E	FS/BLM, SC

This spring was not located within a CNHP Potential Conservation Area.

Ecological Functions: Overall, this wetland is in relatively good condition. Groundwater discharge is occurring on site and, during times of normal or higher groundwater discharge is likely hydrologically supporting East Salt Creek via seepage to the creek channel. There is evidence of hoof action (small pits or hummocks scattered throughout the wetland) from livestock indicating a potential for soil disturbance resulting in erosion, altered hydrology, and altered nutrient cycles. However, a return visit during June 2001 showed that the area was functioning properly. The rancher who runs cattle in this area apparently is resting this area, and likely others upstream, during 2001 to "allow the grass to grow back". This type of management will maintain ecological conditions and allow this spring to continue to function properly. The shrubs provide good habitat for birds and the herbaceous vegetation offers forage for larger mammals. The spring also supports many insects and thereby provides food chain support. The spring does not provide fish habitat, but does support amphibians.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition as current ecological processes are mostly intact.

Nonnative and Aggressive Species: Tamarisk, Russian olive, chicory, and red clover are present in relative abundance.

Restoration and Management Comments: The grazing regime might be altered to benefit the ecological health of the seep/spring wetlands by implementing deferred and rest rotation-grazing cycles appropriate for this site. The area should be rested to allow the native vegetation to regain vigor. The ditch could also be removed to reestablish natural hydrological flow from the springs to the creek. This would also maximize the natural extent of the spring wetlands.

Water Chemistry: Water flow was determined to be < 1/4 GPM. Water chemistry was as follows:

pH: 7.98
Conductivity: 2030 μ S/cm
Temperature: 28.6 C

Macroinvertebrates: No macroinvertebrates were observed in the wetland.

Photos: E5, E6, and E7.

SSR15

Location: Along Barrel Spring Creek and is indicated on the quadrangle map as Barrel Spring. GPS Point: Zone 12, 06968825E 4380572N.

Legal Description: USGS 7.5-minute quadrangle: Calf Canyon. T6S R102W Section 12 SE4 NE4.

Elevation: 6400 feet.

Dominant Plant Species and/or Associations: Nebraska sedge (*Carex nebrascensis*) is the dominant plant association while Baltic rush (*Juncus balticus*) and hardstem bulrush (*Schoenoplectus acutus*) are also very abundant. Hornwort (*Ceratophyllum demersum*) is the dominant aquatic plant near the spring and along the springbrook.

General Description: This spring discharges on an east-facing bench just above Barrel Spring Creek. The spring was flowing and did not appear to be affected by recent lack of precipitation as other springs visited in the area were. Discharging groundwater flows along a well-defined springbrook for approximately 20 meters before draining over a small ledge into the creek. This spring is obviously permanent and has been discharging in this same location for a long time as indicated by the accumulation of peat (approximately a seven inch layer) within the springbrook channel. This is unusual, as no other spring encountered during this project had an organic (peat) soil horizon. Upland vegetation consists of Douglas-fir (*Pseudotsuga menziesii*), serviceberry (*Amelanchier utahensis*), and Gambel's oak (*Quercus gambelii*). A sagebrush (*Artemisia* sp.) shrubland surrounds the spring wetland and is heavily grazed. There used to be fencing around the spring and springbrook but it is no longer standing and no longer precludes livestock from the wetland.

Plant and Animal Species Observed: Species present include Nebraska sedge, Baltic rush, foxtail barley (*Hordeum jubatum*), spikerush (*Eleocharis* sp.), goosefoot (*Chenopodium* sp.), curly dock (*Rumex crispus*), alkali crowfoot (*Ranunculus cymbalaria*), hardstem bulrush, wild licorice (*Glycyrrhiza lepidota*), and bull thistle (*Cirsium vulgare*).

Natural Heritage Program Element Occurrences:

Table 17. Natural Heritage elements at SSR15.

Element	Common Name	Global Rank	State Rank	EO Rank	Federal and State Status
Plant Communities					
<i>Carex nebrascensis</i>	Nebraska sedge spring wetland	G4	S3	C	
Snails					
<i>Lymnaea elodes</i>	Marsh pondsnail	G5	SU	E	

Nebraska sedge is a common, but declining association that is threatened by improper livestock grazing, hydrological alterations, and heavy recreational use. It forms open meadows near seeps and springs and along the margins of stream banks and lakes. This occurrence is rated a "C" due to its small size and is in otherwise good condition. This spring was not located within a CNHP Potential Conservation Area.

Ecological Functions: Overall, this wetland is in fair condition due to overgrazing. The topography of the springbrook is laden with hummocks resulting from excessive hoof action. The potential for erosion of the organic soil horizon and subsequent draining of portions of the spring wetland is high. Nutrient cycles have also likely been altered due to soil disturbance. Permanent groundwater discharge and subsequent organic matter accumulation produces dissolved organic carbon sources that eventually make their way downstream and provide carbon for macroinvertebrates and nutrients for plant growth.

Proper Functioning Condition Rating: This spring is rated as Functional At Risk (with a downward trend) as current ecological processes have been disrupted from improper grazing.

Nonnative and Aggressive Species: Bull thistle is present, but its abundance was not great enough to be displacing native species at this time. However, populations of this species should be closely monitored to ensure that it does not spread.

Restoration and Management Comments: This is a unique spring wetland due to the organic soil horizon (peat layer) that has accumulated along the springbrook. No other seep or spring visited during the course of this project had similar organic matter accumulation. Peat formation in high elevation regions of Colorado occurs on the order of 8-30 cm/1000 years (Cooper and MacDonald 2000). Thus, the loss of these unique soils would require thousands of years to restore. Efforts should be taken immediately to repair the fencing around the spring and springbrook to protect the wetland from further degradation.

Water Chemistry: Water flow was determined to be 3/4 GPM. Water chemistry was as follows:

pH: 7.58
Conductivity: 1560 μ S/cm
Temperature: 14.7 C

Macroinvertebrates: Snails were collected from aquatic vegetation near the spring source. They were determined to be marsh pond snails (*Lymnaea elodes*), a globally common species (G5/SU).

Photos: E8, E9, and E10.

SSR16

Location: On an east-facing bench approximately 200 feet above the creek on the west side of Corral Canyon. The spring is shown on the quadrangle map as small pond. GPS Point: Was not able to receive a signal.

Legal Description: USGS 7.5-minute quadrangle: Calf Canyon. T6S R101W Section 9 S2 SE4.

Elevation: 7200 feet.

Dominant Plant Species and/or Associations: Hornwort (*Ceratophyllum demersum*) is the dominant aquatic plant in the pond while hardstem bulrush (*Schoenoplectus acutus*) is the dominant plant association around the pond border. Nebraska sedge (*Carex nebrascensis*) and Baltic rush (*Juncus balticus*) are also abundant around the pond.

General Description: This spring wetland consists of a small pond that has formed on a bench above the main drainage in Corral Canyon. The spring originates on an adjacent slope and drains into the pond. There was no flowing water from the spring during the site visit. Along the margins of the pond, where hardstem bulrush was dominant, large quantities of organic matter has accumulated throughout the soil profile to a depth of 14 inches, indicating that this pond has existed for a long time. Beneath this organic rich A-horizon (did not believe this was an organic, or histic, horizon), was an abrupt transition to a sandy clay layer. The entire area was heavily grazed as indicated by heavy hoof action throughout the margin of the wetland and in the surrounding uplands. Gambel's oak (*Quercus gambelii*) and Douglas-fir (*Pseudotsuga menziesii*) are the dominant overstory species in the uplands.

Plant and Animal Species Observed: Plant species present include hornwort, hardstem bulrush, Nebraska sedge, Baltic rush, bull thistle (*Cirsium vulgare*), river birch (*Betula occidentalis*), alkali crowfoot (*Ranunculus cymbalaria*), foxtail barley (*Hordeum jubatum*), wild rose (*Rosa woodsii*), and mare's tail (*Hippuris vulgaris*).

Numerous tiger salamander larvae were observed in the pond. Also, there were many garter snakes swimming in the pond and on shore, which were presumed to be feeding on the salamander larvae. Dragonflies and damselflies were also observed around the pond.

Natural Heritage Program Element Occurrences:

Table 18. Natural Heritage elements at SSR16.

Element	Common Name	Global Rank	State Rank	EO Rank	Federal and State Status
Plant Communities					
<i>Schoenoplectus acutus</i>	Hardstem bulrush emergent wetland	G5	S3?	C	

The hardstem bulrush plant association occurs in marshes, along the margins of lakes and ponds, and in backwaters areas of rivers in water up to one meter deep. The continually saturated conditions of the environment in which it occurs and the aggressive characteristic of this species as a colonizer precludes most other species from this association (Hansen et al. 1995). This occurrence is rated a "C" due to its small size and potential degradation from heavy grazing.

This spring is located with the **East Salt Creek Potential Conservation Area**, a **B2** site (Very High Significance) (Rocchio et al. 2001 and Lyon et al. 2001). The site contains a population of the globally imperiled Piceance bladderpod (*Lesquerella parviflora*), the globally vulnerable montane narrowleaf cottonwood/skunkbrush riparian forest (*Populus angustifolia/Rhus trilobata*), and a unique stand of balsam poplar (*P. balsamifera*).

Ecological Functions: Overall, this wetland is in good condition but is threatened by overgrazing. The topography of the margin of the pond is laden with hummocks resulting from excessive hoof action. The potential for erosion of the organic soil horizon and subsequent draining of portions of the wetland is high. Nutrient cycles have also likely been altered due to soil disturbance. The wetland is providing excellent habitat for amphibians, insects, and snakes and likely forage for some large animals. Hardstem bulrush provides nesting habitat and cover for a variety of songbirds and waterfowl (Hansen et al. 1995).

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition but clearly is exhibiting a downward trend, as current ecological processes have been disrupted from improper grazing.

Nonnative and Aggressive Species: Bull thistle is present, but its abundance was not great enough to be displacing native species at this time. However, populations of this species should be closely monitored to ensure that it does not spread.

Restoration and Management Comments: Inundated conditions and low palatability of hardstem bulrush limit livestock use of much of the wetland (Hansen et al. 1995). However, Nebraska sedge is very palatable to livestock (and to elk) and this is evident by the amount of grazing that has occurred around the pond margin where this species is growing. Nebraska sedge typically withstands heavy grazing pressure, primarily due to its rhizomatous growth, but heavy pressure during early shoot growth lessens plant vigor (Hansen et al. 1995). Thus, late season grazing, after surface soils have dried, will decrease the likelihood of damage to the plants and will also decrease the amount of hoof action along the wetland margin (Hansen et al. 1995). However, there was also a lot of hoof action within the hardstem bulrush portion of the wetland. Protecting this area from further degradation is necessary to ensure that hydrology and nutrient cycles remain intact.

Water Chemistry: There was no flowing water emerging from the spring. The pond appeared to be at least a few feet in depth. Water chemistry was measured in the pond and was as follows:

pH: 8.67
Conductivity: 2340 $\mu\text{S}/\text{cm}$
Temperature: 30.5 C

Macroinvertebrates: No snails or mussels were observed.

Photos: E11, E12, and E13.

SSR17

Location: At the headwaters of an unnamed tributary to the main drainage within Corral Canyon (just west of SSR16). GPS Point: Zone 12. 0700297E 4379131N.

Legal Description: USGS 7.5-minute quadrangle: Calf Canyon. T6S R101W Section 9 S2 SW4.

Elevation: 7400 feet.

Dominant Plant Species and/or Associations: Narrowleaf cottonwood (*Populus angustifolia*), balsam poplar (*Populus balsamifera*), and sandbar willow (*Salix exigua*) are dominant along most of the springbrook. Beaked sedge (*Carex utriculata*) is very common around the pool wetlands.

General Description: This spring discharges at the headwaters of a fairly long, steep, springbrook that is divided into a series of steep reaches and small pools on an east-facing slope. At the headwaters of this springbrook, is a stand of balsam poplar. This species is common at more northern latitudes but is at the southern edge of its distribution in Colorado. The stand occurs at an old spring source, which no longer discharges. The spring currently discharges approximately 50 feet west of the old source, then flows downhill along a steep drainage, and is periodically interrupted by small flat areas where wetland vegetation has established around small pools. Adjacent slopes are dominated by Gambel's oak (*Quercus gambelii*), Utah serviceberry (*Amelanchier utahensis*), and juniper (*Juniperus osteosperma*).

Plant and Animal Species Observed: Beaked sedge, mare's tail (*Hippuris vulgaris*), hardstem bulrush (*Scirpus acutus*), brookgrass (*Catabrosa aquatica*), willowherb (*Epilobium* sp.), cattail (*Typha latifolia*), alkali crowfoot (*Ranunculus cymbalaria*), American speedwell (*Veronica americana*), and wild mint (*Mentha arvensis*) are abundant in the small pools. Sandbar willow (*Salix exigua*), mountain willow (*S. monticola*), red-osier dogwood (*Cornus sericea*), skunkbrush (*Rhus trilobata*), wild rose (*Rosa woodsii*), balsam poplar, and narrowleaf cottonwood are dominant along portions of the springbrook. Baltic rush (*Juncus balticus*) is found on mesic meadows near the springbrook.

Unidentified snakes, dragonflies, and damselflies were observed near the small pools.

Natural Heritage Program Element Occurrences:

Table 19. Natural Heritage elements at SSR17.

Element	Common Name	Global Rank	State Rank	EO Rank	Federal and State Status
Plant Communities					
<i>Populus balsamifera</i>	Montane riparian woodland	GU	S2?	B	
<i>Populus angustifolia</i> / <i>Salix exigua</i>	Narrowleaf cottonwood riparian forest	G4	S4	B	

Balsam poplar has a limited distribution in Colorado and is somewhat restricted to the north-central regions of the state (Harrington 1954). Colorado may be the southern limit of the range of balsam poplar (USDA PLANTS). The balsam poplar plant association is a minor type in Colorado and rarely forms stands larger than a few hundred yards long. The narrowleaf cottonwood/sandbar willow riparian forest is a very common plant association of young seedling and sapling narrowleaf cottonwood intermixed with coyote willow. The association occupies point bars, gravel bars, benches and low areas that are flooded annually.

This spring is located with the **East Salt Creek Potential Conservation Area**, a **B2** site (Very High Significance) (Rocchio et al. 2001 and Lyon et al. 2001). The site contains a population of the globally imperiled Piceance bladderpod (*Lesquerella parviflora*), the globally vulnerable montane narrowleaf cottonwood/skunkbrush riparian forest (*Populus angustifolia*/*Rhus trilobata*), and a unique stand of balsam poplar (*P. balsamifera*).

Ecological Functions: Overall, this wetland is in good condition but heavy grazing pressure is threatening ecological functions. Increased hoof action in or near the springbrook and/or small pools could disrupt hydrology and nutrient cycles and increase erosion. Currently, groundwater water storage is high due to the buildup of organic-rich soil horizons, which restrict water movement, and the numerous small depressions along the springbrook. These areas provide a permanent source of water in an otherwise arid landscape, thus many species use these areas for water and forage. Many birds, small mammals, signs of bear and elk, and numerous butterfly species were observed near the spring. The springbrook did not appear able to support fish populations, possibly due to the very steep nature of the channel. Permanent discharge of groundwater and subsequent organic matter accumulation produces dissolved organic carbon sources, and likely very little in the way of particulate organic carbon, that eventually make their way into East Salt Creek. Moist soil and permanent flowing water help support insect populations.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition but current ecological processes could be disrupted from without proper grazing management.

Nonnative and Aggressive Species: Bull thistle is present, but its abundance was not great enough to be displacing native species at this time. However, populations of this species should be closely monitored to ensure that it does not spread.

Restoration and Management Comments: Heavy grazing is occurring near the springs. Dense vegetation has precluded heavy livestock activity along portions of the springbrook, however in areas where there is little shrub or tree cover, excessive erosion is occurring from heavy hoof action disrupting the soil surface on steep slopes. Beneficial management actions would include fencing to allow plant growth to recover in those areas where erosion is occurring. Additionally, the grazing regime might be altered to benefit the ecological health of the spring wetland by implementing deferred and rest rotation-grazing cycles appropriate for this site. Late summer and early fall grazing is not recommended for areas where willows occur, as willow species are vulnerable to pruning damage due to limited regrowth at the end of the growing season (Hansen et al. 1995). However, late season grazing, after surface soils have dried, will decrease the amount of hoof action along the springbrook, thus decreasing the potential for erosion and alteration of hydrology (Hansen et al. 1995). The area could be rested for an extended period to allow the native vegetation to regain vigor. Protecting this area from further degradation is necessary to ensure that hydrology and nutrient cycles remain intact.

Water Chemistry: Water flow was determined to be 1/4 GPM using the drop weir.

Water chemistry was as follows:

pH: 8.37
Conductivity: 730 μ S/cm
Temperature: 20.2 C

Macroinvertebrates: No snails or mussels were observed.

Photos: E14, E15, E16, E17, E18, E19, E20, E21, E22, E23, and E24.

SSR18

Location: At the headwaters of an unnamed drainage to Roan Creek and is labeled on the quadrangle map as Tom's Spring. GPS Point: Zone 12. 0706773E 4381884N.

Legal Description: USGS 7.5-minute quadrangle: Henderson Ridge. T7S R100W Section 34 SE4 SE4.

Elevation: 8440 feet.

Dominant Plant Species and/or Associations: Brookgrass (*Catabrosa aquatica*), American speedwell (*Veronica americana*), and small-winged sedge (*Carex microptera*) are common along the springbrook while Utah serviceberry (*Amelanchier utahensis*) and wild rose (*Rosa woodsii*) are common along the banks. There is no vegetation near the spring source.

General Description: This spring discharges at the headwaters of a steep drainage. From the source, the springbrook flows down a moderate gradient for a short distance before plummeting down a very steep drainage. The spring is developed near the source and appears to be regularly maintained. The development consists of a concrete containment structure that captures discharging groundwater then transports it via a pipe to a nearby stock tank. The location of the stock tank has resulted in heavy trampling of vegetation resulting in practically no vegetation growing in this area. Downstream, streamside-vegetation growth is well established but consists of many non-native species. Adjacent slopes are dominated by Utah serviceberry (*Amelanchier utahensis*), and sagebrush (*Artemisia sp.*).

Plant and Animal Species Observed: Plant species diversity is high and includes brookgrass, American speedwell, small-winged sedge, Utah serviceberry, wild rose, alkali crowfoot (*Ranunculus cymbalaria*), stinging nettle (*Urtica dioica*), bull thistle (*Cirsium vulgare*), Canada thistle (*C. arvense*), houndstongue (*Cynoglossum officinale*), leafy aster (*Aster foliaceus*), Kentucky bluegrass (*Poa pratensis*), ticklegrass (*Agrostis scabra*), mullein (*Verbascum thapsus*), curly dock (*Rumex crispus*), blue wildrye (*Elymus glauca*), common dandelion (*Taraxacum officinale*), willowherb (*Epilobium sp.*), yarrow (*Achillea lanulosa*), large-leaved avens (*Geum macrophyllum*), speedwell (*Veronica catenata*), toad rush (*Juncus bufonius*), Rocky Mountain rush (*J. saximontanus*), mountain willow (*Salix monticola*), gooseberry (*Ribes sp.*), and river birch (*Betula occidentalis*).

Natural Heritage Program Element Occurrences:

No elements tracked by the CNHP were documented at this specific location, however the spring is contained in CNHP's **4A Ridge Potential Conservation Area**, which is ranked as a **B2** (Very High Significance) site (Rocchio et al. 2001 and Lyon et al. 2001). The PCA contains populations of four rare plants, Piceance bladderpod (*Lesquerella parviflora*; G2G3), Arapien stickleaf (*Nuttallia argillosa*; G3), sun loving meadowrue

(*Thalictrum heliophilum*; G3), and the hanging garden sullivantia (*Sullivantia hapemanii* var. *purpusii*; G3T3); and the rare narrowleaf cottonwood/skunkbrush riparian forest (*Populus angustifolia*/*Rhus trilobata*; G3).

Ecological Functions: Overall, this wetland is in fair condition due to overgrazing of the spring source. The area near the stock tank is laden with hummocks resulting from excessive hoof action and is completely void of vegetation. The potential for soil erosion is high which could affect water quality of downstream areas and could cause downcutting of springbrook habitat immediately downstream of the source. Nutrient cycles have also likely been altered due to soil disturbance. Downstream from the stock tank, the wetland provides browse for mammals and likely supports invertebrate populations.

Proper Functioning Condition Rating: This spring is rated as Functional At Risk (with a downward trend) as current ecological processes have been disrupted from improper grazing.

Nonnative and Aggressive Species: Bull thistle, Canada thistle, mullein, houndstongue, Kentucky bluegrass, common dandelion, and curly dock are all present and well represented in the area.

Restoration and Management Comments: Complete restoration of this wetland would entail removing all of the spring "development" structures to reestablish natural hydrological flow. This spring appears to be managed for supplying water to livestock thus, removing the development structure may be unlikely scenario. However, given that the location of the spring is topographically higher than downstream areas, it may be feasible to move the stock tank away from the spring source (possibly the opposite, downstream side of the creek in the upland area). This would allow vegetation near the source to reestablish. Additionally, the entire area could be rested to allow the native vegetation to regain vigor. Protecting this area from further degradation is necessary to ensure that hydrology, soils, and nutrient cycles remain intact.

Water Chemistry: There was no flowing water emerging from the spring, however much of the area was saturated from seepage. Water chemistry was as follows:

pH: 7.95
Conductivity: 6550 μ S/cm
Temperature: 10.9 C

Macroinvertebrates: No snails or mussels were observed.

Photos: G19, G20, G21, and G22.

SSR19

Location: Along the west side of South Canyon Road, approximately 0.5 mile from the intersection with CO Hwy. 139. GPS Point: Zone 12, 0687110E, 4383506N.

Legal Description: USGS 7.5-minute quadrangle: Douglas Pass. T5S R102W Section 34 SW4 NE4.

Elevation: 8000 feet.

Dominant Plant Species and/or Associations: Baltic rush (*Juncus balticus*), western wheatgrass (*Pascopyrum smithii*), and clustered field sedge (*Carex praegracilis*) occupy mesic meadows while spikerush (*Eleocharis palustris*) is dominant in the ditch.

General Description: The South Canyon Road bisects this hillside seep. A culvert has been installed underneath the road to allow hydrological flow from the upper to the lower side of the seep. On the lower side, a ditch has been installed, to direct flow from the culvert down slope. Grazing occurs in the area, but impacts were minimal at this location, possibly due to the low palatability of Baltic rush. Upland vegetation consists of Douglas-fir (*Pseudotsuga menziesii*), serviceberry (*Amelanchier utahensis*), and Gambel's oak (*Quercus gambelii*).

Plant and Animal Species Observed: Species present include Baltic rush, western wheatgrass, clustered field sedge, spikerush, Nebraska sedge (*Carex nebrascensis*), foxtail barley (*Hordeum jubatum*), red clover (*Trifolium repens*), yellow sweetclover (*Melilotus officinale*), yarrow (*Achillea lanulosa*), wild rose (*Rosa woodsii*), Kentucky bluegrass (*Poa pratensis*), white panicle aster (*Aster lanceolatus* subsp. *hesperius*), false-Solomon's seal (*Maianthemum stellata*), mullein (*Verbascum thapsus*), bull thistle (*Cirsium vulgare*), gumweed (*Grindelia integrifolia*), houndstongue (*Cynoglossum officinale*), and common dandelion (*Taraxacum officinale*).

Natural Heritage Program Element Occurrences:

Table 20. Natural Heritage elements at SSR19.

Element	Common Name	Global Rank	State Rank	EO Rank	Federal and State Status
Plant Communities					
<i>Juncus balticus</i> var. <i>balticus</i>	Wet meadow	G5	S5	C	

Baltic rush is a common plant association that often increases in abundance with increased disturbance. This occurrence is rated "C" due to its small size and otherwise is in good condition.

This spring is contained within CNHP's **Douglas Pass Potential Conservation Area**, which is ranked as a **B4** site (Moderate Significance) (see Rocchio et al. 2001, Lyon et al. 2001). This PCA has one of the largest known occurrences of the large-flower

globemallow (*Iliamna grandiflora*; G3?Q/S1), a plant that is very rare in Colorado. It also contains a good occurrence of the state rare Douglas fir/Rocky Mountain maple lower montane forest plant community (*Pseudotsuga menziesii*/*Acer glabrum*; G4/S1).

Ecological Functions: Overall, this wetland is in good condition. Groundwater discharge is occurring on site. Currently, the seep wetland is providing good bank stabilization functions and provides temporary surface water storage. Nutrient cycles appear to be intact. The wetland likely provides forage for wildlife, although both creeping spikerush and Baltic rush are not very palatable. The seep does not provide fish habitat. The wetland may also be retaining excess sediments, toxicants, and nutrients associated with runoff from the road.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition, however the presence of the ditch threatens the long-term stability of ecosystem functions due to the potential for increased drainage and thereby decreased extent of the seep wetland.

Nonnative and Aggressive Species: Bull thistle, mullein, houndstongue, Kentucky bluegrass, common dandelion, red clover, and yellow sweetclover are all present and well represented in the area. Populations of this species should be closely monitored and/or eradicated to ensure that they do not spread.

Restoration and Management Comments: Complete restoration of hydrological processes is limited due to the presence of the road, which bisects the seep wetland and likely has affected subsurface groundwater flow. However, removing the ditch could restore some portions of natural hydrology on site, allowing groundwater to seep through the wetland as opposed to quickly draining off-site.

Water Chemistry: Water flow or chemistry was not measured, as there was no flowing water emerging from the spring, however much of the area was saturated from seepage.

Macroinvertebrates: No macroinvertebrates were observed in the wetland.

Photos: G23, G24, G25, G26, and G27.

SSR20

Location: Along the west side of South Canyon Road, approximately 0.6 mile from the intersection with CO Hwy. 139, just south of SSR19. GPS Point: Zone 12, 0687028E, 4383396N.

Legal Description: USGS 7.5-minute quadrangle: Douglas Pass. T5S R102W Section 34 NW4 SE4.

Elevation: 8000 feet.

Dominant Plant Species and/or Associations: Baltic rush (*Juncus balticus*) is the dominant plant association.

General Description: This hillside seep is very similar to the one found at SSR19, although it is not bisected by South Canyon Road and does not contain a ditch. Grazing occurs in the area, as indicated by the hummocks, resulting from hoof action, scattered in the wetland. However, the vegetation did not appear to have been grazed recently. The seep extends down slope and is fairly extensive. Upland vegetation consists of Douglas-fir (*Pseudotsuga menziesii*), serviceberry (*Amelanchier utahensis*), and Gambel's oak (*Quercus gambelii*).

Plant and Animal Species Observed: Species present include Baltic rush, western wheatgrass (*Pascopyrum smithii*), meadow barley (*Hordeum brachyantherum*), yellow sweetclover (*Melilotus officinale*), yarrow (*Achillea lanulosa*), wild rose (*Rosa woodsii*), Kentucky bluegrass (*Poa pratensis*), white panicle aster (*Aster lanceolatus* subsp. *hesperius*), mullein (*Verbascum thapsus*), bull thistle (*Cirsium vulgare*), and common dandelion (*Taraxacum officinale*).

Natural Heritage Program Element Occurrences:

Table 21. Natural Heritage elements at SSR20.

Element	Common Name	Global Rank	State Rank	EO Rank	Federal and State Status
Plant Communities					
<i>Juncus balticus</i> var. <i>balticus</i>	Wet meadow	G5	S5	C	

Baltic rush is a common plant association that often increases in abundance with increased disturbance. This occurrence is rated "C" due to its small size and otherwise is in good condition.

This spring is contained within CNHP's **Douglas Pass Potential Conservation Area**, which is ranked as a **B4** site (Moderate Significance) (see Rocchio et al. 2001, Lyon et al. 2001). This PCA has one of the largest known occurrences of the large-flower globemallow (*Iliamna grandiflora*; G3?Q/S1), a plant that is very rare in Colorado. It

also contains a good occurrence of the state rare Douglas fir/Rocky Mountain maple lower montane forest plant community (*Pseudotsuga menziesii*/*Acer glabrum*; G4/S1).

Ecological Functions: Overall, this wetland is in good condition. Groundwater discharge is occurring on site. Currently, the seep wetland is providing good bank stabilization functions and provides temporary surface water storage. Nutrient cycles appear to be intact. The wetland likely provides forage for wildlife, although Baltic rush is not very palatable. The seep does not provide fish habitat. The wetland may also be retaining excess sediments, toxicants, and nutrients associated with runoff from the road.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition but current ecological processes could be disrupted from without proper grazing management.

Nonnative and Aggressive Species: Bull thistle, mullein, Kentucky bluegrass, common dandelion, and yellow sweetclover are all present and well represented in the area.

Restoration and Management Comments: Populations of the non-native species should be closely monitored and/or eradicated to ensure that they do not spread.

Water Chemistry: Water flow or chemistry was not measured, as there was no flowing water emerging from the spring, however much of the area was saturated from seepage.

Macroinvertebrates: Only a land snail (*Oreohelix* sp.; GUSU) was collected from the area. No wetland dependent snails or mussels were observed.

Photos: G28 and G29.

SSR21

Location: Along the west side of South Canyon Road, approximately 0.7 mile from the intersection with CO Hwy. 139, just south of SSR20. GPS Point: Zone 12, 06870001E, 4383298N.

Legal Description: USGS 7.5-minute quadrangle: Douglas Pass. T5S R102W Section 34 S2 SE4.

Elevation: 8000 feet.

Dominant Plant Species and/or Associations: Nebraska sedge (*Carex nebrascensis*) is dominant near the source and along the springbrook while Baltic rush (*Juncus balticus*) is the dominant plant association in the wet meadow on the lower side of the road.

General Description: This hillside spring is bisected by South Canyon Road. A culvert has been installed underneath the road to allow hydrological flow from the west to the east side of the spring. The source occurs on the west side of the road and supports a small emergent wetland before draining beneath the road via a culvert. On the east side of the road the springbrook supports a wet meadow and a discernible channel is not present. The wet meadow extends down slope. Upland vegetation consists of Douglas-fir (*Pseudotsuga menziesii*), serviceberry (*Amelanchier utahensis*), and Gambel's oak (*Quercus gambelii*).

Plant and Animal Species Observed: Species present include Baltic rush, Nebraska sedge, foxtail barley (*Hordeum jubatum*), yellow sweetclover (*Melilotus officinale*), western mountain aster (*Aster spathulatus*), houndstongue (*Cynoglossum officinale*), wild rose (*Rosa woodsii*), red clover (*Trifolium repens*), Kentucky bluegrass (*Poa pratensis*), mullein (*Verbascum thapsus*), false-Solomon's seal (*Maianthemum stellata*), bull thistle (*Cirsium vulgare*), golden banner (*Thermopsis montana*), blue-eyed grass (*Sisyrinchium demissum*), dagger-leaf rush (*Juncus tracyi*), willowherb (*Epilobium ciliata*), and common dandelion (*Taraxacum officinale*) are found in the wet meadow. Hornwort (*Ceratophyllum demersum*), alkali crowfoot (*Ranunculus cymbalaria*), and cattail (*Typha latifolia*) are found in the deepest water near the source.

Natural Heritage Program Element Occurrences:

Table 22. Natural Heritage elements at SSR21.

Element	Common Name	Global Rank	State Rank	EO Rank	Federal and State Status
Plant Communities					
<i>Juncus balticus</i> var. <i>balticus</i>	Wet meadow	G5	S5	C	

Baltic rush is a common plant association that often increases in abundance with increased disturbance. This occurrence is rated "C" due to its small size and otherwise is in good condition.

This spring is contained within CNHP's **Douglas Pass Potential Conservation Area**, which is ranked as a **B4** site (Moderate Significance) (see Rocchio et al. 2001, Lyon et al. 2001). This PCA has one of the largest known occurrences of the large-flower globemallow (*Iliamna grandiflora*; G3?Q/S1), a plant that is very rare in Colorado. It also contains a good occurrence of the state rare Douglas fir/Rocky Mountain maple lower montane forest plant community (*Pseudotsuga menziesii/Acer glabrum*; G4/S1).

Ecological Functions: Overall, this wetland is in good condition. Groundwater discharge is occurring on site. Currently, the seep wetland is providing good bank stabilization functions and provides temporary surface water storage. Nutrient cycles appear to be intact. The wetland likely provides forage for wildlife, although Baltic rush is not very palatable. The spring does not provide fish habitat. The wetland may also be retaining excess sediments, toxicants, and nutrients associated with runoff from the road.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition as most ecological processes are intact.

Nonnative and Aggressive Species: Bull thistle, mullein, Kentucky bluegrass, common dandelion, houndstongue, and yellow sweetclover are all present and well represented in the area.

Restoration and Management Comments: Populations of the non-native species should be closely monitored and/or eradicated to ensure that they do not spread.

Water Chemistry: Water flow was determined to be 1/4 GPM using an ocular estimate. Water chemistry was as follows:

pH: 7.77
Conductivity: 364 μ S/cm
Temperature: 14.8 C

Macroinvertebrates: No snails or mussels were observed.

Photos: G30 and G31.

SSR22

Location: Along the west side of South Canyon Road, approximately 0.8 mile from the intersection with CO Hwy. 139, just south of SSR20. GPS Point: Zone 12, 0686868E, 4382939N.

Legal Description: USGS 7.5-minute quadrangle: Douglas Pass. T5S R102W Section 34 SW4 SE4.

Elevation: 8100 feet.

Dominant Plant Species and/or Associations: Rocky Mountain maple (*Acer glabrum*) and fowl mannagrass (*Glyceria striata*) are dominant along the springbrook and near the source. Hornwort (*Ceratophyllum demersum*) is a common aquatic plant and creeping spikerush (*Eleocharis palustris*) is dominant along the pond margin. Baltic rush (*Juncus balticus*), Nebraska sedge (*Carex nebrascensis*), and small-winged sedge (*C. microptera*) are common in adjacent wet meadows.

General Description: This hillside spring discharges directly out of bedrock then flows a short distance to a small pond located on a bench above South Canyon Road. Upslope of the pond, vegetation consists of Douglas-fir (*Pseudotsuga menziesii*), aspen (*Populus tremuloides*), and Gambel's oak (*Quercus gambelii*) while down slope the upland vegetation is comprised of serviceberry (*Amelanchier utahensis*) and Gambel's oak.

Plant and Animal Species Observed: Species present include Baltic rush, Nebraska sedge, Rocky Mountain maple, fowl mannagrass, hornwort, creeping spikerush, small-winged sedge, clustered field sedge (*Carex praeegracilis*), dagger-leaf rush (*Juncus tracyi*), unidentified aster (*Aster* sp.), alkali crowfoot (*Ranunculus cymbalaria*), floating buttercup (*Ranunculus hyperboreus*), red clover (*Trifolium repens*), wild rose (*Rosa woodsii*), chokecherry (*Prunus virginiana*), red-osier dogwood (*Cornus sericea*), mountain willow (*Salix monticola*), Kentucky bluegrass (*Poa pratensis*), false-Solomon's seal (*Maianthemum stellata*), golden banner (*Thermopsis montana*), Colorado columbine (*Aquilegia coerulea*), cowbane (*Oxypolis fendleri*), bull thistle (*Cirsium vulgare*), western wheatgrass (*Pascopyrum smithii*), yarrow (*Achillea lanulosa*), stinging nettle (*Urtica dioica*), blue wildrye (*Elymus glauca*), red goosefoot (*Chenopodium rubrum*), and common dandelion (*Taraxacum officinale*) are found in the wet meadow.

Natural Heritage Program Element Occurrences:

No elements tracked by the CNHP were documented at this site, however this spring is contained within CNHP's **Douglas Pass Potential Conservation Area**, which is ranked as a **B4** site (Moderate Significance) (see Rocchio et al. 2001, Lyon et al. 2001). This PCA has one of the largest known occurrences of the large-flower globemallow (*Iliamna grandiflora*; G3?Q/S1), a plant that is very rare in Colorado. It also contains a good occurrence of the state rare Douglas fir/Rocky Mountain maple lower montane forest plant community (*Pseudotsuga menziesii*/*Acer glabrum*; G4/S1).

Ecological Functions: Overall, this wetland is in good condition. Groundwater discharge is occurring on site. Currently, the seep wetland is providing good bank stabilization functions and provides temporary surface water storage. Nutrient cycles appear to be intact. The wetland likely provides forage for wildlife. The spring does not provide fish habitat but does provide aquatic habitat for amphibians. Hummocks, resulting from hoof action, are present along the springbrook. Activity that would perpetuate or increase these hummocks could potentially affect hydrological functions and subsequently alter nutrient cycles and water storage.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition as most ecological processes were intact. However, an increase in hummocks near the springbrook could affect ecological functions.

Nonnative and Aggressive Species: Bull thistle, Kentucky bluegrass, and common dandelion are all present and well represented in the area.

Restoration and Management Comments: Populations of the non-native species should be closely monitored and/or eradicated to ensure that they do not spread.

Water Chemistry: Water flow was determined to be 1/4 GPM using an ocular estimate. Water chemistry was as follows:

pH: 8.26
Conductivity: 148 μ S/cm
Temperature: 10.3 C

Macroinvertebrates: No snails or mussels were observed.

Photos: G32, G33, G34, and G35.

SSR23

Location: Along the southwest side of Bitter Spring Canyon, approximately 1.0 mile from the intersection with CO Hwy. 139. GPS Point: Zone 12, 0688023E, 4378979N.

Legal Description: USGS 7.5-minute quadrangle: Douglas Pass. T6S R102W Section 18 SE4 NW4.

Elevation: 6400 feet.

Dominant Plant Species and/or Associations: Baltic rush (*Juncus balticus*) and clustered field sedge (*Carex nebrascensis*) are the most common species that occupy the wet meadow while alkali bulrush (*Scirpus maritimus*) is common in the wettest areas.

General Description: This hillside spring discharges directly out of bedrock then flows down a very steep slope, where wetland vegetation and soils retain water and form a moderate size slope wetland. Near the bottom of the slope, seepage from the wetland infiltrates into the valley alluvium almost immediately upon contact with the alluvium. Salt crusts are prevalent throughout the wetland. Soils are sandy and had large quantities of organic matter accumulation near the source. An old stock tank and piping, which are no longer functional, exist on site and are currently located in the adjacent upland area. Upland vegetation consists of Gambel's oak (*Quercus gambelii*), serviceberry (*Amelanchier utahensis*), juniper (*Juniperus* sp.), and sagebrush (*Artemisia* sp.).

Plant and Animal Species Observed: Species present include Baltic rush, clustered field sedge, alkali bulrush, hardstem bulrush (*Schoenoplectus acutus*), alkali crowfoot (*Ranunculus cymbalaria*), wild rose (*Rosa woodsii*), skunkbrush (*Rhus trilobata*), Kentucky bluegrass (*Poa pratensis*), blue wildrye (*Elymus glauca*), yellow sweetclover (*Melilotus officinale*), common dandelion (*Taraxacum officinale*), mullein (*Verbascum thapsus*), western mountain aster (*Aster spathulatus*), and Canada thistle (*Cirsium arvense*) are found in the wetland.

Numerous species of butterflies, dragonflies, damselflies, and other insects were observed in the wetland.

Natural Heritage Program Element Occurrences:

Table 23. Natural Heritage elements at SSR23.

Element	Common Name	Global Rank	State Rank	EO Rank	Federal and State Status
Plant Communities					
<i>Juncus balticus</i> var. <i>balticus</i>	Wet meadow	G5	S5	C	
<i>Carex praegracilis</i>	Wet meadow	G3G4	S3S4	C	

Baltic rush is a common plant association that often increases in abundance with increased disturbance. The clustered field sedge plant association is known from

Montana, Idaho, Wyoming, and Colorado. In Colorado, this association forms small meadows in swales and along stream channels. Both occurrences are rated "C" due to their small size. This spring is not located within a CNHP Potential Conservation Area.

Ecological Functions: This wetland is in fair condition as it is threatened by excessive hoof action, especially along the steep springbrook. Groundwater discharge is occurring on site. Currently, the seep wetland is providing fair bank stabilization functions and provides temporary surface water storage. Nutrient cycles appear to be intact in most areas, however in areas where hoof action is disturbing the soil, nutrient cycles have likely been altered. The wetland likely provides forage and watering for wildlife. The spring does not provide fish habitat but does provide aquatic habitat for amphibians. An increase in hummocks (from hoof action) could potentially affect hydrological functions via an increase in erosion, decrease in water storage, and decrease in extent of the wetland.

Proper Functioning Condition Rating: This spring is rated as Function At Risk as erosion, and subsequent alteration of hydrology is possible under current grazing management.

Nonnative and Aggressive Species: Bull thistle, Kentucky bluegrass, yellow sweetclover, mullein, and common dandelion are all present in the area.

Restoration and Management Comments: Soils of the clustered sedge association are susceptible to compaction if grazed in early spring and summer when saturated. However, clustered sedge may be an effective stabilizer of degraded, wet meadows. It has long, creeping rhizomes that quickly produce a tall, dense canopy of aboveground shoots (Hansen et al. 1988). Maintaining this community may help alleviate erosion. Implementing deferred and rest rotation-grazing cycles appropriate for this site may also assist in maintaining ecological functions.

Water Chemistry: Water flow was determined to be 1/2 GPM using the weir. Water chemistry was as follows:

pH: 7.93
Conductivity: 580 μ S/cm
Temperature: 10.6 C

Macroinvertebrates: No snails or mussels were observed.

Photos: H1, H2, H3, H4, H5, and H6.

SSR24

Location: Up an unnamed drainage on the east side of Calf Canyon, approximately 1.0 mile from the confluence with Hay Canyon. GPS Point: Zone 12, 0694440E, 4380862N.

Legal Description: USGS 7.5-minute quadrangle: Calf Canyon. T6S R102W Section 11 E2 NW4.

Elevation: 6800 feet.

Dominant Plant Species and/or Associations: Beaked spikerush (*Eleocharis rostellata*) occupies the wet meadow near the spring source while Baltic rush (*Juncus balticus*) is common in the lower wet meadow.

General Description: The spring is discharging at base of a steep slope from beneath a thick layer of organic matter and sandy clay material. The source area consists of a quaking, unvegetated open water/mud area. Flow from the source area seeps below into a moderate size beaked spikerush community before plummeting down a steep springbrook and supporting a Baltic rush meadow before finally infiltrating into the soil. This lower Baltic rush meadow was fairly dry at the time of the site visit, but obviously receives enough groundwater flow to support a mesic meadow. There were numerous cows in the area. Most did not enter the beaked spikerush community as the soils were very unstable (lots of organic matter accumulation) and the area was very saturated. However, the cattle appear to be using the springbrook quite often, resulting in an abundance of hummocks in this area and at the edge of the beaked spikerush community. Upland vegetation consists of Gambel's oak (*Quercus gambelii*), serviceberry (*Amelanchier utahensis*), pinyon (*Pinus edulis*), juniper (*Juniperus* sp.), and sagebrush (*Artemisia* sp.).

Plant and Animal Species Observed: Species present include Baltic rush, beaked spikerush, alkali crowfoot (*Ranunculus cymbalaria*), wild rose (*Rosa woodsii*), Kentucky bluegrass (*Poa pratensis*), blue wildrye (*Elymus glauca*), yellow sweetclover (*Melilotus officinale*), longstyle rush (*Juncus longistylis*), foxtail barley (*Hordeum jubatum*), rabbit-foot grass (*Polypogon monspeliensis*), giant wildrye (*Leymus cinereus*), western wheatgrass (*Pascopyrum smithii*), Nebraska sedge (*Carex nebrascensis*), hornwort (*Ceratophyllum demersum*), and bull thistle (*Cirsium vulgare*).

Numerous species of butterflies, dragonflies, damselflies, and other insects were observed in the wetland.

Natural Heritage Program Element Occurrences:

Table 24. Natural Heritage elements at SSR24.

Element	Common Name	Global Rank	State Rank	EO Rank	Federal and State Status
Plant Communities					
<i>Eleocharis rostellata</i>	Beaked spikerush emergent wetland	G2G3	S2S3	B	
<i>Juncus balticus</i> var. <i>balticus</i>	Wet meadow	G5	S5	C	

The beaked spikerush emergent wetland is an uncommon plant association and is found in wetlands with permanent flowing water including calcareous wet meadows, seeps, stream margins, and near mineral springs. This particular occurrence is rated a "B" due to the soil disturbance along the edges and its moderate size. Baltic rush is a common plant association that often increases in abundance with increased disturbance. This occurrence is rated "C" due to its small size. This spring is contained within CNHP's **Calf Canyon Potential Conservation Area**, which is ranked as a **B3** site (High Significance) (see Rocchio et al. 2001, Lyon et al. 2001; however Calf Canyon is ranked as a B4 site in these reports as element occurrences associated with SSR24 and SSR26 had not yet been documented). This PCA has a good occurrence of the globally vulnerable beaked spikerush emergent wetland (*Eleocharis rostellata*; G2G3/S2S3), a good occurrence of the globally vulnerable river birch/mesic forb foothills riparian shrubland (*Betula occidentalis*/mesic forb; G3/S2), and a fair occurrence of the globally vulnerable river birch/mesic graminoid lower montane riparian shrubland (*Betula occidentalis*/mesic graminoid; G3/S2).

Ecological Functions: Overall, this wetland is in good condition. Groundwater discharge is occurring on site. Currently, the seep wetland is providing good bank stabilization functions. The beaked spikerush wetland was very highly saturated and was obviously storing large amounts of surface water. Nutrient cycles appear to be intact. The wetland likely provides forage for wildlife. The wetland also supports a diversity of butterflies, dragonflies, damselflies, and other insects. The spring does not provide fish habitat but does provide aquatic habitat for amphibians. Hummocks, resulting from hoof action, are present along the springbrook and at the edge of beaked spikerush wetland. An increase in these hummocks (from hoof action) could potentially affect hydrological functions via an increase in erosion, decrease in water storage, and decrease in extent of the wetland.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition but threatened by potential erosion, and subsequent alteration of hydrology from hoof action.

Nonnative and Aggressive Species: Bull thistle, Kentucky bluegrass, yellow sweetclover, are present in the area.

Restoration and Management Comments: Fencing livestock out the of the steep springbrook and implementing deferred and rest rotation-grazing cycles appropriate for this site may assist in maintaining ecological functions.

Water Chemistry: Water flow was difficult to determine as it was discharging beneath a layer soil/organic matter. However, flow was obviously permanent and has a fairly large volume as indicated by the saturation of the beaked spikerush wetland. Water chemistry was as follows:

pH: 7.83
Conductivity: 178 $\mu\text{S}/\text{cm}$
Temperature: 20.1 C

Macroinvertebrates: No snails or mussels were observed.

Photos: H7, H8, H9, H10, H11, H12, H13, H14, H15, and H16.

SSR25

Location: Up an unnamed drainage near the headwaters of Calf Canyon, on the east side of the canyon just west of Calf Point. GPS Point: Zone 12, 0694461E, 4382732N.

Legal Description: USGS 7.5-minute quadrangle: Calf Canyon. T6S R102W Section 2 NE4 NW4.

Elevation: 7000 feet.

Dominant Plant Species and/or Associations: River birch/mesic forb is the dominant plant association occupying this spring.

General Description: The spring discharges from beneath a large boulder that sits within the channel of a small stream. The spring does not lie at the actual head of the drainage and upstream portions of the creek appear to be intermittent and only running during periods of heavy snowmelt or rainfall. There was some evidence of livestock use in the area but with very little disturbance to the spring. The extent of the wetland is minimal and only exists along the banks of the creek except downstream near the confluence with seepage from SSR26, where large wet meadows have formed. Upland vegetation consists of Gambel's oak (*Quercus gambelii*), serviceberry (*Amelanchier utahensis*), aspen (*Populus tremuloides*), and Douglas-fir (*Pseudotsuga menziesii*).

Plant and Animal Species Observed: Species present include river birch, red-osier dogwood (*Cornus sericea*), fowl mannagrass (*Glyceria striata*), large-leaved avens (*Geum macrophyllum*), false-Solomon's seal (*Maianthemum stellata*), common dandelion (*Taraxacum officinale*), American brooklime (*Veronica americana*), alkali crowfoot (*Ranunculus cymbalaria*), bull thistle (*Cirsium vulgare*), Kentucky bluegrass (*Poa pratensis*), **northern bog violet** (*Viola nephrophylla*), wild rose (*Rosa woodsii*), monument plant (*Fraser speciosa*), houndstongue (*Cynoglossum officinale*), and mullein (*Verbascum thapsus*).

Numerous species of butterflies and other insects were observed in the wetland.

Natural Heritage Program Element Occurrences:

Table 25. Natural Heritage elements at SSR25.

Element	Common Name	Global Rank	State Rank	EO Rank	Federal and State Status
Plant Communities					
<i>Betula occidentalis</i> /mesic forb	Foothills riparian shrubland	G3	S2	B	

The river birch/mesic forb riparian shrubland is well documented throughout the western states but is threatened by development and road construction. This occurrence is relatively pristine and is rated a "B" only because of its small size. This spring is contained within CNHP's **Calf Canyon Potential Conservation Area**, which is ranked

as a **B3** site (High Significance) (see Rocchio et al. 2001, Lyon et al. 2001; however Calf Canyon is ranked as a B4 site in these reports as element occurrences associated with SSR24 and SSR26 had not yet been documented). This PCA has a good occurrence of the globally vulnerable beaked spikerush emergent wetland (*Eleocharis rostellata*; G2G3/S2S3), a good occurrence of the globally vulnerable river birch/mesic forb foothills riparian shrubland (*Betula occidentalis*/mesic forb; G3/S2), and a fair occurrence of the globally vulnerable river birch/mesic graminoid lower montane riparian shrubland (*Betula occidentalis*/mesic graminoid; G3/S2).

Ecological Functions: Overall, this wetland is in good condition. Groundwater discharge is occurring on site. Currently, the wetland is providing good bank stabilization functions. Nutrient cycles appear to be intact. The wetland provides forage and a permanent water source for wildlife. The wetland also supports a diversity of butterflies and other insects. The spring may provide fish habitat as there is ample water in the creek for small fishes and woody debris and large boulders provide a nice riffle/pool complex.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition as most ecological processes appear to be intact.

Nonnative and Aggressive Species: Kentucky bluegrass, mullein, houndstongue, and common dandelion are present in the area.

Restoration and Management Comments: Eradicating and monitoring the status of the nonnative species should be conducted to ensure they do not displace native species.

Water Chemistry: Water flow was difficult to determine using the weir due to a very rocky substrate. Ocular estimate was approximately 2 GPM. Water chemistry was as follows:

pH: 8.12
Conductivity: 068 μ S/cm
Temperature: 10.2 C

Macroinvertebrates: No snails or mussels were observed.

Photos: H17, H18, H19, and H20.

SSR26

Location: Up an unnamed drainage near the headwaters of Calf Canyon, on the east side of the canyon just west of Calf Point. The spring is located west-northwest of SSR25. GPS Point: Zone 12, 0694364E, 4382774N.

Legal Description: USGS 7.5-minute quadrangle: Calf Canyon. T6S R102W Section 2 NE4 NW4.

Elevation: 7000 feet.

Dominant Plant Species and/or Associations: Nebraska sedge (*Carex nebrascensis*), Baltic rush (*Juncus balticus*), and river birch (*Betula occidentalis*) are common species in the area.

General Description: The spring discharges beneath a large river birch, then flows along a sinuous springbrook through a small wet meadow dominated by Nebraska sedge and Baltic rush. The springbrook flows through a stand of river birch before entering another wet meadow and finally converging with the main drainage (flow from SSR25). There was some evidence of livestock use in the area but with very little disturbance to the spring. Upland vegetation consists of Gambel's oak (*Quercus gambelii*) and serviceberry (*Amelanchier utahensis*)

Plant and Animal Species Observed: Species present include river birch, Nebraska sedge, Baltic rush, fowl mannagrass (*Glyceria striata*), American brooklime (*Veronica americana*), alkali crowfoot (*Ranunculus cymbalaria*), bull thistle (*Cirsium vulgare*), Kentucky bluegrass (*Poa pratensis*), **northern bog violet (*Viola nephrophylla*)**, wild rose (*Rosa woodsii*), black medic (*Medicago lupulina*), small-winged sedge (*Carex microptera*), meadow barley (*Hordeum brachyantherum*), creeping spikerush (*Eleocharis palustris*), field horsetail (*Equisetum arvense*), hornwort (*Ceratophyllum demersum*), cow bane (*Oxypolis fendleri*), golden banner (*Thermopsis montana*), monument plant (*Fraser speciosa*), longstyle rush (*Juncus longistylis*), and vetch (*Vicia americana*).

Numerous species of butterflies, damselflies, dragonflies, and other insects were observed in the wetland.

Natural Heritage Program Element Occurrences:

Table 26. Natural Heritage elements at SSR26.

Element	Common Name	Global Rank	State Rank	EO Rank	Federal and State Status
Plant Communities					
<i>Betula occidentalis</i> /mesic graminoid	Lower montane riparian shrubland	G3	S2	C	
Mussel					
<i>Pisidium nitidum</i>	Shiny peaclam	G5	SU		

Element	Common Name	Global Rank	State Rank	EO Rank	Federal and State Status
Snails					
<i>Lymnaea</i> sp.	Unidentified pondsnail	G?	S?		

The river birch/mesic graminoid community has been well documented in several western states but is threatened by poor livestock management, stream flow alteration, and heavy recreation use. This occurrence is in good condition but is very small, hence the low EO rank. This spring is contained within CNHP's **Calf Canyon Potential Conservation Area**, which is ranked as a **B3** site (High Significance) (see Rocchio et al. 2001, Lyon et al. 2001; however Calf Canyon is ranked as a B4 site in these reports as element occurrences associated with SSR24 and SSR26 had not yet been documented). This PCA has a good occurrence of the globally vulnerable beaked spikerush emergent wetland (*Eleocharis rostellata*; G2G3/S2S3), a good occurrence of the globally vulnerable river birch/mesic forb foothills riparian shrubland (*Betula occidentalis*/mesic forb; G3/S2), and a fair occurrence of the globally vulnerable river birch/mesic graminoid lower montane riparian shrubland (*Betula occidentalis*/mesic graminoid; G3/S2).

Ecological Functions: Overall, this wetland is in good condition. Groundwater discharge is occurring on site. Currently, the wetland is providing good bank stabilization functions. Nutrient cycles appear to be intact. The wetland provides forage and a permanent water source for wildlife. The wetland also supports a diversity of butterflies, damselflies, dragonflies, and other insects. The spring does not provide fish habitat but does provide aquatic habitat for amphibians.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition as most ecological processes appear to be intact.

Nonnative and Aggressive Species: Kentucky bluegrass, black medic, and bull thistle are present in the area.

Restoration and Management Comments: Eradicating and monitoring the status of the nonnative species should be conducted to ensure they do not displace native species.

Water Chemistry: Water flow was difficult to determine using the weir due to a very rocky substrate. Ocular estimate was approximately 1.5 GPM. Water chemistry was as follows:

pH: 8.06
 Conductivity: 089 μ S/cm
 Temperature: 12.7 C

Macroinvertebrates: The shiny peaclam (*Pisidium nitidum*) and ?? were both found at this location.

Photos: H21, H22, and H23.

SSR27

Location: Along the east side of the creek running through Calf Canyon, approximately 1.0 mile from the confluence with Hay Canyon. The spring is located just off the road on the lower side. GPS Point: Zone 12, 0693913E, 4380689N.

Legal Description: USGS 7.5-minute quadrangle: Calf Canyon. T6S R102W Section 10 SE4 NE4.

Elevation: 6500 feet.

Dominant Plant Species and/or Associations: Baltic rush (*Juncus balticus*) and creeping spikerush (*Eleocharis palustris*) are common species in the area.

General Description: The seep discharges on a secondary floodplain terrace in multiple locations. The entire area is saturated and the sources are believed to be located in a few locations, which consist of quaking, unvegetated open water and mud. There are numerous small rivulets running throughout the area but no main springbrook. Seepage from this area runs down slope and drains into the main creek in Calf Canyon. Livestock have grazed the area recently and were located just around the corner during the site visit. Since Baltic rush is not very palatable, the vegetation in the wetland was not affected by grazing activities. However, livestock do spend time in the wetland, as indicated by the numerous hummocks (from hoof action) in the wetland. Thus far, the hummocks do not appear to be affecting ecosystem functions. Just downstream from this seep is another, smaller seep that is very similar to this one. Adjacent upland vegetation consists of sagebrush (*Artemisia* sp.) and further upslope, Gambel's oak (*Quercus gambelii*) and serviceberry (*Amelanchier utahensis*).

Plant and Animal Species Observed: Species present include Baltic rush, creeping spikerush, American brooklime (*Veronica americana*), alkali crowfoot (*Ranunculus cymbalaria*), bull thistle (*Cirsium vulgare*), Kentucky bluegrass (*Poa pratensis*), wild rose (*Rosa woodsii*), black medic (*Medicago lupulina*), foxtail barley (*Hordeum jubatum*), meadow barley (*H. brachyantherum*), field horsetail (*Equisetum arvense*), hornwort (*Ceratophyllum demersum*), common dandelion (*Taraxacum officinale*), blue-eyed grass (*Sisyrinchium demissum*), western wheatgrass (*Pascopyrum smithii*), and clustered field sedge (*Carex praegracilis*). Unidentified moss species were prevalent in many of the small rivulets throughout the wetland.

Numerous species of butterflies, damselflies, and other insects were observed in the wetland. Also, an unidentified vole was observed scurrying through the wetland.

Natural Heritage Program Element Occurrences:

Table 27. Natural Heritage elements at SSR27.

Element	Common Name	Global Rank	State Rank	EO Rank	Federal and State Status
Plant Communities					
<i>Juncus balticus</i> var. <i>balticus</i>	Wet meadow	G5	S5	C	

Baltic rush is a common plant association that often increases in abundance with increased disturbance. This occurrence is rated "C" due to its small size. This spring is contained within CNHP's **Calf Canyon Potential Conservation Area**, which is ranked as a **B3** site (High Significance) (see Rocchio et al. 2001, Lyon et al. 2001; however Calf Canyon is ranked as a B4 site in these reports as element occurrences associated with SSR24 and SSR26 had not yet been documented). This PCA has a good occurrence of the globally vulnerable beaked spikerush emergent wetland (*Eleocharis rostellata*; G2G3/S2S3), a good occurrence of the globally vulnerable river birch/mesic forb foothills riparian shrubland (*Betula occidentalis*/mesic forb; G3/S2), and a fair occurrence of the globally vulnerable river birch/mesic graminoid lower montane riparian shrubland (*Betula occidentalis*/mesic graminoid; G3/S2).

Ecological Functions: Overall, this wetland is in good condition. Groundwater discharge is occurring on site. Currently, the wetland is providing good bank stabilization functions. Nutrient cycles appear to be intact. The wetland provides forage and a permanent water source for wildlife. The wetland also supports a diversity of butterflies, damselflies, and other insects. The spring does not provide fish habitat but does provide aquatic habitat for amphibians.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition as most ecological processes appear to be intact.

Nonnative and Aggressive Species: Kentucky bluegrass, black medic, common dandelion, and bull thistle are present in the area.

Restoration and Management Comments: Eradicating and monitoring the status of the nonnative species should be conducted to ensure they do not displace native species. Implementing deferred and rest rotation-grazing cycles appropriate for this site may assist in maintaining ecological functions.

Water Chemistry: The entire area was saturated but there was not a deep enough source of open water to measure water chemistry from. Flow was also difficult to determine as there was not a discernible source, but rather discharge appears to be occurring throughout the site.

Macroinvertebrates: No macroinvertebrates were observed at this spring.

Photos: H24, H25, and H26.

SSR28

Location: On a south-facing slope along Hay Canyon, approximately 1/3 mile from the confluence with Calf Canyon. The spring is near a small cabin and mostly occurs on private land, but the source appears to be on BLM property. GPS Point: Zone 12, 0693575E, 4379301N.

Legal Description: USGS 7.5-minute quadrangle: Calf Canyon. T6S R102W Section 15 NE4 NE4.

Elevation: 6300 feet.

Dominant Plant Species and/or Associations: Beaked spikerush (*Eleocharis rostellata*) is dominate near the source while Baltic rush (*Juncus balticus*) is very common down slope along the springbrook.

General Description: The spring discharges at the base of a steep slope. There are two main source areas, which have permanent flow. The entire wetland is highly saturated. The water seeps down slope a short distance before infiltrating back into the soil. There were no signs of recent grazing and the wetland was in good condition. One of the main sources is surrounded by old fencing. Adjacent upland vegetation consists of sagebrush (*Artemisia* sp.) surrounding the springbrook and above the source is Gambel's oak (*Quercus gambelii*) and juniper (*Juniperus* sp.).

Plant and Animal Species Observed: Species present include Baltic rush, beaked spikerush, alkali crowfoot (*Ranunculus cymbalaria*), Kentucky bluegrass (*Poa pratensis*), wild rose (*Rosa woodsii*), black medic (*Medicago lupulina*), foxtail barley (*Hordeum jubatum*), meadow barley (*H. brachyantherum*), hornwort (*Ceratophyllum demersum*), common dandelion (*Taraxacum officinale*), yellow sweetclover (*Melilotus officinale*), orchard grass (*Dactylis glomerata*), giant wildrye (*Leymus cinereus*), whitetop (*Cardaria* sp.), arrowgrass (*Triglochin maritima*), and clustered field sedge (*Carex praegracilis*).

Numerous species of butterflies, damselflies, and other insects were observed in the wetland.

Natural Heritage Program Element Occurrences:

Table 28. Natural Heritage elements at SSR28.

Element	Common Name	Global Rank	State Rank	EO Rank	Federal and State Status
Plant Communities					
<i>Eleocharis rostellata</i>	Beaked spikerush emergent wetland	G2G3	S2S3	C	

The beaked spikerush emergent wetland is an uncommon plant association and is found in wetlands with permanent flowing water including calcareous wet meadows, seeps, stream margins, and near mineral springs. This occurrence is rated "C" due to its small

size. This spring is not contained in a CNHP Potential Conservation Area but is just downstream from the **Calf Canyon Potential Conservation Area**, which is ranked as a **B3** site (High Significance) (see Rocchio et al. 2001, Lyon et al. 2001; however Calf Canyon is ranked as a B4 site in these reports as element occurrences associated with SSR24 and SSR26 had not yet been documented). This PCA has a good occurrence of the globally vulnerable beaked spikerush emergent wetland (*Eleocharis rostellata*; G2G3/S2S3), a good occurrence of the globally vulnerable river birch/mesic forb foothills riparian shrubland (*Betula occidentalis*/mesic forb; G3/S2), and a fair occurrence of the globally vulnerable river birch/mesic graminoid lower montane riparian shrubland (*Betula occidentalis*/mesic graminoid; G3/S2).

Ecological Functions: Overall, this wetland is in good condition. Groundwater discharge is occurring on site. Currently, the wetland is providing good bank stabilization functions. Nutrient cycles appear to be intact. The wetland provides forage and a permanent water source for wildlife. The wetland also supports a diversity of butterflies, damselflies, and other insects. The spring does not provide fish habitat but does provide aquatic habitat for amphibians.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition as most ecological processes appear to be intact.

Nonnative and Aggressive Species: Kentucky bluegrass, black medic, common dandelion, orchard grass, whitetop, and yellow sweetclover are fairly abundant in the area.

Restoration and Management Comments: Eradicating and monitoring the status of the nonnative species should be conducted to ensure they do not continue to displace native species.

Water Chemistry: Water flow was determined to be 1/2 GPM using the weir. Water chemistry was as follows:

pH: 7.77
Conductivity: 268 μ S/cm
Temperature: 13.5 C

Macroinvertebrates: No macroinvertebrates were observed at this spring.

Photos: H27, H28, and H29.

SSR29

Location: On a east-facing slope along the Right Fork of Barrel Spring Creek, approximately 1 1/2 miles upstream from the cabin near Barrel Spring. GPS Point: Zone 12, 0698105E, 4383297N.

Legal Description: USGS 7.5-minute quadrangle: Calf Canyon. T5S R101W Section 35 W2 SE4.

Elevation: 7400 feet.

Dominant Plant Species and/or Associations: Nebraska sedge (*Carex nebrascensis*) and brookgrass (*Catabrosa aquatica*) are the dominant species in the wet meadows while narrowleaf cottonwood (*Populus angustifolia*) is common along the springbrook near the confluence with the creek.

General Description: The actual spring source was never located but is believed to discharge at the base of extremely steep cliffs, on a bench above the wet meadows documented at this site. The spring flows from the source down a steep waterfall, which is excellent habitat for the globally vulnerable hanging garden sullivantia (*Sullivantia hapemanii* var. *purpusii*; G3T3/S3 Forest Service Sensitive), although no plants were found, then enters a large, beautiful wet meadow dominated by Nebraska sedge and brookgrass. The entire meadow was saturated with a few inches of standing water in some locations. Soils in this meadow have large quantities of organic matter accumulation (Munsell soil color was 10 YR 1/1) and emitted a sulfur or "rotten egg odor" indicating that it is highly reduced. The springbrook then flow down slope along the OHV road/trail, where erosion could be a potential problem in the future, into another wet meadow. From the meadow, the springbrook flows through a mature stand of narrowleaf cottonwoods before entering the creek. Adjacent upland vegetation consists of Gambel's oak (*Quercus gambelii*), serviceberry (*Amelanchier utahensis*), and aspen (*Populus tremuloides*).

Plant and Animal Species Observed: Species present include Nebraska sedge, brookgrass, narrowleaf cottonwood, river birch (*Betula occidentalis*), red-osier dogwood (*Cornus sericea*), chokecherry (*Prunus virginiana*), gooseberry (*Ribes montigenum*), lance-leaf willow (*Salix lucida* subsp. *lasiandra*), creeping spikerush (*Eleocharis palustris*), houndstongue (*Cynoglossum officinale*), alkali crowfoot (*Ranunculus cymbalaria*), Kentucky bluegrass (*Poa pratensis*), black medic (*Medicago lupulina*), common dandelion (*Taraxacum officinale*), fowl mannagrass (*Glyceria striata*), Baltic rush (*Juncus balticus*), small-winged sedge (*Carex microptera*), **northern bog violet (*Viola nephrophylla*)**, stinging nettle (*Urtica dioica*), American brooklime (*Veronica americana*), Richardson's geranium (*Geranium richardsonii*), vetch (*Vicia americana*), mountain bluebells (*Mertensia ciliata*), and blister buttercup (*Ranunculus sceleratus* var. *sceleratus*).

Numerous species of butterflies, damselflies, and other insects were observed in the wetland.

Natural Heritage Program Element Occurrences:

Table 29. Natural Heritage elements at SSR29.

Element	Common Name	Global Rank	State Rank	EO Rank	Federal and State Status
Plant Communities					
<i>Carex nebrascensis</i>	Nebraska sedge spring wetland	G4	S3	B	

Nebraska sedge is a common, but declining association that is threatened by improper livestock grazing, hydrological alterations, and heavy recreational use. It forms open meadows near seeps and springs and along the margins of stream banks and lakes. This spring is not located within a CNHP Potential Conservation Area.

Ecological Functions: Overall, this wetland is in excellent condition. Groundwater discharge and temporary surface water storage is occurring on site. Currently, the wetland is providing good bank stabilization functions. Nutrient cycles appear to be intact. The wetland provides forage and a permanent water source for wildlife. The wetland also supports a diversity of butterflies, damselflies, and other insects. The spring does not provide fish habitat but does provide aquatic habitat for amphibians.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition as most ecological processes appear to be intact.

Nonnative and Aggressive Species: Kentucky bluegrass, houndstongue, black medic, and common dandelion are present in the area.

Restoration and Management Comments: Eradicating and monitoring the status of the nonnative species should be conducted to ensure they do not continue to displace native species. Apparently, current livestock management of the area consists of a rest-rotation regime. This appears to be benefiting the ecological health of the wetland and should continue.

Water Chemistry: Water flow was determined to be 2 GPM using the weir. However, flow was not measured at the actual source. Water chemistry was as follows:

pH: 8.068
Conductivity: 1226 μ S/cm
Temperature: 21.6 C

Macroinvertebrates: No macroinvertebrates were observed at this spring.

Photos: H30, H31, H32, H33, H34, H35, and H36.

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APPENDIX: SELECTED PHOTOS OF SEEPS AND SPRINGS



SSR1



SSR2



SSR3



SSR4



SSR5



SSR6



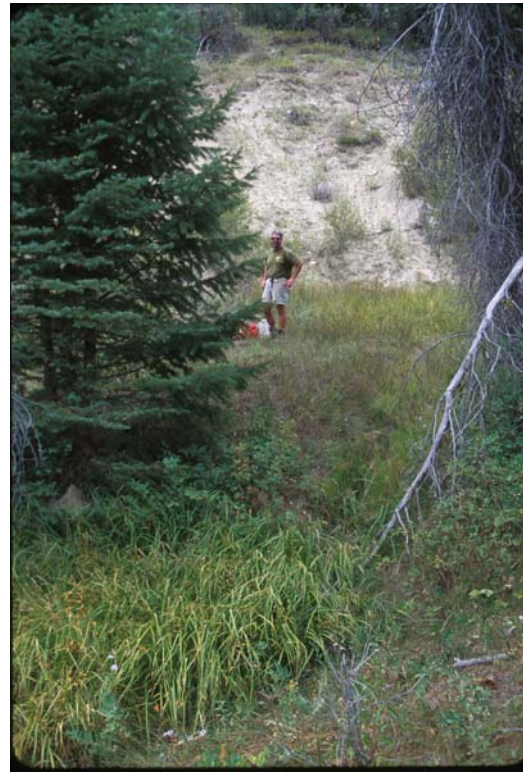
SSR7



SSR8



SSR9



SSR10



SSR11



SSR12



SSR13



SSR14



SSR15



SSR16



SSR17



SSR18 - source



SSR18 - downstream



SSR19



SSR20



SSR21



SSR22



SSR23



SSR24



SSR25



SSR26



SSR27



SSR28



SSR29



Viola nephrophylla

host plant for *Speyeria nokomis nokomis* (Nokomis fritillary - G4T2/S1)

ADDENDUM: Roan Creek Seeps and Springs Survey

An addendum to:

**Survey of Seeps and Springs within the Bureau of Land
Management's Grand Junction Field Office Management Area
(Garfield County, CO)**

Prepared for:

**Bureau of Land Management, Grand Junction Field Office
2815 H Road
Grand Junction, CO 81506**

Prepared by:

**Joe Rocchio, Denise Culver, and Georgia Doyle
June 13, 2002**

**Colorado Natural Heritage Program
College of Natural Resources
254 General Services Building
Colorado State University
Fort Collins, Colorado 80523**



**Colorado
State**
University

Knowledge to Go Places

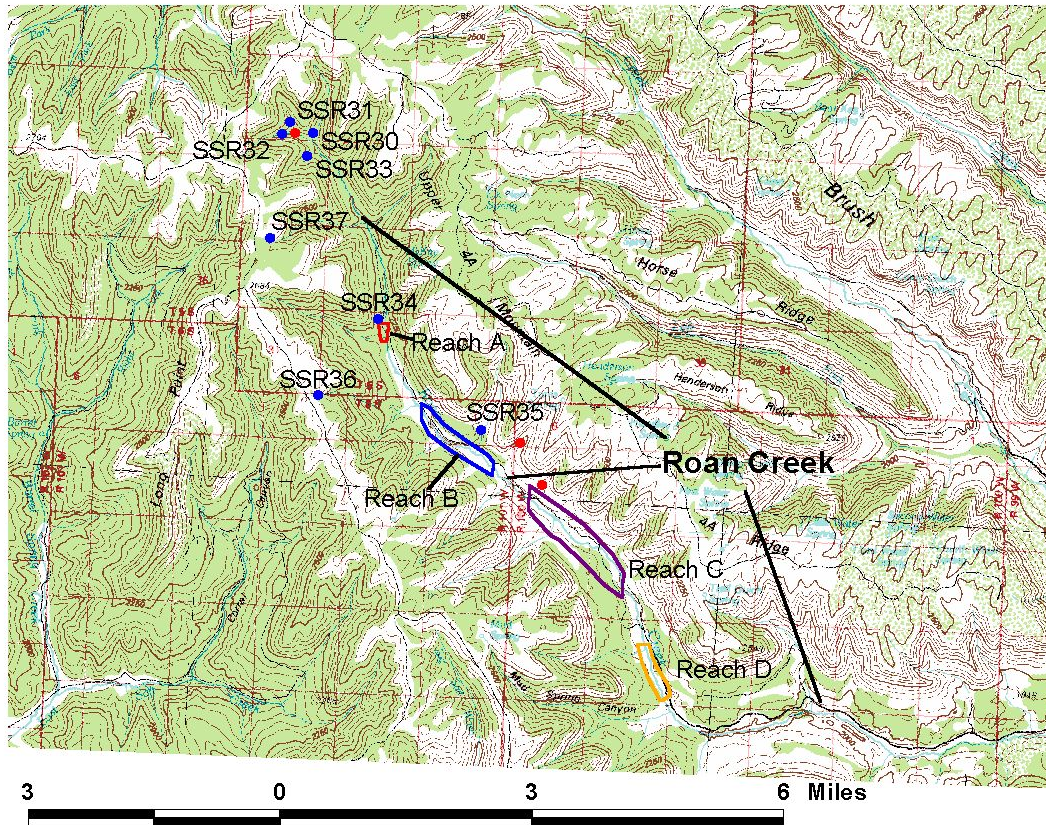
Executive Summary

This addendum summarizes findings of a survey of seeps and springs on Bureau of Land Management lands along the upper Roan Creek drainage in Garfield County, CO. This report is not meant to stand alone, but rather has been written as an addendum to the following report:

Rocchio, J., J. Sovell, and P. Lyon. 2001. Survey of Seeps and Springs within the Bureau of Land Management's Grand Junction Field Office Management Area (Garfield County, CO). Unpublished report prepared for the Bureau of Land Management, Grand Junction District. Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO. CNHP Report # 130.

Seeps and springs were assigned a simple label with a numeric order and begin with SSR30 (SSR29 was the last spring discussed within the report above).

Seeps/Springs and Riparian Reaches on BLM Lands Along Roan Creek



- Springs Not Found
- Roan Creek Seeps/Springs
- Riparian Reach A
- Riparian Reach B
- Riparian Reach C
- Riparian Reach D



GENERAL INFORMATION

This map was produced by the Colorado Natural Heritage Program, a sponsored program of the College of Natural Resources at Colorado State University. Digital maps, and other information on biological topics can be viewed and downloaded from our website at: <http://www.cnhp.colostate.edu>. Support for this map was provided by the Colorado Division of Wildlife, and the Natural Diversity Information Source at Colorado State University. Contact information is below.

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DISCLAIMER

The information provided should not replace field studies necessary for more localized planning efforts. Please note that the absence of any data does not mean that other resources of special concern do not occur, but rather our files do not currently contain information to document this presence. The data contained herein are provided on an as-is, as-available basis without warranties of any kind, expressed or implied, including (but not limited to) warranties of merchantability, fitness for a particular purpose, and non-infringement. CNHP, Colorado State University and the State of Colorado further expressly disclaim any warranty that the data are error-free or current as of the date supplied.

SSR30

Location: Along an unnamed drainage at the headwaters of Roan Creek. GPS Point: Zone 12. 0701686E 4386639N.

Legal Description: USGS 7.5-minute quadrangle: Calf Canyon. T5S R100W Section 18 SE4 SE4.

Elevation: 7545 feet.

Dominant Plant Species and/or Associations: Chokecherry (*Prunus virginiana*) is the dominant shrub near the source and along the periphery of the wetland. Mixed forbs and grasses dominate the springbrook. Various moss species are dominant on the precipitate rock found at this spring.

General Description: This spring discharges in two locations on a steep-sided, south-facing slope. The springbrooks associated with each source converge at the base of the slope prior to entering the creek below. Drainage then flows downstream approximately 50 feet before infiltrating into the alluvium. The drainage is dry thereafter. Given the extremely dry conditions of 2002, the amount of discharge and temperature of the spring indicates that it is associated with a regional aquifer (as opposed to local, precipitation driven aquifers) (USDI 2001). A pack trail crosses the wetland at the base of the slope and continues upstream. Surrounding upland vegetation includes Douglas-fir (*Pseudotsuga menziesii*), aspen (*Populus tremuloides*), and scattered Gambel's oak (*Quercus gambelii*). Precipitate (appears to be calcium carbonate) covers much of the lower slope over which the springbrook drains. Numerous moss species are growing on this precipitate.

Plant and Animal Species Observed: Plant species diversity is high and includes chokecherry, thinleaf alder (*Alnus incana*), gooseberry (*Ribes* sp.), northern bog violet (*Viola nephrophylla*), fowl mannagrass (*Glyceria striata*), American brooklime (*Veronica americana*), wild rose (*Rosa woodsii*), thistle (*Cirsium* sp.), houndstongue (*Cynoglossum officinale*), aster (*Aster* sp.), mullein (*Verbascum thapsus*), common dandelion (*Taraxacum officinale*), geranium (*Geranium richardsonii*), cow-parsnip (*Heracleum sphondylium* subsp. *montanum*), yarrow (*Achillea lanulosa*), bluebells (*Mertensia ciliata*), and false-Solomon's seal (*Maianthemum stellatum*).

Mayfly nymphs and worms were found in the springbrook channel.

Natural Heritage Program Element Occurrences: No elements tracked by CNHP were documented at this specific location, however the spring is contained in CNHP's **Barrel Spring Point Potential Conservation Area**, which is ranked as a **B2** (Very High Significance) site (see Lyon et al. 2001). The PCA contains populations of two rare plants, Piceance bladderpod (*Lesquerella parviflora*; G2G3) and the hanging garden sullivantia (*Sullivantia hapemanii* var. *purpusii*; G3T3). The sullivantia occurs at the

head of the drainage along which this spring occurs but was not found growing at the spring.

The northern bog violet, the host plant for the globally imperiled (G4T2) Nokomis fritillary (*Speyeria nokomis nokomis*), is abundant at this spring. No records of the Nokomis fritillary exist for this site and the butterfly was not observed during the site visit, however data was collected in late May (2002) and the butterfly's typical flight period is late summer (Opler 1999; Pyle 2000).

Ecological Functions: Overall, this wetland is in good condition. Non-native species, such as houndstongue, could threaten the diversity of native plant species. The potential for soil erosion, resulting from trampling and excessive of hoof action, is high along the springbrook which could affect water quality of downstream areas and could cause downcutting of springbrook habitat immediately downstream of the spring source. Currently livestock/wildlife hoof action along the springbrook is only occurring in a few locations. Nutrient cycles appear to be intact and normal but have the potential to be altered by soil disturbance. The wetland provides browse for wildlife and supports invertebrate populations.

Proper Functioning Condition Rating: This spring is rated as "Proper Functioning Condition" as current ecological and physical processes are intact.

Nonnative and Aggressive Species: Mullein, houndstongue, and common dandelion are all present and well represented in the area.

Restoration and Management Comments: Any development activities should ensure that some water (as much as possible) is left flowing down the natural springbrook in order to maintain the wetland vegetation and persistence of dense moss growth on the precipitate rock.

Water Chemistry: Water flow was estimated to be approximately 2-3 GPM at each source. Water chemistry was as follows:

pH: not recorded (pH meter was not reading correctly)

Conductivity: 610 μ S/cm

Temperature: 8.8 C

Macroinvertebrates: No snails or mussels were observed.

Photos: D10-13 (2001).

SSR31

Location: Along an unnamed drainage at the headwaters of Roan Creek. GPS Point: Zone 12. 0701221E 4386828N.

Legal Description: USGS 7.5-minute quadrangle: Calf Canyon. T5S R100W Section 18 W2 SE4.

Elevation: 7757 feet.

Dominant Plant Species and/or Associations: There is very little vegetation present at the spring, however a large red-osier dogwood (*Cornus sericea*) occurs just above the spring source.

General Description: This spring discharges from a steep north-facing slope approximately 10 feet above the creek channel. Most of the area near the spring is void of vegetation. This may be a result of excessive trampling from livestock and wildlife, as indicated by the pack trail near the spring. Adjacent slopes are well vegetated and dry. Drainage from the springs flows into the creek then continues downstream approximately 100 feet before infiltrating into the alluvium. Given the extremely dry conditions of 2002, the amount of discharge and temperature of the spring indicates that it is associated with a regional aquifer (as opposed to local, precipitation driven aquifers) (USDI 2001). Surrounding upland vegetation is mainly Douglas-fir (*Pseudotsuga menziesii*) and serviceberry (*Amelanchier utahensis*). Woody debris covers much of the creek bottom.

Plant and Animal Species Observed: Plant species observed in the spring wetland include red-osier dogwood (*Cornus sericea*), northern bog violet (*Viola nephrophylla*), fowl mannagrass (*Glyceria striata*), houndstongue (*Cynoglossum officinale*), stinging nettle (*Urtica dioica*), large-leaved avens (*Geum macrophyllum*), common dandelion (*Taraxacum officinale*), yarrow (*Achillea lanulosa*), and bluebells (*Mertensia ciliata*).

No snails or other macroinvertebrates were found in the springbrook channel.

Natural Heritage Program Element Occurrences: No elements tracked by CNHP were documented at this specific location, however the spring is contained in CNHP's **Barrel Spring Point Potential Conservation Area**, which is ranked as a **B2** (Very High Significance) site (see Lyon et al. 2001). The PCA contains populations of two rare plants, Piceance bladderpod (*Lesquerella parviflora*; G2G3) and the hanging garden sullivantia (*Sullivantia hapemanii* var. *purpusii*; G3T3). The sullivantia occurs at the head of the unnamed drainage along which this spring occurs but was not found growing at the spring.

Ecological Functions: This wetland is not functioning properly. Lack of vegetation growth, resulting from trampling and excessive hoof action, increases the probability of excessive erosion, which could affect water quality of downstream areas and may cause downcutting and dewatering of the wetland at the spring source. Wildlife habitat,

nutrient cycling, and water storage capabilities are all negatively affected by the lack of vegetation.

Proper Functioning Condition Rating: This spring is rated as "Functional At Risk" as current ecological and physical processes are disturbed. Lack of vegetation limits water retention, alters nutrient cycling, increases erosion, limits wildlife habitat, and could decrease the extent of the wetland.

Nonnative and Aggressive Species: Houndstongue and common dandelion are present in the area.

Restoration and Management Comments: This spring and its associated springbrook should be fenced to allow wetland vegetation to reestablish and to stabilize the soil.

Water Chemistry: Water flow was found to be 1.5 GPM at the source (used the weir). Water chemistry was as follows:

pH: not recorded (pH meter was not reading correctly)
Conductivity: 500 μ S/cm
Temperature: 9.4 C

Macroinvertebrates: No snails or mussels were observed.

Photos: D14-16 (2001).

SSR32

Location: Along an unnamed drainage at the headwaters of Roan Creek. GPS Point: Zone 12. 0701091E 4386582N.

Legal Description: USGS 7.5-minute quadrangle: Calf Canyon. T5S R100W Section 18 SE4 SW4.

Elevation: 7759 feet.

Dominant Plant Species and/or Association: Mixed forbs and graminoids dominate the spring.

General Description: This spring discharges from the creek channel and flows approximately 30 feet before infiltrating back into the alluvium. There is little vegetation growing along the springbrook. The adjacent south-facing slope is very moist with various moss species covering much of the lower slope. The moist conditions may be the result of groundwater seepage, although this could not be confirmed during the site visit. Given the extremely dry conditions of 2002, the amount of discharge and temperature of the spring indicates that it is associated with a regional aquifer (as opposed to local, precipitation driven aquifers) (USDI 2001). Surrounding vegetation is mainly Douglas-fir (*Pseudotsuga menziesii*).

Plant and Animal Species Observed: Plant species observed in the spring wetland include chokecherry (*Prunus virginiana*), gooseberry (*Ribes* sp.), violets (*Viola* sp.), fowl mannagrass (*Glyceria striata*), stinging nettle (*Urtica dioica*), large-leaved avens (*Geum macrophyllum*), common dandelion (*Taraxacum officinale*), cow-parsnip (*Heracleum sphondylium* subsp. *montanum*), geranium (*Geranium richardsonii*), bedstraw (*Galium* sp.), American brooklime (*Veronica americana*), and bluebells (*Mertensia ciliata*).

Douglas-fir, chokecherry, elderberry (*Sambucus microbotrys*), large-leaved avens, violets (*Viola* sp.), gooseberry, and stinging nettle covered much of the lower slope.

No snails or other macroinvertebrates were found in the springbrook channel but there were numerous butterflies in the area.

Natural Heritage Program Element Occurrences: No elements tracked by CNHP were documented at this specific location, however the spring is contained in CNHP's **Barrel Spring Point Potential Conservation Area**, which is ranked as a **B2** (Very High Significance) site (see Lyon et al. 2001). The PCA contains populations of two rare plants, Piceance bladderpod (*Lesquerella parviflora*; G2G3) and the hanging garden sullivantia (*Sullivantia hapemanii* var. *purpusii*; G3T3). The sullivantia occurs at the head of the unnamed drainage along which this spring occurs but was not found growing at the spring.

Ecological Functions: Overall, this wetland is in good condition. Currently livestock/wildlife hoof action along the springbrook is only occurring in a few locations. Nutrient cycles appear to be intact and normal but have the potential to be altered by soil disturbance. Non-native species were not abundant. The wetland provides browse for wildlife and supports invertebrate populations.

Proper Functioning Condition Rating: This spring is rated as Proper Functioning Condition as current ecological and physical processes are intact. Streambanks are stable and wetland vegetation appears to be at maximum extent.

Nonnative and Aggressive Species: Common dandelion is present in the area.

Restoration and Management Comments: Any develop activities should ensure that some water (as much as possible) is left flowing in order to maintain wetland vegetation.

Water Chemistry: Water flow was found to be approximately 1.5-2 GPM at the source (ocular estimate). Water chemistry was as follows:

pH: not recorded (pH meter was not reading correctly)

Conductivity: 580 μ S/cm

Temperature: 7.0 C

Macroinvertebrates: No snails or mussels were observed.

Photos: D17-19 (2001).

SSR33

Location: Along an unnamed drainage at the headwaters of Roan Creek. GPS Point: Zone 12. 0701599E 4386206N.

Legal Description: USGS 7.5-minute quadrangle: Calf Canyon. T5S R100W Section 19 NE4 NE4.

Elevation: 7663 feet.

Dominant Plant Species and/or Association: Chokecherry (*Prunus virginiana*) dominates one of the spring sources. Of the two other sources, one discharges within the creek bed and doesn't have a dominant species associated with it, while the other source is void of vegetation.

General Description: Three small springs discharge within approximately 100 feet of each other. The first spring (furthest downstream) discharges from a south-facing slope from beneath a Douglas-fir (*Pseudotsuga menziesii*) and is the most intact of the three sources. A pack trail cuts across the springbrook and immediately downslope from this trail is an abundance of northern bog violets (*Viola nephrophylla*) growing in dense clumps. Hoof action is occurring near the pack trail but the dense growth of violets seems to be stabilizing this area. The second spring (next one upstream) also discharges from the south-facing slope but the source has been excavated forming a small, stagnant pond void of vegetation. The third spring (furthest upstream) discharges from the creek channel. The channel is very rocky and contains an abundance of woody debris. There is very little vegetation growing along the creek. Surrounding upland vegetation is mainly Douglas-fir (*Pseudotsuga menziesii*), aspen (*Populus tremuloides*), and serviceberry (*Amelanchier utahensis*).

Given the extremely dry conditions of 2002, the amount of discharge and temperature of the spring indicates that it is associated with a regional aquifer (as opposed to local, precipitation driven aquifers) (USDI 2001).

Plant and Animal Species Observed: Plant species observed at the first spring include chokecherry (*Prunus virginiana*), wild rose (*Rosa woodsii*), northern bog violet (*Viola nephrophylla*), fowl mannagrass (*Glyceria striata*), common dandelion (*Taraxacum officinale*), cow-parsnip (*Heracleum sphondylium* subsp. *montanum*), geranium (*Geranium richardsonii*), bedstraw (*Galium* sp.), American brooklime (*Veronica americana*), bluebells (*Mertensia ciliata*), thistle (*Cirsium* sp.), yarrow (*Achillea lanulosa*), and sedge (*Carex* sp.). No plants were growing at the second spring. Plant species near the third spring and along the creek channel include sporadic chokecherry and red-osier dogwood (*Cornus sericea*), bluebells, stinging nettle, gooseberry (*Ribes* sp.), large-leaved avens (*Geum macrophyllum*), Douglas-fir (*Pseudotsuga menziesii*), and monkshood (*Aconitum columbianum*).

No snails or other macroinvertebrates were found in the springbrook channel but there were numerous butterflies in the area.

Natural Heritage Program Element Occurrences: No elements tracked by CNHP were documented at this specific location and the site is not located within a CNHP Potential Conservation Area.

Ecological Functions: The first and third springs are in good condition while the second is not functioning naturally. Currently livestock/wildlife hoof action is occurring in a few locations, especially near the first and second springs. Nutrient cycles appear to be intact and normal in the first and third springs but have been altered by soil disturbance in the second. The springs provide browse and water for mammals and supports invertebrate populations. Export of nutrients and organic carbon is occurring in the first and third springs, while export has been decreased due to the lack of vegetation and soil disturbance at the second spring.

Proper Functioning Condition Rating: The first and third springs are rated as "Proper Functioning Condition" as current ecological and physical processes are intact. However, additional trampling near the first spring could disrupt hydrology and induce erosion. The second spring is rated as "Functional At Risk" as it is void of vegetation and has physically been altered from its natural state.

Nonnative and Aggressive Species: Common dandelion is present in the area.

Restoration and Management Comments: Any develop activities should ensure that some (as much as possible) is left flowing in order to maintain the wetland vegetation. The first spring and its associated wetland should be fenced to allow wetland vegetation to reestablish disturbed areas and to stabilize the soil. Restoring the second spring would require regrading the area back to its original level and fencing the area to allow vegetation establishment.

Water Chemistry: Water flow was found to be approximately 0.5 GPM (ocular estimate of first spring). Water chemistry was as follows (taken from first spring):

pH: not recorded (pH meter was not reading correctly)

Conductivity: 490 μ S/cm

Temperature: 10.9 C

Macroinvertebrates: No snails or mussels were observed.

Photos: D20-21 (2001).

SSR34

Location: On a terrace above Roan Creek. GPS Point: Zone 12. 0703166E 4383177N.

Legal Description: USGS 7.5-minute quadrangle: Calf Canyon. T5S R100W Section 32 NW4 NE4.

Elevation: 7205 feet.

Dominant Plant Species and/or Association: Narrowleaf cottonwood (*Populus angustifolia*) dominates the overstory and Nebraska sedge (*Carex nebrascensis*) dominates the lowermost wetland.

General Description: The spring emerges from three sources at the base of an east-facing slope. Drainage from these springs come together to form one springbrook, which flows downslope into a small wetland, dominated by Nebraska sedge, just west of the road. A small culvert carries water from this wetland underneath the road and finally down a steep bank into Roan Creek. Narrowleaf cottonwood, river birch (*Betula occidentalis*), chokecherry (*Prunus virginiana*), and thinleaf alder (*Alnus incana*) occupy much of the area. The undergrowth consists of various forbs and graminoids. Surrounding upland vegetation is mainly Douglas-fir (*Pseudotsuga menziesii*) and serviceberry (*Amelanchier utahensis*). Given the extremely dry conditions of 2002, the amount of discharge and temperature of the spring indicates that it is associated with a regional aquifer (as opposed to local, precipitation driven aquifers) (USDI 2001).

Plant and Animal Species Observed: Plant species observed include narrowleaf cottonwood, river birch, chokecherry, alder, wild rose (*Rosa woodsii*), gooseberry (*Ribes* sp.), serviceberry (*Amelanchier utahensis*), Nebraska sedge, fowl mannagrass (*Glyceria striata*), common dandelion (*Taraxacum officinale*), American brooklime (*Veronica americana*), alkali crowfoot (*Halerpestes cymbalaria*), sedge (*Carex* sp.), stinging nettle (*Urtica dioica*), and false-Solomon's seal (*Maianthemum stellatum*).

No snails were found in the springbrook channel but mayfly and caddisfly nymphs were observed.

Natural Heritage Program Element Occurrences: No elements tracked by CNHP were documented at this specific location and the site is not located within a CNHP Potential Conservation Area.

Ecological Functions: There is a lot of hoof action at the spring sources and along associated springbrooks. This may increase erosion, and thus alter hydrology, along the channel and has decreased wetland vegetation cover in many areas, including the small wetland adjacent to the road. Diversity of vegetation structure is good but vegetation volume is minimal in the shrub and herbaceous layers. Nutrient cycles appear to be intact and normal but may be impacted by soil disturbance from excessive hoof action. The

area provides browse and water for wildlife and supports invertebrate populations. Export of nutrients and organic carbon is occurring to Roan Creek.

Proper Functioning Condition Rating: This spring is considered "Functional at Risk", due to the excessive hoof action (trampling) along the springbrook and in the lower wetland. This has altered hydrology in the lower wetland and decreased wetland vegetation cover. Impacts associated with hoof action are less so along the springbrook, but impacts are visible.

Nonnative and Aggressive Species: Common dandelion is abundant in the area.

Restoration and Management Comments: The lower wetland and the main springbrook should be fenced to allow wetland vegetation to reestablish and ensure hydrology remains intact. Any develop activities should ensure that some (as much as possible) is left flowing in order to maintain the wetland vegetation.

Water Chemistry: Water flow was found to be approximately 1 GPM (ocular estimate). Water chemistry was as follows:

pH: 8.0
Conductivity: 920 $\mu\text{S}/\text{cm}$
Temperature: 9.0 C

Macroinvertebrates: No snails or mussels were observed.

Photos: D22-25 (2001).

SSR35

Location: Along an unnamed tributary of Roan Creek. GPS Point: Zone 12. 0705263E 4381185N.

Legal Description: USGS 7.5-minute quadrangle: Henderson Ridge. T6S R101W Section 1 NE4 NE4.

Elevation: 7083 feet.

Dominant Plant Species and/or Association: There is very little vegetation present at the uppermost spring, but Rocky Mountain willow (*Salix monticola*) and Baltic rush (*Juncus balticus*) are the dominant species at the spring near the mouth of the drainage.

General Description: Numerous small seeps discharge along this drainage, both within the channel and from adjacent, streambank slopes. However, two main springs were found along this drainage. The first occurs near the mouth of the drainage on an adjacent slope. There is a large wet meadow here dominated by scattered Rocky Mountain willow and Baltic rush. The meadow was mostly dry during the site visit. The second spring occurs further up the drainage and discharges within the channel. Vegetative cover is low at this spring due to the narrow and rocky nature of the channel. Surrounding upland vegetation is mainly Douglas-fir (*Pseudotsuga menziesii*), Gambel's oak (*Quercus gambelii*), and serviceberry (*Amelanchier utahensis*). Given the extremely dry conditions of 2002, the amount of discharge and temperature of the spring indicates that it is associated with a regional aquifer (as opposed to local, precipitation driven aquifers) (USDI 2001).

Plant and Animal Species Observed: Plant species observed at the lower spring include Rocky Mountain willow, common dandelion (*Taraxacum officinale*), sedge (*Carex* sp.), Baltic rush, black medic (*Medicago lupulina*), northern bog violet (*Viola nephrophylla*), scouring rush (*Hippochaete laevigata*), and houndstongue (*Cynoglossum officinale*). Plant species observed in the vicinity of the second, uppermost spring include Rocky Mountain willow, cow-parsnip (*Heracleum sphondylium* subsp. *montanum*), geranium (*Geranium richardsonii*), bedstraw (*Galium* sp.), bluebells (*Mertensia ciliata*), common dandelion, houndstongue, willowherb (*Epilobium ciliatum*), stinging nettle (*Urtica dioica*), and mullein (*Verbascum thapsus*).

No snails were found in the springbrook channel but mayfly, stonefly, and caddisfly immatures were observed.

Natural Heritage Program Element Occurrences: No elements tracked by CNHP were documented at this specific location and the site is not located within a CNHP Potential Conservation Area.

Ecological Functions: There is very little disturbance observed at both springs. Some grazing/trampling may be occurring in the lower most spring but with no major impacts.

Nutrient cycles appear to be intact and normal at both locations as hydrology, soils, and vegetative growth appeared undisturbed. The lower spring provides browse and water for wildlife and supports invertebrate populations. Both springs export nutrients and organic carbon, as the volume of discharge is high enough to carry material downstream to Roan Creek.

Proper Functioning Condition Rating: This spring is "Proper Functioning Condition," as most physical and ecological processes appear intact.

Nonnative and Aggressive Species: Common dandelion, houndstongue, and mullein are abundant in the area.

Restoration and Management Comments: Any develop activities should ensure that some water (as much as possible) is left flowing in order to maintain the wetland vegetation.

Water Chemistry: Water flow was found to be approximately 1 GPM (ocular estimate at upper spring). Water chemistry was as follows (taken from upper spring):

pH: 7.6
Conductivity: 840 μ S/cm
Temperature: 8.0 C

Macroinvertebrates: No snails or mussels were observed.

Photos: D29-31 (2001).

SSR36

Location: At the headwater of an unnamed tributary (first drainage north of McKay Canyon) of Roan Creek. GPS Point: Zone 12. 0702103E 4381644N.

Legal Description: USGS 7.5-minute quadrangle: Calf Canyon. T6S R101W Section 3 N2 NE4.

Elevation: 8678 feet.

Dominant Plant Species and/or Association: Mixed forbs and graminoids dominate the spring.

General Description: This spring discharges within the creek channel in a few locations, all within approximately 50 feet of each other. Volume of groundwater discharge from all locations was minimal. The wetland is very linear and small. Some green algae is growing in the creek channel, possibly associated with livestock activity in the area. A small reservoir/impoundment exists 100 feet upstream and may be impounding discharge from what was once the main spring source. Surrounding upland vegetation on the adjacent north-facing slope is mainly Douglas-fir (*Pseudotsuga menziesii*) and aspen (*Populus tremuloides*) while sagebrush (*Artemisia tridentata*) and serviceberry (*Amelanchier utahensis*) occupy the south-facing slope.

Plant and Animal Species Observed: Plant species observed include common dandelion (*Taraxacum officinale*), stinging nettle (*Urtica dioica*), fowl mannagrass (*Glyceria striata*), large-leaved avens (*Geum macrophyllum*), and American brooklime (*Veronica americana*).

Natural Heritage Program Element Occurrences: No elements tracked by CNHP were documented at this specific location, however the spring is contained in CNHP's **Barrel Spring Point Potential Conservation Area**, which is ranked as a **B2** (Very High Significance) site (see Lyon et al. 2001). The PCA contains populations of two rare plants, Piceance bladderpod (*Lesquerella parviflora*; G2G3) and the hanging garden sullivantia (*Sullivantia hapemanii* var. *purpusii*; G3T3).

Ecological Functions: Nutrient cycles may be altered from excess nutrient inputs from local livestock activity, as indicated by growth of green algae in creek. There is very little browse available to livestock and/or wildlife as the wetland is very small. The reservoir may be disrupting the spring's hydrology, especially if its impounding groundwater discharge, which might otherwise discharge via the spring.

Proper Functioning Condition Rating: Physical processes appear intact. That is, there is no excessive erosion or minimization of wetland vegetation. Although the reservoir may be altering hydrology, the extent of the wetland would not likely be much larger given the geomorphic setting of this spring. However, the volume of discharge might be

greater and thus support a different suite of species. This spring is rated as "Proper Functioning Condition."

Nonnative and Aggressive Species: Common dandelion is present in the area.

Restoration and Management Comments: : The spring could be fenced to keep excess nutrients from impacting water quality. Groundwater seepage from the reservoir may be also impacting water quality of the spring.

Water Chemistry: Water flow was found to be approximately 0.5 GPM (ocular estimate). Water chemistry was as follows:

pH: not recorded (pH meter was not reading correctly)
Conductivity: 415 μ S/cm
Temperature: 6.9 C

Macroinvertebrates: No snails or mussels were observed.

Photos: A1-2 (2002).

SSR37

Location: At the headwater of an unnamed tributary of Roan Creek. GPS Point: Zone 12. 0701001E 4384586N.

Legal Description: USGS 7.5-minute quadrangle: Calf Canyon. T5S R100W Section 30 NW4 E2.

Elevation: 8713 feet.

Dominant Plant Species and/or Association: Mixed shrubs and forbs (very little vegetation present at source) dominate the spring.

General Description: This is a very small and low volume spring discharging within the creek channel. The spring appears to be permanent, as indicated by the amount of moss growing on rocks near the source, but discharge was limited to groundwater dripping out of bedrock and there was no discernable flow occurring. There was very little wetland vegetation in the area. The surrounding area is very steep with Douglas-fir (*Pseudotsuga menziesii*) and aspen (*Populus tremuloides*) dominating the north-facing slope while sagebrush (*Artemisia tridentata*) and serviceberry (*Amelanchier utahensis*) occupy the south-facing slope.

Plant and Animal Species Observed: Plant species observed include chokecherry (*Prunus virginiana*), gooseberry (*Ribes* sp.), fowl mannagrass (*Glyceria striata*), bluebells (*Mertensia ciliata*), yarrow (*Achillea lanulosa*), sedge (*Carex* sp.), an unidentified fern, and at least three different moss species.

Natural Heritage Program Element Occurrences: No elements tracked by CNHP were documented at this specific location, however the spring is contained in CNHP's **East Salt Creek Headwaters Potential Conservation Area**, which is ranked as a **B2** (Very High Significance) site (see Rocchio et al. 2001 and Lyon et al. 2001). The PCA contains a population of the globally imperiled (G2) Piceance bladderpod (*Lesquerella parviflora*), the globally vulnerable (G3) montane narrowleaf cottonwood/skunkbrush riparian forest (*Populus angustifolia/Rhus trilobata*), and a unique stand of balsam poplar (*Populus balsamifera*) (GU).

Ecological Functions: Nutrient cycles appear to be intact and normal as hydrology, soils, and vegetative growth appear undisturbed. The minimal vegetation cover and groundwater discharge provide little browse and water for wildlife. Nutrient and organic carbon export is minimal due to the low volume of discharge.

Proper Functioning Condition Rating: Physical processes appear intact. That is, there is no excessive erosion or minimization of wetland vegetation, thus this spring is rated as "Proper Functioning Condition."

Nonnative and Aggressive Species: None observed.

Restoration and Management Comments: Given the low volume of discharge, any development activities may negatively affect the persistence of this spring. Also, given the very steep nature of the area, attracting livestock to the area would likely result in excessive erosion of the spring and surrounding upland slopes.

Water Chemistry: Water flow and chemistry could not be measured given the low volume of discharge.

Macroinvertebrates: No snails or mussels were observed.

Photos: A3-5 (2002).

BLM Roan Creek Riparian Reaches

Reach A: BLM parcel located in T5S R100W Section 32, NE4 NE4. This is a very small stretch suffering from excessive bank erosion, sparse herbaceous cover, and little shrub cover. Most of the willows present do not look healthy. Additional vegetative cover, especially willows, may increase the extent of floodplain wetlands by stabilizing soils and increasing water retention. There is abundant evidence of livestock grazing. Stonefly, mayfly, and caddisfly immatures were located in the stream suggesting stream water quality is good. The following plant species were observed: Rocky Mountain willow (*Salix monticola*), gooseberry (*Ribes* sp.), Baltic rush (*Juncus balticus*), common dandelion (*Taraxacum officinale*), houndstongue (*Cynoglossum officinale*), mullein (*Verbascum thapsus*), scouring rush (*Hippochaete laevigata*), horsetail (*Equisetum arvense*), American brooklime (*Veronica americana*), northern bog-violet (*Viola nephrophylla*), and Nebraska sedge (*Carex nebrascensis*).

Rated as "Functional At Risk" due to the instability of the stream banks and continued degradation of floodplain vegetation (willows) which could increase bank instability. Photos: D26-28 (2001).

Reach B: BLM parcel located in T6S R101W Section 1 SW4, Section 2 NE2, Section 12 N2. This riparian stretch is in good condition. Beaver dams occur along the reach, streambanks are well vegetated, stream quality (as indicated by the presence of stonefly, mayfly, and caddisfly immatures) is good, and willows do not appear to be grazed too heavily. The following plant species were observed: Rocky Mountain willow (*Salix monticola*), golden currant (*Ribes aureum*), wild rose (*Rosa woodsii*), Baltic rush (*Juncus balticus*), common dandelion (*Taraxacum officinale*), houndstongue (*Cynoglossum officinale*), mullein (*Verbascum thapsus*), American brooklime (*Veronica americana*), aster (*Aster* sp.), fowl mannagrass (*Glyceria striata*), yarrow (*Achillea lanulosa*), Canada thistle (*Cirsium arvense*), alkali crowfoot (*Halerpestes cymbalaria*), hornwort (*Ceratophyllum demersum*), and reed canarygrass (*Phalaris arundinacea*).

Rated as "Proper Functioning Condition."
Photos: D32-33 (2001).

Reach C: BLM parcel located in T6S R100W Section 7 S2, Section 17 W2, and Section 18 NE4 NE4. The riparian area in this parcel has a few undercut streambanks and some willows appear to be under excessive grazing. The following plant species were observed: Rocky Mountain willow (*Salix monticola*), sandbar willow (*S. exigua*), golden currant (*Ribes aureum*), Baltic rush (*Juncus balticus*), common dandelion (*Taraxacum officinale*), houndstongue (*Cynoglossum officinale*), mullein (*Verbascum thapsus*), American brooklime (*Veronica americana*), fowl mannagrass (*Glyceria striata*), yarrow (*Achillea lanulosa*), reed canarygrass (*Phalaris arundinacea*), horsetail (*Equisetum arvense*), common spikerush (*Eleocharis palustris*), sedge (*Carex* sp.), and black medic (*Medicago lupulina*).

Rated as "Functional At Risk" due to the instability of the stream banks and continued degradation of floodplain vegetation (willows) which could increase bank instability. Photos: D34-35 (2001).

Reach D: BLM parcel located in T6S R100W Section 20 E2. Most streambanks are adequately vegetated but a few are being undercut. Regeneration of willows is occurring along this stretch and river birch (*Betula occidentalis*) is abundant. Stream quality is good as indicated by the presence of stonefly, mayfly, and caddisfly nymphs. The following plant species were observed: river birch, Rocky Mountain willow (*Salix monticola*), sandbar willow (*S. exigua*), Baltic rush (*Juncus balticus*), common dandelion (*Taraxacum officinale*), houndstongue (*Cynoglossum officinale*), mullein (*Verbascum thapsus*), American brooklime (*Veronica americana*), fowl mannagrass (*Glyceria striata*), scouring rush (*Hippochaete hyemalis*), yarrow (*Achillea lanulosa*), alkali crowfoot (*Halerpestes cymbalaria*), common plantain (*Plantago major*), reed canarygrass (*Phalaris arundinacea*), sedge (*Carex* sp.), and black medic (*Medicago lupulina*).

Rated as "Proper Functioning Condition."
Photos: D36 (2001).

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