

MUD LAKE OPEN SPACE

**PART I: RESOURCE EVALUATION &
MANAGEMENT CONSIDERATIONS**

Boulder County Parks & Open Space Department

November 25, 2002

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LANDSCAPE SETTING

1.0 INTRODUCTION

Mud Lake, at one time called Muskee Lake, has had a long history of human use and exploration. The property was first homesteaded in the early 1870s in conjunction with the gold and silver mining occurring around Nederland and Caribou. The tungsten mining boom, which began around 1910, heavily influenced use of the property; major tungsten mines were located just west of Mud Lake and were accessed by roads through the property, while lesser mines and exploratory operations occurred on the property. The lake itself has drawn the attention of many university researchers studying amphibians and mollusks; early studies and reports date from the 1930s. Citizens from the Nederland area have long enjoyed the area for hiking, picnicking, ice-skating, and other outdoor activities.

Staff is grateful to the people involved in protecting this property, including Linda Heide, The Town of Nederland and its citizens, Wild Bear, and all the citizens of Boulder County.

2.0 GENERAL DESCRIPTION OF PROPERTY

2.1 Location

Mud Lake Open Space is located in western Boulder County, Colorado, directly north of the Town of Nederland (Figure 1). The property contains two separate parcels. A 190-acre parcel (referred to as Mud Lake) is bounded by Indian Peaks Drive (County Road 128W) on the south, the Peak-to-Peak Highway on the east, and County Road 126 on its north. A 36-acre parcel (referred to as the Ridge Road Parcel) is located ¼ mile east of the Peak-to-Peak Highway along Ridge Road.

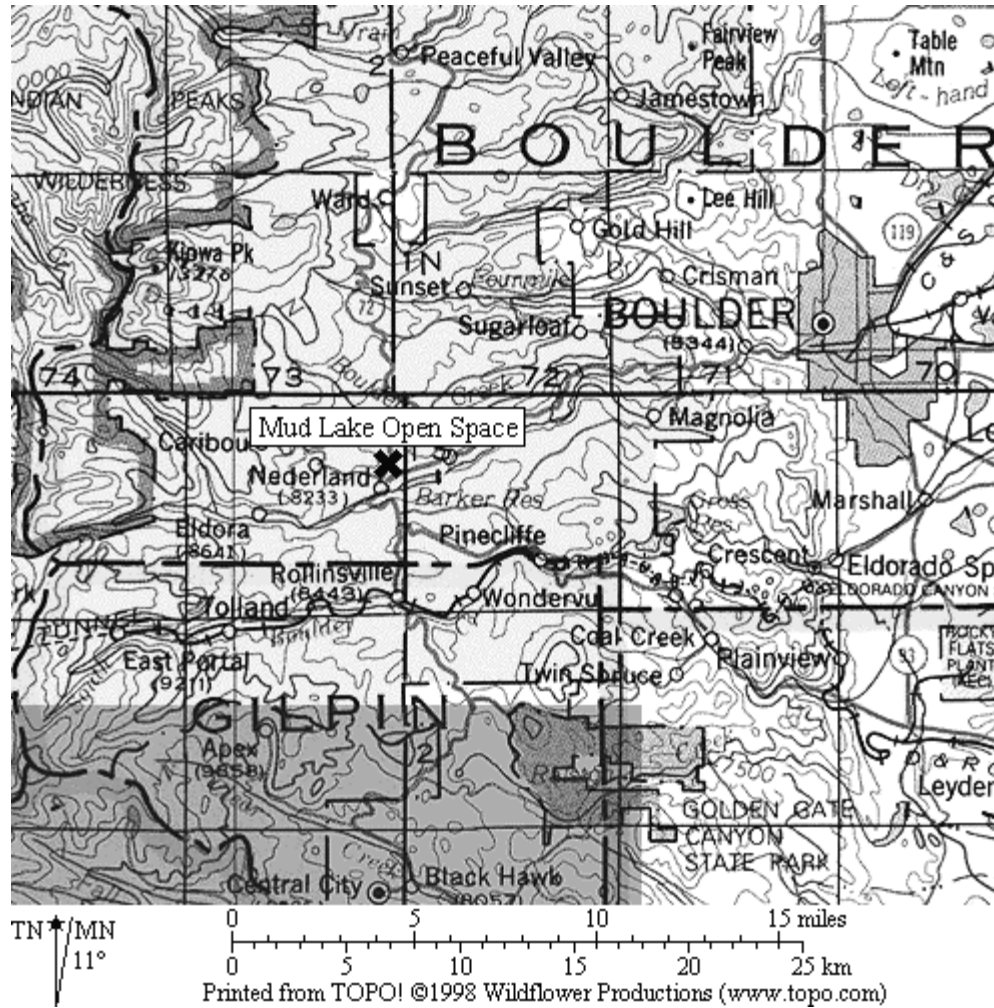
Other descriptive locators include:

- East slope of the Front Range of the Southern Rocky Mountains;
- Northern end of the Colorado Mineral Belt;
- North Boulder Creek watershed;
- Montane lifezone;
- In Section 12, Township 1S, Range 73 West.

2.2 Terms of Acquisition

In 1999, the Town of Nederland approached Boulder County for participation in the preservation of Mud Lake Open Space. The Town had negotiated to purchase a 260-acre property from Linda Heide and through a subsequent Intergovernmental Agreement (IGA) the Town and the County formulated purchase schedules and future land objectives. The largest portion of the property--the parcel north of County Road 128W--is open space; the portion south of County Road 128W is annexed to the Town and is being developed for residential use and for some industrial uses relocated from areas within the Town—including the Town garage with the public works maintenance shops and a private excavating business. While up to 22 acres of this 70-acre parcel south of the County Road 128W could be developed, the remaining 48 acres will be open space in the Town of Nederland. The Wild Bear Center for Nature Discovery (formerly

Figure 1 – Location



the Wild Bear Science School), a non-profit natural science education organization, will be located on a 4-acre parcel within Mud Lake Open Space. The Town of Nederland also annexed a portion of the land north of CR128W thereby easing future annexation of the Wild Bear parcel if the center’s development isn’t approved by the County. Other related real estate transactions allowed the construction of the Boulder Valley School District bus barn on the Ridge Road parcel--freeing up more space in Nederland for other uses including a new Town fire station at the old bus barn site and affordable housing at the old fire station location. These various transactions allowed the purchase of the property using a variety of means and sources of funds.

The purchase of the property occurred over 3 years. Boulder County participated by making the first year \$600,000 payment. This entitled Boulder County to the fee ownership of the property north of County Road 128W, excepting the 4 acre parcel that is owned by Wild Bear. Over the course of the agreement period, the Town of Nederland paid \$1.3 million for the various properties in the deal some of which were funded by the sales of the portion of the property adjacent to Nederland (south of County Road 128W). Of the county’s \$600,000 total, \$150,000 was reimbursed by the Town, and \$144,000 was from affordable housing funds; \$306,000 came from county open space funds. Wild Bear contributed \$100,000 to the deal.

As part of the acquisition negotiations, Boulder County and Nederland agreed to jointly develop a management plan for the property, which will include passive recreational opportunities as well as environmental preservation. Wild Bear will help with the environmental stewardship of the property as part of their educational mission.

2.3 Climate

The National Weather Service information for Nederland (Table 1) provides a reliable estimate of conditions at Mud Lake since the two sites are within a mile or two of each other and they share similar elevation ranges.

Table 1

Monthly Climate Summary - Nederland, CO													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Avg. Max. Temp. (F)	34.9	38.4	41.6	48.7	57.6	69.2	75.2	73.2	65.2	55.3	43.1	37.2	53.3
Avg. Min. Temp. (F)	10.2	13.7	16.6	22.5	29.3	37.1	42.6	41.2	33.8	25.4	17.6	12.5	25.3
Avg. Total Precip. (in.)	0.5	0.5	1.3	2.2	2.7	1.6	2.4	2.0	1.7	1.0	1.1	.7	17.7
Avg. Total Snow (in.)	13.3	13.1	24.0	25.0	12.2	1.8	0.0	0.0	5.1	9.3	19.9	16.2	139.8
Period of Record: 4/13/1970 - 5/31/1988; data from National Weather Service, Denver, CO.													

The elevation of the site, between 8600 and 8250 feet, provides a dramatic temperature contrast to the typically warmer conditions found on the plains, about 3000 feet lower. While none of the monthly average maximum temperatures are below 32 degrees, all but the four “summer” months have monthly minimum temperatures below 32 degrees. Every month averages at least 24 degrees of minimum to maximum monthly temperature difference; this range reflects the relatively wide daily temperature variations every month of the year in this

high-elevation, relatively dry, and often sunny climate: Mud Lake typically experiences a 25-degree daily temperature range and a 40-degree seasonal change (as measured by average monthly maximum temperatures). Annual precipitation for the area averages 18 inches. Spring has the greatest amount of precipitation followed by summer. Barry (1973) had similar climatic findings at a study site several miles north of Nederland at 8,500. He found mean annual precipitation to be 21.7 inches with May being the wettest month and January the driest. Approximately 140 inches of snow fall annually; April, March and November are the snowiest.

Each of the seasons has distinct weather patterns (Benedict 1991). Winter weather is influenced by storm systems originating over the Pacific Ocean that are driven east by the jet stream. During spring, the diminishing strength of the westerlies allows Gulf air masses to push their way northward into the Great Plains with increasing frequency resulting in heavy precipitation. During summer, the air patterns are a mix of comparatively dry air that flows from the west interspersed with influxes of Gulf moisture which fuel either afternoon thunderstorms or persistent upslope storms. By fall, the flow of Gulf moisture ceases and the strong westerlies have yet to arrive resulting in comparatively little precipitation and lots of sunshine—the period known as Indian summer.

Wind is a significant element of the local climate. Prevailing winds are generally west to east with average wind speeds around 9 miles per hour. Peak wind events generally begin sometime in the fall and continue into winter and spring. During this time, the weather patterns are generally driven by upper-air westerlies. These airflows are influenced broadly by the Southern Rocky Mountains, and locally by the Continental Divide located 8 miles west of Nederland, which helps form ripples and waves in the air currents as they flow down toward the Great Plains. Long periods of winds gusting 20 to 50 miles per hour are common, along with occasional gusts approaching 100 miles per hour. Strong downslope winds often bring warmer temperatures due to adiabatic heating. These winds are known as chinook winds (a Native American word meaning “snow eater”) and influence the depth of the snow pack and the location of snow-free areas, which can be utilized for winter forage by grazing animals.

2.4 Topography

The area lies within the montane lifezone of the east flank of the Front Range of the Southern Rocky Mountains. The low point is in the northeast corner of the Mud Lake parcel where Sherwood Creek exits the property with an elevation above sea level of 8,250 feet. The highest point is in the southwest corner of the Mud Lake parcel and measures 8,600 feet.

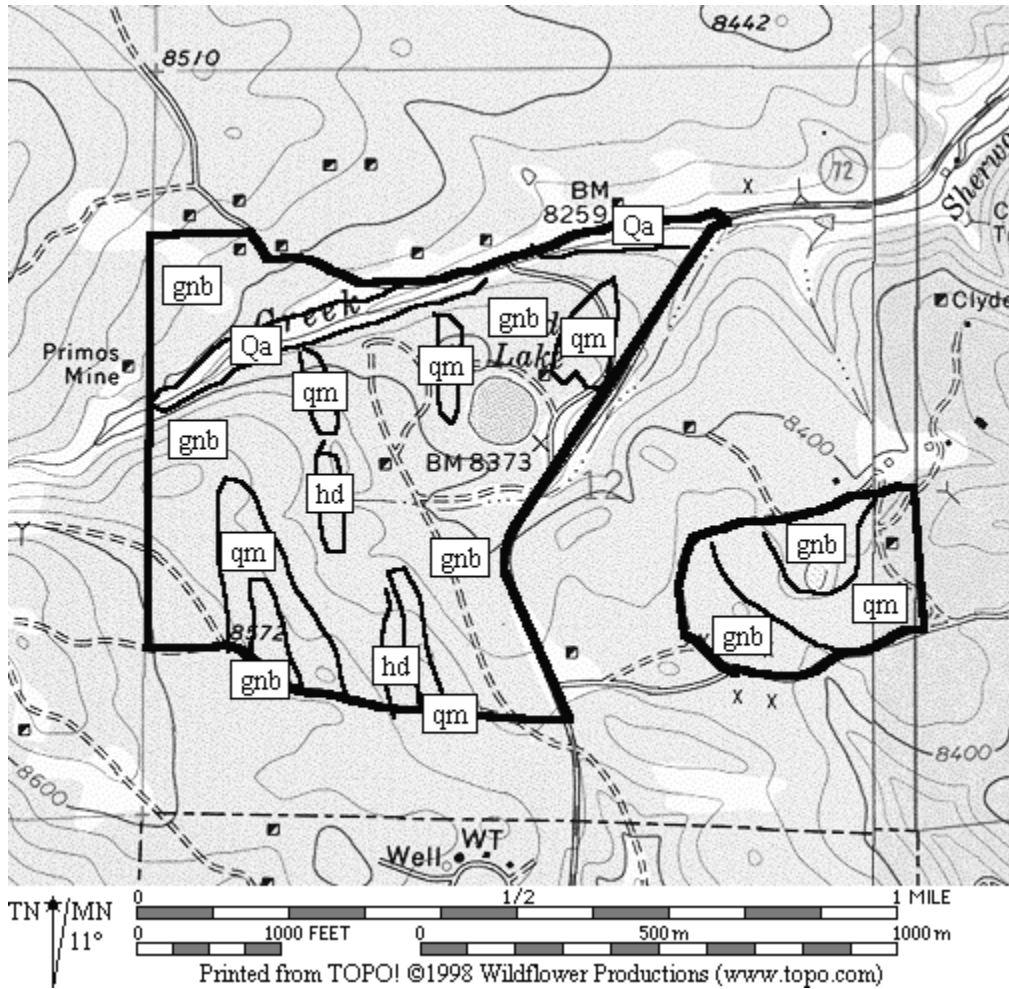
The Mud Lake parcel gradually slopes down in elevation from southwest to northeast. The steepest part of the parcel is the north-facing slope above Sherwood Creek. Mud Lake itself is a depression, possibly made by a meteor, that has no outlet—a small closed basin.

The Ridge Road parcel is slightly undulating, with no dominating trend to slope. It also contains a depression, near its center, which has no outlet.

2.5 Geology

The oldest, Precambrian rocks on the property dominate its geology (Figure 2). They are comprised of Biotite Gneiss (gnb), a metasedimentary rock at least 1.8 billion years old. These rocks were probably derived from middle Precambrian (2.5 to 1.6 billion years ago) materials that were subsequently folded, faulted, and partially metamorphosed.

Figure 2 – Geology



Legend

- gnb - Biotite Gneiss
- qm - Quartz Monzonite
- hd - Hornblende Diorite
- Qa - Alluvium

During the later part of the middle Precambrian, igneous intrusions began to occur throughout the region, including Hornblend Diorite (hd) and Quartz Monzonite (qm). The region then went through a long history of subsidence and deposition. About 70 million years ago, during the end of the Mesozoic Era, it is theorized that major plate tectonic activity increased with a high-speed convergence of the Pacific sea floor and the North American plates. One result of the convergence was the Laramide Orogeny, the beginning of the rise of the Rocky Mountains. The mountain building process resumed in the middle of the Tertiary Period (65 to 2 million years ago); most of our mountain ranges and drainage patterns were established during this period. There were also intrusions of igneous and volcanic rock into the many joints and fractures produced from the upward thrusting of the landscape. Some of these intrusions were rich in minerals and produced the Colorado Mineral Belt, a 50 mile-wide belt that extends from Durango in southwestern Colorado to central Boulder County.

The most recent (within the last 10,000 years) geologic process affecting the property has been the deposition of surface alluvium (Qa). These deposits of poorly sorted silt, sand, gravel, and boulders are primarily found along Sherwood Creek. Because of the unusual location of the depression that holds Mud Lake, some researchers have wondered about its origins and speculated that it could have been created by a meteorite impact.

2.6 Soils

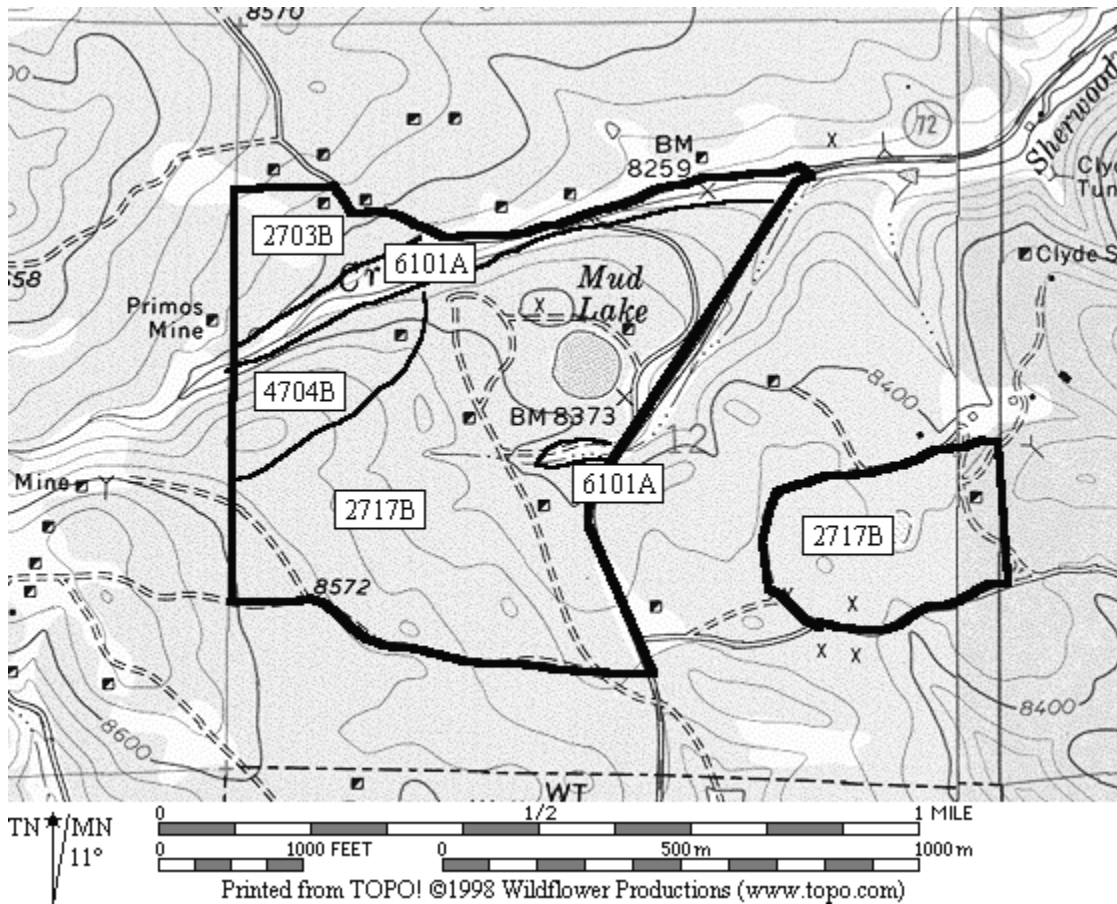
Soils are heavily influenced by geology (bedrock parent material) and slope. On metamorphic and igneous rocks, soils are comprised of weathered residuum (decomposing parent material) and are either stony or rubbly. Floodplain deposits are comprised of alluvium. Soils are better developed on flat or slightly sloped surfaces such as floodplains and plateaus. Four soil types are found on the property (Figure 3) (Foothills Engineering Consultants 1996). General descriptions of their characteristics follow.

2703B – Vanet-Ratake Families Complex, 5% to 40% slope, very stony: Generally found on benches, the parent material is residuum. The soil has rapid permeability and medium runoff. This soil type is found on the south aspect above Sherwood Creek. Vegetation is comprised of plant associations dominated by ponderosa pine (refer to Appendix 1 for scientific names of plants).

2717B – Vanet-Wetmore Families – Rock Outcrop Complex, 5% to 40% slopes, stony: Found on plateaus, this soil is comprised of residuum. It has rapid permeability and medium runoff. It is the dominant soil type of the property. Vegetation is generally comprised of lodgepole pine and mixed conifer.

4704B – Bullwark-Catamount Families – Rock Land Complex, 5% to 40% slopes, rubbly: Found on plateaus and gentle slopes, this soil is comprised of colluvium and residuum. It has rapid permeability and high runoff. It is found on the west-central part of the Mud Lake parcel, above Sherwood Creek. Vegetation is comprised of plant associations dominated by lodgepole pine, Douglas-fir, ponderosa pine, and common juniper.

Figure 3 – Soils



Legend

- 2703B - Vanet-Ratake Families Complex
- 2717B - Vanet-Wetmore Families-Rock Outcrop Complex
- 4704B - Bullwark-Catamount Families-Rock Land Complex
- 6101A - Cryaquolls-Cryoborolls Complex

6101A – Cryaquolls-Cryoborolls Complex, 0% to 15% slopes: Found in floodplains, this soil type is comprised of alluvium. It has moderate permeability and negligible runoff. It is found along Sherwood Creek and a second small drainage south of Mud Lake. Vegetation is comprised of riparian plant associations.

2.7 Hydrology

The surface and subsurface waters of the property are within the Boulder Creek Basin. All of the Mud Lake Parcel and portions of the Ridge Road parcel flow north/northeast into Sherwood Creek and tributaries of Sherwood Creek, which in turn flow into North Boulder Creek. The remainder of the Ridge Road parcel flows south into tributaries of Barker Reservoir and Middle Boulder Creek. North and Middle Boulder Creeks converge in Boulder Canyon at Boulder Falls.

Sherwood Creek is a 1st order stream that flows through the northern edge of the Mud Lake parcel. While flow data has not been taken on the stream, a comparison with similar sized drainages indicates that maximum spring and summer flows are probably less than 10 cubic feet per second (cfs), while winter minimums approach 0.1 cfs. A large unforested slope lies less than 1000 feet upstream from the west property line. This disturbance appears to be contributing excessive amounts of sediment into the creek corridor.

Mud Lake is a circular lake approximately four acres in size. Measurements indicate that the depth of the lake averages 3-4 feet, with a maximum depth of 7 feet. A small spring near the western edge of the lake provides some water, but the source for the whole lake is unknown.

2.8 Adjacent Land Use and Ownership

The surrounding land uses and ownerships of the Mud Lake parcel are:

East: The Peak-to-Peak Highway forms the east boundary. Farther east, lands are a mix of private vacant land, and light-industrial uses (school bus barn, refuse transfer center, State Highway service center, and USFS service center).

South: Lands to the south are within the corporate limits of the Town of Nederland. Developing uses include residential, community open space, and light industrial (excavating business and Nederland Public Works service center). Farther south are the residential and business districts of Nederland.

West: Lands to the west are privately owned and vacant. Remains of old tungsten mines are present.

North: Land to the north is privately owned and is part of Caribou Ranch retained by Jim Guercio. The land just north of CR 126 is planned for large-lot residential development.

The surrounding land uses and ownerships of the Ridge Road parcel are:

East: Lands to the east include rural residential, vacant private land, and Forest Service.

South: Lands to the south are light-industrial (refuse transfer center, County/State Highway service center, and USFS service center).

West: Lands to the west are light-industrial (school bus barn), and vacant private land.

North: Lands to the north are vacant private and rural residential.

2.9 Property Context

The Mud Lake property and the lake itself have been along a mountain transportation corridor for many years. While the site has always been close to the Town of Nederland, recent development on the north side of the town has brought residents nearly adjacent to the property's southern boundary. As active mining, forestry, and ranching has waned over the last years, dispersed residential development has proceeded at a measured but continual pace in the surrounding landscape, most of which is in the County's Forestry Zoning District. Although National Forest lands are common in this portion of the County, most of the land within several miles of Mud Lake is not federally owned. Recreational use of public land is an important community value and once Caribou Ranch Open Space is available to the public, this area will see increased visits and traffic.

RESOURCE EVALUATIONS

3.0 VEGETATIVE RESOURCES

3.1 Field Studies

BCPOS staff and volunteers inventoried the plants and mapped (Figure 4) the vegetative communities at Mud Lake Open Space. The plant ecology staff (Claire DeLeo, Jennifer Kesler, and Joshua Kanaplue) concentrated on the wetland and riparian areas while Dave Hallock, Resource Planner for Boulder County Parks and Open Space, mapped other plant communities. Diane J. Brown, volunteer botanist, conducted an inventory of plants. Appendix 1 is a list of all the plants (including their scientific names) found on the property.

3.2 Upland Plant Communities

The majority of the Mud Lake property is composed of a mix of pine species, including ponderosa pine, lodgepole pine and limber pine. These mixed forests have understories of native grasses, forbs and non-native grasses and weeds. Lodgepole pine is the dominant forest type of Mud Lake Open Space and the dominant tree in the Mixed Conifer forest of the Ridge Road parcel, a condition that probably results from fires during the mining period 150 years ago; lodgepole is a fire-adapted species that readily colonizes burned sites at this elevation. Small stands of ponderosa pine and aspen are scattered throughout the lodgepole. Riparian forests and shrublands are present along Sherwood Creek. A riparian forest is also present along a small drainage south of Mud Lake, (sometimes referred to as the “Wild Bear” drainage since a portion crosses their 5 acre parcel). A ponderosa pine forest is present in the northwest corner of the property. Emergent wetland plants are present within and on the perimeter of Mud Lake. Descriptions of the major vegetative communities found on the property are below.

LP - Lodgepole Pine Forest: Mud Lake is dominated by forests of lodgepole pine. These forests have little understory associated with them and are highly disturbed with non-natives and excessive vegetative litter. The majority of trees are in the 8" to 12" DBH (diameter at breast height) category. The lodgepole forest is most uniform and dense as the land drops toward Sherwood Creek. On the remainder of the property, the lodgepole forest has a mosaic pattern where density varies, and it is mixed with other conifers (ponderosa pine, Douglas-fir, blue spruce, Engelmann spruce) and small patches of aspen. Many of the largest trees (20" to 30" DBH) are ponderosa pine. Much of the forest has received past management, including thinning and small patch cuts. Some of the larger thinned areas and patch cuts are classified as Thinned Forest (TH). In some places, the forest management retained the larger ponderosa pines while taking out much of the understory trees.

DF – Douglas-Fir Forest: This is a community that is common at an elevation range of 8500 to 10,500 feet. At Mud Lake, this community type is found at 8200 to 8600 feet on north-facing slopes. Past logging and subsequent fire suppression have probably increased the distribution of this forest type at the expense of the more fire-dependent lodgepole pine.

TH - Thinned Forest: These are small openings in the lodgepole forest which were significantly thinned or patch cut. In some cases, the larger ponderosa pines were retained. They are now regenerating with aspen and/or conifers.

A - Aspen Forests: Small aspen forests dominate several locations on the property. The trees are generally less than 10" DBH. Scattered conifers may be present as well as patches of meadow.

PP - Ponderosa Pine Forests and Woodlands: The loose feldspar gravel of the property along with the presence of dry, south-facing slopes has allowed the growth of ponderosa pine on the property. This community type is also characterized by an understory of kinnikinnik and mountain muhly, although mountain muhly is only seen in trace amounts. The understory of these areas is very disturbed by vehicle and foot traffic, thus decreasing its diversity. Some of the sites are open and mixed with an understory of shrubs and grasses. Other conifer tree types may be present. Ponderosa pine forest dominates the property in the northwest corner. There is a wide range of tree sizes, most being between 6" to 18" DBH, with a scattering of larger trees measuring 20" to 28" DBH. Within the remainder of the property, small stands of ponderosa pine are found, particularly on south and southeast facing aspects or on rocky knolls. These ponderosas are generally large, ranging in size from 20" to 34" DBH.

MC - Mixed Conifer Forest: This community follows a small drainage on the Mud Lake Parcel and dominates the Ridge Road parcel. It is comprised of blue spruce, Engelmann spruce, lodgepole pine, ponderosa pine and some aspen. There are many large-diameter trees; blue spruce range in size from 20" to 30" DBH. One 33" ponderosa was found along with a 25" lodgepole pine. Lodgepole pine and ponderosa pine are the most common tree species, with scattered Douglas-fir, limber pine and aspen.

M-Upland Meadows: The upland meadows of the property are dominated by an overstory of aspen and an understory of smooth brome. After an evaluation of historic aerial photographs and the observation of the spread of aspen seedlings at these sites, it appears that aspen trees are gradually dominating these sites and meadow grasses are concurrently decreasing. Non-native grasses, including Timothy and smooth brome, make up approximately 25% of the total cover of the aspen meadows. The dominant forb observed was golden banner. A dry meadow is located north of Sherwood Creek and is comprised of grasses and sedges, with some scattered ponderosa pine. A small circular meadow that is seasonally wet is found on the Ridge Road parcel. It is dominated by tufted hairgrass.

D - Disturbed: These sites have been subject to heavy disturbance from mining and camping. There is evidence of some regeneration.

DM - Disturbed Meadow: The largest disturbed site in the northwest corner of the property is currently dominated by meadow plants.

3.3 Riparian and Wetland Areas

Mud Lake Open Space has two unique water features, Sherwood Creek and Mud Lake itself. Several riparian wetland plant communities are found along the banks of the creek. The most significant riparian community of Sherwood Creek is the willow carr. A willow carr is a plant association defined by a mix of willow shrubs, which cover more than 25% of the soil area, without deciduous riparian trees. Water loving grasses, rushes and sedges are the dominant understory cover of the willow carr. The dominant willows are mountain willow and Bebb's

willow. The plants of the willow carr and Sherwood Creek wetlands are more thoroughly discussed in the Riparian Plant Community section.

The unique topographic position and setting of Mud Lake has resulted in an abrupt transition from wetland plant species to upland plant species. The large community of hardstem bulrush (*Scheonoplectus lacustris* subsp. *acutus*) on the north end of the lake is unusual because this wetland plant community is not often found at this high an elevation in Boulder County. The other wetland plant communities surrounding the lake are predominately willows and sedges.

R-Riparian Plant Communities: Shrublands and wetlands are found within the riparian area along northeastern half of Sherwood Creek. The most significant of these plant communities is the willow carr. The dominant willow along the creek is mountain willow (*Salix monticola*) with Bebb's willow (*Salix bebbiana*) and Drummond's willow (*Salix drummondiana*) also prevalent. Willow hybrids are also probably present since hybridization is common in willows. The understory of the willow carr is composed of forbs and graminoids similar to those found on other wet or mesic areas of the property. The dominant species in the understory of the willow carr are the non-native redtop (*Agrostis gigantea*) and horsetail (*Equisetum pratense*). Riparian forests along Sherwood Creek extend up the adjacent north-facing hillside. The forest is comprised of Engelmann spruce, blue spruce, subalpine fir, lodgepole pine, aspen and Douglas-fir. Engelmann spruce and subalpine fir are more prevalent along the western part of Sherwood Creek. The south-facing hillside above Sherwood Creek is comprised of grasses mixed with shrubby cinquefoil. The riparian areas include six species of willow (Appendix 5), one of which is a wetland obligate, planeleaf willow (*Salix planifolia*). An obligate wetland plant is almost always found in a wetland under natural conditions (Reed 1988).

W-Wetlands: Staff classified the wetland areas into five plant community types, which include ten obligate wetland species with numerous facultative species (Appendix 5).

1. Bebb's willow (*Salix bebbiana*)/Beaked sedge (*Carex utriculata*) This community type is commonly found in the area surrounding Mud Lake. The over story around the lake is intermixed with Bebb's willow (*Salix bebbiana*), mountain willow (*Salix monticola*) and Geyer's willow (*Salix geyeriana*). The emergent vegetation surrounding the lake is composed of beaked sedge (*Carex utriculata*), water sedge (*Carex aquatilis*) and redtop (*Agrostis gigantea*). The most common weed species is Canada thistle (*Breca arvensis*).

2. Hardstem bulrush (*Scheonoplectus lacustris* subsp. *acutus*) The second community surrounding the lake is hardstem bulrush (*Scheonoplectus lacustris* subsp. *acutus*). Hardstem bulrush dominates the northeast edge of the lake. This community is very valuable for wetland-associated wildlife due to the overhead cover the plants provide. Restoration efforts should include using plugs to connect the two sections of bulrush that are separated by erosion. The erosion of this site appears to be from people wading at the waters edge.

3. Beaked sedge (*Carex utriculata*) – Water sedge (*Carex aquatilis*) This wetland community is located at the east end of Sherwood Creek next to the Peak-to-Peak highway. The association of beaked sedge (*Carex utriculata*) and water sedge (*Carex aquatilis*) is also found along the fringe of the willow carr along Sherwood Creek. Included in this area are arctic rush (*Juncus arcticus*) and tufted hairgrass (*Deschampsia caespitosa*). This area was relatively free of weed species and hay grasses as compared to other areas of the property.

4. Canada reedgrass (*Calamogrostis canadensis*) – Beaked sedge (*Carex utriculata*) This wetland plant community is found directly south of Mud Lake next to the Peak-to-Peak highway. A diverse collection of species is found along with the dominant grass, Canada reedgrass (*Calamogrostis canadensis*). The overstory of this area includes aspen (*Populus tremuloides*), mountain willow (*Salix monticola*) and bush honeysuckle (*Distigia involucrata*). The factors that differentiate this community from the adjacent wetland community are a higher concentration of water and a denser overstory.

5. Redtop (*Agrostis gigantea*) – Bedstraw (*Galium trifidum*) This wetland community is directly west of the above community. This association is dominated by redtop and bedstraw. Other grasses in this area are Kentucky bluegrass (*Poa pratensis*) and swamp bluegrass (*Poa palustris*). Spruce trees surround the south edge of this wetland. The overstory in this wetland includes aspen (*Populus tremuloides*), mountain willow (*Salix monticola*) and bush honeysuckle (*Distigia involucrata*).

3.4 Exotic Species and Noxious Weeds

The noxious weeds of greatest concern are Canada thistle (*Breca arvense*) and musk thistle (*Carduus nutans*). Both thistle species are aggressive invaders and can quickly dominate moist, grassy areas to the detriment of other, native plants. Common introduced hay grasses on the property include smooth brome (*Bromopsis inermis*) and Kentucky bluegrass (*Poa pratensis*). These hay grasses may decrease the spread and growth of native grasses and other forbs that are intermixed with native grasses.

3.5 Rare and Imperiled Plants

The Mud Lake property has habitat and plant associations that would indicate the possible presence of the rare wood lily (*Lilium philadelphicum*) and a rare moonwort (*Botrychium lineare*). The Mud Lake property elevation range between 8250 and 8600 feet is also a relevant factor indicating possible presence of these above-mentioned plants. Wood lily (*Lilium philadelphicum*) prefers a habitat that includes moist woods, thickets and wet meadows at an elevation of 6800-9800 feet (Colorado Rare Plant Field Guide, 1997). Moonwort (*Botrychium lineare*) prefers habitat, which includes grassy slopes, among medium-height grasses along edges of streams and forests at an elevation of 7900 - 9500 feet (Colorado Rare Plant Field Guide 1997). The last recorded occurrence of this plant in Boulder County was on the Switzerland Trail north of Caribou Ranch in 1947.

No visual identification of these two species occurred during field investigation, in the summer of 2000. Further investigation is necessary to confirm that these rare plants do not occur on this property.

3.6 Restoration and Management Considerations

3.61 Upland Forests and Meadows

Restoration of upland areas should include trash removal, closing numerous braided trails, and closure to motorized vehicles. Restoration of the upland meadows should include removal of non-native hay grasses and planting with native grasses and forbs.

3.62 Wetland Areas

To protect shoreline wetlands, any trails should be established away from the lake with access perhaps at only one side of the lake. Visitor traffic should be directed away from the deeper wetland areas where hardstem bulrush (*Scheonoplectus lacustris* subsp. *acutus*) is established and to protect shoreline wetlands regulations for the lake should include no dogs, no swimming, and no boating. The shoreline should be transplanted with wetland donor plugs of hardstem bulrush and the surrounding eroded and disturbed wetlands should be restored.

3.63 Riparian Areas

Restoration and management for areas along Sherwood Creek would include removal of rocks and debris at the old road crossing and re-establishment of the creek above ground. This will require removal of the culvert and road fill over the creek and then planting willows. The removal of stream sediment and the restoration of extensive disturbed slopes upstream from the Mud Lake property would help minimize excessive sediment deposition on downstream riparian areas.

4.0 WILDLIFE RESOURCES

4.1 Field Studies

Most of the faunal information for this report was gleaned from existing sources but Parks and Open Space staff did conduct a breeding bird survey in 2000 (Hallock 2000). Mud Lake has a long history of scientific collection for amphibians and freshwater mollusks. In the course of studies associated with the University of Colorado as well as the Colorado Division of Wildlife a number of researchers have sampled the lake. Additionally, Dr. Shi-Kuei Wu, retired invertebrate curator from the University of Colorado Museum, conducted a shoreline inventory of the lake in 2000 searching for small invertebrates.

4.2 Mammals

Approximately 44 species of mammals, representing about 45% of all mammal species in the county, could call Mud Lake Open Space home (Appendix 2). The most common is probably the deer mouse, though it is seldom seen. Other common ground dwelling rodents include several chipmunk species (least and Uinta) and golden-mantled ground squirrel. Chickarees (sometimes called pine squirrels) are the most common squirrels. Nuttall's cottontails and snowshoe hares are present. Mountain lion, black bear, bobcat, coyote, red fox, mule deer, and long-tailed weasel are regularly seen.

4.3 Birds

The single-season breeding bird inventory (Hallock 2000) surveyed the status and abundance of all breeding bird species; checked the status of species of special concern and mapped their locations; and determined the locations of high quality habitats for avian species.

A total of 51 species were seen within the property during the 2000 breeding season (Appendix 3). Of this total, 10 were confirmed as breeding, 33 were considered probable breeders and another 7 were classified as possible breeders. Another 10 species not seen during

the inventory are considered potential breeders due to suitable habitat and may be seen in future years.

The most common (10+ breeding pairs) species found on the property fall into two groups. The first are those that breed in coniferous forests, the most common habitat on the property. These birds are mountain chickadee, ruby-crowned kinglet, yellow-rumped warbler, and pine siskin. The second group of common breeding birds consists of habitat generalists who can utilize the resources of several types of habitat and have small nesting territories. This group includes broad-tailed hummingbird, American robin, and gray-headed junco. Other fairly common (5 – 10 breeding pairs) species include hairy woodpecker, northern flicker, warbling vireo, Steller's jay, and hermit thrush.

4.3.1 Birds of Special Interest

Species of Special Concern are those with one or more of the following characteristics: endangered, threatened, rare, declining, isolated and restricted populations, or sensitive to habitat change. The Boulder County Nature Association maintains a list of Boulder County Species of Special Concern (Hallock and Jones 1999). The list is a compilation of species of concern lists from federal, state, and local organizations and agencies including: U.S. Fish and Wildlife Service, Colorado Division of Wildlife, U.S. Forest Service, Colorado Natural Heritage Program, Partners in Flight, and Boulder County Nature Association.

There are two categories of concern on the list. The “primary concern species” are listed because of factors such as population decline, rareness, and/or habitat restrictions for uncommon species in Boulder County. Watchlisted birds are those whose abundance in the county is rated at either “fairly common” or “common”, but because of other factors, the species warrants monitoring. Some of these factors include state or regional concerns (population decline or threats), local habitat restrictions, the county provides habitats important for their survival, or because they are good indicators of habitat change.

A total of 5 species of special concern were seen within the study area during the 2000 breeding season (Table 2). All 5 are watchlisted species.

Ring-necked duck is a watchlisted species. They are considered restricted breeders in the county by BCNA. They nest in the mountains in marshes adjacent to ponds. A single male was observed several times in Mud Lake. There was no direct evidence of breeding. Of the nesting waterfowl in the mountains of Boulder County, ring-necks are the least common. Their habitat requirements appear the most specialized: shallow ponds, generally at least an acre in size, with adjacent emergent vegetation where the nest is located. In contrast to other North American diving ducks, ring-necks readily take to ponds with shallow water and submerged vegetation. They normally feed in water less than 6 feet in depth (Bellrose 1976).

Pygmy nuthatches are listed as a sensitive species in USFS Region 2, a management indicator species by Arapaho and Roosevelt National Forests, and a restricted breeder by BCNA. They were observed on the property in the ponderosa pine forest located in the northwest corner. They are considered excellent indicators of mature ponderosa pine forests. Because they usually drill their own cavities, they need mature ponderosas, with old and decayed wood. The ideal habitat consists of park-like, open forests of tall ponderosa where the pines have broken-off stubs of branches or tree-tops (Bent 1948).

Golden-crowned kinglets are listed as a sensitive species in USFS Region 2, a management indicator species by Arapaho and Roosevelt National Forests, and a restricted breeder by BCNA. They were observed on the property in the riparian forests along Sherwood

Creek and along the small drainage southwest of Mud Lake. They are birds of interior forests and tend to favor riparian coniferous forests with large-diameter trees (Kingery 1998). Engelmann spruce and subalpine fir are preferred tree types. They glean for insects at the outer tips of boughs in foliage.

Both **MacGillivray’s warblers** and **Western tanagers** are listed as species of concern by Partners in Flight because of possible population declines in the American West. MacGillivray’s warblers were observed in the riparian shrublands along Sherwood Creek. Their habitat centers on shrublands in both wet and dry situations (Colorado Partners in Flight 1999). They generally favor tall shrubs (> 6 feet in height) for nesting and feeding. Western tanagers were seen in the study area in the ponderosa pine forests located in the northwest corner of the property. Though they breed in a variety of habitats, they prefer ponderosa pine and mixed-conifer woodlands (Kingery 1998). They typically place their nest on the branch of a conifer tree.

Table 2: Avian Species of Special Concern Seen on Mud Lake Open Space			
Species	USFS	PIF	BCNA
Ring-necked Duck			4
Pygmy Nuthatch	S, M		4
Golden-crowned Kinglet	S, M		4
MacGillivray’s Warbler		1D	
Western Tanager		1D	
<p>U. S. Forest Service (USFS) Region 2 Threatened, Endangered and Sensitive Plants and Animals <u>Category:</u> S - Sensitive Arapaho and Roosevelt National Forests Management Indicator Species <u>Category:</u> M - Management Indicator Species</p> <p>Partners in Flight (PIF) Methods for Setting Bird Conservation Priorities for State and Physiographic Areas of North America (Carter et al., 1998) <u>Category:</u> 1D - High area importance and high downward population trend</p> <p>Boulder County Nature Association (BCNA) Boulder County Nature Association Avian Species of Special Concern (Hallock and Jones 1999) <u>Category:</u> 4 - Isolated and Restricted Populations (Species that are found only at certain locations and/or have narrow habitat niches)</p>			

4.3.2 Avian Habitats of Special Interest

The results of the breeding bird survey indicate there are areas on the property that warrant special attention relative to avian species. Habitats of Special Interest are those areas that

are rich in breeding species diversity or density, have important habitat components such as high structural diversity or old-growth, or support several species of concern. The most significant area was the Sherwood Creek riparian area. Mud Lake and the riparian area south of it warrant attention as well (Figure 5).

The Sherwood Creek riparian area contains habitat that is rich for breeding birds. The riparian habitat is a mix of forest and shrubland. The riparian forest is comprised of aspen, Colorado blue spruce, Engelmann spruce, subalpine fir, Douglas-fir and lodgepole pine. There is good structural diversity and large-diameter trees are present. Tall shrubs are found in the understory. The riparian forest extends up the adjacent north-facing hillside. The riparian shrublands are comprised of several types of willow and alder, and are best developed in the northeast corner of the property. The avian habitat is rich and specialized. It is probable this site has the highest breeding bird density on the property. Two Avian Species of Special Concern were present: MacGillivray's warbler (at least two separate territories), and golden-crowned kinglet. Other species particular to this habitat include cordilleran flycatcher, dusky flycatcher, Wilson's warbler, song sparrow, Lincoln's sparrow and black-headed grosbeak. A sharp-shinned hawk nested in the hillside above the creek.

Mud Lake is a small (4 acre) and shallow body of water. Emergent vegetation is found around portions of the perimeter. During the study, at least 1 pair of mallards successfully nested at the lake and produced young. A single male ring-necked duck was observed several times at the lake, but there was no evidence of nesting. Red-winged blackbirds nested in the emergent plants on the east side of the lake. The lake is also used by migratory waterfowl in the spring and fall.

Because of the small size of the lake, its ability to provide nesting and migratory habitat for waterfowl will be dependent on the level and intensity of human use around and on the lake and the habituation of the waterfowl to that use. The lake is approximately 450' in diameter. Waterfowl were observed moving to the opposite side from where people were present along the lakeshore. Flight distance is the measurement from the source of a disturbance to the animal when the animal physically flees to a safer location; for several types of waterfowl it has been found to average approximately 300 feet (Miller 1994).

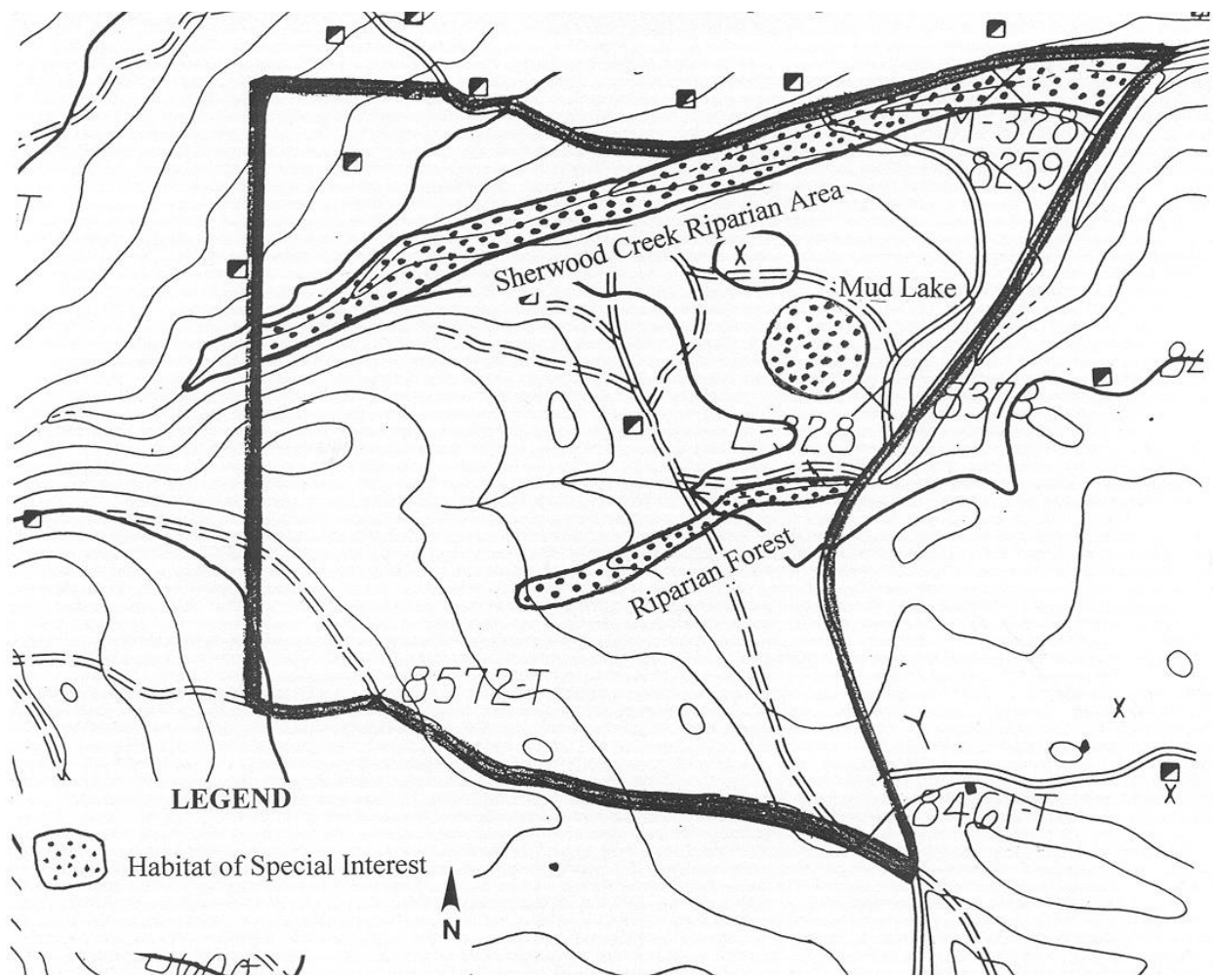
It is probable that due to the property becoming public open space and the presence of the nature center, use of the property, and specifically the area around the lake, will increase. The greatest impacts to birds will come from uses on or within the lake, and uses on the perimeter--especially if all sides have human presence. Prohibiting uses from occurring on and within the lake (with the exception of during the winter) would help protect birds using this area. Also, having at least one side of the lakeshore closed to human use would be advantageous to nesting and migrating waterfowl—using the 300-foot flight distance designation at least the waterfowl in a portion of the lake and adjacent shoreline would be less affected by visitors.

A small riparian forest is present in the drainage located south of Mud Lake. Large-diameter conifers, particularly Colorado blue spruce, structurally dominate it. Small patches of aspen are also present. It has good structural diversity. Golden-crowned kinglets, which favor interior coniferous forests with large trees, were present.

4.4 Amphibians and Reptiles

While fish are not present, seven potential amphibians and reptiles could reside at Mud Lake (Appendix 4). Three species are present on the property. Two additional species have historic records on the property.

Figure 5 – Avian Habitats of Special Interest



Tiger salamanders are found in small ponds and lakes up to 12,000 feet. They were first recorded in Mud Lake in 1939. Robert Meyers studied the morphological variations in tiger salamanders at several lakes in western Boulder County, including Muskee Lake (now Mud Lake) (Meyers 1939).

In 1947, researchers reported polydactylism and limb duplication in a population of tiger salamanders in Muskee Lake (Bishop and Hamilton 1947). They considered this to be the first record of mass polydactylism in amphibians. Polydactylism is a developmental problem where extra feet and toes grow during metamorphosis.

Hammerson (1992) and a crew of researchers seined the lake during a 1991 survey and found an extensive tiger salamander population. They seined along one side of the lake, which was gently sloping and had extensive areas of emergent sedges and bulrush. The bottom was fine gravel in some areas and, especially in deeper (waist-deep) water, covered with several inches of organic detritus. Hammerson felt that Mud Lake was “unusual in having large populations of both *Ambystoma tigrinum* [tiger salamander] and crayfish. Reese (1969, Ph.D. thesis, Univ. Colorado, Boulder) found that salamanders and crayfish generally do not occur synoptically. This lake is worthy of protection both for its large population of paedomorphic salamanders and for its unique ecology.”

In 1992, Carey observed a die off of all tiger salamander larvae in Mud Lake (Carey, pers. com.). The larvae were infected with *Aeromonas hydrophila*, a ubiquitous fresh water bacterium. In 1994, Carey observed that the tiger salamander larvae in Mud Lake developed and metamorphosed normally (Livo 1995). Tiger salamanders have been observed at Mud Lake in recent years (Carey, pers. com.).

Northern leopard frogs are found in shallow permanent water up to an elevation of 10,000 feet. They were first recorded in Mud Lake in 1931 (Johnson 1932). The last recorded account was in 1959 (University of Colorado Museum records), but they have not been found in more recent surveys (Livo 1995). Livo writes:

The first note concerning a decline in numbers of leopard frogs in Boulder County was made by Rosine (1955), when discussing polydactylism in *Rana pipiens* from Mud Lake (similar abnormalities had previously been reported for tiger salamanders from the same site). Rosine (1955) writes, “Since 1951, the submerged aquatic flora has changed noticeably, with some species more abundant and others very much less so...the frogs and salamanders, formerly numerous, are now markedly less in numbers.”

Northern leopard frogs are ranked by the Colorado Natural Heritage Program as S3 (vulnerable in Colorado since only between 21 - 100 occurrences are known). They are also a State-of-Colorado Species of Concern and a Forest Service Sensitive Species.

Boreal toads are found in wet areas in the upper montane and subalpine, between elevations of 8,500 and 11,000 feet. They were documented from Mud Lake in 1931 (Johnson 1932), but they have not been found in recent surveys (Livo 1995). The Southern Rocky Mountain population of boreal toad is a candidate for Federal listing as endangered or threatened. The State of Colorado considers them endangered while they are considered a Forest Service Sensitive Species, and have an S1 rating (critically imperiled in state because of extreme rarity) from the Colorado Natural Heritage Program.

Striped chorus frogs are found in wet meadows and marshy ponds up to elevations of 12,000 feet. They were first documented in Mud Lake in 1947 (University of Colorado Museum records). Field workers observed them the summer of 2001 at Mud Lake.

Only one species of reptile, the Western Terrestrial Garter Snake, was observed on the Mud Lake property during field surveys in 2001; it was first recorded on the property in 1931 (Johnson 1932).

4.5 Invertebrates

Invertebrates comprise the vast majority of animal species found at Mud Lake, including all insects, butterflies, moths, mollusks, and crayfish. Mud Lake has historically been a significant site for collecting several species of freshwater mollusks (snails, clams, and bivalves) (Wu 1989). The most significant of these was the Sharp Sprite (*Promenetus exacuus*), which has a rating of S2 from the Colorado Natural Heritage Program (considered imperiled in Colorado because of fewer than 20 known sites). Other mollusks collected in the past from Mud Lake include Duck Physa (*Physa cenatina*), Ash Gyro (*Gyraulus parvus*), Rough Rams-horn (*Helisoma subcrenatum*), and Quadrangular Pea (*Pisidium milium*). During a shoreline survey by Dr. Shi-Kuei Wu (9/2000), there was little evidence of mollusks at the lake.

Crayfish (*Cambarus diogenes diogenes*) are very common in Mud Lake. Hammerson (1992) found them numbering in the thousands, in all sizes up to several inches long. The presence of crayfish in mountain lakes is apparently the result of introductions (Unger 1978). They were not mentioned as being present in the inventory by Johnson (1932). Some researchers feel that crayfish can have adverse on amphibians and mollusks and, if possible, should be removed.

5.0 CULTURAL RESOURCES

5.1 Cultural History

Humans have utilized Boulder County for over 10,000 years, although the prehistoric period is currently not as evident on the landscape as historic times. The following information is derived from existing sources.

Historic Context

The gold rush and homesteading era began in 1858 when William Green Russell and a small party of prospectors announced they had discovered gold in the area that became modern Denver. This and subsequent discoveries led to the Rush of 1859 and subsequent settlement along the Front Range. Mining in Boulder County began in 1859 as S. James Aikens discovered the first free vein of gold approximately 12 miles west of present day Boulder near Goldhill. Soon after, gold was discovered in other locations in the county such as Magnolia, Sugarloaf, Wallstreet, Crisman, Salina, Sunshine, and Ward. There were also major discoveries in nearby Central City and Black Hawk. During the 1860s and 1870s Nederland was known by several other names including Dayton, Brownsville and Middle Boulder. It was a stopping point for travel between Ward and Black Hawk.

The presence of mines and miners created a market for food and timber. This market, combined with liberal Federal land disposal laws (the Homestead Act of 1862 and the Timber

Culture Law of 1873), led to the patenting and homesteading of lands. The lands covering Mud Lake were homesteaded in the early 1870s (Figure 6).

Tungsten was a rock known from the days of early prospecting in Boulder County as “black iron,” but its true value was not recognized until 1899. The discovery of tungsten ore coincided with a period during which tungsten steel was first introduced in the manufacture of high-speed cutting tools. Prospecting for tungsten ore started to take off around 1905. The value and the amount of ore produced skyrocketed during World War I as it was used in the production of steel for military equipment. Production declined after World War I but picked up again during World War II, declining thereafter (Lovering and Tweto 1953).

There was significant tungsten mining activity just north and west of Mud Lake Open Space. Significant mines included Primos, Conger, Quay, and Illinois. Many of the old roads crossing Mud Lake accessed the mines to the west. There was mining exploration and activity on Mud Lake, but of less significance than surrounding areas. However, there are many prospect pits, mine shafts, and adits on the property and in places some of the old equipment remains. There are no remaining structures on the site.

6.0 VISITOR RESOURCES

6.1 Existing Recreation

The natural, undeveloped character of the Mud Lake area attracts visitors. The surprising lake and the relatively gentle, forested terrain draw visitors to the site while the existing network of old mining roads and social trails allows people to easily access much of the property from the adjacent public roads. The proximity of Nederland alone generates visits to this public land, and with public roads on three sides of the property access is not difficult. The fact that there had been no owner residing on the site in recent time combined with the access and proximity factors to create recreational trespass situations in the past. The public purchase of the property has allowed this moderate level of recreational use--consisting primarily of hiking but included some limited mountain biking and equestrian use as well--to continue. The lake itself has provided a variety of recreational pursuits to visitors in the past, including wading, dog exercising, and in the winter ice-skating and hockey (however, current Parks and Open Space regulations prohibit many of these lake activities, except skating). The north and east lake shores seem to receive the most use based on vegetation loss and trail proximity, and this part of the lake includes a small “beach” for easy access to the water. Additionally, the lake continues to provide dramatic views to the west, a beautiful setting for typical shoreline activities like picnicking.

Since County Parks and Open Space management of the area, the standard Rules and Regulations have applied to the property except for a specific provision in the IGA, which allows ice-skating. Primarily the rules allow pedestrian, mountain biking, and equestrian uses at this time with dogs allowed only if they are on leash. The lake is closed to boating, fishing, swimming and wading.

Recreation use at the Ridge Road parcel is not as common, but there are social trails used by hikers and mountain bikers that cross the property.

6.2 Recreation Resources

As noted above, the property has no shortage of roads and trails. On-site mining and the need for a transportation network connecting Nederland to the camps and ranches north of town fueled

the development of the historic roads and trails on the Mud Lake property. Many of these remain passable to this day, ranging from old highway routes and county Jeep roads to small social paths and all manner of trails in between. While there is a north-south trend to most of the old roads and trails there are exceptions: the two spurs of County Road 126J on the property connect the private land west of Mud Lake to Indian Peaks Drive (County Road 128) and County Road 126; and in the middle of the property, a number of trails circle or access the lake and one trail that extends up a drainage to the west. Two trails cross Sherwood Creek. In 2000, staff used a global positioning system to map features of the Mud Lake property and determined there were about 4.5 miles of roads and trails, a relatively high amount on a small property. This density means that nearly every part of the property is within 500 feet of a trail. There are no regional County or USFS trails near the property, but recreationists do use the adjacent county roads for walking and mountain biking.

Like other mountain property, Mud Lake offers beautiful scenery as viewed from adjacent lands, gorgeous views from within the property, and unique places secluded from offsite views and sounds. The property provides forested scenery from all three adjacent public roads. Within the property, high points along the ridge above Sherwood Creek allow dramatic views of the mountains to the northwest. Other areas of the property foster a unique “sense of place” and provide a special setting for experiencing the landscape: the meadows and aspen groves in the west, the Sherwood Gulch area, the lake shoreline, and pine woodlands north of the lake. Some of these same areas are prime wildlife viewing spots.

While the property abounds with cultural features, primarily these are pits, adits, and shafts from mining that pose more of a safety hazard than an interpretive opportunity. Some of the mine sites had been regraded and buried in the past while others appear to have been just abandoned. County staff has fenced the most dangerous openings and the Colorado Mine Safety division will work to permanently close them.

The shallow nature of the lake and its domination by crayfish naturally limit the boating, swimming, and fishing opportunities and the current rules and regulations prohibit these uses for safety and resource protection.

The Ridge Road parcel is a more homogeneous property. The lack of vertical relief creates a more uniform forest, minimal opportunities for dramatic views, and less unique places. The property is surrounded by roads and a powerline runs through a portion of it. There is a small wet meadow surrounded by aspens that is an unusual spot in the midst of the lodgepole pines that dominate the site. Because of its small size, the adjacent developments, especially to the south, diminish the opportunity for solitude on the property.

Last year, the Town of Nederland completed an Open Space, Trails, Parks, and Outdoor Recreation Master Plan (Town of Nederland, 2001) that identified recreation and natural resource priorities in the greater Nederland area. As part of the Master Plan process, a citizen survey (Churches and McCarley 2000) ranked the importance of various open space, recreation, and resource issues. Eighty percent of the respondents ranked open space as important to the future of the Nederland area and 74% said trails were important. Mud Lake was specifically identified as “very important” in the residents’ lives by 37% of the respondents. Seventy-seven percent of the respondents felt that a well-marked and -maintained multi-use trail system was very much or somewhat needed. In prioritizing specific, proposed trail segments, the link from Nederland to Mud Lake was the fifth most important, cited by 72% of the respondents as very or somewhat important. The fact that 72% of the respondents indicated they hike at least four times a month corroborates the rest of the survey results that show Nederland residents use trails and find them important to their quality of life. The survey and community meetings held as part of

the master planning process indicated that trails linking neighborhoods, open space, and schools are favored by residents since they promote a more pedestrian-friendly environment and alternative transportation.

The importance of the Mud Lake property for open space and recreation in the Nederland area is directly apparent in two of the “actions” recommended by the plan: 1. preserve and protect lands between Mud Lake and Caribou Ranch, 2. establish trail links between the Town and Mud Lake and the greater Nederland area and Mud Lake. Accordingly, the Parks and Trails Map in the Plan depicts these conceptual trail corridors and alignments. On the map, the proposed trail corridors link Mud Lake with Caribou Ranch, the Hurricane Hill area, and the Town along the Peak-to-Peak. The proposed trail alignment links the town with the elementary school, then through the west side of Indian Peaks Open Space to the proposed Wild Bear Center in Mud Lake Open Space. The Ridge Road parcel is near the alignment between Mud Lake and Hurricane Hill.

6.3 Education

By the terms of the IGA, The Wild Bear Center for Nature Discovery is a partner to the County in the stewardship of this property. Wild Bear acquired a 4-acre parcel in the middle of the Mud Lake property and has long-term plans to develop an environmental education facility on their inholding. In the meantime, the school already uses that parcel and the Mud Lake area as a setting and resource for its nature interpretation and environmental education programs. At this time, the school must obtain permits from the County Parks and Open Space Department for these activities. In the future, Wild Bear is expected to perform some stewardship of the County property as part of their mission.

MANAGEMENT CONSIDERATIONS

7.0 PRELIMINARY MANAGEMENT PLANNING

Based on the IGA, documents associated with the purchase of the property, resource evaluations in this document, and the citizen survey and recommendations of the Town of Nederland's Open Space Master Plan (2001) staff has compiled a list of management issues and possible management directions beginning with a vision statement and broad goals for the open space. The County and the Town will jointly develop a formal management plan for the property in a separate document following the approval of this resource evaluation.

7.1 Vision Statement

An open space buffer/link between Nederland and Caribou Ranch that provides quality recreation/interpretive experiences, protection of the site's ecological features, and the setting for an outdoor science school.

7.2 Management Direction

Mud Lake Open Space could serve as a public land buffer/trail linkage from Nederland to the Caribou Ranch area. This was contemplated during both the open space master planning for Nederland (Town of Nederland 2001) and the management planning for Caribou Ranch Open Space. Visitors can enjoy the features of the site itself or, once Caribou Ranch Open Space is opened to the public, people could travel through the property as a way of reaching the site. Given the current status of recreation, trails, and natural resources, Mud Lake might be able to absorb more public use (without significant negative effects). This can offset the more limited public access to Caribou Ranch Open Space--which doesn't have the same public use history and will continue to have closed areas and seasonally limited access in order to protect its more sensitive resources and landscape.

Mud Lake's close association with the Nederland area has fostered a use pattern by residents for recreation and appreciation of the site's beauty that continues today. An important goal for the property could be to provide a trail connection and/or trailhead adjacent to town resulting in quick, close access for Nederland residents enabling them to enjoy a short hike or ride to a small, mountain lake and the surrounding forest. In the past, since the property is on the edge of town, motorized vehicle use, dumping, and camping occurred and seemed to be established a precedent for unlawful behavior that, while drastically diminished, persists to this day--mainly in the form of vandalism.

Mud Lake Open Space will be the larger setting for Wild Bear's environmental education and stewardship center since it surrounds their 4 acre parcel. The Wild Bear Center for Nature Discovery not only plans to build a facility on their land, but they anticipate using the Mud Lake property for their programs. They will also participate in stewardship of the property--for example, possibly helping with restoration projects. Wild Bear has easements across Mud Lake Open Space to their property for both pedestrian and limited vehicular access. The management planning process for Mud Lake Open Space will help clarify and define Wild Bear's future use of the County property for stewardship, education, and fundraising (both before and after the completion of the nature center). Wild Bear would also like to identify a location for their facility on their property.

With all of the historic mining, past and continuing recreation, and proximity to residential areas and public roads the property's resources haven't remained unaffected. For example, the U.S. Forest Service indicates that none of the property qualifies as effective habitat (Habitat Effectiveness Map, USFS 1995). This isn't surprising since the mileage of old roads and trails on the property extrapolates to a very high density--over 15 miles per square mile--without even considering the roads along its three sides. So, given these impacts, staff expected the condition of natural resources on much of Mud Lake Open Space to be typical for a mountain parcel near a town, and our reviews, surveys, and studies support this conclusion. However, the resource evaluations in the previous sections of this document as well as a GIS analysis in the Town of Nederland's Open Space Master Plan (2001) indicate some important exceptions that warrant conservation and protection: Mud Lake and its associated wetlands, Sherwood Creek and its associated riparian area, and the drainage south of Mud Lake. Vegetation restoration would likely initially focus on the wetlands at Mud Lake and trail/road crossings of Sherwood Creek.

Additionally, the Boulder County Comprehensive Plan identifies the east side of the property adjacent to the Peak-to-Peak Scenic Byway as an Open Corridor, important for the views it provides to travelers on that roadway. This is another value that warrants protection.

The Ridge Road parcel could be left as is with the few social trails already existing but officially designated as trails. If a regional/connecting trail utilizes the property, a primary trail could be appropriately located and improved. If social trails proliferate, efforts to keep use focused on the existing, primary trails could be taken.

In summary, staff generally proposes to balance the impacts of recreation and approved uses on this site with measures to preserve and enhance its remaining ecological potential. The nature of the acquisition and the proximity to public roads and Nederland create a set of fixed conditions for the property. But, apart from those parameters, measures can be taken to minimize the impacts of recreation and other activities. For example, trails can be moved away from more sensitive areas in order to protect resources, and the restoration of some features could improve wildlife habitat on the property.

7.3 Management Opportunities and Constraints

1. TRAILS: The relatively high amount of existing roads/trails (4.5 miles for a "smaller" property) creates an opportunity to use the existing travelways in order to minimize the impacts of new trail construction. Some existing routes must remain since their use is protected by access easements and/or stipulated in the IGA—trails must access Mud Lake and the Wild Bear Center. (The primary trail from Indian Peaks Drive north toward the lake is the principal pedestrian access to the Wild Bear Center and is designated as such by their access easement.) Alternatively, other existing trails may not be in appropriate locations for reasons like safety, resource conflicts, trail maintenance problems, poor visitor enjoyment, etc. and could be marked for reclamation. In order to have safe trails with better maintenance characteristics and more sensitive locations, new trail segments may need to be created; this would be done in a manner to minimize overall trail impacts to the property.
2. TRAILS: Existing multi-use trail(s) allow bicyclists to quickly pass through the property to connect north Nederland with County Roads 126 and 126N--roads that create trail loops west of the property for mountain bikers. These same trails can provide an alternative to driving to the future Caribou Ranch trailhead. However, since no bikes are

allowed on Caribou, there would need to be bike “parking” at a Caribou trailhead. With the number of trails on the property, there is a chance to separate some user groups to enhance visitor experience. Perhaps one multi-use trail could be separated from Wild Bear’s access easement that will likely have high levels of pedestrian traffic. However, this must be balanced by minimizing trail impacts on the site and wildlife.

3. **PARKING/TRAILHEAD:** There could be a Caribou Ranch trailhead on the disturbed area in the northwest corner of the property. The site is relatively flat, between one and two acres in size, cleared already, and is on one of the parts of the property that is closest to Caribou. It could serve well as a parking location since road access to the site already exists too, but it would need improvement and would require a 500-foot long connector trail along County Road 126 to link the two county properties.
4. **IGA parameters stipulate:**
 - a. Passive public use.
 - b. Commercial timber harvest, motorized use, and building/road expansion (beyond that already approved) are all prohibited.
 - c. No part of the Wild Bear school can be visible from the lake or the Peak to Peak.
 - d. The management plan must consider accustomed town uses like ice skating, mountain biking, equestrian, and picnic facilities
 - e. Wild Bear Center can conduct outdoor classes on the county’s land.
5. **ROADS/PROPERTY ACCESS**
 - a. Wild Bear has vehicle (handicapped, delivery, and shuttle) access from Peak-to-Peak through the county land to their site.
 - b. Wild Bear has emergency vehicle and pedestrian access to their site from Indian Peaks Drive.
 - c. County Road 126J segments cross the property. Closure and vacation of these could help in property management and restrict unauthorized motorized use
6. **USE:** There is no agricultural use at this time nor is it anticipated in the future.
7. **WILDLIFE:** The improvement of lake for amphibians/invertebrates is possible, but there may be too many crayfish now.
8. **CULTURAL RESOURCES:** Interpretation of mining sites, the significance of Mud Lake itself, and old travelways is possible, but improvements and resources will need to be protected against vandalism.

7.4 Current Management Needs

Since the property is already open to the public there are some immediate issues that need attention:

1. **Mine safety**—Staff has already mapped and documented the 13 unsafe areas and fenced them off. Staff met with the Inactive Mine Reclamation Program staff of the Colorado State Division of Minerals and Geology (Julie Annear) to determine a course of action: the State will do the work of closing the 13 shafts/adits/pits and remove trash from those. Boulder County is expected to provide a portion of this funding. The Program focuses on mine safety, not environmental reclamation, so the county will need to follow up with reseedling/weed control once the state work is complete. Wildlife staff has made an initial check for bats and has not found any, but as part of the program, the state helps

check for bats to ensure none are harmed during the closures. The state also didn't find any on their initial survey.

2. Road /Trail closures/vacations. In an effort to quell illegal camping and motor vehicle use of the property as well as trespass on adjacent lands, staff has fenced some areas. Two spurs of County Road 126J pass through the property to the land west of Mud Lake. In order to prevent unauthorized motor vehicle access of the Mud Lake property, staff would like to gate and lock off these two roads. This will require a formal road vacation and concurrence with the landowner to the west.
3. Forest Management—Staff is recommending some fire mitigation since, with increased public use, fire risk increases, also
 - a. Some thinning for mistletoe and high mortality areas
 - b. Some thinning in spots to regenerate aspen stands
 - c. Some vehicular access will be necessary for forest management
4. Staff will continued to enforce our Park rules—camping has been a problem.
5. Staff will work on formulating an interim agreement on Wild Bear's use/stewardship of county land
6. Staff will work on weed control, especially along County Road 126 and Sherwood Creek
7. While ice skating is allowed (per the IGA), organized hockey will be further discussed during management planning. Issues with organized hockey are primarily related to parking and access.
8. Staff is looking for ways to prevent parking along SH 72 to access the lake and property due to traffic/safety concerns.

LITERATURE CITED

Barry, R. 1973. A climatological transect on the east slope of the Front Range, Colorado. *Arctic and Alpine Research* 5:89-110.

Bellrose, F. 1976. *Ducks, Geese and Swans of North America*. 2nd ed. Stackpole Books, Harrisburg, PA.

Benedict, A. 1991. *A Sierra Club Naturalist's Guide: The Southern Rocky Mountains*. Sierra Club Books, San Francisco.

Bent, A. 1948. *Life Histories of North American Nuthatches, Wrens, Thrashers, and their Allies*. U.S. National Museum Bulletin 195. Washington, D.C.

Bishop and Hamilton. 1947. *Science* 106:641.

Carter, M., W. Hunter, D. Pashley, J. Bradley, D. Aid, J. Price, and G. Butcher. 1998. The Partners in Flight method for setting bird conservation priorities for states and physiographic areas of North America. Unpublished memo.

Churches and McCarley. 2000. Citizen Survey on Open Space, Trails, Parks and Outdoor Recreation Summary Report. Peak to Peak Healthy Communities Project.

Fitzgerald, J., C. Meaney, and D. Armstrong. 1994. *Mammals of Colorado*. Denver Museum of Natural History and University Press of Colorado.

Foothills Engineering Consultants. 1996. Draft Soil and Ecological Land Unit Survey for Arapaho-Roosevelt National Forests, Colorado. Fort Collins, CO.

Hallock, D. 2000. Breeding Bird Survey, Mud Lake Open Space. Report prepared for Boulder County parks and Open Space Department.

Hallock, D., and S. Jones. 1999. Boulder County Avian Species of Special Concern. Boulder County Nature Association.

Hammerson, G. 1992. Field surveys of amphibians in the mountains of Colorado, 1991. Report funded by the U.S. Fish and Wildlife Service, U.S. Forest Service, Colorado Division of Wildlife, and Colorado Office of The Nature Conservancy. Colorado Division of Wildlife, Denver.

Johnson, K. 1932. Ecology of a glacial lake in central Colorado. M.S. Thesis, University of Colorado, Boulder.

Kingery, H. 1998. *Colorado Breeding Bird Atlas*. Colorado Bird Atlas Partnership and Colorado Division of Wildlife, Denver.

- Livo, L. 1995. Amphibian surveys in Boulder, Clear Creek and Gilpin Counties, Colorado, 1994. Conducted in cooperation with Colorado Division of Wildlife and the U.S. Forest Service.
- Lovering, T., and O. Tweto. 1953. Geology and Ore Deposits of the Boulder County Tungsten District, Colorado. Geological Survey Professional Paper 245.
- Meyers, R. 1939. Morphological variations in *Ambystoma tigrinum* Green at various altitudes. M.S. Thesis, University of Colorado, Boulder.
- Miller, C. 1994. Review of flight distances for different types of wildlife. Unpublished report. City of Boulder Open Space.
- Reed, Jr., Porter B. 1988. National List of Plant Species That Occur in Wetlands: National Summary. U.S. Fish & Wildlife Service. Biol. Rep. 88 (24).
- Rosine, W. 1955. Polydactylism in a second species of amphibian in Muskee Lake, Colorado. *Copeia* 2:136.
- Town of Nederland. 2001. Town of Nederland and Surrounding Areas Open Space, Trails, Parks, and Outdoor Recreation Master Plan.
- Unger, P. 1978. Natural History Inventory of Colorado No. 3: The Crayfishes of Colorado. University of Colorado Museum, Boulder.
- U.S. Forest Service. 1995. Habitat Effectiveness Map from the Draft Environmental Impact Statement for the Revised Land and Resource Management Plan of the Arapaho and Roosevelt National Forests and Pawnee National Grasslands.
- Wu, S-K. 1989. Natural History Inventory of Colorado No. 11: Colorado Freshwater Mollusks. University of Colorado Museum, Boulder.

APPENDIX 1: PLANTS FOUND ON MUD LAKE OPEN SPACE

Trees

<i>Abies lasiocarpa</i>	Subalpine fir
<i>Picea engelmannii</i>	Engelmann Spruce
<i>Picea pungens</i>	Colorado Blue Spruce
<i>Picea pungens</i> X <i>engelmannii</i>	Colorado Blue Spruce/Engelmann Spruce hybrid
<i>Pseudotsuga menziesii</i>	Douglas-fir
<i>Pinus contorta</i> ssp. <i>latifolia</i>	Lodgepole Pine
<i>Pinus flexilis</i>	Limber Pine
<i>Pinus ponderosa</i> ssp. <i>scopulorum</i>	Ponderosa Pine
<i>Populus tremuloides</i>	Aspen

Shrubs and Vines

<i>Alnus incana</i> ssp. <i>tenuifolia</i>	Thinleaf alder
<i>Amelanchier alnifolia</i>	Serviceberry
<i>Arctostaphylos uva-ursi</i> ssp. <i>coactilis</i>	Kinnikinnick
<i>Artemisia frigida</i>	Fringed Sage
<i>Atragene columbiana</i>	Columbia Clematis
<i>Betula fontinalis</i>	River Birch
<i>Ceanothus fendleri</i>	Buckbrush
<i>Distegia involucrata</i>	Twinberry Honeysuckle
<i>Juniperus communis</i> ssp. <i>alpina</i>	Common Juniper
<i>Pentaphylloides floribunda</i>	Bush Cinquefoil
<i>Purshia tridentata</i>	Antelope Brush
<i>Ribes cereum</i>	Squaw Currant
<i>Ribes inerme</i>	White-stemmed Gooseberry
<i>Rosa woodsii</i>	Woods Rose
<i>Rubus idaeus</i>	Wild Red Raspberry
<i>Salix drummondiana</i>	Drummond Willow
<i>Salix lasiandra</i> var. <i>caudata</i>	Whiplash Willow
<i>Salix monticola</i>	Yellow-twiggged Willow
<i>Salix scouleriana</i>	Scouler willow
<i>Sambucus microbotrys</i>	Red Elderberry
<i>Shepherdia canadensis</i>	Buffaloberry
<i>Symphoricarpos rotundifolius</i>	Snowberry

Forbs

<i>Acetosella vulgaris</i>	Sheep Sorrel
<i>Achillea lanulosa</i>	Yarrow
<i>Aconitum columbianum</i>	Monkshood
<i>Adenolinim lewisii</i> (<i>Linum lewisii</i>)	Wild Blue Flax

Forbs (continued)

<i>Adoxa moschatellina</i>	Musk-root
<i>Agoseris aurantiaca</i>	Burnt-orange False Dandelion
<i>Allium geoyeri</i>	Geyer Onion
<i>Amerosedum lanceolatum</i>	Yellow Stonecrop
<i>Anaphalis margaritacea</i>	Pearly Everlasting
<i>Anemone multifida</i> var. <i>globosa</i>	Pacific Anemone
<i>Anemonidium canadense</i>	Meadow Anemone
<i>Angelica ampla</i>	Giant Angelica
<i>Antennaria parvifolia</i>	Mountain Pussytoes
<i>Anticlea elegans</i> (= <i>Zygadenus elegans</i>)	Death Camas
<i>Apocynum androsaemifolium</i>	Dogbane
<i>Aquilegia coerulea</i>	Colorado columbine
<i>Aralia nudicaulis</i>	Wild sarsaparilla
<i>Arnica cordifolia</i>	Heart-leaf Arnica
<i>Arnica parryi</i>	Rayless Arnica
<i>Artemesia ludoviciana</i> ssp. <i>incompta</i>	Prairie Sagewort
<i>Aster porteri</i>	Porter Aster
<i>Astragalus adsurgens</i> var. <i>robustior</i>	Standing Vetch
<i>Astragalus alpinus</i>	Alpine Milk Vetch
<i>Astragalus flexuosus</i>	Limber Vetch
<i>Astragalus parryi</i>	Parry Milk Vetch
<i>Astragalus shortianus</i>	Early Purple Milkvetch
<i>Astragalus tenellus</i>	Loose-flowered Milkvetch
<i>Bahia dissecta</i>	Field Chrysanthemum
<i>Barbarea orthoceras</i>	Wintercress
<i>Bistorta bistortoides</i>	American Bistort
<i>Boechera drummondii</i>	Drummond Rockcress
<i>Boechera fendleri</i> (= <i>Arabis fendleri</i>)	Fendler rock-cress
<i>Calypso bulbosa</i>	Fairy Slipper
<i>Campanula parryi</i>	Parry Harebell
<i>Campanula rotundifolia</i>	Harebell
<i>Cardamine cordifolia</i>	Heart-leaved Bittercress
<i>Carduus nutans</i>	Musk Thistle (introduced)
<i>Carum carvi</i>	Caraway
<i>Castilleja miniata</i>	Scarlet Paintbrush
<i>Castilleja sulphurea</i>	Yellow Paintbrush
<i>Cerastium strictum</i> (= <i>C. arvense</i>)	Mouse Ear Chickweed
<i>Chamerion danielsii</i> (= <i>Epilobium ang.</i>)	Common fireweed
<i>Chimaphila umbellata</i> ssp. <i>occidentalis</i>	Pipsissewa
<i>Chlorocrepis albiflora</i> (= <i>Hieracium alb.</i>)	White Hawkweed
<i>Chlorocrepis fendleri</i>	Fendler Hawkweed
<i>Cirsium arvense</i>	Canada Thistle (introduced)

Forbs (continued)

<i>Cirsium centaurae</i>	American Thistle
<i>Conioselinum scopulorum</i>	Hemlock Parsley
<i>Corallorhiza maculata</i>	Spotted Coral-root
<i>Cynoglossum officinale</i>	Houndstongue
<i>Dodecatheon pulchellum</i>	Shooting Star
<i>Draba aurea</i>	Golden Draba
<i>Drymocallis fissa</i> (= <i>Potentilla fissa</i>)	Leafy Cinquefoil
<i>Epilobium ciliatum</i>	Northern Willow-herb
<i>Erigeron compositus</i>	Cut-leaf Daisy
<i>Erigeron eximius</i>	Forest Erigeron
<i>Erigeron flagellaris</i>	Whiplash Erigeron
<i>Erigeron speciosus</i>	Aspen Daisy
<i>Erigeron vetensis</i>	Early Blue Erigeron
<i>Eriogonum umbellatum</i>	Sulphurflower
<i>Erysimum capitatum</i>	Western Wallflower
<i>Erythrocoma triflora</i> (= <i>Geum triflorum</i>)	Pink Plumes
<i>Fragaria vesca</i> ssp. <i>bracteata</i>	Wild Strawberry
<i>Fragaria virginiana</i> ssp. <i>glauca</i>	Wild Strawberry
<i>Frasera speciosa</i>	Green Gentian
<i>Gaillardia aristata</i>	Gaillardia
<i>Galium septentrionale</i>	Northern Bedstraw
<i>Galium triflorum</i>	Fragrant Bedstraw
<i>Gentianella acuta</i>	Fringed Gentian
<i>Geranium fremontii</i>	Fremont Geranium
<i>Geranium richardsonii</i>	Richardson Geranium
<i>Grindelia subalpina</i>	Gumweed
<i>Geum macrophyllum</i>	Bur Avens
<i>Harbouria trachypleura</i>	Whiskbroom Parsley
<i>Helianthella quinquenervis</i>	Aspen Sunflower
<i>Heracleum sphondylium montanum</i>	Cow Parsnip
<i>Heterotheca villosa</i>	Hairy Golden Aster
<i>Hydrophyllum fendleri</i>	Fendler waterleaf
<i>Iris missouriensis</i>	Rocky Mountain Iris
<i>Lepidotheca suaveolens</i>	Pineapple Weed
<i>Lesquerella montana</i>	Mountain Bladderpod
<i>Leucanthemum vulgare</i>	Ox-eye Daisy (introduced)
<i>Ligusticum porteri</i>	Porter Lovage or Osha
<i>Limnorchis stricta</i> (= <i>L. saccata</i>)	Green Bog Orchid
<i>Limnorchis dilitata albiflora</i>	White Bog Orchid
<i>Linaria vulgaris</i>	Butter-and-Eggs (introduced)
<i>Lupinus argenteus</i>	Silvery Lupine
<i>Maianthemum stellatum</i> (<i>Smilacina</i>)	Star Solomon Plume
<i>Melilotus officinale</i>	Sweet Yellow Clover (introduced)
<i>Mertensia ciliata</i>	Tall Chiming Bells

Forbs (continued)

<i>Mertensia lanceolata</i>	Lance-leaf Chiming Bells
<i>Micranthes odontoloma</i>	Brook Saxifrage
<i>Moehringia lateriflora</i>	Blunt-leaved Sandwort
<i>Noccaea montana</i> (=Thlaspi montanum)	Mountain Candytuft
<i>Oenothera villosa</i>	Yellow Evening Primrose
<i>Oligosporus caudatus</i>	Field Wormwood
<i>Oreocarya virgata</i> (=Cryptantha virgata)	Miners Candle
<i>Oreochrysum parryi</i>	Parry Goldenweed
<i>Orthilia secunda</i> (=Pyrola secunda)	One-sided Wintergreen
<i>Orthocarpus luteus</i>	Yellow Owl Clover
<i>Osmorhiza depauperata</i>	Sweet Cicely
<i>Oxypolis fendleri</i>	Cowbane
<i>Oxytropis deflexa</i> var. <i>sericea</i>	Drop-pod Loco
<i>Oxytropis lambertii</i>	Lambert Loco
<i>Oxytropis sericea</i>	Silky or Rocky Mountain Loco
<i>Oxytropis multiceps</i>	Tufted Loco
<i>Packera fendleri</i>	Fendler Senecio
<i>Pedicularis procera</i> (=P. grayi)	Gray' s Fernleaf Lousewort
<i>Penstemon glaber</i>	Mountain Beard-tongue
<i>Penstemon secundiflorus</i>	Tall One-sided Penstemon
<i>Penstemon virens</i>	Greenleaf Penstemon
<i>Plantago major</i>	Plantain
<i>Pneumonanthe affinis</i>	Prairie Gentian
<i>Pneumonanthe parryi</i>	Parry Gentian
<i>Potentilla hippiana</i>	Silvery Potentilla
<i>Potentilla pulcherrima</i>	Beauty Cinquefoil
<i>Pseudocymopterus montanus</i>	Mountain Parsley
<i>Pterospora andromedea</i>	Pinedrops
<i>Pyrola chlorantha</i>	Green Pyrola
<i>Pyrola rotundifolia</i>	Pink-flowered Pyrola
<i>Ranunculus inamoenus</i>	Homely Buttercup
<i>Rudbeckia ampla</i>	Tall Coneflower
<i>Rudbeckia hirta</i>	Black-eyed Susan
<i>Rumex crispus</i>	Curly Dock (introduced)
<i>Scrophularia lanceolata</i>	Lance-leaf Figwort
<i>Scutellaria brittonii</i>	Britton Skullcap
<i>Senecio integerrimus</i>	Lambstongue Groundsel
<i>Sidalcea candida</i>	White Checkermallow
<i>Solidago spathulata</i> ssp. <i>neomexicana</i>	Dwarf Goldenrod
<i>Taraxacum officinale</i>	Dandelion (introduced)
<i>Thalictrum fendleri</i>	Fendler Meadowrue
<i>Thermopsis divaricarpa</i>	Golden Banner
<i>Thlaspi arvense</i>	Pennycress (introduced)
<i>Tragopogon pratensis</i>	Salsify (introduced)

Forbs (continued)

Trifolium pratense
Trifolium repens
Valeriana edulis
Verbascum thapsus
Viola adunca
Viola renifolia
Viola rydbergii

Red Clover (introduced)
White Dutch Clover (introduced)
Edible Valerian
Common Mullein (introduced)
Hook Violet
Kidney-leaved Violet
Rydberg Violet

Grasses

Agrostis gigantea
Alopecurus aequalis
Anisantha tectorum (=Bromus tectorum)
Bromopsis inermis (=Bromus inermis)
Bromopsis porteri (=Bromus porteria)
Calamagrostis canadensis
Calamagrostis purpurascens
Dactylis glomerata
Danthonia parryi
Deschampsia cespitosa
Elymus longifolius (=Sitanion longifolium)
Elymus trachycaulus
Festuca thurberi
Koeleria macrantha (=Koeleria cristata)
Leucopoa kingii (Hesperochloa kingii)
Muhlenbergia montana
Phleum pratense
Poa pratense
Stipa lettermanii

Redtop (introduced)
Foxtail
Cheatgrass (introduced)
Smooth brome (introduced)
Nodding brome
Bluejoint reedgrass
Purple reedgrass
Orchardgrass (introduced)
Parry oatgrass
Tufted hairgrass
Squirreltail
Slender wheatgrass
Thurber fescue
Junegrass
Spike fescue
Mountain muhly
Timothy (introduced)
Kentucky bluegrass (introduced)
Letterman needlegrass

Sedges, Rushes

Carex aquatilis
Carex geyeri

Aquatic sedge
Elk sedge

APPENDIX 2: POTENTIAL MAMMALS

Information for this list is taken from “Mammalian Fauna of Boulder County”, Boulder County Comprehensive Plan: Environmental Resources Element (1984), and *Mammals of Colorado* (Fitzgerald et al. 1994)

Habitat Codes: C - Coniferous Forest/Woodland; R - Riparian Forest/Shrubland; A - Aspen Forest; G - Grassland/Meadow; W - Wet Meadow; T - Talus/Rock Outcrops

<u>Species</u>	<u>Habitat</u>
INSECTIVORES	
Masked Shrew (<i>Sorex cinereus</i>)	C,R,A,G,W,T
Merriam' s Shrew (<i>Sorex merriami</i>)	C,G
Montane Shrew (<i>Sorex monticolus</i>)	C,R,A,G,W,T
Dwarf Shrew (<i>Sorex nanus</i>)	C,R,A,G,W,T
Water Shrew (<i>Sorex palustris</i>)	R,A,W
BATS	
Long-eared Myotis (<i>Myotis evotis</i>)	C
Little Brown Myotis (<i>Myotis lucifugus</i>)	C,R,A,G,W
Long-legged Myotis (<i>Myotis volans</i>)	C,R,A
Hoary Bat (<i>Lasiurus cinereus</i>)	C,A
Silver-haired Bat (<i>Lasionycteris noctivagans</i>)	C,A
Big Brown Bat (<i>Eptesicus fuscus</i>)	C,A
Townsend=s Big-eared Bat (<i>Plecotus townsendii</i>)	C,R,A,G
RABBITS AND ALLIES	
American Pika (<i>Ochotona princeps</i>)	T
Nuttall' s Cottontail (<i>Sylvilagus nuttallii</i>)	C,R,A
Snowshoe Hare (<i>Lepus americanus</i>)	C,R,A
White-tailed Jackrabbit (<i>Lepus townsendii</i>)	C,G,A,T
RODENTS	
Least Chipmunk (<i>Tamias minimus</i>)	C,R,A,G,W,T
Uinta Chipmunk (<i>Tamias umbrinus</i>)	C,A,T
Yellow-bellied Marmot (<i>Marmota flaviventris</i>)	C,R,A,G,W,T
Wyoming Ground Squirrel (<i>Spermophilus elegans</i>)	G
Golden-mantled Ground Squirrel (<i>Spermophilus franklinii</i>)	C,A,G,T
Aberts Squirrel (<i>Sciurus aberti</i>)	C
Chickaree (<i>Tamiasciurus hudsonicus</i>)	C
Northern Pocket Gopher (<i>Thomomys talpoides</i>)	C,A,G,T
American Beaver (<i>Castor canadensis</i>)	R
Deer Mouse (<i>Peromyscus maniculatus</i>)	C,R,A,G,W,T
Bushy-tailed Woodrat (<i>Neotoma cinerea</i>)	C,G,W,T
Southern Red-backed Vole (<i>Clethrionomys gapperi</i>)	C,R,A
Heather Vole (<i>Phenacomys intermedius</i>)	C,R,A

Long-tailed Vole (<i>Microtus langicaudus</i>)	C,R,A,T
Montane Vole (<i>Microtus montanus</i>)	C,R,A,T
Meadow Vole (<i>Microtus pennsylvanicus</i>)	G,R,A
Common Muskrat (<i>Ondatra zibethicus</i>)	R,W
Western Jumping Mouse (<i>Zapus princeps</i>)	R,A
Common Porcupine (<i>Erethizon dorsatum</i>)	C,R,A

CARNIVORES

Coyote (<i>Canis latrans</i>)	C,R,A,G,W,T
Red Fox (<i>Vulpes vulpes</i>)	C,R,A,G,W,T
Gray Fox (<i>Urocyon cinereoargenteus</i>)	C,T
Black Bear (<i>Ursus americanus</i>)	C,R,A
Raccoon (<i>Procyon lotor</i>)	C,R,A
American Marten (<i>Martes americana</i>)	C
Short-tailed Weasel (<i>Mustela erminea</i>)	C,R,A,G,T
Long-tailed Weasel (<i>Mustela frenata</i>)	C,R,A,G,T
Mink (<i>Mustela vison</i>)	R
American Badger (<i>Taxidea taxus</i>)	C,R,T
Striped Skunk (<i>Mephitis mephitis</i>)	C,R,A,G,W,T
Mountain Lion (<i>Felis concolor</i>)	C,R,A,G,T
Bobcat (<i>Lynx rufus</i>)	C,R

EVEN-TOED UNGULATES

American Elk (<i>Cervus elaphus</i>)	C,G,A,W
Mule Deer (<i>Odocoileus hemionus</i>)	C,G,R,A,W

APPENDIX 3: BIRD SURVEY SUMMARY

Bird Species Observed and Other Potential Breeders at Mud Lake Open Space				
Species	Observed	Status	Habitat	Abundance (breeding pairs)
Mallard	X	Confirmed	L	1
Ring-necked Duck	X	Possible	L	0 - 1
Osprey	X	Visitor	L	
Sharp-shinned Hawk	X	Confirmed	CF, A	1
Cooper's Hawk		Potential	CF, A	
Northern Goshawk		Visitor	CF	
Red-tailed Hawk	X	Possible	CF	0 - 1
Blue Grouse		Potential	CF	
Killdeer	X	Possible	L	1
Spotted Sandpiper	X	Possible	L	1
Mourning Dove		Potential	CF	
Great Horned Owl		Potential	CF, Rf	
Northern Pygmy-owl		Potential	CF, Rf	
Northern Saw-whet Owl		Potential	CF, Rf	
Common Nighthawk	X	Possible	CF	1
Broad-tailed Hummingbird	X	Probable	CF, A, R	10+
Williamson's Sapsucker	X	Confirmed	CF, A	2 - 5
Red-naped Sapsucker	X	Probable	A, Rf	2 - 5
Downy Woodpecker	X	Probable	A, Rf	1 - 2
Hairy Woodpecker	X	Probable	CF, A, Rf	5 - 10
Northern Flicker	X	Confirmed	A, CF, Rf	5 - 10
Olive-sided Flycatcher		Potential	CF	
Western Wood-Pewee	X	Probable	CF, A	2 - 5
Hammond's Flycatcher		Potential	CF, Rf	
Dusky Flycatcher	X	Probable	Rs	2 - 5
Cordilleran Flycatcher	X	Probable	Rf, CF	1 - 2
Warbling Vireo	X	Probable	A, Rs	5 - 10

APPENDIX 3: Continued				
Species	Observed	Status	Habitat	Abundance (breeding pairs)
Steller's Jay	X	Probable	CF	5 - 10
Clark's Nutcracker	X	Probable	CF	1 - 2
American Crow	X	Possible	CF	1
Common Raven	X	Possible	CF	1
Tree Swallow	X	Probable	A	2 - 5
Violet-green Swallow		Potential	CF, A	
Black-capped Chickadee	X	Probable	A, Rf	2 - 5
Mountain Chickadee	X	Confirmed	CF, A, Rf	10+
Red-breasted Nuthatch	X	Probable	CF, Rf, A	2 - 5
White-breasted Nuthatch	X	Probable	CFp, A	1 - 2
Pygmy Nuthatch	X	Probable	CFp	1 - 2
Brown Creeper	X	Probable	CF, Rf	1 - 2
House Wren	X	Confirmed	A, Rf, CF	2 - 5
Golden-crowned Kinglet	X	Probable	Rf	2 - 5
Ruby-crowned Kinglet	X	Probable	CF, Rf	10+
Mountain Bluebird	X	Probable	A	1 - 2
Townsend's Solitaire	X	Probable	CF	1 - 2
Swainson's Thrush		Potential	R	
Hermit Thrush	X	Probable	CF	5 - 10
American Robin	X	Confirmed	CF, A, R	10+
Yellow-rumped Warbler	X	Probable	CF, Rf	10+
MacGillivray's Warbler	X	Probable	Rs	2
Wilson's Warbler	X	Probable	Rs	2 - 5
Western Tanager	X	Probable	CFp	1 - 2
Chipping Sparrow	X	Probable	CFp	1 - 2
Song Sparrow	X	Probable	Rs	2 - 5
Lincoln's Sparrow	X	Probable	Rs	2 - 5
Gray-headed Junco	X	Confirmed	CF, A	10+
Black-headed Grosbeak	X	Probable	Rs	1 - 2

APPENDIX 3: Continued				
Species	Observed	Status	Habitat	Abundance (breeding pairs)
Red-winged Blackbird	X	Confirmed	L	2 - 5
Brown-headed Cowbird	X	Probable	CF, A, R	2 - 5
Cassin' s Finch	X	Probable	CF	2 - 5
Red Crossbill	X	Confirmed	CF	2 - 5
Pine Siskin	X	Probable	CF	10+
Evening Grosbeak	X	Probable	CF	1 – 2
<u>Habitat:</u> CF - Coniferous Forest; Cfp - Ponderosa Pine Forest; A - Aspen Forest; R - Riparian; Rf - Riparian Forest; Rs - Riparian Shrubland; L – Lake				

APPENDIX 4: POTENTIAL AMPHIBIANS AND REPTILES

<u>Species</u>	<u>Habitat Preference</u>
TRUE TOADS	
Western Toad <i>Bufo boreas</i>	Wet areas, 8,500' - 11,000'
MOLE SALAMANDERS	
Barred Tiger Salamander <i>Ambystoma tigrinum</i>	Small ponds and lakes up to 12,000'
TREEFROGS	
Striped Chorus Frog <i>Psuedacris triseriata</i>	Wet meadows and marshy ponds to 12,000'
TRUE FROGS	
Northern Leopard Frog <i>Rana pipiens</i>	Banks, shallow permanent water up to 10,000'
IGUANIDS	
Eastern Fence Lizard <i>Sceloporus undulatus</i>	Rocky terrain in mountains up to 9,000'
COLUBRIDS	
Smooth Green Snake <i>Opheodrys vernalis</i>	Riparian vegetation between 5,500' and 9,000'
W. Terrestrial Garter Snake <i>Thamnophis elegans</i>	Most habitats below 11,000', except plains

APPENDIX 5: MUD LAKE WETLAND PLANTS, SUMMER 2000

Species	Common Name	Family	¹ Indicator
Forbs/Graminoids			
<i>Agrostis gigantea</i>	Redtop	Poaceae	FACW
<i>Aster</i> sp.		Asteraceae	
<i>Breca arvensis</i>	Canada thistle	Asteraceae	FACU
<i>Bromopsis porteri</i>	Nodding brome	Poaceae	NL
<i>Calamagrostis canadensis</i>	Canada reedgrass	Poaceae	OBL
<i>Carex aquatilis</i>	Water sedge	Cyperaceae	OBL
<i>Carex nebrascensis</i>	Nebraska sedge	Cyperaceae	OBL
<i>Carex pachystachya</i>	Sedge	Cyperaceae	FACU
<i>Carex utriculata</i>	Beaked sedge	Cyperaceae	OBL
<i>Deschampsia caespitosa</i>	Tufted hairgrass	Poaceae	FACW
<i>Eleocharis palustris</i>	Spikerush	Cyperaceae	OBL
<i>Epilobium brachycarpum</i>	Willow herb	Onagraceae	
<i>Equisetum pratense</i>	Horsetail	Equisetaceae	FACW
<i>Fragaria vesca</i>	Wild strawberry	Rosaceae	NI
<i>Galium septentionale</i>	Northern bedstraw	Rubiaceae	FAC
<i>Galium trifidum</i>	Bedstraw	Rubiaceae	OBL
<i>Geum macrophyllum</i>	Large leaf avens	Rosaceae	OBL
<i>Glyceria elata</i>	Mannagrass	Poaceae	OBL
<i>Heracleum sphondylium</i>	Cow parsnip	Apiaceae	FACW-
<i>Juncus saximontanus</i>	Rocky Mountain rush	Juncaceae	FACW+
<i>Juncus arcticus</i>	Arctic rush	Juncaceae	FACW
<i>Lazula parviflora</i>	Woodrush	Juncaceae	FAC
<i>Mentha arvensis</i>	Field mint	Lamiaceae	FACW
<i>Mertensia ciliata</i>	Bluebells	Boraginaceae	OBL
<i>Pentaphylloides floribunda</i>	Shrubby cinquefoil	Rosaceae	FACW
<i>Phleum pratense</i>	Timothy	Poaceae	FACU
<i>Poa palustris</i>	Swamp bluegrass	Poaceae	FACW
<i>Poa pratensis</i>	Kentucky bluegrass	Poaceae	FACU
<i>Rosa woodsii</i>	Rose	Rosaceae	
<i>Rudbeckia ampla</i>	Coneflower	Asteraceae	FAC+
<i>Schoenoplectus lacustris acutus</i>	Hardstem bulrush	Cyperaceae	OBL
<i>Sidalcea candida</i>	Checkermallow	Malvaceae	FACW+
<i>Taraxacum officianle</i>	Dandelion	Asteraceae	

Species	Common Name	Family	¹ Indicator
Shrubs			
<i>Alnus incana</i>	Narrow leaf alder	Betulaceae	FACW
<i>Betula glandulosa</i>	Bog Birch	Betulaceae	OBL
<i>Distigia involucrate</i>	Bush honeysuckle	Caprifoliaceae	FAC
<i>Salix bebbiana</i>	Bebb willow	Salicaceae	FACW-
<i>Salix drummondiana</i>	Drummond willow	Salicaceae	FACW+
<i>Salix geyeriana</i>	Geyer willow	Salicaceae	
<i>Salix glauca</i> var. <i>villosa</i>	Grey willow	Salicaceae	FACW-
<i>Salix lasiandra</i>	Whiplash willow	Salicaceae	FACW+
<i>Salix monticola</i>	Mountain willow	Salicaceae	FACW+
<i>Salix planifolia</i>	Planeleaf willow	Salicaceae	OBL
Trees			
<i>Picea engelmannii</i>	Engleman spruce	Pinaceae	
<i>Pinus contorta</i>	Lodgepole pine	Pinaceae	
<i>Pinus flexilis</i>	Limber pine	Pinaceae	
<i>Pinus ponderosa</i>	Ponderosa pine	Pinaceae	
<i>Picea pungens</i>	Colorado bluespruce	Pinaceae	
<i>Populus tremuloides</i>	Aspen	Salicaceae	
<i>Pseudotsuga menziesii</i>	Douglas-fir	Pinaceae	
<i>Sabina scopulorum</i>	Rocky Mountain juniper	Cupressaceae	

1. Wetland indicator raking: Represents the estimated probability of a species occurring in wetlands versus non-wetlands. Intended to describe the affinity of a given species for wetland habitats. From Reed (1988).

Indicator Categories:

Obligate Wetland (OBL): Species occurs in wetlands almost always (>99%) under natural conditions.

Facultative Wetland (FACW): Usually occurs in wetlands (67-99%), but occasionally found in non-wetlands.

Facultative (FAC): Equally likely to be found in wetlands or non-wetlands (34-66%).

Facultative Upland (FACU): Usually occurs in non-wetlands (67-99%), but occasionally found in wetlands.

Obligate Upland (UPL): Almost always occurs in non-wetlands (>99%).

No Indicator (NI): No indicator rating available.