WETLANDS OF THE CRESTED BUTTE REGION

MAPPING
FUNCTIONAL EVALUATION
HYDROLOGIC REGIME

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HYDROLOGIC REGIME

Prepared for:

TOWN OF CRESTED BUTTE, COLORADO

and

ENVIRONMENTAL PROTECTION AGENCY, REGION VIII

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d. all impoundments of waters otherwise defined as waters of the United States under the definition;

e. tributaries of waters identified" (elsewhere in the regulations);

f. "wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs" (a-f) "of this section" (33 C.F.R. 5328.3(a): 40 C.F.R. 5230.3(s) 1986).

For purposes of this report, wetlands are defined as:

> "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas" (33 C.F.R. Part 328.3(b); C.F.R. 5230.3(t) 1986).

Section 404 of the Clean Water Act regulates the discharge of dredged or fill material into waters of the United States. The goal of these regulations is to reduce the introduction of pollutants into our nation's waters and to preserve and restore the integrity of our nations waters, including wetlands.

Not only do wetlands play a key role in protecting the nation's waters, but recent syntheses of scientific data have improved our understanding of the broad range of wetland functions (Adamus and Stockwell 1983, Sather and Stuber 1984). Wetlands are now known to be critical in the function of: (a) ground water recharge; (b) ground water discharge; (c) flood water retention / detention / storage; (d) shore-line anchoring; (e) sediment trapping; (f) water quality improvement; (g) food chain support; (h) fish and wildlife habitat; and (i) active and passive human recreation. Not all wetlands provide all of these functions, and most provide only a few functions to a very high degrec. These functions are valuable to human society. Thus, wetlands providing any function to a high degree, or wetlands providing a broad range of functions, are valuable to society.

Purpose

The purpose of this project was to identify, map, describe and evaluate the functions being performed by wetlands occurring in the Crested Butte, Colorado area. The data may be used by the U.S. Environmental Protection Agency in evaluating the applicability of the advanced identification process, the purpose of which is to designate wetlands which federal regulators feel are suitable or unsuitable for disposal of dredged and fill material. Advanced identification of key wetlands will help protect the water quality and other wetland functions of the region and provide local regulators and the regulated public with information to allow appropriate advanced planning and decision making. The advanced identification process is described in the Section 404 (b)(1) Guidelines or 40 C.F.R. Part 230.80. Evaluation of all wetlands in the study area will allow an objective evaluation and make it possible to identify wetlands with the highest functional values and the most sensitive wetlands.

Further, the data could be used by the Town of Crested Butte or Gunnison County to develop wetland regulation programs. Clearly, local governments have the experience to deal with their environment, resources and opportunities better than federal or state government agencies. In recent years there has been an important move by local governments in Colorado to develop local wetland regulations (eg. San Miguel County, City of Boulder, Greenwood Village, and Eagle County). Several other local governments are preparing regulations. Reasons why local governments might want to consider adopting such regulations include the realization that local governments have the most clear and comprehensive view, knowledge and stake in the resources involved.

THE STUDY AREA

This study took place in the vicinity of the Town of Crested Butte, in Gunnison County, Colorado, during 1992. The study area includes the entire Coal Creek drainage corridor from Irwin to Crested Butte, the Slate River valley from Nicholson Lake downstream to Skyland Golf Course, and Washington Gulch from the Meridian Lake and Reservoir downstream to the Slate River (see Figure 1). The study area encompasses approximately 7,200 acres.

Geology of the Study Area

Geologic processes have created the landscape and landforms of the Crested Butte area. Tectonics have placed bedrock units in their current positions and elevations, and erosional and depositional forces have shaped this land into its current features.

Gaskill et al. (1967) have produced a geologic map of the Oh-Be-Joyful Quadrangle which shows the bedrock units occurring at the land surface in the study area. The area has a typical western Colorado Paleozoic (600-240 million years ago (mya)), Mesozoic (240-65 mya) and early Cenozoic (65 mya to present) sedimentary rock sequence along with many unique Precambrian (older than 600 mya) laccoliths, and laccolith-like bodies which intruded through the sedimentary rock sequence. Examples of laccoliths include Crested Butte Mountain and Gothic Mountain. The precambrian rocks are more resistent to erosion than the sedimentary rocks and they remain tall and isolated, giving the region its unique mountain character.

The oldest sedimentary rocks are Pennsylvanian (325-280 mya), and Permian (280-240 mya) in age and include the Beldon, Minturn and Maroon Formations occurring generally east and north of the study area. The main valleys in the study area are composed of Mancos Shale, an upper Cretaceous (135-100 mya) marine shale unit that is up to 5,000 feet thick. This soft and easily erodible bedrock forms the Slate River, Washington Gulch and East River valleys.

Glaciers have developed and advanced from the high West Elk and Elk Mountains and then melted many times over the past two million years, a time period known as the Pleistocene. For glaciers to form, snowfall in the winter must exceed snowmelt in the summer. Those conditions occur only in periods of extreme precipitation or very cool and short summers. The great weight of glacier ice, that can be thousands of feet thick, erodes valleys into broad U-shaped features and carries an enormous sediment load downvalley. This load is frozen in the ice and along the glaciers margins. A glacier can act like a bulldozer, pushing ahead and aside gigantic ridges of unsorted sediments containing boulders, sand, gravels and other particles.

When climate changes cause glaciers to melt, the ice stagnates in valleys. Glaciers do not "retreat". The sediment it had been pushing ahead, called a terminal moraine, creates a dam across the valley floor. This dam can pool up water rushing from the melting glacier and capture sediment released from the melting glacier. Dams such as this often break creating catastrophic floods. When the dams hold, sediment accumulates filling the pool. The town of Crested Butte is built on glacial moraine. Figure 2 shows a series of terminal moraines that occur in the vicinity of the Gothic Road near the Slate River bridge (located at number 3 on Figure 2). These moraines still control the gradient of the Slate River upstream from that point. The gradient is flatter above the moraine and steeper below the moraine. Glacial till and meltwater outwash bury the Slate River valley near the Town of Crested Butte. It has been estimated that up to 300 feet of glacier debris, called till or outwash, occurs in the Slate River valley just upstream from Crested Butte.

Multiple glaciers have formed, advanced and melted in the study area. The moraines found near Gothic Road are from a relatively small glacier. Evidence of an older and much larger glacier advance can be seen far downvalley at the Skyland Golf Course. The golf course is built on large hilly material formed by the in-place melting of glacier ice. This material, called "dead ice moraine", indicates that these deposits are from a stagnant, as opposed to a moving, glacier. The importance of the glaciers are that they created very broad and flat bottomed valleys, perfect places for water to slow, pool up and form wetlands. Terminal moraines create valley control points that determine stream gradient for miles above the moraine. The moraines occurring in the Slate River valley near the Gothic Road have created a tremendously important wetland complex.

Several other more contemporary landscape features have also been of great importance in creating the Crested Butte region wetlands, and some have been discussed by Robinson and Dea (1981). A large alluvial fan deposit created by material transported down Baxter Gulch has filled the Slate River valley in the area of the Riverbend development. This fan extends from the mountain toe slope on the Smith Ranch, all the way to the Slate River. This fill apparently has dammed up the Slate River in the past, and causes a major gradient change. The fan created another obstruction to the flow of water and created a dam-like feature, causing river water to slow in the area above the fan, depositing sediment and leveling the valley. In the area above the fan the valley gradient is gentle, while at and below the fan the gradient is steep. This low gradient section extends from the fan to nearly half-way to town, a distance of approximately one mile. In this section the Slate River meanders, the water table is high, and extensive wetlands occur. This area supports one of the two large complex wetland systems in the study area. Another surficial geologic feature, a landslide, formed the dam that holds Nicholson Lake.

Glacial till on valley slopes forms an aquifer that creates springs at the base of

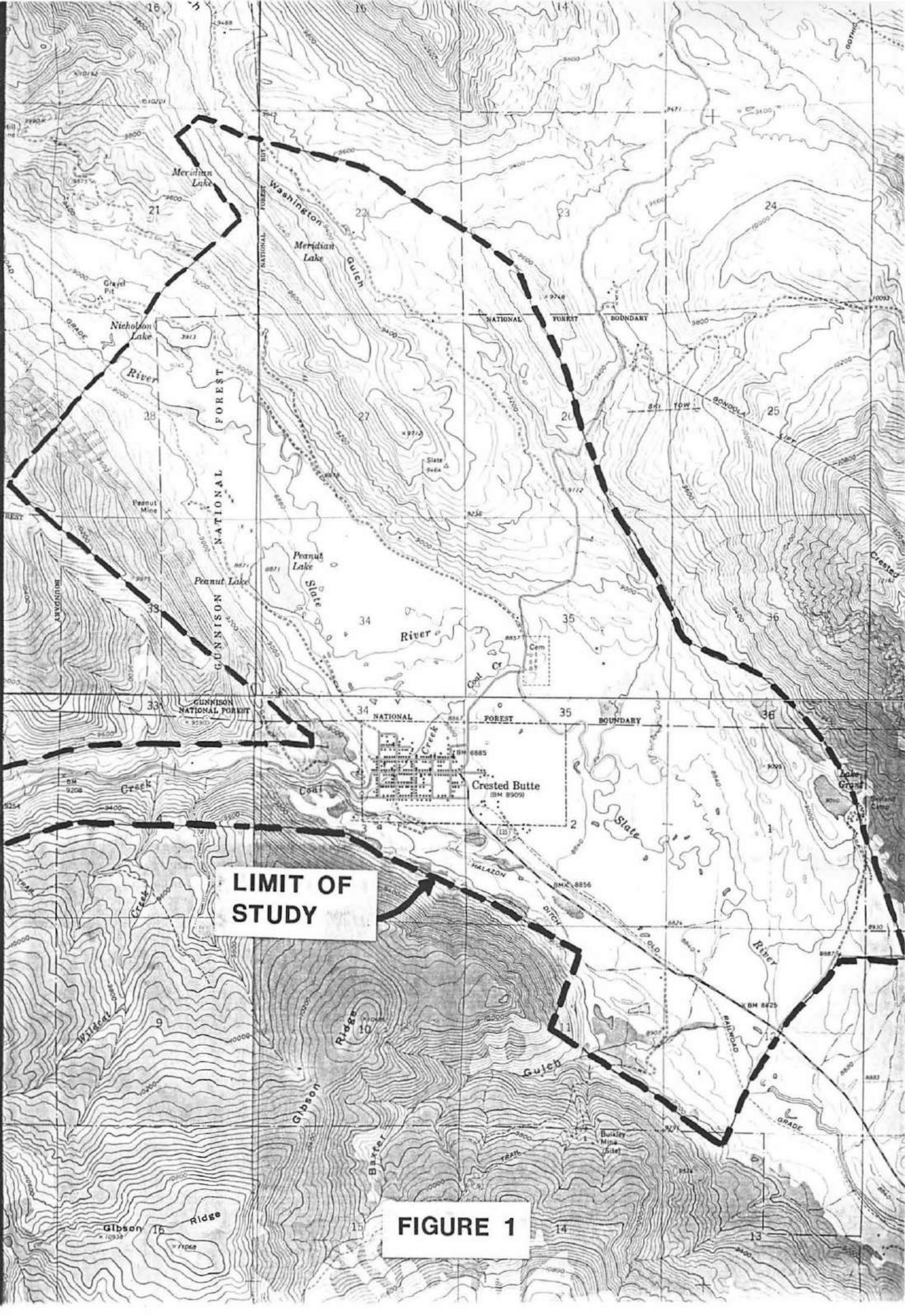
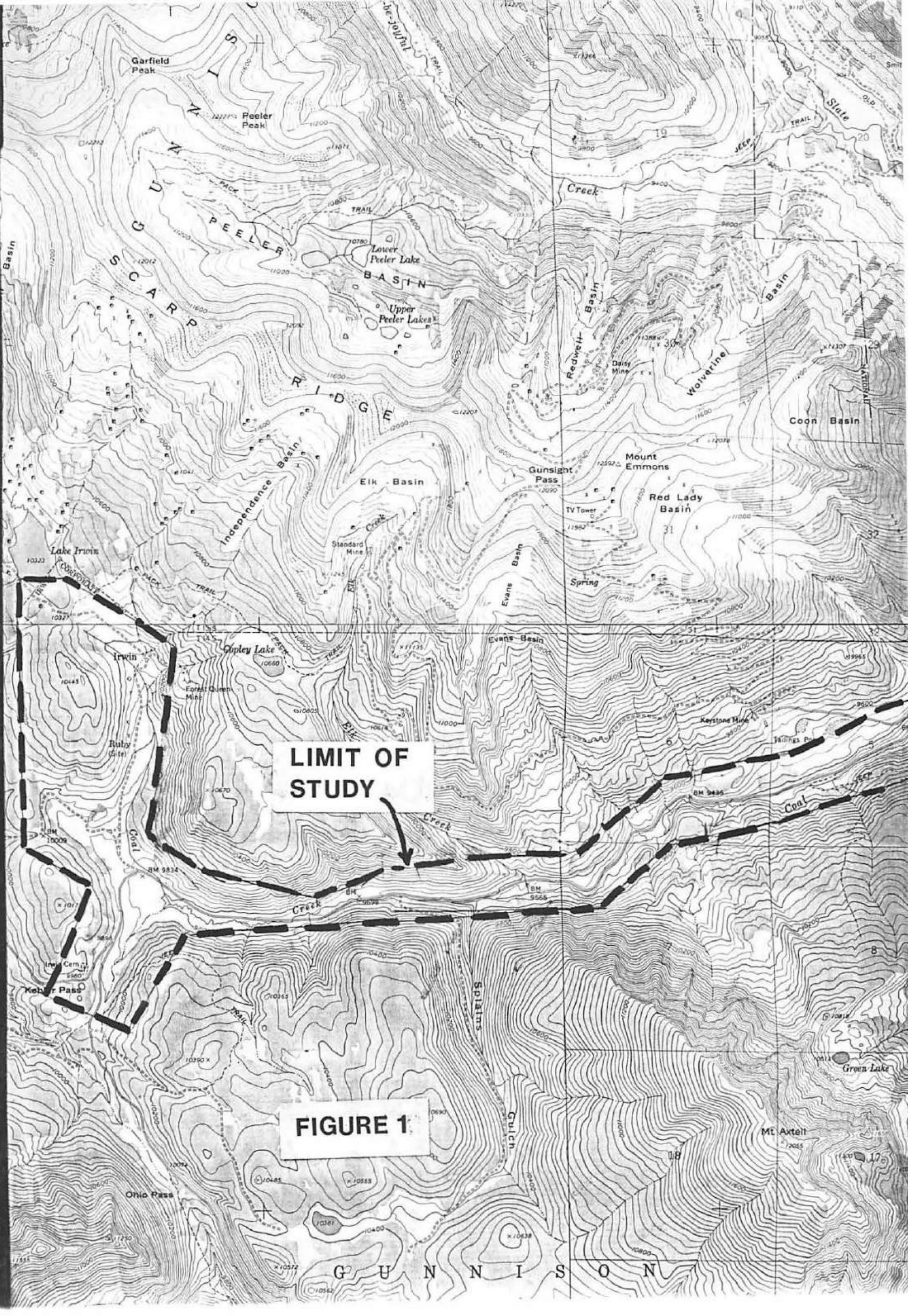


FIGURE 1



Garfield Peak
Peeler Peak
GUNNISON
SCARP RIDGE
PEELER BASIN
Lower Peeler Lake
Upper Peeler Lakes
Redwell Basin
Daisy Mine
Wolverine Basin
Coon Basin
Slate
Creek
Mount Emmons
Gunsight Pass
Red Lady Basin
TV Tower
Independence Basin
Elk Basin
Standard Mine
Lake Irwin
Evans Basin
Spring
Irwin
Copley Lake
Forest Queen Mine
Keystone Mine
Tailings Pond
Ruby (Site)
LIMIT OF STUDY
Coal Creek
BM 9834
BM 9565
BM 9435
BM 10009
Irwin Cem.
Kebler Pass
Splains Gulch
Green Lake
Mt. Axtell
Ohio Pass
TRAIL
JEEP

FIGURE 1

Typical Wetlands of the Crested Butte Area

Winter, Slate River North of Crested Butte

FIGURE 2

slopes as shown in Figure 3. Rain and snowmelt water seeps into the coarse material and moves downslope. When the ground water contacts saturated soils of the valley floor, the water table rises to the ground surface discharging as spring flow. Springs create the permanently saturated soils in the Crested Butte region. In these areas dead plant leaves and roots do not fully decompose so they accumulate to form peat soils. An example of this processes can be seen in the Slate River valley bottom just southeast of the O'Neal house. This process can maintain higher water tables on valley edges than on valley bottoms.

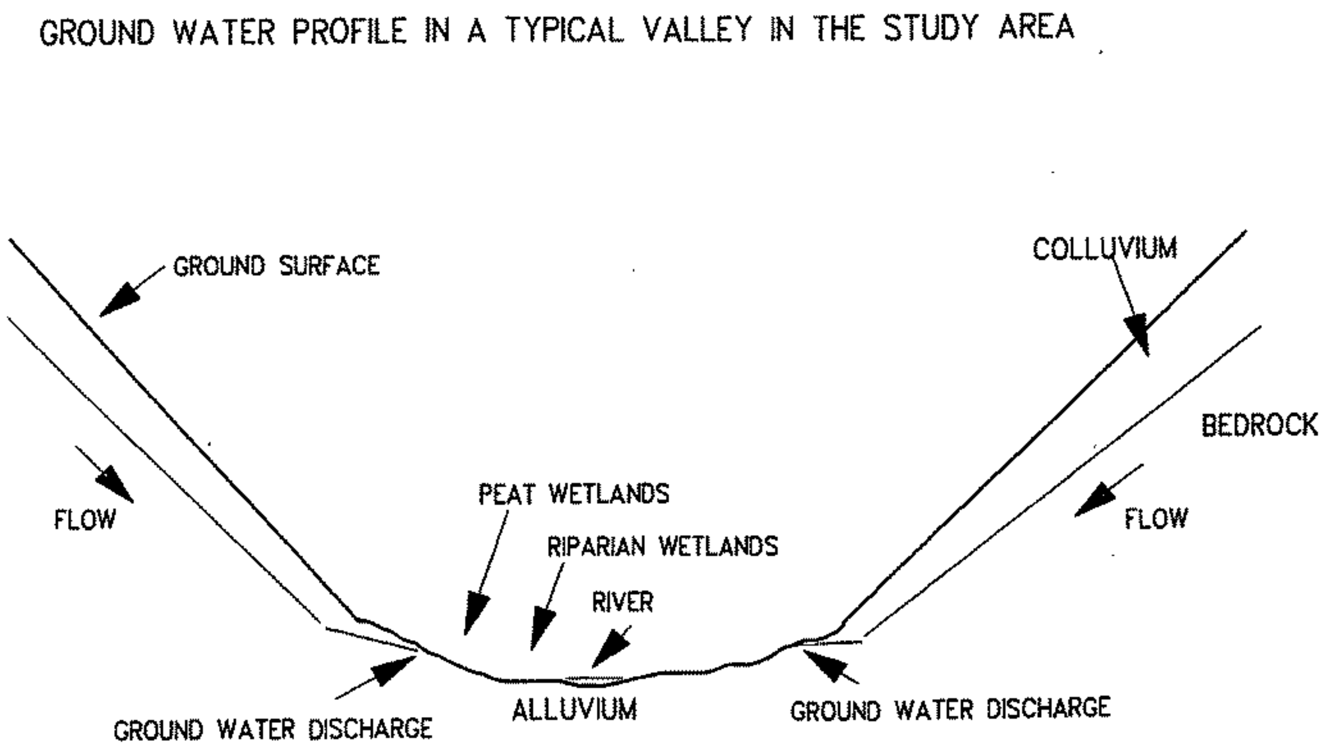


Figure 3. Typical profile in the Crested Butte area (exaggerated) showing a bedrock valley with a mantle of colluvium (fractured rock). Ground water flows downslope, coming closer to the soil surface downslope. When the ground water reaches the valley bottom alluvium (river transported material) which is saturated, it rises to the soil surface and typically reaches the soil surface, being discharged as spring flow. Wetlands can thus occur above the valley bottom due to this ground water flow.

Vegetation of the Study Area

The vegetation of the Crested Butte area is dominated by mountain big sagebrush on summer dry Mancos Shale uplands of the valley bottoms and slopes. Forests occur only on steeper hillsides and coarser textured rock. Aspen or lodgepole pine forests are common where past disturbance from fire or logging has occurred, and at higher elevations engelmann spruce and subalpine fir forests dominate.

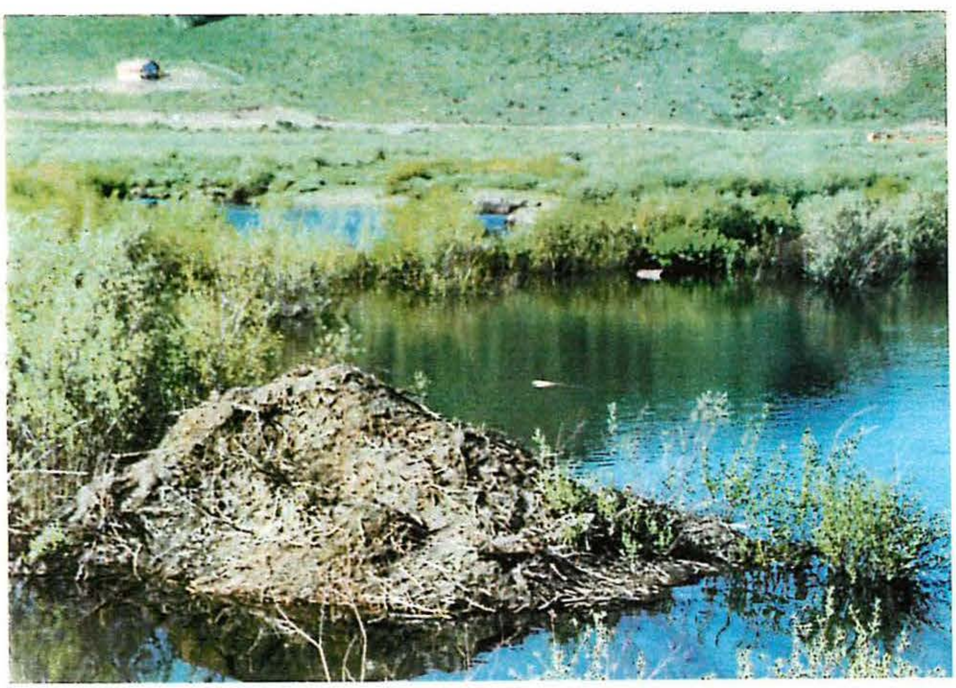
Extensive wetlands occur on valley floors dominated by geyer willow, mountain willow, beaked sedge, and numerous other plant species. Many wetlands have been converted to pastures for hay production or grazing by draining the wetlands, irrigating drylands, willow removal and other processes. Beavers are an important component in the wetland equation, putting and maintaining water on the floodplain and promoting its storage. Beavers help retain a tremendous volume of water in the Crested Butte area which provides late summer and autumn stream base flows. Beavers also help create and maintain the most important non-big game wildlife habitat in the area, namely the willow thickets, wet meadows, ponds, sloughs and sedge peatlands. More details of the Crested Butte region vegetation can be found in Langenheim (1962). More details about the impact of beavers on wetlands can be found in U.S. Fish and Wildlife Leafet 13.4.7 by James K. Ringelman (1991).

Land Access Issues in the Study Area

Access was denied to me for several large blocks of land in the study area, mostly in the Slate River valley bottom and the Washington Gulch area. The areas were surveyed from tall hills and surrounding roads and their wetlands are mapped and functions described as best as possible.

Typical Wetlands Plants and Creatures of the Crested Butte Area

Wetlands and beaver dam near Gothic Road, 1992



Peanut Lake beaver house

METHODS

Wetland Mapping

A complete set of aerial photographs for this region were obtained from the U.S. Department of Agriculture and used as a preliminary guide for locating wetlands. Wetland maps for this region have not been developed by the U.S. Fish and Wildlife Service's National Wetlands Inventory. Since most wetlands in the study area are spatially connected, the distinction between individual wetlands studied was based more on land ownership, vegetation types and other factors. Each wetland was numbered, with the number appearing on the field data sheet for that wetland (Appendix 3). Certain wetlands, suspected of having been created by the agricultural practice of irrigation are identified on the wetland maps with the letter "a" after the wetland number, for example 25a. It should be remembered that access was denied to many agricultural lands, and a few other areas that could have been created solely by irrigation could occur in the study area.

The purpose of this mapping was not to plot the exact wetland-upland boundary for regulatory purposes but to identify where wetlands exist in the study area. For regulatory purposes each wetland's boundary must be delineated more precisely. Other information collected at each wetland site was a general site description, notes on the soil substrate, hydroperiod (duration of flooding or soil saturation), notes on water level fluctuations, percentage of the area that is vegetated and unvegetated, notes on the source of water, wetland history (if known), current disturbance regime, and known outside threats. Wetland acreage was calculated for each numbered wetland using a planimeter.

Vegetation

Data were collected to describe the composition of the vegetation in each plant community occurring in each wetland. A species list was made for each wetland, and the percent canopy coverage for each species within each community was estimated. A wetland plant species list (flora) for the study area was developed and is presented in Appendix 2. The vegetation data were analyzed by two-way indicator species analysis, a divisive, hierarchical cluster analysis program using the computer program TWINSPAN (Hill 1979). This analysis was used to make decisions regarding the plant communities occurring in the study area. These communities are described later in this report. This is important because each community has characteristics and provides functions that are unique.

Soils

Notes on the depth to water table and hydric characteristics of the soil were also collected for communities. Soil colors, were listed on the field data sheets. Both matrix chroma, just below the A horizon, and mottle colors, where they occurred, are identified. Standard soil colors are provided from Munsell Soil Color Charts (Munsell Color, Baltimore, MD). In addition, soils have been mapped in the study area by the U.S. Soil Conservation Service. These data are presented in two publications; Soils of the Gunnison Area (Hunter and Spears 1975) which covers the Slate River region, and Soils of the Taylor River area (Fox 1977) which covers Washington Gulch area.

Hydrology

A total of 32 ground water monitoring wells and staff gauges were installed and monitored periodically in the study area during 1992. Wells were created by hand auguring a hole, placing a section of machine slotted PVC pipe into the hole and backfilling with native soil. The PVC was capped on both the bottom and top. The wells were monitored several times during the summer of 1992. The purpose of the monitoring was to determine ground and surface water levels in wetlands and streams throughout the study area. Staff gauges were metal or wooden fence posts anchored in lakes and streams to monitor water levels.

The data are used to characterize surface and ground water levels throughout the study area, and an attempt is made to calculate the water storage, in acre feet, of wetlands in the study area.

Water storage in wetlands was estimated using the following method. Ground water wells in the study area were used to determine the depth to water table at the beginning of the summer vs. the end of summer. This difference in feet of thickness was multiplied by the area of wetland that represented that type of hydrologic regime to attain a total soil volume that would possess water storage. Soil samples were collected from most well sites and analyzed at the CSU soils laboratory to determine texture. Texture was then used following the diagrams on page 24 of Todd (1962) to determine specific yield (the volume of water that can potentially be removed from the soil). Specific yield (a percentage of the soil volume) was multiplied by the soil volume with that texture to determine water storage.

Wetland Functions

The following functions were evaluated for each wetland: ground water recharge, ground water discharge, flood storage, shoreline anchoring, sediment trapping, water quality improvement, food chain support, fish habitat, wildlife habitat, active recreation and passive recreation. Each of these functions was ranked on two different scales. The first scale ranks the intensity with which that function was or could be performed by that wetland in its current condition on a scale of 1-3. The different plant communities within each wetland were not separately evaluated, but the entire wetland was given a single rating. A rating of 1 indicates that that function was not being performed and could not be

Typical Wetlands of the Crested Butte Area

Extensive willow thickets

Ground water monitoring well number 7

performed by that particular wetland. For example, a *Juncus* (rush) dominated community that never has standing water would not and could not provide fish habitat. A ranking of 2 indicated that the function was performed to a low to moderate degree. A ranking of 3 indicated that the function was performed to a high degree. For example, a wetland that provides important wildlife habitat would be given a 3 for that function.

The second ranking system is used to indicate the confidence in the ranking given with the 1-3 scale. This ranking system is based on a three letter scale "a", "b", "c". A rank of "c" was given if there was great uncertainty of the degree to which the function was being performed. A rating of "b" was given if the rating was relatively certain, and "a" was given if the rating was certain. For example, in ranking the fish habitat function, if fish were observed then an "a" was given for this function. This rating does not indicate the quality of the fish habitat. The quality of the habitat for fish is ranked on the 1-3 scale. So if during this investigation a common species of minnow was found in an intermittent stream the rating for fish habitat function might be 2a. The 2 would denote a moderate functional value for fish habitat, and the "a" denotes certainty that the habitat does exist. If, however, the same intermittent stream did not have observable fish populations, the rank for the fish habitat function would be 2b or 2c.

Some functions are in conflict with each other. For example, trapping of fine sediment is often incompatible with ground water recharge and ground water discharge because the sediment makes the soil surface less permeable. Sediment trapping may also be incompatible with the flood storage and desynchronization function because sediment accumulation reduces the capacity of flood storage basins. Sediment trapping, however, is a virtual prerequisite for the water quality improvement function because nutrients and metals are often transported on sediments. Because a wetland can perform one function to a high degree, but not other functions, it is hard to compare wetlands. Thus, each function in each wetland is evaluated separately, and no single general rating for each wetland is attempted.

However, some wetlands clearly perform more functions than others, and some wetlands clearly perform certain functions to a higher degree than other wetlands. This will be obvious on the data sheets for each wetland provided in Appendix 3 and in the discussion presented later in this report. For a complete description of each wetland function evaluated in this study see Appendix 1. Wetlands that provide the most functions to a high degree have been suggested as priority wetlands for the study area.

RESULTS

HYDROLOGY

Precipitation

Snowfall for Gothic in the water years (a water year extends from November through October, but snowfall is reported from November to April) 1975-1976 to 1991-1992 is shown in Figure 4. This information was collected by Billy Barr, a resident of Gothic, Colorado. The information was compiled by the Colorado Avalanche Information Center. The 17 year snowfall average is 322 inches. Considerable year to year variability occurs in snowfall, ranging from approximately 140 inches in 1976-1977 to approximately 450 inches in 1979-1980. The summer of 1992, when the present study was performed followed a winter which received approximately 220 inches of snowfall at Gothic, approximately 70% of normal winter precipitation. Snowfall for the Town of Crested Butte is also available since the winter of 1962-1963. This data is shown in Figure 5.

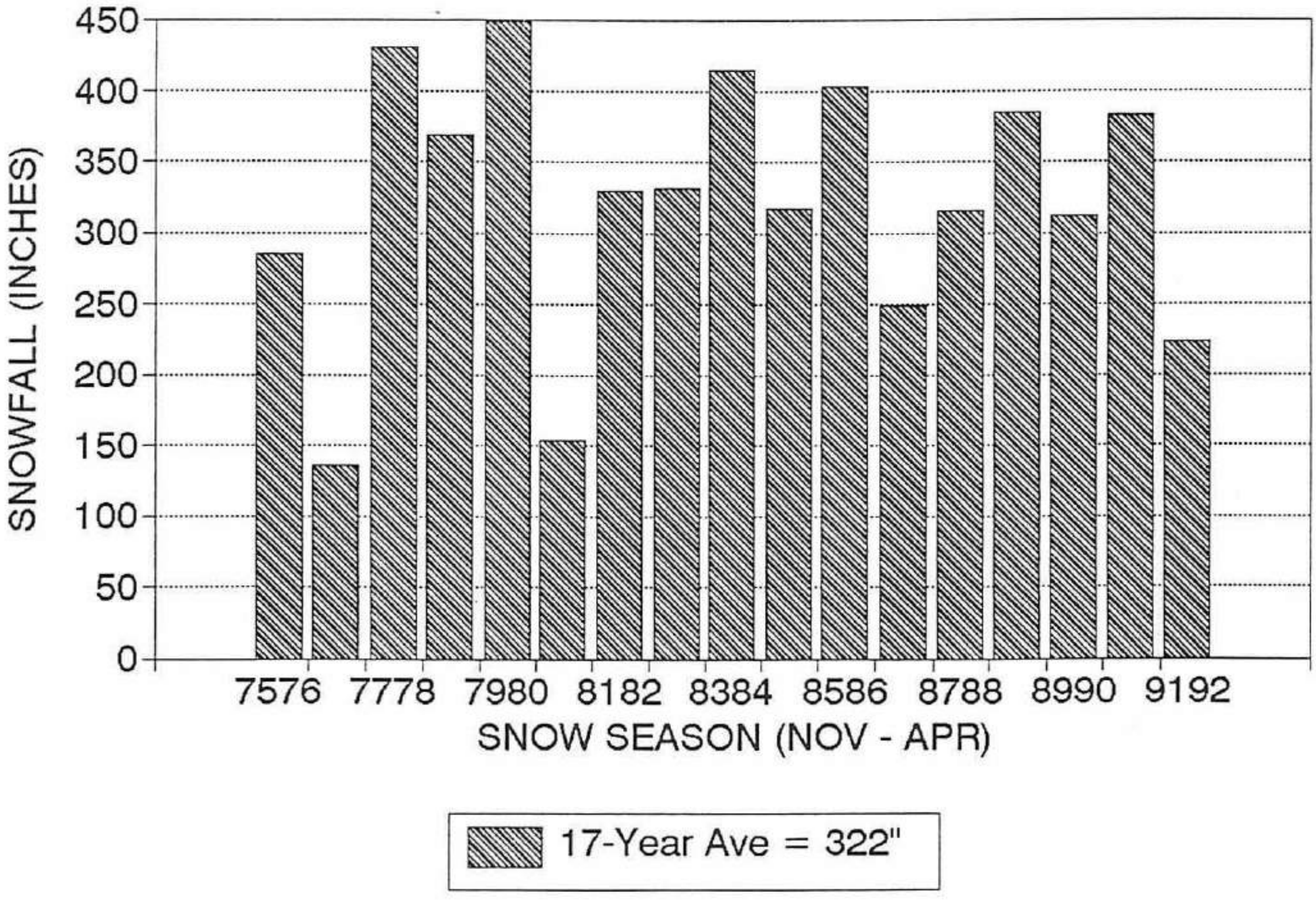


Figure 4. Snowfall for Gothic, Colorado 1975-1976 to 1991-1992.

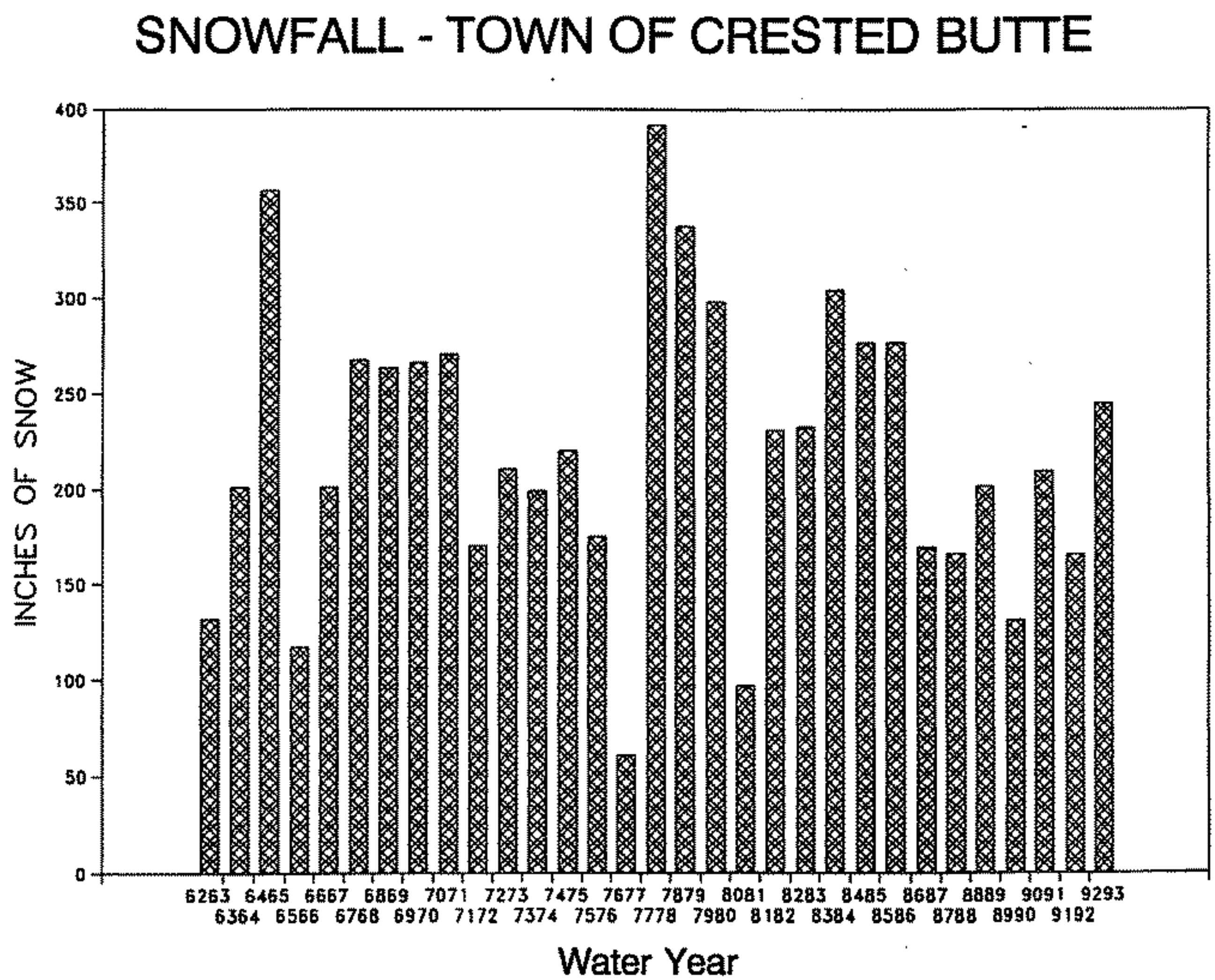


Figure 5. Snowfall for Crested Butte, water year 1962-1963 to present.

Since the Crested Butte area receives most of its precipitation as winter snowfall, the low snowpack indicates that the present study occurred during a moderately dry year and it was the driest winter since 1980-1981. The surface and ground water levels recorded during this study are probably low as compared to the same times on more typical water years.

Water equivalent in the Gothic snowpack is presented as Figure 6. The 17 year average for water in the snowpack is 22.47 inches. The winter of 1991-1992 received approximately 15 inches of water in snow, approximately 66% of normal. This also confirms that the study period occurred during a dry year.

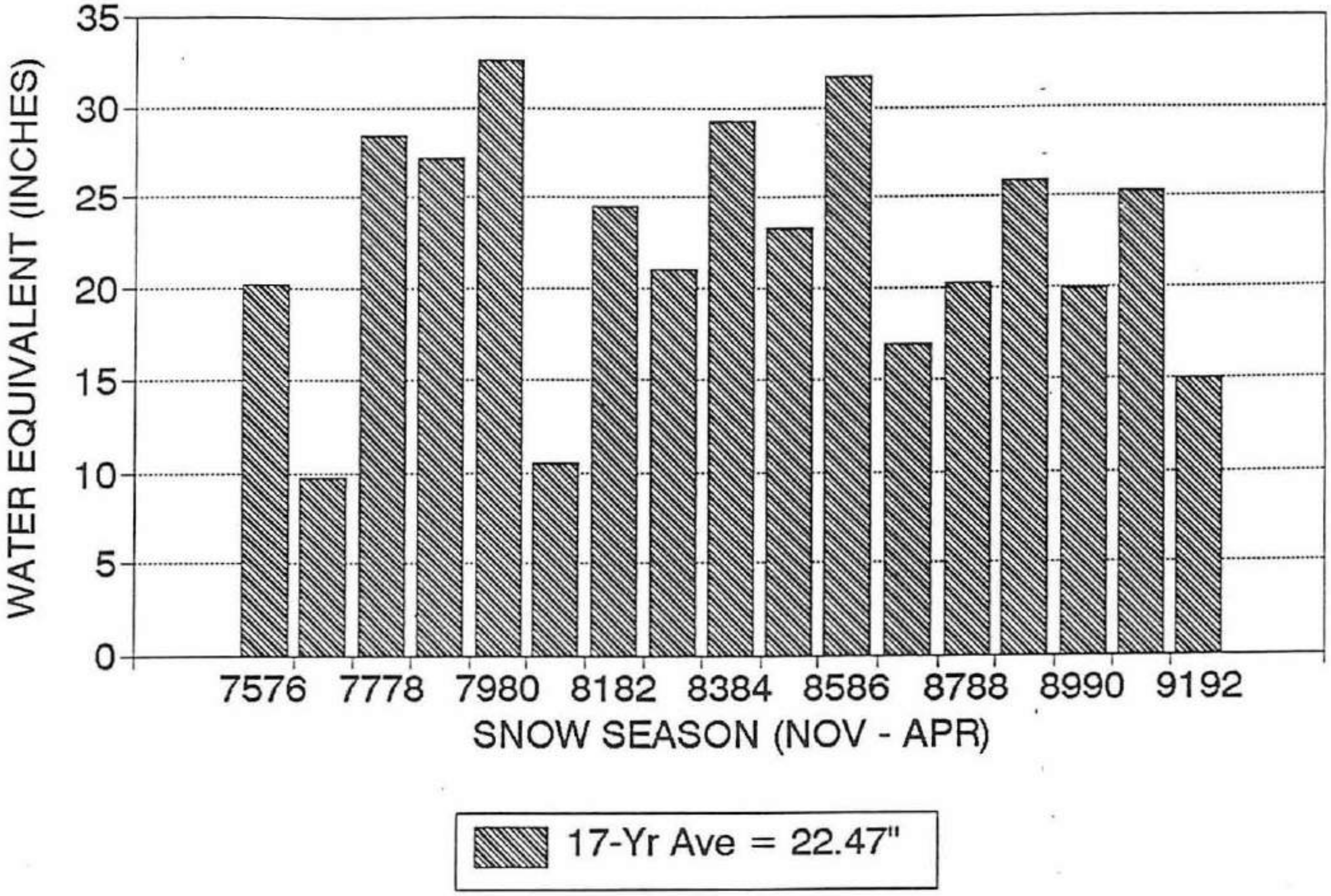


Figure 6. Water equivalent in the Gothic snowpack 1975-1976 through 1991-1992.

Surface and Ground Water

Surface water flows instream result largely from the snowpack discussed above. Winter precipitation accumulates for six or seven months, then melts in a few months creating surface flows. These flows can be large if a heavy snow year is followed by a spring period of warm or rainy weather. The flows that create bankfull, and overbank flows in streams, are responsible for driving channel forming processes. Flooding was not observed during the spring of 1992. Surface water flow records for the study area are sporadic and incomplete. No station is currently monitored by the U.S. Geological Survey or other public entity and no long-term streamflow records are available. There is an abundance of surface water in the study area, as one large (Slate River) and two smaller (Coal Creek and Washington Gulch) streams occur.

Groundwater in the Crested Butte area is derived from four principal sources:

(1) recharge from the principal streams and rivers in the region; (2) direct precipitation including snowmelt; (3) irrigation by man; and (4) recharge from off-site groundwater sources. In the study area, irrigation occurs primarily in the areas around Washington Gulch and in the Slate River valley downstream from Crested Butte.

The potential for a groundwater supply for the Town of Crested Butte, Gunnison County, Colorado was evaluated by Wright Water Engineers in 1980 (WWE 1981). They evaluated several sites in the Slate River valley between the Town of Crested Butte and Peanut Lake, but this water supply was not developed.

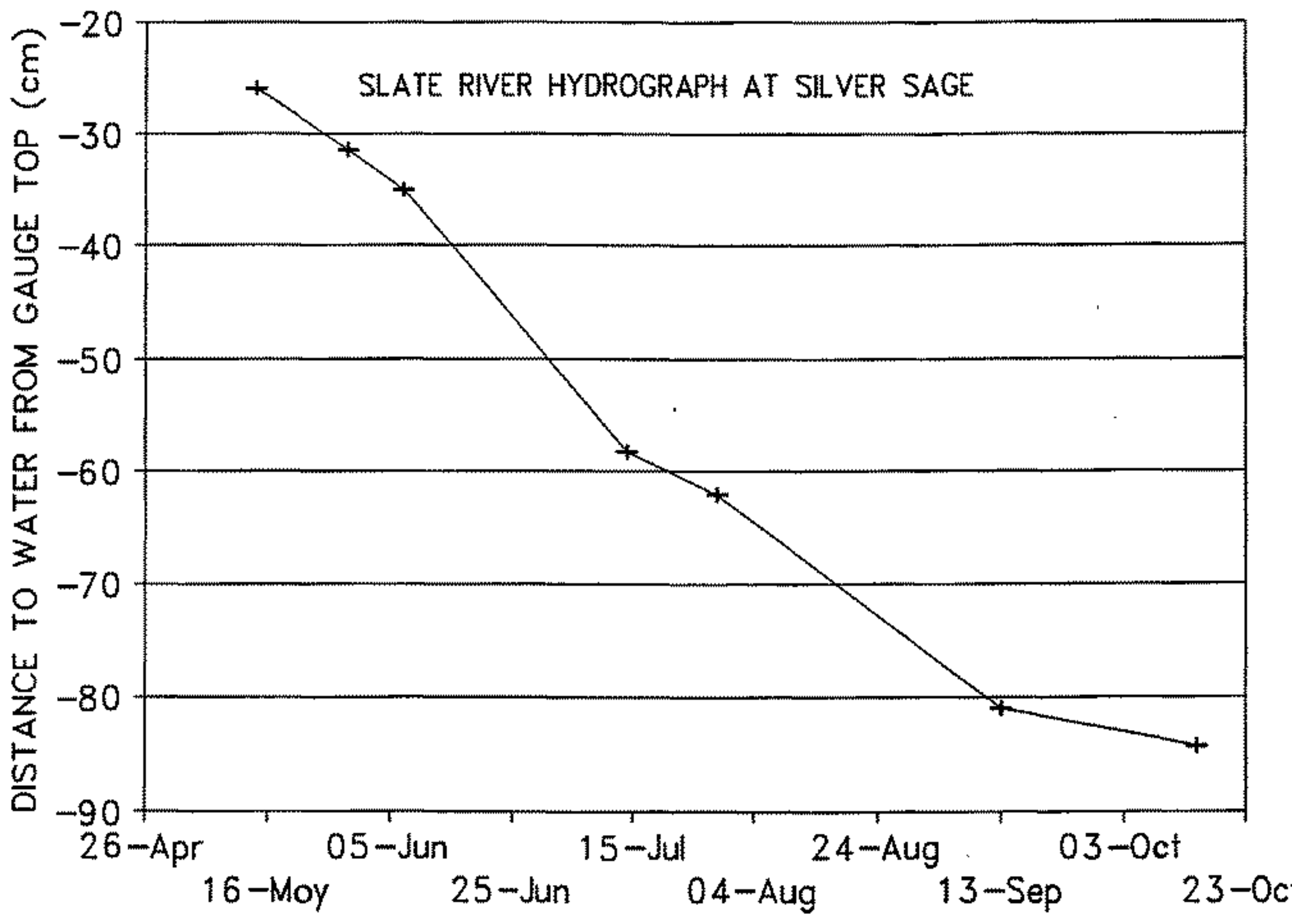


Figure 7. Hydrograph for the Slate River in the study area. The stream has a relatively steady drop in level through the summer, while the groundwater levels recorded in the study area are more responsive to weather phenomenon. This is most likely due to the fact that runoff events occur more quickly in streams, and a storm could be missed.

A stream hydrograph for the Slate River in the Crested Butte region is shown in Figure 7. This figure shows the information gathered at a staff gauge located the proposed Silver Sage Development at the downstream end of the study area.

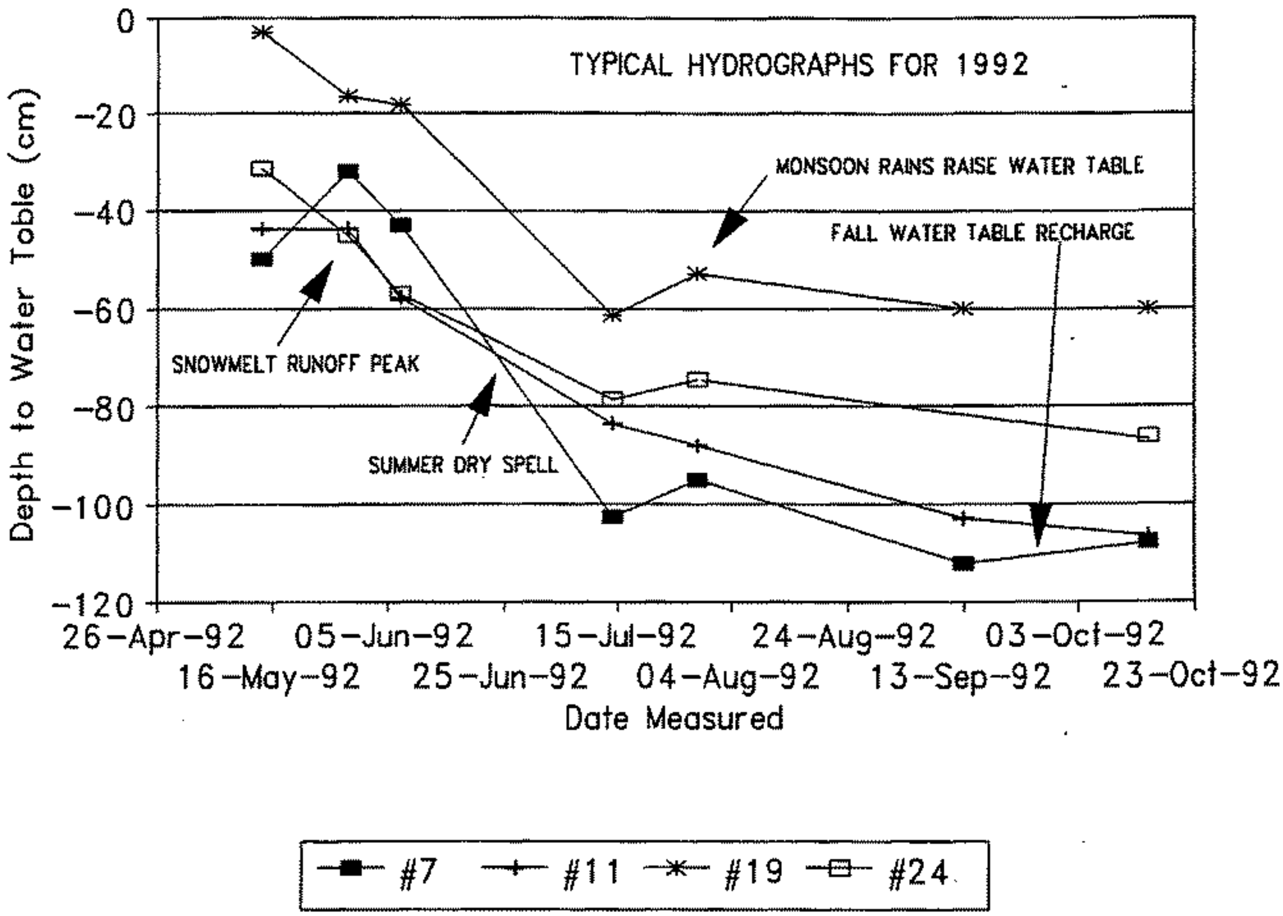


Figure 8. Typical groundwater hydrographs for Crested Butte wetlands during 1992

Figure 8 shows typical ground water hydrographs for the study area during 1992. Groundwater rises in some wells in late May coinciding with the peak stream discharges for the year. Water levels then declined in all wells during the early dry part of the summer. Monsoon rains began in late July and water levels rose. Water levels dropped again in late summer, leveling off, or even rising once plant evapotranspirator (ground water removal) ceased.

Water Storage in Wetlands

Fine-textured soils have higher porosity than more coarse-textured soils, but they also have higher specific retention (water held on the soil particles unavailable for extraction without pressure). Thus, fine-textured soils have relatively low specific yield. Yield ranges from approximately 10% for sandy clay soils to nearly 30% for coarse sands. Most wetland soils in the study area occur on valley bottoms and have relatively fine-textured soils due to overbank flooding and beaver dams collecting fines. Soil textures ranged from clayey to silty in most areas, although soils are more coarsely textured lower in the profile.

The wetlands in the Crested Butte area contain approximately 840 acre feet of water in the early summer (May) and this water is discharged to streams during the summer. It should be understood that this estimate is made based on water volume stored in soils during a dry year and I estimate that during a wet year soils may contain up to 50% more water due to the higher water tables. Much of this water is discharged to streams in the middle of summer, particularly in July when groundwater wells recorded their greatest drop. Water was then stored again during rain events and the remaining water was discharged in late summer and fall.

Soils

Soils in the Crested Butte area are described in two Soil Conservation Service Soil Surveys: Gunnison Area (Hunter and Spears 1975) which covers the Slate River region; and Taylor River area (Fox 1977) which covers the Washington Gulch area. In general, the Washington Gulch area is dominated by the Bassel-Bucklon association and consists of well-drained, deep and shallow soils that formed in glacial deposits, shale residuum and colluvium. The upper Slate River valley bottom contains Irim loam soils. This soil occurs on floodplains with a fluctuating water table which may be near the soil surface in spring. They are classified as Typic Haplaquolls. They have an aquic moisture regime (anaerobic conditions occur during a portion of the growing season), are in the soil order Mollisols (organic and base rich soils), and are hydric (wetland) soils.

The Slate River valley below Crested Butte supports Gas Creek sandy loam soils which are classified as Typic Haplaquolls and are hydric soils. The soils mapping provided by the SCS indicates that very broad expanses of hydric soils occur in the Crested Butte Region. The scale of mapping is 1:31,680 and does not indicate that peat soils (Histosols) occur. However, my investigation indicates that peat soils are common in the Crested Butte region where groundwater is discharged to the surface and soils stay wet through the summer.

Water Chemistry and Water Quality

Water chemistry of the Slate River and its tributaries has been studied by a number of different parties, and for a number of different reasons. Water quality baseline studies in relation to the proposed Mount Emmons Mine were prepared for AMAX, Inc. by Camp Dresser & McKee Inc. in 1980 (CDM 1980). This report presents data collected for the study period April 1978 through March 1979. At the time of this study, mine drainage from the Keystone Mine had nearly eliminated aquatic life, clouded the waters, and stained the substrate of Coal Creek. These conditions occurred on Coal Creek downstream as far as its confluence with the Slate River. Natural "iron bogs" also occur in the Coal Creek drainage which also elevate metal concentrations and acidity of these waters. The AMAX study collected water samples monthly at 17 stations, in Washington Gulch, Slate River, Coal Creek, and Alkali Creek, Ohio Creek and East River downstream from Crested Butte.

Water samples were analyzed for nutrients, metals, inorganic chemicals, organic constituents, and physical properties. During periods of high stream flow (spring and early summer) most stations had their lowest concentrations of total dissolved solids, hardness and alkalinity but had high concentrations of Al (aluminum), Fe (iron), turbidity, and suspended solids. The low readings are due, most likely, to dilution with snowmelt water, while the high readings may have resulted from the material in suspension during high stream flows. The concentrations of most metals were highest in late summer. Downstream stations generally had poorer water quality than upstream stations in each tributary.

The most dramatic change in water quality occurred on Coal Creek below the Keystone Mine, where increases in the concentrations of zinc, lead, copper, cadmium, iron, aluminum and manganese occurred due to Keystone Mine drainage entering the Creek. Mine drainages in other parts of the study area mostly resulted in elevated zinc concentrations. Zinc is relatively mobile in natural waters and can be toxic to trout species, as it was in Coal Creek. Their station SR1 (Slate River 1), which occurs just upstream from the confluence of the Slate River with Coal Creek, indicated that the Slate exceeded Colorado Department of Health (1979) guidelines for zinc. In addition, their station SR2 (Slate River 2), located just downstream from the confluence of the Slate River with Coal Creek, exceeded standards for cadmium, copper, iron, manganese, lead, and zinc. This report also indicated that elevated concentrations of nutrients were also found at SR2 due to domestic waste waters from Crested Butte. Zinc concentrations were in excess of state guidelines at 14 of the 17 stations that they sampled in the Gunnison Basin, and zinc exceeded the maximum allowable toxicant concentration for rainbow trout at 8 stations. Table 1 provides CDM's data for station Coal Creek 2a (located approximately 100 yards above the Keystone Mine discharge into Coal Creek) and station Coal Creek 3 (located approximately 100 yards downstream from the discharge).

Table 1. Water quality characteristics of Coal Creek above and below the Keystone Mine discharge, data from CDM (1980). Affects of pH are unknown.

PARAMETER	ABOVE		BELOW
	AVE	MAX	AVE
pH	6.7		4.1
Arsenic	0.01	0.01	0.25
Cadmium	0.011	0.02	0.23
Copper	0.05	0.10	0.58
Iron	0.317	1.55	25.90
Lead	0.013	0.05	0.20
Manganese	0.59	2.3	22.00
Zinc	0.97	3.1	15.10

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Water quality data for the Slate River stations sampled during the AMAX study are presented in Table 2. Station SR1 is located above the confluence with Coal Creek, and SR2 is located below the confluence with Coal Creek. Since this data was collected, AMAX has constructed and operates a water treatment plant to remove heavy metals from mine discharge. The cleanup of this water is discussed by Todd et al. (1982). Two months following start-up of the plant, brook and brown trout were found in the previously affected segment of Coal Creek. Four months later, the aquatic macroinvertebrates had recolonized the previously impacted creek. Sixteen months after plant start-up, macroinvertebrate taxa were typical of clean high mountain streams, and several age classes of brook and brown trout were distributed throughout the formerly dead stream segment. Thus, the most concentrated source of heavy metals in the study area

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Table 2. Water quality characteristics of Slate River above and below confluence with Coal Creek during 1979. Data are mean values for all samples collected from April 1978 through March 1979, all data in mg/l (parts per million) (CDM 1980).

PARAMETER	ABOVE	BELOW
	AVE	AVE
pH	7.2	7.0
Arsenic	<0.01	<0.01
Cadmium	<0.01	0.012
Copper	<0.05	0.067
Iron	0.35	2.1
Lead	<0.01	0.013
Manganese	0.06	2.2
Zinc	0.067	1.99

A letter dated 27 September 1972 from Alan E. Czenkusch, Gunnison County Sanitarian, to Central Mining Corporation, dba Peanut Mine in Crested Butte, conveyed the results of tests run by the State of Colorado Health Department . The samples were collected by Mr. Tom Sherrill and Mr. Czenkusch at the mine operation on 13 September 1972. The acceptable levels of cyanide concentration permitted to be discharged into waters of the State of Colorado is 0.20 ppm, and the effluent tested contained 18.0 ppm cyanide. The letter also suggested that the mine company develop a detailed plan for avoiding pollution of a marsh located below the mine. The mine responded by creating a small dike to separate the mine effluent from the marsh. However, to this day, mine drainage water and eroded mine tailings flow into Peanut Lake in the spring and early summer. These metals could be stored in the sediment. The effects of this pollution are not known.

In 1980, Wright Water Engineers was hired by the Town of Crested Butte to evaluate the potential for a groundwater supply (WWE 1981). During this study they collected and analyzed the chemical content of water from five sites, two on the Slate River, one from a gravel pit, one from the James Dolan well and one from the Larry Tanning well. The two Slate River sample sites, one gravel pit, and Larry Tanning well all had a calcium bicarbonate type water that was relatively soft. The Tanning well contained moderate concentrations of manganese and zinc. The Dolan well is not in Slate River alluvium, but is in Mancos Shale, and contained a sodium bicarbonate type water that was 7 times as alkaline as the Slate River water. No other heavy metals occurred in high concentrations.

Recently the High Country Citizens Alliance (HCCA) has been conducting a water quality sampling program in the Gunnison Valley (HCCA 1991). A series of letter reports dated 4 May 1991, 26 August 1991, 9 December 1991 and 27 March 1992, authored by Lynn Cudlip, were reviewed. Water samples were analyzed for temperature, pH, conductivity, ortho-phosphate, total phosphorus, nitrate, unionized ammonia, total nitrogen and dissolved oxygen. The data for the Slate River station (below Coal Creek) for the parameters listed were all within acceptable ranges. This Slate River station had the lowest values for several parameters of the stations sampled. However, Ms. Cudlip identified the possibility of acidic waters near Peanut Lake which would be looked at later in 1992.

Mr. Bill McKee of the Colorado Department of Health performed a search of the Environmental Protection Agency's STORET system, a data base of sampling sites and their associated water quality data, on 4 August 1992 to provide me with a print out of water quality data in the data base. Water samples bave been collected and analyzed for chemical content from the Slate River at the Gothic Road bridge many times. Table 3 summarizes much of the STORET data available for several sample stations in the study area.

Table 3. Concentrations of selected elements in the Slate River near the Gothic Road bridge. Site 1 is below the confluence with Coal Creek, site 2 is Slate River above the confluence with Coal Creek, Site 3 is Coal Creek. All data are: means of the # of samples taken, are total metals and reported in ug/l, and rounded to the nearest whole ug.

SITE	DATE	#	Zn	Cu	Pb	Cd	Cr	Al
2	16 May 79	1-5	82	5	141	1	5	1100
2	20 Aug 80		56	11	88	7	9	519
1	22 Aug 80	20-28	744	17	43	4	8	660
1	28 Aug 80	20-28	831	24	61	10	8	882
1	1 Apr 81	1	1231	20	30	5	5	-
3	11 Jun 81	1	.2	.006	.005			
3	30 Sep 81	1	.5		.005	.002		

*See standards for these metals on table 4.

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The Peanut Lake area in the Slate River valley is an area with great potential wildlife habitat value. It is also an area where mining has occurred, and the quality of water in this area has not been previously analyzed. During July of 1992, I identified three potential sources of pollution and collected samples from these sites plus water from Peanut Lake itself. I determined the water's pH in the field using an Orion model 250a pH meter. The samples were filtered and acidified at the Mountain Meadows Research Laboratory in Gunnison and kept cold until delivered to the CSU soils testing laboratory in Fort Collins where ICP was used to analyze the water to determine concentrations of the major metals. The three potential pollution sources are described below and shown on Figure 9.
These sources are:

1. The point where Peanut Mine drainage crosses the county road near the western side of the Wild Bird Estates. This is the same water source described in the letter from Alan Czenkusch to the Peanut Mine Company.

2. A mine adit occurs below the road, just above Peanut Lake and contributes 1-2 cubic feet of water per second. This is a mine drainage tunnel, and its origin is unknown.

3. A coal mine portal on the hill west of Peanut Lake.

The chemistry of waters from each of these stations, and that collected on the west shore of Peanut Lake, are listed below.

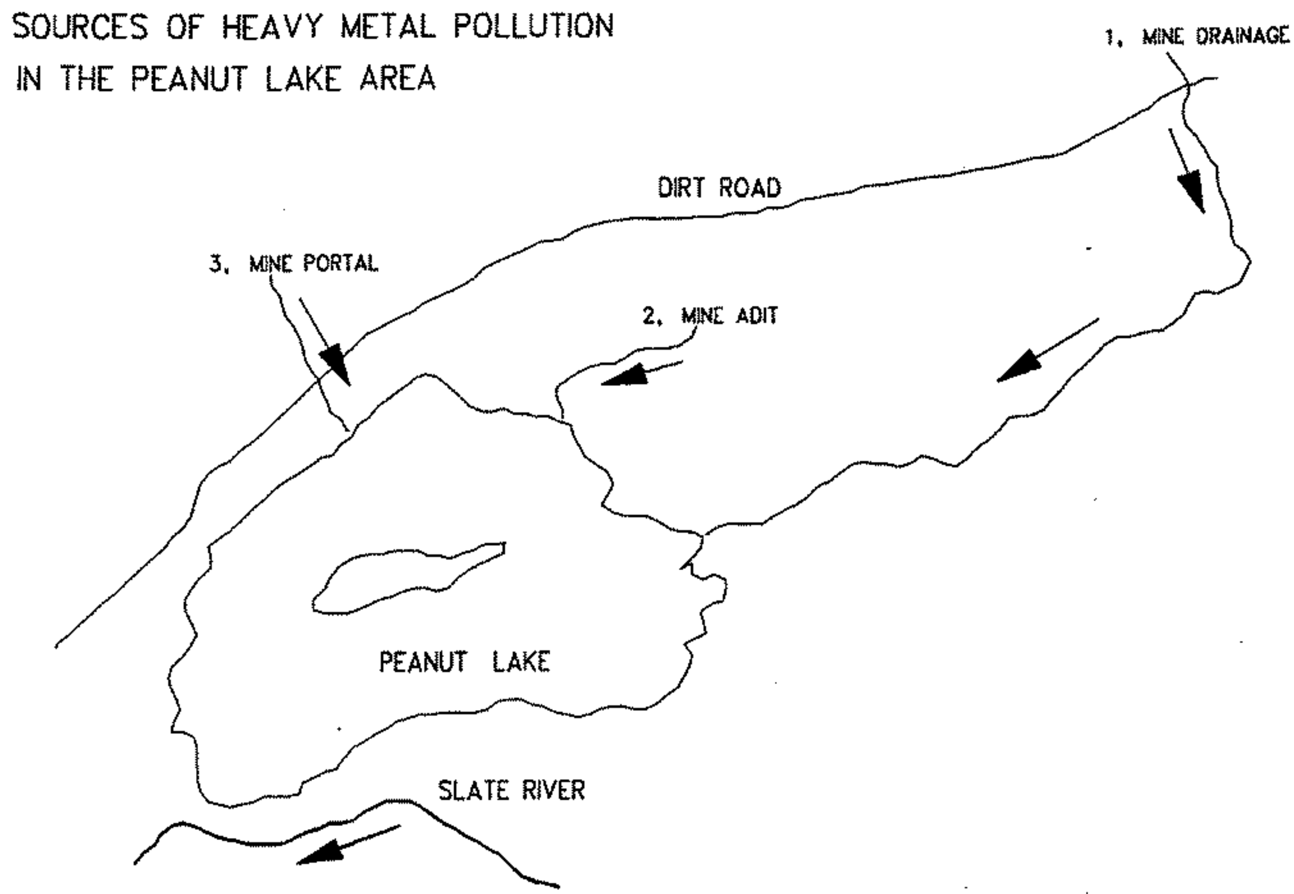


Figure 9. Sketch map showing locations of heavy metals pollution sources in the Peanut Lake area. See text for details and descriptions.

Table 4. Concentrations of selected metals in water samples collected in the Peanut Lake area, in July 1992. All values are in micrograms/liter (ug/l or parts per billion). Standards are based on total alkalinity determined in July 1992 which was 44 mg/l. The data presented below are one sample collected at each site. Number's are location on attached Figure.

SAMPLES	Cd	Pb	Mn	Cu	Zn	Ni	Al	Cr	Fe	Ph
Peanut Lake	<10	<50	40	<10	20	<10	<100	<10	16	7.00
Peanut Mine drainage (1)	180	<50	1520	90	2456	10	<100	<10	20	6.48
Mine portal (3)	<10	<50	20	20	20	<10	<100	<10	8	7.01
Mine adit (2)	<10	<50	1300	20	860	20	300	40	58	6.78
STANDARDS										
Aquatic										
acute (one day)	3.91	25.45	-	8.18	112	494	950	50		
chronic	.59	1.2	1000	5.86	45	51	150		300	
Agriculture (30 day)	10	100.	200	200	2000	200	-	100		
Drinking water	10	50.	50	1000	5000	-	-	50	300	
Fish	1.55*				56**					

* (1 day) ** (30 days)

The data in Table 4 indicate that water running from the Peanut Mine, mine portal, and mine adit all contain significant concentrations of heavy metals. The mine drainage contains high concentrations of Mn, Cu, Cd and Zn. The mine portal contains high concentrations of Cu and the mine adit contains high concentrations of Mn, Zn and Cu. The Peanut Lake sample did not contain any heavy metal in concentrations exceeding aquatic life standards. However, this sample was collected during mid-July, long after snowmelt runoff and before the monsoon rains began, and most likely represents a best case situation. Also, it is possible that heavy metals have accumulated in Peanut Lake sediments.

Peanut Mine drainage runs down through a series of tailings ponds and then enters a small wetland just west of Wild Bird Estates. Natural wetlands should not be used for mine drainage treatment because all wetland organisms will be affected, however wetlands could be built to treat mine drainage.

Other recent water quality data for the Crested Butte regions has been collected by Susan Brown and students from the Crested Butte public schools. These samples are being analyzed as part of the "Rivers of Colorado Water Watch Network", sponsored by the Colorado Division of Wildlife. I examined field and laboratory data for alkalinity, hardness, temperature, pH, and dissolved oxygen for monthly samples collected between February and December 1992. All samples had alkaline water with pH ranging from 7.06 to 8.91, although most ranged from 7.5 to 8.2. Dissolved oxygen was high on all dates, and alkalinity ranged from 10 to 72, being highest in winter and lowest during spring runoff. These samples have been sent to CSU for metals analysis, but results have not yet been reported.

Wetland Vegetation Types

The Crested Butte region has a surprisingly great diversity of wetland vegetation types, considering the small study area and the relatively small difference in elevation across the area. The major wetland vegetation types are: (1) willow thickets on the floodplains of which several different community types occur, (2) submerged aquatic vegetation in beaver ponds, lakes and slow moving streams, (3) grass, sedge and herb dominated wet meadows, and (4) peatland (fen) communities at seeps and springs, and on lake and pond edges. Typically irrigated agriculture grows wet meadow vegetation.

The plant species and community types of the region occur along a gradient from permanent standing water to seasonally high water table. Each species occupies a limited portion of this gradient due to its ability to survive in that environment and competition with other plants.

Aquatic Communities

Aquatic communities are dominated by submerged plants. The sites may have permanent or seasonal standing water. These sites occur at the large permanent lakes in the study area (Peanut, Meridian and Nicholson Lakes), and in small beaver ponds and slow moving stream sections throughout the area.

1. *Elodea sp.* dominates aquatic communities in water bodies on the Skyland Golf Course. This species is indicative of eutrophic (nutrient enriched) water bodies.

2. *Myriophyllum spicatum* dominates the aquatic community at Peanut Lake. This lake has fairly clear water with some heavy metal loading from the Peanut Mine, mine tailings surrounding the lake and coal mine adits. This community provides most of the waterfowl habitat at Peanut Lake.

3. *Potamogeton praegracilis* dominates aquatic communities at Meridian Lake. This large aquatic plant occurs in what appears to be a freshwater mountain lake with relatively pure water and no obvious pollution sources. It probably represents the pristine condition for aquatic communities in the study area.

4. *Potamogeton pectinatus - Potamogeton pusillus.* These small leafed pondweeds occur in small beaver ponds throughout the study area. They represent a very common wetland marsh type that is very valuable to waterfowl.

5. *Potamogeton richardsonis* dominates aquatic communities in a few beaver ponds at the western edge of the study area on the Slate River floodplain. The water is up to 3 feet deep and is clear but subject to erosive forces in spring flooding.

Marsh Communities

Marshes occur in seasonal or permanently shallow water. Most plants emerge above the water level and are tall and robust. In general these sites are seasonally dry and soils are of mineral sediments, rarely peat (organic).

6. *Persicaria amphibia* dominates aquatic communities on the edge of Lake Grant. It usually is semi-aquatic as some leaves and whole plants are completely submerged, but usually the plants are taller, than the water is deep.

7. *Eleocharis palustris.* Spike rush dominates shallow standing water on the edge of beaver ponds and reservoirs. It does not occur on the edge of permanent natural lakes where Carex utriculata occurs.

8. *Hippuris vulgaris* was found dominating one pond on the Smith Ranch. It, like Persicaria amphibia is a semi-aquatic plant that can dominate marshes.

9. *Typha lotifolia* (broad leaf cattail) dominates a few small stands in the study area, notably marshes on the Skyland Golf Course, and one small pond near Wild

Bird Estates. In general cattails are indicators of eutrophication (nutrient enrichment or pollution) from human sources, particularly fertilizers and sewage. Cattails are tall plants that can shade out short plants, and cattail invasion into a native plant community usually spells doom for the existing plants. The problem lies in the development of simple cattail monocultures and the loss of natural diversity. To protect the existing diversity of Crested Butte point and non-point nutrient pollution sources must be identified and further pollution prevented. In my experience, once cattail invasion starts it is hard to stop.

10. *Alopecurus aequalis* (foxtail) dominates mud banks in beaver ponds that dry up seasonally and are highly disturbed by changing water levels.

11. *Eleocharis parvula* (spikerush) - *Limosella aquatica* (mudwort). This minor community of diminutive herbaceous plants occurs on the margins of beaver ponds and is indicative of fluctuating water levels.

12. *Phalaris arundinacea* (reed canary grass) dominates similar sites as cattail, but in slightly drier sites. It too is a weedy species indicative of eutrophication.

Shrublands on floodplains

13. *Salix geyeriana* (geyer willow) - *Calamagrostis canadensis* (canada reed grass). This is the most common willow community on the floodplain of the Slate River. It is easily recognized as geyer willow by its blue stems. This community is critical habitat for birds such as warblers. The woody plant roots of willows also provide important streambank stability and the leaves that blow into the Slate River most likely provide important food for the aquatic food chain including aquatic insects. Water table characteristics of these stands are shown in Figure 10.

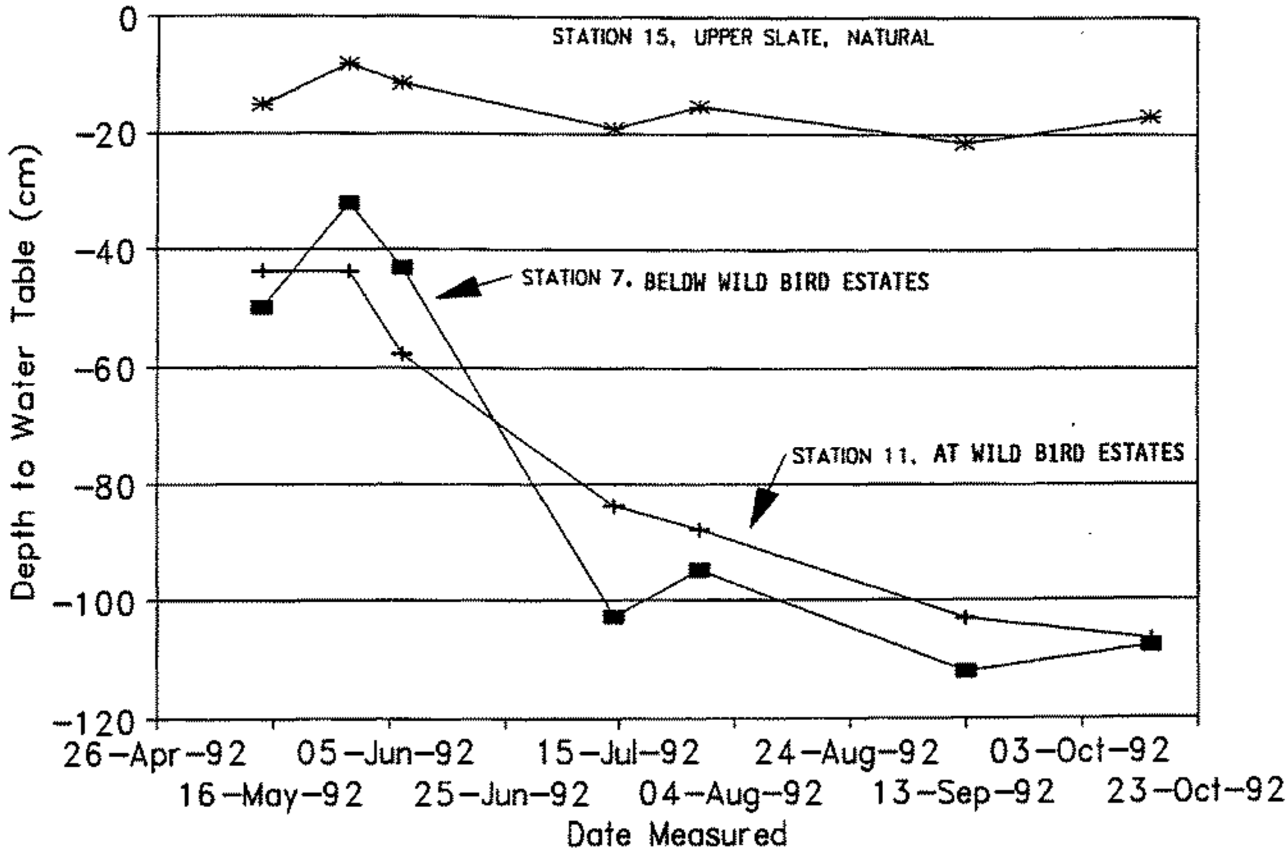


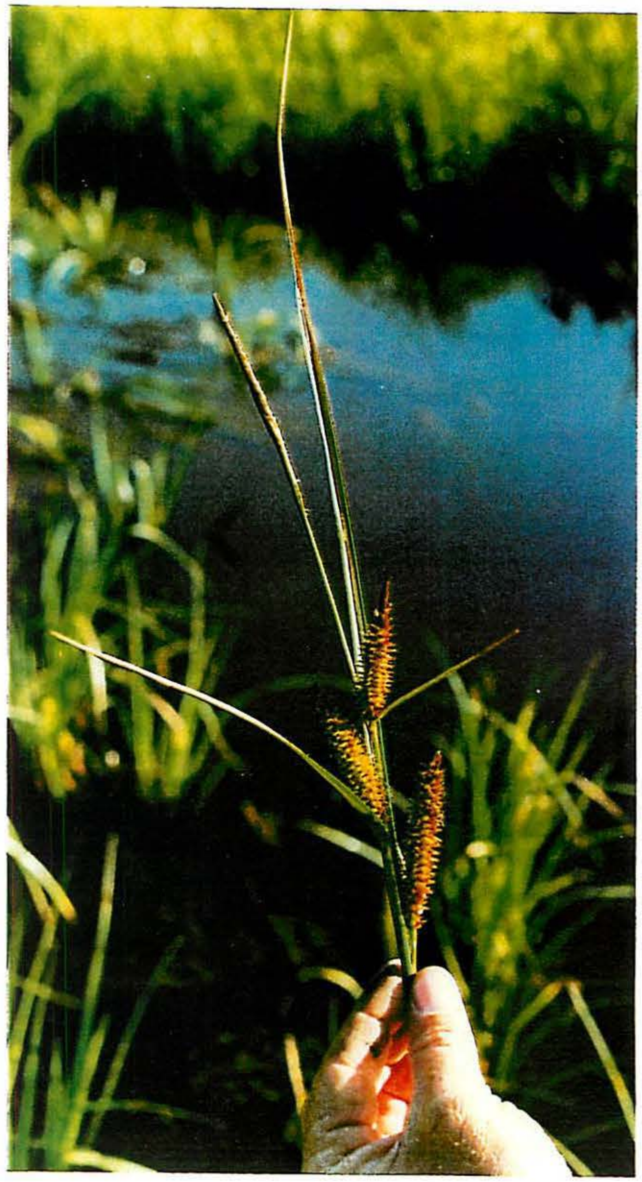
Figure 10. Ground water levels in three geyer willow stands. Note that the water levels in the area above Wild Bird are much higher than in areas below. This appears to be the difference between healthy wetlands in the upper valley, vs. impacted and partially drained wetlands in the lower valley.

14. *Salix monticola* (mountain willow) - *Calamagrostis canadensis* (canada reed grass). This is a common willow community occurring on the floodplain of the Snake River and it provides similar functions.

15. *Salix drummondiana* (drummond willow) - *Calamagrostis canadensis* (canada reed grass). This is a minor willow community type occurring along the Snake

Typical Wetlands Plants of the Crested Butte Area

Salix monticola, willow



Carex utriculata, beaked sedge

River.

16. *Alnus incana* (alder) - Calamagrostis canadensis (canada reed grass). Alder dominated communities occur only along the fast moving water portions of Coal Creek above Crested Butte in the study area. Elsewhere in Colorado it is a very common community type. It provides important songbird habitat and food chain support for aquatic ecosystems.

17. Picea engelmannii (engelman spruce) - Calamagrostis canadensis (canada reed grass). Evergreen forests are uncommon along the floodplain of Coal Creek above Crested Butte and only a few stands were seen.

26. Seriphidium cana (silver sage) dominates a number of different stands and forms distinctive plant communities along the Slate River in the region of Skyland Golf Course. Stands dominated by this plant species are considered to be wetlands

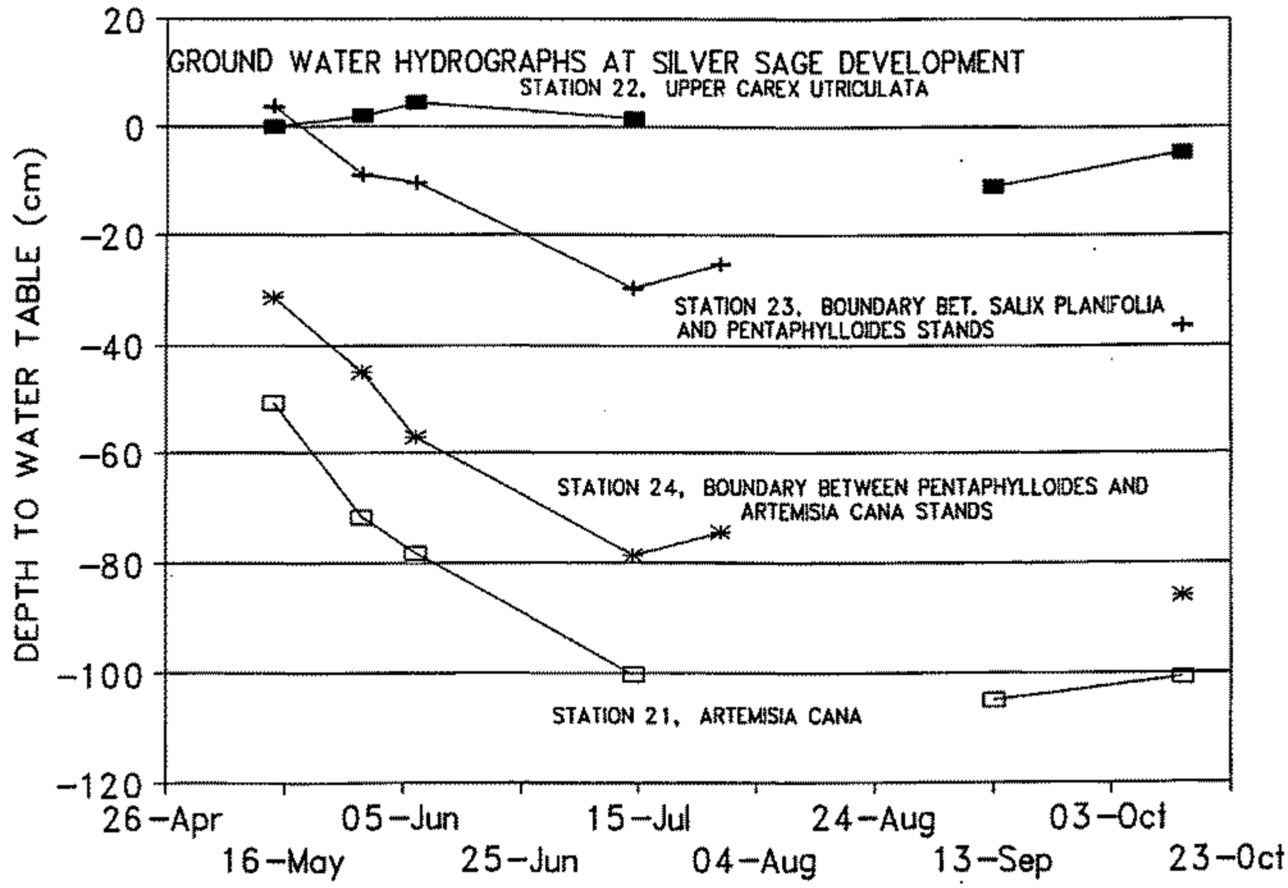


Figure 11. Four groundwater well hydrographs for a transect on the proposed "Silver Sage" development. Station 22 is adjacent to a small surface water body. See text, above, for discussion of this data.

in certain portions of the West. Figure 11 presents four hydrographs for wells I installed along a transect in the proposed Silver Sage development near the

Skyland Golf Course. Three wells, 22, 23 and 24 are located on the boundaries between two different communities and provide data for the dry end of that community. Well 21 is located in the highest part of the Seriphidium cana community, as it occurs on a hilltop. Wells 24 and 21 indicate that the Seriphidium cana community has a water table between 30 and 50 cm at the beginning of the growing season. This lowers to 1 meter in parts of the stand in the dry part of mid summer. Considering the low snow year, these water tables are probably low for an average year. These data indicate that the Seriphidium cana community studied is a wetland, having saturated soils in the root zone during many if not most growing seasons.

Wet Meadow Communities

Wet meadows occur in areas with high water tables but rarely in standing water more than a few inches in depth. They do not have peat soils, and many times soils are dry by mid-summer.

18. *Corydalis caseana* (giant corydalis) - *Mertensia ciliata* (chiming bells). This community is composed of giant herbaceous plants and occurs along spring-fed slopes in the area of Irwin. It occurs on mineral soils in sites that are wet only in the early summer.

19. *Deschampsia cespitosa* (tufted hairgrass) dominated communities are uncommon in the study area, occupying wet meadows and filled beaver ponds.

20. *Oxypolis fendleri* (cowbane) - *Senecio triangularis* (triangle butterwort). This community occupies the margins of small flowing springs and streams. It occurs along the numerous springs which are tributary to Coal Creek and other sites in the area.

Peatland Communities

Peatlands develop where the soils are saturated for nearly the entire summer, and plant roots and leaves do not completely decompose. This organic matter accumulates and becomes the soil. Peat ecosystems are different than the other wetland types because of their hydrologic regime.

21. *Carex utriculata* (beaked sedge) forms near monocultures in sites with seasonal standing water up to 40 cm deep. These sites can be permanent lake margins (such as around Peanut Lake) and also at large spring systems. It is a very common and important community type in the study area providing important nesting and feeding habitat for snipe and wilson's phalarope as well as many species of ducks and teal. This species can form deep peat soil.

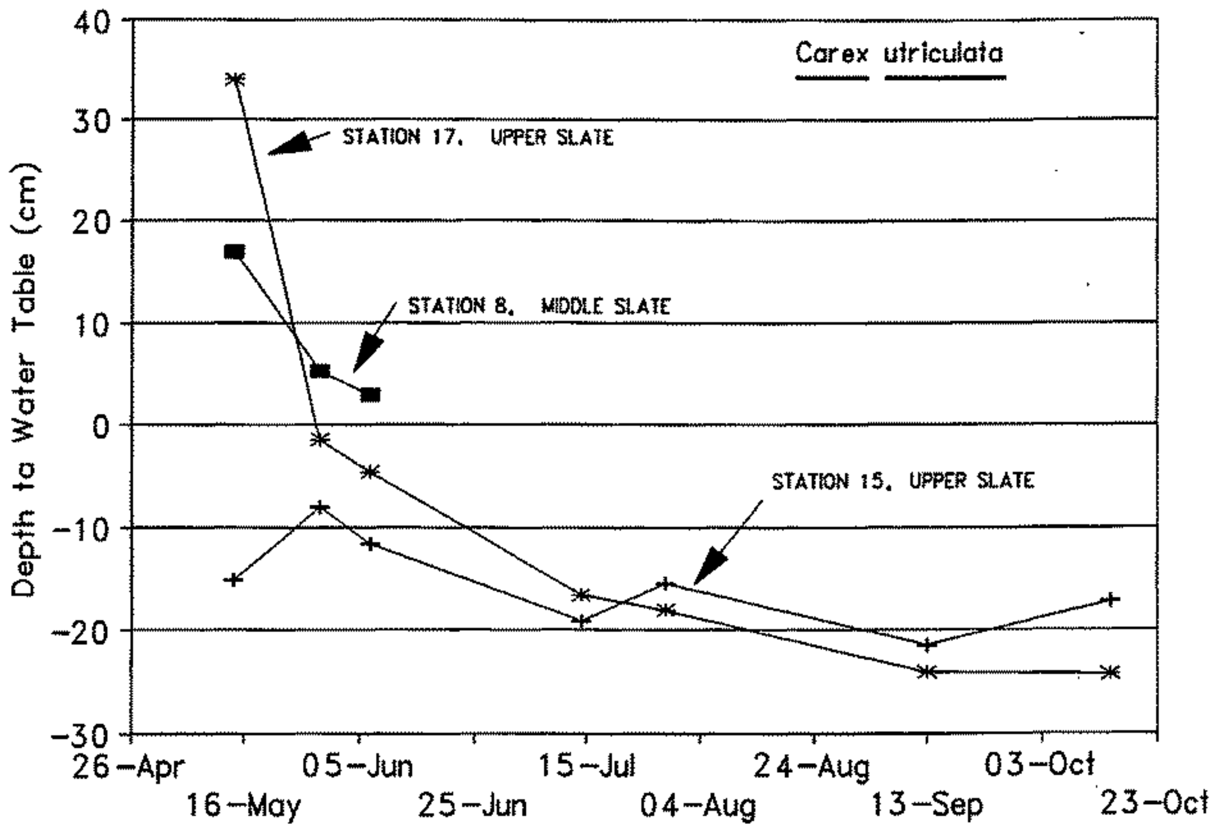


Figure 12. Hydrographs for *Carex utriculata* stands in the study area.

22. *Carex aquatilis* (water sedge) is the dominant plant species in groundwater discharge systems (springs) and forms deep peat soils. It is very common in the study area, particularly in the Slate River valley. The soils provide water filtration functions and can remove and retain heavy metals.

23. *Carex simulata* (sedge) is common in certain parts of Colorado, such as South Park, but was only found to dominate one stand in the Crested Butte area.

24. *Salix planifolia* (planeleaf willow) - *Carex aquatilis* (water sedge). This peat-forming community occurs in the wettest sites that support willows in the study area. These sites are groundwater discharge locations and the soils provide water quality functions.

25. *Salix wolfii* (wolf willow) - *Carex aquatilis* (water sedge). This community occurs at similar sites to the last community, but the sites are less wet.

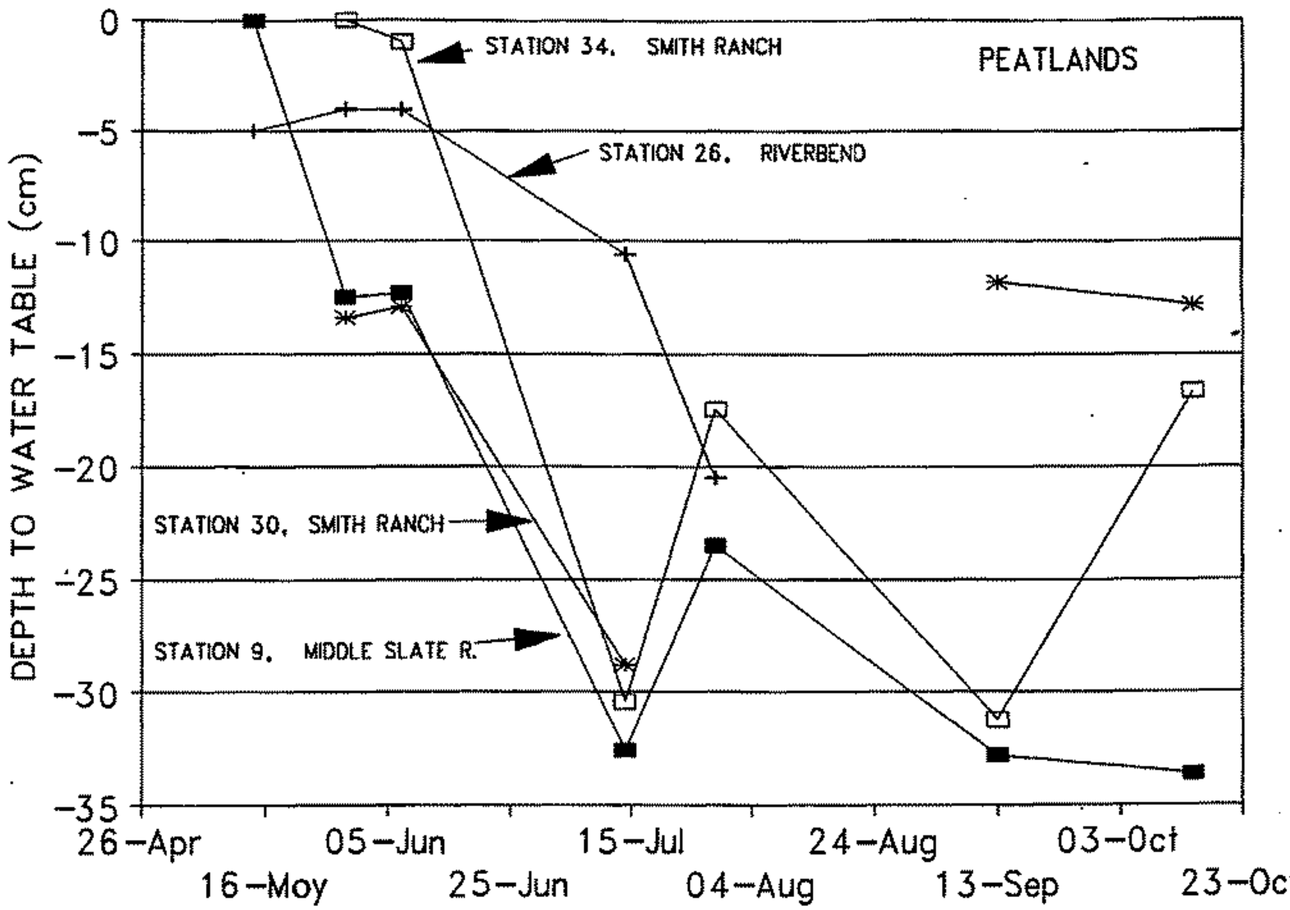


Figure 13. Ground water hydrographs for three shrub and one herb dominated peatlands in the study area. Station 20 is located in the groundwater discharge portion of the alluvial fan at Riverbend. This station is in a water sedge dominated fen. The other three stations are in sites dominated by planeleaf willow and wolf willow, and have remarkably similar hydrographs. All stations have very high water tables in the early summer and even though 1992 was a low snow year, all stations maintained water tables within 35 cm for the entire summer.

These very different wetland plant community types reflect on the great hydrologic diversity in the study area. It contains a diversity of habitats that support numerous plant and animal species and soil forming and geochemical processes important to maintaining regional water quality.

WETLAND ACREAGE CALCUATIONS

Wetlands in the Crested Butte study area were mapped onto 1988 U.S. Department of Agriculture natural color aerial photographs which had been printed at a scale of 1"=586'. The photographs were taken on 8/14/88 and are printed on 38" x 38" sheets of paper. Six photographs cover the study area. Each is listed in Table 5, and the area of coverage is described.

Table 5. Aerial photographs used in this study were purchased from the U.S. Department of Agriculture. Photograph date is 14 August 1988.

Photo #	AREA OF COVERAGE
288-93	Washington Gulch from Meridian Res. to confluence with Slate River.
288-91	Slate River valley from Crested Butte south to study boundary.
388-67	Upper Slate River from Gothic Road to Nicholson Lake
388-66	Coal Creek, lower section, from Crested Butte.
388-143	Coal Creek, middle section.
288-16	Coal Creek, upper section to Irwin.

Table 6. Acreage of each mapped wetland in the study area. This table also shows the aerial photo each wetland can be located on.

Wetland#	acres	photo	
1	12.3	388-67	
2	128.0	388-67	
3	30.5	388-67	
4	30.3	388-67	
5	66.3	388-67	
6	18.3	288-91	
7	32.1	388-67	
8	30.3	288-91	
9	36.9	288-16	
10	142.9	288-16	
11	114.4	288-93	
12	33.3	388-67	
13	23.6	388-67	
14	42.6	288-93	
15	31.1	388-143	
16	54.8	388-143	
17	7.2	288-16	
18	51.1	388-66	288-91
19	133.0	288-91	
20	75.2	288-91	
21	34.9	288-93	
22	139.0	288-93	
23	284.5	288-93	
24	600.6	288-91	
25	361.0	388-67	
Total	2,153.0		

The total land area within the study area is 7,200. Thus, 30% (2,153/7,200 = 30%) of the study area is wetland. This is a very high percentage, but it should be remembered that the study area only includes the valley bottom area of the Slate River, Coal Creek and Washington Gulch. However for comparison, other regions of Colorado that I have surveyed, using similar methods, have a much lower percentage of land as wetland. The 14,000 acre Telluride planning area is 6% wetland (Cooper and Gilbert 1990), the 450,000 acre South Park (north of U.S. Hwy 24) study area is 12.3% wetland (Cooper 1989), the 32,000 acre City of Boulder region included 547 wetland acres which was 1.7% of the study area (Cooper 1988).

WETLAND FUNCTIONAL ANALYSIS

Wetland functions were evaluated for the 25 different wetland areas delineated. These functions are summarized in Table 7.

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Table 7. Functional evaluation data for all wetlands.

Wetland #	Function												
	GWR	GWD	FLS	SLA	SED	WQI	FCS	FIS	WIL	REC	PAS	tot	ave
1	1-2B	3A	2A	3A	3A	2-3B	3A	3A	2A	2B	3A	28	2.5
2	2A	3A	3A	3A	3A	3A	3A	3A	3A	2A	3A	31	2.8
3	2A	3A	3A	3A	3A	2-3B	3A	3A	3A	2B	2A	29.5	2.7
4	2B	2B	3A	2B	3A	2A	2B	2B	3A	2B	2A	25	2.3
5	2A	2A	2A	2A	3A	2C	3A-B	2A	3A	2A	3A	28	2.4
6	3A	3A	3A	2B	3A	3A	3A	3B	3B	2B	3A	31	2.8
7	2B	2B	3B	2B	2B	2B	2A	2A	3A	2A	2A	24	2.2
8	1-2B	3A	2B	2B	2B	3A	2B	1-2B	2A	1-2B	2A	22.5	2.0
9	2B	2B	1B	2A	3A	2-3B	1B	1A	3A	1A	3A	21.5	1.9
10	3A	2A	2-3A	3A	3A	3A	2A	1A	3A	2B	3A	26.5	2.4
11	2A	1-2B	2B	2B	3A	2A	2B	1-2B	2A	1A	1-2A	20.5	1.9
12	3A	3A	2-3A	2A	3A	3A	2A	2A-B	3A	2B	3A	27	2.5
13	3A	3A	3A	2-3A	2-3A	2-3B	3A	2A	2A	2-3A	2-3A-B	28.5	2.6
14	1-2B	1-2B	3A	2B	3A	2-3B	2B	3A	3A	3A	3B	27.5	2.5
15	2B	3A	2B	3A	2B	3B	3A	2A	2A	2A	3A	27	2.5
16	1-2B	2A	3A	3A	3A	3A	3A	3A	2-3A	3A	3A	30	2.7
17	2B	3A	2B	3A	3A	3A	2A	1A	2-3B	1B	2A	24.5	2.2
18	1-2B	1-2B	2A	3A	2-3A	2-3A	3A	2A	2A	2A	2A	24	2.2
19	3A	3A	2B	2B	2B	2A-B	2-3B	2A	1-2A	1-2A	2A	24.5	2.2
20	2A	3A	2A	1-2B	2B	1-2B	1-2B	1A	2A-B	1A	2A	19.5	1.8
21	1-2B	3A	1A	3A	1A	3A	3A	2-3A	2-3A	2-3A	2A	25	2.3
22EST	2C	2C	2C	3C	2C	2C	2C	2C	2C	1C	2C		
23EST	2C	2C	3C	2C	2C	3C	2C	2C	2C	1C	2C		
24EST	2C	2C	3C	3C	2C	2C	2C	2C	2C	1C	1C		
25EST	2C	3C	3C	3C	2C	2C	3C	3C	3C	1C	1C		
tot	44	52.5	50	55	55	54	51	43.5	53	40	52		
ave	2.1	2.5	2.4	2.6	2.6	2.6	2.4	2.1	2.5	1.9	2.5		

******** Abbreviations **

GWR = Ground Water Recharge; GWD = Ground Water Discharge;
FLS = Flood Storage; SLA = Shore Line Anchoring; SED = Sediment Trapping;
WQI = Water Quality Improvement; FCS = Food Chain Support; FIS = Fish Habitat;
WIL = Wildlife Habitat; REC = Recreation; PAS = Passive Recreation;
tot = summ of all wetland functions;
ave = Average Functional Rating (3 is max possible)
est = estimated as access to land was denied.

1 = low functional value, 2 = moderate functional value, 3 = high value
a = confidence of rating is high, b = confidence moderate, c = confidence low

A rating of "3" for a function indicates that it is being performed to a high degree. A rating of "A" indicates certainty about the degree to which the function is being performed. The numeric functions are tabulated to determine the functions performed by Crested Butte wetlands.

Table 7 also totals and averages the ratings for each function for all wetlands. This sum provides a synthesis of which functions are performed by Crested Butte wetlands. The functions with the highest averages (see table 7, bottom row) are: sediment retention, shoreline anchoring, water quality improvement, wildlife habitat and ground water discharge. Each is listed below with reasons for their high ranking. Then, the functions with lower rankings including: flood storage, food chain support, and groundwater recharge are discussed.

Sediment retention is performed by most Crested Butte wetlands. This is due to the position of most wetlands to receive water from adjacent uplands.

Shoreline anchoring is rated high for these wetlands indicating the proximity of most wetlands to streams, and lakes or ponds. The shoreline vegetation of willows and sedges that occurs in most areas is in adequate condition, but in many areas it has been depleted or degraded and requires restoration.

Water quality improvement is performed by most Crested Butte wetlands because they have seasonally high water tables, anaerobic conditions for long periods of time, and retain sediment and heavy metals.

Groundwater discharge supports many wetlands in the study area. Thus, its contribution is critical, particularly in dry summers and in areas where stream degradation had lowered the local water table. Groundwater flow sustains wetlands in many parts of the study area, and the anaerobic conditions in wetlands treats this water.

Flood storage and **food chain support** functions are ranked only of moderate value in the study area which was surprising. Most likely this is due to the degraded condition of streams and the apparent decoupling of streams and floodplains in many areas, which limits flood storage. Also, aquatic **food chain support** is largely driven by willows on stream banks providing leaf litter for adjacent aquatic ecosystems. However, the condition of many riparian zones in the study areas was such that willows were greatly reduced and this function was degraded.

Few wetlands were determined to provide **groundwater recharge** because the water table in this region is high and little opportunity exists for recharge. In addition, recreation is limited because most wetlands are on private lands which have limited entry.

SUGGESTED PRIORITY WETLANDS OF THE CRESTED BUTTE AREA

Several factors must be kept in mind in determining which wetlands should be designated as priority wetlands. First, within the study area probably no wetlands are completely pristine. All have been impacted at one time or another over the past 120 years by human activities including livestock grazing, mine wastes, beaver removal by trappers, ditching to lower water tables, vegetation removal, etc. In addition, wetlands in a few areas have been created by human activities through the redistribution of water via ditches onto naturally dry portions of the landscape. Thus, in any particular area, wetland functions that once were performed may not be performed at present and functions that now are being performed may not have been performed in the past.

Based upon the ratings of ecological functions for Crested Butte wetlands, several wetland areas are identified as being most worthy of protection. Each wetland that is recommended for priority ranking is listed and discussed below. The order in which they are presented is the order of their quality. Two very high quality wetlands exist in the study area. Eight others are valuable today in their current condition, but have the potential for being very valuable if restored. These ten sites are shown on the map provided as Figure 14 and each is described below.

1. **Slate River valley between Wild Bird Estates and the Nicholson Lake** subdivision hill, encompassed in my wetland number 2 on photograph 388-67. This is the most pristine and high quality wetland in the study area. It should be the first priority for conservation purchase and preservation. It provides not only a baseline site that can be used to determine how to restore the remainder of the Slate River valley, but it also has tremendous educational and ecological value.

2. **The lower Slate River willow wetlands that extends from Silver Sage northwest approximately 1/2 of the distance to Crested Butte**, encompassed as the southeastern portion of my wetland number 24 on photograph 288-91. This area has spectacular tall willow and oxbow complexes in a meandering river section just above the Baxter Gulch alluvial fan. It provides extraordinary habitat, and water treatment.

3. **The Slate River valley upstream from Gothic Road and below the ditches.** The 1962 aerial photographs indicate that this site supported tremendous wetlands. These have been partially dried up and the vegetation destroyed, but these changes are reversible. This site is the southeastern portion of my wetland number 25 on Photograph 388-67, and all of wetlands 1 and 13.

4. The area just west of priority site number 2, and encompassed within the southwestern portion of my wetland number 24 on photograph 288-91. This area would have to have its original hydrologic regime restored and willows planted to restore the vegetation.

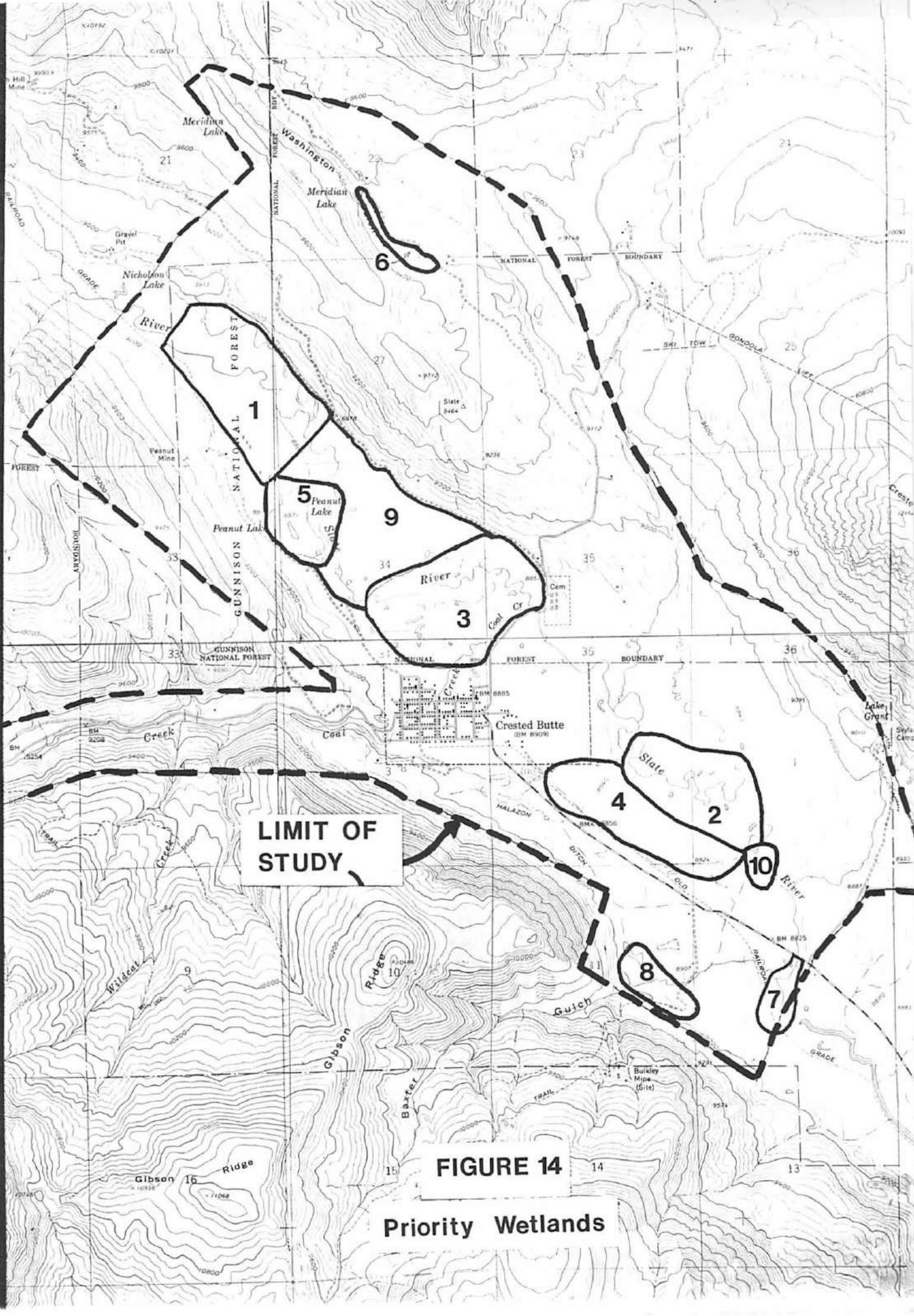


FIGURE 14

Priority Wetlands

Typical Wetlands of the Crested Butte Area

Upper Slate River wetlands and beaver dam, fall 1992

Healthy wetlands showing sedges and willows

5. **The Peanut Lake area** has a number of problems related to heavy metals pollution and risk of drainage by stream capture. However, this large water body provides important habitat and may be restorable. This area is encompassed in my wetland number 5 on photograph 388-67.

6. A small area of willow thicket **just below Meridian Reservoir on Washington Gulch.** This area is regulated by reservoir operation, but it supports valuable bird habitat. This area is encompassed in the southeastern portion of my wetland number 21 and the northwestern portion of my wetland number 22 on photograph 288-93.

7. **The Slate River on the Smith Ranch.** The stream channel in this area is too wide, thus, little fish habitat is available. This area is the southeastern portion of my wetland number 19 on photograph 288-91.

8. The groundwater discharge sites at **the base of Baxter Gulch** supports a number of very interesting wetland community types. However, much of the area has been ditched. This is the far western portion of my wetland number 19 on photograph 288-91.

9. This wetland is the remainder of the upper Slate River valley between priority wetlands 1, 3 and 5. This area has been extensively modified by ditching, gravel mining and grazing. It could be restored. This area is encompassed by the northern portion of my wetland number 25, and wetland number 7 on photograph 388-67.

10. The **groundwater discharge sites at the toe of the Baxter Gulch alluvial fan** are **located at Riverbend,** and **the riverside wetlands at the Silver Sage area.** These extensive wetlands are in fairly good shape, although much of the area has been filled for home construction, and overgrazing has destroyed much of the stream edge vegetation. This area is my wetland number 8, and portions of wetland 6 on photograph 288-91.

IMPACTS TO CRESTED BUTTE WETLANDS

During the course of this study numerous wetland impacts were observed in the Crested Butte area. Some of the most obvious wetland impacts, such as filling, have had a relatively small impact, while other less obvious or easily overlooked impacts have a tremendous impact. For example, the Slate River valley from Wild Bird Estates downstream to the Gothic Road appears relatively natural. However, I examined aerial photographs of this site from 1962, 1978 and 1988 and calculated the area of wetlands occurring in this area on these three different dates. The data are presented in Table 8.

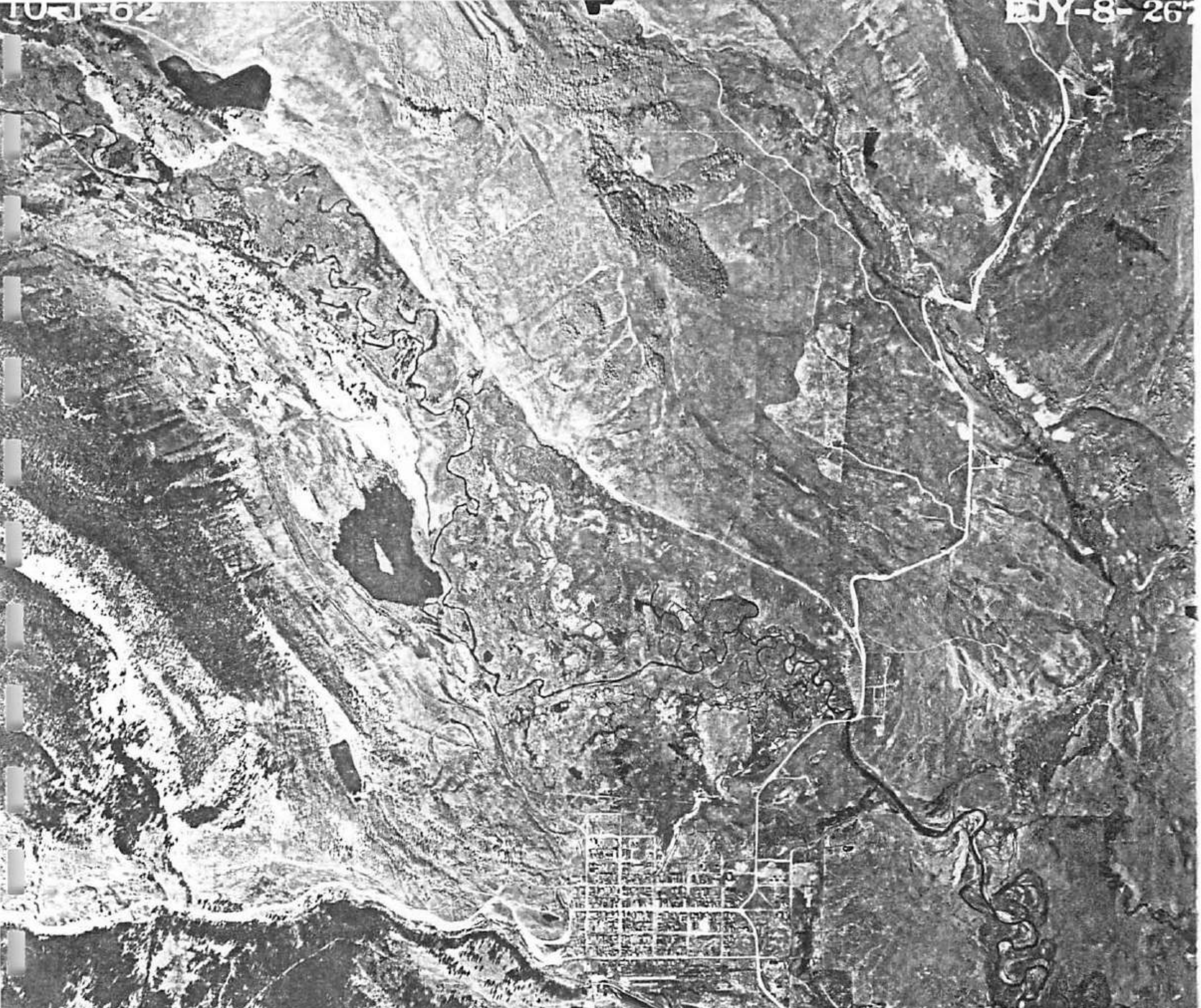
Table 8. Acreage of wetlands in the Slate River valley between Wild Bird Estates and the Gothic Road from 1962 to 1988.

	1962	1978	1988
ACREAGE	859	678	554
NET LOSS	-	181	305

The data presented in table 8 indicate a 35% loss of wetland area in this part of the Slate River valley in 26 years. Little of this loss was due to filling. It was due to ditching, water table decline, and river downcutting. In addition, gravel mining, willow removal and other direct impacts have occurred in recent years. These actions were taken to increase the area available for agricultural use, ie. cattle grazing which is the historical Caucasian land use for this area.

While the overall population of the Crested Butte region has changed tremendously in the past 20 years, the land uses that impact wetlands have continued. To discuss current impacts to Crested Butte wetlands I divide these activities into 5 categories; (1) ditching, (2) stream channelization and stream degradation, (3) vegetation destruction, (4) heavy metal pollution, and (5) eutrophication. Each is discussed below, and solutions for each activity are suggested. In addition, a restoration plan for the Slate River valley is proposed.

(1) **Ditching** involved the construction of a trench to depths below the water table, capturing groundwater in the trench and allowing it to flow to the river, or another conveyance structure. Typically, groundwater is flowing from upvalley or upslope toward the valley center or downvalley. Ditching can intercept this flowing water and effectively dry out down-gradient areas, removing important hydrologic support to wetland plant species. Three large ditches have been constructed in the Slate River valley between approximately 1/2 and 1 mile upriver from Crested Butte. They are easily seen on aerial photograph 388-67, or the air photograph presented as Figure 2 (number 1 and 2 on the photo). These ditches



1962 aerial photograph.

1978 aerial photograph.

1978 aerial photograph.

have essentially collected all groundwater on the north side of the Slate River just downstream from Peanut Lake, thereby drying up the entire area below. A comparison of the 1962 and 1988 photographs indicates how extensive the drying has been. In 1962, approximately 24 areas of open water are shown, most likely maintained by beavers. In 1988, there were no open water areas. This reduced area of open water indicates how profoundly the water table lowering has been on the entire area. The site can no longer support beavers or surface water, and most likely the willow communities there are stressed.

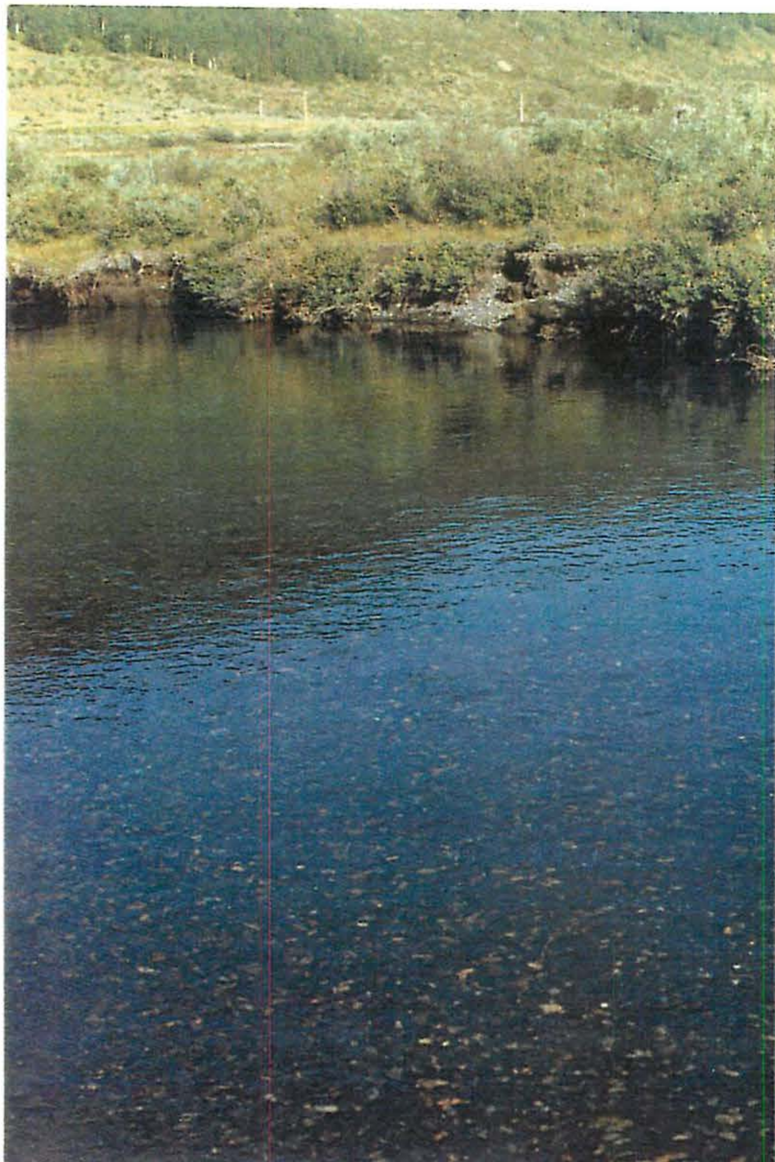
(2) **Stream channelization** and stream degradation has occurred along the stretch from the Gothic Road upstream to just past the Wild Bird Estates bridge. Some of this has apparently been caused by human intervention to straighten stream sections, protect bridges and remove gravel. However, the entire reach is now unstable and downcutting. The downcutting has brought the stream channel below the rooting depths of trees, willow shrubs and the herbaceous plants that line the stream bank. These plants are no longer effective for stabilizing the banks and lateral erosion is occurring. This is easily seen in the area of the Wild Bird Estates bridge. Once the stream channel degrades to the point where beavers no longer can divert water onto the floodplain, and the willows are ineffective at bank stabilization, then the Slate River is disconnected from its floodplain. Once that happens, further deterioration of the wetlands and stream channel habitat is inevitable.

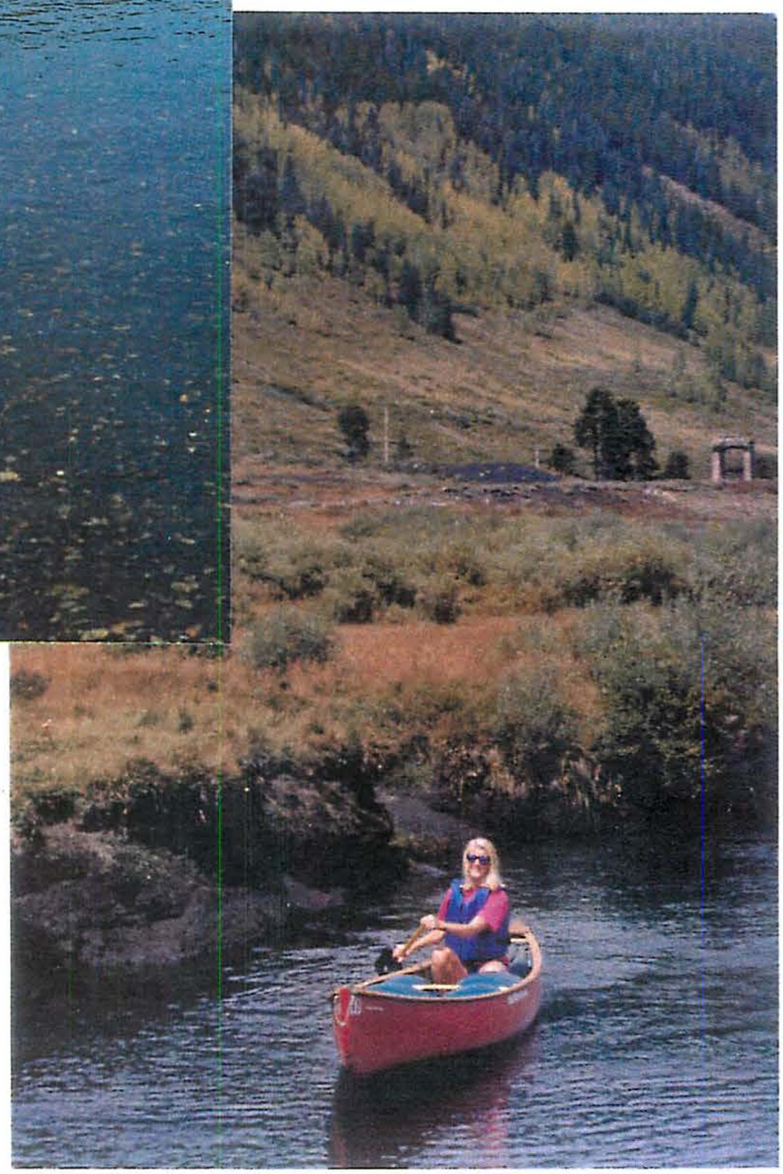
Figure 10 shows a hydrograph comparing water levels during 1992 in geyer willow communities both above and below Wild Bird Estates. These hydrographs show that early summer water levels are approximately 20 to 30 cm lower in the area below Wild Bird Estates, but mid to late summer water levels may be 70 to 80 cm lower. This difference is due to the controlling effect of stream channel elevation on adjacent ground water levels. A lower stream channel is similar to a ditch and can effectively drain areas. The lower stream level makes it impossible for beavers to remove water from the stream channel and spread it out on the floodplain. Beavers have made good use of groundwater and small tributaries that entered the Slate River valley from valley slopes. However, the water table now is so low that these tributaries no longer carry surface flow.

Slate River is migrating laterally at an alarming rate as can be seen at Wild Bird Estates and many other areas. Migration is caused by destabilizing the stream banks either by vegetation removal or mining of the stream channel allowing it to down cut and under cut the willows that normally line and protect the banks. Once this lateral migration starts, the stream can widen until it erodes much of the valley bottom, forms a new base level and establishes a new channel and floodplain.

(3) **Vegetation destruction**, particularly of willows, has occurred throughout the study area. I estimate that approximately 40% of the willows in the Slate River valley have been removed to expand the land area available for agriculture. The

Typical Wetlands of the Crested Butte Area





Stream bank Degradation

greatest impacts have occurred in the area from Crested Butte downstream to Riverbend where willows have been removed from more than 50% of the floodplain. Willow removal in that area can easily be seen on any aerial photograph because several fence lines show where willows have been pulled on only one side. More recent willow destruction has occurred in the Crested Butte vicinity, particularly just on the northern edge of town, near Coal Creek. This can be seen in Figure 2 (at number 8).

The cause for concern is well grounded. Willows are the most important wetland plant in the Crested Butte region. They provide essential streambank stabilization which reduces the risk of streambank erosion. Willow thickets are the most important habitat for many species of wildlife, particularly migratory birds. They are essential food for beavers and beavers are the necessary ingredient for floodplain maintenance. In addition, willow leaves fall into the Slate River in the autumn and provide essential food for aquatic invertebrates, which form the base of the food chain for trout. In addition, willow plants live for dozens or hundreds of years, and provide tremendous functional stability to valley bottoms. Maintaining healthy willow populations is key to healthy streambanks and wildlife populations.

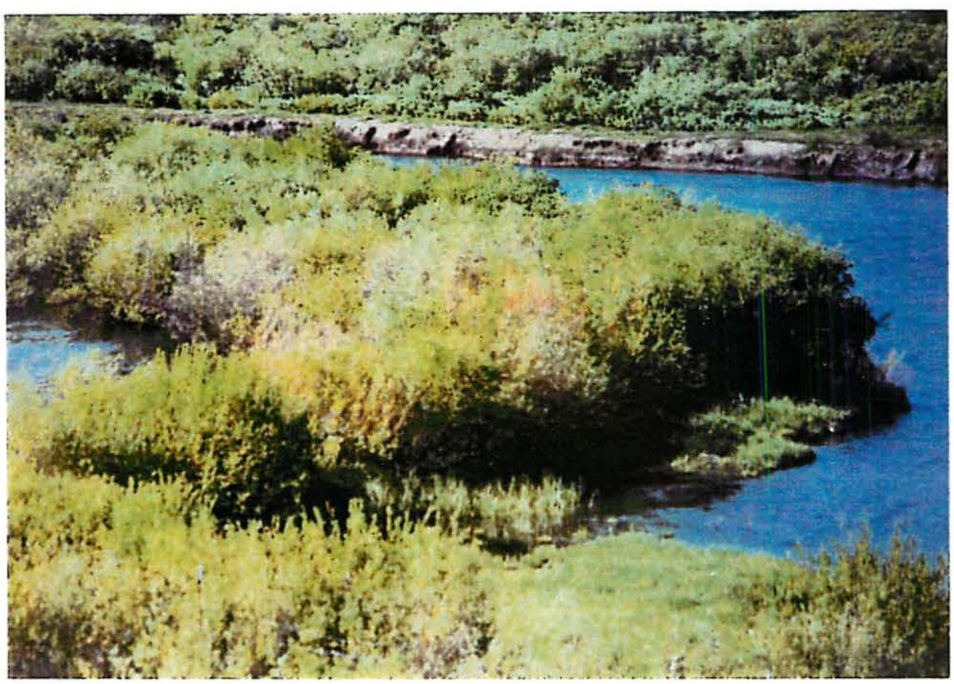
(4) **Heavy metal pollution** in the study area appears to result largely from mine drainage and mine tailings erosion that reaches surface water bodies in the study area. The main problems identified are in the Peanut Lake area. In the past (CDM 1980), the worst pollution source was from the Keystone Mine adit into Coal Creek. However, AMAX has built and operates a water treatment plant in that location for removing metals from the mine drainage. Fish and aquatic invertebrates have returned to Coal Creek below the mine in the years since cleanup. Mine tailings still remain in the Peanut Lake area, and one large pile can be seen in Figure 2 (at number 6).

As discussed in the water quality section of this report, the water flowing from several sources into Peanut Lake is of concern. While the volume of mine drainage water flowing in the Peanut Lake area is small compared to the Keystone Mine drainage, it is cause for concern because aquatic life such as birds use Peanut lake, dead fish are frequently found on the shores of Peanut Lake, and the lake itself is precariously maintained by a beaver dam adjacent to the Slate River. This thin strip of land can be seen on Figure 2 (at number 5).

Beaver dams such as this one can last for decades, but from examination of historic aerial photographs, the distance between the lake and Slate River appears to have thinned, so that now the two water bodies are only a few feet apart (see photographs on the next page). The 1988 aerial photograph, used as the wetland basemap for this part of the study area (#388-67), indicates that there are two possible points of bank weakness. One is a beaver run that can be seen where the Slate River first comes along side the Lake, and the second is where the Slate

Typical Wetlands of the Crested Butte Area

Peanut Lake (left) and Slate River (right)



Peanut Lake and Slate River
The lake is 2-3 feet higher than the river.
Lake elevation is maintained by the beaver dam.
Note stream bank degradation in background .

River last is adjacent to the Lake. Indeed the entire reach of bank between these two points is precarious. In addition, Peanut Lake is several feet higher in elevation than the baseflow of the Slate River.

The problems with Peanut Lake's eventual capture by the Slate River may have developed due to stream channel downcutting or migration which resulted in erosion of the land between the channel and Peanut Lake. It is probable that a large flood event will undercut the remaining bank and capture Peanut Lake initiating its drainage. If this occurs during a high water period, the lake may drain slowly over a period days. However, if the water level in the river is considerably lower than the water level in Peanut Lake, the lake could drain suddenly.

Peanut Lake is approximately 32 acres is size, and ranges from 2 to 5 feet in depth, and contains approximately 100 to 120 acre feet of water when full. Its sudden drainage would not be a catastrophe for downstream landowners, but a flow of this extent would probably mobilize sediment which may contain high concentrations of heavy metals, such as zinc, and transport it to the Slate River. The effect of this sediment on water quality and habitat in the Slate River is unknown, but very significant impacts to fish and aquatic invertebrates as well as habitats in the Slate River, for many miles downstream, would likely result.

(5) **Eutrophication** results from excessive nutrients concentrating in water bodies. The nutrients allow algal growth and the invasion of nutrient demanding plant species such as broad leaf cattail. The most important nutrients are nitrogen and phosphorus which are limiting in most aquatic ecosystems. The three important nutrient sources found in the Crested Butte area are fertilizers applied to lawns, municipal waste water, and septic systems with leach fields located near water bodies.

Two areas of eutrophication were identified in the study area. Wetlands on the Skyland Golf Course and at Grant Lake are dominated by cattail (Tyhpa latifolia), reed canary grass (Phalaris arundinacea), elodea (Elodea spp.) and other plants that indicate nutrient pollution. I suggest this because these plants are not present in similar habitats in the Crested Butte area that are unimpacted by nutrient input. The small wetland pond south of Wild Bird Estates also has cattail invading and establishing in an aquatic ecosystem currently dominated by beaked sedge (Carex utriculata). The establishment of these plants heralds a change in ecosystem type from natural to anthropogenic. The cause for concern is that beaked sedge stands are habitat for waterfowl, while the cattail stands are usable only by species such as red-wing blackbirds. Cattails also shade other plants and will result in the loss of species diversity in the affected areas.

Solutions include: limiting fertilizer use or transport to affected waters, more careful construction and maintenance of septic systems, and precluding leach fields in areas that could possibly drain into aquatic ecosystems, wetlands or other water bodies.

The Crested Butte waste water plant discharges to the Slate River. Waste water of this type usually contains appreciable concentrations of nitrogen compounds. The quality of this water could be significantly improved by a wetland treatment system. I suggest either building a small wetland near the treatment facility, or transporting the waste water via pipeline to an existing wetland that currently is supported by irrigation, or is of low quality. The benefit would be a reduction in nitrogen loading to the Slate River.

SUGGESTED RESTORATION PLAN FOR THE SLATE RIVER VALLEY

Restoration means returning an ecosystem to a prior state or condition. For the Slate River valley, this means a river and floodplain ecosystem that function and contain the types of vegetation and ecological processes that occurred prior to human settlement. While most of the Slate River valley wetlands in the area between Wild Bird Estates and Riverbend have been modified for other uses, the area between Wild Bird and Nicholson Lake is virtually pristine. The area has not been channelized, mined, grazed, ditched, or polluted in any way that is detrimental to the ecosystems. This area contains intact vegetation, floodplain processes and animal populations that provide a baseline understanding of wetland ecosystems for the Slate River valley. The area contains tall and short willow communities, small stands of conifers, numerous beaver ponds and sloughs, and a river that is in equilibrium with its floodplain.

The water table for this area is shown in Figure 10 and is very stable and close to the soil surface for much of the growing season. This is in stark contrast to the water table in other willow stands downstream of Wild Bird Estates, where the water table is high in spring but drops greatly during the summer. The natural condition in the study area is for beavers to store water on the floodplain and maintain high water tables throughout the summer. Water storage is probably 2 to 5 times as great in the natural versus modified floodplain systems. This would enhance late summer baseflows in streams as water is discharged from beaver dams and floodplain soils to the Slate River, in addition to providing waterfowl habitat and water quality functions.

Land would first be purchased, or conservation easements purchased. I recommend that the area in which to start is from Wild Bird Estates downstream to Gothic Road or from Crested Butte to the Baxter Gulch alluvial fan. Restoration must include the following steps, with pre-project and post project data on water levels, and vegetation response collected to determine the success of each action.

1. Fill drainage ditches, such as those shown as numbers 1 and 2 on Figure 2.
2. Determine if the Slate River has been diverted or channelized by gravel mining or diking and remove dikes and unchannelize. Gravel mines in this area are shown at number 7 on Figure 2.
3. Stream channel modification to stop channel degradation in the region of Wild Bird. Stream channel degradation threatens to disconnect the Slate River and its floodplain. Once that happens, further deterioration of the wetlands and stream channel habitat is inevitable.
4. Willow plantings as dormant stem cuttings (see Cooper 1993 for methods) or seedlings grown from local seed, in areas where they have formerly been removed and along stream banks and floodplains. The stream channel must be in connection with the floodplain, meaning that beavers must be able to divert and hold water on the floodplain, and willow roots must reach the channel bottom and

Typical Wetlands of the Crested Butte Area

August 1978

Fulica americana, Coot nest

stabilize the banks. Once the habitat that beavers can thrive in is established, the ecosystem can then be maintained by beavers.

The main ecosystem to restore is the willow wetland ecosystem that once extended from Riverbend upstream to Nicholson Lake. The willows provide essential habitat for neotropical migrant birds (eg. wilsons warbler) that are declining worldwide due to wetland destruction. Functioning floodplains will also contain abundant standing water as beaver ponds which will support significant populations of ducks and teal, phalaropes, snipe and other birds. These species nest in the Crested Butte area.

The main elements of wetland restoration include coupling the stream to the floodplain and establishing willows on the stream banks and floodplain. This could be performed for a reasonably small effort.

SUMMARY

The Crested Butte study area of approximately 7,000 acres contains a remarkable concentration and great diversity of high quality wetlands. These range from willow shrublands on floodplains, to sedge dominated peatlands, to irrigated hay meadows and natural lakes. These wetlands provide habitat for birds, fish and mammals and they provide important water quality functions by filtering the tremendous runoff and sediment load delivered to aquatic ecosystems.

More than 30% of the study area is wetland. Although much of this wetland area has been modified for human use and is degraded from an ecological perspective, most impacts can be reversed and true restoration is possible. The Slate River valley, from Nicholson Lake downstream to Riverbend, once existed, and could exist in the future, as one of the finest wetland complexes in Colorado. Two extraordinary sections exist today, that just below Nicholson Lake, and that just above Riverbend. The remainder of the valley, between these points, could be restored and it is encouraged that restoration be considered in long-term planning perspectives now. The preservation of excellent wetlands, and restoration of degraded wetlands, will help Crested Butte retain its natural beauty and functional characteristics that have drawn people to this area. Fully functioning wetlands are perfect indicators that the region's ecosystems are healthy and that the opportunities for human life and property are not limited by poor water quality, a paucity of wildlife, or degraded land.

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APPENDIX 1. DESCRIPTION OF WETLAND FUNCTIONS

The following is a description of each function listed above, and a description of how each function was evaluated in the field. Also included is a description of how the ranking system for that function was used in the field. These functions and the indicators of whether or not a function is currently or could potentially be performed by a wetland are from "A Method For Wetland Functional Analysis: Volumes I and II" by Paul Adamus and L. Stockwell, published by the Federal Highway Administration (Adamus and Stockwell 1983). This manual has recently been revised and updated and is published by the U.S. Army Corps of Engineers in draft form as the Wetland Evaluation Technique (WET) (Adamus et al. 1987). This latter document has been utilized only slightly because it appeared when this work was already in progress.

Ground Water Recharge. This function involves the movement of surface water or precipitation into the ground water flow system. This is a very difficult function to estimate without actual flow measurements. Physical characteristics of a wetland that appear to be good indicators that ground water recharge is occurring are:

* porous underlying strata,
* low sediment trapping efficiency,
* a dam occurring on the waterway at the wetland location,
* a densely vegetated basin,
* a constricted outlet,
* surface water inflow is greater than surface water outflow,
* the wetland occurs high in the basin and the wetland is irregularly shaped with high wetland edge to wetland area ratio.

A dam site on alluvium would most likely perform this function and would be given a high rating. A moving stream in alluvium would likely have a medium chance of performing this function. A fast moving stream on clay substrate (which is relatively impermeable) would probably not perform this function or perform it very slightly. It would thus get a low ranking.

Ground Water Discharge. This function involves the movement of ground water into surface water (e.g. springs). It is very difficult to estimate whether or not this function is operating unless it is actually seen or measured. Factors which give an indication that this function may be performed include:

* unconstricted outlet,
* occurs low in the watershed (low hydrologic head),
* lithologically diverse (different bedrock types, some of which may be waterbearing),
* a dam upstream (which would be recharging the ground water just upstream), and
* the basin is not silty.

Many wetlands occur due to ground water discharge.

Flood Storage. Flood storage is the process by which peak flows (from runoff, surface flow, ground water interflow and discharge and precipitation) enter a wetland basin and are delayed in their downslope journey. This function includes flood desynchronization. This latter process involves the simultaneous storage of peak flows in numerous basins within a watershed and their subsequent gradual release in a non-simultaneous, staggered manner. Wetlands which are known to perform this function typically have some of the following characteristics:

* occur in a large watershed,
* are along an order 1 or 2 (very small) stream,
* the size of the wetland is greatly increased in flood times,
* the basin is large and deep,
* has a low gradient,
* sediments are unsaturated (not permanently saturated),
* has high above-ground and/or below-ground storage,
* has no outlet and has dense vegetation.

A wetland that would most likely perform this function to a high degree would occupy a large and broad, low gradient basin or a small basin that has a dam on it. Wetlands that most likely would not perform this function would be channelized stretches of streams and the numerous irrigation ditches and canals in the study area.

Shoreline Anchoring. Shoreline anchoring is the stabilization of soil at the water's edge or in shallow water by plant species with fibrous roots and may include long-term accretion of sediment and/or peat. Wetlands that perform this function occur along open water (lakes and streams). Rating this function is done under the assumption that vegetation density and vegetation type and wetland width are important predictors. Wetlands dominated by woody vegetation located along streams in which the stream bottom is largely covered by fibrous roots surely provide this function to a high degree. Wetlands that would not perform this function are those that do not have open water.

Sediment Trapping. Sediment trapping is the process by which inorganic particulate matter of any size is retained and deposited within a wetland or its basin. This function may be performed for short-term or long-term. Wetlands which perform this function typically have the following characteristics:

* no outlet,
* surface water input exceeds surface water output,
* dense vegetation, and
* gently sloping wetland edges.

They also have deposits of mud or organics which indicate deposition. Wetlands that perform this function to a high degree occur behind a dam such as a glacial moraine or alluvial fan that has reduced valley gradient. Sediment can also be trapped on shorelines.

Nutrient Retention and Removal. Nutrient retention is the storing of nutrients within the substrate and vegetation of wetlands. Nutrient removal is the purging of nitrogen nutrients by conversion to gas (denitrification) while nutrient retention may involve trapping of runoff-borne nutrients in wetlands before they are carried downstream or to underlying aquifers. Nutrient storage in wetlands may be for long-term (greater than 5 years) or short-term (30 days to 5 years). The most critical nutrients for retention in aquatic ecosystems and removal are nitrogen and phosphorus compounds, although other nutrients may also be important.

Wetlands that perform the nutrient retention or removal function for long-term typically have the following characteristics:

* high sediment trapping function,
* organic matter accumulation,
* no outlet,
* flooded permanently or semi-permanently (this creates reducing soil conditions which support active populations of denitrification bacteria and also minimizes the oxidation of organics which facilitates peat accumulation).

An example of a wetland with long-term nutrient retention functions would be one with highly productive vegetation and highly organic soils that are permanently saturated. Other examples would be where sediment retention is high, because many nutrients are received adsorbed to sediments. Many wetlands located in urban and industrial areas would perform this function.

Wetlands that perform this function for short-term typically have the following characteristics:

* high net biological productivity,
* sediment retention,
* non-acid soils, and/or
* occur in watersheds that are highly developed including urban, industrial, and/or agricultural land uses with eroding soils and/or where fertilizer is applied.

An example of a wetland that performs this function for the short-term is one with extremely productive vegetation and permanently saturated soils. Most densely vegetated marsh stands would meet this criterion. A wetland that would not perform this function would have a very sparse vegetation, little sediment retention, and a steep slope which would keep sediment moving.

Food Chain Support. Food chain support is the direct or indirect use of nutrients, in any form, by animals inhabiting aquatic environments. Food chain support may occur within that wetland basin or downstream. Wetlands that perform downstream food chain support typically have the following characteristics;

* an outlet,
* non-acidic waters,
* not sandy substrate,

* not permanently flooded,
* a dense and diverse vegetation with high sustained productivity,
* not stagnant or with severe scouring,
* not hypersaline,
* good flushing flows, and
* vegetation overhanging the water.

Wetlands that perform within-basin food chain support typically have the following characteristics;
* not stagnant water,
* highly productive vegetation,
* irregularly shaped wetland with no outlet,
* without being entirely shallow and warm water in the summer, and
* has good mixing of the water.

An example of a wetland that would have high within- basin food chain support value would have high diversity of plants and animals.

Habitat. Habitat includes those physical and chemical factors which affect the metabolism, attachment, and predator avoidance of the adult or larval forms of fish, and the food and cover needs of wildlife in the place where they reside. These factors determine the suitability of a given site for an animal species. For this study, habitat was evaluated for fish and for wildlife (birds and mammals) separately. Wetland physical and chemical characteristics that are good for one species are not necessarily good for another species, thus there are few indicators of good habitat for animals in general.

Wetlands that provide good fish habitat typically have the following characteristics:
* some open water which is not shallow,
* not acidic,
* not turbid,
* no barriers to migration,
* no oxygen stagnation,
* no artificial fluctuations,
* not oligotrophic,
* not flashy, and
* cool water temperatures with some shade.

Wetlands which do not have open water are examples of wetlands that do not provide the fish habitat function.

Wetlands that provide good wildlife habitat typically have some of the following characteristics:
* good edge ratio,
* islands,

* high plant diversity,
* some (but not excessive) alkalinity,
* sinuous and irregular basin,
* the basin and wetland are not small,
* gentle gradient,
* no artificial water level fluctuations,
* not moss dominated,
* pH exceeds 6.0,
* some open water,
* not urban or deep water,
* not channelized or farmed,
* undisturbed by man, and
* has good food sources.

An example of a wetland that would probably provide high quality wildlife habitat would support a diverse and productive vegetation, have some open water, be fairly undisturbed and provide some isolation from man's activities.

Active Recreation. Active recreation refers to recreational activities which are water-dependant and can occur either in an incidental or obligatory manner in wetlands. This includes the following activities: swimming, boating, canoeing, kayaking and sailing. Hunting is not water-dependant and is not considered here. Wetlands that provide this function typically have the following characteristics:

* direct evidence of actual use for a certain activity,
* convenient public access,
* mostly unvegetated,
* some sand,
* little debris,
* slow standing water,
* channels and boat launch facilities,
* permanently flooded basin,
* no algal blooms and
* not weedy.

A wetland that would provide these characteristics in the study area would typically be a stream large enough to support boating and would also support this function. Most wetlands in the study area however, do not support this function to a high degree because there is limited public access.

Passive Recreation and Heritage Value. This function includes use of wetlands for aesthetic enjoyment, nature study, picnicking, education, scientific research, open space, preservation of rare species, maintenance of the gene pool, protection of archaeologically or geologically unique features, maintenance of historic sites and numerous other activities. Wetlands that perform this function typically have the following characteristics:

* rare plants,

* landscape diversity,
* unity of landscape elements,
* are a natural area,
* scarcity of this type of wetland,
* freedom from eyesores.

Many wetlands in the study area provide this function at present, but many could be restored.

APPENDIX 2. WETLAND PLANT SPECIES OF THE CRESTED BUTTE REGION

Plant nomenclature follows Weber 1976 and 1987.

SCIENTIFIC NAME	COMMON NAME
Abies lasiocarpa	subalpine fir
Achillea lanulosa	yarrow
Aconitum columbianum	monks hood
Agoseris glauca	agoseris
Agropyron trachycaulon	grass
Agrostis gigantea	redtop
Agrostis palustris	agrostis
Agrostis scabra	tickle grass
Alnus tenuifolia	narrow-leaf alder
Alopecurus aequalis	foxtail
Anaphalis margaritacea	
Angelica pinnata	angelica
Antennaria microphyllum	pussy toes
Argentina anserina	silver leaf
Aster foliolosus	aster
Bacopa rotundifolia	water-hyssop
Batrachium tricophyllus	water crowfoot
Betula glandulosa	shrub birch
Bistorta bistortoides	bistort
Bistorta vivipara	bistort
Bromopsis inermis	smooth brome
Calamagrostis canadensis	canadian reed grass
Calamagrostis stricta	reed grass
Campanula parryi	parry harebell
Cardamine cordifolia	cardamine
Carex aquatilis	water sedge
Carex aurea	golden sedge
Carex buxbaumii	sedge
Carex capillaris	sedge
Carex dioica	sedge
Carex disperma	sedge
Carex festivella	sedge
Carex lanuginosa	sedge
Carex microptera	sedge
Carex nebraskensis	sedge
Carex praegracilis	sedge
Carex saxatilis	sedge
Carex simulata	sedge
Carex vesicaria	sedge
Castilleja sulphurea	yellow paintbrush

Typical Wetlands Plants of the Crested Butte Area

Critesion brachyantherum, foxtail

Gentianopsis thermalis, fringed gentian

Ceratophyllum demersum	hornwort
Chamerion angustifolium	fireweed
Chamerion latifolium	river beauty
Chara sp.	stonewort
Cirsium arvense	canada thisle
Conioselenium scopulorum	umbel
Critesion brachyantherum	foxtail
Dactylis glomerata	orchard grass
Danthonia intermedia	oat grass
Eleocharis parvula	spike rush
Eleocharis macrostachya	spike rush
Elodea canadensis	elodea
Epilobium lactophyllum	willow-herb
Equisetum arvense	horsetail
Erigeron lonchophyllus	daisy
Festuca pratensis	meadow fescue
Fragaria virginiana	strawberry
Galium boreale	bedstraw
Gentianopsis thermalis	fringed gentian
Geum macrophyllum	geum
Geum triflorum	geum
Glyceria striata	manna grass
Hierochloe hirta	sweet grass
Hippuris vulgaris	mares tail
Hordeum jubatum	foxtail barkey
Hypochaete hyemalis	scouring rush
Iris missouriensis	iris
Juncus arcticus	rush
Juncus interior	rush
Juncus longistylis	rush
Juncus saximontana	rush
Juncus tracyi	rush
Lemna minor	duckweed
Ligularia bigelowii	ligularia
Limosella aquatica	toad flax
Linium lewisii	flax
Lonicera involucrata	twinberry
Luzula parviflora	luzula
Maianthemum stellatum	false solomon seal
Medicago sativa	alfalfa
Melilotus officionalis	sweet clover
Mentha arvense	mint
Myriophyllum sibiricum	water milfoil
Nasturtium officionale	water-cress
Pedicularis groenlandicum	elephantella

Typical Wetlands Plants of the Crested Butte Area

Chamerion latifolium, river beauty

Pedicularis groenlandica, elephantella

Persicaria amphibia	smartweed
Petasites sagittata	colts foot
Phalaris arundinacea	reed canary grass
Phleum pratense	timothy
Picea engelmannii	engelmann spruce
Pinus contorta	lodgepole pine
Plantago lanceolata	english plantain
Plantago major	common plantain
Pneumonanthe affinis	gentian
Poa compressa	canada bluegrass
Poa leptocoma	blue grass
Poa pratensis	kentucky bluegrass
Polemonium caeruleum	western jacobs ladder
Potamogeton foliosus	pondweed
Potamogeton gramineus	pondweed
Potamogeton pectinatus	pondweed
Potamogeton richardsonis	pondweed
Potentilla gracilis	five finger
Prunella vulgaris	prunella
Psychrophila leptosepala	marsh marigold
Ranunculus cymbalaria	shore buttercup
Rhodiola rhodanthum	queens crown
Ribes inerme	current
Rorippa palustris	cress
Rumex aquaticus	dock
Rumex salicifolius	willow dock
Salix bebbiana	bebb willow
Salix drummondiana	drummond willow
Salix exigua	sandbar willow
Salix geyeriana	geyer willow
Salix monticola	mountain willow
Salix planifolia	plane leaf willow
Salix wolfii	wolf willow
Seriphidium canum	silver sage
Sidalcea candida	mallow
Solidago gigantea	golden rod
Spiranthes romanzoffiana	ladies tresses
Stellaria crassifolia	chickweed
Swertia perennis	star gentian
Taraxacum Officionale	common dandelion
Thalictrum alpinum	alpine meadow rue
Thlaspi arvensis	pennycrest
Trifolium pratense	red clover
Trifolium repens	white clover
Typha latifolia	broad leaf cattail

Typical Wetlands Plants and Creatures of the Crested Butte Area

Polemonium caeruleum

Homo sapien cooper, Dr. David Cooper

Utricularia spp.	bladderwort
Valeriana edule	valerian
Veratrum tenuipetalum	corn husk lily
Verbena hastata	blue vervain
Veronica americana	speedwell
Veronica anagallis-aquatica	speedwell
Veronica nutans	speedwell
Vicia americana	vetch
Viola epipsiloides	white violet

APPENDIX 3.
FIELD DATA SHEETS

CRESTED BUTTE WETLAND STUDY - 1992
DATA COLLECTED BY: DAVID J. COOPER

WETLAND NUMBER: CB-1 DATE: 7/27/92

LDCATIDN: NW side Slate R + highway

DESCRIPTIDN DF WETLAND:
spring complex on N+E and riparian shrubland. A number of different communities here.

HYDROLOGY:
Groundwater inflow on N+E, stream creates backwat
Also, beaver channels

WETLAND HISTORY:
Natural

DISTURBANCE REGIME:
Historic grazing

THREATS:

WATER CHEMISTRY:

FUNCTIDN/VALUE RATINGS AND COMMENTS
ratings: 1=low; 2=medium; 3=high
confidence in ratings: a=high; b=moderate; c=low

Ground water recharge: 1-2 B

Ground water discharge: 3 A

Flood storage: 2 A

Shoreline anchoring: 3 A

Sediment trapping: 3 A

Water quality improvement: 2-3 B

Food chain support: 3 A

Habitat: fish: 3 A
other wildlife: 2 A

Active recreation: 2 B

Passive recreation: 3 A

CDMMENTS:

VEGETATION AND SOILS DATA

Community type:	% of wetland
1 Carex utriculata (water depth - 14-20 cm)	1
2 Carex saxatilis (margin of wetland in seas. fl. spring)	2
3 Salix geyeriana - S. boothii (tall willow thicket along rider)	3
4 Salix wolfii - Carex laux wT = 48.7 cm today CB#1	4
5 Salix wolfii - Fragaria = at CC#1 →	5
6 Carex utriculata - ~~[illegible]~~ Carex (wt 5 cm at w)	6 peat

Soil data for each community:
1
2
3
4
5
6

Plant species — **Canopy coverage for each species by community**

Plant species	1	2	3	4	5	6	7
Carex utriculata	90	1				90	1
Carex aquatilis	2					10	
Carex saxatilis		60					
Argentina anserina		5		5			
Mentha arvensis		3		1		+	
Agrostis scabra		1			+		
Deschampsia cespitosa				10	20	2	1
Salix geyeriana			30				
Salix boothii			40				
Salix wolfii				30	50		
Salix planifolia							
Pentaphylloides floribunda			3	15	5		
Aster foliaceus			5	2	2		
Agrostis palustris			20				
Taraxacum officionale			5	3	7		
Geum macrophyllum			1	3	1		
Phleum commutatum			5		3		
Climacium dendroides			3				
Drepanocladus			1				
Poa palustris			5				
Calamagrostis canadensis			15				
Salix drummondiana			3				
Betula glandulosa				10	15		
Anaphalis marg				1	3		
Potentilla gracilis				2	2		
Swertia perennis				+	2		
Carex microptera				5			
Galium boreale				3	1		
Fragaria virginiana				2	10		
Trifolium pratense				1	3		

VEGETATION AND SOILS DATA

Community type: % of wetland

7 ~~1~~ Carex simulata – (large spring complex near road jct) 1
8 ~~2~~ Carex simulata – slope spring w/flat @ 10 cm 2
9 ~~3~~ Veronica 3
10 4 Juncus arcticus – Argentina 4
11 5 Carex aqu– Conioselinum 5
6 6

Soil data for each community:

1
2
3
4
5
6

Plant species — Canopy coverage for each species by community

Plant species	4	5	6	7	8	
Hordeum brachyantherum				1		
Caltha leptosepala	5	2				
Petasites sagittata	+					
Rhodiola rhodanthum	1	3				
Conioselinum scopulorum	1	1				
Danthonia intermedia	1	1				
Geum triflorum	5	3				
Carex buxbaumii	30					
Thalictrum alpinum	1	5				
Rorippa palustris	+					
Castilleja sulphurea	+	2				
Gentianopsis thermalis	+					
Valeriana edule	+	+				
Maianthemum		1				
Trifolium repens	1	3				
Ligularia bigelovii		1				
Thalictrum		3				
Antennaria micro		2				
Achillea lanulosa		1				
Poa pratensis		10				
Solidago		3				
Agrostis glauca		+				
Juncus arcticus		5				
Spiranthes romanzoffiana		+				
Bistorta vivipara		+				
B. bistortoides		+				
Campanula parryi		+				
Carex ?			10			
Calamagrostis stricta			2	1		
Rumex aquaticus						
Carex simulata				90	60	

CRESTED BUTTE WETLAND STUDY - 1992
DATA COLLECTED BY: DAVID J. COOPER

WETLAND NUMBER: 1 - continued = p 2. DATE: 7/27

LOCATION:

DESCRIPTION OF WETLAND:

HYDROLOGY:

WETLAND HISTORY:

DISTURBANCE REGIME:

THREATS:

WATER CHEMISTRY:

FUNCTION/VALUE RATINGS AND COMMENTS
ratings: 1=low; 2=medium; 3=high
confidence in ratinga: a=high; b=moderate; c=low

Ground water recharge:

Ground water discharge:

Flood storage:

Shoreline anchoring:

Sediment trapping:

Water quality improvement:

Food chain support:

Habitat: fish:
other wildlife:

Active recreation:

Passive recreation:

COMMENTS:

CRESTED BUTTE WETLAND STUDY - 1992
DATA CDLLECTED BY: DAVID J. COOPER

WETLAND NUMBER: 1 - cont = p3 DATE: 7/27/92

LOCATION:

DESCRIPTION OF WETLAND:

HYDROLOGY:

WETLAND HISTORY:

DISTURBANCE REGIME:

THREATS:

WATER CHEMISTRY:

FUNCTION/VALUE RATINGS AND COMMENTS
ratings: 1=low; 2=medium; 3=high
confidence in ratinga: a=high; b=moderate; c=low

Ground water recharge:

Ground water discharge:

Flood storage:

Shoreline anchoring:

Sediment trapping:

Water quality improvement:

Food chain support:

Habitat: fiah:
other wildlife:

Active recreation:

Pasaive recreation:

COMMENTS:

VEGETATION AND SOILS DATA

Community type:

1
2
3
4
5
6

% of wetland

1
2
3
4
5
6

Soil data for each community:

1
2
3
4
5
6

Plant species	Canopy coverage for each species by community: 8	9	10	11	5	6
	~~1~~ 8	~~2~~ 9	~~3~~ 10	~~4~~ 11	5	6
Viola epipsela	10					
Erigeron lonchophyllus	2					
Caltha	10					
Drepanocladus aduncus	50					
Bryum	20					
Argentina anserina	2		20			
Juncus arcticus	5					
Epilobium lact noturions	+	3		5		
Salix wolfii	2					
Pedicularis groenlandica	5					
Veronica anagallis-aquatica		5				
Glyceria striata		3				
Hyporhatta hyemalis	+					
Hordeum brachyantherum	+					
Hierochloe hirta	+					
Trifolium			3			
Juncus arcticus			70			
Potentilla gracilis			5			
Deschampsia cesp.			5			
Potentilla - palmate, but lfts incised			10			
Phleum			1			
Hordeum brachy			2	3		
Poa pratensis			5			
Stellaria						
Polemonium caeruleum				+		
~~[illegible]~~ Pneumonanthe affinis				+		
Carex aquatilis				90		
Conioselinum				10		
Trifolium			5			

CRESTED BUTTE WETLAND STUDY - 1992
DATA COLLECTED BY: DAVID J. COOPER

WETLAND NUMBER: 2 DATE: 7/27/92

LOCATION: Mc Elroys

DESCRIPTION OF WETLAND: Huge willow complex controlled by beaver

HYDROLOGY:
Mostly slate R water diverted by beavers, but also ground water from slopes

WETLAND HISTORY: Natural - maybe the best wetland complex in the area.

DISTURBANCE REGIME: None seen

THREATS: None known

WATER CHEMISTRY:

FUNCTION/VALUE RATINGS AND COMMENTS
ratings: 1=low; 2=medium; 3=high
confidence in ratinga: a=high; b=moderate; c=low

Ground water recharge: 2A

Ground water discharge: 3A

Flood storage: 3A

Shoreline anchoring: 3A

Sediment trapping: 3A

Water quality improvement: 3A

Food chain support: 3 A

Habitat: fish: 3A
other wildlife: sora at #1, 3A

Active recreation: 2A

Passive recreation: 3 A

COMMENTS: Very high quality

VEGETATION AND SOILS DATA

Community type:
1 Carex utriculata
2 Sal geyeriana - Car utr
3 Mud bank
4 Aquatic - st water
5 Salix geyeriana
6 Eleocharis palustris

CC#14 well = water = +22cm
CC#15=

% of wetland
1
2
3
4
5
6

Soil data for each community:
1
2
3
4
5
6

Plant species — Canopy coverage for each species by community

Plant species	1 (12)	2 (13)	3 (14)	4 (15)	5 (16)	6 (17)
Carex utriculata	90	70			10	
Rumex aquaticus	1					
Carex aquatilis		5				
Salix geyeriana		60			80	
Salix wolfii		5				
Salix planifolia		3				
Eleocharis parvula			80			
Potamogeton pectinatus				10		
Chara				60		
Limosella aquatica			20			
Castilleja sulphurea					1	
Calamagrostis canadensis					30	
Ribes inerme					10	
Polemonium caeruleum					2	
Geum macrophyllum					5	
Mentha arvensis					1	
~~Aster~~ fol.					1	
Conioselinum scopulorum					1	
Fragaria virginiana					15	
Juncus tracyi					+	
Cardamine cordifolia					1	
Carex aurea					+	
Petasites sagittata					1	
Lonicera involucrata					5	
Eleocharis palustris						60
Hippuris vulgaris						2
Swertia perennis					+	5
Climacium dendroides					25	
Bare soil			20	20		

CRESTEO BUTTE WETLAND STUDY - 1992
DATA COLLECTED BY: DAVIO J. COOPER

WETLAND NUMBER: 2, cont = p2 DATE: 7/27/92
LOCATION:
OESCRIPTION OF WETLAND:

HYDROLOGY:

WETLAND HISTORY:

OISTURBANCE REGIME:

THREATS:

WATER CHEMISTRY:

FUNCTION/VALUE RATINGS AND COMMENTS
ratings: 1=low; 2=medium; 3=high
confidence in ratings: a=high; b=moderate; c=low

Ground water recharge:

Ground water discharge:

Flood storage:

Shoreline anchoring:

Sediment trapping:

Water quality improvement:

Food chain support:

Habitat: fish:
other wildlife:

Active recreation:

Passive recreation:

COMMENTS:

VEGETATIDN AND SOILS DATA

Community type: % of wetland

7 ~~1~~ Carex dioica - Aulacomnium palustre 1

8 ~~2~~ Salix wolfii - Carex aquatilis 2

9 ~~3~~ Alopecurus aequalis (flooded mud pool) water 8 cm deep 3

10 ~~4~~ Aquatic water (water 15 cm deep) 4

11 ~~5~~ Potamogeton richardsonii (water >30 cm deep) 5

12 ~~6~~ Salix wolfii - Carex utriculata - well B#17 = 16 6

Soil data for each community:

1
2
3
4
5
6

Plant species	18 / ~~1~~ 7	19 / ~~2~~ 8	20 / ~~3~~ 9	21 / ~~4~~ 10	22 / ~~5~~ 11	23 / ~~6~~ 12
	Canopy coverage for each species by community					
Salix wolfii	30	50				60
Carex dioica	30	1				
Juncus	10					
Aulacomnium palustre	60	15				
Anaphalis margaritacea	25	10				
Aster fol.	2					
Pedicularis groenlandica	5					
Geum macrophyllum	1					
Carex cf aquatilis	15	60				
Betula glandulosa	10					
Erigeron lonchophyllus	1					
Pentaphylloides floribunda		2				2
Castilleja sulphurea		1				
Alopecurus aequalis			25			
Batrachium circinatum				20		
Chara				10		
Potamogeton foliosus				40	10	
Potamogeton richardsonii					50	
Carex utriculata						70
Other species seen						
Luzula parviflora						
~~[illegible]~~ Carex disperma						
Poa leptocoma						
Veronica nutans						
Carex capillaris						

CRESTED BUTTE WETLAND STUDY - 1992
DATA COLLECTED BY: DAVID J. COOPER

WETLAND NUMBER: 2, cont - page 3 DATE: 7/27/92
LOCATION:
DESCRIPTION OF WETLAND:

HYDROLOGY:

WETLAND HISTORY:

DISTURBANCE REGIME:

THREATS:

WATER CHEMISTRY:

FUNCTION/VALUE RATINGS AND COMMENTS
ratings: 1=low; 2=medium; 3=high
confidence in ratings: a=high; b=moderate; c=low

Ground water recharge:

Ground water discharge:

Flood storage:

Shoreline anchoring:

Sediment trapping:

Water quality improvement:

Food chain support:

Habitat: fish:
other wildlife:

Active recreation:

Passive recreation:

COMMENTS:

VEGETATION AND SOILS DATA

Community type:
13 Carex microptera - filled beaver pond.
2
3
4
5
6

% of wetland
1
2
3
4
5
6

Soil data for each community:
1
2
3
4
5
6

Plant species	Canopy coverage for each species by community 24 13	2	3	4	5	6
Carex microptera	40					
Deschampsia cespitosa	15					
Achillea lanulosa	10					
Agrostis ~~palustris~~ scabra	5					
Poa pratensis	5					
Taraxacum	10					
Prunella	5					
Carex aquatilis	10					

CRESTED BUTTE WETLAND STUDY - 1992
DATA COLLECTED BY: DAVID J. COOPER

WETLAND NUMBER: CB-3 DATE: 7/28/92

LOCATION: McElroy - Between Peanut mill + W boundary, Bet. Slate River and road

DESCRIPTION OF WETLAND:
Along Slate River. A complex of communities caused by flood and beaver eat-out patterns and beaver flooding.

HYDROLOGY: stream connection and small springs from South

WETLAND HISTORY: Natural, some changes due to road construction

DISTURBANCE REGIME: Grazing.

THREATS:

WATER CHEMISTRY:

FUNCTION/VALUE RATINGS AND COMMENTS
ratings: 1=low; 2=medium; 3=high
confidence in ratings: a=high; b=moderate; c=low

Ground water recharge: 2A

Ground water discharge: 3A

Flood storage: 3A

Shoreline anchoring: 3A

Sediment trapping: 3A

Water quality improvement: 2-3B

Food chain support: 3A

Habitat: fish: 3A
other wildlife: 3A

Active recreation: 2B

Passive recreation: 2A

COMMENTS:

VEGETATION AND SOILS DATA

Community type: — % of wetland

1 Salix - Carex utriculata (on stream floodplain) — 1 30
2 Picea - Calamagrostis canadensis — 2 10
3 Salix - Calamagrostis canadensis — 3 30
4 Pentaphylloides floribunda — 4 10
5 Salix planifolia - Calamagrostis canadensis — 5 10
6 Salix planifolia - Carex aquatilis — 6 10

Soil data for each community:
1 gravel soil, flooded in early summer for many weeks
2 gravels on floodplain, just at upper flood level
3
4 Soil just below A = at 6" = 10YR 3/1 color w/ox root channels
5
6

Plant species	1 (25)	2 (26)	3 (27)	4 (28)	5 (29)	6 (30)	
Salix monticola	40		20	1	←	Phleum	com
S. geyeriana	30		20	2	←	Potentilla	grac
S. planifolia	20			7	10	Poa	pratensis
S drummondiana	5		30	5	←	Achillea	lanulo
				2	←	Rhodiola	rhodantha
Carex utriculata	70		5	2	←	Valeriana	edu
Carex aquatilis	30	5	5	3	←	Carex	microp
Calamagrostis canadensis		60	80	5	30	Antennaria	microphy
Picea engelmannii		30		1	1 ←	Geum	macroph
Pinus contorta		20		1	←	Agrostis	scabra
Cardamine cordifolia		5		+	←	Juncus	confusus
Equisetum arvense		20			10	Sidalcea	
Galium trifidum		1			+	Poa	~~pal~~
Angelica pinnata		1				60	Carex aquatilis
Lonicera involucrata		1				40	Salix planifolia
Luzula parviflora		+					
Abies lasiocarpa		10					
Ribes lacustre		5					
Pentaphylloides floribunda				80			
Conioselinum scopulorum				7	5		
Veratrum				5	1		
Deschampsia cespitosa				15			
Psychrophila leptosepala				10	40	40	
Aconitum columbianum				2			
Galium boreale				3			
Fragaria virginiana				25			
Bryum pseudotriquetrum				10	30		
Danthonia intermedia				1			
Petasites ~~[illegible]~~ sagittata				–			
Drepanocladus uncinatus				–			
Chamerion latifolium - on floodpl soils				–			

CRESTED BUTTE WETLAND STUDY - 1992
DATA COLLECTED BY: DAVID J. COOPER

WETLAND NUMBER: CB- 4 DATE: 7/28/92
LOCATION: N of mine, S of Slate R - W of Peanut L. on Wild Bird
DESCRIPTION OF WETLAND:
Marshes in bedrock

HYDROLOGY: Ground water + surface water from springs. The area is confined by bedrock + moraines

WETLAND HISTORY: Natural

DISTURBANCE REGIME: Grazing

THREATS:

WATER CHEMISTRY:

FUNCTION/VALUE RATINGS AND COMMENTS
ratings: 1=low; 2=medium; 3=high
confidence in ratings: a=high; b=moderate; c=low

Ground water recharge: 2 B

Ground water discharge: 2 B

Flood storage: 3 A

Shoreline anchoring: 2 B

Sediment trapping: 3 A

Water quality improvement: 2 A

Food chain support: 2 B

Habitat: fish: 2 B
other wildlife: 3 A

Active recreation: 2 B

Passive recreation: 2 A

COMMENTS:

VEGETATION AND SOILS DATA

Community type: % of wetland

1 Eleocharis palustris — Hippuris vulgaris (25cm stw) (up to 20cm stw) 1 10

2 Carex utriculata 2 15

3 Pond Margin 3 5

4 Carex buxbaumii edge of Car utr. 4 5

5 Salix planifolia 5 15

6 6

Soil data for each community:

1

2

3

4

5

6

Ele Car utr Car utr Ele Salg. Carex b Pen flor

Plant species	1 (31)	2 (32)	3 (33)	4 (34)	5 (35)	6
Eleocharis palustris	80	1				
Hippuris vulgaris	15					
Carex utriculata		80			40	
Potamogeton 2 lf types	10	10				
Utricularia		1				
Persicaria amphibia	+				5	
Pentaphylloides floribunda					5	
Juncus longistylus			7	5		
Agrostis scabra			5	5		
Eleocharis			25			
Carex microptera			10			
Galium trifidum			5		1	
Epilobium lactiflorum			1			
Taraxacum officinale			5			
Achillea lanulosa			3			
Hierochloe hirta			2			
Geum macrophyllum			5		3	
Spiranthes romanzoffiana			1			
Glyceria striata			1			
Deschampsia cespitosa				10		
Carex lanuginosa				15		
Pedicularis groenlandica				1		
Carex buxbaumii				50		
Danthonia intermedia				2		
Antennaria microphylla				5		
Salix planifolia					80	
Conioselinum scopulorum					5	
Salix wolfii					10	
Betula glandulosa					2	

CB-4, page 2

VEGETATION AND SOILS DATA

Community type:
6 Salix geyeriana - Calamagrostis
7 Pentaphylloides -
3 Carex utriculata
4
5
6

% of wetland
1 10
2 10
3 50
4
5
6

Soil data for each community:
1
2
3
4
5
6

Plant species	36 (6)	37 (7)	38 (8)	4	5	6
Salix geyeriana	60					
Lonicera involucrata	5					
Calamagrostis canadensis	50					
Pentaphylloides floribunda	5	20				
Betula glandulosa	2	1				
Thalictrum	1					
Geum macrophyllum	3	5				
Fragaria virginiana	10	20				
Danthonia intermedia		10				
Deschampsia cespitosa		10				
Antennaria microphylla		15				
Potentilla gracilis		5				
Poa pratensis		5				
Epilobium lactiflorum		+				
Taraxacum officionale		5				
Carex microptera		10				
Geum triflorum		2				
Thalictrum		1				
Castilleja sulphurea		+				
Carex utriculata			95			

CRESTED BUTTE WETLAND STUDY - 1992
DATA COLLECTED BY: DAVID J. COOPER

WETLAND NUMBER: 5 DATE: 7/28/92

LOCATION: Peanut Lake area

DESCRIPTION OF WETLAND:
Lake and surrounding springs - I only had access to SW and S portion of lake

HYDROLOGY:
spring + mine drainage fed

WETLAND HISTORY: Natural Lake

DISTURBANCE REGIME: metal Loading

THREATS:

WATER CHEMISTRY:

FUNCTION/VALUE RATINGS AND COMMENTS
ratings: 1=low; 2=medium; 3=high
confidence in ratings: a=high; b=moderate; c=low

Ground water recharge: 2A

Ground water discharge: 2A

Flood storage: 2A

Shoreline anchoring: 2A

Sediment trapping: 3 A

Water quality improvement: ~~1~~ 2c

Food chain support: 3 A - B

Habitat: fish: 2A
other wildlife: 3A

Active recreation: 2A

Passive recreation: 3A

COMMENTS:

VEGETATION AND SOILS DATA

Community type: % of wetland

1 Carex utriculata (<cm stw; but up to 30cm stw) 1 10
2 Eleocharis palustris (water >30cm) 2 5
3 Salix geyeriana – Ribes lacustre 3 5
4 Deschampsia cespitosa – Hordeum brachyantherum 4 3
5 Deschampsia cespitosa (in minor drainage – from mill channel) 5
6 Springs at lake edge 6 1

Soil data for each community:
1
2
3
4
5
6

Plant species	Canopy coverage for each species by community 39 1	40 2	41 3	42 4	43 5	44 6
Carex utriculata	90					
Rumex aquaticus	1					
Carex aquatilis	5				10	
Eleocharis palustris		60				
Potamogeton gram		2				
Ribes lacustre			25			
Salix geyeriana			70			
S. monticola			15			
Poa pratensis			5			
Calamagrostis canadensis			15			
Sidalcea candida			5			
Epilobium angustifolium			5			
Aconitum columbianum			1			
Lonicera involucrata			5			
Geum macrophyllum			10			
Agropyron trachycaulon			5			
Pentaphylloides floribunda			5			
Hordeum brachyantherum				15		
Aster fol.				5		
Deschampsia cespitosa				60	80	
Carex microptera				3		
Bryum pseudotriquetrum				40		
Salix planifolia						
S. wolfii						
Psychrophila leptosepala						
Rorippa						
Epilobium						62
Glyceria striata						15
Veronica americana						10
Galium trifidum						5

CB-5
page 2

VEGETATION AND SOILS DATA

Community type:
1 Myriophyllum (water to 3½ deep) > — cm
2 Salix wolfii - rich spring
3 Mimulus - Epilobium - spring
4
5
6

% of wetland
1 60
2 10
3 5
4
5
6

Soil data for each community:
1 st water!!
2 Spring area, sat to surf,
3 kills & sat perm + ? disturbed
4
5
6

Plant species — Canopy coverage for each species by community

Plant species	45 (1)	46 (2)	47 (3)	4	5	6
Myriophyllum spicatum	70					
Potamogeton cf praelongum	25					
Potamogeton cf pusillus	20					
Salix wolfii		50				
S. planifolia		40				
Carex atriculata		~~20~~ 5				
Psychrophila leptosepala		30				
Aconitum columbianum		3				
Sidalcea candida		10				
Oncoselenium scopulorum		15				
Geum macrophyllum		5				
Rumex		1				
Carex microptera		5				
Veratrum tenuipetalum		2				
Poa pratensis		10				
Calamagrostis		10				
Herb-1		2				
Epilobium lactiflorum			30			
Mimulus			15			
Juncus tracyi			10			
Glyceria striata			10			
Bacopa			3			
Veronica americana			10			
Poa reflexa			2			
Alopecurus aequalis			2			

CRESTED BUTTE WETLAND STUDY - 1992
DATA COLLECTED BY: DAVID J. COOPER

WETLAND NUMBER: CB-6 DATE: 7/28/92

LOCATION: Micky Coopers

DESCRIPTION OF WETLAND: Springs, slate R. banks, sloughs.

HYDROLOGY: Groundwater flow from E to W toward slate R.

WETLAND HISTORY: Natural spring + stream

DISTURBANCE REGIME: Heavy past grazing has denuded stream bank which is sloughing badly into river.

THREATS:

WATER CHEMISTRY:

FUNCTION/VALUE RATINGS AND COMMENTS
ratings: 1=low; 2=medium; 3=high
confidence in ratings: e=high; b=moderate; c=low

Ground water recharge: 3A

Ground water discharge: 3A

Flood storege: 3A

Shoreline anchoring: 2B - could be restored

Sediment trapping: 3A

Weter quality improvement: 3A

Food chain eupport: 3A

Habitat: fish: 3B
other wildlife: 3B

Active recreation: 2B

Paseive recreation: 3A

COMMENTS:

VEGETATION AND SOILS DATA

Community type: Salix wolfii
1 wt CB #20 = Salix wolfii
2 Salix wolfii — Carex aqu
3 Pentaphylloides floribunda 52½ cm to wt today
~~10~~ Pentaphylloides floribunda — lower edge = 25 cm to wt today

% of wetland
1 10
2 10
3 20
10 10

Soil data for each community:
1 wt info from CB #20 = sat to surf for many weeks
2 Sat to surface today
3 wt = CB #19 — soil at 20 cm = 10YR 3/1, no mottles, or ox root ch.

Plant species	1 (48)	2 (49)	3 (50)	10 (51)		
Salix wolfii	60	40	5	5	← Antennaria microphylla	
Carex aquatilis	–	60	–	1	← Circium coloradense	
Juncus arcticus	5	2	5			
Phleum	5		5			
Poa pratensis	10		20	20		
Achillea lanulosa	3	3	5	5		
Pentaphylloides floribunda	10		40	50		
Carex microptera	15	5	2	5		
Prunella	5		–			
Taraxacum	2		10	20		
Castilleja sulphurea	1	1	1			
Fragaria virginiana	2		10	10		
Rumex	+		2			
Swertia perennis	1		–			
Deschampsia cespitosa	1	1	1	1		
Valeriana edulis	+		–	2		
Juncus	1		–			
Psychrophila leptosepala	/	15	–			
Salix planifolia		20	–			
Drepanocladus aduncus		30	–			
Pedicularis groenlandica		2	–			
Luzula multi...		1	–			
Campylium stellatum		20	–			
Bistorta vivipara		2	2			
Carex aurea		1	–			
Philonotis fontana		5	–			
Potentilla gracilis			7	5		
Geum triflorum			5	2		
Artemisia cana			3	1		
Galium boreale			2			
Conioselinum scopulorum				5		

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VEGETATION AND SOILS DATA

Community type:
4 Carex ut. - Carex
5 Deschampsia cespitosa - Carex microptera
6 Calliergon
7 Carex utric at #26
8 Artemisia cana -
11 Carex aquatilis

% of wetland
4 = 20
5 = 5
6 = 5
7 = 10
8 = 5
11 = 5

Soil data for each community:
4 5cm st water today
5 —
6 — water 28cm deep today
7 ↗ 20cm " "
8 WT - 74 - 117 cm below soil today
11 WT at soil surface

Canopy coverage for each species by community

Plant species	50 (3)	52 (4)	53 (5)	54 (6)	55 (7)	56 (8)	57 (11)
Aster fol.	1						
Solidago spathulata	+					5	
Danthonia intermedia	1						
Carex utriculata		90			95		
Carex same as CB#1 w/ Car utr		10					
Rumex aquaticus		1					
Agrostis palustris		+					
Deschampsia cespitosa		1	60				
Galium trifidum		2					5
Carex aquatilis		5					90
Potentilla			3				
Phleum			5				
Taraxacum			10			10	
Hordeum brachyantherum			10				1
Carex microptera			40				
Argentina anserina			5				1
Carex festivella			2				
Poa pratensis			5			20	
Bistorta bistortoides			1				
Pentaphylloides						[illegible]0	
Calliergon				100			
Eleocharis palustris				1			
Artemisia cana						70	
Linum lewisii						2	
Campanula parryi						1	
Achillea lanulosa						5	
Potentilla gracilis						3	
Vicia americana						1	
[illegible]						2	
Calamagrostis stricta							1
Moss							40

CRESTED BUTTE WETLAND STUDY - 1992
DATA CDLLECTED BY: DAVID J. COOPER

WETLAND NUMBER: CB-7 DATE: 7/29/92
LOCATION: Mill Br. Est - Nord
DESCRIPTION DF WETLAND:
Banks along Slate River

HYDRDLOGY: connection to Slate R. in main area. But the floodplain is degrading vertically and horizontally, thus lowering

WETLAND HISTORY: Natural, but impacted by downstream efforts to dewater Slate Valley.

DISTURBANCE REGIME: Grazing

THREATS: stream downcutting and lateral migration

WATER CHEMISTRY:

FUNCTION/VALUE RATINGS AND COMMENTS
retings: 1=low; 2=medium; 3=high
confidence in retings: a=high; b=moderate; c=low

Ground weter recharge: 2 B

Ground weter discharge: 2 B

Flood storage: 3 B

Shoreline anchoring: 2 B

Sediment trepping: 2 B

Water quality improvement: 2 B

Food chain support: 2 A

Habitat: fish: 2 A
other wildlife: 3 A

Active recreetion: 2 A

Pessive recreetion: 2 A

COMMENTS: The area along Slate R. is degrading rapidly. Willows should be planted on the banks to > stability, but it may not work due to downstream changes

VEGETATION AND SOILS DATA

Community type: — % of wetland

1 Salix geyeriana — Calamagrostis = CB#11 = 85cm today — 1
2 Deschampsia — gravel bar on Slater. — 2
3 Salix monticola — Calamagrostis canadensis — 3
4 Pentaphylloides floribunda — — 4
5 — 5
6 — 6

Soil data for each community:

1 –
2 capillary water at surface row, and
3
4
5
6

Plant species — Canopy coverage for each species by community

	1 (58)	2 (59)	3 (60)	4 (61)	5 (62)	6
Salix geyeriana	70		10	—	—	
Salix wolfii	15			5	40	
Lonicera involucrata	1			—	—	
Pentaphylloides floribunda	5		3	50		
Salix monticola		15		—		
Juncus longistylus		+		—		
Deschampsia cespitosa		30		10		
Calamagrostis canadensis	40		30	—		
Poa pratensis	15	3	—	30		
Fragaria virginiana	15		20	7		
Geum macrophyllum	10		5	—	7	
Taraxacum officinale	10	3	7	10		
Achillea lanulosa	5		5	3		
Ligularia bigelowii	1			—		
Thalictrum	10			1		
Polemonium caeruleum	+			—	2	
Aster foliaceous	+	1		+		
Cardamine cordifolia	1			—		
Conioselenium scopulorum	1			—		
Bromopsis lanatipes	1	+		—		
Prunella		7		—		
Glyceria striata		1		—		
Agrostis scabra		1		1		
Cerastium arvense		1		—		
Plantago major		1		—		
~~Pratensis~~ Galium boreale	—	~~2~~	—	1		
Trifolium repens		3		—		
Agrostis palustris		2		—		
Phleum pratense		1		—		
Conioselenium scopulorum				—		
BG	5	60	10	15		

D7-p2

VEGETATION AND SOILS DATA

Community type:
1
2
3
4
5
6

% of wetland
1
2
3
4
5
6

Soil data for each community:
1
2
3
4
5
6

Plant species	Canopy coverage for each species by community 60 3	61 4	62 5	4	5	6
	—	—	—			
Salix monticola	70	—	—			
Agropyron trachycaulon	2	1	—			
Salix drummondiana	5	—	—			
Pinus contorta	5	—	—			
Picea engelmannii	1	—	—			
Potentilla flabelliformis	1	—	—			
Danthonia intermedia	[illegible]	7	—			
Agoseris glauca	[illegible]	1	—			
Psychrophila leptosepala	—	3	30			
Campanula parryi	—	7	—			
Solidago spathulata	—	5	—			
Carex ~~[illegible]~~ utriculata	—	—	~~[illegible]~~ 30			
Salix planifolia	—	—	50			
Betula glandulosa	—	—	3			
Galium trifidum	—	—	3			

CRESTED BUTTE WETLAND STUDY - 1992
DATA COLLECTED BY: DAVID J. COOPER

WETLAND NUMBER: CB-8 DATE: 7/29/92
LOCATION: ~~RB~~ River Bend area
DESCRIPTION OF WETLAND:
Groundwater fed ~~[illegible]~~ wet meadow

HYDROLOGY: Water moves in alluvial fan of creek and exits at base of fan creating extensive wetlands

WETLAND HISTORY: Natural

DISTURBANCE REGIME: Houses built around

THREATS: Continued filling

WATER CHEMISTRY:

FUNCTION/VALUE RATINGS AND COMMENTS
ratinge: 1=low; 2=medium; 3=high
confidence in ratinge: a=high; b=moderate; c=low

Ground water recharge: 1-2B

Ground water diecharge: 3A

Flood storage: 2B

Shoreline anchoring: 2B

Sediment trapping: 2B

Water quality improvement: 3A

Food chain eupport: 2B

Habitat: fish: 1-2B
other wildlife: 2A

Active recreation: 1-2B

Passive recreation: 2A

COMMENTS:

VEGETATION AND SOILS DATA

Community type:
1 Carex aquatilis — Psychrophila   Wt today = 20cm
2 Carex utriculata
3 Poa pratensis — use = LB26 to get water levels in June
4
5
6

% of wetland
1
2
3
4
5
6

Soil data for each community:
1 peat >40 cm thick
2 wt at soil surf = peat
3 wt at [illegible] in today / soil is 10YR3/1 at top, grades to 10YR4/1 at 30cm
4
5
6

Plant species — **Canopy coverage for each species by community**

Plant species	1 (63)	2 (64)	3 (65)	4	5	6
Carex utriculata	30	40	–			
Deschampsia cespitosa	5		5			
Carex microptera	5		20			
Carex aquatilis	50	5	–			
Psychrophila leptosepala	40	5	5			
Bistorta bistortoides	7		1			
Limnorchis hyperborea	1		–			
Poa palustris	+		–			
Rumex aquaticus		5	–			
Rorippa / Thelypodium		+	–			
Cuthocallis chamisoi		1	–			
Senecio crocatus	1		1			
Taraxacum officinale			15			
Castilleja sulphurea			3			
Poa pratensis			50			
Juncus arcticus			25			
Agoseris glauca			2			
Campanula parryi			1			
Potentilla			2			
Trifolium			2			
Phleum			1			
Aster foliaceous			1			
Achillea lanulosa			5			
Gentianopsis affinis			1			

CRESTED BUTTE WETLAND STUDY - 1992
DATA COLLECTED BY: DAVID J. COOPER

WETLAND NUMBER: CB-9 DATE: 7/29/92

LOCATION: Irwin area

DESCRIPTION OF WETLAND: complex of intermittent brooks + creeks, valley bottom wetlands

HYDROLOGY: ground water + snowmelt recharge

WETLAND HISTORY: Natural snow-melt channels and slopes

DISTURBANCE REGIME: flooding + sediment deposition

THREATS:

WATER CHEMISTRY:

FUNCTION/VALUE RATINGS AND COMMENTS
ratings: 1=low; 2=medium; 3=high
confidence in ratings: a=high; b=moderate; c=low

Ground water recharge: 2 B

Ground water discharge: 2 B

Flood storage: 1 B

Shoreline anchoring: 2 A

Sediment trapping: 3 A

Water quality improvement: 2-3 B

Food chain support: 1 B

Habitat: fish: 1 A
other wildlife: 3 A

Active recreation: 1 A

Passive recreation: 3 A

COMMENTS:

VEGETATION AND SOILS DATA

Community type:
1 Corydalis caseana - Delphinium (meadow)
2 Senecio triangularis (brook)
3 same as 1
4 Same as 1
5 Psychrophila
6 same as 1

% of wetland
1
2
3
4
5
6

Soil data for each community:
1 10YR 5/2 at 10" w/ ox root ch, mottles (orange) + can squeeze out water
2 along brook - sat. to near surface
3 same as 1
4
5 ~~???~~ brook - sat to surface
6 same as 1

Plant species	1 (66)	2 (67)	3 (68)	4 (69)	5 (70)	6 (71)
Corydalis caseana	60		50	50		60
Delphinium barbeyi	~~30~~		25	20		30
~~T...~~ Poa leptocoma	+	5	2	1		1
Mertensia ciliata	20	30	30	50		50
Heracleum sph.	25	10	30	20		30
Senecio serra	~~5~~	5	2	10		
~~Ag~~ Agropyron trachycaulon	1		5			
Senecio triangularis	–	70				
Angelica	–	–				
Aconitum columbianum	–	15				
Cardamine cordifolia		~~4~~0				
Veratrum						1
Oxypolis fendleri					10	
Psychrophila leptosepala					80	
Saxifraga odontoloma					5	
Veronica nutans					1	

CRESTED BUTTE WETLAND STUDY - 1992
DATA CDLLECTED BY: DAVID J. COOPER

WETLAND NUMBER: CB-10 DATE: 7/29/92

LOCATION: Valley Bottom at turnoff to Irwin

DESCRIPTIDN OF WETLAND:
Valley bottom willow stands and meadows

HYDROLOGY: Ground water fed in summer but flooded with snowmelt water in spring

WETLAND HISTORY: Natural

DISTURBANCE REGIME:

THREATS:

WATER CHEMISTRY:

FUNCTION/VALUE RATINGS AND COMMENTS
ratings: 1=low; 2=medium; 3=high
confidence in ratings: a=high; b=moderate; c=low

Ground water recharge: 3A

Ground water discharge: 2A

Flood storage: 2-3A

Shoreline anchoring: 3A

Sediment trapping: 3A

Water quality improvement: 3A

Food chain support: 2A

Habitat: fish: 1A
other wildlife: 3A

Active recreation: 2B

Passive recreation: 3A

COMMENTS:

VEGETATION AND SOILS DATA

Community type:
1 Salix planifolia – Psychrophila leptosepala
2 Carex aquatilis – "
3 Calamagrostis canadensis –
4 Carex psychrophila
5 Carex aquatilis – Philonotis (rills) in (+)
6 Erigeron peregrinus

% of wetland
1
2
3
4
5
6

Soil data for each community:
1 Silty – 3 cm Organic layer then 10YR 4/1 to surf w/ ~~ox~~ root ch + rocks
2 sat to surface
3 Saturated to surface
4 Peat + sat to surface
5 Sat to surf
6 Seep on forest edge Bet Spruce + salix / Soil 10YR 4/1 to surf – no mottles

Plant species	1 (72)	2 73	3 74	4 75	5 76	6 77	78
Salix planifolia	90					ø	12
Salix ... lifolia							10
Calamagrostis canadensis			100				30
Psychrophila leptosepala	30	40	5	.30	10	30	20
Mertensia ciliata	20						
Senecio triangularis	10						10
Achillea lanulosa	3					5	
Valeriana edule	1						
Poa reflexa	2					2	
Conioselinum scopulorum	10						
Aconitum columbianum	2						5
Fragaria virginiana	3						
Veronica nutans	1						
Carex aquatilis		90	10	20	60		
Bistorta bistortoides		2					
Rhodiola rhodanthum			5	20			
Epilobium lactiflorum			1	3	7		
Deschampsia cespitosa				5	5	3	
Carex cf Jonesii?				60			
Pedicularis groenlandica				15	7		
Philonotis fontana				50	80		
Gentianopsis algida				+			
Luzula multi						1	
Erigeron peregrinus						25	
Arnica mollis						15	
Agropyron trachycaulon						5	
Senecio						2	
Saxifraga oregana						1	
Plantago tweedyi						1	
Equisetum arvense							3

CB-10 page 2

VEGETATION AND SOILS DATA

Community type:
1
2
3
4
5
6

% of wetland
1
2
3
4
5
6

Soil data for each community:
1
2
3
4
5
6

78

Plant species	Canopy coverage for each species by community					
cont →	127	2	3	4	5	6
epilobium ang.	2					
Bistorta bistortoides	1					
epilobium lactiflorum	1					

CRESTED BUTTE WETLAND STUDY - 1992
DATA COLLECTED BY: DAVID J. COOPER

WETLAND NUMBER: CB-11 DATE: 7/29/92

LOCATION: E side of Road to Ski area - near Washington Gulch

DESCRIPTION OF WETLAND:
meadows + Washington Gulch - A huge + diverse wetland complex with an abundance of native + introd. pasture species

HYDROLOGY:
Ground water from west erupts here, also irrigation ditch on high pt + ridge creates "seeb"

WETLAND HISTORY: Some natural and some created by agricultural irrigation.

DISTURBANCE REGIME:
Haying.

THREATS: may be developed?

WATER CHEMISTRY:

FUNCTION/VALUE RATINGS AND COMMENTS
ratings: 1=low; 2=medium; 3=high
confidence in ratings: a=high; b=moderate; c=low

Ground water recharge: 2A

Ground water discharge: 1-2B

Flood storage: 2 B

Shoreline anchoring: 2 B

Sediment trapping: 3A

Water quality improvement: 2 A

Food chain support: 2B

Habitat: fish: 1-2 B
other wildlife: 2A

Active recreation: 1A

Passive recreation: 1-2A

COMMENTS:

VEGETATION AND SOILS DATA

Community type:
1 Juncus arcticus
2 Salix monticola- Calamagrostis canadensis
3 Carex utriculata
4 Juncus arcticus
5
6

% of wetland
1
2
3
4
5
6

U

Soil data for each community:
1 saturated to surface / soil black 10 YR 3/1 to surface
2 sat to surf
3 2 cm st water
4 sat to surface
5
6

Plant species	1 (79)	2 (80)	3 (81)	4 (82)	5	6
Juncus arcticus	40			30		
Poa pratensis	20					
Juncus longistylus	10			15		
Hypericum formosum	10			–		
Carex microptera	5					
Phleum pratense	7			30		
Cirsium arvense	3					
Geum macrophyllum	2					
Conioselenium scopulorum	5	2				
Carex lanuginosa	1					
Carex praegracilis	3					
Hordeum brachyantherum	5					
Deschampsia cespitosa	1					
Kobresia [illegible]	2					
Salix monticola	–	70				
Calamagrostis canadensis	–	60				
Heracleum	–	30				
Aconitum columbianum	–	2				
Lonicera involucrata	–	1				
Carex utriculata			90			
Glyceria striata			1			
Rumex aquaticus			3			
Carex aquatilis			10			
Pedicularis groenlandica				7		
Limnorchis hyperborea				5		
Psychrophila leptosepala				10		
Cerastium arvense				5		
Trifolium pratense				7		
Drepanocladus aduncus				70		
Agrostis palustris				5		

~~Alopecurus~~

VEGETATION AND SOILS DATA

Community type:

5 ~~Phleum pratense~~ Calamagrostis canadensis
6 Juncus arcticus (typical)
7 Eleocharis palustris
8 Carex nebraskensis
9 Carex aquatilis – meadow
10 Juncus longistylis – spring slope

% of wetland
1
2
3
4
5
6

Soil data for each community:

5 flooded
6 flooded
7 flooded
8 in flowing water
9 saturated to surface
10 sat to surface

Plant species	82 (4)	83 (5)	84 (6)	85 (7)	86 (8)	87 (9)	88 (10)
Trifolium repens	10						
T. hybridum	5		5			2	2
Taraxacum officinale	7						5
Equisetum arvense	2		1			2	
Phleum pratense		70				20	10
Calamagrostis canadensis		30					
Mentha arvense		1	1				
Epilobium lactiflorum		1					
Alopecurus pratensis		15	5	1			
Juncus arcticus			90	1	2		
Eleocharis palustris				95			
Carex nebraskensis					60		
Triglochin palustre						2	
Spiranthes romanzoffiana							
Carex aquatilis						60	
Pedicularis groenl.						3	2
Trifolium pratense						2	2
Carex microptera						2	40
Gentianopsis thermalis						5	
Hypericum formosum						1	
Agrostis palustris						7	
Juncus longistylus						5	50
Bistorta vivipara							5
Carex angustior							2
Limnorchis hyperborea							2
Glyceria striata							2
Rorippa palustris							1
Cerastium arvense							3
Deschampsia							1
Carex aurea							
Eleocharis							

Canopy coverage for each species by community c B-11, p 3

VEGETATIDN AND SOILS DATA

Community type:
1) Eleocharis
2
3
4
5
6

% of wetland
1
2
3
4
5
6

Soil data for each community:
1) sat - spring slope
2
3
4
5
6

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Plant species	Canopy coverage for each species by community 1)	2	3	4	5	6
Eleocharis	60					
Triglochin palustre	15					
Juncus longistylus	5					
~~???~~ Juncus triceps	5					
Deschampsia cespitosa	2					
Carex angustior	1					
Pedicularis groenlandica	2					
Drepanocladus aduncus	70					
Carex nebraskensis	5					

CRESTED BUTTE WETLAND STUDY - 1992
DATA COLLECTED BY: DAVIO J. COOPER

WETLAND NUMBER: CB-12 DATE: 7/30/92
LOCATION: S side Slate R, W of CB, E of Mine
DESCRIPTION OF WETLAND:
Large spring-fed fen + carr, some connection to the river

HYDROLOGY:
Ground water flow from S + W.

WETLAND HISTORY:

DISTURBANCE REGIME: Grazing by horses, otherwise appears undisturbed

THREATS: Downcutting on Slate R.

WATER CHEMISTRY:

FUNCTION/VALUE RATINGS AND COMMENTS
ratings: 1=low; 2=medium; 3=high
confidence in ratings: a=high; b=moderate; c=low

Ground water recharge: 3A

Ground water discharge: 3A

Flood storage: 2-3A

Shoreline anchoring: 2A, but could be 3A

Sediment trapping: 3A

Water quality improvement: 3 A

Food chain support: 2A

Habitat: fish: 2A-B
other wildlife: 3A

Active recreation: 2B

Passive recreation: 3A

COMMENTS:

VEGETATION AND SOILS DATA

Community type:

1 Carex utriculata
2 Salix geyeriana - Poa pratensis (was Sg - Caragu?)
3 Deschampsia - gravel (Ba)
4
5
6

% of wetland

1
2
3
4
5
6

Soil data for each community:

1 Flooded no data, well CB-1 soil 10YR 4/1 to top - no mottles
2 Sg CB-7 well / Soil, 10YR 2/1 to top
3 Gravel - cap fringe reach to soil surface
4
5
6

Plant species — Canopy coverage for each species by community

Plant species	1 (90)	2 (91)	3 (92)	4	5	6
Carex utriculata	100					
Geum macrophyllum	1					
Salix geyeriana		60	1			
Salix planifolia		20				
Salix monticola		10	2			
Calamagrostis canadensis		5				
Poa pratensis		50	2			
Taraxacum officinale		40				
Hordeum brachyantherum		5				
Stellaria longipes		1				
Argentina anserina		1	5			
Agrostis palustris		1	1			
Aster foliaceus		2	2			
Meli		3				
Trifol hybridum		5				
Carex aquatilis		5	1			
Polemonium caeruleum		1				
Phleum pratensis		2				
Trifolium repens		5				
Deschampsia cespitosa			25			
Prunella			5			
Glyceria striata			5			
Juncus longistylus			2			
Agrostis scabra			3			
Carex microptera			1			
Veronica americana			1			
Bromopsis lanatipes		5				
Fragaria virginiana		5				

VEGETATION AND SOILS DATA

Community type: % of wetland

4 Salix wolfii - Carex aquatilis (See well CB-9) 1
5 same ↑ 2
6 Carex aquatilis - 3
7 Salix geyeriana - Calamagrostis canadensis (WT ≅ 60cm - re CB#35) 4
8 Salix planifolia - Carex utriculata WT=16cm below ground re: CB#34 5
6 6

Soil data for each community:

4 Organic = peat
5 peat
6 gley + peat in small slough
7 Black + organic
8
9

Plant species	93 4	94 5	95 6	96 7	97 8	9
Salix wolfii	95	80				
Carex aquatilis	40	30	90		20	
Fragaria virginiana	5	15				
Taraxacum	5	—				
Aulacomnium palustre	60	80				
Conioselinum scopulorum	3	10				
Pedicularis groenlandica	1	—				
Geum macrophyllum		5				
Salix planifolia		30			70	
Bryum pseudotriquetrum		~~[illegible]~~	10			
Calamagrostis canadensis				50		
Epilobium angustifolium				1		
Achillea lanulosa				2		
Salix geyeriana				80		
Lonicera involucrata				2		
Pentaphylloides floribunda				3		
Carex utriculata					50	

~~CB 11~~ 2

CRESTED BUTTE WETLAND STUDY - 1992
DATA COLLECTED BY: DAVID J. COOPER

WETLAND NUMBER: CB-13 DATE: 7/30/92
LOCATION: Coal cr. upstream from slate R + S side slate R
DESCRIPTION OF WETLAND:
willow carr complex + river banks.

HYDROLOGY: Groundwater flow from S+W, Beaver dams

WETLAND HISTORY: Natural, but beavers seem absent + land derelict,

DISTURBANCE REGIME:

THREATS:

WATER CHEMISTRY:

FUNCTION/VALUE RATINGS AND COMMENTS
ratings: 1=low; 2=medium; 3=high
confidence in ratings: a=high; b=moderate; c=low

Ground water recharge: 3A

Ground water discharge: 3A

Flood storage: 3A

Shoreline anchoring: 2-3A, stream downcut

Sediment trapping: 2-3A (in beaver ponds)

Water quality improvement: ? 2-3B

Food chain support: 3A

Habitat: fish: 2A
other wildlife: 2A

Active recreation: fishing? - 2-3A

Passive recreation: 2-3 A-B

COMMENTS:
This area has many natural and wet characteristics. There are also aspects that have been changed. The beavers are gone apparently. The stream channel lowering (Slate R.) has lowered stream base level.

VEGETATION AND SOILS DATA

Community type: % of wetland
1 Salix geyeriana – Calamagrostis can (hummock areas) 1
2 Salix geyeriana – Carex aquatilis 2
3 Salix geyeriana – Poa reflexa 3
4 Alopecurus – mud w/ 3 cm st water in beaver 4
5 Carex utriculata – pond 5
6 Eleoch 6
7 = Pot pect.

Soil data for each community:
1 mineral, 10YR 4/1 w/ abund orange mottles at 10"
2
3
4 mud in water
5 seasfl.
6 mud to surf = sat
7 = under ≥ 30 cm water

Plant species Canopy coverage for each species by community

	1 (98)	2 (99)	3 (100)	4 (101)	5 (102)	6 (103)	7 (104)
Salix geyeriana	60	40	70				
Salix planifolia		10					
S. monticola		10					
Calamagrostis canadensis	50	5					
Pentaphylloides floribunda	2						
Mertensia ciliata	5						
Heracleum sph	30						
Thalictrum fendleri	25	15	3				
Geum macrophyllum	5		2				
Cirsium coloradense	1						
Galium boreale	3						
Aster foliaceous	1						
Achillea lanulosa	3						
Fragaria virginiana	10						
Stellaria galeata							
Carex aquatilis		60			10		
Polemonium caeruleum		5					
Poa reflexa			60				
Epilobium lactiflorum			1				
Alopecurus aequalis				40			
Callitriche h.				30			
Carex utriculata					80		
Eleocharis parvula (mud						60	
Rorippa palustris				2			
Potamogeton pect							60
pusillus							5
Sparganium ang.							15
Chara							5

CRESTED BUTTE WETLAND STUDY - 1992
DATA COLLECTED BY: DAVID J. COOPER

WETLAND NUMBER: CB-14 DATE: 7/30/92
LOCATION: Meridian Lake
DESCRIPTION OF WETLAND: Lake, including littoral + aquatic vegetation

HYDROLOGY: Groundwater inflow on E + W.

WETLAND HISTORY: Natural Lake, in bedrock valley.

DISTURBANCE REGIME: ?

THREATS: ?

WATER CHEMISTRY: ?

FUNCTION/VALUE RATINGS AND COMMENTS
ratings: 1=low; 2=medium; 3=high
confidence in ratings: a=high; b=moderate; c=low

Ground water recharge: 1-2 B

Ground water discharge: 1-2 B

Flood storage: 3A

Shoreline anchoring: 2 B

Sediment trapping: 3 A

Water quality improvement: 2-3 B

Food chain support: 2B

Habitat: fish: 3A
other wildlife: 3A

Active recreation: 3 A

Passive recreation: 3 B

COMMENTS:

VEGETATION AND SOILS DATA

Community type:
1 Potamogeton praelongus - P.
2
3
4
5 Salix planifolia - Calamagrostis canadensis
6

% of wetland
1
2
3
4
5
6

Soil data for each community:
1 water > 40 cm deep + into deep clear water
2
3
4
5
6

Plant species	Canopy coverage for each species by community 1 (105)	2 (106)	3 (107)	4 (108)	5 (109)	6
Potamogeton praelongus	70					
P. pusillus	25					
Eleocharis palustris		60				
Carex utriculata			80		2	
Carex aquatilis				90	1	
Calamagrostis canadensis					40	
Conioselinum scopulorum					5	
Mertensia ciliata					30	
Cardamine cordifolia					20	
Salix planifolia					80	
Veratrum					3	

CRESTED BUTTE WETLAND STUDY - 1992
DATA COLLECTED BY: DAVID J. COOPER

WETLAND NUMBER: 15 DATE: 8/19/92

LOCATION: Coal Cr - Splain Gulch to Avalanche

DESCRIPTION OF WETLAND:
Riparian shrubland along Coal Cr.

HYDROLOGY: seeps from slopes and stream overflow

WETLAND HISTORY: Natural on S, but road fill on N.

DISTURBANCE REGIME: Dust!

THREATS:

WATER CHEMISTRY:

FUNCTION/VALUE RATINGS AND COMMENTS
ratings: 1=low; 2=medium; 3=high
confidence in ratings: a=high; b=moderate; c=low

Ground water recharge: 2 B

Ground water discharge: 3 A

Flood storage: 2 B

Shoreline anchoring: 3 A

Sediment trapping: 2 B

Water quality improvement: 3 B

Food chain support: 3 A

Habitat: fish: 2 A
other wildlife: 2 A

Active recreation: 2 A

Passive recreation: 3 A

COMMENTS:

VEGETATION AND SOILS DATA

Community type:
1 Salix planifolia
2 Brook edge
3 Cardamine – Senecio
4 Hillside seeps
5 Sax odont – drip dry
6 Salix drummondii – Salix monticola

% of wetland
1 30
2 10
3 5
4 10
5 5
6 40

Soil data for each community:
1 10YR 3/1 at 12" = gray – no mottling = mineral
2 wet rocks + gravel
3 Same
4 Silty – gleyed + mottled 10YR 3/1
5 Saturated seep
6 Same as #1

Plant species		Canopy coverage for each species by community: 1 (110)	2 (111)	3 (112)	4 (113)	5 (114)	6 (115)
Sax	~~[illegible]~~ odontoloma				2	25	
Salix pla..		90					
~~[illegible]~~ Acon..		3					
Hordc		10					5
Mertensia	ciliata	35	10				30
~~Angelica~~ li...		5					
Cardamine		3	15	40	5		30
Geum	mac	1					
Calamagrostis		7			1		5
Bist.	bist	2					
Sen	Tri		5	30	20	2	5
Lig	pho..		2	1			
Rhod	[illegible]		3				
[illegible]			1				
~~Mert~~ [illegible]	mert		15	3	2		
Parn	fimbriata		5		1		
Swertia			1				
Veronica	[illegible]		1	1			
Oxypolis			20	15	30	5	
Arnica	mol...		2		1		
Erigeron	peregrinus		2				
Deschampsia	caespitosa		1		3		
Psychrophila	leptosepala		3	3	5		
Poa	lepto		2		1	3	
Epilobium			5	5	2		
Drepanocladus	aduncus		30		10	70	
Poa	bunch		1		1		
Equisetum	arvense		5	2	3	5	
Mimulus	guttatus			1		1	
Mnium					15	20	
branched moss					30	1	

CB-15

VEGETATION AND SOILS DATA

Community type:

7 Juncus arcticus
8 Salix drum — cal can
3
4
5
6

% of wetland
1
2
3
4
5
6

Soil data for each community:

7 sand, in overflow area, but gley + mottles in fine-text areas
8
3
4
5
6

Plant species	Canopy coverage for each species by community 113 / 4	114 / 5	115 / 6	116 / 7	117 / 8	6
Liverwort	5	2				
Conioselenium scopulorum	1					
Bryum	1	1				
Thalictrum fendleri					5	
Salix drummondiana			40		70	
Salix monticola			50			
Salix planifolia			10			
Juncus arcticus				60		
Potentilla gracilis				5		
Aster				10		
Cal can				3	40	
Achillea lanulosa				5		
~~[illegible]~~ Valeriana edulis				1		
Epilobium angustifolium						
Agropyron trachycaulon				5		
Heracleum					5	
Veratrum Ten					2	
Lonicera					2	
Mertensia					5	
Aconitum					5	
Cardamine					5	
Senecio +					2	
Conioselenium					1	

CRESTED BUTTE WETLAND STUDY - 1992
DATA COLLECTED BY: DAVID J. COOPER

WETLAND NUMBER: 16 DATE: 8/19/92

LOCATION: Coal Creek - Beaver complex

DESCRIPTION OF WETLAND:
Beaver complex along coal creek - most wetlands in and around ponds

HYDROLOGY:
Beaver dam main channel and side tribs

WETLAND HISTORY: Natural

DISTURBANCE REGIME:

THREATS:

WATER CHEMISTRY:

FUNCTION/VALUE RATINGS AND COMMENTS
ratings: 1=low; 2=medium; 3=high
confidence in ratings: a=high; b=moderate; c=low

Ground water recharge: 1-2 B

Ground water discharge: 2 A

Flood storage: 3A

Shoreline anchoring: 3A

Sediment trapping: 3A

Water quality improvement: 3A

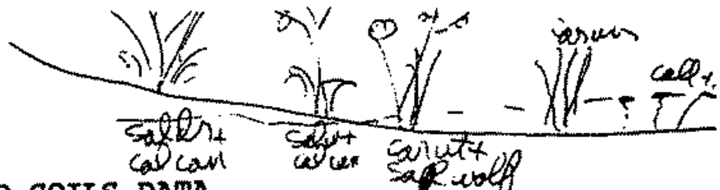
Food chain support: 3A

Habitat: fish: 3A
other wildlife: 2-3A

Active recreation: 3A

Passive recreation: 3A

COMMENTS:



VEGETATION AND SOILS DATA

Community type: % of wetland

1 Cal can (filled pond) 1
2 Carex utriculata 2
3 Callitriche - Alopecurus - pond beaves = active 3
4 Salix wolfii - Carex utriculata (beaver pond edge) 4
5 Salix wolfii - Calamagrostis canadensis 5
6 Salix drummond - Calamagrostis c- 6

Soil data for each community:
1 mineral / gley 10YR 3/1 w/ orange mottles
2 10 cm st water
3 20 cm st w
4 3 cm st water
5 Sat to surface - gleyed (10YR 3/1) - w/ many orange mottles / 5 cm peat
6 Water table at surface - mineral soils

Plant species	Canopy coverage for each species by community: 118	119	120	121	122	123
Calamagrostis canadensis	100	5		5	40	30
Epilobium	5					
Senecio triangularis	3					
Carex aquatilis	2					
Carex utriculata		80		80		
Callitriche			30			
Alopecurus aequalis			30			
Salix wolfii				40	80	5
Cardamine cordifolia					20	15
Mertensia ciliata					15	20
Senecio triangularis					5	
Conioselinum scopulorum					2	5
Geum macrophyllum					2	
Salix drummondiana						70
Salix planifolia						15
Stellaria calycantha						3
Heracleum						2
Salix monticola						5

VEGETATION AND SOILS DATA

Community type: R

7 ~~1~~ Moss in creek
8 ~~2~~ Salix planifolia - Calamagrostis canadensis
9 3 Salix planifolia - Carex utriculata
10 ~~4~~ Creek bank - Cardamine
5
6

% of wetland
1
2
3
4
5
6

Soil data for each community:

7 ~~1~~ In creek
8 ~~2~~ wt at surface soils gleyed + mottled
9 3 5-10 cm st water
10 ~~4~~ wt at surface
5
6

Canopy coverage for each species by community

Plant species	124 7	125 8	126 9	127 10		
Aquatic moss	40					
Salix planifolia	-	100	30			
Calamagrostis canadensis	-	40				
Carex utriculata			80			
Cardamine cordifolia				60		
Senecio triangularis				10		
Oxypolis fendleri				10		
Equisetum arvense				5		
Caltha aquatilis				2	0	
Agrostis				2		
Poa				1		
Deschampsia cespitosa				1		
Drepanocladus				50		

CRESTED BUTTE WETLAND STUDY - 1992
DATA CDLLECTED BY: DAVID J. COOPER

WETLAND NUMBER: 17 DATE: 8/19/92

LOCATION: Irwin - Town + drainage

DESCRIFTIDN DF WETLAND:
springs and creek

HYDROLOGY: Groundwater fed + some drainage from lake

WETLAND HISTORY: Natural

DISTURBANCE REGIME: - some ditching for road construction

THREATS:

WATER CHEMISTRY: Lots of iron in streams

FUNCTION/VALUE RATINGS AND COMMENTS
ratings: 1=low; 2=medium; 3=high
confidence in ratings: a=high; b=modarate; c=low

Ground watar recharge: 2B

Ground water discharga: 3A

Flood storaga: 2B

Shoreline anchoring: 3A

Sediment trapping: 3A

Wster quality improvement: 3A

Food chain support: 2A

Habitat: fish: 1A
othar wildlifa: 2-3B

Active recreation: 1B

Fassive recreation: 2A

COMMENTS:

VEGETATION AND SOILS DATA

Community type: 1
1 Carex aquatilis
2 Salix planifolia - Calamagrostis
3 Salix planifolia - Carex aquatilis
4 Salix monticola - Ca[illegible]
5 Senecio triangularis - [illegible]
6 Calamagrostis - [illegible]

% of wetland
1 <1
2 70
3 10
4 15
5 <1
6 5

Soil data for each community:
1 seep - wt at surface
2 mineral - gley / 10YR 3/1
3 ~~In water table~~
4 - along stream - fines over gravel - 10YR 3/2 w/ ox root ch.
5 - gley soils / 10YR 3/1
6

Plant species		1 (128)	2 (129)	3 (130)	4 (131)	5 (132)	6 (133)
Carex aquatilis	57	90		20			
Senecio triangularis	462	5	5	5	2	70	25
Epilobium lact.	459	10	3				
Geum macrophyllum	180	5					
Drepanocladus aduncus	[illegible]	5					
Salix planifolia			90	70			
Aconitum delp			1		10	15	15
Heracleum l			2		3	5	
Psychrophila leptosepala	341		-	40		10	
Agrostis [illegible]			1				
Equisetum arvense	164		5	3	~~2~~		
Cardamine cordifolia			10	5	5	20	25
Mertensia ciliata	274		15		10		30
Stellaria calycantha			1				
Salix monticola					90		
Calamagrostis can	52		25		20		40
Oxypolis	462			5	5	5	
Veratrum	437				2	10	20
Rumex densiflorus							5
Carex microptera							1
Limnorchis [illegible]				1			

VEGETATION AND SOILS DATA

Community type:

7 1 Erigeron peregrinus - Arnica mollis
8 2 Glyceria - Mimulus
9 3 Corydalis -
4
5
6

% of wetland

1 <1
2 <1
3
4
5
6

Soil data for each community:

7 1 soils mineral, slightly gley & some ox root ch/10YR4/2
8 2 stream bank
9 3 mineral 7.5YR 3/2 w/ ox root ch - spring flow area
4
5
6

Plant species — **Canopy coverage for each species by community**

Plant species	Code	7 1 (134)	8 2 (135)	9 3 (136)	4	5	6
Erigeron peregrinus	640	15					
[illegible] ex. [illegible]	341	10					
Arnica mollis	317	5					
Deschampsia cespitosa	135	5					
Bistorta vivipara	47	2					
Poa palustris	314	5					
[illegible] rhizom.	—	7					
Juncus mertensianus	234	5					
Glyceria striata	187		30				
Mimulus guttatus	130		10				
Epilobium lact	459		5				
Agrostis palustris	5		2				
Cardamine cordifolia	455		1				
Oxypolis fendleri	462		1				
Corydalis caseana				40			
Veratrum	437			25			
Mertensia ciliata	274			25			
Senecio triangularis	458			15			
Heracleum	196			15			
Aconitum	457			10			

CRESTED BUTTE WETLAND STUDY - 1992
DATA COLLECTED BY: DAVID J. COOPER

WETLAND NUMBER: 18 DATE: 8/19/92

LOCATION: lower Coal Cr. above CB

DESCRIPTION OF WETLAND:
Riparian shrublands along Coal Creek

HYDROLOGY:
Creek + flooding

WETLAND HISTORY: natural

DISTURBANCE REGIME: Periodic flooding
sediment in creek

THREATS:

WATER CHEMISTRY:

FUNCTION/VALUE RATINGS AND COMMENTS
ratings: 1=low; 2=medium; 3=high
confidence in ratings: a=high; b=moderate; c=low

Ground water recharge: 1 - 2 B

Ground water discharge: 1 - 2 B

Flood storage: 2 A

Shoreline anchoring: 3 A

Sediment trapping: 2 - 3 A

Water quality improvement: 2 - 3 A

Food chain support: 3 A

Habitat: fish: 2 A
other wildlife: 2 A

Active recreation: 2 A

Passive recreation: 2 A

COMMENTS:

VEGETATION AND SOILS DATA

Community type:
1 Salix drummondiana - Calamagrostis
2 Alnus incana - cal can
3 Abies lasiocarpa - cal can
4
5
6

% of wetland
1 70
2 10
3 10
4
5
6

Soil data for each community:
1
2
3
4
5
6

Plant species — Canopy coverage for each species by community

Plant species		1 (137)	2 (138)	3 (139)	4	5	6
Salix drummondiana		60	20				
Alnus incana		2	60	15			
Salix monticola		10					
Lonicera involucrata				5			
Calamagrostis canadensis		15	15	40			
Deschampsia cespitosa		2					
Agrostis palustris	5	5					
Maianthemum				1			
Eq arvense	164		3				
Actea rubra				5			
Rubus idaeus				1			
Chamerion angustifolium				5			
Mertensia ciliata			5				
Abies lasiocarpa			1	50			
Picea engelmannii			3	10			
Pinus contorta	705						

CRESTED BUTTE WETLAND STUDY - 1992
DATA COLLECTED BY: DAVID J. COOPER

WETLAND NUMBER: 19 DATE: 8/20/92

LOCATION: Smith Ranch

DESCRIPTION OF WETLAND:
Large meadow, willow + spring complex

HYDROLOGY:
surface stream and abundant ground water

WETLAND HISTORY: Some natural, but many disturbed by water diversions + irrigation

DISTURBANCE REGIME:

THREATS:

WATER CHEMISTRY:

FUNCTION/VALUE RATINGS AND COMMENTS
ratinge: 1=low; 2=medium; 3=high
confidence in ratings: a=high; b=moderate; c=low

Ground water recharge: 3 A

Ground water discharge: 3 A

Flood storage: 2 B

Shoreline anchoring: 2 B

Sediment trapping: 2 B

Water quality improvement: 2 A - B

Food chain eupport: 2 A - B

Habitat: fish: 2-3 A
other wildlife: 2 A

Active recreation: 1-2 A

Paesive recreation: 2 A

COMMENTS:

CB-32 = 48.5

VEGETATION AND SOILS DATA

Community type:
1 Salix wolfii – Carex aquatilis
2 Carex utriculata
3 Salix planifolia – Carex utriculata at CB-32 slough
4 Hippuris vulgaris –
5 Carex aquatilis
6 Alopecurus pratensis

% of wetland
1
2
3
4
5
6

Soil data for each community:
1 CB-30 40.7 – 29.7 = wT = 11 cm / soils mineral + gleyed
2 under 25 cm water
3 ~~15 cm st water~~ – soils = wt 24.5 cm today / soils peat
4 30 cm at w
5 wt at surface
6 soils gleyed 10YR 4/1 to surface – site ≅ 20 cm lower in elev than well

Plant species		Canopy coverage for each species by community CB-31 140 2	141	142	143 A	144 B	B145
Salix wolfii	221	40					
Salix planifolia	270	20		70			
Betula glandulosa	43	10					
Pentaphylloides floribunda	294	5					
Salix geyeriana	376			[illegible]			
Carex aquatilis	57	30	5			80	
Juncus arcticus	217	10					
Deschampsia cespitosa	135	10				5	5
Carex festivella	495	1					3
Carex utriculata	97		80	60			
Agrostis scabra	4		1				
Epilobium lact.	459		3			2	
Petasites sagittata	302	1					
Geum macrophyllum	190	10					
Fragaria	771						
Thalictrum	—	3					
Stellaria							
Viola							
Rumex aquaticus	359		1				
Calamagrostis inexpansa	53					2	
Hippuris vulgaris	202				40		
Alopecurus pratensis	477						10
Taraxacum officionale	486						5
Potentilla aquatilis	498						3
Climacium dendroides	461			2			
Drepanocladus				5			
Camplyium				3			

VEGETATION AND SOILS DATA

Community type:
7 Alopecurus
8 "
9 Salix geyeriana
10 Pentaphylloides floribunda – Juncus arcticus
11 Salix monticola – Calamagr
12

% of wetland
1
2
3
4
5
6

Soil data for each community:
7 mud bank of Slate R – seasonally flooded.
8 "
9 —
10 soil 10YR 3/1 at 8" w/abund ox root channels
11 soil gleyed 10YR 3/1 to surface
12

Plant species		146 7	147 8	148 9	148 10	149 11	12
Alopecurus aequalis	7	7	20				
Limosella aquatica	260	10					
Veronica americana	440	2					
V. peregrina	443	1					
Mimulus guttatus	620	1					
Equisetum arvense	164	5					
Epilobium lactiflorum	455	1					
Agrostis stolonifera	5	2					
A. scabra	4	1					
Eleocharis parvula	151	2					
Rorippa sinuata	...	3					
Juncus sax	238	1					
Poa reptans	353		15				
Glyceria striata	187		1				
Salix geyeriana	376			70		40	
Lonicera involucrata	462			15			
Ribes lacustre	706			10			
Equisetum arvense	164			2			
Galium boreale	480			2			
Pentaphylloides floribunda	294			5	40		
Thalictrum fendleri	417			5			
Phleum pratense	426			15	30		
Poa pratensis	315			10			
~~Equisetum arvense~~ Juncus arcticus	217			5	50		
Taraxacum off	426				10		
Potentilla gracilis	490				5		
Salix monticola	377					50	
Calamagrostis can	52			30		20	
Heracleum	196					10	
Urtica dioica	427					15	
Conioselinum scopulorum	119			5			

VEGETATION AND SOILS DATA

Community type:
12 Picea - Abies - Calamagrostis
13 Alnus incana
14 Alnus - Calamagrostis
15 Salix geyeriana
5
6

% of wetland
1
2
3
4
5
6

Soil data for each community:
12
13 peat!
14 wt at surface - soil gleyed w/ oxidized root channels
15 wt to surface
5
6

Plant species		149 11 cont	150 12	151 13	152 14	153 15	6
Aconitum	457	5					
Cardamine cordifolia	455	5					
Maianthemum stellatum	270	1					
Picea engelmannii	414		60	10	5		
Abies lasiocarpa	465		20				
Lonicera involucrata	463		10				
Equisetum arvense	164		15	15			
Geum macrophyllum	180		10	5	5		
Swertia perennis	413		5	5			
Rosa woodsii	466		5				
Carex disperma	65		5	50			
Galium triflorum	542		1				
Calamagrostis canadensis	52		20		40		
Alnus	472			70	60		
Pyrola chlorantha	835			15			
Heracleum	196				15		
Salix drummondiana	456				5		
Viola can					1		
Salix geyeriana	376					60	
Carex utriculata	99					50	
Galium trifidum	175					5	

CRESTED BUTTE WETLAND STUDY - 1992
DATA COLLECTED BY: DAVID J. COOPER

WETLAND NUMBER: 20 DATE: 8/20/92

LOCATION: Gold Course - Skyland

DESCRIPTION OF WETLAND:
Small streams and springs in dead ice moraine landscape willow carrs + sedge meadows

HYDROLOGY:
Ground water fed in large part

WETLAND HISTORY: was natural complex, but overlain now with golf course

DISTURBANCE REGIME:

THREATS: - ditching, culverts at wrong elevations, eutrophication, head cutting

WATER CHEMISTRY:

FUNCTION/VALUE RATINGS AND COMMENTS
ratings: 1=low; 2=medium; 3=high
confidence in retings: e=high; b=moderete; c=low

Ground weter recharge: 2A

Ground water discharge: 3A

Flood storege: 2A

Shoreline anchoring: 1-2B

Sediment trepping: ? ~~[illegible]~~ 2B

Weter quelity improvement: 1-2B

Food chein support: 1-2B

Habitat: fish: 1A
other wildlifs: 2B-2A

Active recreetion: 1A

Pessive recreation: 2A

COMMENTS:

VEGETATION AND SOILS DATA

Community types:
1 Salix wolfii – Carex
2 Carex aquatilis
3 Carex utriculata
4 Pentaphylloides floribunda – Juncus
5
6

% of wetland
1 40
2 5
3 5
4 20
5
6

Soil data for each community:
1 8" peat then 7.5YR 3/1 very gleyed mineral soil
2 Peat
3 mineral, 6" deep = 10 YR 3/1 matrix w/abund oxidized root channels
4
5
6

Plant species		1 (154)	2 (155)	3 (156)	4 (157)	5	6
Salix wolfii	381	60			10		
Pentaphylloides floribunda	294	3			60		
Carex utriculata	97	70	5	95			
Deschampsia cespitosa	135	10	3		2		
Phleum pratense	476	15					
Juncus arcticus	217	10			40		
Carex aquatilis	57		90				
Muhlenbergia filiformis	783		2	-			
Geum macrophyllum	190	5	2				
Pedicularis groenlandica	292	2					
Psychrophila leptosepala	341	5					
Valeriana edulis	436	+			1		
Conioselinum scopulorum	119	1					
Galium trifidum	175		7	1			
Epilobium lact	459		3	3			
Agrostis scabra	4		1				
Penstemon procerus					3		
Poa pratensis	315				20		
Erigeron lonchophyllus	165				2		
Achillea lanulosa	488				5		
Potentilla gracilis	498				15		
Fragaria virg	499				15		
Aster foliaceus	654				10		
Danthonia					5		
Solidago					2		
Agropyron trachy					3		
Gentianopsis thermalis	112				+		
Geum triflorum					1		
Drepanocladus aduncus	353	10	20				

20-
cont

VEGETATION AND SOILS DATA

Community type: Elodea

1 Aquatics Elodea
2 Shallow shoreline – Eleocharis palustris
3 mud flat shoreline of lake –
4 Phalaris – lake edge
5 Typha latifolia – lake emergent
6 Carutr – invaded by Phalaris

% of wetland

1 /0
2 5
3 <1
4 5
5 <1
6 <1

Typha Phalaris Carex

Elodea Emergent

Soil data for each community:

1 > 20 cm st water – Abundant!
2 ≈ 10 cm st water
3 mud = sat. to surface
4 lakeedge – wt < 20 cm
5 in standing water – 10 cm deep.
6 – wt at surf or 5 cm st water

Plant species — **Canopy coverage for each species by community**

Plant species		158 (7A)	159 (8B)	160 (9B)	161 (10A)	162 (11B)	163 (12B)
Eleocharis parvula	[illegible]			30			
Rorippa	—			5			
Plagiobothrys	[illegible]			15			
Limosella aquatica	260			30			
Veronica americana	[illegible]			1			
Persicaria amphibia	211		60				
Eleocharis palustris	150		30				
Elodea	—	100	~~30~~			5	
Phalaris arundinacea	-				100		40
Sidalcea candida	293				3		
Typha latifolia	[illegible]					60	
Carex utriculata	97						40
Epilobium lactiflorum	[illegible]						10

CB-20 p3 cont

VEGETATION AND SOILS DATA

Community type:
13 Poa pratensis
14 Carex ut
15 mud flat
16 Elodea
5
6

% of wetland
1 < 1
2 < 1
3 < 1
4 < 1
5
6

Soil data for each community:
13 mineral - 10YR3/1 below 3" - firm organic above
14 8cm st water
15 dry, but had ≥ 20cm st water
16 ≥ 30cm st water
5
6

Plant species	164 (13)	165 (14)	166 (15)	167 (16)	5	6
Poa pratensis	90					
Deschampsia cespitosa	15					
Geum macrophyllum	5					
Stellaria longifolia	10					
Carex festivella ?	10					
Juncus arcticus	10					
Psychrophila leptosepala	5					
Carex utriculata		20				
Typha latifolia		60				
Ranunculus cymbalaria		10				
Glyceria striata		5				
Eleocharis palustris		10				
Phalaris		10				
Veronica			5			
Gnaphalium			10			
Alopecurus aequalis			5			
Plagiobothrys			15			
Elodea				95		
Myriophyllum				10		

CRESTED BUTTE WETLAND STUDY - 1992
DATA COLLECTEO BY: DAVIO J. COOPER

WETLAND NUMBER: 21 DATE: 8/21/92

LOCATION: Meridian Reservoir + area

OESCRIPTION OF WETLAND:
Reservoir margin, ~~&~~ but mainly willow shrubland along Washington Gulch creek.

HYDROLOGY:
Ground water, particularly from N, and stream flow

WETLAND HISTORY: Natural, other than reservoir.

OISTURBANCE REGIME: Grazing, dewatering below reservoir.

THREATS:

WATER CHEMISTRY:

FUNCTION/VALUE RATINGS AND COMMENTS
ratings: 1=low; 2=medium; 3=high
confidence in ratings: a=high; b=moderate; c=low

Ground water recharge: 1-2 B

Ground water discharge: 3 A

Flood storage: provided by Reservoir

Shoreline anchoring: 3A

Sediment trapping: by reservoir

Water quality improvement: 3 A

Food chain support: 3 A

Habitat: fish: 2-3 A
other wildlife: 2-3 A

Active recreation: 2-3 A

Passive recreation: 2A

COMMENTS:

VEGETATION AND SOILS DATA

Community type:

1 Potamogeton pusillus
2 Salix monticola
3 Salix wolfii - ~~[illegible]~~ Calamagrostis
4 Salix wolfii - Carex aquatilis
5 - also Sal wl Car utr on hillside - no data
6

% of wetland
1 10
2 40
3 25
4 25
5
6

Soil data for each community:
1 under 20 - 40 cm water - in res
2 soils mineral, gleyed 10 4 R 3/1 to surface
3 gley to surface
4 water table at soil surface
5
6

Plant species		1 (168)	2 (169)	3 (170)	4 (171)	5	6
Potamogeton pusillus	333	40					
Elodea	—	5		[illegible]			
Salix wolfii	381			70	50		
Salix monticola	377		80				
S. ~~geyeriana~~ drummondiana	456		30				
Pentaphylloides floribunda	294		5	5	5		
Lonicera involucrata	463		15				
Betula glandulosa	43		5		5		
Thalictrum fendleri	417						
Heracleum			10				
Agropyron trachycaulon			[illegible]				
Equisetum arvense	164		5				
Ligularia bigelowii	639		2				
Fragaria virginiana	499		5				
Chamerion angustifolium	461		1				
Galium boreale	480		2				
Poa pratensis	315		20	10			
Sidalcea candida	393		5				
Senecio triangularis	458		1				
Aster foliaceous	654		7				
Taraxacum officinale	486		5	1			
Calamagrostis canadensis	52		25	40			
Phleum pratense	476		1	2			
Carex aquatilis	57			5	80		
Valeriana edulis	436			3			
Aconitum	457		1	5			
Geum macrophyllum	180			2			
Salix planifolia	379			25	10		
Conioselinum scopulorum	119			5	5		
Swertia perennis	413				7		
Drepanocladus aduncus	553			20			