

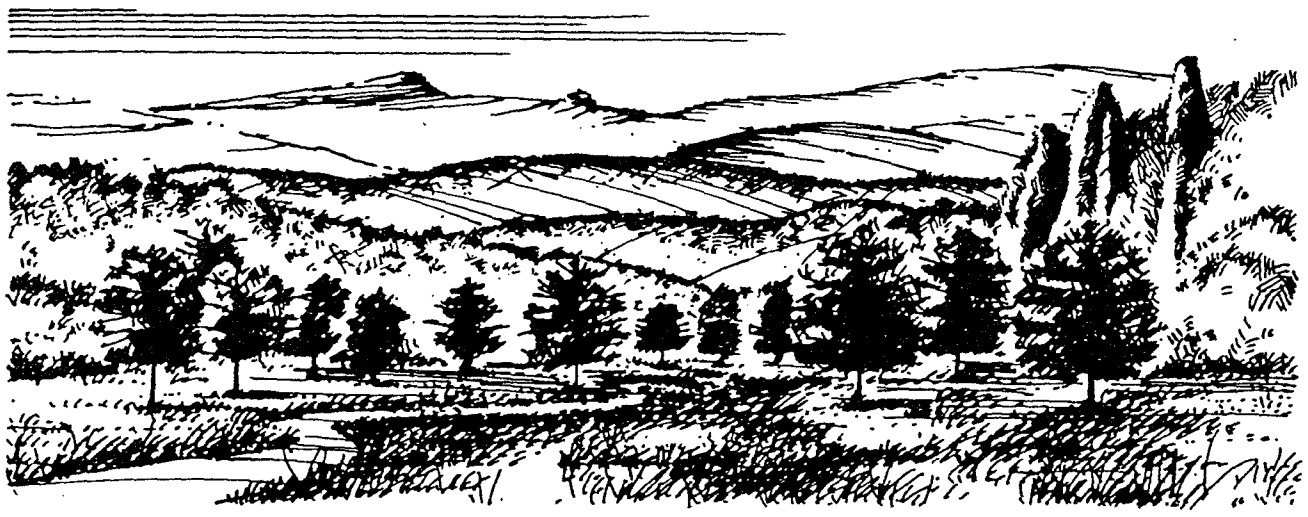
Study



ERO Resources

ERO Resources

Environmental Analysis of Proposed Developments to the Foothills/Wonderland Lake Open Space Areas and Adjoining Lands



Prepared For:

City of Boulder
Real Estate/Open Space Department

Prepared By:

ERO Resources Corporation

In Association With:

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March 1993

**ENVIRONMENTAL ANALYSIS OF
PROPOSED DEVELOPMENTS TO THE
FOOTHILLS/WONDERLAND LAKE OPEN SPACE AREAS
AND
ADJOINING LANDS
EXTENSION REPORT**

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INTRODUCTION

The City of Boulder Open Space Department (OSD) has requested an environmental analysis of proposed developments in the vicinity of the Foothills/Wonderland Lake Open Space Areas. The OSD needs the following information relative to the natural resources of these areas:

- Effects of current recreation use on the environmental resources of the area;
- Identification of natural resources in the area that are potentially sensitive to visitor use;
- Determination of the likely effects of increased visitor use on these resources;
- Recommendations for mitigating current or potential future impacts.
- A jurisdictional wetland delineation of an area between Wonderland Lake and Broadway;

This report is an extension to the Foothills Open Space Report (June 15, 1992). This report references the Foothills report for the purposes of perspective and relative comparisons.

OBJECTIVES

This analysis is based on the goal of maintaining the environmental integrity of the site by maintaining, restoring, and improving the site's natural resources and mitigating adverse impacts to those resources due to trail routing and visitor use or other past disturbances. We recognize that the purposes and goals of the OSD are many and varied, and that competing goals and uses can conflict. This report should not be viewed as an attempt to balance competing or conflicting goals and uses but as a decision-

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making tool that focuses upon the conservation and management of natural areas on open space lands with a particular emphasis on:

- sensitive plant communities and/or wildlife habitat;
- flora and/or fauna of special concern;
- water resources;
- general aesthetics.

The overall goal of this analysis is to provide the OSD with natural resource information and recommendations that will assist the OSD in responding to their short-term needs and long-term management plans. To meet this overall goal we identified the following objectives:

- Create a baseline map of the site that shows vegetation/habitat types, soil erosion hazard areas, and existing trails and use areas.
- Collect and present information that builds on existing OSD programs and capabilities and previously performed analyses of adjoining open space lands.
- Identify areas that are sensitive to visitor use.
- Identify adverse impacts to the site by historical and current use.
- Determine potential adverse impacts to natural resources from projected use and improvements (on-site and off-site).
- Develop recommendations for management, monitoring and mitigation measures.
- Develop a process for future analysis, monitoring, and management.

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SITE DESCRIPTION

The Foothills/Wonderland Lake Open Space Areas (study area) adjoin the City of Boulder at the city's northwestern corner and is divided into two separate areas (Figure 1). The northern study area covers approximately 23 acres and is referred to in this report as the Lee Hill Road area. The southern area covers approximately 168 acres and is referred to in this report as the Wonderland Lake area. The Foothills/Wonderland Lake Open Space Areas are linked by trails to Open Space properties to the north and northeast that allow access to the Boulder Reservoir area.

The Lee Hill Road study area is a relatively homogeneous landscape comprised of two major landscape features:

1. A broad and relatively flat area dominated by perennial and annual weeds. Rolling mixed grass prairie dominates the toe of the foothill.
2. Four Mile Canyon Creek, which forms a narrow wooded riparian corridor through the study area.

The Wonderland Lake study area has a diverse and varied landscape comprised of four major landscape features.

1. A north-south oriented steep foothills ridge with ponderosa pine savanna and shrublands forms the western boundary of the study area and visually dominates the site.
2. A broad and rolling mixed grass prairie dominates the toe of the foothills ridge and the relatively flat areas that merge with Wonderland Lake.
3. Wonderland Lake and its shoreline.
4. The broad flat wetlands that border Wonderland Lake to the north, south, and west, and occur along Wonderland Creek east of the Wonderland Lake dam.

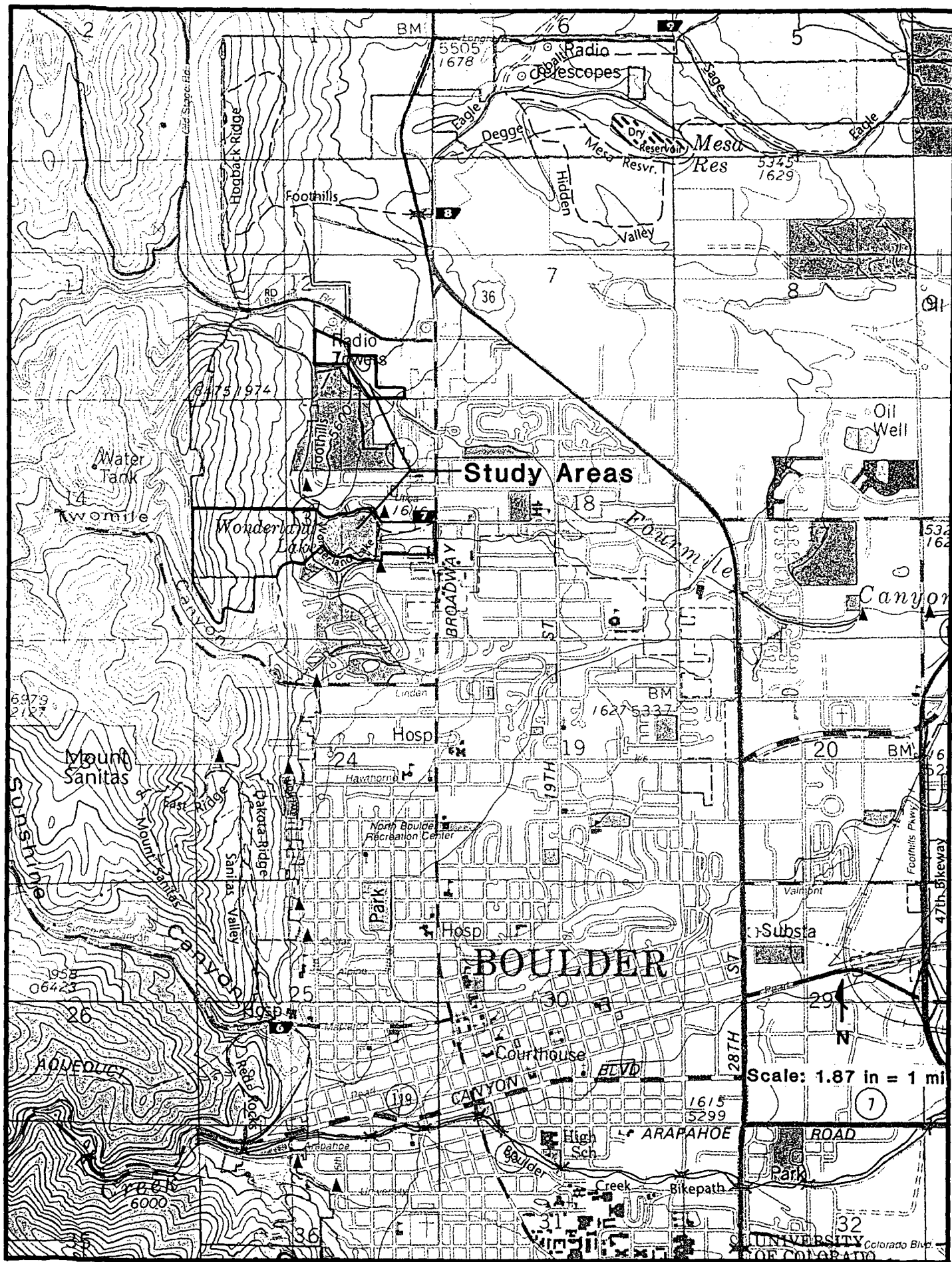


FIGURE 1 Wonderland Lake Study Areas

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EXISTING RECREATION FACILITIES AND USE

Lee Hill Road Area

Authorized recreational facilities on this portion of the study area include only trails and trail heads. Access is via a trail head on the south side of Lee Hill Road, and from the Foothills Trail main stem. The Lee Hill Road trail head is not designated on OSD maps, and improvements consist only of a gate and information signage. Parking is available on the shoulders of Lee Hill Road (a very hazardous traffic situation) and on a graded portion of non-OSD land on the south side of the road just east of the trail head and the OSD boundary fence. A relatively new short trail segment connects this trail head to the main stem of the Foothills Trail and has a modest timber structure on its alignment to span Four Mile Canyon Creek.

Unauthorized recreational facilities include three camp sites along both sides of the banks of Four Mile Canyon Creek. These camp sites, which appear to be utilized mainly by homeless people, consist of denuded ground (100 square feet or so per site), fire pits, fire wood stores, and litter. The camp sites are accompanied by several small "gardens," which have been ingeniously constructed as rock and sand islands within or at the edge of the stream bed and planted with vegetables and flowers. These gardens cumulatively are no more than a hundred square feet.

Wonderland Lake Area

Recreational facilities on this portion of the study area consist of the Foothills Nature Center, the shores of Wonderland Lake, trails and trail heads. Access to this portion of the site from the east is via the Foothills Nature Center parking lot, and from the west shoulder of Broadway about 400 ft. south of the Nature Center parking. Access from the north and south is via the first residential street west of Broadway and the portion of the

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Foothills Trail parallel to the Silver Lake Ditch. Access from the north is via a second residential street west of Broadway, a city park just north of Wonderland Lake, and from Linden Drive west of the first hogback. Access from the north is from the extreme north west corner of the site via a social trail network within the original Foothills Study Area. There are no mapped designated trail heads on this portion of the site, although the Nature Center parking lot functions as a well-appointed trail head facility.

All trails on the site are unimproved with the exception of the Wonderland Lake Trail and Trail Loop, which have been graded and are mineral surfaced. All unimproved trails are in reasonably good condition with the exception of a short section of trail on the east face of the Wonderland Lake Dam, which is extremely steep.

Use of all trails seems logical and reasonable with two exceptions. A short section of unimproved trail between Broadway and the Wonderland Lake Dam runs parallel and only a few hundred feet south of the east west section of the Wonderland Lake Trail, which starts out of the Nature Center parking lot (Existing Recreation Resources Map, separate cover). This is problematic only in that the unimproved trail duplicates the designated improved trail. The parallel social trail may be accommodating use from the residential neighborhood on the east side of Broadway, south of the southeast corner of the site. Since there are no sidewalks on the OSD contiguous portion of Broadway, OSD visitors from the neighborhood may be preferring to cross Broadway at the southeast corner of the site rather than to walk north along Broadway to enter the site at the Nature Center entrance. This use pattern will likely change with the planned path and water quality developments for this area. At the extreme southwest corner of the site, a social trail enters OSD land off of Linden Drive. This social trail courses a short distance south to the south end of the hogback, where it turns east and stops at the end of the

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hogback at a rocky promontory (Existing Recreation Resources Map, separate cover). This is apparently a favored view point - the view east across the city and valley is very good and the view point a pleasant place to rest.

Conversations with fishermen at Wonderland Lake indicate that fishing use of the lake is not intensive. We did not observe any physical evidence or related impacts indicative of heavy fishing activity.

PROPOSED IMPROVEMENTS

The following improvements addressed by this analysis are proposed for the Foothills/Wonderland Lake Open Space areas and adjoining lands.

- Future development of city park land adjacent to the eastern boundary of the study area.
- A new north Boulder subdivision has been proposed for the general area east of the existing OSD trail head on the south side of Lee Hill Road between Lee Hill Road and the creek.

Although we do not believe it is within our scope or purview to comment on the City's proposed plans for the adjoining new park site, some general conclusions about its relationship to the study area can be made at this time:

- A new city park in this location will undoubtedly bring additional recreationally-oriented visitors to this location, which definitely will increase OSD trail usage. Additional usage can be estimated by examining additional parking provided by the proposed park in addition to parking currently available to OSD trail users.
- It would seem unlikely that any new connective OSD trail segments, beyond those currently existing or proposed as a part of the new park's construction to accommodate the park site, would be necessary.

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The following recommendations pertaining to the proposed subdivision and its relationship to the Lee Hill Road portion of the site should be considered by OSD:

- OSD should insist that the developer fence or otherwise demarcate their boundaries with a physical structure to discourage random access (except at designated points) and boundary encroachment.
- OSD should provide the developer with packets of OSD information, including maps and OSD regulatory information, for the developer to distribute to prospective real estate purchasers.
- OSD should negotiate with the developer to provide for public right-of-way access points to OSD lands from any residential parts of the development. Such access needs to be examined on a site specific basis as to environmental and management impacts.
- OSD should study development of an off-road trail head to provide parking on the south side of Lee Hill Road near the existing trail head, to replace parking currently occurring on private land, to alleviate danger of current parking on Lee Hill road shoulder, and to reduce the potential for OSD visitors impacting the new subdivision by parking in business lots or on residential streets.
- OSD should coordinate with City Parks Department to investigate the possibility of allowing OSD trail users a trail head function at the pavilions/tennis/basketball parking area at the northeast corner of their proposed park as a possible alternative to a new trail head facility on Lee Hill Road. If OSD negotiates access points into park and/or OSD lands from proposed Lee Hill Subdivision, such access can be collected via a park or OSD trail on the south side of the creek, funneling trail use north to an intersection with the Foothills Trail main stem.

METHODS

Information on existing vegetation and wildlife and the effects of recreation use on the natural resources of the study area were generated primarily from site visits in June 1992 and the professional experience and expertise of the principal investigators. Information

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on soil erosion hazards and species of special concern were primarily based on existing references and previous studies.

Vegetation

Vegetation types were mapped on 1 inch = 400 feet blueline copies of PSCO's 1984 aerial photography. Vegetation types were based upon the habitat type classification (map unit names and abbreviations) used in the recently developed Boulder Wildlife Habitat Database (City of Boulder, draft document, September 1990). These vegetation types were used in this study with limited modification to provide continuity with an ongoing Boulder program.

Information on plant species of special concern was based on descriptive and map data provided by the Colorado Natural Areas Program (CNAP). Additionally, personal communications with Janet Coles (CNAP) and Mark Gershman (OSD) were used to identify the potential for occurrences of plant species of special concern in the study area.

Wildlife

The evaluation of wildlife habitats was based on two site visits that were conducted in June 1992 and discussions with a long-time resident. Wildlife species that are of likely occurrence throughout the year were inferred from existing literature as well as the principal investigator's records of wildlife distributions in the major habitats within Boulder County.

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Soils

The soils evaluation was performed using existing information supplied primarily from the Soil Conservation Service (SCS). This includes the Boulder County soil survey and soil interpretation records for each soil type occurring in the study area. A field visit was conducted on June 5, 1992 to observe site characteristics, update soil mapping, and identify potential jurisdictional wetland areas.

Recreation and Visual Resources

The existing and potential recreation environments (physical improvements, user characteristics) were addressed relative to impacts to environmental resources, most typically vegetation, wildlife, soils and visual impacts. The assessment was accomplished by preparing an inventory and map of the existing study area. Based on field work and photography, resource impacts resulting from recreation use were identified. The proposed improvements for the site and adjoining area were also considered in determining potential impacts.

Mapping

A base map for the study area was prepared by using a 1 inch = 400 feet and 1 inch = 200 feet photographic enlargements of a standard USGS 7.5 minute quad. Study area features and resources were mapped as overlays. Base features, including existing recreation facilities, have been mapped on one overlay. Vegetation types and soil erosion hazards have been mapped on separate overlays. This will facilitate AutoCadd/LandCadd data entry if desired at a future date.

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EXISTING NATURAL RESOURCES

The two areas that jointly comprise the study area differ substantially in the variety and quality of the natural resources they support. The Wonderland Lake area supports a wide diversity of vegetation and habitat types including stands of ponderosa pine savanna along the hogback that grades to a rolling mixed grass prairie to the east and becomes relatively level terrain west of Wonderland Lake. The Wonderland Lake area supports a variety of aquatic, wet, and mesic habitats that are particularly attractive to a wide variety of birds. This combination of characteristics allows visitors the opportunity to hike from a suburban aquatic and wetland system, through mixed grass and tall grass prairies, to ponderosa pine covered hogback ridges with beautiful vistas of the Boulder area while covering a one-way distance of less than 1.5 miles.

In stark contrast, the Lee Hill road area offers little variety except for the narrow riparian corridor of Four Mile Canyon Creek and the views of neighboring open space lands. The area is dominated by annual and perennial weeds, is oddly shaped, and borders unattractive industrial and urban development.

Vegetation

Wonderland Lake Area. The vegetation within the Wonderland Lake area is diverse. Nine different vegetation types were mapped (Appendix A) within the study area (Vegetation Map, under separate cover). The diversity of vegetation types is primarily a function of the hogback and Wonderland Lake. The hogback supports four of the vegetation types and the Wonderland Lake area supports the remaining five vegetation types. The vegetation type with the greatest aerial extent is the mixed grass prairie that dominates the rolling terrain between the hogback and Wonderland Lake (Vegetation Map, under separate cover).

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The hogback supports two particularly interesting vegetation features. A long narrow mixed grass prairie area runs north and south between two areas of ponderosa pine savanna. This narrow mixed grass prairie area occurs on an extension of the Baller stony sandy loam soils between a narrow outcrop of sandstone and the main body of the hogback. This distribution of vegetation types is both aesthetically pleasing as well as locally ecologically significant as it forms a long ecotone that is contained within the broader ecotone of the hogback. Numerous deer were observed along this ecotone.

The other particularly interesting vegetation feature along the hogback is the area mapped as scattered trees/mixed mountain shrubland (SCT/MMS). This area is immediately north of the mixed prairie previously discussed. Of the open space properties visited thus far, this is the only area that has been observed to support a large population of hackberry (*Celtis reticulata*). The gnarled and stunted trees form a pygmy forest in the talus and rock outcrop area. Although the understory has been extensively disturbed (most likely historically by livestock seeking shade), the forest is a unique attraction to visitors, giving one an impression of a more eastern vegetation setting when under the forest canopy.

Lee Hill Road Area. The Lee Hill Road area has been severely disturbed and, except for the narrow riparian corridor along Four Mile Canyon Creek, is dominated by a mix of annual and perennial weeds. The riparian corridor, though narrow, appears to be healthy.

Wildlife

The major wildlife habitats in the vicinity of the study areas include mixed grass prairie, scattered ponderosa pine, and the aquatic habitats associated with Wonderland Lake.

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Wildlife species of both forested and plains ecosystems overlap here, and the shoreline and lake add to the diversity of wildlife in the area.

Wonderland Lake Area. The Wonderland Lake area is an attractive and diverse wildlife area. The lake, although small (approximately 21 surface acres) and enclosed by housing developments on three sides, provides excellent habitat for wildlife. The shoreline is densely vegetated. Cattails, a few small trees, and many herbaceous species surround the lake and extend to the water's edge. The lake as well as the associated shoreline vegetation provide excellent habitat for water birds, songbirds, small mammals, reptiles, and amphibians. The lists of potential species for this site (Appendix B) are quite long, and primarily reflect species known to be attracted to open water areas with densely vegetated shorelines that occur along the Front Range. There is a limited amount of aquatic and mesic habitat, however, and the nearby housing developments will discourage many wildlife species from breeding or remaining long at the site.

The meadow habitat in the drainageway east of the lake provides habitat for several important small mammal prey species, notably prairie voles, meadow voles, and deer mice. Several species of reptiles and amphibians are likely to occur here as well.

The east-facing slope of the hogback, which extends west of the lake for approximately one half mile, provides habitat that is in marked contrast to the lake and its associated mesic vegetation. The hogback is dominated by dryland grasses and scattered ponderosa pine. This is an arid habitat by comparison, and the wildlife species likely to be seen here are those characteristic of the ponderosa-grassland ecotone that extends along the Front Range. Mule deer are common along the hogback, as are coyotes and prairie songbirds such as western meadowlarks, vesper sparrows, and others.

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Lee Hill Road Area. The Lee Hill Road area, in stark contrast to the Wonderland Lake area, has minimal habitat diversity except for the narrow riparian corridor bordering Four Mile Canyon Creek. A small prairie dog colony occurs along the northern border of the Lee Hill study area.

Soils

The study area is composed of seven map units as shown in Table 1. Five of the units are soil consociations and two are miscellaneous land types. These are delineated on the Soils and Erosion Hazard Map (separate cover) for the study area. The map was generated from the SCS soils map and adjusted after the field visit to more accurately tie the map units to landforms, and to delineate smaller dissimilar inclusions such as wet areas.

Table 1. Soil map unit legend.

Map Unit Symbol	Map Unit Name
BaF	Baller stony sandy loam, 9 to 35 percent slopes
Ha	Haplaquolls, 0 to 5 percent slope
NdD	Nederland very cobbly sandy loam, 1 to 12 percent slopes
NuC	Nunn clay loam, 3 to 5 percent slopes
SmF	Sixmile stony loam, 10 to 50 percent slopes
SRO	Sedimentary rock outcrop
VaC	Valmont clay loam, 1 to 5 percent slopes

Baller soils (BaF) comprise most of the study area west of Wonderland Lake and are shallow, stony soils on moderate to steep slopes. They have rapid runoff, low available

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water capacity, and a high risk of erosion. The Haplaquolls are deep, somewhat poorly drained clayey soils along drainageways and around the margin of Wonderland Lake. Runoff is slow, available water capacity is high and the risk of erosion is low. Nederland (NdD) is the other major soil type and occurs adjacent to Wonderland Lake and along Four Mile Canyon Creek to the north. They are deep, cobbly soils on alluvial fans and outwash plains. They have slow to medium runoff, moderate available water capacity, and slight risk of erosion. Nunn soils (NuC) are deep clayey soils that occur on alluvial fans and valley sideslopes. They have medium runoff, high available water capacity, and moderate risk of erosion. Sixmile soils (SmF) are moderately deep clay loam soils that occur on forested hogback scarp slopes. They usually have a stony surface layer. They have rapid runoff, moderate to high available water capacity, and a high risk of erosion. Map unit SRO is primarily composed of sparsely vegetated shale, limestone and sandstone outcrops. Any soil in this map unit is thin and highly susceptible to erosion. Valmont soils (VaC) are not extensive in the study area. They are deep clayey to loamy soils that occur on alluvial fans. These soils have medium runoff, moderate available water capacity, and slight erosion hazard.

Recreation and Visual Resources

Variety of Terrain. The Wonderland Lake area has generous quantities of very rugged and steep terrain as well as mild and quite negotiable level terrain. The Lee Hill Road area is topographically flat and unremarkable.

Access. Access to the Lee Hill Road area from public right-of-way is excellent from Lee Hill Road although parking is a problem, as previously discussed. The site is, however, bisected by Four Mile Canyon Creek, complicating access to the south half of the tract. The creek barrier is currently surmounted by a wooden bridge on the existing trail.

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Access to the Wonderland Lake portion is excellent from all currently sought directions with the possible exception of the east side, where lack of sidewalks along Broadway may be encouraging OSD users to use an east west unimproved trail that duplicates the existing, parallel, improved Wonderland Lake Trail segment between the Nature Center and the lake. (This could change with the on-going improvements to Broadway and planned path development.)

Views & Vistas. The Wonderland Lake area is highly visible from the Boulder urban area except where obstructed by urban forest or structures. The view of the Boulder valley and Boulder urbanized area is outstanding particularly from the hogback, although the hogback vista is difficult to reach. A small area near the south end of the hogback is currently used as a neighborhood view point. The Lee Hill Road area is not particularly visible owing to its unremarkable terrain and its proximity to adjacent industrial development. Views from this area are good toward the foothills, but severely impacted to the east and southeast by adjacent urban and industrial development.

Four Mile Canyon Creek Riparian Corridor. The portion of Four Mile Canyon Creek contiguous to the OSD site is not spectacular but contains enough woody vegetation and water to be an attraction to visitors on a site that is otherwise very arid and lacks topographic and vegetation diversity.

Wonderland Lake. The lake is a great visual resource. From a recreational perspective, fish are apparently thriving in the lake but the lake does not seem to receive high fishing pressure.

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SENSITIVE SITE FEATURES

Sensitive Vegetation Types

The riparian vegetation along Four Mile Canyon Creek forms a narrow riparian corridor that could be sensitive to heavy visitor use in the Lee Hill road area as the riparian corridor is the most attractive feature in the area. At this time, except for a few limited areas of unauthorized camping, the riparian corridor appears relatively healthy and unaffected by visitor use. Willows and cottonwoods are reproducing and bank erosion appears minimal.

The wetlands and shoreline bordering Wonderland Lake are potentially susceptible to heavy visitor traffic. It is common to have lake shorelines rimmed with visitor trails. At this time, the Wonderland Lake area and its adjoining shoreline have not been significantly adversely affected by visitor use. Restriction of visitor access to the western portions of the reservoir area appear thus far to be effective at limiting visitor impacts to the western shoreline and wetlands.

Plant Species of Special Concern

No known species of special concern occur within the study area. Adjoining areas do support species of special concern as discussed in the Foothills Report (June 15, 1992).

Sensitive Wildlife Habitat Features

The shoreline and adjacent vegetation surrounding the lake is of critical importance to wildlife. Trails here should attempt to keep people from trampling the vegetation and destroying the shoreline. Dogs should not be permitted to run loose, particularly in this area, as they not only frighten wildlife but trample the vegetation as well.

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Soils and Erosion Hazard

Presented in Table 2 are soil and land properties and interpretations germane to the intended use of the soils. The ratings are based on restrictive soil features such as wetness, slope and surface soil texture. Flooding is not considered in the ratings, nor does it appear to be a factor in the proposed uses of the study area.

Table 2. Soil properties and interpretations for recreation development.

Map Unit	Risk of Erosion		Limitations for:		Hydric Soils	
	K Factor ¹	Hazard	Trails	Picnic Areas	% of Unit	Landscape Position
BaF	.10/.05	high	severe	severe	3	swales
Ha	.24/.28	low	moderate	severe	95	drainages
NdD	.05/.05	slight	slight	moderate	5	swales
NuC	.32/.28	moderate	slight	slight	1	swales
SmF	.24/.24	high	severe	severe	4	swales
SRO	NR	NR	severe	severe	--	--
VaV	.24/.28	slight	slight	slight	--	--

¹Surface value/subsurface value; NR = moderate

Risk of erosion considers both the erodibility of the soil by water, and landscape features. The K factor indicates the susceptibility of unprotected soil to sheet and rill erosion by water. Estimates are based primarily on soil texture. The higher the value, the more susceptible the soil is to erosion by water. The erosion hazard for each map unit reflects the combination of surface texture, slope, and runoff. As shown on the Soils and Erosion Hazard maps (separate cover), map units BaF and SmF are particularly susceptible to

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erosion if disturbed. The presence of interbedded sedimentary rock (shale, sandstone and limestone) in these map units poses a significant threat to facilities development. Under natural conditions, the rock and vegetative cover has provided adequate protection from heavy rainfall events and snowmelt. However, some slumping and erosion was noted near toeslopes and rock outcrops in unit BaF. Nederland, Nunn and Valmont soils (NdD, NuC and VaC), located around Wonderland Lake and the Lee Hill Road trail head area, have a low erosion hazard. Some small gullies have developed on these soils in the north portion of the study area south of Four Mile Canyon Creek.

Limitations for trails and picnic areas refer to the suitability of soil factors that affect this use. A slight limitation indicates that soil properties are generally favorable; conversely, a severe limitation means that special design, intense maintenance or costly soil reclamation, or a combination of these, is usually required. These facilities are associated with heavy foot traffic and should require little or no cutting or filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface. Usage of the present access trail south of Four Mile Canyon Creek has created many low spots, which tend to accumulate rainfall and snowmelt. This puddling gives way to rutting from bicycle traffic, widening of the trail to avoid puddles and ruts and, inevitably, erosion in some areas. Continued graveling of the trail should alleviate this problem.

Map unit SRO should be avoided for any use because of the instability of shale and the steep sandstone bluffs. The map units BaF and SmF were rated as severe for trail and picnic area usage because of steep slopes, rocks and the high risk of erosion if disturbed. Placement of trails through these map units is typically not recommended due to the

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above factors and the problems associated with thinly bedded sedimentary rocks, particularly clay shales. The Haplaquolls are typically wet soils. As such, they are only moderately suitable for trails and only along the upper or drier edges of these soils. Several social trails were observed to cross these soils, and they appear only to be functional in periods of low water flows. Nederland soils (NdD) were rated moderate for trail and picnic area development because of the presence of cobbles and stones on the soil surface. However, favorable slopes and low risk of erosion makes these soils quite suitable for development in less stony areas. Nunn and Valmont soils (NuC and VaC) have no limitation for trail or picnic area development, but these units are of minor extent in the study area. All trails with heavy use, such as the Foothills property access trail, will need improvements to control rutting, puddling, and erosion.

Hydric soils were highlighted in Table 2 to indicate potential wetland areas. If encountered, wetlands should be avoided for development due to both their potential importance as infrequently occurring environments and because of the limitations for development posed by wetness. In the Wonderland Lake area, the Haplaquolls (Ha) near the lake itself constitute the largest contiguous block of hydric soils. Other potential wetland areas are limited to inclusions of swales in map units BaF, NdD, NuC, and SmF. The area downstream from Wonderland Lake was mapped in detail to identify jurisdictional wetlands (Appendix C).

IMPACTS TO NATURAL RESOURCES

Existing Impacts

The most significant impacts to natural resources are attributable to historical land use, natural disturbances, and recreation use. Historical land use (most likely livestock grazing) has disturbed vegetation in the Lee Hill Road area. This area is now dominated

ANALYSIS OF PROPOSED DEVELOPMENTS TO THE FOOTHILLS/WONDERLAND LAKE OPEN SPACE AREAS AND ADJOINING LANDS

by weedy and undesirable species. It is unlikely that the Lee Hill Road area will be colonized by desirable native species in the near future.

Potential Conflicts with Proposed Developments and Natural Resources

The proposed developments in the vicinity of the study area will affect the use of the study area and affect the site's natural resources. However, proper planning of these developments can reduce the potential impacts to natural resources. Proper closing and consolidation of social trails and creation of a "high trail-low trail" system as discussed in the Foothills Open Space Report will help route and disperse traffic throughout open space areas adjoining the study area while avoiding sensitive site features. Proper planning and integration of the proposed City park with the adjoining Foothills Open Space area could divert (as well as contribute) some types of recreation use from the study area.

RECOMMENDED SITE IMPROVEMENTS

The following recommendations should be considered in the context of the recommendations of the Foothills Open Space Report (June 15, 1992).

1. Find a suitable site on the Lee Hill Road area for an off-road trail head facility adjacent to the existing trail with automobile parking and other typical trail head improvements, or collaborate with City Parks to develop a trail head function inside of the new park development when it comes on line, and consider selling the portion of OSD land north of the Four Mile Canyon Creek floodplain for private development.

Rationale: OSD visitor parking on the shoulder of Lee Hill Road is extremely unsafe from a traffic management perspective and a trail head with off-road parking is needed. If a cooperative arrangement with City Parks could be made for a joint use parking area within the new park, duplication of City services may be minimized. The Lee Hill Road area, with the exception of the riparian corridor, does not seem to be of typically high quality OSD land with

**ANALYSIS OF PROPOSED DEVELOPMENTS TO
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environmental, recreational, and strategic importance. Ground north of the creek floodplain may be better suited for private development than for Open Space, and the floodplain and related riparian environment can be a good buffer between open space and private development.

2. Study the possibility of adding sidewalks to both sides of Broadway where contiguous to OSD land, and closing the existing access and unimproved trail between Broadway and the lake dam, including the short segment of trail mounting the east face of the dam.

Rationale: This unimproved trail segment is unnecessarily duplicative of the improved trail coming out of the Nature Center, and would probably not be needed if OSD trail users could walk down Broadway via sidewalks to the existing improved trail. The short trail segment on the face of the dam is too steep, and would probably be rendered unnecessary by closing the unimproved trail coming from Broadway.

3. All heavily used trail segments in the north part of the study area should be upgraded where necessary, with girding and surfacing to accommodate current and future use.

Rationale: The Foothills access trail in the north part of the study area is heavily used and unimproved soil conditions are not adequate to support current use. South of Four Mile Canyon Creek, trails are becoming wider as users skirt muddy, rutted, and rocky areas.

General Recommendations

1. Erosion hazard on disturbed areas with slopes over 12 percent is severe; unavoidable trail development in these areas must consider erosion control measures on both trails and cut banks. Trail development on these slopes should be avoided due to presence of shale and potential slope failure.
2. Minimize disturbances such as cut and fill on slopes greater than 12%. Use switchback trails on steep slopes.
3. Avoid limestone-shale outcrop area in the NE part of the study area.
4. Avoid wetland areas.

**ANALYSIS OF PROPOSED DEVELOPMENTS TO
THE FOOTHILLS/WONDERLAND LAKE
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5. Avoid the Four Mile Canyon Creek riparian area.
6. Dogs should be controlled in the area due to the numerous deer in the study area.

LONG RANGE MANAGEMENT AND MONITORING RECOMMENDATIONS

OSD's long range management plans or goals for the Wonderland Lake and Lee Hill Road areas are unknown; the monitoring of site conditions and trends needs to be designed and evaluated relative to OSD management plans and goals. The following recommendations are based upon the objective of conservation and management of the study area's natural resources and does not attempt to balance competing and/or conflicting goals.

1. **Riparian vegetation.** Riparian vegetation monitoring of Four Mile Canyon Creek should focus on continued reproduction of woody riparian species (particularly cottonwoods and willows) and maintenance of total woody riparian area (i.e., track losses due to informal trails, and natural causes).

A series of permanent belt transects can be established by permanently locating 2 stakes 30 meters apart and recording all cottonwood and willow seedlings and saplings within 2 meters of either side of the line defined by the stakes. The belt transects can be rapidly sampled annually and compared over time for trends. If reproduction rapidly declines and younger trees and shrubs are not recruited into the riparian population, the area will eventually decline.

Trends in total area can be reviewed by periodic aerial photography or well placed on-the-ground photography.

2. **Maintenance of vegetation type distributions.** Grasslands are frequently associated with disturbance regimes (e.g., grazing and fire). Colonization of the mixed prairie grasslands by woody species is possible; however, it does not appear at this time that there is a threat of losing the mixed grass prairie areas to invasion by woody species. Loss of grasslands to woody species can best be monitored by periodic (5 year interval) review of gross vegetation mapping similar to the mapping effort for this analysis. A more likely threat to the study area is continued or expanded disturbance of the mixed grass prairie and subsequent invasion by weedy species. This is particularly true for those areas adjacent to the Lee Hill Road area. Large

**ANALYSIS OF PROPOSED DEVELOPMENTS TO
THE FOOTHILLS/WONDERLAND LAKE
OPEN SPACE AREAS AND ADJOINING LANDS**

weedy areas should be delineated and periodically monitored for expansion/contraction and changes in species composition.

3. **Visitation.** Monitor visitor use with a trail counter, vehicle counts, registration boxes, or on-site observation.
4. **Control of Russian olive and salt cedar.** A small stand of salt cedar has become established along the northeastern shoreline of Wonderland Lake (see Vegetation Map). Additionally, Russian olive has become established around the lake and the drainage below. Both species should be controlled. An approach to control is outlined in Appendix D.
5. **Interpretive opportunities.** The eastern Wonderland Lake shoreline area has excellent opportunities for interpretive programs that, if properly planned, could keep visitor use to the east and away from the western shoreline. A boardwalk and observation/blind could be a nice interpretive amenity for Wonderland Lake.

**ANALYSIS OF PROPOSED DEVELOPMENTS TO
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OPEN SPACE AREAS AND ADJOINING LANDS**

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APPENDIX A: VEGETATION TYPE DESCRIPTIONS

APPENDIX A: VEGETATION TYPE DESCRIPTIONS

VEGETATION TYPE DESCRIPTIONS

The classification of vegetation types (existing plant community types) follows the habitat type classification system developed for the Boulder Wildlife Habitat Database (City of Boulder, draft, 1990) with some changes. Deviations from the Boulder Wildlife Habitat Database include the additions of a combined Scattered Trees/Mixed Mountain Shrubland and the addition of "Steep/Sparse Vegetation" to the "Rock Outcrops" type. The map abbreviation follows the vegetation type name in parentheses.

Ponderosa Pine Savanna (PPS) - The Ponderosa Pine Savanna type occurs along the elevated (ca. 6,000 to 6,400 feet) western boundary of the study area. This type is characterized by widely spaced ponderosa pines (*Pinus ponderosa*) with an understory dominated by grasses. The grass understory varies from a dominance of tall grasses, primarily big bluestem (*Andropogon gerardii*) in a few sites to the more common dominance by short grasses, primarily blue grama (*Bouteloua gracilis*). Common understory vegetation includes: Western wheatgrass (*Agropyron smithii*), little bluestem (*Schizachyrium scoparius*), Scribner's needlegrass (*Stipa scribnerii*), sideoats grama (*Bouteloua curtipendula*), cheatgrass (*Bromus tectorum*), sun sedge (*Carex heliophila*), Oregon grape (*Mahonia repens*), wild tarragon (*Artemesia dracunculus*), winged eriogonum (*Eriogonum altatum*), Spanish bayonet (*Yucca glauca*), snakeweed (*Xanthocephalum sarothrae*), and prickly pear (*Opuntia* spp.).

Riparian Forest (RPF) - The Riparian Forest type occurs along Four Mile Canyon Creek and is dominated by cottonwoods (*Populus deltoides*) and willows (*Salix exigua*). The herbaceous understory includes bluegrass, Canada wild-rye (*Elymus canadensis*), smooth brome and orchard grass (*Dactylis glomerata*).

Willow Shrubland (WLS) - The willow shrubland occurs along Four Mile Canyon Creek. The thickets are typically dominated by coyote willow (*Salix exigua*).

APPENDIX A: VEGETATION TYPE DESCRIPTIONS

Scattered Trees/Mixed Mountain Shrubland (SCT/MMS) - This type is limited to an area in the northwestern portion of the Wonderland Lake study area and is best described as a "pygmy forest" comprised of widely spaced hackberries (*Celtis reticulata*) and shrubs such as mountain snowberry (*Symphoricarpos orephilus*), squaw currant (*Ribes cereum*), and chokecherry (*Prunus virginiana*). The herbaceous understory is dominated by cheatgrass (*Bromus japonicus* and *B. tectorum*). The site is adjacent to tallus and boulders are scattered throughout the type.

Rush Meadows (RSM) - A small wetland dominated by arctic rush (*Juncus arcticus*) occurs in a drainage swale near the southern portion of the study area.

Mixed Grass Prairie (MGP) - This is the most common vegetation type in the study area and also the most variable. The Mixed Grass Prairie type is equivalent to Bunin's (1985) Mid-Height Grassland. Commonly occurring species in areas mapped as MGP include: blue grama, sideoats grama, red three-awn (*Aristida longiseta*), western wheatgrass, cheatgrass, wild tarragon, prairie sage (*Artemesia ludoviciana*), pasture sage (*A. frigida*), Spanish bayonet, and prickly pear. In scattered locations, particularly with increasing elevation, tall grasses such as big bluestem, little bluestem, and switchgrass (*Panicum virgatum*) occur mixed with mid grasses or, in a few small isolated instances, occur in nearly pure tallgrass stands. The lower eastern boundary of the study site has had a history of disturbance. These disturbed areas are dominated by cheatgrass, prickly pear, snakeroot, and Spanish bayonet. It appears the disturbance was most likely due to historical grazing by livestock.

Foothills Tallgrass Prairie (TGP) - Areas mapped as Tallgrass Prairie are restricted to slopes in the southeastern portion of the Wonderland Lake study area. This type grades to mixed prairie and ponderosa pine savanna. The majority of the area mapped as Foothills Tallgrass Prairie fits Bunin's (1985) description of xeric tall grassland. Other

APPENDIX A: VEGETATION TYPE DESCRIPTIONS

species commonly occurring in this type are the same as the understory species described for the Ponderosa Pine Savannas.

Bottomland Grassland (BLG) - This type occurs around Wonderland Lake and is dominated by slender wheatgrass (*Agropyron trachycaulum*), Kentucky bluegrass (*Poa pratensis*), and smooth brome (*Bromus inermis*).

Rocky Outcrops and Steep/Sparse Vegetation (ROC) - These areas occur in the northwestern portion of the Wonderland Lake study area and are comprised of rock with widely scattered grasses and shrubs.

Cattail Marshes (CTM) - Cattail marshes occur around Wonderland Lake, the largest marsh occurs at the west end of the lake. These marshes are dominated by nearly homogeneous stands of common cattail (*Typha latifolia*).

Annual Weed/Perennial Weed Community (AWC/PWC) - This type dominates the Lee Hill Road study area. Common weeds include bindweed (*Convolvulus arvensis*), summer cyprus (*Kochia iranica*), and goosefoot (*Chenopodian* spp.).

Table 1. Birds likely to be seen along the Foothills Trail

<u>Common name</u>	<u>Scientific name</u>
Red-tailed hawk	<i>Buteo jamaicensis</i>
Swainson's hawk	<i>Buteo swainsoni</i>
Northern harrier	<i>Circus cyaneus</i>
American kestrel	<i>Falco sparverius</i>
Mourning dove	<i>Zenaida macroura</i>
Common nighthawk	<i>Chordeiles minor</i>
Broad-tailed hummingbird	<i>Selasphorus platycercus</i>
Rufous hummingbird	<i>Selasphorus rufus</i>
Belted kingfisher	<i>Ceryle alcyon</i>
Common flicker	<i>Colaptes auratus</i>
Hairy woodpecker	<i>Picoides villosus</i>
Downy woodpecker	<i>Picoides pubescens</i>
Willow flycatcher	<i>Empidonax traillii</i>
Western wood-pewee	<i>Contopus sordidulus</i>
Black-billed magpie	<i>Pica pica</i>
American crow	<i>Corvus brachyrhynchos</i>
Black-capped chickadee	<i>Parus atricapillus</i>
Pygmy nuthatch	<i>Sitta pygmaea</i>
House wren	<i>Troglodytes aedon</i>
American robin	<i>Turdus migratorius</i>
Mountain bluebird	<i>Sialia currucoides</i>
Townsend's solitaire	<i>Myadestes townsendi</i>
Ruby-crowned kinglet	<i>Regulus calendula</i>
Black-headed grosbeak	<i>Pheucticus melanocephalus</i>
Rufous-sided towhee	<i>Pipilo erythrophthalmus</i>
Dark-eyed junco	<i>Junco hyemalis</i>

APPENDIX B: WILDLIFE

American tree sparrow	<i>Spizella arborea</i>
Chipping sparrow	<i>Spizella passerina</i>
White-crowned sparrow	<i>Zonotrichia leucophrys</i>
Lincoln's sparrow	<i>Melospiza lincolnii</i>

Table 2. Mammals of probable occurrence near the Foothills Trail

<u>Common name</u>	<u>Scientific name</u>
Yellow-bellied marmot	<i>Marmota flaviventris</i>
Abert's squirrel	<i>Sciurus aberti</i>
Fox squirrel	<i>Sciurus niger</i>
Northern Pocket gopher	<i>Thomomys talpoides</i>
Deer mouse	<i>Peromyscus maniculatus</i>
Rock mouse	<i>Peromyscus difficilis</i>
Northern grasshopper mouse	<i>Onychomys leucogaster</i>
Bushy-tailed woodrat	<i>Neotoma cinerea</i>
Coyote	<i>Canis latrans</i>
Raccoon	<i>Procyon lotor</i>
Striped skunk	<i>Mephitis mephitis</i>
Mule deer	<i>Odocoileus hemionus</i>

APPENDIX C: JURISDICTIONAL WETLAND DELINEATION

**JURISDICTIONAL WETLAND DELINEATION
FOR WONDERLAND LAKE AREA**

BOULDER OPEN SPACE

BOULDER COUNTY, COLORADO

INTRODUCTION

On June 4 and 5, 1992, an on-site jurisdictional wetland delineation of an area below Wonderland Lake was performed using the methods and criteria established by the 1989 Federal Manual for Identifying and Delineating Jurisdictional Wetlands (1989 manual). No previous wetland delineation of the area has been performed to the best of our knowledge.

SITE DESCRIPTION AND LOCATION

The area of delineation occurs west of Broadway and east of Wonderland Lake and is bisected by Wonderland Creek (Figure C-1). The wetlands are dominated by arctic rush (*Juncus articus*) and sedges (*Carex nebrascensis* and *C. praegracilis*) and are associated with a broad swale drained by Wonderland Creek.

METHODS

The entire area was field checked for the presence of potential wetland areas. Ten detailed delineation sites were established and are noted on the attached delineation map (Pocket Figure). Data on soils, vegetation, and hydrology were collected at each site following the guidance of the 1989 manual for routine on-site delineations (completed data forms attached).

RESULTS

Approximately 1.0 acres of jurisdictional wetlands were determined to occur within the project area. The wetlands appear to be supported by sideslope drainage from the north and south.

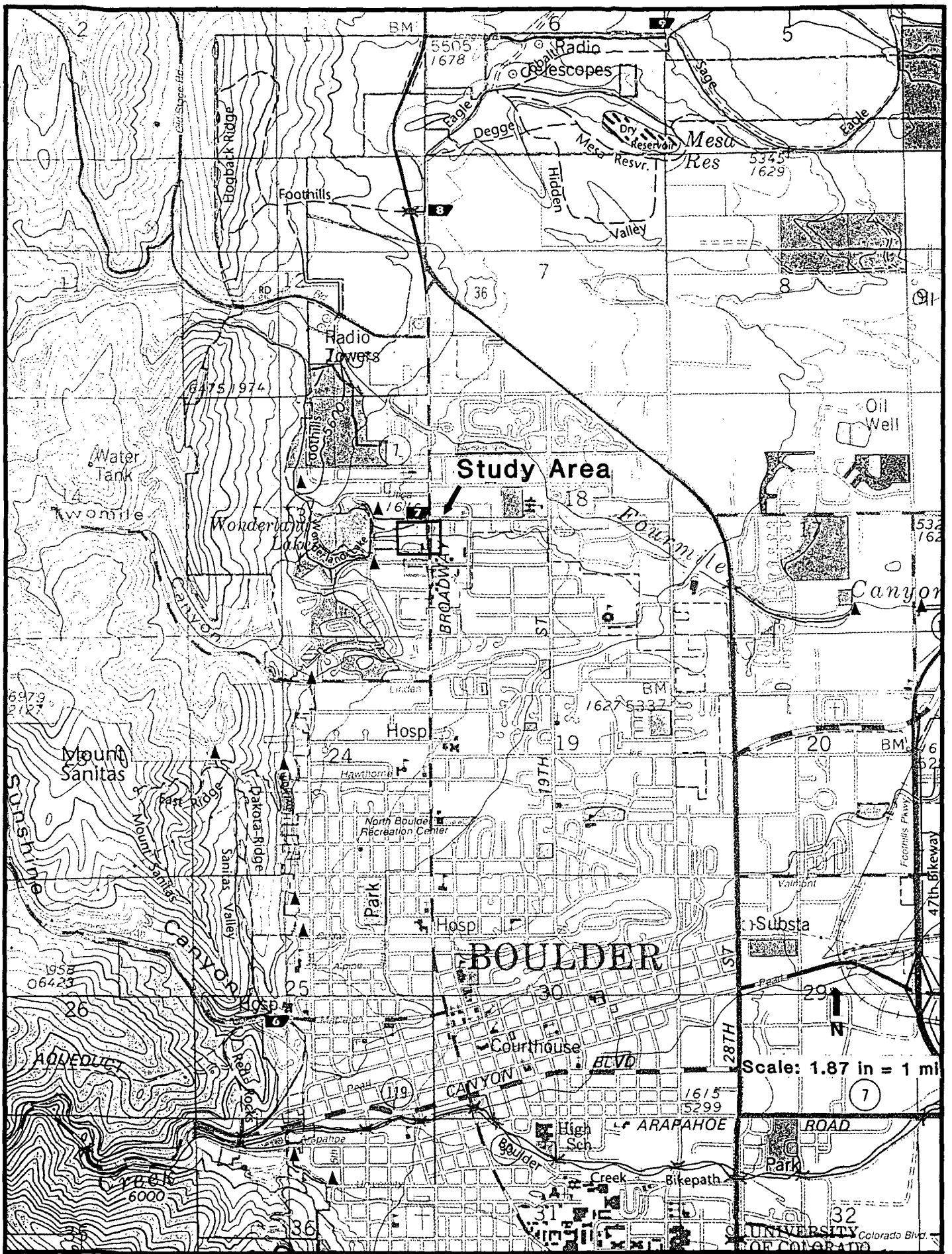


FIGURE C-1 Jurisdictional Wetland Delineation, Wonderland Lake area

APPENDIX C: JURISDICTIONAL WETLAND DELINEATION
FOR WONDERLAND LAKE AREA

Table C-1. Dominant vegetation, names, and abbreviations appearing on field forms.

Abbreviation	Common Name	Scientific Name
AGSM	western wheatgrass	<i>Agropyron smithii</i>
CANE	Nebraska sedge	<i>Carex nebrascensis</i>
CAPR	clustered field sedge	<i>Carex praegracilis</i>
CIAR	Canada thistle	<i>Cirsium arvense</i>
JUAR	artic rush	<i>Juncus articus</i>
PHAR	reed canary grass	<i>Phalaris arundinacea</i>
POPR	Kentucky bluegrass	<i>Poa pratensis</i>

ONSITE WETLAND DELINEATION FORM

Site No 1
 By STD/JEF
 Date 6/4/92

Project Wonderland Lake
 Applicant/Owner OSD County Boulder State Colorado
 Do normal environmental conditions exist at the plant community?
 Yes No If no, explain _____

Has the vegetation, soils, and/or hydrology been significantly disturbed?
 Yes No If yes, explain _____

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Other Plant Species	Indicator Status
<u>JUAR</u>	<u>OBL</u>	<u>1</u>		
<u>P & SM</u>	<u>FACU</u>	<u>2</u>		
<u>POPR</u>	<u>FACU</u>	<u>12</u>		

Plant community #/name Western Wheatgrass / Arctic rush
 Percent of dominant species that are OBL, FACU, and/or FAC 33 % OBL
 Is the hydrophytic vegetation criterion met? Yes No Rationale < 50% of the dominant vegetation is FAC

Notes _____

SOILS

Soil Classification Argic Mollisol Series/phase _____
 Is the soil on the hydric soils list? Yes No Undetermined
 Is the soil a Histosol? Yes No Histic epipedon present? Yes No
 Is the soil: Mottled? Yes No Depth at which mottles first encountered (12" parent distinct)
 Is the soil: Gleyed? Yes No Depth to gley (32" distinct)
 Matrix Color 2.5Y 4/0 Mottle Colors 2.5Y 4/2 - 5/2
 Other hydric soil indicators low chroma @ 12"
 Rooting depth > 32"
 Is the hydric soil criterion met? Yes No Rationale no A horizon, low chroma

Notes _____

calcareous throughout

8"-	CL
12"-	2.5Y 3-4/2
16"-	2.5Y 4/0
24"-	c2f grCL + 2.5Y 4/3
32"-	2.5Y 4/0 c2d 2.5Y 5/6

HYDROLOGY

Is the ground surface inundated? Yes No Surface water depth _____
 Is the soil saturated? Yes No Depth to free-standing water in pit/soil probe hole 7 32"
 Oxidized rhizospheres? Yes No Depth _____
 Other field evidence of surface inundation or soil saturation _____

Is the wetland hydrology criterion met? Yes No Rationale _____

Notes _____

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes No Rationale for jurisdictional decision Criteria for wetland vegetation, wetland soils & wetland hydrology are not met

Notes _____

Preliminary determination
 wetland upland borderline

ONSITE WETLAND DELINEATION FORM

Site No 2
 By SJD/TEF
 Date 6/9/92

Project Wonderland Lake
 Applicant/Owner OSD County Boulder State Colorado
 Do normal environmental conditions exist at the plant community?
 Yes No If no, explain _____

Has the vegetation, soils, and/or hydrology been significantly disturbed?
 Yes No If yes, explain _____

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Other Plant Species	Indicator Status
<u>JUAR</u>	<u>OBL</u>	<u>H</u>		
<u>ADPE</u>	<u>FACU</u>	<u>U</u>		

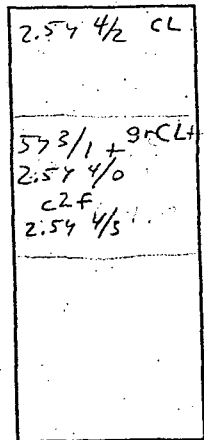
Plant community #/name Arctic wet / blue grass
 Percent of dominant species that are OBL, FACU, and/or FAC 50%
 Is the hydrophytic vegetation criterion met? Yes No Rationale 50% of the dominant vegetation is OBL

Notes borderline

SOILS

Soil Classification Aquept / Aquic Subgroup Series/phase _____
 Is the soil on the hydric soils list? Yes No Undetermined
 Is the soil a Histosol? Yes No Histic epipedon present? Yes No
 Is the soil: Mottled? Yes No Depth at which mottles first encountered 10" (Start)
 Is the soil: Gleyed? Yes No Depth to gley _____
 Matrix Color 5Y 7/1 & 2.5Y 4/0 Mottle Colors 2.5Y 4/3
 Other Hydric soil indicators low chroma below 10"
 Rooting depth > 22"
 Is the hydric soil criterion met? Yes No Rationale _____

Notes Calcium throughout; segregated lime at 12"



HYDROLOGY

Is the ground surface inundated? Yes No Surface water depth _____
 Is the soil saturated? Yes No Depth to free-standing water in pit/soil probe hole > 22"
 Oxidized rhizospheres? Yes No Depth _____
 Other field evidence of surface inundation or soil saturation _____

Is the wetland hydrology criterion met? Yes No Rationale _____

Notes _____

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes No Rationale for jurisdictional decision Criteria for wetland vegetation, wetland soils & wetland hydrology are not met

Notes _____

Preliminary determination
 wetland upland borderline

ONSITE WETLAND DELINEATION FORM

Site No 3
 By STG/TEP
 Date _____

Project Woodland Lake
 Applicant/Owner OSA County Boulder State Colorado
 Do normal environmental conditions exist at the plant community?
 Yes _____ No _____ If no, explain _____

Has the vegetation, soils, and/or hydrology been significantly disturbed?
 Yes _____ No _____ If yes, explain _____

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Other Plant Species	Indicator Status
<u>CAPR</u>	<u>FACW</u>	<u>-</u>		
<u>JUAR</u>	<u>OBL</u>	<u>H</u>		
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Plant community #/name Sedge/Rush
 Percent of dominant species that are OBL, FACW, and/or FAC 100%
 Is the hydrophytic vegetation criterion met? Yes No _____ Rationale _____ > 50% of the dominant vegetation is _____

Notes _____

SOILS

Soil Classification Aquept Series/phase _____
 Is the soil on the hydric soils list? Yes _____ No Undetermined
 Is the soil a Histosol? Yes _____ No Histic epipedon present? Yes _____ No
 Is the soil: Mottled? Yes No _____ Depth at which mottles first encountered 6"
 Is the soil: Gleyed? Yes _____ No Depth to gley _____
 Matrix Color 2.5Y 4/3 Mottle Colors 5Y 3/1, 5Y 4/1
 Other Hydric soil indicators low chroma mottles
 Rooting depth > 20"
 Is the hydric soil criterion met? Yes _____ No _____ Rationale MATBR--MADUX chroma too high for mottled soils; only because there are more high chroma mottles than low chroma "mottles". calcareous throughout - borderline

HYDROLOGY

Is the ground surface inundated? Yes _____ No Surface water depth _____
 Is the soil saturated? Yes _____ No Depth to free-standing water in pit/soil probe hole > 21" 17"
 Oxidized rhizospheres? Yes No _____ Depth 4-5"
 Other field evidence of surface inundation or soil saturation _____
 Is the wetland hydrology criterion met? Yes No _____ Rationale _____

Notes _____

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes No _____ Rationale for jurisdictional decision Criteria for wetland vegetation, wetland soils & wetland hydrology are met
 Notes _____

Preliminary determination
 ___ wetland ___ upland ___ borderline

4	1072 3/2 CL
8"	2.5Y 4/3 gFC cid 5Y 3/1
16"	5Y 5/3 gVCL
24"	M2 d 5Y 4/1
32"	

ONSITE WETLAND DELINEATION FORM

Site No 4
 By STD 17EF
 Date 6/4/92

Project Wonderland Lake
 Applicant/Owner OSD County Rowlder State Colorado
 Do normal environmental conditions exist at the plant community?
 Yes No If no, explain _____

Has the vegetation, soils, and/or hydrology been significantly disturbed?
 Yes No If yes, explain _____

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Other Plant Species	Indicator Status
<u>JUAR</u>	<u>JBL</u>	<u>H</u>	<u>C. P. ME</u>	
<u>C. T. ER</u>	<u>FACW</u>	<u>ms</u>	<u>L. ACTUALA</u>	
			<u>POPR</u>	

Plant community #/name Rush / Thistle
 Percent of dominant species that are OBL, FACW, and/or FAC 50%
 Is the hydrophytic vegetation criterion met? Yes No Rationale 50% of the dominant vegetation is borderline

Notes _____

SOILS

Soil Classification Aquoll Series/phase _____
 Is the soil on the hydric soils list? Yes No Undetermined
 Is the soil a Histosol? Yes No Histic epipedon present? Yes No
 Is the soil: Mottled? Yes No Depth at which mottles first encountered 14" from
 Is the soil: Gleyed? Yes No Depth to gley (16" distinct)
 Matrix Color 5Y 4/1 Mottle Colors 2.5Y 4/4
 Other Hydric soil indicators oxidized rhizosphere, 2"-6"
 Rooting depth > 24"
 Is the hydric soil criterion met? Yes No Rationale _____

Notes calcareous below 7"

4"	10YR 7/2 CL
8"	5Y 2.5/1 CL c2f
9"	2.5Y 4/3 10YR 3/1 CL
16"	c2f 10YR 4/4
24"	5Y 4/1 grC m2cl 2.5Y 4/4
32"	

HYDROLOGY

Is the ground surface inundated? Yes No Surface water depth _____
 Is the soil saturated? Yes No 15" Depth to free-standing water in pit/soil probe hole 18"
 Oxidized rhizospheres? Yes No Depth _____
 Other field evidence of surface inundation or soil saturation _____

Is the wetland hydrology criterion met? Yes No Rationale _____

Notes _____

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes No Rationale for jurisdictional decision Criteria for wetland vegetation, wetland soils & wetland hydrology are ~~not~~ met

Notes borderline

Preliminary determination
 wetland upland borderline

ONSITE WETLAND DELINEATION FORM

Site No 5
 By SD NBF
 Date 5/14/92

Project Wonder Lake Lake
 Applicant/Owner OSO County Boulder State Colorado
 Do normal environmental conditions exist at the plant community?
 Yes No If no, explain _____

Has the vegetation, soils, and/or hydrology been significantly disturbed?
 Yes No If yes, explain _____

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Other Plant Species	Indicator Status
<u>PHAR</u>	<u>FACW</u>	<u>H</u>	<u>CEAR</u>	<u>FACU</u>
<u>CANE</u>	<u>OBL</u>	<u>L</u>	<u>Poa</u>	<u>FACW</u>
			<u>Claytonia</u>	<u>OBL</u>
			<u>SCAM</u>	

Plant community #/name Canary seed grass / sedge
 Percent of dominant species that are OBL, FACW, and/or FAC 100%
 Is the hydrophytic vegetation criterion met? Yes No Rationale > 50% of the dominant vegetation is

Notes _____

SOILS

Soil Classification Aquoll Series/phase _____
 Is the soil on the hydric soils list? Yes No Undetermined
 Is the soil a Histosol? Yes No Histic epipedon present? Yes No
 Is the soil: Mottled? Yes No Depth at which mottles first encountered 13" (distinct mottles)
 Is the soil: Gleyed? Yes No Depth to gley _____
 Matrix Color 10 YR 3-4/1 Mottle Colors 7.5 YR 3/4, 4/4
 Other Hydric soil indicators oxidized rhizosphere 4-10"
 Rooting depth > 24"
 Is the hydric soil criterion met? Yes No Rationale _____

Notes _____

5	1092 3/8 Lt
8"-	1092 3/2 CL SIF
13	1092 3/4
16"-	1092 4/1 C2d
20	7.5 10 4/4, 3/4
24"-	5.7 4/1
32"-	4.2 P 7.5 10 4/6, 4/4

HYDROLOGY

Is the ground surface inundated? Yes No Surface water depth _____
 Is the soil saturated? Yes No Depth to free-standing water in pit/soil probe hole 26"
 Oxidized rhizospheres? Yes No Depth 6"
 Other field evidence of surface inundation or soil saturation _____

Is the wetland hydrology criterion met? Yes No Rationale _____

Notes Pit is 4' from stream

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes No Rationale for jurisdictional decision Criteria for wetland vegetation, wetland soils & wetland hydrology are/are not met

Notes _____

Preliminary determination
 wetland upland borderline

ONSITE WETLAND DELINEATION FORM

Site No 6
 By STD/TEP
 Date 6/5/92

Project Wonderland Lake
 Applicant/Owner DSD County Boulder State Colorado
 Do normal environmental conditions exist at the plant community?
 Yes No If no, explain _____

Has the vegetation, soils, and/or hydrology been significantly disturbed?
 Yes No If yes, explain _____

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Other Plant Species	Indicator Status
<u>CAPR</u>	<u>OBL</u>	<u>H</u>		
<u>CANE</u>	<u>OBL</u>	<u>H</u>		
<u>CIAR</u>	<u>FACU</u>	<u>H</u>		

Plant community #/name Sedge / Thistle
 Percent of dominant species that are OBL, FACU, and/or FAC 64%
 Is the hydrophytic vegetation criterion met? Yes No Rationale > 50% of the dominant vegetation is

Notes _____

SOILS

Soil Classification Azuvoll Series/phase _____
 Is the soil on the hydric soils list? Yes No Undetermined
 Is the soil a Histosol? Yes No Histic epipedon present? Yes No
 Is the soil mottled? Yes No Depth at which mottles first encountered 9"
 Is the soil gleyed? Yes No Depth to gley 19"
 Matrix Color 10 YR 3/1; 5Y 4/1 Mottle Colors 7.5YR 4/4; 2.5Y 5/6
 Other hydric soil indicators Oxidized rhizosphere, 4-10
 Rooting depth > 24"
 Is the hydric soil criterion met? Yes No Rationale _____

Notes _____

	10YR 3/2 L+
8"-	10YR 3/1 CL 22d 7.5YR 4/4
16"-	
19"	5YR 4/1; m21
24"-	2.5Y 5/6 mottled
32"-	

HYDROLOGY

Is the ground surface inundated? Yes No Surface water depth _____
 Is the soil saturated? Yes No 16" Depth to free-standing water in pit/soil probe hole 19"
 Oxidized rhizospheres? Yes No Depth 6"
 Other field evidence of surface inundation or soil saturation _____

Is the wetland hydrology criterion met? Yes No Rationale _____

Notes _____

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes No Rationale for jurisdictional decision Criteria for wetland vegetation, wetland soils & wetland hydrology are/are not met

Notes _____

Preliminary determination
 wetland upland borderline

ONSITE WETLAND DELINEATION FORM

Site No 7
 By SPD/HEP
 Date 6/5/92

Project Wonderland Lake
 Applicant/Owner OSD County Boulder State Colorado
 Do normal environmental conditions exist at the plant community?
 Yes No If no, explain _____

Has the vegetation, soils, and/or hydrology been significantly disturbed?
 Yes No If yes, explain _____

VEGETATION

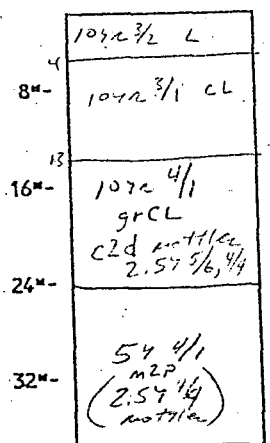
Dominant Plant Species	Indicator Status	Stratum	Other Plant Species	Indicator Status
<u>JUAR</u>	<u>DBL</u>	<u>H</u>		
<u>CEFR</u>	<u>FACU</u>	<u>H</u>		

Plant community #/name Rush / Thistle
 Percent of dominant species that are OBL, FACU, and/or FAC 50%
 Is the hydrophytic vegetation criterion met? Yes No Rationale 50% of the dominant vegetation is OBL

Notes Borderline

SOILS

Soil Classification Aquoll Series/phase _____
 Is the soil on the hydric soils list? Yes No Undetermined
 Is the soil a Histosol? Yes No Histic epipedon present? Yes No
 Is the soil: Mottled? Yes No Depth at which mottles first encountered 12"
 Is the soil: Gleyed? Yes No Depth to gley 13"
 Matrix Color 10YR 3/1, 4/1 Mottle Colors 2.5Y 5/6 + 4/4
 Other Hydric soil indicators Oxidized rhizosphere, 3-10"
 Rooting depth >24"
 Is the hydric soil criterion met? Yes No Rationale _____



Notes _____

HYDROLOGY

Is the ground surface inundated? Yes No Surface water depth _____
 Is the soil saturated? Yes No 12" Depth to free-standing water in pit/soil probe hole 15"
 Oxidized rhizospheres? Yes No Depth 6"
 Other field evidence of surface inundation or soil saturation _____

Is the wetland hydrology criterion met? Yes No Rationale _____

Notes _____

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes No Rationale for jurisdictional decision Criteria for wetland vegetation, wetland soils & wetland hydrology are/are not met

Notes _____

Preliminary determination
 wetland upland borderline

ONSITE WETLAND DELINEATION FORM

Site No 8
 By SPO JEF
 Date 6/5/92

Project Woodsland Lake
 Applicant/Owner OSD County Boulder State Colorado
 Do normal environmental conditions exist at the plant community?
 Yes No If no, explain _____

Has the vegetation, soils, and/or hydrology been significantly disturbed?
 Yes No If yes, explain _____

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Other Plant Species	Indicator Status
<u>CAPR</u>	<u>OBL</u>	<u>H</u>		

Plant community #/name Sedge
 Percent of dominant species that are OBL, FACW, and/or FAC 100 %
 Is the hydrophytic vegetation criterion met? Yes No Rationale > 50% of the dominant vegetation is

Notes _____

SOILS

Soil Classification Aquoll Series/phase _____
 Is the soil on the hydric soils list? Yes No Undetermined
 Is the soil a Histosol? Yes No Histic epipedon present? Yes No
 Is the soil: Mottled? Yes No Depth at which mottles first encountered 3"
 Is the soil: Gleyed? Yes No Depth to gley _____
 Matrix Color 10YR 3/1 - 4/1 Mottle Colors 2.5Y 4/3 - 10YR 5/6
 Other hydric soil indicators possibly few soft iron masses, 3-10"
 Rooting depth >20"
 Is the hydric soil criterion met? Yes No Rationale _____

3"	10YR 2/2 L
8"	10YR 3/1 grCL C2d 2.5Y 4/3
18"	10YR 4/1 CLt C2p 10YR 5/6
16"	10YR 5/6
18"	2.5Y 5/6-5/2 m2p
26"	2.5Y 6/6
32"	

Notes _____

HYDROLOGY

Is the ground surface inundated? Yes No Surface water depth _____
 Is the soil saturated? Yes No 19" Depth to free-standing water in pit/soil probe hole 22"
 Oxidized rhizospheres? Yes No Depth _____
 Other field evidence of surface inundation or soil saturation _____

Is the wetland hydrology criterion met? Yes No Rationale _____

Notes Borderline

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes No Rationale for jurisdictional decision Criteria for wetland vegetation, wetland soils & wetland hydrology are/are not met hydrology assumed

Notes _____

Preliminary determination
 wetland upland borderline

ONSITE WETLAND DELINEATION FORM

Site No 9
 By STD/TEP
 Date 6/5/92

Project Wonderland Lake
 Applicant/Owner BSD County Boulder State Colorado
 Do normal environmental conditions exist at the plant community?
 Yes No If no, explain _____

Has the vegetation, soils, and/or hydrology been significantly disturbed?
 Yes No If yes, explain _____

VEGETATION

Dominant Plant Species	Indicator Status	Stratum	Other Plant Species	Indicator Status
<u>JUAR</u>	<u>OBL</u>	<u>H</u>	<u>CIAR</u>	<u>FACU</u>
_____	_____	_____	<u>AMPS</u>	_____
_____	_____	_____	<u>ACLA</u>	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

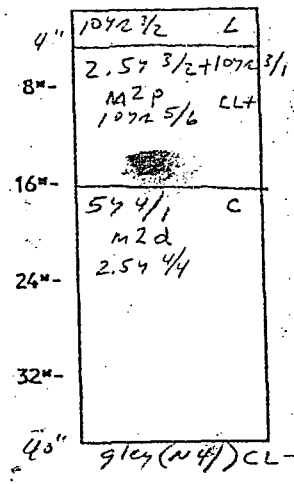
Plant community #/name Rush
 Percent of dominant species that are OBL, FACW, and/or FAC 100%
 Is the hydrophytic vegetation criterion met? Yes No Rationale > 50% of the dominant vegetation is

Notes _____

SOILS

Soil Classification Aquoll Series/phase _____
 Is the soil on the hydric soils list? Yes No Undetermined
 Is the soil a Histosol? Yes No Histic epipedon present? Yes No
 Is the soil: Mottled? Yes No Depth at which mottles first encountered 5"
 Is the soil: Gleyed? Yes No Depth to gley 40"
 Matrix Color 10 YR 3/1 + 2.5 Y 3/2 Mottle Colors 10 YR 5/6
 Other Hydric soil indicators _____
 Rooting depth _____
 Is the hydric soil criterion met? Yes No Rationale _____

Notes _____



HYDROLOGY

Is the ground surface inundated? Yes No Surface water depth _____
 Is the soil saturated? Yes No Depth to free-standing water in pit/soil probe hole 7.45"
 Oxidized rhizospheres? Yes No Depth _____
 Other field evidence of surface inundation or soil saturation _____

Is the wetland hydrology criterion met? Yes No Rationale _____

Notes _____

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes No Rationale for jurisdictional decision Criteria for wetland vegetation, wetland soils & wetland hydrology are/are not met
 Notes Meets criteria if hydrology is assumed.

Preliminary determination
 wetland upland borderline

ONSITE WETLAND DELINEATION FORM

Site No 10
 By SPD
 Date 6/15/92

Project Wonderland Lake
 Applicant/Owner OSD County Boulder State Colorado

Do normal environmental conditions exist at the plant community?
 Yes No If no, explain _____

Has the vegetation, soils, and/or hydrology been significantly disturbed?
 Yes No If yes, explain _____

VEGETATION

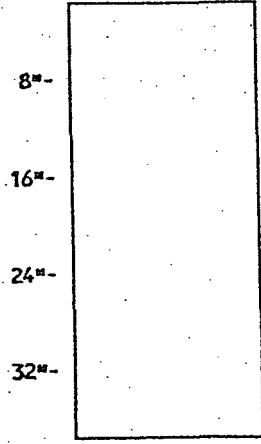
Dominant Plant Species	Indicator Status	Stratum	Other Plant Species	Indicator Status
<u>POPR</u>	<u>FACU</u>	<u>I+</u>	<u>CANE</u>	<u>OBL</u>
<u>CTAR</u>	<u>FACU</u>	<u>I+</u>	<u>ALLA</u>	

Plant community #/name _____
 Percent of dominant species that are OBL, FACU, and/or FAC 0 %
 Is the hydrophytic vegetation criterion met? Yes No Rationale < 50% of the dominant vegetation is

Notes _____

SOILS

Soil Classification Aquoll Series/phase _____
 Is the soil on the hydric soils list? Yes No Undetermined
 Is the soil a Histosol? Yes No Histic epipedon present? Yes No
 Is the soil: Mottled? Yes No Depth at which mottles first encountered 5"
 Is the soil: Gleyed? Yes No Depth to gley _____
 Matrix Color 10 YR 3/1 Mottle Colors 10 YR 4/6
 Other Hydric soil indicators _____
 Rooting depth _____
 Is the hydric soil criterion met? Yes No Rationale _____



Notes _____

HYDROLOGY

Is the ground surface inundated? Yes No Surface water depth _____
 Is the soil saturated? Yes No Depth to free-standing water in pit/soil probe hole > 18"
 Oxidized rhizospheres? Yes No Depth 4"
 Other field evidence of surface inundation or soil saturation _____

Is the wetland hydrology criterion met? Yes No Rationale _____

Notes _____

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the plant community a wetland? Yes No Rationale for jurisdictional decision Criteria for wetland vegetation, wetland soils & wetland hydrology are/are not met

Notes _____

Preliminary determination
 wetland upland borderline

APPENDIX D: CONTROL OF RUSSIAN OLIVE AND SALT CEDAR

CONTROL OF RUSSIAN OLIVE AND SALT CEDAR

The following information is based upon work by William Neil in California and The Nature Conservancy's (TNC) work on the San Miguel River Preserve in Colorado and Hassayampa River in Arizona. Recent tests by TNC along the San Miguel River have shown a success kill rate for salt cedar of nearly 100 percent using the EPA-approved systemic herbicide Garlon 4 to cut stumps. Fall applications have proven the most successful.

Chainsaws can be used to cut tamarisk stumps larger than 1½ inches in diameter. Compound action lope shears can cut smaller plants. Plants should be cut within four inches of the ground. To be effective, stumps should be treated within five minutes of cutting. The systemic herbicide Garlon 4 is sprayed onto the basal area of the stump. Garlon 4 is diluted 1 part Garlon to 2 parts water on the day of application. Garlon 4 is the most appropriate herbicide currently available for use in a riparian environment. Red Rit dye should be added to the solution to aid in identification of treated stumps. Dow Chemical, maker of Garlon 4, has just introduced a premixed-predyed Garlon 4 product called Pathfinder. Cost of Pathfinder is \$28/gallon, compared to a diluted Garlon 4 cost of \$23/gallon. Pathfinder contains an added solvent, however, that promotes bark penetration and, thus, increases effectiveness. Pathfinder, with Garlon 4 as its herbicide ingredient, is now considered the "herbicide of choice" for treating tamarisk stumps.

One disadvantage of Pathfinder is that it is difficult to contain and handle. The solvent has low viscosity and low surface tension, so it leaks out more readily through the caps and nozzles of spray bottles. Also, it is highly hydrophobic, so cleaning skin and equipment requires a detergent rather than simple rinsing or soap and water. Because of Pathfinder's leakage potential, a small pressurized dispenser is preferable to the trigger-pump spray bottle. For about \$5, the Home Depot chain sells a 3-pint hand-pressurized sprayer made by "RL" Industries.

APPENDIX D: CONTROL OF RUSSIAN OLIVE AND SALT CEDAR

Garlon decomposes rapidly after application, in a day or less in sunlit water, and from two weeks to two months in soil. Therefore, as a non-restricted herbicide, it can be used by applicators without state certification and without a permit from the county agriculture agent.

Monitoring and follow-up treatment should be done. Follow-up treatments (if needed) are best completed the following June, before resprouts (if any occur) have time to gain biomass. Retreated areas should be monitored every six months until complete mortality is insured.

Pathfinder became registered throughout the U.S. at the beginning of the year. Information on Pathfinder can be obtained by contacting Bob Brenton with Dow Elanco (916) 373-0347 or (916) 921-0380.

Although this treatment has been designed for salt cedar, it should work successfully for Russian olive as well.