NORTH BOULDER VALLEY

INVENTORY REPORT

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NORTH BOULDER VALLEY INVENTORY REPORT EXECUTIVE SUMMARY

An interdisciplinary team of Open Space staff was formed during 1995 to develop a management plan for the City of Boulder Open Space lands in North Boulder Valley. The purpose of the plan is to provide specific management direction for the natural, cultural, agricultural and passive recreational resources, to resolve potential conflicts between management goals and to ensure effective public participation. North Boulder Valley is one of seven distinct areas delineated for area management planning; area delineation was based primarily on size, watershed, location and land uses.

The North Boulder Valley Inventory Report will be used to integrate various resource needs with management issues related to area. The data will be used by the City of Boulder Open Space Program in evaluating implementation techniques designed to address long term passive recreation and natural resource management. The public and Open Space Board of Trustees will review the North Boulder Valley Inventory Report and provide recommendations for developing the North Boulder Valley Area Management Plan. A variety of opportunities will exist for public participation in providing information and recommendations for the plan and reviewing the proposed management actions for North Boulder Valley: open houses, meetings with neighbors, interest groups and interested people, field trips and formal public meetings.

SUMMARY OF INVENTORY REPORT

Geology. North Boulder Valley is geologically diverse with three geologic processes characterizing the area: deposition, erosion and uplift. Fossils are common in ancient marine shales of the Front Range and within the management area. Protection of fragile paleontological resources may pose conflicts for other land uses and is the principal management issue.

Soils. Twenty-three soils in North Boulder Valley support a variety of land uses, including agricultural croplands, livestock grazing lands and passive recreational uses. These soils sustain a variety of native grasslands, shrublands, wetlands and forests, providing important habitats for native plants and animals. Minimizing soil erosion and preventing soil loss are the primary management issues in North Boulder Valley.

Vegetation. Vegetation in North Boulder Valley consists of a complex mosaic of plant communities and agricultural fields. Over half of North Boulder Valley is comprised of grassland. Agricultural lands account for about one third of the total land area. Six different ecosystems or major plant communities are found in the management area: grasslands, shrublands, forests/woodlands, riparian or stream vegetation, wet meadows and agricultural lands. Seventeen different vegetation types are identified as meeting specific habitat

requirements for native vertebrate animal species. One rare plant, Bell's twinpod, is found on outcrops of Pierre and Niobrara shales in North Boulder Valley.

The ecological condition of the ecosystems and vegetation types varies, influenced significantly by past and present land uses. A history of heavy utilization by livestock is reflected in the species composition and frequency on the Beech, Boulder Valley Ranch and Boulder Land Irrigation and Power properties. Infestations of non-native plants are common. The primary exotic species of special concern in the management area are diffuse knapweed, Canada thistle, Mediterranean sage, Russian olive and cheatgrass. The sections of the management area that are west of U.S. 36 generally appear to contain the most diverse plant communities and contain relatively few invasive exotic species. Friable soils and an uncommon flora make the shale communities in the management area among the most fragile and significant in the Boulder Valley. Maintaining healthy native plant and animal communities is a major management issue.

Wetlands. Twenty-three distinct wetlands cover approximately 220 acres of wetlands (5% of the land surface in North Boulder Valley). Wetlands providing the highest functional quality are on the Axelson property, the Dry Creek drainage, the central draw on the Beech property and the northwestern edge of Lefthand Reservoir on the Beech property. The majority of the wetlands in North Boulder Valley are naturally occurring, although many of the wetlands are artificial, associated with, and dependent upon, irrigation water and delivery systems.

Wildlife. The diversity of wildlife habitats supports a rich variety of wildlife species. Ten major vertebrate habitat types occur in North Boulder Valley with mixed grass prairie as the dominant habitat type. More than 150 vertebrate species are documented in North Boulder Valley. Riparian areas and wetlands surrounding adjacent Boulder Reservoir, Lefthand Reservoir and west of Longhorn Road are critical for supporting populations of migrating and breeding neotropical migrant bird species, northern harriers, American bitterns and, potentially, the Prebles meadow jumping mouse. Grasslands in North Boulder Valley contribute to the preservation of the black-tailed prairie dog in Boulder County. Proximity to high concentrations of a waterfowl at the adjacent Boulder Reservoir and prairie dog colonies in North Boulder Valley are important for maintaining large raptor populations. Twenty-seven of the sixty-nine species listed as species of concern in the Boulder Valley Comprehensive Plan have been recorded for the management area. An American white pelican, ferruginous hawk, bald eagle and peregrine falcon are listed by the Colorado Division of Wildlife as species of concern and have been recorded in North Boulder Valley. White-faced ibis, northern goshawk, ferruginous hawk, bald eagle, peregrine falcon and burrowing owl are listed as species of concern by the U.S. Fish and Wildlife Service and are recorded for North Boulder Valley.

Cultural Resources. Cultural resources from North Boulder Valley show that human presence in the area existed off-and-on over the past 10,000 to 15,000 years. Cultural resource themes represented in North Boulder Valley include: (1) aboriginal pre-EuroAmerican history, (2) agriculture, (3) mining, (4) transportation and (5) water and irrigation systems.

Forty-two cultural resource sites and twenty-seven isolated finds have been documented in North Boulder Valley. Some of the cultural resource sites in the management area include an apparent game drive wall, stone circles, rockshelters, mining structures, a possible historic burial, an abandoned railroad grade, trash dumps, home sites and agricultural ditches. The stone wall may be a prehistoric game drive wall and could be the only known example of a game drive wall in the hogback area of the plains/foothills transition region. In addition to the stone wall, a prehistoric lithic site, stone circle sites, rock shelters and one of the historic homesite ruins may be eligible for the National Register of Historic Places for their potential ability to yield data important to the history or prehistory of the management area. The brick farm house at the Johnson Property is eligible for the National Register of Historic Places because it is an example of common brick construction and architecture used during the 1880s and 1890s. The remaining sites are not eligible for the National Register of Historic Places, but some of the standing buildings may be eligible for local landmarking. Interpreting, protecting and preserving significant and fragile archeological and historical resources are major management challenges.

Property and real estate. Open Space land acquisition in North Boulder Valley began in 1973 with the purchase of four key properties (Boulder Valley Ranch/Lore, Boulder Land Irrigation and Power, Gilbert and Mann). Twenty-nine different properties are included in the management area. Several properties have conservation easements owned by the City. Conservation easements usually mean that the seller retains the use and management rights associated with the property. Three private properties claim access rights through the management area. Development of lands adjacent to Open Space (e.g., Lake Valley Estates, North Rim) results in several management needs: designated access to Open Space, encroachment on Open Space, impacts on native animals and plants and their habitats and increased demands for recreational opportunities.

Facilities. Several Open Space properties have facilities on them and the Open Space Program has constructed other facilities for land management purposes, primarily for passive recreational use. Existing facilities in North Boulder Valley include shelters, outhouses, a pavilion, six houses, barns and associated outbuildings. Many of these facilities are currently not in use. Each facility needs to be evaluated for their potential Open Space use and managed accordingly.

Agriculture. Agricultural practices in North Boulder Valley include cattle grazing, horse boarding and harvesting of irrigated crops (forage and grains). Agricultural lands in North Boulder Valley comprise some of the largest remaining contiguous properties under cultivation or grazing in the Boulder Valley. Three agricultural leases operate in the management area and are leased to local farmers and ranchers to help maintain viable agricultural operations and accomplish management goals. The Boulder Valley Ranch lease area is 1365 acres and approximately 336 acres are irrigated as hay fields and pasture. The Axelson-Johnson-Dawson and Cowles lease area is 892 acres and approximately 550 acres are irrigated lands consisting of small grains, hay fields and pasture. Farmers Ditch and Lefthand Creek (by the Star and Johnson Ditches) are sources for irrigation water in North Boulder Valley.

Approximately 350 acres of state significant agricultural lands occur in North Boulder Valley. Almost 1100 acres of locally significant agricultural lands are designated in North Boulder Valley. The principal agricultural management issue is the sustainability of agricultural operations in the future with growing demands for competing land uses.

Passive Recreation. Approximately 116,000 visits occurred in North Boulder Valley during 1995. Bicycling (46%), hiking (36%), jogging (21%) and horseback riding (2%) were the principal passive recreational activities in North Boulder Valley during 1995. Many visitors exercise dogs during these activities. Four designated trailheads (Foothills, Boulder Valley Ranch, Beech and Eagle) are located in the management area; one designated trailhead (Four Mile Creek) is just outside the management area. Approximately 13 miles of designated trails exist in North Boulder Valley. All of the trails are open to hikers, runners, walkers and horseback riders; six miles of trails are open to bicycle riders. The Foothills, Sage and Eagle Trails are the busiest trails in the management area and account for approximately 82% of all visitor use in North Boulder Valley.

An extensive network of undesignated trails is developing in North Boulder Valley. Undesignated trails develop from informal use and result in unnecessary impacts to soils, fragmentation of plant and animal communities and creation of corridors for the invasion of non-native species. Undesignated trails have developed primarily on more recently acquired Open Space where no designated trails or access points have been established. Encouraging use of official trails and evaluating and reducing the impacts of off-trail use by eliminating undesignated trails are major management needs for the area.

Education and Outreach. Traditional "nature walks," interpretive programs, volunteer projects, including trail construction and maintenance and trash pickup, are conducted annually at North Boulder Valley. Public outreach and participation are important components of the area management planning and monitoring of management actions; these components will be a focus of the education and outreach effort.

1. INTRODUCTION

The North Boulder Valley Management Area (Figure 1.1) is a unique portion of Boulder's Open Space land system. The combination of topography, climate, geology and soils results in a rich ecological diversity. Ponderosa pine woodlands with native grass and shrub understories, mixed grass and shortgrass prairies, are significant plant communities in North Boulder Valley. Rare plants, such as Bell's twinpod, occur on the shale outcrops along the mesas. North Boulder Valley and adjacent Boulder Reservoir support numerous wetlands, including sedge meadows, cattail marshes and lake shorelines.

These diverse plant communities support a wide variety of mammals, birds, reptiles, amphibians and invertebrates. Extensive prairie dog colonies provide the prey base and habitat for more than ten species of raptors, including historic occurrences of burrowing owls. Wintering and migrating bald eagles use perch sites in the area. Mule deer and mountain lions are common in the ponderosa pine woodlands and shrub lands of the higher elevations.

Agriculture is the predominate land use east of U.S. Highway 36/State Highway 7 (U.S. 36) and helps to maintain the rural character of the Boulder Valley. Agricultural practices include cattle grazing, horse boarding and harvesting of irrigated crops (forage and grains).

Portions of the North Boulder Valley Management Area are also very popular with a wide variety of passive recreationists. Common activities include jogging, bicycling, exercising pets, hiking, horseback riding, photography, wildlife viewing and hang gliding. Unusual geologic formations can be observed and studied within the area and on the adjacent Boulder County Six-Mile Fold Natural Area.

The purpose of the North Boulder Valley Area Management Plan will be to resolve conflicting resource goals, provide long term management and preservation of the natural and cultural resources while providing opportunities for effective public input.

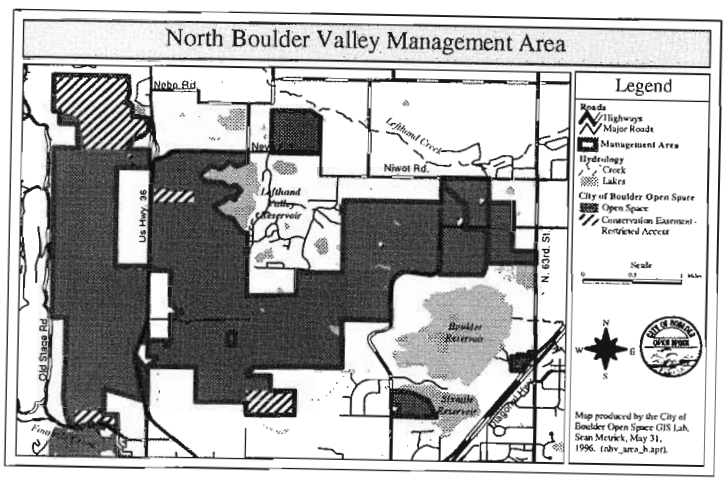

Figure 1.1

The North Boulder Valley Management Area includes all City of Boulder Open Space lands located between Olde Stage Road (to the west), Neva Road (to the north), the Diagonal (to the east) and Lee Hill Road (to the south). Inter-agency cooperation and analysis of surrounding land uses will be stressed throughout the planning process.

1.1 PURPOSES OF AREA MANAGEMENT PLANS

The City of Boulder Open Space Long Range Management Policies (City of Boulder 1995) direct the formulation and use of "area management plans" to incorporate many of the concepts of landscape level planning (e.g., preservation of biological diversity, ecosystem functions and values, habitat fragmentation) into land and resource management activities. Area management plans will translate information, guidelines, goals, objectives, policies and principles into strategies that work on-the-ground. Provisions of the Boulder County and Boulder Valley Comprehensive Plans will be integrated into these on-the-ground translations.

Area management plans will provide the framework to link Open Space Program policies, goals, capital improvement projects, annual budgets and work programs to the management of City of Boulder Open Space lands. This planning framework will be used to:

1. evaluate and incorporate appropriate uses of Open Space as delineated in the City Charter, with the management actions necessary to provide for these uses,
2. protect the community's Open Space investment,
3. monitor and evaluate impacts from these uses and
4. provide the basis for future management decisions.

The Open Space system has seven discrete areas (Figure 1.2) delineated for area management planning purposes: North Boulder Valley, Sanitas-Dakota Ridge, Devils Thumb-South Mesa, Eldorado Mountain, Marshall Mesa, South Boulder Creek and East Boulder. These areas will enable the Program to link broad policies and goals to the specific management needs of a particular geographic region and set priorities for annual work plans and budgets. Four principal criteria have been chosen to define the management areas:

- geographic proximity and contiguity -- connectivity and landscape pattern (such as topography and plant communities),

- watersheds -- definable watersheds and the associated agricultural irrigation delivery systems,

- size of area -- areas must be large enough to encompass certain identified or desired natural functions and processes, but small enough to permit the collection and analysis of data in reasonable time frames and

- land use of the area -- historical and current land uses influence the ecological condition of areas and are important for determining future management requirements; existing uses may be retained or changed in the future to meet management and protection objectives.

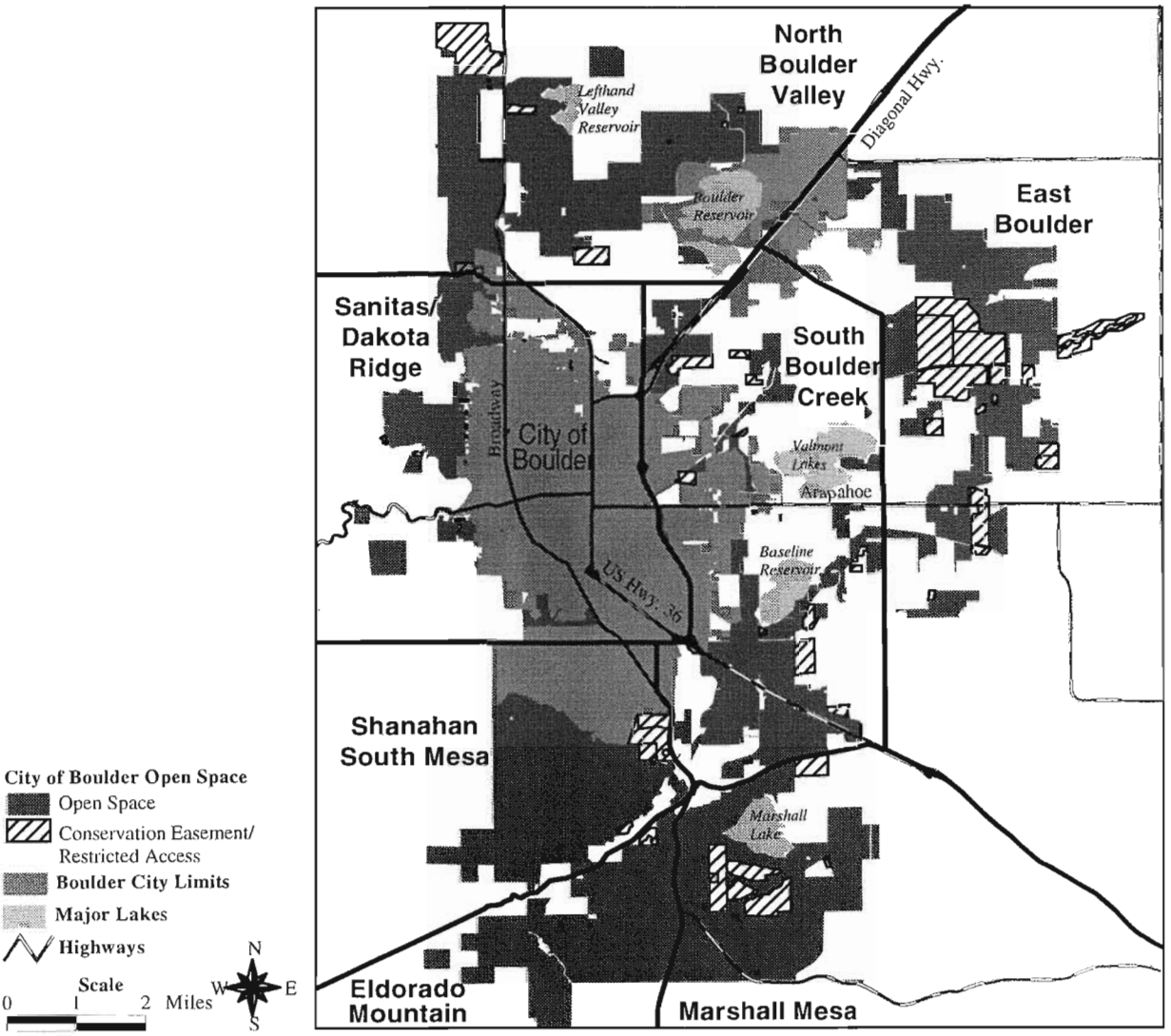

Figure 1.2: Map of conceptual management areas

The principles to be used in area management planning (City of Boulder 1995) are: (1) "involve the public" using a variety of citizen participation techniques; (2) "involve other government agencies" to ensure coordinated and compatible regional resource management; (3) "use interdisciplinary teams" to ensure adequate consideration of resource information and management needs; (4) "use best available information" to prepare analyses and databases where resource information can be stored and used in spatial and temporal analyses; (5) "use a Geographic Information System" to assist in understanding and communicating spatial information; (6) "evaluate management alternatives" accounting for a range of possible and appropriate management actions; (7) "use an ecosystem approach" that considers ecological processes and functions; and (8) "manage competing purposes" weighing potential benefits and impacts of proposed management actions and considering long-term viability and health of natural ecosystems.

1.2 GOALS OF THE NORTH BOULDER VALLEY AREA MANAGEMENT PLAN

- Assess the ecological significance and regional importance of the North Boulder Valley Management Area by evaluating the current uses and natural condition of the management area.

- Complete evaluations of plants, animals, natural communities, geology, hydrology, passive recreation use, agricultural use and archaeology of City Open Space lands within North Boulder Valley.

- Prepare suitable: (1) ecological preservation and restoration, (2) passive recreational use/ development and (3) agricultural use/development alternatives based on the results of the completed environmental, current use and historical use assessments.

- Present analyses of natural conditions, current uses and proposed management alternatives for review by Open Space staff, public agencies, citizen-neighborhood-user group organizations, the general public and Open Space Board of Trustees.

- Formulate and implement an area management plan for North Boulder Valley to guide environmental protection-preservation-restoration, passive recreational and appropriate agricultural uses and develop a monitoring program to evaluate the results of the adopted changes.

1.3 AREA MANAGEMENT PLANNING PROCESS

An interdisciplinary team of Open Space staff was formed in 1995 to develop a management plan for the City of Boulder Open Space lands in North Boulder Valley. The purpose of the interdisciplinary team was to integrate the various skills and expertise within the Open Space Program into a common problem-solving effort. The interdisciplinary team will be primarily responsible for implementing the planning process necessary to meet the goals of the North Boulder Valley Management Area. Steps in the planning process are:

1. identify issues and concerns,
2. conduct a thorough resource inventory and complete an inventory report,
3. develop general management direction,
4. draft plan with proposed management objectives and actions,
5. adopt and implement plan and
6. monitor and revise the selected plan.

Although the interdisciplinary team will be primarily responsible for implementing the planning process, other Open Space staff members, local agencies and interested citizens will have opportunities to participate in the development of the plan. The Open Space Board of Trustees will review and approve the management plan and Open Space staff will implement and monitor the selected plan.

1.4 ROLE OF THE INVENTORY REPORT IN AREA MANAGEMENT PLANNING PROCESS

This North Boulder Valley Inventory Report will be used to integrate various resource needs with management issues related to North Boulder Valley. The data will be used by the City of Boulder Open Space Program in evaluating implementation techniques designed to address long term passive recreation and natural resource management. The North Boulder Valley Inventory Report will be available for public review and the results presented at an open house in early June, 1996. A short presentation on the inventory report will be given to the Open Space Board of Trustees in June of 1996. The goal of these public meetings will be to review the inventory report, incorporate citizen comment and begin formulating the general management direction for the management area.

A draft of the proposed general management direction will be available to the public and Open Space Board of Trustees later in the summer. Input from these meetings will be considered and the team will begin to develop specific actions to accomplish the goals of the management plan.

A draft North Boulder Valley Management Plan, with specific management actions, will be presented at another series of public meetings and presentations in early fall of 1996. Input from these meetings will be incorporated into the next draft management plan and presented to the Open Space Board of Trustees for its review and approval. Each open house and public meeting will be announced in local newspapers, posted on information boards throughout the management area and sent to interested individuals.

Once the North Boulder Valley Area Management Plan is adopted, the Open Space staff will develop implementation strategies and incorporate the desired management actions into annual capital improvement projects and annual work programs. Annual capital improvement projects and work programs are reviewed and approved by City Council, through the City's budget process. The plan will be monitored and evaluated on an annual basis by Open Space staff.

2. THE PLANNING CONTEXT FOR AREA MANAGEMENT PLANS

Policies and management direction for the City of Boulder's Open Space Program are provided by the City Manager and City Council based upon recommendations of the Open Space Board of Trustees. The Open Space Board of Trustees is a five member citizen board appointed by the City Council. The Open Space Program is administered by a director appointed by the City Manager. Volunteers and a staff of sixty-five resource specialists, planners, land managers, educators and property agents are divided into eight divisions (resource conservation, land management, education and outreach, planning, acquisitions, financial services, geographic information systems and administrative services). The Program manages approximately 26,000 acres of prairie grasslands, montane forests and shrublands, riparian floodplains and wetlands, reservoirs and streams, rangelands, agricultural croplands and associated facilities within the Open Space system.

Direction for management of Open Space land was broadly contained in early City Council resolutions. The broadest goals of the program were "the preservation and protection of the natural environment that has given Boulder much of its character" and included a variety of strategies including "lease back arrangements whereby land ...can be continued for agricultural or other uses that are not inconsistent with the overall objectives of the ...program" (Resolution No. 24, 1968). The Open Space Board of Trustees was created by Council in August 1973, and, within the following twelve months, the Board drafted an Open Space Plan which delineated purposes and functions of Open Space similar to those adopted by Charter amendment in 1986. The plan recommended land management consistent with the stated purposes and functions of "the most appropriate conservation, preservation and management techniques."

Area management plans are the critical component for translating the general policies in the Long Range Management Policies, City Charter, Boulder Valley Comprehensive Plan and Boulder County Comprehensive Plan. City ordinances and regulations and resource management plans into specific management actions on the ground. Area management plans help determine what actions will be needed to maintain the Open Space system and to determine project priorities and budgeting of Open Space funds.

Natural resource planning is the primary basis for management decisions on public lands. Only in the past twenty years has planning occurred for undeveloped public lands where the management objectives have been to preserve natural lands and natural processes and functions in specific areas. Much of recent public land management falls under the rubric of "multiple-use planning." Landscape-level planning that accounts for natural processes and functions through time and over space is recognized now as a more effective and comprehensive approach to guiding management of natural resources and public lands.

Four principal planning documents guide the City of Boulder's Open Space Program's land and resource management program: Long Range Management Policies, City of Boulder Charter, Boulder Valley Comprehensive Plan and Boulder County Comprehensive Plan.

2.1 LONG RANGE MANAGEMENT POLICIES

The Long Range Management Policies provide the general guidance and direction for management of Open Space during the next fifteen years. The Long Range Management Policies were approved by the Open Space Board of Trustees and adopted by the City Council in February, 1995. The Long Range Management Policies will be revised every five years. Four basic management concepts were identified in the Long Range Management Policies to accomplish the goals of the Program:

- ecosystem approach -- an ecosystem approach will be employed to maintain fundamental ecological processes, where possible;

- use of interdisciplinary teams -- management planning for Open Space will use interdisciplinary teams to identify, define and recommend implementation techniques to accomplish resource and use monitoring, inventory, research, mitigation and enforcement activities;

- best available information -- current scientific research and data collection and analysis will be encouraged to fill identified information gaps to provide best available information for management planning and implementation, and to investigate management issues in a problem-focused context and

- inventories and monitoring -- resource inventories and long-term monitoring will provide information for temporal and spatial trend analyses and are the basis for adjustments in management to meet City Charter goals, serve the community and protect the land.

2.2 CITY OF BOULDER CHARTER

Article 12, Section 176 of the Charter of the City of Boulder defines the purposes of Open Space as:

(a) Preservation or restoration of natural areas characterized by or including terrain geologic formations, flora or fauna that area unusual, spectacular, historically important, scientifically valuable, or unique or that represent outstanding or rare examples of native species;

(b) Preservation of water resources in their natural or traditional state, scenic areas or vistas, wildlife habitats or fragile ecosystems;

(c) Preservation of land for passive recreational use, such as hiking, photography or nature studies and, if specifically designated, bicycling, horseback riding or fishing.

(d) Preservation of agricultural uses and land suitable for agricultural production;

(e) Utilization of land for shaping development of the city, limiting urban sprawl and disciplining growth;

(f) Utilization of non-urban land for spatial definition of urban areas;

(g) Utilization of land to prevent encroachment on floodplains; and

(h) Preservation of land for its aesthetic or passive recreational value and its contribution to the quality of life of the community.

The guidance provided by the City Charter may result in conflicting management objectives in certain areas. Area management plans will incorporate the general guidance of the City Charter into resource analyses and will provide the basis for resolving conflicting management goals on specific Open Space lands.

2.3 BOULDER VALLEY COMPREHENSIVE PLAN

The Boulder Valley Comprehensive Plan establishes the coordination between the City of Boulder and Boulder County on planning issues involving both agencies. The Boulder Valley is a Community Service Area within Boulder County where the City and County have agreed upon a set of land use and management policies to implement joint planning objectives.

The current Boulder Valley Comprehensive Plan, adopted by both the City and the County in 1977, and updated periodically thereafter, describes the City's current Open Space Plan as providing "the basic structure of the Boulder Valley Comprehensive Plan" (City of Boulder 1990a). The Boulder Valley Comprehensive Plan includes the purposes and functions of Open Space as defined by the Open Space Board of Trustees. Other community, environmental and design policies set goals for protecting many features of the Boulder Valley, including the appearance of major entryways, agricultural areas, critical habitat areas, and aquifer and groundwater recharge areas. Many of the policies and maps in the Boulder County Comprehensive Plan, dealing with the protection and management of significant agricultural lands, wildlife and plant habitats, natural landmarks and natural areas and archaeologically sensitive areas, are now components of the Boulder Valley Comprehensive Plan. The 1996

update of the Boulder Valley Comprehensive Plan added a Natural Ecosystem Map and related policies. All of these maps and policies apply to one or more areas to be sed in the North Boulder Valley Area Management Plan.

The 1996 update of the Boulder Valley Comprehensive Plan listed general policy direction for resource and land protection and management. Restoring, maintaining and sustaining the environmental quality of the Boulder Valley are principal emphases of the revised Boulder Valley Comprehensive Plan. Protecting and restoring native ecosystems, biological diversity and natural processes are essential elements of these policies. Preservation of agricultural lands, wetlands, open space and historic and cultural resources are other major components of the environmental sections of the Boulder Valley Comprehensive Plan (see Appendix 2.1 for a sting of applicable policies).

The Boulder Valley Natural Ecosystems Map, designating significant, high quality native ecosystems or restorable native ecosystems in the Boulder Valley is a component of Boulder Valley Comprehensive Plan land use map. Boulder Valley natural ecosystems are defined as places that support natural ecosystems of native plants and animals or possess important ecological, biological or geological values. Boulder Valley natural ecosystems may also contain features that are rare, unique or sensitive to human disturbance and are essential to maintain the scientific and educational importance of places representing the rich natural history of the Boulder Valley. The Natural Ecosystems Map also identifies connections and buffers that are important for sustaining biological diversity and viable habitats for native species, for protecting the ecological health of certain natural systems and for buffering potential impacts from adjacent land uses. Most of the Open Space in the North Boulder Valley management area has been designated as significant natural ecosystems on the Boulder Valley Natural Ecosystems Map.

The purpose of the Boulder Valley Natural Ecosystems Map is to guide City and County planning decisions in the protection of wildlife and plant habitats. Natural ecosystem designations will not necessarily preclude development or human use of a particular area, but will serve to educate agencies and landowners about environmental concerns in particular areas. Information contained in the Natural Ecosystems Map may be used in planning decisions for service area changes, land use designation changes, annexations and zonings, development reviews, Valley-wide planning, subcommunity and departmental master planning, land acquisitions and private land management.

2.4 BOULDER COUNTY COMPREHENSIVE PLAN

County comprehensive plans are mandated by state law and address county land use. Lands in North Boulder Valley, for the most part, are under the land use jurisdiction of Boulder County. Boulder County adopted one of the earliest and most comprehensive county land use plans in Colorado. The Boulder County Comprehensive Plan is revised every five years and is adopted

by the Boulder County Planning Commission. The plan has four principal elements: land use, parks and open space, environmental resources (including Environmental Conservation Areas) and cultural resources (Boulder County Land Use Staff 1986). The plan is also a guide for development in the County's rural areas, outside municipal planning boundaries. Revisions are prepared with the cooperation of municipalities, but are not subject to their approval.

Several major goals and policies in the Boulder County Comprehensive Plan are relevant to Open Space area management planning. Open space should meet human needs and public use of open space should be consistent with the purposes of the acquisition of the land and resource management plans. Preservation and conservation of agricultural lands is a primary goal for Boulder County as is maintenance of the rural character of the County. A county-wide trail system is promoted and coordination and cooperation with private landowners to accomplish the goals of the Comprehensive Plan is key. Preservation of rare plant habitats and natural communities are Comprehensive Plan goals and historic and cultural sites and resources will be identified and protected in the County. Preservation of identified natural areas, natural landmarks, riparian ecosystems and critical wildlife habitats are key components of the Boulder County Comprehensive Plan.

2.4.1 Critical Wildlife Habitats

The North Boulder Valley Management Area is within the historical or current ranges of several federally listed threatened or endangered animals: gray wolf, black-footed ferret, peregrine falcon and bald eagle.

More than thirty-five of the seventy-six native breeding bird species of special concern listed in the Boulder County Comprehensive Plan are known or expected to occur in North Boulder Valley. Twenty of the forty-two mammals of special concern listed in the plan are known or expected to occur in North Boulder Valley. Relatively large prairie dog towns in the management area have provided a major prey base and habitat for a variety of birds, mammals , reptiles and amphibians and invertebrates. Periodic epizootics of sylvatic plague result in large die-offs of prairie dogs and the subsequent slow recolonization from surviving colonies.

No native fish surveys have been completed for North Boulder Valley although twenty native fish are listed as species of special concern in the County Comprehensive Plan. Twenty-four reptiles and amphibians are listed as species of special concern in the Boulder County Comprehensive Plan with seven known to occur in North Boulder Valley, although no comprehensive inventories have been completed. The Boulder County Comprehensive Plan does not list any invertebrate species of special concern.

2.4.2 Rare Plant Habitats and Natural Communities

Preservation of rare plant habitats and natural communities (including riparian areas and wetlands) as functioning native ecosystems is another policy direction provided in the Boulder County Comprehensive Plan. The County Comprehensive Plan lists forty plant species of special concern in Boulder County (Colorado Natural Heritage Inventory 1995). Colorado plant species of special concern are "geographically restricted, with few occurrences and with threats to a significant proportion of the known occurrences." Bell's twinpod (*Physaria bellii*), listed as very rare and susceptible to extirpation, occurs in North Boulder Valley. *Physaria bellii* is a Colorado endemic species that is found only along the Front Range and has narrow habitat parameters limited to shaley outcrops.

The North Boulder Valley Management Area has three of the eleven plant communities of statewide significance identified in the Boulder County Comprehensive Plan. All of the plant communities of statewide significance are either geographically isolated, not protected in sufficient size or threatened by current land uses. The eastern slope of the northern Colorado Front Range is known to be particularly rich in unique, rare or threatened plant communities. The combination of topography, climate, geology and soils results in this rich ecological diversity. Ponderosa pine woodlands, mixed grass prairie and shortgrass prairies are significant plant communities in North Boulder Valley.

2.4.3 Environmental Conservation Areas

Environmental Conservation Areas "are large and relatively undeveloped areas of the County that possess a high degree of naturalness, contain high quality or unique landscape features and/or have significant restoration potential. Size, quality and geographic location make them an important tool for combating the affects [sic] of habitat fragmentation." Environmental Conservation Areas are delineated by the County as areas capable of meeting criteria of size, naturalness, ecological condition and quality, connectivity and sufficient information.

Thirteen Environmental Conservation Areas are designated in the Boulder County Comprehensive Plan. Environmental Conservation Area #11, Boulder Valley Ranch/Beech Open Space, is included in the North Boulder Valley Management Area. The Boulder Valley Ranch/Beech Open Space Environmental Conservation Area encompasses approximately 5,500 acres of the ecotone between the Great Plains grasslands and Foothills grasslands, shrublands and montane woodlands. Two critical wildlife habitats and five known occurrences of plant species of special concern are identified in this Environmental Conservation Area. The Environmental Conservation Area meets several quality and uniqueness factors: winter raptor concentration area, only known nesting area for northern harriers in Boulder County, prairie dog colony, historic and potential nesting habitat for burrowing owls, occurrences of the rare Bell's twinpod and connections to other public lands providing opportunities for movement and migration of

species as they responding to climatic and seasonal variations. Environmental Conservation Area #11 contains several "naturalness" measures including intact habitat unfragmented by roads and trails, and areas with prairie and wetlands restoration potential. County designated Six-Mile Fold Natural Area is adjacent to the management area.

The North Boulder Valley Management Area within the Boulder Valley Ranch/Beech Open Space Environmental Conservation Area is characterized by native shortgrass and mixed grass prairies on the mesas and outwash plains and robust mixed grass prairie in the drainage swales and bottomlands. Significant wetlands occur in areas with seasonal moisture or are supported by artificial irrigation. The adjacent Boulder Reservoir, owned by the City of Boulder Parks and Recreation Department, supports numerous wetlands, including sedge meadows, cattail marshes and lake shorelines. The management area supports extensive prairie dog colonies providing the prey base for more than ten species of raptors. Wintering and migrating bald eagles use perch and roost sites in the area. Rare plants occur on the Pierre shale outcrops along the mesas. Several woody draws support a wide variety of small mammals and birds.

3. A BRIEF NATURAL HISTORY OF THE BOULDER VALLEY

3.1 INTRODUCTION

The coming together of the Great Plains prairies and the forests of Colorado's Front Range of the Rocky Mountains creates varied habitats of biological richness and natural diversity. This convergence of two great physiographic provinces is denoted on the east by the Great Plains province, ranging from rolling hills to flatlands, and the rugged dissected topography of the Rocky Mountain province on the west. In the Boulder area, this geologic convergence and the sculpting of wind and water for thousands of years has resulted in many micro-environments that not only support numerous native plants and animals, but also attract human settlement and development that benefit from the abundant natural diversity and scenic beauty. North Boulder Valley is part of this rising of the foothills of Colorado's Front Range, from the grassland expanses of the high plains. Its distinctive geologic strata support varied habitats for a wide diversity of native plants and animals.

3.2 TOPOGRAPHY

Topographical variation of the landscape in the Lefthand Creek watershed is one of the management area's most distinctive characteristics (Figure 3.1). Elevational differences and the scouring and depositional action of wind and water combine to determine predictable locations of plants and animals as well as unpredictable surprises. Some of these biological surprises are the high quality remnant habitats for large predators such as black bears and mountain lions and the occurrences of alpine plants commonly found on the alpine tundra thousands of feet higher and many miles away.

3.3 CLIMATE

The climate of the Boulder Valley area is as variable as its geology and topography. Generally, North Boulder Valley experiences a continental climate of hot, dry summers and cold winters. The semi-aridity of the area is typical of the steppe grasslands of the high plains and results from its location in the orographic rain shadow created by the mountains to the west. Annual precipitation averages between 12 and 18 inches annually. Periodic droughts are common in the climatic record. Chinook winds can exceed 100 miles per hour and occur frequently between December and March. Occasional upslope weather conditions bring the most moisture to the area. The topographic variability heightens micro-climatic influences across the landscape.

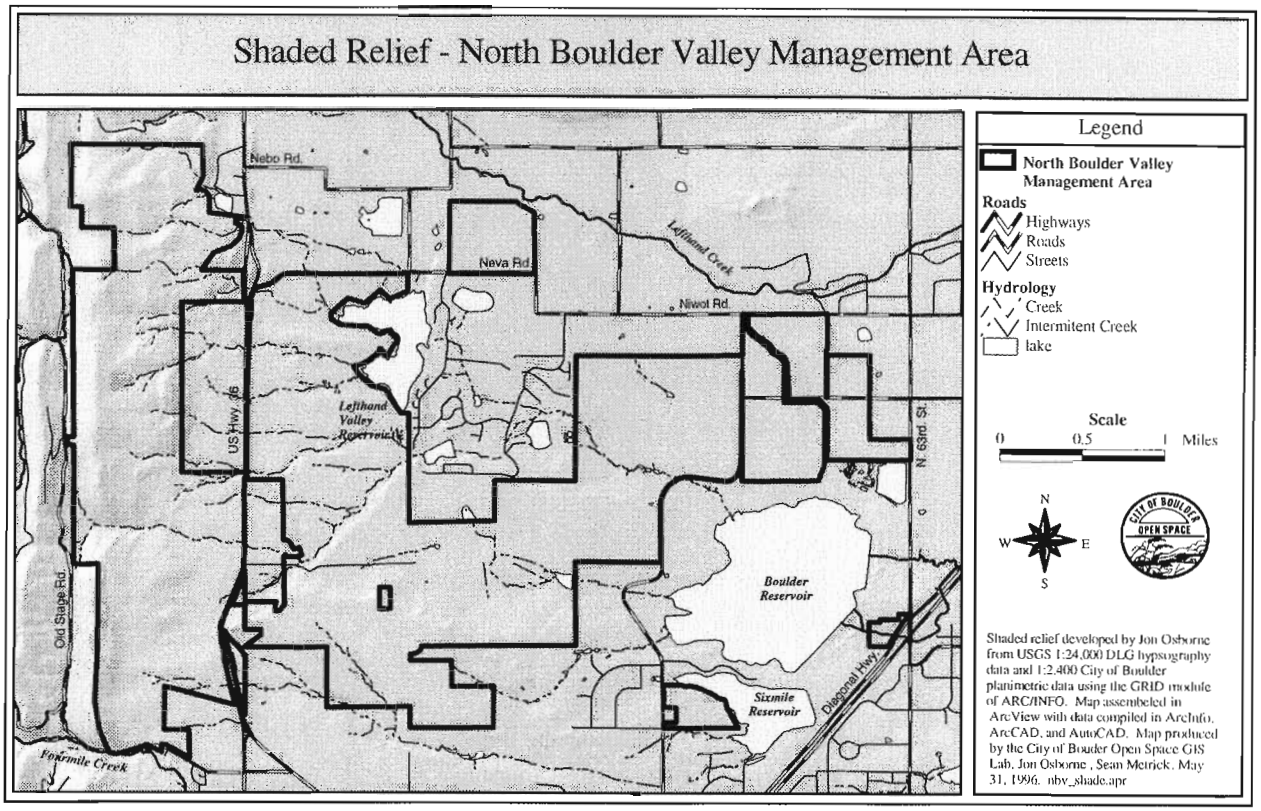

Figure 3.1: Shaded relief map of the North Boulder Valley Management Area

3.4 HYDROLOGY FOR NORTH BOULDER VALLEY

North Boulder Valley is in the watershed of Lefthand Creek, a principal tributary of the Saint Vrain River. Three ephemeral drainages occur on the management area's Open Space lands. Water is found intermittently in these drainages, primarily a result of seasonal moisture. Several wetlands occur in association with these drainages and with the springs and seeps in the area. Local topography is characterized by an approximate 10% slope to the east with multiple undulations and natural drainage gulches (Figure 3.2*).

Groundwater occurs within the shallow alluvial/colluvial deposits associated with the intermittent surface-water drainages crossing the site, within fractured bedrock of the Niobrara formation and within the Oyster Bed and Fort Hayes limestones of the Niobrara formation (Harlan Casey and Assoc. 1993).

The regional water-table gradient, within the shallow groundwater system in the upper part of the bedrock and the overlying surficial material, along major drainages, is largely controlled by the overall topographic relief and the geologic conditions of the area. In the North Boulder Valley groundwater and surface water generally drain eastward into two principal receptacles, Lefthand Reservoir and the adjacent Boulder Reservoir.

3.5 GREAT PLAINS MIXED GRASS PRAIRIE OF NORTH BOULDER VALLEY

North Boulder Valley is primarily characterized by native shortgrass and mixed grass prairies on the mesas and outwash plains and tallgrass prairies in the drainage swales and bottomlands. Significant wetlands occur in areas with seasonal moisture or are maintained by artificial irrigation. The adjacent Boulder Reservoir supports numerous wetlands, including sedge meadows, cattail marshes and lacustrine shorelines. North Boulder Valley is home to extensive prairie dog colonies whose populations fluctuate dramatically. Numerous raptors are found in North Boulder Valley where the variety and diversity of wildlife habitats enable birds of prey to hunt, nest and raise their young. Wintering and migrating bald eagles and golden eagles use the perch and roost opportunities provided by mature cottonwoods located in the management area as well. Rare plants occur on the Pierre and Niobrara shale outcrops along the mesa edges. Numerous woody draws support high densities of small mammals and birds.

North Boulder Valley is recognized as an ecologically significant area in regional and local contexts. Significant patches of relatively unfragmented grassland, habitat for plant and animal species of special concern, potential for natural area restoration and connectivity to other public lands make this a very important area. The biological diversity associated with the plains/foothills ecotone is well-represented within North Boulder Valley.

3.6 SOUTHWEST IN THE NORTH

One of the most important ecological phenomena representative of the Boulder Valley's position along the Front Range is the northward penetration of plant and animal species commonly associated with warmer climates of the Sonoran desert Southwest. The Mexican wood rat is one of the best examples of several plant and animal species on the edges of their ranges and the "southwest influence" in the Boulder Valley. Species on the edges of their ranges are significant in the way they respond to evolutionary pressures, changes in climate and landscape disturbances. Here, on these edges, the dynamic of range extensions and retreats is played out. Gene flow on the edges of range occurs largely undetected, but becomes the directional force for the future of all species.

3.7 NATURAL PROCESSES AND WESTERN LANDSCAPES

Natural processes influence the character of the land, and the plants and animals that live there vary spatially and temporally. Geologic processes occurring over thousands and millions of years determined the foundation of the landforms found in North Boulder Valley. Climate and climatic changes over hundreds and thousands of years forced species to adapt or die. Plants and animals chronicle the story of humid cycles of greater moisture and arid cycles of scant moisture. Tree-rings, pack rat middens, pollen cores and fossils reveal these things. Plants and animals adapted to climate changes. They moved around on the land in a dynamic ebb and flow of species responding to change. Drought is the constant in the Great Plains since the end of the last glacial epoch 15,000 years ago. Only in the last 100 years have landscapes been viewed as static and inert.

3.7.1 Fire

Historically, fire-evolved natural communities of plants and animals developed over time where frequent small scale fires and periodic large scale fires determined what appeared on the land. Prairie grasslands had fire frequencies estimated between three and fifteen years. Lower treeline marks the meeting of forest and grassland on the eastern mountain front. The invasion and retreat of trees into the grasslands resulted from changing moisture regimes and fire frequencies during extensive periods of aridity interspersed with occasional wetter periods. Ponderosa pine savannahs at this grassland-forest transition area had fires burning every eight to twelve years. Fire frequency levels for montane woodlands ranged from a minimum of 1-3 years to a maximum of 29-162 years (Veblen et al. 1996). Lightning-caused fires comprise the majority of historic fires prior to European settlement. Indigenous peoples set fires to improve hunting opportunities. Most human-caused fires occurred in grasslands, although some fires ran into the ponderosa pine woodlands.

3.7.2 Grazing

Ungulate grazing has influenced the nature of grasslands in western North America for thousands of years. Large bison herds and elk and antelope moved seasonally across the prairies. Intensive grazing by herds was short duration and seasonal, influenced by natural barriers. Recovery of grasslands from grazing was dependent upon climatic conditions and grazing intervals, but was sufficient to support periodic grazing from migratory herds.

3.7.3 Settlement

Permanent land uses or human settlements did not occur prior to European settlement of the region 150 years ago. Seasonal migrations marked the movement of animal and human inhabitants over the land. Settlement has exerted perhaps the most profound change in the dynamic natural processes of this region. Humans became the primary change agents on the land. Exotic plants and weeds replaced native plant communities. Water was redirected and rechanneled, fires were extinguished and forests cut. Native grazing herds were slaughtered, replaced by exotic livestock, and grazing patterns changed from migratory herds to fenced and confined cattle pastures. Human populations swelled to where the elimination of natural processes was necessary to ensure the safety and convenience of developing urbanized areas.

3.7.4 Development

During the 100 years between settlement in 1860 and urban and suburban development in 1960, North Boulder Valley was characterized by a mix of small dairy farms and cattle ranches dependent upon the annual delivery of mountain water to irrigate the former prairies. Farms and ranches serviced the developing college town of Boulder and the growing Denver metropolitan area. Many of these farms and ranches were bought up for residential development in the 1960s and 1970s. Much of the Open Space in North Boulder Valley was purchased during this time. Traditional farming and ranching practices continued under Open Space Program management through leases with former landowners or local farmers. Recreational uses in North Boulder Valley were limited mostly to a system of old cow paths and farm roads to accommodate hikers, horseback riders, dog walkers and bicyclists. Some areas in North Boulder Valley were managed as wildlife habitats, especially rangelands where prairie dog colonies persisted. North Boulder Valley became less isolated from residential development pressure and growing recreational uses in the 1980s and 1990s.

3.8 THE INVENTORY REPORT

The North Boulder Valley Inventory Report and Area Management Plan is the first comprehensive evaluation of the natural resources in North Boulder Valley to define the management direction and commitment necessary to maintain and preserve this place, the natural processes that make it what it is and the vision of what it will be in the future.

The remainder of this report describes the various natural and cultural resources of the North Boulder Valley Management Area. Each section provides a brief introduction, resource information, issues and data gaps. The methods used for various sections are detailed in Appendix 3.1. In many cases, specific areas of Open Space are noted by property name.

Historically, the City has used the seller's name, or family name, as a way to identify unique purchased Open Space properties. Many times, a property may not use the sellers name and instead will be associated with an historic farm or family or for a geographical location or some physical characteristic of the property. Figure 10.1* shows the location of each property, its size and acquisition date.

4. GEOLOGY

4.1 INTRODUCTION

The North Boulder Valley Management Area consists of two distinctly different geologic areas: the Front Range to the west and the alluvial plains to the east, divided approximately by U.S. 36 running north-south. North Boulder Valley is geologically diverse with three geologic processes, deposition, erosion and uplift, characterizing the area. The geology of North Boulder Valley has been mapped (Wrucke and Wilson).

4.2 RESOURCE INFORMATION

The Front Range is considered the eastern-most portion of the Rocky Mountain ranges. In geologic terms, this is the uplift zone. Regionally, the area can be visualized as a giant upward arch in which the rocks of the center of the range have been uplifted relative to those both to the east and the west (Harlan, Casey and Assoc. 1993). Over millions of years, beginning approximately 65 million years ago, the originally horizontal layers of sedimentary rock were forced upward. The stress resulting from this uplift activity caused frequent folding and warping, resulting in features such as the adjacent Six-Mile Fold. Faulting occurred where the strain of the slow continuous uplift exceeded the elasticity of the rocks to bend. During the period of mountain uplift, molten magma was injected into the sedimentary layers where the magma cooled and solidified to form sills and dikes of quartz latite (Boone 1990). Over time, the sedimentary rocks have been eroded, exposing the basement complex of igneous and metamorphic rocks upon which they rested. These igneous and metamorphic rocks can now be seen in areas west of the Dakota Hogback ridge.

The oldest sedimentary rocks which outcrop in North Boulder Valley area comprise the Dakota Group. They were deposited about 120 million years ago (Pendleton 1977). This sedimentary complex is dominated by a ridge of gray to tan sandstones forming the Dakota hogback along the western boundary of the management area. These sediments, deposited as sands and gravels, were carried eastward by streams and rivers draining mountains in Utah and Nevada. As the mountains rose to the west, an enormous inland sea invaded the central portion of North America. Beach sands were deposited along the edge of this sea forming the lower part of the Dakota Group (Runnells 1976).

Deposition for the next 70 million years was characterized by advances and retreats of this inland sea. The rocks which remain today suggest a wide range of ancient environments including deep seas (Pierre shale), deltas and sandy beaches (Dakota sandstones) and coastal swamps and reefs

(coal beds and limestone deposits of the Niobrara formation). Between 10,000 and 15,000 feet of rock formations are preserved from this prolonged period of deposition (Braddock undated, Runnells 1976). The most recent uplift of the Rocky Mountains began approximately 70 million years ago. Until then, all the sediments deposited during the previous 70 million years had been lying generally horizontal. As the Rocky Mountains emerged these sandstones, siltstones, limestones and clays were tilted and bent upwards (Figure 4.1). The sedimentary bedrock of the North Boulder Valley Management Area shattered, fractured and faulted as they were tilted upwards. This period is called the Laramide orogeny (Braddock undated, Runnels 1976)

As the mountains rose, significant episodes of rapid erosion and deposition have resulted in massive out-pourings of debris onto the nearby plains. This process capped the ancient Cretaceous deposits with varying thicknesses of coarse sediments. Remnants of these deposits include the isolated butte of Haystack Mountain, adjacent to North Boulder Valley, and the large mesas found along the base of the foothills west of Boulder (e.g., Table Mountain, also adjacent to the management area). Many of these recent relatively unconsolidated deposits as well as the underlying bedrock layers are being cut into by the numerous east/west trending drainages which dissect the area.

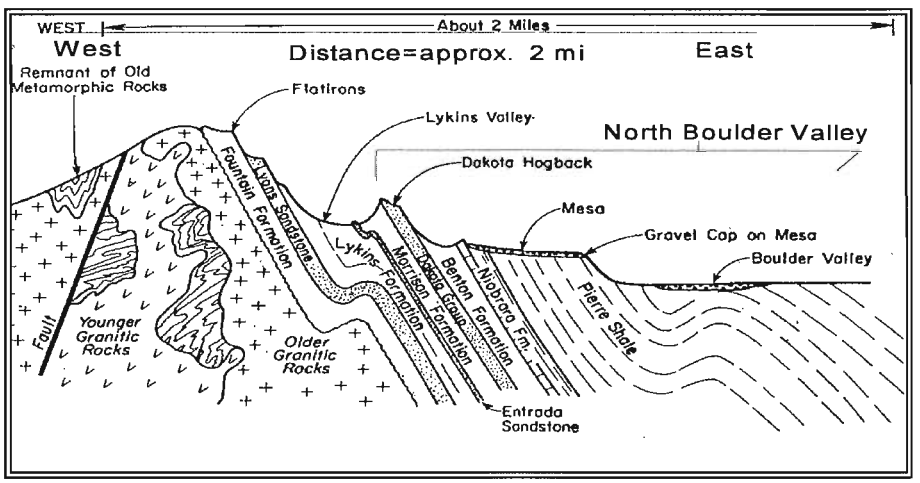

Figure 4.1: Simplified and generalized geologic cross-section west-east across the Boulder area. Thickness of formations not to scale, and the vertical scale is exaggerated for emphasis. Diagrammatic to show features, but close to accurate for most of the Boulder area (from Runnells 1976).

Erosion and deposition continued as important geological factors throughout the establishment of the Rocky Mountains; and came to characterize the landscape once again after mountain building slowed about a million years ago. Sediments from the Rocky Mountains were transported eastward by rivers draining the mountains and in the last million years by rivers draining mountain glaciers.

Since the period of uplift, erosion has been a dominant geologic process in North Boulder Valley. The Front Range ridges and peaks in the west and the lower flatlands or alluvial plains to the east have provided the slopes necessary for erosion. The ground surface is gradually being eroded down relative to bedrock layers (igneous and metamorphic rock layers). Over the last few hundred thousand years these erosional processes have produced nested erosion surfaces or pediments that slope gently eastward from the foothills ridges. These erosional surfaces are capped by thin layers of gravel washed out from the more resistant ridges or hogbacks (Harlan, Casey and Assoc. 1993). The surface topography on the east side of U.S. 36 is dominated by erosional benches that slope gently to the east away from the foot of the prominent Dakota Hogback ridge. These benches are located between alluvial drainages fanning out to the east and are capped by thin layers of alluvium gravel.

4.2.1 Six-Mile Fold

The Six-Mile Fold is managed by Boulder County Parks and Open Space and is located adjacent to the North Boulder Valley Management Area, north of the Beech West property and east of the Joder Arabian Ranch. Six-Mile Fold is designated a County Natural Area and Natural Landmark in the Boulder County Comprehensive Plan.

Six-Mile Fold is a long asymmetrical anticline on the east and syncline on the west plunging to the southeast and the south. Six-Mile Fold is visual evidence of the results of the uplift of the Front Range of the Rocky Mountains. The relative resistance of the Niobrara limestones to erosion and the erosion of the less resistant strata of this plunging fold, produces the Z-shaped pattern where the whitish Fort Hays limestone is visible from the air and shown on geologic maps (Braddock undated) .

The rocks of the Six-Mile Fold contain abundant invertebrate fossils including inocermids (clams) and ammonites as well as shark teeth [including *Inoceramus labiatus, Metoicoceral whitei, Inoceranus deformus and Ostrea congesta*]. Numerous marine fossils have been collected from Six-Mile Fold. Some of these fossils are curated at the University of Colorado Museum in Boulder. Most fossil collection at Six-Mile Fold has been casual public prospecting (Braddock undated). Collection of fossils is illegal on Boulder County and City of Boulder Open Space lands.

The geologic features of Six-Mile Fold are not unique to the Front Range, but are important because the representative features resulting from the Rocky Mountain Uplift are easily viewed and studied here. The low density of vegetation and the integrity of the property which has been maintained through time, allow the features of Six-Mile Fold to be studied easily (Boulder County 1980s).

4.2.2 Paleontology

The paleontological significance of the Six-Mile Fold is well documented. Other paleontologically significant resources may occur in North Boulder Valley. This information has not been well researched or documented. Fossils are found in ancient marine shales along the entire Front Range and alluvial plain areas. These fossils are common and not unique to North Boulder Valley Management Area. Some less common fossil specimens have been found in the area. Ancient marine crab fossils have been found near the Mesa Reservoir/Boulder Valley Ranch area and reportedly a mosesaur, an early marine reptile, fossil was found closer to the Front Range area (Bill Braddock, Emmett Evenoff and Ed Larson, University of Colorado, pers. comm. 1995). The Morrison formation of the Late Jurassic Period outcrops within the North Boulder Valley Management Area and contains dinosaur bone fragments (Boone 1990). The Boulder quadrangle geologic map identifies sites of fossil discovery (Wruncke and Wilson).

4.3 ISSUES

- Protection of fragile paleontological resources and areas may pose conflicts for other land uses.

- Collection of fossils and erosion of sites are principal management issues.

4.4 DATA GAPS

- Inventories of significant fossils are major data gaps in North Boulder Valley.

5. SOILS

5.1 INTRODUCTION

The Boulder County Area soil survey was published in 1975 by the U.S. Department of Agriculture, Soil Conservation Service[1] (Moreland and Moreland 1975). Although the mountainous portions of the county are excluded from the survey, the soils of the entire Boulder Valley have been mapped and are a part of the survey. The information used for description and analysis of the soils of North Boulder Valley are derived from the soil survey and data provided by the Colorado State office of the Natural Resource Conservation Service.

5.2 RESOURCE INFORMATION

5.2.1 Soil Orders

Soils are classified based upon similarity of origin, moisture regime, temperature, color, texture and structure. Important chemical and mineralogical properties include pH, soil depth, and the presence of organic matter, clay, iron and salts. At the broadest level, soils are classified into a variety of orders. Orders are related to soil-forming processes and are determined in the field by the presence or absence of diagnostic layers, or horizons, in the soil. There are four soil orders in North Boulder Valley: mollisols, entisols, inceptisols and ardisols (Figure 5.1 and Figure 5.2).

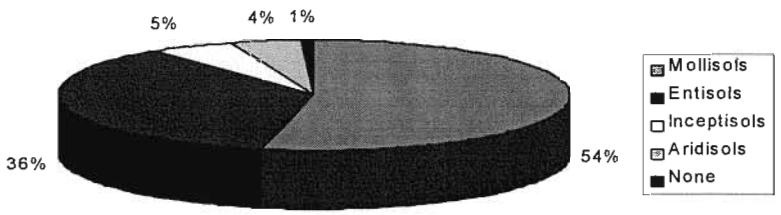

Figure 5.1
Soil orders in North Boulder Valley

[1]Note: The Soil Conservation Service has recently been renamed the Natural Resource Conservation Service.

Mollisols are dark grassland soils characterized by a thick dark surface horizon. Most of the important agricultural soils in North America are mollisols and developed under prairie vegetation.

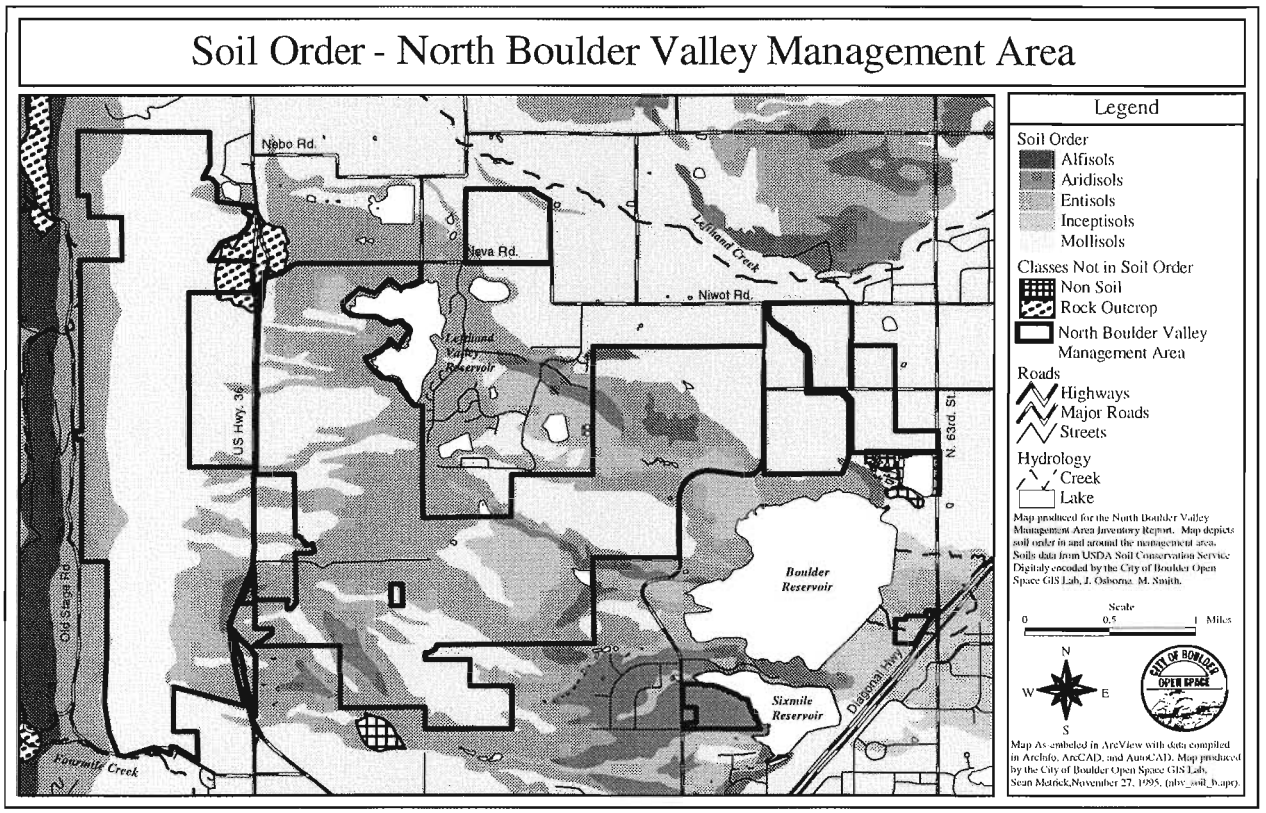

Figure 5.2
Map of soil orders in North Boulder Valley

In North Boulder Valley there are three types of mollisols: (1) those which dominate the generally flat dry mesa tops, characterized by well developed layers of clay in the soil profile, (2) the soils dominating the east facing slope of the Dakota Ridge although these soils because of their rockiness and relatively thin dark surface horizon are just barely classified as mollisols and (3) some small areas at the base of mesa slopes characterized by the presence of clay and the dry setting.

Entisols cover more than 30% of North Boulder Valley. These are mineral soils which lack diagnostic horizons, or where horizons are just beginning to develop. There are two areas dominated by entisols: (1) the shallow soils which are slowly accumulating on the Dakota Ridge and (2) the soils developing on the side slopes of the mesas and Dakota Ridge. In all cases, there

are areas where aspect, slope, climate, underlying bedrock and erosion establish conditions which limit soil development. Although some entisols are very fertile (such as recent river deposits), the hot and dry entisols of North Boulder Valley tend to be relatively sparsely vegetated.

The third soil order in North Boulder Valley are the inceptisols. Like entisols, inceptisols are characterized by relatively poor horizon development. Although inceptisols show horizons, these are thought to develop relatively quickly rather than from extreme or prolonged weathering. For example, soil saturation resulting from flooding can quickly alter underlying rocks and sediment forming soils. In North Boulder Valley inceptisols are restricted to areas of poor drainage, tend to be areas of salt accumulation and often underlie wetlands.

Less than five percent of North Boulder Valley contains aridisols. As indicated by the name, aridisols are mineral soils in dry climates. They are typically characterized by surface horizons with little organic accumulation and light yellow/tan colors. Aridisols are typically not subject to intensive leaching either because of low levels of precipitation or a sheltered location. Aridisols are scattered throughout North Boulder Valley in steep narrow draws and along mesa-sides. The Ditzel property is shown to be completely underlain by aridisols.

5.2.2 Soil Series

Although soil orders provide good general information regarding soil properties, soils are classified at increasingly finer levels to help farmers, ranchers, engineers and others develop plans for conservation and land use. The soil series is a useful level of classification because most soil surveys provide maps showing the approximate boundaries of soil series. Each soil series has major horizons, or layers, that are similar in thickness, arrangement and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Non-technical soil descriptions for each of the soils in North Boulder Valley are given in Appendix 5.1.

Table 5.1: Soil order, series and phase description. Data from Moreland and Moreland (1975)

Order	Series	Phase
Aridisols	HELDT	Heldt Clay 3-5% slopes
	RENOHILL	Renohill silty clay loam 1-3% slopes
	RENOHILL	Renohill silty clay loam 3-9% slopes
Entisols	MANVEL	Manvel loam
	RENOHILL	Renohill loam 3-9% slopes
	SAMSIL	Samsil clay 3-12% slopes
	SAMSIL/SHINGLE	Samsil-Shingle complex 5-25% slopes
	SIXMILE	Sixmile stony loam 10-50% slopes
	TERRACE ESCARPMENTS	Terrace Escarpments

Order	Series	Phase
Inceptisols	LONGMONT	Longmont clay 0-3% slopes
	BALLER	Baller stony sandy loam 9-35% slopes
	KUTCH	Kutch clay loam 3-9% slopes
	LAPORTE	Laporte very fine sandy loam 5-20% slopes
	NEDERLAND	Nederland very cobbly sandy loam 1-12% slopes
Mollisols	NUNN	Nunn clay loam 1-3% slopes
	NUNN	Nunn clay loam 3-5% slopes
	NUNN	Nunn clay loam 5-9% slopes
	VALMONT	Valmont clay loam 1-3%slopes
	VALMONT	Valmont clay loam 3-5%slopes
	VALMONT	Valmont clay loam 5-25%slopes

Further refinement is often provided in a soil survey to differentiate when soils of one series differ in texture, slope, stoniness or other characteristics that affect the use of a soil. On the basis of such differences, soil series are divided into phases. Table 5.1 shows the relationship of soil order, series and phase for North Boulder Valley. Figure 5.3* is a map of North Boulder Valley at the soil series level.

5.2.3 Soil Characteristics

While soil classification alone provides a great deal of useful information for land managers, soil scientists have also conducted detailed evaluations of soils to better understand their suitability and limitations for particular uses.

Wind Erosion Ratings

Although not included in the soil survey, the Natural Resource Conservation Service has developed a *Highly Erodible Soil Listing* (Natural Resource Conservation Service 1987) for Boulder County which gives technical information regarding susceptibility of each soil phase to wind and water erosion. Vulnerability of soils to wind erosion is shown in Table 5.2 and Figure 5.4. Wind erosion is more serious problem where vegetation has been removed, for example in areas used as annual cropland, overgrazed areas or burned areas. Farming practices such as strip cropping, stubble mulch, reduced tillage, no tillage and treatment of critical areas (re-seeding, planting, etc.) can reduce the extent of wind (and water) erosion of soil in cropped systems.

Table 5.2: Susceptibility of soils prone to wind erosion for North Boulder Valley

Soil Series	Phase	Susceptibility to Wind Erosion
LONGMONT	LoB	Highly erodible

Soil Series	Phase	Susceptibility to Wind Erosion
BALLER	BaF	Highly erodible
LAPORTE	LaE	Highly erodible
MANVEL	Me	Highly erodible
RENOHILL	RnD	Highly erodible
RENOHILL	ReD	Highly erodible
SAMSIL	SaD	Highly erodible
SAMSIL	SeE	Highly erodible
SHINGLE	SeE	Highly erodible
HELDT	HeC	Highly erodible
VALMONT	VaB	Highly erodible
VALMONT	VaC	Highly erodible
RENOHILL	RnB	Highly erodible

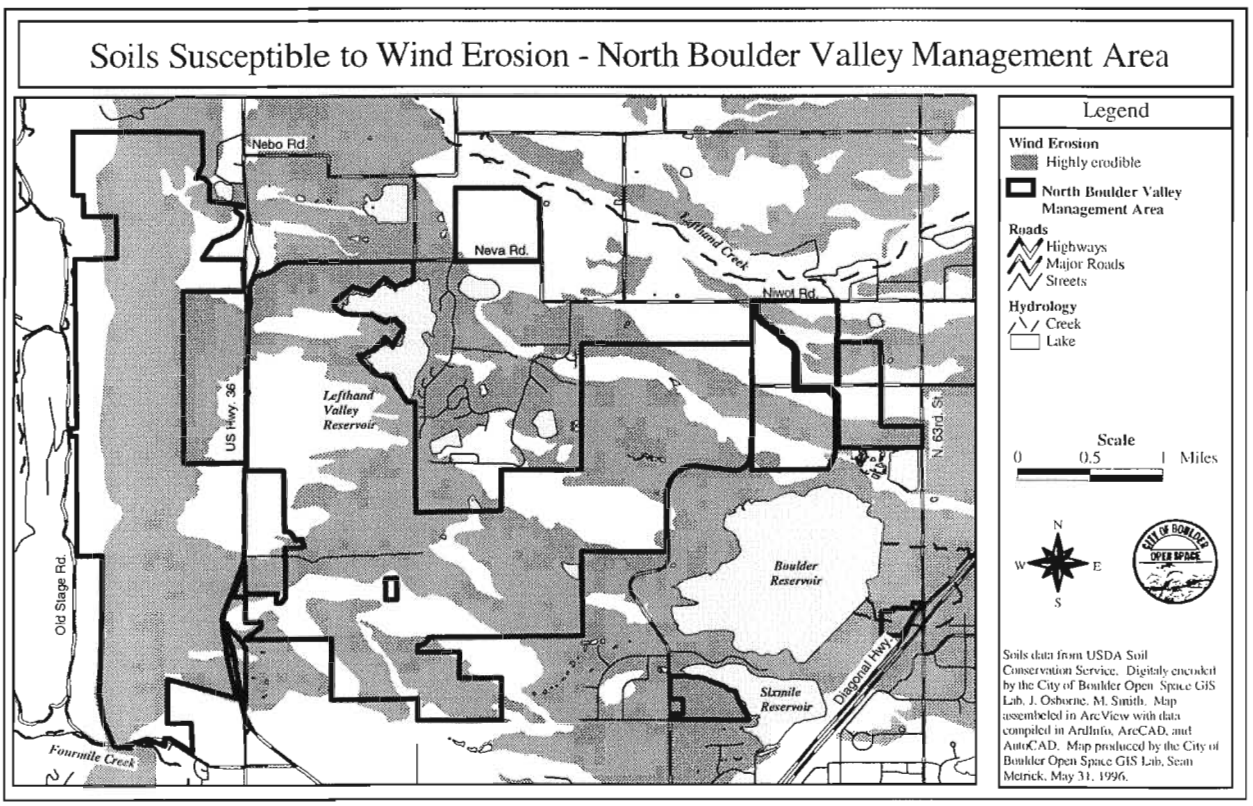

Figure 5.4 Soils susceptible to wind erosion

Water Erosion Ratings

Soils vulnerable to water erosion are shown in Table 5.3 and Figure 5.5. Water erosion is a greater threat to soil conservation in North Boulder Valley because: (1) well-established vegetation does not always protect an area from soil loss due to water erosion and (2) sedimentation resulting from erosion can have far-reaching adverse impacts on the ecological and agricultural function of wetlands, ponds, creeks and ditches. Further details of the implications for management of soils prone to water erosion are given in section 5.3.

Table 5.3: Susceptibility of soils prone to water erosion for North Boulder Valley. Data from Natural Resource Conservation Service (1987).

Soil Series	Phase	Susceptibility to Water Erosion
SIXMILE	SmF	Highly erodible
SHINGLE	SeE	Highly erodible
SAMSIL	SeE	Highly erodible
LAPORTE	LaE	Highly erodible
RENOHILL	ReD	Potentially highly erodible
TERRACE ESCARPMENTS	Te	Potentially highly erodible
SAMSIL	SaD	Potentially highly erodible
RENOHILL	RnD	Potentially highly erodible
KUTCH	KuD	Potentially highly erodible
BALLER	BaF	Potentially highly erodible

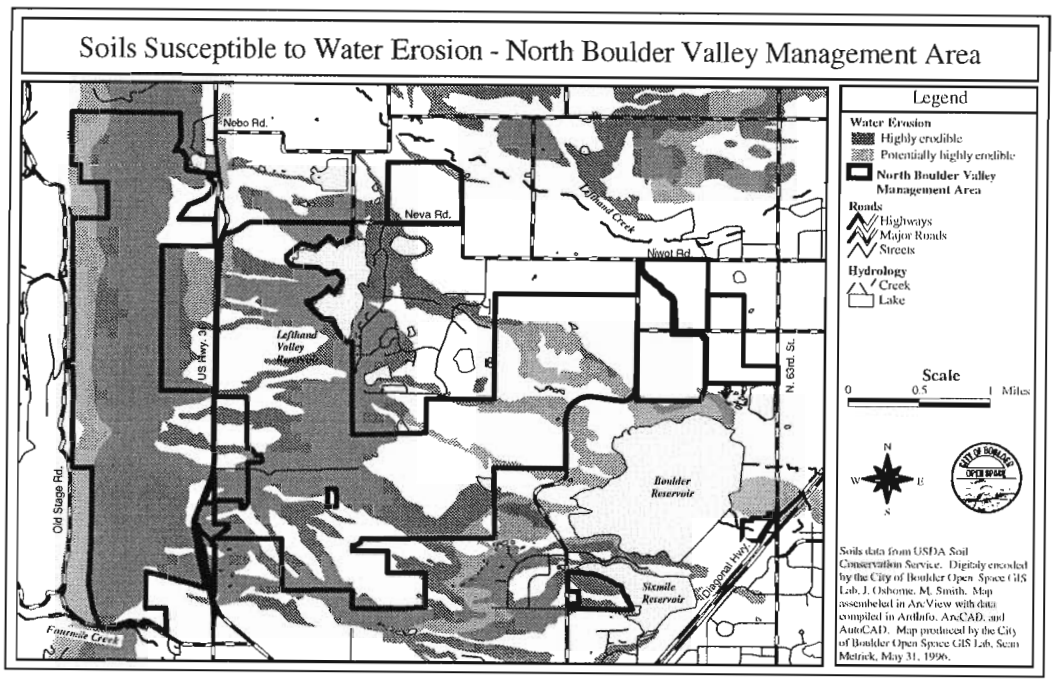

Figure 5.5 Soils susceptible to water erosion

Other Soil Characteristics

Much of the other of the readily available soil information in the soil survey relates to agriculture, engineering and recreational uses. The Boulder County Area soil survey (Moreland and Moreland 1975) provides information for several such uses. Those uses relevant to the management of North Boulder Valley are shown in Table 5.4 and discussed in greater detail in section 5.3.

Table 5.4 Other soil characteristics

USE	LIMITATIONS
AGRICULTURE - irrigation - drainage of cropland/pasture - crops suitability for cropping and predicted average acre yields have been computed for each soil phase	*Soil suitability is discussed in great detail in the agricultural land use reports by ERO (1995, 1996).*
SILVICULTURE - native forest management	*Changes in soil composition resulting from fire suppression are suspected. Even in 1975, it was noted that most of the woodlands are being used for recreation and homesites rather than wood production.*
RECREATIONAL USES - picnic areas - paths and trails	- slope - rock outcrop - clay - slow permeability
WILDLIFE only general information, not specific to any soil classification unit	- lack of shelter - lack of water
ENGINEERING/CONSTRUCTION - pond/reservoir - embankments/dikes - septic tank absorption fields	- depth to bedrock - depth to seasonal high water - slow permeability - low available water capacity - high salinity - high alkalinity - high shrink-swell potential - slope

5.3 ISSUES

Agricultural Land Uses
In 1975, an agricultural consulting firm prepared recommendations for the agricultural management of the Open Space land system, as it then existed (Nortrust 1975). This report stated the rangeland and irrigated pastures were in fair to poor condition. However, the consultants felt that with proper management the property could be easily improved to an acceptable condition. Also included in the report were recommendations about irrigation scheduling, fertilizer application rates, and grazing management that would help meet management objectives. Their recommendations were based on the classification and soil conditions within the Management Area. ERO (a consulting firm) has recently prepared two reports (1995,1996) which describe the role of soil suitability in determining agricultural productivity. For more information about agriculture in the North Boulder Valley, please refer to the Agriculture section of this report

However agricultural land uses are controlled by many soil characteristics other than nutrient status and irrigability. For example, historical patterns of livestock grazing have devastated the creek banks and steep slopes in some areas of North Boulder Valley. Prior to Open Space management, the steep, fine-textured creek banks of Dry Creek were severely eroded as a result of trampling by cattle. The Open Space Program removed livestock from the Dry Creek bottom lands soon after acquiring the property. The creek banks are now revegetated, and in considerably better condition. Similar impacts from cattle and horses can be noted on steep slopes, ditch banks and some bottom lands which are susceptible to erosion.

Annual cropping can result in significant amounts of wind and water erosion. The Natural Resource Conservation Service and soil scientists throughout the world have developed many soil conservation practices tailored for annual crops. Opportunities exist for the lease manager(s) of the Axelson/Johnson and the Boulder Valley Ranch leases to work with the Natural Resource Conservation Service to insure minimal soil loss and sedimentation from annual croplands.

Irrigation ditches excavated in erosion prone, fine-grained soils, can also result in long-term management problems as the ditch channels become deeply incised and the grade needed for effective water distribution no longer exists. Eroded ditch channels tend to be replaced by newly excavated parallel trenches with no better engineering. These erode in turn and are replaced by yet other ditches. This loss of soil and damage to the landscape can be minimized in coordination with other management goals (wetlands preservation, cost-effectiveness, conservation of irrigation water, etc.).

Farm roads often widen and deepen as they traverse highly erodible soils. The pattern is similar to what happens with ditches. As the ruts develop, a new two-track is established alongside the old road. Often the old road becomes a watercourse and is eroded by runoff. The newer road eventually deepens and yet another two track is established. Similar patterns develop with pedestrian, bike and horse trails (see below). Importing a well-drained, coarse-grained (weed-free) road surface is an effective way of maintaining roads in erodible soils.

Trails

The extensive fine-textured and clay rich soils erodible soils in the management area present a significant erosion hazard if not specially engineered to take a path or road. Undesignated trails usually lack erosion control treatments, such as water bars and specially prepared trail surfaces. These trails tend to become wider and deeper over time as the soil erodes. For example, undesignated trails on the Beech East property cut through the Renohill loam. In some spots, erosion has exposed the bedrock, 10 to 20 inches below the ground surface. Once the vegetation is killed by trampling, there is little to hold this dry fine-textured soil together. Water and wind carry the soil particles downstream and downwind. Unmanaged trails in areas with a high erosion hazard result not only in the removal of native vegetation but sedimentation of the creeks, ponds and wetlands which lie downstream. Native vegetation is also replaced by weedy species. Mediterranean sage (*Salvia aethiopes*) is especially prevalent along the disturbed edges of trails where sporadic foot or hoof traffic keeps native vegetation from becoming established but the level of disturbance is not severe enough to exclude this aggressive weed.

Native Vegetation

Native plant communities are, to a great extent, a reflection of the underlying soil structure. Protection of the soil profile from artificial disturbances should be an integral component of a native plant conservation strategy. Where this soil has been disturbed by natural forces (landslides, prairie dogs or fire) changes to the vegetation are certain to follow. For example, ruderals (plants adapted for growth in disturbed or low-nutrient conditions) often dominate landslide areas. The vegetation of prairie dog colonies is affected, in part, by the disturbances to soil cause by prairie dogs (Ingram and Detling 1984, White 1986, Carlson and White 1988). The impacts of fire are more subtle and related to topography, intensity of the fire, regional climate, soil texture, nutrients, organic matter, soil pH, etc. (Kitzberger 1991).

Rare plants such as Bell's twinpod are endemic to the exposed shaley soils and are dependent upon these areas for their continued existence.

Animals

The Open Space Program has typically not managed any of the invertebrate soil animals which are responsible for fundamental ecosystem processes, such as nutrient cycling and, which form the basis of energy flow in grasslands, forests and other habitats. Large burrowing vertebrates, mostly mammals, are somewhat better understood. Black-tailed prairie dogs are well-studied and

clearly have effects upon the chemical and physical characteristics of soils (Ingram and Detling 1984, White 1986, Carlson and White 1988) as well as upon the likelihood of soil erosion, resulting, for example, from removal of grass cover in areas of erodible soils.

Other Engineering Uses
Visitor use facilities, such as picnic areas and pit toilets, need to be constructed with an understanding of the limitations imposed by soil conditions. Erodible soils are unsuitable for heavy uses such as picnic areas unless specifically engineered to improve their resistance to wear and tear. Shallow soils (with outcropping rock or shallow rocky layers), areas with high seasonal water, slow permeability, or high shrink-swell potential are typically unsuitable for the placement of leach fields or septic systems.

5.4 DATA GAPS

- Delineation of finer scale soil mapping units is needed to plan for intensive localized uses.

- Evaluate erosion potential and possible conservation strategies (best management practices) for agricultural uses in erodible soils (annual crops, grazing, irrigation, farm roads).

- Relate trail condition and maintenance to erodability of soils throughout the management area.
  - Which soils should be avoided because of high construction/maintenance costs?
  - Where should trails be reconstructed along a more gentle grade?
  - Where should trail surfacing be considered?

6. VEGETATION

6.1 INTRODUCTION

The vegetation section describes the non-wetland vegetation of the North Boulder Valley Management Area, and discusses factors that influence the distribution and condition of plant communities occurring in North Boulder Valley. Completed and ongoing research pertaining to native plant community management is described and gaps in the information required for effective planning are identified. This information has been compiled for use in developing and evaluating resource management alternatives for North Boulder Valley.

Vegetation Management History
To date, Open Space management activities in North Boulder Valley have focused on monitoring and controlling problem non-native species and directing grazing and crop management through agricultural lease agreements. Baseline inventories, and experimental and observational research have been conducted to address information needs in North Boulder Valley and other sections of the Open Space system. Studies of native plant species and communities, exotic species and agricultural land have included:

- wetlands inventory and mapping (see Wetlands section),
- survey and mapping of non-wetland vegetation in the management area (conducted by Open Space staff and volunteers, 1995),
- survey and mapping of vegetation of the Open Space system (Bunin 1985),
- survey of vegetation of the Beech Open Space Management Area (Boone 1990),
- periodic, scheduled inventory and mapping of exotic species of special concern (conducted by Open Space staff),
- ecological and population studies of the rare Bell's twinpod (*Physaria bellii*) (Carpenter 1995, 1996; mapping and counts conducted by Open Space staff and volunteers),
- characterization of grassland plant and animal communities (Bock et al. 1995, Bennett et al. 1995),
- multiple use analysis of the Boulder Valley Ranch agricultural lease area (ERO 1996),
- experimental crop plantings: alfalfa-grass mixtures for pesticide reduction and development of expanded hay markets (research conducted by L. Rieske, Colorado State University),
- the influence of cattle grazing on the population dynamics of diffuse knapweed (research initiated in 1996 by G. Beck and L. Rittenhouse, Colorado State University) and
- Mediterranean sage biological control insect monitoring (Colorado State Department of Agriculture, Division of Plant Industry).

Vegetation types have been classified and described for wildlife habitat studies conducted on Open Space lands (Thompson and Strauch 1987, Keammerer et al. 1990, Bock et al. 1995).

6.2 RESOURCE INFORMATION

The vegetation occurring in North Boulder Valley reflects the topographic, elevational, geologic and climatic diversity that is characteristic of the eastern slope of the Colorado Front Range Foothills. Landscape and biological diversity is high where the Great Plains and Rocky Mountain ecological provinces (Bailey et al. 1994) meet and overlap in the Boulder Valley area. Plant communities in Front Range ecotonal areas contain plains and montane species. The major vegetation types in the management area are shortgrass prairie, mixed grass prairie, foothills mixed grassland, plains and foothills shrubland, riparian, wet meadow and wetland communities, ponderosa pine savannah, and ponderosa pine forest and woodland (Table 6.1).

Patterns in the vegetation are related to soil types, hydrology and hydrogeology, wildlife activity, additional biotic and abiotic processes and past and present land uses. Grassland communities occur in a mosaic of patches with short and mixed grass prairie species in dry, upland areas and mixed and tall grass species in swales and bottomland. Shrubland communities follow drainages, mesa escarpments and north-facing hillsides. Riparian shrubland, woodland and forest stands occur where water flows seasonally in draws and irrigation ditches. Ponderosa pine savannah, woodland and forest patches are generally found on ridgetops and terrace escarpments. Shale outcrops of the Niobrara Formation in the management area support plant species that are uncommon or rare in the Boulder Valley area. Princess plume (*Stanleya pinnata*), chainpod (*Hedysarum boreale*), New Mexico needle grass (*Hesperostipa neomexicana*) and Bell's twinpod (*Physaria bellii*) (globally rare) are some of the species associated with soils derived from the calcareous shale.

Past and present land uses have contributed to the introduction and spread of exotic plant species in most native plant communities and agricultural areas. Livestock grazing, hayfield and cropland cultivation, road and trail construction and use, urban development, water use, fire suppression and logging have influenced the character of the vegetation in the area for more than a century. Relationships between land use history and the condition of native plant community habitat will be important to address during the area management planning process.

Table 6.1 Percent Cover of Vegetation and Other Land Cover Types: North Boulder Valley Management Area (Due to rounding, percentages do not add up to 100)

Ecosystem/Major Cover Type	Vegetation Type	Acres	Percent Cover
Grassland (upland herbaceous)	Foothills Mixed Grassland	518	11
	Mixed Grass Prairie	1610	35
	Shortgrass Prairie	210	5
	Ponderosa Pine Savannah	30	<1
	Forb Dominated	16	<1
Grassland Total		2384	52
Shrubland (upland)	Foothills Shrubland	191	4
	Scarp Woodlands	21	<1
Shrubland Total		212	5
Forest/Woodland Total	Ponderosa Pine Forest/Woodland	195	4
Riparian	Foothills Riparian Forest/Woodland	1.5	<1
	Plains Riparian Forest/Woodland	15	<1
	Plains/Foothills Riparian Shrubland	20	<1
Riparian Total		37	<1
Wet Meadow Total		190	4

Ecosystem/Major Cover Type	Vegetation Type	Acres	Percent Cover
Agricultural Lands	Alfalfa	25	<1
	Alfalfa/Grass	196	4
	Non-native Hay/Pasture	988	22
	Crop	149	3
Agricultural Lands Total		1358	30
Other Cover Types	Conservation Easements, Buildings, Parking Lots	212	5
	Open Water	9	<1
	Exposed Rock/Talus	6	<1
Total Other Types		227	5
Total Acreage		4603	

Please refer to the maps in Figure 6.1* and Figure 6.2* which display vegetation by habitat and ecosystem.

6.2.1 Detailed Description of Vegetation

Vegetation Mapping Goals and Applications

The vegetation of North Boulder Valley consists of a complex mosaic of plant communities and agricultural fields. Results from a recent Open Space Program survey and mapping of the management area vegetation provide both fine and coarse-level descriptions of the present vegetation cover. The level of detail chosen to describe vegetation depends on the research and management applications for that information. A coarse classification and description of vegetation types is useful for assessing wildlife habitat affinities and the relative abundance of vegetation types (i.e., shortgrass prairie, ponderosa pine forest). Coarse level vegetation analysis can provide a whole-system or landscape context for use in resource management planning. Finer scale descriptions of vegetation are used for evaluating plant community health, monitoring sensitive species and communities, identifying micro-scale habitat (i.e., invertebrate habitat) and data sharing.

Vegetation mapping conducted by Open Space staff and volunteers and contracted (ERO 1996) staff has focused on characterizing vegetation patterns on the plant community or association level. Where rare species are identified, a finer, species level analysis has been applied. The Open Space Program's goals for vegetation surveying and mapping are to: (1) identify and describe plant communities and wildlife habitat types and (2) assess the quality and condition of plant communities. Results from mapping can be used to:

- determine the distribution, frequency and areal coverage of communities and habitat types,
- design and facilitate wildlife habitat research,
- refine habitat information for the wildlife habitat (affinity) database,
- develop monitoring and management plans for rare and uncommon species and communities,
- identify important landscape-scale features (i.e., large, unfragmented habitat units, corridors for wildlife movement between habitat units, eastern extensions of the foothills ecotonal types, etc.) for conservation purposes,
- determine natural variation within plant communities,
- identify high quality sites in terms of wildlife habitat and native plant community integrity,
- identify declining (including exotic plant invasion) plant communities and habitat types, and potential restoration areas,
- construct an Open Space system-wide context for formulating resource management plans and
- assist in visitor use planning.

Vegetation mapping methods are presented in Appendix 3.1.

Vegetation Classification

Vegetation classification systems group discernable patterns in vegetation by using selected attributes (i.e., structure, floristics, landscape patterns, etc.) (Bourgeron and Engelking 1994). The Open Space Program uses *A Preliminary Vegetation Classification of the Western United States* (Bourgeron and Engelking 1994) to classify vegetation for management and research purposes. This hierarchical classification is based on international (UNESCO 1973) and national (Driscoll et al. 1984) classification schemes. This widely-used system allows the Program to develop data sets that are compatible with vegetation data across the United States and throughout the world. Use of this standardized vegetation classification creates opportunities for the Program to share information about local vegetation with the academic and professional scientific communities and other land managers. The facilitation of data sharing can provide the Program with valuable local, regional and global contexts for vegetation management.

The Bourgeron and Engelking classification hierarchy consists of six levels ranging from coarse to fine level characterizations. The broadest classes are based on the physiognomy or characteristic features of the vegetation (i.e., forest, evergreen forest, etc.). Species composition and dominance define the finest levels of the hierarchy. "Plant association" is the finest

vegetation characterization, and is generally defined as a plant community having a characteristic species composition with uniform physiognomy and habitat conditions (Bourgeron and Engelking 1994). Plant communities or associations represent existing vegetation regardless of successional status and are described by two or more dominant species (Bourgeron and Engelking 1994). Other classification schemes have used the plant association concept to describe potential natural or climax vegetation.

The Open Space Program also employs separate classifications to describe vegetation in less technical terms and to characterize wildlife habitat. The description of vegetation in North Boulder Valley classifies vegetation coarsely as "vegetation types" and describes the plant communities or associations that occur within each vegetation type. Wildlife "habitats" represent a broad classification of general differences in the structure and composition of vegetation. The utilitarian habitat types are often parallel with vegetation types. Numerous plant communities and associations can be found within each wildlife habitat type.

Vegetation Types and Community Descriptions
The vegetation descriptions in this section are organized hierarchically by: (1) ecosystem type (i.e., grassland, shrubland, etc.), (2) vegetation type (i.e., mixed grass prairie, foothills shrubland, etc.) and (3) community or association (described by several co-occurring species or co-dominant species forming a recurrent pattern). Scientific nomenclature follows the *Checklist of Vascular Plants of Boulder County, Colorado* (Weber 1995). The vegetation type descriptions can be applied to vegetation across the greater Boulder Valley area. Table 6.2 lists vegetation types and the communities within each type in North Boulder Valley. Vegetation types and associated soil types are presented in Appendix 6.1. Wetlands (including wet meadows) and croplands are described in the Wetlands and Agriculture sections of this report. The Beech Open Space Management Plan (Boone 1990) includes a plant list for the Beech properties.

The terms "plains" and "foothills" appear frequently in the vegetation type descriptions. In the Boulder Valley, plains generally occur between 5,000 and 6,000 feet and foothills occur between 6,000 and 8,000 feet. The base of the Flatirons and the hogbacks west of Boulder are approximately 6,000 feet in elevation. Both plains and foothills communities can be found outside of these altitudinal boundaries. Due to the orographic effect of the foothills, plains communities generally begin to develop east of U.S. 36. Topographic differences, such as mesa tops, can extend the eastern boundaries of foothills/montane species.

Grassland (Upland Herbaceous; Non-riparian) [ecosystem type]

Mixed Grass Prairie [vegetation type]
Mixed grass prairie is a plains grassland comprised of a mix of midgrass, tallgrass and shortgrass species. Montane grasses are absent from mixed grass prairie. Common grass species are little bluestem (*Schizachyrium scoparium*), western wheat (*Pascopyrum smithii*), blue grama (*Chondrosum gracile*), needle and thread (*Hesperostipa comata*), Indian rice (*Achnatherum*

hymenoides) and side oats grama (*Bouteloua curtipendula*). Mixed grass prairie is dominated by native grass species, and contains a wide variety of less frequently occurring forb and shrub species. Non-native grass and forb species are often a component.

[plant communities or associations]
Western wheat/native bluegrass (*Pascopyrum smithii/Poa agassizensis*): plains swale grassland.
Western wheat/blue grama (*Pascopyrom smithii/ Chondrosum gracile*): with other native grasses, cheat grass *(Bromus tectorum*) and Japanese brome (*Bromus japonicus*) (presence and frequency of bromes variable) and patches of forbs (mostly native).
Western wheat/blue grama/buffalo (*Pascopyrum smithii/Chondrosum gracile/Buchloe dactyloides)* with non-native grasses: crested wheat *(Agropyron cristatum*) and smooth brome (*Bromopsis inermis*).
Needle and thread *(Hesperostipa comata)* mixed grass prairie: with blue grama (*Chondrosum gracile*), western wheat (*Pascopyrum smithii*), three awn (*Aristida purpurea*), big bluestem (*Andropogon gerardii*), little bluestem (*Schizachrium scoparium*), Indian rice (*Achnatherum hymenoides*), buffalo (*Buchloe dactyloides*), cheat grass (*Bromus tectorum*), Japanese brome (*Bromus japonicus*). Bell's twinpod (*Physaria bellii*) habitat.
Needle and thread/Indian rice grass (*Hesperostipa comata/Achnatherum hymenoides*): with green needle grass (*Nassella viridula*).
Indian rice grass (*Achnatherum hymenoides*) shale barren community: with needle and thread (*Hesperostipa comata*) or New Mexico feather grass (*Hesperostipa neomexicana*), hawthorn (*Crataegus macracantha occidentalis*), ponderosa pine (*Pinus ponderosa*) and native forbs.
Indian rice mixed grass prairie: with three awn (*Aristida purpurea*), blue grama (*Chondrosum gracile*), buffalo (*Buchloe dactyloides*), western wheat (*Pascopyrum smithii*) and forbs (mostly native). Bell's twinpod (*Physaria bellii*) habitat.
Green needle grass (*Nassella viridula*): with western wheat (*Pascopyrum smithii*), cheat (*Bromus tectorum*), Japanese brome (*Bromus japonicus*), and native and non-native forbs (knapweed (*Acosta diffusa*), sweet clover (*Melilotus albus* or *officinale*).
New Mexico feather grass (*Hesperostipa neomexicana*): with mixed native grasses, Bell's twinpod (*Physaria bellii*) and other forbs, and scattered serviceberry (*Amelanchier utahensis*) shrubs.
Side oats grama/little bluestem (*Bouteloua curtipendula/Schizachyrium scoparium*): with cattail, teasel, Canada thistle and Canadian reed-grass (*Calamagrostis canadensis*) in draws.

Foothills Mixed Grassland
Foothills grasslands contain a mix of tall-, mid- and shortgrass species. This is a broad grassland habitat category that includes both plains and montane species. Big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), mountain muhly (*Muhlenbergia montana*), side oats grama (*Bouteloua curtipendula*), green needlegrass (*Nassella viridula*) and spike fescue

(*Leucopoa kingii*) are example species. Foothills grasslands may extend into the plains region on mesa tops and in cooler, moister microclimates.

Foothills mixed grassland matrix: mixed grass species (mostly native dominants), forbs and mountain mahogany (*Cercocarpus montanus*) and ponderosa pine (*Pinus ponderosa*) at higher elevations. Occurrences of the foothills mixed grassland matrix are west of U.S. 36. Large portions of this community were burned in 1990 (Olde Stage fire).

Shortgrass Prairie

Shortgrass prairie is a plains grassland type dominated by blue grama (*Bouteloua gracilis*) and buffalo grass (*Buchloe dactyloides*). Western wheat (*Pascopyrum smithii*) occurs in depressions or clay soils. Fringed sage (*Artemesia frigida*) is a common forb.

Blue grama/buffalo (*Bouteloua gracilis/Buchloe dactyloides*): with mixed native and non-native grasses and forbs, and four-winged saltbush (*Atriplex canescens*).

Savannah

The savannah is intermediate between forest/woodland and grassland, and can be characterized by larger, widely spaced ponderosa pine (or other tree species) with a well-developed grassland understory and few shrubs. Tree cover is between 11% and 25%. Typical grasses include: prairie dropseed (*Sporobolus heterolepis*), side-oats grama (*Bouteloua curtipendula*), big bluestem (*Andropogon gerardii*), Canada bluegrass (*Poa compressa*), mountain muhly (*Muhlenbergia montana*). This habitat type was historically a dynamic, fire maintained system. Small areas of North Boulder Valley include ponderosa pine savannah.

Forb Dominated Vegetation

This is a broad vegetation type that includes variable habitat conditions. Native or non-native forb species may dominate a plant community. A forb is a broad-leaved herbaceous plant.

Dogbane *(Apocynum sp.)* **community.**

Fringed sage (*Artemisia frigida*): with mixed grass understory.

Mediterranean sage (*Salvia aethiopis*): with western wheat (*Pascopyrum smithii*) and mixed grass/forb patches.

Non-native Grasslands: Hayfields and Pasture

Hayfields and pasture in this category consist of non-native monocultures or co-dominant non-native species. Some hayfields and rangeland in the Open Space system have significant or dominant native grass cover. Native-dominated hayfields and pasture are classified with other native grassland habitat types. Non-native grasslands cover approximately one-fifth of the management area.

Crested wheat/smooth brome (*Agropyron cristatum/Bromopsis inermis*).

Non-native grass monoculture: sometimes irrigated.

Non-native, irrigated hayfields.

Shrubland

Foothill Shrubland

Smooth sumac (*Rhus glabra ssp. cismontana*), skunkbush (*Rhus aromatica trilobata*), mountain mahogany (*Cercocarpus montanus*) and chokecherry (*Padus virginiana*) may be dominants in foothills shrub thickets. The shrubland canopy is often dense with a relatively undeveloped understory. Although this is not classified as a riparian type, foothills shrub communities may be closely associated with intermittent streams and draws. These foothills drainages may rarely carry water, but maintain a high water table.

Wild plum (*Prunus americana*): with scattered sumac (*Rhus aromatica trilobata*), snowberry (*Symphoricarpus occidentalis*) and rose (*Rosa woodsii*).

Ninebark (*Physocarpus monogynus*)**/wild plum** (*Prunus americana*).

Chokecherry (*Padus virginiana melanocarpa*): with variable understory.

Mountain mahogany (*Cercocarpus montanus*): with variable native grass understory.

Hawthorn thicket (*Crataegus erythropoda* and *C. macracantha occidentalis*).

Sumac shrubland (*Rhus aromatica trilobata*): with snowberry (*Symphoricarpus occidentalis*), rose (*Rosa woodsii*) and serviceberry (*Amelanchier utahensis*).

Foothills shrubland mix: sumac (*Rhus aromatica trilobata*), mountain mahogany (*Cercocarpus montanus*), Boulder raspberry (*Oreobatus deliciosus*), currant (*Ribes cereum*), snowberry (*Symphoricarpus occidentalis*), ninebark (*Physocarpus monogynus*), plum (*Prunus americana*), chokecherry (*Padus virginiana melanocarpa*) and scattered ponderosa pine (*Pinus ponderosa*).

Scarp Woodlands

Scarp woodlands are characterized as isolated patches of woodlands on mesa escarpments. Ponderosa pine (*Pinus ponderosa*), skunkbush (*Rhus trilobata*), currant (*Ribes cereum*), mountain mahogany (*Cercocarpus montanus*) and other woody species may occur in the escarpment communities. Scarp woodlands represent a small, but significant component of the native vegetation types in North Boulder Valley. Woodland patches in a matrix of grassland provide structural diversity which is an important habitat characteristic for many animal species.

Snowberry (*Symphoricarpus occidentalis*): with mixed grass understory.

Smooth sumac (*Rhus glabra*).

Scarp woodlands mix: hackberry (*Celtis reticulata*), wild plum (*Prunus americana*) , chokecherry (*Symphoricarpus occidentalis*, currant (*Ribes cereum*), sumac (*Rhus aromatica trilobata*) and mountain mahogany (*Cercocarpus montanus*).

Forest and Woodland

(Forest = greater than 60% tree cover, Woodland = 26%-60% cover) (Upland)

Ponderosa Pine Forest/Woodland

This broad type includes densely forested areas and woodlands dominated by ponderosa pine (*Pinus ponderosa*). The understory is variable, depending on canopy cover, soil, aspect, etc. Shrubs, grasses and forbs occur with varying density. Ponderosa pine forests are typically closed canopy, and were probably more woodland or savannah-like before fire-suppression.

Riparian Vegetation Types

Plains and Foothills Riparian Shrubland

Riparian shrubland habitat is typically comprised of large shrub thickets associated with streams, creeks or ditches. Coyote willow (*Salix exigua*) and hawthorn (*Crataegus erythropoda* and *C. macracantha*) are common dominants. Some shrub species may occur in upland areas or in close association with riparian habitat.

Coyote and bluestem willow/sedge (*Salix exigua* or *S. irrorata/Carex* spp.)

Plains riparian shrub mix: sumac (*Rhus aromatica trilobata*), hawthorn (*Crataegus erythropoda and C.macracantha)*, plum (*Prunus americana*), snowberry (*Symphoricarpus occidentalis*) and chokecherry (*Padus virginiana melanocarpa*).

Foothills riparian shrubland and scattered tree mix:

(1) hawthorn (*Crataegus erythropoda and C.macracantha*), mountain maple *(Acer glabrum*), plum (*Prunus americana*), aspen (*Populus tremuloides*) and ninebark (*Physocarpus monogynus*).

(2) chokecherry (*Padus virginiana melanocarpa*), plum (*Prunus americana*), rose (*Rosa woodsii*), hawthorn (*Crataegus erythropoda and C.macracantha*), sumac (*Rhus aromatica trilobata*), ninebark (*Physocarpus monogynus*), hackberry (*Celtis reticulata*), mountain maple (*Acer glabrum*), coyote willow (*Salix exigua*), bluestem willow (*Salix irrorata*), yellow currant (*Ribes aureum*), snowberry (*Symphoricarpus occidentalis*) and scattered peach-leaved willow (*Salix amygdaloides*) and plains cottonwood (*Populus deltoides*).

Plains Riparian Forest/Woodland

Forest and woodland riparian habitat is associated with streams, creeks or occasionally ditches along the plains. Plains cottonwood (*Populus deltoides*), peach-leaved willow (*Salix amygdaloides*), narrowleaf cottonwood (*Populus angustifolia*), crack willow (*Salix fragilis*). Box elder (*Acer negundo*) and Russian-olive (*Eleagnus angustifolia*) are characteristic of plains riparian communities. Shrubs may co-dominate with tree species in riparian communities.

Plains cottonwood.

Foothills Riparian Forest/Woodland

Riparian areas in the foothills are dominated by narrowleaf cottonwood (*Populus angustifolia*), box elder (*Acer negundo*), chokecherry (*Prunus virginiana*) wild plum (*Prunus americana*) and

willows (*Salix sp.*) and other tree and shrub species. The shrub understory can include coyote willow (*Salix exigua*), hawthorn (*Crataegus macracantha* and *C. erythropoda)*, wild plum (*Prunus americana*), leadplant (*Amorpha fruticosa*) and other species.

Foothills riparian forest/woodland mix: ponderosa pine (*Pinus ponderosa*), narrowleaf cottonwood (*Populus angustifolia*), lanceleaf cottonwood (*Populus x acuminata*), birch *(Betula fontinalis*) and mixed shrub species.

Table 6.2

Plant Communities: area expressed in acres and as a percentage of vegetation type area

Vegetation Type	Community	Total Area (Acres)	% of Veg. Type Area
Foothills Mixed Grassland	Foothills mixed grassland matrix	518.3	100
Mixed Grass Prairie	Western wheat/native bluegrass	103.9	6
	Western wheat/blue grama/buffalo	215.1	13
	Indian rice mixed grass prairie	22.1	1
	Western wheat/blue grama	927.7	58
	Needle and thread mixed grass prairie	189.9	12
	New Mexico feather grass	11.3	<1
	Green needle grass	107.3	7
	Indian rice grass	10.1	1
	Needle and thread/Indian rice grass	16.8	1
	Sideoats grama/little bluestem	3.1	<1
Shortgrass Prairie	Blue grama/buffalo	210.4	100
Savannah	Ponderosa pine savannah	29.9	100
Forb Dominated Vegetation	Mediterranean sage	13.3	86
	Dogbane community	1.0	6
	Fringed sage	1.2	8

Vegetation Type	Community	Total Area (Acres)	% of Veg. Type Area
Foothills shrubland	Mountain mahogany	62.8	33
	Hawthorn thicket	0.7	<1
	Sumac shrubland	40.1	21
	Foothills shrubland mix	39.6	21
	Wild plum	32.2	17
	Ninebark	15.0	8
	Chokecherry	0.8	<1
Scarp Woodland	Scarp woodland mix	6.4	30
	Snowberry	12.5	59
	Smooth sumac	2.2	10
Ponderosa pine forest/woodland	Ponderosa pine	194.5	100
Foothills Riparian Forest/Woodland	Foothills riparian forest woodland mix	1.5	100
Plains Riparian Forest/Woodland	Plains cottonwood	15.1	100
Plains and Foothills Riparian Shrubland	Plains riparian shrub mix	2.7	14
	Foothills riparian shrubland and scattered tree mix	15.1	77
	Coyote and bluestem willow/sedge	1.9	10
Non-native Grassland: Hayfield and Pasture	Crested wheat/smooth brome	247.1	21
	Other non-native hay/pasture	740.2	62
	Alfalfa/grass	196.5	17

6.2.2 Sensitive Species and Communities

North Boulder Valley supports a diverse native flora including rare species and communities. An important purpose of City of Boulder Open Space is to preserve and restore natural areas

supporting "outstanding or rare examples of native species" (City of Boulder Charter). The Boulder County Comprehensive Plan sets goals for preserving rare plant habitat, natural communities and the natural processes that maintain functioning native ecosystems. Other documents guiding land and resource management in the Boulder Valley area (i.e., Boulder Valley Comprehensive Plan; Open Space Long Range Management Policies) call for the promotion of biological diversity and the protection of sensitive species.

Two plant species and several communities or associations occurring in the management area are included in the Colorado Natural Heritage Program list of "rare and imperiled animals, plants, and natural communities." Appendix 6.2 summarizes the Colorado Natural Heritage Program information that is pertinent to North Boulder Valley and explains rare plant status rankings. The Boulder County Comprehensive Plan uses the Colorado Natural Heritage Program list to identify rare species and "significant natural communities."

Sensitive Species

Bell's twinpod *(Physaria bellii)*
Physaria bellii is a rare, perennial species belonging to the mustard family. The plant is endemic to the eastern edge of the foothills of the northern Front Range in Jefferson, Boulder and Larimer counties (Carpenter 1996). *Physaria bellii* habitat is typically barren outcrops of the Niobrara and Pierre shale Formations, characterized by limey shales. The U.S. Fish and Wildlife Service assigns Category 2 status to *Physaria bellii*, meaning that it is a candidate for formal listing as endangered or threatened, but more information about the species is needed to make a final determination. The Category 2 designation for all species with that federal status is currently undergoing revision by the U.S. Fish and Wildlife Service.

Significant populations of *Physaria bellii* occur in North Boulder Valley (Figure 6.3*). The Colorado Natural Heritage Program reports that two of the twenty-five known occurrences of this species in the world are found within City of Boulder Open Space in North Boulder Valley (Carpenter 1996). The only occurrences of *P. bellii* that are formally protected on public land are managed by City of Boulder Open Space and Boulder County Parks and Open Space.

Very little is known about the biology and ecology of *P. bellii*. The only published account of the species is the original species description (Carpenter 1996). The plant is probably rare because it is confined to specific geological strata which occur over a limited area. It is unlikely that this species was ever common or much more widespread than it is today (Carpenter 1996).

Protection of *Physaria bellii* populations and habitat is an Open Space Program goal. Until recently, only limited inventory and monitoring has been conducted. Since 1966, occurrences of *P. bellii* have been censused and mapped in four distinct areas of North Boulder Valley. Some occurrences have been mapped twice between 1990 and 1996. Counts have been conducted in all four areas, however, no occurrence has been censused more than once. Mapping and census

methods need to be standardized for future monitoring. Based on the available data, it appears that populations in the management area have been fairly stable since 1990. Long-term monitoring of population dynamics will be required in order to determine species viability.

Research is currently being conducted on *Physaria bellii* population trends in the management area (Carpenter 1996). The study was initiated in 1993 and is funded through the City of Boulder Open Space Research Program. The main objectives of the project are to: (1) determine whether population size is increasing, decreasing or stable and (2) determine if diffuse knapweed (*Acosta diffusa*) has detrimental effects on *P. bellii* and the plant community of which it is a part (Carpenter 1996). Research plots have been located to include a variety of slopes, aspects, substrates, vegetation densities and disturbance factors. Results from the monitoring program can be used to assess the affects of management activities in *P. bellii* habitat.

Birdfoot violet (*Viola pedatifida*)
Viola pedatifida, also called birdfoot or prairie violet, is a Great Plains species that is near a western edge of its range in Colorado. Throughout most of its range the violet is infrequent to common (McGregor et al. 1986) and in Colorado the species is considered rare. The habitat ranges from open woodland to prairie meadow. In Boulder Valley, *V. pedatifida* usually occurs in association with ponderosa pine and rocky terrain. Several of the local occurrences are on City of Boulder Open Space and at least two of those are in North Boulder Valley Management Area.

An inventory and monitoring program has not been developed for this rare species. Occurrences in the management area are documented by dot placements on aerial photos.

Sensitive Communities

Several communities and associations of special concern occur or are likely to occur in North Boulder Valley. The Great Plains mixed grass prairie, mixed foothills shrubland and shortgrass prairie communities are found in the management area. All of the species associated with the foothills ponderosa pine savannah, foothills ponderosa pine scrub woodland and xeric tallgrass prairie communities are present, however, additional survey work is needed to locate remnant patches of these undocumented communities.

Many grassland associations and communities of special concern were once common in the vicinity of the Boulder Valley. The Boulder Valley Comprehensive Plan notes: "Some plant associations which were formerly common in the County have been nearly extirpated. New plant communities that did not formerly occur in the County have replaced them. The original presettlement plant associations are important because they represent the baseline from which we can study the effects of current land use practices, because they are part of the County's natural heritage, and because their loss may mean the loss of additional species that are dependent on presettlement conditions" (City of Boulder 1990a).

Recent vegetation mapping in the management area has identified sensitive communities and associations. A program is needed to monitor trends in community size and species composition and to assess community health. A Boulder Valley-wide context in terms of sensitive community cover, frequency and health is needed to assist in management planning.

6.2.3 Exotic Species of Special Concern

Urbanization, agriculture and other land uses have contributed to significant changes in the flora of the Boulder Valley area (Weber 1995). In some areas, a significant proportion of the flora is exotic. Exotic plants, also termed aliens, weeds or non-natives, commonly threaten native plant communities by invading and displacing native species. Invasive non-natives reduce native species diversity, affect natural processes, raise the cost of farming and land management and diminish the aesthetic and recreational values of natural areas.

Non-native plant species have been introduced to the management area through road-building, gardening, landscaping and agriculture. Some problem species (e.g., cheatgrass (*Anisantha tectorum*) and leafy spurge (*Tithymalus uralensis* (*Euphorbia esula*)) were brought in unintentionally in contaminated agricultural seed or hay and ship ballast material. Gardening and landscaping plants accompanied early settlers and continue to be introduced through revegetation and xeric plantings (Weber 1995).

The Open Space Program recognizes the invasion of non-native species as a significant threat to natural and agricultural resources. The Long Range Management Policies assign a high priority to "the management of non-native species that have a substantial negative impact on Open Space resources and that can reasonably be expected to be successfully controlled" (City of Boulder 1995). Exotic species control is accomplished through Integrated Pest Management. The Program resource management team includes an Integrated Pest Management specialist and an Integrated Pest Management Policy has been written. Integrated Pest Management strategies are applied throughout the Open Space system and often include interagency coordination. The policies and law directing the management of non-native species on Open Space land are listed in Section IV.C.9.b. of the Long Range Management Policies. Open Space policy follows the direction given by the Colorado Department of Agriculture Weed Management Act (Title 35 Article 5.5).

Integrated Pest Management is a decision-making process which selects, integrates and implements weed control techniques to prevent or manage non-native populations. Integrated Pest Management focuses on long-term prevention or suppression of problem species while reducing the impact that control techniques may have on the environment, human health and non-target organisms. A whole systems approach is used, looking at the non-native species as it relates to the entire ecosystem.

Ranking, inventory, mapping, monitoring and evaluation are the methods used in setting Integrated Pest Management priorities. A ranking system provides an objective, ecologically-based decision-making framework for targeting species and infestations. Weed maps and inventories characterize infestations in terms of size, location and threat to resources. Monitoring and evaluation track infestations and treatments over time to determine the successes and failures of the program. Mapping and treatment data are stored in the Open Space Program's Geographic Information System database.

Prevention, education, cultural control, mechanical control, biological control and chemical control are the techniques used in Integrated Pest Management. Effective, economical weed management combines several techniques to achieve desired results with the minimum environmental impact.

Problem Species and Control Methods in North Boulder Valley

The primary exotic species of special concern in the management area are diffuse knapweed (*Acosta diffusa*), Canada thistle (*Breea arvensis*), Mediterranean sage (*Salvia aethiopis*), Russian olive (*Elaeagnus angustifolia*) and cheatgrass (*Anisantha tectorum*) (Figure 6.3*). Musk thistle (*Carduus nutans macrolepis*), an invasive exotic that poses a less serious threat to native plant communities in the area, is also managed. These species are designated as undesirable plants by the Colorado Weed Management Act, Boulder County Undesirable Plant Management Plan and City of Boulder Open Space Program. Integrated Pest Management strategies continue to be developed for each target species as more information is acquired. An essential component of a successful Integrated Pest Management program in North Boulder Valley is the coordination and cooperation of all landowners in efforts to control invasive non-natives.

Descriptions of the following species can be found in *Weeds of the West* (Whitson 1992).

Diffuse knapweed

Diffuse knapweed has been present on public and private land in North Boulder Valley for many years. The Boulder Valley Ranch property contains the most severe infestations. Control methods that have been used include reseeding of native species, herbicide applications, mowing, hand pulling, biological control with beneficial insects and flood irrigation. Where disturbances such as trail building occur, reseeding with native species has been used to help prevent weed invasion. Species have been selected to compete best with invading knapweed. Herbicides continue to be an important control as alternatives are investigated. Mowing has been used in some areas to prevent seed formation, and is followed by chemical treatment in the fall. Hand pulling is a conservative approach used in rare plant (*Physaria bellii*) habitat. Biological control insects have been released in remote or steep areas where other control methods cannot be employed. High soil moistures created by irrigation suppress knapweed and promote competition by other species. Research on the effects of livestock grazing on knapweed has been initiated. Investigation of the effects of fire on the species is needed.

Canada thistle
Canada thistle occurs commonly in North Boulder Valley along ditches and in other areas with seasonally high soil moistures. Most ditch infestations have not been treated. Drained wetlands also seem to play host to Canada thistle. Control techniques applied to other infestations have included: spring grazing, mowing, herbicide treatment and prescribed burning. Mechanical treatment (i.e., mowing) has been the most common control used in the management area. Limited use of herbicides has occurred in the fall following summer mechanical treatment. A 60 acre prescribed burn was conducted on Boulder Valley Ranch during the spring of 1996 for Canada thistle control and wildlife habitat enhancement.

Mediterranean sage
This garden escapee was introduced on a private property west of U.S. 36 in the vicinity of the Schneider and Boulder Land Irrigation and Power (BLIP) properties. The most severe infestations occur on public and private land in the Schneider and BLIP areas. Small infestations have been observed as far northeast as Nelson Road and to the east at Boulder Reservoir. Open Space Program control methods have included: mowing, hand digging, herbicide applications and biological control insects. Intensive mowing and hand digging has successfully contained populations on Open Space land. Reports that mowing may encourage this biennial species to behave as a perennial suggest that mowing is not a good long-term control method. Herbicides have been used to develop buffer zones along boundaries where adjacent properties are infested. Areas that are inaccessible to mowers have been treated with herbicide. Releases of beneficial insects have occurred annually since 1992. Reseeding treatments will begin during the 1996 growing season in previously treated areas.

Russian olive
Russian olive infestations in riparian and wet meadow communities are not severe in North Boulder Valley. Russian olive threatens native plant and animal diversity as densities gradually increase. Open Space Program control techniques include the removal of individuals smaller than 4 inches in diameter by weed wrench, and chemical treatment of larger trees. Treated, dead individuals are cut and removed, or left standing to provide structural diversity for wildlife.

Cheatgrass
Cheatgrass is present in varying densities throughout a large percentage of the management area. Infestations in cropland are minimal. Native plant communities on the Boulder Valley Ranch, Beech East and BLIP properties contain the largest populations. Spring grazing is used to suppress cheatgrass in rangeland areas. The Open Space Program plans to include spring or fall prescribed burns in the Integrated Pest Management strategy for controlling this pervasive species.

Musk thistle
Musk thistle often occurs in areas with Canada thistle infestations. Both species have been treated by mowing. Unlike Canada thistle, musk thistle is a biennial and does not spread by the

root system (rhizomes). Hand and shovel removal are effective control methods for musk thistle due to these characteristics.

Exotic Species Monitoring and Data Management

The spread of target species and the effects of control treatments are monitored by the systematic mapping of infested areas. Mapping methods used for weed monitoring are described in Appendix 3.1. Weed mapping is conducted on a portion of Open Space land each year so that the entire system is mapped over a three to four year period. Annual mapping may occur in rare plant sites, research areas and intensively managed weed populations. Monitoring data is stored in the Open Space Program's Geographic Information System. Integrated Pest Management strategies are developed and improved as results from monitoring data are evaluated.

Information on the release and monitoring of biological control insects is also stored in the Geographic Information System. Periodic spot checks are conducted to monitor most beneficial insect species. Insects have been released to control diffuse knapweed, Mediterranean sage, Canada thistle, musk thistle and Russian wheat aphid in the management area.

Exotic Species Research

- The influence of cattle grazing on the population dynamics of diffuse knapweed. G. Beck and L. Rittenhouse, Colorado State University. Research initiated in 1996.
- Effects of diffuse knapweed infestations on the rare plant, *Physaria bellii*: A. Carpenter, The Nature Conservancy Colorado Program. Research initiated in 1995.
- Mediterranean sage biological control insect monitoring by Colorado State Dept. of Agriculture, Division of Plant Industry. Contact: G. Falls

6.2.4 Ecological Processes and Other Factors Influencing Vegetation Patterns

Many variables and ecological relationships affect vegetation types and patterns. This section summarizes factors influencing vegetation and focuses on information needed to develop a resource management plan.

Fire

- Native vegetation in the Boulder Valley area is adapted to fire. Example adaptations include:
  - the primary growth tissue in prairie grass species is usually below ground level which promotes survival after fire and
  - ponderosa pine seed germination is stimulated by fire and the thick plates of bark on mature trees are fire resistant.

- Fire is a key ecological process sustaining native ecosystem health and integrity. The biological and structural diversity of native communities is influenced by fire. Examples of the effects of fire on native plant communities include:
  - accumulated dead plant material (litter) is broken down or removed by fire, nutrients recycle and seedling growth is stimulated by allowing light and nutrients to reach the soil surface,
  - fire can regulate population levels of insect species that affect plant survival (i.e., ponderosa pine),
  - catastrophic fires are prevented by relatively frequent fires that remove dead plant material and reduce tree seedling and sapling densities,
  - the regeneration of many native species is influenced by and sometimes dependent on the disturbance and heat produced by fire (i.e., ponderosa pine) and
  - invasive exotic plant species may be negatively or positively affected by fire, depending on the species and the conditions of the fire.

- Fire history in the Boulder Valley area has been studied predominantly in montane forest communities (Goldblum and Veblen 1992, Veblen and Lorenz 1986, Laven and Gallup 1995). Post-European settlement changes in fire frequencies have caused significant changes in native plant and animal communities. Before European settlement, fires generally occurred frequently and with low intensity. Fire has been suppressed over the last 80 to 100 years. Without frequent, low intensity fire, dead plant material has accumulated and plant community composition has changed. The conditions resulting from fire suppression can lead to high intensity wildland fires.

  The most recent, large wildfire occurring in North Boulder Valley was the Olde Stage Fire. In November, 1990, this human-caused fire burned approximately 2200 acres and eleven homes. A large portion of the area was included in the fire. The effects of the fire on native plant communities has not been formally monitored. Anecdotal information suggests that the reproduction and frequency of some native grass species increased significantly during the two to three years following the fire. Post-fire observations indicate that the rare plant, *Physaria bellii*, was not adversely affected by the fire conditions created by the Olde Stage Fire (Carpenter 1996). A large percentage of the ponderosa forest and woodland in the area was burned in the 1990 fire. Historic photos and characteristics of the forest community within North Boulder Valley suggest that pre-European settlement ponderosa pine densities were low. Little ponderosa pine regeneration has been observed since the 1990 fire.

- Sensitive species and communities in North Boulder Valley are adapted to pre-European settlement fire ecology. The effects of human-caused changes in fire regime and behavior on rare species and communities is unknown or poorly understood. Plans to restore natural fire regimes in native plant communities through prescribed burning need to address sensitive species.

- Fire can be a valuable resource management tool. Prescribed fire can mimic natural fire and reduce the risk of catastrophic wildfire by decreasing accumulating dead plant material and woody plant densities. The seasonal timing and the weather conditions under which prescribed fires are conducted are important factors to consider in order to ensure ecosystem health and human safety. Sample goals for a prescribed burning program include:
  - reintroduce fire as a natural process in the prairie ecosystem to maintain a balance of woody and non-woody prairie vegetation,
  - evaluate prescribed burning as an integrated weed management tool,
  - develop procedures and methods for safe implementation of prescribed burning,
  - promote cooperative interagency resource management and
  - involve and educate local residents about fire ecology and the role of fire in maintaining healthy ecosystems.

Hydrology and water use
- Patterns in vegetation reflect ground water levels, duration of snow cover and water manipulation for agriculture (see Wetland section).
- Tallgrass community remnants in swales and in irrigated areas may be sensitive to changes in water manipulation (i.e., improved structures and ditch maintenance).

Geology and soils
- Patterns in vegetation are usually closely correlated with geology and soils.
- Rare plant species and uncommon communities may be associated with specific geology or soil types.
- Friable (soft, unstable) soils in North Boulder Valley are particularly sensitive to human and livestock trampling. Uncommon plant communities and *Physaria bellii* (Bell's twinpod) occur on the friable shale outcrops of the Pierre shale and Niobrara Formations.

Wildlife
- Wildlife use patterns are reflected in vegetation patterns. Native plant communities are adapted to ecological relationships with animal species. Changes in the presence, distribution and movement of animal species like black-tailed prairie dogs and mule deer effect plant community composition and structure. Changes in animal densities due to predator extirpation, fire suppression and pressures from human land use affect native plant community dynamics.
- The viability of native flowering plant species is dependent on native pollinator species. Knowledge of invertebrate populations and other animal pollinators is important for management of native vegetation.

Biological invasion
- Non-native plant and animal invasion affects native plant and animal habitat by displacing species through competition and by disrupting pre-exotic invasion population dynamics.
- Control treatments for invasive exotics can impact native plant and animal species.

Land use and land management

- Livestock grazing can influence plant community composition and health. Domestic, grazing animals select some species and avoid others, alter soil nutrient balances and disturb the soil surface. Native prairie communities are adapted to ungulate grazing and management planning for domestic livestock grazing should incorporate knowledge of pre-European settlement ungulate grazing patterns. Livestock grazing is an important integrated weed management tool in native grassland communities.
- Cultivated crops and hayfields can influence native vegetation by introducing exotic species, altering soil nutrient regimes, changing run-off patterns and amounts, re-directing water and introducing chemicals used for pest control. Smooth brome (*Bromopsis enermis*) is an example of a grass species commonly used in hay production that can invade native plant communities and displace native species.
- The effects of recreational activities on native plant communities vary depending on the type and intensity of recreation, the soil type and seasonal conditions (e.g., wet, muddy conditions). Cumulative effects of recreational activity on vegetation (e.g., trail widening, ancillary trail formation, effects of deposition of erosional materials and changed runoff patterns) may be different than short-term effects, and must be considered in resource management planning.
- Urban development has replaced and fragmented native plant and animal habitat in the larger Boulder Valley area. Exotic species can escape from developed areas into natural areas.

Restoration and revegetation

- Plant species introduced through restoration and revegetation projects have the potential to affect natural community dynamics and the genetic integrity of extant native plant populations. Careful planning should guide the selection of species and seed or propagule sources for restoration and revegetation projects. The Long Range Management Policies provide general guidance for landscaping, revegetation and restoration (section IV.C.5).

Landscape features

- Landscape diversity in the Boulder Valley area creates habitat diversity for native plant and animal species. The landscape complexity created by the topographical and climatic gradients in the area is reflected in the rich flora. Weber (1995) notes the diverse and unusual flora found in north-facing canyons and outwash mesas, including bryophytes, lichens, disjunct eastern woodland species and prairie plants.
- Human activity has altered the distribution and patch size of native vegetation types. The affects of these changes on native plant community sustainability and native species viability is largely unknown. The conservation biology concepts of connectivity and fragmentation should be considered and applied in resource management planning.

6.2.5 Condition of Native Plant Communities

The vegetation of North Boulder Valley varies in quality and condition. The "snapshot" of Open Space natural area condition that is evident today, has been influenced by dynamic, natural processes and human land use through time. A program for monitoring and evaluating native plant community health is not in place. Criteria for ecosystem health assessment are being developed as a component of the City of Boulder Ecosystem Plan for the Boulder Valley area. The Ecosystem Plan framework for assessing ecosystem health can guide the development of a program to monitor and evaluate native plant community health. The ability to assess condition and detect trends in community health is important for resource management planning.

General Evaluation of Condition
The Beech, Boulder Valley Ranch and BLIP Open Space complex has a history of heavy utilization by livestock. Weed infestations can be an affect of human land use. Signs of intensive livestock grazing throughout the century include the presence of plants that increase with grazing like cheatgrass (*Anisantha tectorum*), fringed sage (*Artemisia frigida*), prickly pear (*Opuntia* sp.), Spanish bayonet (*Yucca glauca*) and snakeweed (*Gutierrezia sarothrae*). Snakeweed is particularly abundant on the northern half of East Beech, while cheatgrass is abundant on the southern half of the property. Patches of blue grama (*Chondrosum gracile*), which also increases with moderate grazing, are scattered throughout the management area. The areas dominated by shortgrass species in the BLIP and Boulder Valley Ranch areas are reported to be in relatively poor condition with many weedy species. Patches of little bluestem (*Schizachyrium scoparium*) and native tallgrass species are scattered throughout this entire property complex.

The sections of North Boulder Valley that are west of U.S. 36 appear to contain the healthiest plant communities. The forest, shrubland and grassland types are diverse and contain relatively few invasive exotic species. The Olde Stage Fire (1990) stimulated native grass vigor for several years following the fire. Grassland patches of New Mexico feather grass, little bluestem and tallgrass species create diverse, high quality plant communities.

Shale outcrops support an arid land flora that is uncommon in the Boulder Valley. These unusual plant communities found in the Six-Mile Fold area and on other shaley outcrops, often include the rare endemic, *Physaria bellii*. Friable soils and an uncommon flora make the shale communities in the management area among the most fragile and significant in the whole Boulder Valley.

6.3 ISSUES

Species and communities of special concern

- Lack of information on the biology and ecology of rare species (including the importance of processes like fire and prairie dog activity to the maintenance of *Physaria bellii* habitat)
- Lack of information on the impacts of weed invasion and human activity on *P. bellii*.
- Lack of information on the Open Space system and regional context for sensitive species and communities.
- Exotic plant invasion and spread.
- Recreational use of rare plant and community habitat.
- Need for public education concerning sensitive species and communities.
- Grazing in rare plant habitat.
- Need for long-term monitoring plans for tracking population viability and community condition.

Fire management

- Lack of information and/or management planning related to: fire history, natural fire regime for native plant communities, fire as a tool for rangeland and agricultural management, desired condition (seral stage, structural character) of plant communities related to wildlife management, fire as a weed control method and fire effects monitoring.
- Fire suppression in native plant communities that are adapted to periodic fire.

Grazing management

- Lack of information and/or management planning related to: grazing as a management tool for maintaining native plant communities and controlling non-native invasions, maintaining viable livestock operations by carefully designed grazing plans which are based on site specific, area-wide, system-wide and long-term contexts (spatial, temporal and multi-scale context with cumulative effects considered) and grazing effects monitoring.

Agricultural (crop/hayfield) management

- Crop-types and hayfield species (e.g., smooth brome) in proximity to native plant communities.
- Irrigation effects on native plant communities.

Exotic plant management

- Weed infestations in native plant communities.
- Effects of control methods on native species.
- Lack of information on the ecology and biology of native-exotic plant relationships.
- Weed infestations on adjacent land, not managed by City of Boulder Open Space, provide the seed source to re-infest Open Space areas where weed control efforts have been implemented. Adequate and appropriate fencing can provide a short-term solution to this problem by

creating a barrier to blowing knapweed and Mediterranean sage plants. Coordinated weed management involving public and private landowners is an essential step in resolving this critical management issue.
- Land over-utilization by livestock can contribute to exotic species invasions by disturbing soils, altering plant species composition and transporting weed seeds. Important factors to consider when addressing this issue are the timing and duration of grazing, the animal type, the stocking rate, the land use rotation schedule and the sensitivity or condition of the plant communities involved.

Wildlife and native plant community interactions
- Prairie dog activity can affect native plant community composition and condition. The *City of Boulder Grassland Management, Black-tailed Prairie Dog Habitat Conservation Plan* (City of Boulder 1996) identifies weed mapping in prairie dog Habitat Conservation Areas as a seasonal mapping priority. The Plan directs the Integrated Pest Management coordinator to review monitoring data, and in coordination with the prairie dog interdisciplinary team, develop management recommendations consistent with the goals of the Integrated Pest Management program and the prairie dog plan. Implementation of the Plan will include coordinating management of rare plants, other native vegetation and prairie dog Habitat Conservation Areas.

Passive Recreation
- Use types, patterns and levels.
- Trails: fragmentation, exotic species spread, dispersed (off-trail) recreation/use, trampling/widening over time (cumulative effects), trail placement in rare or uncommon and high quality native plant communities.
- Visitor experience and education -- maintaining (or restoring) the integrity (functionality of supporting processes, diversity, dynamics) of native plant/animal communities for high quality visitor experience over the long-term.

Hydrology and water quality
- Effects of water manipulation (irrigation equipment/structures, water use patterns) on native plant communities.
- Effects of changes in hydrology related to road and trail construction and maintenance and of wells.
- Effects of water quality (related to agricultural runoff and Beech property chemical contamination).

6.4 DATA GAPS

- A systematic inventory of plant species in the management area and a complete species list.
- Areas not inventoried and mapped in management area (new properties).

- Rare plant species and community information: biology, ecology.
- Rare plant monitoring program.
- Exotic plant species information: biology, ecology and control methods.
- Condition and health assesssment methodology needs to be developed and applied to evaluate plant communities and agricultural lands throughout the Open Space system. Presently, information on plant condition is anecdotal.
- System-wide context for evaluating and prioritizing management of vegetation types (a system-wide vegetation map).

7. WETLANDS

7.1 INTRODUCTION

The purpose of this section is to describe the wetlands occurring in North Boulder Valley Management Area. The report focuses upon those wetlands on City of Boulder Open Space and includes information about wetlands on neighboring lands where available and appropriate. The data will be used by the City of Boulder Open Space Program in evaluating implementation techniques proposed to address natural resource management goals in North Boulder Valley area. This identification of wetland areas, functions and values is intended to assist the staff as it formulates plans and programs to protect plant and animal habitat, water quality and other wetland functions as part of the North Boulder Valley Area Management Plan.

Wetland Policies Relevant to North Boulder Valley
For the purpose of this report a wetland is an area that is inundated (flooded) or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions (Appendix 7.1). This wetland definition is used in the Clean Water Act (33 U.S.C. §1344) and the City of Boulder wetlands protection ordinance (B.R.C. 1981 §9-12).

The development and management of wetlands are governed by federal, County and City regulations and policies. Federal policies are for the most part regulatory and are administered jointly by the U.S. Army Corps of Engineers and the Environmental Protection Agency. County wetlands policies consist of broad direction from the Boulder County Planning Commission. City wetlands policy includes policy direction in the Boulder Valley Comprehensive Plan, regulatory aspects of the City's land use code (the wetlands protection ordinance), City Council's direction with regard to wetlands protection and the Open Space Program's Long Range Management Policies. More detailed information regarding these policies can be found in Appendix 7.2. Appendix 3.1 contains a section on the methods used for the collection of wetland information.

7.2 RESOURCE INFORMATION

7.2.1 Hydrogeology Relevant to Wetlands

Groundwater movement is dependent upon a permeable substrate that allows for water flow. In the North Boulder Valley Management Area much of the groundwater flow takes place in porous sandstones and unconsolidated material (such as soil and other recent sediments laid down by water, landslides, or wind) or in older fractured limestones and siltstones. Recent weathering and freeze/thaw cycles may have also contributed to the shallow fracturing.

Rainwater and regional groundwater flows contribute to the water which percolates through the alluvial gravels and fractured limestone bedrock. Much of this water follows the local topography and flows eastward where a number of things may occur:

1. Water flows from hillsides where creeks have cut down below the groundwater table forming seeps. Because of extensive groundwater discharge in this area, it is common for the creeks to be gaining--that is increasing their flow without surface water input.
   - *Seeps occur just east of Foothills Highway and east of the Beech Aircraft property Flows in Dry Creek and Little Dry Creek increase without additional surface water input as they approach Boulder Reservoir.*

2. Springs and seeps form as groundwater flow is interrupted by impermeable shale.
   - *Flows emerge from the wet hillside to the north of Dry Creek on the Axelson property.*

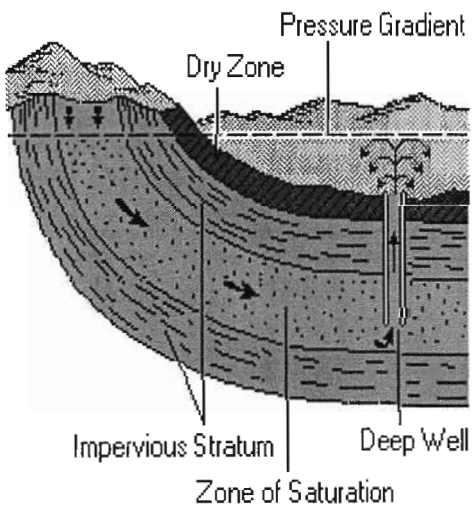

Figure 7.1 Schematic drawing of artesian well (from *The Concise Columbia Encyclopedia*, Columbia University Press. Copyright 1995 by Columbia University Press.)

3. Near surface groundwater disappears as water is diverted into voids in the underlying deposits of shale and limestone.
   - *This phenomenon is interpreted from groundwater well information and is not readily observed at the surface.*

4. Near surface flows increase as underlying water bearing deposits of shale and limestone discharge into the more shallow aquifer.
   - *This phenomenon is interpreted from groundwater well information and is not readily observed at the surface.*

5. Water percolates to great depths as upturned sedimentary beds dive beneath the Pierre shale. This water is released by oil and gas wells and flows to the surface under its own pressure (so-called artesian wells--Figure 7.1).
   - *Numerous imperfectly plugged oil and gas wells are leaking water on the Axelson property.*

Water chemistry is also affected by the local geology. The marine sediments which dominate the management area are strongly alkaline. Waters flowing over and through these deposits dissolve

the calcium, sodium and magnesium salts. When water accumulates and dries in closed basins and shallow depressions, "alkali flats" form. These are most apparent on the east side of the adjacent Boulder Reservoir and on the Hart-Jones property. In some areas groundwater approaches, but does not reach, the ground surface before evaporating. In these instances, hardpan layers (sometimes called caliche) or nodules of various salts form in the soil several inches below the surface. The accumulation of salts affects the degree to which these areas can support vegetation and soil organisms.

7.2.2 Soils

Wetlands in the North Boulder Valley Management Area are restricted to six major soil types (Figure 7.2). Wetlands are found in the clay rich Longmont and Heldt soils. Once wet, these shale-derived soils generally stay saturated due to their low conductivity and permeability. The Renohill silty clay loam is an important wetland soil. It occurs at the junction of the superficial alluvial material and the underlying shale bedrock and is saturated by a large seep on the Axelson property. This soil has been formed from both the shale bedrock and unconsolidated alluvial material.

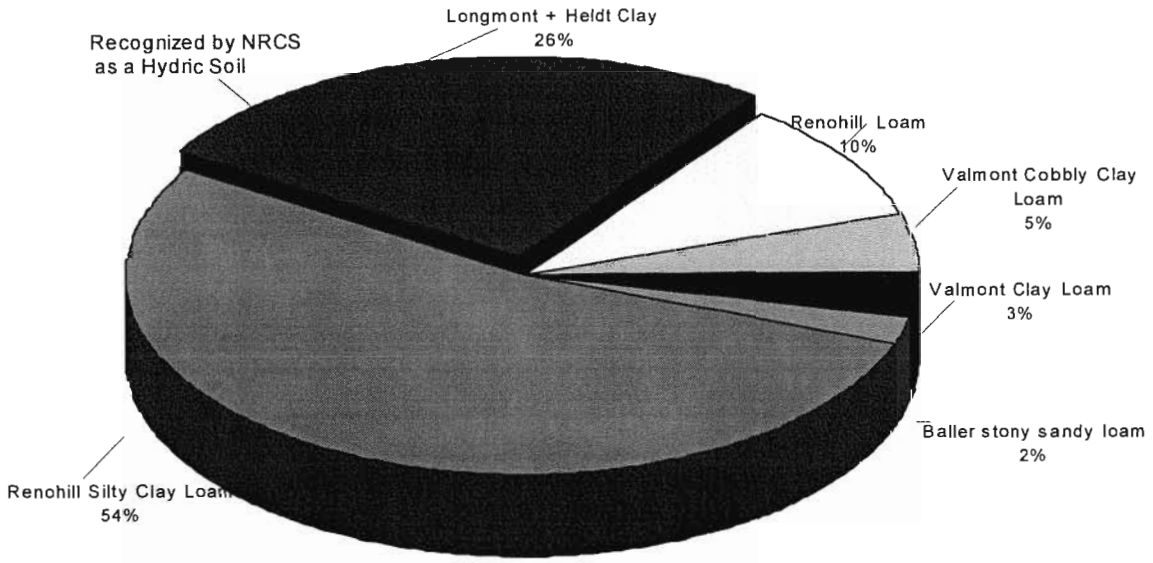

Figure 7.2: Soils of wetlands in the North Boulder Valley Management Area. Total wetland acreage = approximately 220 acres.

7.2.3 Landscape Context

The management area is located in the Left Hand and Dry Creek basins (or watersheds). All precipitation and groundwater does not evaporate, or is not conveyed out of the basin by irrigation ditches or other artificial means, is conveyed into Dry Creek (which includes Boulder Reservoir). Dry Creek flows into Lefthand Creek, then into South St. Vrain Creek, the South Platte River, the Missouri River, and, eventually, to the Mississippi River and to the Gulf of Mexico. Dry Creek and Little Dry Creek appear to be the only named drainages in the management area. There are however several small, gulches and draws which cut across the Beech, BLIP, Schneider, Nejezchleb and Boulder Valley Ranch properties.

7.2.4 Wetland Distribution

Approximately 220 acres of wetlands have been identified on City of Boulder Open Space within the management area. Wetlands cover approximately 4.9% of the land area in North Boulder Valley. This value falls short of the ratio of wetland area for the entire Open Space system (5.9%) and for the Boulder Valley Comprehensive Planning Area (6.0%). One would expect the management area to have relatively fewer acres of wetlands, because the boundary just misses the most significant topographic low (the expansive low area which has been dammed to form Boulder Reservoir).

The 220 acres of wetland are made up of approximately twenty-three distinct wetlands. Figure 7.3 shows that the majority of wetlands are between 1 and 10 acres in size. Most of the wetland area is found in three wetlands over 10 acres. A single wetland on the Axelson property accounts for over half the extent of wetlands in the management area. Even when this wetland complex is divided (see below), the distributional pattern does not change significantly.

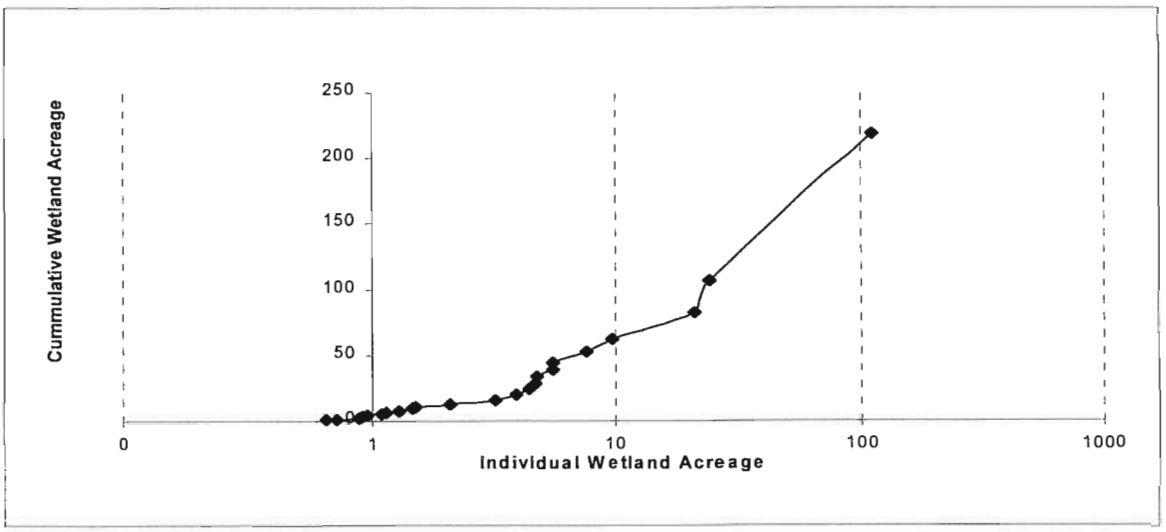

Figure 7.3 Individual wetland area and cumulative wetland area, North Boulder Valley Management Area. (note: X axis is logarithmic).

Several large reservoirs (Boulder, Six-Mile, Lefthand Valley, Loukonen and Coot Lake) surround the management area, but little perennial open water exists within the management area proper. The 5 acre reservoir at Boulder Valley Ranch in the Little Dry Creek drainage is probably the largest, followed by the stock pond on the Axelson property (about 1.6 acres) and the three small ponds along Dry Creek (about 1.5 acres).

Perennial creeks flank North Boulder Valley to the north and south. Lefthand Creek approaches as close as 550 feet north of the Dawson property along Niwot Road. Fourmile Canyon Creek is adjacent to the management area's southwest boundary near the Parsons development rights property.

The drainage basin between Lefthand Creek and Fourmile Canyon Creek is characterized by a series of small valleys and ridges generally trending east west. No contribution of surface water from drainages west of the Dakota Ridge occurs, unlike most of the other areas of the eastern Boulder Valley. Examples of these "montane drainages" are familiar to residents of Boulder: South Boulder Creek, Bear Canyon Creek, Skunk Creek, Gregory Creek, Sunshine Creek and Fourmile Canyon Creek. West of the management area however, Six-Mile Creek is diverted from flowing onto the plains by the Dakota Ridge and it joins with Lefthand Creek just northwest of the management area. Although there is no drainage from the upper montane areas, several small un-named drainages cross the management area and adjacent properties. These all have their confluence in the general area of Boulder Reservoir/Six-Mile Reservoir.

The largest of these drainages is Dry Creek. This stream was probably dry (and therefore appropriately named) much of the year before the development of the Lake Valley Golf Course and the Lake Valley Estates/North Rim residential developments. Dry Creek now has a perennial base flow. The water source is primarily effluent from Lake Valley's wastewater treatment facility, runoff from the developed areas and, seasonally, tailwater from irrigation on the golf course and irrigated area farms.

Little Dry Creek flows south of Dry Creek through Boulder Valley Ranch. A dam was constructed along Little Dry Creek near the eastern boundary of the Boulder Valley Ranch property sometime between 1938 and 1955 creating a small (± 5 acres) pond for agricultural use. A number of other un-named drainages cross the private property to the south of the management area. These areas are evident along 51st and 47th streets north of Jay Road.

7.2.5 Seasonal Wetlands Not Previously Observed

The spring of 1995 was unusually wet (Table 7.1) and areas that are only rarely flooded supported wetlands for the first time in several years. The two relatively large areas within North Boulder Valley where this occurred were the Mesa Reservoir area (16 acres), and the low area at the base of Dakota Ridge just west of Foothills Highway (the Parsons property, about .6 acres)

(Figure 7.4*). Other wetlands formed in the intermittent creek drainages and behind small ridges throughout the management area.

Table 7.1 : Precipitation as a percentage of average for the late spring/early summer, 1995. (Data from Colorado Climate Center 1996)

Month	%
April	352
May	320
June	181

The location and extent of these wetlands that form in wet years might be effectively predicted by using digital elevation models to compute watershed size in areas of particular soil type.

7.2.6 Wetland Origin and Water Source

Both shallow and deep groundwater play an important role in the distribution of wetlands in the management area. Wetland origins were evaluated in the field for each wetlands in the management area. Wetland origin describes the process by which ground or surface water was brought into proximity with the ground surface. In addition, water source was also evaluated. Water source describes the supply of water by which a wetland is maintained.

The majority of the wetlands (n=14) are naturally occurring (Figure 7.5). Groundwater is the most important water source (Figure 7.6) for naturally occurring wetlands. Some wetlands are naturally occurring and supported by surface drainage. Some small wetlands occur in the drainages that dissect the mesas. Other wetlands, such as those forming at Mesa Reservoir and on the Parsons property, are only apparent in exceptionally wet years.

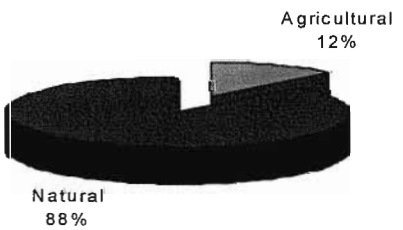

Figure 7.5: Origin for wetlands of the North Boulder Valley Management Area. Total wetland acreage = approximately 220 acres.

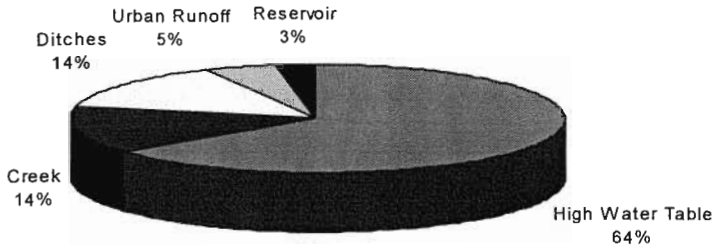

Figure 7.6: Water sources for wetlands in the North Boulder Valley Management Area. Total wetland acreage in management area ~ 220 acres.

The water source for wetlands of agricultural origin is usually an irrigation ditch. Farmer's Ditch, and various ditches from Lefthand Creek irrigate the management area. However, some stock ponds have been constructed along natural seeps or in natural drainages. These water supply systems are detailed in ERO (1995, 1996) and Hydrosphere (1995).

ERO (1995) also indicated that changes in water management could have an adverse impact on wetlands. Specifically, more efficient (less traditional) irrigation practices might reduce return flows which have been important water sources for some wetlands in their study area.

A small wetlands complex was constructed along Dry Creek in 1991 as compensatory mitigation for wetlands destroyed elsewhere by a private developer. Other wetlands have been created on City-owned lands in the vicinity of the management area at Coot Lake and along Little Dry Creek.

7.2.7 Information Needs Relevant to Wetland Origin and Water Source

The contribution of irrigation and natural flows for each wetland are difficult to separate. Understanding the long-standing reliance of wetlands upon artificial water sources is critical, prior to making alterations in the water delivery systems in the study area.

Potential wetland creation opportunities should also be identified and considered as a possible use for the water rights held by the City.

Wetland Plant Communities

As part of the 1990 report, Cooper described a number of wetland plant communities for the Boulder Valley (Cooper 1990). That classification scheme is useful for deciphering the complex

variety of plant associations in wetlands of the Boulder Valley. Fifteen wetland plant communities have been described from the study area (Table 7.2).

Table 7.2: Plant communities of North Boulder Valley wetlands.

Habitat	Community Name	Acres
Wet Meadow	*Juncus balticus*	36.20
Marsh	*Typha latifolia-T. angustifolia-Scirpus lacustris-S. acutus*	35.93
Wet Meadow	*Scirpus americanus*	29.41
Wet Meadow	*Distichilis spicata-Iva axillaris*	26.32
--	*Unrecorded*	24.73
Wet Meadow	*Carex praegracilis/Bromopsis inermis*	22.92
Wet Meadow	*Agrostis gigantea*	21.73
Wet Meadow	*Spartina pectinata*	20.81
Plns Riparian Forest	*Populus sargentii-Salix amygdaloides-Bromopsis inermis*	11.82
Wet Meadow	*Carex nebraskensis*	7.58
Wet Meadow	*Eleocharis macrostachya-Juncus sp.*	7.07
Wet Meadow	*Poa pratensis-Trifolium arvense*	5.57
Marsh	*Persicaria lapathifolia-Persicaria maculata*	5.57
Marsh	*Typha latifolia-Cirsium arvense*	4.44
Wet Meadow	*Glyceria maxima-Anemone canadensis*	1.52
Wet Meadow	*Phalaris arundinacea-Cirsium arvense*	1.31

These communities fall into three general groups and several subgroups (Cooper, 1990). Those that are recorded from the management area are *italicized* and an example is given.

1. **Marshes** or communities in permanent shallow water (water depths over 6.6 feet are not considered wetlands)
   -dominated by floating plants
   -dominated by rooted submergent plants
   -dominated by rooted emergent plants
   Example: Cattail and bulrush marshes at pond edges.

2. **Wet meadows** or communities with seasonal or permanent high water tables but without permanent standing water
   -herbaceous wetlands with organic soils and mineral rich water supplies
   Example: Sedge meadows of open flat areas where groundwater seeps near the surface and dense stands of cattails and bulrushes in low areas.
   -herbaceous wetlands with mineral soils and fresh water
   Example: Fields of wiregrass/arctic rush in heavily irrigated and grazed pastures and meadows.

-herbaceous wetlands with mineral soils and alkaline water source
Example: Inland salt marshes as on the Hart Jones property.

3. **Riparian Wetlands** or communities adjacent to running water.
   -herbaceous wetlands
   Example: Wetlands along the banks of Dry Creek.
   -shrub wetlands
   -forested wetlands

A list of wetland plant species recorded for the management area is provided in Appendix 7.3. Several species are invasive and weedy. These species are highlighted and represent a significant management problem. Wetland indicator status information is provided along with the scientific and common name (if any) for each species. Indicator status is a classification devised by the U.S. Fish and Wildlife Service (Reed 1988) to describe the likelihood that a given plant will be encountered in a wetland. The categories of indicator status are defined in Table 7.3.

Table 7.3: Indicator status for wetland plants (from Reed 1988).

Obligate Wetland (OBL)
Occur almost always (estimated probability > 99%) under natural conditions in wetlands.
Facultative Wetland (FACW)
Usually occur in wetlands (estimated probability 67%-99%), but occasionally found in non-wetlands.
Facultative (FAC)
Equally likely to occur in wetlands or non-wetlands (estimated probability 34%-66%).
Facultative Upland (FACU)
Usually occur in non-wetlands (estimated probability 67%-99%), but occasionally found in wetlands (estimated probability 1%-33%).
Obligate Upland (UPL)
Occur in wetlands in another part of the county, but occur almost always (estimated probability >99%) under natural conditions in non-wetlands. Species not listed are considered UPL.

The Colorado Natural Heritage Program (Colorado Natural Heritage Program 1995) has identified rare and imperiled plants animals and natural communities. The *Sporobolus airoides* Great Plains Salt Meadow [roughly equivalent to the *Distichilis spicata-Iva axillaris* community described by Cooper (1990)] is the only wetland plant community occurring in the management area that is ranked by the Colorado Natural Heritage Program. The community is ranked "as possibly imperiled globally because of rarity or because of other factors demonstrably making it very vulnerable to extinction throughout its range." No state ranking is suggested.

The following species of vertebrates (Table 7.4) are listed as rare or imperiled (Colorado Natural Heritage Program 1995) and have been recorded from the wetlands of the management area (see Colorado Natural Heritage Program 1995 for key to rankings). The Open Space Program's invertebrate database was not checked for records of rare or imperiled wetland species in the management area.

Table 7.4 : Colorado Natural Heritage Program Ranking of Rare and Imperiled Vertebrate Species (from Colorado Natural Heritage Program 1995)

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FED STATUS	STATE STATUS	FED SENS
Rana pipiens	Northern Leopard Frog	G5	S3S4		SC	FS
Falco peregrinus anatum	American Peregrine Falcon	G3	S2 B,SZN	LE	T	
Haliaeetus lucocephalus	Bald Eagle	G4	S1 B,S3N	LT	T	
Pandion haliaetus	Osprey	G5	S1 B,SZN			FS
Falco mexicanus	Prairie Falcon	G5	S3S4 B,S4N			

No species of plants recorded from the management area wetlands are listed by the Colorado Natural Heritage Program (1995).

Wetland Function and Value

Table 7.5 shows the wetland functions provided, on average, by North Boulder Valley Management Area wetlands to a high (3.5-5), moderate (2.5-3.4) and low degree (1-2.4).

Table 7.5: Wetland functions provided in the North Boulder Valley Management Area.

High (rating 3.5-5)	**Moderate** (rating 2.5-3.4)	**Low** (rating 1-2.4)
Groundwater discharge	Shoreline anchoring	Groundwater recharge
Wildlife habitat	Within basin foodchain support	Flood storage
Passive Recreation	Downstream foodchain support	Fish habitat
	Short-term nutrient storage	

Table 7.5: Wetland functions provided in the North Boulder Valley Management Area.

High (rating 3.5-5)	Moderate (rating 2.5-3.4)	Low (rating 1-2.4)
	Long-term nutrient storage	
	Sediment trapping	

The wetlands providing most functions to a high degree are the wetland complex on the Axelson property which includes the seepy hillside in the center of section 33 (T2N, R70W) and the Dry Creek drainage (#548), the central draw on the Beech property (#445) and the large wetland east of the pavilion and west of Lefthand Valley Reservoir on the Beech property (#444).

Wetland function in the North Boulder Valley Management Area is similar to that for wetlands on the private lands which surround the management area. Open Space wetlands provide slightly higher than average ratings for groundwater recharge, shoreline anchoring and within-basin foodchain support. Much of the wetland function in the larger area is provided by the wetlands around the adjacent Boulder Reservoir. Although these areas have been identified and described (Appendix 7.4), the degree to which they provide ecological function and community value has not been determined.

7.2.8 Notes on Individual Wetlands

(see Figure 7.4* for location of individual wetlands)

Hart-Jones Wetlands (#s 406 and 407)

These are the only alkali flats in the management area; they are rare on Open Space. They are part of a much more extensive system in the Dry Creek basin downstream of Boulder Reservoir. Others are located on City-owned property west of N. 63rd Street, and on private property east of N.63rd Street. The Hart Jones wetlands are good examples of an alkali flat that receives relatively little human use and is not usually grazed by livestock. Other similar wetlands on Open Space are grazed, and have very different vegetative cover. The Boulder Reservoir alkali flats have been the site of the annual Kinetics Conveyance Event which is highly disruptive to wetland functions and values.

Ditzel Wetlands (#473)

Some small lush alkali meadows can be found along the shores of Six-Mile Reservoir. These areas are grazed and mowed routinely. There are larger wet areas throughout this property supported by the irrigation system. Most of these (other than right *in* the ditches) do not meet the City's wetland definition.

Johnson Property Wetlands (#s 418-422)
Wetland #418 is located along a ditch. In order to have consistent treatment of ditches in the management area, this wetland (and #475 on BVR) should be removed from the inventory. Alternatively, all wetlands along ditches should be mapped and evaluated. This wetland may perform important treatment of the runoff entering the Boulder Supply Canal.

Wetland #419 is a breeding site for amphibians. Several larvae [probably leopard frog (*Rana pipiens* tadpoles] were collected here, but not identified.

According to ERO (1995), wetland #422 is supported largely by irrigation tailwater. This is an extensive and floristically diverse area with well developed wetland soils. Natural groundwater discharge may also be important as a water source for this wetland. This wetland should be re-visited and carefully evaluated prior to implementing any major changes in the irrigation of surrounding agricultural fields.

ERO (1995) identified a wetland on the Johnson property near the northeast corner of Monarch Road and 55th Street. The area was visited on several occasions, however no wetland was found.

The Open Space Program should examine the opportunities to create wetlands, or manage uncultivated filter strips along the margins of the fields on the Johnson property to reduce the amounts of pesticides and fertilizers which are discharged into the Boulder Supply Canal. The City of Boulder Water Quality staff have provided a map showing the areas of their greatest concern.

Axelson Property Wetlands (#548)
This wetland needs to be divided into several smaller and distinct wetlands.

Dry Creek has potential for enhancement. Impacts from upstream development and past agricultural practices have created a deeply incised creek channel. A restoration project was designed and submitted to Volunteers for Outdoor Colorado in 1992. The project was not selected.

In 1986, the Open Space Program, together with the Public Works and Parks and Recreation Departments, undertook a study (Camp, Dresser and McKee 1986) with the Northern Colorado Water Conservancy District to examine the high quality wetlands associated with Boulder Reservoir and the potential to mitigate for operational impacts to the wetlands of raising the water level in the reservoir. Recommended mitigation techniques included enhancement of wetland habitat on nearby Parks and Recreation Department property to the northeast at Coot Lake and westerly on the Little Dry Creek drainage. The study identified the Axelson farm property as contributing significantly to the wildlife habitat in the management area. It recommended that it should be preserved as Open Space with the wetlands on the property along

Dry Creek enhanced and restored. The Open Space Program was able to purchase that property and attendant water rights in 1990.

The ponds and associated wetlands in the Dry Creek drainage on the Axelson property were originally constructed in 1991, by Aquatic and Wetland Consultants on behalf of Markel Homes Inc. The wetlands were built to fulfill an order of consent by the U.S. Environmental Protection Agency for alleged illegal wetland filling activities by Markel Homes Inc. The City has made legal commitments to the U.S. Environmental Protection Agency regarding the management of these wetlands. One specific provision is that the Environmental Protection Agency must approve any agricultural land uses in the wetland area.

A relatively large wetland along the northern boundary of the Axelson property is not included in the wetlands database. Although this wetland was mapped and evaluated, the information was not transferred to the database. This information will be added to the database and the wetlands coverage. This wetland is supported by the hydrothermal effluent of the Haystack Midwest Well No. 3 on private property to the north. The wetland supports a population of fish which has not been collected or identified. Attempts to collect fish in the winter of 1995-6 were not successful.

The stock pond on the Axelson property offers great opportunities for restoration and wetland creation.

Boulder Valley Ranch Wetlands (#s 448, 449, 462, 474, 475 and a bit of 61)
Wetland #475 is associated with the Farmer's Ditch as it crosses the property. Ditches are not considered jurisdiction wetlands by either the City or federal agencies. Nevertheless, ditches contribute important wetland functions and values. The Open Space Program should assess what level of information is appropriate or necessary to manage these areas properly.

The Open Space Program and the Colorado Division of Wildlife proposed modifying wetland #449 (Little Dry Creek) to improve duck habitat using money from Ducks Unlimited. The project was not implemented (Program and the Colorado Division of Wildlife could not locate an acceptable and affordable source of material for constructing the berms).

Boulder Land Irrigation and Power Wetlands (#s 461, 447 and parts of 71 and 66)
The boundaries of wetland #447 should be modified, as wetlands extend upstream and towards wetland #71.

There is a dried out pond on the BLIP property that may have been fenced at one time to protect wetland values. The area is currently a large weed infestation, is technically not a wetland and provides no wetland function or value.

Beech Wetlands (#s 444, 445, 447, 463, 464)
Wetland #444 is designated a significant wetland in the Boulder County Comprehensive Plan. This wetland has been proposed for modification by the Colorado Division of Wildlife and Boulder County. The project involved the construction of small ponded areas within the wetland for duck habitat. The project was not completed. The Program should contact the Colorado Division of Wildlife to determine its expectations and intentions relevant to this proposed project. Other wetlands on the eastern portion of the Beech property were observed during the winter and spring of 1995-6 and should be mapped for inclusion in the database.

Several small spring fed drainages have their headwaters east of Foothills Highway, and flow eastward to Left Hand Valley Reservoir. The drainages are wet for a significant portion of the year, and are clearly used by livestock as watering areas. Impacts caused by long term acces by livestock are evident in all these drainages. Impacts include erosion of the mesa sides, destruction of shrubby vegetation, siltation and probably reduction in plant biodiversity. Since there are no drainages from which cattle have been exclude, such impacts are, at this point, conjecture.

Three drainage canals traverse wetland #444. The Program should examine the potential impacts of removing or modifying these canals to maximize wetland function.

Wetland #447 should be included together with a portion of the drainage to the north, which supports wetland vegetation near the eastern property line.

7.3 ISSUES

- Coordination of grazing and the conservation of wetland extent, function and value.
  - When are wetland functions most sensitive to grazing impacts?
  - When are wetlands of greatest benefit as livestock pasture and forage?

- Coordination with lessees to insure that pesticide and fertilize applications minimize the adverse impacts of these chemicals.

- Coordination of Integrated Pest Management techniques (fire, pesticides, grazing) and timing, mostly for Canada thistle control, with the conservation of wetland function and value.

- Coordination of trail and road construction and maintenance with the conservation of wetland function and value (protecting existing hydrology, avoiding fragmentation of habitat blocks, insuring pre-existing connections are maintained, examining opportunities for increased connectivity of habitat blocks where important).

- Prioritizing environmental education and outreach to increase public awareness of wetland function and value.

- Establishing protocol for long-term monitoring or periodic re-evaluation of wetland function, value, threats, vegetative cover, overall condition, etc.

- Periodic monitoring of wetlands which support breeding amphibian populations.

- Coordination of irrigation (rates, timing, changes to infrastructure) with the conservation of wetland function and value.

In addition to the issues listed above, many of the issues identified in the Vegetation section are applicable to wetlands as plant communities. The Wildlife section also includes issues important for wildlife habitat in North Boulder Valley. Many of those issues are applicable to wetlands, since they are important wildlife habitat.

7.4 DATA GAPS

Data Needs Relevant to the Communities, Plants and Animals of the North Boulder Valley Management Area Wetlands

The wetlands inventory was not designed to collect information about animal use in wetlands. Instead, incidental sightings of animals were recorded.

- The flora of the alkali wetlands should be examined several times during the growing season. Many of the wetland plants found in these areas are able to complete their life cycles during the brief periods of inundation. The species list could be significantly lengthened by visiting these areas at intervals through the spring and summer. Much of the inventory work could be completed by volunteers, such as members of the Boulder chapter of the Colorado Native Plant Society, or by the Open Space Program's herbarium volunteers as part of their summer work program.

Data Needs Relevant to Maintaining and Improving Wetland Function and Value

Groundwater Discharge

The Program should improve its understanding of the ownership of all the springs, seeps and ponds supported by groundwater discharge within the management area. For example the City owns the McEndaffer seep as identified by Hydrosphere (1995).

- The Program should consider seeking advice from a water attorney or the water resource specialist to determine the advisability of filing upon other areas of groundwater discharge.

Wildlife Habitat

- Conduct a more thorough investigation of animal use of wetlands could improve the Program's understanding of the species of concern and the value of wetlands as wildlife habitat.

Passive Recreation

The visitor use analysis conducted for the management area (Wheeler 1995) indicates that patterns of use are independent of wetlands distribution. However, passive recreational use patterns in and around wetlands probably occur at too fine a scale to be tracked by such a survey. For example, the small reservoir on Little Dry Creek probably receives the highest levels of recreational use, where is some fishing and many people let their dogs go for a swim. Other passive recreation taking place in and around wetlands include nature observation such as birding, photography, etc.

- Monitor passive recreational use patterns in wetlands of the management area.

Shoreline Anchoring

Wetlands performing this function are not widespread in the North Boulder Valley Management Area. Livestock activity probably represents the most serious threat to the integrity of this function. Prior to the Program's acquisition of the Axelson property, livestock grazing had significant and adverse impacts to the banks of Dry Creek. The removal of livestock from that area, for the past five years, has allowed for recovery of the creek side wetlands. Livestock access to creeks and ponds should be evaluated to limit impacts to shorelines. Other opportunities may exist to improve this wetland function through the management of livestock.

- Review wetland functions and threats to shoreline anchoring by livestock, and recommend modifications in agricultural land use practices where appropriate.
  - Hart-Jones,
  - Johnson,
  - Axelson stock pond

Food Chain Support

No obvious needs for further information here.

- Further research should be encouraged to help staff gain a better understanding of the relationship of this ecological function to wildlife habitat value. Such information might suggest alternative management strategies.

Nutrient Storage (Retention and Removal)

Given the position of the North Boulder Valley Management Area, upstream of the City's largest drinking water reservoir, this function is extremely important. However, staff has little specific information about this function. The surrounding watershed is developed with residential (Lake Valley Estates, North Rim, Lake Valley Golf Course), industrial (Beech Aircraft) and agricultural (Open Space) land uses--all of which have potential adverse impacts for Boulder Reservoir. Cooperation and joint research with the Water Quality staff will help Open Space staff

understand the treatment effects of wetlands in the North Boulder Valley Management Area for drinking water quality.

Staff has consulted with the Water Quality staff on ways that agricultural management could be modified to help mitigate the impacts of pesticide and herbicide application upon water quality, especially around the outfalls into the Boulder Feeder Canal (Johnson, Dawson, Axelson East), Farmers' Ditch and Little Dry Creek.

- Continue to cooperate with the Water Quality and Environmental Services staff of the Utilities Division in the Public Works Department on water quality impacts to Boulder Reservoir, and the role wetlands may play in mitigating the impact of Open Space agricultural practices on water quality of Boulder Reservoir.

- Conduct a literature review of information regarding nutrient retention and storage as well as pertinent management recommendations.

Sediment Trapping

- Encourage further research to help the Open Space Program gain a better understanding of the relationship of this ecological function to water quality and wildlife habitat value (such as the need of clear water for hunting by herons and other visual predators). Such information should help guide wetlands management.

Groundwater Recharge

Little is known about the movement of surface water back into the ground in the management area. The relationship of irrigation tailwater to groundwater recharge is discussed by ERO (1995, 1996). A better understanding of the link between irrigation return flows and wetlands will be important as the Program considers alternatives for management of irrigation. No specific work item has been identified for this wetland function.

Flood Storage

The above average precipitation in 1995 provided the Program with an indication of the potential impacts of flooding on the natural systems and infrastructure of the Open Space system. Constructed wetlands may be useful in certain areas to minimize the impacts of flood flows.

- Analyze the locations of flood impacts and potential wetland creation sites to assess the practicality of using wetlands to mitigate soil erosion and flood damage to infrastructure.

Fish Habitat

This function should be better assessed. Of special interest is a small population of fish that inhabit a pool along the northern boundary of the Axelson property. The pool is sustained year round by flow from a deep well which expresses warm (hot) water.

- Work with the Colorado Division of Wildlife, or others to inventory the fish populations in Little Dry Creek reservoir, in Dry Creek and the "hydrothermal pool."

Contaminants

Information about BETEX levels, and levels of other contaminants downstream of the fenced section of the contaminated draw should be included in considerations of future use of the East Beech property.

8. WILDLIFE

8.1 INTRODUCTION

The North Boulder Valley Management Area contains a rich assortment of wildlife species. More than 150 species of vertebrates have been documented in the management area. The area has ten major habitat types dominated by mixed-grass prairie (see Vegetation section). A variety of wetlands and adjacent open water habitats contribute to the diverse wildlife assemblage observed in the management area. North Boulder Valley is known for its extensive black-tailed prairie dog colonies and associated species (mainly wintering raptors). Bald eagles, golden eagles and ferruginous hawks hunt in the area when prairie dog populations are healthy. The cattail/bulrush wetlands of the management area provide some of the only habitat for nesting northern harriers in the region. The mixed grass and shortgrass prairies undisturbed by prairie dogs contain a unique assemblage of reptiles, including the short-horned lizard. The shrublands and wooded riparian areas support the common mule deer and populations of Lewis' woodpeckers, a species of special concern. They also provide important foraging areas for migrating neotropical migrant birds. Mountain lions are common in the ponderosa pine woodlands and shrublands of the higher elevations. The diversity of wildlife in the management area is representative of the many animal communities of the Boulder Valley.

Preservation of wildlife habitat has been a principal Open Space Program wildlife management objective. Prairie dogs were controlled and prairie dog preserves identified and managed through various prairie dog management plans (City of Boulder 1987, City of Boulder 1996). Prairie dog colonies served as prey base for raptors. Mesa Reservoir was identified as wildlife habitat and some wildlife plantings occurred. The Boulder Valley Ranch pond was stocked with fish and fishing permitted. Hunting has not been permitted on any Open Space property including within North Boulder Valley. No comprehensive assessment of wildlife in North Boulder Valley Management Area has occurred.

The principal focus of the wildlife management program has been to collect baseline wildlife inventory information. This report presents data from observations, research and inventory reports relevant to North Boulder Valley. Information is provided on species expected in the management area, species documented in the management area, and historical records of vertebrate species. Information on habitat types, surrounding land use and special wildlife values has been noted along with a discussion of habitat affinities for selected wildlife species. Information gaps and information requirements for management and inventories are listed.

Direction for wildlife management in Long Range Management Policies
The Long Range Management Policies provide general guidance for wildlife management on Open Space lands. An ecosystem approach to maintaining natural processes and functions to the extent possible will serve as the basis for land management decisions for Open Space. Ensuring

that native plants and animals (mammals, birds, reptiles, amphibians, fish, insects arachnids, molluscs and crustaceans) have places to live (habitats) is a priority goal of the Open Space Program. Restoration of extirpated species and conservation of threatened or endangered animals is a management goal in the context of preserving and restoring native ecosystems.

North Boulder Valley is a critical area for wildlife dependent upon the habitat diversity of shortgrass prairies, ponds and wetlands, woody draws, intermittent stream drainages, mixed grass prairies, ponderosa pine savannahs, shale barrens and agricultural croplands. The associations of these habitats and the connections between undeveloped landscapes that are vital to maintain healthy wildlife populations are important components of North Boulder Valley.

8.2 RESOURCE INFORMATION

The Open Space wildlife species database contains 1559 records from North Boulder Valley (Appendix 8.1): 120 of the potential 248 birds reported to occur in the Boulder Valley, 19 of the 73 mammals, 6 of the 21 reptiles and 3 of the possible 7 amphibians. Appendix 8.3 Figure 1 shows the relative percentage of each vertebrate class represented in the wildlife sightings database for North Boulder Valley.

Appendix 8.2 summarizes the status of rare species, threatened or endangered species and species of special concern identified by the Colorado Natural Heritage Program, U.S. Fish and Wildlife Service, Colorado Division of Wildlife and the Boulder County Comprehensive Plan. Twenty-seven of the sixty-nine bird species listed as rare have been recorded for North Boulder Valley. American white pelican, ferruginous hawk, bald eagle and peregrine falcon are listed by the Colorado Division of Wildlife as species of concern and are recorded for North Boulder Valley. White-faced ibis, northern goshawk, ferruginous hawk, bald eagle, peregrine falcon and burrowing owl are listed as species of concern by the U.S. Fish and Wildlife Service and are recorded for North Boulder Valley. A total of sixteen species listed in the Boulder County Comprehensive Plan as species of concern are reported for North Boulder Valley.

The predator sightings database has six sightings of mountain lions and no sightings of black bears recorded for North Boulder Valley (sightings from 1987-1995). Most of the mountain lion sightings have occurred in the ponderosa pine habitat near the Foothills trail and in the Pinebrook Hills subdivision southwest of the management area.

Annual (since 1987) deer population trend surveys (via helicopter and ground counts) have shown a stable deer population for the area surveyed (Appendix 8.3 Figure 2).

Winter raptor counts (1984-1995) from the Boulder County Nature Association's Boulder Reservoir route show declining populations of ferruginous hawks and increasing populations of red-tail hawks and bald eagles (Boulder County Nature Association, unpublished data). Christmas Bird Count data (1950-1993) for the Boulder block show stable populations for red-

tailed hawks, and golden eagles and increasing populations of bald eagles and dramatically increasing populations of ferruginous hawks (Appendix 8.3 Figures 3-6). For the past ten years Christmas Bird Count data shows stable populations of bald eagles, golden eagles and red-tailed hawks with increasing populations of ferruginous hawks (Appendix 8.3 Figures 7-11).

Data from various sources varies in quality
Comprehensive inventories of vertebrate wildlife of North Boulder Valley have not been completed. Information used in this report comes from a variety of sources. Site-specific information is added to the wildlife species database. Due to the variable quality of observers and unstructured design of the wildlife species database, observation information is useful for anecdotal recording of sightings and for comparison to lists of species that are suspected or known to occur in the management area.

Accuracy of the avian survey route information is correlated to the skill level of the observers. The small sample size makes the information from North Boulder Valley useful for comparison only with species lists.

The predator tracking program has limited value for the Open Space system due to the small area being sampled (Miller 1995). No information from the predator tracking transect was used for this report.

Winter raptor counts are accurate and detailed when the skill level and consistency of data collection of the observers are maintained annually. Results from the winter raptor survey are valuable for determining trends in raptor numbers rather than density, due to the techniques used in the survey (therefore numbers cannot be compared with other areas in the Boulder Valley or the state). Christmas Bird Count data are not specific to North Boulder Valley. These data are useful for viewing population trends over time (trend information only).

Annual deer counts provide trend analysis for the entire survey area with limited utility when desegregated for smaller areas.

8.2.1 Discussion

Habitat types, land use influences, unique wildlife values, results of analyzing existing information, information on species and species' assemblages, information gaps for inventory and monitoring and information needs for wildlife management are presented below.

Habitat diversity and species abundance
North Boulder Valley has ten habitat types: marsh, mixed grass prairie, shortgrass prairie, wet meadows, ponderosa pine woodlands and savannah, riparian, shrublands, open water/shoreline, cliff and cropland (grains and alfalfa)(Figure 6.1*). The combination of these habitat types and elevational gradient supports a diverse assemblage of vertebrate wildlife species. More than 300

species of vertebrates are expected to occur in North Boulder Valley (Appendix 8.1). Nearly 150 of these have been documented in the Open Space wildlife species database (Appendix 8.1).

The variety of habitat types that support a diversity of vertebrate species makes North Boulder Valley unusual. Riparian and wetland habitats support high biological diversity and are essential for maintaining wildlife populations in semi-arid environments (e.g., when associated with drier upland grasslands). Wetlands surrounding adjacent Boulder Reservoir, Lefthand Reservoir, Dry Creek and the unnamed riparian area west of Longhorn Road (Schneider, Nejezchleb properties) are critical for supporting populations of migrating and breeding neotropical migrant birds, northern harriers, American bitterns and, potentially, the Preble's meadow jumping mouse.

Due to human development, the mixed grass prairie is a rapidly disappearing habitat along the Front Range of the Rockies, particularly in Boulder County. Grassland avifauna are a group of species declining more rapidly than any other suite of birds nationwide (Knopf 1996). The grasslands in North Boulder Valley are critical to the preservation of the black-tailed prairie dog whose numbers have declined more than 98% across the range of the species (Miller et al. 1995). Wintering raptors are dependent upon the extensive prairie dog colonies in the management area (Jones, 1987).

Land use related to species composition and distribution

Vertebrate species found in North Boulder Valley are influenced by the types of land use within and around the management area. Livestock grazing, farming, recreation, urban and suburban development, roads and water management can have significant influences on the animals found in the management area. Livestock grazing affects the structure and quality of the habitat which in turn determines the quality of habitat for breeding and foraging animals. Row-crop agriculture and water management (irrigation) can benefit or diminish the types of species found in North Boulder Valley. Chemical pesticide use from agricultural operations and surrounding development affects invertebrate food resources for animals, which is critical during periods such as the breeding season. Recreational activities (hiking, biking, dog exercise, horse back riding) can impede the reproductive success and survival of animals in proximity to high recreational use areas in North Boulder Valley (Knight and Miller 1995).

Continual disturbance (i.e., recreation, urban expansion) during critical time periods (breeding season, high stress periods) can limit breeding potential and cause disturbance-intolerant species to abandon the area. Urban and suburban developments and trails provide opportunities for species that are uniquely adapted to the characteristics of a developed environment to negatively impact native species. Predatory species such as black-billed magpies, skunks, raccoons and domestic house cats can limit reproductive potential of nesting birds and mammals. Abundant concentrations of adaptive waterfowl (Canada geese) can transmit disease and cause significant crop loss. Diminishing availability of undisturbed wildland in Boulder County makes the maintenance of areas undisturbed by fire important. Catastrophic wildfires that impact the entire landscape can result in some habitats becoming unsuitable for certain species; however, managed

prescribed burns and prescribed natural fires are important for maintaining habitat quality for some species.

8.2.2 Highlights from Existing Information

Extensive grasslands provide critical habitat for a variety of grassland avifauna and the black-tailed prairie dog. The management area is important for the preservation of large colonies of prairie dogs (City of Boulder 1996) and their associated wildlife species, particularly winter raptors (Jones 1987, 1993). The value of grasslands undisturbed by prairie dogs is also important (Bock and Bock 1994, 1995). The association of the grasslands, shrublands and cliff communities to reptiles is important. A potential prairie rattlesnake hibernaculum on the Nejezchleb property is an example of the value of habitat associations.

Wetlands and wet meadows support a variety of species, such as northern harriers, savannah sparrows, and Virginia and sora rails. Bat use (Adams 1995) of the pond on the Nejezchleb property and the location of a tiger salamander from that same pond (Averil and Damas 1994) demonstrate the importance of micro-habitats to wildlife species.

The documented wildlife species reports from the wildlife habitat database do not adequately represent the biological diversity of the vertebrate wildlife in North Boulder Valley. The absence of a variety of important species that are expected to be in the management area is a concern (long-eared owls, various reptiles, shortgrass prairie avifauna, shorebirds and Preble's meadow jumping mouse). Several previously documented species have not been recorded recently in the management area (e.g., burrowing owl, blue grosbeak).

Birds

Winter raptors - Bald eagles, golden eagles, ferruginous hawks, red-tailed and rough-legged hawks are common in North Boulder Valley during winter months. The proximity to high concentrations of waterfowl at the adjacent Boulder Reservoir and the prairie dog colonies in North Boulder Valley are important components for maintaining large raptor populations. Christmas Bird Count data indicate generally increasing or stable raptor populations over the past forty-five years (Appendix 8.3). Winter raptor survey data show stable or slightly decreasing populations of raptors in the area around Boulder Reservoir. Some of the declines could be due to disturbance from humans (Holmes et al. 1993) where visitor use is high. North Boulder Valley area has had historically high raptor numbers, particularly during periods between extensive bubonic plague epizootics that reduce rodent populations. Raptor perch sites are abundant (Fletcher 1995).

Maintaining viable prairie dog populations and grassland habitats for other small mammals and avoiding disturbance of hunting raptors by humans will be important. A unique opportunity to

focus watchable wildlife educational projects is available due to the high concentration and variety of winter raptors.

Owls: Burrowing owls, barn owls and long-eared and short-eared owls historically resided in the management area. Long-eared owls are now found regularly north of North Boulder Valley near Lykins Gulch. Short-eared owls are only seen occasionally, mainly during the non-breeding season. Barn owls inhabited the silo and outbuildings of the Johnson house until their demolition in 1994. Burrowing owls have not been documented nesting in the management area since 1990. They formerly occupied sites near Boulder Reservoir and on the Axelson property.

Miscellaneous bird species: Documentation of avian species other than raptors is poor (i.e., there are only three avian transects for more than 4900 acres). The lark sparrow is documented nesting in the area around Mesa Reservoir (David Craig, pers. comm.). Savannah sparrows and bobolinks have been observed using the wet meadow areas of the Axelson property and the irrigated hay land on the Ditzel property; their breeding status is unknown. All of these species belong to a group of grassland birds (neotropical migrants) that are of concern nationwide (Knopf 1996). Grassland species not on the list of species observed, but expected to occur, include long-billed curlew, lark bunting, grasshopper sparrow and dickcissel.

Several riparian species occur in the management area including Lewis' woodpecker and blue grosbeak. However, their breeding and population status are not known. The wetland areas around the Boulder Valley Ranch ponds are to date unsurveyed, although they hold good potential for numerous wetland species.

Mammals

Prairie dogs - Black-tailed prairie dog colonies are mapped in the management area. Information from 1958 aerial photos indicates extensive prairie dog colonies in the management area. This may have been the most extensive colony system in the Boulder Valley for that time period. A prairie dog habitat conservation area is designated within North Boulder Valley and is generally located on the Beech (east), Boulder Land Irrigation and Power, Gilbert, Mann, Nejezchleb, Parsons and Schneider properties (City of Boulder 1996). Two prairie dog transition areas are also delineated and are generally located on the Boulder Valley Ranch (field 7), Lore, Johnson and Dawson properties; decisions on the status and management of prairie dogs in these areas will be made based on monitoring and management objectives outlined in the *City of Boulder Grassland Management: Black-Tailed Prairie Dog Habitat Conservation Plan* (1996).

Preble's meadow jumping mouse: Habitat around Boulder Reservoir and some of the wet meadow/wetland areas of North Boulder Valley may be suitable habitat for the Preble's meadow jumping mouse (a U.S. Fish and Wildlife Service Species of Concern -- proposed for listing as threatened or endangered). None of the areas in North Boulder Valley were surveyed during the 1995 small mammal census (Armstrong et al. 1995).

Mountain lions: Mountain lion activity is moderate in North Boulder Valley, mainly restricted to the high elevation foothill, ponderosa pine savannahs. Most of the activity is centered around the riparian area and shrublands of the Schneider and Nejezchleb properties. Reports of mountain lion encounters have not been received. However, mountain lions have been seen in the subdivisions to the west of North Boulder Valley.

Amphibians

A single immature tiger salamander was documented from the pond on the Schneider property in 1994. The presence of 150-300 goldfish in the pond may be interfering with salamander reproduction. Surveys have targeted habitats known to have amphibians; however, the survey locations were not documented (Merrit 1993). Spring vocalization surveys in 1995 documented chorus frogs and Woodhouses toads from the area around the Boulder Valley Ranch pond (Gershman, unpublished data).

Reptiles

A potential rattlesnake hibernaculum and frequent occurrences of rattlesnakes in the management area make North Boulder Valley an important preserve for the prairie rattlesnake (a species of special concern). Almost half the potential reptile species found in mixed grass prairies are reported to occur in North Boulder Valley. Little is known about the population levels, breeding status or distribution of reptiles in North Boulder Valley.

Invertebrates

A comprehensive invertebrate inventory has not been undertaken for North Boulder Valley. However, Scott (1995) completed a preliminary inventory of areas around the Schneider property and Eagle Trailhead. Numbers of insects were relatively low, however, a broad diversity of insect species were identified. Three non-native species were identified; honey bees could potentially be out-competing native bees, which were poorly represented in the inventory.

Fish

Little is known about fish populations in North Boulder Valley. Fish have been reported in the Boulder Valley Ranch pond (stocked in the past) and have been seen in the warm pools of water on the Axelson property (Mark Gershman, pers. comm.); 150-300 goldfish live in the pond on the Schneider property. They may be interfering with development and habitat suitability of the pond's tiger salamanders.

Problem Wildlife Species

Wildlife species whose life history characteristics and actions are inconsistent with wildlife management objectives for native or desirable wildlife are defined as "problem" wildlife species. European starlings, mule deer and Canada geese are examples of problem wildlife for Open Space management. European starlings directly compete for nest locations with native cavity nesting birds, including northern flickers, Lewis' woodpeckers, American kestrels and downy

and hairy woodpeckers. Starlings concentrate around urban and suburban areas and farm or ranch buildings. A former livery operation near the Eagle Trailhead provides ample foraging areas for European starlings where they consume the spilled grain and insect loads of the Boulder Valley Ranch agricultural operation. Mule deer are not a major management problem in North Boulder Valley (Appendix 8.4). Canada geese have not been a problem in North Boulder Valley; however, the proximity to Boulder Reservoir, Lefthand Reservoir, the Lake Valley Golf Course and large reclamation projects or grain crops that provide ample forage for geese (particularly in winter) may attract geese.

8.3 ISSUES

Managing wildlife populations

- Maintain animal diversity and critical habitats by resolving potentially conflicting management objectives

Maintaining, restoring and protecting wildlife habitats and habitat quality

- Manage to restore or protect natural ecosystem functions and habitat quality

Determining role of natural ecosystems in North Boulder Valley for maintaining species diversity and natural functions in Boulder Valley

Determining impact of non-native plant and animal species on native species diversity and habitat function

Determining impacts of recreational uses and levels of use on native species diversity and habitat quality

8.4 DATA GAPS

- Comprehensive reptile survey.
- Comprehensive amphibian survey.
- Comprehensive fish survey.
- Breeding bird survey.
- Small owl and cavity nesting survey in ponderosa pine habitats.
- Small mammal survey with species of special concern focus.
- Invertebrate survey of quality habitats and species of special concern.
- Prairie dog surveys and monitoring.

9. CULTURAL RESOURCES

9.1 INTRODUCTION

City of Boulder Open Space lands have played a significant role in preserving the cultural heritage of the Boulder Valley. The natural and cultural resources of these lands contribute to a better understanding of human presence and existence in the Boulder Valley. Cultural resources may include buildings, structures, sites, districts or objects having scientific, historic, prehistoric, archaeologic or social values. Only cultural resources more than fifty years old will be considered for the purposes of this section. Many of these resources are irreplaceable and efforts will be made to preserve and protect significant cultural resources whenever possible and reasonable.

The City of Boulder Open Space Program has these goals for cultural resources (Wheeler 1990):

1. to recognize cultural resource values and integrate them into the management of Open Space lands,
2. to establish procedures for identification, documentation, evaluation, recovery and curation of cultural resources,
3. to protect and preserve significant cultural resources and
4. to interpret, educate and train visitors and staff about cultural resources.

This section will discuss the cultural background of North Boulder Valley, review cultural resource inventories, data gaps and issues related to the cultural resources of the North Boulder Valley Management Area.

9.2 RESOURCE INFORMATION

The diversity of the foothills ecosystems may have presented aboriginal peoples with a proportional richness of resources. Close access to the easterly plains would have further expanded the potential resource range of early Native Americans.

The known cultural history of the northeastern plains/foothills transition zone of Colorado includes North Boulder Valley and has been summarized in several previous documents: the prehistory of the plains in Eighmy's (1984) *Colorado Plains Prehistoric Context*, the history in Mehls' *Colorado Plains Historic Context* (1984a) and *The New Empire of the Rockies* (Mehls 1984b). The montane region has been summarized in Guthrie et al. (1984) *Colorado Mountains Prehistoric Context* and Mehls (1984c) *Colorado Mountains Historic Context*.

Prehistoric groups are known to have occupied northeastern Colorado since at least 11,500 years ago. The Paleo-Indian Period existed from about 9500 to 5500 B.C. and subsistence practices at

this time included both hunting and gathering of natural resources. Most known Paleo-Indian sites are big game kill sites where large and occasionally fluted lanceolate projectile points are associated with animal remains (Gleichman and Gleichman 1989). The period from about 5500 B.C. to 1 A.D. in northeastern Colorado is known as the Plains Archaic Period and coincides with a significant change in subsistence to a more generalized broad-spectrum hunting-gathering strategy (Frison 1978). The foothills and mountains of Colorado may have been occupied during the Early Archaic Period and may have provided food and shelter from a severe warming and drying climatic episode on the plains (Benedict and Olson 1978). Middle Archaic sites with McKean Complex tool assemblages are known for the region, as are some Late Archaic manifestations. The Plains Archaic is followed by the Ceramic Period (1-1550 A.D.), also known as the Late Prehistoric Period. In this area a hunting-gathering lifestyle was retained, with seasonal movements of people into the Front Range. Sites relating to this period are known to be present in eastern Boulder County, including a site along Rock Creek (5BL2712)[2], which has been partially excavated (Gleichman et al. 1995).

The Protohistoric Period refers to the era after European contact, and before widespread Euro-American settlement, ca. 1600-1800 A.D. European trade items began to be used by indigenous peoples and horses became available. Colorado was occupied during the 18th century by the Comanche in the plains and the Ute in the foothills and mountains. By the early 19th century the Cheyenne and Arapaho began to occupy most of the plains of eastern Colorado (Buckles 1968). The Native Americans were forced out of the area by the late 1860s.

Although fur trappers were attracted to Boulder County in the early 1800s, their numbers were limited and it was not until the discovery of gold in California in 1849 that large numbers of Euro-Americans began to migrate to the west. The first encampment of Euro-American settlers in Boulder County was in 1858; a small group in search of gold camped at the mouth of Boulder Canyon. In 1859, the first major discovery of gold in Boulder County was made and soon hundreds of prospectors rushed into the area. At that time, Arapaho Indians inhabited much of the Boulder area. Irrigated agriculture and ranching were beginning to occur by 1860 (Fetter 1983).

The productive soils of northern Boulder County were well suited to agriculture. The foothills were used for ranching and the plains were used for farming and ranching. By the 1860s, scattered farms appeared on the plains east of Boulder City and reservoirs and ditches were being constructed to improve the agricultural productivity of the land. The need for hay and produce in the gold camps west of Boulder further stimulated agriculture (Dyni 1989). The area was also traversed by transportation corridors such as railroad lines, stagecoach lines and later automobile roads. Current uses of North Boulder Valley center on passive recreation and agriculture.

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[2]These site numbers are based on a nationwide Smithsonian numbering system.

9.2.1 Cultural Resource Inventories

A cultural resource inventory of North Boulder Valley was completed during the fall and winter of 1995, as part of an intensive (100%) survey of approximately 4431 acres for the Open Space Program (Gleichman and Phillips 1996). This inventory included a detailed literature search, interviews with long term residents and an intensive field survey of the area. The field survey was conducted between May 1994 and January 1996; the project area was expanded several times as additional parcels were designated for study.

The inventory was performed to locate, record and evaluate all visible cultural resources within North Boulder Valley and to provide the City of Boulder with recommendations concerning these resources (see Appendix 3.1 for further information on cultural resource inventory methods). These inventories increase the Program's cultural resource database and facilitate management decisions regarding cultural resources. Locational information on cultural resources susceptible to site vandalism will not be available to the general public, but will be available to those with a legitimate need to inspect or study the sites. All cultural resources were evaluated for their significance in terms of eligibility for inclusion on both the State Register of Historic Properties and the National Register of Historic Places (Appendix 3.1). Cultural resources which do not meet the criteria for inclusion on the State or National Registers may still be locally significant and eligible for local landmarking.

The cultural resource inventory provides recommendations for protection of cultural resources from adverse impacts (recreational use, agricultural practices, etc.) and assesses other threats to these resources. A set of expectations based on findings during previous investigations in the vicinity has been developed to help understand the prehistory and history of the area.

Prehistoric cultural resources located within North Boulder Valley can provide information for a number of research concerns such as regional chronology, settlement patterns, resource utilization, site function and cultural affiliation. Much of this information is outlined in Eighmy (1984). Data concerning historic sites can also provide information about mid to late 19th and early 20th century homesteads, farming and ranching in Boulder County, as defined in the Boulder Historic Context Project (Friedman 1989; see also Mehls 1984a, 1984b).

Archaeological site density in this part of eastern Colorado is variable. Previous cultural resource inventories in the immediate area have identified historic resources (generally associated with irrigation and agriculture), a few prehistoric sites and isolated artifacts. The low number of aboriginal sites known for this area may in part be due to heavy vegetation growth resulting in poor ground visibility. Low site numbers may reflect the intensive historic use of the management area and the proximity of urban and suburban development, with prehistoric material being lost to collection and otherwise obliterated by plowing and other development. Prehistoric camps tend to be located near water sources in areas with gently sloping terraces or

ridge tops. Several prehistoric resources have been documented on and near the Dakota hogback; a few undocumented prehistoric cultural resources are likely in the management area.

Historic Euro-American remains were known to be present in North Boulder Valley and are more common than prehistoric sites. A rich history of farming, ranching, mining and recreation has resulted in numerous sites related to these activities, such as house foundations, animal enclosures, irrigation ditches, farm machinery and trash deposits.

9.2.2 Cultural Resource Inventory Results

Previous archaeological and historical studies have been conducted in and around the management area by the Indian Peaks Chapter of the Colorado Archaeological Society, the University of Colorado Department of Anthropology and Native Cultural Services, a local consulting firm. Previous studies have resulted in the documentation of sixteen sites and three isolated finds. Isolated finds were defined as no more than four artifacts in the space of 100 by 100 meters, or solitary features without associated artifacts. Sites were minimally defined by the presence of five or more artifacts, two or more features or a feature with artifacts or structural remains. Previously recorded sites include: four prehistoric sites; a possible historic burial; the Boulder, Left Hand and Middle Park Railroad bed; two trash dumps; the ruins of an historic homesite; three ditches (Silver Lake, Star, Hinman) and four standing farm houses. Three of the farm houses are still standing (Ellison, Lot 5 or the Ellison fire cache, Johnson residence, Axelson residence #3) and one residence (Ellison, Lot 1) has been demolished.

The cultural resource inventory recorded twenty-six new sites and twenty-four new isolated finds. The sites include: three prehistoric sites, one of which is an apparent game drive wall; two rockshelters which may have had both prehistoric and historic use; a grave; the ruins of three historic homesites, a powder house and a nickel smelter; three sites with stone structures, a stone-lined dugout, five trash dumps; two ditches (Boulder Feeder Canal, Farmers Ditch); and four standing buildings. The buildings are the Gilbert Ranch house (Schneider residence), farm houses at 6559 N. 55th (Axelson residence #2) and 6281 N. 55 (Axelson residence #1) and a stone building at the Boulder Valley Ranch (ranch shop). A total of sixty-nine formal cultural properties have been identified in North Boulder Valley.

A prehistoric lithic site (5BL2714/2716), stone circle sites (5BL10, 5BL259), rock shelters (5BL6613, 5BL6614) and one of the historic homesite ruins (5BL6626) may be eligible for the National Register of Historic Places (Appendix 3.1) for their potential ability to yield data important to the history or prehistory of the management area. The presence and quantity of buried cultural material can only be determined by further test excavations.

The brick farm house at the Johnson Property (5BL3875) is eligible for the National Register of Historic Places because it is an example of common brick construction and architecture used during the 1880s and 1890s.

A stone wall (5BL6611)may be prehistoric and, if confirmed, would be eligible for the National Register of Historic Places because it would be an example of prehistoric architecture and could yield data important to the prehistory of the management area. This site is the only known example of a game drive wall in the hogback area of the plains/foothills transition region. Other aboriginal game drive systems occur at higher elevations.

The remaining sites are not eligible for the National Register of Historic Places, but some of the standing buildings may be eligible for local landmarking. The stone shop at Boulder Valley Ranch (5BL6628) and the Axelson farm (5BL4127) (Axelson residence #3) may be eligible for local landmarking. Axelson residence #1 (5BL6629) and Axelson residence #2 (5BL6630) and the Gilbert ranch (5BL6615) (also currently known as the Schneider residence) are relatively undistinguished examples of farm/ranch dwellings. These buildings have all been subject to recent modifications. Final determination of local landmark status would require further analysis comparing them to with other similar buildings in the County. Comparative data is unavailable until the Boulder County standing building survey is completed.

9.2.3 Cultural Resource Themes

The Boulder Historic Context Project (Friedman 1989) defines cultural resource themes for the Boulder Valley. Previously discussed cultural resource sites in North Boulder Valley relate to and provide pertinent information on many historic themes in the Boulder Valley, including Aboriginal Prehistory, Agriculture, Mining and Extractive Industries, Transportation and Water Resources.

Aboriginal Prehistory, about 12,000 B.C. to A.D. 1880
North Boulder Valley, particularly near the hogback, has several sites related to aboriginal prehistory. The location of the sites meets expectations, as the plains-foothills transition zone is known for resource procurement by prehistoric people.

The stone wall (5BL6610) descending the hogback is thought to be aboriginal, based on its construction and configuration. While there are numerous stone fences in Boulder County along the hogback and in the foothills, most are demonstrably historic. Prehistoric game drive systems involving stone walls are documented for higher elevations near the continental divide (Benedict and Olson 1978, Benedict 1985). Little is known about how these drive systems or walls functioned. Two lithic scatters on the crest of the hogback (5BL6619, 5BL6620) are ephemeral sites, probably resulting from hunting excursions. A more substantial lithic and ground stone scatter was previously documented as 5BL2714 and 5BL2716. This appears to be the same site, and during a recent visit a fragment of a Mount Albion projectile point was recovered. The

Mount Albion complex dates to the Early Archaic period, about 6000 years ago. A previously recorded stone circle site (5BL10) may have been a prehistoric village. The stone circles are not currently visible on the ground surface, which indicates soil deposition has taken place and emphasizes the probability of buried (subsurface) cultural material elsewhere in the management area. A solitary stone circle (5BL259) may have been a habitation structure, "tepee ring" or may have served some other purpose.

Agriculture, about 1859 to present
Agriculture covers a broad expanse of time and activity within the Boulder Valley. Agricultural properties include farms, a flour/grist mill, gardens, orchards, livestock ranches, dairy industries and fisheries (Friedman 1989). Some of the sites and isolated features recorded by this inventory relate to the agricultural theme.

Use of the management area for pasture and growing crops continues today. Some prominent ranching families have used this area for agriculture, including the Tyler, Maxwell, Axelson, Euler, Parsons and Gilbert families. The Open Space Program leases portions of the management area to ranchers and farmers. Water resource sites are also associated with agriculture in the management area and will be discussed below.

Mining, Minerals and Extractive Industries, about 1858 to present
Much of the early history of settlement in the Boulder Valley is connected with mineral extraction. Boulder was originally settled by gold seekers in 1858. While precious metal mining took place in the mountains, coal mining was a major endeavor in the Boulder-Weld Coal Field near Marshall. The demand for fresh produce stimulated agricultural production throughout the Boulder Valley, including North Boulder Valley. The ruins of the "Cobalt Gold Mining Smelter" (5BL5044) directly relate to metal mining in the mountains. This site is reported to have been used to smelt nickel ore from mines in Gold Hill which were owned by the Cobalt Gold Mining Company. Whether the site was also used to smelt gold or other metals is unclear. It is thought that the smelter was used briefly during the late 1930s and early 1940s.

Oil exploration and extraction took place in many areas of North Boulder Valley. The Boulder Oil Field (a.k.a. the Haystack Field) is located in the management area and is about 2 by 6 miles, extending northeast along the present Boulder-Longmont Diagonal. According to Smith (1981), the "Old Whiterock" well was sunk at the top of Gunbarrel Hill in 1892. Ferdinand V. Hayden, after surveying the area for the U.S. Geological Survey in 1901 referred to Boulder County as lying over "a veritable sea of oil" (Smith 1981). Isaac Canfield hit oil in an exploratory well in January, 1902 and by April of that same year, 117 oil companies were operating in the area of the Boulder-Longmont Diagonal. 1909 was one of the peak years and more than 85,000 barrels of oil were produced. This boom was short-lived and production fell to approximately 7000 barrels in 1914, and by 1923 only 12 wells were operating in the county. Of the 183 wells that were drilled during this period, 102 were dry, 76 produced oil and 5 produced gas. By 1953, just 2500 barrels of oil were produced (Jenson 1954).

Even though the boom was short lived, oil exploration and drilling continued into the 1950s and indeed continues to a limited extent today on adjacent private lands. After the turn of the century, a number of different companies owned large areas of land in North Boulder Valley, including Inland Oil and Refining Company, Haystack Dome Oil Company, United Oil Company, Continental Oil Company and Northern Oil and Refining Company. In the 1940s, oil uses declined and agriculture became the dominant land use.

Four capped wells and some minor debris associated with oil drilling are found west of 55th Street and north of the Boulder Reservoir. The wells and debris are documented as isolated features (5BL5064-5BL5067 and 5BL6729 & 5BL6730) and were owned or leased by a series of oil companies from just after the turn of the century up through the 1950s. In the immediate vicinity, the Inland Oil & Refining Company had a couple of "gushers," Inland #13 and Inland #5 (as shown on "Drumm's Second Revised Map of Boulder Oil Fields," 1924, and "Drumm's Pocket Map of Boulder County," 1932).

Transportation, about 1540 to present
Aboriginal and pioneer transportation routes may have passed through this portion of northern Boulder County, though no specific routes have been reported within North Boulder Valley. Historic transportation in the area was principally on railroads and stagecoaches. Some sites in the management area apparently relate to the construction of the Boulder, Left Hand & Middle Park Railroad bed (5BL417). A large rock dam (5BL6616) may have been built to control runoff in a drainage crossed by the railroad. The railroad line was never completed.

Numerous portions of ephemeral road beds can be observed throughout the management area and probably served informal transportation functions for local farmers.

Water Resources, about 1859 to present
Irrigation ditches have been an integral part of the history of Boulder since October 1, 1859 (Schoolland 1980). Ditches were built across the Boulder Valley in rapid succession. The construction of several early ditches tapping Boulder Creek and Lefthand Creek was critical to the development of the cultural landscape. The first ditch to traverse North Boulder Valley was the Farmers Ditch, with an appropriation date of October 1, 1863 for 3000 acre feet of water. The ditch has a priority number of fourteen, tapping Boulder Creek and flowing northeast through the City to the Boulder Valley Ranch. The Silver Lake Ditch also takes water from Boulder Creek. It was constructed by J.P. Maxwell and George Oliver, and has an appropriation date of February 28, 1888 with a priority number of forty-eight. The ditch formerly filled Mesa Reservoir. Other features of this water transport and storage system are Silver Lake Reservoir and Island Lake Reservoir, built in the high country to supply water to the ditch. These two reservoirs were sold to the City in 1906, and are in the City of Boulder Watershed. Mesa Reservoir is no longer used to store water.

Star Ditch originates at Lefthand Creek and irrigates lands to the south and east of the creek. It has an appropriation date of April 1, 1871. Hinman Ditch originally diverted water from Lefthand Creek, but is now a carrier ditch using water from other ditches. The Lefthand diversion is no longer used. Early records of this ditch are lost, but it also probably dates to the 1870s or 1880s.

These ditches, together with small reservoirs and stock pond, s supplied the water needed to support the agricultural development of North Boulder Valley.

9.3 ISSUES

- Resolve potential conflicts with other resource management goals.
- Identify "best management practices" to protect and preserve significant cultural resource sites.
- Identify sites eligible for local landmarking.
- Determine appropriate uses of significant historical structures within the management area.
- Determine if test excavations should be conducted at certain sites. These sites may contain archaeological information which could provide additional knowledge on the prehistory of the area.

9.4 DATA GAPS

Undetected prehistoric sites may be contained within North Boulder Valley. If any prehistoric artifacts or features are uncovered during management activities or practices, all work should be temporarily stopped until these resources are evaluated. This policy is more fully outlined in the Long Range Management Policies and Cultural Resource Guidelines.

Several documented sites may contain buried cultural material and test excavations are needed to fully evaluate the sites. Some of the prehistoric sites in the management area and one historic habitation may contain potential archaeological information. Only testing within the bounds of specific research inquiries may determine the information potential of these sites.

Specific recommendations concerning local landmarking have not been completed and will need to be evaluated on a case-by-case basis. The Boulder County Historic Preservation Advisory Board, the City of Boulder Landmarks Advisory Board and the Open Space Board of Trustees should be consulted prior to any management action concerning these historic structures.

10. PROPERTY INFORMATION

10.1 INTRODUCTION

Acquisition of four key properties in 1973, known as the Boulder Valley Ranch/Lore, Boulder Land Irrigation and Power, Gilbert and Mann properties, provided the nearly 1400 acre foundation around which the balance of North Boulder Valley Open Space lands have been assembled.

The North Boulder Valley Management Area contains lands that have been designated as open space by the Boulder Valley Comprehensive Plan and that meet open space goals and criteria set forth in the City Charter and those that were designated in the accelerated acquisition plan approved by City Council and the electorate in November of 1989.

This section inventories property concerns for the Open Space lands in North Boulder Valley, private properties with access rights through North Boulder Valley Open Space, nearby properties under consideration for acquisition and adjacent lands affecting North Boulder Valley.

10.2 RESOURCE INFORMATION

10.2.1 Open Space Properties

Table 10.1, on the following pages, contains information on ownership status, acreage, year acquired, public easements, conservation easements, private easements and rights-of-way for the individual properties in North Boulder Valley. Additional information is detailed below.

For some of North Boulder Valley properties, the City of Boulder has a "less than fee" ownership interest. In these cases, the City owns the "development rights" or a "conservation easement" for the property. In North Boulder Valley, in all these cases, the City purchased certain rights from the Seller and the Seller kept certain rights. Also, in all these cases, the Seller is still the fee owner or has underlying ownership of the property, with the exception of the rights that were sold to the City.

Axelson, West
A significant portion of the property contains the Dry Creek drainage into the Boulder Reservoir. The purchase included water rights of 359 shares of Lefthand Ditch and 1 ½ shares of the Star Ditch. The Star Ditch is a carrier ditch for Lefthand water. The City owns one-half of the mineral rights in the south one-half of the north one-half of Section 33, T2NR70W.

Table 10.1 North Boulder Valley Property Inventory

PROPERTY	OWNERSHIP STATUS	ACRES	YEAR ACQUIRED	PUBLIC EASEMENT	CONSERVATION EASEMENT
Axelson, West	fee	479	1990		
Axelson, West	development rights	1	1990		
Axelson, East	fee	40	1990		
Beech, East	fee	617	1988	easement & ROW for: Neva Road (County Road 34); Foothills Highway (U.S. 36, State Hwy. 7; County Road purposes (granted 1955)	
Beech, East	temporary closure	33	1988		
Beech, West	fee	350	1988		
Beech, West	conservation easement	8	1988		City can enter for maintenance/patrol/emergency access; public access shall not be restricted/ prohibited; City will construct trail, trailhead, & parking area; City shall design animal control program & give prior consent before control undertaken
Beech, West (north parcel)	conservation easement	1	1988		Beech shall not place or construct any road or structure except boundary line fence; no public access beyond Beech reclaiming waste disposal pit
Beech, West (south parcel)	conservation easement	1	1988		Beech shall not place or construct any road or structure except boundary line fence; no public access beyond Beech reclaiming waste disposal pit
Beech, West	County fee	200	1988		City holds on portion of property; City can enter for maintenance, patrol, & emergency access; County shall not restrict or prohibit public access through the property
Boulder Land, Irrigation and Power	fee	518	1973	City permanent easement & ROW (Longhorn Road) to provide access to property	
Boulder Valley Ranch (103 Corp.)/Lore	fee	639	1973		

PROPERTY	PRIVATE EASEMENT	RIGHT-OF-WAY (ROW)	OTHER
Axelson, West (fee)	Markel Homes, Inc. temporary easement & non-exclusive license for access for not more than 7 years for wetland restoration project	Star Ditch; County Rd. 51; Dry Creek	Star Ditch access to powerline via vehicle gate
Axelson, West (development rights)		Dry Creek	contained leaking oil well that has been plugged & the area cleaned up
Axelson, East	Poudre Valley Rural Electric Assoc. (REA) easement & ROW for electric transmission line	N. 63rd St.	
Beech, East (fee)	10' wide Mountain States Telephone & Telegraph easement (T&T) & ROW for utility purposes; Beech reserved: existing 30' wide waterline easement, new 30' wide waterline easement from meter pit		Water Co. shall have right to use Left Hand Valley Reservoir feeder ditch & Left Hand Valley Reservoir facilities of the Ditch Co. as carriers of its water to fill Loukonen Bros. Reservoir & Reservoir Enlargement
Beech, East (temporary closure)			contaminated area closed to public use by Boulder County until Beech has cleaned up area
Beech, West (fee)	10' wide & 16.5' wide Mountain States T&T easements & ROW for utility purposes; Foothills Water Users Assoc. 20' wide for water pipeline & ingress & egress; temporary access to waste pits for reclamation	Highway (U.S. 36) --- PRIVATE (cont.): 2.3 acre temporary easement around north 1 acre waste disposal pit	subdivision covenants for Olde Stage Lot 11 prohibit use as a parking lot
Beech, West (cons. easement)			
Beech, West (cons. easement, N)			waste disposal pit; will be deeded to City once City satisfied EPA has approved cleanup
Beech, West (cons. easement, S)			waste disposal pit; will be deeded to City once City satisfied EPA has approved cleanup
Beech, West (Co. fee)	Beech reserved permanent non-exclusive easement for water storage tanks & underground water utility lines; access & waterline easement		
Boulder Land, Irrigation and Power	10' wide to Mountain States T&T for underground utility ROW; rights of owners of Silver Lake Ditch to use the ditch presently located; Public Service Co. for gas pipeline	Silver Lake Ditch	Luchetta access driveway; Rubin & Snyder claim access off Mesa Res. Rd.; rights granted to: U of C High Altitude Observatory; Fairway Utility, Inc. & Rocky Flats Water Co. for installation of water storage & distribution system; rights in & to ditch(s)
Boulder Valley Ranch (103 Corp.)/Lore	Mountain Bell for underground phone service for current overhead line for 2 houses on adjacent Luchetta property	10' wide, Mountain States T&T for communication & other facilities to serve Hidden Valley Ranch	

PROPERTY	OWNERSHIP STATUS	ACRES	YEAR ACQUIRED	PUBLIC EASEMENT	CONSERVATION EASEMENT
Boulder Warehouse	development rights	80	1974	City along western & southern boundaries for access by foot, horse, or non-motorized vehicle by the general public (status in question)	
Brewbaker	fee	140	1996	easements to County over & across existing roads, farm lanes & irrigation routes for irrigation and agricultural purposes	
Cowles	fee	40	1991	County Road 36 (Monarch Rd.)	
Dawson	fee	72	1992	water line purposes 20' in width	
Dawson	conservation easement	4	1992		Dawson may restrict public access; development restricted to 1 single-family dwelling (2500 sq. ft.) & existing out buildings (4150 sq. ft.); no paved driveway wider than 20'; new road to dwelling only w/ Dawson's approval
Degge	fee	5	1988		
Degge/Schneider	fee	2	1976		
Ditzel	fee	57	1984		
Ellison	fee	75	1991	owner agrees to dedicate what's necessary for installation of domestic water system; ROW for N. 51st Street; utilities	Lot 5
Gilbert	fee	47	1973		
Hart-Jones	fee	18	1975	easement & ROW for County Road 39; City easement & ROW for installation, construction, repair, maintenance, & reconstruction of underground water line	
Joder, West	fee	20	1991		if property not used for trail by 1/31/2011, land may be conveyed back to Joders subject to a conservation easement (similar to one on Joder II)
Joder, East	County fee	3	1991	40' wide non-exclusive easement & ROW for ingress & egress (for public access from U.S. 36)	County conveyed to City over Easement Area; City right to preserve/protect land/views in present natural condition; County to manage/ maintain

PROPERTY	PRIVATE EASEMENT	RIGHT-OF-WAY (ROW)	OTHER
Boulder Warehouse			Boulder Warehouse has right to: build single-family dwelling & accessory buildings permitted by right in County rural residential district; access; build fences, cross-fences, gates as reasonable as needed for agricultural use
Brewbaker	easements to Brewbakers over & across existing roads, farm lanes & irrigation routes for irrigation and agricultural purposes; 30' utility easement to Boehm Family Ltd. Partnership	Neva Road	
Cowles			
Dawson (fee)		Niwot Road; Monarch Road; Mountain States T&T	
Dawson (cons. easement)			
Degge	ditch easement; 30' wide easement & ROW for water pipeline to Fairways Water & Sanitation Dist.		subject to 99 year lease to Boulder Land, Irrigation, and Power
Degge/Schneider			
Ditzel	Ditzel to enter 4.45 acre parcel to maintain/ operate any ditch/lateral and/or diversion box pertinent to purchase of said water rights		
Ellison			
Gilbert			100' wide access strip to Parsons' property will be granted
Hart-Jones			Boulder Reservoir south drainage channel runs through property
Joder, West			emergency & fire access through property granted; questionable access from west boundary to Olde Stage Road/Buckingham Park parking lot
Joder, East (County fee)	Mountain States T&T ROW easement for communication facilities; Poudre Valley REA ROW easement for electric transmission/ distribution line/systems	40' wide to Left Hand Land & Water Co. for roadway & water pipeline	dogs accompanying public required to be on leash

PROPERTY	OWNERSHIP STATUS	ACRES	YEAR ACQUIRED	PUBLIC EASEMENT	CONSERVATION EASEMENT
Joder II	conservation easement	336	1996	CONSERVATION (cont.): Joder's can't sell or dedicate any easement or ROW without City approval; City can enter to inspect property & enforce rights	development limited to existing 4 residences, horse ranch facility, & challenge course; 2 existing mobile homes can each be replaced by a single-family 3000 finished sq. ft. dwelling; Joders may restrict public access
Johnson	fee	264	1992	15' to Dawsons for access to parcel they retained from their property	
Johnson	conservation easement	4	1992		Johnson may restrict public access; development restricted to 1 single-family dwelling (2500 sq. ft.) & existing out buildings; new road to dwelling only w/ Johnson's approval
Loukonen Brothers	fee	1	1986		
Mann	fee	186	1973		
Mesa Reservoir	conservation easement	110	1983	CONSERVATION (cont.): if City repairs dam & re-establishes fishery, shall be open to public	Div. of Wildlife can perform: law enforcement duties & obligations, work to preserve & enhance viability as significant habitat for wildlife; City may maintain road area & existing roads & can construct/maintain trail for non-motorized use
Nejezchleb	fee	83	1993		
Parsons	fee	241	1976		
Parsons	development rights	33	1976		
Parsons	trail right-of-way	2	1976		
Schneider	fee	238	1992		
Walker	fee	25	1991		

PROPERTY	PRIVATE EASEMENT	RIGHT-OF-WAY (ROW)	OTHER
Joder II	equestrian easement for Saddle Club Estates to remain for Wright & Dagle's lifetimes; 20' electric transmission to Left Hand Water; Poudre Valley REA for electric lines/systems; Mtn. States T&T for communication facilities; ingress & egress easement	U.S. Highway 36; 40' to Left Hand Land & Water; ditches & canals as recorded; 40' for road & water pipeline to Foothills Water Users Assn.	access to & from adjacent City Open Space shall only be at designated access points; jointly & equally responsible for construction & maintenance of perimeter fences & gates
Johnson (fee)	Tracts B, C, D, F, & I are perpetual easements & ROW; Mountain States T&T for construction, operation, & maintenance of communication facilities	Niwot Road; N. 55th Street; Monarch Road; any rights in & to Hinman Ditch; any rights to small irrigation ditch; rights of others to driveway over westerly portion of Parcel I; any rights in & to Johnson Ditch & Star Ditch	Northern Colorado Water Conservancy District supply canal runs through property
Johnson (cons. easement)			
Loukonen Brothers			
Mann		ditches or canals constructed by authority of U.S. as reserved in patent recorded 1898	
Mesa Reservoir			City recognizes right of Krakover for access to property on Mesa Res. Road as long as City in control of Mesa Res. property
Nejezchleb	easement & ROW for servicing & maintaining water well		does not have access from Olde Stage Road
Parsons (fee)	10' wide waterline & well easement; 10' ditch easement		OSBT approved fence on west side of property
Parsons (development rights)			no public access to property
Parsons (trail right-of-way)			City agrees to limit use of said trail parcel to recreational use by the public & to prohibit motorized vehicles from said parcel with the exception of emergency vehicles
Schneider		ditches & canals constructed by authority of U.S. in patent recorded 1910; State Hwy. 7; County for road purposes	
Walker			

Axelson, East
This non-contiguous parcel lies north of Coot Lake which is owned and managed by the City of Boulder Parks and Recreation Department. The City owns the mineral rights under this property.

Beech properties
This joint City-Boulder County purchase covers all the properties listed in Table 10.1. U.S. 36 splits the purchase into two main parts; Beech East and Beech West. The contract with the County requires a management plan to be developed and approved by both parties. This plan has not been completed and approved by both parties. The plan should address trail uses, parking and agricultural uses and other issues. The final plan should also include fire protection and cost share responsibilities between the City and County.

Beech West
The Beech West property includes Lot 11 of the Old Stage Subdivision. The City purchased mineral rights owned by the Joder's (property owners to the north) under the northerly 40 acres of this property.

Beech West, north and south conservation easements
These 1 acre sites are still owned by Beech Aircraft. The City has conservation easements over these sites because of potential contamination issues. Clean-up and remediation have occurred on these sites, however the City will only retain conservation easements that prohibit public access to the sites.

Beech East
A small portion of this parcel, the "No Name" drainage has been temporarily closed to the public due to potentially hazardous conditions. These hazardous conditions are currently being monitored to test for possible contamination and the impacts to other properties in the vicinity.

Beech Aircraft retained all of its water rights in the Lefthand Water District but has traditionally allowed use of 1 share of the water at the picnic facility on Beech East. This water is not formally granted and could therefore change any time Beech needs the water. If this water is important to the future use of the property, a formal conveyance document is needed.

The parcel is adjacent to the Lefthand Valley Reservoir. The reservoir is private and closed to public access. A boundary correction between the City and Lefthand Water District needs to take place. Lefthand's board of directors is in agreement on this issue. Lefthand is required by the State Engineer to undertake improvements to the dam on its property that will allow the reservoir to spill slightly outside its property boundaries at the time of a 100 year storm. The Boulder County Commissioners will be considering these improvements in May/June, 1996. There have been some discussions about obtaining access across the reservoir property to provide for parking.

Easements reserved by Beech Aircraft for water lines and delivery systems could have serious impacts to the Beech East parcel. Most of these easements are along the southerly part of the property.

Boulder Land Irrigation and Power Company (BLIP)
The Mesa Reservoir road crosses the BLIP property and is owned in fee by the City. It is accessed by other users who wish to claim legal access to their inholdings in the area. These claims should be resolved and documented.

There are safety concerns associated with this property, as the Boulder Rifle Club is located to its south.

Boulder Valley Ranch/Lore
These properties were originally called Hidden Valley Ranch. The name was changed in the late 1970s in response to litigation. The property includes extensive agricultural improvements and limited improvements designed for a horse livery operation. The current lease covers a farm operation, a private boarding facility and a public riding arena. The lease does not allow the operation of a public livery.

Because of the size of the property and its proximity, on the north, to established and new residential development, issues affecting gates and fences have been difficult to manage.

Boulder Warehouse
The property is unimproved at this time. Conflicts might occur whenever the owner of the property exercises the right to build the house that was reserved in the conservation easement agreement.

At the time of the purchase, the Open Space Program planned to connect a trail from the old City dump area, out to Kelso Road and North 55th Street. This trail was never developed, however, an undesignated trails does exist. Currently, the neighbors of this parcel call the owner and ask permission to access the property. Located directly to the west of the negotiated trail alignment is the Boulder Rifle Club property which raises safety issues for use of the negotiated trail alignment. Any relocation of the trail, proposed as a result of the area management plan, might require further negotiations with the owner.

There is a gate currently on the easterly boundary of this property. It is not the intention of the owner to keep the City from accessing the property. Arrangements need to be made with the owner to access the gate.

In the recent past, the owner has received numerous complaints of illegal dumping on the property and pistol/shotgun shooting. It is the owner's responsibility to control these activities according to the City's agreement.

The Parks and Recreation Department owns an 80 acre parcel, known as the Papini property, directly to the east of this property.

Cowles
Acquisition included sixty shares of Lefthand Ditch water and three-eights share of Star Ditch, which is a carrier ditch for Lefthand water.

Dawson
All mineral rights and eighty shares of Lefthand Ditch water were conveyed with the purchase.

Degge Property
This parcel was purchased for access from U.S. 36 to the northerly boundary of BLIP.

Degge/Schneider
This corridor was acquired in 1976 to fill in a gap between the industrial area south of Longhorn Road and the BLIP property and to help provide part of the annexation route to the IBM plant and Gunbarrel.

Ditzel
Mr. Ditzel granted a general easement on the parcel he retained on N. 51st Street for operation and maintenance of the ditch or lateral. There is no record of this easement except that it is referred to in the contract. This issue should be resolved by a conveyance document.

This property has been the subject of a proposed on-street bike path along N. 55th Street. Mr. Ditzel has indicated his willingness to dedicate a trail easement over the parcel retained by him. Any future improvements to N. 51st Street will impact City owned open space properties.

Ellison
This property contains an approved County Non-Urban Planned Unit Development of five parcels with a 55 acre outlot. The outlot, which includes the improvements, is covered by a County conservation easement that was required as part of the Non-Urban Planned Unit Development. The conservation easement does not conflict with the City's ownership.

A portion of the property is currently used as a fire cache for local fire protection agencies. The public has access to the property, however public access may need to be limited in the area closest to the fire cache building.

The City owns one-half of the property's mineral rights.

Gilbert
The Gilbert's donated a strip of land to the City for access to the Parsons property. This parcel may be impacted by future highway improvements related to the development of the privately

owned Mann property and Dakota Ridge subdivision (north of Lee High Road, next to the private Mann parcel).

Hart-Jones
The property is adjacent to a City of Boulder Water Treatment Plant and could be impacted by future improvements to the plant and any intersection improvements to the Diagonal Highway and 63rd Street.

Joder, West
The City purchased this parcel along with the Joder East property and subsequently sold the East property to Boulder County. Joder East lies adjacent to County owned Six-Mile Fold and was acquired for a parking lot and future trail connection.

Joder West was purchased with the intent of providing a trail connection between the Beech West property and Buckingham Park (owned by City of Boulder Mountain Parks). The property lies along the eastern and northern boundary of the Rice Estates Non-Urban Planned Unit Development. An easement along that boundary of Rice Estates was dedicated to the County for a trail. If Joder West and the Rice Estates easement are used for a trail connection and trail development, it is likely that more land will be needed.

Joder II
The conservation easement does not include any public access to this parcel other than the public that is invited through community events or horse boarding at the facility.

The conservation easement allows the existing uses of the property which include four residences (two are mobile homes), horse boarding/riding operation , and a challenge course operated for organizational development. Specific improvements allowed to the ranch are defined in the conservation easement. All existing facilities have a designated building envelope. Plans not included in the conservation easement must be reviewed and approved by the City. The minerals are owned by the Joders, with a clause in the conservation easement prohibiting their extraction. The Joders have agreed to cost share fencing with the City along the boundaries between the two ownerships. The fence on the west, between the Joder Ranch and Buckingham Park, should be moved to the correct boundary of the properties.

The management issues that need to be addressed for this property are: fences, inventory and development of a management plan agreed to by the Joders (not required by contract) and monitoring the terms of the conservation easement.

Additionally, this property is impacted by an inholding ownership of Lefthand Water District. The district owns the small parcel where the existing water tank is located. There are a number of waterline easements and alignments that need to be corrected and there is no legal access to the tank site. The expansion that Lefthand desires to add to the tank site and the easement issues

are all subject to the Joder Conservation Easement. This means that any plans must be reviewed and approved by the City as well as the Joders. Currently there is a 1041 Land Use Review and subdivision exemption pending with Boulder County for this project. It is currently under consideration by the Board of County Commissioners.

Johnson
All mineral rights and 380 shares of Lefthand Ditch water and 1 ½ shares in the Star Ditch.

The Boulder Creek Supply Canal crosses the property within a 75 foot wide fenced easement. This easement is used by the public without permission from the Northern Colorado Water Conservancy District.

There appears to be an easement that affects the easterly portion of the property but the type of easement is unknown.

Loukonen Brothers
Located at the toe of Mesa Reservoir, the purchase of this property settled a long-standing lawsuit. With the purchase, the City extinguished a 1961 conditional claim for the expansion of the reservoir that could have compromised the integrity of the wildlife and scenic values of the Mesa Reservoir property, as well as the management of the Farmer's Ditch.

Mann
Currently, this property is not adversely affected by private ownerships. However, a development covering the adjacent privately owned Mann property, which could include as many a 440 residential units, is in the City's Major Site Review process. Development pressures from this parcel and the Dakota Ridge Subdivision will have major impacts on the existing Foothills Trail and surrounding open space properties.

Mesa Reservoir
In 1954, the Colorado Game and Fish Department utilized Federal funds, administered through the Department of the Interior under the Aid to Fish and Wildlife Regulations, to purchase the reservoir, associated water rights and approximately 110 acres of land. In 1973, the property was leased by the Colorado Division of Wildlife to the City of Boulder Parks and Recreation Department for twenty-five years. The condition of the ditch and dam deteriorated over the years and by 1977, water was not available to fill the reservoir and the State discontinued stocking it with catfish. In 1982, the State sold a conservation easement in gross on the entire property to the City of Boulder for open space purposes. By this time, the State engineer had placed the dam on its list of hazardous structures and the Division of Wildlife had determined that the reservoir was no longer able to meet the goals of its original purchase.

In most conservation easement situations, the seller usually retains the use and management rights of the property. In this case, the State conveyed the use and management to the City with some limitations.

Access to the Mesa Reservoir property is from U.S. 36, however, access from Broadway to this point is unclear as to public ownership. The City is responsible for maintaining the road into the Mesa Reservoir property.

Nejezchleb
The agreement for servicing and maintaining the existing wells related to the Schneider Property. This easement is no longer in effect because of the City's ownership of both parcels.

Parsons
Two easements were reserved by the sellers to serve the Parsons' development rights parcel. Utility lines may exist without benefit of legal easements.

This property and the existing Foothills Trail will be impacted by the development of the Parsons development rights property and any future development of the private Mann property and the Dakota Ridge subdivision to east.

Parsons, development rights
Future development is limited to one unit per 5 acres or a total of six units. This property is within the Boulder city limits.

Parsons, trail right-of-way
This right-of way contains the Foothills Trail. There may be some errors in the width of this trail as fenced.

Schneider
The right of way for State Highway 7 (U.S. 36) is 41.2 feet wide and is adjacent to the west line of the existing U. S. 36.

Walker
All all mineral rights were included in the purchase.

10.2.2 Private Properties Claiming Access Rights Through Open Space Properties

Luchetta
This 80 acre farm property is located north of Longhorn Road and has access off Longhorn Road to its driveway. The City installed a gate to this access to discourage the public from driving across the BLIP land to this private property. The property has been identified as one which

would be appropriate for conservation easement preservation, although no meaningful discussions have been held with the owner.

Rubin Property
This 2 acre parcel, containing an office/warehouse/industrial metal building, is located south of Longhorn Road on County land zoned Industrial/Commercial. There is an access easement to the property along the road to Mesa Reservoir.

Snyder Property
This 5.25 acre parcel is located south of Longhorn Road and appears to also have access along the road to Mesa Reservoir. The property may be currently used as a U.S. Government facility. The property has been identified as an important inholding within the open space ownership which should be monitored for any change in use or ownership.

10.2.3 Other Properties Under Current Consideration for Acquisition or Preservation for Open Space Purposes

BLIP
Approximately 92 acres between U.S. 36 and the BLIP Open Space property remains in private hands and subject to a long-term land lease. Discussions have been initiated for possible acquisition and preservation of all or parts of this "inholding."

Degge
This is an approximately 55 acres between the Boulder Warehouse Open Space property and the City's Planning Reserve Area. It is within the "Pleasant Valley" riparian/wildlife area.

Gorce
An 11 acre in-holding in two parcels between Boulder Reservoir and the Longmont Diagonal, its development would have impacts on the entry corridor into Boulder.

Henrickson
These 80 acres, including a farmstead, are located southeast of the Boulder Warehouse Open Space property and south of Papini property. It is in the "Pleasant Valley" riparian/wildlife area within the Area III Rural Preservation Area of the Boulder Valley Comprehensive Plan.

Seigle
Approximately 39 acres along the Longmont Diagonal, contiguous to the southeast side of the Six-Mile Reservoir. Major impacts to the entry corridor into Boulder would occur should this parcel be developed.

Stratton
Approximately 80 acres northeast of Beech East Open Space, this property is contiguous to the soon-to-be acquired Brewbaker Open Space parcel. It would add to the irrigated farmland buffer on the northern part of the Open Space system.

10.2.4 Adjacent Lands Affecting the North Boulder Valley Management Area

Surrounding Land Uses/Zoning
The majority of the land uses surrounding North Boulder Valley Area are residential (see Figure 10.2 Land use zoning map). There are two golf courses, a recreational facility at Boulder Reservoir and a rifle range within the immediate vicinity of the Management Area.

There are three properties with existing industrial zoning categories. Foothills Business Park (formerly Beech Aircraft) on the west side of U.S. 36, the property north and south of Longhorn Road which is on the east side of U.S. 36 and the concrete plant south of Longhorn Road and east of U.S. 36.

The County zoning for the area is primarily residential or agricultural. The City of Boulder has annexed a substantial portion of the Management Area as a route to IBM which is located along the Diagonal Highway.

Lefthand Water is proposing a new water tank within the Joder Conservation Easement and will extend a water line to Spurgeon Reservoir (located east of 39th Street between Nebo and Neva Roads). There are 300 existing tap commitments and an additional 94 taps that could be provided at build out of the area.

Boulder Reservoir
The City Parks and Recreation Department owns approximately 1,400 acres contiguous to the southeasterly side of North Boulder Valley. It operates a large aquatic based active recreation concession on the property, charging fees for use. Additional expansion of the facility is assumed based on the Parks Master Plan. Opportunities for mutual benefits and potential impacts to and from the contiguous Open Space properties must continue to be analyzed by both the Open Space Program and the Parks and Recreation Department.

Cleary
An 11.68 acre inholding of private property is located east of N. 51st Street between Boulder Reservoir and the Johnson Open Space. A large new residence on this property will be very visible and could potentially raise access and land use issues for this location.

Krakover Property
This 56 acre parcel adjacent to the Boulder Valley Ranch and Boulder Warehouse Open Space currently does not have discernable legal access. It has been identified for possible future acquisition.

Lake Valley Estates/North Rim/North Rim Filing 2 subdivisions
Outlots G and M are owned by Boulder County and provide for non-road and non-motorized access that begins from the northern entryway into North Rim, east to Axelson's west boundary, then south to the north boundaries of Boulder Valley Ranch/Lore property, then heading west to the east boundary of Beech East. This provides trail access onto City Open Space and the Sage Trail. There is also an Outlot N located in the southeast portion of this subdivision to provide a buffer between the Boulder Valley Ranch/Lore property and North Rim. Outlot I provides for non-road purposes.

Outlot J in North Rim, Filing II, replat of Block 2, is owned by the Lefthand Water District. The City received an easement across the Outlot for its ditch lateral from Farmer's Ditch. There is no provision in this easement agreement for public access along the ditch lateral easement.

In a 1994 agreement between the developer of North Rim/Lake Valley Estates and the Open Space Board of Trustees, construction of a split rail fence with wire mesh along Outlot G was required to keep domestic pets off of Open Space and prairie dogs out of the subdivision. The fence has been constructed but addition of the wire mesh has not been completed. As a part of the North Rim subdivision approval, the City required that trees be planted along the southerly lots adjacent to Boulder Valley Ranch to create more of a buffer between the subdivision and Open Space.

Longhorn Road
It has been determined that this is a private road maintained solely by City Open Space from the Boulder Valley Ranch property boundary east into the Ranch. The City obtained access along the rest of the road to U.S. 36 from the BLIP owners who own the industrial properties along the road. Shared maintenance cost agreements need to be negotiated with the owners and/or tenants of these businesses.

Nutting Property
This privately owned property is located along the southerly boundary of Boulder Valley Ranch adjacent to the Valhalla Subdivision. The property is leased to for private horse boarding operation. The property owner has used an unauthorized gate to access the Eagle Trail. An access point from this property onto Open Space can, under current policy, only be granted if the City receives a reciprocal public access easement through the Nutting property. There is a potential problem with this type of agreement at this location, due to the terms of the lease of the Boulder Valley Ranch's agricultural tenant.

Planning Reserve Area
The Planning Reserve Area is approximately 900 acres, north and east of the 28th Street Bypass (U.S. 36) along the southwesterly border of North Boulder Valley. The Planning Reserve Area is the only land area designated as such in the Boulder Valley Comprehensive Plan. This Comprehensive Plan designation preserves both rural preservation and urban development options until detailed land use and services planning for potential growth areas is completed. At some future date it will be determined which portions of the Planning Reserve should be brought into the City's Service Area and which portions should ultimately be placed in the adjacent Rural Preservation Area, making them potentially available and/or suitable for open space preservation.

Approximately 300 acres on the easterly side of the Planning Reserve Area are currently being considered for the Parks and Recreation Department's Large Parcel acquisition. If this site were to be selected for acquisition, it is assumed that a major portion of the Planning Reserve Area would be annexed in the near term, and issues regarding Service Area expansion, land use and annexation of other properties in the Planning Reserve Area would have to be addressed.

The 900 acre Planning Reserve Area consists of approximately forty-five private ownerships ranging in size from less than an acre to over 100 acres. The potential impact of future annexation, development, and growth in the Planning Reserve area on North Boulder Valley must be considered in future City decisions.

Rice Estates Non-Urban Planned Unit Development
The eaves and deck of the newer house in this subdivision overhang and encroach onto the City's Joder West property. The County has reserved a 10 foot wide trail easement along the northerly boundary of Rice Estates adjacent to the Joder West property.

Saddle Club Estates
Saddle Club Estates is a platted subdivision in the County with the potential for 26 lots to be constructed northeast of the Joder Property.

Sage Valley Non-Contiguous Non-Urban Planned Unit development
This County subdivision is located east of U.S. 36 between Nimbus and Neva Roads at N. 39th Street. There is a 15 foot public trail easement that goes along the easterly boundary of this subdivision that would go along N. 39th Street and end at Neva Road, across from Beech East.

Six-Mile Fold
Boulder County purchased a conservation easement from the Joder Family in 1979 to protect the archeological and geological values of this property and rare and endangered plant species. Because of the heavy public use of the area for educational purposes, the public may wish to access the 336 acre Joder conservation easement area located to the north and west of this property.

Waterstone
This is a Boulder County Non-Contiguous Non-Urban Planned Unit Development is located between the Ditzel and Nu-west (the latter outside North Boulder Valley) Open Space properties. It consists of twenty-six residential lots, each on 1-2 acres, an 89 acre private agricultural outlot and an 8 acre lot designated as Boulder County Open Space. There could be access issues between Waterstone residents and the public.

Other Small Non-Urban Planned Unit Developments
There are a number of small two to three lot Non-Urban Planned Unit Developments in the County west of U.S. 36 such as Figi and the Pines, Henderson and Le Mann. These properties are north and adjacent to the Joder property.

10.3 ISSUES

- Determine properties that need to be acquired to accommodate property issues raised through the North Boulder Valley Area Management Plan.

- Further research property issues raised through the North Boulder Valley Area Management Plan.

- All public utility easements need to be located so that access issues can be resolved with utility companies.

10.4 DATA GAPS

All easements that affect City owned Open Space need to be located, described and documented for recording. Once these easements are determined, easement owners need to be contacted to clarify access points. Old easements that are not being used should be abandoned.

Title policies are needed for the following properties:
- Beech
- BLIP (parcels 5,7,10,12,13,15,16, and 19)
- Boulder Warehouse
- Degge/Schneider
- Gilbert
- Mesa Reservoir

11. FACILITY INFORMATION

11.1 INTRODUCTION

For the purposes of this inventory, facilities are considered to be structures or buildings which serve residential, office or agricultural functions (see the Passive Recreation section for further information on other types of Open Space facilities). Several existing buildings and structures, including barns, silos, corrals and residences have been purchased incidental to land acquisition. Facilities on Open Space may be preserved and used for the implementation of Open Space Program goals. Uses may include, but are not limited to (City of Boulder 1995):

- maintenance and management of structures for public Open Space use and education,
- leasing for uses and occupancies related to Open Space Program needs,
- securing and maintaining the structures for future Open Space needs, including Open Space office and maintenance needs and
- removal of structures that cannot be made structurally sound or otherwise appropriate for Open Space Program needs.

The goal of facility management is to ensure safe, responsible and efficient use and maintenance of all structures or buildings owned by the City of Boulder Open Space Program. Facilities with local, state or national historical significance should be preserved whenever possible depending on the associated costs and appropriate provisions for public safety.

11.2 RESOURCE INFORMATION

The resource information section will briefly describe facilities located within North Boulder Valley and associated outbuildings. Historical significance has been covered in the Cultural Resource section. See Figure 11.1* for specific locations of each facility.

Axelson complex #1
A single story, two bedroom farmhouse, currently leased by an agricultural lessee, is located at 6821 N. 55th Street. The structure, measuring approximately 1500 square feet, is generally in good condition. Exterior paint is acceptable and a new shingle roof was recently added.

Outbuildings
Seven sheds and a steel grain bin exist on the property. The largest, possibly utilized as a garage at one time, measures approximately 240 square feet, and is secured by double doors on the front. None of these structures presents any immediate danger, but the four sheds (and chicken coops) north of the access drive are in poor condition and do not currently contribute to the utility of the complex.

Axelson complex #2
A single level, two bedroom farmhouse, currently leased by an agricultural lessee's hired hand, is located at 6559 N. 55th Street. The structure, measuring approximately 880 square feet, is in good overall condition, having been brought up to code in both plumbing and electrical during 1989. The house needs new exterior paint. The existing shake shingle roof is showing age and should be upgraded with a new roof before any interior damage could occur as a result of leakage.

Outbuildings
Several large outbuildings exist on this property. A small garage/shed, measuring approximately 375 square feet stands at the end of drive, just northwest of the house. A large, two vehicle garage (in very good condition and with a good shingle roof) measuring approximately 750 square feet, two smaller storage sheds and a large sheet metal Quonset hut measuring approximately 715 square feet are located north of the actual residence yard. The Quonset hut is used for storage of large agricultural equipment and is in good condition structurally, but is extremely rusted, which may detract from the aesthetic value of the property.

Axelson complex #3 (Grandma's home)
A farmhouse, currently unoccupied, is located on N. 55th Street (no residence address available). The two story structure, measuring approximately 1300 square feet, is in poor condition. Both the shake shingle roof and exterior paint are extremely weathered. Extensive electrical, plumbing and structural repairs are needed to restore this structure to a habitable condition.

Outbuildings
The yard area north and west of the farm house is congested with several aging sheds and farm structures. All are small, apparently insignificant structures with the exception of a large milk barn measuring approximately 1100 square feet, with two large loafing sheds to the west. The smaller sheds are in poor condition and do not add to the utility of the complex. Removal of several piles of old tires and tree limbs on the property is suggested.

Ellison Fire Cache
Originally a two bedroom farmhouse, located at 6003 N. 51st Street, currently houses the City of Boulder wildland fire team and associated agencies. This structure operates under a County special use permit. This structure, measuring approximately 1400 square feet, is in generally good condition. Exterior paint is acceptable and a new shingle roof was recently added. The interior of this house, including the basement, has been brought up to the electrical code and all plumbing needs have been met. The single biggest concern at this location has been the seasonal problem of bees inhabiting the west chimney (a small bee farm is in operation just north of the facility). This was addressed in 1994 by capping the chimney (an obsolete shaft) with mortar and sheet metal, and it has been monitored since then.

Outbuildings
On the north side of the driveway loop stands a two vehicle garage measuring approximately 460 square feet. Exterior paint is acceptable and a new shingle roof was recently added. This building is used to house a work shop and firefighting hand tools. On the south side of the garage, a temporary "tuff shed" has been added for supplemental storage. Approximately 100 yards to the north of the garage stands a cinder block silo that is in good structural condition and well away from the areas of regular activity.

Boulder Valley Ranch complex (residence, apartment and outbuildings)
A single level, three bedroom ranch style home, currently occupied by an agricultural lessee, is located at 3700 Longhorn Road (Boulder Valley Ranch complex). The structure, a multi-bedroom log style home measuring approximately 2400 square feet, is in generally good condition having recently been the focus of storm window and insulation upgrades as well as roof repairs. The exterior paint is showing age and is scheduled (as are the rest of the outbuildings and barns at the Ranch) for painting in 1996. The living room of the residence houses a large stone-faced fireplace. In 1994, the fireplace was upgraded to improve the safety of the steel encasement and chimney shaft.

Boulder Valley Ranch apartment: A very small rectangular ranch building, currently unoccupied, is located on the northwest side of the Boulder Valley Ranch complex. The one level, one bedroom "studio"wood structure, measuring approximately 300 square feet, is readily habitable, being in generally good condition and needing no significant upgrades or maintenance. This unit has been traditionally inhabited by hired hands. The exterior paint is showing age and is scheduled for painting in 1996.

Outbuildings (Boulder Valley Ranch horse stables, shop, barns, riding arena, pumphouse)
A large horse stable facility stands to the north of the Boulder Valley Ranch residence. This structure measures approximately 3400 square feet, and is used to house the lessee's livestock as well as being leased to other boarders. The stables are aging, but in relatively good condition; they were upgraded in 1988-89. The exterior paint is aging and is slated for painting in 1996. On the south east exterior of the structure is a large aging corral complex in generally poor, but functional ,condition.

To the east, across the parking area from the facility stands a large, rectangular barn, used primarily for hay storage. The structure measures approximately 720 square feet, and is in generally acceptable condition, with the exception of the exterior paint (scheduled for painting in 1996).

Several hundred yards east of the ranch house is a pumphouse which supplies water to the Boulder Valley Ranch residence and livestock facility. The pumphouse is enclosed in a small

secured wooden structure with electric heat. A second livestock watering pump is located at the north end of Luchetta's driveway; it is installed below ground and secured by a padlock.

In the middle of the parking area and traffic loop stands a stone building currently used as a ranch shop. This structure measures approximately 430 square feet, and is in generally acceptable condition, except for possibly needing a new roof. A concern regarding this building, and the area immediately surrounding it, is the accumulation of debris and ranch related implements that congest the area and present a range of potential hazards. A cleanup as well as a well defined policy for the upkeep of the area, is recommended.

On the south end of the parking area and ranch home is a relatively new riding arena facility built in the late 1980s. This structure is constructed with high tensile fence technology and is the most durable and aesthetic fence at the facility. The arena measures approximately 27,000 square feet and is utilized for horse training.

Johnson complex

This farmhouse, currently unoccupied, is located at 6430 N. 55th Street. The two story, three bedroom brick structure, measuring approximately 950 square feet, is readily habitable, being in relatively good condition and having been brought up to the electrical code. The exterior brick is sound (partially supplemented with additional mortar work) and the roof of the main structure is acceptable. A new shingle roof is currently being added on the cinder block addition of the home, over the attached bathroom, where leaking caused interior ceiling damage in the spring of 1995. The interior condition is acceptable, with the exception of window glass needing repairs from damage that occurred during the blasting demolition of the two silos south east of the house in 1993.

Outbuildings

On the south side of the Johnson home, an oblong cinder block milk barn measures approximately 1800 square feet. This structure is in good condition with the exception of window pane damage that occurred during the demolition blasting of the two silos. It needs an interior cleanup. Two wood milk sheds remain on the grounds; all other outbuildings were removed in early 1994.

Schneider complex

A farmhouse, currently occupied by an Open Space Program employee caretaker, is located at 5881 N. Foothills Highway (U.S. 36). This single level, three bedroom structure, measuring approximately 1100 square feet, is in generally good condition, having recently been the focus of several upgrades, including foundation work, exterior door replacement, insulation and storm windows. The exterior paint is aging and repainting is scheduled for 1996.

Outbuildings
At the southwest corner of the access drive stands a two vehicle garage. This structure, measuring approximately 990 square feet, is in generally good condition with acceptable exterior paint and roof. It is presently used for caretaker vehicle parking and storage of farm supplies. Past use has included deployment of an Open Space firefighting brush truck on a seasonal basis. On the north side of the garage stands an outbuilding known as "the shepherd's cabin." This structure, unique in its arched roof design, measures approximately 130 square feet and is currently used for storage. The cabin is in generally good condition with acceptable exterior paint.

11.3 ISSUES

What are appropriate uses of facilities and associated outbuildings

- There are six pre-existing residential structures located within North Boulder Valley. One residence is leased to a City employee caretaker and two residential structures are leased to agricultural lessees. The Axelson #3 and Johnson residences are currently not in use. The Ellison residence is currently used as a regional fire cache.

- There are numerous outbuildings located within the management area. Some of these outbuildings are used for agricultural purposes and others are currently not in use.

- Need to develop acceptable standards and inspection schedules for all occupied buildings on Open Space.

11.4 DATA GAPS

Cost estimates are needed for various repairs

- Extensive repairs are needed at Axelson #3.

12. AGRICULTURE

12.1 INTRODUCTION

The purpose of this section is to describe the agricultural resources in North Boulder Valley Management Area, those areas that are currently under agricultural management and areas that could be managed for agriculture. The data will be used by the Open Space Program to evaluate current management techniques. Agricultural management occurs within the framework of maintaining other land uses: prairie dog preserves, native prairies, wildlife habitat and passive recreation.

The North Boulder Valley Management Area has historically had many different types of agricultural production. Agricultural operations have included beef production, dairy farms, sheep production, poultry production, horse boarding, dry land grain production, irrigated forage production and irrigated grain production.

Open Space Program agricultural management goals, prior to 1996, were to maintain existing leases while trying to preserve native plant and animal populations and allow for passive recreation opportunities. Maintaining the infrastructure for agricultural production, such as irrigation structures, delivery systems, farming and grazing improvements, has also been an objective for the agricultural program.

Responsible management of agricultural lands has been a priority for the Open Space Program and there was an early recognition that the farms and ranches being purchased had special needs. In 1975, a consulting firm completed an agricultural management plan for the then current Open space system. This plan included specific analysis and recommendations, for five of the properties in North Boulder Valley. The plan recognized that "in harmonizing the possible agricultural uses of the various parcels with the Purposes and Functions of Open Space it is readily apparent that the most desirable use of a given tract is not necessarily the most profitable economic use" and made recommendations for specific parcels that were "aimed at stabilizing and then improving each tract's ecosystem" (Nortrust 1975). A self-admitted shortcoming of the plan was that its expertise and scope were limited to making recommendations for parcels "designed to increase their carrying capacity for domestic animals." While it recommended agricultural uses "oriented to the minimization of conflicts with wildlife," it also recommended that competent advice should be obtained from wildlife specialists regarding enhancement of the wildlife values on Open Space. The plan recommended adopting basic agricultural management principles: having written leases and annual plans (including budgets), inspections and documentation. Weed management needs included addressing weed infestations arising farm management practices of previous owners. Water rights management was also considered a key issue.

12.2 RESOURCE INFORMATION

This agricultural resource information section reviews the importance of agricultural lands in North Boulder Valley, describes existing leases, assesses the agricultural resources of the management area and identifies issues and information gaps.

12.2.1 Importance of North Boulder Valley Agricultural Lands

Preservation of prime agricultural land is one of the most critical land use planning issues in Colorado. The City of Boulder's Open Space Program and the Boulder County Parks and Open Space Department help to preserve agricultural practices and contribute to the economy of Boulder County. Agriculture in North Boulder Valley is important due to its size and the significance of its lands to local and state agriculture.

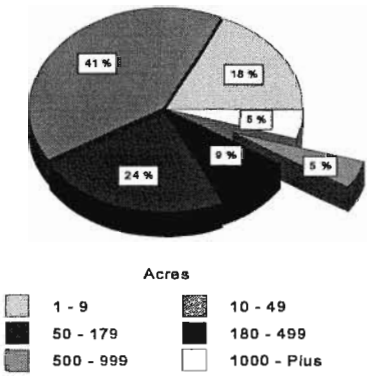

Figure 12.1
Percent farms by size for Boulder County Colorado, 1992 Census of Agriculture, Volume 1 Geographic Area Series.

Size

The properties in North Boulder Valley are important due to their size and history. The 1992 Census of Agriculture (U.S. Department of Agriculture) shows the average farm size in Boulder County was less than 50 acres. The Axelson-Johnson-Dawson-Cowles lease area is 905 acres and the Boulder Valley Ranch lease area is 1137 acres. Farms of this size are uncommon in Boulder County. Only 5% of the farms in Boulder County are between 500 and 999 acres. Another 5% of the farms are greater than 1000 acres. Thirty-four farms in the County were similar in size to these leased areas.

Significant Agricultural Lands

The management area contains Agricultural Lands of Statewide and Local Importance (Figure 12.2*). In Boulder County, three classifications are used for identifying significant agricultural lands: Agricultural Land of National Importance, where the best and most significant use is production of common food and fiber crops; Agricultural Lands of Statewide Importance, irrigated lands and high potential dry cropland and Agricultural Lands of Local Importance. Agricultural Land of Local Importance are determined based on criteria devised by the Longmont office of the Soil Conservation Service and the Boulder County Extension Office, based on their work with farmers over the years, and include those agricultural lands of key importance to the local agricultural economy. These three classifications are based upon the Colorado Important Farmland Inventory (Soil Conservation Service 1982; see Appendix 12.1 for details of designation criteria).

North Boulder Valley contains 350 acres of Land of Statewide Importance and 1100 acres of Lands of Local Importance. No Lands of National Significance occur in North Boulder Valley.

12.2.2 Agricultural Leases

The Open Space Program leases properties to local farmers and ranchers to help maintain viable agricultural operations in the Boulder Valley. The lease agreements for Open Space properties typically outline the duties of the City and the lessee to accomplish goals for the particular property. General covenants for the lessees have included diligent application of water, respect for wildlife, wetlands and native grasses, specific grazing limitations and protection of cultural resources.

The City of Boulder Open Space Program currently manages three leases in the management area: the Boulder Valley Ranch lease, the Ditzel lease and the Axelson-Johnson-Dawson-Cowles lease (Figure 12.3). When these leases are renegotiated, the new leases will take into account the analyses prepared by ERO (1995, 1996) since they were signed. The standard agricultural lease is shown in Appendix 12.2. Appendix 12.3 (1995 Crop Production) and Appendix 12.4 (1995 Grazing Summary) present statistics for the management area.

Boulder Valley Ranch Lease
The current Boulder Valley Ranch lease originated on January 1, 1994, and has a one year term with a one year extension option. The current rental rate is $3050.00 annually, due and payable on or before October 15th of each year.

Ditzel Lease
The current Ditzel lease originated on January 1, 1994, and has a one year term with a one year extension option. The current rental rate is $1300.00 annually, due and payable on or before October 15th of each year.

Axelson-Johnson-Dawson-Cowles Lease
The current Axelson-Johnson-Dawson-Cowles lease originated on January 1, 1996, and has a two year term with a one year extension option. The Axelson property has an annual rent of $4,372.50, due and payable as follows: $500.00 on or before April 15 and the remainder of $3,872.50 on or before December 1 for each year the lease is in effect. The Johnson-Dawson-Cowles property has an annual rent of $4,933.50, due and payable as follows: $500.00 on or before April 15 and the remainder of $4,433.50 on or before December 1 of each year the lease is in effect.

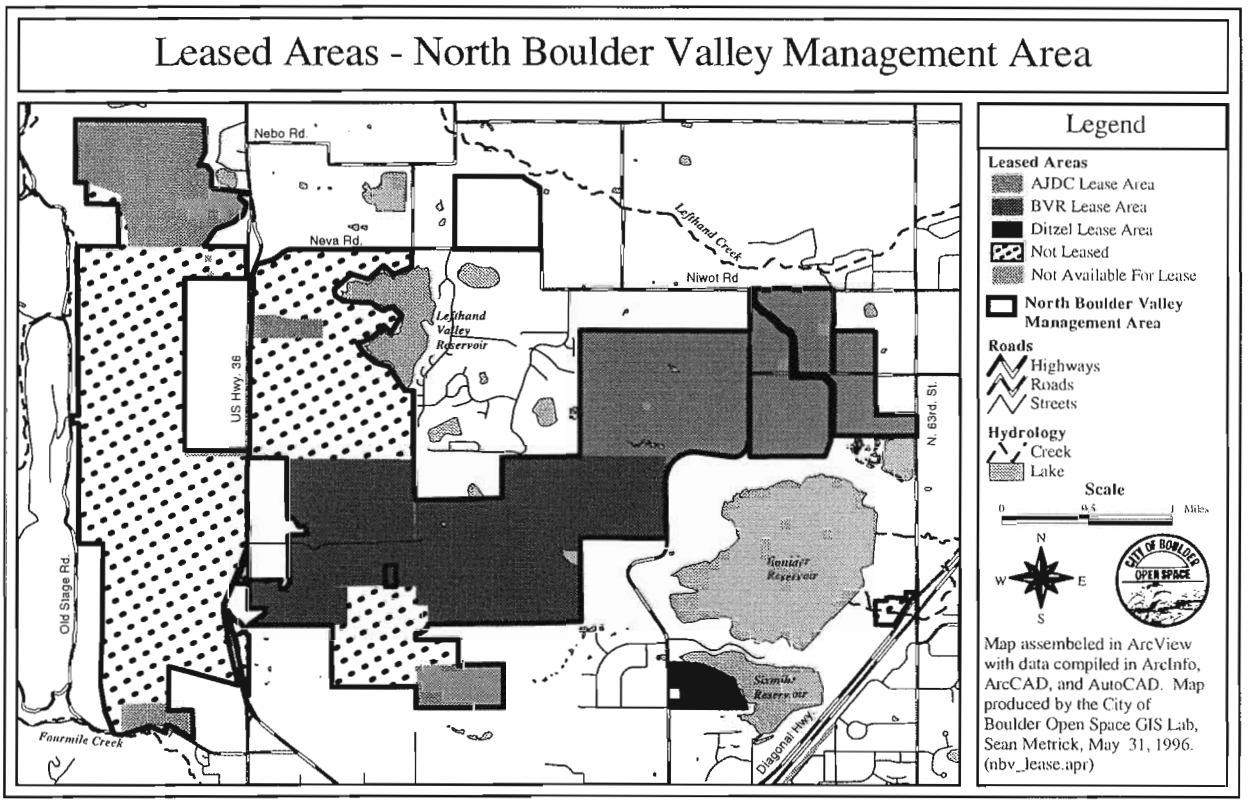

Figure 12.3 Agricultural leased areas in North Boulder Valley

12.2.3 Agricultural Resources

Agricultural resources include soils, soil capability, water resources, agricultural improvements and the local agricultural economy. The type, quantity and quality of the crops grown in North Boulder Valley are all dependant on these factors.

Soils and Soil Capability

Soil type and capability information is essential for agricultural land management. Capability classification is the grouping of soils to show, in a general way, their suitability for most types of farming. Soils capability is heavily influenced by the availability of irrigation water. Classifications used for the management area are those for irrigated soils. Not all the soils in the management area are irrigated and only those soils that are irrigated are farmed. The Irrigated Soil Capability Map, Figure 12.4*, shows the different soil limitations for the management area.

Currently, areas with many soil limitations are farmed and areas with fewer soil limitations are not farmed. Dilapidated irrigation delivery structures and physical limitations for water delivery influence the areas and soils that are farmed.

Water Resources

Water resources are a key factor in evaluating an agricultural operation. Available water resources include water rights, water availability, existing delivery structures and irrigable lands. Water availability determines what crops can be grown, and with soil type, what yields can be expected. Please refer to Appendix 12.5 for additional water rights information.

Irrigable Land

Irrigable land is land that has no restrictions for hay production due to soils or topography, and occurs under the existing irrigation system. Wetlands are not irrigable. Historically, irrigated soils that are not rated as irrigable may be suitable for irrigated pasture. The limitations for these "non-irrigable" lands include shallow depth to bedrock, slopes too steep to be irrigated efficiently, poor natural drainage and excessive salinity and sodicity. The Boulder Valley Ranch agricultural lease area consists of about 1,365 acres, of which 336 are currently irrigated (ERO 1995). There are 244 acres of irrigated hay fields and 92 acres of irrigated pasture (Figure 12.5). Another 117 acres can be served by the existing ditch system: 73 acres are non-irrigable because they are hilly or have shallow soils. Of the 453 acres served by the Farmer's Ditch, only 74% are currently irrigated. The current distribution of land use at Boulder Valley Ranch and Ditzel are shown in Figure 12.5.

Surface cobbles on many of the soils within the property, excessive slope or shallow depth to bedrock, limit the type of crops which can be grown in this area. These areas are suited for hay production and native plant community restoration.

The Ditzel property consists of 56.4 acres of irrigated hay fields located between N. 51st Street and Six-Mile Reservoir, southeast of Boulder Valley Ranch.

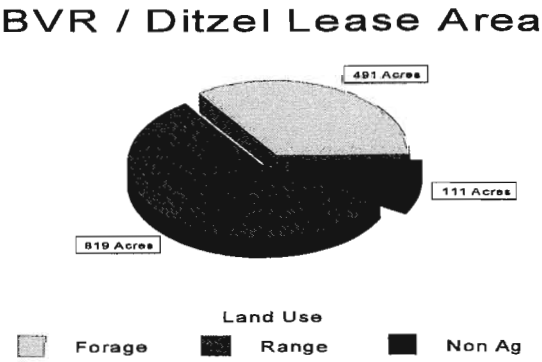

Figure 12.5
Boulder Valley Ranch and Ditzel lease areas land use.

The Axelson-Johnson-Dawson-Cowles lease area consists of 892 acres: 480 to 550 acres have been irrigated historically in one season, growing small grains, and serving as hay fields and pasture. In 1993, 516 acres of the lease area were irrigated. Overall, 567 acres are considered irrigable. Mixed grass prairie, currently inhabited by prairie dogs, could be converted to irrigated fields but requires land leveling, revegetation and additional water share purchases. Redesignation of the Cowles property from a prairie dog research/ management area to irrigated cropland has recently occurred. Staff recommends continued evaluation of the size and irrigability of this land, along with the available irrigation water.

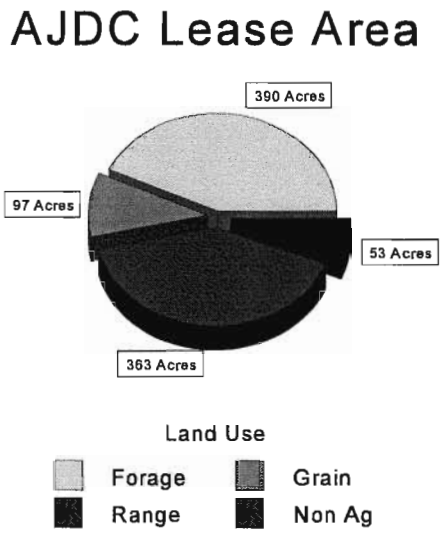

Figure 12.6
Axelson-Johnson-Dawson-Cowles lease area land use.

Irrigation Water

The irrigation water within the management area comes from two sources: Farmer's Ditch, from Boulder Creek and Lefthand Creek via the Star and Johnson Ditches. The majority of the irrigation water is delivered through earthen ditches. The ditch diversion structures are generally open concrete and are between two and thirty years old. The majority of the current irrigation systems will need to be replaced or repaired in the near future.

The irrigation ditches in the Management Area are typically in service during the May through mid-September period. Irrigation scheduling differs depending upon the crops being grown. The lessees currently irrigate alfalfa once before each of three harvests, grass hay twice before each of two harvests, and corn four times before harvest (ERO 1995). More or less irrigation may be required depending upon weather conditions and the availability of irrigation water in the ditches.

The Boulder Valley Ranch lease area is solely supplied with irrigation water from the Farmer's Ditch. The Farmer's Ditch was decreed 73.29 cubic feet/second (cfs) with an

appropriation date of October 10, 1862, making it the fourteenth ditch in priority on Boulder Creek. As of November 8, 1995, the total number of Farmer's Ditch shares owned by the City of Boulder was 65.8152 (out of 100 total shares). The City of Boulder Utilities Department owns 43.1045 shares, the City of Boulder Open Space Program 21.9607, and the City of Boulder Parks and Recreation Department 0.75 (Hydrosphere 1995). From 1950 through 1993, the Farmer's Ditch has diverted an annual average of 6,328 acre feet through its headgate on Boulder Creek. The average daily diversion rate is 33 cfs. No measuring devices exist on the Farmer's Ditch at or above Boulder Valley Ranch to provide data on how much water has been historically used on this property. Based on the number of shares owned and the historical average yield of 79.2 acre feet/share, approximately 1,478 acre feet of water potentially are available at Boulder Valley Ranch. This number includes a transmission loss of 15%. The calculated crop water demand, based on currently irrigated acreage, is 928 acre feet delivered to Boulder Valley Ranch.

The Ditzel lease property is also irrigated by the Farmer's Ditch through 1.125 shares of Farmer's Ditch water with an average yield of 79.2 acre feet/share. An annual yield of approximately 77.5 acre feet are expected, including a 15% transmission loss.

The Axelson-Johnson-Dawson-Cowles lease area is serviced by two ditches: Star Ditch and Johnson Ditch. Each ditch system consists of a series of primary laterals. The water supply originates in Lefthand Creek where flows are diverted to Lefthand Valley Reservoir. The Reservoir Outlet or Feeder Canal supplies water for diversion by both the Star and Johnson ditches; the Star Ditch can also divert water directly from the creek. The Open Space Program owns 879 shares of Lefthand Ditch Company water rights currently used for irrigation within the lease area (ERO 1995). Seasonally, the Open Space Program leases an additional 374 shares of Lefthand Ditch water from the City of Boulder Utilities Department. The yield per share has decreased over the years due to tighter water administration. The current yield (1990-1994 average) is 1.11 acre feet/share yielding 1,391 acre feet/year. The Open Space owns shares of Lefthand Ditch equal 976 acre feet annually and owns 4.83 shares of the Star Ditch.

Delivery Structures

A complete inventory of the irrigation delivery structures associated with the management area has not yet been completed. This is a significant data gap.

Farmer's Ditch - The Boulder Valley Ranch lease area is the final water user on this ditch before it flows into Boulder Reservoir. There are several bottlenecks in the Farmer's Ditch that reduce its capacity well below its original 73 cfs decree. A previous study for the Utilities Department showed that the peak diversion rate by the Farmer's Ditch has declined gradually from 65 cfs in the early 1950s to current levels ranging from 30-40 cfs.

Johnson Ditch - The ditch diverts from the Reservoir Outlet Canal (6 cfs at full capacity). Water is diverted at a concrete structure with a 2 foot weir along the Johnson Ditch for measuring the flow rate.

Star Ditch - The Star Ditch's water rights were turned over to Lefthand Ditch Company as part of a consolidation effort. The Star Ditch is, for all practical purposes, a carrier ditch for Lefthand Ditch water. The ditch can divert water either from the Reservoir Outlet Canal or directly from Lefthand Creek. Water is diverted about 90% of the time from the canal; diversions from the creek are generally limited to early spring and late fall (D. Cushman, pers. comm.). The Star Ditch has three primary laterals within the lease area, as well as serving numerous downstream users including the IBM property. A full ditch capacity of 9 cfs is diverted (D. Cushman, pers. comm.).

Agricultural Improvements

Agricultural improvements include any natural or human-made structures that will benefit a farming or ranching operation, including livestock barns, corrals, hay storage areas and housing. Improvements would also include fences, irrigation infrastructure and livestock watering sources. The Open Space Program is currently conducting several improvement inventories. The inventories describe facilities, fences, irrigation infrastructure and watering sources. Much of the field work has been completed for this inventory. However, some digitizing and computer analysis is needed before this information can adequately be summarized.

Facilities

Two of the houses owned by the Open Space Program in the management area are leased by agricultural lessees, another is leased by an agricultural lessee's laborer and two are vacant. Other improvements in the management area include several livestock barns, numerous storage sheds, a riding arena and hay storage facilities (see the Facility Information section for further information).

Fences

A comprehensive fence inventory has been completed for North Boulder Valley. A data base has also been developed to manage the information and to facilitate the creation of reports summarizing the information.

In the North Boulder Valley Management Area there are approximately 51 miles of fence ranging in quality from disjunct to new high tensile fence. The fence inventory revealed that nearly 14 miles (27%) of the fences in the North Boulder Valley are in "like new" condition. In addition, approximately 31 miles (61%) of the fences are in acceptable condition. A total of nearly 6 miles (12%) of the fences are in disrepair or are disjunct. Figure 12.7* is a map showing the location, type, and condition of all fences and gates located within the Management Area.

Irrigation Infrastructure
The irrigation delivery systems within the management area range in age from two to thirty years old. A complete inventory is underway to determine the type, condition, location, service area and volume of each structure and lateral.

Livestock Watering
The location, condition and quantity of water supplied for livestock is critical to a viable agricultural operation. A complete inventory of current and potential livestock watering sources is needed. The inventory should also identify areas where livestock grazing may not be an option due to the lack of available water.

12.2.4 Non-Native Species

Non-native species, or weeds, pose a threat to agricultural operations because of soil, water and plant competition (see the Vegetation section for further information on non-native species). Exotic species have a tendency to "out compete" native species for these nutrients. If control of non-native species does not occur, the exotic species can become a monoculture. Crop rotation, mechanical control, biological control and herbicides have been used to varying extents to prevent crop damage and the spread of weeds. Non-native species in North Boulder Valley Management Area are of most concern on the untilled lands.

Exotic Plant Management
Historically, this area has been extensively grazed, resulting in highly disturbed conditions favorable to weed invasions. The primary weed species of concern in the management area are diffuse knapweed, Canada thistle, Mediterranean sage, Russian olive and cheatgrass. In particular, cheatgrass occurs extensively in North Boulder Valley. Crop and range quality decline with the invasion of cheatgrass. Cheatgrass is not widespread in the croplands; cheatgrass is widespread in the mixed grass prairie areas. Spring and fall grazing has been used to suppress the spread of cheatgrass in some of these areas. Prescribed fire is a control technique for reducing cheatgrass and a 20 acre burn is planned for the Beech East property in 1996.

Insect Management On Cropland
Most crop insect populations in North Boulder Valley have thus far been below predetermined damage thresholds. Pesticide control has been limited based on these thresholds. These lower levels of crop pests might be due to the isolation of the area's cropland relative to the rest of the agricultural areas in the County. Alfalfa weevil and Russian wheat aphid pose the most significant threat to crop production in this area. Research has been proposed on the Axelson East property to examine different grass/alfalfa ratios and the use of Integrated Pest Management to reduce or eliminate pesticide use in alfalfa fields.

12.2.5 Economics

Economics are important to the planning and decision making in all agricultural operations. Issues in the management area include the viability of irrigated croplands, cattle production, the horse boarding operation and the relative economics and tradeoffs of alternative land uses.

The Open Space Program tries to balance the economic factors associated with farming and ranching with the lease rates. As agricultural improvements are made to the properties, lease rates are adjusted.

North Boulder Valley is used for livestock production; that is, the "cow/calf" business. This type of operation involves maintaining a herd of cows that are bred yearly. Generally, livestock graze on Open Space during the winter and spring months. Calves born each spring are sold the following year. Sale of these yearlings is the primary income source for livestock producers. No cow/calf operation utilizes Open Space year round and all of the lessees must buy or lease private land to supplement their Open Space lease areas. Agricultural facilities such as calving sheds and shelters, and livestock working facilities such as corrals are crucial to these operations.

Cattle operations provide benefits to Open Space as cattle are used as a management tool. Cattle are used to reduce hazardous fuel loading or thatch and to control weeds. Cattle graze native grasses during dormancy, when the weeds are green which does not damage the native species, but sets back the exotic species. In areas where cool and warm season grasses exist, grazing is rotated to allow each type of grass to set seed during alternate years. The goals of cattle grazing are to increase native species, replicate large ungulates, control weeds, lower thatch buildup and preserve historic agricultural practices within the Boulder Valley.

Forage production is probably the most economically stable agricultural enterprise in the Boulder Valley. A high number of farms produce hay in Boulder County, including those in North Boulder Valley. Forage production requires fertilizer, insecticide, equipment and fuel costs, but the market value of hay has remained constant. Fuel, labor and seed costs are lower than other types of crop production since planting does not occur every year and the majority of hay land does not require pesticide or insecticide applications. Hay fields on Open Space are grazed during the winter months which decreases the need for fertilizer. Boulder County's large horse population makes marketing hay relatively easy. Efficient irrigation systems and hay storage facilities are agricultural facilities that increase the profitability of forage production. Storage facilities allow the producer to demand a premium for "barn stored" hay and efficient irrigation systems require the application of less fertilizer. Inefficient irrigation systems result in excess water being applied to the land, flushing the nutrients out of the soil and into the ground water. Smaller amounts of water applied more often allow nutrients to remain in the soil.

12.3 ISSUES

Irrigation

- Condition and maintenance of existing irrigation structures.
- Need for additional irrigation structures.
- Increased efficiency of irrigation through improvements (sprinklers).
- Acquire and maintain adequate irrigation water supply.

Fencing

- Develop standards and upgrade fences to standards.
- Improve interior fences where needed for livestock management.
- Fence using management areas, not property boundaries.
- Maintenance of fences.

Livestock Improvements

- Identify areas where livestock will be managed, and repair or construct appropriate facilities.
- Improve and/or develop livestock water supply.
- Determine lessee responsibilities for agricultural improvements.

Other Improvements

- Refine policy for management of residential facilities.
- Public usage of leased areas (parking lots, arenas, etc.).
- Maintenance of public/leased areas (roads, parking lots, etc.).

Multiple Use

- Designation of restricted areas.
- Consider designation of recreation only areas.
- Seasonal trail or area closures.
- Use restrictions by type (dogs, bikes, horses, etc.).

Leases

- Develop long term agricultural plans.
- Lease terms and conditions.
- Non-leased land use (prescriptive use, leased in future).
- Non-leased land management (prescribed fire vs. prescriptive grazing).

Conflicts

- Potential conflicts between agricultural activities and recreational uses.
- Conflicts among dogs, livestock, recreational users and wildlife.
- Fragmentation of habitat by trails and other recreational impacts within the management area.

- Wildlife disturbance and habitat degradation due to access, agricultural and recreational use.
- Crop damage due to off-trail recreational use.

Economics

- Cost to Open Space Program to maintain agricultural properties.

12.4 DATA GAPS

- Agricultural management plan.
- Complete water resources inventory.
- Evaluate alternative crops and cropping practices and methods (possible research projects).
- Review production costs to evaluate fair market value and appropriate lease payments.
- Facilities and improvements inventory.
- Study of impacts of recreation on agricultural activities.

13. PASSIVE RECREATION

13.1 INTRODUCTION

City of Boulder Open Space lands including North Boulder Valley are popular recreation destinations. Almost two million visits occurred on City of Boulder Open Space lands last year alone. Recent Open Space studies indicate system-wide visitation is steadily increasing at a rate of approximately 12% to 19% annually. Increased visitor use has resulted in conflicts, safety concerns, trail widening, proliferation of undesignated trails, increased trail maintenance, conflicts with agricultural operations and impacts to natural resources. Recent and proposed residential developments in north Boulder will influence future visitation patterns, potentially affecting the quality of outdoor recreation experiences and the natural resources of the management area.

The City of Boulder Open Space Program's Long Range Management Policies state "Open Space will be managed in a way that provides for aesthetic enjoyment, minimizes cumulative impacts to the natural ecosystems and conflicts between users, considers user safety, preserves responsible agricultural use, provides for a quality recreational experience and protects natural areas" (City of Boulder 1995).

In the City of Boulder Charter, passive recreation is listed as one the purposes of Open Space and certain activities are listed: hiking, photography or nature studies and, if specifically designated, bicycling, horseback riding or fishing. "Recreation" is often defined as activities that offer a contrast to work-related activities and that offer the possibility of constructive, restorative and pleasurable benefits (Hammitt and Cole 1987). "Passive recreation" is generally considered to be these activities that occur in a natural setting which require minimal developments or facilities and the importance of the environment or setting for the activities is greater than in developed or active recreation situations.

The principal focus of passive recreation management in past years has been to inventory and maintain designated trails and access points. Future passive recreation goals for North Boulder Valley will be developed in the next steps of the area management planning process.

13.2 RESOURCE INFORMATION

The Open Space Program began acquiring properties in North Boulder Valley in 1973. These lands did not become known or heavily visited until the mid 1980s. Many of the trails in the management area were never formally constructed or designed as trails and have resulted from various equestrian livery and boarding operations that operated on Boulder Valley Ranch. In

many cases, extensive reconstruction has been needed because these trails were not properly located, designed or constructed.

Today more than 116,000 visits occur annually on various portions of North Boulder Valley Management Area. Visitors have easy access to approximately 13 miles of designated trails and four trailheads. Common activities include jogging, bicycling, exercising pets and hiking. Other activities include horseback riding, photography, wildlife viewing and hang gliding. The Foothills and Eagle Trails are extremely popular and provide an off-road bicycle trail connection to Boulder Reservoir.

In addition to providing passive recreation opportunities, the Open Space lands located within North Boulder Valley serve as an important aesthetic visual resource. The foothills and rolling grasslands provide excellent views for residents and visitors and serve as a natural visual buffer between nearby communities. This unique buffer provides Boulder its own distinct identity which clearly delineating it from other communities.

This section will discuss visitation characteristics and trends, passive recreation facilities (trails, access points and structures), existing regulations, issues and information gaps.

13.2.1 Visitation Characteristics and Trends

Estimates derived from a system-wide visitor use study (Zeller et al. 1993) indicate that approximately 1,455,418 visits occurred on City of Boulder Open Space lands from June 1, 1992 to May 31, 1993. Of these total visits, approximately 88,021 (6% of system-wide visits) occurred in the North Boulder Valley Management Area. The management area was considered to be a "developing region" (an area with relatively low visitor use and adjacent to rural, developing areas). This estimate of use does not include activities that occurred on Open Space lands east of N. 55th Street (the Johnson, Cowles, Dawson and east Axelson properties). A small amount of informal use does occur on the Open Space lands east of N. 55th Street, primarily along the Boulder Reservoir feeder canal that is not owned or managed by the City of Boulder.

Visitation trend data, collected during 1993/1994, indicated a 17% increase in system-wide visitor use (1,701,587 visits) or approximately 102,985 visits to North Boulder Valley. 1994/1995 data indicated a 13% increase in system-wide visitation over the previous year (1,921,205 visits for 1993/1994) or approximately 116,373 visits to the management area. Visitor use estimates for the management area are based on the assumption that system-wide trend data has a direct relationship with visitor use for North Boulder Valley.

System-wide information on seasons-of-use indicates the majority of use occurs during the spring (38%), followed by fall (28%), summer (24%) and winter (10%). System-wide information also indicates an average party size of 1.4 persons with 70% of these visits being

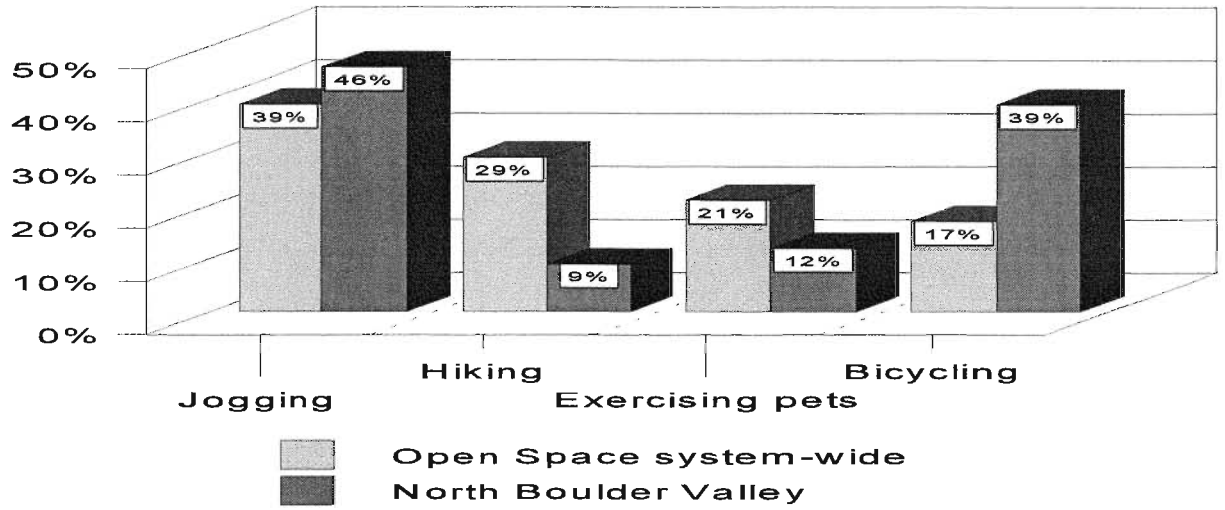

Figure 13.1
Comparison of activities system-wide and in North Boulder Valley

single visits. Ninety percent of all parties consisted of one or two persons. The average length of visits was 53 minutes system-wide; the North Boulder Valley Management Area was consistent with this length of visit.

Jogging was the most common activity throughout North Boulder Valley and system-wide on Open Space (Figure 13.1). Activity choices do vary within various regions of the management area and throughout different seasons of the year. The types of activities in which visitors participate have important considerations for passive recreation management. Different types of use have varied physical and natural resource requirements along with varying degrees of impact to visitors and the natural environment. For example, equestrians and bicyclists can travel greater distances than hikers; a well-designed trail system for these types of activities consists of longer trails or trails that link to other areas. Equestrians and bicyclists also generally travel at higher speeds and the potential for conflicts with other users is greater. Visitor education on trail etiquette and well-designed trails in heavily visited, multiple-use areas are extremely important.

The place of residence of visitors using Open Space varies between areas. System-wide, 90.9% of the visitors reside in Boulder County, compared to 99.5% of visitors to the North Boulder Valley Management Area. Visitors from outside Boulder County tend to use areas that have specific attractions and larger well known trailheads, such as the South Mesa Trailhead near Eldorado Springs. Currently, the North Boulder Valley Management Area has four small parking areas and is not well known by out-of-city and out-of-county visitors. During the summer of 1994, a trail was constructed from the North Rim/Lake Valley Estates subdivisions to the Boulder Valley Ranch trail system which has probably resulted in a higher percentage of Boulder County residents using the management area (this potential increase was not studied in the original 1992/1993 study or the study conducted during 1995 and no estimates are available).

Knowing where visitors reside enables managers to target specific education programs to various areas and determine specific funding strategies for management.

13.2.2 Distribution of Visitor Use

An additional visitor use study (Wheeler 1995) was conducted during the fall of 1995 to provide specific information on visitor use and distribution of use within the management area. The purpose of this study was to provide information on the relative amount of use and the types of activities that occur on various trails and regions of the management area. It also provided information on the time of day and day of the week use occurs, information about off-trail activities and trends in dog use (on-leash, off-leash and distance from trail/owner).

The North Boulder Valley Management Area was divided into four study zones. Each study zone was further divided into regions (Figure 13.2). A total of 15,436 visits were observed during 84 hours of sampling in the 1995 visitor use study. Although an accurate number of visits or visitors was not determined from this study (see the previous section on the 1993 visitation study for this type of information), the data does demonstrate how visitor use is distributed between various trails and regions within the management area.

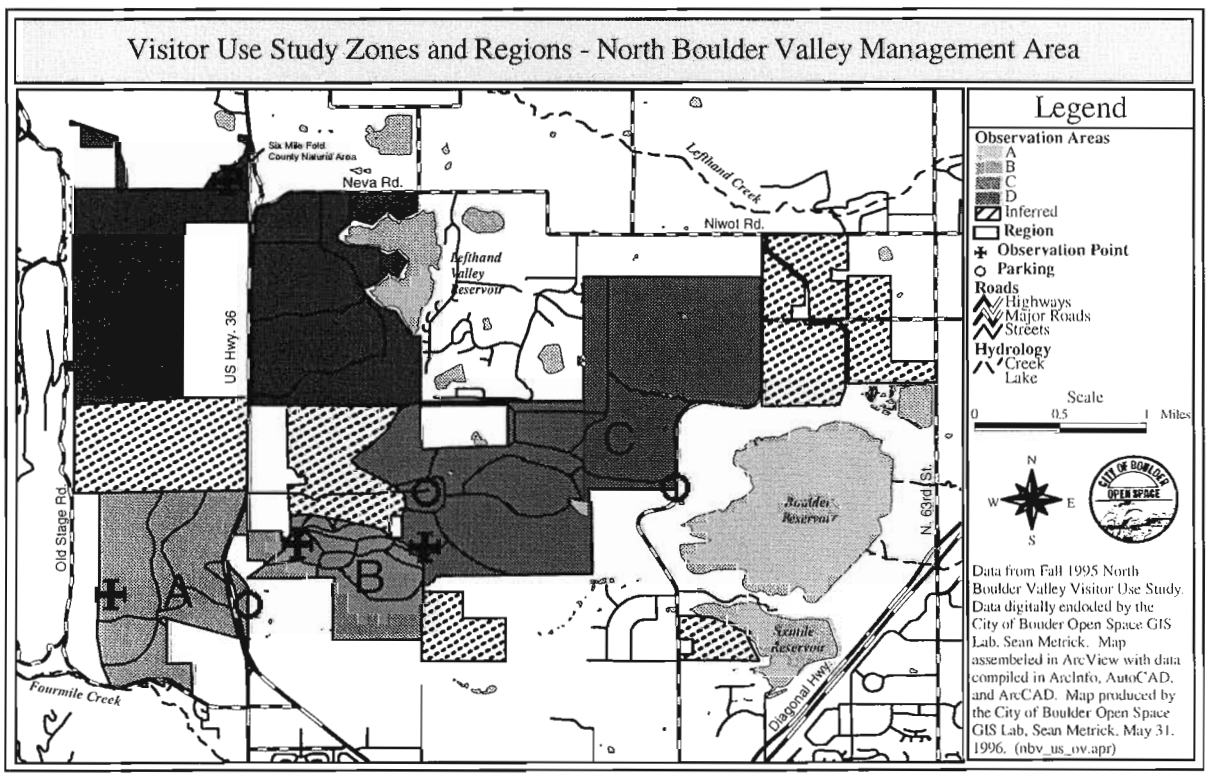

Figure 13.2 North Boulder Valley study zones and regions

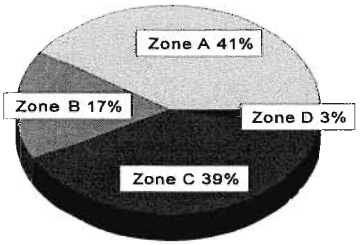

Figure 13.4
Distribution of visits
by study zones

Figure 13.3* shows relative use levels for every trail and region within the study area. Study zones A and C were the most-visited areas within the management area, accounting for almost 80% of the total visits observed (Figure 13.4). The lowest use was observed in Zone D and accounted for only 3% of all the use observed in the area.

The heaviest use occurred along the Eagle, Foothills and Sage Trails, accounting for approximately 82% of the total visits observed within the area (Figure 13.5).

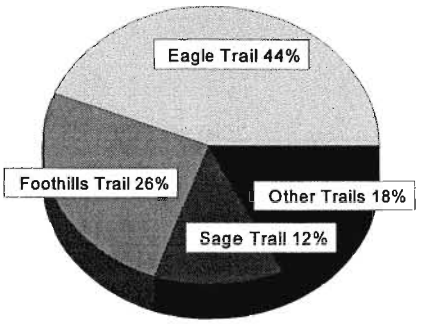

Figure 13.5
Distribution of visits by trails

Use of the designated trailheads was fairly evenly distributed with the exception of the Beech Trailhead. Beech Trailhead received the lowest use with slightly more than 1% of the total visitor use observed. This trailhead currently does not access any designated trails and is not widely known. These numbers do not represent vehicle use; they are the total number of visits that occurred in the immediate vicinity of the trailhead. The Eagle, Foothills and Boulder Valley Ranch Trailheads have trails through them and visitors using these trails were counted along with visitors accessing by vehicle.

Time of day and day of the week use occurs

Observers sampled on weekdays and weekends during three different time periods: early sampling was conducted from sunrise until three hours later, mid day sampling was conducted from 10:30 A.M. until 1:30 P.M. and late sampling was conducted from three hours prior to sunset until sunset. Use increased slightly during the mid day and late sampling (Figure 13.6). This information is based on data collected from November 8 to December 16, 1995 and other variations may occur in different seasons (i.e., - visitors may go out more in the early and late periods during the hotter months).

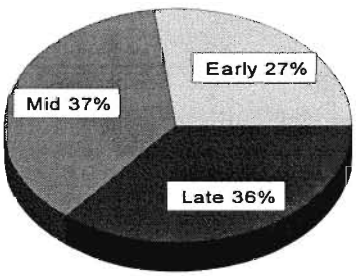

Figure 13.6
Time of day use occurs

Thirty-two percent (32%) of the visits observed occurred on weekdays and 68% of the visits observed occurred on weekends. Particular activity types also varied depending on the day of the week. One hundred percent (100%) of all hang gliding use was observed during mid and late sampling on Saturdays. Other activities which changed significantly include equestrian use (85.5% of all equestrian use occurred on weekends), bicycle use (76% of all bicycle use occurred on weekends) and only 34.3% of "other" uses occurred on weekends (i.e., picnickers, reading at trailheads, etc.).

Activity Type

The activity types described below are from data collected from November 8 to December 16, 1995. Variations in activity types between the two studies (1995 and 1993) could have resulted from several factors. First, the purposes of the 1993 study were quite different from the 1995 study and different sampling strategies were used. For example, during the 1993 study visitors were counted only when exiting Open Space, avoiding duplication of counts. The purpose of the 1995 study was to determine the relative amount of use in each area of North Boulder Valley, so visitors were counted in each area that they went into (often being counted multiple times).

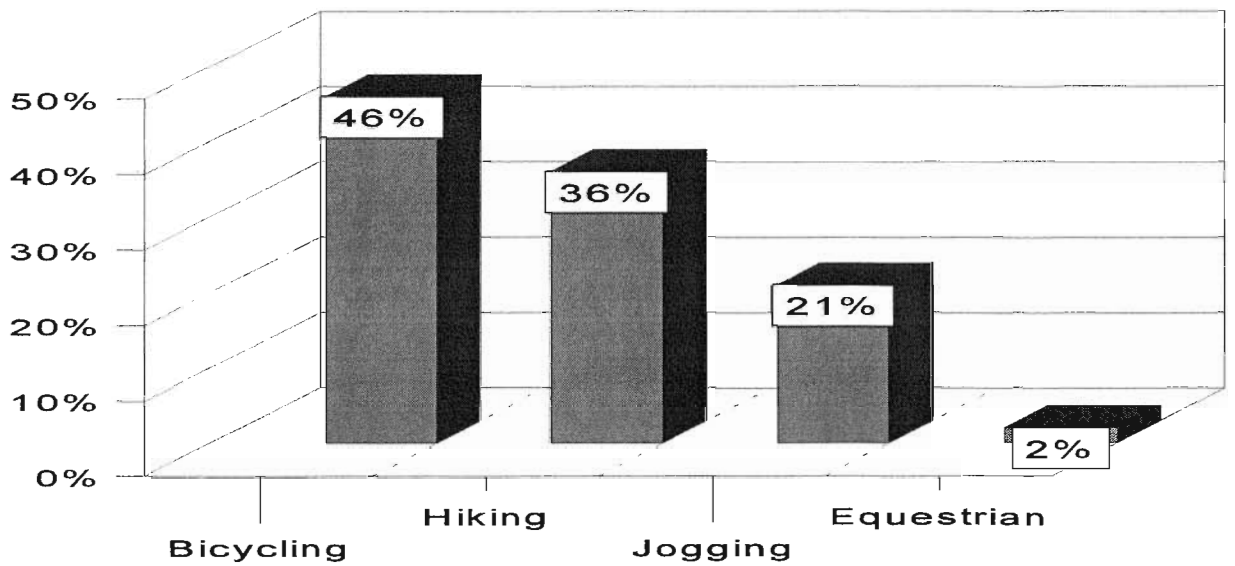

Figure 13.7
North Boulder Valley activities from 1995 study

Bicycling was the most popular activity and accounted for approximately 40% of all activities observed within the management area (Figure 13.7). Bicycling was particularly high in Zone B and accounted for approximately 45% of all activities observed within this zone. Hiking was the second most popular activity within the entire study area followed by jogging, equestrian use, "other" activities and hang gliding. Equestrian use was particularly high in Zone D and accounted for approximately 20% of all Zone D activities. Zone D also experienced significant differences in activities in the "other" category (42% of all Zone D activities).

It is interesting to note that 58% of all bicycle use occurred along the Eagle Trail. Equestrian use was very high along the Eagle Trail (30%) and Sage Trail (26%). Eagle Trail was also very popular with joggers, accounting for 42% of all jogging use observed within the study area.

Off-trail activities

Over 5% of all visits observed during the study were on undesignated trails. Undesignated trails are areas where informal use patterns have created obvious physical disturbances on the natural landscape. This estimate of use is probably low due to the fact that many undesignated trails are so close to designated trails that observers could not distinguish which type of trail visitors were using. In these cases, observers assumed visitors to be on the designated trails. Only 2.4% of all visitor use observed within the area occurred away from some type of trail (designated and undesignated trails). Of those visits observed off-trails, 21% were within 0 to 25 meters, 28% were within 25 to 100 meters and the remaining 51% were further than 100 meters off designated trails or undesignated trails.

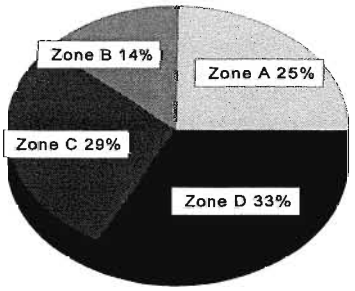

Figure 13.8
Off-trail activities by study zones

The highest amount of off-trail activities occurred in study zone D, accounting for approximately 33% of all off-trail use observed within North Boulder Valley (Figure 13.8). Zone D does not have any designated trails. Therefore, 100% of the visitor use observed in this area was either on undesignated trails or completely away from any type of trail.

Dog use

Observers recorded the number of dogs observed in each region, whether or not the dog was on or off of a hand-held leash, how far the dogs were from their owners and the distance from the trail. Of a total of 4495 dog visits observed, the majority of dogs were observed in study zone C (45%), followed by study zone A (30%), zone B (23%) and zone D (2%). Approximately 89% were off of a hand-held leash and approximately 11% were on a hand-held leash. Approximately 70% of the dogs observed were within 0 to 25 meters from the owner and approximately 86% were within 0 to 25 meters from the trail. Approximately 41% of all dog use occurred on weekdays and the remaining 59% occurred on weekends.

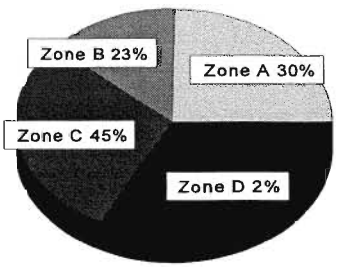

Figure 13.9
Dog visits by study zones

Currently dogs are required to be on a hand-held leash in portions of Zone A (see section 13.2.3 for further details). Approximately 80% of all the dogs observed in Zone A were not on a hand-held leash. In the portion of Zone A where dogs are required to be on a hand-held leash, only 21% of the dog owners complied with the posted regulations and the remaining 79% let their dogs off-leash.

13.2.3 Passive Recreation Facilities

Passive recreation facilities in North Boulder Valley include designated access points such as trailheads, designated trails (trails which are signed, shown on public trail maps and maintained by Open Space staff) and structures. Undesignated access points and undesignated trails are areas where informal use patterns have created obvious physical disturbances on the natural landscape. The Open Space Program discourages use of undesignated access points and undesignated trails to minimize impacts to natural resources by erosion and disturbance, to minimize the proliferation of trails on Open Space resulting in fragmentation of wildlife habitat, to reduce resources needed to effectively maintain these areas and to reduce trespass problems on adjacent private property.

Designated Access Points (Figure 13.10*)
Four designated trailheads are located within North Boulder Valley and Four Mile Creek Trailhead is located just outside the southern boundary of the management area. These trailheads generally provide parking, trash cans, information on local regulations and trails and convenient access to trails in the management area. Designated access points focus use into appropriate areas and discourage use in sensitive or fragile areas. Random pedestrian access is discouraged but basically unrestricted along the entire perimeter of the area with exterior fences being the only control of access. Private horse boarding facilities surround the management area and are occasionally used as access points by equestrians. Equestrians primarily use county roads to access the trails in North Boulder Valley.

Foothills Trailhead - located on the North Broadway extension, just north of the Broadway intersection with U.S. 36. Parking for approximately twenty vehicles, limited horse trailer parking, a bear-proof trash can, a new corral fence around the parking area, information board and a trailhead sign are provided.

Assessment: The Foothills Trailhead is a heavily used parking area, but seems to accommodate current needs for vehicle access and parking in this area. The corral fence around the perimeter of the parking lot was reconstructed during the summer of 1995 but repairs are needed to the barb wire boundary fence located along U.S. 36. Occasionally this lot is used by illegal campers and additional signs may be needed to help prevent this type of use. Currently no handicap parking is provided and handicapped accessibility is somewhat limited on trails in this area. Horse trailer parking is difficult due to the small size of the parking lot. Many trail users in this area pass through the parking lot and continue along the dirt roads and other trails in this area. A separated trail should be created if this trailhead is redesigned in the future to avoid conflicts with vehicles.

Boulder Valley Ranch Trailhead - located at the east end of Longhorn Road, approximately one mile east of U.S. 36. Parking for approximately twenty vehicles, a handicap accessible restroom, horse trailer parking nearby, a bear-proof trash can, corral fence around the parking area, information board and a trailhead sign are provided.

Assessment: This trailhead currently receives moderate vehicle use. A portion of this parking area should be designated for handicap use as many of the trails in this area are accessible. This area is heavily used by people exercising pets and dog excrement could become a problem. A culvert on Longhorn Road needs repair to eliminate a drainage problem and a potential hazard to visitors crossing Longhorn Road (this crossing accesses the northern portion of Sage Trail).

Beech Trailhead - located southeast of the intersection with Neva Road and U.S. 36. Parking for approximately twenty-five vehicles, a restroom which is currently closed due to vandalism, a covered shelter, horse trailer parking, a bear-proof trash can, post and slot rail fence around the parking area, information board and a trailhead sign are provided.

Assessment: Illegal activities are common due to the trailhead's poor location (located approximately one quarter mile interior of the property and not visible from major roads in the management area). A disproportionate amount of weekly maintenance is spent removing graffiti, litter and broken glass. The long entrance road needs to be graded on a routine basis and snow plowing is difficult. Other potential trailhead locations should be evaluated for this area (see Beech structures for further information).

Eagle Trailhead - located on the west side of N. 55th Street, approximately 2 miles north of Jay Road (just north of the entrance to Boulder Reservoir). Parking for approximately twenty-five vehicles, horse trailer parking, a bear-proof trash can, corral fence around the parking area, information board and a trailhead sign are provided.

Assessment: This trailhead is used on a regular basis and receives heavy use during weekends. The parking lot is frequently used by horse trailers that occupy a large portion of the lot (car and trailer parking is not designated). Many trail visitors pass through the parking lot and continue along the dirt roads to other trails in this area (trails around Boulder Reservoir). A separate trail should be created if this trailhead is redesigned in the future to avoid conflicts with vehicles.

Four Mile Creek Trailhead - located just outside North Boulder Valley on the south side of Lee Hill Road approximately one half mile west of Broadway. Paved parking for approximately forty vehicles (two of which are reserved for handicap parking), large bear proof trash can, corral fence around the parking area, dog excrement station, bike racks, information board, a recycling station (aluminum and glass) and a trailhead sign are provided.

Assessment: This trailhead receives moderate use and appears to be frequently used as a "park and ride lot." Snow plowing and horse trailer parking is difficult because concrete parking stops are used to designate the parking spaces. The Foothills Trail crosses Lee Hill Road at this trailhead and visitors must use caution because of the speed vehicles travel on Lee Hill Road. A trail underpass was proposed as part of the North Boulder Infrastructure Plan in order to address

development issues in this area. Signs warning vehicles of the pedestrian crossing should be considered in the future.

Mesa Reservoir access - informal parking area located east of the North Broadway extension off of U.S. 36. Informal roadside parking for approximately ten vehicles is available.

Assessment: Many visitors use this informal roadside parking instead of the Foothills Trailhead (located approximately one-half mile to the west) in order to get closer vehicle access to the trails in this area. Parking should be discouraged because of inadequate space, difficulty in turning around and potential blockage for emergency access vehicles. This entrance road provides private vehicle access to another landowner in this area and is not entirely controlled by the Open Space Program.

North Rim access - located along the south/central end of the North Rim subdivision. No parking is available and currently there are no signs or amenities.

Assessment: This access point links with the public trails provided on the plat of the North Rim subdivision and provides access to the northern portion of the Boulder Valley Ranch trail system. It also connects to the Boulder County Parks and Open Space North Rim Trail corridor which continues northward to Neva Road. An information board should be considered at this location to welcome visitors and present the rules of the area.

Designated Trails (Figure 13.10*)
Designated trails are considered to be official trails within the Open Space system which are signed and maintained by Open Space staff and appear on public trail maps. There are approximately 75 miles of designated trails within the entire Open Space system and approximately 13 miles located within the North Boulder Valley Management Area. All of the trails within the management area are open to hikers, joggers, equestrians and people exercising pets. Bicyclists are allowed only on trails designated with the international bicycle symbol (approximately 5.7 miles are open to bicycle use in North Boulder Valley and 32 miles in the entire Open Space system). Most trails in the management area consist of 8-10 foot wide gravel surfaced trails and are well suited for the multiple uses they provide.

The majority of the designated trails within the management area are in good condition. Short sections of the Foothills and Eagle Trails may need to be reconstructed or rerouted. Many of the trails located around Mesa Reservoir (Degge, Hidden Valley and Mesa Reservoir Trails) are becoming braided because they are flat and difficult to drain properly. Eventually these trails may have to be surfaced with crusher fines, considered for relocation or closure to prevent further erosion and damage. The following narrative briefly describes the designated trails, access points to these trails and a brief assessment of each trail.

Foothills Trail- This trail starts on the west side of Wonderland Lake and continues north across Lee Hill Road into the North Boulder Valley Management Area. The trail ends at the Foothills Trailhead and turns into the Eagle Trail which continues through Boulder Valley Ranch and to Boulder Reservoir. The majority of the Foothills Trail is an 8 foot wide crusher-fines trail, with a road base section 0.6 miles long and 8 feet wide north of Lee Hill Road to the Hogback Trail where it becomes a 4-5 foot wide native surface trail. Routine maintenance consists of cleaning waterbars and occasional grading. The narrow sections of this trail became severely eroded and braided during the spring of 1995 due heavy rains along with continued use. Extensive reconstruction occurred during the summer of 1995 and these sections are currently in good condition.

Access points - The Four Mile Creek Trailhead and Foothills Trailhead are the designated access points for this trail. The majority of visitors use the designated access points, but more use is occurring on an undesignated trail that cuts across the privately owned land known as the Mann property north of Lee Hill Road. Any potential development of the privately owned land should be required to coordinate access and resource protection needs with the adjacent Open Space system.

Assessment of Foothills Trail:
The trail has widened substantially in recent years. The primary passive recreation issues for this trail are visitor use conflicts due to increased use and multiple uses, trail widening in the steep rough areas, development of undesignated trails and soil erosion. The Foothills Trail is heavily used by joggers and bicyclists. User conflicts are moderate.

Hogback Ridge Trail - This trail begins about midway along the Foothills Trail and climbs steeply to the top of a prominent ridge. Once on top of the ridge, the trail follows the ridge line northward and then gradually returns southward to just above the intersection with the Foothills Trail. This section of the trail is approximately 1.7 miles in length and is a narrow (approximately 2 feet wide), native surface trail. The entire trail is open to hikers, joggers and equestrians.

Access points - The majority of visitors use the Foothills Trail but a few visitors come from the residential neighborhood west of the Open Space boundary (along Olde Stage Road).

Assessment of Hogback Ridge Trail:
The trail is in fair condition throughout most of its length with several sections that are extremely steep (15 to 20% slope). Wet areas are common on the northeast portions of the trail. These sections require more annual maintenance, but currently are in relatively good condition. Structural and drainage improvements may be necessary as visitor use increases. Rattlesnakes are commonly encountered during the summer months and visitors should use caution. Law enforcement concerns include dogs off leash and bicycles in restricted areas.

Eagle Trail - This trail begins at the Foothills Trailhead located along U.S. 36 and follows a gravel road to the entrance of Mesa Reservoir. At this point, motorized vehicles are prohibited and Eagle Trail continues as a rocky service road/trail until it becomes a 5 foot crusher-fines trail across the top of the mesa. The trail (a narrow unsurfaced section) then drops down a steep mesa and connects back into a gravel service road/trail until it ends at the Eagle Trailhead. Many visitors continue along N. 51st Street to Boulder Reservoir, where they return to Boulder or continue around the Reservoir.

Access points - The Foothills Trailhead, Boulder Valley Ranch Trailhead via the Sage Trail and Eagle Trailhead are the designated access points. The majority of visitors use the designated access points mentioned above, but some residents of the Valhalla subdivision access the southeast corner of the Boulder Valley Ranch property eventually connecting to the Eagle Trail.

Assessment of Eagle Trail:
The trail is heavily used by joggers and bicyclists. User conflicts are minimal except along the steep, narrow portion of this trail. This section is covered with ice throughout much of the winter and visitors should use caution. The Open Space Program is considering acquisition of adjacent lands in order to reroute this section to an area with less grade and better southern exposure. Just east of this steep section, the trail is wide and smooth, sometimes resulting in bicyclists traveling at high rates of speed. Visitors occasionally encounter rattlesnakes and farm equipment on this trail.

Degge Trail - This trail begins just north of the Foothills Trailhead and travels eastward across rolling grasslands until it eventually joins the Eagle Trail. The trail is a narrow and unsurfaced. Many visitors use this trail to form a loop with other trails in the management area.

Access points - The Foothills Trailhead via the Eagle Trail and Boulder Valley Ranch Trailhead via the Sage and Eagle Trails are the designated access points.

Assessment of Degge Trail:
This trail receives low levels of use but is braided in several areas because of the flat terrain and poor drainage. This trail, along with others in this area (Hidden Valley and Mesa Reservoir Trails) may need to be relocated or surfaced with crusher fines to prevent further braiding and erosion. As with other trails in this area, visitors should be cautious about encountering rattlesnakes.

Hidden Valley Trail - This trail begins just north of the Foothills Trailhead (same as Degge Trail above) and travels eastward across rolling grasslands until it joins the Eagle Trail. The trail is narrow and unsurfaced. Many visitors use this trail to form a loop with other trails in the management area.

Access points - The Foothills Trailhead via the Eagle Trail and Boulder Valley Ranch Trailhead via the Sage and Eagle Trails are the designated access points.

Assessment of Hidden Valley Trail:
This trail receives low levels of use but is braided in several areas because of the flat terrain and poor drainage. This trail, along with others in this area (Degge and Mesa Reservoir Trails) may need to be surfaced with crusher fines, considered for relocation or closure to prevent further braiding and erosion. As with other trails in this area, visitors should be cautious about encountering rattlesnakes. The southern portion of this trail is located near the Boulder Rifle Club's shooting range (located on private land). Although the risk to visitors is minimal, the loud sounds that come from this area can be quite disturbing. Additional signing and fencing may resolve these issues; if not, this trail should be closed or relocated.

Mesa Reservoir Trail - This trail begins just northeast of the Mesa Reservoir access (an informal parking area located east of the North Broadway extension off of U.S. Highway 36) and travels around a dry reservoir (known as Mesa Reservoir) until it eventually joins back into the Eagle Trail. The trail is a narrow and unsurfaced. Many visitors use this trail to form a loop with other trails in the area.

Access points - The Foothills Trailhead via the Eagle, Degge or Hidden Valley Trails, Boulder Valley Ranch Trailhead via the Sage and Eagle Trails or the Mesa Reservoir access are the designated access points.

Assessment of Mesa Reservoir Trail:
This trail receives low to moderate levels of use, but is braided in several areas because of the flat terrain and poor drainage. This trail, along with others in this area (Degge and Hidden Valley Trails) may need to be surfaced with crusher fines, considered for relocation or closure to prevent further braiding and erosion. As with other trails in this area, visitors should be cautious about encountering rattlesnakes.

Cobalt Trail - This narrow, unsurfaced trail begins at the Boulder Valley Ranch Trailhead and travels westward to the top of a mesa. Cobalt Trail eventually joins the Eagle Trail and many visitors use the Eagle and Sage Trails to form a loop back to the Boulder Valley Ranch Trailhead.

Access points - The Boulder Valley Ranch Trailhead or Foothills Trailhead via the Eagle Trail are the designated access points.

Assessment of Cobalt Trail:
This trail receives low levels of use and is generally in good condition. The lower portion of this trail is poorly drained and may need to be surfaced or relocated to provide better drainage. As with other trails in this area, visitors should be cautious about encountering rattlesnakes. An old undesignated trail still receives low levels of use (primarily from horse boarders from the facility

at Boulder Valley Ranch) and leads to an area with sensitive plants and fossil formations. All types of visitor use should be discouraged in this sensitive area.

Old Mill Trail - This narrow, unsurfaced trail begins along the Cobalt Trail and travels southward to the top of a mesa where an old smelter site is located. The Old Mill Trail eventually joins the Eagle Trail and many visitors use the Eagle, Sage and Cobalt Trails to form a loop back to the Boulder Valley Ranch Trailhead.

Access points - The Boulder Valley Ranch Trailhead via the Cobalt Trail or Foothills Trailhead via the Eagle Trail are the designated access points.

Assessment of Old Mill Trail:
This trail receives low levels of use and is generally in good condition. As with other trails in this area, visitors should be cautious about encountering rattlesnakes.

Sage Trail - This heavily used trail begins at the Boulder Valley Ranch Trailhead and travels around the area known as Boulder Valley Ranch. The majority of this trail is an 8 foot wide surfaced trail and is frequently used as part of the agricultural operation.

Access points - The Boulder Valley Ranch Trailhead and Eagle Trailhead via the Eagle Trail are the designated access points.

Assessment of Sage Trail:
The trail is heavily used by joggers and bicyclists. Visitors occasionally encounter rattlesnakes and farm equipment on this trail, but no major concerns are apparent. An undesignated trail comes off of the Cobalt Trail near the Boulder Valley Ranch Trailhead and Sage Trail. All informal visitor use should be discouraged in this sensitive area.

North Rim Trail (City of Boulder Open Space) - This short trail connects the Sage and Eagle Trails with the Boulder County Parks and Open Space portion of the North Rim Trail and the Lake Valley Estates and North Rim subdivisions. It was constructed as a five-foot wide crusher fines trail during the summer of 1994. Residents of the area agreed to use it as their primary access to the designated Open Space trails in this area.

Access points - The North Rim access, the entrance road to the North Rim subdivision or the Eagle Trailhead via Eagle Trail are the designated access points. Most North Rim/Lake Valley Estates residents enter this trail corridor through an undeveloped portion of the North Rim subdivision (near the south end of the Lake Valley Golf Course), but many enter through their back yards.

Assessment of North Rim Trail:
This trail provides a good connection for residents in this area and is in excellent condition. Signs should be considered at the entrance to this trail to advise visitors of jurisdiction and rules of Open Space. Weeds have been a continual problem in this area and often grow over the trail corridor.

Surrounding access and trails (not within the North Boulder Valley Management Area)
The following list of surrounding access points and trails is only a brief summary and is not intended to be a comprehensive list of all available recreation facilities.

Boulder Reservoir (City of Boulder Parks and Recreation Department) - Boulder Reservoir is a very popular recreation area. It receives heavy visitor use during the warmer summer months and moderate levels of use throughout the year. It provides parking, restrooms, covered shelter areas and areas for active recreation (wind surfing, boating, fishing, swimming, volleyball, large group events and picnics).

City of Boulder Mountain Parks (a division of the City of Boulder Parks and Recreation Department)

Lands around Boulder Reservoir - The Mountain Parks Division owns several properties east of the management area and assists with the management of the natural lands around Boulder Reservoir. Coot Lake is located on the west side of N. 63rd Street and provides parking, restrooms, a handicap accessible fishing pier and access to trails in the area. A well established undesignated trail goes around Boulder Reservoir is used by many visitors in conjunction with the trails around Boulder Valley Ranch and the service road which parallels the Boulder reservoir feeder canal (owned by Northern Colorado Water Conservancy District and is not officially open for public use).

Buckingham Park area - There are several properties owned by Mountain Parks located along Lefthand Canyon Drive. The Buckingham Park Trailhead provides parking, picnic tables and restrooms. There are several other small parking areas west of Buckingham Park which provide limited parking and picnic facilities.

Boulder County Parks and Open Space

Six-Mile Fold - No designated trails or access points are currently available. This area receives low to moderate levels of visitor use. Most visitors use this area to explore and study the unusual geologic formations (see the Geology section of this report). Several educational groups use Six-Mile Fold for instructional purposes, including the Geology Department at the University of Colorado.

Heil/Hall Ranch - These large natural areas are located north of Lefthand Canyon Drive and no public access areas or trails are currently available. Boulder County Parks and Open

Space Department is in the process developing management plans for this area and it is not currently open to the public.

North Rim Trail - This unsurfaced trail was deeded to Boulder County Parks and Open Space as part of the Planned Unit Development for the Lake Valley Estates and North Rim subdivisions. Most residents enter this trail corridor through an undeveloped portion of the North Rim subdivision (near the south end of the Lake Valley Golf Course), but many enter through their back yards.

Although never improved as a trail, it provides an important trail link for the residents north of North Boulder Valley. Eventually this trail will need to be surfaced with crusher fines and signs will be needed to promote appropriate access and use. Residents have landscaped over many sections of this trail; landscaping will become an issue when the trail is improved. The City of Boulder Open Space and Boulder County Parks and Open Space staffs have discussed the possibility of exchanging management responsibilities; no formal agreements have been made. Unresolved issues include enforcement of the mesh fence requirements on homeowner fences which abut the trail corridor and designated areas for neighborhood access to this trail.

Horse boarding facilities - There are numerous privately owned horse boarding operations surrounding the North Boulder Valley Management Area that provide trails and riding opportunities. These facilities are not open to the general public. Boarders sometimes access adjacent Open Space lands along County roads.

Undesignated trails (Figure 13.10*)
Although the majority of use occurs on the designated trail system of North Boulder Valley, an extensive network of undesignated trails is developing north of the Foothills Trail and on the Beech property. Undesignated trails are areas where informal use patterns have created obvious physical disturbances on the natural landscape. These informal undesignated trails fragment plant and animal communities and create corridors for the invasion of non-native plants. Undesignated trails have developed primarily on more recently acquired Open Space properties (Beech (East and West), Schneider and Axelson) where no designated trails or access points have been established. There are over 13 miles of undesignated trails and 18 miles of old road grades (most of which receive some informal use) located within the boundaries of the North Boulder Valley Management Area. Future connections may lessen use of these undesignated trails, but careful management will be required to eliminate use of these undesignated trails.

Undesignated trails associated with the Foothills Trail and Open Space lands to the north - Two predominate undesignated trails have developed along the Foothills Trail (Figure 13.10*). The first undesignated trail comes from the private Mann property (located south and east of the Foothills Trail) and visitors use this as a shortcut to the designated trail. The second undesignated

trail begins at the second fence line west of U.S. 36 and continues north along an old abandoned railroad grade.

Beech property - Both the East and West Beech properties have an extensive network of service roads which receive low levels of informal visitor use. Informal undesignated trails have also developed between Neva Road and northeast of the North Rim Trail, and off of Olde Stage Road. Many of these undesignated trails travel through wetlands and could result in resource impacts.

Open Space lands immediately west of N. 51st / N. 55th Streets - Some informal use occurs in the southeast corner of the Boulder Valley Ranch property from the Valhalla residential development and east through City of Boulder Parks and Recreation Department property to N. 51st Street. Informal visitor use also occurs on the Open Space lands east of N. 55th and Monarch Road (the Axelson property).

Future trail connections in these areas may lessen the use of undesignated trails, but additional management actions will be required to successfully eliminate use of these undesignated trails. Issues to consider when eliminating use of these undesignated trails include:

1. reduce visitor use conflicts (widen designated trails to accommodate use levels, possible separation or regulation of certain uses, reduce speeds visitors travel, eliminate blind spots by removal of surrounding vegetation or rerouting the trail),
2. consider providing formal trail access to the proposed residential developments north of Lee Hill Road and County residential areas north and east of the management area,
3. consider providing trail access to Beech Open Space,
4. creation of additional loop trails to discourage random development of undesignated trails,
5. increased trail maintenance (wet areas, obstacles, building up the trail surface to allow adequate drainage, etc.),
6. increased cooperation with adjacent landowners and agencies and
7. increased education on potential visitor use impacts and discouraging off-trail use.

Continued off-trail equestrian use could lead to further development of undesignated trails. This use should be carefully monitored and controlled. Limiting off-trail equestrian use and other visitor use during wet conditions may be necessary.

The potential residential development of the private Mann property, located north of Lee Hill Road, will place additional use requirements on the North Boulder Valley trail system. Carefully planned access points that connect with existing designated trails will be essential to focus use into appropriate areas and discourage use in sensitive or fragile areas: Attention should be placed on providing access points which connect with RTD bus routes and bicycle routes. The Open Space Program needs to participate in reviewing development proposals to ensure that trail

connections and access points to Open Space are effective and have minimal environmental impacts.

Passive Recreation Structures (Figure 11.1*)
Beech Picnic Shelter/outhouse - A large modern picnic shelter stands east of the parking area at the Beech Trailhead. This structure, measuring approximately 1520 square feet, consists of a solid concrete pad and heavy duty contemporary wood construction. A large stone-faced fireplace at the west side of the structure has been welded shut and mortared over to deter further misuse and the vandalism that has occurred at this location. A stone outhouse with both men's and women's facilities stands west of the parking lot at the Beech Trailhead. This structure, measuring approximately 110 square feet, is of sound construction and fully functional, but has, for the time being, been boarded up to discourage vandalism and graffiti.

Prior to acquisition by the City of Boulder and Boulder County, this facility was used by Beech Aircraft for large employee social functions. The facility was rented for large social functions when Boulder County Parks and Open Space managed the property. The City of Boulder Open Space Program took over management of the facility in 1995; it is no longer rented for social functions. Large illegal parties are common and vandalism frequently occurs to the flagstone chimney and restrooms (see Beech Trailhead assessment for further information).

Boulder Valley Ranch Silver Nickel - A large barn-like structure that was constructed primarily for recreational use is located at the north end of the Boulder Valley Ranch complex. This enclosed, heated structure houses a large stone fireplace, stage area for performances, a full kitchen area once utilized to prepare ranch hands' meals, a partial loft used for storage, and men's and women's restrooms that were upgraded in approximately 1990. This facility measures approximately 4860 square feet.

This building has not been used in recent years and currently stands vacant. Many moderate to extensive upgrades would be required in order to return it to active use. The insulation should be reviewed as well as general weather sealing to save on heating such large square footage on a regular basis. Although construction of the restroom facilities was completed, existing plumbing fixtures remain non-functional.

Boulder Valley Ranch Outhouse - This is a standard Open Space wood-structured vault toilet, located at the Boulder Valley Ranch Trailhead, just southwest of the Boulder Valley Ranch parking area on Longhorn Road. The men's and women's chambers measure approximately 72 square feet. The facility is cleaned and restocked on a weekly basis. Ventilation is supplemented by two spinning wind turbines installed on the roof of the structure, one above each vault/ chamber.

Mesa Reservoir outhouse/shelters - These facilities were installed in the early 1960s when the (now dry) Mesa Reservoir was an active public recreation area. The outhouse is a cinder block

structure, located on the northwest bank of the lake bed, measuring approximately 100 square feet total (both chambers). The commodes and the structure itself are showing age and are not maintained on the routine trailhead rounds. The building was painted in 1982 but has seen little use since then due to its remote location. Two small picnic shelters also stand at this location. They consist of a concrete pad, 3 inch diameter steel pipe and sheet metal roof construction, measuring approximately 126 square feet. Other than being dated in style and design (a simple pitched roof mounted on two "V" shaped steel posts), the shelters are in reasonably good condition, though showing age. The shelter along the west bank of the lake bed receives little if any use due to its remote location. The northern shelter is located along the popular Eagle Trail and is occasionally used as a rest stop, providing one of the only shaded areas along this portion of the trail. Both shelters present no structural hazard at this time.

Planned Recreation Facilities

The Open Space Program is currently negotiating with private land owners for additional open space land to reroute the steep portion of the Eagle Trail (see comments under Designated Trails - Eagle Trail). Rerouting this section of trail would significantly improve safety and reduce the potential for visitor conflicts.

The City of Boulder Parks and Recreation Department is currently developing plans for North Boulder Community Park which is located just east of the Foothills Trail between Lee Hill Road and Wonderland Lake (south of the North Boulder Valley Management Area). Visitors to this developed park site will certainly have some effect on the adjacent Open Space lands. In addition to this large community park, the Tributary Greenways Program (a division of the City of Boulder Transportation Department) is planning to provide an off-street alternative modes path to this park site, to connect with the Foothills Trail. This concrete multiple use path will be located somewhere south of Four Mile Creek and will eventually connect with similar trails to the east. Both of these recreational facilities will influence the type and quantity of visitors to the open space lands surrounding Wonderland Lake and into the North Boulder Valley Management Area.

It is essential to plan appropriate public access points within the management area. In the past, pedestrian gates have been randomly placed to provide public access to various properties. These gates have resulted in the creation of numerous undesignated trails. These undesignated trails fragment plant and animal communities, cause unnecessary erosion and are difficult to eliminate once use patterns have become established.

Carefully planned access points connecting existing trails will enable the Open Space Program to focus use into appropriate areas, while discouraging use in sensitive or fragile areas. Open Space trailheads have become increasingly popular. Many of these trailheads are at or near parking capacity every weekend and often on weekdays. Encouraging use of alternate transportation modes will be an important consideration. More attention should be placed on providing access points which tie into existing RTD bus routes and bicycle routes.

13.2.3 Passive Recreation Regulations

A variety of regulations exist on City of Boulder Open Space (see Appendix 13.1). These regulations apply to both Open Space and Mountain Parks and are intended to help protect these lands while ensuring a safe and enjoyable experience for those who visit these areas. The following regulations are particularly relevant to passive recreation management of North Boulder Valley.

Dog regulations (Boulder Revised Code 6-1-12)
Dogs are required to be on a hand-held leash on all City of Boulder Open Space lands that are located within the legal boundaries of the incorporated portions of the City. Incorporated portions of the City meander in and out of the North Boulder Management Area and make effective signing and enforcement difficult. Potential revisions to the City of Boulder dog regulations are currently being evaluated (in a separate planning process) and any revised regulations will be incorporated into the area management planning process when available.

Liveries / commercial use (Boulder Revised Code 8-3-7 and 4-20-40)
Livery operations are the only commercial uses currently regulated by the City of Boulder Open Space Program. Livery operators must apply for a permit which is evaluated by the Open Space Program on a case-by-case basis. Livery operators that are approved by the Program must pay a fee with permits issued for one year.

Other unregulated commercial uses that occur on Open Space and within the management area include hang gliding instruction, commercial video production and outdoor education classes (plant and wildlife identification, outdoor photography classes, climbing instruction, etc.). In particular, several hang gliding schools are using the Open Space areas northwest of the Foothills Trailhead resulting in the development of undesignated trails that may cause unnecessary impacts to the natural resources of the management area (e.g., Bell's twinpod grows on the shale outcrops used for hang gliding instruction).

Bike regulations (Boulder Revised Code 8-3-6)
Bicycles can be ridden on trails marked with the international bike symbol; all other trails are closed to bicycle use. Mountain bicycling advocates have requested additional bicycle access to several areas within the management area.

Special use permits (Boulder Revised Code 8-3-14)
Any organized activity which involves more than fifty people must apply for a special use permit. Applications are evaluated by the Open Space Program. Special use permits are granted or denied based on their compatibility with the purposes of Open Space and the potential for impacts to other visitors and the natural resources of the area. Numerous requests for large

groups (picnics, company parties) have been made to use the large pavilion located near the Beech Trailhead. Other requests include use of the trails in the management area for informal and competitive sporting events (cross country running events and bicycle races).

13.3 ISSUES

Trails, access and structures

- Increased visitation levels and multiple uses in some areas have resulted in visitor conflicts and impacts to natural resources.
- Continued use and proliferation of undesignated trails (particularly on the more recently acquired Schneider, Beech and Axelson properties) .
- Access to Open Space from the northern portion of N. 55th Street and access to the Beech properties from the existing Boulder Valley Ranch trails and Joder Ranch.
- Access to Beech East Open Space from Neva Road.
- Trail maintenance and improvements (steep portion of the Foothills Trail; safety and erosion concerns on the steep portion of the Eagle Trail; and improving drainage and preventing braiding on Degge, Hidden Valley and Mesa Reservoir Trails).
- Use of area by domestic pets and associated impacts (dog management issues related to impacts to visitors, livestock and wildlife).
- Adjacent landowner uses (land practices, horse boarding facilities).
- Future use of Beech Pavilion, passive recreational facilities around Boulder Valley Ranch such as the riding arena and Silver Nickel, and the shelters, outhouse and service roads around Mesa Reservoir.
- Input and management of commercial uses (hang gliding, horse concessions, etc.)
- Access and increased use which could result from intense residential development on the private Mann property.

Enforcement issues

- Current dog regulations are difficult to post and enforce.
- Large parties, litter, vandalism and illegal uses at Beech Trailhead.
- Campers at various trailheads.
- Mediation of user conflicts.
- Illegal fossil collection.

Safety concerns

- Beech groundwater contamination.
- Wildlife management: large rattlesnake population and mountain lion use in the management area.
- Hidden Valley Trail: proximity to Boulder Rifle Club's shooting range.
- Steep portion of the Eagle Trail which is heavily used by a variety of passive recreationists.

- Safe crossing for the Foothills Trail at Lee Hill Road.

13.4 DATA GAPS

Impacts from passive recreation
Additional research is needed to evaluate the potential impacts of passive recreation on natural resources (fragmentation of sensitive plant and animal communities) and visitor experiences (crowding, visitor conflicts). Studies are being developed and conducted which will evaluate recreational impacts. Results from these studies should be incorporated into the future management of this area.

Future dog management policies
Potential revisions to the City of Boulder dog regulations are currently being evaluated (in a separate planning process) and these revised regulations need to be incorporated into the area management planning process when available.

Future development of adjacent lands
Appropriate location and management of access must be incorporated into the management of North Boulder Valley.

Passive recreation needs assessment
No studies have been formally conducted to determine the passive recreation needs of Boulder citizens who support the acquisition of Open Space lands through their tax dollars. Studies of past and current visitor use activities have been conducted (Zeller et al. 1993, Wheeler 1995). Public meetings have been conducted throughout the area management planning process and staff has incorporated this public input into the planning effort.

Comprehensive City ecosystem and trail plans
Resource plans -- Ecosystem Plan, Visitor Use Plan and Forest Ecosystem Plan -- that provide a comprehensive analysis of the City's natural resources are being developed and will have to be incorporated into the management of the area.

14. EDUCATION AND OUTREACH

14.1 INTRODUCTION

The Open Space Program conducts education and outreach programs to achieve the goals established in the Long Range Management Plan in order to:

- instill an appreciation for the balance of natural processes and native ecosystem communities,
- foster respect for life in its many forms and recognize the human species as only one component of the natural world and
- develop a conservation ethic that produces respect for Open Space and for the environment.

The Program's outreach activities, conducted primarily by the Education and Outreach Division, provide opportunities for comment, direction and information on issues important to the community back to the Program. An effective public process is essential to maintain understanding and support for the Open Space Program and to ensure awareness of community issues. The Program endeavors, to the best of its ability, to be responsive to the groups and individuals which comprise this broad and diverse "public."

The Program's education and outreach goals are met through the following activities:

- disseminate information concerning the ecology and natural history of the area,
- disseminate information concerning the goals, projects and operations of the Open Space Program,
- disseminate information about the conflicts that arise when humans interact with natural systems, and about ways of lessening or eliminating the impact of those conflicts,
- conduct projects and programs that provide opportunities for people to establish a relationship with the Open Space Program and land system and
- engage in public processes which provide opportunities for public input and involvement in Open Space planning and decision making.

Education and outreach activities are conducted at the request of civic groups, neighborhood organizations, schools and other groups. The Nature Trails activity series provides year-round educational opportunities. In addition, the Program publishes and distributes a quarterly newsletter, *Open Space...Naturally!* The Program's education and outreach activities and its newsletter are free. The effectiveness of these education and outreach activities is assessed regularly to assure that Program goals are being achieved and that the public is being effectively served. These evaluations include internal and external evaluation forms, activity debriefings and staff assessments of programming effectiveness. The Education and Outreach Division will

continue to develop evaluation standards and measures to be used in assessing the quality and effectiveness of its education and outreach activities. The Education and Outreach Division is currently engaged in an evaluation of needs and resources for the development of a five year education and outreach plan.

The Education and Outreach Division now maintains an internet/world wide web site on the Boulder Community Network (http://bcn.boulder.co.us)for the Open Space Program. The site reaches the public electronically and offers education about the natural resources to be found on City of Boulder Open Space along with providing the public an opportunity to comment and request further information.

Direct interactions between staff and the public help the Program accomplish many of its education and outreach objectives. It is a priority for all employees to actively and positively interact with the public. The majority of in-field public contacts with Open Space visitors are made by various members of the staff engaged in field work, rangers while engaged in patrol and Public Information Coordinators. A primary duty of patrolling rangers is to interact with the public, providing information and assessing public opinion and sentiment. Rangers also consider education to be a primary objective of law enforcement contacts. Public Information Coordinators contact thousands of Open Space visitors per year. They disseminate information to the public through direct personal contact and by maintaining the Program's information boards. Public Information Coordinators also provide trailhead education programs, aid in assessing public sentiment, assist at special education and outreach events, participate in public process activities and supplement ranger presence in the field.

14.2 RESOURCE INFORMATION

Education and Outreach "resources" are natural features or historic human-made features which can be utilized in the advancement of the Program's education and outreach goals and objectives. Education and outreach resources in the North Boulder Valley Management Area include:

- wildlife: raptors, snakes, prairie dogs, bats, mountain lions, coyotes, lightning bugs, etc.
- plant life: native grasslands, noxious weeds, endangered flora, trees, restoration/reclamation
- cultural: prehistoric sites, nickel smelter, reservoirs and ditches, historic buildings and land uses, abandoned railroad grade, oil and mineral exploration
- geologic: fossils, mesas, shale outcrops, foothills
- agricultural: cattle, crop production, Boulder Valley Ranch operations, water use,
- wetlands: ponds, ditches, wetlands and
- other: Olde Stage fire site, weather, stars.

14.2.1 Education and Outreach Amenities

Amenities are facilities or developments which support education and outreach functions. There are four trailheads and approximately 13 miles of designated trails located within the management area which provide opportunities for education and outreach activities. They include parking lots, information boards, restrooms, pavilions and other amenities. See the Passive Recreation section of this report for further information on these amenities.

Information Boards
Information boards with brochure dispensers are located at four trailheads in this management area. These boards display an area map with trail information, rules and regulations (including international symbols), Nature Trails program notices and timely notices of importance (e.g., wildlife warnings, emergency trail closures, public meetings, etc). Conveniently located information boards provide visitors with easy access to brochures and information twenty-four hours a day.

14.2.2 Educational Activities

Open Space staff works closely with the public, local school districts, other City departments and outside agencies to provide education activities to the public, students and various organizations. These activities are often the most effective way to convey an understanding of the values and importance of open space and the environment, increasing natural resource protection and increasing visitor enjoyment and visitor safety. Recent urban development adjacent to Open Space increases the need for the Program's education and outreach activities in North Boulder Valley.

The Program, through it's Nature Trails series, conducts an average of four to six educational activities in the North Boulder Valley Management Area annually. Educational programming in this area has not followed a central theme; programming has been opportunistic, taking advantage of education resources, citizen interest and staff availability. Education topics have included raptors, fire ecology, mountain lion ecology, bats, rattlesnakes, rare plants, archaeology, wetland ecology, astronomy, nocturnal wildlife and responsible visitor use.

Three neighborhood-specific activities were conducted in this area in 1995. Education and outreach activities the Program conducts for schools and civic groups outside the North Boulder Valley Management Area also directly benefit this area. Activities that instill an understanding and appreciation of open space and the environment, develop a sense of environmental stewardship and increase the likelihood of positive interactions between user groups, benefit this area regardless of the location where these activities are conducted. This "cross-education" is especially important due to the absence of public schools in this area.

14.2.3 Volunteer Projects and Programs

Volunteers are a valuable resource to the Open Space staff and the public. The public is encouraged to participate in the accomplishment of the purposes of Open Space as stated in the City Charter through the Open Space volunteer program. Over the years, numerous volunteer projects and activities have been conducted in North Boulder Valley. Staff commits numerous hours to the education and training of volunteers in order to afford them the tools necessary to accomplish their assignments and provide exceptional service to the City of Boulder and the public.

- Many volunteers with extensive professional and avocational skills have conducted inventories and assessments of cultural, historic and natural resources. Ongoing research and monitoring projects have included endangered plant, raptor, predator, avian and bat studies.
- Students have earned internship credit for completing service learning and research projects.
- Court-ordered community service has allowed citizens to make restitution to the community through service to Open Space on large and small scale clean-ups, weeding and maintenance work. Community Service workers contribute approximately 40 hours of labor to the Program annually in this area.
- Wildlife habitat plantings, revegetation of disturbed areas, trail building and general maintenance have been done by volunteers during neighborhood volunteer projects and special group events. For example:
  - annual Bike Week activities are conducted with GO Boulder and Boulder Off-Road Alliance (a local mountain bike group),
  - resurfacing the Eagle Trail (25 volunteers, 113 hours),
  - Foothills Trail maintenance (7 volunteers, 35 hours),
  - North Rim Connector Trail construction by fourteen North Rim residents (33 hours) and
  - closure of an undesignated trail by five Rocky Mountain Hang Gliding Association members (30 hours).
- A Stewardship Program for this management area was initiated in 1994, allowing interested citizens to make an ongoing commitment to caring for and learning about the area.
- Open Space Trail Guides spend approximately 600 hours annually in this area providing information to the public.
- Since 1994, jail crews have contributed over 1000 hours of labor-intensive service to the Program in this management area. Activities have included trash pick up, prairie dog management work, fence construction, reclamation work, integrated pest management and irrigation work.
- Several youth organizations, including organizations serving youth at risk, have worked in this area since 1986.
  - 1986-1992: tree planting by Denver Children's Home (100-200 hours per year),
  - 1992: Sage Trail surfacing by Achievement Corps (350 hours),

- 1993, 1994: fence removal and trail maintenance by Denver Children's Home (40 hours per year) and
- 1995: Foothills Trail maintenance and weed control by Ceders youth group (235 hours).

14.2.4 Education and Outreach Activities of Adjacent Agencies and Land Owners

Numerous other agencies and individuals are involved with education, outreach and volunteerism in the vicinity of the North Boulder Valley Management Area. Open Space education and outreach activities will coordinate with and complement other educational programs, when possible. A partial inventory of these agencies and individuals follows.

Boulder County Parks and Open Space
Educational activities conducted by Boulder County Parks and Open Space focus on the geology of the Six-Mile Fold. The County and the University of Colorado have conducted geology programs at this site. Prairie and grassland ecosystems and Native American history have been the topics of other education programs. Volunteer projects have included weed management and jail crew labor projects. Boulder County Parks and Open Space will begin offering orientations to the North Foothills open space (Heil and Hall properties) in September, 1996.

Joder Arabian Ranch
This private horse boarding facility is located on the northern edge of the management area. Outdoor leadership courses are also offered on the Joder property. Activities are conducted by both the Joder family and other contractors. Schools, corporations and other community groups make use of this facility. Some environmental education is included during these courses and the ranch owner has expressed an interest in expanding these programs. In 1995, the Boulder County Horsemen's Association and Boulder Off-Road Alliance held a workshop on shared trail use at the Ranch.

City of Boulder Mountain Parks
Mountain Parks conducts many education and volunteer activities on adjacent Mountain Parks property in this area. Topics of education programs have included riparian, wetland and successional ecosystems; aquatic biology; environmental awareness/appreciation; various wildlife-related topics; Project WILD; New Games and others. Volunteer programs have included trash pick up, wildlife surveys, wetland mitigation, weed management and fish habitat improvement.

Boulder Reservoir
The Boulder Reservoir, operated by the City of Boulder Parks and Recreation Department, offers classes to the public on water safety and sports such as sailing, water skiing and sail boarding. Government agencies and special groups conduct training on water and ice rescue, scuba diving

and dog obedience. The Reservoir is also used informally for such activities such as bird and wildlife watching.

14.3 ISSUES

Issues are areas of concern in which the Program should evaluate education and outreach activities. Education and outreach opportunities may arise from public interest in a particular topic or project, or from the Program's need to address a particular issue or emergency.

- Use and creation of undesignated trails.
- Visitor conflicts between various types of use.
- Protection of sensitive species.
- Protection of sensitive geologic, historic and prehistoric sites.
- Vandalism to Open Space property and facilities.
- Increased visitor use and potential impacts to the environment.
- New housing developments adjacent or near to Open Space and the associated impacts.
- Lack of communication between other land management areas on topics of mutual concern .
- Protection of livestock and cropland on agriculturally active Open Space properties.

14.4 DATA GAPS

- Evaluation standards and measures are needed to assess the quality and effectiveness of the Program's education and outreach activities. Some of these standards will be developed with a communication consultant hired in 1996.
- Divisions within the Program need to identify their needs for education and outreach. The Education and Outreach Division will then work with staff of these divisions to provide the requested services.
- Engage in public process to determine the public's needs for and expectation of education and outreach in the management area.

REPORT CONTRIBUTORS

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Mark Gershman (Natural Resource Planner) - wetlands inventory and analysis; coordination of wetland issues (permits, Best Management Practices)

Ann Goodhart (Property Agent) - real estate/property/easement information and related issues

Mark Grundy (Resource Specialist) - agricultural resources and reclamation; coordination of natural resource and ranger staff inventory and analysis, ERO and Hydrosphere consultants

Cindy Hansen (Education/ Outreach Specialist) - community outreach, inventory of potential outreach/education opportunities, and overall coordination with the Education Outreach Division

Dave Kuntz (Planning Supervisor) - planning context; coordination with administrative staff and Open Space Board of Trustees (OSBT); and integrating project into Open Space Program's work program

John Leither (Trails Coordinator) - trail inventories; trail construction and maintenance issues; overall coordination with Land Management staff

Sean Metrick (Technical Research Assistant) - cartography and Geographic Information System (GIS) analysis

Clint Miller (Wildlife Biologist) - wildlife inventory and analysis; coordination of research needs

Lynn Riedel (Plant Ecologist) - vegetation inventory and analysis; coordination of integrated pest management and fire management

Donna Sewell (Support staff) - assistance and coordination with the support staff

Brent Wheeler (Resource Planner) - project leader; passive recreation and cultural resource inventories; and coordination of public process, Geographic Information System (GIS) needs, coordination with Boulder County Parks and Open Space and City of Boulder Mountain Parks

Other Inventory Report Contributors

Many other staff members, surrounding agencies, consultants and volunteers were involved in collecting information and completing inventory reports. Other significant contributors include:

Roy Bell (Natural Resource Specialist) - soil information

Randy Coombs (Boulder County Parks and Open Space Resource Specialist) - coordination with Boulder County Parks and Open Space

Laurie Deiter (Natural Resource Specialist) - integrated pest management

ERO (environmental consulting firm) - agricultural analysis of Boulder Valley Ranch lease

Ann FitzSimmons (Administrative Assistant) - inventory report editing

Lorna Flormoe (Trail Crew Lead Person) - geologic information

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Rich Smith (Education and Outreach Coordinator) - Education and outreach information

Delani Wheeler (Deputy Director) - historical perspectives on Open Space acquisition and management

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APPENDICES

APPENDIX 2.1 PLANNING CONTEXT

2.1.1 Boulder Valley Comprehensive Plans

1) protection and restoration of significant native ecosystems and habitats for native plant and animal species on public and private lands through acquisition, land use planning, development review and public land management practices.

2) promotion of biological diversity and protection of endangered species and their habitats.

3) restoration of degraded habitat and reintroduction of extirpated native species may occur as a means of enhancing native flora and fauna in the Boulder Valley.

4) management of natural areas designated in the Boulder County Comprehensive Plan within the Boulder Valley will be consistent with the natural area goals and policies of the Boulder County Comprehensive Plan.

5) preservation, enhancement and restoration of ecosystem connections and buffers by preserving large areas of unfragmented habitat and undeveloped lands critical for sustaining biological diversity and viable habitats for native species and for minimizing impacts from developed lands.

6) maintenance and restoration of ecological processes through recognition that ecological change is an integral part of the functioning of natural systems and that natural processes will be utilized or mimicked to sustain, protect and enhance native ecosystems.

7) protection of natural and artificial wetlands to provide habitat for rare, threatened and endangered plants and animals, to maintain water and air quality, to provide recreational use where appropriate and, where development and filling of wetlands is permitted, to restore or replace those wetlands and functions.

8) provide public access to educate citizens on the importance of the natural environment and to areas, where appropriate and where unacceptable degradation, unacceptable impacts to habitat and wildlife, or to ensure public safety.

9) preservation of agricultural lands as a source of food and fuel and for their contribution to cultural, environmental and economic diversity.

10) protection of unique geological features from alteration or destruction.

11) integration of ecosystem principles with wildfire hazard mitigation to guard against the danger of wildland fire in developments adjacent to forests and grasslands.

12) protection of water quality and aquifer and groundwater recharge areas within the Boulder Creek basin and Boulder Valley watersheds.

13) incorporation of short- and long-term environmental costs into resource planning decisions.

14) preservation of Open Space lands with unique natural features and characteristics by purchase of development rights, fee simple gifts or purchases and other measures.

15) commitment to using integrated pest management to reduce the use of chemical herbicides, pesticides and fungicides through selection of the most environmentally-sound approach to pest management.

16) preservation of historic and cultural resources through identification and protection of buildings, districts and sites of historical, architectural, archaeological or cultural significance.

17) ensure a sustainable community by maintaining and enhancing the liveability, health and vitality of the Boulder Valley and its bioregion and natural environment.

2.1.2 Boulder County Comprehensive Plan

Parks and Open Space: goals and policies

- Open space should meet human needs throughout the County in order to protect and enhance the quality of life and enjoyment of the environment, especially preserving lands adjacent to water bodies from development and preserving lands that provide scenic vistas such as the foothills portion of the County as much as possible in their natural state.

- Public use of open space shall be consistent with the purposes of the acquisition of the land and management plans prepared and the means to implement these plans.

- Open space should be promoted as an urban-shaping method and as a means of protecting from development those areas which have significant environmental, scenic or cultural value.

- A County-wide trail system shall be promoted to serve transportation and recreation purposes to provide for pedestrian, equestrian, bicycle and other uses, where each is

warranted, and trail locations shall minimize their impacts on the environment and surrounding private properties.

- County encourages cooperation between private landowners, non-county agencies and other government jurisdictions in open space preservation and trails development.

Land Use: goals and policies

- Maintain rural character by locating future urban development within or adjacent to existing urban areas in order to preserve agriculture, forestry and open land uses.

- Preserve and conserve agricultural lands.

Environmental Resources: Goals and Policies

- Conserve and preserve unique or distinctive natural features, areas and systems, recognizing the irreplaceable character of these natural features and areas and their importance to the quality of life in Boulder County.

- Preserve County natural areas and natural landmarks through planning of compatible surrounding land uses. Buckingham Palisades and Haystack Mountain are Boulder County Natural Landmarks. Six-Mile Fold is designated as both a County and State Natural Landmark.

- Designate critical wildlife habitats to ensure thorough reviews of land use proposals and compatibility of adjacent land uses.

- Preserve rare plant habitats and natural communities (including riparian areas and wetlands) as functioning native ecosystems, to maintain and enhance regional bio-diversity and contribute to an information baseline of ecological processes and functions.

- Cooperate with public agencies and private landowners in developing regional approaches to protecting natural communities and rare plant habitats; land use proposals will be reviewed to avoid disturbing, damaging or disrupting natural communities or rare plant habitats.

- Conserve wetlands; encourage private landowners to protect wetlands on private property and cooperate with public agencies and private landowners to develop regional approaches to protecting wetlands.

- Promote sound conservation practices with landowners and establish cooperative management plans with private landowners and public land management agencies, where appropriate.

- Protect riparian ecosystems, wildlife habitat and movement corridors by minimizing human impacts to riparian ecosystems from development, roads and trails and working with appropriate management agencies and property owners to protect or restore riparian areas.

- Ensure suitable minimum and maximum stream flows that maintain stream channel morphology, support hydrologically connected wetlands and perpetuate plant and animal species dependent on riparian ecosystems.

- Evaluate land use proposals that could have adverse impacts on riparian ecosystems to encourage avoidance of riparian ecosystems or to require appropriate mitigation.

- Encourage preservation and use of agricultural lands designated as National, Statewide or Local Importance

- Discourage conversion of agricultural lands to urban uses except in cases where the proposed use is consistent with the Boulder County Comprehensive Plan and would not affect adversely significant agricultural lands.

- Identify significant shortgrass prairie ecosystems and encourage the development of management plans for these prairie ecosystems.

The following goals and policies for Environmental Conservation Areas are among those contained in the Boulder County Comprehensive Plan that are relevant for area management planning:

- Conserve and preserve Environmental Conservation Areas to perpetuate species, biological communities and ecological processes that function over large geographic areas and require a high degree of naturalness.

- Encourage removal of development rights from Environmental Conservation Areas through transfer, donation, acquisition or trade.

- Minimize impacts on the flora and fauna of Environmental Conservation Areas from development by locating and designing the development.

- Encourage and participate in the development of coordinated management plans with various public and private owners to conserve, protect or restore the values of Environment Conservation Areas.

- Manage Environmental Conservation Areas to encourage use or mimicry of natural processes, maintenance or reintroduction of native species, restoration of degraded plant communities, elimination of undesirable exotic species, minimizing human impacts and development of long-term ecological monitoring programs.

- Land uses adjacent to Environmental Conservation Areas should be low intensity and provide a degree of buffering.

Cultural Resources: Goals and Policies

- Identify and protect prehistoric and historic sites that meet national, state or local criteria for historic designation from destruction or harmful alteration.

- Research county historic structures, sites and districts and archaeologically sensitive areas.

- Ensure that historic and archaeological resources are protected through the Boulder County Land Use Code and regulations.

- Encourage interjurisdictional cooperation to further the goals of historic and archaeological preservation. The City of Boulder Open Space Board of Trustees should be consulted when projects on City Open Space lands affect historic structures or sites.

APPENDIX 3.1 METHODS

3.1.1 Geographic Information Systems Methods

Geographic Information System (GIS) data development and support for the North Boulder Valley Inventory Report was provided by the City of Boulder Open Space GIS Lab.

Data was digitized and converted from the U.S. Department of Agriculture Soil Conservation Service and Boulder County sources. Most of the information represented was developed in-house, using 1993 orthographic 1" = 100' and 1" = 200' (digital) aerial photos as a field and map base. Additional planimetric line-work, developed for the City of Boulder by Merrick Aerial Photography (Denver), was used for building footprints and contours.

In-house fieldwork and mapping were digitized primarily in AutoCAD, using a CalComp Drawing Board 2 (9200) tablet. Attribution, analysis and data assembly were performed in AutoCAD, ArcCAD and ArcInfo.

The Lab consists of six PCS and one Sun Sparc 20 Unix machine operating CorelDRAW, Microsoft Word, Excel and Access, AutoCAD, ArcCAD, ArcView and ArcInfo software on a multi-platform integrated network (Windows 95, Windows NT, Novell and Unix). Graphic output is produced on Hewlett Packard printers and plotters.

All non-Open Space data sources retain copyrights and restrictions on their respective digital data. The City of Boulder's Electronic Data Dissemination Policies are available from the Public Works Department (441-3200). The maps in this report may not be reproduced without consent from the Open Space Department (441-3440).

3.1.2 Vegetation Mapping Methods

The vegetation mapping projects conducted on City of Boulder Open Space lands have used qualitative methods to classify and describe vegetation. Open Space Program methods establish a minimum mapping unit of ½ acre. Mapping is initiated in the office or computer lab by identifying distinct vegetation types on orthophotographs (April 1993, scale: 1" = 100' and 1" = 200') and drawing boundaries to delineate the types. Boundaries can be drawn directly on aerial photographs or on digital (computerized) versions of aerial photographs. This preliminary vegetation analysis can distinguish coarse level vegetation types such as forest, shrubland, and grassland.

Field checking of the initial map allows for boundary adjustments and the identification of plant communities. Fine level vegetation types are delineated based on plant species composition and frequency, soil types, geology and geomorphology. Species dominance is determined from

ocular estimates of frequency and cover within a square meter frame placed randomly, two to three times within a vegetation type. Field notes for each community polygon include lists or descriptions of dominant, common, uncommon and rare species, variation within the community, site condition, land use information, signs of wildlife use and other site characteristics.

Field data are entered into a Geographic Information System where they can be manipulated to produce a computer generated display of the vegetation. The Geographic Information System software used presently by the Program includes AutoCAD GSX Overlay, ArcCAD, and ArcView. A Geographic Information System database stores descriptive information (i.e., name of vegetation type) and numerical data (i.e., area of polygons, frequency of polygons, etc.). A classification hierarchy used to describe vegetation can be stored in the database. The North Boulder Valley Management Area vegetation types have been assigned community, habitat and ecosystem classes. The management area vegetation can be displayed with varying levels of detail by manipulating the database information.

Weed Mapping Methods

Weed infestations on Open Space are mapped onto aerial photographs and then entered into the Open Space Geographical Information System. The spread of weeds and the effects of various control methods on individual infestations can then be monitored over time. This data also helps prioritize and schedule treatment areas.

Individual infestations are mapped on 1"=200' or 1"=100' blue line or black line ortho photos using colored pencils. Each species of weed is mapped using a different color:

SPECIES	COLOR	SPECIES	COLOR
Canada Thistle	yellow	Purple Loosetrife	orange
Musk Thistle	red	Toadflax (Dalm. or Yellow)	purple
Diffuse Knapweed	light blue	Russian Olive	brown
Leafy Spurge	light green	*Other (Med. Sage, Myrtle Spurge, Cinquefoil, Tamarisk, etc.)	black
Whitetop/Hoary Cress	pink		

*When mapping with black, the species it represents should be noted on the map.

The density of each infestation is determined according to the table below, and the appropriate symbol is drawn within the boundaries of the infestation. A 1 meter diameter hoop is used for the first few days of mapping to allow mappers to get a feeling for what different densities look like. After that densities are estimated.

CATEGORY	SYMBOL	PARAMETERS
Scattered	S	>2 plants/ 50 sq .feet but <2 plants/ sq. meter
Light	L	2 to 5 plants/ sq. meter
Moderate	M	6 to 9 plants/ sq. meter
Heavy	H	10 or more plants/ sq. meter

A minimum mapping area has been set at 50 square feet or 1/16th of an acre. This means that infestations smaller than this size must be mapped as 1/16 acre. This equals a one half inch square on 1"=100' maps and a 1/4 inch square on 1"=200'. This does not mean, that they must be mapped as squares and many times will follow soils or land types. Fifty feet is also the minimum distance between two infestations of the same species. If weed infestations having the same density are closer than 50 feet, they become one infestation. All infestations should be mapped as closed polygons. If an infestation continues off of the property being mapped, a dotted line along the property boundary can denote this.

Densities are also "blended" together in certain situations. This helps streamline data and makes it easier to digitize. For example, Canada thistle spreads vegetatively so a map could look like a "bulls eye" of three or four different densities in one area. These densities should be blended to favor the two most distinctive densities. Infestations containing two densities that were similar in plants per meter (5 plants/meter and 7 plants/meter on average) are blended. In this situation, choose the density that covers the most area.

Mapping technique can vary depending on the number of mappers. A solitary mapper covers ground methodically until a weed is found, and then circles it to determine if another weed of the same species is within 50 feet of it. If so, the infestation is mappable and the location is plotted on the aerial photograph. The mapper then follows the infestation until it ends (i.e., goes 50 feet without finding a weed) in all directions, plotting the boundary as she goes. Two mappers can follow the boundary in opposite directions until they meet, and then draw the boundary on the map. Three or more mappers may operate independently (if enough copies of the map are available) or cover the property in swaths, walking 20 to 50 feet apart (depending on terrain, vegetation and weed density) and telling the designated mapper (walking in the middle of the swath) what they see. The most efficient method depends on the size and shape of the property, the availability of landmarks, and the vegetation density.

3.1.3 Wetlands Research Methods

The first comprehensive wetland mapping project that included the Boulder Valley was undertaken by the U.S. Fish and Wildlife Service as part of the National Wetland Inventory. For the Boulder Valley wetlands coverage, National Wetland Inventory mapping was published in 1983 and is based upon 1976 aerial photography. National Wetland Inventory mapping was published at a scale of 1:24,000 and produced as an overlay to existing U.S. Geological Survey 7.5 minute topographical maps. The Boulder and Niwot, Colorado quadrangles contain the National Wetland Inventory information relevant to the North Boulder Valley Management Area. Wetlands are classified on National Wetland Inventory maps in accordance with Cowardin *et al.* (1979).

In the North Boulder Valley Management Area the National Wetland Inventory mapping provides good, general information about the location of wetlands. However, because of the

methods used and the time lapse since the mapping, the current extent of wetlands differs dramatically from the National Wetland Inventory information.

The U.S. Environmental Protection Agency and the City of Boulder co-sponsored a wetland mapping and evaluation project during the summers of 1987, 1988 and 1990 in anticipation of a local wetlands protection program (Cooper 1988). Subsequent work beginning in the summer of 1992 resulted in compatible mapping and evaluation of wetlands on other Open Space property within the study area. The full details of the methodology are given in Cooper (1988) and Gershman (1991) and are summarized here.

A set of 1"=400' aerial photographs and National Wetland Inventory maps for the Open Space system were used to approximate the locations of wetlands. A field data sheet was prepared for each wetland. The evaluation included a floristic inventory and rough estimates of plant cover for plant species encountered. Each wetland was rated with regard to the following ecological functions and social values shown in the table below.

Wetland functions and values ranked in City of Boulder Wetlands Identification project.

Groundwater Recharge	Groundwater Discharge	Flood Storage	Fish Habitat
Passive Recreation	Wildlife Habitat	Shoreline Anchoring	
Active Recreation (not used for Open Space wetlands)	Nutrient Retention long term short term	Food Chain Support within basin downstream	

The ranking system provided a scale to measure the degree to which each function is performed. Each wetland was given a single rating.

A rating of 1 indicates that a function was not being performed and could not be performed by that particular wetland. A ranking of 2 indicates that the function was performed to a low degree. A ranking of 3 indicates that the function was performed to a medium or average degree. A ranking of 4 indicates that the function was performed to a high degree. A ranking of 5 indicates a function was performed to an extremely high degree. Further description of these functions and values may be found in Cooper (1988).

The approximate boundaries of each wetland were drawn on field copies of aerial photographs. Each wetland outline was numbered; numbers were the same on the aerial photographs and the data sheet. Information from the data sheets was then recorded in a computerized database. Wetland boundaries were transferred to mylar base maps and digitized for use with a geographic information system. Beginning in 1991, wetland boundaries were digitized directly from aerial photographs and no mylars were prepared. The wetland boundaries are approximate and do not

represent delineations for legal purposes. It is also possible that some wetlands were not mapped.

The North Boulder Valley study area was revisited several times in the summer and fall of 1995 to reassess conditions, map wetlands on properties acquired since the initial mapping effort and look for wetlands that may have been missed during the earlier surveys.

3.1.4 Wildlife Research Methods

Information sources
Information for the North Boulder Valley wildlife report was gathered from a variety of sources: (1) research projects done in North Boulder Valley (Adams 1995, Adams et al. 1987, Bock and Bock 1994, 1995, Blumestien 1986, Brighton and Lyman 1995, Coppolillo 1993, Daley 1992, Dawson 1989, Fletcher 1995, Jones 1987, 1989, 1993, Knight and Miller 1995, Motis 1989, Sandy 1989, Scott 1995); (2) consultant reports done for the Open Space Program (BCNA 1990, ERO Resources 1995, Thompson and Strauch 1987); (3) Open Space Program survey and monitoring work and associated databases (e.g., Wildlife Sightings Database, Avian Transects, Deer Survey, Predator Sightings Database); and (4) staff and volunteer knowledge of the management area and information from local organizations and agencies with particular knowledge of the management area (i.e., Boulder County Nature Association , City of Boulder Mountain Parks, Boulder County Parks and Open Space).

Information on habitat affinities of various vertebrate species was developed to compare documented reports of animals with species expected to occur in North Boulder Valley. The Open Space Program maintains a Wildlife Sightings Database that contains location-specific reports of a variety of wildlife species. This database has more than 14,000 sightings for the entire Open Space system (from 1987-present). Records cataloged in the database include location-specific data from research and consultant reports as well as incidental sightings and wildlife monitoring results.

Management recommendations and background information contained in various consultant reports, research reports, unpublished Program reports, and historic studies that pertain to the management area were incorporated into databases. Historic studies (Alexander 1937, Betts 1913, Henderson 1909) and other databases (Audubon Christmas Bird Count , Boulder County Nature Association Winter Raptor Survey) or information (Fitzgerald et al. 1995, Andrews and Ryder 1992) that focus on vertebrates throughout the Boulder Valley and Colorado were used to ensure thorough analyses of wildlife in North Boulder Valley.

Avian transects
Three avian (formerly "wildlife") survey routes (nineteen system-wide) are located in North Boulder Valley -- one on the north side of Boulder Valley Ranch pond in the grasslands, one on the Schneider and Nejezchleb properties in the riparian zone, and one on Parsons property in

mixed-grass prairie. Each route contains a series of 100 meter fixed radius circular plots (point counts). Transects are sampled by trained volunteers in January, April, July, and October (one sample per sampling period). Information from these surveys has been incorporated into the wildlife species database, since it is not realistic to analyze information from individual routes or individual points along the routes.

Predator tracking transect
A predator tracking transect was located on the Parsons property; this was discontinued in 1995 (see Miller 1995). No information from this transect was available for this report.

Herpetofauna survey
A survey of amphibians and reptiles was conducted throughout the system (Merrit 1993). General reconnaissance and designated transects were used in a variety of habitats and areas. One transect was located north of the Boulder Valley Ranch pond; it yielded no results. Spring vocalization surveys were conducted in 1995 to census amphibians (Gershman, unpubl. data).

Winter raptor and bird surveys
Winter Raptor Survey routes are run once each month from November-March each year by volunteers from the Boulder County Nature Association. Designated routes are driven at a constant speed and raptors seen from the survey route are recorded to species on a map. A relative abundance (raptors/km) is obtained to provide information on determining population trends. The Boulder Reservoir winter raptor survey route (which includes City and private land) has been sampled since 1984.

The Audubon Christmas Bird Count has been run since 1909 in Boulder County (annually since 1950). A 12 kilometer radius circle centered on 19th and Alpine Streets in Boulder is surveyed for one day by volunteer bird watchers annually in December. Relative numbers of birds (birds/count with party hours controlled) are obtained. Although the Christmas Bird Count data are not specific to North Boulder Valley, the trends in bird numbers for the Boulder Valley are pertinent for comparison.

Christmas Bird Count results can be compared to Winter Raptor Survey results by reformatting the Christmas Bird Count data using the number of each species divided by the total number of hours observers spent in the field to control for effort bias between years (observations/party hours). The result is normalized (0-1) by dividing the observations/party hours by the largest value.

Deer survey
Annual mule deer censuses are done by the City of Boulder Mountain Parks Division and Open Space Program. Two different techniques, yielding the same result (number of deer/count period), are done across the western half of the City owned lands including the Mountain Parks and Open Space. The southern boundary for the counts is Eldorado Canyon Drive and the

northern boundary is the canyon on the Schneider and Nejezchleb properties. The developed area of the city is the eastern boundary and the western boundary is located at the furthest western border of the City of Boulder property boundary. Helicopter surveys are flown each December-February. Three counts are taken and a mean and standard error of deer/year is obtained. There is no attempt to differentiate between sex's or age. Spring (April) ground counts are done annually to obtain an additional estimate of relative abundance of deer (deer/year). Designated transects are walked in the same survey area described above. Sex is noted if discernable during the ground counts.

3.1.5 Cultural Resource Inventory Methods

The North Boulder Valley Management Area was inventoried by a crew of three to four archaeologists walking a series of parallel, adjacent transects at intervals of 30 meters or less. In relatively flat areas, transects could be oriented along compass bearings. In steeper areas, transects followed contours of the slopes where possible. Road and drainage cuts, tracks and trails, eroded surfaces, anthills, and rodent backdirt piles were closely inspected for evidence of buried cultural material. Vegetative cover throughout the project area was generally heavy, consisting of thick grasses in open meadows. Ground visibility was generally poor, averaging about 20-40% visibility.

Evidence of cultural resources was sought in the form of material debris, structural remains or any other unusual surface anomaly. Isolated finds were defined as no more than four artifacts in the space of 100 by 100 meters, or solitary features without associated artifacts. Sites were minimally defined by the presence of five or more artifacts, two or more features, or a feature with artifacts or structural remains. The appropriate Colorado Office of Archaeology and Historic Preservation forms were completed for each site or find. Black-and-white photographs were taken and a sketch map drawn of each site. Artifacts were described in the field. No testing was conducted, nor were any artifact collections made.

Significance and Eligibility Assessments
The sites and isolated finds newly documented within the project area were evaluated for their significance and eligibility to the National Register of Historic Places, the State Register of Historic Properties and the Boulder County Register of Historic Places. Specific management recommendations regarding treatment of the cultural resources follow the eligibility assessments.

National Register of Historic Places eligibility is judged according the criteria set forth in 36CFR 60.4 below:

> "National Register Criteria" means the following criteria established by the Secretary of the Interior for the use in evaluating and determining the eligibility of properties for listing in the National Register: The quality of significance in American history, architecture, archaeology, engineering and culture is present in districts, sites, buildings,

structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling and association and:

(A) That are associated with events that have made a significant contribution to the broad patterns of our history; or

(B) That are associated with the lives of persons significant in our past; or

(C) That embody the distinctive characteristics of a type, period or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

(D) That have yielded, or may be likely to yield, information important in prehistory of history.

The State Register of Historic Properties uses essentially the same criteria as above, with the addition of a fifth criterion, that being "geographical importance." The Boulder County Register is designed to recognize cultural properties of local significance.

3.1.6 Property Information Inventory Methods

Two main sources were used to collect the information on the individual Open Space properties: the property data base, located in the Program's Geographic Information System and the property inventory files, located in the Program's administrative office. The property inventory files are the end product of a research effort undertaken to assist with the area management planning process. The property inventory files contain any information relevant to a property's purchase and management, as it relates to public or private access to the property. Information in the property inventory files was gleaned from the Program's extensive inventory of files compiled for each Open Space property purchase. Additional files from the City's Central Records were also used.

APPENDIX 5.1 NON-TECHNICAL SOILS DESCRIPTION

Information derived from Moreland and Moreland (1975).

Map Symbol(acres)	Description
BaF (1,022)	BALLER STONY SANDY LOAM, 9-35% SLOPES: The Baller soil is shallow and well drained. It is formed on upland ridges from sandstone. The surface is a grayish-brown stony sandy loam. The underlying material is a brownish-gray stony sandy loam. Permeability is rapid, and roots can penetrate to a depth of 10-20 inches. Available water holding capacity is low. Runoff is rapid with a high water erosion hazard. The hazard of soil blowing is high. This soil has a moderate to severe limitation for paths and trails due to percent slope. All of the acreage of this soil is in native grass. In some places there are scattered stands of ponderosa pine.
Cu (11)	COLLUVIAL LAND: The Colluvial Land is in long narrow valleys. This land type varies widely in depth, texture, color, reaction and stoniness. The surface layer is mainly a sandy loam that contains varying amounts of stones and cobbles. The underlying material ranges from loamy sands to clay. The soil material ranges from shallow to deep. Lime content ranges from strongly calcareous to noncalcareous, and reaction ranges from neutral to moderately alkaline. Colluvial Land receives runoff from adjacent slopes. The water erosion hazard is high. The wind erosion hazard is moderate to high. Most areas of Colluvial Land have stones and cobbles on the surface that interfere with cultivation. This soil has a moderate to severe limitation for paths and trails due to stones and cobbles in the surface layer and it is subject to water runoff from adjacent slopes. Most of the acreage is used for grass. Some small local areas that were once farmed have been reseeded to grass.
HeC (98)	HELDT CLAY, 3-5% SLOPES: The Heldt soil is deep and well drained. It formed in fine texture alluvium derived from soft shale. Typically the surface layer is calcareous clay loam about 5 inches thick. The subsoil is calcareous silty clay about 32 inches thick. The substratum is calcareous silty clay loam to a depth of 60 inches or more. Permeability is slow. Available water holding capacity is high. The rooting depth is typically 60 inches or more. Runoff water is slow to moderate and hazard of water erosion is slight to moderate. Hazard of soil blowing is high. This soil has a severe limitation for paths and trails due to silty clay layer. About half of

Map Symbol(acres)	Description
	the acreage is used for irrigated crops and the rest is used for dryland crops.
KuD (32)	KUTCH CLAY LOAM, 3-9% SLOPES: The Kutch soil is moderately deep and well drained. The soils are formed on uplands and valley sides from sedimentary rock. The surface is a dark grayish-brown clay loam. In some places scattered gravel and cobblestones are on the surface. The subsoil is brown clay. The permeability is slow. Its available water holding capacity is moderate. Normal rooting depth is 20-40 inches. Runoff is rapid and the water erosion hazard is moderate. The wind erosion hazard is high. This soil has a moderate limitation for paths and trails due to the clay loam surface layer. This soil is used for irrigated and nonirrigated crops and for native pasture.
LaE (19)	LAPORTE VERY FINE SANDY LOAM, 5-20% SLOPES: This soil formed on upland ridges in loamy residuum derived from limestone and limy shale. The surface layer is strongly calcareous, pale-brown very fine sandy loam about 8 inches thick. The underlying material is strongly calcareous, pale-brown loam , about 5 inches thick, that overlies limestone. Soil reaction is moderately alkaline. Laporte soils have a moderate permeability. Available water holding capacity is low. Roots can penetrate to a depth of between 10-20 inches. Runoff is medium to rapid on this soil. The water erosion is high. The wind erosion hazard is high. This soil has a slight to moderate limitation for paths and trails due to percent slope. These soils are used mainly for pasture or range.
LoB (250)	LONGMONT CLAY, 0-3% SLOPES: The Longmont soil is a deep, poorly drained soil which may be salty or alkaline. It is formed on upland swales and terraces from shale material. The surface is calcareous light brownish-gray and light olive-brown clay. The underlying material is calcareous, light olive-brown and pale-olive clay. The soils have slow permeability. Their available water holding capacity is high. Roots penetrate to 60 inches or more and the seasonable high water table is between a depth of 2-4 feet. Runoff is slow and the water erosion hazard is slight. The wind erosion hazard is high. This soil has a severe limitation for paths and trails due to clay surface layer. Almost all of the acreage of this soil is in pasture.

Map Symbol(acres)	Description
Me (41)	MANVEL LOAM, 1-3% SLOPES: The Manvel soil is a deep well-drained soil. It is formed on smooth uplands in calcareous, loamy material. The surface is a grayish-brown loam. The underlying material is a pale brown and yellowish-brown loam. The soils have moderate permeability. Their available water holding capacity is high. Roots penetrate to 60 inches or more. Runoff is medium and the water erosion hazard is slight. The wind erosion hazard is high. This soil has a slight limitation for paths and trails. All of the acreage of this soil is used for irrigated and dryland crops and for pasture.
NdD (31)	NEDERLAND VERY COBBLY SANDY LOAM, 1-3% SLOPES: These soils is on outwash fans and on the uplands. In most places it occurs as areas more than 50 acres in size. These areas have many stones and cobblestones on the surface. Included with this soil in mapping are some soils that lack a sandy clay loam subsoil and that are very stony and cobbly sandy loam throughout the profile. Also included are some small areas of Valmont cobbly clay loam, 1-5% slopes. The included soils make up about 20% of each mapped area. Runoff is slow to medium on this soil. The erosion water hazard is slight. The wind erosion hazard is slight. This soil has a moderate to severe limitation for paths and trails due a very cobbles surface layer. Most of the acreage of this soil is used for range or pasture.
NS (4)	NON-SOIL: This is an area where the entire soil profile has been removed from the site. This leaves parent material exposed. Generally the site has been mined for topsoil, roadfill, gravel or rock or a combination of materials.
NuB (12)	NUNN CLAY LOAM, 1-3% SLOPES: The Nunn soil is a deep well-drained soil. It is formed on terraces and valley side slopes in loamy material. The surface is a grayish-brown clay loam. The underlying material is a clay or clay loam. The soils have slow and moderately slow permeability. Their available water holding capacity is high. Roots penetrate to 60 inches or more. Runoff is medium and the water erosion hazard is slight. The wind erosion hazard is slight. This soil has a moderate limitation for paths and trails due to clay loam surface layer. Most of the acreage of soil is used for irrigated crops and pasture, and the rest is used for dryland crops.

Map Symbol(acres)	Description
NuC (63)	NUNN CLAY LOAM, 3-5% SLOPES: The Nunn soil is a deep well-drained soil. It is formed on terraces and valley side slopes in loamy material. The surface is a grayish-brown clay loam. The soils have slow and moderately slow permeability. This soil has a severe limitation for paths and trails due to clay loam surface layer. It is formed on terraces and valley side slopes in loamy material. The surface is a grayish-brown clay loam. The underlying material is a clay or clay loam. The soils have slow and moderately slow permeability. Their available water holding capacity is high. Roots penetrate to 60 inches or more. Runoff is medium and the water erosion hazard is slight. The wind erosion hazard is slight. This soil has a moderate limitation for paths and trails due to clay loam surface layer. Most of the acreage of this soil is used for irrigated and dryland crops and for pasture.
NuD (36)	NUNN CLAY LOAM, 5-9% SLOPES: The Nunn soil is a deep well-drained soil. It is formed on terraces and valley side slopes in loamy material. The surface is a grayish-brown clay loam. The underlying material is clay or clay loam. The soils have moderately slow permeability. Their available water holding capacity is high. Roots penetrate to 60 inches or more. Runoff is rapid and the water erosion hazard is slight. The wind erosion hazard is slight. This soil has a moderate limitation for paths and trails due to clay loam surface layer. Most of the acreage of this soil is used for irrigated and dryland crops and for pasture.
ReD (891)	RENOHILL LOAM, 3-9% SLOPES: The Renohill soil is a moderately deep, well-drained soil. It is formed on upland hills and ridges in loamy material. The surface is a slightly calcareous, light olive brown silty clay loam. The underlying material is a light olive brown and light yellowish-brown silty clay and silty clay loam. The soils have slow permeability. Their available water holding capacity is moderate. Roots penetrate 20-40 inches. Runoff is rapid and the water erosion hazard is high. The wind erosion hazard is high. Most of this area is in native range. This soil has a slight limitation for paths and trails.
RnB (56)	RENOHILL SILTY CLAY LOAM, 1-3% SLOPES: The Renohill soil is a moderately deep soil. It is formed on upland hills and ridges in loamy material. The surface is a slightly calcareous, light olive-brown silty clay loam. The underlying material is a light olive-brown and light yellowish-

Map Symbol(acres)	Description
	brown silty clay and silty clay loam. The soils have slow permeability. Their available water holding capacity is moderate. Roots penetrate 20-40 inches. Runoff is medium and the water erosion hazard is slight. The wind erosion hazard is high. This soil has a moderate limitation for paths and trails due to silty clay loam surface layer. Almost all of the acreage of this soil is cultivated and is used for irrigated crops and pasture.
RnD (56)	RENOHILL SILTY CLAY LOAM, 3-9% SLOPES: The Renohill soil is a moderately deep soil. It is formed on upland hills and ridges in loamy material. The surface is a slightly calcareous, light olive brown silty clay loam. The underlying material is a light olive brown and light yellowish-brown silty clay and silty clay loam. The soils have slow permeability. Their available water holding capacity is moderate. Roots penetrate 20-40 inches. Runoff is rapid and the water erosion hazard is moderate. The wind erosion hazard is high. This soil has a moderate limitation for paths and trails due to silty clay loam surface layer. All of the acreage of this soil is used for irrigated and dryland crops and for pasture.
Ro (27)	ROCK OUTCROP: Rock outcrop consist mainly of steep slopes and cliffs in the mostly western part of the Soil Survey area. These barren areas are predominantly exposed bedrock that consist of mixed materials, including granite, sandstone, shale and limestone. Included in mapping are areas of shallow soil that has less slope and is in areas of mixed colluvium near the bottom of slopes. This soil has a severe limitation for paths and trails due to exposed bedrock on the surface. Rock outcrop is used mainly for watershed and wildlife habitat.
SaD (26)	SAMSIL CLAY, 3-12% SLOPES: The Samsil soil is shallow and well drained. It formed on upland ridges in residuum from shale. The surface is strongly calcareous, light brownish-gray clay. Underlying this is a strongly calcareous, light yellowish-brown clay. Permeability is slow. Available water holding capacity is low. Effective rooting depth is 5-20 inches. Runoff is rapid and the hazard of water erosion is moderate. Wind erosion hazard is high. This soil has a severe limitation for paths and trails due to clay surface layer. This soil is best suited to pasture and is best used for dry pasture.
SeE (208)	SAMSIL-SHINGLE COMPLEX, 5-25% SLOPES: This complex is made up of about 40% Samsil clay and about 40% Shingle soils. The soils are

Map Symbol(acres)	Description
	shallow and well drained. The Samsil soils are formed on upland ridges in residuum from shale. The surface is strongly calcareous, light brownish-gray clay. Underlying this is a strongly calcareous, light yellowish-brown clay. The Shingle soils formed on upland hills and ridges in calcareous loamy residuum from shale and sandstone. The surface layer is strongly calcareous, pale-brown loam. Underlying this is strongly calcareous, brownish-yellow loam over weathered shale and sandstone. The surface layer is mildly alkaline, and with increased depth, it becomes moderately alkaline. Permeability for the complex is slow to moderate. Available water holding capacity is low. Effective rooting depth is 5-20 inches. Runoff is rapid and the hazard of water erosion is severe. The wind erosion hazard is high. This soil has a moderate to severe limitation for paths and trails due to clay surface layer in places. Most of the acreage is used for pasture or range.
SmF (250)	SIXMILE STONY LOAM, 10-50% SLOPES: This soil is on the uplands on the western side of steep ridges. This soil is moderately deep, and well drained. Roots can penetrate to a depth of between 20-40 inches. Included with this soil in mapping are narrow bands of Rock outcrop and rock escarpments. Rock outcrop is throughout the management area, and in most places the escarpments are on ridgetops. Also included near the base of slopes are small areas of Colluvial land. Included Rock outcrop, rock escarpments and Colluvial land make up about 20% of each mapped area. Runoff is rapid on this soil. The water erosion hazard is high. The wind erosion hazard is slight. This soil has a moderate to severe limitation for paths and trails due to percent slope. All of the acreage of this soil is in native range.
Te (327)	TERRACE ESCARPMENTS: Terrace Escarpments are on side slopes of old outwash fans and terraces in the central part of the Soil Survey area. Soil areas are long and narrow. These areas consist of undifferentiated shallow soils that have many cobbles and stones on the surface. In many places there is merely a thin layer of cobbles over sandstone or shale. Included in mapping are some deeper soils near the bottom of slopes. Runoff is rapid, and the water erosion hazard is high. The wind erosion hazard is slight. Terrace escarpments take in water slowly, but in places intake of water is influenced by the amount of stones and cobblestones on the surface. Only limited moisture is available for plants because these undifferentiated soils are shallow. This soil has a moderate to severe

Map Symbol	Description
	limitation for paths and trails due to percent slope. This soil is used for native range and wildlife habitat.
VaB (398)	VALMONT CLAY LOAM, 1-3% SLOPES: This soil is on terraces and fans. In most places it is long, narrow areas more than 20 acres in size. The surfaces a grayish-brown light clay loam that contains various amounts of cobbles and gravel. The upper part of the subsoil is brown clay loam. The middle part is brown light clay loam and the lower part is calcareous, light-brown gravelly clay loam. The underlying material is calcareous, pinkish-white and light-brown very gravelly loam. Roots can penetrate to a depth of 60 inches or more. Permeability is moderately slow and available water holding capacity is moderate. Runoff is medium on this soil. The water erosion hazard is slight. The wind erosion hazard is high. This soil has a moderate limitation for paths and trails due to clay loam surface layer. Most of this acreage is used for irrigated and dryland crops and pasture.
VaC (9)	VALMONT CLAY LOAM, 3-5% SLOPES: This soil is on terraces and fans. In most places it is long, narrow areas more than 20 acres in size. The surfaces a grayish-brown light clay loam that contains various amounts of cobbles and gravel. The upper part of the subsoil is brown clay loam. The middle part is brown light clay loam and the lower part is calcareous, light-brown gravelly clay loam. The underlying material is calcareous, pinkish-white and light-brown very gravelly loam. Roots can penetrate to a depth of 60 inches or more. Permeability is moderately slow and available water holding capacity is moderate. Runoff is rapid on this soil. The water erosion hazard is slight to moderate. The wind erosion hazard is high. This soil has a moderate limitation for paths and trails due to cobbly clay loam surface layer. Most of this acreage is used for irrigated and dryland crops and pasture.
VcC (939)	VALMONT COBBLY CLAY LOAM, 1-5% SLOPES: This soil is on high terraces and outwash fans. In most places it is areas more than 20 acres in size. The surfaces a grayish-brown light cobbly clay loam that contains various amounts of cobbles and gravel. The subsoil is cobbly clay loam or cobbly loam. The underlying material is calcareous, pinkish-white and light-brown very gravelly loam. Roots can penetrate to a depth of 60 inches or more. Permeability is moderately slow and available water

holding capacity is moderate. Runoff is rapid on this soil. The water erosion hazard is slight to moderate. The wind erosion hazard is slight. This soil has a moderate limitation for paths and trails due to cobbly clay loam surface layer. This soil is not well suited to cultivation and the harvest of crops because it has to many cobblestones and to much gravel on its surface. It is a good grass producing soil. Most of the area is used for native range.

The following soils, including those previously listed above, are found in the are immediately surrounding the North Boulder Valley Management Area.

Map Symbol	Description
CaB	CALKINS SANDY LOAM, 1-3% SLOPES: The Calkins soil is deep and poorly drained. It is formed of loamy material on terraces and bottom lands. Its surface is a grayish-brown sandy loam. A brownish-gray coarse sandy loam underlies this material. The permeability is moderate to rapid and it has a moderate to high water holding capacity. The possible rooting depth extends to 60 inches or more. Runoff is slow with a slight water erosion hazard. The hazard of soil blowing is high. This soil has a slight to moderate limitation for paths and trails due to somewhat poorly drained soils. All of the acreage of this soil is used for irrigated crops.
GrF	GOLDVALE-ROCK OUTCROP COMPLEX, 9-55% SLOPES: This complex is made up of about 55% Goldvale stony course sandy loam and about 30% Rock outcrop. This complex is on long mountain spurs and ridges in the western part of the Soil Survey area. Goldvale soils are on the smoother west-facing slopes where there are trees. Rock outcrop is throughout the complex, but particular on the ridgetops. Included in this complex in mapping are minor amounts of shallow soils on ridgetops, and alluvial soils along the edges of streams and drainage ways. These included soils make up about 15% of each mapping area. Runoff is rapid on areas of this complex. The water erosion hazard is moderate to high. The wind erosion hazard is slight. This soil has a moderate to severe limitation for paths and trails due to percent slopes and rock outcrops throughout the complex. All of the acreage of this complex is used for grazing livestock and for woodland.
HeB	HELDT CLAY, 0-3% SLOPES: The Heldt soil is deep and well drained. It formed in fine texture alluvium derived from soft shale. Typically the surface

Map Symbol	Description
	layer is calcareous clay loam about 5 inches thick. The subsoil is calcareous silty clay about 32 inches thick. The substratum is calcareous silty clay loam to a depth of 60 inches or more. Permeability is slow. Available water holding capacity is high. The rooting depth is typically 60 inches or more. Runoff is slow and hazard of water erosion is slight. Hazard of soil blowing is high. This soil has a severe limitation for paths and trails due to silty clay layer. About two-thirds of the acreage of this soil is used for irrigated crops. The rest is used for dryland crops.
NuA	NUNN CLAY LOAM, 0-1% SLOPES: The Nunn soil is a deep well-drained soil. It is formed on terraces and valley side slopes in loamy material. The surface is a grayish-brown clay loam. The underlying material is a clay or clay loam. The soils have slow and moderately slow permeability. Their available water holding capacity is high. Roots penetrate to 60 inches or more. Runoff is slow and the water erosion hazard is slight. The wind erosion hazard is slight. This soil has a moderate limitation for paths and trails due to clay loam surface layer. Almost all of the acreage of this soil is used for irrigated crops, but a few acres are used for irrigated pasture
Nh	NIWOT SOILS, 0-1% SLOPES: These soils are on stream terraces and bottoms. In most places they occur as irregularly shaped areas. The surface layer is variable in texture, from sandy clay loam to light clay loam to loam. Included with these soils in mapping are small, almost barren gravel bars and small areas of Love land soils. Also included are unnamed soils that are sandy. These included soils and gravel bars make up about 15% of each mapped area. Runoff is slow on these soils. The water erosion hazard is slight except for back cutting near channels. The wind erosion hazard is slight. This soil has a moderate limitation for paths and trails due to being somewhat poorly drained soils. Because of their position in the landscape, these soils are frequently flooded. They have a seasonal high water table. Because of the high water table and the depth to sand or gravel, these soils are best suited for the use as pasture or meadow.
NnB	NUNN SANDY CLAY LOAM, 1-3% SLOPES: The Nunn soil is deep and well drained. It is formed on terraces and valley side slopes in loamy alluvium. The surface layer is clay loam. The subsoil is clay and clay loam. The soil has slow to moderately slow permeability. The available water holding capacity is high. Roots penetrate to a depth of 60 inches or more. Runoff is medium and the water erosion hazard is slight. The wind erosion hazard is slight. This soil has a moderate limitation for paths and trails due to sandy clay loam surface layer.

Almost all of the acreage of this soil is used for irrigated crops, but a few acres are used for irrigated pasture.

PrF PINTA-ROCK OUTCROP COMPLEX, 5-55% SLOPES: This complex is on upland ridges. It is about 45% Pinata very stony loam fine sand and about 35% Rock outcrop. The Pinta soils are made up of moderately deep well drained soils that formed on upland ridges and side slopes. These soils developed in stony sand to clay residuum and colluvium weathered sandstone and shale. The surface layer is pink very stony loamy fine sand. The subsoil is a red very stony clay that overlies sandstone. Soil reaction is slightly acid. Pinata soils have slow permeability. Available water capacity for the profile is moderate. Rock outcrop consist mainly of steep slopes and cliffs in the mostly western part of the Soil Survey area. These barren areas are predominantly exposed bedrock that consist of mixed materials, including granite, sandstone, shale and limestone. Included in mapping are areas of shallow soil that has less slope and is in areas of mixed colluvium near the bottom of slopes. Runoff is medium to rapid on areas of this complex. The water erosion hazard is moderate. The wind erosion hazard is high. Roots can penetrate to a depth of between 20-40 inches. This soil has a slight to severe limitation for paths and trails due to percent slopes and moderate to severe limitation due to rock outcrops throughout the complex. Most of the acreage of this complex is used for forestry, wildlife habitat and limited grazing by livestock

APPENDIX 6.1 VEGETATION TYPES AND ASSOCIATED SOIL UNITS

Vegetation Type	*Soil Unit*
Foothills Mixed Grassland	Nederland Very Cobbly Sandy Loam (NdD)
	Nunn Clay Loam (NuD)
	Renohill Loam (ReD)
	Renohill Silty Clay Loam (RnD)
	Rock Outcrop (Ro)
	Samsil Clay (SaD)
	Samsil-Shingle Complex (SeE)
	Sixmile Stony Loam (SmF)
	Terrace Escarpments (Te)
	Valmont Clay Loam (VaB)
	Valmont Cobbly Clay Loam (VcC)
Mixed Grass Prairie	Baller Stony Sandy Loam (BaF)
	Heldt Clay (HeC)
	Kutch Clay Loam (KuD)
	Laport Very Fine Sandy Loam (LaE)
	Longmont Clay (LoB)
	Nederland Very Cobbly Sandy Loam (NdD)
	Nunn Clay Loam (NuD)
	Renohill Loam (ReD)
	Renohill Silty Clay Loam (RnB, RnD)
	Rock Outcrop (Ro)
	Samsil-Shingle Complex (SeE)

Vegetation Type	*Soil Unit*
	Terrace Escarpments (Te)
	Valmont Clay Loam (VaB, VaC)
	Valmont Cobbly Clay Loam (VcC)
Shortgrass Prairie	Laport Very Fine Sandy Loam (LaE)
	Renohill Loam (ReD)
	Terrace Escarpments (Te)
	Valmont Cobbly Clay Loam (VcC)
Savannah	Baller Stony Sandy Loam (BaF)
	Colluvial Land (Cu)
	Sixmile Stony Loam (SmF)
Forb Dominated Vegetation	Renohill Loam (ReD)
	Terrace Escarpments (Te)
	Valmont Cobbly Clay Loam (VcC)
Foothills shrubland	Baller Stony Sandy Loam (BaF)
	Colluvial Land (Cu)
	Laport Very Fine Sandy Loam (LaE)
	Manvel Loam (Me)
	Nederland Very Cobbly Sandy Loam (NdD)
	Nunn Clay Loam (NuD)
	Renohill Loam (ReD)
	Rock Outcrop (Ro)
	Samsil Clay (SaD)
	Sixmile Stony Loam (SmF)
	Terrace Escarpments (Te)
	Valmont Cobbly Clay Loam (VcC)

Vegetation Type	*Soil Unit*
Scarp Woodland	Baller Stony Sandy Loam (BaF)
	Rock Outcrop (Ro)
Ponderosa pine forest/woodland	Baller Stony Sandy Loam (BaF)
	Colluvial Land (Cu)
	Sixmile Stony Loam (SmF)
Foothills Riparian Forest/Woodland	Nunn Clay Loam (NuD)
	Renohill Loam (ReD)
	Terrace Escarpments (Te)
Plains Riparian Forest/Woodland	Baller Stony Sandy Loam (BaF)
	Laport Very Fine Sandy Loam (LaE)
	Renohill Loam (ReD)
	Rock Outcrop (Ro)
	Terrace Escarpments (Te)
	Valmont Clay Loam (VaB)
	Valmont Cobbly Clay Loam (VcC)
Plains Riparian Shrubland	Baller Stony Sandy Loam (BaF)
	Colluvial Land (Cu)
	Renohill Loam (ReD)
	Sixmile Stony Loam (SmF)
	Terrace Escarpments (Te)
Non-native Grassland: Hayfield and Pasture	Baller Stony Sandy Loam (BaF)
	Heldt Clay (HeC)
	Kutch Clay Loam (KuD)
	Laport Very Fine Sandy Loam (LaE)
	Longmont Clay (LoB)

Vegetation Type	*Soil Unit*
	Manvel Loam (Me)
	Non-soil (NS)
	Nunn Clay Loam (NuB, NuC)
	Renohill Loam (ReD)
	Renohill Silty Clay Loam (RnB, RnD)
	Rock Outcrop (Ro)
	Samsil Clay (SaD)
	Samsil-Shingle Complex (SeE)
	Terrace Escarpments (Te)
	Valmont Clay Loam (VaB, Vac)
	Valmont Cobbly Clay Loam (VcC)

APPENDIX 6.2 SENSITIVE PLANTS

Sensitive plant species and communities occurring in the management area (Colorado Natural Heritage Program 1995, Boulder County Land Use Staff 1986).

Common Name	Scientific Name	Global Rank*	State Rank*	Federal Status*	State Status *
Sensitive species					
Bell's twinpod	*Physaria bellii*	G2	S2	C2	
Prairie (birdfoot) violet	*Viola pedatifida*	G5	S2		
Sensitive communities					
Foothills Ponderosa Pine Savannah	*Pinus ponderosa/Leucopoa kingii*	G2	S2		
Foothills Ponderosa Pine Scrub Woodland	*Pinus ponderosa/ Cercocarpus Montanus/ Andropogon gerardii*	G2	S2?		
Great Plains Mixed Grass Prairie	*Stipa comata*	G2	S2		
	Stipa neomexicana	G2	S2		
Mixed Foothills Shrubland	*Cercocarpus montanus*	G2	S2		
Shortgrass Prairie	*Bouteloua gracilis/ Buchloe dactyloides*	G2?	S2?		
Xeric Tallgrass Prairie	*Andropogon gerardii/ Schizachryum scoparium*	G2	S2		

See the end of Appendix 8.2 for ranking definitions

APPENDIX 7.1 SIGNIFICANT WETLAND DEFINITION

Significant wetlands are those wetlands which either:

(1) Meet the criteria set forth in the Boulder County Comprehensive Plan as follows:

a) wetlands important for flood control, water quality and runoff stabilization;
b) wetlands designated as Critical Wildlife Habitat;
c) wetlands designated as a Critical Plant Association;
d) wetlands designated as a part of a County Natural Area

or;

(2) Perform at least one wetland function to a high degree.

The procedure for the evaluation of wetland function is given in Advanced Identification of Wetlands in the City of Boulder Comprehensive Planning Area (Cooper, 1988). Wetlands identified during the Advanced Identification project have been evaluated. The evaluation sheets are available from the City of Boulder Planning Department.

or;

(3) Provide habitat for a species of special concern including

a) species (plants and animals or wildlife) listed as threatened or endangered by the United States Fish and Wildlife Service;
b) animal or wildlife species listed by the State of Colorado as threatened or endangered, species of special concern, or species or undetermined status;
c) plant species listed by the State of Colorado as species of special concern;
d) critical animal or wildlife species as listed in the Boulder County Comprehensive Plan.

or;

(4) Could be made significant by a reasonable restoration effort.

or;

(5) Those wetlands with a direct hydrological connection to a significant wetland, the destruction of which would adversely affect the significant wetland.

APPENDIX 7.2 APPLICABLE WETLAND POLICIES

Wetland Policies Relevant to North Boulder Valley
The development and management of wetlands are governed by federal, County and City regulations and policies.

Federal Policy
Section 404 of the Clean Water Act requires the federal government to regulate the dredging and placement of fill materials in waters of the United States. "Waters of the United States" is a broad regulatory concept; it has not been interpreted to include all the water in the United States but does include wetlands and creeks such as South Boulder Creek. The Army Corps of Engineers and the Environmental Protection Agency jointly administer the Clean Water Act, with the Corps of Engineers generally responsible for the regulatory program.

The regulation of wetlands by the federal government, however, is not synonymous with wetland protection. The intent of the Clean Water Act is to "restore and maintain the physical, chemical and biological integrity of our nation's waters"; only the filling and dredging of wetlands are regulated. No federal regulations prohibit the draining of wetlands or the removal of wetland vegetation, two activities which could destroy a wetland as effectively as filling or dredging. The Clean Water Act requires a regulatory review of activities that may destroy wetlands, but it does not prohibit such activities.

The Corps of Engineers operates the permitting process by which regulated activities are reviewed. To streamline the permit application review, the Corps of Engineers issued a set of standing permits for many commonplace activities. In most cases there is no requirement to even notify the Corps of a proposed regulated activity, if it is authorized by one of these standing permits. Perhaps the most well known of these permits is the "Nationwide 26" permit. Under the provisions of this permit a person may:

- fill up to one acre of wetland without notifying the Corps.
- fill from one to under ten acres of wetland without an individual permit, if he or she first notify the Corps and receive a letter of authorization.

Nationwide permit #26 is applicable in all isolated wetlands *except* those below the headwaters of a "5-cfs" stream. In the Boulder Valley there are only two "5-cfs streams"--that is creeks or streams which achieve a discharge of 5 cubic feet per second (cfs). These are Boulder Creek and South Boulder Creek. The headwaters of a "5-cfs stream" is that point on the stream where the discharge averages 5 cfs. The headwaters of Boulder Creek are at Boulder Falls and the headwaters of South Boulder Creek are just southwest of Nederland in Gilpin County. The entire reaches of both these streams as they flow through the Boulder Valley are below their respective headwaters.

Someone wishing to fill a wetland along the bank of Boulder Creek could not receive authorization from the Corps of Engineers under Nationwide 26. Nationwide 26 does not apply to wetlands *adjacent* to a 5-cfs stream below its headwaters. No exact definition of adjacent has been offered. The determination of agency application of this term is usually made by the field representative of the Corps of Engineers.

Applicants must request an individual Department of the Army permit for activities that cannot be authorized by any nationwide permit. The Corps may require compensatory mitigation. The requirement is usually to construct or restore a wetland to offset the wetland loss resulting from the permitted activity allowed through the individual permit process.

Boulder County Policies

The following set of goals, objectives and policies have been approved by the Boulder County Planning Commission (September 28, 1994) as part of the Environmental Resources Element of the Boulder County Comprehensive Plan.

Goal B.5.
Wetlands should be preserved to protect their natural values and ecosystem functions.

Wetland Objectives
Without adding another layer of regulation to wetlands protection, the County seeks to conserve wetland resources, particularly those designated as significant. The County will encourage the avoidance of wetlands during the land development process and will recommend land management plans and techniques that will prevent and minimize adverse impacts to wetlands.

Wetland Policies

3.25 *Land owners of existing significant wetlands will be encouraged to seek assistance from Soil Conservation Services or Parks and Open Space Department for the purpose of formulating management plans.*

3.26 *The County will encourage applicants of land use proposals to avoid damaging, disturbing, or disrupting any significant wetlands. Where impacts to significant wetlands are unavoidable, the County shall request appropriate mitigation including restoration, enhancement, and/or creation of wetlands along with the implementation of a management and monitoring plan. Although requested protection measures for locally significant wetlands may exceed the requirements of other governmental agencies, the practices are intended to complement, and not negate, any other wetland requirements.*

3.27 *Boulder County shall cooperate with the Soil Conservation Service's (*sic*) policy of providing no financial or technical assistance for the conversion of significant wetlands to other uses.*

2.28 *The County shall cooperate and participate with other governmental agencies and other publica and private organizations to develop regional approaches to wetlands protection. Where significant wetlands have been identified on public land, the County will pursue intergovernmental agreements to ensure the specific protection of these resources. Where significant wetlands exist within Community Service Areas* [such as the Boulder Valley], *Boulder County shall provide assistance to municipalities for the establishment of wetland management plans to avoid the degradation of such wetlands.*

2.29 *Significant wetlands, which in addition have been identified as critical wildlife habitats or critical plant associations or rare plant sites, should conform with t the applicable goals and policies of the Boulder County Comprehensive Plan.*

3.30 *Development proposals affecting wetlands other than those identified as significant particularly those with high functional ratings, a large size, hydrologic connections, wildlife habitat value, or human interest, should also be evaluated for potential impacts and mitigation measures.*

The Boulder County Comprehensive Plan also calls upon County staff to:

1) monitor and evaluate wetlands to determine which ones should be considered significant;
2) use conservation easements to protect significant wetlands on private property;
3) amend County regulations to require details of wetland impacts for development proposals affecting significant wetlands.

City of Boulder Policies

The Boulder Valley Comprehensive Plan has a specific wetland policy statement:

> *Natural and human-made wetlands are valuable as wildlife habitat or recreation areas and can enhance water quality. The City and the County shall develop programs to protect and enhance significant wetlands in the Boulder Valley in concert with federal requirements. The City shall discourage the destruction of significant wetlands, but when development is permitted and the filling of wetlands cannot be avoided, they shall be restored or replaced* (Policy 4.12)

The Long Range Management Policies contains the following general guidance regarding wetlands protection:

Adverse impacts to floodplains and wetlands will be avoided wherever possible. Where avoidance cannot be achieved, mitigating measures will be implemented to minimize potential harm to the natural values of floodplains, riparian areas, and wetlands in accordance with the City's Wetlands Ordinance and other applicable regulations. Losses to wetlands will be compensated by restoration or creation of similar habitats elsewhere according to the standards set forth in the Wetlands Ordinance and other applicable regulations.

Agricultural leases will be managed to protect or enhance riparian areas, wetlands, and waterways on Open Space lands and to maximize the protection or enhancement of water quality whenever possible in accordance with the City of Boulder Non-Point Source Pollution Program;

The Department will:

- *Develop inventory methodologies and conduct inventories of wetlands, riparian areas, and floodplains as needed on Open Space lands;*
- *Identify areas subject to flooding and take actions to limit risks to people and property, as appropriate;*
- *Inventory existing facilities and uses that affect floodplains, riparian areas, and wetlands and prepare plans for protection or restoration, as appropriate; and*
- *Identify native plants and animals that require these habitats and prepare plans for their protection.*

Wetlands and other sensitive natural areas will be avoided when building trails.

APPENDIX 7.3 NORTH BOULDER VALLEY WETLAND PLANTS

Plants Occurring in Wetlands of the North Boulder Valley Management Area (89 species)

Non-native weedy species shown in highlighted text. NWI rank explained in text.

Scientific Name	Common Name	NWI Rank
Negundo aceroides	Box-elder Maple	FAC
Agastache foeniculum	Giant Hyssop	FAC
Pascopyrum smithii	Western wheatgrass	FACU

Scientific Name	Common Name	NWI Rank
Agrostis gigantea	Redtop	FACW+
Alisma triviale	Water plantain	OBL
Alopecurus aequalis	Foxtail	OBL
Asclepias incarnata	Marsh milkweed	OBL
Asclepias speciosa	Showy milkweed	FAC
Atriplex canescens	Saltbrush	FACU-
Atriplex prostrata (?)	Spear orache	FACW+
Barbarea orthoceras	Winter-cress	OBL
Bromopsis inermis	Smooth brome	UPL
Carex emoryi	Sedge	OBL
Carex hystricina	Sedge	OBL
Carex lanuginosa	Sedge	OBL
Carex nebrascensis	Sedge	OBL
Carex praegracilis	Sedge	FACW+
Carex scoparia	Broomlike sedge	FACW+
Chara sp.	Stonewort	UPL
Cichorium intybus	Chicory	UPL
Cirsium arvense	Canada thisle	FACU
Cirsium ochrocentrum	Wavy-leaved thistle	FACU
Psilochenia acuminata	W. Hawks beard	UPL
Dactylis glomerata	Orchard grass	FACU
Dipsacus sylvestris	Teasel	FAC
Distichlis stricta	Saltgrass	FACW+
Elaeagnus angustifolia	Russian olive	FAC
Eleocharis acicularis	Spike rush	OBL
Eleocharis parvula anachaeta	Spike rush	OBL
Eleocharis palustris	Spike rush	OBL
Epilobium ciliatum	Willow-herb	OBL
Epilobium leptophyllum	Willow-herb	facw+
Hippochaete hyemailis	Horsetail	FACW+
Festuca pratensis	Meadow fescue	FAC
Glyceria grandis	Manna grass	OBL
Glyceria striata stricta	Manna grass	OBL
Glycyrrhiza lepidota	Wild liquorice	FACU
Critesion brachyantherum	Foxtail barkey	FACW+
Iris missouriensis	Iris	OBL
Juncus arcticus ater	Arctic rush	OBL
Juncus articulatus	Rush	OBL
Juncus gerardii	Rush	UPL
Juncus interior	Rush	FAC
Juncus longistylis	Rush	FACW+

Scientific Name	Common Name	NWI Rank
Juncus nodosus	Rush	OBL
Juncus saximontanus	Rush	FACW+
Juncus torreyi	Rush	FACW+
Lemna minor	Duckweed	OBL
Cardaria latifolium	White top	FACW+
Lycopus americanus	Water horehound	OBL
Lythrum alatum	Loosestrife	OBL
Mentha arvense	Mint	FACW+
Muhlenbergia asperifolia	Alkali muhly	FACW+
Nasturtium officionale	Water-cress	OBL
Padus virginia	Chokecherry	FACU
Persicaria amphibia	Smartweed	OBL
Persicaria maculata	Smartweed	OBL
Phalaris arundinacea	Reed canary grass	facw+
Plantago lanceolata	English plantain	FAC
Poa pratensis	Kentucky bluegrass	FACU
Podospermum laciniatum	False Salsify	UPL
Polypogon monospeliensis	Rabbits foot grass	OBL
Populus X acuminata	Cottonwood	FAC
Populus angustifolia	N.L. cottonwood	FACW
Populus deltoides monilifera	Plains cottonwoods	FAC
Prunus americana	American plum	UPL
Rhus americana trilobata	Skunkbrush	UPL
Rorippa palustris	Cress	OBL
Rumex crispus	Dock	FACW+
Rumex triangulivalvis	Willow dock	OBL
Salix amygdaloides	Peach leaf willow	FACW+
Salix exigua	Sandbar willow	OBL
Salix fragilis	Crack Willow	FAC
Schoenoplectus lacustris acutus	Softstem bulrush	OBL
Scirpus pungens	Three square	OBL
Schoenoplectus lacustris creber	Hardstem bulrush	OBL
Scirpus microcarpus	Bulrush	OBL
Scirpus pallidus	Bulrush	OBL
Sonchus oleraceus	Cow thistle	FACU
Spartina pectinata	Prairie cordgrass	FACW+
Spergularia media	Sand spurry	UPL
Sporobolus airoides	Alkali sacaton	FAC
Typha angustifolia	Narrow leaf cattail	OBL
Typha latifolia	Broad leaf cattail	OBL
Ulmus americana	American elm	FAC

Scientific Name	Common Name	NWI Rank
Verbascum thapsus	Mullein	UPL
Verbena hastata	Blue vervain	FACW+
Veronica anagallis-aquatica	Speedwell	OBL
Vitis riparia	Wild grape	FAC

APPENDIX 7.4 BOULDER RESERVOIR WETLANDS INFORMATION

The following information is a brief report prepared by Mark Gershman, Natural Resource Planner for the City of Boulder Open Space. The report was compiled from five site visits to the wetlands surrounding Boulder Reservoir from September 27 to October 21, 1995. This report was requested by the City of Boulder Planning and Parks Departments in order gather baseline information on the wetlands surrounding Boulder Reservoir.

Boulder Reservoir Wetlands Information

October 23, 1995

The goal of this project was to map the approximate location and extent of wetlands on City of Boulder property adjacent to Boulder Reservoir (east of N. 51/55th Streets, west of N. 63rd Street). Wetlands east of the southern dam face were mapped previously. This mapping was necessary in order to insure that activities affecting these wetlands can be appropriately regulated by the City of Boulder under the provisions of the wetlands protection ordinance (BRC 1981. Title 9 §12). I visited the site five times. The first visit for this project was on 27 September and my last on 21 October, 1995.

This project was also useful in helping to characterize regional patterns of wetland distribution and vegetation for the North Boulder Valley Area Management plan. This plan is currently being developed by the City of Boulder Open Space Program.

The wetlands around Boulder Reservoir can be divided into three classes: 1)shorelines, 2)mudflats and associated wetlands, and 3)tributary drainages. Each of these wetland classes is associated with differing but intergrading plant communities.

SHORELINES

The wetlands along the shoreline of Boulder Reservoir have been severely disturbed by fluctuating water levels. Because of the varying location of "the shore" it is difficult to make a clear demarcation between shoreline and mudflat wetlands. For the purpose of this description, *shoreline*

wetlands were described wherever a linear wetland plant community was encountered running parallel to the reservoir water level.

The soil along the shoreline of Boulder Reservoir is uniformly a dark saturated clay. The area is mapped as Longmont clay, a deep poorly drained salty/alkaline soil derived from shale (Moreland and Moreland 1975). The plant community is relatively simple and consistent. The overstory is composed of plains cottonwoods (*Populus deltoides, P. angustifolia* and *P.* X *acuminata*) with scattered, sometimes in dense stands or groves, peach-leaved willows (*Salix amygdaloides*). Stands of coyote willows (*S. interior*) can also be found along the shorelines. The understory is a virtual monoculture of a rush (Juncaceae) that does not produce many flowering culms. In more well-drained areas, this rush was identifiable as *Juncus compressus.* This identification is consistent with the description of the vegetation by Dr. David Buckner (in Camp Dresser and McKee 1986) who characterized this rush as locally conspicuous in sedge-rush wetlands around the reservoir. There were also scattered stems of American three-square (*Schoenoplectus pungens*) and reed canary grass (*Phalaroides arundinacea*). Both *J. compressus* and *S. pungens* are plants most commonly encountered in alkali areas.

The distribution of woody plants appears to be associated with water level manipulations. When periods of "draw-down" or water level stabilization coincided with the seed fall of woody plant species, woody plants germinated. The plants were able to persist probably through a combination of their physiology and the available water capacity of the wet clay soils. The understory vegetation, that is to say the stands of *Juncus compressus*, was clearly exhibiting a response to regular periodic inundation. I compared the stands in the supposed inundated area with nearby stands growing at slightly higher elevation (which I assumed did not experience regular flooding). My (subjective) analysis suggests that plants growing in the lower areas were more slender, taller, with a greater amount of arenchyma (air conducting tissue--usually associated with plants growing in flooded conditions) and were generally much less likely to produce flowers.

MUDFLATS⇨ALKALI GRASSLANDS ⇨WET MEADOW ⇨CATTAIL/BULRUSH STANDS

Mudflat wetlands were defined along the Boulder Reservoir shoreline as typically broad areas of wetland appearing to develop on drying mudflats as the reservoir water level dropped. These mudflats gradually gave way to a wet meadow community on the upland side.

Mudflats wetlands were dominated by a small introduced annual grass *Crypsis alopecuroides*. This grass which grows only about 5 cm tall was found in monocultures of up to 3 to 5 acres and represented the only vegetation adjacent to the unvegetated mudflats. Other species commonly encountered on the drying mudflats include: cockleburs (*Arctium minus*) (growing out of the drying mud cracks at remarkably high density), foxtail barley (*Hordeum jubatum*), nodding tickseed (*Bidens frondosa/vulagata*), vegetative growth of curly dock (*Rumex crispus*), and stunted individuals of *Amaranthus retroflexus*.

These mudflats graded into alkali flat grasslands dominated by inland salt grass (*Distichilis spicata* spp. *stricta*), alkali sacaton (*Sporobolus airoides*), western wheat (*Pascopyrum smithii*) with

scattered patches of *Iva axillaris* and, sumpweed (*Spergularia media*). Alkali bluegrass (*Poa juncifolia*) and Nuttall alkaligrass (*Puccinelia airoides*) were reported by Buckner (Camp, Dresser and McKee 1986) and are probably also present, although not noted in 1995.

The grasslands intermix and grade into wet meadows dominated by arctic rush (*Juncus arcitus* ssp. *ater*), American three-square, *Carex praegracilis* and Canada thistle (*Cirsium arvense*). Scattered throughout this community were isolated (sometimes dense) stands of reed canary grass, spikerush (*Eleocharis palustris*), swamp milkweed (*Asclepias incarnata*), wild lettuce (*Lactuca serriola*), and cattails (*Typha latifolia*). Of interesting note was a population of a tall member of the mallow or hibiscus family in the wet meadows of NE ¼ of Sec. 4 (T1N, R70W).

Larger often circular clonal stands of cattails intermixed with bulrushes (*Schoenoplectus lacustris*) are found in depressions and seepy areas of these wet meadows.

TRIBUTARY DRAINAGES

Little Dry Creek, Dry Creek and two small unnamed creeks flow from the west to Boulder Reservoir. The vegetation along these creeks varies remarkably according to gradient. In steep areas, the creeks tend to be narrow and incised with only a small wetland/riparian fringe. As they spread out onto the flat areas around the reservoir shoreline, broader and more expansive marshes develop. The vegetation ranges from western wheat and alkali sacaton in the drier areas to cattails and bulrushes in the wet areas.

APPENDIX 7.5 THE BEECH WETLANDS: A SITE OF GROUNDWATER CONTAMINATION

Harlan and Associates Inc. on behalf of Beech Aircraft are monitoring and implementing a remediation plan to address contaminated ground and surface water. This contamination was identified in 1991 in an un-named drainage in the center of Section 31, T1N, R70W and brought to the attention of the Colorado Department of Environmental Health. The nature and extent of contamination resulting from past land uses is still somewhat poorly understood. However it is vital that the Open Space Program gain an understanding about the contamination of ground and surface water and that this understanding be articulated in the North Boulder Valley Area Management Plan.

The historical operations at the Beech Facility include the manufacture and assembly of missiles and aerospace equipment. These practices included chemical surface treatment, metal surface cleaning and missile target fueling. These operations began in the winter of 1967/68 and most activities were suspended in late 1987 (Harlan, Casey and Assoc. 1994). Missile fueling continues on site.

The wash down water, spent solvents and electro-plating wastes from the Beech Facility were disposed of in a surface impoundment where volatile organic compounds were expected to evaporate. The surface impoundment could have been probably unlined or soil-lined. The impoundment was closed in the early 1980s with the approval of the Colorado Department of

Environmental Health and a waste-water treatment building was constructed on the same location. The underlying soil was excavated and, after a period of on-site storage, was removed to a licensed facility as non-hazardous waste.

In 1991 the Colorado Department of Environmental Health confirmed the presence of volatile organic compounds's in a seep on the Beech Open Space property (managed at that time by Boulder County Parks and Open Space). Beech Aircraft began an investigation of: (1) the geologic and hydrogeologic conditions of the area and (2) springs, seeps, perennial streams, other areas of groundwater discharge and selected wells down gradient of the site to determine risks associated with possible groundwater contamination. No risks to drinking water sources were identified at that time.

The results of an on-site investigation confirmed that the surface impoundment is the primary (perhaps sole) source of contaminants. Two distinct types of volatile organic compounds's have been identified at the Beech Facility: naturally occurring BTEX constituents (benzene, toluene, ethly-benzene and xylenes) and organic solvents (acetone, vinyl chloride, freon, and others).

The volatile organic compounds's have persisted in the groundwater for fifteen to twenty-five years. This may be due to: (1) the fact that they are heavier than water, (2) are contained within a geological basin and (3) the groundwater transmission rates are very slow in the Niobrara shales.

Beech has proposed, has had approved (by the Colorado Department of Environmental Health) and has installed a network of groundwater extraction wells within the former surface impoundment area to: (1) depress the water table within the former surface impoundment area to contain the residual source of the volatile organic compounds's within the local geologic basin and (2) to help with the removal of the residual source material.

Groundwater is pumped from eight wells bored to various depths in the contaminated area. The water/contaminants are piped to a treatment facility where volatile organic compounds's are removed. The effluent from the treatment facility is discharged down gradient of the contaminated area into the so-called "No-Name drainage." Results provided to the Program in January, 1996 indicate that the treatment process has not yet had an effect on Volatile organic compounds levels on the seeps (#1 and #2) on Open Space. The most recent data contained in the report were collected in December, 1995.

Much greater detail about this contamination is available in Harlan, Casey and Associates (1993, 1994).

The seep areas on the Beech property east of U.S. 36 were closed to the public by the Boulder County Parks and Open Space Department in 1991 and have remained fenced and closed to public use since then.

APPENDIX 8.1 VERTEBRATE WILDLIFE EXPECTED AND RECORDED FOR NORTH BOULDER VALLEY

Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Black bullhead														
Black crappie														
Bluegill														
Brown trout														
Carp														
Channel catfish														
Common bullhead														
Creek chub														
Eastern brook trout														
Fathead minnow														
Gizzard shad														
Golden shiner														
Goldfish														
Grass carp														
Green sunfish														
Greenback cutthroat trout														
Horny head														
Iowa darter														
Kokanee salmon														
Lake trout														
Largemouth bass														
Longnose sucker														
Mccloud river rainbow trout														
Pumpkinseed														
Redfin shiner														
Smallmouth bass														
Steelhead trout														
Threadfin shad														
Walleye														
Western mosquitofish														
White crappie														
White sucker														

1= alfalfa/alfalfa hay; = annual crops; 3= cliff; 4=foothills riparian; 5= marsh; 6=mixed grass prairie; 7=plains riparian; 8=ponderosa pine forest/woodland; 9=savannah; 10=shortgrass prairie; 11=shrubland; 12=standing water; 13=talus; 14=wet meadow; shaded columns indicate species potentially found in this habitat; cells shown with ♦ indicate a documented sighting of this species

Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Yellow perch														
Boreal chorus frog												♦		
Bullfrog														
Great plains toad														
Plains spadefoot toad														
Utah tiger salamander										♦		♦		
Western leopard frog														
Woodhouse's toad												♦		♦
Bullsnake						♦								
Eastern short-horned lizard		♦				♦				♦				
Eastern yellow-bellied racer						♦					♦			♦
Lesser earless lizard														
Man-ylined skink														
Northern lined snake														
Northern prairie lizard										♦				
Northern water snake														
Ornate box turtle														
Plains black-headed snake														
Plains hognose snake														
Prairie rattlesnake						♦				♦				
Red-sided garter snake														
Six-lined racerunner														
Snapping turtle														
Wandering garter snake														
Western milk snake						♦								
Western painted turtle														
Western plains garter snake														
Western smooth green snake														
Western spiny softshell turtle														
American avocet														
American bittern														
American coot														
American crow	♦					♦	♦	♦		♦	♦			
American dipper				♦										
American goldfinch					♦	♦	♦			♦				

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Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14
American kestrel	♦					♦	♦		♦	♦		♦		
American pipit										♦				
American redstart														
American robin				♦	♦	♦	♦	♦		♦	♦			
American tree sparrow							♦							
American white pelican										♦		♦		
American wigeon	♦													
Ash-throated flycatcher											♦			
Baird's sandpiper														
Bald eagle	♦	♦			♦	♦	♦			♦	♦	♦		
Band-tailed pigeon														
Bank swallow														
Barn swallow					♦	♦				♦				
Barrow's goldeneye														
Bay-breasted warbler														
Belted kingfisher														
Black-billed magpie	♦			♦		♦	♦	♦	♦	♦	♦			♦
Black-capped chickadee				♦		♦	♦	♦		♦	♦			
Black-crowned night heron														
Black-headed grosbeak														
Black-throated blue warbler							♦							
Black and white warbler														
Black swift														
Black tern														
Blackpoll warbler														
Blue-gray gnatcatcher						♦								
Blue-winged teal					♦					♦				
Blue grosbeak				♦		♦				♦				
Blue grouse								♦		♦				
Blue jay						♦	♦			♦				
Bobolink														♦
Bohemian waxwing														
Bonaparte's gull														
Brewer's blackbird					♦	♦	♦			♦				
Brewer's sparrow														

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Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Broad-tailed hummingbird				♦		♦				♦				
Brown-headed cowbird										♦				
Brown creeper														
Brown thrasher														
Bufflehead														
Burrowing owl		♦				♦								
California gull														
Canada goose	♦				♦	♦				♦		♦		
Canvasback														
Canyon wren						♦					♦			
Cassin's finch														
Cedar waxwing														
Chestnut-sided warbler														
Chipping sparrow						♦	♦			♦	♦			
Cinnamon teal														
Clark's grebe														
Clark's nutcracker														
Clay-colored sparrow							♦							
Cliff swallow						♦				♦				
Common barn owl														
Common bushtit														
Common goldeneye														
Common grackle					♦	♦	♦			♦				
Common loon										♦				
Common merganser														
Common nighthawk						♦				♦				
Common poorwill														
Common raven					♦	♦		♦		♦				
Common redpoll														
Common snipe				♦	♦	♦				♦				
Common yellowthroat					♦					♦				
Cooper's hawk						♦	♦		♦					
Cordilleran flycatcher														
Double-crested cormorant					♦					♦				
Downy woodpecker						♦	♦	♦		♦				

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Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Dusky flycatcher										♦				
Eared grebe														
Eastern bluebird														
Eastern kingbird						♦	♦			♦				
Eastern screech-owl														
European starling						♦	♦			♦	♦			
Evening grosbeak														
Ferruginous hawk	♦					♦		♦	♦	♦		♦		
Flammulated owl														
Forster's tern														
Fox sparrow														
Franklin's gull						♦				♦				
Gadwall												♦		
Golden-crowned kinglet														
Golden eagle	♦	♦				♦		♦	♦	♦	♦	♦	♦	♦
Grasshopper sparrow						♦	♦			♦				
Gray catbird														
Gray jay														
Great blue heron	♦				♦	♦				♦		♦		
Great egret														
Great horned owl		♦				♦	♦	♦	♦	♦	♦			
Greater scaup														
Greater yellowlegs														
Green-tailed towhee							♦							
Green-winged teal										♦				
Hairy woodpecker														
Hammond's flycatcher														
Harris' sparrow														
Hermit thrush										♦				
Herring gull														
Hooded merganser														
Horned grebe														
Horned lark						♦	♦			♦				
House finch						♦	♦			♦	♦			
House sparrow						♦								

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Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14
House wren					♦	♦	♦							
Indigo bunting										♦				
Killdeer	♦				♦	♦				♦		♦		
Lapland longspur														
Lark bunting														
Lark sparrow						♦				♦				
Lazuli bunting										♦				
Least bittern														
Least sandpiper														
Lesser goldfinch										♦				
Lesser scaup														
Lesser yellowlegs														
Lewis' woodpecker				♦										
Lincoln's sparrow							♦							
Loggerhead shrike		♦				♦				♦				
Long-billed curlew														
Long-billed dowitcher														
Long-eared owl							♦							
Macgillivray's warbler							♦							
Mallard	♦				♦	♦	♦			♦		♦		
Marbled godwit														
Marsh wren					♦									
Merlin						♦								
Mountain bluebird						♦			♦	♦				
Mountain chickadee									♦					
Mountain plover														
Mourning dove					♦	♦	♦			♦	♦			
Myrtle warbler						♦	♦			♦				
Nashville warbler														
Northern bobwhite														
Northern flicker				♦	♦	♦	♦	♦		♦	♦			
Northern goshawk								♦						
Northern harrier	♦				♦	♦	♦			♦		♦		
Northern mockingbird														
Northern oriole						♦	♦			♦				

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Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Northern parula														
Northern pintail														
Northern pygmy-owl														
Northern rough-winged swallow														
Northern saw-whet owl								♦						
Northern shoveler										♦				
Northern shrike						♦								
Northern waterthrush														
Olive-sided flycatcher														
Orange-crowned warbler							♦							
Osprey						♦								♦
Ovenbird														
Pacific loon														
Pectoral sandpiper														
Peregrine falcon										♦				
Pied-billed grebe										♦				
Pine grosbeak														
Pine siskin						♦				♦				
Pinyon jay														
Prairie falcon	♦							♦	♦	♦				
Pygmy nuthatch														
Red-breasted merganser														
Red-breasted nuthatch														
Red-eyed vireo														
Red-headed woodpecker						♦								
Red-naped sapsucker														
Red-necked phalarope														
Red-tailed hawk	♦			♦	♦	♦	♦		♦	♦	♦			♦
Red-winged blackbird	♦				♦	♦	♦			♦				
Red crossbill														
Redhead														
Ring-billed gull							♦			♦				
Ring-necked duck														
Ring-necked pheasant		♦				♦								
Rock dove						♦	♦			♦				

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Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Rock wren				♦		♦					♦			
Rose-breasted grosbeak														
Rosy finch														
Rough-legged hawk	♦	♦				♦	♦			♦				
Ruby-crowned kinglet											♦			
Ruddy duck														
Rufous-sided towhee				♦		♦	♦			♦	♦			
Rufous hummingbird														
Rusty blackbird														
Sage thrasher						♦					♦			
Sandhill crane														
Savannah sparrow						♦				♦				
Say's phoebe						♦				♦				
Scrub jay						♦								
Semipalmated sandpiper														
Sharp-shinned hawk						♦		♦		♦				
Sharp-tailed grouse														
Short-eared owl														
Slate-colored junco						♦	♦				♦			
Snow goose														
Snowy egret														
Solitary sandpiper														
Solitary vireo														
Song sparrow					♦	♦	♦							
Sora					♦									
Spotted sandpiper														
Steller's jay						♦		♦	♦					
Swainson's hawk		♦						♦						
Swainson's thrush														
Tennessee warbler							♦							
Three-toed woodpecker														
Townsend's solitaire														
Townsend's warbler														
Tree swallow							♦							
Tundra swan														

1= alfalfa/alfalfa hay; = annual crops; 3= cliff; 4=foothills riparian; 5= marsh; 6=mixed grass prairie; 7=plains riparian; 8=ponderosa pine forest/woodland; 9=savannah; 10=shortgrass prairie; 11=shrubland; 12=standing water; 13=talus; 14=wet meadow; shaded columns indicate species potentially found in this habitat; cells shown with ♦ indicate a documented sighting of this species

Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Turkey vulture						♦				♦				
Veery														
Vesper sparrow						♦				♦				
Violet-green swallow						♦								
Virginia rail					♦									
Virginia's warbler														
Warbling vireo														
Western bluebird														
Western grebe														
Western kingbird						♦				♦				
Western meadowlark	♦					♦	♦			♦				
Western sandpiper														
Western tanager														
Western wood-pewee														
White-breasted nuthatch														
White-crowned sparrow						♦	♦			♦				
White-faced ibis						♦								
White-throated sparrow														
White-throated swift														
Wild turkey														
Willet														
Williamson's sapsucker														
Willow flycatcher														
Wilson's phalarope														
Wilson's warbler							♦							
Winter wren														
Wood duck														
Yellow-bellied sapsucker														
Yellow-billed cuckoo														
Yellow-breasted chat							♦							
Yellow-headed blackbird										♦				
Yellow warbler							♦							
Abert's squirrel														
American elk						♦								
Badger						♦								

1= alfalfa/alfalfa hay; = annual crops; 3= cliff; 4=foothills riparian; 5= marsh; 6=mixed grass prairie; 7=plains riparian; 8=ponderosa pine forest/woodland; 9=savannah; 10=shortgrass prairie; 11=shrubland; 12=standing water; 13=talus; 14=wet meadow; shaded columns indicate species potentially found in this habitat; cells shown with ♦ indicate a documented sighting of this species

Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Beaver														
Big brown bat														
Black-footed ferret														
Black-tailed jackrabbit														
Black-tailed prairie dog	♦					♦				♦				
Black bear														
Bobcat														
Chestnut-faced pocket gopher														
Colorado chipmunk														
Coyote		♦			♦	♦	♦		♦	♦	♦			♦
Deer mouse				♦		♦	♦	♦	♦		♦			
Desert cottontail														
Dwarf shrew														
Eastern cottontail	♦					♦				♦				
Fox squirrel														
Fringed myotis														
Golden-mantled ground squirrel														
Gray fox														
Hispid pocket mouse				♦		♦		♦	♦					
Hoary bat														
House mouse														
Least chipmunk														
Little brown bat														
Long-eared myotis														
Long-legged myotis														
Long-tailed vole														
Long-tailed weasel														
Masked shrew		♦												
Meadow jumping mouse														
Meadow vole						♦		♦						
Merriam's shrew														
Mexican woodrat				♦		♦		♦			♦			
Mink														
Montane shrew														
Montane vole														

1= alfalfa/alfalfa hay; = annual crops; 3= cliff; 4=foothills riparian; 5= marsh; 6=mixed grass prairie; 7=plains riparian; 8=ponderosa pine forest/woodland; 9=savannah; 10=shortgrass prairie; 11=shrubland; 12=standing water; 13=talus; 14=wet meadow; shaded columns indicate species potentially found in this habitat; cells shown with ♦ indicate a documented sighting of this species

Common Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mountain cottontail										♦				
Mountain lion						♦			♦					
Mule deer						♦	♦	♦	♦		♦			
Muskrat														
Northern grasshopper mouse														
Northern pocket gopher														
Northern river otter														
Norway rat														
Olive-backed pocket mouse														
Plains pocket gopher														
Porcupine														
Prairie vole														
Pronghorn														
Raccoon					♦									
Red-backed vole														
Red bat														
Red fox	♦									♦				♦
Red squirrel														
Ringtail														
Rock mouse														
Rock squirrel														
Short-tailed weasel						♦								
Silver-haired bat														
Small-footed myotis														
Spotted skunk														
Striped skunk						♦								
Swift fox														
Thirteen-lined ground squirrel														
Townsend's big-eared bat														
Western harvest mouse														
Western jumping mouse														
Western small-footed myotis														
White-tailed deer						♦				♦				
White-tailed jackrabbit						♦			♦			♦		
Yellow-bellied marmot														

1= alfalfa/alfalfa hay; = annual crops; 3= cliff; 4=foothills riparian; 5= marsh; 6=mixed grass prairie; 7=plains riparian; 8=ponderosa pine forest/woodland; 9=savannah; 10=shortgrass prairie; 11=shrubland; 12=standing water; 13=talus; 14=wet meadow; shaded columns indicate species potentially found in this habitat; cells shown with ♦ indicate a documented sighting of this species

Table: Vertebrate Species Status (Colorado Natural Heritage Program, Federal Threatened and Endangered (T+E), State T+E, and sensitive, Boulder County Comprehensive Plan)

Common Name	Scientific Name	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	Boulder County Comp Plan
Brassy minnow	Hybognathus hankinsoni	G5	S3			uncommon
Common shiner	Notropis cornutus	G5	S2		SC	rare
Greenback cutthroat trout	Salmo clarki	G5T2	S2	LT	T	state threatened
Iowa darter	Etheostoma exile	G5	S2		SC	
Johnny darter	Etheostoma nigrum	G5	S3			rare
Lake chub	Couesius plumbeus	G5	S1			extirpated
Plains minnow	Hybognathus placitus	G5	SH	C2	SC	
Plains topminnow	Fundulus sciadicus	G4	S2	C2	SC	uncommon
Stonecat	Noturus flavus	G5	S1		SC	
Northern leopard frog	Rana pipiens	G5	S3S4		SC	concern
Racer	Coluber constrictor	G5T5	S2S3			
Western hognose snake	Heterodon nasicus	G5	S1			
Many-lined skink	Eumeces multivirgatus	G5T4	S3S4			
Milk snake	Lampropeltis triangulum	G5T4	S2			
Smooth green snake	Opheodrys vernalis	G5	S3S4			
Lined snake	Tropidoclonion lineatum	G5	S3			concern
Eared grebe	Podicipeds nigricollis	G5	S3S4B SZN			1
American white pelican	Pelecanus erythrorhynchos	G3	S1B SZN		SC	
American bittern	Botaurus lentiginosus	G4	S3S4B SZN			1,5
American bittern	Botaurus lentiginosus	G4	S3S4B SZN			5
Least bittern	Ixobrychus exilis	G5	S2B SZN			3,5
Great blue heron	Ardea herodias	G5	S3B SZN			5
Great egret	Ardea albus	G5	S1B			3,5
Great egret	Ardea albus	G5	S1B			5
Snowy egret	Egretta thula	G5	S2B SZN			
Green heron	Butorides virescens	G5	S3B SZN			
Black-crowned night-heron	Nycticorax nycticorax	G5	S3B SZN			5
Yellow-crowned night-heron	Nyctanassa violacea	G5	S1B SZN			
White-faced ibis	Plegadis falcinellus	G5	S2B SZN	C2		
Snow goose	Chen caeruleslens	G5	S3S4N			
Canvasback	Aythya valisineria	G5	S2B SZN			
Barrow's goldeneye	Bucephala islandica	G5	S2B SZN		SC	4
Bufflehead	Bucephala albeola	G5	S1B SZN			
Hooded merganser	Lophodytes cucullatus	G5	S1B SZN			
Turkey vulture	Cathartes aura	G5	S3B SZN			
Osprey	Pandion haliaetus	G5	S1B SZN			
Bald eagle	Haliaeetus leucocephalus	G4	S1B S3N	LT	T	
Northern harrier	Circus cyaneus	G5	S3S4B S4N			1,5
Sharp-shinned hawk	Accipiter striatus	G5	S3S4B S4N			
Cooper's hawk	Accipiter cooperii	G4	S3S4B S4N			
Northern goshawk	Accipiter gentilis	G5	S3S4B S4N	C2		2
Ferruginous hawk	Buteo regalis	G4	S3B S5N	C2	SC	
Golden eagle	Aquila chrysaetos	G5	S3S4B S4N			5
Merlin	Falco columbarius	G5	S1B S4N			

Table: Vertebrate Species Status (Colorado Natural Heritage Program, Federal Threatened and Endangered (T+E), State T+E, and sensitive, Boulder County Comprehensive Plan)

Common Name	Scientific Name	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	Boulder County Comp Plan
Prairie falcon	Falco mexicanus	G5	S3S4B S4N			5
Sora	Porzana carolina	G5	S3S4B SZN			
Mountain plover	Charadrius montanus	G3	S2B SZN	C2	SC	4
Black-necked stilt	Himantopus mexicanus	G5	S3B SZN			
Willet	Catoptrophorus semipalmatus	G5	S1B SZN			
Upland sandpiper	Bartramia longicauda	G5	S3B SZN			
Long-billed curlew	Numenius americanus	G5	S2B SZN	3C	SC	4
Ring-billed gull	Larus delawarensis	G5	SHB SZN			
Caspian tern	Sterna caspia	G5	SUB SZN			
Forster's tern	Sterna forsteri	G5	S2B			
Interior least tern	Sterna antillarum	G4T2Q	S1B	LE		
Black tern	Chlidonias niger	G4	S3S4B SZN	C2		
Burrowing owl	Speotyto cunicularia	G5	S3S4B	C2		1,5
Long-eared owl	Asio otus	G5	S3S4B SZN			1
Short-eared owl	Asio flammeus	G5	S2B SZN			3,5
Boreal owl	Aegolius funereus	G5	S2			
Black swift	Cypseloides niger	G4	S2B			3,5
Red-headed woodpecker	Melanerpes erythrocephalus	G5	S3S4B SZN			2,5
Red-bellied woodpecker	Melanerpes carolinus	G5	S3S4B SZN			
Three-toed woodpecker	Picoides tridactylus	G5	S3S4			5
Olive-sided flycatcher	Contopus borealis	G5	S3S4B			
Least flycatcher	Empidonax minimus	G5	S1B SZN			3
Eastern phoebe	Sayornis phoebe	G5	S3B SZN			
Scissor-tailed flycatcher	Tyrannus forficatus	G5	S1B			
Purple martin	Progne subis	G5	S3B			
Carolina wren	Thryothorus ludovicianus	G5	S1			
Marsh wren	Cistothorus palustris	G5	S3B SZN			
Eastern bluebird	Sialia sialis	G5	S2B SZN			
Veery	Catharus fuscescens	G5	S3S4B SZN			3
Gray catbird	Dumetella carolinensis	G5	S3S4B SZN			5
Cedar waxwing	Bombycilla cedrorum	G5	S3B S5N			5
Loggerhead shrike	Lanius ludovicianus	G4	S3B SZN			1,5
Bell's vireo	Vireo bellii	G5	S2B			
Red-eyed vireo	Vireo olivaceus	G5	S3B SZN			
Chestnut-sided warbler	Dendroica pensylvanica	G5	S2B SZN			3,5
American redstart	Setophaga ruticilla	G5	S1?B SZN			3
Ovenbird	Seiurus aurocapillus	G5	S2B			3
Hooded warbler	Wilsonia citrina	G5	SUB SZN			
Northern cardinal	Cardinalis cardinalis	G5	S1B SZN			
Rose-breasted grosbeak	Pheucticus ludovicianus	G5	S1B			
Indigo bunting	Passerina cyanea	G5	S3S4B SZN			
Dickcissel	Spiza americana	G5	S3B			
Field sparrow	Spizella pusilla	G5	S1B SZN			
Savannah sparrow	Passerculus sandwichensis	G5	S3S4B SZN			5

Table: Vertebrate Species Status (Colorado Natural Heritage Program, Federal Threatened and Endangered (T+E), State T+E, and sensitive, Boulder County Comprehensive Plan)

Common Name	Scientific Name	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	Boulder County Comp Plan
Grasshopper sparrow	Ammodramus savannarum	G5	S3S4B SZN			5
Bobolink	Dolichonyx oryzivorus	G5	S3B SZN			5
Orchard oriole	Icterus spurius	G5	S3S4B			
White-winged crossbill	Loxia leucoptera	G5	S1B SZN			
Evening grosbeak	Coccothraustes vespertinus	G5	S2S3B S5N			
Dwarf shrew	Sorex nanus	G5	S3			5
Merriam's shrew	Sorex merriami	G5	S3			4
Merriam's shrew	Sorex merriami	G5	S3			5
Pygmy shrew	Sorex hoyi	G5T2T3	S1			4,5,6
Elliot's Short-tailed Shrew	Blarina hylophaga	G5	S1			
Desert shrew	Notiosorex crawfordi	G5	S3?			
Eastern mole	Scalopus aquaticus	G5	S3			
Fringed myotis	Myotis thysanodes	G5	S3S4	C2		5
Red bat	Lasiurus borealis	G5	S2B			
Townsend's big-eared bat	Plecotus townsendii	G4T4	S3	C2		
Brazilian free-tailed bat	Tadarida brasiliensis	G5	S1			
Least chipmunk	Tamias minimus	G5T?	S3			
Cliff chipmunk	Tamias dorsalis	G5	S2			
Yellow-bellied marmot	Marmota flaviventris	G5T?	S3			
Spotted ground squirrel	Spermophilus spilosoma	G5T?	S1			4,5
Golden-mantled ground squirrel	Spermophilus lateralis	G5TU	S1			
Brush mouse	Peromyscus boylii	G5T?	S2			
Hispid cotton rat	Sigmodon hispidus	G5	S3			
Eastern woodrat	Neotoma floridana	G5	S3S4			
Southern plains woodrat	Neotoma micropus	G5	S3			
White-throated woodrat	Neotoma albigula	G5T?	S2			
Desert woodrat	Neotoma lepida	G5	S1			
Bushy-tailed woodrat	Neotoma cinerea	G5T?	S2			
Meadow vole	Microtus pennsylvanicus	G5T?	S1			4
Mexican vole	Microtus mexicanus	G5	S1			
Sagebrush vole	Lemmiscus curtatus	G5	S2			
Meadow jumping mouse	Zapus hudsonius preblei	G5T2	S1S2	C2	SC	4,5
Gray Wolf	Canis lupus	G4	SX	LE	E	1
Kit fox	Vulpes macrotis	G5	S1?		SC	
Swift fox	Vulpes velox	G3	S3?	C2		4,5
Black-footed ferret	Mustela nigripes	G1	SH	LE	E	2,A,B
American badger	Taxidea taxus	G5T?	S1			4
Northern river otter	Lutra canadensis	G5	S3S4		E	
Lynx	Lynx lynx	G5	S1	C2	E	2,B

The Natural Heritage Ranking System

Information is gathered by Colorado Natural Heritage Program on Colorado's plants, animals, and natural communities. Each of these species and natural communities is considered an element of natural diversity, or simply an element. Each element is assigned a rank that indicates its relative degree of imperilment on a five-point scale (e.g., 1 = critically imperiled because of extreme rarity, 5 = demonstrably secure). The primary criterion for ranking elements is the number of occurrences, i.e., the number of known distinct localities or populations. This factor is weighted more heavily because, all other factors being equal, an element found in one place is more imperiled than something found in twenty-one places. Also of importance are the size of the geographic range, the number of individuals, trends in both population and distribution, identifiable threats, and the number of already protected occurrences. However, the emphasis remains on the number of occurrences, such that ranks are an index of known biological rarity.

Element rarity ranks are assigned both in terms of the element's degree of imperilment within Colorado (its State or S-rank) and the element's imperilment over its entire range (its Global or G-rank). Taken together, these two ranks give an instant picture of the degree of imperilment of an element. Colorado Natural Heritage Program actively collects, maps, and electronically processes specific occurrence information for elements considered critically imperiled to rare (S1 - S3). Those with a ranking of S3S4 are "watchlisted," meaning that specific occurrence data are collected and periodically analyzed to determine whether more active tracking is warranted. Watchlisted species are noted in the lists by an asterisk (*) next to the species name. A complete description of each of the Natural Heritage ranks is provided in Tables 1A and 1B.

This single rank system works readily for all species except those that are migratory. Those animals that migrate may spend only a portion of their life cycles within the state. In these cases, it is necessary to distinguish between breeding, non-breeding, and resident species. As noted in Table 1, ranks followed by a "B," e.g., S1B, indicate that the rank applies only to the status of breeding occurrences. Similarly, ranks followed by an "N," e.g., S4N, refer to nonbreeding status, typically during migration and winter. Elements without this notation are believed to be year-round residents within the state.

Definition of Natural Heritage Global Rarity Ranks

These ranks should not be interpreted as legal designations.

Global Rank (G): Based on the range-wide status of a species.

G1 Critically imperiled globally because of extreme rarity (5 or fewer occurrences, or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extinction. (Critically endangered throughout its range).

G2 Imperiled globally because of rarity (6 to 20 occurrences), or because of other factors demonstrably making it very vulnerable to extinction throughout its range. (Endangered throughout its range).

G3 Very rare or local throughout its range or found locally in a restricted range (21 to 100 occurrences). (Threatened throughout its range).

G4 Apparently secure globally, though it might be quite rare in parts of its range, especially at the periphery.

G5 Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.

GX Presumed extinct.

G#? Indicates uncertainty about an assigned global rank.

GU Unable to assign rank due to lack of available information.

GQ Indicates uncertainty about taxonomic status.

G#T# Trinomial rank (T) is used for subspecies or varieties. These taxa are ranked on the same criteria as G1-G5.

Definition of Natural Heritage State Rarity Ranks

These ranks should not be interpreted as legal designations.

State rank (S): Based on the status of a species in an individual state. S ranks may differ between states based on the relative abundance of a species in each state.

S1 Critically imperiled in state because of extreme rarity (5 or fewer occurrences, or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extirpation from the state. (Critically endangered in state).

S2 Imperiled in state because of rarity (6 to 20 occurrences), or because of other factors demonstrably making it very vulnerable to extirpation from the state. Endangered or threatened in state).
S3 Rare in state (21 to 100 occurrences).
S3S4 Watchlisted; specific occurrence data are collected and periodically analyzed to determine whether more active tracking is warranted
S#B Refers to the breeding season imperilment of elements that are not permanent residents.
S#N Refers to the non-breeding season imperilment of elements that are not permanent residents. Where no consistent location can be discerned for migrants or non-breeding populations, a rank of SZN is used.
SZ Migrant whose occurrences are too irregular, transitory, and/or dispersed to be reliably identified, mapped, and protected.
SH Historically known from the state, but not verified for an extended period, usually 15 years; this rank is used primarily when inventory has been attempted recently.
SX Presumed extirpated from state.
S#? Indicates uncertainty about an assigned state rank.
SU Unable to assign rarity rank, often because of low search effort or cryptic nature of the element.
SA Accidental in the state.
SR Reported to occur in the state, but unverified.
S? Unranked; some evidence that species may be imperiled, but awaiting formal rarity ranking.Federal and State Agency Special Designations

FEDERAL STATUS:

U.S. Fish and Wildlife Service (58 Federal Register 51147, 1993) and (61 Federal Register 7598, 1996)
LE Endangered; taxa formally listed as endangered.
E(S/A) Endangered due to similarity of appearance with listed species.
LT Threatened; taxa formally listed as threatened.
P Proposed E or T; taxa formally proposed for listing as endangered or threatened.
C Candidate: taxa for which the Service has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened.
(C1) FORMERLY: Notice of Review, Category 1: taxa for which substantial biological information exists on file to support proposing to list as endangered or threatened.
(C2) FORMERLY : Notice of Review, Category 2: taxa for which current information indicates that proposing to list as endangered or threatened is possible, but appropriate or substantial biological information is not on file to support an immediate rulemaking.
(C2*) FORMERLY : Taxa believed to be possibly extirpated in the wild.
(3A) FORMERLY : Taxa for which the USFWS has persuasive evidence of extinction.
(3B) FORMERLY : Names that based on current taxonomic knowledge do not represent taxa meeting the Endangered Species Act's definition of a species.
(3C) FORMERLY: Notice of Review, Category 3C: taxa that have proven to be more abundant or widespread than was previously believed, and/or those that are not subject to any identifiable threat.

U.S. Forest Service (Forest Service Manual 2670.5) (noted by the Forest Service as "S")
FS: Sensitive: those plant and animal species identified by the Regional Forester for which population viability is a concern as evidenced by: a. Significant current or predicted downward trends in population numbers or density. b Significant current or predicted downward trends in habitat capability that would educe a species' existing distribution.

Bureau of Land Management (BLM Manual 6840.06D) (noted by BLM as "S")
BLM: Sensitive: those species found on public lands, designated by a State Director, that could easily become endangered or extinct in a state. The protection provided for sensitive species is the same as that provided for C (candidate) species.

STATE STATUS:
Colorado Division of Wildlife
E Endangered T Threatened SC Special Concern

Legal Designations
Natural Heritage rarity ranks should not be interpreted as legal designations. Although most species protected under state or federal endangered species laws are extremely rare, not all rare species receive legal protection. Legal status is designated by either the U.S. Fish and Wildlife Service under the Endangered Species Act or by the Colorado Division of Wildlife under Colorado Statutes 33-2-105 Article 2. In addition, the U.S. Forest Service recognizes some species as "Sensitive," as does the Bureau of Land Management. Table 2 defines the special status assigned by these agencies and provides a key to the abbreviations used by Colorado Natural Heritage Program.
Please note that the U.S. Fish and Wildlife Service has issued a Notice of Review in the February 28 Federal Register for plants and animal species that are "candidates" for listing as endangered or threatened under the Endangered Species Act. The revised candidate list replaces an old system that listed many more species under three categories: Category I (C1), Category 2 (C2), and Category 3 (including 3A, 3B, 3C). Beginning with the February 28 notice, the Service will recognize as candidates for listing only species that would have been included in the former Category 1. This includes those species for which the Service has sufficient information on their biological status and threats to propose them as endangered or threatened under the Endangered Species Act.
Candidate species listed in the February 28 Federal Register are indicated with a "C." Former Category 2 and Category 3 codes are noted in this publication in parentheses, eg. (C2). Although obsolete legal status codes will not be provided in future issues, Colorado Natural Heritage Program will continue to maintain them in it's Biological and Conservation Data system for reference.

Boulder County Comprehensive Plan Animals of Special Concern-definitions of designations.

Mammals

Class 1. Extirpated species
Species for which there is historical documentation, but which no longer occur in Boulder County.

Class 2. Threatened and Endangered species.
A. Federally-listed threatened or endangered species.
B. State-listed threatened or endangered species.

Class 3. Species undergoing long-term , non-cyclical population declines.

Class 4. Species of restricted habitat.

Class 5. Species of undetermined status.

Class 6. Additional "mammal species of special concern" Colorado Natural Heritage Inventory, Department of Natural Resources, and The Nature Conservancy.

Birds

Class 1. Extirpated Species.
A. Extirpated breeding species in Boulder County.
1. Those species for which there is historical documentation, but no sightings during the breeding season in the last ten years.
2. Based on BCWI.

Class 2. Endangered and Threatened Species.
A. Federally endangered and threatened species.
B. State endangered and threatened species.

Class 3. Species Undergoing Long Term, Noncyclical Population Declines.
- A. From Supplement IV.1, "Comparative Status of the Breeding Birds of Boulder County."
- B. American Birds "Blue List " (Tate and Tate, 1982).

Class 4. Species with Habitat Restrictions.
- A. Rare breeding bird species in Boulder County.
  - 1. Based on Boulder County Wildlife Inventory and Holitza and Krieg (1981).
- B. Breeding bird species with isolated or restricted populations.
  - 1. Based on Boulder County Wildlife Inventory (Boulder Audubon Society 1974-1983).
- C. Colorado Division of Wildlife "Stenotopic Birds-Colorado."
  - 1. Based on Graul et al. (1980).
- D. Winter resident species with restricted habitats.
  - 1. Based on Boulder County Wildlife Inventory (Boulder Audubon Society 1974-1983).

Class 5. Colorado Natural Heritage Inventory "Animal Species of Special Concern".

Fish

The relative Abundance category has five basic classifications:

(a) Extirpated

(b) Threatened or endangered - State or Federal

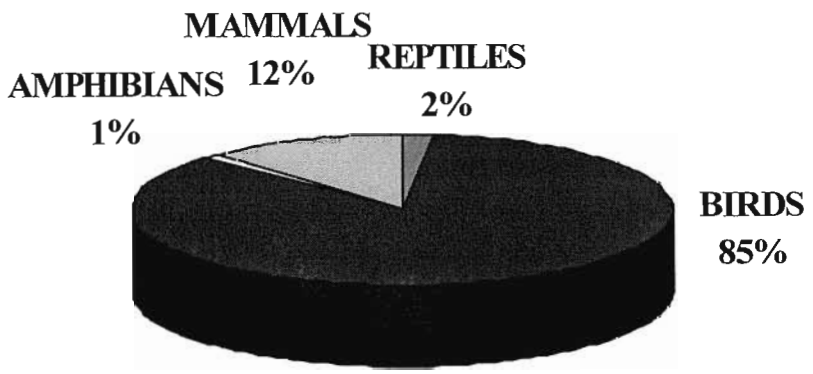
(c) Rare - Less than 50 fish per collection and 10 or fewer sites. The sub units of 1, 2, or 3 refer to reason for rarity. Rare - 1 is due to limited amount of preferred habitat. Rare - 2 species were never common. Rare - 3 species were historically more common but declines have been due to habitat degradation. Continued declines could lead to extirpation of these species from the County. None of the 7 rare species have been historically abundant.

(d) Uncommon - Less than 100 fish per collection and at 11-25 sites. Habitat deterioration has affected a number of these species or they may have very specific habitat requirements which has precluded them from becoming common.

(e) Common - More than 100 fish per collection and at 25+ sites.

APPENDIX 8.3 SUPPORTING WILDLIFE DATA

Figure 1 Percentages of vertebrate classes recorded for the North Boulder Valley Management Area from the Wildlife Sightings Database (1987-present).



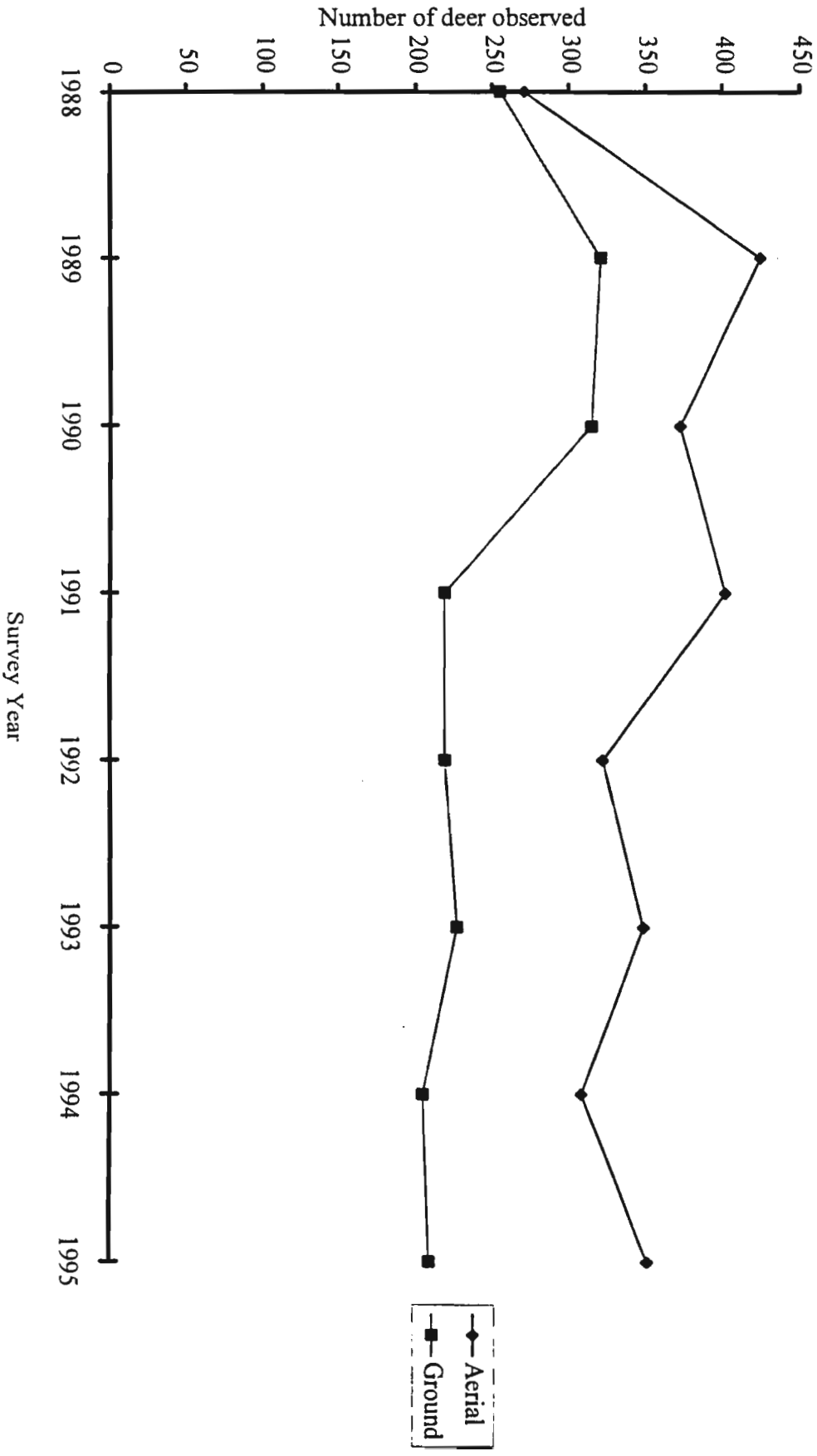


Figure 2. Annual deer counts for the City of Boulder Open Space.

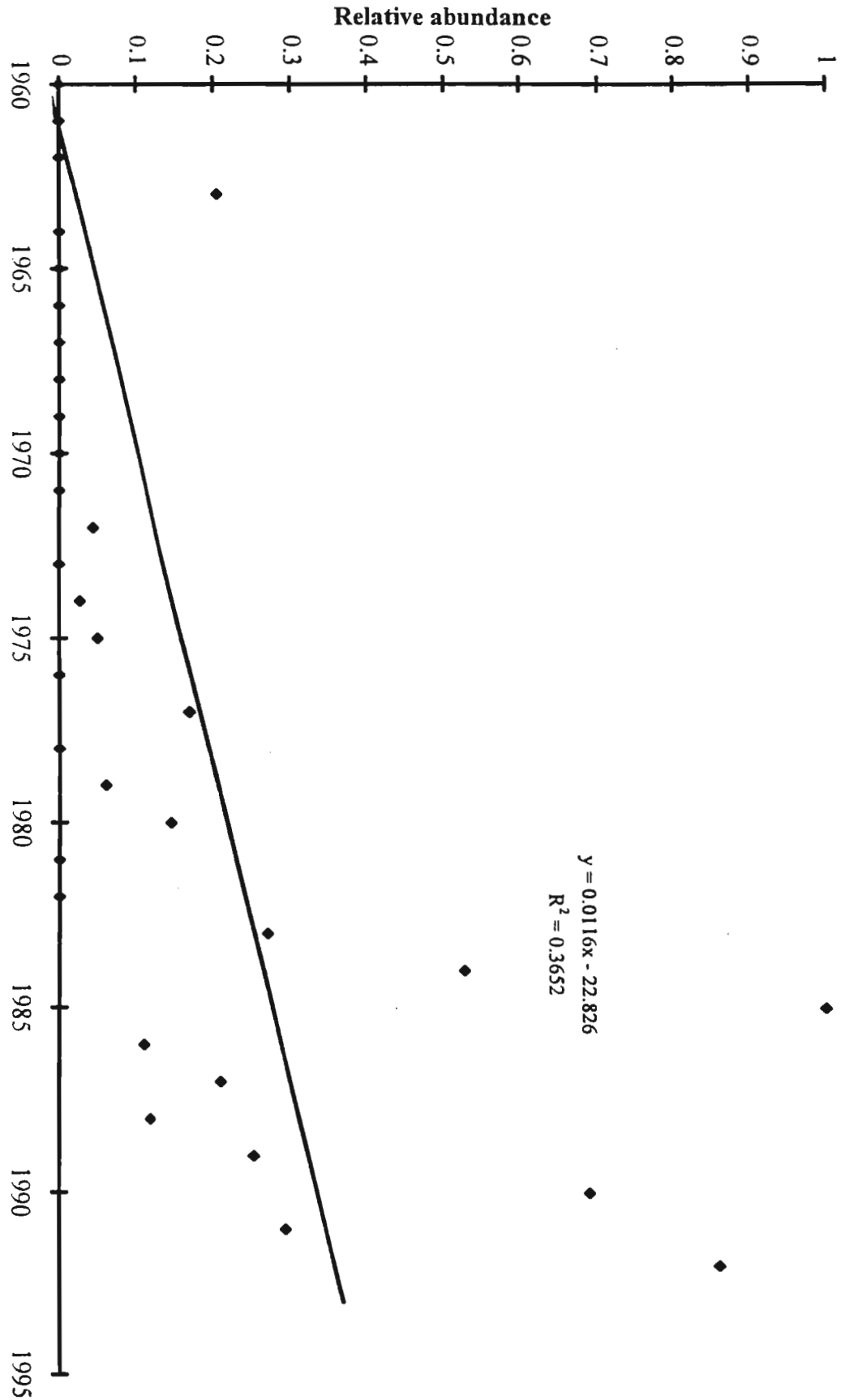


Figure 3. Bald eagle population trends (CBC Boulder Block 1951-1992).

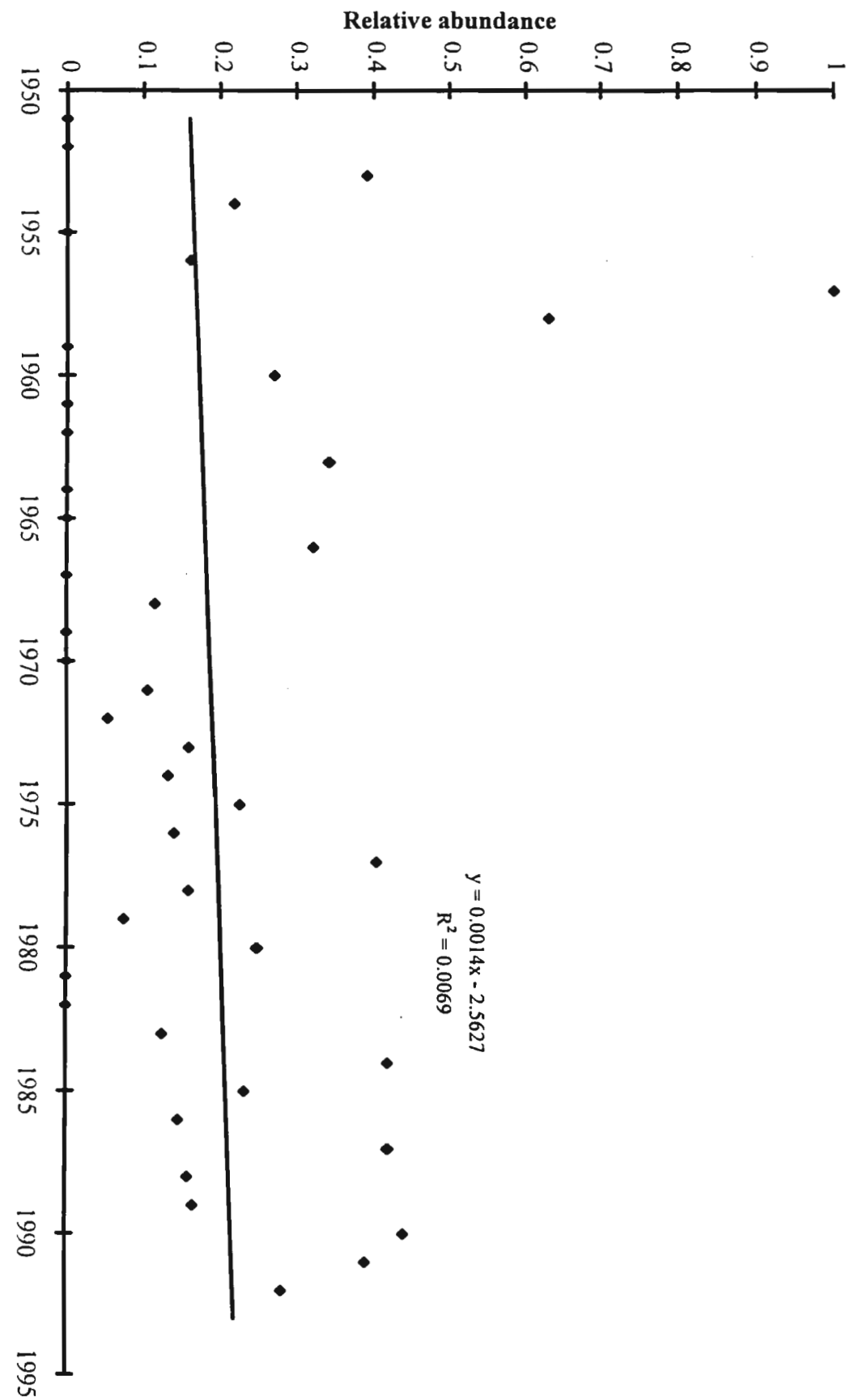


Figure 4. Golden eagle population trends (CBC Boulder Block 1951-1992).

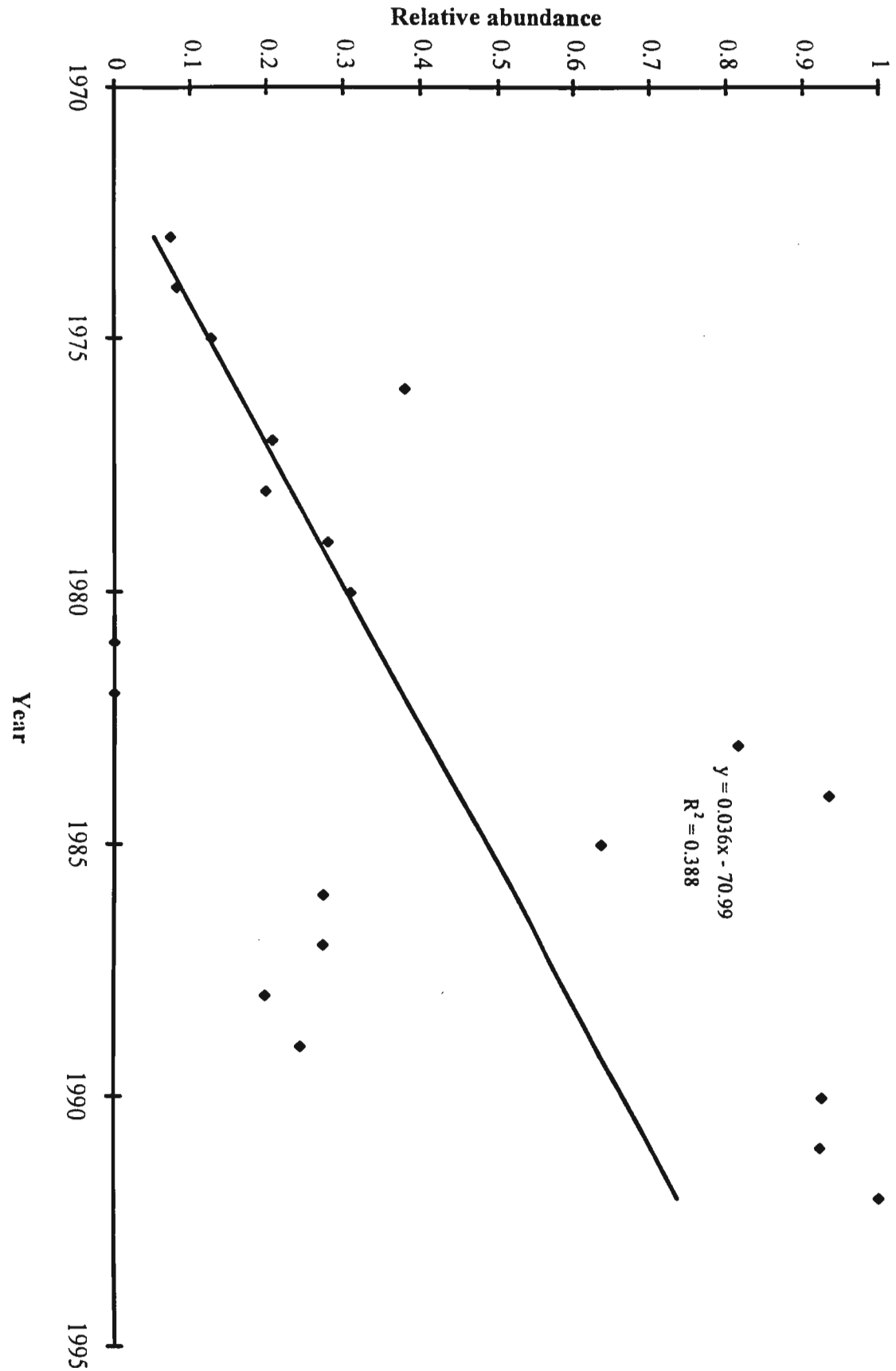


Figure 5. Ferruginous hawk population trends (CBC Boulder Block 1972-1992).

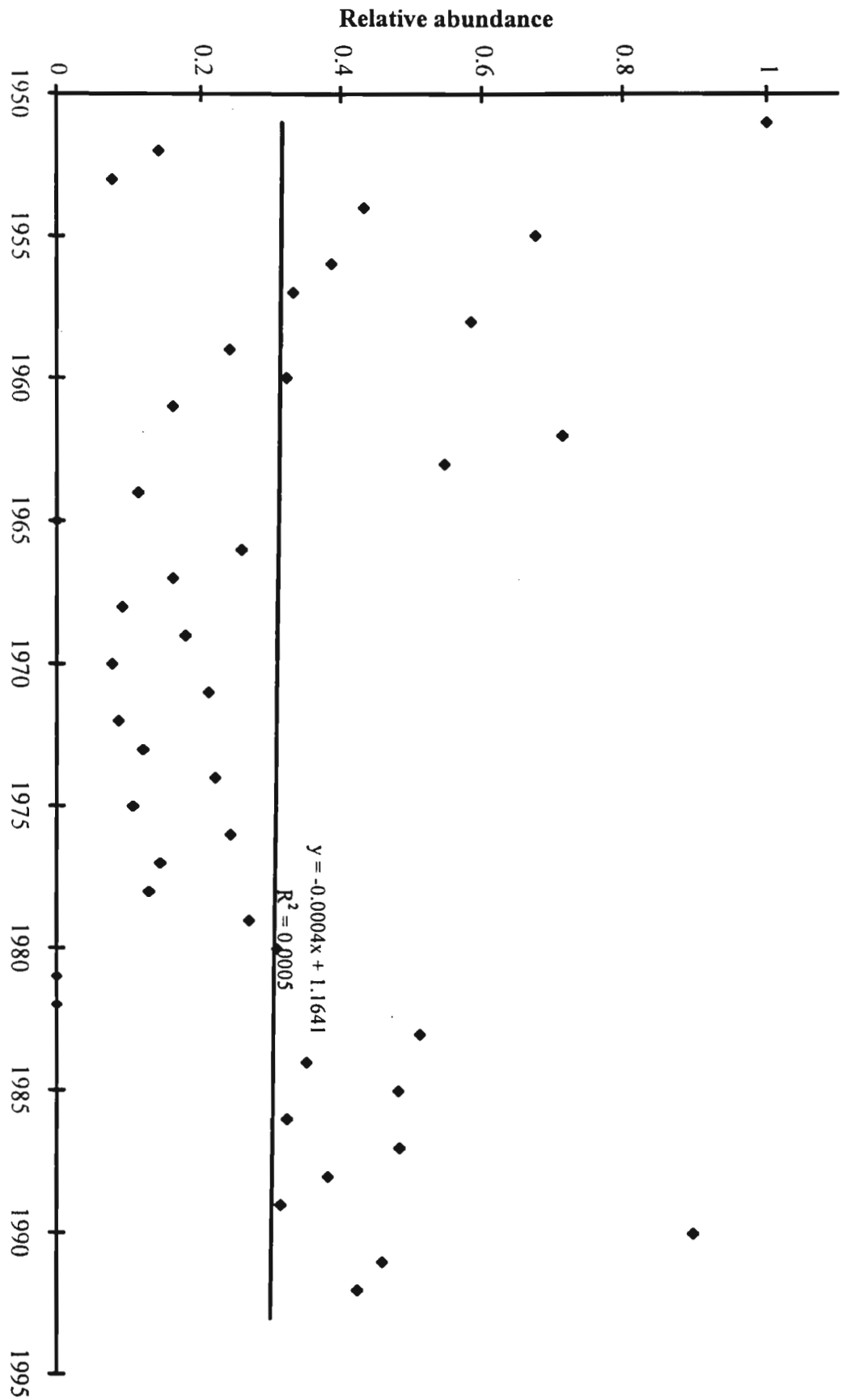


Figure 6. Red-tailed hawk population trends (CBC Boulder Block 1950-1992).

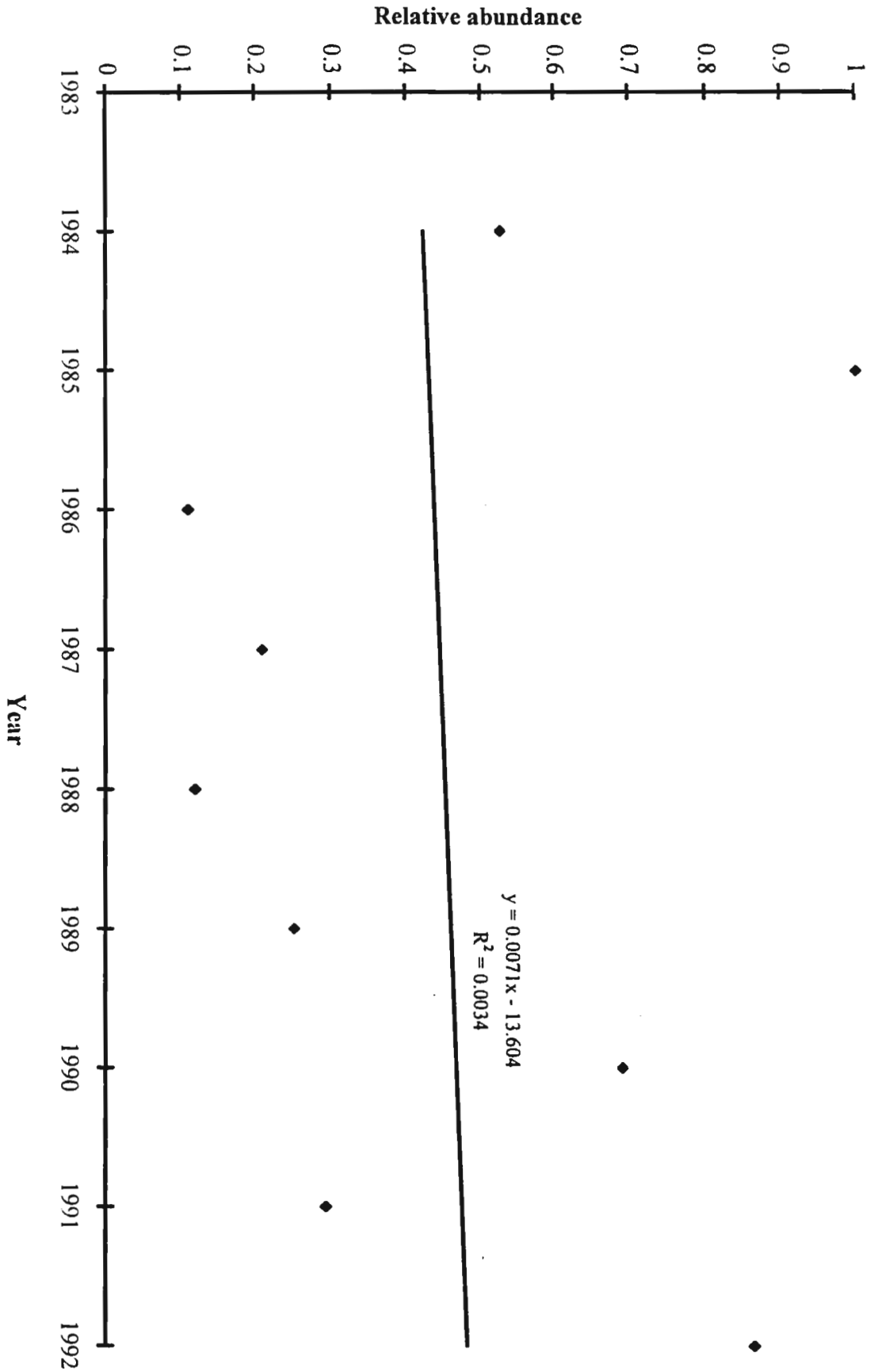


Figure 7. Bald eagle population trends (CBC Boulder Block 1983-1992).

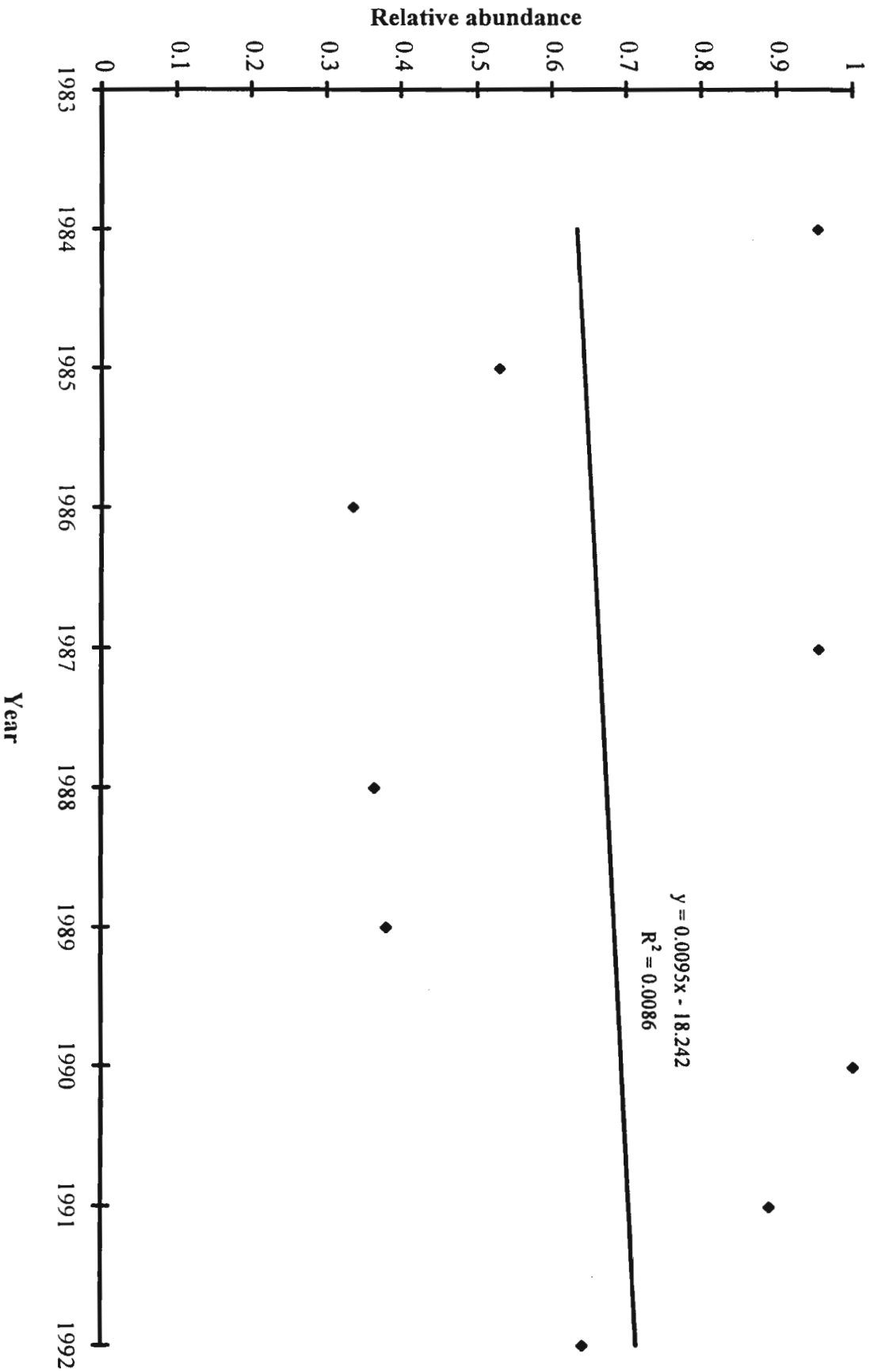


Figure 8. Golden eagle population trends (CBC Boulder Block 1983-1992).

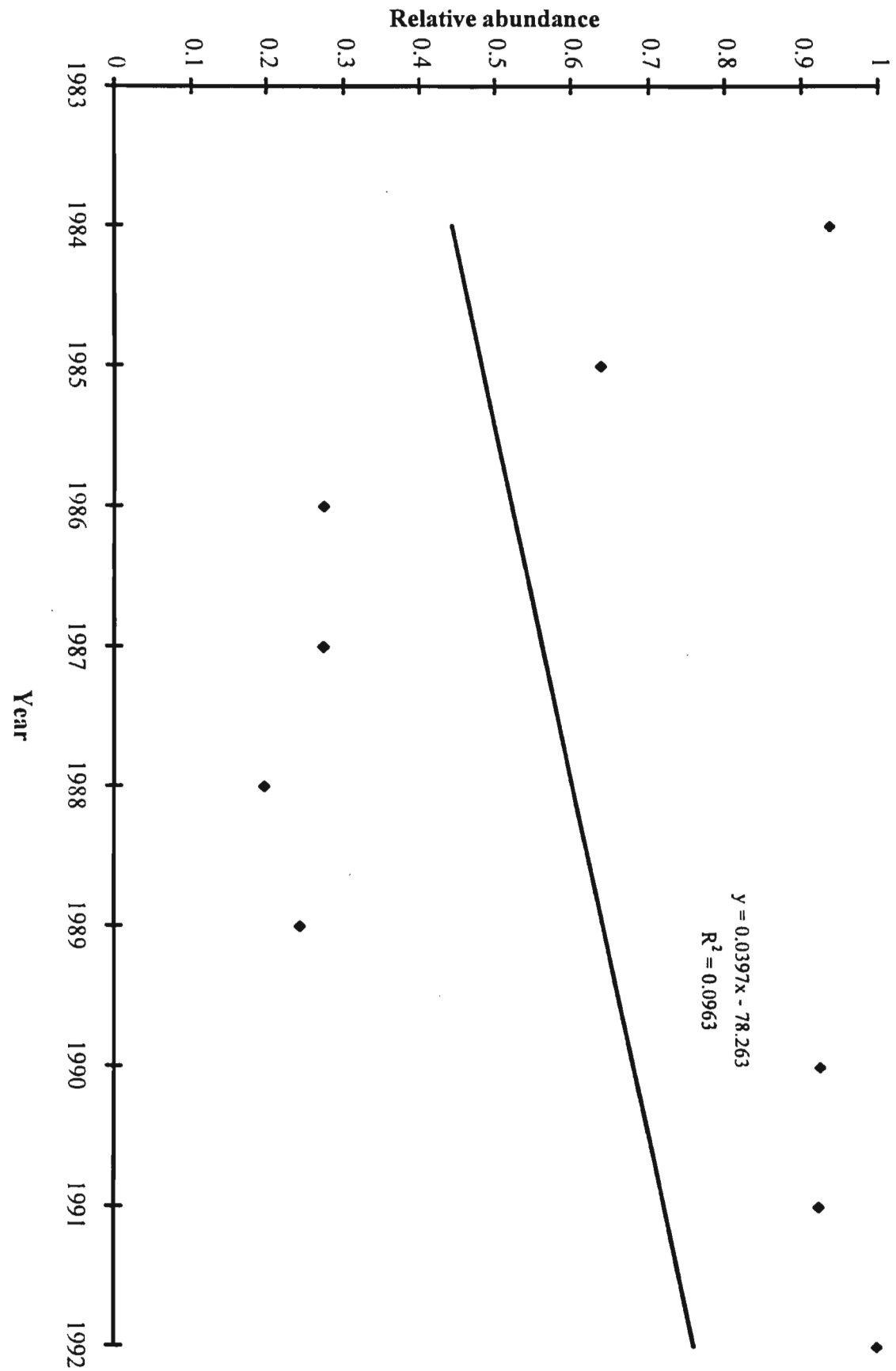


Figure 9. Ferruginous hawk population trends (CBC Boulder Block 1983-1992).

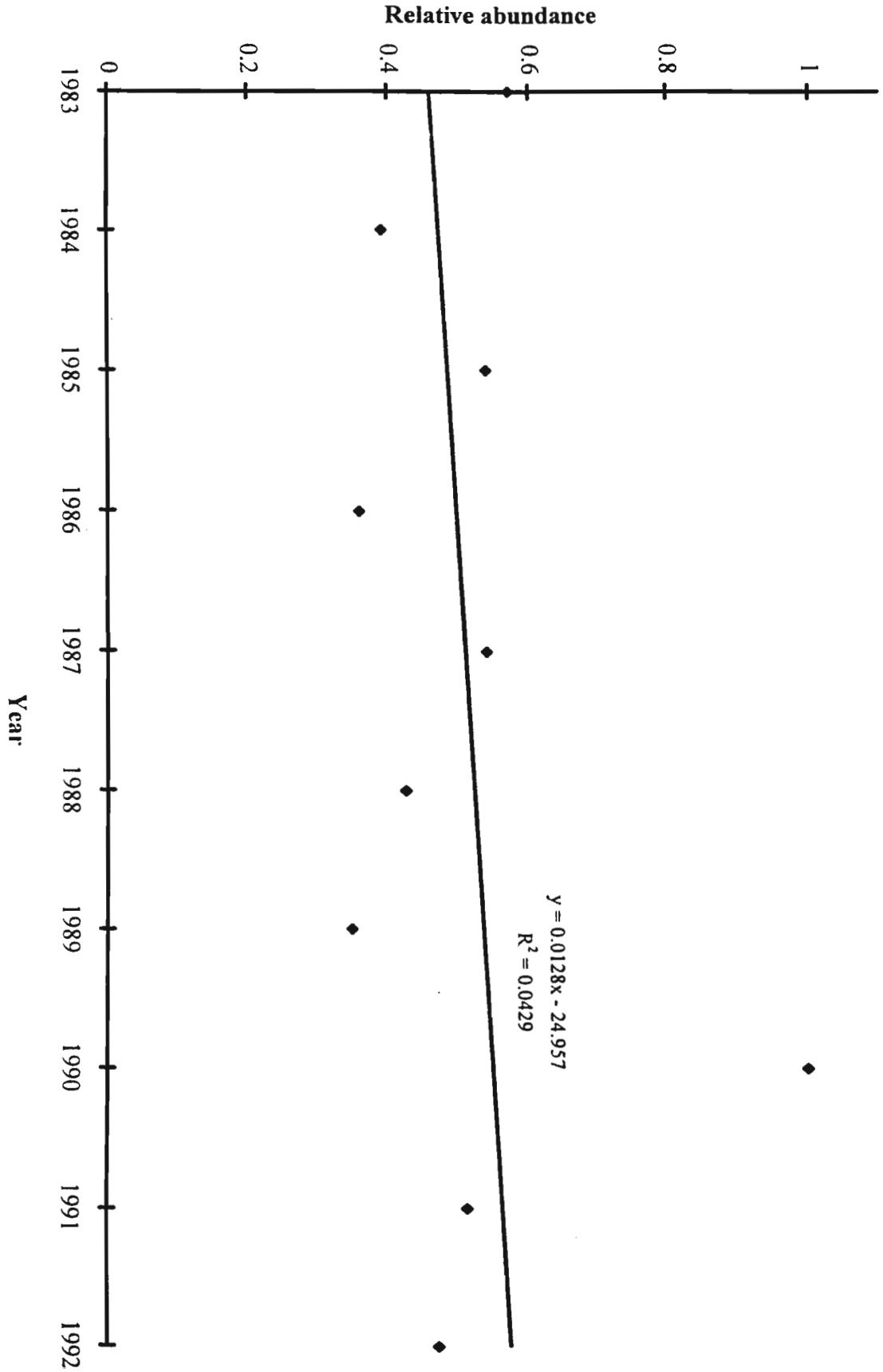


Figure 10. Red-tailed hawk population trends (CBC Boulder Block 1983-1992).

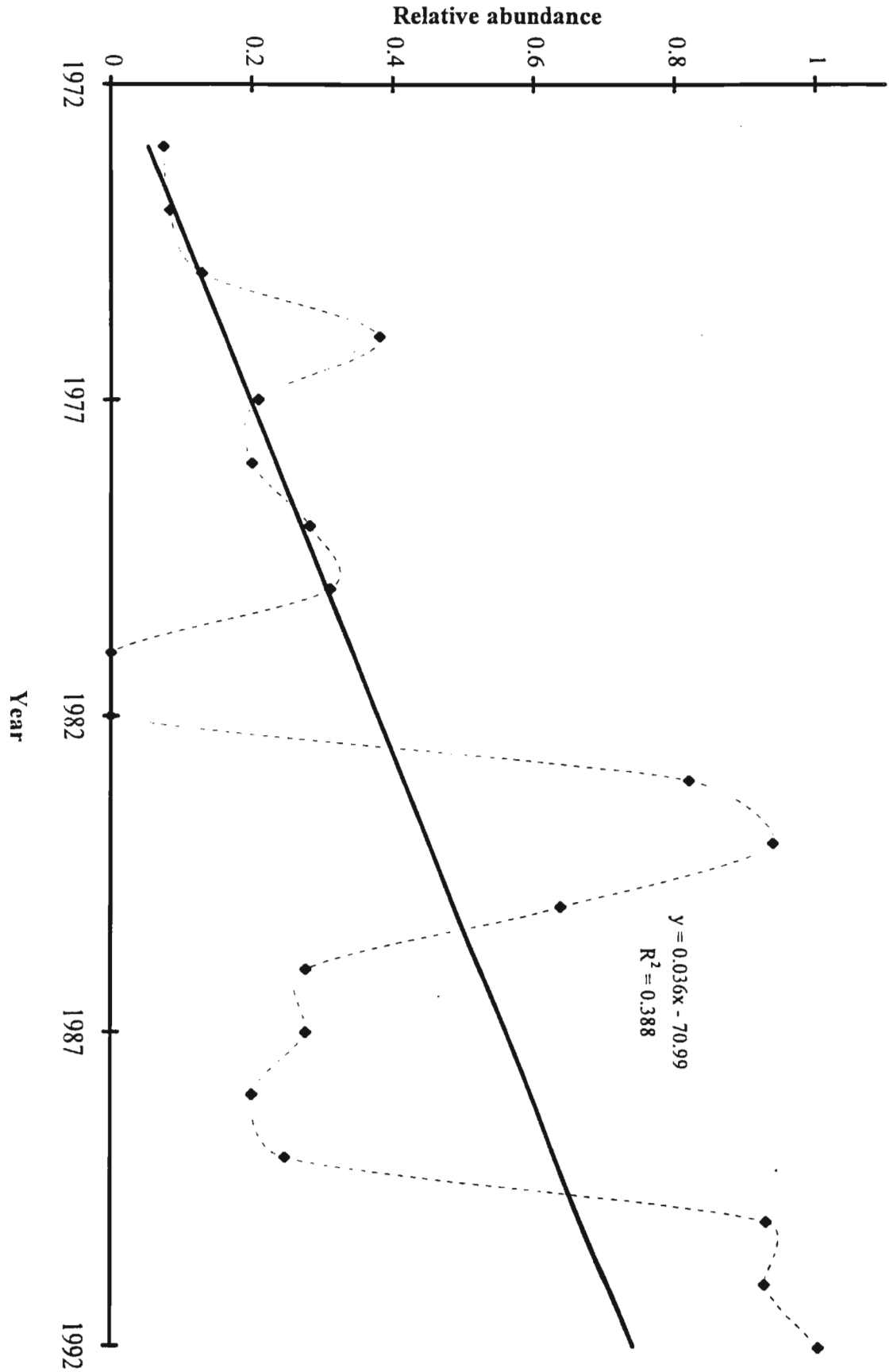


Figure 11. Ferruginous hawk population trends (CBC Boulder Block 1972-1992).

APPENDIX 12.1 CRITERIA AND DESCRIPTIONS OF SIGNIFICANT AGRICULTURAL LANDS

Agricultural Lands of National Importance
Agricultural lands of national importance are either "prime" or "unique" farmlands.

Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oil seed crops; and is also available for those uses (the land could be cropland, pasture land, rangeland, forest land or other land, but not urban built-up land or water). Soils of National Importance have the soil quality, growing season and moisture supply needed to economically produce sustained high yields of crops when treated and managed, including water management, according to acceptable farming methods.

To be considered prime farmland, the soil must meet specific criteria which are outlined in the following publications: "Soil Taxonomy, Agriculture Handbook 436"; "Soil Survey Manual, Agriculture Handbook 18"; "Rainfall-Erosion Losses from Cropland, Agriculture Handbook 282"; "Wind Erosion Forces in the United States and Their Uses in Predicting Soil Loss, Agriculture Handbook 346"; and Saline and Alkali Soils, Agriculture Handbook 60."

Prime farmland soils, as defined by the U. S. Department of Agriculture, are soils that are best suited to produce food, feed, forage, fiber and oil seed crops. Such soils have properties that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. The moisture supply, of course, must be adequate and the growing season has to be sufficiently long. Prime farmland soils produce the highest yields with minimal inputs of energy and economic resources and farming these soils results in the least damage to the environment.

Prime farmland soils may presently be in use as cropland, pasture, or woodland, or they may be in other uses. They either are used for producing food or fiber or are available for these uses. Urban or built-up land and water areas cannot be considered prime farmland.

Prime farmland soils usually get an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity level of the soils is acceptable. The soils have few or no rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not subject frequent flooding during the growing season. The slopes range from 1-6%. Soils that have a high water table, are subject to flooding or saline may qualify as prime farmland soils if the limitations or hazards are overcome by drainage, flood control or leaching. On-site evaluation is necessary to determine the effectiveness of corrective measures. More information on the criteria for prime farmland soils can be obtained at the local office of the Natural Resource Conservation Service, formally the Soil Conservation Service.

Unique farmland is land other than prime farmland that is used for the production of specific high value food and fiber crops. It has the special combination of soil quality, location, growing season and moisture supply needed to economically produce sustained quality and/or high yield of a specific crop, when treated and managed according to acceptable farming methods. Two areas in Colorado are considered Unique Farmlands of National Importance. The fruit orchards in the Grand Valley and the Delta-Montrose areas, and the seed potato and fruit and vegetable producing areas of the San Luis Valley.

Agricultural Lands of Statewide Importance
These areas are of statewide importance because of their production of food, feed, fiber, forage and oilseed crops. Three categories used for considering soils as statewide important are; Irrigated Land (not prime), Irrigated Land (water supply inadequate) and High Potential Dry Cropland.

Irrigated Land (not prime) are lands that are important to the state's agricultural economy but do not meet the prime criteria for one or more reasons. The State has determined that these crops could be grown in other parts of the State but should receive special consideration when planning and evaluating the agricultural resources of the State. These areas have a combination of soils, climate, historic land use and/or geographic location which contribute to the viability of the local livestock industry, fruit and vegetable growing areas and certified fruit and vegetable seed producing areas.

Irrigated Land (water supply inadequate) is identified in some counties as Statewide Important Farmland. On these lands the irrigation water is inadequate to meet the moisture requirements of prime farmlands.

High Potential Dry Cropland is identified as Statewide Important Farmland. These soils have adequate moisture supply and water holding capacity for an alternate crop-fallow system. They are not salt or sodium affected. When managed properly, they are not highly erosive. Although yield is not used as specific criteria for defining this category, these soils can be expected to yield 20 bushels of wheat per acre or better under a wheat -fallow rotation. Most of this land is used for dryland wheat, although grain sorghum, forage sorghum and corn are also grown. In most instances, soils in this category meet the requirements for Prime Farmland and would become prime if they were irrigated. These areas may or may not be farmed at the present time.

Agricultural Lands of Local Importance
Agricultural lands of local importance contains three categories: irrigated cropland, dry cropland and rangeland. These are lands which, based on their current and historic use and their inherent soil properties are the County's most important agricultural lands.

Identification of the three categories of agricultural land of local importance is based on criteria devised by the Longmont office of the Natural Resource Conservation Service and the Boulder County Extension Office. These lands are lands which, based on their current and historic land use and their inherent soil properties are the County's most important agricultural lands. Based

on the Natural Resource Conservation Service and Extension work with farmers over the years, the irrigated cropland, dry cropland and rangeland that are identified are those agricultural lands of key importance to our local agricultural economy.

APPENDIX 12.2 STANDARD AGRICULTURAL LEASE TERMS AND PROVISIONS

SECTION 1. TERM OF LEASE/OPTION TO RENEW

This section describes the starting and ending dates for the lease as well as any renewal options. Also found in this section is a month-to-month clause that allows the lessee to continue the lease under existing conditions after the lease has expired.

SECTION 2. NO PARTNERSHIP, EMPLOYMENT OF AGENCY

This section describes that this lease doesn't constitute a partnership between the lessee and the City of Boulder. Neither party shall be liable for debts or obligations incurred by the other.

SECTION 3. RENT

This section describes the amount of rent that is required. The lease can be constructed as a "cash lease" or a "calculated lease". If the lease amount is calculated, this section will explain how the calculation will be carried out. The date that the rent is due will also be found in this section. Late payment penalties are explained in this section as well.

SECTION 4. CROP, GRAZING AND WILDLIFE MANAGEMENT PROVISIONS

This section outlines management requirements in the following areas:

- Crop Management
- Grazing
- Wildlife Management
- Other Duties
- Cultural Resource Management

SECTION 5. OPERATOR'S INVESTMENT AND EXPENSES

This section describes what type of investment and expense items the lessee is responsible for. There is a detailed list of expenses and each parties responsibilities in Exhibit B. This section also spells out the insurance requirements necessary to occupy the property.

SECTION 6. TALLGRASS PRAIRIE PRESERVATION

This section identifies the Open SpaceTallgrass Management program and that if the operator is requested to manage the property for tallgrass prairie, he or she will do so in accordance with the provisions found in Exhibit B.

SECTION 7. WETLAND MANAGEMENT

This section mandates the lessee protect all wetland areas located on the property as specifically set forth in Exhibit B.

SECTION 8. CONSERVATION PROGRAMS OR PRACTICES

This section describes the lessees involvement in any conservation or government programs or practices designed to aid agriculture.

SECTION 9. ENDANGERED PLANTS

This section mandates that the lessee protect any endangered, threatened or rare plants species on the property.

SECTION 10. TERMINATION

This section spells out the "grounds for Termination," "Settlement Upon Termination" and the "Condition of Property" after termination.

SECTION 11. GENERAL COVENANTS

This section has several sub-sections that cover the basic rules of the Open Space Program as they apply to the lessee.

SECTION 12. POSTING OF PROPERTY/USE BY PUBLIC AND OWNER

The City may post the name and telephone number of the lessee at any entrances to the property. The property will remain open to the public for use under the Open Space regulations and ordinances.

SECTION 13. NOTICE

The addresses for correspondence by the City and the lessee.

SECTION 14. SEVERABILITY

This section simply states that if one part of the lease is found to be unenforceable by a court, the remainder of the lease shall remain in effect.

SECTION 15. NON-WAIVER

"No assent, express or implied, to any breach of any one or more of the provisions hereof shall be deemed or taken to be a waiver of any succeeding or other breach of the same or a different provision."

SECTION 16. AMENDMENTS/ENTIRE AGREEMENT

This section contains the signatures of the City Manager on behalf of the City and of the lessee.

APPENDIX 12.3 CROP PRICES

Year	Corn	Wheat	Barley	Sugar Beet	Grass Hay	Alfalfa Hay	Pinto Bean	Cattle
	$/Bushel			$/Ton			$/100lbs	$/cwt
1947	2.17	2.23	1.49	11.50	14.00	18.90	10.10	
48	1.33	1.90	1.02	9.80	16.00	16.30	7.10	
49	1.27	1.87	0.90	10.90	14.50	14.40	6.50	
50	1.60	2.00	1.14	12.00	19.30	19.30	6.50	
51	1.84	2.11	1.29	11.90	22.70	22.70	6.70	
52	1.63	2.05	1.34	11.90	32.00	29.80	8.20	
53	1.56	2.04	1.12	11.70	22.70	20.20	7.10	
54	1.55	2.15	1.20	10.60	29.10	25.60	6.50	
55	1.42	1.95	1.02	11.30	25.50	21.80	5.40	
56	1.43	1.90	1.07	12.30	26.20	25.40	6.40	
57	1.13	1.83	0.77	11.90	19.00	17.70	5.60	
58	1.08	1.65	0.77	12.30	14.20	15.80	5.70	
59	1.12	1.69	0.77	11.90	20.20	22.70	6.80	
60	1.06	1.67	0.75	12.40	24.50	24.20	7.00	
61	1.15	1.74	0.84	12.10	25.00	21.20	5.80	
62	1.20	1.94	0.93	13.70	23.50	20.90	6.30	
63	1.20	1.82	0.97	12.30	29.70	27.30	5.90	
64	1.26	1.31	1.31	12.40	31.00	27.40	7.70	
65	1.26	1.33	1.38	12.80	31.20	24.50	7.60	
66	1.32	1.56	1.50	12.90	30.50	24.90	6.10	
67	1.15	1.24	1.39	14.10	27.90	26.60	8.20	
68	1.15	1.12	1.45	14.90	28.50	26.00	6.30	
69	1.18	1.13	1.47	8.70	25.30	25.60	9.40	
70	1.32	1.19	1.39	14.90	25.50	25.50	7.50	

Year	Corn	Wheat	Barley	Sugar Beet	Grass Hay	Alfalfa Hay	Pinto Bean	Cattle
71	1.19	1.20	1.51	15.60	30.50	30.50	9.60	
1972	1.61	1.77	1.77	17.70	41.05	39.50	8.60	
73	2.54	3.91	2.07	35.90	46.55	44.25	26.90	
74	3.02	3.81	2.79	50.30	52.00	52.00	28.00	
75	2.62	3.24	2.64	28.70	53.80	54.10	15.50	
76	2.13	2.36	2.17	21.10	55.30	56.30	11.70	
77	1.94	2.12	2.35	26.30	57.30	55.45	19.00	
78	2.26	2.81	2.31	27.60	49.80	50.10	17.00	
79	2.53	3.53	2.39	34.10	52.30	53.30	26.60	
80	3.06	3.70	2.87	47.50	66.00	63.90	28.70	66.80
81	2.50	3.59	2.81	33.80	66.00	64.60	14.80	63.70
82	2.75	3.34	2.96	35.00	65.00	66.50	11.70	63.50
83	3.17	3.23	2.97	33.40	64.50	70.50	18.40	62.60
84	2.66	3.18	2.61	22.40	67.00	74.00	16.70	64.90
85	2.37	2.76	2.60	27.40	56.00	58.00	17.20	59.90
86	1.60	2.25	2.15	32.90	56.00	58.80	15.20	58.70
87	1.95	2.51	2.56	35.40	61.00	62.40	14.60	67.40
88	2.54	3.69	3.01	42.10	74.50	85.70	31.20	72.50
89	2.32	3.68	3.28	43.70	89.00	92.50	30.40	75.30
90	2.36	2.47	3.06	39.80	77.50	81.00	15.90	80.00
91	2.43	3.07	3.14	39.80	70.00	71.00	13.70	76.30
92	2.23	3.15	2.57	39.50	62.50	64.50	19.00	76.30
93	2.65	3.21	2.93	38.40	73.50	77.00	27.00	78.50
94	2.40	3.50	2.70		89.00	91.00	16.60	70.50
Net Change	**+.23**	**+1.27**	**+1.21**	**+26.90**	**+75.00**	**+72.10**	**+6.50**	**+3.70**

12.3.1 1994-1995 North Boulder Valley Crop Summary

Lease Area	Year	Crop	Acreage	Yield	Unit of Measure
AJDC	1994	Wheat	52	2600	Bushels
AJDC	1994	Corn Grain	35	3200	Bushels
ADJC	1994	Hay	250	720	Tons
BVR	1994	Hay	78	58.81	Tons
AJDC	1995	Wheat	40	1400	Bushels
AJDC	1995	Corn Silage	42	600	Tons
AJDC	1995	Hay	250	667	Tons
BVR	1995	Hay	N/A	N/A	Tons

APPENDIX 12.4 1994 NORTH BOULDER VALLEY LIVESTOCK GRAZING SUMMARY

Property	Land Use	W*		Sp*		Su*		F*		Total
		C**	H**	C	H	C	H	C	H	
BVR	Irr. hay/pasture	14	60	51	8		34	28		195
	Native range				56	96	12			164
Ellison/Lore	Irr. hay/pasture					12		73		85
Ditzel	Irr. hay/pasture	63								63
South Beech	Native range									
Axelson	Irr. hay/pasture	132								132
	Native range									
Johnson	Irr. hay/pasture	79			11		22	161		273
Dawson	Irr. hay/pasture	30		30						60
Cowles	Irr. hay/pasture									

C = cattle
H = horses
*W = Jan. 1 - March 31
*Sp = April 1 - June 30
*Su = July 1 - Sept. 30
*F = Oct. 1 - Dec. 31

12.4.1 1995 North Boulder Valley Livestock Grazing Summary

Property	Land Use	W*		Sp*		Su*		F*		Total
		C**	H**	C	H	C	H	C	H	
BVR	Irr. hay/pasture		74	15	38	51	52	8	73	311
	Native range			29	37	51	22	25		164
Ellison/Lore	Irr. hay/pasture	36		11				45		92
Ditzel	Irr. hay/pasture	36								36
South Beech	Native range					127				127
Axelson	Irr. hay/pasture	80		33				6		119
	Native range	46		62						108
Johnson	Irr. hay/pasture	65						36		101
Dawson	Irr. hay/pasture	18								18

Property	Land Use	W*		Sp*		Su*		F*		Total
		C**	H**	C	H	C	H	C	H	
Cowles	Irr. hay/pasture			15		9				24

C = cattle H = horses
*W = Jan. 1 - March 31 *Sp = April 1 - June 30 *Su = July 1 - Sept. 30 *F = Oct. 1 - Dec. 31

APPENDIX 12.5 NORTH BOULDER VALLEY WATER RIGHTS SUMMARY

Ditch Name	# Shares	Source	Original Decree	Current Decree	Avg. Yield/Share
Farmers Ditch	21.9607	Boulder Creek	73.29	52.9837	79.2/af
Lefthand Ditch	879.000	St.Vrain Creek	726.0	726.0	1.11/af
Star Ditch	4.83	Lefthand Ditch	25.68	0.00	*
Johnson Ditch	**	Lefthand Ditch	8.55	0.00	*

*** Average yield is dependent on the number of shares held in Lefthand Ditch.**
**** Unincorperated Ditch**

APPENDIX 13.1 CITY OF BOULDER OPEN SPACE REGULATIONS

DOG REGULATIONS Dogs must be within sight of the owner/keeper and under voice control at all times here and on other Open Space land outside of Boulder City limits. Dogs observed harassing or menacing any person, wildlife or livestock may be destroyed by a City Ranger or other authorized person. Visitors are responsible for picking up their pet's excrement. Other dog regulations are in effect in other areas. Please check these regulations before bringing any pet onto Open Space.

BIKING REGULATIONS Bicycles (non-motorized vehicles) are permitted only on those trails designated, and signed as being open to bicycles.

GLASS CONTAINERS Glass containers are prohibited.

DAMAGING PROPERTY Any damaging or removal of Open Space property or natural features including but not limited to wildflowers, rocks, wildlife, trees, etc. is prohibited.

WILDLIFE PROTECTION It is prohibited to disturb any wildlife or wildlife habitat on Open Space land. Hunting, trapping, chasing or removing wildlife is specifically prohibited. Any research project must be authorized by the Open Space Department.

CAMPING Camping is prohibited on Open Space, along with use of a vehicle as a residence. No tents or nets can be erected.

FIRES Fires are permitted only in designated firepits. Fires are prohibited between 11:00 p.m. and 6:00 a.m. Fires must be extinguished completely prior to leaving the area. During times of extreme fire danger fire bans may be instituted.

FIREWORKS Possession or discharge of fireworks is prohibited. Fireworks include firecrackers, roman candles, model rockets, hot air balloons and numerous other items.

LITTER Please dispose of litter properly or remove it from the area if trash containers are full. It is prohibited to dispose of trash on Open Space land or in Open Space trash receptacles which is not generated by activities conducted on Open Space.

CURFEW It is prohibited to park a vehicle on Open Space or in an Open Space lot between 12:00 midnight and 5:00 a.m.

MOTOR VEHICLES Motor vehicles are prohibited except in parking lots.

WEAPONS AND FIREARMS Possession or discharge of a firearm or weapon, or discharge of any projectile from a firearm, bow, slingshot, or other weapon, is prohibited.

TRESPASS Entering closed areas or climbing on buildings is prohibited.

HORSE AND LIVESTOCK/GRAZING Grazing of domestic animals and commercial livestock operations are prohibited without a permit. Livery operations are prohibited without a permit from the City of Boulder Open Space Dept.

PERMITS FOR ORGANIZED EVENTS Any recreational, athletic, or social event intended for an attendance of 50 or more persons will need a permit. Contact the City of Boulder Open Space Department for application information.

BOLTING No person involved in rock climbing is allowed to place or attach any fixed hardware.

OTHER PROHIBITED CONDUCT Golfing, polluting the water, wading or boating on lakes or ponds, sliding (sledding) except in designated areas, amplified sound systems, and disturbing the peace of other users by noise.

ALCOHOL Please be aware that state law prohibits the consumption of alcohol greater than 3.2% in any public place.

THESE ARE ONLY SOME OF THE REGULATIONS IN EFFECT ON CITY OF BOULDER OPEN SPACE. PLEASE BE AWARE THAT YOU ARE RESPONSIBLE FOR KNOWING AND OBEYING ALL OPEN SPACE REGULATIONS. VIOLATIONS MAY RESULT IN FINES AND/OR IMPRISONMENT. FOR FURTHER INFORMATION PLEASE CONTACT THE CITY OF BOULDER OPEN SPACE DEPARTMENT, AT 441-4142 OR 441-3440. IN CASE OF AN EMERGENCY, DIAL 911.

APPENDIX 14.1 ACCOMPANYING SET OF MAPS AND FIGURES

Table 10.1 North Boulder Valley Property Inventory

PROPERTY	OWNERSHIP STATUS	ACRES	YEAR ACQUIRED	PUBLIC EASEMENT	CONSERVATION EASEMENT
Axelson, West	fee	479	1990		
Axelson, West	development rights	1	1990		
Axelson, East	fee	40	1990		
Beech, East	fee	617	1988	easement & ROW for: Neva Road (County Road 34); Foothills Highway (U.S. 36, State Hwy. 7; County Road purposes (granted 1955)	
Beech, East	temporary closure	33	1988		
Beech, West	fee	350	1988		
Beech, West	conservation easement	8	1988		City can enter for maintenance/patrol/emergency access; public access shall not be restricted/ prohibited; City will construct trail, trailhead, & parking area; City shall design animal control program & give prior consent before control undertaken
Beech, West (north parcel)	conservation easement	1	1988		Beech shall not place or construct any road or structure except boundary line fence; no public access beyond Beech reclaiming waste disposal pit
Beech, West (south parcel)	conservation easement	1	1988		Beech shall not place or construct any road or structure except boundary line fence; no public access beyond Beech reclaiming waste disposal pit
Beech, West	County fee	200	1988		City holds on portion of property; City can enter for maintenance, patrol, & emergency access; County shall not restrict or prohibit public access through the property
Boulder Land, Irrigation and Power	fee	518	1973	City permanent easement & ROW (Longhorn Road) to provide access to property	
Boulder Valley Ranch (103 Corp.)/Lore	fee	639	1973		

PROPERTY	PRIVATE EASEMENT	RIGHT-OF-WAY (ROW)	OTHER
Axelson, West (fee)	Markel Homes, Inc. temporary easement & non-exclusive license for access for not more than 7 years for wetland restoration project	Star Ditch; County Rd. 51; Dry Creek	Star Ditch access to powerline via vehicle gate
Axelson, West (development rights)		Dry Creek	contained leaking oil well that has been plugged & the area cleaned up
Axelson, East	Poudre Valley Rural Electric Assoc. (REA) easement & ROW for electric transmission line	N. 63rd St.	
Beech, East (fee)	10' wide Mountain States Telephone & Telegraph easement (T&T) & ROW for utility purposes; Beech reserved: existing 30' wide waterline easement, new 30' wide waterline easement from meter pit		Water Co. shall have right to use Left Hand Valley Reservoir feeder ditch & Left Hand Valley Reservoir facilities of the Ditch Co. as carriers of its water to fill Loukonen Bros. Reservoir & Reservoir Enlargement
Beech, East (temporary closure)			contaminated area closed to public use by Boulder County until Beech has cleaned up area
Beech, West (fee)	10' wide & 16.5' wide Mountain States T&T easements & ROW for utility purposes; Foothills Water Users Assoc. 20' wide for water pipeline & ingress & egress; temporary access to waste pits for reclamation	Highway (U.S. 36) --- PRIVATE (cont.): 2.3 acre temporary easement around north 1 acre waste disposal pit	subdivision covenants for Olde Stage Lot 11 prohibit use as a parking lot
Beech, West (cons. easement)			
Beech, West (cons. easement, N)			waste disposal pit; will be deeded to City once City satisfied EPA has approved cleanup
Beech, West (cons. easement, S)			waste disposal pit; will be deeded to City once City satisfied EPA has approved cleanup
Beech, West (Co. fee)	Beech reserved permanent non-exclusive easement for water storage tanks & underground water utility lines; access & waterline easement		
Boulder Land, Irrigation and Power	10' wide to Mountain States T&T for underground utility ROW; rights of owners of Silver Lake Ditch to use the ditch presently located; Public Service Co. for gas pipeline	Silver Lake Ditch	Luchetta access driveway; Rubin & Snyder claim access off Mesa Res. Rd.; rights granted to: U of C High Altitude Observatory; Fairway Utility, Inc. & Rocky Flats Water Co. for installation of water storage & distribution system; rights in & to ditch(s)
Boulder Valley Ranch (103 Corp.)/Lore	Mountain Bell for underground phone service for current overhead line for 2 houses on adjacent Luchetta property	10' wide, Mountain States T&T for communication & other facilities to serve Hidden Valley Ranch	

PROPERTY	OWNERSHIP STATUS	ACRES	YEAR ACQUIRED	PUBLIC EASEMENT	CONSERVATION EASEMENT
Boulder Warehouse	development rights	80	1974	City along western & southern boundaries for access by foot, horse, or non-motorized vehicle by the general public (status in question)	
Brewbaker	fee	140	1996	easements to County over & across existing roads, farm lanes & irrigation routes for irrigation and agricultural purposes	
Cowles	fee	40	1991	County Road 36 (Monarch Rd.)	
Dawson	fee	72	1992	water line purposes 20' in width	
Dawson	conservation easement	4	1992		Dawson may restrict public access; development restricted to 1 single-family dwelling (2500 sq. ft.) & existing out buildings (4150 sq. ft.); no paved driveway wider than 20'; new road to dwelling only w/ Dawson's approval
Degge	fee	5	1988		
Degge/Schneider	fee	2	1976		
Ditzel	fee	57	1984		
Ellison	fee	75	1991	owner agrees to dedicate what's necessary for installation of domestic water system; ROW for N. 51st Street; utilities	Lot 5
Gilbert	fee	47	1973		
Hart-Jones	fee	18	1975	easement & ROW for County Road 39; City easement & ROW for installation, construction, repair, maintenance, & reconstruction of underground water line	
Joder, West	fee	20	1991		if property not used for trail by 1/31/2011, land may be conveyed back to Joders subject to a conservation easement (similar to one on Joder II)
Joder, East	County fee	3	1991	40' wide non-exclusive easement & ROW for ingress & egress (for public access from U.S. 36)	County conveyed to City over Easement Area; City right to preserve/protect land/views in present natural condition; County to manage/ maintain

PROPERTY	PRIVATE EASEMENT	RIGHT-OF-WAY (ROW)	OTHER
Boulder Warehouse			Boulder Warehouse has right to: build single-family dwelling & accessory buildings permitted by right in County rural residential district; access; build fences, cross-fences, gates as reasonable as needed for agricultural use
Brewbaker	easements to Brewbakers over & across existing roads, farm lanes & irrigation routes for irrigation and agricultural purposes; 30' utility easement to Boehm Family Ltd. Partnership	Neva Road	
Cowles			
Dawson (fee)		Niwot Road; Monarch Road; Mountain States T&T	
Dawson (cons. easement)			
Degge	ditch easement; 30' wide easement & ROW for water pipeline to Fairways Water & Sanitation Dist.		subject to 99 year lease to Boulder Land, Irrigation, and Power
Degge/Schneider			
Ditzel	Ditzel to enter 4.45 acre parcel to maintain/ operate any ditch/lateral and/or diversion box pertinent to purchase of said water rights		
Ellison			
Gilbert			100' wide access strip to Parsons' property will be granted
Hart-Jones			Boulder Reservoir south drainage channel runs through property
Joder, West			emergency & fire access through property granted; questionable access from west boundary to Olde Stage Road/Buckingham Park parking lot
Joder, East (County fee)	Mountain States T&T ROW easement for communication facilities; Poudre Valley REA ROW easement for electric transmission/ distribution line/systems	40' wide to Left Hand Land & Water Co. for roadway & water pipeline	dogs accompanying public required to be on leash

PROPERTY	OWNERSHIP STATUS	ACRES	YEAR ACQUIRED	PUBLIC EASEMENT	CONSERVATION EASEMENT
Joder II	conservation easement	336	1996	CONSERVATION (cont.): Joder's can't sell or dedicate any easement or ROW without City approval; City can enter to inspect property & enforce rights	development limited to existing 4 residences, horse ranch facility, & challenge course; 2 existing mobile homes can each be replaced by a single-family 3000 finished sq. ft. dwelling; Joders may restrict public access
Johnson	fee	264	1992	15' to Dawsons for access to parcel they retained from their property	
Johnson	conservation easement	4	1992		Johnson may restrict public access; development restricted to 1 single-family dwelling (2500 sq. ft.) & existing out buildings; new road to dwelling only w/ Johnson's approval
Loukonen Brothers	fee	1	1986		
Mann	fee	186	1973		
Mesa Reservoir	conservation easement	110	1983	CONSERVATION (cont.): if City repairs dam & re-establishes fishery, shall be open to public	Div. of Wildlife can perform: law enforcement duties & obligations, work to preserve & enhance viability as significant habitat for wildlife; City may maintain road area & existing roads & can construct/maintain trail for non-motorized use
Nejezchleb	fee	83	1993		
Parsons	fee	241	1976		
Parsons	development rights	33	1976		
Parsons	trail right-of-way	2	1976		
Schneider	fee	238	1992		
Walker	fee	25	1991		

PROPERTY	PRIVATE EASEMENT	RIGHT-OF-WAY (ROW)	OTHER
Joder II	equestrian easement for Saddle Club Estates to remain for Wright & Dagle's lifetimes; 20' electric transmission to Left Hand Water; Poudre Valley REA for electric lines/systems; Mtn. States T&T for communication facilities; ingress & egress easement	U.S. Highway 36; 40' to Left Hand Land & Water; ditches & canals as recorded; 40' for road & water pipeline to Foothills Water Users Assn.	access to & from adjacent City Open Space shall only be at designated access points; jointly & equally responsible for construction & maintenance of perimeter fences & gates
Johnson (fee)	Tracts B, C, D, F, & I are perpetual easements & ROW; Mountain States T&T for construction, operation, & maintenance of communication facilities	Niwot Road; N. 55th Street; Monarch Road; any rights in & to Hinman Ditch; any rights to small irrigation ditch; rights of others to driveway over westerly portion of Parcel I; any rights in & to Johnson Ditch & Star Ditch	Northern Colorado Water Conservancy District supply canal runs through property
Johnson (cons. easement)			
Loukonen Brothers			
Mann		ditches or canals constructed by authority of U.S. as reserved in patent recorded 1898	
Mesa Reservoir			City recognizes right of Krakover for access to property on Mesa Res. Road as long as City in control of Mesa Res. property
Nejezchleb	easement & ROW for servicing & maintaining water well		does not have access from Olde Stage Road
Parsons (fee)	10' wide waterline & well easement; 10' ditch easement		OSBT approved fence on west side of property
Parsons (development rights)			no public access to property
Parsons (trail right-of-way)			City agrees to limit use of said trail parcel to recreational use by the public & to prohibit motorized vehicles from said parcel with the exception of emergency vehicles
Schneider		ditches & canals constructed by authority of U.S. in patent recorded 1910; State Hwy. 7; County for road purposes	
Walker			

Table: Vertebrate Species Status (Colorado Natural Heritage Program, Federal Threatened and Endangered (T+E), State T+E, and sensitive, Boulder County Comprehensive Plan)

Common Name	Scientific Name	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	Boulder County Comp Plan
Brassy minnow	Hybognathus hankinsoni	G5	S3			uncommon
Common shiner	Notropis cornutus	G5	S2		SC	rare
Greenback cutthroat trout	Salmo clarki	G5T2	S2	LT	T	state threatened
Iowa darter	Etheostoma exile	G5	S2		SC	
Johnny darter	Etheostoma nigrum	G5	S3			rare
Lake chub	Couesius plumbeus	G5	S1			extirpated
Plains minnow	Hybognathus placitus	G5	SH	C2	SC	
Plains topminnow	Fundulus sciadicus	G4	S2	C2	SC	uncommon
Stonecat	Noturus flavus	G5	S1		SC	
Northern leopard frog	Rana pipiens	G5	S3S4		SC	concern
Racer	Coluber constrictor	G5T5	S2S3			
Western hognose snake	Heterodon nasicus	G5	S1			
Many-lined skink	Eumeces multivirgatus	G5T4	S3S4			
Milk snake	Lampropeltis triangulum	G5T4	S2			
Smooth green snake	Opheodrys vernalis	G5	S3S4			
Lined snake	Tropidoclonion lineatum	G5	S3			concern
Eared grebe	Podicipeds nigricollis	G5	S3S4B SZN			1
American white pelican	Pelecanus erythrorhynchos	G3	S1B SZN		SC	
American bittern	Botaurus lentiginosus	G4	S3S4B SZN			1,5
American bittern	Botaurus lentiginosus	G4	S3S4B SZN			5
Least bittern	Ixobrychus exilis	G5	S2B SZN			3,5
Great blue heron	Ardea herodias	G5	S3B SZN			5
Great egret	Ardea albus	G5	S1B			3,5
Great egret	Ardea albus	G5	S1B			5
Snowy egret	Egretta thula	G5	S2B SZN			
Green heron	Butorides virescens	G5	S3B SZN			
Black-crowned night-heron	Nycticorax nycticorax	G5	S3B SZN			5
Yellow-crowned night-heron	Nyctanassa violacea	G5	S1B SZN			
White-faced ibis	Plegadis falcinellus	G5	S2B SZN	C2		
Snow goose	Chen caeruleslens	G5	S3S4N			
Canvasback	Aythya valisineria	G5	S2B SZN			
Barrow's goldeneye	Bucephala islandica	G5	S2B SZN		SC	4
Bufflehead	Bucephala albeola	G5	S1B SZN			
Hooded merganser	Lophodytes cucullatus	G5	S1B SZN			
Turkey vulture	Cathartes aura	G5	S3B SZN			
Osprey	Pandion haliaetus	G5	S1B SZN			
Bald eagle	Haliaeetus leucocephalus	G4	S1B S3N	LT	T	
Northern harrier	Circus cyaneus	G5	S3S4B S4N			1,5
Sharp-shinned hawk	Accipiter striatus	G5	S3S4B S4N			
Cooper's hawk	Accipiter cooperii	G4	S3S4B S4N			
Northern goshawk	Accipiter gentilis	G5	S3S4B S4N	C2		2
Ferruginous hawk	Buteo regalis	G4	S3B S5N	C2	SC	
Golden eagle	Aquila chrysaetos	G5	S3S4B S4N			5
Merlin	Falco columbarius	G5	S1B S4N			

Table: Vertebrate Species Status (Colorado Natural Heritage Program, Federal Threatened and Endangered (T+E), State T+E, and sensitive, Boulder County Comprehensive Plan)

Common Name	Scientific Name	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	Boulder County Comp Plan
Prairie falcon	Falco mexicanus	G5	S3S4B S4N			5
Sora	Porzana carolina	G5	S3S4B SZN			
Mountain plover	Charadrius montanus	G3	S2B SZN	C2	SC	4
Black-necked stilt	Himantopus mexicanus	G5	S3B SZN			
Willet	Catoptrophorus semipalmatus	G5	S1B SZN			
Upland sandpiper	Bartramia longicauda	G5	S3B SZN			
Long-billed curlew	Numenius americanus	G5	S2B SZN	3C	SC	4
Ring-billed gull	Larus delawarensis	G5	SHB SZN			
Caspian tern	Sterna caspia	G5	SUB SZN			
Forster's tern	Sterna forsteri	G5	S2B			
Interior least tern	Sterna antillarum	G4T2Q	S1B	LE		
Black tern	Chlidonias niger	G4	S3S4B SZN	C2		
Burrowing owl	Speotyto cunicularia	G5	S3S4B	C2		1,5
Long-eared owl	Asio otus	G5	S3S4B SZN			1
Short-eared owl	Asio flammeus	G5	S2B SZN			3,5
Boreal owl	Aegolius funereus	G5	S2			
Black swift	Cypseloides niger	G4	S2B			3,5
Red-headed woodpecker	Melanerpes erythrocephalus	G5	S3S4B SZN			2,5
Red-bellied woodpecker	Melanerpes carolinus	G5	S3S4B SZN			
Three-toed woodpecker	Picoides tridactylus	G5	S3S4			5
Olive-sided flycatcher	Contopus borealis	G5	S3S4B			
Least flycatcher	Empidonax minimus	G5	S1B SZN			3
Eastern phoebe	Sayornis phoebe	G5	S3B SZN			
Scissor-tailed flycatcher	Tyrannus forficatus	G5	S1B			
Purple martin	Progne subis	G5	S3B			
Carolina wren	Thryothorus ludovicianus	G5	S1			
Marsh wren	Cistothorus palustris	G5	S3B SZN			
Eastern bluebird	Sialia sialis	G5	S2B SZN			
Veery	Catharus fuscescens	G5	S3S4B SZN			3
Gray catbird	Dumetella carolinensis	G5	S3S4B SZN			5
Cedar waxwing	Bombycilla cedrorum	G5	S3B S5N			5
Loggerhead shrike	Lanius ludovicianus	G4	S3B SZN			1,5
Bell's vireo	Vireo bellii	G5	S2B			
Red-eyed vireo	Vireo olivaceus	G5	S3B SZN			
Chestnut-sided warbler	Dendroica pensylvanica	G5	S2B SZN			3,5
American redstart	Setophaga ruticilla	G5	S1?B SZN			3
Ovenbird	Seiurus aurocapillus	G5	S2B			3
Hooded warbler	Wilsonia citrina	G5	SUB SZN			
Northern cardinal	Cardinalis cardinalis	G5	S1B SZN			
Rose-breasted grosbeak	Pheucticus ludovicianus	G5	S1B			
Indigo bunting	Passerina cyanea	G5	S3S4B SZN			
Dickcissel	Spiza americana	G5	S3B			
Field sparrow	Spizella pusilla	G5	S1B SZN			
Savannah sparrow	Passerculus sandwichensis	G5	S3S4B SZN			5

Table: Vertebrate Species Status (Colorado Natural Heritage Program, Federal Threatened and Endangered (T+E), State T+E, and sensitive, Boulder County Comprehensive Plan)

Common Name	Scientific Name	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS	Boulder County Comp Plan
Grasshopper sparrow	Ammodramus savannarum	G5	S3S4B SZN			5
Bobolink	Dolichonyx oryzivorus	G5	S3B SZN			5
Orchard oriole	Icterus spurius	G5	S3S4B			
White-winged crossbill	Loxia leucoptera	G5	S1B SZN			
Evening grosbeak	Coccothraustes vespertinus	G5	S2S3B S5N			
Dwarf shrew	Sorex nanus	G5	S3			5
Merriam's shrew	Sorex merriami	G5	S3			4
Merriam's shrew	Sorex merriami	G5	S3			5
Pygmy shrew	Sorex hoyi	G5T2T3	S1			4,5,6
Elliot's Short-tailed Shrew	Blarina hylophaga	G5	S1			
Desert shrew	Notiosorex crawfordi	G5	S3?			
Eastern mole	Scalopus aquaticus	G5	S3			
Fringed myotis	Myotis thysanodes	G5	S3S4	C2		5
Red bat	Lasiurus borealis	G5	S2B			
Townsend's big-eared bat	Plecotus townsendii	G4T4	S3	C2		
Brazilian free-tailed bat	Tadarida brasiliensis	G5	S1			
Least chipmunk	Tamias minimus	G5T?	S3			
Cliff chipmunk	Tamias dorsalis	G5	S2			
Yellow-bellied marmot	Marmota flaviventris	G5T?	S3			
Spotted ground squirrel	Spermophilus spilosoma	G5T?	S1			4,5
Golden-mantled ground squirrel	Spermophilus lateralis	G5TU	S1			
Brush mouse	Peromyscus boylii	G5T?	S2			
Hispid cotton rat	Sigmodon hispidus	G5	S3			
Eastern woodrat	Neotoma floridana	G5	S3S4			
Southern plains woodrat	Neotoma micropus	G5	S3			
White-throated woodrat	Neotoma albigula	G5T?	S2			
Desert woodrat	Neotoma lepida	G5	S1			
Bushy-tailed woodrat	Neotoma cinerea	G5T?	S2			
Meadow vole	Microtus pennsylvanicus	G5T?	S1			4
Mexican vole	Microtus mexicanus	G5	S1			
Sagebrush vole	Lemmiscus curtatus	G5	S2			
Meadow jumping mouse	Zapus hudsonius preblei	G5T2	S1S2	C2	SC	4,5
Gray Wolf	Canis lupus	G4	SX	LE	E	1
Kit fox	Vulpes macrotis	G5	S1?		SC	
Swift fox	Vulpes velox	G3	S3?	C2		4,5
Black-footed ferret	Mustela nigripes	G1	SH	LE	E	2,A,B
American badger	Taxidea taxus	G5T?	S1			4
Northern river otter	Lutra canadensis	G5	S3S4		E	
Lynx	Lynx lynx	G5	S1	C2	E	2,B

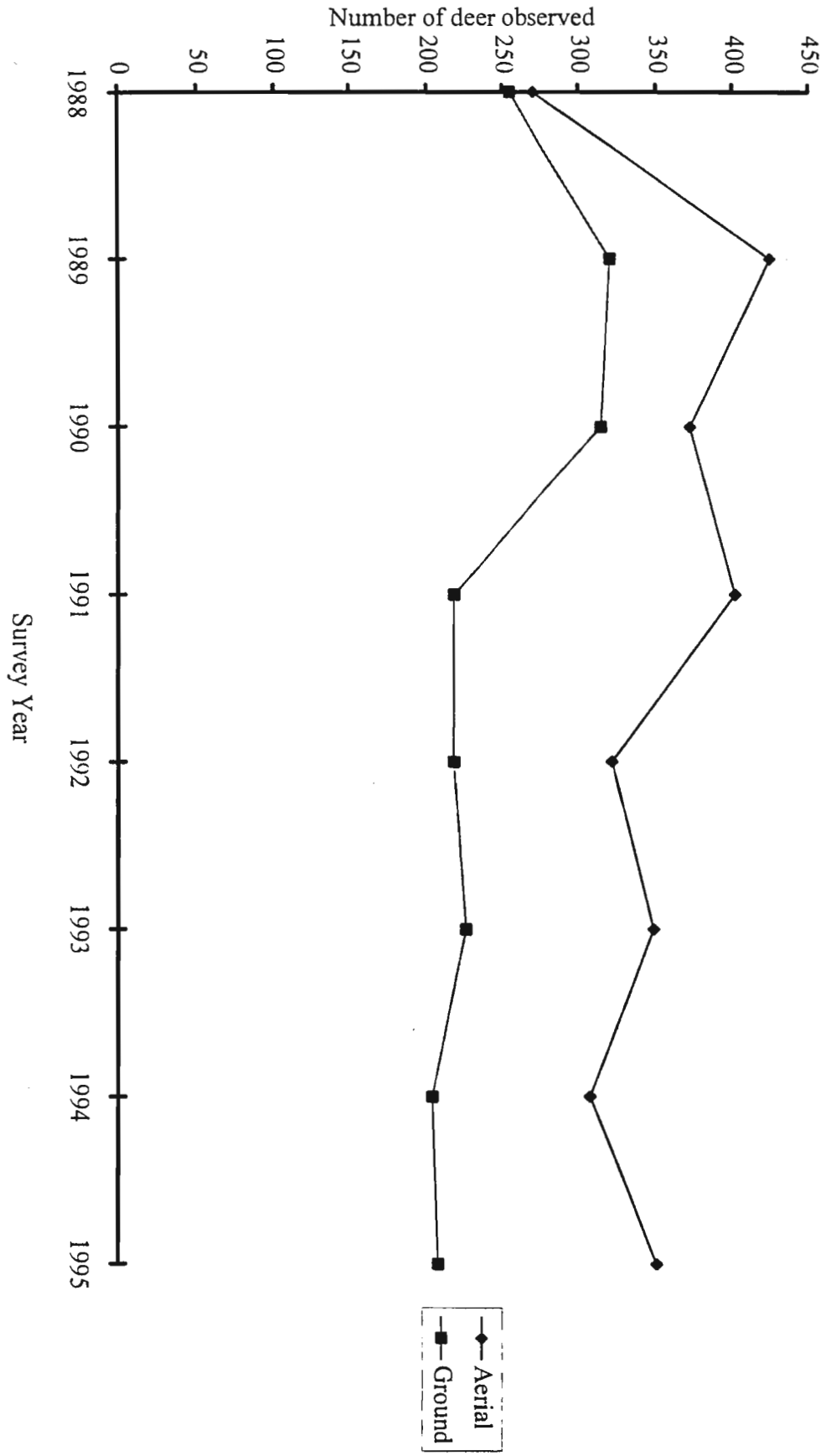


Figure 2. Annual deer counts for the City of Boulder Open Space.

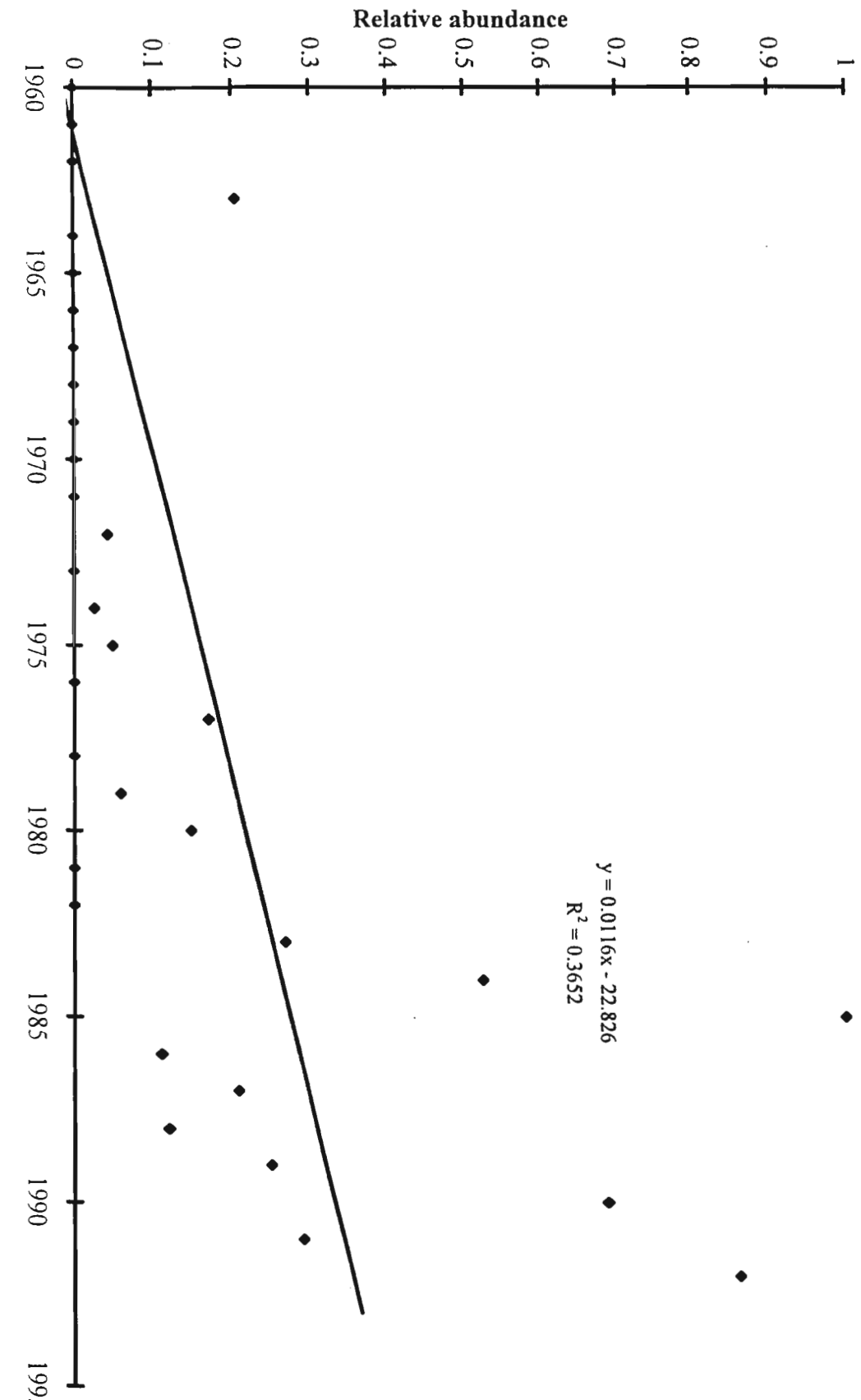
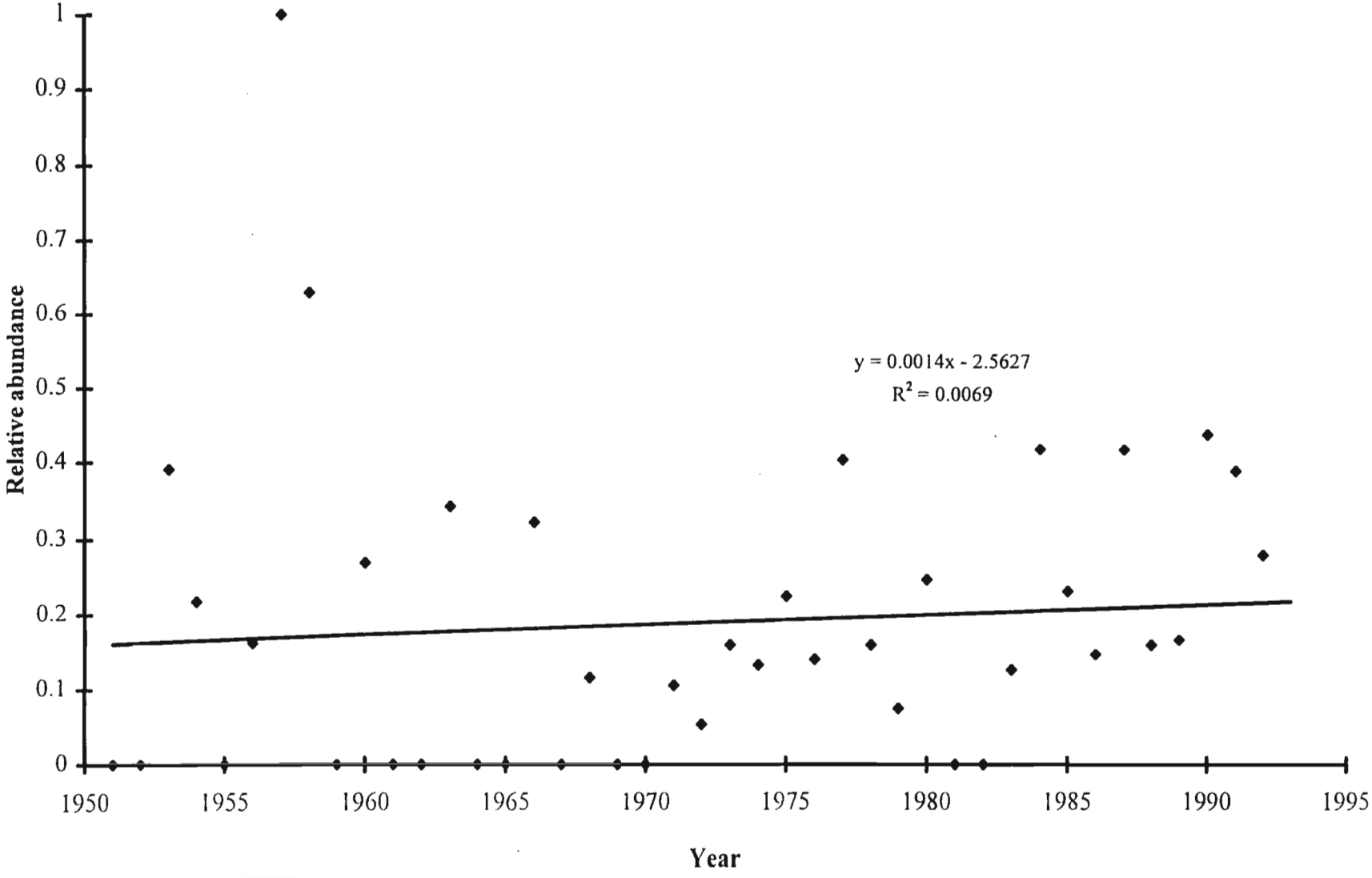


Figure 3. Bald eagle population trends (CBC Boulder Block 1951-1992).

Figure 4. Golden eagle population trends (CBC Boulder Block 1951-1992).



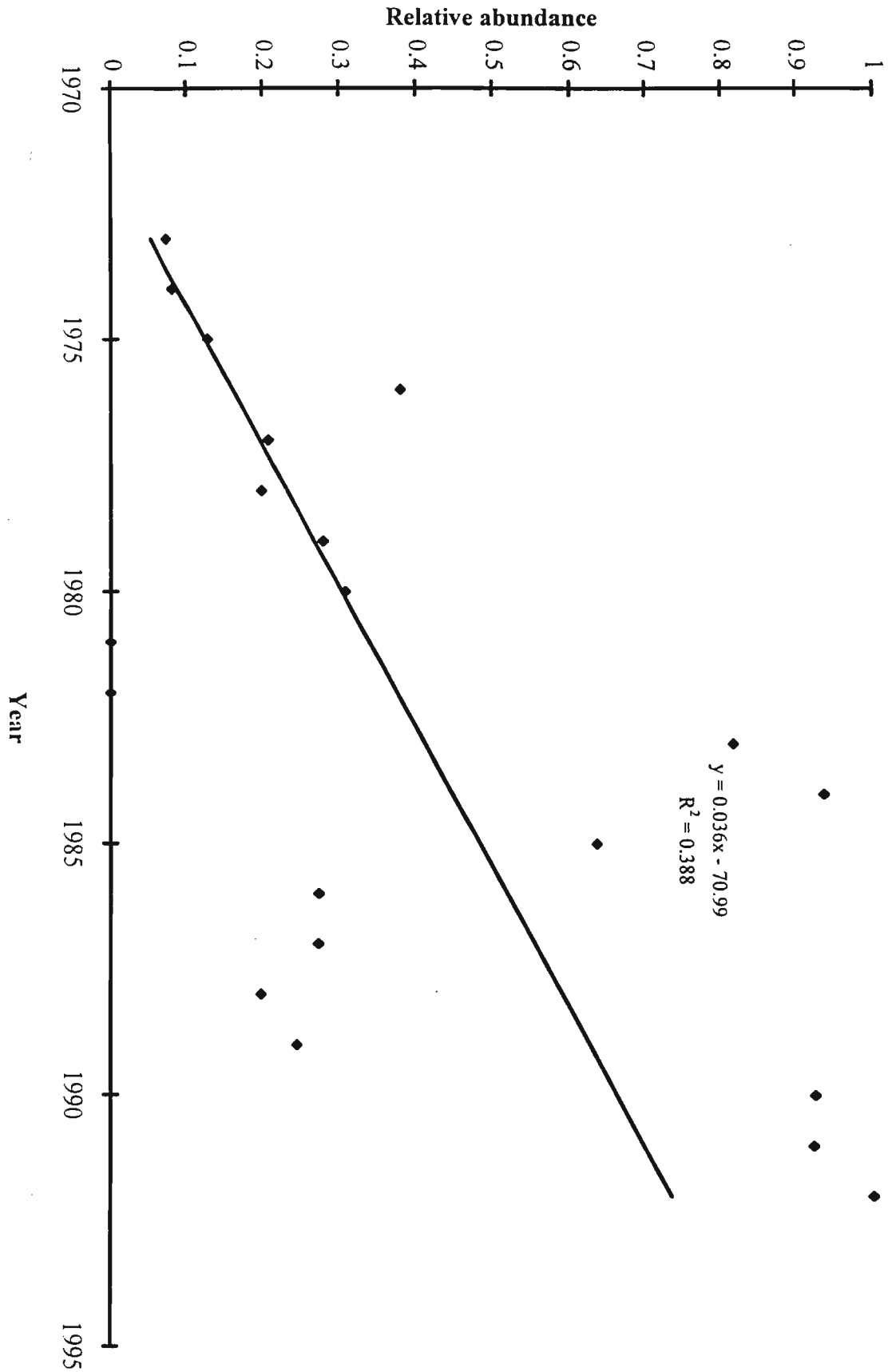


Figure 5. Ferruginous hawk population trends (CBC Boulder Block 1972-1992).

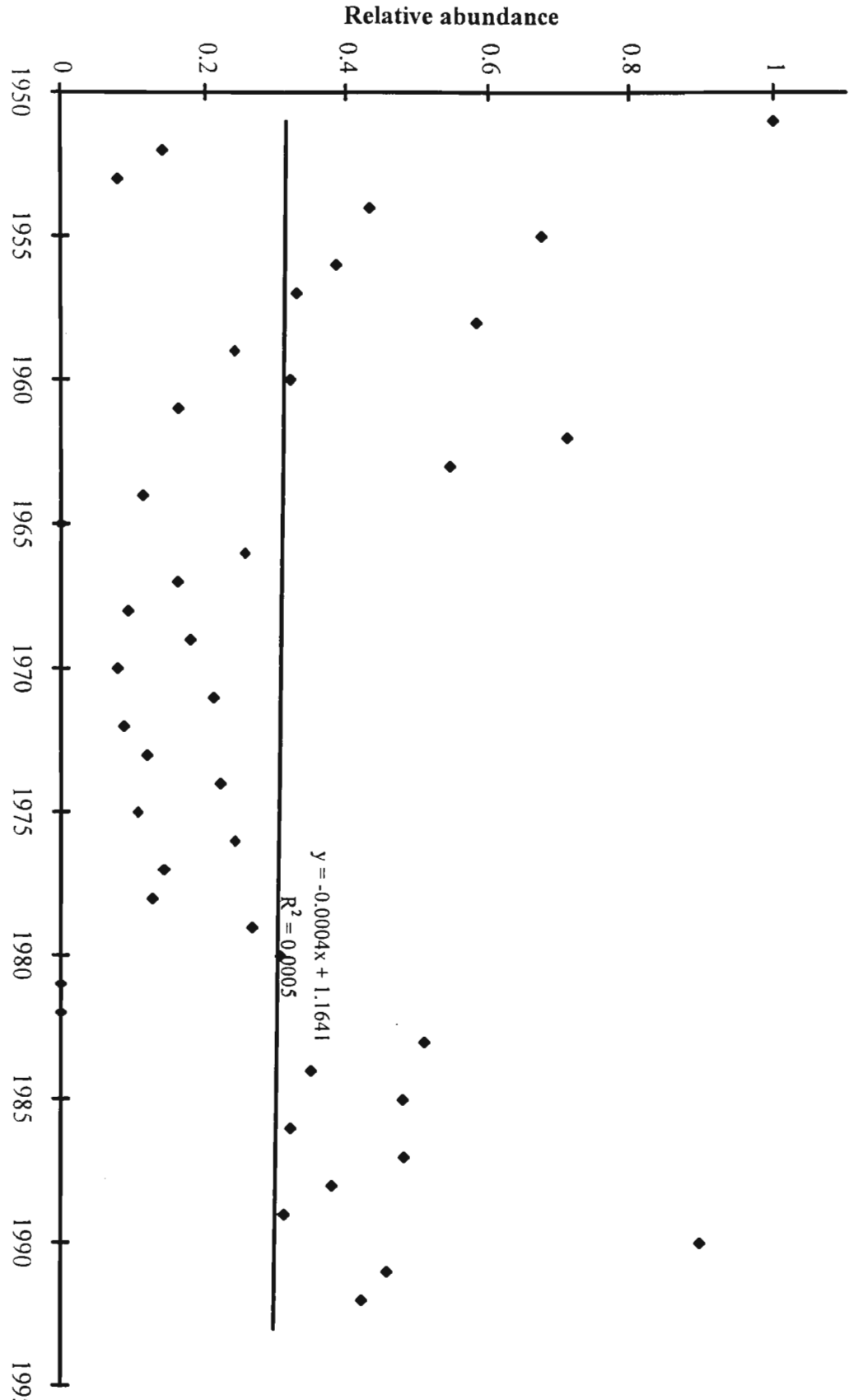


Figure 6. Red-tailed hawk population trends (CBC Boulder Block 1950-1992).

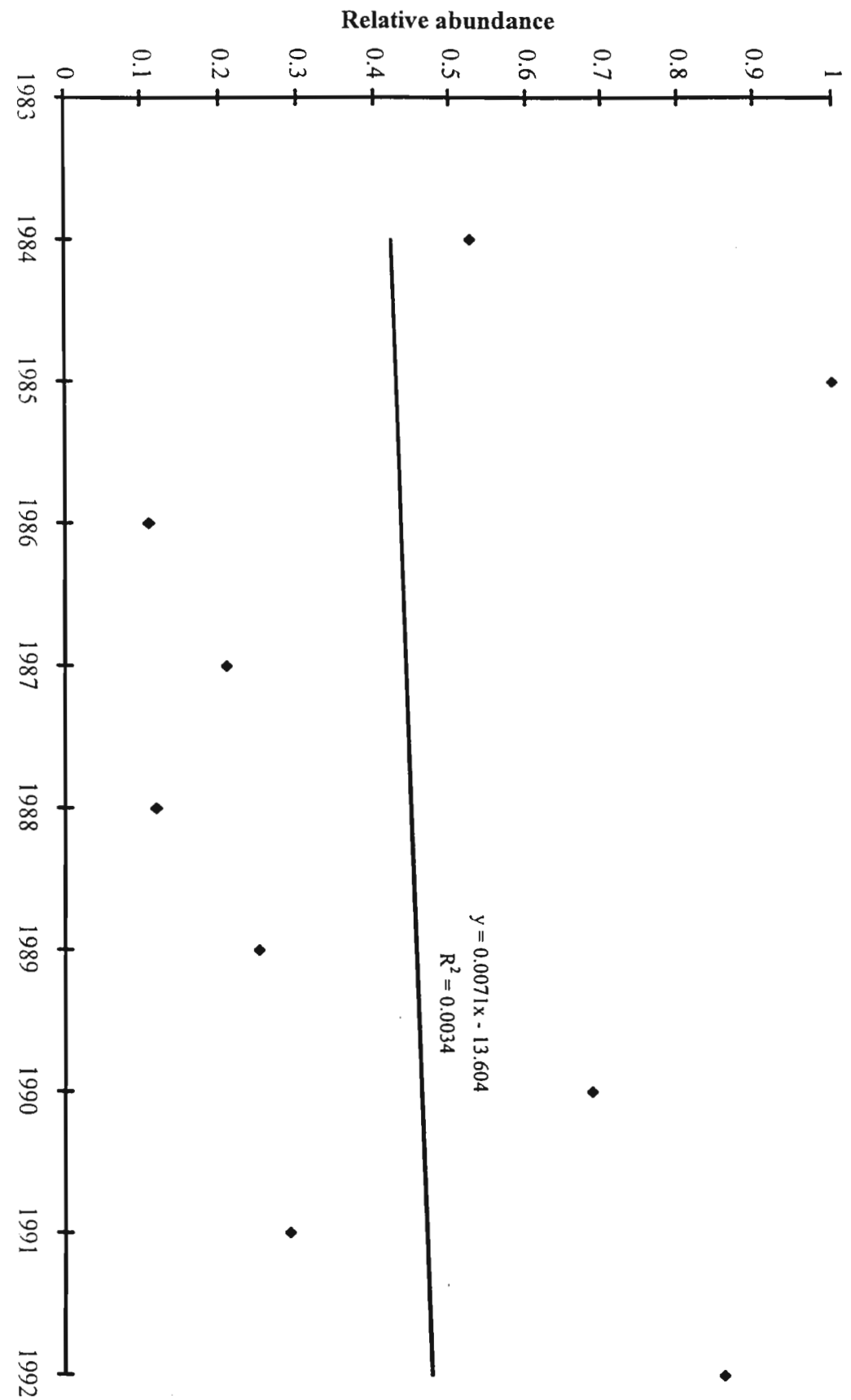


Figure 7. Bald eagle population trends (CBC Boulder Block 1983-1992).

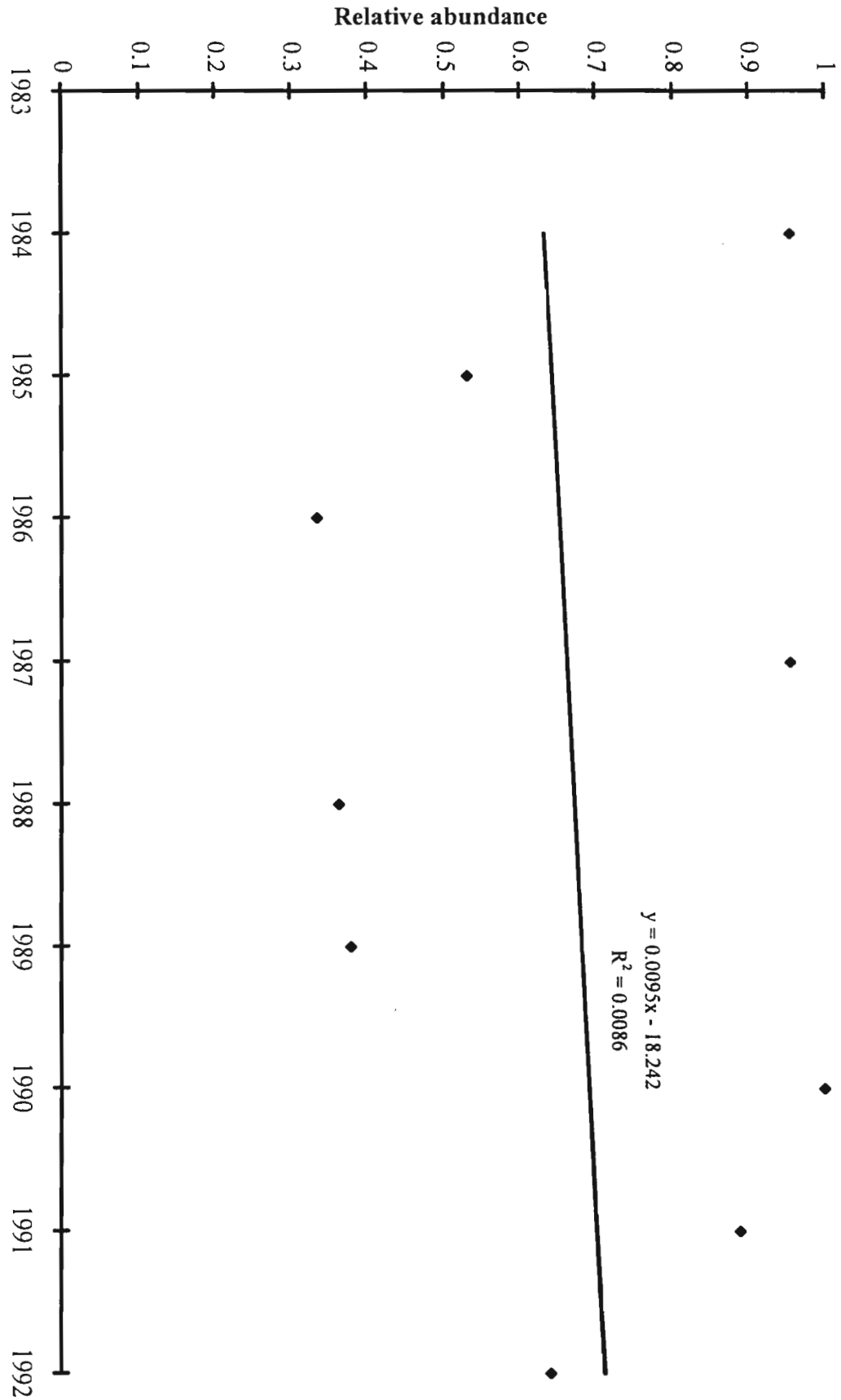


Figure 8. Golden eagle population trends (CBC Boulder Block 1983-1992).

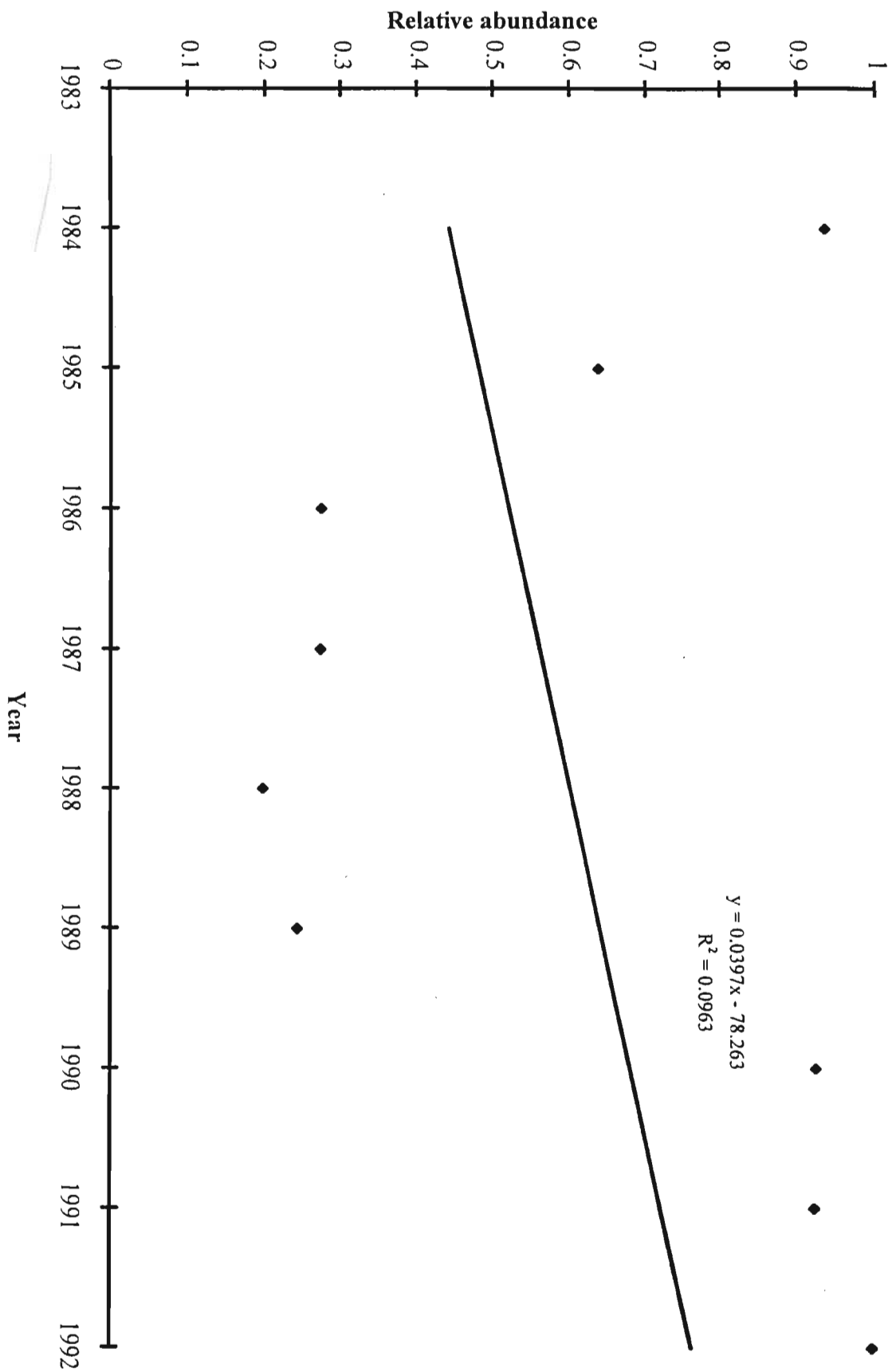


Figure 9. Ferruginous hawk population trends (CBC Boulder Block 1983-1992).

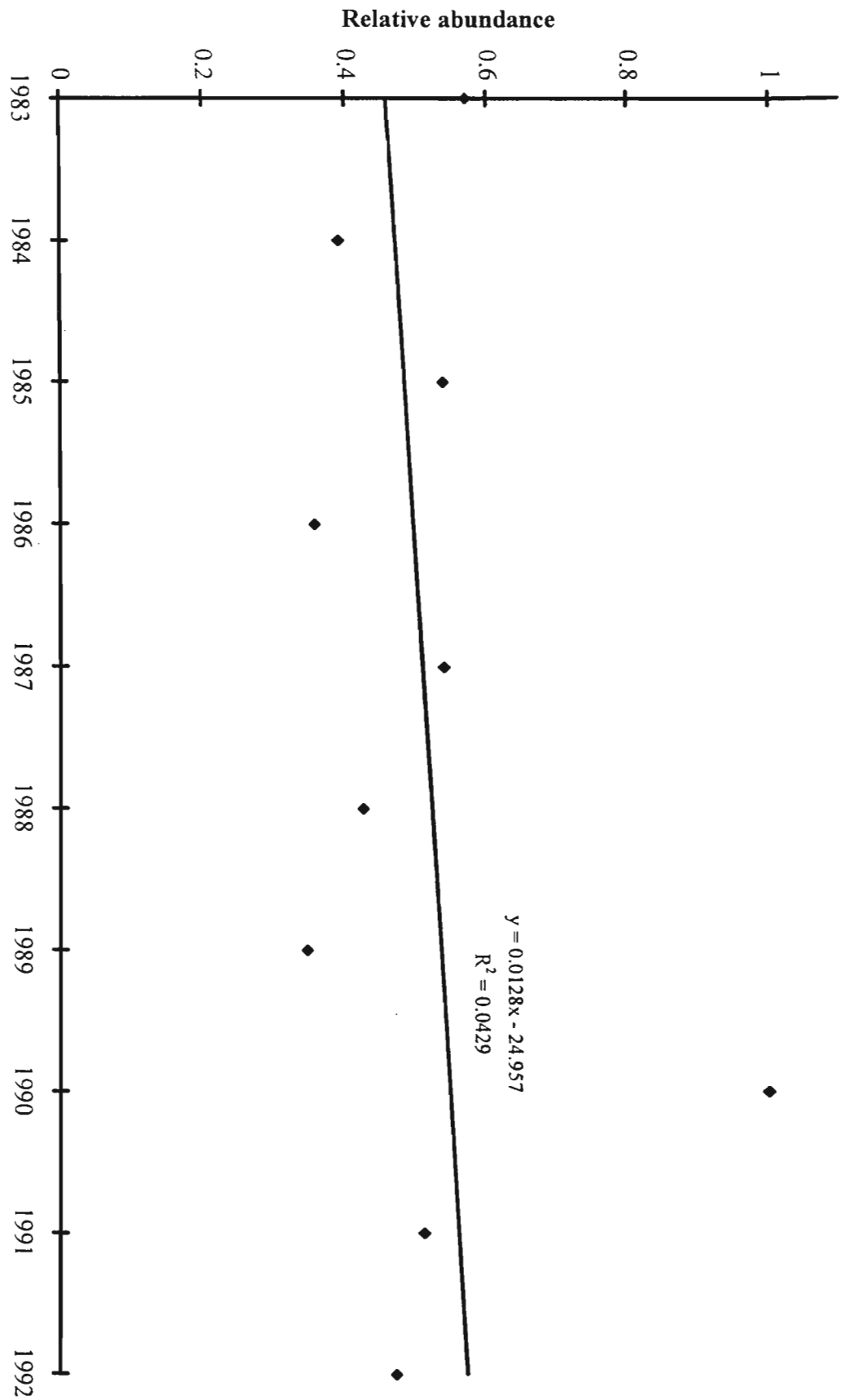


Figure 10. Red-tailed hawk population trends (CBC Boulder Block 1983-1992).

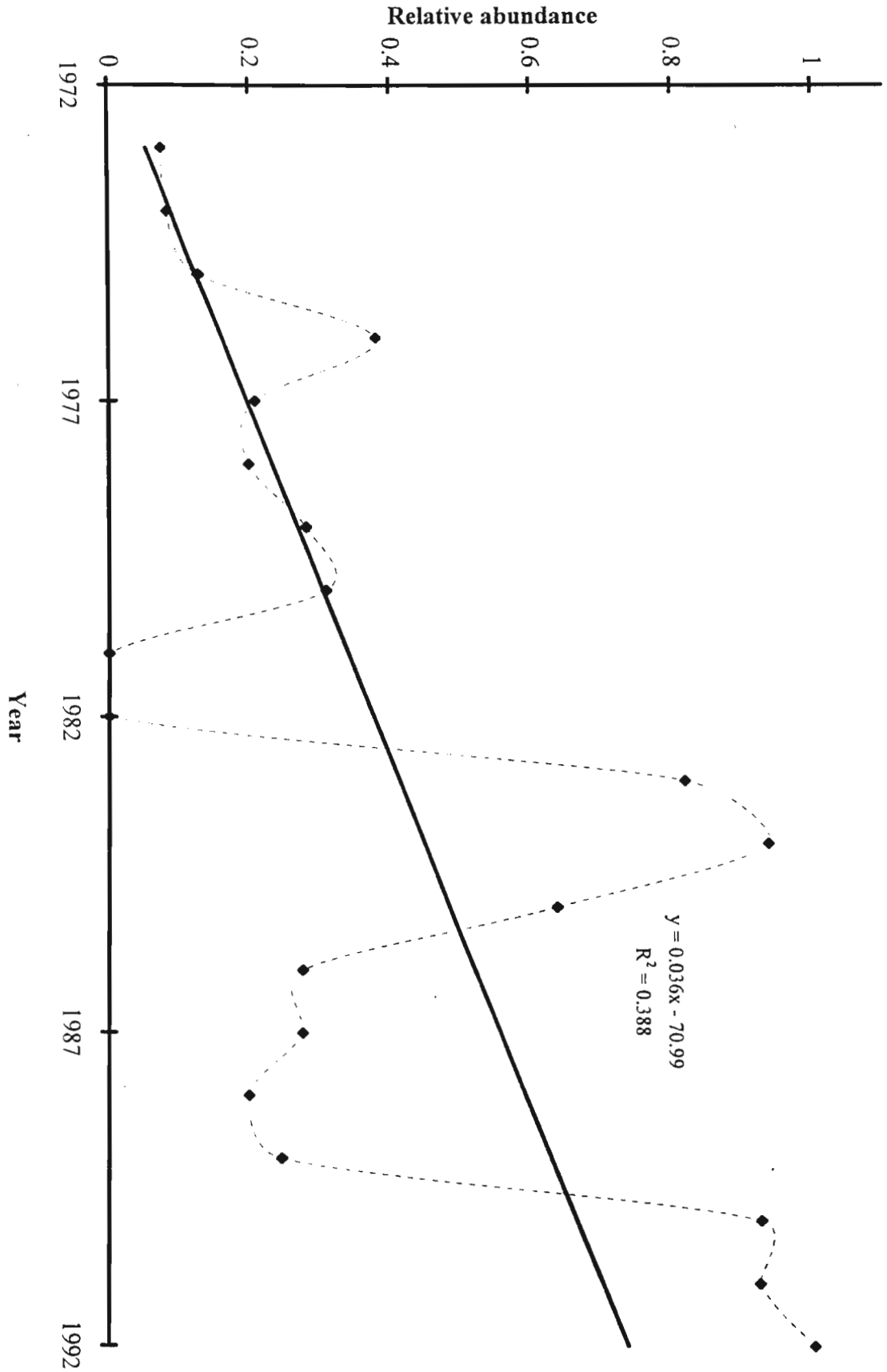


Figure 11. Ferruginous hawk population trends (CBC Boulder Block 1972-1992).

Figure 3.2: Slope / Aspect
North Boulder Valley Management Area

Legend

Aspect Classification

- Flat
- North
- East
- West
- South

Slope Classification

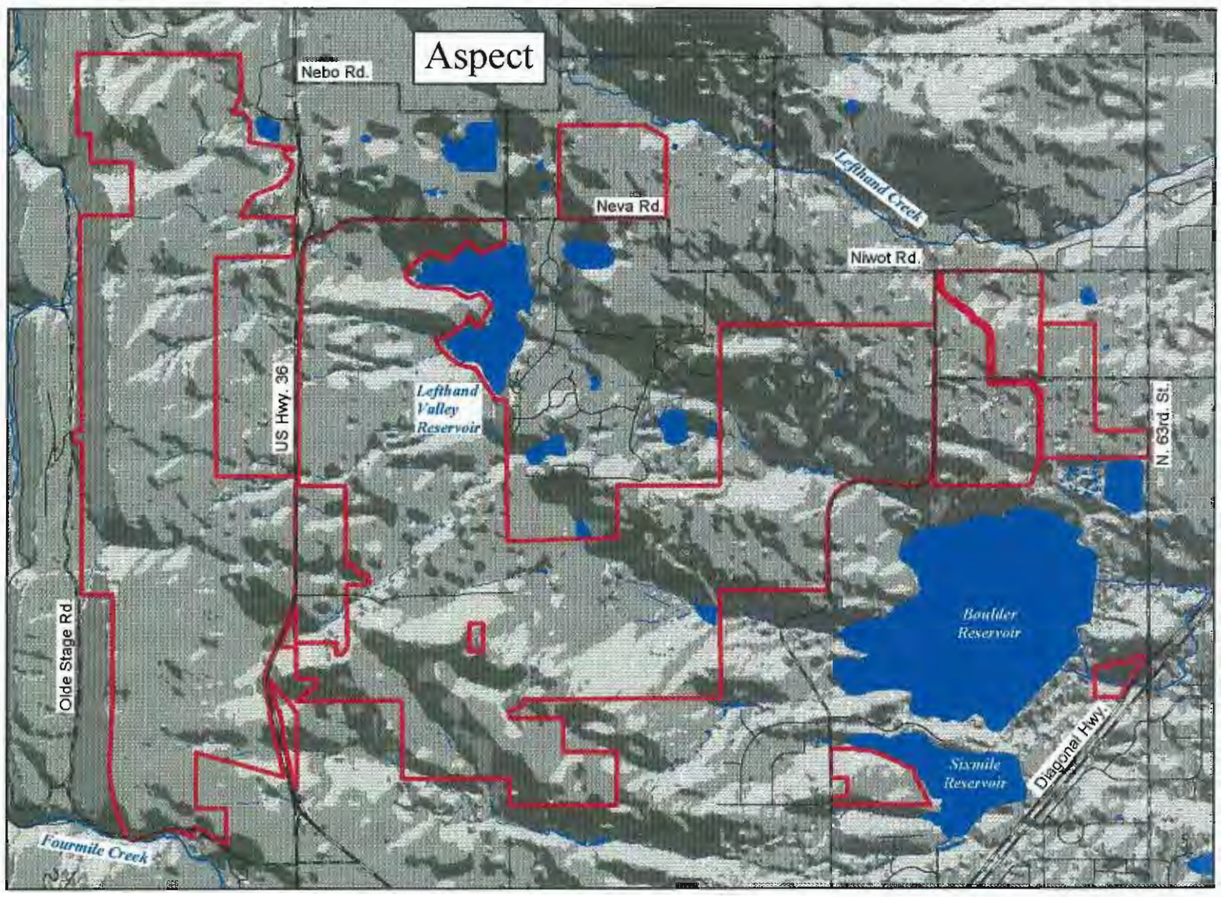
- Less than 8%
- Between 8% and 20%
- Between 20% and 30%
- Greater than 30%
- **North Boulder Valley Management Area**

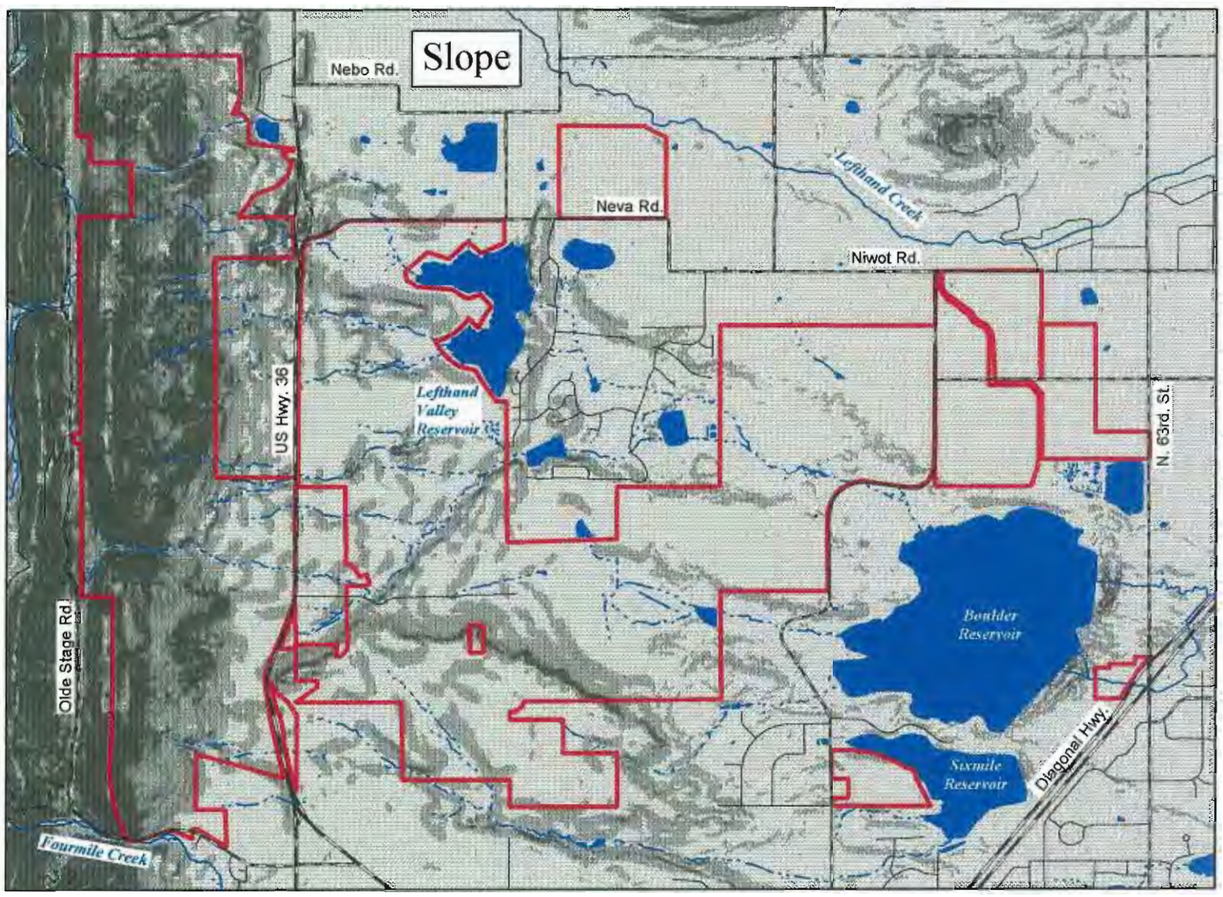
Roads

- Highways
- Roads
- Streets

Hydrology

- Creek
- Intermitent Creek
- Lake





Classified slope and aspect maps developed by Jon Osborne from USGS 1:24,000 DLG hypsography data and 1:2,400 City of Boulder planimetric data using the GRID module of ARC/INFO.

Scale

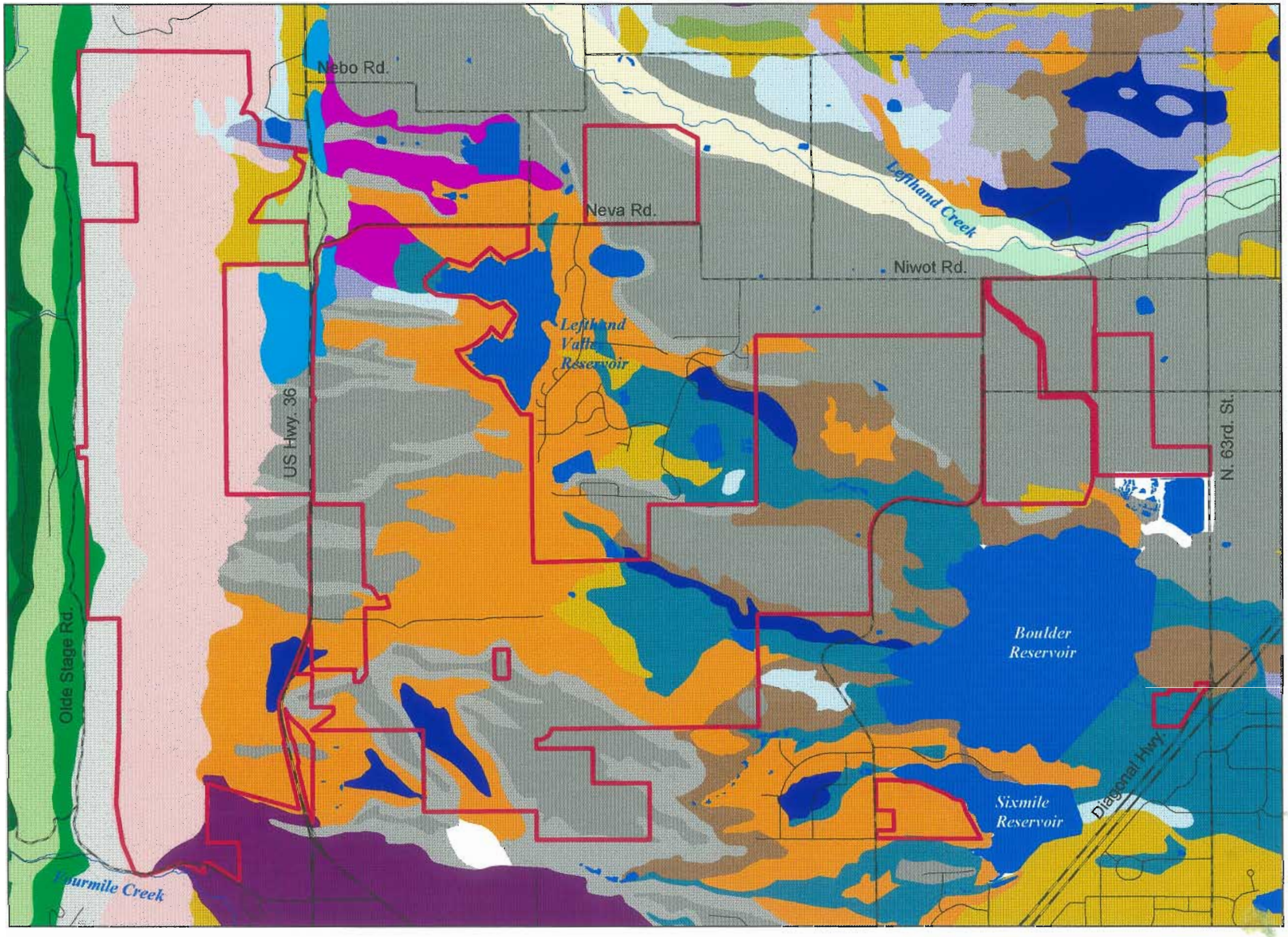
0 0.5 1 Miles

N W E S

CITY OF BOULDER OPEN SPACE

Map assembled in Arc/View with data compiled in Arc/Info, ArcCad and AutoCad.
Map prepared by the City of Boulder Open Space GIS Lab, Jon Osborne, Sean Metrick, May 31, 1996. (nbv_slpasp.apr)

Figure 5.3: Soil Series - North Boulder Valley Management Area



Legend

Soils (those listed in red are within the management area) (white areas are non soil)

- Baller
- Calkins
- Colluvial Land
- Goldvale
- Hargreave
- Heldt
- Kutch
- Laporte
- Longmont
- Manter
- Manvel
- Nederland
- Niwot
- Nunn
- Otero
- Renohill
- Rock Outcrop
- Samsil
- Shingle
- Sixmile
- Terrace Escarpments
- Valmont
- North Boulder Valley Management Area

Roads
- Highways
- Major Roads
- Streets

Hydrology
- Creek
- Lake

Map produced for the North Boulder Valley Management Area Inventory Report. Map depicts detailed soils in and around the management area. Soils data from USDA Soil Conservation Service in cooperation with Colorado Agricultural Experiment Station, 1975. Digitaly encoded by the City of Boulder Open Space GIS Lab, J. Osborne, M. Smith.

Scale

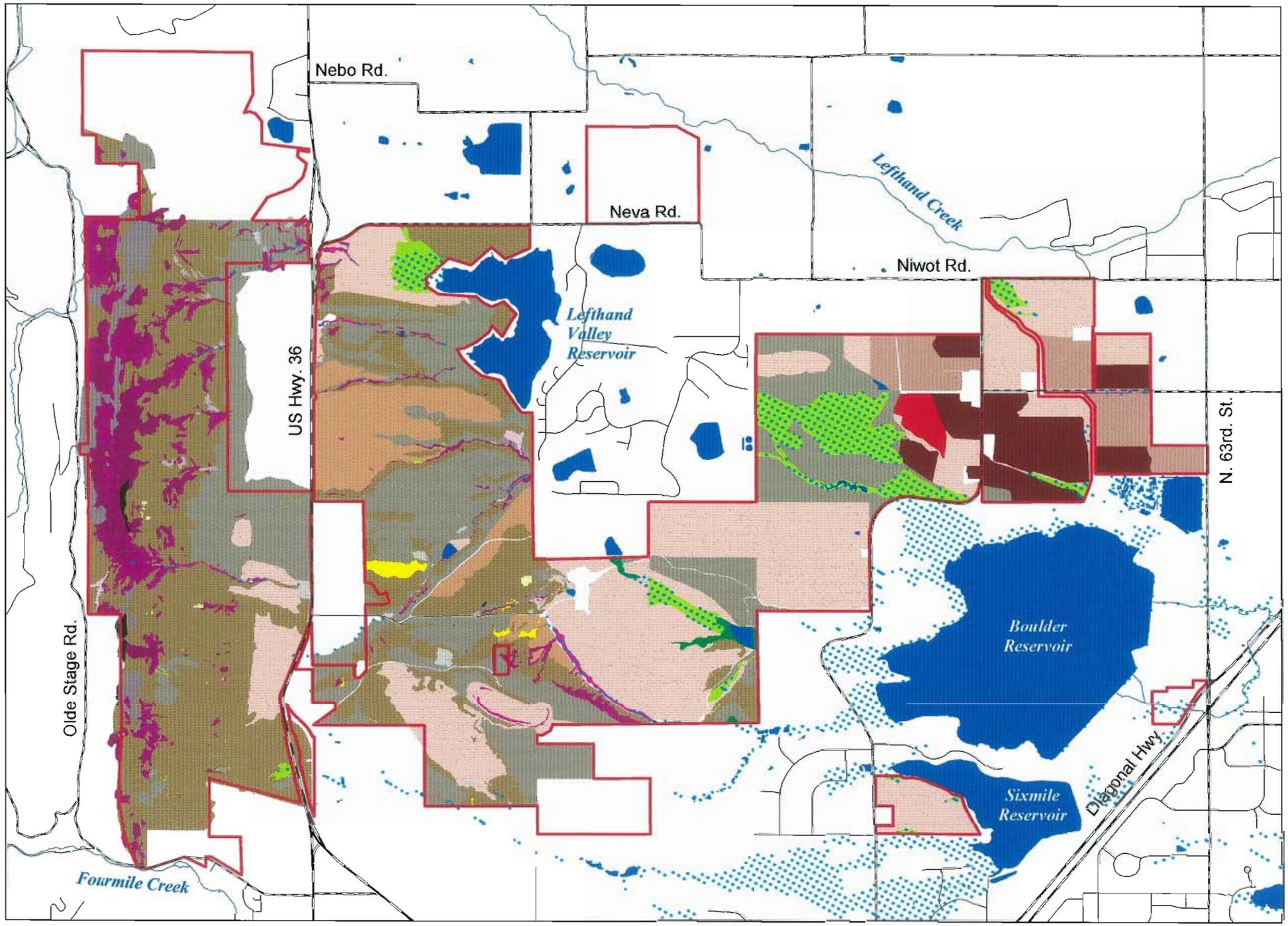
0 0.5 1 Miles

N W E S

CITY OF BOULDER OPEN SPACE

Map Assembeled in ArcView with data compiled in AreInfo, AreCAD, and AutoCAD.
Map produced by the City of Boulder Open Space GIS Lab, Sean Metriek, May 31, 1996. (nbv_soils.apr).

Figure 6.1: Vegetation by Habitat - North Boulder Valley Management Area



Legend

Habitat*
- Alfalfa
- Alfalfa/Grass
- Cattail/Bulrush Marsh
- Cliff
- Crop
- Disturbed
- Exotic Forb Dominated
- Foothills Mixed Grassland
- Foothills Riparian Forest/Woodland
- Foothills Shrubland
- Forb Dominated
- Mixed Grass Prairie
- Non-Native Hay/Pasture
- Open Water
- Plains Riparian Forest/Woodland
- Plains Riparian Shrubland
- Ponderosa Pine Forest
- Ponderosa Pine Savannah
- Scarp Woodland
- Shortgrass Prairie
- Talus
- Wet Meadow

Roads
- Highways
- Major Roads
- Streets
- North Boulder Valley Management Area

Hydrology
- Creek
- Lake
- Wetland

*Vegetation mapping is not complete.

Map produced for the North Boulder Valley Management Area Inventory Report. Map depicts vegetation broken down by habitat. Vegetation digitally encoded and field mapped by the City of Boulder Open Space Gis Lab, M. Smith. Habitat classificaitons encoded by the City of Boulder Open Space GIS Lab, J. Osborne. Habitat classification by City of Boulder Open Space, M. Gershman, L. Riedel, C. Miller. Additional imput from the City of Boulder Mountain Parks.

Scale

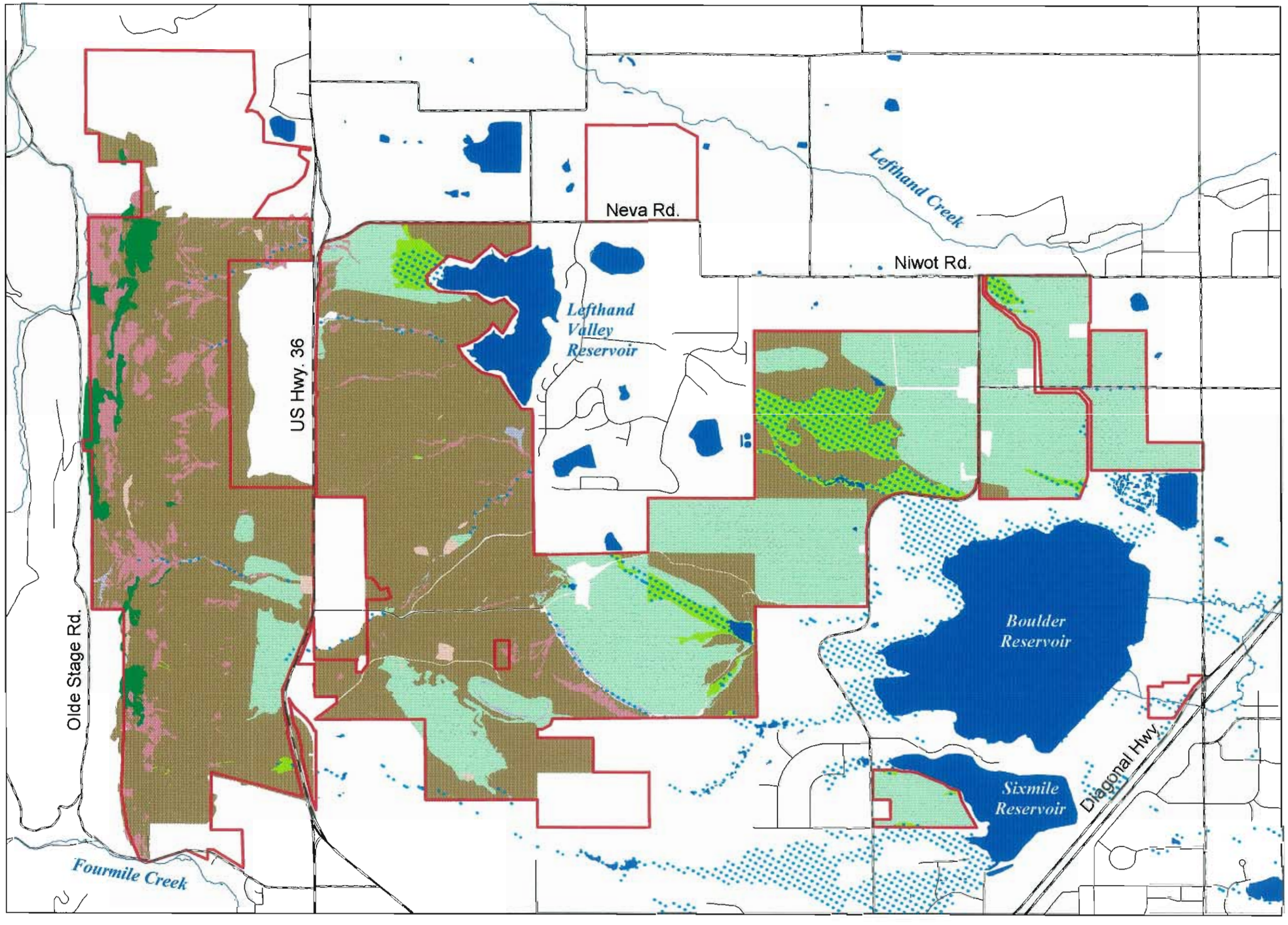
0 0.5 1 Miles

N W E S

CITY OF BOULDER OPEN SPACE

Map produced in ArcView with data compiled in AreInfo, ArcCAD, and AutoCAD.
Map assembeled by the City of Boulder Open Space GIS Lab, Sean Metrick, May 31, 1996. (nbv_veg.apr)

Figure 6.2: Vegetation by Ecosystem Type - North Boulder Valley Management Area



Legend

Ecosystem Type*
- Cropland/Hay/Pasture
- Forest/Woodland (upland)
- Grassland (upland herbaceous)
- Other Cover Types
- Riparian
- Shrubland (upland)
- Wetland/Wet Meadow

North Boulder Valley Management Area

Roads
- Highways
- Major Roads
- Streets

Hydrology
- Creek
- Lake
- Wetland

*Vegetation mapping is not complete.

Map produced for the North Boulder Valley Management Area Inventory Report. Map depicts vegetation broken down by ecosystem type. Vegetation data digitally encoded and field mapped by the City of Boulder Open Space GIS Lab, M. Smith. Ecosystem classification by the City of Boulder Open Space. Additional imput from the City of Boulder Mountain Parks.

Scale

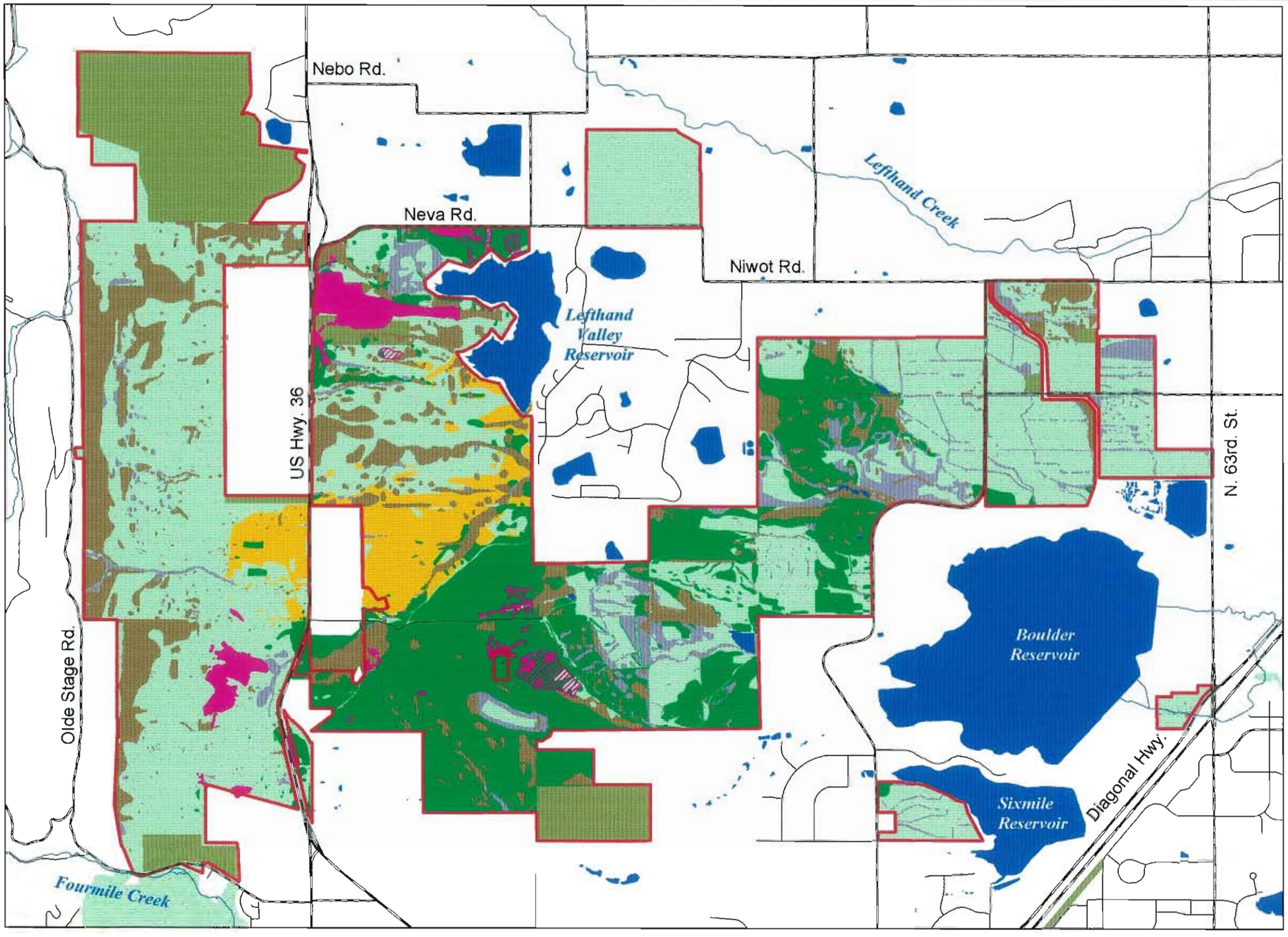
0 0.5 1 Miles

N W E S

CITY OF BOULDER OPEN SPACE

Map produced in ArcView with data compiled in ArcInfo, AreCAD, and AutoCAD.
Map assembeled by the City of Boulder Open Space GIS Lab, Sean Metrick, May 31, 1996. (nbv_veg.apr)

Figure 6.3: Physaria in Relation to Exotic Species of Special Concern
North Boulder Valley Management Area



Legend

Physaria
- Observed Physaria
- Potential Physaria Habitat

Exotic Plant Species
- Russian Olive
- Musk Thistle
- Canada Thistle
- Diffuse Knapweed
- Mediteranean Sage

North Boulder Valley Management Area

Roads
- Highways
- Major Roads
- Streets

Hydrology
- Creek
- Lake

City of Boulder Open Space
- Open Space
- Conservation Easement/Restricted Access

Map produced for the North Boulder Valley Management Area Inventory Report. Map depicts Physaria in relation to Canada Thistle, MuskThistle, Diffuse Knapweed, and Mediteranean Sage. Data compiled from field mapping, 1992-1996. Mapping done by the City of Boulder Open Space Integrated Pest Management Crew.

Scale

0 0.5 1 Miles

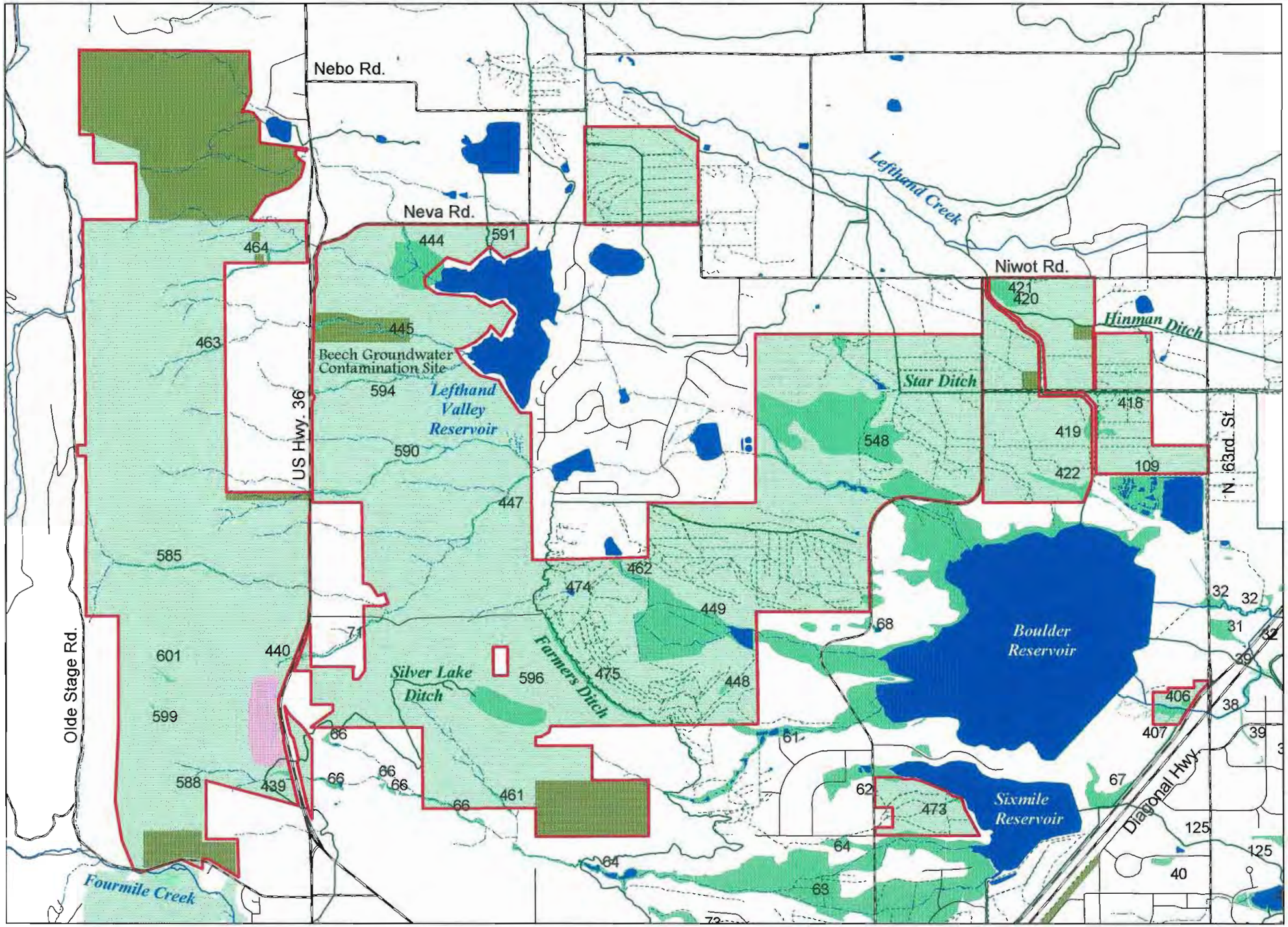
N W E S

CITY OF BOULDER OPEN SPACE

Map assembeled in ArcView with data compiled in ArcInfo, ArcCAD, and AutoCAD.
Map produced by the City of Boulder Open Space GIS Lab, Sean Metrick, May 31, 1996. (nbv_rareplant.ap2).

The information depicted is provided as a graphical representation only. While source documents were developed in compliance with National Map Accuracy Standards, the City of Boulder provides no guarantee, expressed or implied, as to the accuracy and/or completeness of the information contained hereon.

Figure 7.4: Wetlands / Water Resources - North Boulder Valley Management Area



Legend

Wetlands
- Wetland
- Seasonal Wetland
- Wetland Numbering Example: 125

Hydrology
- Creek
- Intermitent Creek
- Ditch
- Lateral Ditch
- Lake
- **North Boulder Valley Management Area**

Roads
- Highways
- Major Roads
- Streets

City of Boulder Open Space
- Open Space
- Conservation Easement/Restricted Access

Wetlands mapped primarily for the City of Bouder Open Space. Extent of wetlands mapping is not complete for all areas off of City Open Space lands.

Map produced for the North Boulder Valley Management Area Inventory Report. Map depicts wetlands and their corresponding index numbers. Wetland data from field mapping by D. Cooper and M. Gershman. Digitally encoded by the City of Boulder Open Space GIS Lab.

Scale

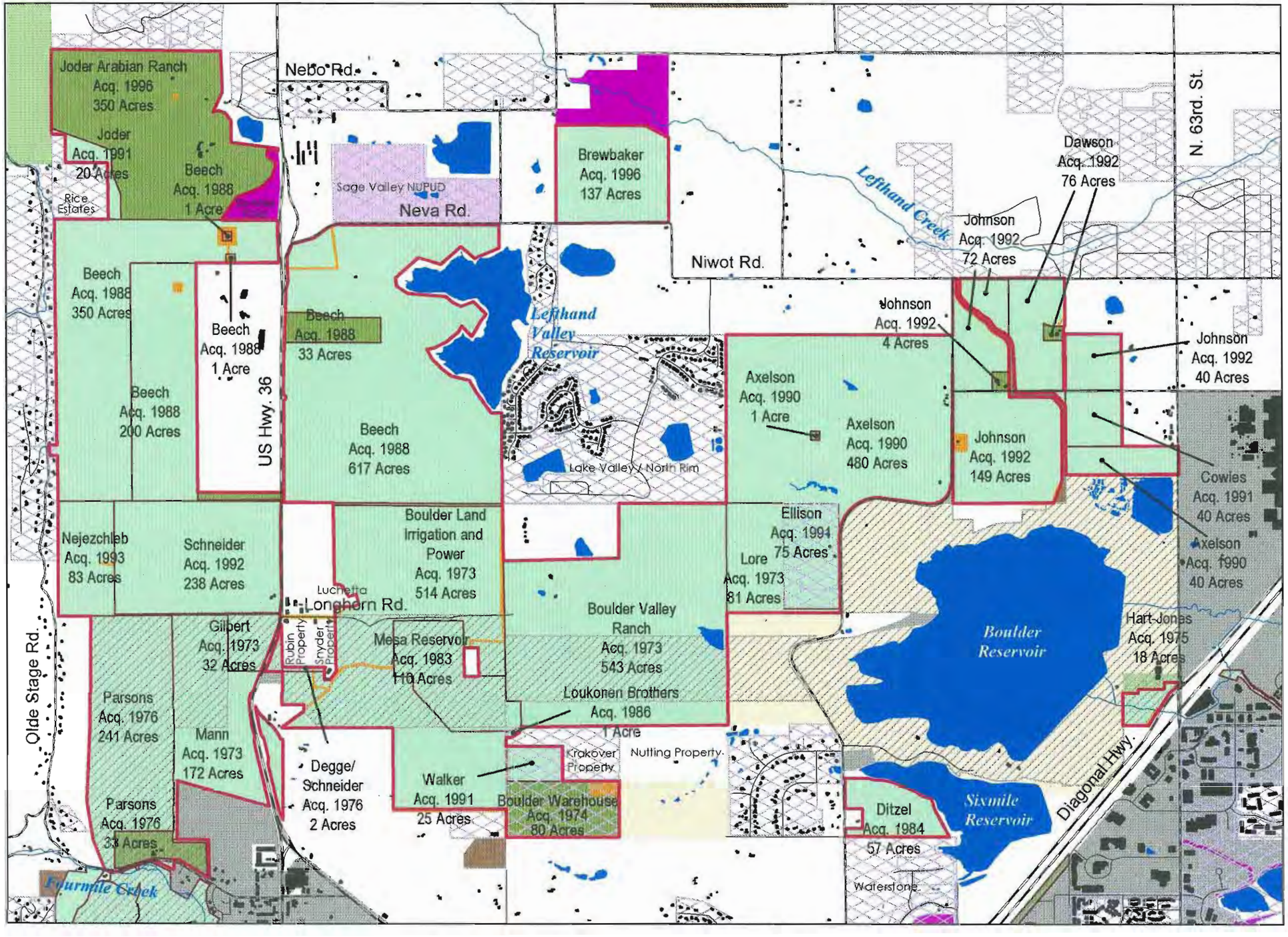
0 0.5 1 Miles

N W E S

CITY OF BOULDER OPEN SPACE

Map assembeled in AreView with data compiled in ArcInfo, ArcCAD, and AutoCAD.
Map produced by the City of Boulder Open Space GIS Lab, Sean Metriek, May 31, 1996. (nbv_wet.apr).

Figure 10.1: Land Ownership - North Boulder Valley Management Area



Legend

City of Boulder Open Space
- Property Name, Acquisition Year, Acres
- Open Space
- Conservation Easement/ Restricted Access
- **Easement**
- **Subdivided / Platted Land**
- **Building (Data Current to 1993)**

Other Government Land
- Boulder County Conservation Easement
- Boulder County Open Space
- City of Boulder Parks
- City of Boulder Mountain Parks
- Other Public Land
- Boulder City Limits
- City Limits Overlap

North Boulder Valley Management Area

Roads
- Highways
- Major Roads
- Streets

Hydrology
- Creek
- Lake

Map produced for the North Boulder Valley Management Area Inventory Report. Map depicts Open Space properties with name, acquisition year, and area in acres. Surrounding Ownership is also shown. Building data form 1993 Merrick aerial photos, City of Boulder data.

Scale

0 0.5 1 Miles

N
W E
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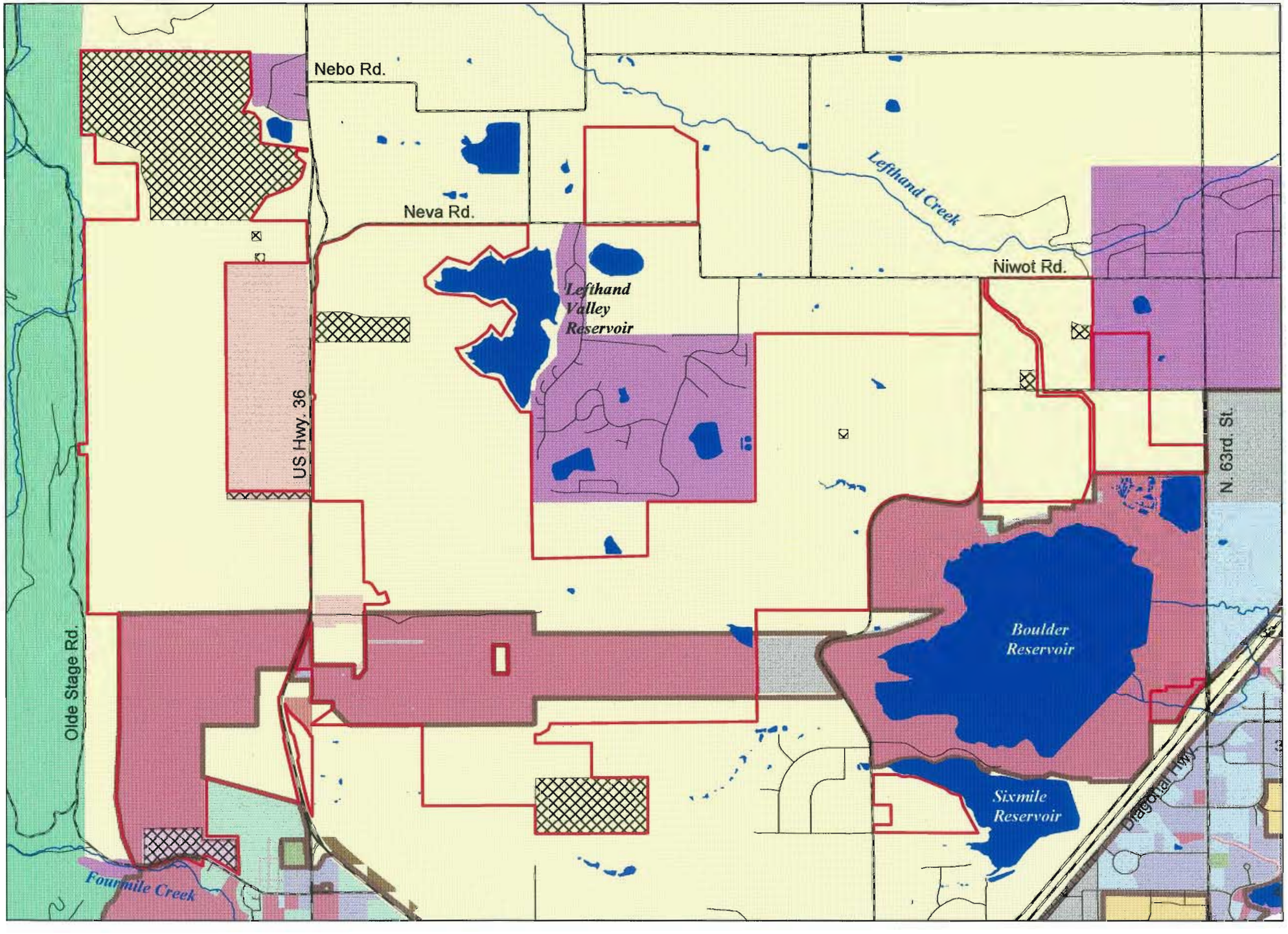
Map assembeled in ArcView with data compiled in ArcInfo, ArcCAD, and AutoCAD.
Map produced by the City of Boulder Open Space GIS Lab, Sean Metrick, May 31, 1996. (nbv_acq.apr).

Figure 10.2: Land Use Zoning - North Boulder Valley Management Area



Legend

Zoning - County
- Agriculture
- Commercial
- Forest
- General Industrial
- Light Industrial
- Manufacturing
- Rural Residantial
- Transitional

Zoning Data Not Available

Zoning - Inside City Limits
- Residential
- Commercial
- Industrial
- Agricultural
- Natural Resources
- Public Utilities
- Tax Exempt

North Boulder Valley Management Area

Open Space - No Public Access

Roads
- Highways
- Major Roads
- Streets

Hydrology
- Creek
- Lake

Map produced for the North Boulder Valley Management Area Inventory Report. Map depicts Land Use Zoning. Zoning data provided by the Boulder County Land Use Department.

Scale

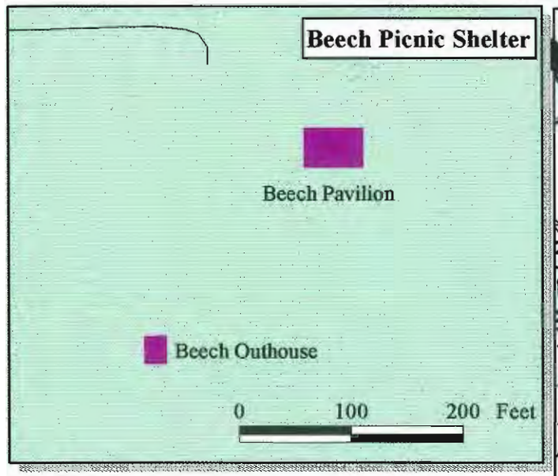
0 0.5 1 Miles

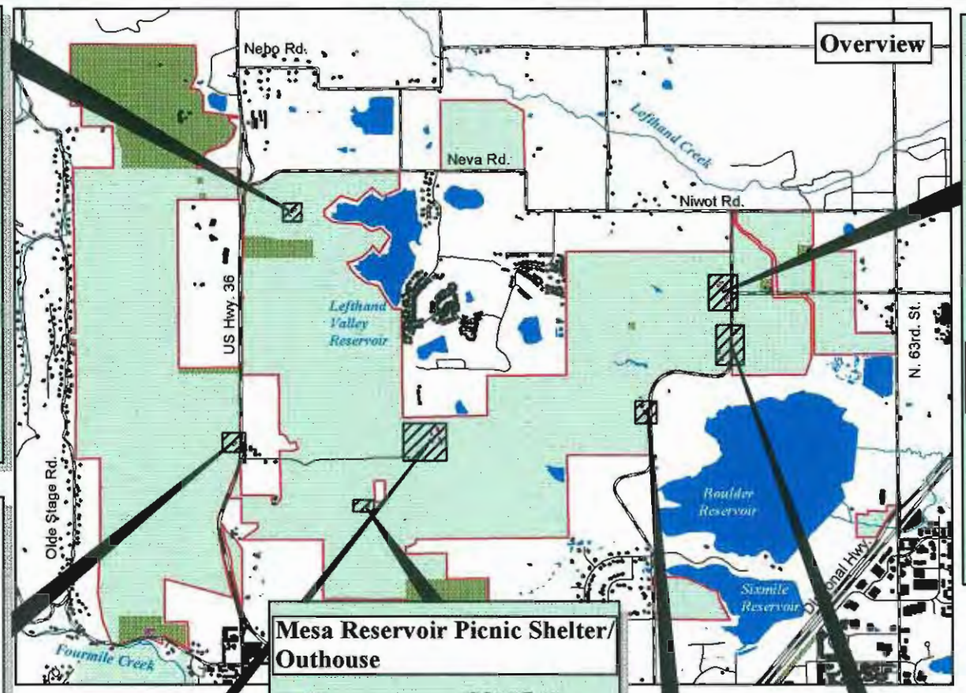
N W E S

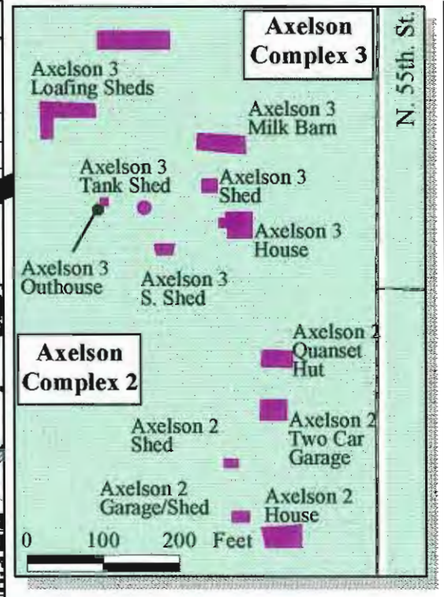
CITY OF BOULDER OPEN SPACE

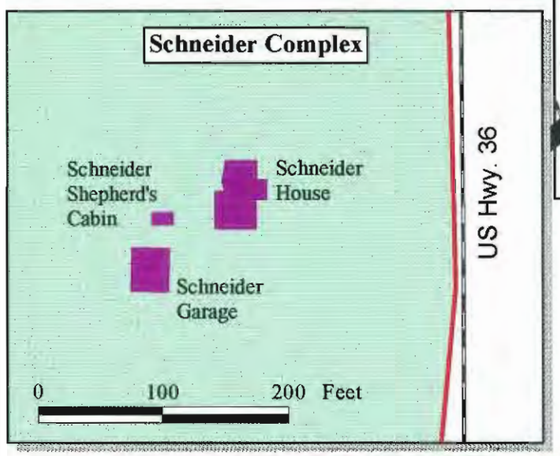
Map assembeled in ArcView with data compiled in ArcInfo, ArcCAD, and AutoCAD.
Map produced by the City of Boulder Open Space GIS Lab, Sean Metriek, April 17, 1997. (nbv_zone.apr).

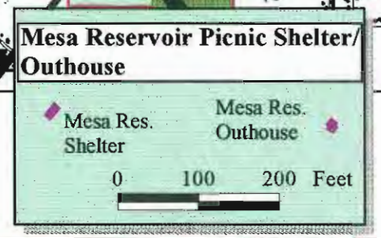
Figure 11.1: Facilities - North Boulder Valley Management Area

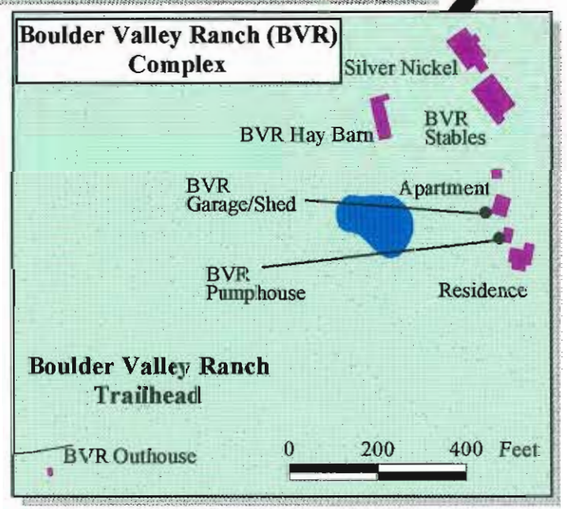


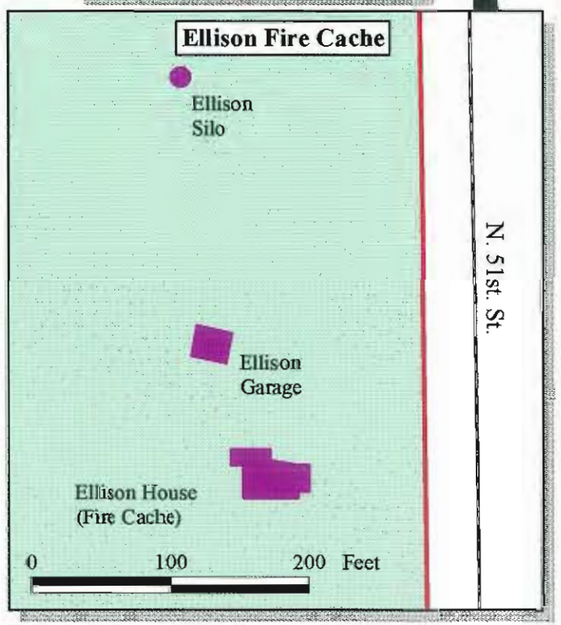


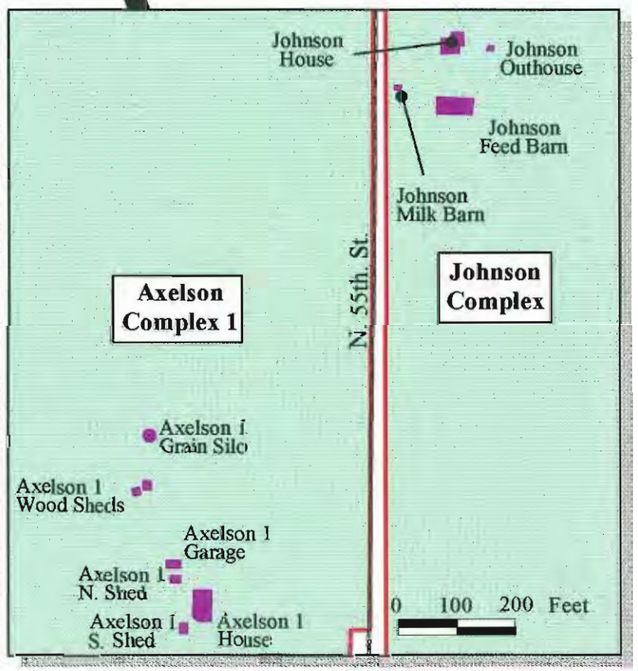












Legend

Buildings

- **Open Space Facilities**
- **Other Buildings**
- **North Boulder Valley Management Area**

Roads

- Highways
- Major Roads
- Streets

Hydrology

- Creek
- Lake

City of Boulder Open Space

- Open Space
- Conservation Easement/ Restricted Access

Map produced for the North Boulder Valley Management Area Inventory Report. Map depicts facilities in the management area. Building data from 1993 Merrick aerial photos, City of Boulder Data. Open Space Facilities digitized in house.

Scale

0 0.5 1 1.5 2 Miles

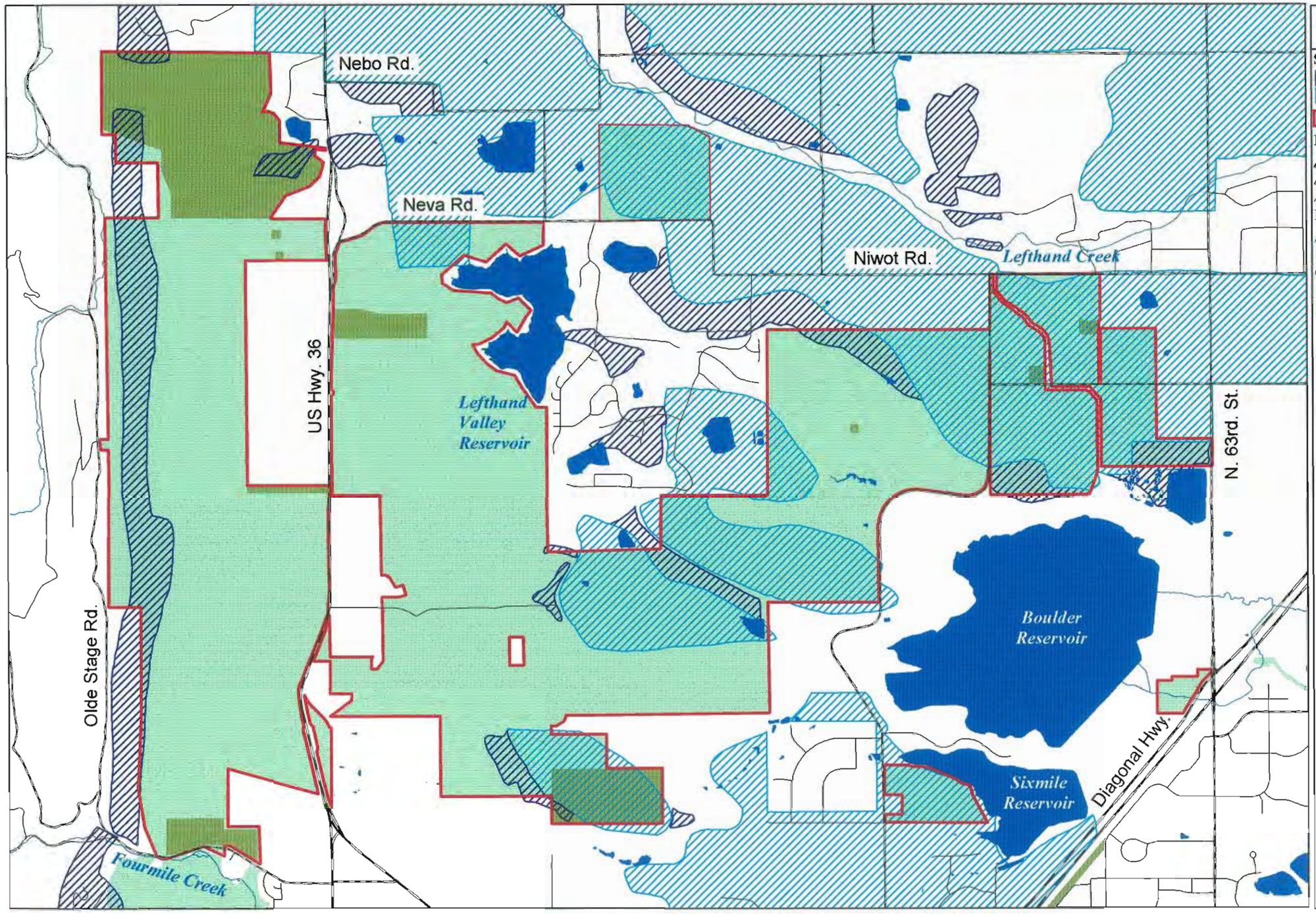
Scale applies to overview only.

N W E S

CITY OF BOULDER OPEN SPACE

Map assembeled in ArcView with data compiled in ArcInfo, ArcCAD, and AutoCAD.
Map produced by the City of Boulder Open Space GIS Lab, Sean Metrick, May 31, 1996. (nbv_bldg.apr).

Figure 12.2: Significant Agricultural Land - North Boulder Valley Management Area



Legend

Significant Agricultural Land
- Local Significance
- State Significance

North Boulder Valley Management Area

Roads
- Highways
- Major Roads
- Streets

Hydrology
- Creek
- Lake

City of Boulder Open Space
- Open Space
- Conservation Easement/Restricted Access

Map produced for the North Boulder Valley Management Area Inventory Report. Map depicts significant agricultural land in relation to the management area. Significant agricultural land data courtesy of the Boulder County Land Use Department.

Scale

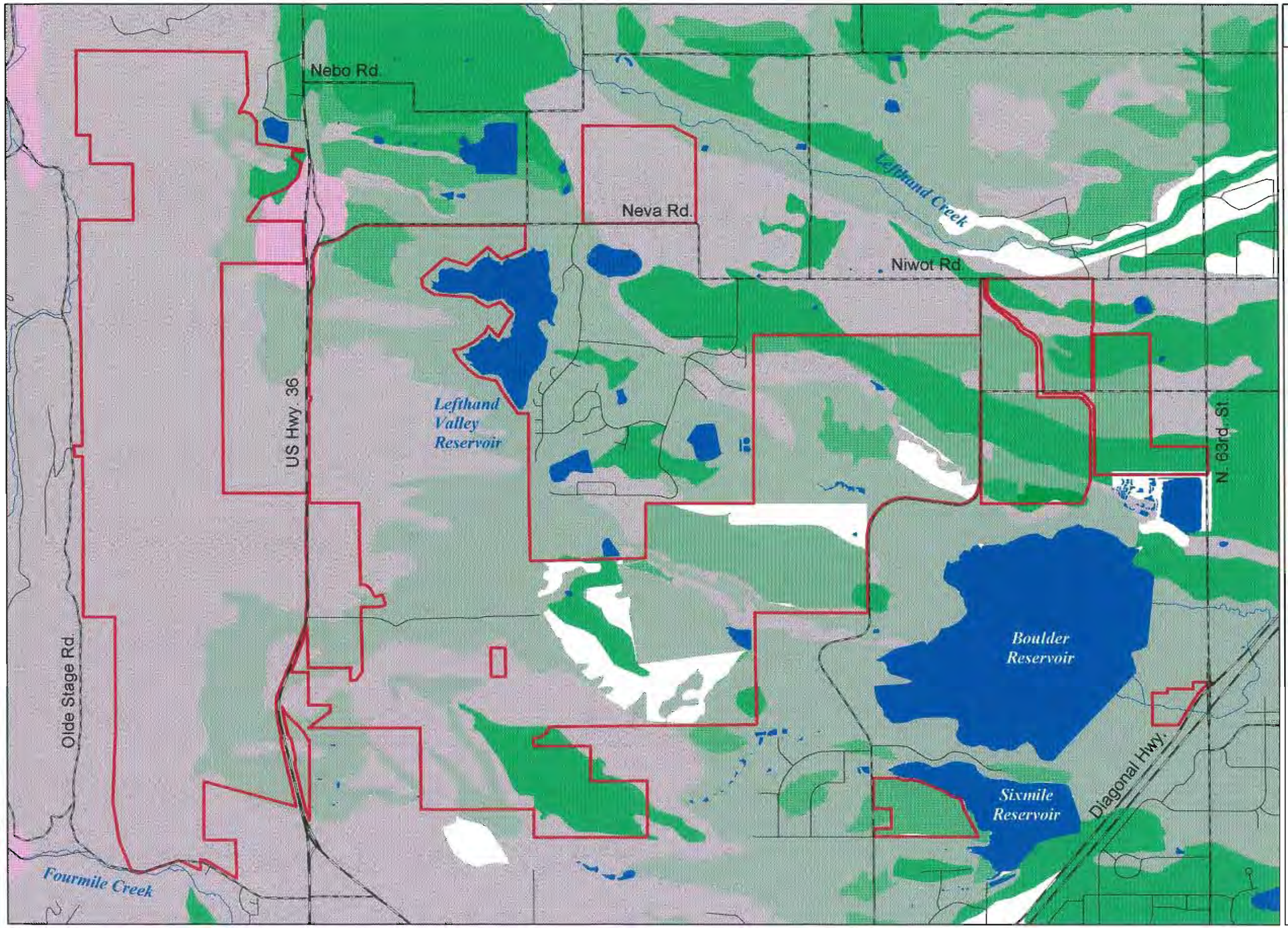
0 0.5 1 Miles

N W E S

CITY OF BOULDER OPEN SPACE

Map assembemed in Arc/View with data compiled in Arc/Info, AutoCAD, and ArcCAD.
Map prepared by the City of Boulder Open Spaee GIS Lab, Sean Metrick May 31, 1996. (nbv_sal.apr)

Figure 12.4: Agricultural Soil Capability - North Boulder Valley Management Area



Legend

Soil Capability Class*

1 2 3 4 5 6 7 8 White Areas Are Unclassified.

Class 1 - Soils have few limitations that restrict their use.
Class 2 - Soils have moderate limitations that reduce the choice of plants or require moderate conservation practices
Class 3 - Soils have severe limitations that reduce the choice of plants, require special conservation practices or both.
Class 4 - Soils have very severe limitations that restrict the choice of plants, require very careful management or both.
Class 5 - Soils are subject to little or no erosiou but have other limitations, impractal to remove, that limit their use largely to pasture or range, woodland or wildlife.
Class 6 - Soils have severe limitations that make them generally unsuitable to cultivation and limit their use largely to pasture of range, woodland or wildlife food and cover.
Class 7 - soils have very severe limitations that make them unsuitable to cultivation and that restriet their use largely to grazing, woodland or wildlife.
Class 8 - Soils and landforms have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife, water supply or to esthetic purposes.

*Soil capability based upon soil type and irrigation only.
Analysis of slope and aspect are not included.
Soil capability reflects 1995 irrigation patterns.

North Boulder Valley Management Area

Roads

Highways Major Roads Streets

Hydrology

Creek Lake

Map produced for the North Boulder Valley Management Area Inventory Report. Map depicts soil capability classes. Soils data from the USDA Soil Conservation Survey in cooperation with the Colorado Agricultural Station, 1975. Digitally encoded by the City of Boulder Open Space GIS Lab, J. Osborne, M. Smitth.

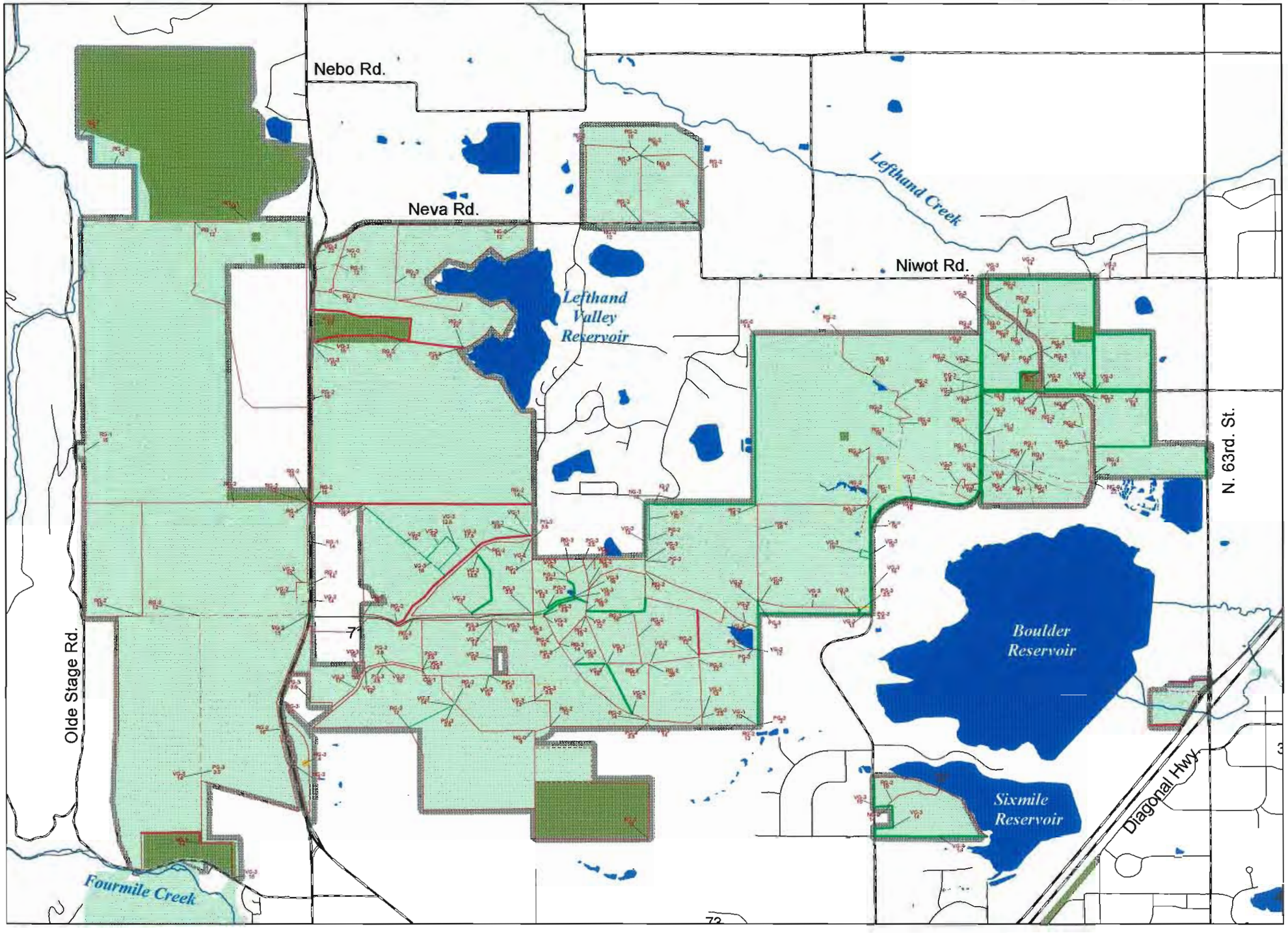
Scale

0 0.5 1 Miles

N W E S

Map assembled in Arc/View with data compiled in Arc/Info, ArcCad and AutoCad.
Map prepared by the City of Boulder Open Space GIS Lab, Sean Metrick, May 31, 1996. (nbv_so-q.apr)

Figure 12.7: Fence Information - North Boulder Valley Management Area



Legend

Fence Type (by color)
- High Tensile
- Barbed Wire
- Wood
- Smooth Woven
- Electric
- Chain Link

Fence Condition (by line type)
- Like New
- Acceptable
- Disrepair
- Disjunct

Gate Type
- PG: Pedestrian
- VG: Vehicle
- RG: Ranch
- IG: Flood
- NG: No Gate
- CG: Cattle Guard

Gate Condition
- 3: Like New
- 2: Acceptable
- 1: Disrepair
- 0: Disjunct

Gate Label Example

Gate Type — RG-2 — Gate Condition
12 — Gate Width In Feet

North Boulder Valley Management Area

Roads
- Highways
- Major Roads
- Streets

Hydrology
- Creek
- Lake

City of Boulder Open Space
- Open Space
- Conservation Easement/Restricted Access

Map produced for the North Boulder Valley Management Area Inventory Report. Map depicts fences identified by condition and type.

Scale

0 — 0.5 — 1 Miles

N
W E
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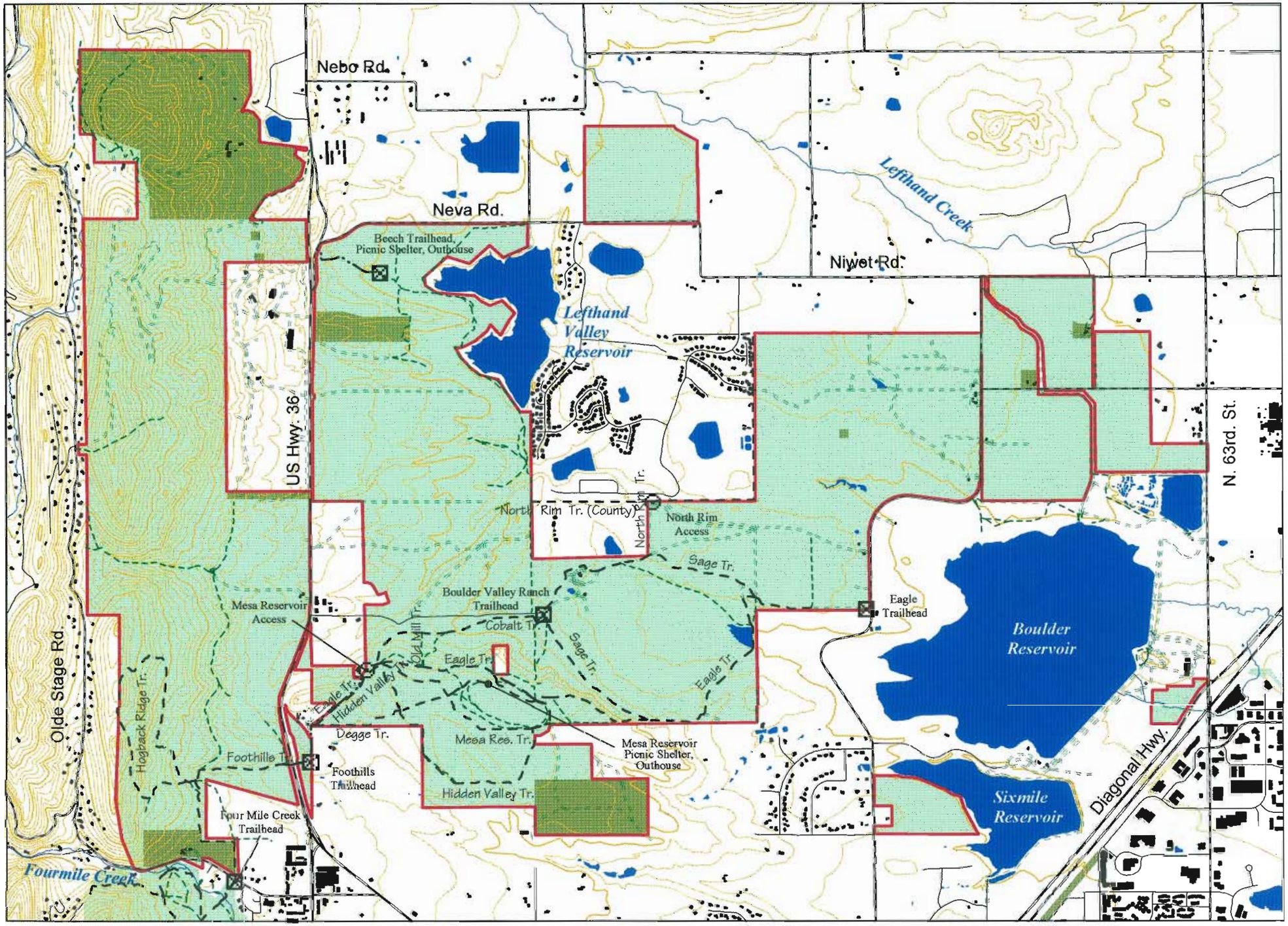
Map assembeled in ArcView with data compiled in ArcInfo, ArcCAD, and AutoCAD.
Map produced by the City of Boulder Open Space GIS Lab, Sean Metrick, May 31, 1996. (nbv_fence.apr).

Figure 13.10: Access / Trails - North Boulder Valley Management Area



Legend

Open Space Access
- Pedestrian
- Parking

DesignatedTrails
- Designated Trail
- Public Access Road

UndesignatedTrails
- Access Road
- Undesignated Trail

Contour
- 200' Index
- 40' Intermediate

North Boulder Valley Management Area

Roads
- Highway
- Major Road
- Street

Hydrology
- Creek
- Lakes

City of Boulder Open Space
- Open Space
- Conservation Easement/Restricted Access

Building (data current to 1993)

Map prepared for the North Boulder Valley Management Area Inventory Report. Map depicts designated trails and access points. Building data from 1993 Merriek aerial photos, City of Boulder data.

Scale

0 0.5 1 Miles

N W E S

CITY OF BOULDER OPEN SPACE

Map assembeled in ArcView with data compiled in ArcInfo, AutoCAD, and ArcCAD.
Map produced by the City of Boulder Open Space GIS Lab, Sean Metrick, May 31, 1996. (nbv_trails.apr)

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