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Boulder Valley Ditches
OSMP Study
Study
Canzonieri, Carmella & Michael H

3231

Boulder Valley Ditches
Carmella Canzonieri et al



Boulder Valley Ditches

a landscape
preservation and
design study

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Boulder Valley Ditches

1. Ditches?

"In the many ... irrigating channels which traverse the city in so many quarters Boulder has what seems like a veritable treasure of municipal decorations, now for the most part neglected and defaced, but all retaining their essential elements unspoiled and ready to shed beauty all about them if only given a proper setting."

Frederick Law Olmsted, Jr.
1910

Whiterock Ditch passes beneath
the Farmers' Market



Within the city of Boulder, Colorado, there are two year-round creeks, and 23 other waterways that flow half the year. These are irrigation ditches, bringing water through the city on its way to fields, pastures, orchards and gardens. The 30 miles of ditches make up most of the system of watercourses in Boulder.

The ditches are old. Raising food in this semi-arid region required irrigation, so Boulder's first ditch was dug in the city's first year, and most were finished by the 1870s. Cottonwoods and willows have grown over more than a century and the ditches now seem more natural than artificial. The rest of the city has grown around them, sometimes forming itself around the ditches, sometime ignoring and swallowing them.

Most of Boulder's ditches still flow. Many lawns and gardens in north and east Boulder are watered by *laterals*, little distribution canals which are the ditch system's capillaries. In other neighborhoods the laterals are gone. In the city's open space and in the undeveloped land beyond it the irrigation landscape remains largely intact, with miles of ditches and far more of laterals watering crops and pasture.

Most other western cities of any size are not so lucky. Santa Fe, *Albuquerque*, for example, were hundreds of years older and even more extensive than Boulder's ditches, but only one remains within the city. Ditches disappear when their water is diverted to municipal systems. They disappear when irrigated land is converted into something else. They disappear, for all intents and purposes, when development or fear or apathy puts them in a pipe.

Ditches embody a visible connection with a past of human organization, and a physical linkage between agricultural land and urban spaces. This study explores the potential for making Boulder's ditch system a recognized part of the community's image and a frame for distinctive landscape and urban form.

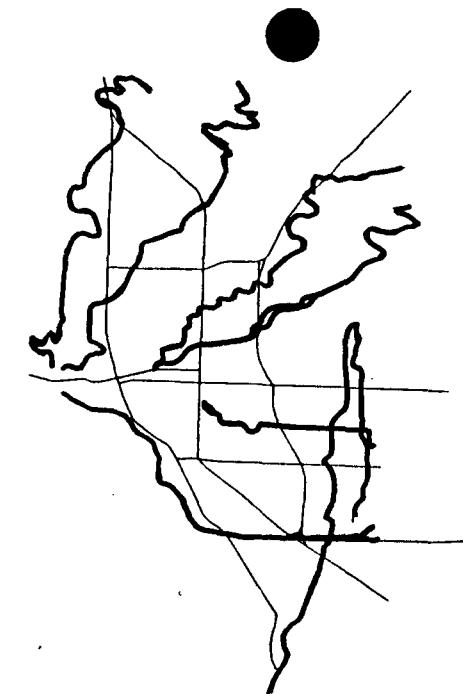
We selected seven ditches which represent the range of relationships between ditches and the urban and rural landscape. The study area is a large portion of the city of Boulder, which has a population of 88,000 and is the center of a county of 227,000. The city manages an extensive open space system of 24,000 acres, together with parks and mountain parks which bring the total of public open space to more than 41,000 acres.

We first inventoried physical and spatial characteristics of the seven ditches. Groups of students walked and photographed each ditch, usually more than once. We developed seven sets of maps, describing the ditches' physical characteristics and structures associated with them, vegetation, access, context and view from the ditches, and places from which the ditches can be seen.

Individual students investigated and made themselves experts upon topics important to understanding ditches: history; riparian ecology; agricultural and urban irrigation; the law of water rights, ditch companies and their rights-of-way, and environmental regulation; ditch safety and liability; hydraulic engineering; flood hazard and stormwater control; and Boulder's water supply, open space, development, and preservation policies. The first section below is a compilation of this work, a primer of ditches.

Water didn't come easy in the west. Significant rivers are rare and precipitation scarce. Only artificial waterways enabled settlement in arid lands. The flow of water had to be designed to be carried as far as possible from its source, and through an interconnected system, be delivered to each furrow in the field.

Wheat and some dry beans can be grown in Colorado on existing rainfall, as their intensive water needs come early in the season when moisture is plentiful. But in this climate relying on existing rainfall is risky, and for most crops impossible. Most irrigation in Colorado is for livestock feed, such as corn and hay. Other crops include sugar beets, dry beans, potatoes, sorghum, rye, fruits, and other vegetables all of which require consistent water through the growing season.



What ditches are for and how they work

picnickers on Sunset Hill with Whiterock Ditch in the background, c. 1890.
Folsom Street now runs along the base of the hill

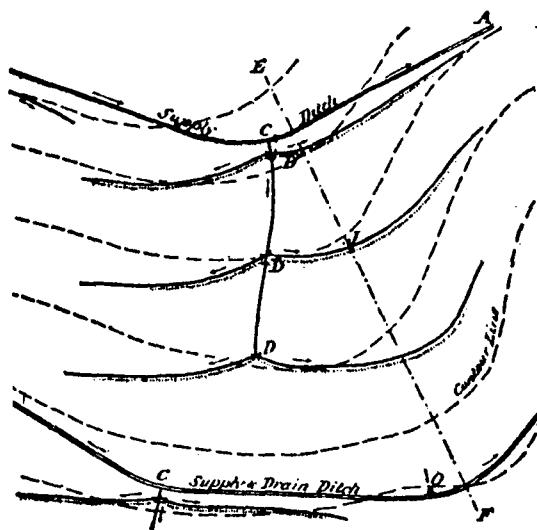
(courtesy Carnegie Library)



The first ditches were simple diversions from streams to lowland areas. Then they were built on higher elevations. In time the system developed in complexity with the addition of storage basins and reservoirs and major construction projects to divert water to lands of a different watershed, even across the continental divide. These works were made possible by community cooperation, and since each farmer depended on the system, the ditches became a visible symbol of community bonds.

Techniques were mostly from the 'rule of thumb' school. In the early days, ditches were built by hand. Wooden tools with minimal iron work surfaces were used to move and haul the soil. Material removed from the channel was used to build up the sides of the ditch.

Early irrigation relied on gravity flow through systems of ditches and furrows which followed contours at a slight slope. This system is still the most common today. Water is either flooded over an area of land or channeled through furrows for row crops. This requires careful grading of land and positioning of ditches to follow slopes of less than 10 feet per mile. Flood irrigation requires the least capital outlay of all irrigation techniques, and no supplemental energy except for human labor. With respect to labor it is the most intensive and it is least efficient in its use of water.



King, *Irrigation & Drainage* (1903)

Underground piping can improve water efficiency. Sprinklers also improve efficiency, are more adaptable to hilly territory and sandy soils, and are less labor intensive. But they require more capital outlay and energy. A *drip* or *trickle irrigation* system is even more efficient and more expensive; it is attractive for orchards and high value crops.

Ditch control structures include headgates (where water leaves the natural stream to enter the ditch), lateral gates (where water leaves the main ditch), and spillways (where extra water is dumped, avoiding damage to the system). Early control systems were often nothing more than a few planks piled atop one another. By adding or removing the top plank, water could be diverted as desired. This level of sophistication is still represented in some Boulder-area ditches; others show a higher degree of engineering. Reinforced concrete with forged iron mechanical systems are a newer generation. The premise remains the same. Capacity is controlled by depth and speed of water flow. This is managed by spillways, gates, and ditch linings. Stepping down the ditches also controls flow rate and may increase or decrease depth and speed. This process also oxygenates the water for a healthier stream.

Colorado water law is based on the doctrine of *Prior Appropriation*: "First in time, first in right." A water right specifies a volume of flow, a point of diversion, a category of use, and a priority date. Senior rights receive their full allotment before junior rights get any water. Since junior rights get water only when flow is high, the priority date of a water right determines its value.

Every water right, including an exchange or trade, is created by decree. Any transfer of rights from one ditch to another requires a decree for change in the point of diversion. A ditch or lateral may be extended or moved without decree as long no additional water is appropriated. Water shares may be bought and sold, and the original priority date travels with the right.

The state water commissioner oversees ditch headgates from the stream, issuing a 'call' that specifies for each day how much each ditch will be entitled to take.

Ditch companies have a fiduciary responsibility to their shareholders to deliver water as inexpensively and efficiently as they can. Ditch companies are ordinarily non-profit corporations in which ownership of a water right on the ditch makes the water right owner part owner of the ditch company, with a voting right based on share ownership. This ownership is then subject to an annual fee based on shares for the maintenance of the ditch. The ditch company hires a ditch rider who is responsible for daily allocation of water to the lateral headgates supplied by the ditch. Laterals that serve a number of users may have their own organizations. The ditch rider is responsible for light maintenance; heavier maintenance and clean-up is carried out each spring before running water in the ditch.



flood irrigation

History

Boulder valley pioneers in the second half of the nineteenth century crossed the plains to find a barren, gently rolling landscape out of which shot the Rocky Mountains. From the mountains flowed a turbulent, snow-fed stream lined by scattered cottonwood trees.

A group of prospectors established the first settlement on October 17, 1858 at Red Rocks. After a placer discovery at Gold Run on January 16, 1859, over a thousand people flooded the area. Some recognized opportunity on the plains and filed homesteads to provide the prospectors with food and supplies. Fresh fruits and vegetables came from small garden patches tilled near streams.

Settlers began to experiment with the construction of water channels, an idea inspired from stories of early Spanish settlers, of ancient Anasazi and Hohokam Indians, as well as from more recent Mormon settlements in Utah. Lower Boulder Ditch, the first in northern Colorado, began drawing water from Boulder Creek in 1859, both for irrigation and to power John Rothrock's flour mill. Smith-Goss and Howell ditches followed later that year.

Boulder's farms produced better than its mines. Once out on the plains the farmers recognized they were surrounded by a potentially rich agricultural district with an inexhaustible water source. The farmers had a vision of expanding the ditch system, irrigating hundreds of acres eastward to Kansas. Construction followed with Anderson Farmer and North Boulder Farmer's ditches. By 1862, 24 ditch companies had filed for rights to divert water from Boulder Creek. Left Hand Ditch Company transformed nearly 20,000 acres to agricultural land and built 12 subsidiary ditches: Lake, Tollgate, Haldi, Crocker, Table Mountain, Bader, Johnson, Star, Hinman, Holland, Budd, Hornbaker and Williamson. Colorado in 1881 provided for recording water rights. In 1882, Boulder water rights were adjudicated for the first time and 98 ditch companies filed to use Boulder Creek (Appendix 2 lists Boulder-area ditch decrees).

Extensive ditch development in the 1880s brought more land into agriculture, and production increased as Japanese and Mexican settlers migrated to the area.

Significant changes like the ones the ditches made to agricultural land were also visible within the town. Here ditches were used for watering street landscapes and gardens, settling the summer dust, domestic water, fighting fires, watering livestock, filling reservoirs, and making ice. For children they were a place to sled and skate in the winter and sail their boats in the summer. Early pioneers, such as M. G. Smith and Judge George Berkeley, enthusiastically cultivated trees and many varieties of plants. Joseph Wolf experimented with a wide variety of fruits, such as strawberries, raspberries, blackberries, apples, and grapes. Later he used the water to add cattle, horses, and Merino sheep to his farm.

Prior to 1870s, area creeks and ditches also served as the municipal water system; water was carried with buckets to the households. In 1872, A.J. Macky, A. A. Brookfield, and J.P. Maxwell

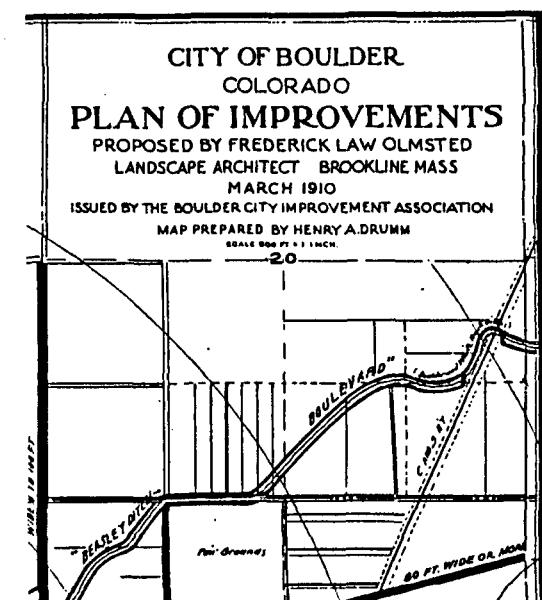
organized the Boulder Aqueduct Company "to lay pipes from Farmer's Ditch along the principal streets, with pipes leading into every house where they may be desired." Silver Lake Ditch was part of the municipal water system, which served 2,500 residents. Boulder in 1875 began to acquire ditch shares to supplement its more junior water rights, first with eight shares of Farmer's ditch followed by Anderson. The town expanded and improved its municipal water works by building an extensive ditch and reservoir system.

Visitors to the area wrote about the ditches. One visitor enjoyed an irrigation ditch running at the edge of a summit to the lake (probably Silver Lake ditch) as the route for his morning walks. Another visitor, Mrs. M.P. Colburn of Massachusetts, wrote of her visit to Boulder in 1878:

Gardens are universal Right here I speak of the peculiar method in general use for watering these great gardens - which not peculiar for the West, would yet be a novel method with us - I mean irrigation. The mountains furnish the means, and the ingenuity of man turns it to account ... Ditches are dug everywhere ... coursing their way into every garden and keeping the ground continually moist and fertile. Should Colorado depend upon rain for moisture, I very much fear that they would have to depend also upon canned vegetables, or else go without. These ditches are large enough, and of enough importance to be christened ... now have "Farmers Ditch" and "University Ditch" ...

"When Boulder is visited by an eastern stranger who has an eye for beauty," wrote one such easterner, "and some acquaintance with the use to which water is put in the gardens and cities of older countries he cannot fail to be strikingly impressed with the neglect of what seems to him an extraordinary opportunity for civic beauty." That 'eastern stranger' was Frederick Law Olmsted, Jr., Professor of Landscape Architecture at Harvard University and one of the founders of the profession of city planning. In 1910, at the invitation of a group of Boulder citizens, Olmsted prepared a pamphlet of suggestions for the city's 'improvement.' In addition to proposing the greenway ultimately realized decades later as the Boulder Creek Path, he suggested a promenade along Whiterock (then called Beasley) Ditch through the center of town, and a parkway following it beyond Folsom the eastern edge of Boulder. Olmsted proposed a park and trail along Farmer's Ditch below Red Rocks Park:

Given sunshine and breeze and the wonderful plunging view across the valley to rugged mountains bathed in sunlight; given shade from the direct glare of the sun and sky, easily to be obtained by planting; the one thing wanted to complete the situation is water, and the quiet flowing canal on its way to irrigate the fields beyond the city gives the very note that is needed. To be sure its banks are here shabby and neglected, the vegetation is weedy and an appearance of squalor is more or less in evidence, so that a superficial observer might turn away without feeling the least interest in the ditch. But all the essential elements of the most beautiful scenes of Italy are here, waiting only a little patient, skillful care to unite them into a little picture of paradise.



Olmsted devoted several pages to ditches throughout Boulder (the full text of his ditch remarks is in appendix 1). They clearly charmed him.

If the inherent beauty of the water of the irrigating channels were supplemented by such treatment of their immediate borders as would remove the unpleasant associations that now in many places attach to them, such treatments as would bring out and enhance the natural associations of refreshment and abundance that are inseparable from them and would reinforce their intrinsic charm, these channels alone would serve to make Boulder a place of high civic beauty.

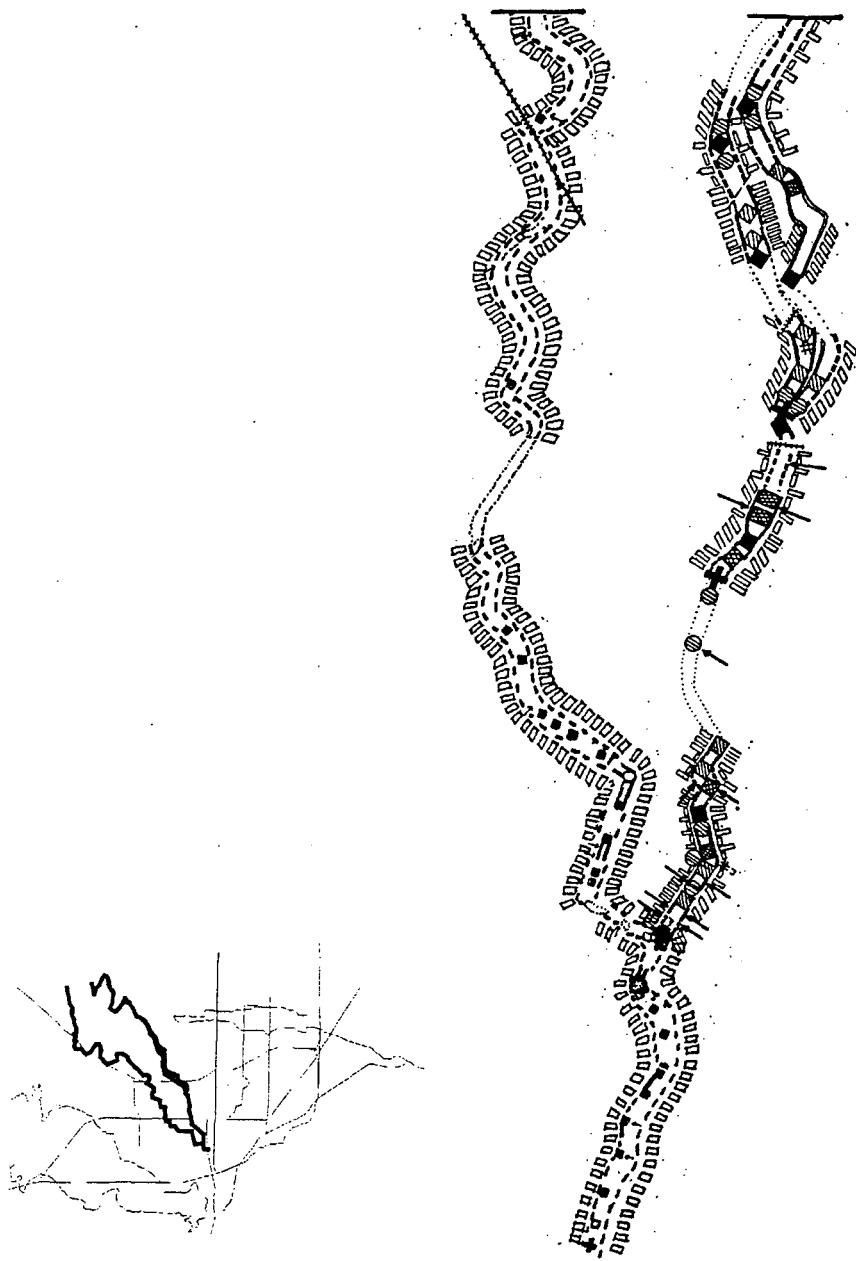


Inventory Maps

**North Boulder Farmers,
Boulder & Lefthand,
and Whiterock Ditch**

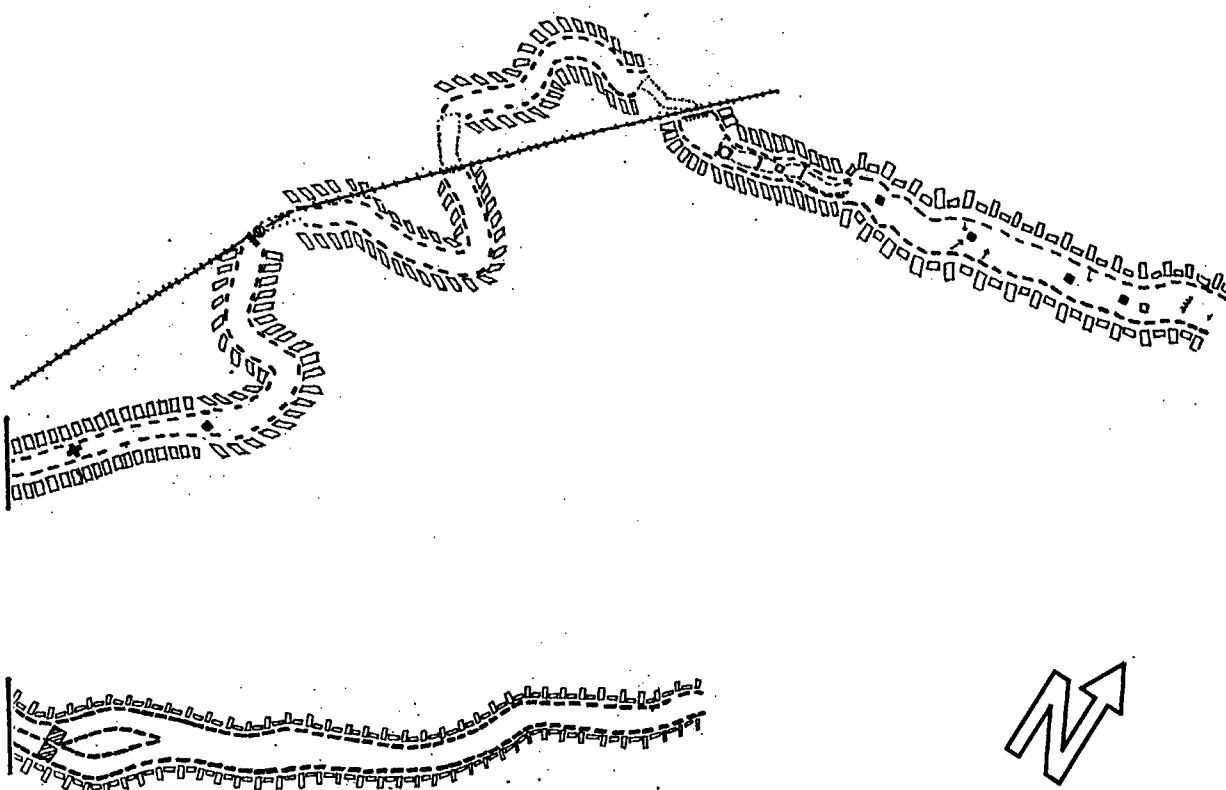
Artifacts & Physical Features
Access
Vegetation
Context & Views from Ditch
Views to Ditch

Citywide
Artifacts & Physical Features
Access
Vegetation
Context & Views from Ditch
Views to Ditch

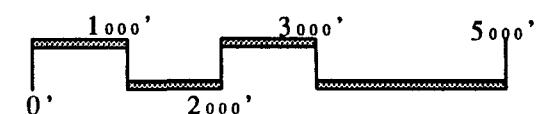


*North Boulder Farmers, Boulder
& Lefthand, and Whiterock Ditch*

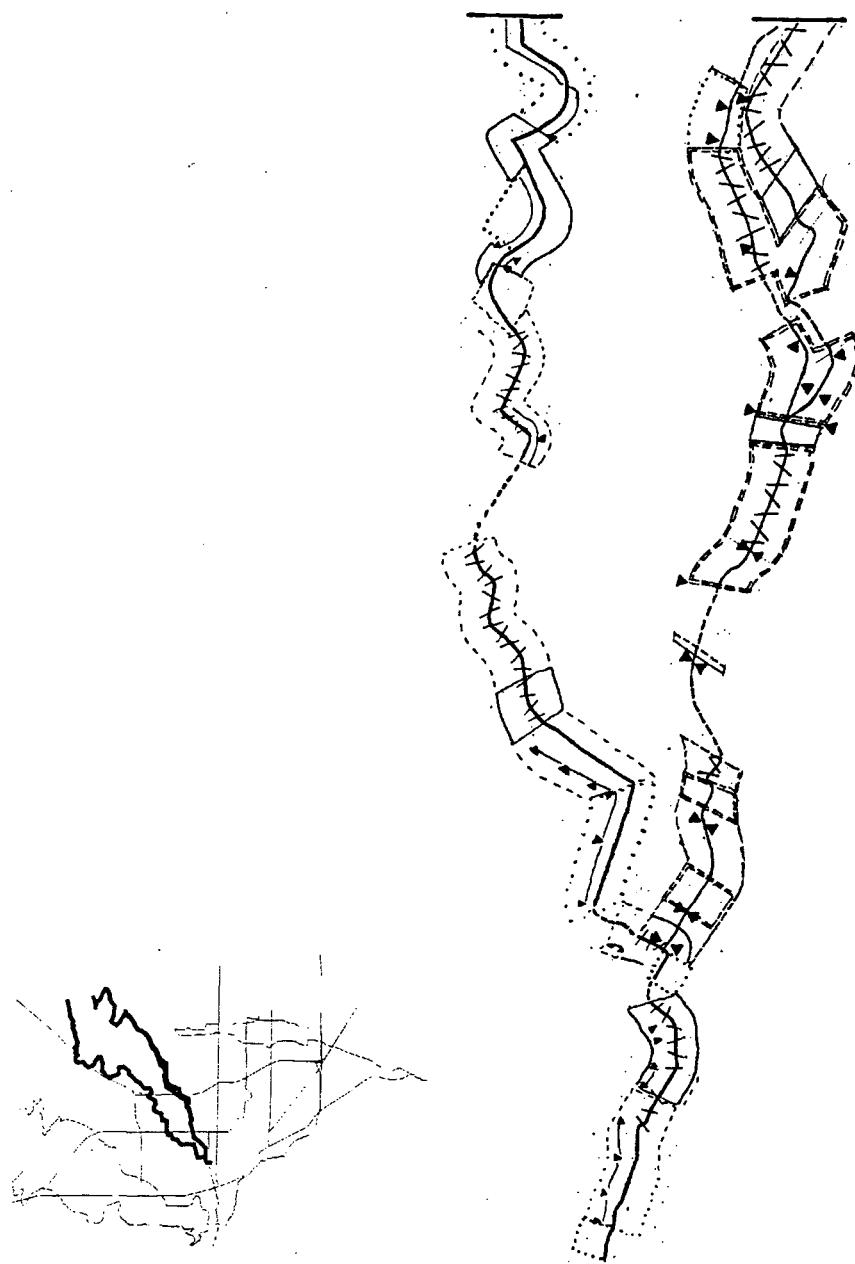
**Artifacts
& Physical Features**

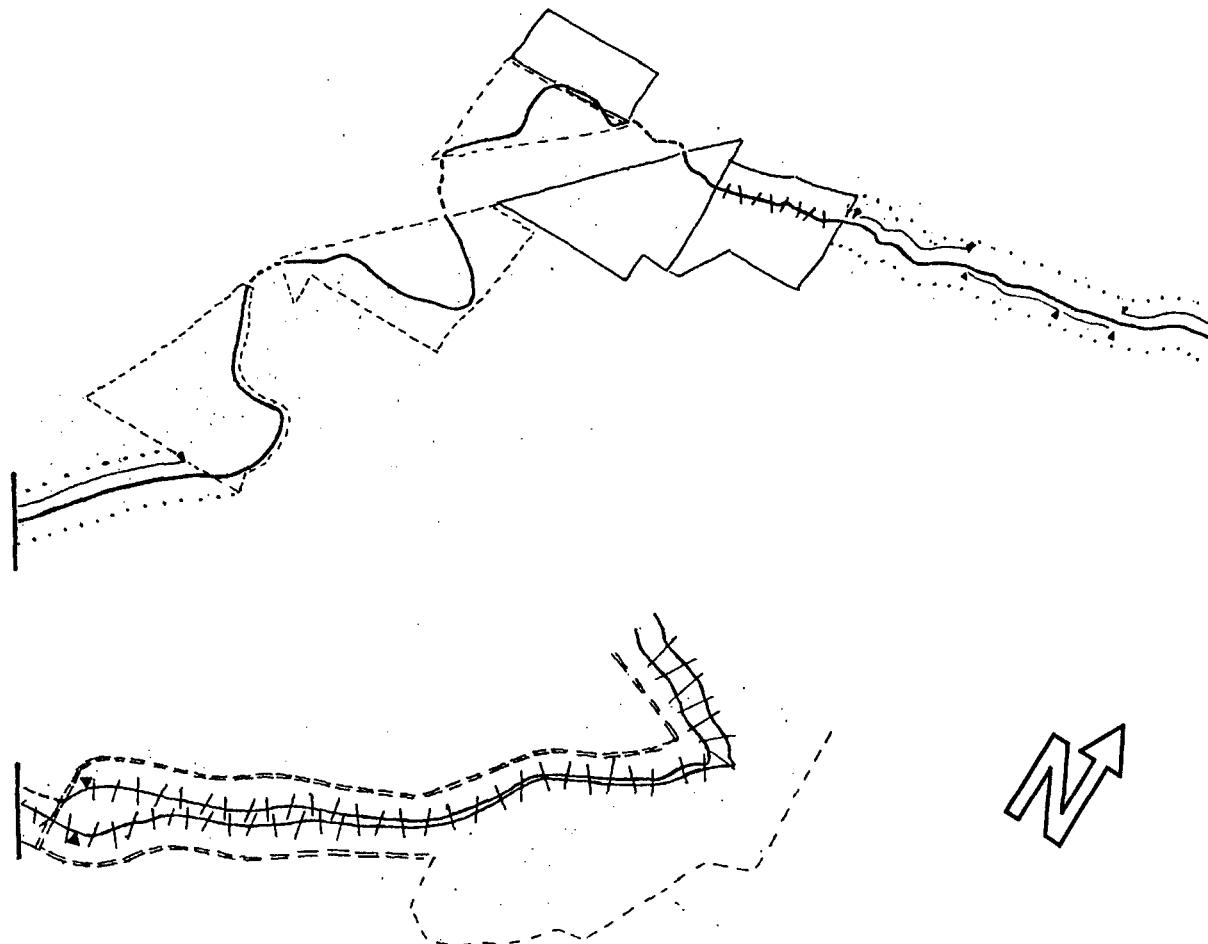


	Major Headgate		Building Over Ditch
	Minor Headgate		Earth Lined
	Storm Drain		Underground
	Drop Structure		Open Lined
	Syphon		Bridge - Major Arterial
	Railroad		Bridge - Local Res/Com
	Elevated Ditch Structure		Bridge - Private
	0-20% Side Slope		Footbridge
	20-50% Side Slope		Screen Fence
	Vertical Side Slope		Open Fence
	Ungrated Culvert		Grated Culvert



1"=2000'





North Boulder Farmers, Boulder & Lefthand, and Whiterock Ditch Access

Type

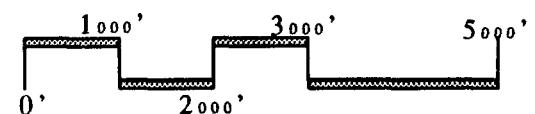
- Open area
- Linear w/Point access

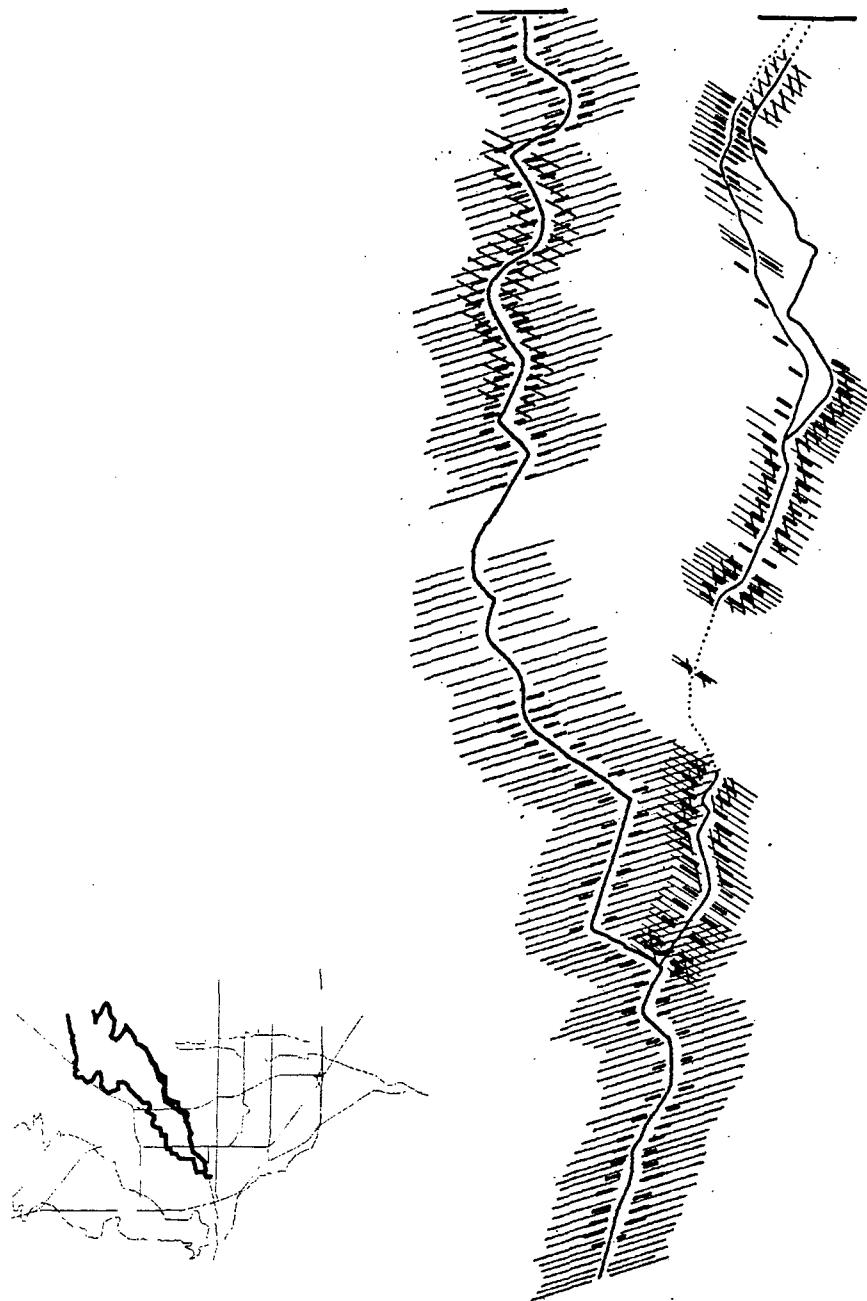
Difficult access

Ditch underground

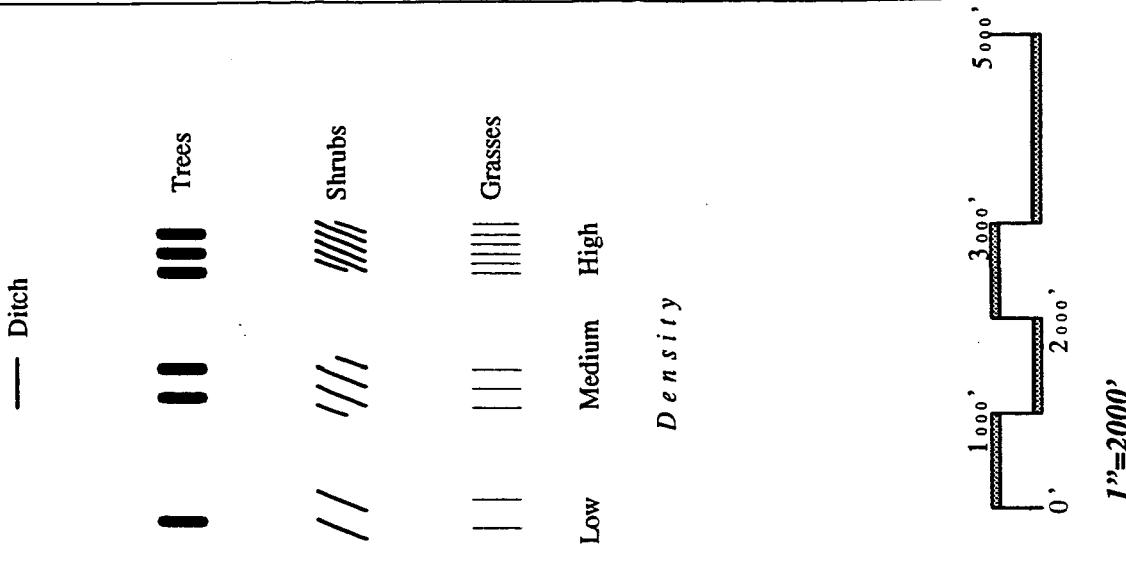
Degree

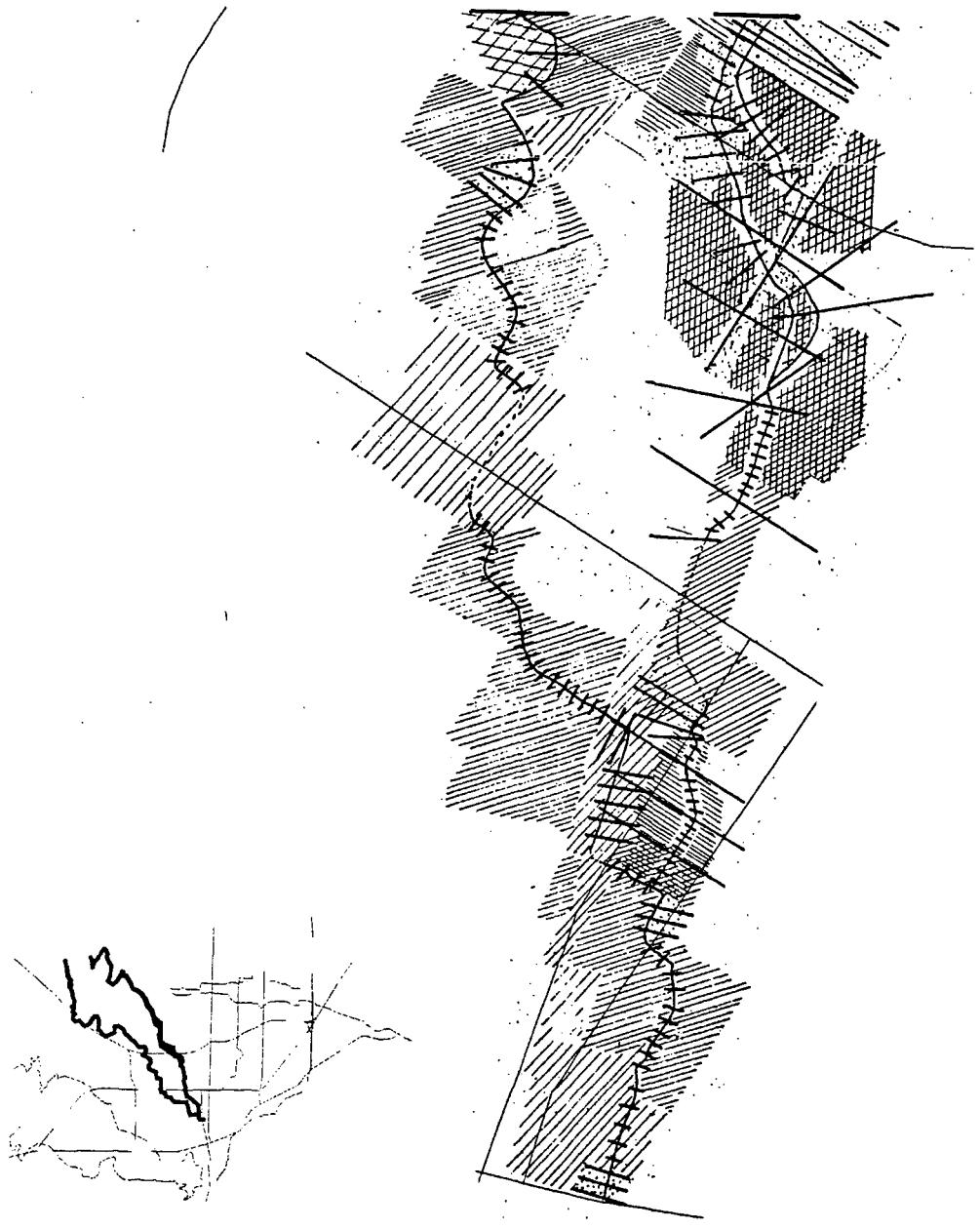
- | | |
|--|------------|
| | Encouraged |
| | Allowed |
| | Restricted |
| | No Access |



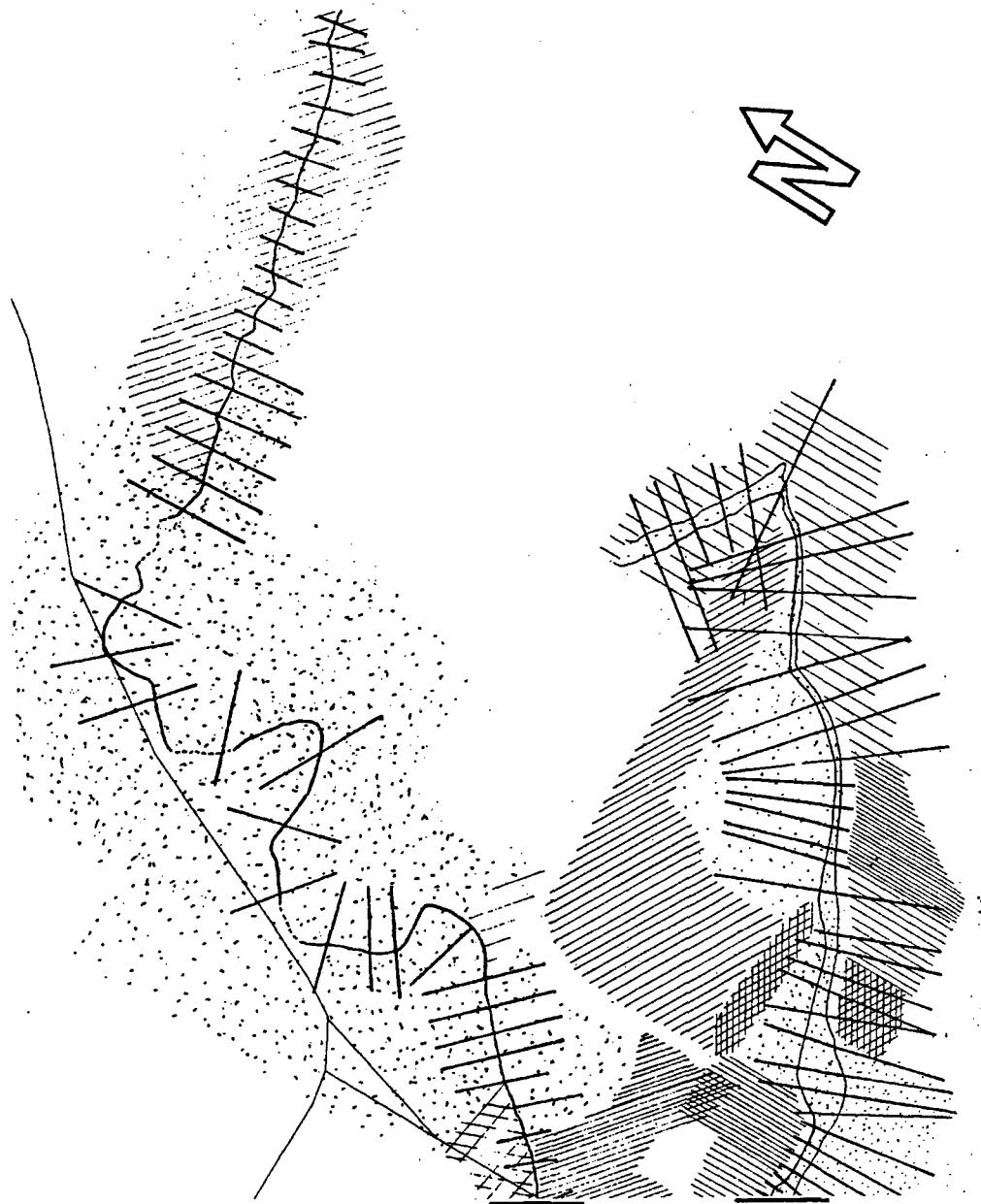
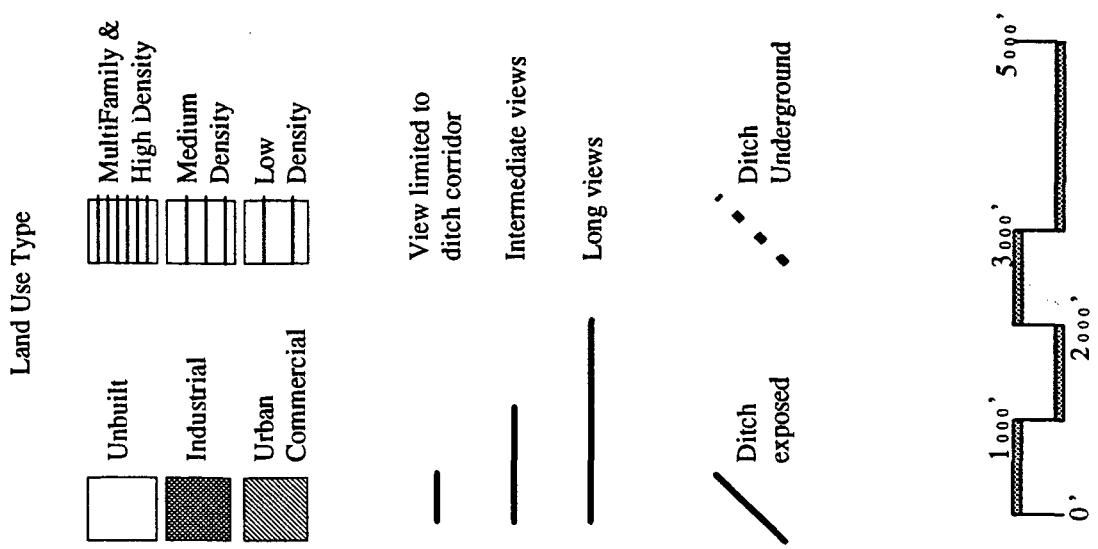


*North Boulder Farmers, Boulder
& Left Hand, and Whiterock Ditch
Vegetation*

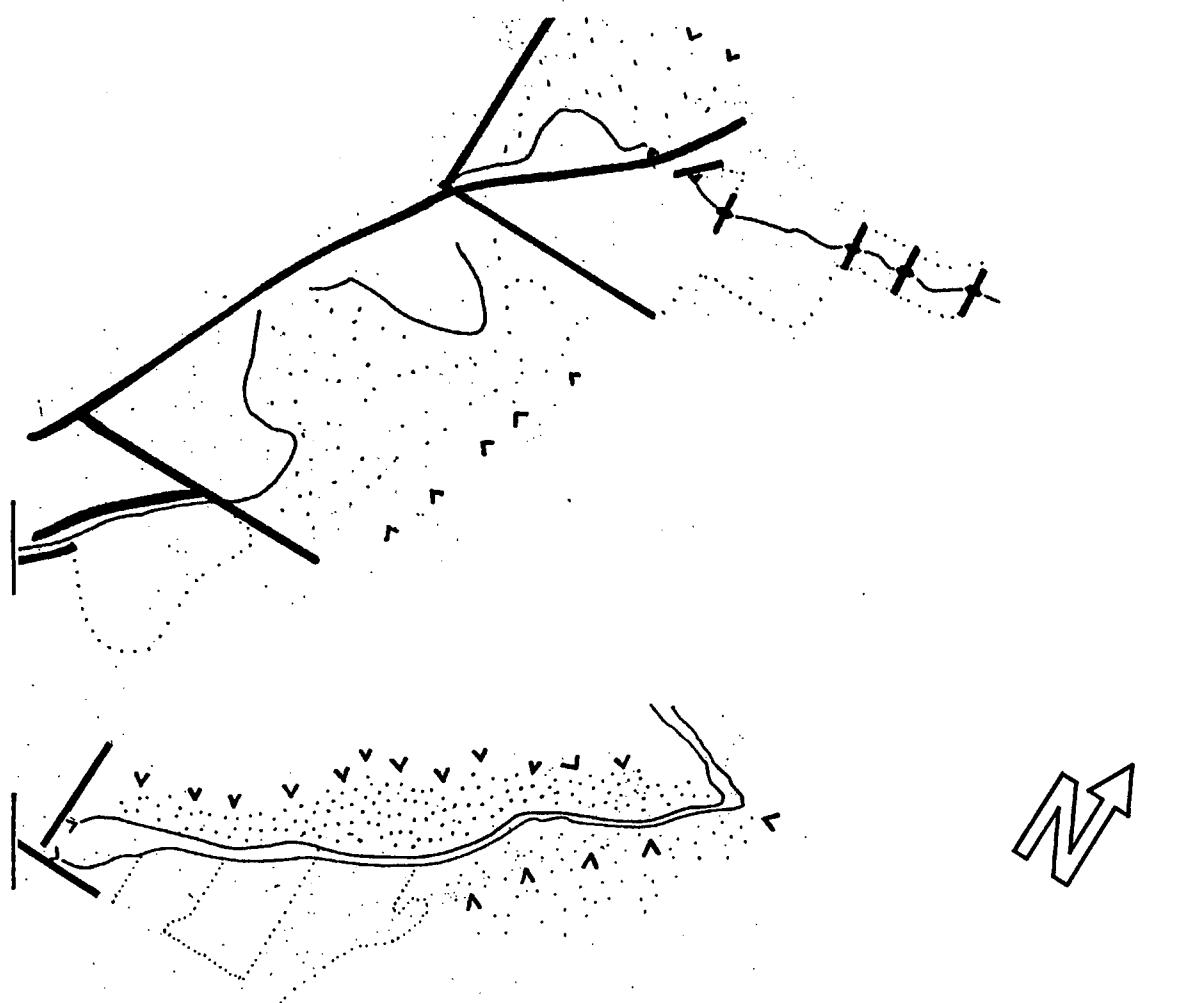




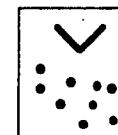
*North Boulder Farmers, Boulder
& LeftHand, and Whiterock Ditch
Context
& Views From Ditch*







North Boulder Farmers, Boulder & Lefthand, and Whiterock Ditch Views To Ditch



Broad areas over
which the ditch is
visible from a
distance



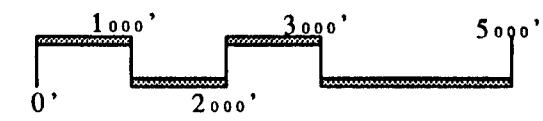
Public space from
which the ditch is
visible



Street from which
the ditch is visible



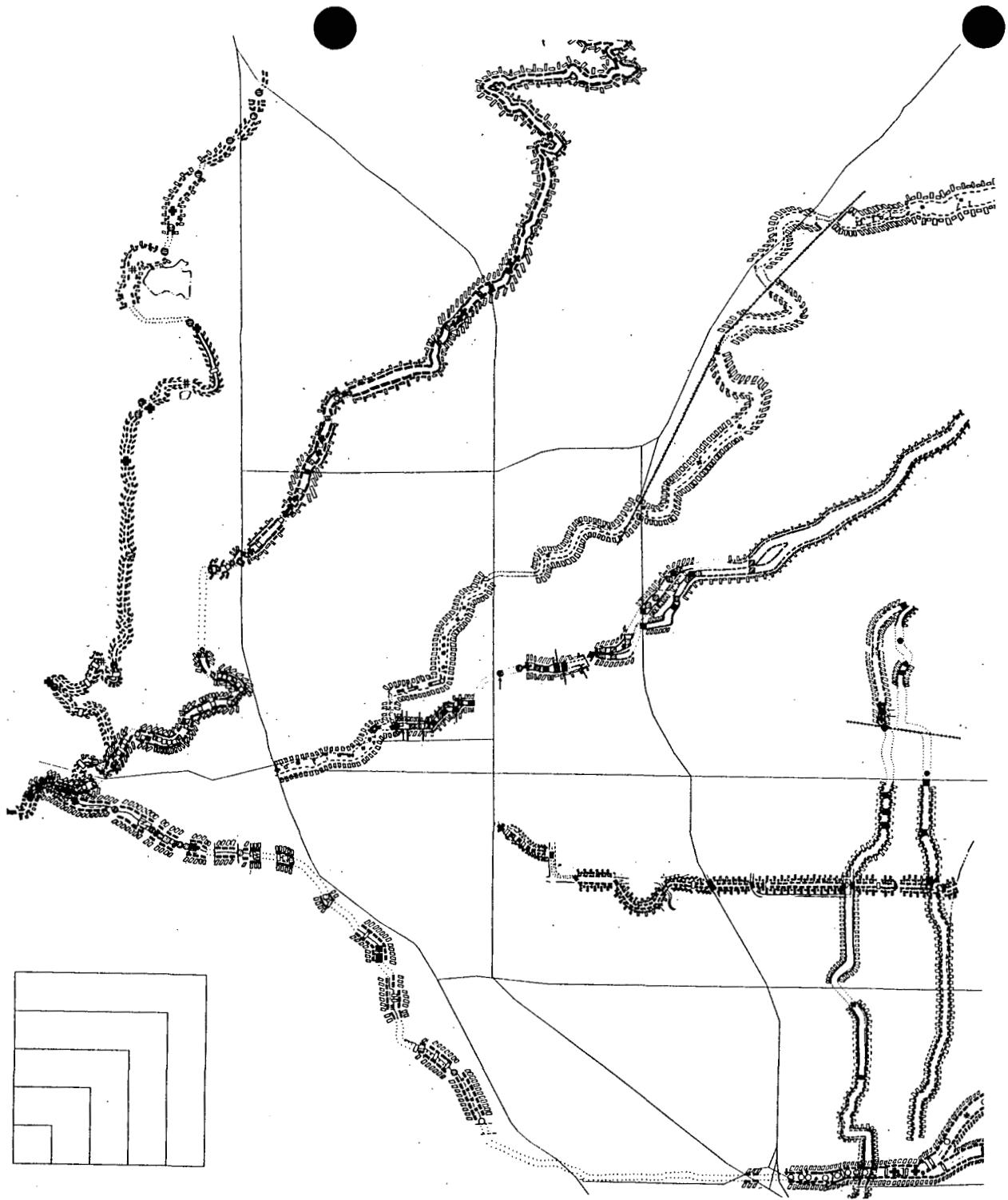
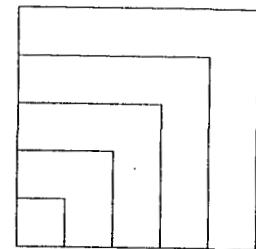
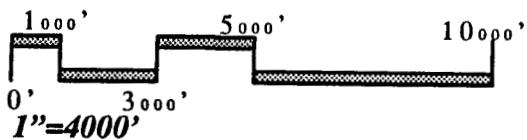
Ditch



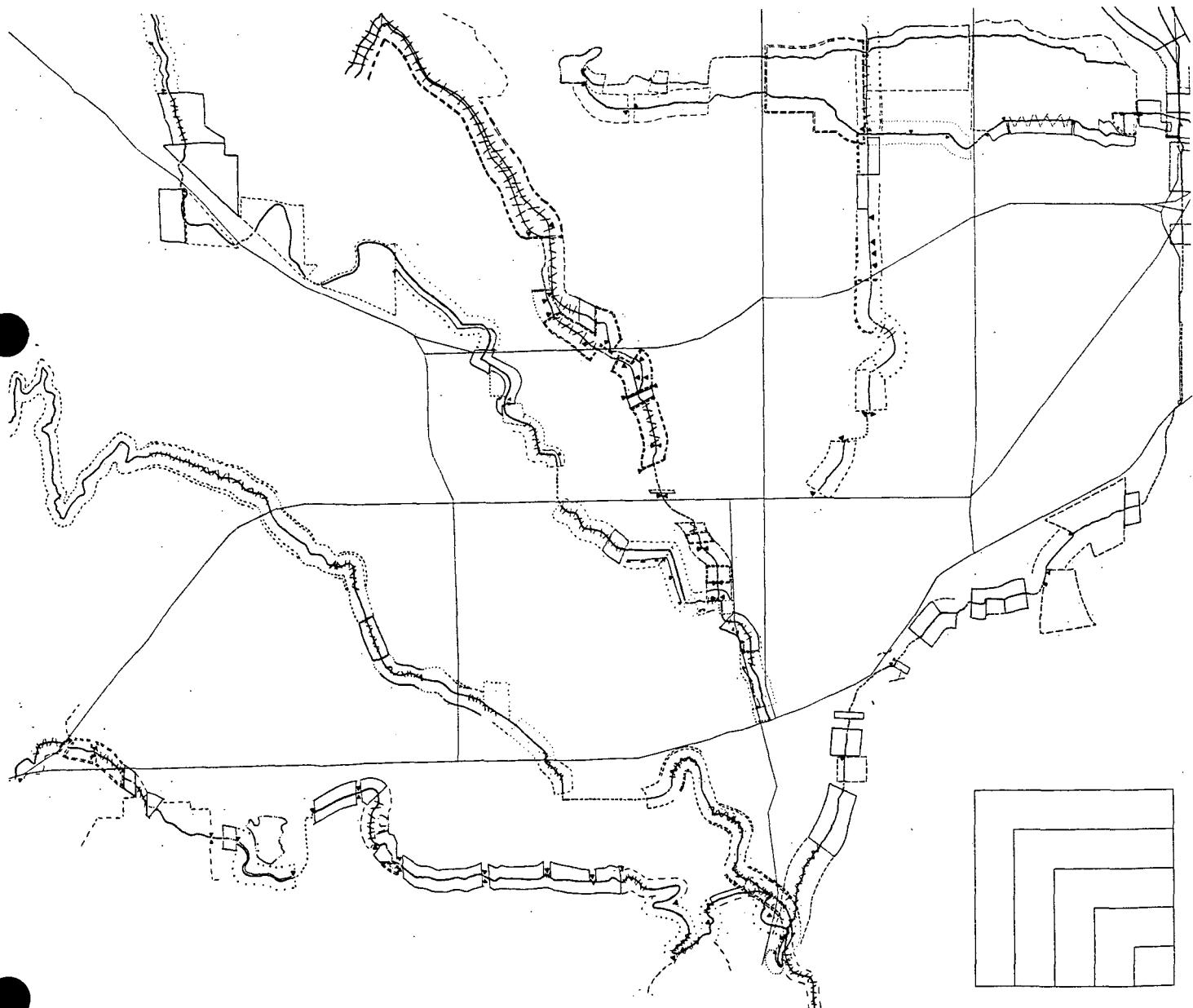
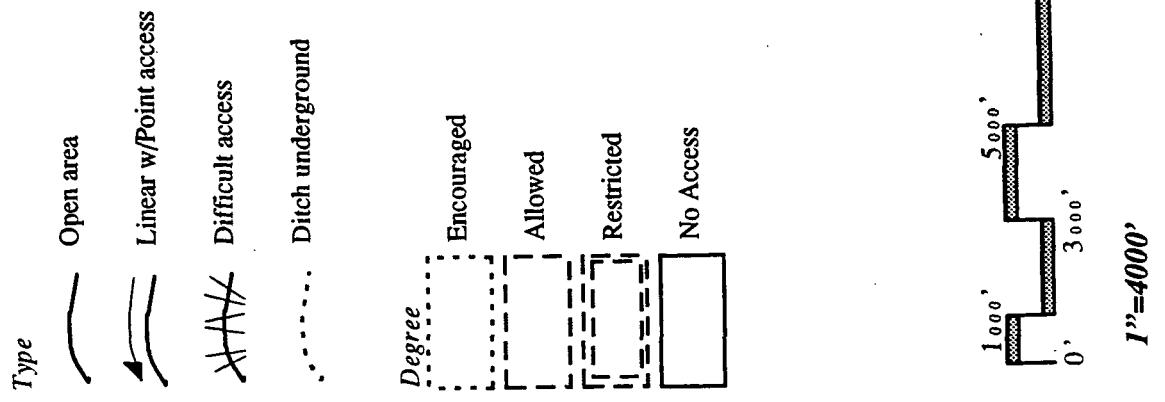
1"=2000'

Citywide Artifacts & Physical Features

	Major Headgate		Building Over Ditch
	Minor Headgate		Earth Lined
	Storm Drain		Underground
	Drop Structure		Open Lined
	Syphon		Bridge - Major Arterial
	Railroad		Bridge Local Res/Com
	Elevated Ditch Structure		Bridge - Private
	0-20% Side Slope		Bridge - Foot Traffic
	20-50% Side Slope		Screen Fence
	Vertical Side Slope		Open Fence
	Ungrated Culvert		Grated Culvert



Citywide Access



Citywide Vegetation

— Ditch

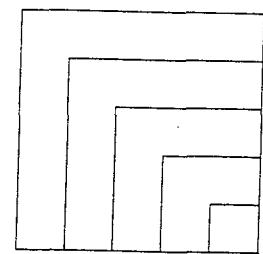
— Trees

— Shrubs

— Grasses

Low Medium High

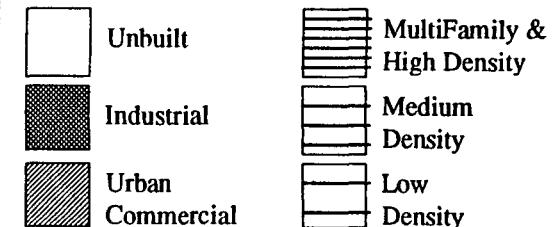
Density



1000' 5000' 10000'
0' 3000' 10000'
 $1''=4000'$

Citywide Context **& Views From Ditch**

Land Use Type



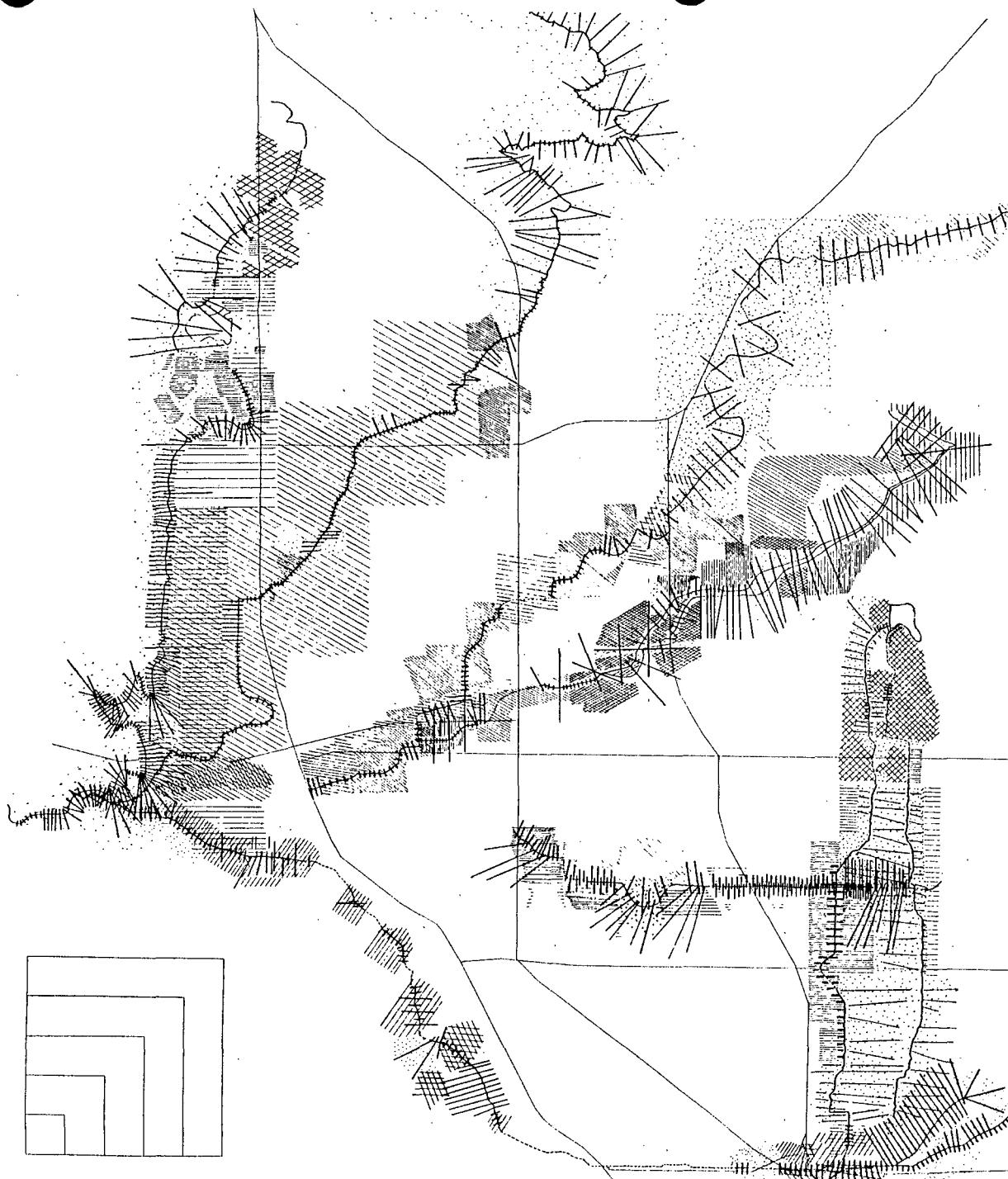
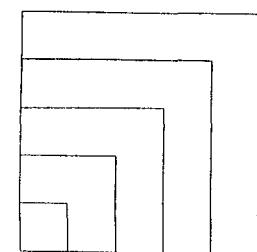
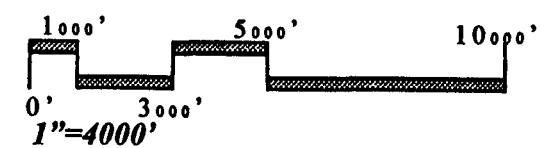
View limited to
ditch corridor

Intermediate views

Long views

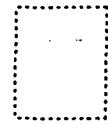
Ditch
exposed

Ditch
Underground

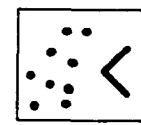


Citywide Views To Ditch

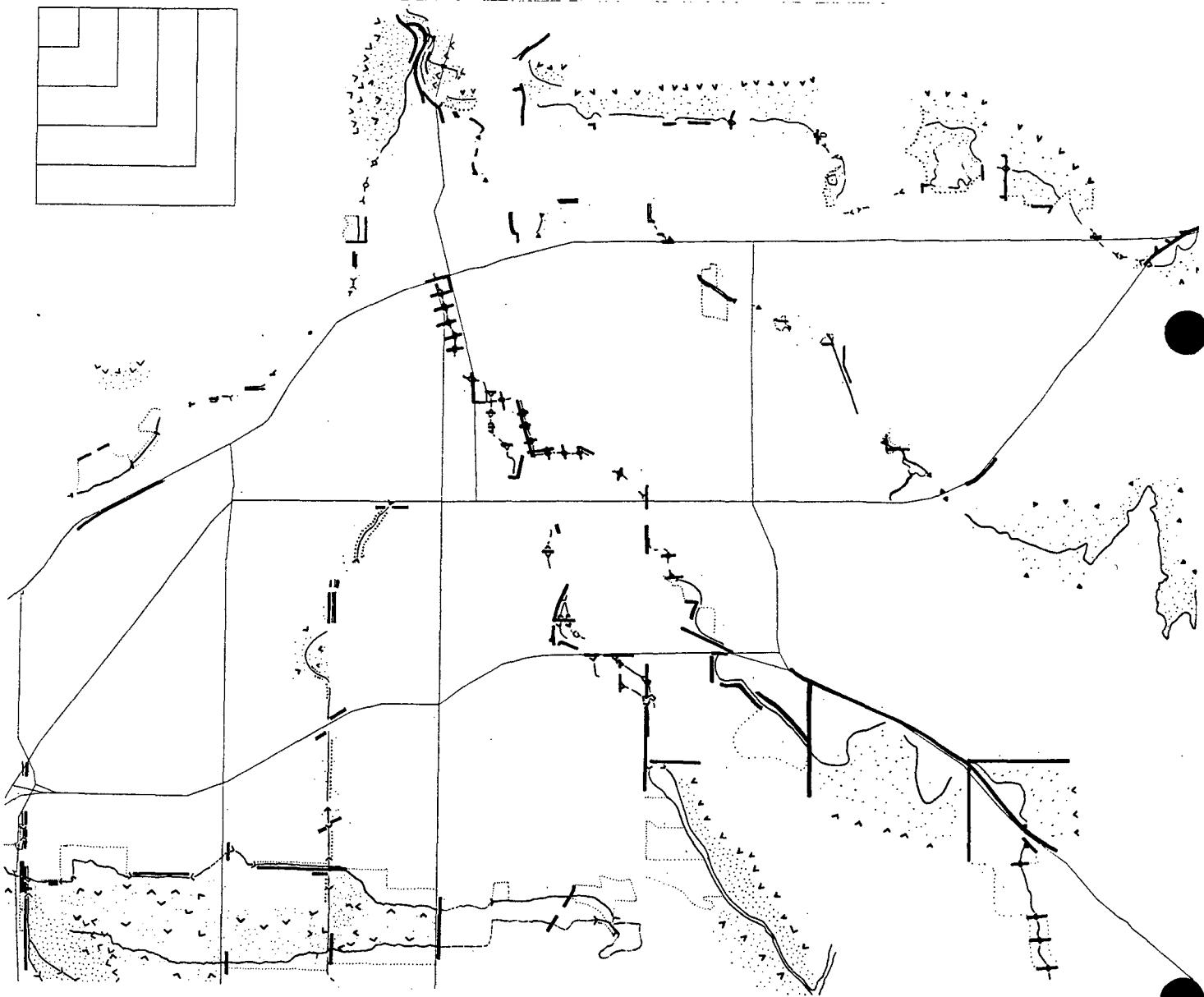
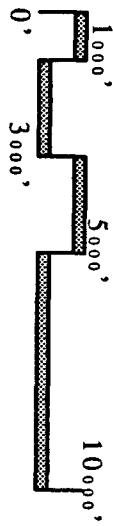
Broad areas over
which the ditch is
visible from a
distance



Public space from
which the ditch is
visible



- Street from which the ditch is visible
- Ditch



2. Ditches Connect

After the selected data were mapped for each ditch, we combined maps of the same category for all the ditches to observe their relationship at the city scale, and then overlaid maps of different categories. All these different combinations suggested the creation of a new intersecting network, connecting related kinds of sites from different ditches: a system of urban public spaces across several ditches, a system of neighborhood small-scale spaces, a recreational system, an ecological system. Each ditch then will contribute to the network with different portions matching different systems.

Ditches connect because of their relationship to topography. Natural watercourses follow the low ground, dropping as quickly as possible on their way to the sea. Ditches run as high and drop as little as is practical, so that they can irrigate as much ground as possible. They follow the contour lines, making a web or two-dimensional fabric as they cross creeks, valleys, roads and railroads.

Most fundamentally, ditches connect fields and gardens with their sources of water. Along their route, they connect the inhabitants of the city with the creek at one end and farms at the other. They connect all the neighborhoods through which they pass. For wildlife, they connect the creeks' riparian corridors with the open space beyond the city, and with many backyards and pockets of greenery in between. For pedestrians and bicyclists, they can be an alternative right-of-way network that connects Boulder destinations independently of streets.

The process of revealing through design the urban reaches of ditches can generate awareness of the continuity of the whole system, including its rural stretches. Raising awareness of the whole will raise interest in preserving its parts. Ditches can form a new interconnected network of public spaces and habitats, and at the growing urban edge can be a source of form, a regionally-derived alternative to formless suburbia.

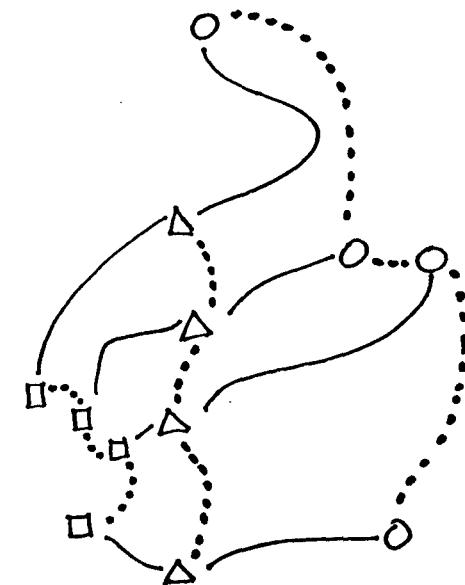
There are currently 1.5 million visits per year to Boulder City open space and both the City and County of Boulder are faced with escalating demands on open space. Potential conflicts are, therefore, apt to arise between preservation and recreational use of open land.

Use existing ditch corridors as a supplement to natural riparian corridors, and as a bypass to sensitive areas.

Trails along natural watercourses can damage delicate ecosystems. Using ditch corridors for trails and paths can aid in stabilizing fragile areas along natural waterways.

Heavy use has damaged the **South Boulder Creek Trail** north of South Boulder Road. A bikeway could run instead along Enterprise Ditch, just east of the creek, connecting with other portions of the bike system. This would reduce use of the South Boulder Creek Trail, which could

Introduction



Open Space

then be realigned to minimize impact to those sensitive areas along the creek showing strain. It would allow sections of trail such as this one to be closed as needed, or on a seasonal basis to allow the damaged system to repair itself, without losing connectivity to other portions of the trails.

Another sensitive area is the north side of Boulder Creek just north of Valmont at the Pearl Parkway alignment. The city has identified this as critical wildlife habitat, which could be endangered by a bikeway. The Boulder/Lefthand trail would extend the proposed Boulder Creek Bikepath north and west of this habitat, parallelling the Boulder and Lefthand Ditch.

Ditches are not without their own riparian habitat. Whether to follow a ditch or creek should be decided case by case.

The Open Space Department should use its ownership in ditch companies to promote public policies (such as historic preservation, habitat protection, and trail access) outside of open space.

Approximately 10,000 of the 24,000 acres of city open space is ditch-irrigated. The Open Space Department owns shares in 25 ditches. The table in the margin shows the ten ditches in which the Department has the greatest ownership. A complete list appears in appendix 3.

The Open Space Department's Long-Range Management Plan calls for buying water rights when acquiring additional land, and maintaining historical uses of the water. Water rights may also be purchased without land acquisition and can be used for irrigation, land management, or habitat conservation. A Water Management Plan will promote irrigation efficiency and protect the Department's existing water rights.

Open Space is responsible for maintaining water delivery and storage structures on its land, but has postponed maintenance. These repairs demand long-term commitment, alternative funding sources, and cooperation with other water users and the ditch companies. The Open Space Department will encourage ditch companies to use environmentally sensitive maintenance practices. The department has the power to go beyond maintenance policies to focus on other critical issues such as preservation, habitat, and trail linkage.

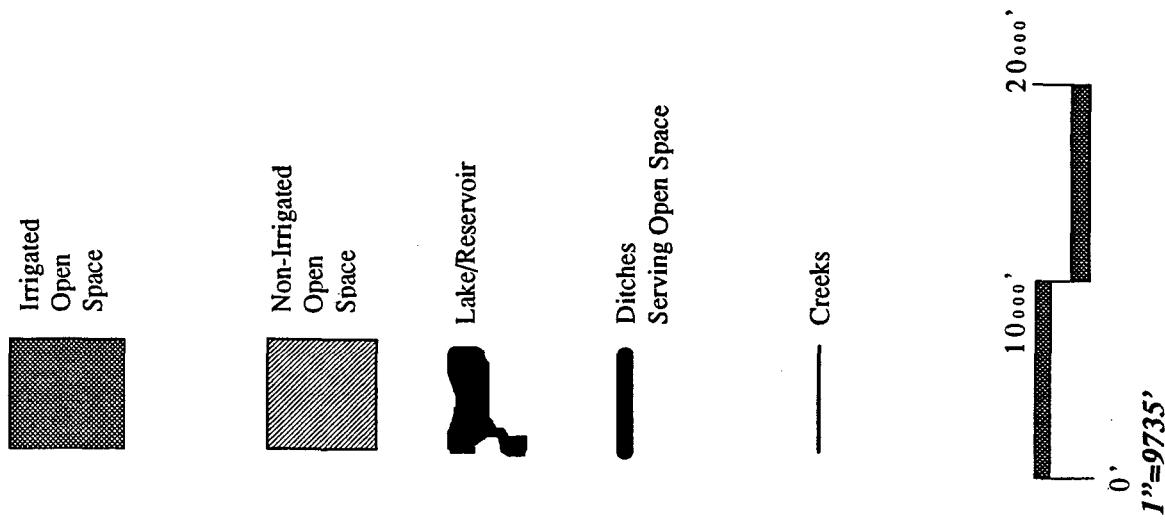
Other government agencies and institutions in Boulder also hold significant water rights. The City of Boulder owns 60 percent of Farmers' Ditch, of which only 6.5 percent is under the control of the Open Space Department. The County Open Space Department also owns shares in Boulder ditches (see appendix 3). Inter-departmental cooperation and coordination with other public organizations such as the University can reinforce the Open Space Department's efforts.

Collaboration with the County Open Space Department is a logical first step. Significant water rights give the department leverage to ensure that water continues to run through the ditches. The city should use its ditch shares to influence the character of ditches even beyond open space boundaries.

City Open Space ditch ownership

Howard	61.0%
Green	54.7%
Smith-Goss	39.1%
Star	34.5%
Marshallville	33.3%
Dry Creek #2	31.3%
McGinn	23.8%
North Boulder Farmers	20.1%
Whiterock	15.7%
Davidson	15.3%

Boulder Open Space Irrigation



Trails

An extensive system of trails runs through and around Boulder. However, gaps remain.

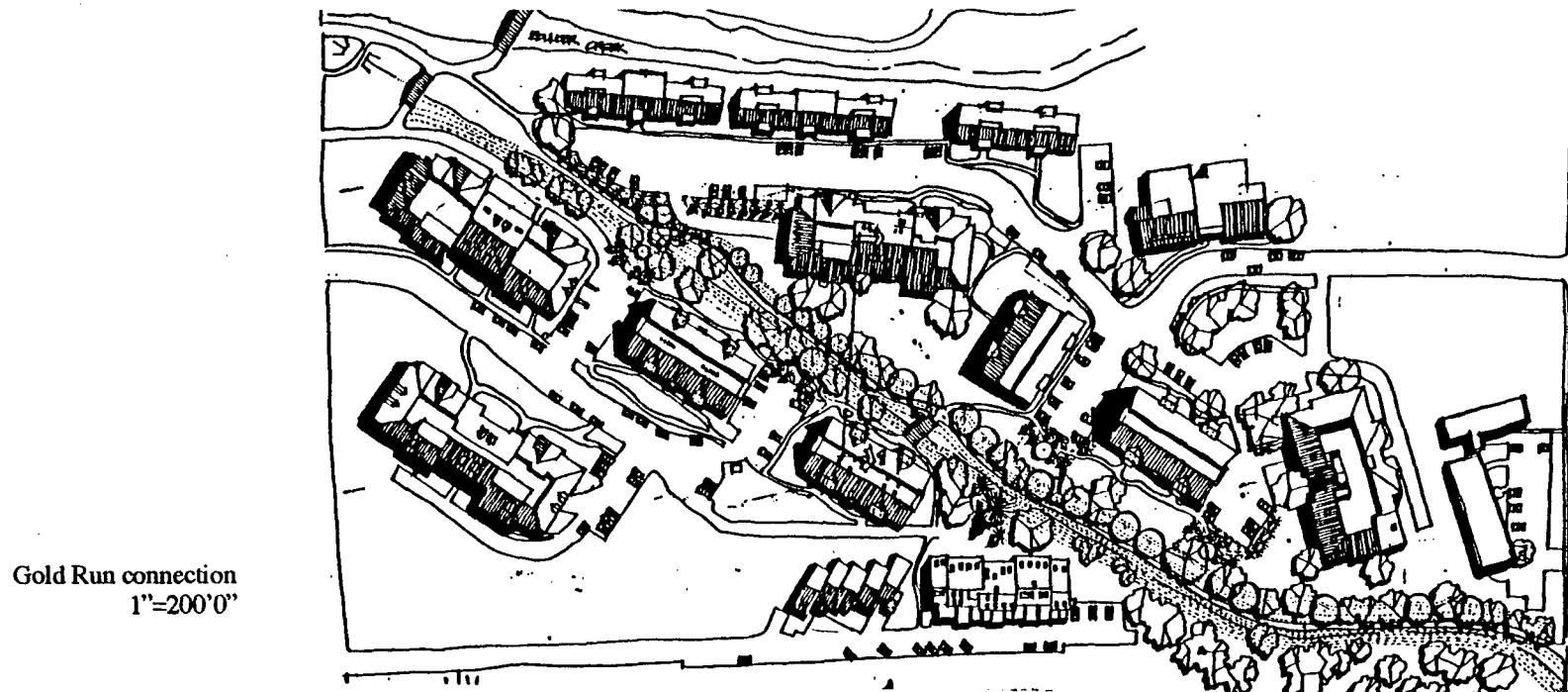
Ditches can close gaps in the trail system.

Several links on the eastern and northern edges will complete major sections of the bikeway system:

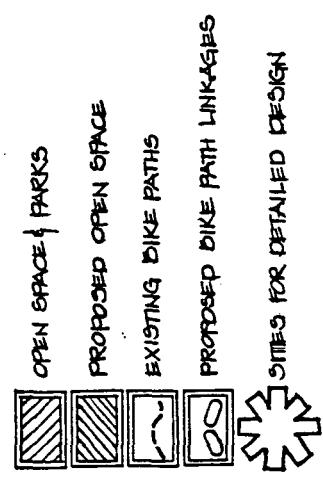
South Boulder/Teller Farm Trail. This trail begins at the trailhead for the South Boulder Creek Trail. It proceeds due north from the trailhead, providing an alternative to the ecologically sensitive South Boulder Creek and the existing trail, to meet with the Centennial Trail. These trails merge to the east toward Dry Creek, turn north, parallel with Dry Creek to Arapahoe Road, then east to link up at the trailhead for the East Boulder/Teller Farm Trail.

Lefthand Trail. This trail link would continue Boulder Creek Bikepath, leaving the creek to follow the Boulder and Lefthand Ditch to its intersection with Four Mile Canyon Creek. There it turns north to 63d street, crossing the ditch twice and ending at the confluence of the Boulder Farmers, Boulder and Lefthand and Whiterock Ditches.

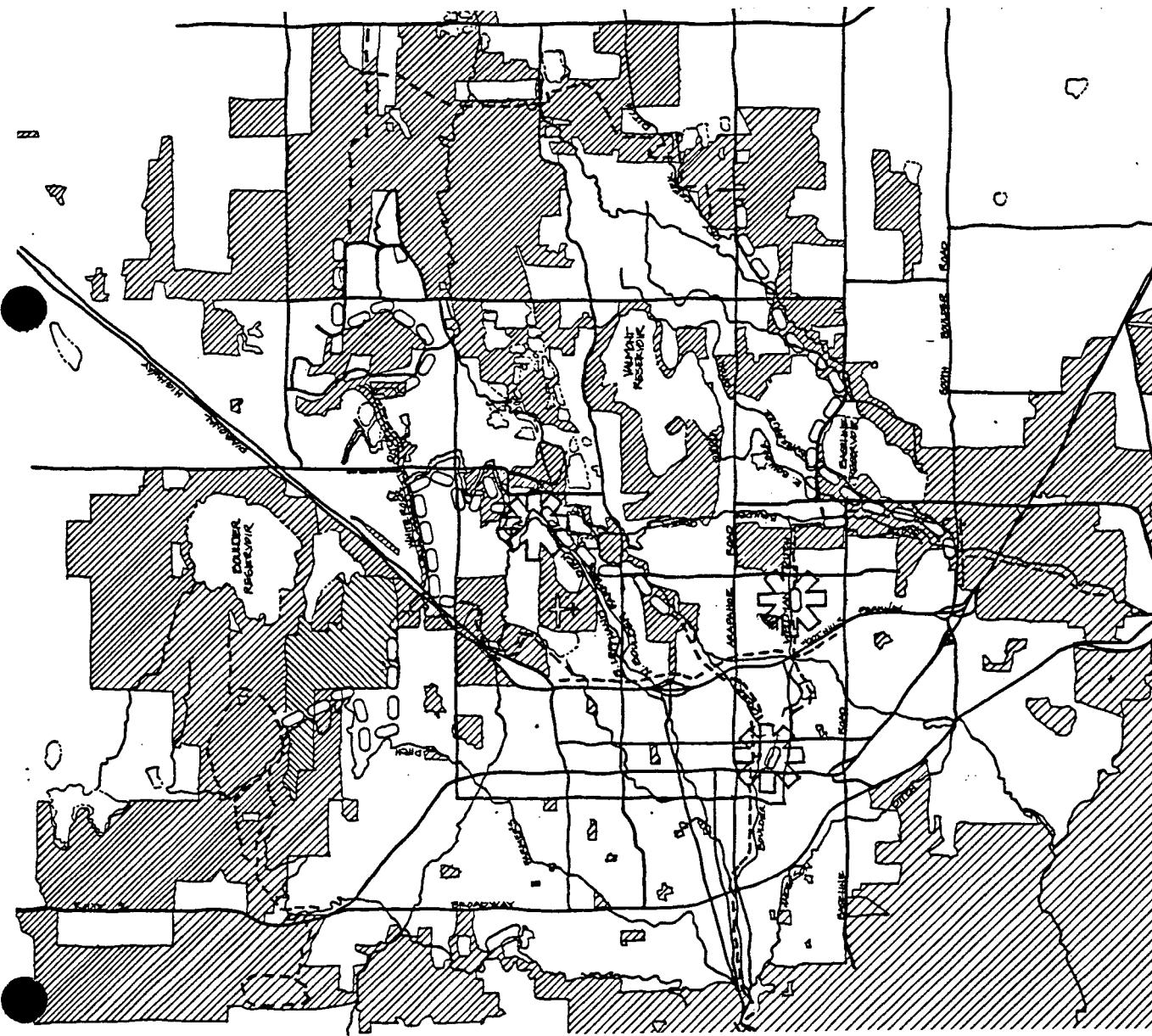
The Gold Run Connection links Boulder Creek Path with Wellman Ditch trail through the Gold Run Apartments on 30th Street. The design serves apartment residents as well as the general public, and minimizes views to the parking lots along the path.

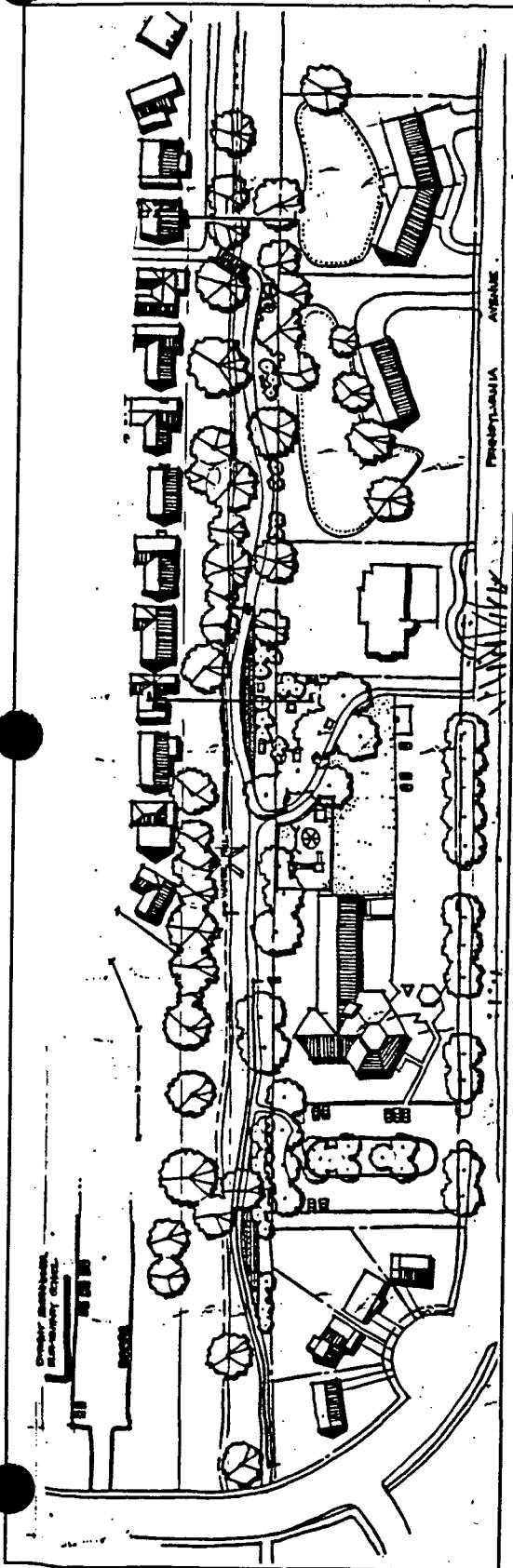


Boulder Bike Paths

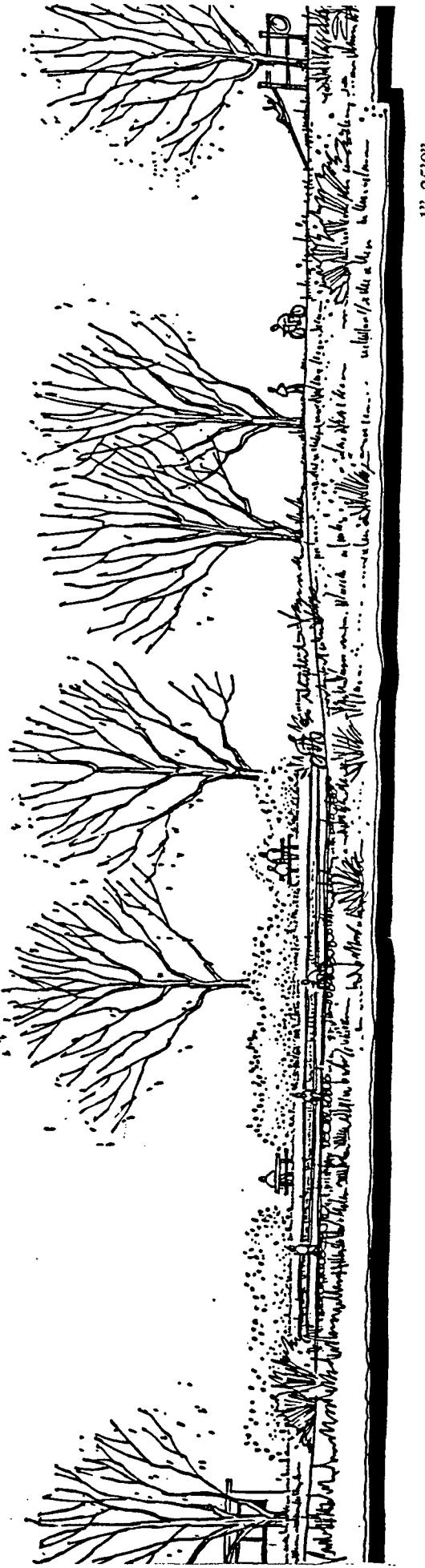


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The Wellman Connection in East Boulder bridges a 100-yard gap in the current system. The path now discourages commuter traffic because it ends at Pennsylvania Avenue; users must follow the side of the road to pick up the trail again by the Flatirons Golf Course. Wellman Ditch is unusual in having its own right-of-way which could connect these two segments while avoiding private lots. The ditch channel can provide a grade separation that will maintain privacy in adjacent backyards. A picnic area and parking lot here would serve trail users as well as church functions.



Boulder/Whiterock Trail. This link begins on the west side of Boulder Reservoir, connecting into the Eagle Trail and proceeding south, parallel with Farmers Ditch until crossing the Diagonal Highway at its intersection with Whiterock Ditch. The trail parallels Whiterock Ditch to the Country Club just west of 75th Street; and continues east to connect into the existing East Boulder/Gunbarrel Farm Trail.

Create a multi-use trail system as a transportation alternative.

Boulder is increasingly clogged with cars, mainly due to the city's growth as an employment center. A citywide trail system provides a commuting alternative, if its parts are well-connected, and ditches can help make those connections. A trail system located in open spaces will receive more use than bike lanes along major roadways. Path users appreciate the cool air, beautiful vegetation, and diverse wildlife. Commuters will bike, run, or walk to work if that is more attractive and fun than driving; one of those attractions can be ditches.

Federal funding, through the Intermodal Surface Transportation Efficiency Act (ISTEA), can help create trail systems as alternative forms of transportation. Part of the funds can pay for scenic easements and scenic or historic sites.



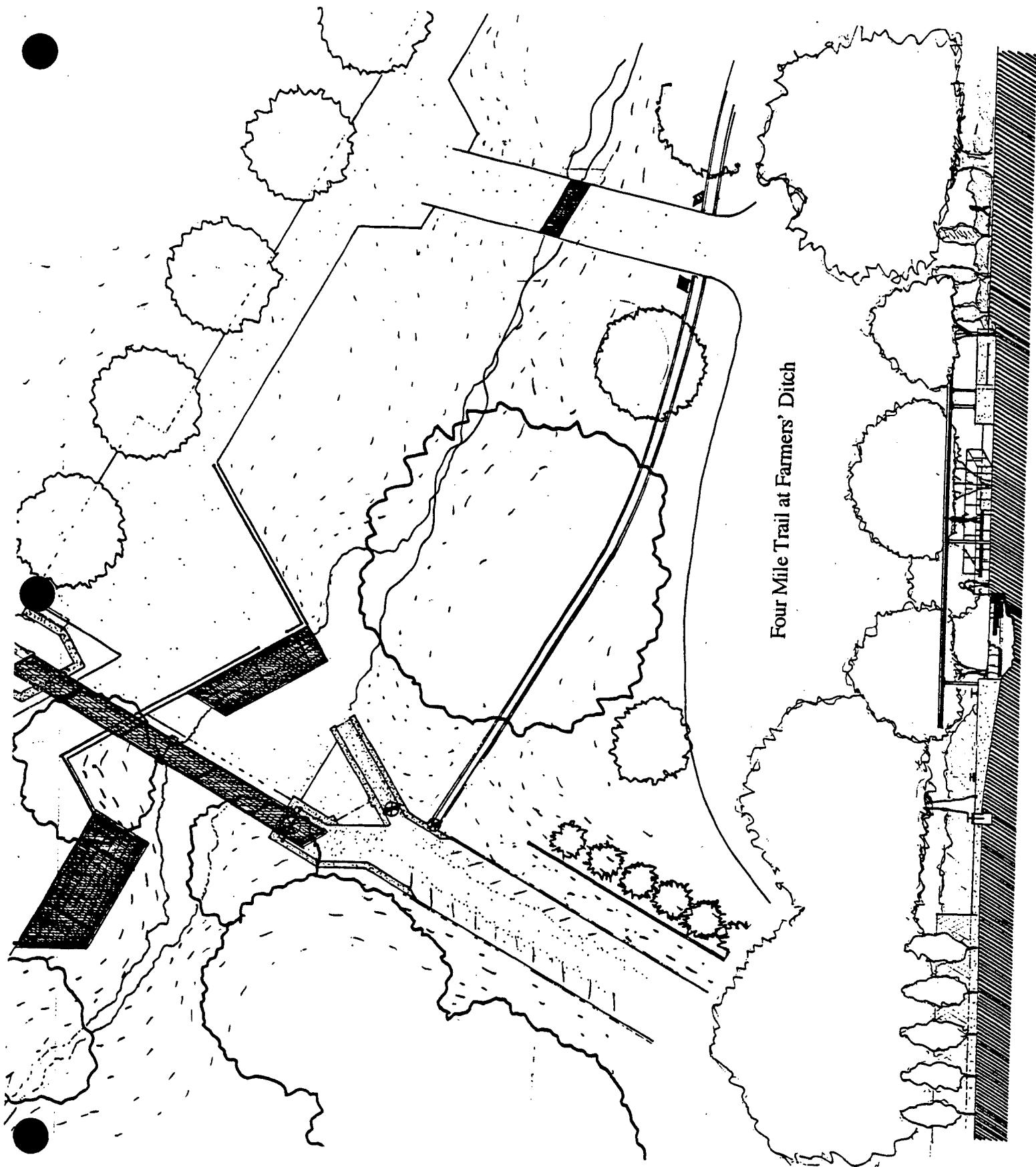
joggers on the Highline Canal trail
near Denver

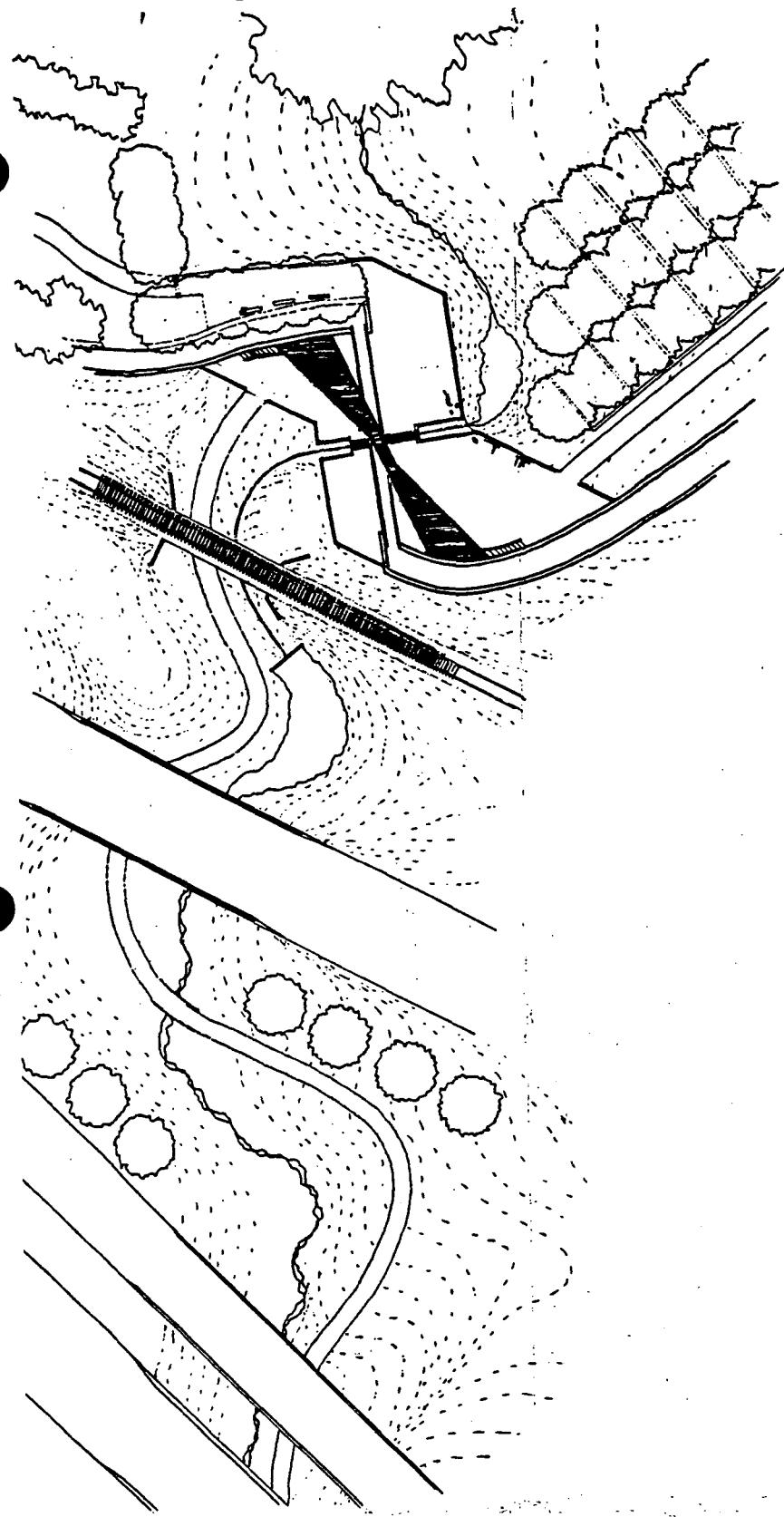
(courtesy Kate Kienast)

Trails along and across ditches promote awareness of their historical and cultural significance.

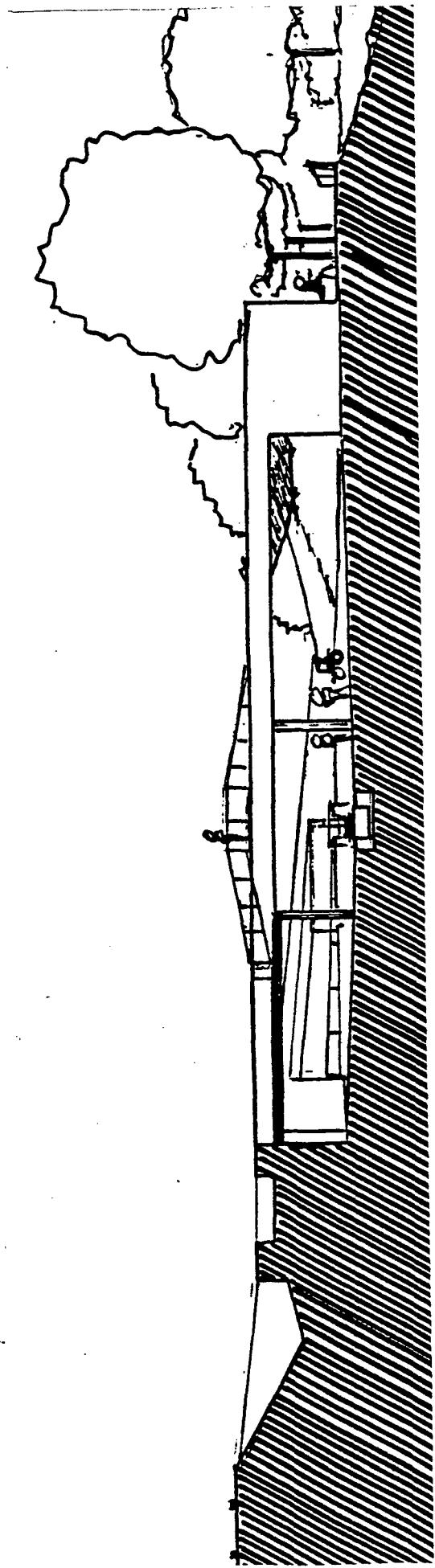
Four Mile Trail. This proposed trail link will connect the Wonderland Lake Trail system with the Lefthand Trail and, via Cottonwood Trail, the Boulder/Whiterock Trail. The connection along Four Mile Canyon Creek will cross Silverlake Ditch, Farmers Ditch, Boulder and Whiterock Ditch and Boulder Farmers and Boulder and Lefthand Ditches at points of particular interest. Much of the length of this proposed trail connection is either already constructed or is in city open space.

Four Mile Trail at Farmers' Ditch





Four Mile Trail at Whiterock Ditch



Encourage private developers and private property owners to participate in trails development.

Many trails are on open space property, but they can only function as an interconnected system by making links across lands that are in private hands. Public acquisition is one way to make these links, but not the only way. When these lands are developed, the city can require dedication of a corridor along the ditch. The land development review process should specifically seek preservation of ditches and their associated vegetation.

Habitat

Ditch Ecology

Long-term seasonal presence of water in the ditches creates vegetation conditions similar to those of natural watercourses. Cottonwood and willow trees, both native species, are commonly found along the banks of ditches. Trees are the dominate contributor to the habitat available to wildlife along ditches. Numerous species of shrubs and grasses, both native and non-native, are also found there. This vegetation affords varying riparian conditions along the ditches. Although periodic maintenance keep ditches from developing certain natural characteristics, they do exhibit much of the vegetation density and diversity of natural riparian areas. Adjacent human activity and human disturbance within the habitat are significant. Because of intermittent water supply, ditches lack aquatic and microbial processes found in natural watercourses. The low slope and static architecture of ditches also differentiate them from natural riparian areas.

Even though these factors limit development of natural ecosystems along ditches, many sections of ditch within the Boulder Valley include valuable riparian habitat. Some of the most important sections of ditch are adjacent to wetland areas. Where ditches bisect (and sometimes contribute to) wetlands, they may be made to take on natural ecosystem qualities. Maintaining habitat where ditches cross or lie parallel to natural streams they may reinforce these natural riparian areas.

To evaluate ditches as wildlife habitats, we first extrapolated information from the Keammerer database of existing wildlife habitat quality in the Boulder Valley. The Keammerer study inventories roughly quarter-section land areas according to an index of habitat quality indicators. Each land area or "record" is evaluated according to twenty-six specific measures. Each measure has a scoring possibility of one to ten. Several of the measures involve verbal descriptions of the habitat.

Where the Kaemmerer study examined sections that include ditches, we used its ratings. Elsewhere we used our vegetation and context maps to evaluate the vegetation and adjacent land quality of each section of ditch. The best vegetation, indicated by presence of trees, shrubs and grasses, received the highest vegetation rating of three. Significant open areas adjacent to ditch banks

Received the highest context rating of three. Combined, these ratings ranged from zero for piped sections to six for sections with much vegetation and adjacent open space.

Give priority to maintaining and enhancing ditch sections that contribute to Boulder's wildlife habitat.

Contributing connectors: connect or reinforce existing habitat areas.

Rural maintain: contribute to wildlife value of existing habitat areas.

Edge maintain: border and contribute to habitat areas.

Urban Corridor: although in heavily populated areas, these ditches have areas of vegetation diversity and may yield benefits by maintenance. They may be the only available areas, having intermittent water supply, to connect the natural water courses. The city seems to have recognized this already through future purchase designations and acquisition of certain parts of Boulder Farmers and Farmers ditches.

Ditch habitat improvements, in Appendix 6, lists specific measures for enhancing the sections of ditch we identify here as contributing to wildlife habitat.

Contributing Connectors

1. Silverlake between Wonderland Lake and Four Mile Creek
2. Farmers between Wonderland Creek drainage and Four Mile Creek
3. Boulder-Whiterock between Wonderland Creek drainage and Four Mile Creek
4. Boulder-Farmers between Wonderland Creek drainage and Four Mile Creek
5. Wellman Feeder Canal
6. Wellman between Foothills Parkway and South Boulder Creek
7. Anderson at Baseline Reservoir

Rural Maintain

8. Silverlake north of Four Mile Creek
9. Farmers north of Four Mile Creek
10. Boulder-Whiterock northeast of the Diagonal Highway

Edge Maintain

11. Dry Ditch #2
12. Section of Boulder-Whiterock north of Four Mile Creek to the Diagonal Highway

13. Howard

14. Silverlake

Urban Corridor:

15. Boulder-Farmers

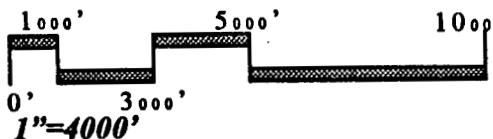
16. Farmers

Minor Improvement Sections:

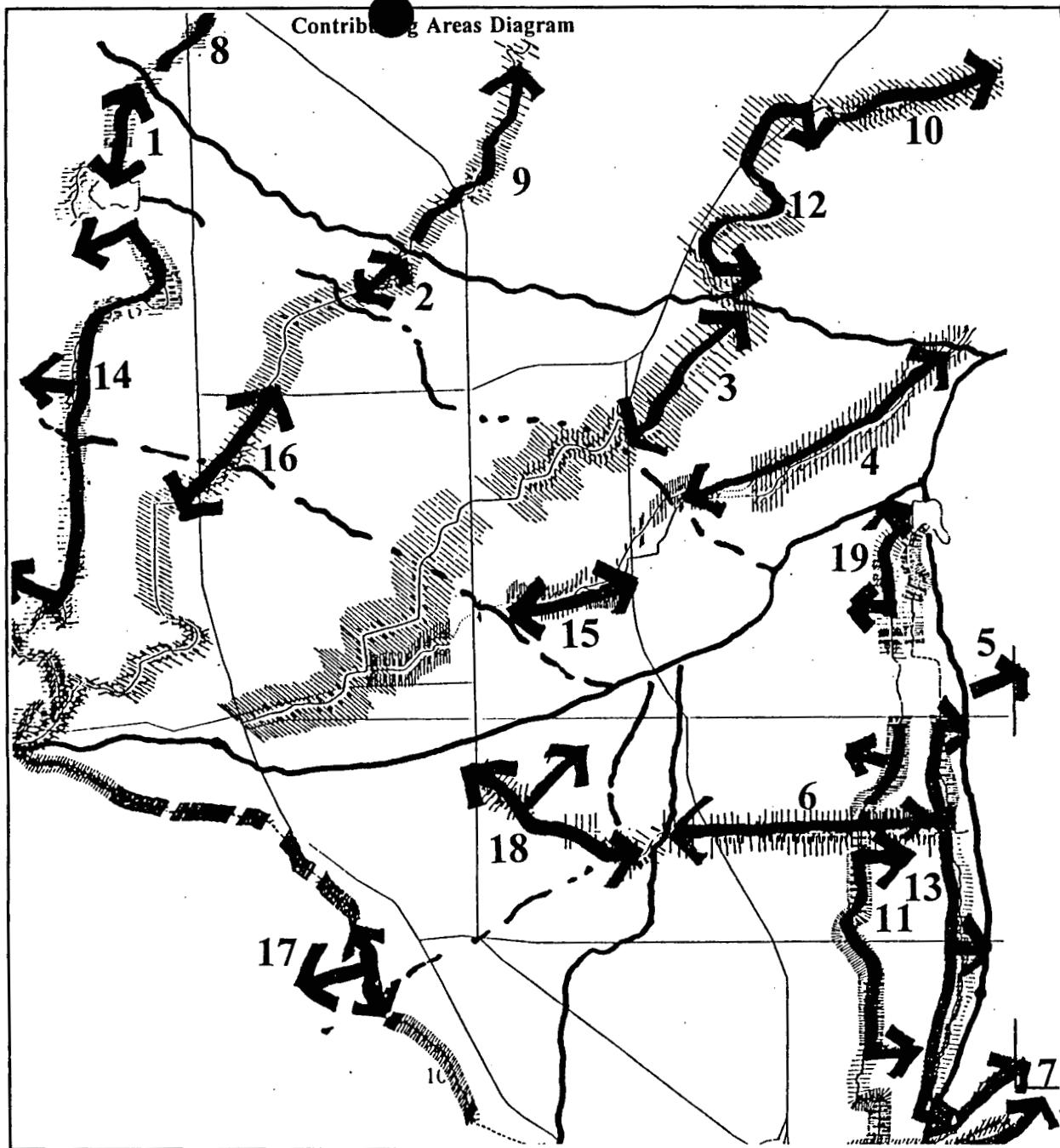
17. Anderson at NIST

18. Wellman from Boulder Creek east to Foothills Parkway

19. Dry Ditch #2 at Municipal Golf Course and east of Cottonwood Grove



Contributing Areas Diagram



Ditches make useful connections for pedestrians and bikers, and useful connections for wildlife moving around the city. Ditches also connect us to the past. "First in time, first in right" - awareness of history is built into the basis of Colorado water law.

Attention to preservation has increased during the past twenty years. However, out of 55,000 sites, districts, and monuments listed on the National Register of Historic Places, nearly 90 percent are buildings. Most National Register surveys tied ditches to a significant person or event but failed to indicate the contribution the ditch system has made to the development of Boulder Valley.

The ditches are a living history of Boulder Valley. They tell a story of how early pioneers manipulated their environment to survive in the semi-arid climate, on once barren land. They tell the story of neighbors being brought together to manage and maintain the running of the ditches and the formation of friendships.

Today many cities are struggling to reclaim their sense of place and community, seeking something that makes them unique and distinguishable from everyplace else. Boulder's ditches provide just such an element. They flow through the center of the city passing past neighborhoods of all income levels, commercial and industrial districts, and through open space onto the agricultural lands. The ditches, as a connective tissue, offer an opportunity not only for understanding the past, but for developing a new history.

Increase awareness of the ditches.

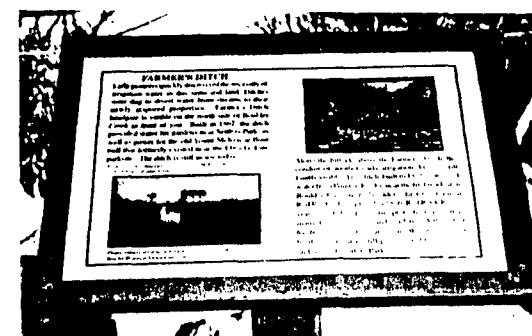
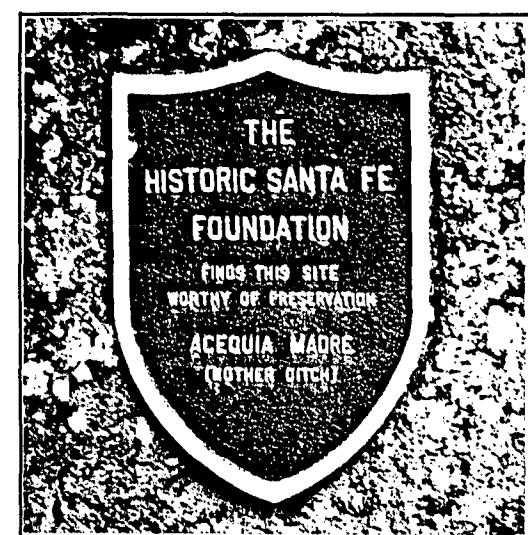
To preserve the ditch system it is important to increase awareness of the ditches, educating citizens about their place in history, their uses today, and a vision for their future. To do this, Boulder should develop an oral and written history of the ditch system and irrigation techniques and uses (for an excellent start, see the Silver Lake Ditch video at Carnegie Library). Common design elements such as signage can help awareness of the continuity of the system.

Boulder should adopt an historic preservation policy that retains the important features of the city's ditches.

While they irrigate, Boulder's ditches serve other important functions. Since Boulder's ditches are among the oldest structures in Boulder, they are an important visual feature throughout the city. They also provide a good opportunity for heritage education. By increasing public awareness of Boulder's ditches, residents and visitors will better understand the city's agricultural history and its form. A preservation policy can keep ditches from disappearing from Boulder's landscape, and help retain their historic and connective qualities.

3. Ditches Are Good

Cultural Preservation



Historic Preservation Policy



Smith-Goss Ditch along Arapahoe Avenue



Mapleton Avenue bridge over Farmers' Ditch

Survey the features of Boulder's ditches which are historically, visually, or ecologically significant.

The ditches' significant features can be determined by inventory maps. The maps in this report show significant vegetation, sections of ditch that are visible and accessible to the public, ditch lining, and artifacts along the ditch such as headgates. They show that these significant features vary in concentration throughout the city.

Identify which significant features will be regulated for their preservation, to what extent they will be regulated, and where they will be regulated.

The features most important to retaining ditches' visibility are an open channel, significant vegetation, and an unobstructed view. The features most important for retaining ditches' historic integrity are an open ditch channel on its original alignment, lining materials, ditch artifacts, adjacent vegetation, and adjacent historic structures and landscapes. The features most important to wildlife corridors include adjacent vegetation and land uses. The features most important to trail connectivity are accessibility and adjacent land uses.

Protect the whole ditch system by local ordinance. For most of the system, the protection should be more flexible than landmarking.

A hierarchy of regulation should be based on the ditches' degree of visibility, accessibility, and significance:

- **Historic districts** - In historic districts, such as Mapleton Hill, list the ditch as a contributing feature. Regulate the ditch landscape strictly. Keep the ditch on its existing alignment, and use lining materials consistent with the district's historic character. Retain historic vegetation such as large cottonwood trees. Save all historic artifacts, such as headgates, flumes and bridges; when they cannot be repaired, replace them with similar structures. The boundary of the regulated landscape should include the ditch channel, any important adjacent vegetation, and any thematically related landscapes or structures, such as orchards or historic homesteads.

- **Visible portions of the ditch on public land:** this category includes street rights-of-way, parks, and open space. In order to increase public awareness of the ditches' historic significance, and to retain them as familiar features in Boulder, the boundary of regulation should include the ditch channel, and any important vegetation or landscape features adjacent to the ditch. In these areas, the ditch channel should be open, and the view to the ditch must remain unobstructed. Where significant vegetation is adjacent to the ditch, the vegetation should remain, as well as the ditch's present alignment. Historic lining materials and artifacts, such as headgates, should be retained wherever possible.

Portions of the ditch in new development: the land development review process should strictly regulate ditches' significant features to avoid the threats that new development often imposes on the ditch landscape. Developers should be required to keep the ditch in an open channel, and retain stands of significant vegetation. Realignment of the ditch should be allowed only in the absence of significant vegetation. A right-of-way should be required to ensure maintenance access to the ditch. Consider also the ditch's connectivity function, both for trails and as a wildlife corridor. Regulation should not be so strict that it discourages taking advantage of the ditch as an urban design opportunity (see section below).

- **Visible portions of the ditch in existing development:** where the ditch flows through front yards or on commercial lots, keep it visible in an open channel. Significant vegetation and the ditch's alignment should remain unchanged.
- **Portions of the ditch on private agricultural land:** here the ditch and related elements, such as rows of cottonwoods, are usually visible to the public. Therefore, the ditch channel should remain visible, and significant vegetation should be retained. Preserving the rural character of the ditches is the most important element to public education of Boulder's agricultural past.
- **Non-visible portions of the ditch on public land:** typically where the ditch is piped or covered. Farmer's Ditch is siphoned under North Boulder Park; Anderson is piped under Table Mesa Drive. When possible these ditches should be uncovered, or obstructions such as fences removed in order to make them visible to the public.
- **Non-visible portions of the ditch in existing private development:** these are usually places where the ditch flows through residential back yards or is piped under private land. If the ditch channel is open, and significant adjacent vegetation exists, the vegetation, as well as the open ditch channel should be retained on its present alignment; no further regulation is necessary. If the ditch is piped or covered it need not be regulated.

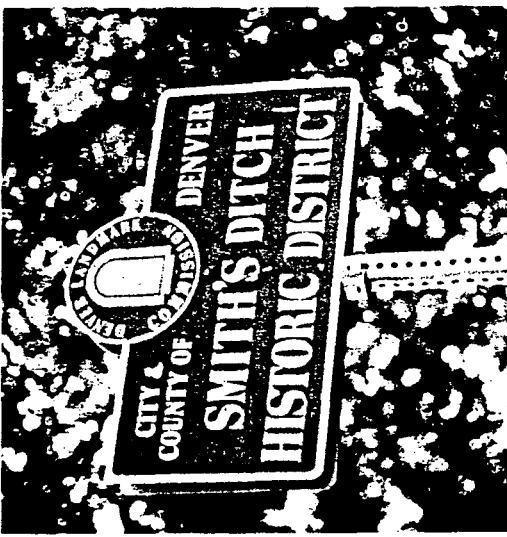
Implementation

Historic landmark districts could be an effective way to preserve Boulder's ditches. The ditches qualify for landmark designation because of their age and role in Boulder's development, and because they represent established and familiar visual features in the city. Specific guidelines would be established in the ordinances setting up individual ditches' landmark districts. Other possible tools to preserve Boulder's ditches are conservation districts and the city's water policies.

Identify activities and processes that threaten Boulder's ditches, and systematically answer them (see 'The Policy Environment of Ditch Preservation,' below).



Whiterock ditch headgates in Central Park,
c. 1910 and today



Ditches as urban design opportunity



irrigation lateral in
Norlin Quadrangle National Register district
University of Colorado campus

"Here and anywhere a considerable degree of charm is felt the very moment anyone takes care of the borders of such an irrigating stream in an appreciative spirit."

Frederick Law Olmsted, Jr.

1910



postcard, c. 1912 (courtesy Carnegie Library)

Landscape design: Using the ditches to show history

Each site suggests a different scale and degree of intervention. The scale could vary from working with a single ditch artifact, such as a flume, to a historic site or district, to a homestead-sized piece of land with an active ditch.

The degree of intervention could also vary greatly. The least would involve preserving the ditch, laterals or other feature from destruction. An example where this is appropriate is the laterals in CU's Norlin quadrangle.

Another level of interaction is simply to call attention to the site. A site where this seems appropriate is on the east side of 23rd street, half a block north of Canyon Boulevard. There is a nonfunctional double headgate located in a small grassy area between the road and a driveway into an apartment building. One could call attention to both the artifact and the ditch by adding a seating structure facing them. It could be placed over the nonfunctional lateral with a break in it at the lateral. The seating would call attention to the ditch by offering a place from which to view it and perhaps by raising questions about what the headgate was, and why someone thought it was worth making a seat to look at it.

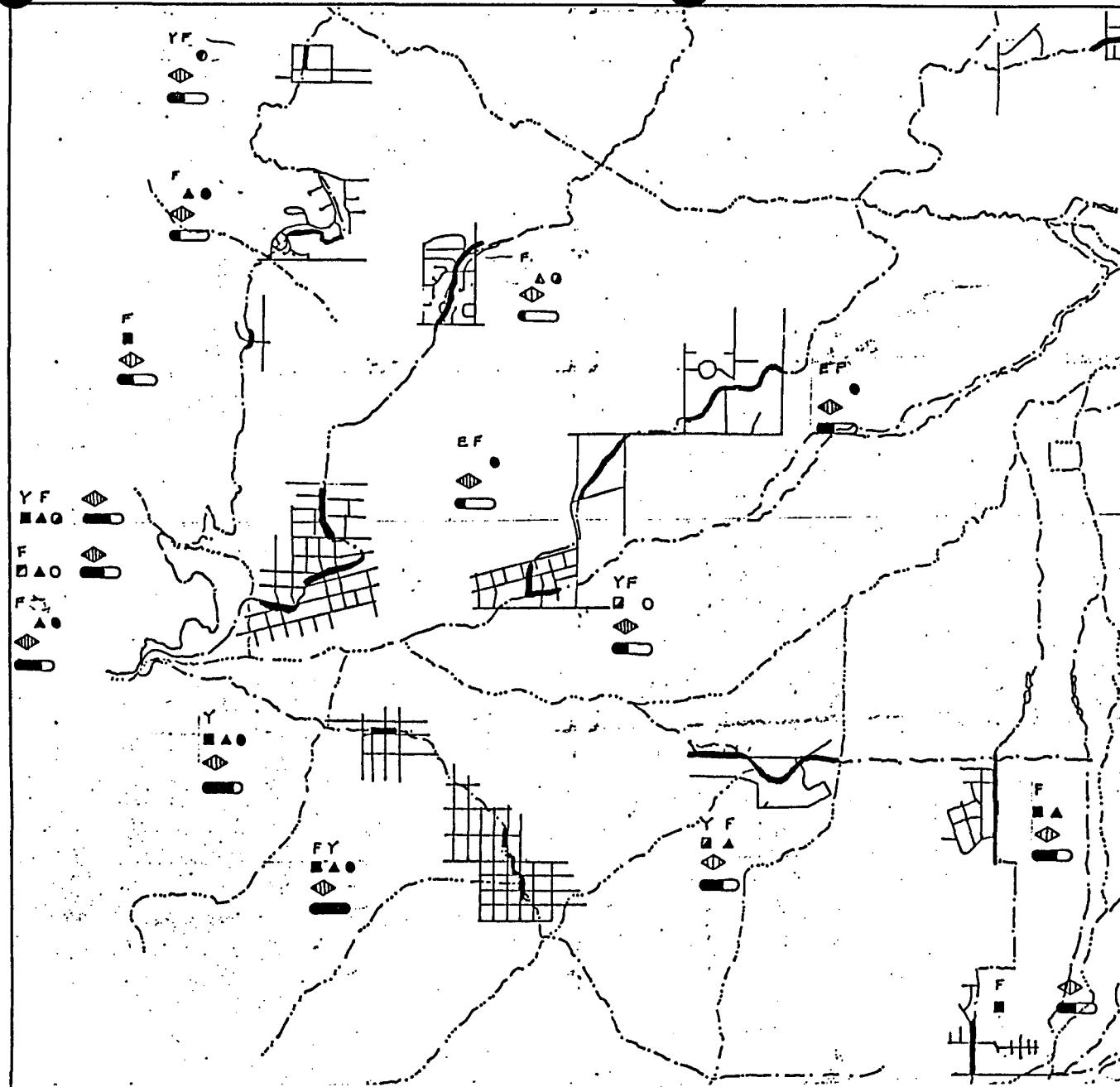
A third level of interaction is to reactivate something which is currently nonfunctional. A site where this might be appropriate is a field just northeast of the North Boulder Recreation Center. The field abuts Farmers ditch on the downhill side and is currently used as a community garden, but does not use water from the ditch to irrigate. Some or all of the three currently inactive headgates at this site could be reactivated to irrigate the field. Still another level of interaction is to recreate what no longer exists. A place where this might be appropriate is Mapleton Hill Historic district. At one time the maple trees which lined Mapleton Street were watered by a ditch lateral.

Neighborhoods of Boulder

In Boulder's urban residential areas, ditches often run close to houses. Around the ditches, dense residential fabric makes intimate spaces. Often the ditches run through private yards and are only accessible by the residents of that lot. Sometimes they run along a street or alley, providing at least the possibility of access by neighborhood residents .

Backyard ditches are personalized and taken care of by those who are fortunate enough to own them. Ditches along streets may be less cared for because they don't seem to belong to anyone in particular. When they have been lined with concrete they may not look very attractive.

To make the ditch a more meaningful part of the residential experience as well as the urban fabric its use and spatial context need to be considered. People need to be able to use ditch water to



**Neighborhood
places
along ditches**

PICTURES CLASS PHYSICAL PROXIMITY TO:

- HOUSES
- STREET
- ▲ PATH
- ◇ MEASURE OF DENSITY OF URBAN FABRIC
- - MEASURE OF INTERVENTION FOR IMPROVEMENT

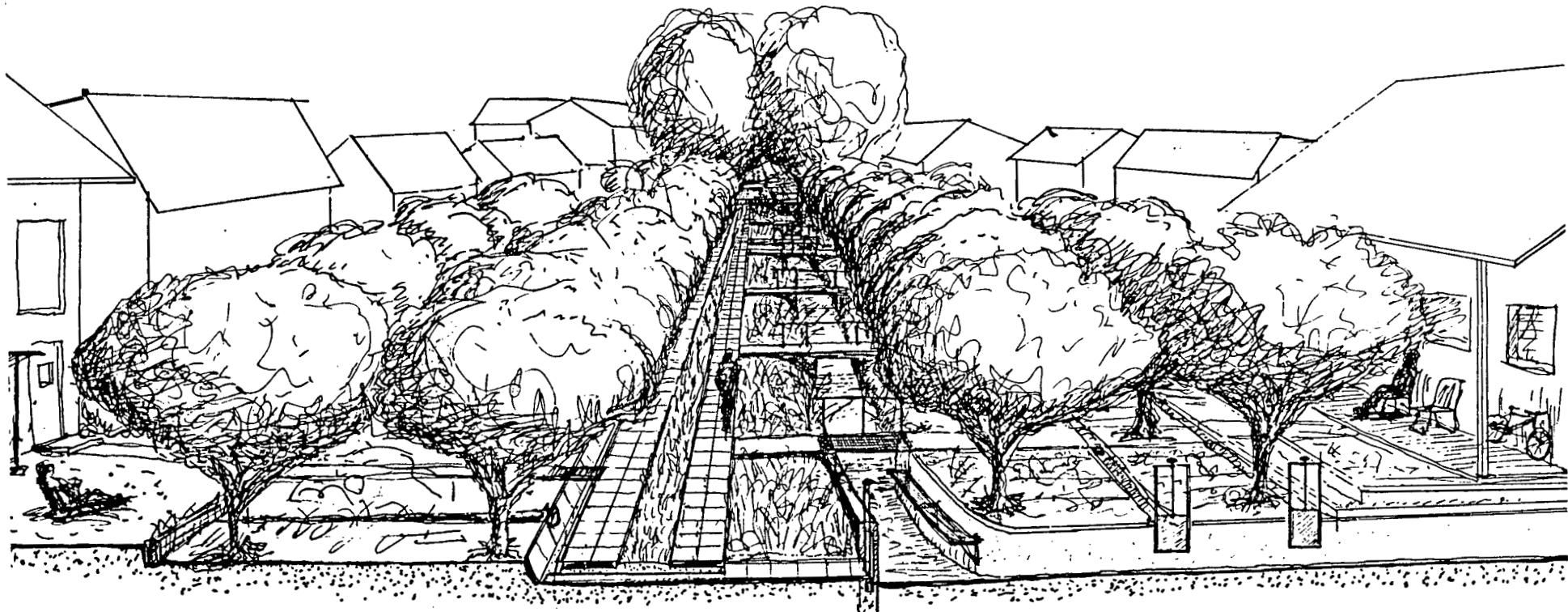
MARADUITS

- Y young adult
- F family
- E elderly

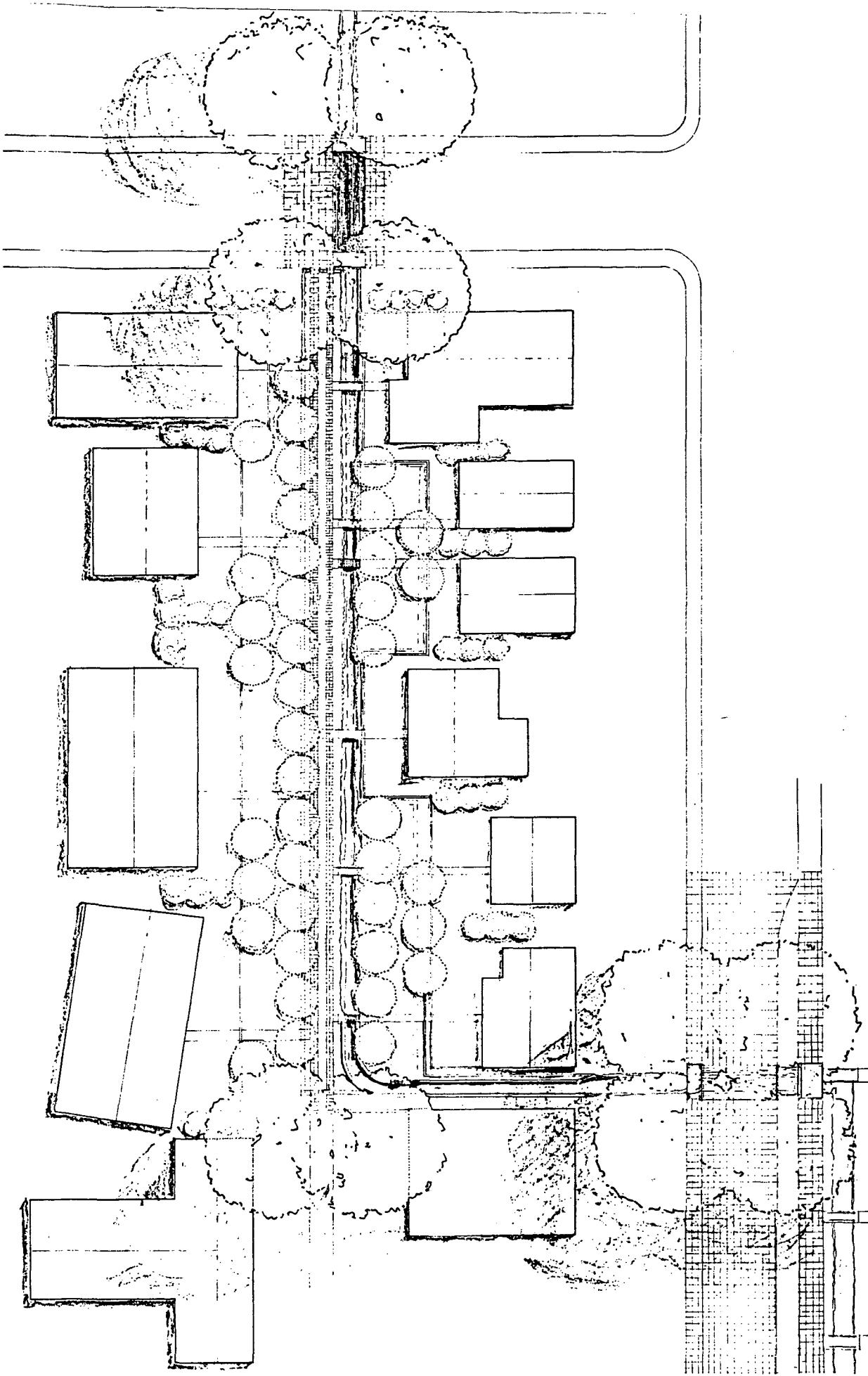
To make the ditch a more meaningful part of the residential experience as well as the urban fabric its use and spatial context need to be considered. People need to be able to use ditch water to irrigate their yards. Where the ditch runs along a street it can become the focus of a neighborhood landscape. The ditch can become the vital edge between the street and private front porches.

Architectural elements related to the ditch - headgates, bridges, linings, walls - should serve to reveal it. For example, where the ditch has been lined transparent bridges reveal it best. Where the ditch is soft-sided, heavier bridges work well as long as they aren't too wide.

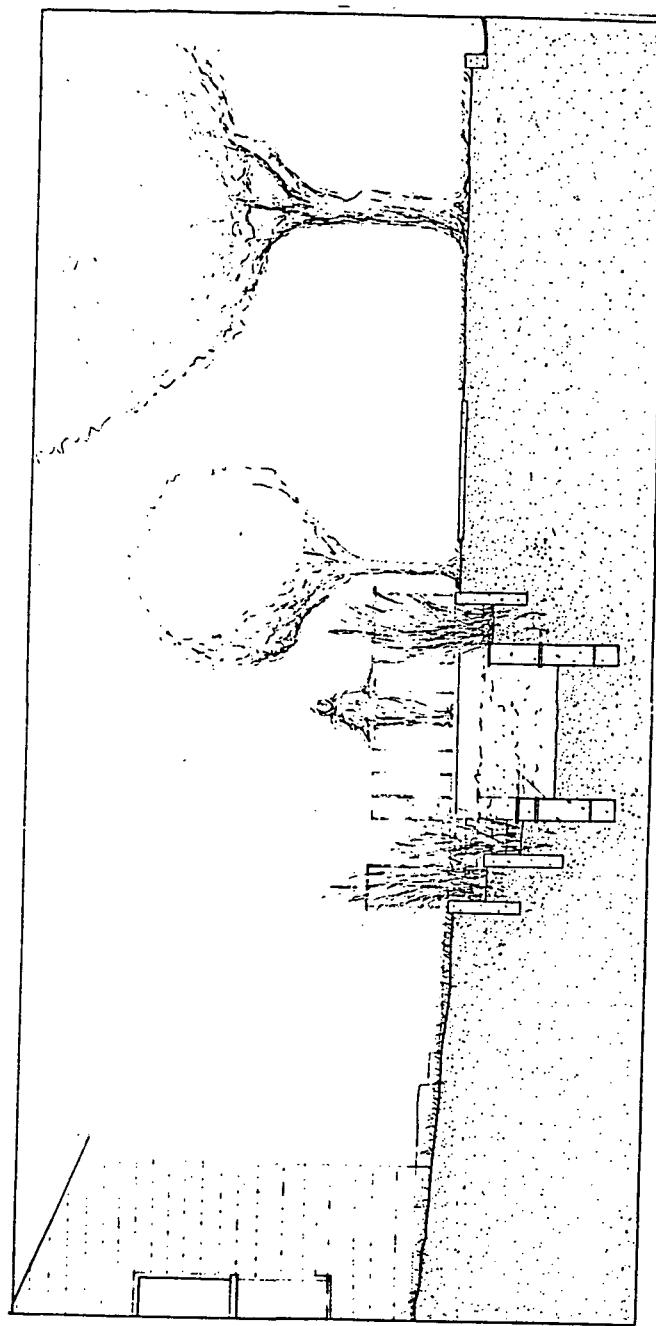
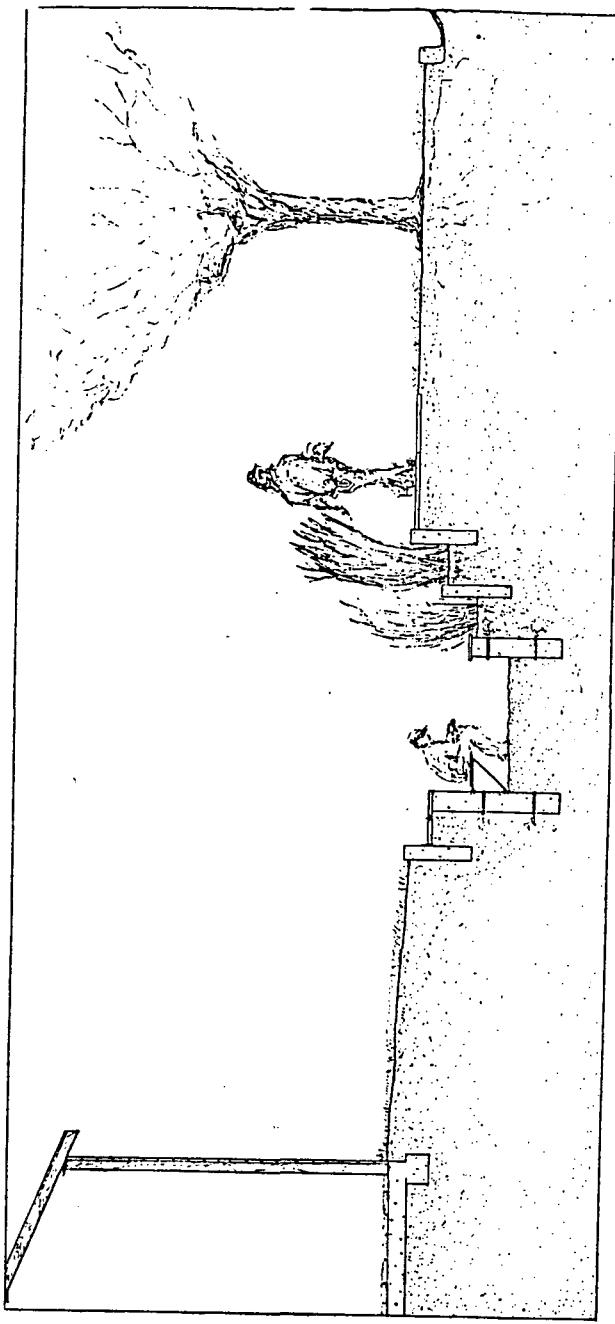
If people are connected to the ditch in use and place they will be able to make the mental connection to the larger network of ditches in Boulder and the natural and cultural history they are a part of.



Anderson Ditch in interior of block, 19th & Baseline (proposed)



Anderson Ditch in interior of block, 19th & Baseline (proposed)

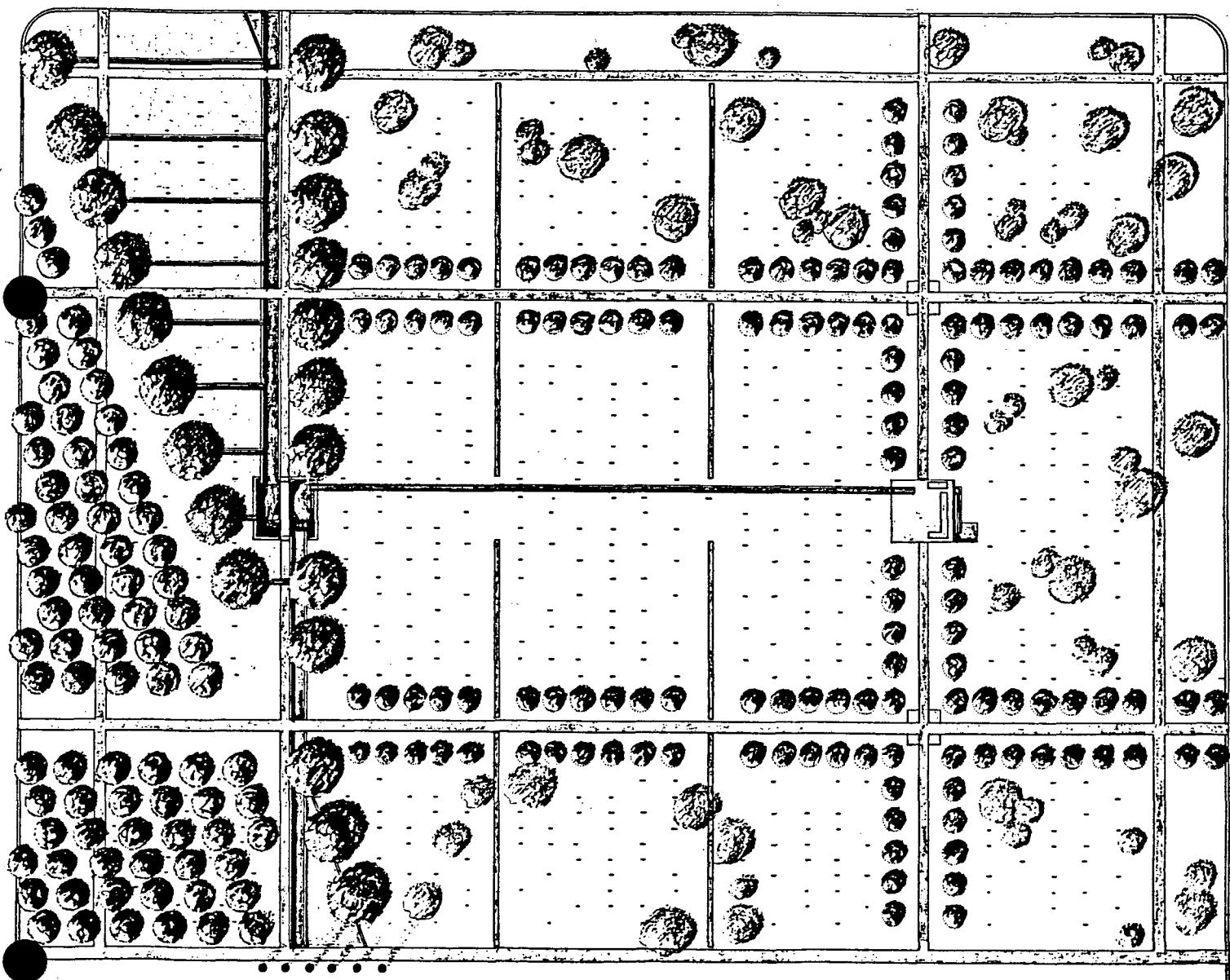


Anderson Ditch along
Pennsylvania Avenue

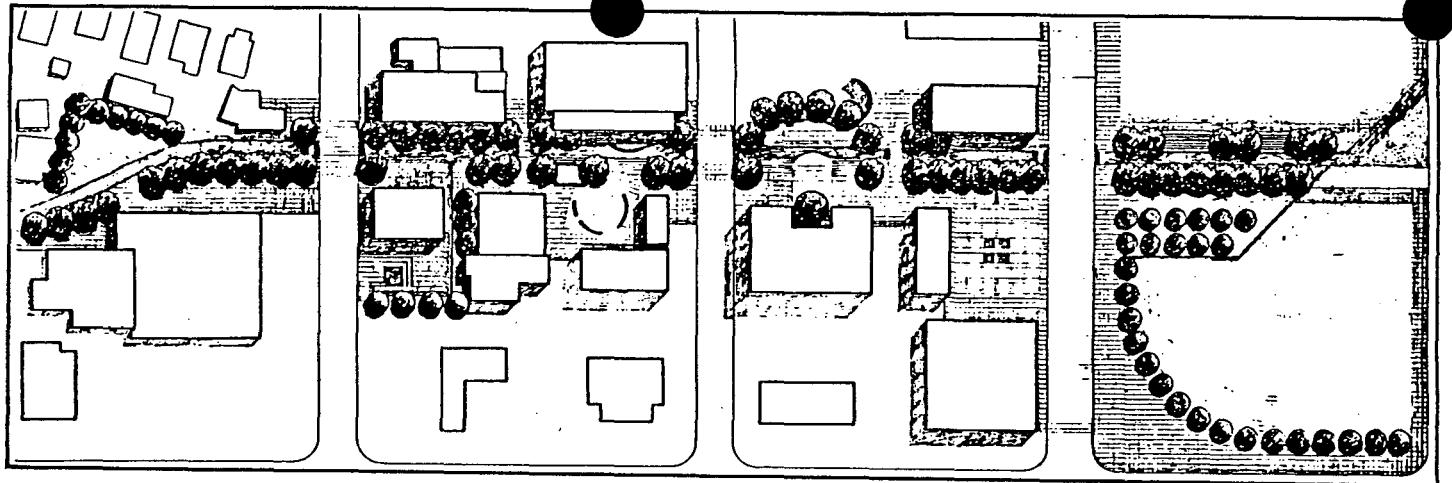
Ditches bring water, light, fresh air and trees. If our mission as landscape architects is to humanize the city, we should take advantage of the ditch as a landscape element in urban spaces. The idea in developing these three different sites is to represent how different solutions can show new attitudes toward the spaces.

Pioneer Cemetery: This is an historical place for Boulder, but people don't feel they have to respect it so they use it as a play area. The idea for using this site is to preserve the old structure and environment while defining the site as a cemetery. This definition will come from a barrier to the street using trees, to give the idea of an enclosed place.

1"=100'0"

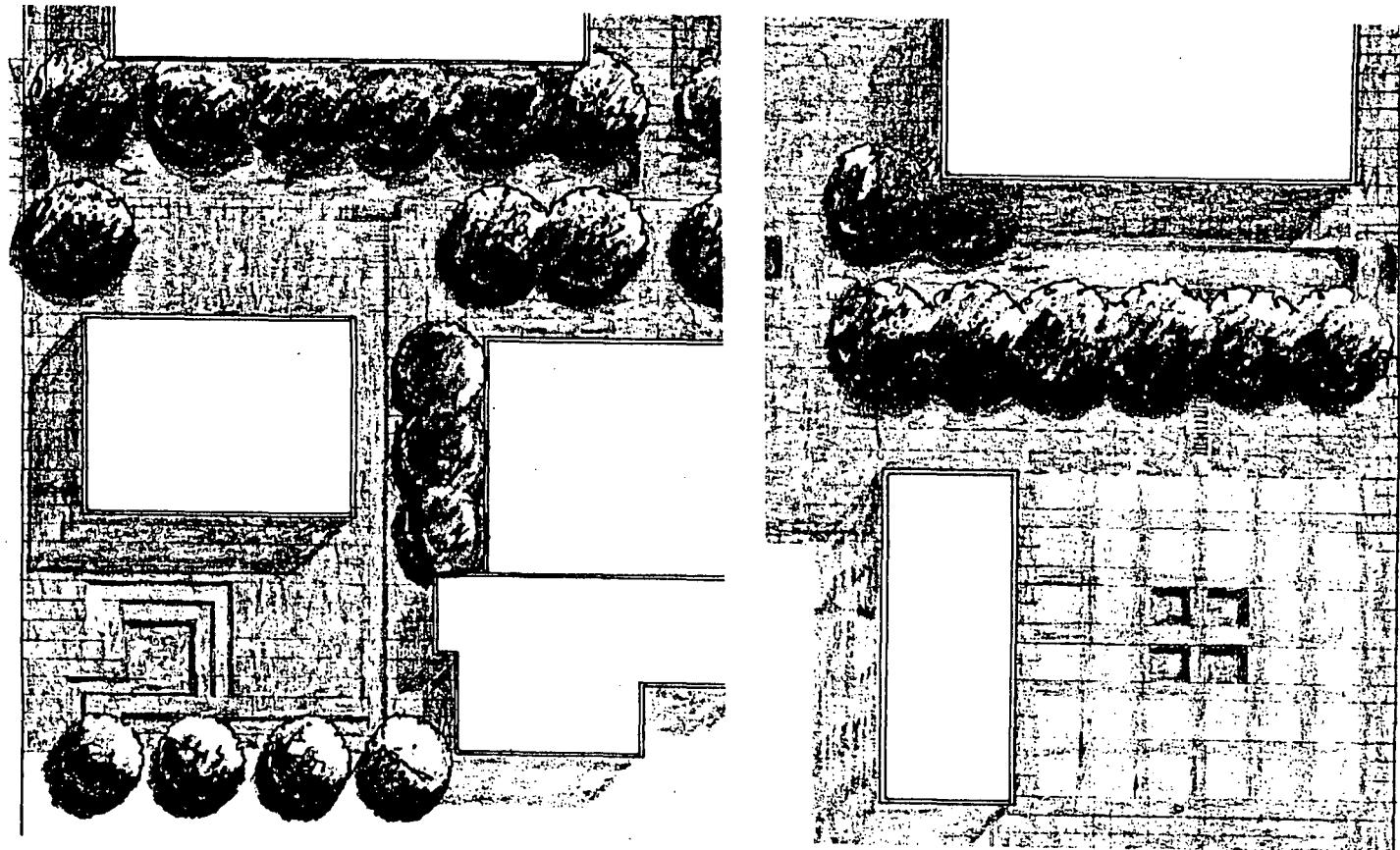


1"=200'0"



Whiterock
Ditch between
Broadway and
16th Street:
Along the ditch
are buildings
without room to
expand their
activities. How
can all these
activities have
their own sites
along the ditch,
separated from
the street, with a
new ambiance of
music, trees, and
shade?

1"=50'0"



The Policy Environment for Ditch Preservation

Water Policy

No water, no ditches. The city's water policy is the key to ditch preservation. Boulder's water use has changed greatly over the years. In the past, the city's water was mainly used for agriculture, and ditches were invaluable. Today the city's main water use is in urban and residential areas, which do not require that water be transported through ditches. Previously, Boulder's water policy focused mainly on agriculture and ditch use. Water policy is now focused on satisfying ever growing urban and residential water needs, raising concern about ditch preservation.

This section provides an overview of the city of Boulder's water policy. It also makes recommendations for using the policy to help preserve Boulder's ditches, a new water policy goal.

Over time, the city of Boulder has pursued an aggressive water policy. As a result, it has a large supply of water. Historically, the city has received water from three primary sources: Boulder Creek, Windy Gap project water deliveries, and Colorado-Big Thompson water deliveries from the Colorado River into Boulder Reservoir. In addition, the city has water stored in several other reservoirs such as Wonderland Lake, Silver Lake, Barker Reservoir, Baseline Reservoir, and Marshall Reservoir. Many of Boulder's ditches are an integral part of the city's water system and move water to and from water storage areas.

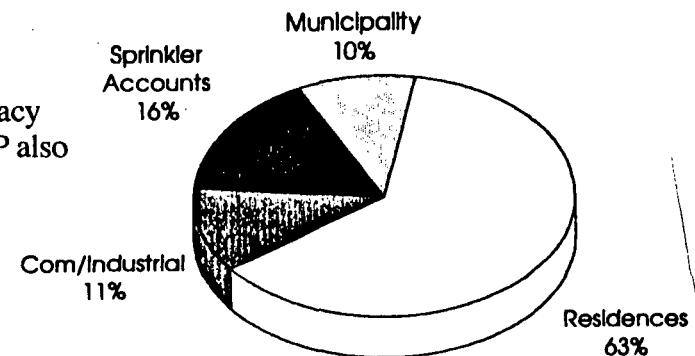
In 1988, the city of Boulder developed a raw water master plan (RWMP) assessing the adequacy of the city's existing water supply system and evaluating future courses of action. The RWMP also identified specific water-related goals, among them:

- Adequate provision of water for projected population (32,900 acre feet [af] after 2040)
- Preservation of agriculture and open space
- Multi-purpose uses of raw water
- Improvement of Boulder Creek instream flow

Ditch preservation should be added to the city's water-related planning goals.

Excess water supply: In 1988, Boulder held water rights capable of providing approximately 45,000 acre feet (af) a year. This exceeds the city's projected needs (32,900 af after 2040). Boulder Creek will provide the city a sufficient main water supply. In 1992, Boulder sold 43 of its 80 units of Windy Gap supply to the city of Broomfield for \$21,465,000. The RWMP noted that income from the Windy Gap sale could be reinvested in water-sharing agreements with agriculture or in additional purchases of open space (both of which could preserve ditches).

Boulder Exterior Water Use 1985-86



Preservation of agriculture is key to preserving ditches; cooperative water sharing with agriculture provides the city secure water supplies while assuring the financial solvency of agriculture.

Preserving significant agricultural lands is one of Boulder's comprehensive planning goals. The raw water plan says that the city's current practice of providing low-cost water will not preserve agriculture and open space, which are under pressure from other municipalities and development interests for both land and water rights. This means that ditches are threatened as well. The RWMP lists the following options for preserving agriculture and open space:

- Public acquisition (this has been implemented aggressively for open space)
- Land use planning
- Transfer of development rights
- Purchase, sale, or lease of water

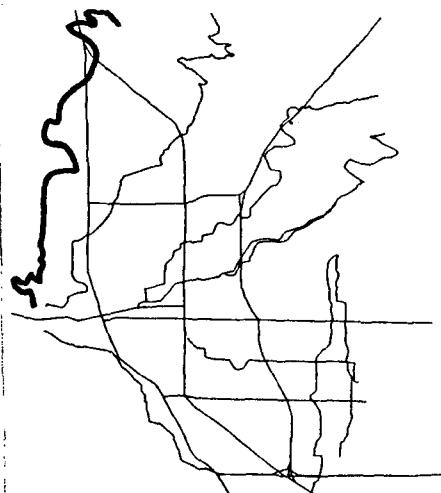
The Boulder City Council tagged the \$21 million from Windy Gap for purchase of replacement water supplies, including ditch shares and *interruptable supply contracts*. Interruptible supply contracts allow farmers to use city water shares for irrigation; in severe drought years, the city will take the necessary water for city use and subsidize the farmers for their lost crops. The city is pursuing but has not yet signed any interruptible supply contracts with ditch companies. This will preserve agriculture while diversifying water supplies.

To save ditches in the city, Boulder could arrange interruptable supply contracts with irrigators other than farmers.

Interruptible supply contracts could be offered to urban irrigators as well as farmers. In addition, the city could purchase and lease junior water rights; irrigators would receive irrigation water until a drought year. The city could then keep its more reliable senior rights for municipal uses. Leasing or contracting water rights to irrigators would encourage ditch preservation and provide Boulder the same benefits as interruptible supply contracts.

In particular, the city should make some such water-sharing agreements on Silver Lake Ditch.

Silver Lake is a potentially threatened Boulder ditch. According to an old agreement between the ditch company and the city, its shares cannot be sold but instead revert to the city when no longer used. This water is then stored in Silver Lake as part of the municipal supply. Silver Lake Ditch shares are effectively tied to the land, unlike most Colorado water rights. The ditch irrigates only a fraction of what it once did, and these remaining shares mostly water gardens and small plots within the urban area. As the company gets smaller, it becomes less viable; it might already be unable to survive when the ditch requires major rebuilding. The city can accomplish its municipal



supply goals by taking only the right to use Silver Lake water in severe drought years, letting the ditch flow the rest of the time. Through interruptible supply contracts, the city could become a water broker for the ditch, encouraging preservation by maintaining a critical mass of shareholders.

Instream Flow: Five cubic feet per second [cfs] is the minimum allowable to maintain the ecology of Boulder Creek. According to the RWMP, to improve instream flow, the city of Boulder is considering diverting water exchange rights in several ditches, selling or leasing rights downstream, or moving the ditch diversion points downstream. In 1990, the city dedicated several senior water rights to the Colorado Water Conservation Board (CWCB) to improve the creek's instream flow.

A concentrated effort to increase Boulder Creek's instream flow could compete with ditches. Moving ditch diversion points downstream would be especially threatening.

Boulder should consider a variety of options to improve the creek's instream flow while preserving the city's ditches. For example, the city could divert some flow from all of the ditches rather than completely diverting the flow from one or two. Increasing instream flow could compete with ditch preservation unless the water diverted from the ditches is minimized or replaced with another source.

Moving any ditch's diversion point downstream would mean abandonment of the bypassed portion. These upstream sections are the most historic parts of Boulder's ditches; these ditches have become part of the urban landscape.

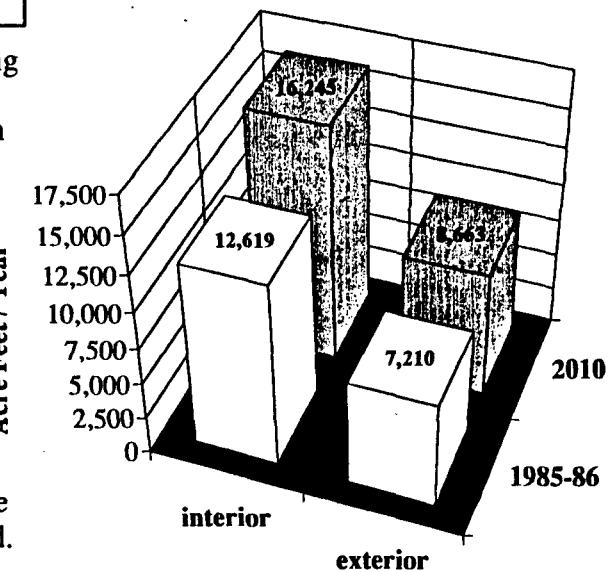
Treated Water Master Plan

The following is a brief analysis of the relevant portions of the City of Boulder Treated Water Master Plan (TWMP). Ditch water is raw, not treated, water. If Boulder's treated water use can be reduced by efficiently using ditch water for urban irrigation, ditch preservation will be encouraged.

In 1985, Boulder's treated water demand on an average day was 18 million gallons (mgd) (33 mgd peak month). By 2040, the city estimates that treated water demand will be 28 mgd per average day and 50 mgd per peak month. Residences use the majority of treated exterior water, both today and in the future. And residential and other uses of treated exterior water are projected to increase over the next 20 years. If the city could efficiently substitute untreated ditch water for even a percentage of this exterior water demand, Boulder's treatment capacity requirements would decrease. In addition, the city's ditches would be preserved.

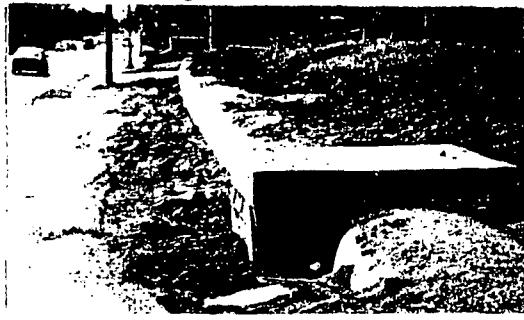
Ditch water, rather than treated water, should be used to irrigate urban areas and Boulder municipal lands; this will save the ditches as well as treatment capacity.

Boulder Municipal Water Use





Anderson Ditch c. 1950 (courtesy Carnegie Library) and in 1992, during construction of pedestrian underpass



Valmont Road, looking west toward 28th Street. Whiterock Ditch now runs under the grass strip.

The city could work with the ditch companies, agriculture, and urban residents to substitute raw ditch water for treated water. This would save both treatment capacity and ditches. In addition, it could promote water conservation. If, during a drought, homeowners and other water users are forced to use treated city water rather than ditch water, the sudden increase in cost will encourage them to conserve water. The city could also use ditch water to irrigate municipal lands, thus decreasing the city's use of treated water.

Threats

Threats to the ditch system are often the consequence of urban growth. Developers may gain usable real estate by covering ditches. The city's land development review should seek to preserve ditches.

Transportation projects stemming from growth are another potential threat to ditches. Where ditches and laterals parallel roads, road widening may destroy the ditch landscape. The cases below describe threats of visual loss of the ditch system in Boulder's urban area.

Anderson Ditch at the Broadway and College pedestrian underpass: until recently, a short stretch of Anderson Ditch paralleled the sidewalk on the west side of Broadway, perhaps the most prominently visible stretch of ditch in Boulder (see photo). As part of the pedestrian underpass project, this ditch was piped underneath a lawn. The then-existing sidewalk was considered to be too narrow for mixed bicycle and pedestrian use, and its proximity to the road was susceptible to splash, icing and snow storage problems. City design standards required that any new sidewalks be detached and widened.

The visual loss of this section contributes to the decline in awareness of the ditch. Much of Anderson Ditch is already covered over. Sections that are still exposed are hard to identify or connect with their history. It would be sorry to someday see that the only reference we have to our ditch system is maps and dashed lines drawn on the sidewalks and streets where the ditches were once exposed. Preserving this small but important section of ditch could have been better accomplished under a more protective guideline recognizing it as a historic resource.

Whiterock Ditch at Valmont Road: Whiterock Ditch was recently covered for about 200 feet from 28th Street east along Valmont Road where it previously ran exposed along the roadside. This was done initially to accommodate the widening of the street for a right hand turn lane. Engineering guidelines designate a given length of roadway for the turn lane, and the roadway was further widened for a bike lane. A trade with the property owners for increased right of way resulted in them asking for the ditch to be covered over to give better access to their businesses. This resulted with the ditch being covered over along this stretch of the roadway with a small section of turf. The design could have left more of the ditch exposed.

Laterals along Jay Road between 28th and Diagonal Highway: headgates on both sides of Jay Road lead to four parallel laterals, two along the roadway and two set back at the property lines, watering pastures and lawns. They once watered the Recreation Department's Roper Soccer fields, but the city traded this land to a developer and transferred the water rights to the municipal system. The laterals across the first phase of this development are already piped. Water will continue to flow along Jay Road to irrigate city open space, but it may not be visible. In a federally-funded project the road will be widened to three lanes plus a bike lane and sidewalks, probably relocating the headgates and piping at least two of the laterals. The farms closer to the Diagonal Highway still use the laterals for irrigation.

No policies address preservation of irrigation laterals. Jay Road's laterals are as much a part of historical landscape as the ditch they originate from. Piping them may lower the water table in existing wetlands just south of the Roper Field development, thus causing not only visual but also environmental damage.

It is important for the ditch system inventory to include laterals. Land use change from irrigated pastures and farmlands to developed sites has a large impact on the loss of these laterals. They could better serve as amenities in the developments, preserving the historic landscape.

The Transportation Master Plan aims "to contribute to a positive and attractive visual image and the desired community character." Boulder's ditches are an important part of the city's character.

Since transportation projects deal with busy roads and intersections, they affect the pieces of the system most prominent in our perception. No single project may have a tremendous impact, but the accumulation of such projects will have consequences on the visual loss of historic landscape. Such projects should specifically address preserving the awareness of the overall ditch system.

Safety & Liability

Safety and liability are often the biggest impediments to more imaginative use of ditch corridors. Having a ditch is less safe than not having one, but there are practical answers for specific hazards. Cooperative solutions to these problems may be the greatest single opportunity for better use of ditches.

Ditches have been blamed in the past for the spread of cholera, typhoid and dysentery. In addition, their wet and dry cycles have resulted in the death of some fish. However, in the last hundred years the hazard which again and again grabs people's attention is drownings and near drownings. At least twelve children and one adult have drowned in Boulder-area ditches since 1917 (no drownings were recorded in the ditches before 1917). These tragedies bring periodic calls for

complete fencing or piping of the ditches. They are less likely to bring about the sort of calm and sustained attention that could actually improve ditch safety.

Safety should be a goal in itself, but often a more powerful motivator is the fear of liability. Governments are immune to liability from natural hazards such as creeks, but not for man-made features such as ditches. Ditch companies, landowners and the city share concerns about public safety since any of them can be held liable when an accident occurs. All are considered responsible for hazard areas along the ditch since there is some ambiguity as to who holds what interest in the ditch easement and who is responsible for safe upkeep of the ditch and surrounds. A general rule is that whoever maintains or builds a structure on a ditch is responsible for its safety. There is a disincentive for any party to provide safety features along the ditch because whoever installs the feature is held responsible if it fails.

While the city, landowners and ditch companies share many concerns, their views on ditch use tend to differ. The city may be interested in using the ditch system as a community asset by offering views of ditches, trails or parks at appropriate places along ditches, and interesting ditch crossings, all of which draw attention to ditches and draw people nearer to them. Ditch companies, on the other hand, have a fiduciary responsibility to shareholders to move water and minimize any obstruction of that goal. Landowners may hold either view: some incorporate the ditch into their landscaping, while others fence it off from the rest of their property. Increased community awareness and appreciation of ditches can benefit the ditch company and landowner because people who value the ditch and know why it exists will treat it more respectfully (think of Boulder Creek, which no one proposes piping or fencing).

Exploring ways of drawing people to Boulder ditches goes hand-in-hand with exploring means of making ditches friendly and safe. Otherwise the ditch amenity may come to be viewed as an "attractive nuisance," leading the public to hazard and exposing those who maintain ditches to liability. Conflicts over ditch use are resolvable if all parties' needs are understood, each party's role is clear, and cooperative agreement is reached about who holds what responsibilities and how they will be carried out.

Specific, identifiable conditions increase the likelihood of accidents and may warrant ditch improvement or advice to the public.

- When and where water level and velocity are high or have recently risen
- Where water goes underground or drops in elevation (siphons, culverts, spillways, drop structures).
- When awareness of ditch dangers is low (such as new housing near ditches)
- Where children and animals are in close proximity with the ditch
- When and where spectators are not near or cannot get to the ditch for rescue

Arrange for shared liability and make cooperative agreements delineating who is responsible for maintenance of land and ditch, and for hazard reduction.

The ditch company holds easements for the purpose of moving water. The landowner may do anything within the easement which does not interfere with that function. Neither party is solely responsible for warding off potential hazard, so the most effective way to reduce conflict and achieve safer ditches is to join as one responsible body.

- The ditch companies could co-insure on the city liability policy, but Boulder's current insurance practices make that difficult.
- The city could take more responsibility for safety and maintenance at ditch crossings and paths, since it has greater financial resources than the ditch companies. City expense and responsibility would be rewarded by greater ditch company cooperation and reduced exposure to liability through improved maintenance and safety.

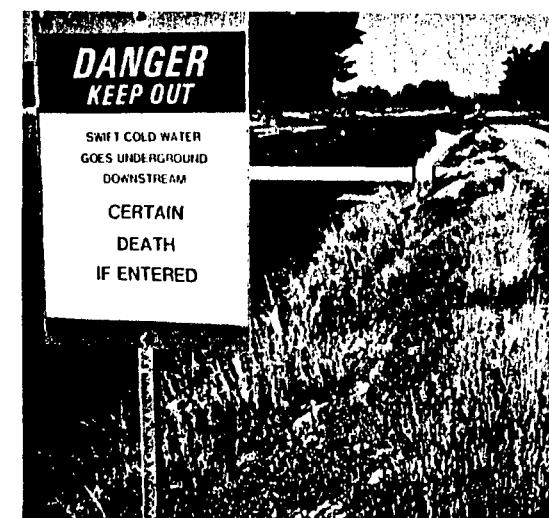
Include ditch companies in the decision-making process and develop policies and safety standards that address their concerns.

- Safety features should not block flow or create maintenance headaches for ditch companies.
- Ditch company representatives should have a regular place at development hearings so that their concerns can be taken into consideration in conditions of approval or development agreements.
- Design standards should be developed and applied for path distance from ditches to allow reasonable access for maintenance and storing debris removed from ditches.

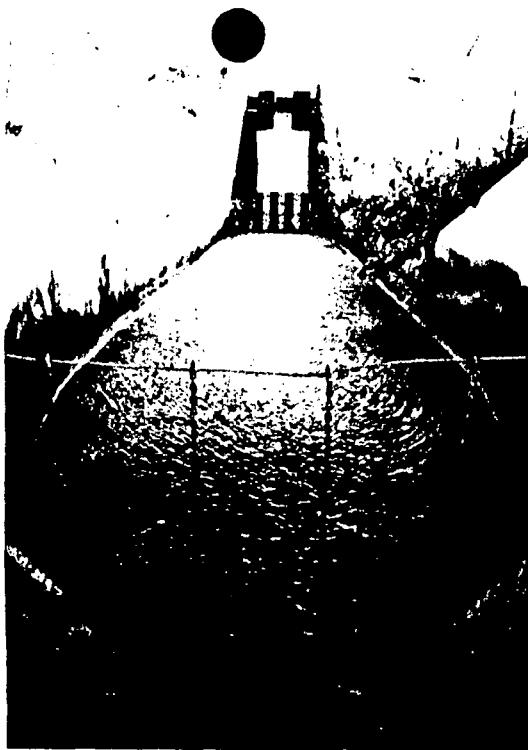
Promote a public relationship with the ditch.

If ditches are viewed as an historical, aesthetically distinctive and purposeful feature of the city, people will respect them instead of using them as trash receptacles. If people understand ditches and their potential hazards, there is less likelihood of accident.

- Offer open access to ditches in public places to promote a positive relationship with the ditch, instead of fencing them off and warding people away.
- Educate the public about ditch benefits and hazards by advising when gates are open and water is high (as the Boulder *Daily Camera* announces when Boulder Creek is high). Friendly advisory signs in parks or along paths can remind people of their own responsibility ("Certain Death" applies at few locations but "Watch Your Children", "Dogs on Leash" and "Danger during High Flow" signs would alert people without alarming them).



sign on Boulder Feeder Canal



Boulder Feeder Canal drop structure
into Boulder Reservoir

Prevent the public from having any relationship with hazardous features such as culverts, siphons, spillways or drop structures by creating safety feature standards.

- Advise where safety features would best be located (in front of siphons and spillways) and provide standards for their application. For instance, standards should ensure that racks (or body catchers) will achieve the desired effect by having a low angle (to lift people and debris out of the water and a safety platform on top (to climb up to and for others to assist rescue).
- Identify locations frequented by those most at risk (children, dogs) where special safety features are needed (such as toddler walls along ditches near schools, and closely-spaced rails on the bottom half of handrails). These could also act as design features that signify the ditch and enhance its appearance.
- Make the public ditch accessible to enable rescue and maintenance. A city in Arizona was sued because it had put up a 8' high fence along the ditch which prevented rescue of a youth who had climbed over it.
- Where people are allowed into or very near the ditch, increase ditch width to decrease flow rate, or reduce bank slope.
- Employ diversions to keep those at risk away from danger. For example, kiddy ditches can be diverted from the main ditch in parks (and then returned further along) to provide safe access to water for children and dogs.
- Add safety features in phases determined by prior accidents and known hazards.

4. Conclusion

More than other places, Boulder can do what it wants with its ditches. People in Boulder like to see and hear the water running in ditches, but they haven't yet articulated this as public policy. Ditches here are not in imminent danger of disappearance, but neither are they treated with the care and attention they deserve as an essential part of the city's landscape. Without this attention they continue to be lost piece by piece, and Boulder could yet follow the example of other cities and lose its ditches wholesale.

Boulder's municipal open space and its water rights give it an unusual degree of control over its landscape. Boulder owns the rights to more water than it needs. The city is the majority owner of several ditch companies, and a major shareholder in most of the others. Boulder has decided to use its extra water to preserve the agricultural landscape around it. Part of that mission should be preserving the ditches running through the city.

Preserving ditches will be more complicated than preserving buildings. Traditional methods such as landmark designation and listing on the National Register of Historic Places can help, but only when ditches face discrete threats such as real estate development or roadbuilding. Broader efforts will be necessary to make sure ditch irrigation remains a viable part of Boulder's landscape and its water economy. The efforts will need to involve many different agencies - the Landmarks and Planning boards, the Open Space and Public Utilities departments. Beyond the city, they ought to involve the county open space department, the university, and other public ditch shareholders.

The efforts will also need to involve ditch companies. Most of them in Boulder are shoestring operations. The miles of ditch passing through the city before they get to their first irrigator are, in an economic view, non-producing assets, and expensive and troublesome ones. Compared with Boulder's ditch companies, the city has greater resources, and also broader interests. The city manages storm drainage and flood control systems, expands a recreational and ecological greenway system, and seeks to enhance the safety and the visual and historic environment of its residents. Ditches contribute to all of these functions, though all are secondary to the ditches' initial purpose and contribute nothing to the ditch system's maintenance. The city has in fact recognized this by taking on some ditch maintenance chores. It is fair and logical to trade city resources for public goals, such as access, visibility, and habitat enhancement.

More than a third of Boulder's municipal water use is used outdoors, mainly where we have chosen to sustain one or another landscape. Preserving ditches is a landscape choice.



Appendices

1. Frederick Law Olmsted, Jr., on Boulder's ditches

from *The Improvement of Boulder Colorado. Report to the City Improvement Association by Frederick Law Olmsted Jr.* (March 1910), 20-22:

Treatment of Farmers' Ditch

In connection with this park taking [along the lower slopes of Red Rocks] some intelligent treatment of the margins of the Farmers' Ditch with a shady path and benches would of course be undertaken, and a great deal of skill should be utilized to make this a pleasant shady spot for people to stroll and sit and enjoy the view, but without allowing any trees to interfere unduly with the views from the street and from the houses north of it. This means careful study on the spot and the limitation of the foliage to exactly the right places. Not improbably it would mean, in part, recourse to systematic pruning, or to the use of a vine-clad arbor or pergola for shading part of the path instead of trees, but it might be possible to accomplish the result by selecting small trees of low habit and placing them very carefully. Already there has been some manipulation of the natural growth along the ditch by pruning, apparently to improve views from houses, on the opposite side of the street, but it has neither been systematic nor agreeable in its general effect.

The presence of the Farmers' Ditch is a very happy feature here, as a part of a public promenade. Given sunshine and breeze and the wonderful plunging view across the valley to rugged mountains bathed in sunlight; given shade from the direct glare of the sun and sky, easily to be obtained by planting; the one thing wanted to complete the situation is water, and the quiet flowing canal on its way to irrigate the fields beyond the city gives the very note that is needed. To be sure its banks are here shabby and neglected, the vegetation is weedy and an appearance of squalor is more or less in evidence, so that a superficial observer might turn away without feeling the least interest in the ditch. But all the essential elements of the most beautiful scenes of Italy are here, waiting only a little patient, skillful care to unite them into a little picture of paradise.

Pleasant improvements now existing along the Farmers' Ditch

Indeed, there is nearby, although without the distant view and without the outlook from shade into sunlit space which is the soul of this situation, an example which suggests the charm that can be found in the simple combination of the quiet, flowing water of the irrigating ditch with a little well-kept foliage. At several points between Spruce Street and the Mapleton School the so-called ditch, in passing through a garden, becomes the central feature of a really charming scene. The stiff walling of the banks and the raising of the adjacent ground quite high above the water level makes the water count for less than it might, and we can call to mind many more lovely gardens bordering canals in European countries where the people have acquired a greater knack at such things; but here and anywhere a considerable degree of charm is felt the very moment anyone takes care of the borders of such an irrigating stream in an appreciative spirit. The hand of a good housekeeper is the thing most essentially needed, doing away with dirt and slatternly neglect, but not changing everything into a rigid and mechanical formalism.

We are inclined to dwell upon this point, because not only in the Farmers' Ditch but in the many other irrigating channels which traverse the city in so many quarters Boulder has what seems like a veritable treasure of municipal decorations, now for the most part neglected and defaced, but all retaining their essential elements unspoiled and ready to shed beauty all about them if only given a proper setting.

Opportunity presented by the irrigating ditches

Among those people of every generation and every race who have most enjoyed life and the beauty of the world about them, but especially among people dwelling in climates of sunshine, blue skies and dry air, the testimony is overwhelming, whether we look to the poets and to literary records of the enjoyment of beauty, or to painters, or to gardeners themselves; that living water, glancing in the sunlight and the shadow, is one of the most refreshing, cheerful, lovely elements that can be introduced into any scene. Whether it be spring or jet or fountain, picturesque cascade or smooth overpouring of mill-dam, meandering brook or prim canal, the essential beauty persists throughout; and only the signs of human contempt, foul contamination and slovenly surroundings, can obscure the natural beauty of water in the open air. A thing that strikes the easterner unaccustomed to the irrigating ditch, is that however neglected and ignored such a ditch may be as to its banks and surroundings there is something about it radically different from the ditches he is familiar with at home; a something that makes it far more attractive, more suggestive of pleasant possibilities. The feeling is hard to analyze, but it arises, perhaps, mainly

from two causes. First, the water of the ditches is relatively clean and sparkling; and second, it is elevated close to the level of the adjacent ground, or even above it, thus catching the sunlight and holding the eye, and expressing the fact that it is cared for and conveyed as a thing of value destined for human use, instead of being sunk in a drainage ditch as far below the surface as possible, rejected and considered only as something to be got rid of quickly and completely. If the inherent beauty of the water of the irrigating channels were supplemented by such treatment of their immediate borders as would remove the unpleasant associations that now in many places attach to them, such treatments as would bring out and enhance the natural associations of refreshment and abundance that are inseparable from them and would re-enforce their intrinsic charm, these channels alone would serve to make Boulder a place of high civic beauty.

An Aesthetic Predicament

If only people could be got to realize that while they are looking for beauty in things which have no purpose except for decorative purposes, the highest possible beauty is to be found nine times out of ten in the most utilitarian things when perfected and treated as worthy of respect and loving care, they would be saved a vast deal of extravagant and foolish expenditure which now leads to confusion, disharmony and ugliness though made in the vain hope of achieving beauty. It is the peculiar difficulty of such an awakening to the value of beauty in the scheme of life as is now being manifested all over our country, that people whose interest has been largely concentrated upon utilitarian things from the commercial standpoint are apt, when they do awaken to the value of beauty and set to work to get their share of the enjoyment of it, to look anywhere else for it rather than in the familiar things which they have always regarded as of commercial or practical interest only, not at all realizing that the lack of beauty or the positive ugliness of these things is due solely to the misshaping of them by their own narrow commercialism and that of others like them.

We trust the good people of Boulder will pardon us for this preaching. They are no worse sinners than most of us in this great, prosperous, well-meaning nation, where opportunities are so numerous that we spend all our energies trying to grasp more of them than we can hold and so have no time left in which really to live. It is merely that a person is more vividly struck by examples of foolish waste of a kind new to him than by those to which he has become accustomed; so when Boulder is visited by an eastern stranger who has an eye for beauty and some acquaintance with the use to which water is put in the gardens and cities of older countries he cannot fail to be strikingly impressed with the neglect of what seems to him an extraordinary opportunity for civic beauty.

How to get park value from the ditches

There are several canals in which the city has a shareholder's interest in addition to its powers of general control, and along the banks of most of these the city has a right-of-way. Many indeed are within the limits of streets or public alleys, already adequate in width or capable of being widened at slight expense so as to provide the essential elements of the public enjoyment of the opportunity which the waterway presents.

What are those essentials?

First, convenient provision for the public to pass or to stop where it can enjoy the opportunity. This may mean no more than the roadway and sidewalks of a street within which the waterway occurs, or even a bridge carrying some street over a waterway in such a manner that those crossing it can get a pleasant view over a rail or parapet designed to present the view to the best advantage. Or it may mean a special path running along near the water with occasional benches at the more inviting spots; and from that anything up to summer-houses and refreshment booths and concert groves along the banks of waterways, with all of the incidental provisions for public comfort and convenience that attend upon public parks. The only vital thing in this regard is that convenient, sage and decent provision be made in some manner for the coming and going and pausing of the people where they can enjoy the beauty that is offered. Civic beauty is worthless, even if it can be said to exist at all, where it is not seen and enjoyed by the people.

Second, offensive, foul and ugly things, where they come into view, should be done away with, made over, or obscured by foliage or otherwise, so far as possible; a general impression that the place is regarded by someone as worth caring for, as expressed by the fact that it is always swept and garnished, has a great deal to do with the extent to which others will care for it and be able to appreciate it.

Third, agreeable scenes and compositions should be noted and enhanced, or created, mainly by such control of light and shade and of enclosing and framing masses as can readily be effected through controlling the disposition of the foliage of trees and bushes. Along many of the ditches that run through alleys or on private rights-of-way there are many trees and bushes already present in combination with the water and the sky very pretty scenes and which need only to be supplemented by a good path and a few benches and an impression of good order and solicitous appreciation to become ready-made park spots of the highest value. In many other places judicious removals and a very moderate amount of supplementary planting would soon bring similar results. In other places the foliage element is still to be supplied by planting.

Fourth, places a certain amount of manipulation of the edges of the channel or of the adjacent surface of the ground may be called for in order to harmonize these elements with the general effect of the scene of which they form a part. Fortunately the volume of water is comparatively constant and its surface is normally but little below the level of the banks, so that the channels just as they now are give that ever-delightful impression of brimming abundance and of intimacy of relation between the surface of the water and that of the ground. Generally speaking, the more closely on a level they can be and the more intimate their relation the happier will be the result. Where the general impression of a scene is one of formality, of conspicuous regularity of order in its dominant features, the margin of the water may need some rectification to bring it into harmony with this impression; where the general effect is notably picturesque and informal it may be that some inharmoniously formal lines in the canal could be to advantage modified or obscured; not infrequently, especially where a path comes next to the ditch, it may be desirable to introduce a simple curbing or piece of wall (mostly below the water level) to hold the earth from crumbling or slumping. But generally speaking it is better to avoid the use of walls or banks which would have the effect of depressing the water below the adjacent ground by more than a very small fraction of the width of the stream. If this mistake is avoided the water will be all right anyhow, and it will be just as well to do nothing to its margin except what is really needed as a practical matter for the proper maintenance of the ditch. In the case of the little ditches that run along in the parking of so many of the streets in the easterly part of the town, the boards which form their sides rise just to the level of the ground and are generally overhung with grass that gets a delightful, fresh richness from the water. The effect is charming and it would seem a pity to substitute a conspicuous and rigidly formal curbing either of concrete or stone and the substitution of a perfectly smooth bottom for one made of rough cobblestones takes out an element of interest and beauty for no sufficient reason, for the sparkle and dance of the water as it runs over the cobbles is part of its life and charm. The boards must give way for something more permanent, certainly, because their maintenance is troublesome and expensive. But why not substitute for them thin slabs of local sandstone of irregular lengths set at the same height as the present edgings so that the grass will overgrow them somewhat as it now does the plan? And why not use the same old cobble pavement for the bottom?

Beasley Ditch

Of the larger waterways the Beasley [Whiterock] Ditch was the only one of which we made a complete examination throughout its length within the city. With the possible exception of one or two short passages we found that it would be possible to convert this ditch and its margins into a very attractive public promenade at surprisingly small expense. From 12th Street [Broadway] to 19th Street, for example, it runs mostly through a public

area not used as a thoroughfare for other purposes, and by the acquisition of a few bits of vacant land, the opening of a good path, and a small amount of thinning and planting, the thing would be done; while just north of 21st Street the ditch passes through or borders a piece of land excellently adapted for local park purposes and can be made to add much to its park value if acquired. It is however, useless to discuss these possibilities in detail in view of the proposition since called to our attention for a great increase in the capacity of the Beasley Ditch. This will involve, of course, an entire change of conditions all along the route and radical changes in many streets. The matter should be taken up by the city and the proprietors of the project in a spirit of intelligent co-operation and a well-conceived plan should be adopted that will take into account the hydraulic requirements, the result upon the street system, and the opportunities for public recreation afforded by the banks of the canal if properly utilized. One suggestion which we were prepared to offer in any case appears still more appropriate in view of the probable changes in the Beasley Ditch. It is that in widening the County Road and extending it north from Pearl street past the east end of Lovers' Hill as a great, cross-town thoroughfare, the Beasley Ditch, so far as it occupies the line of the street, be treated as a formal ornamental canal or basin running down the center of the boulevard, with a fairly wide border of grass on either hand and flanking rows of trees on the edges of the two roadways that would border this parking.

2. Ditch decrees

Combined Decrees Ditch Names	Lowest Priority	Creek Source	Earliest Date
Boulder Feeder	1	Boulder	10-1-1859
Smith & Goss	2	Boulder	11-15-1859
Howell (& Beasley)(3,23)	3	Boulder	12-1-1859
Anderson	4	Boulder	10-1-1860
Harden	11	Boulder	6-1-1862
N. Hann (Wellman, Nichols & Hahn)	11	Boulder	6-1-1862
North Boulder Farmers	11	Boulder	6-1-1862
Green (13,17, 27,29)	13	Boulder	9-15-1862
Farmers	14	Boulder	10-1-1862
Houck or Houck No. 1	16	Boulder	4-1-1863
Butte Mill	22	Boulder	3-1-1865
Boulder & Lefthand (11,16,36,38)	11	Boulder	12-1-1873

				Boulder & Lefthand	36 Boulder	4/1/1870	163.80
Boulder & Whiterock (35, 1 Goose)	35 Boulder	12-1-1873		Boulder & Lefthand, transfer from Dry Creek (DH Nichols)	11 Boulder	6/1/1872	10.00
Boulder Supply Canal	37 Boulder	6-17-1875		Boulder & Lefthand, from Dry Creek (W. N. Hahn)	11 Boulder	6/1/1872	3.59
Wellman	39 Boulder	5-1-1878		Boulder & Lefthand, transfer from Houck No. 1	16 Boulder	4/1/1883	2.50
Silver Lake (11,13 N.S.)	11N.S. Boulder	2-28-1888		Boulder & Lefthand, transfer to Boulder Creek (abandoned)	Boulder	6/1/1872	12.09
Eggleston (Antrey & Eggleston)	1 Coal	4-1-1860		Boulder & Whiterock	35 Boulder	12/1/1873	190.58
Eggleston No. 2	3 Coal	5-1-1862		Boulder & Whiterock	1 Goose	12/1/1873	26.04
Howard	3 S. Boulder	4-1-1860		Community South Boulder Coal Creek	28 South Boulder	6/1/1873	53.55
McGinn (1,10,15)	1 S. Boulder	5-1-1860		Com. South Boulder Coal Creek, from Dry Creek (Davidson)	7 South Boulder	6/1/1863	5.20
Jones & Donnelly	7 S. Boulder	5-1-1860		Cottonwood No. 1, transfer from Leyner	17 South Boulder	4/1/1866	15.58
Scheater	2 S. Boulder	6-1-1860		Cottonwood No. 1, transfer from Leyner	13 Dry	4/1/1865	3.00
East Boulder	4 S. Boulder	4-1-1862		Davidson	26 South Boulder	4/1/1872	116.30
South Boulder & Bear Creek (5,8,20)	5 S. Boulder	5-25-1862		Davidson, 1st Engagement	32 South Boulder	5/1/1875	8.73
Dry Creek (7,11)	7 S. Boulder	6-1-1862		Dry Creek (claim of Wm. A. Davidson)	7 South Boulder	5/1/1863	29.95
Cottonwood No. 2	6 S. Boulder	4-15-1863		Dry Creek, trans. to South Boulder & Coal Creek (Davidson)	7 South Boulder	5/1/1863	5.20
Dry Creek No. 2	9 S. Boulder	5-1-1864		Dry Creek (claim of G. Berkey)	11 Boulder	6/1/1862	1.00
Andrews & Farewell (11,25)	11 S. Boulder	6-1-1864		Dry Creek (claim of M.G. Smith)	11 Boulder	6/1/1862	1.00
Enterprise (12,17)	12 S. Boulder	2-1-1865		Dry Creek (claim of Mary S. Stoddard et al)	11 Boulder	6/1/1862	1.00
Leyner (13, Dry 13)	13 S. Boulder	4-1-1865		Dry Creek (claim of David H. Nichols)	11 Boulder	6/1/1862	1.00
Marshallville	14 S. Boulder	6-1-1865		Dry Creek, trans. to Boulder & Lefthand (W. N. & Hahn)	11 Boulder	6/1/1862	3.59
Cottonwood No. 1 (17, Dry 13)	17 S. Boulder	4-1-1866		Dry Creek (claim of Wm. Breach)	11 Boulder	6/1/1862	1.00
Coal Ridge, transfer from South	19 S. Boulder	6-1-1866		Dry Creek tr. to South Boulder Creek (aband. Davidson's)	South Boulder	5/1/1863	4.95
South	19 S. Boulder	6-1-1866		Enterprise (Anuary & Eggleston)	1 Coal	4/1/1860	4.16
South Boulder Canyon (21,24)	21 S. Boulder	5-15-1870		Enterprise No. 2	3 Coal	5/1/1862	4.63
Davidson (26,32)	26 S. Boulder	4-15-1872		Enterprise	12 South Boulder	2/1/1865	34.08
Community South Boulder Coal Creek	7 S. Boulder	6-1-1873		Enterprise, 1st Eng.	17 South Boulder	5/1/1866	6.68
Goodhue	29 S. Boulder	6-1-1873		Green	13 Boulder	9/1/1862	34.58
South Boulder & Rock Creek	30 S. Boulder	6-1-1873		Green, 1st Eng.	17 Boulder	5/1/1863	34.58
Andrews & Farewell	11 South Boulder	6/1/1864	1.13	Green, 2nd Eng.	27 Boulder	5/1/1864	34.58
Andrews & Farewell, 1st Eng.	25 South Boulder	5/1/1871	6.26	Green, 3rd Eng.	29 Boulder	3/1/1865	34.58
Boulder & Lefthand	36 Boulder	12/1/1873	82.80	Houck or Houck No. 1	16 Boulder	4/1/1863	15.97
				Houck or Houck No. 1, transfer to Boulder & Lefthand	16 Boulder	4/1/1883	-2.50
				Houck or Houck No. 1 (abandoned to Boulder)	16 Boulder	4/1/1863	-12.97
				Houck or Houck No. 1	16 Boulder	4/1/1863	-0.50
				Howell	3 Boulder	1/2/1/1859	4.7.53
				Howell & Beasley	23 Boulder	3/1/1865	28.80
				Leyner	13 South Boulder	4/1/1865	164.00
				Leyner, transfer to Cottonwood No. 1	13 Dry	4/1/1865	-3.00
				McGinn	1 South Boulder	5/1/1860	3.19
				McGinn, 1st Eng.	10 South Boulder	5/1/1864	
				McGinn, 2nd Eng.	15 South Boulder	5/1/1865	1.087
				Schaefer	2 South Boulder	6/1/1860	26.08
				Silver Lake	11 N.S. Boulder	2/20/1868	20.00
				Silver Lake, 1st Eng.	13 N.S. Boulder	1/1/1900	25.00
				South Boulder & Bear Creek	5 South Boulder	5/25/1862	16.60

Priority	Appropriation	Amount	Date	Creek Source	Sec. F.
Individual Decrees & Transfer Decrees					
Ditch names of Boulder list (& decree book)					

South Boulder & Bear Creek, 1st Enlg.	8	South Boulder	5/9/1865	9.81
South Boulder & Bear Creek 2nd Enlg.	20	South Boulder	3/15/1868	28.28
South Boulder & Bear Creek 3rd Enlg.	23	South Boulder	5/15/1871	74.41
South Boulder Canyon	21	South Boulder	5/15/1870	26.37
South Boulder Canyon, 1st Enlg.	24	South Boulder	5/15/1871	165.63
South	19	South Boulder	6/1/1866	9.16
South, transfer to South Boulder Creek (abandoned)		South Boulder	6/1/1866	-5.16
South, transfer to Coal Ridge	19	South Boulder	6/1/1866	-1.00
Wellman	39	Boulder	5/1/1878	12.74

Decree data from:

Tabulation of Water Right Decrees, State of Colorado, Irrigation Division No. 1, Water District Number 6

Compiled from certified copies of court decrees by C.C. Hezmalhach of the State Engineers Office

Published by The Smith-Brooks Printing Company, Denver, Colorado 1920

3. Public ditch ownership

Boulder City and County Open Space Department

Ownership of Boulder Ditch Rights

Ditches	City	County	Total	Combined	
				Shares	Shares
Andrews-Farwell			8.00	N-A	-
Baseline Land & Reservoir	57.00	3.00	555.00	10.81%	
Beckwith Ditch Co.			1.66	N-A	-
Boulder & Lefthand	0.50	2.60	16640.00	0.02%	
Boulder & Weld Co. Ditch Co.			0.25	N-A	-
Boulder & Whiterock	192.25	40.00	5500.00	4.22%	
Butte Mill	6.60		42.00	15.71%	
Cottonwood #2	2.67		197.00	1.36%	
Davidson	474.50		3103.00	15.29%	
Dry Creek-Davidson	172.00		N-A	-	
Dry Creek #2	93.76		300.00	31.25%	
East Boulder	0.18		12.00	1.50%	

Enterprise	2.60	44.00	5.91%
Farmers	6.52	69.56	76.08%
Green	17.50	32.00	54.69%
Goodhue		455.24	N-A
Howard	21.35	35.00	61.00%
Jones & Donnelly	48.00	614.00	7.82%
Lefthand	1292.00	535.00	16640.00
Leyner Cottonwood	308.00	N-A	-
Longmont Supply Co.		N-A	-
Marshallville	26.67	80.00	33.34%
Martha Mathews Ditch Co.		45.00	N-A
McGinn	9.50	40.00	23.75%
New Anderson	6.89	100.00	6.89%
North Boulder Farmers	1158.20	5760.00	20.11%
N. Colo. Conservancy Dist.		50.00	N-A
Oligarchy Irrigation Co.		6.75	N-A
Smith-Goss	85.25	218.00	39.11%
South Boulder-Bear Creek	1.75	20.00	8.75%
South Boulder Canyon	57.00	610.00	9.34%
Star Ditch	4.83	14.00	34.50%

Approximately 10,000 of the 24,000 acres (41.7%) of city open space is irrigated.

Sources: City of Boulder Open Space Department, Boulder Public Works, Boulder County Open Space Department

4. Right-of-way law

"All persons and corporations shall have the right-of-way across public, private and corporate lands for the purpose of conveying water for domestic purposes, for the irrigation of agricultural lands, and for mining and manufacturing purposes, and for drainage, upon payment of just compensation." (Colorado Constitution, article XVI, § 7.)

Scope of the Right-of-Way: The easement extends to whatever is necessary to maintain and use the ditch or other structure. It is limited by the past conduct of parties - it cannot be arbitrarily enlarged or shrunk out of context of use. The ditch easement owner may be able to spill waste water where necessary to the maintenance of the ditch - but this does not protect the ditch easement owner from liability for spill damage due to negligence. If a ditch is allowed to extend beyond the right-of-way, the owner of the land may be able to collect damages.

Loss of the Right-of-Way: The right-of-way can be lost by abandonment, which is defined as nonuse and intent to abandon. Intent to not abandon can be proven through plans to rebuild old or build new control structures, or maintenance of other agreements for water rights, even if the ditch itself is not used for an extended period (in one case from 1921 to 1969). If the right-of-way is abandoned, the structures for conveying water are retained and may be removed by the ditch easement owner, within a reasonable length of time, without being subject to trespass.

Maintenance and Repair of Ditch: The owners of any ditch for irrigation or other purposes shall carefully maintain the embankments thereof so that the waters of such ditch may not flood or damage the premises of others, and shall make a tail ditch so as to return the water in such ditch with as little waste as possible into the stream from which it was taken.

The owner of a ditch is not liable for damages as a result of water seeping therefrom, unless it appears that such seepage was caused by the negligent construction or operation of the ditch.

5. Environmental law and ditches

Two federal laws apply to the waters in the United States: The Clean Water Act of 1977 and the Wetlands Protection Act. These laws are administered by federal, state and local agencies.

The U.S. Environmental Protection Agency's official position on irrigation ditches is that they are reviewed on a case-by-case basis. Each request for review is looked at for wetlands habitat and conformance with the Clean Water Act.

The U.S. Army Corps of Engineers is the federal agency with primary responsibility for determining the presence of wetlands and enforcing the Wetlands Protection Act. In most cases, the Corps does not take jurisdiction over irrigation ditches. Section 30 CFR 328.3 D(A) of the Federal Register "Non-Title Irrigation Ditches Excavated on Dry Land" states that regular, routine maintenance of a ditch, excavated over dry land, that is now considered a wetland is not regulated. The ditch would also be exempt from regulation if it existed prior to 1977 in a wetland and maintenance is required. For ditches created after 1977, in wetlands, and with a Corps of

Engineers construction permit, the maintenance may or may not be regulated. The Corps looks at each ditch on a case-by-case basis.

The City of Boulder has developed a comprehensive wetlands map which indicates concentrated areas of wetlands. Some are located in the seeps created by unlined ditches. The city's wetlands regulations take into account not only the wetlands but a buffer of 25 to 50 feet. Not many ditches within Boulder would be subject to this regulation because most of the ditches are lined in some manner.

Regular, routine maintenance within the ditch itself does not require a permit. However, new headgates or laterals might require one, if they affect any seep area that is now classified as wetland. The ditches themselves are not usually subject to these regulations and the city has taken over maintenance of most of the headgates located in or near wetlands, so ditches and wetland regulations have not yet been at odds. The ditch companies have expressly stated that they are not subject to these regulations and have not agreed to be regulated by the city for activities in their ditches or laterals.

6. Habitat evaluations

Keammerer Study Data:

Ditch	Habitat Record	* Quality	Sec. 3 Record	* Quality
Silverlake	20 50	6 5	303 305	6 4
Farmers	26 28 70 71 73	6 7 3 3 2	304 307 308 309 310 312	5 7 10 8 6 6
Boulder - Whiterock	29 30 34 49 76 77 79	8 6 4 7 4 2 2	311 314 315	5 4 7
Boulder - Farmers	58 60 77 78	7 7 2 2	316 319	6 8

Wellman	10 33 45 80	7 4 9 3		
Anderson	7 8 82 83	7 7 2 3		
Howard	51 65 85	6 5		
Dry Ditch #2	7 16 51 65 85	7 7 6 5	336	9

*quality ratings are from one to ten, ten being the best habitat quality in the Boulder area; from the Keammerer Study.

Assessment Results from Applying Our Index

Ditch	Index Combined Quality Ratings 0 [worst] to 6 [best], east to west or north to south
Silverlake	4 5 4 3 5 0 3 3 3+ 4+ 2 4+ 2 3+ 4+ 6 5+ 4 6
Farmers	5 4+ 2 4 3 4 3 2 3 4 5
Boulder Whiterock	4 3 5 5+ 5 3 4 3 2 3 3
Boulder Farmers	4+ 0 3 4 2 4 0 4 3
Wellman	5+ 4+ 3 4+ 2 0 4
Anderson	6 5 1 2 0 3 4
Howard	4 2 3 2 0 3 4 3 4+ 3+
Dry Ditch #2	4+ 3+ 2 3+ 4+ 3 2 3+ 2 6 3 5

Ditch Habitat Improvements

The following improvements could be made to ditch sections that contribute to habitat values. The improvements are not intended to apply to all lengths of all ditches discussed in this report, but specifically to those listed in the next section.

Plant native vegetation. Plant species missing from and critical to habitat. Plant species which supply food to attracted wildlife. Plant densely in certain areas to provide cover, denning, nesting sites and buffers from disturbance.

- B. Limit cleaning to below ditch water line and to certain access points only.
- C. Lateralize ditches or create ponds in wetlands.
- D. Set development and activities back from the ditch where possible.
- E. Avoid installing trails at edges and particularly at critical or narrow areas.
- F. Intersect ditches with human activities as much as possible, rather than paralleling long ditch sections.
- G. Parallel ditch sections with future human activities in an intermittent fashion rather than continuously.
- H. Identify areas where ditches may contribute to ground water recharge and vegetation restoration; try to avoid lining these sections.
- I. Increase length of water supply season where ditches contribute to critical habitat maintenance.
- J. Remove cattle from continuous access to ditches in grazing areas.
- K. Reduce wildlife conflicts as indicated by Keammerer Study.
- L. Reduce domestic animal nuisance where possible or select less important habitats as areas for domestic animal exercising.
- M. Eliminate fences near ditches; use fences to separate domestic animals from them.
- N. Uncover ditch and place in earthen structure as much as feasible.

Priority Improvement Areas: within or adjacent to designated critical habitat, or listed as contributing habitat by the Keammerer Study, or within, cross or parallel natural water courses and are within Zone A of the 100 Year Flood Plain and within city-designated wetlands:

ditch sections	improvements	status
Contributing Connectors:		
1. Silverlake: Wonderland Lake to Four Mile Cr.	a b m n	Fair
2. Farmers: Wonderland Drainage to Four Mile Cr.	a b d l m	Fair
3. Boulder-Whiterock: Wonderland Drainage to Four Mile Cr.	a b c d f g l m	Fair
4. Boulder-Farmers: Wonderland Drainage to Four Mile Cr.	a b c d f g l m	Fair
5. Wellman Feeder Canal	a b d e f g	Great
6. Wellman: Foothills Pkwy. to South Boulder Cr.		Good
7. Anderson at Baseline Reservoir		Great

Rural Maintain: 8. Silverlake: North of Four Mile Cr. 9. Farmers: North of Four Mile Cr. 10.Boulder-Whiterock: Northeast of Diagonal Highway		Good Great Fair
Edge Maintain: 11.Dry Cr. Ditch #2 12.Boulder-Whiterock: North of Four Mile Cr. to Diagonal 13.Howard 14.Silverlake	a b c d e f g j m a b c d e f g j k	Fair Good Fair Great
Urban Corridor: 15.Boulder-Farmers 16.Farmers		Fair Fair
Minor Improvement Sections: 17.Anderson at NIST 18.Wellman: Boulder Cr. east to Foothills Pkwy. 19.Dry Cr. Ditch #2: Golfcourse & east of Cottonwood Grove	a c d a b c d f l	Fair Fair Fair

7. Flood hazard & stormwater control

Floods in Boulder are primarily caused by intense rainfall during the spring and summer months. Runoff from mountain snowpack contributes to but is not a serious cause of flooding. Flood plains within the city are roughly defined as areas between 2,000 to 2,500 feet away from Boulder Cr..

A city employee noted that ditches rarely flood and are not taken into account during flood studies. Historically, ditches were meant to carry a specific flow (Farmer's Ditch, 72 cubic feet/second (cfs); Whiterock Ditch, 180 cfs; Anderson Ditch, 50 cfs). As a result, ditches are not classified as flood control and drainage mechanisms and do not officially handle floodwater because of liability concerns. But ditch company involvement in flood control has increased because development sends more drainage to the ditches than does the natural topography. Boulder is only now beginning to address these concerns.

One recent example in Gunbarrel North involves city, ditch company, and developer cooperation. A subdivision developer provided detention ponds to regulate the flow of stormwater from Gun Barrel Hill into Whiterock Ditch, which is located on the property.

City maintenance crews and ditch companies have maintained an unofficial relationship regarding stormwater control. If a strong rain is expected, ditch

companies have allowed the ditches to be shut down to handle stormwater (their second duty).

One official form of flood control within a ditch is located at the northern end of Whiterock Ditch, near Niwot. Here, the county and ditch companies cooperated to develop an automatic overflow mechanism on the ditch. If over 200 cfs of water begins to pass through the automatic overflow, the water is diverted to Dry Cr.. The overflow "path" to the Cr. is dedicated to the county and no building is permitted in this area.

On the Flood Insurance Rate Map (FIRM), Whiterock Ditch is coded Zone A , A4, or A14 in large portions of the City of Boulder (generally low spots or spots near creeks). An example of flood hazard area is the southwest side of 28th and Valmont (Zone A4), along Whiterock Ditch. Here, floods take place due to overflow from Goose Cr. and Elmer's Two-Mile Cr. (Zone A2 and A). A ditch company representative said the creeks flood directly into the basement of a building built over the ditch. He said the ditch company gets blamed for the floods; the city is developing a huge flood control channel in this area.

A Farmer's Ditch representative says that it has flooded only once in 20 years, when a headgate was opened after a big rain in Nederland and low spots along the ditch overflowed. Only small portions of Farmer's Ditch are shown as flood zones on the FIRM. Farmer's Ditch has a "small" problem near Iris Street, similar to Whiterock Ditch's problems at 28th and Valmont. Two Mile Cr. (Zone AH) floods at Broadway and Iris Avenue and dumps into the ditch near 17th Street (not zoned on FIRM). The ditch overflows and fills with silt, gravel, and sand. When Farmer's Ditch floods, its overflow goes into Whiterock Ditch.

Runoff south of Boulder Cr. dumps into Anderson Ditch. There is generally not enough runoff to flood Anderson Ditch, although there are drains that dump stormwater into the ditch from developed areas.

Generally, the following advice applies to ditches and flooding: "shut the headgate if you know there is going to be a heavy rain. If you're lucky, it will handle the run-off. If you're not, then it floods."

8. New Mexico ditch survey form

NEW MEXICO HISTORIC ACEQUIA RECORDING FORM

Aequia/System Name:

Associated with (Village, Town, Land Grant):
County: _____ **Stream System:** _____

Organized Under: Ditch Association Irrigation District
Conservancy District Name:

Date of Construction: _____ Registered with SEO? _____

Sources for Date: — State Engineers Office (SEO File #):
Other (specify):

Number of Irrigators: _____ **Total Acreage Irrigated:** _____

MAIN DITCH (ACEQUIA MADRE)

Location of Headgate (UTM): Zone _____ E _____ N _____
USGS: Elevation: Diverts From:

Location of Desagua (UTM): Zone: ___ E ___ N ___
USGS: Elevation: Terminates Into:

Acequia Data Form and Cross Section Form included? Yes No

Number of Lateral Ditches ____ List the name and location (UTM coordinate for the point of diversion) for each below:

Name UTM Zone Easting Northing

Woolard said Form 1 and Form 2 were submitted to the FBI.

ACEQUIA DATA FORM

Ditch Name: _____ Acequia System: _____
Main _____ Lateral _____ Sublateral _____
(PLEASE INCLUDE A USGS 7.5' QUAD WITH THE DITCH CLEARLY MARKED)
Diverts From: _____

Recorded By: _____ Date: _____
Type of Inventory: Comprehensive Partial / † Documented

CONSTRUCTION DETAILS

(Please characterize the various features of the system and provide representative photographs)

Headgates

Lining

Bridges

Flumes, siphons, gaging stations, etc.

Lateral gates

Sublaterals
Aequia Data Form and Cross Section Form included? Yes No

Field Ditches

DITCH DIMENSIONS

Measurement Intervals: 1 Mile 1/2 Mile Other:

Distance	Slope	Berm	Lined?		
Down Ditch	Width	Depth	Degree	Field	Y or N

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